PROCEEDINGS

OF THE

CALIFORNIA ACADEMY

OF

SCIENCES.

VOLUME V.

PART I.

~~1873.~~

SAN FRANCISCO:

1873.—'75

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY

OF

SCIENCES.

ANNUAL MEETING, JANUARY 6TH, 1873.

President in the Chair.

Thirty-eight members present.

Robert M. Brereton was elected a life member, and Theodore A. P. Brown, C. B. Morgan, P. Hatch, M.D., and S. B. Boswell, were elected resident members.

The President delivered his annual address, referring to the progress and prospects of the Academy, and its claims to public consideration.

The Director of the Museum, Curator of Entomology, and Librarian, submitted their annual reports, which were read and accepted.

The Treasurer presented his exhibit of the financial affairs of the Academy, of which the following is a summary: Amount received from monthly dues and life memberships, to date, $2,702.35 ; the disbursements for the same time amount to $1,133.90 ; leaving a balance on hand, of $1,568.45. On motion, the report was accepted and ordered filed.

The annual election being now in order, the following gentlemen were elected officers of the Academy for the current year:

PRESIDENT.

GEORGE DAVIDSON.

VICE-PRESIDENT:

JOHN HEWSTON, JR.

CORRESPONDING SECRETARY:

HENRY G. HANKS.

LIBRARIAN:

C. N. ELLINWOOD, M.D.

TREASURER:

ELISHA BROOKS.

RECORDING SECRETARY:

CHARLES G. YALE.

DIRECTOR OF MUSEUM:

H. G. BLOOMER.

TRUSTEES.*

ROBERT E. C. STEARNS.
THOMAS P. MADDEN.
OLIVER ELDRIDGE.
D. D. COLTON.

Dr. Stout read a paper "On the Chemistry of Great Fires," referring more particularly to certain phenomena connected with the recent disastrous fire at Boston. The views advanced by Dr. Stout elicited much discussion, Dr. Blake and others dissenting.

Regular Meeting, January 20th, 1873.

President in the Chair.

Forty members present.

J. P. Jones, A. A. Gansl, Tiburcio Parrott, and George T. Marye, Jr., were elected life members; and S. P. Middleton, and E. L. Beard, resident members; Montgomery P. Fletcher, and Caspar Schenck, were elected corresponding members.

Robt. E. C. Stearns was elected a life member, on recommendation of the late Trustees, in recognition of services rendered to the Academy.

* The President, Treasurer and Recording Secretary, are Trustees *ex-officio*.

Donations to the Library: Proceedings of the Entomological Society of France, 1868–9. Bulletin Meteor., Mensuel de l'Observatoire de l'Université d'Upsal, Vol. I, Nos. 1–12. Vol. III, Nos. 7–12. Bulletin de l'Acad. Imperiale des Sciences de St. Petersburg, Tome XVII, Nos. 1, 2, 3. Memoires de l'Acad. Imp. des Sciences de St. Petersburg, VII Serie, Tome XVII, Nos. 11, 12. Tome XVIII, Nos. 1–6. Archives Neerlandaises des Sciences Exactes et Naturelles de la Société Hollandaise des Sciences a Harlem, Tome VII, Livraisons 1, 2, 3. Tome VI, Liv. 4 and 5. Giebel's Zeitschrift fur die Gesammten Naturwissenschaften, new series, Bandes I, II, III, IV. Schriften aus Dem Gauzen Gebiete der Botanik herausgegeben vom Kaiserlichen Bot. Garten, Band II, Hft. 1, St. Petersburg, 1853. Zeitschrift der Deutschen geologischen Gesellschaft, Band XXIII, Hft. 4. Band XXIV, Hft. 1–2. Ab handlungen, Herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft, Vol. VIII, Parts I, II. Abhandlungen der Naturhistorischen Gesellschaft zu Nurnberg, Band V. Memoires Royal Bot. Garten St. Petersburg, Tome I, Part I. Acta Universitatis Lundensis 1868, Parts 1–3; also 1869, Parts 1–2; and 1870, Parts 1–2. Jahrbuch der Kaiserlish-Koniglichen Geologischen Reichsanstalt, Band XXII, Nos. 1–2. Verhandlungen der k.k. geol. Reichsanstalt, Nos. 1–7. Revista Med. Quirurgica de la Association Medica Bonaerense, Año 9, No. 6. Catalogus Systematicus Bibliothecæ Horti. Imp. Bot. Petropolitani. Sertum Petropolitanum seu Icones et descrip. plantarum, quæ in Horto Bot. Imp. Petropolitano, Fas. I–IV. Elfter Bericht, Offenbacher Vereins fur Naturkunde im Vereinsjahre, 1870–1871. Sitzungs-Berichte der Natur-wissenschaftlichen Gesellschaft Isis in Dresden, Jahrgang, 1871–72. Animadversiones Botanique of the Acad. Petropolitani, p.p. 1–24, and p.p. 41–59. Enumeratio Plantarum Novarum a Cl. Schrenck: Moscow, June, 1841, and October, 1842. Bericht uber die Sitzungen der Naturforschenden Gesellschaft zu Halle in Jahre, 1870, Jan. and Feb. Uebersicht der Aemter-Vertheilung und wissenschaftlichen Thatigkeit des Naturwiss. Vereins zu Hamburg Altona im Jahre, 1869–70. Bericht uber die Senkenbergische naturforsche Gesellschaft, 1870–1871. Die unseren Kulturpflanzen schadlichen Insekten, by Gustav Kunstler, Wien, 1871. R. Comitato Geologico d'Italia, Bolletino Nos. 7, 8, 9, 10, 1872. Die Grundlagen des Vogelschutz-gesetzes von G. R. von Frauenfeld, Wien, 1871, Part I, July 1871; Part II, October 1871. Die Pflege der Jungen bei Theiren Zwei Vor. von G. R. v. Frauenfeld, Wien, 1871. Proc. Philos. Soc., Glasgow, 1871–72. Trans. Edin. Geol. Soc., Vol. II, Part I, 1872. Belfast Nat. Field Club, 6th Report, 1868–9; 8th Rep., 1870–71; 9th Rep., 1871–72. Proc. Imp. Russ. Geog. Soc., Nos. 1–8, Vol. VII, 1871; Nos. 1–3, Vol. VIII, 1872. Sitz der Kaiser-Akad. Wissen, Parts I and II, III, IV and V, Vol. LXIV (2 sets), Wien, 1871. Monat. der König. Preuss. Akad. der Wissen du Berlin, Parts for April, May, June and July, 1872. Abhand-heraus von Naturwissen-schaftlichen Ver. zu Bremen, Parts I and II, Vol. III, 1872. Zeit. du Deutsch. Geolog. Gesellschaft, Part IV, Vol. XXIII; Parts I and II, Vol. XXIV, Berlin, 1871. Die Uns. Kutturpflanzen schäd. Insekten, Gustav Künstler, Wien, 1871. Ber. über der Senck.

Naturforschende Gesellschaft, 1870–71, Frankfort a. M. Abhand. der Naturhistor. Gesell. zu Nürnberg, Vol. V, Nürnberg 1872, Zeit. furdie Gesammten Natur. New series, Vols. I and II, for 1870; III and IV, for 1871. Berlin 1871. Shrift. der König. Physikalisch-Pkonomischen Gesell. zu Königsberg, Parts I and II, for 1871; Part I for 1872. Königsberg, 1872. Bulletin Soc. Imp. des Natur de Moscow, Nos. I, and III–IV, for 1872, Moscow, 1872. Verhand. des Naturhist. Vereines der Preuss. Rhein, und Westph, 3d series, Part I, of 9th year, Bonn 1872. Mem. L'Acad. Sci. de St. Peters, 1st Series, Vol. XVIII, No. 1. Arch. Néerland. Sci. Exact. et Natur, Parts 4 and 5, Vol. VI, 1871; Parts 1, 2 and 3, Vol. VII, 1872; La Haye, 1871. Der Zoöl. Gart., Nos. 1–6, 1872, Frankfort, a. M., 1872. Bulletin Soc. Sci. Hist. et Natur. de L'Yonne, 25th and 26th Vols. for 1871, 1872. Denk. der Kaiser. Acad. der Wissen, Vol. XXXI, Wien, 1872. Abhand. Senck. Natur-Gesell., Parts I and II, Vol. VIII. Frankfort a. M., 1872. Jahr. Kaiser. König. Geol. Reich., Nos. for April, May, June, Vol. XXII, for 1872, Wien, 1872. Revista. Med. Quirurg, Assoc. Méd. Bonaerense, Buenos Aires, 1872. Verhand der K. K. Geol. Reich., No. 1, 1872, Vienna. Ber. ub die Sitz. der Natur. Gesell. zu Halle, for 1870, Halle. Uebersicht u. s. w. Naturwissen. Vereins zu Hamburg—Altona, 1869, 1870. Die Pflege der Jungenhei Thierén, Wien, 1871. Acta Univers. Lundensis; Philos., 1868; Mathew, 1868; Lund., 1868–9. Bulletin Météor, u. s. w. l'Univers, d'Upsal., Nos. 1–12, Vol. I, Upsal, 1871. Nova Acta. Reg. Soc. Scien. Upsal, Part 1, Vol. VIII, 1868–9; 3d Series, 1871. Upsal, 1871.

Donations to the Museum: Specimen of Durangite, from Durango, Mexico, by Henry G. Hanks.

Mr. Hanks, in presenting the above mineral, remarked that it was supposed to exist in considerable quantity in Durango; that heretofore it had been quite rare; it had no special value, and is prized only as a curious formation.

Dr. Gibbons exhibited specimens of tape-worms engendered in the system of a child. These worms were of a peculiar form, and Dr. Gibbons supposed they were caused from raw meat having been fed to the child for some disease of the bowels. They were beef tape-worms (*Tænia mediocanellata*); the child recently began to discharge isolated worms presenting a notched joint at one end, and the other end rounded more like a head. On further examination under the microscope, the head in one specimen was found to protrude half an inch. No description of the isolated creature was found in the books by Dr. Gibbons. It differs from the ordinary detached segments of tape-worm in the apparent possession of a head at the rounded extremity, approaching in this respect the cysticircus, or imperfectly developed worm, as it is found in the animal tissues. It appears to hold a middle place between the cysticircus and perfect worm as found in the intestines.

New Problems in Mensuration.*

BY GEORGE DAVIDSON.

9. Given the diameter of a sphere, to find the diameters of any number of concentric shells and the central sphere having equal volumes with each other, into which the given sphere is divided.

To divide it into n shells and the inner sphere, let d represent the diameter of the given sphere; x, y, z, etc., the diameters next interior; $(w-1)$ and w the diameters of last shell and inner sphere; then,

$$x^3 = \frac{(n-1)\ d^3}{n} \ : \qquad y^3 = \frac{(n-2)\ d^3}{n} \ : \quad \text{etc.}$$

$$(w = 1)^3 = \frac{2\, d^3}{n} \ : \qquad w^3 = \frac{d^3}{n}$$

10. Given the diameters of a spherical shell, to find the diameters of any number of concentric shells into which it is divided, they having equal volumes with each other.

To divide it into p shells, let d' represent the exterior diameter; d the interior diameter; x, y, z, etc., the diameters reckoned from d' towards d; $(w-1)$ and w the last two diameters; then,

$$x^3 = \frac{d^3 + (p-1)\ d'^2}{p} \ : \qquad y^3 = \frac{2\, d^3 + (p-2)\ d'^3}{p} \ : \text{etc.}$$

$$(w-1)^3 = \frac{(p-2)\, d^3 + 2\, d'^3}{p} \ : \qquad w^3 = \frac{(p-1)\ d^3 + d'^3}{p}$$

11. Given the diameters of a spherical shell, and having divided it into any number of concentric shells of equal volumes with each other, to find the diameters of the consecutive outer shells of equal volumes with the subdivided shell.

Let d', d; x, y, etc., represent the quantities as before; p the number of shells into which the given shell is divided; n the required number of outer shells, and o', o'', o''', etc., the consecutive diameters of these shells; then,

$$o_n^{\ 3} = \frac{(n+p)\ d'^3 - n\, d^3}{p}$$

12. Given the diameter of a spherical shell, and having divided it into any

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* In continuation of former problems; *vide* Vol. IV, pp. 278, 290. NOTE.—Please note the following typographical errors in said problems: Page 290, second line from bottom, for "n^2," read "x^2."; page 290, last line, for "w," read "w^2."

number of concentric shells of equal volumes with each other, to find the diameters of the consecutive inner shells of equal volumes with the subdivided shell.

Let d', d; x, y, etc., and p, represent the quantities as before; n the required number of inner shells, and i', i'', i''', etc, the consecutive diameters of these shells; then,

$$i_n^3 = \frac{(n + p)\, d^3 - n\, d'^3}{p}$$

Dr. Stout submitted specimens of iron sands, such as he had exhibited at a previous meeting. A microscopic examination was made by the members, and a discussion as to the formation, deposition and occurrence of these sands, was participated in by Drs. Stout and Gibbons; also by Prof. Davidson, who mentioned their occurrence in the neighborhood of the Chilchat River; and Mr. Dall, who spoke of samples of black sand from Alaska, sent to him some time ago for examination, which he was surprised to find contained hardly any magnetite.

Regular Meeting, February 3d, 1873.

President in the Chair.

William E. Brown, Frederick H. Waterman, Rev. W. A. Scott, D.D., were elected resident members.

Hon. C. E. DeLong, and Albert Bierstadt, were elected corresponding members.

Donations to the Library: Report of the Medical Society of California, for 1871–2. Transactions and Proceedings of the New Zealand Institute, 1871, Vol. IV; Fishes of New Zealand, etc., by F.W. Hutton, and Notes on the Edible Fishes of New Zealand, by James Hector, M. D., presented by Victor Hector. Proceedings Agassiz Institute of Sacramento, 1872.

Donations to the Museum: A barbed instrument, made by the natives of Kotzebue Sound, from A. Honcharenko. Specimen of silver ore from the Raymond and Ely mines. Specimens of " cement" and "bed-rock," from the gravel of Long Cañon, near Michigan Bluff, Placer county, by Dr. J. M. Willey.

Mr. Stearns read the following paper:

Remarks on a New Alcyonoid Polyp, from Burrard's Inlet.

BY ROBERT E. C. STEARNS.

At a meeting of the Academy held on the 17th July, 1871 (see Proceedings, Vol. IV, page 180,) in referring to a donation to the Museum, made on the previous 5th of June, of what resembled a bundle "of dried willow switches" from Burrard's Inlet, our fellow member, Dr. Blake, regarded them, as I infer from the brief published abstract of his remarks, as pertaining to a new species of sponge. The exceedingly meagre data in our possession at present, preclude any positive conclusion as to the true position of these apparent "rods or switches of bone," for on referring to our records I see that the specimens were sent "with no information accompanying them, except that they were 'skeletons of some kind of fish!'" At the time of the donation, "It was thought by some to be the internal structure of a species of zoöphyte, allied to Virgularia."

With the specimens alone, and without any knowledge of the fleshy or soft parts, and no particulars as to physiognomy or habit of the organization of which each of these switch-like forms is a part, we can only reason from analogy, and not with satisfactory definiteness.

It is quite certain that they are not the back-bones, and quite unlikely that they are fin-bones of any species of fish; as between zoöphytes and sponges, to which latter Dr. Blake regards the specimens as allied, I am decidedly of the opinion, after an examination of the limited authorities at my command, that they belong to a species of zoöphyte, and are included within some one of the groups of the Order of Alcyonoid Polyps.

"The solid secretions of these polyps are of two kinds: Either (1) internal and calcareous; or (2), epidermic, from the base of the polyp. The latter make an axis to the stem or branch, which is either horny * * * * or calcareous. A few species have no solid secretions.

All the species are incapable of locomotion on the base; yet there are some that sometimes occur floating in the open ocean."*

In the third division of the Alcyonoid Polyps, following Prof. Dana's classification, we have the "*Pennatula tribe*, or PENNATULACEA. These are compound alcyonoids, that instead of being attached to rocks, or some firm support, have the base or lower extremity free from polyps and buried in the sand or mud of the sea-bottom, or else live a floating life in the ocean. Their forms are very various."†

After referring to certain species of the *Veretillidæ*, their structure and beauty, other forms are mentioned belonging to the Pennatula tribe, some of

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* Dana; Coral and Coral Islands, pp. 80, 81.

† Ibid., page 91.

which, like the group Pennatulidæ, have a stout axis, with branches either side, arranged regularly in plume-like style, or a "very slender stem and very short lateral polyp-bearing pinnules or processes along it (the Virgularidæ); * * * and some of these have a slender stem, and the polyps arranged along one side of it (the Pavonariadæ); and still others a terminal cluster of polyps (the Umbellularidæ).

The most of these species secrete a slender horny axis, and have slender calcareous spicules among the tissues, somewhat like those of Gorgonidæ."*

This internal *horny* axis is also described as "bony"† by other writers; it is covered with a fleshy substance, of a consistence like that of the Actinia, which, being largely composed of water, leaves but little solid matter when dried, which is brushed off or crumbles away with very little handling.

In the Pennatulæ, or Sea-pens, the central stalk or axis is of moderate length and the pinnæ, rather long, presenting the appearance of a feather; or as Lamarck said, "it seems, in fact, as if nature, in forming this compound animal, had endeavored to copy the external form of a bird's feather."

"In some genera, *Virgularia* and *Pavonaria,* to which the name of "sea-rushes" has been given, the central stem is very much prolonged, some of them measuring between three and four feet in length. The polypiferous lobes are comparatively short." §

To either the sea-pens (Pennatulidæ), or the Umbellate corals (Umbellularidæ), I believe these specimens belong; and of the two groups indicated, I am inclined to place them in the latter; said group is characterized by a "Polypary free, simple elongated, with the polyps at the summit; axis stony, inarticulate, covered with a fleshy cortex; polyps large, terminal, arranged in an umbellate manner at the end of the polypary."‡

Figuier remarks that "Les Ombellulaires ont une tres-longue tige, soutenue par un os de même longueur et terminée au sommet seulement par un bouquet de polypes."||

"The physiological phenomena which the Pennatula present is extremely interesting, since it exhibits the example of a truly composite animal, that is, one in which animals, more or less in number, really perfect so far as comports with the grade of organization to which they belong, form part of a common living * * * body, serving as an intermedium for nutrition to all the individuals, so that they are all nourished together in a mediate manner by means of this common portion of which they form a part.

The nutriment which favorable circumstances have placed within the reach of one individual, nourishes that individual first, and then, by extension, nourishes the common stem; and thus the other polypi, which constitute organic portions of it, receive their share."¶

* Ibid, page 91.

† Dallas, in "Orr's Circle of the Sciences."

§ Dallas, Ibid.

‡ Manual Nat. Hist. Travellers, page 357.

|| La Vie et les Mœurs des Animaux, Paris, 1866.

¶ Cuvier; Mollusca and Radiata, by Griffith and Pidgeon. London, 1834.

Or in other words, the nutrition which is secured or received by an individual polyp, is diffused through and nourishes the whole.

After a consideration of the subject, with the specimens before us, I think the analogies strongly favor a reference to one or the other of the groups I have indicated, instead of the fishes or sponges, to either of which I cannot perceive they hold the slightest relationship.

From the coast of Greenland, Lamarck has described a species of Umbellularia (U. Grœnlandica,) and we might perhaps, with some degree of reason, look for a related form upon the Pacific side, in some northern station where the physical conditions measurably correspond to those of the habitat of the north Atlantic species cited.

It will be readily perceived, that before an accurate determination can be arrived at, the living forms, of which I believe these "switches" are the central stalks or axes, must be studied *in situ*, as it is quite doubtful whether the fleshy portion can be preserved.

At a meeting of the Academy subsequent to the date of Dr. Blake's remarks to which I have alluded, reference was made to a communication by Mr. Sclater, in the scientific weekly publication, "Nature," bearing upon this subject.

After writing down the conclusions which I have just read, through the courtesy of Dr. Hewston, I was enabled to examine a file of that publication, and I find that Mr. Sclater read a paper before the British Association, at the Brighton meeting, August 20th, 1872,* in which he acknowledges the receipt of several specimens of these "switches," from Captain Herd, of the Hudson's Bay Company, with a statement from the Captain that, "These rods are the backbones of a sort of fish found in great abundance at Burraud's Inlet, Washington Territory, North-west America, whence they have been brought by two Captains in our service. These animals are shaped like a Conger eel, but are quite transparent, their bodies being composed of a mass of jelly — they are about 8 inches in diameter. The head is like a shark's head: it is attached to the thick end of the rod — it has two eyes and a mouth placed low down. The backbone is also transparent in the living animal, but becomes hard when dried on the beach by the sun. These fishes swim about in shoals, along with the dog-fishes." Other information was received by Mr. Sclater, of the same tenor.

A specimen of the switches was sent by Mr. Sclater to Prof. Kolliker, of Wurzburg, who had shortly before been engaged in monographing the Pennatulidæ; and the latter gentleman, in reply, stated his belief, "That the object you sent me * * * is indeed the axis of an unknown Pennatulidæ, etc."

"Prof. Flower, Prof. Milne-Edwards of Paris, and several other Naturalists, who visited the rooms of the Zoölogical Society * * all said that the objects were new to them, and that they did not know what they were, but were mostly inclined to regard them as the axis of an unknown Pennatulide animal."†

From the allusion (in the foot-note) in "Nature" to Dr. Gray, and his refer-

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* See "Nature," Vol. VI, page 436. † See "Nature"; also foot-note.

ence of one of these switches to a genus (Osteocella) made by him, I quote as follows from page 405, of the Annals and Magazine of Natural History, Vol. IX, (Fourth Series). Dr. Gray refers to the Genus Osteocella as follows: "Mr. Clifton, many years ago, sent * * * to the British Museum, the 'backbone taken out of the marine animal in bottle marked No. 1. I caught him, or it, swimming with great rapidity in shallow water.' The bottle never reached the British Museum; but the backbone did; and I described it at the end of the 'Catalogue of Sea-Pens, or Pennatulidæ, in the British Museum,' published in 1870, under the name of 'Osteocella Cliftoni'; but considered it very doubtful its belonging to the Pennatulidæ."

The British Museum has lately received a very long, slender bone, 64½ inches long and 3-16 inch broad in its broadest part, which was sent to the Zoölogical Society by the Hudson Bay Company, and evidently came from the northern seas, probably from the west coast of America.

Mr. Carter has kindly examined the Australian specimen sent by Mr. Clifton, and the one sent * * by the Hudson Bay Company * * * and finds them, under the microscope, "present the same horny structure, viz., a fibrous trama, more or less charged with oval cells or spaces, quite unlike that of *Gorgonia* and *Pennatula*, which present a concentric mass of horny layers, charged more or less with calcareous crystalline concretions. It is evidently a second species of the same genus, *Osteocella*."

After a few lines, follows a description of the genus

"*Osteocella*, Gray, Cat. of Pennatulidæ (1870), p. 40."

After describing the style, or axis, he refers to the animal (which neither he nor we have seen) in the following words: "Animal or colony of animals free, marine; otherwise unknown; most probably like the Pennatulidæ, but the style is harder, more calcareous and polished than any known style belonging to that group, which are generally square, sometimes cylindrical, but rarely fusiform in the genus *Virgularia*; or, it may be the long conical bone of a form of decapod cephalopod, which has not yet occurred to naturalists, as Mr. Clifton spoke of its being a free marine animal, and it has a cartilaginous apex like the cuttlefish. * * * * It is evident that there are two species of animal yielding this kind of bony substance:

1. *Osteocella Cliftoni.* Thick, about 11 inches long, tapering at each end. From Western Australia.

2. *Osteocella septentrionalis.* Long, slender, about 64 inches long, attenuated at the base, and very much attenuated and elongated at the other end. Northern Seas? Collected by the Hudson's Bay Company."

This latter, undoubtedly refers to the same forms, of which we have numerous specimens in the Academy's Museum, and which are referred to in this paper.

Dr. Gray proceeds and says: "Mr. Carter informs me that subsequent examination of this axis with acid, 'shows that it is similarly composed to that of *Gorgonia*, viz., of kerataceous fibre or substance, and calcareous crystalline matter like that of the stem of *Osteocella Cliftoni*, and the other Pennatulidæ, which it most nearly resembles'; so that my original view as to the nature of this organ seems to be thus confirmed."

From what is herein quoted from Dr. Gray's paper, it will be perceived, that while the microscopic examination showed it to be "quite unlike that of *Gorgonia* and *Pennatula*," that Mr. Carter's subsequent examination of the second species referred to *Osteocella*, "shows that it is similarly composed to that of *Gorgonia*, * * * and * * * like that of the stem of *Osteocella Cliftoni*, and the other Pennatulidæ," etc.

Dr. Gray's paper implies a collision between the *microscopic test* and the *examination with acid*; and the description of his genus contains a doubt as to which division of the animal kingdom *Osteocella* is related. With high regard for the justly distinguished naturalist, it must be admitted that his genus is quite indefinite, and could be construed to cover a wide range; but as he has attached it to the catalogue of Pennatulidæ, it is perhaps fair to infer that in his mind the balance of reasoning tends in that direction; as between the microscopic and the acid tests, the latter is of insignificant value.

But returning to the "switches," I find that Mr. Sclater does not commit himself, but with apparent consideration for the intelligence of the parties who sent him the specimens and their statement that they belonged to a species of fish, he only says that, "supposing * * * * that these objects are really derived from such an animal as is described and figured above, I can only suggest that they may be the hardened notochords of a low-organized fish, allied either to the Chimæroids or to the Lampreys, in which the notochord is persistent throughout life. It is quite certain, I think, that they cannot be any part of the true vertebral column."

On page 432 of the same number of "Nature," appears an article relating to Mr. Sclater's paper, from Mr. H. N. Moseley, who, after what appears to have been a rather careful examination of the authorities upon the groups to which he thinks it belongs, as well as upon its microscopical structure, expresses an endorsement of Prof. Kolliker's opinion, and closes by saying: "In the mean time I cannot but conclude that Mr. Sclater has been misinformed, and that we are very unlikely ever to see that marvellous fish in the flesh."

Again: in "Nature," of October 24th, 1872,* Mr. J. W. Dawson, Principal of the McGill College, at Montreal, writes that, presuming that the "disputed organism * * is specifically identical with a specimen from Frazer River * * presented * * for the Museum of the University * * *. I at once recognised it as the axis of a Virgularia, or some similar creature * * * *. I submitted it to Prof. Verrill, of Yale College, who had no doubt as to its nature;" and Mr. Whiteaves, of Montreal, noticed it in his report, "as an undescribed Pennatulid."

Then follows Dr. Blake, in "Nature," (of November 28th, 1872)† to which previous reference has been made by me, as it is a part of this Academy's proceedings, in which, as the result of a microscopic investigation, he says: "An

* Vol. VI, No. 156.

† Vol. VII, page 161.

examination of the specimens * * enables me to refer them to the Protozoa class, Spongidæ, or sponges": and he concludes by saying: "Its generic relations will, I think, be with Hyalonema and Euplectella, both sponges of the Pacific."

The foregoing is all that I find relating to the "switches," prior to my remarks as above; I was not aware, at the time, that anything had appeared on the subject, other than the remarks of Dr. Blake, and that of Mr. Sclater's article, to which Dr. Blake referred. Mr. Sclater's article I had not read, but had casually glanced at the drawing of the so-called fish.

But having expended so much time prior to an examination of the files of "Nature," I considered it a matter of sufficient interest to warrant a review of the subject, and present the same to the Academy.

As to what these animal "switches" belong to, it will be seen that Dr. Blake, whose examination of their substance microscopically appears to have been quite thorough, places them with the *sponges.* Mr. Sclater does not commit himself, but *conditionally* refers them to the *fishes*. Dr. Gray described (it) them as a new species of *Osteocella*, whatever that may be, (perhaps a *Pennatulid*) while Professors Kolliker, Flower, Milne-Edwards, Mr. Mosely, Principal Dawson, Prof. Verrill, Mr. Whiteaves, Mr. Dall and myself, regard them as belonging to a species of Alcyonoid polyp, related or pertaining to the group *Pennatulidæ*.

On reviewing the above, it will be noticed that the various parties who presented the specimens, both of the Burrard's Inlet forms and that from West Australia, state that they are bones of, or belong to fishes, implying that they are a part of free-swimming animals; while some species of the *Pennatulacea* "live a floating life in the ocean," it is not unlikely that others may not be constantly stationary, or, if I may use the word, are not *planted, all* of the time; and while floating might be mistaken for fishes, more especially if numerous specimens were seen moving in the water, coincident with the presence of a school of fishes.

In conclusion, I would state my belief that the much-discussed switches are a species of *Umbellularia*, for which Dr. Gray's specific name might be adopted, and attached to the specimens from Burrard's Inlet, in the Academy's collection.

Mr. Dall presented the following description of new species of Cetacea, belonging to the West Coast of North America:

Descriptions of Three New Species of Cetacea, from the Coast of California.*

BY W. H. DALL, U. S. COAST SURVEY.

Delphinus Bairdii, n. s.

Back, posterior sides, fins and flukes, black. Anterior sides gray, with two narrow white lateral stripes. A white lanceolate belly patch. Dorsal falcate;

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* Printed in advance, Jan. 29th, 1873.

beak slender, elongated. Length, six feet seven to nine inches. Length of skull, 18.76 in.; length of beak before the notches, 11.9 in.; height of skull at vertex, 6 in.; greatest breadth at zygomatic process of squamosals, 6.95 in.; breadth between maxillary notches, 3.4 in.; ditto at middle of beak, 2 in. Teeth, $^{53}/_{47}$, the anterior six on each side very small, not projecting above the gums. Two female specimens, Cape Arguello, California, Scammon, 1872; of which one entire skeleton has been forwarded to the National Museum at Washington.

This species belongs to the restricted genus *Delphinus* of Gray, and is peculiar from its extremely attenuated beak and very deep channels on each side of the palate behind. The superior aspect of the skull resembles that of *Clymenia microps*, Gray. It differs from all the described species of the genus in color and osteological characters, and will be fully described in the forthcoming monograph of the Pacific Cetacea, by Capt. C. M. Scammon, U. S. R. M., to whom I am indebted for the opportunity of describing this and the following species. It is dedicated, by request of Capt. Scammon, to Prof. S. F. Baird, of the Smithsonian Institution.

Tursiops Gillii, n. s.

Dull black, lighter on the belly. Dorsal low, falcate. Teeth, $^{?23}/_{22}$. Monterey, California. Lower jaw: length from end of beak to condyles, 16.8 in.; do. to end of coronoid process, 15.8 in.; do. to end of tooth line, 9.3 in.; length of symphysis, 2 in.; width between outer edges of condyles, 9.75 in.; between two posterior teeth, 3.5 in.; height of ramus at coronoid process, 4.4 in. The material for identification of this species is unfortunately very small, being only the lower jaw, and outlines of the animal, drawn by Capt. Scammon. It does not appear to have been described, and the only other species of the genus described from the Pacific is the *T. catalania*, Gray, from N. W. Australia, which is described as being lead colored. It is dedicated, by desire of Capt. Scammon, to Prof. Theodore Gill, of the Smithsonian Institution, whose memoirs on the Cetacea and Pinnipedia of the Pacific are already classical.

Grampus Stearnsii, n. s.

Colors dark, but variable: the anterior portion of the body white, and the sides of the body more or less mottled with gray. Dorsal high, and slightly falcate. Animal 12 or 15 feet long; teeth $\frac{0}{3}$ or $\frac{0}{4}$. Coast of California.

Two lower jaws of this animal are in my hands for examination, and but that no *Grampus* has been described from the Pacific, I should hesitate about applying a specific name to them. Gray has, indeed, catalogued a *Grampus* (?) *sakamata* (!) from Japan, based on a Japanese account quoted by Schlegel, but the genus is by no means certain; the descriptions are conflicting, and the species rests on no scientific basis. The jaws referred to are attributed by Captain Scammon to his "white-headed grampus," and measure, from the end of the beak to the condyles, 17.5 in.; ditto to coronoid process, 16.2 in.; height of ramus at coronoid process, 5 in.; length of symphysis, 2 in.; height of gonys, 2 in.; width between outer corners of condyles, 14 in.; ditto at inferior dental foramen, 7 in. Teeth in one specimen three, and in the other four on each side near the tip, pointed, solid, shaped like an orange seed, and extending forward and outward.

Fuller descriptions of this and the last species will be given in the work referred to. The present species is dedicated, by Capt. Scammon's wish, to Mr. R. E. C. Stearns, of San Francisco, well known for his researches in Natural History.

Remarks on the Auriferous Gravel Deposits in Placer County.

BY J. M. WILLEY, M. D.

Having had occasion, in August last, to visit the celebrated mining region which centres in Forest Hill, I went with expectation of finding confirmation of the usual theory concerning the formation of this gravel deposit.

It is hardly necessary to say, that the gravel beds of the central counties of California are supposed to present sufficient evidence of the existence of a system of large but extinct rivers; and that the course of these ancient rivers is believed to have been oblique, and often at right angles to that of the present streams, and to their tributaries, flowing through the various cañons which have their sources on the western slopes of the Sierra Nevada range.

Although it is possible that such a mode of explanation may account for even so widely spread a deposit of gold-bearing gravel as exists in Placer and adjoining counties, I think there are certain features in this deposit difficult to reconcile with the theory of the ancient river system, and that a closer study of the subject reveals a problem of a very complicated, though interesting nature.

The first thing that arrests the attention, after looking at the large excavations which hydraulic power has worn in the gravel banks, in some places leaving precipices from one to two hundred feet deep, is the profusion of boulders of pure quartz, which cover the worked-out portions of the ground. These boulders lie on the bed rock, in some places many feet in depth. At Forest Hill and Michigan Bluffs, the eye is dazzled in the sun-light reflected from heaps of rounded quartz, some masses of which will measure several cubic yards. The smaller boulders are in general washed away; but I looked with surprise at one portion of an unworked bank at Michigan Bluffs, observing that it was composed almost entirely of quartz fragments, from pebble size upward, all having the usual rounded or ovoid form.

There will be little doubt, I think, that we have here the origin of the gold which occurs so plentifully in connection with the gravel of this section of country, but the question remains as to how the attrition has been performed which liberates it.

What tremendous powers have, in the first place, dislocated from their original casings the gold-bearing quartz ledges, and in the next, ground, to so perfect a smoothness and rotundity, the hardest specimens of white, blue, and rose-colored quartz fragments?

Mere fluvial action, however violent, will account not at all for the first condition, even if it does for the second. Granite, in the Placer county gravel beds, occurs only in boulders associated with the quartz, and that sparingly, the bed rock being universally a slate; and in this respect, the difference between the placer diggings of Idaho Territory and those of central California, is very remarkable. In Idaho, the bed rock is everywhere granite; and the ledges which have supplied the gold are often distinctly traceable, good diggings being found below them, as in Granite Gulch, near Placerville, and none at all above.

To what, then, shall we refer the disruption, in California, of that primitive relationship of rocks, which we find still remaining in Idaho?

Perhaps volcanic action may account for it; and in connection with this view I wish to present to the notice of the Society a specimen of the peculiar substance called cement. This substance occurs very abundantly in distinct, and sometimes alternate, stratification with the gravel, in most of the Placer county mines; in fact, in all of them which I had opportunity of visiting. It does not, so far as I could see, mix with the gravel, but is often of a depth and hardness as seriously to embarrass the operations of the miner. Being entirely barren, it has sometimes to be blasted with powder or nitro-glycerine, before the hydraulic stream will act upon it, and then adds greatly to the cost of hydraulic operations.

As will be observed, it is a grayish white, and so homogeneous, apparently, in its nature, that the miners generally, though very ignorantly, call it pipe-clay. Although this whitish color is the usual tint, I have observed it in some situations to be of various shades of brown.

Now, is this substance a volcanic ash, and if not, what is it?

I think the answer to this question carries with it a solution of much of the difficulty in accounting for the condition of things in central California. Admitting that this cement is a true product of volcanic eruption, the large extent of surface covered by it and its frequent great depth, would lead us to infer an enormous amount of volcanic activity, perhaps in connection with the elevation of the neighboring peaks of the Sierra Nevada range.

Mr. Hanks kindly afforded me a microscopic examination of the present specimen, and it appears to resolve itself into the three elements of granite—quartz, mica and feldspar. This is not an unusual condition of volcanic ash, and if my impression is correct, it is, with the addition of sulphur, exactly the analysis of the ash ejected in the recent eruption of Vesuvius.

But even considering it as settled that cement is a volcanic ash, solidified by time and pressure, we have still two things to account for; one, the almost total disappearance of the granite, the other the levigation of the quartz.

After due consideration of the effects of prolonged action of the surf on both salt and fresh water beaches, in the production of such gravel and boulders as we see in Placer county—as I doubt whether the ancient river system can be taken into the question, or is so clearly traceable—there is one other mode of explanation of most, if not all the phenomena alluded to, which I think deserves attention. I refer to the grinding and comminuting power of glacial action.

Of all the forces of nature which effect transformation of the surface of the earth, the progress of glaciers is among the most potent. Every year brings new proofs of the extent and importance of the changes effected by glacial movement; and perhaps investigation may show that there was a time in which, from the western slopes of the Sierra Nevada range proceeded icy masses, of a magnitude and weight sufficient to have crushed out and destroyed the original relationships of rock over which they traveled; and to have had much to do with, if they were not the principal cause of, the disrupted and almost chaotic state of the earth's surface in Placer county.

Dr. Kellogg called the attention of the Academy to the following new species of plants, specimens of which he exhibited.

Descriptions of new Plants from the Pacific States.

BY A. KELLOGG, M. D.

Lupinus palustris, Kellogg.

Stem stout, annual, fistulous (cotyledons thick, large, connate and persistent), striate by the decurrent nerves from the base of the leaves, 3 to 8 inches, or more, in height, often subsequently branching 3 to 6 inches more beyond the main axis and its elongated terminal spike; long, soft, silky, pubescent, or subglabrous, with barely very minute villi; peduncles stout, as long, or often longer than the leaves (3 to 5 inches), rachis somewhat longer still; leaves loosely clustered toward the top; petioles long, rather robust, base expanded and strongly clasping the stem, the 3 prominent nerves decurrent, stipules subulate, hirsute, ¼ to ½ an inch long, leaflets 6 to 10, obovate-oblong, obtuse, mucronate, retuse, narrowed at the base, glabrous above, subpubescent beneath, ¼ to ½ the length of the petiole; spike 6 to 12 inches; flowers large, violet-blue, pinkish, or verging to white, pedicellate, subverticellate or verticellate, somewhat scarious bracts persistent, subulate, the setaceous acumination extending to about half the length of the lower lip, subscarious calyx bracteolate or ebracteolate hirsute, about half the length of the somewhat ciliated keel, slightly saccate; upper lip 2-toothed, lower herbaceous lip mostly 2-toothed, seldom sub-entire; wings very broad, obtuse, with a rhomboidal outline; petals equal. Legumes very appressed, (silvery?) hirsute, compressed, an inch or more in length, about 8-seeded.

Collected by Kellogg and Bloomer on the San Joaquin River, April 7th, 1869. Differs from *Menziesii* — a 2-seeded species, — whereas this has 8 or more; also one var. (deep purple-blue flower), has very distinct bracteoles. No variety of *L. polyphyllus* — with 13 to 15 leaflets, short, caducous bracts and ebracteolate calyx—3 to 5-feet stem, etc., and if we mistake not, perennial root, will allow it to be placed under that name. *L. latifolius* also has a perennial root, smooth stem, bracts longer than the flowers, ebracteolate calyx, entire lips and glabrous keel, etc.

Lupinus Menziesii, var. *aurea*, Kellogg.

Collected by Kellogg and Samuel Brannan, Jr., in Deer Valley, near Antioch, San Joaquin River, April 22d, 1869; chiefly differing from the accepted description of the species—if we include also *L. densiflorus*—in the 2-toothed lower lip, relative length of leaves, and the entire scarious tube of the calyx, etc.

Stem fistulous, branching from near the axil summit, leaflets about 10, one-third the length of the petiole, glabrous above, pubescent beneath, stipules and bracts scarious, setaceously long acuminate, persistent; calyx-tube scarious, upper-lip 2-toothed, deflexed, somewhat saccate; vexillum short, rounded outline, pubescent on the back at the base, and along the claw above. Legumes hirsute, minute, 2-seeded.

Calystegia villosa, Kellogg.

Bracted Bindweed or Cloak-cup Morning Glory.

Root perennial, horizontal, rhizomoid, and fibrously sub-rooting, at intervals from the main crown; stem oblique or erect, or occasionally twining from right to left, hoary, velvety-villous throughout, 4 inches to 2 feet high; leaves mostly reniform-cordate, hastate-saggittate, (circumscription somewhat triangular,) open sinus, very deep, lobes broad, subrhombic, angular lobes acute, pointed apex abruptly acute, mucronate; petioles mostly about equalling the length and breadth of the lamina, about 3-nerved, the lateral nerves often forked above the sinus (or pseudo-5-nerved): peduncles assurgent or erect, as long or longer than the petioles, terete, fistulous; bracts leafy, subcordate, (rarely subacute) acute or acuminate; or ovate, acute or acuminate, 3 to 5-nerved, sub-entire (or rarely distinctly dentate), loosely appressed, covering the calyx, $\frac{1}{3}$ to $\frac{2}{3}$ the length of the flower, internal or proper calyx sepals very unequal, outer ovate-oblong, acuminate, foliaceous and villous, successively reduced, the 2 or 3 inner scarious, glabrous, ciliate, nerved and narrowed to linear, lanceolate, acuminate, tips only villous.

Style and stamens equal, hirsute at the base. Stigmas 2, linear, oblong; filaments of stamens glabrous, anthers oblong, creamy-white, introrse fixed by the base, etc.

Ovary villous (in young state), ovoid, acute. Flowers white, with a tinge of cream.

Abundant on hillsides at Cisco, C. P. R. R., 6,000 feet high on Sierra Nevada mountains; found by Kellogg and Brannan, June, 1870.

This plant most nearly resembles the Span-long Bind-weed, *Calystegia spithamæa*, but as we see that in the vicinity of San Francisco, it has not the leaf, bracts, calyx, or peduncles; here they are in pairs, and the whole plant more naked. This also includes, probably, *C. stans*, *C. acaulis* and *C. tomentosa*; it cannot be *C. paradoxa*, for that has linear bracts, etc.

Helianthus giganteus, var. *insulus*, Kellogg.

Found on a recent visit to an island of the San Joaquin River, on Mr. Kimball's farm, Webb's Landing. Fall of 1872.

Perennial root; stem 6 to 10 feet high, loosely paniculate; branches purple, smooth, peduncles scabrous; flowers 2 to 3 inches in expansion, (yellow throughout,) rays an inch or more in length, 12 to 20; leaves opposite below, alternate above, lanceolate, acuminate, entire or sub-entire, attenuate below, triplinerved and ciliate at the base, scabrous on both sides, subpetiolate. Involucral scales linear-sublanceolate, attenuate, about twice the length of the disk, squarrose spreading, scabrous, ciliate at the base, 3-nerved; chaff shorter than the expanded florets, linear-oblong, carinate, acute, commonly a short tooth on each side near the apex, striate, pubescent at the summit and on the back, chiefly above; achenia of the disk with 3 to 4 (rarely 5), long, carinate-subulate, chaffy awns, laciniately fringed or finely toothed; ray achenia, with 1–2 well developed awns, the remainder rudimentary. Lobes of the disk florets scabrously ciliate at the base; on the back somewhat lanose and appressed-hirsute, chiefly canescent at the junction with the tube. Receptacle convex, somewhat distinctly alveolate.

There are strong grounds for considering this an entirely new species, rather than variety, but owing to the lateness of the season we prefer more ample investigations; for the present it may rest here. The parallels of other species will be given hereafter.

Chionanthus fraxinifolius, Kellogg.

A shrub 25 to 30 feet high, branches quadrangular, angles winged. Leaves oddly pinnate, leaflets opposite, in about 3 or 4 pairs, with a terminal odd one, (5 to 6 inches in length,) pinnules petiolate, about ⅓ the blade, which is ovate or oval, subacute, serrate, base entire and abruptly short-cuneate, often somewhat oblique, the terminal leaflet obovate, obtuse, cuneate; leaf glabrous throughout, leaves opposite. Panicles drooping, peduncle laterally sub-compressed, numerously subdivided irregularly in alternate, opposite, verticillate, and fasiculate, or in ultimate pedicels of threes, etc., the rather minute oblong scarious bracteoles at the base of the slender pedicels mostly caducous; glabrous throughout; monosepalous calyx cup-shaped, sub-scarious, small, persistent, border-toothed, teeth 4 to 6 or more, obscurely-triangular acute or mucronate elevations, or notched and secondary pseudo-teeth; stamens one to two, filaments short, opposite, alternating the petals, scarcely half the length of the anthers, or longer than the calyx (1-line), when dry, apparently twisted, cohering with the petals at the somewhat expanded base into a partial or entire short ring or tube, anthers linear-oblong, subcordate base, introrse, cells laterally dehiscent, fixed by the base; petals oblong-oval, obtuse, claw ¼ the blade, or if coalescent oblong or obovate, (¼ to ½ an inch in length,) distinct or slightly cohering into a partial tube (in one instance only), and then deciduous with the stamens; style clavate, notched or slightly emarginate, stigma about ⅓ longer than the filament, shorter than the anther or anthers; drupe fleshy, oval or sub-globular—ripe fruit not seen.

Collected by Dr. William O. Ayres, at Borax Lake, about four years ago. The description is made from very imperfect fragments — a full and good set of specimens much desired. Although, in some points, this shrub fails to agree with the generic description, as it now stands, it is manifest that a slight revision only is required to welcome this remarkable discovery.

If, from generic differences above indicated, and more ample means of investigation, this should be deemed of intermediate generic position between *Chionanthus* and *Forsythia*, it should be entitled *Ayrseia fraxinifolia*.

Dr. Ayres observes : " When young, a graceful and beautiful tree or shrub, as it grows older, it loses its beauty very much—becomes straggling and irregular, never showing a straight symmetrical trunk ; 25 to 30 feet high."

Regular Meeting, February 17th, 1873.

President in the Chair.

Forty-three members present.

Gregory P. Hart was elected a resident member, and George C. Hickox and James Lick, life members.

Donations to the Museum: Specimen of Hornblende containing 20 per cent. of magnetic iron from the Chilcat River, by George Davidson. Fossil bones of a species of Rodent found in the drift of the Eureka Consolidated Mining Company, Nevada, at a depth of 247 feet below the surface, near the top of the ore, and immediately under the hanging rock, which is a limestone. Also, a specimen of Silver ore from same mine, by G. T. Lawton. Sections of a pile taken from Greenwich Dock, showing the ravages of a marine crustacean (*Limnoria ?*) which has recently appeared in the harbor of San Francisco, by T. J. Arnold. Head and antlers of the black tail deer, from Utah, by C. B. Turrill. Fossil from the Arizona desert, also specimens of an Isopod crustacean, parasitic on the tomcod and other fishes in the Bay, by J. P. Dameron.

Mr. John Hewston, Jr., in announcing the gift of a valuable piece of land on Market street, read the following deed from our fellow member Mr. James Lick:

This Indenture, made and entered into this fifteenth day of February, A.D. one thousand eight hundred and seventy-three, by and between James Lick of the county of Santa Clara, State of California, party of the first part, and the CALIFORNIA ACADEMY OF SCIENCES, a corporation duly incorporated and acting under the laws of the State of California, having its principal place of business in the city and county of San Francisco, State aforesaid, party of the second part, WITNESSETH: That the said party of the first part, in consideration of the desire he has to promote the diffusion of science, and the prosperity and perpetuity of said party of the second part, hath given, granted and confirmed, and by these presents doth give, grant and confirm unto the said party of the second part, and its successors, all that certain parcel of land situate in said city and county of San Francisco, State aforesaid, circumscribed by a line commencing at a point on the south-easterly line of Market Street, distant one-hundred and ninety-five feet south-westward from the southwesterly corner of Market and Fourth Streets, and running thence south-eastwardly and parallel with said Fourth Street, one hundred and ninety-five feet; thence south-westwardly, at an angle of forty-five degrees, to a point two hundred and seventy-five feet from said south-easterly line of Market Street, which last-mentioned point constitutes the south-westerly corner of the hundred-vara lot hereinafter mentioned; thence north-westerly, and parallel with said Fourth Street, two hundred and seventy-five feet to said south-easterly line of Market Street; thence north-eastwardly and along said last mentioned line of Market Street, eighty feet to the point of commencement; said parcel of land being a portion of that certain lot of land, laid down and commonly known upon the official map of said city of San Francisco, as Hundred-vara Lot No. One hundred and twenty-six: reserving and excepting, out of and from said granted premises, all buildings, tenements and improvements of any of the tenants of said party of the first part, that now are, or may be situate thereon at the time when said party of the second part shall be entitled to the possession of said premises; and excepting and reserving out of and from this grant and conveyance, the right to possess, use and occupy said premises for the period of two years from the date hereof, unless sooner determined, as hereinafter provided; which right of possession, as aforesaid, said party of the first part hereby reserves unto himself, his heirs and assigns: TO HAVE AND TO HOLD, all and singular the premises hereby given and granted unto said party of the second part and its successors, upon the following terms and conditions, nevertheless; which terms and conditions shall be binding and obligatory upon said party of the second part and its successors, that is to say:

FIRST — That said premises shall be used and devoted solely and exclusively for scientific purposes and for none other, and shall never be used for political or religious purposes.

SECOND — That said premises shall never be incumbered by said party of the second part, or its successors; and shall never be allowed or suffered by said party of the second part, or its successors, to be sold for any taxes, assessments, or other charges, levied or placed, or suffered to be levied or placed thereon.

THIRD — That said premises shall never be alienated by said party of the second part, during the life of any of the existing members of said California Academy of Sciences.

Fourth — That said party of the second part shall never lease said premises or any part thereof, or any edifice or any part of any edifice, erected or to be erected thereon, and said party of the second part shall never permit or suffer any person to possess, use or occupy the whole or any part of said premises, or any edifice or any part of any edifice, erected or to be erected thereon, save for its own proper purposes.

Fifth — That said party of the second part shall erect, and forever maintain upon said premises, an edifice of the description hereinafter mentioned; which shall cover all of said premises except that portion thereof hereinafter described, and devoted to the purposes of furnishing light and ventilation to said edifice.

Sixth — That said party of the second part shall erect upon said premises, except that portion thereof hereinafter described, a substantial and elegant brick edifice, three stories in height, with a substantial granite front, faced with appropriate scientific emblems. The structure and design of the edifice shall be classic, and such as will readily distinguish it from buildings used for business or commercial purposes. The style of architecture of said edifice shall be chaste and appropriate, and the same style and order of architecture shall be preserved throughout, in its purity.

Seventh — In order to render this gift and conveyance effectual, said party of the second part must, within two years from the date hereof, secure the necessary funds to commence and to complete said edifice; and must commence the erection of this edifice and complete the same with all reasonable dispatch; and as soon as said party of the second part shall secure the necessary amount of funds, at any time within said period of two years, upon thirty days' written notice of that fact to said party of the first part, or his heirs or devisees, the said party of the second part shall be entitled to the possession of said premises, and the right of possession of said premises hereby reserved to said party of the first part shall thereupon cease and determine. The said party of the first part hereby reserves to himself and his heirs and assigns, the right to use, possess and occupy said premises, up to and until said party of the second part shall have secured the aforesaid necessary amount of funds, and until notified of that fact as aforesaid; but said funds must be secured and the erection of said edifice be commenced, within a period of time not to exceed two years, as aforesaid.

At least one apartment of said edifice shall be constructed suitably for, and devoted to the purposes of a Library; another apartment thereof shall be constructed suitably for, and devoted to the purposes of a Museum; and a third apartment thereof shall be suitably constructed for, and devoted to the purposes of a Hall for Lectures.

Eighth — That the following portion of said premises shall never be built upon but shall forever be kept free and open, for the purpose of affording light and ventilation to said edifice; that is to say, that part of said premises circumscribed by a line commencing at the south-westerly corner of said premises, running thence north-westwardly and parallel with Fourth Street, fifty feet; thence north-eastwardly and parallel with said Market Street, fifty feet; thence running at an angle of forty-five degrees to the point of commencement.

Should said party of the second part, or its successors, violate or fail to fulfill any of the foregoing terms and conditions, then and immediately thereupon, the estate, and all interest given and conveyed, shall cease and determine; and the same, to wit: All interest and estate hereby given and conveyed, shall immediately revert to, and revest in said party of the first part, his heirs and assigns, without any previous entry to assert such failure or breach.

In Witness Whereof, said party of the first part hereunto sets his hand and seal, the day and year first herein above written.

JAMES LICK.

Signed, sealed and delivered in the presence of Samuel Hermann.

State of California,
City and County of San Francisco, } ss.

On this fifteenth day of February, in the year one thousand eight hundred and seventy-three, before me, Samuel Hermann, a Notary Public in and for the said city and county, duly commissioned and sworn, personally appeared James Lick, known to me to be the person whose name is subscribed to the within and foregoing document; and he, the said James Lick, acknowledged to me that he executed the same.

In Witness Whereof, I have hereunto set my hand and affixed my official seal, the day and year in this certificate first above written.

[seal.] Samuel Hermann.
Notary Public.

Recorded in the office of the County Recorder of the city and county of San Francisco, February 20th, A. D. 1873, at 15 min. past 3 P. M., in Liber 696 of Deeds, page 364.

A. R. Hynes,
County Recorder.

The President remarked that he felt incompetent at the time to express the sense of the Academy in fitting terms. The trustees, in considering the project of securing accommodations for the Academy, had never thought of exceeding an expenditure of $25,000. But this site alone, as he had been assured by competent judges, exceeded in value $100,000.

The Probable Periodicity of Rainfall.

BY GEORGE DAVIDSON.

Many attempts have been recently made to establish a periodicity of rainfall commensurate with the eleven-year period of the solar spots. In limited cases the law has appeared to prevail, but in cases as apparently reliable, the results have been adverse. In an extended series of observations of the rainfall in England, stretching through 150 years (British Association Report for 1866) no such maxima and minima could be deduced; and in a series of observations over various parts of the globe, gathered by G. J. Symons, in number 165 of *Nature*, the same want of law is manifest; in fact, where maxima of rainfall should be expected, we find minima, and *vice versa*. These tables are, however, too limited to deduce a general law therefrom. The materials are at hand for a much more comprehensive treatment of the problem.

But if there is a law in such cases isochronous with the exhibition of the sun spots, it must be qualified by other variable functions than rainfall; such as the temperature and pressure of the atmosphere, and the amount of aqueous vapor in the atmosphere, the direction and force of the winds, and the climatology, not only of the adjacent ocean, but of the sources of the great currents that cross the ocean. For example: if the rainfall of the western coast of Europe is assumed dependent upon the same causes which occasion the solar spots, the epochs of the maxima and minima rainfall would not coincide with those of the solar spots, because the precipitation of rain and the temperature of the seaboards of Ireland, Scotland, Norway, Iceland, Spitzenbergen, etc., depend upon the temperature of the Gulf Stream bathing those shores; and the waters of the Gulf of Mexico heated to a maximum at a given epoch would not reach the coast of Norway for possibly a year. The same is true of this coast; the heated waters of the great Japan stream, at their point of departure near the island of Formosa, do not reach this coast for more than a year. Thus whilst these superheated waters are delayed one year in reaching their destinations, the climatic conditions of the coasts of Norway and of California, supposed to be governed by a regular law, have been changed, and the problem is complicated and masked by these changes in the nearer effects of the climate of the adjacent continents; and in the European case, of the Polar Basin.

If there is a law of the rainfall, there will naturally be a similar law for the temperature and pressure of the air, and for the winds; but it must be complicated and masked by the influence of great ocean currents, so that the problem, instead of being simple as it first appears, is in reality very intricate.

An attempt has been made to give an eleven-year period to the cyclones in connection with the rainfall, but evidently upon insufficient data, for Mr. Meldrum only claims that a supposed periodicity has been made out. Lockyer (*Nature*, No, 163) in discussing Mr. Meldrum's records and others at Madras and the Cape of Good Hope, sees in them indications of a periodicity, but his discussion is merely tentative from insufficient materials, and is not satisfactory.

The same eleven-year period has been assigned to the seasons of great freshets in California; but we need, what we cannot obtain, absolute observations over extended areas, and not mere reports, to aid in its establishment. The statement was common in the West that the greatest freshets occur on the great rivers of the Western States about every ten years.

I have had placed in graphical order the rainfall at San Francisco for twenty-three years, from Mr. Thomas Tennent's observations, and exhibit it to show that we cannot, from it alone, predicate any periodicity. Even the well marked short period of comparatively little rainfall and of clear weather during each of our wet seasons, is masked in the averages of monthly rainfall in these years by its not occurring at any well defined epoch. But its existence is well marked and established in the illustration of the monthly rainfall from 1849 to the present.

[In the graphical illustration of the rainfall at San Francisco, the vertical black lines shown in fig. 1 indicate the inches of rainfall each year. The average annual volume of rainfall throughout twenty-three years, for each month from June to July is shown in fig. 2. The short dry period of each wet season is there shown to be marked. In fig. 3 the average monthly and annual volume of rainfall, for every month to the present year, is exhibited. This is on a scale of inches twice that of fig. 2. In this the break in the wet season of most of the years is plainly marked, but it does not occur with any regularity as to time.]

To arrive at a law of periodicity in atmospherical phenomena, will demand a comprehensive scheme of observations over a large extent of the earth and ocean; this scheme to involve all the conditions of atmospherical variations, and the local relations of each station to the whole, and be represented in graphical, rather than in numerical order.

I believe in the law of periodicity of these phenomena, but it will be found an intricate problem, and is doubtless involved with such conditions as the lunar cycle of nineteen years, etc. As stated in my paper last year, upon "Suggestion of a Cosmical Cause for the great Climatic Changes upon the Earth," we must expect abnormal exhibitions of these phenomena from the irregular exhibition of the materials burning upon the surface of the sun; but in a prolonged series of spectroscopic observations of solar phenomena, and observations of physical phenomena on the earth, we will eventually arrive at the law of their recurrence.

Dr. George Hewston called the attention of the Academy to a new species of Crustacean which had recently been detected in the bay, and which was exceedingly destructive to wood-work, more particularly the piling of the wharves along the water front of the city: specimens were exhibited under the microscope, by Dr. Hewston, who referred them to what are popularly known as "gribbles," or "Limnoria"; and to which he attached provisionally the name of *Limnoria California*.

The following amendment to Sec. 2, Art. III of the Constitution having been presented to the Trustees as required by Article VII, was submitted to the Academy and unanimously adopted:

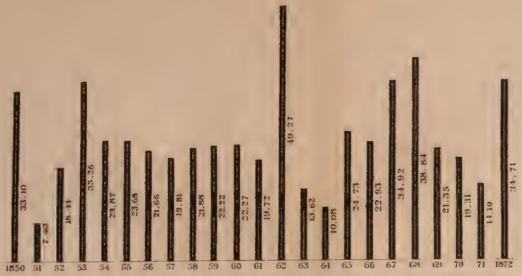

Fig. 1-Yearly Rainfall at San Francisco for 23 Years from 1849-72.

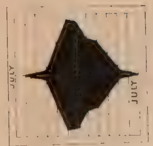

Fig 3-Average Monthly Rainfall for 23 Years 1849-72.

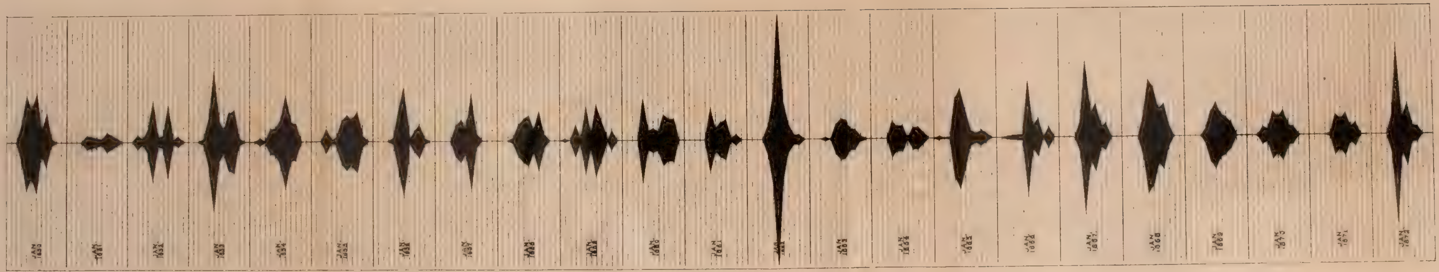

Fig 2-Monthly Rainfall at San Francisco, from 1849-72.

Lith. Britton & Rey, S.F.

"The Vice-President shall attend all meetings of the Trustees, and in case of the absence of the President shall preside at the same and be entitled to vote."

Notes on the Avi-fauna of the Aleutian Islands, from Unalashka eastward.*

BY W. H. DALL, U. S. COAST SURVEY.

The following notes were taken during the year, from October, 1871, to August, 1872, inclusive, while employed in a geographical reconnaissance among the Aleutian Islands, for the U. S. Coast Survey. The specimens have been deposited in the National Museum at Washington; and I am under obligations to Prof. S. F. Baird, of the Smithsonian Institution, for assistance in identifying the species. The nomenclature and arrangement adopted is that of the "Birds of North America," by Baird, Cassin and Lawrence, and the numbers affixed to the species are those of the catalogue of species which accompanies that work. The facts noted are an additional confirmation of the peculiarities of distribution noted by me in previous publications on the fauna and birds of Alaska; and the region visited is of peculiar interest, as being the portion of the West Coast where the Arctic Canadian fauna of the region north of the Alaskan Range, and the characteristic West Coast fauna which prevails south of that range, come together, and are to a certain extent intermingled. Among other things, I would call attention to the fact that the color of the eye in the same species of bird is not invariably the same, even in adults of the same sex, a point which has doubtless been previously noticed by ornithologists, and which my observations on several species confirm. I would remark that the region visited by my party was comprised between the Shumagins on the east and Unalashka on the west, among the islands.

Tinnunculus sparverius, Lin. (13.)

A specimen of this species was killed in Unalashka, in the fall of 1871, but was unfortunately destroyed before the skin could be preserved. It may be considered rare, as it was not noticed on any other occasion.

Aquila canadensis, Lin. (39.)

Obtained at Unga Island, in the spring of 1872, and very common throughout the islands, as far west as Unalashka. The remarks under the head of the next species will apply to this one also. The eye was orange-brown. A resident.

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* Printed in advance, February 8th, 1873.

Halaetus leucocephalus, Sav. (43.)

This species is exceedingly abundant throughout the islands, where it is found during the entire year. It builds on rocky cliffs, and is exceedingly miscellaneous in its diet, subsisting in winter principally upon ducks and ptarmigan, and in summer upon the salmon which are found around the mouths of streams, in such great abundance that the eagles have little or no difficulty in obtaining a sufficiency of food. At one time, near a salmon run in Sanborn Harbor, Nagai, I counted seventeen eagles within a hundred yards. The eyes and feet are pale yellow, and there is a considerable variation in their plumage, some individuals being much darker than others. The young are hardly able to fly before the end of the season, though hatched early in the spring. The nest is usually composed of small sticks, with a lining of dry grass, and the same nest appears to be occupied for several successive seasons. Many of these eagles were found dead during the winter, without any signs of injury or wound, too fat to have starved to death, and with no weather cold enough to have affected them injuriously. I have not been able to suggest any adequate explanation of the mystery.

Brachyotus Cassini, Brewer. (52.)

This species is not uncommon, and is a resident in Unalashka, and probably in the other islands. In those obtained, the iris was bright yellow. It builds in holes in the ground, usually on the side of a steep bank; the hole is horizontal, and the inner end usually a little higher than the aperture; lined with dry grass and feathers. Those which I examined did not exceed two feet in depth. There are no trees in Unalashka, and the species was often observed sitting on the ground near its burrow, and not unfrequently in the day-time.

Nyctea nivea, Gray. (61.)

I did not see this species living, but there were several skins or portions of skins in the village at Unalashka, used as ornaments. Mr. B. Bendel had one in his house, which he had killed himself. It is reported to be a resident.

Cinclus mexicanus, Bon. (164.)

This bird is not uncommon near the small streams in the mountains of Unalashka. It is a resident. The color of the feet varies from flesh to slate color; the eye in fresh specimens appears to be of a light brown, but soon turns black after death. Its habits here are the same as on the Yukon, as far as I was able to observe them.

Hirundo unalashkensis? Gmelin.

In June, 1872, a swallow was occasionally seen at Iliuliuk, Unalashka, which was supposed at the time to be *bicolor*, but may have been the above species. A summer visitor, and said to build.

Troglodytes hyemalis, var. *alascensis*, Baird. (273.)

A resident. Abundant on the rocky cliffs of Amaknak Island, Unalashka, where it is quite familiar and bold. It builds in the crevices of the rocks, but I was not able to find the nest. It has a cheerful and melodious note, and is, to some extent, gregarious; three or four being usually seen together. It was not seen in the Shumagins, though it may occur there. Eye black.

Leucosticte griseinucha, Bon. (323.)

This is one of the most abundant small birds of the islands, and is especially common in Unalashka, where it is a resident. On the 24th of May we found a nest, situated in a crevice of a rocky bank on the shore of Captain's Harbor, Unalashka. It was of grass, very neatly sewed together, and lined with fine grass and a few feathers. It contained five white eggs in a fresh condition, and was about twelve feet above the beach. The bird's eye is black. It was most common on the grassy banks and rocky bluffs near the shore. I do not remember ever having seen one on the higher hills or mountains. It is usually found singly, or in pairs.

Plectrophanes nivalis, Lin. (325.)

This is also a resident of Unalashka, and not uncommon, though shy and usually confined to the mountains. It is only seen near the shore when the heaviest snows of winter have entirely covered up the seeds and berries, and it is forced to find a subsistence on the beaches. It goes in large flocks, and builds on the mountains, though I did not obtain a nest. Eye black.

Passerculus sandwichensis, Baird. (333.)

When about five hundred and fifty miles from land (the Shumagins being nearest) in latitude 47° N., and longitude 152° 03′ W., one of these birds flew aboard, and being secured, lived several days in an extemporized cage. This was on the 13th of September, 1871. The wind was moderate, from the N.W., but had been blowing harder. The eye was black and the feet flesh color. It is a summer resident throughout the islands east of Unalashka, and was not uncommon there and in the Shumagins.

Zonotrichia coronata, Baird. (347.)

This bird was not uncommon in the Shumagins in summer, where it builds; but I have not heard of it at Unalashka. The eye is dark brown. Our specimens were obtained on Popoff Island, June 22, 1872.

Melospiza insignis, Baird.

This bird appears to be a resident of Unalashka, and is common at the Shumagins. It is comparatively common at the former locality, and appears to frequent the low flats and beaches along shore, exclusively. I have never observed it far inland or at any great altitude. Eye black.

Corvus carnivorus, Bartram. (423.)

Abundant around all the villages, but seldom seen far away from the habitations of man. It is half domesticated in its habits, and builds in April, on the rocky cliffs.

Pica hudsonica, Bon. (432.)

Abundant in the Shumagins, building in the alder bushes, and going as far west as they do, namely, to False or Isanotsky Pass, at the termination of Aliaska Peninsula. It is not found in Unalashka, nor on the northern shore of the peninsula. It appears to be a resident, but may migrate in winter.

Lagopus albus, Aud. (467.)

A resident from the Shumagins to Unalashka, but more confined to the mountains, and except during incubation, much shyer than in the Yukon region. In Unalashka it generally retains a few brown feathers even in winter. The nest and eggs (9) were found at Popoff Island, Shumagins, June 20, 1872, the embryos being well developed. I made inquiries in regard to *L. rupestris*, but could get no information, and do not think that species is found in the islands.

Hæmatopus niger, Pallas. (513.)

This bird is a summer visitor to the islands, and was seen both in Unalashka and the Shumagins. The eggs, partly incubated, were obtained on Range Island, Popoff Strait, Shumagins, June 23, 1872. There were two in one nest and one in another, if nest it could be called, being simply a depression in the gravel of the beach without even a straw to soften its asperities. The birds are exceedingly wary, and kept entirely out of gunshot, but were fully recognized. They utter, when disturbed, a peculiar, low whistle; which, once heard, is likely to be remembered; and they have a habit of standing on the beach or rocks a little way apart, and whistling to one another; one calling and the other answering; and keeping it up for half an hour at a time. It is one of the most peculiar birds of the region in its motions, having a grave, solemn and stilted gait, and bobbing its head up and down with every step.

Tringa (*Pelidna*) *maritima*, Brunn. (528)

Iris black. A resident. Abundant along shore throughout the year, in the islands from Unalashka to the Shumagins. Nest and eggs not observed.

Tringa crassirostris, Temm.

Breeding abundantly at the Pribyloff Islands, though previously known only from Eastern China and Japan. (H. W. Elliott, coll.)

Actodromus minutilla, Coues. (532.)

Obtained at Popoff Island, June 20, 1872. Eye black. Rather abundant along the beaches.

Charadrius virginicus, Borck. (503.)

This species was obtained June 22, 1872, at Popoff Island, Shumagins, the only instance when it was observed. Iris black.

Limosa uropygialis, Gould.

This species was obtained—a single individual—on the Chica Rocks, Akutan Pass, near Unalashka, June 2, 1872. It was not observed on any other occasion. Iris black.

Anser Gambelli, Hartl. (565.)

This species is reported as occurring incidentally in spring and fall on the islands near Unalashka, which lie on its way to and from its northern breeding grounds. We obtained no specimens.

Philacte canagica, Bann. (573.)

This species which has been reported from the Aleutian Islands, did not occur among our collections in the region visited. I was at some pains to make inquiries in regard to it, and it appeared to be unknown to the natives. Mr. B. Bendel, however, informs me that during some seasons it is very abundant on the Islands of Akhun and Unalashka, but not near the settlements.

Anas boschas, Lin. (576.)

This is one of the most abundant winter visitors among the ducks at Unalashka. It occurred in plenty as early as October 12th, 1871, and was to be found from that time until the succeeding month of April, when it migrates northward.

Nettion carolinensis, Baird. (579.)

Plenty in winter, and is said to breed occasionally in Unalashka; though the greater number of individuals migrate northward about May 1st.

Querquedula discors, Steph. (521.)

This species is doubtfully reported as occurring at Unalashka in winter. We saw nothing of it.

Mareca penelope, Bon. (586.)

Obtained at Unalashka, October 12th, 1871. Not uncommon among the ducks brought in by the native hunters of that locality. A winter visitor, migrating about May 1st.

Bucephala americana, Baird. (593.)

A winter visitor at Unalashka, migrating in the spring. Eye, pale yellow brown.

Histrionicus torquatus, Bon. (596.)

A winter visitor at Unalashka, and rather common. It remains later than most of the ducks; and some individuals may remain and breed. Also, not rare at the Shumagins in summer.

Harelda glacialis, Leach. (597.)

Eye pale brown. A resident, and quite common; exhibiting great variety in coloration of plumage, as also observed on the Yukon.

Polysticta Stelleri, Eyton. (598.)

This is one of the commonest, as it is the most beautiful, of the ducks of Unalashka. It is a resident there, and also at the Shumagins, where, however, it is much less frequently seen. Unalashka appears to be the metropolis of the species in Alaska. It is more or less gregarious in the winter season, and is to be found in small flocks, which are sometimes joined by individuals of *Somateria spectabilis*, but I have not noticed the *Polysticta* associating with any other species except the one mentioned. About the first of May, the pairing commences, and this duck is never seen with more than one companion during the breeding season. It also becomes very shy, and if the nest be visited by any one, it is forthwith abandoned—a habit I have not observed in any other duck. May 18, 1872, a nest was found on a flat portion of Amaknak Island, Unalashka. It was built between two tussocks of dry grass, and the depression was carefully lined with the same material. Above the nest the standing grass was pressed together so as to entirely conceal it, and it would have escaped notice had not the bird flown out from under our feet. The nest contained one egg, of a pale, olivaceous cast. There was no down or feathers, though these might have been added later in the season, had the nest been undisturbed.

The following variations in the color of the eye were noticed. Nov. 21, dark brown; Dec. 18, pale-brown; May 18, red-brown. The female has a very modest, brown plumage, not as much speckled as the females of the other eiders, and a bright blue spectrum on the wing. The bird was also observed in the Shumagins in March, and in the summer months.

Lampronetta Fischeri, Brandt. (599.)

This species was not killed at Unalashka, though it was observed on several occasions and reported by the natives, who distinguish perfectly the different species of eiders. It was quite rare and very shy, and but one or two individuals were observed at a time. It is a winter visitor, migrating early in May to the breeding grounds on Norton Sound.

Oidemia americana, Swains. (604.)

Eye black. Not uncommon in winter, and migrating with the other ducks in the spring. Noticed at Unalashka and the Shumagins.

Melanetta velvetina, Baird. (601.)

Iris white. Killed Oct. 27th, 1871, at Unalashka, and noticed at intervals there during the winter. It was not seen at the Shumagins, though it may occur there. A winter visitor.

Somateria spectabilis, Leach. (608)

Eye varying from pale clay brown to light warm brown. Not uncommon among the winter ducks at Unalashka, but not observed in the Shumagins.

Mergus americanus, Cassin. (611.)

Several specimens were killed, Dec. 20, at Unalashka, in the outer bay, after a norther. It does not come into the harbor, and cannot be considered as more than an accidental visitor, though reported to be common in winter near the Pribyloff Islands; not observed at the Shumagins. Eye dark. The specimens were so loaded with fat that only the heads could be preserved for identification.

Graculus violaceus, Gray. (627.)

Eye black. Common on the rocks in the outer bay at Unalashka, but seldom approaching the harbor. Gills, light flesh color below, passing into ashy gray above. This species is found in large flocks, and is very inquisitive, flying round and round about the boat when employed in sounding, uttering a shrill cry at intervals. Seen also at the Shumagins, abundantly. A resident.

Diomedea nigripes, Aud. (633*a*.)

Full notes were given on this characteristic North Pacific species, in a paper on the birds of Alaska, published by Dr. Bannister and myself, some time since. It generally joins the vessel within one hundred miles of San Francisco, and on this voyage, as on several others, it left us in Lat. 53° N. Observing its flight, I noticed that its ordinary method of sustentation when there is a breeze, consists in rising against the wind and falling with it; this being sometimes kept up for hours with hardly a stroke of the wings. It rises only against the wind, except in rare cases, when its descending momentum is sufficient to raise it slightly for a short distance, or when the reflex eddy from a high surge is strong enough to give it a slight lift. It uses its strong webbed feet to some extent in balancing itself when turning with the wind; also by extending them downward at a right angle with the body, to check its course, especially when alighting on the water. Generally, when flying, they are stretched out behind with the webs extended, and assist the bird materially in guiding itself, the tail being shorter than the extended feet. It rises by extending its wings and running against the wind over the water, until it is sufficiently raised above the water to use its wings without wetting them. Their eyesight is exceedingly acute; they can distinguish a discolored spot a yard across, in the water, from a distance of at least five miles, and even much further than our unaided eyes can see the bird itself. Its flight in calm weather consists of a series of five or six short, sharp strokes, at intervals of a second or more apart, followed by a short period of comparative quiet. They appear to subsist mainly on a pelagic crab (*Pinnotheres sp.*) and the refuse from vessels. They usually fly in flocks of six or eight, but often smaller, and on one occasion a solitary individual followed the vessel for hundreds of miles without a companion.

Another species, probably a *Diomedea*, larger than the *nigripes*, and with a large amount of white upon the plumage, spotted and streaked with brown, was observed on several occasions cast up dead and decomposed on the beaches of the island, but no fresh specimens were obtained.

Thalassidroma furcata, Gould. (640.)

This bird, though not observed anywhere at sea, was found on the Chica Rocks in the Akutan Pass near Unalashka, breeding, June 2d, 1872. The eye is black. The nests were on the edge of a steep bank, near the shore, and ten or twelve feet above it. The nest was situated in a hole or excavation, extending obliquely downward and backward from the face of the bank, and about a foot deep. It was composed only of a little dry grass or fine roots at the bottom. In two instances the parent bird was caught in the nest, alive. There was only one small white egg, perfectly fresh, though others might have been laid afterward had they remained undisturbed. The black *T. Leachii*, though often seen in the region south of Lat. 50° N., was not noticed by us in this region.

Stercorarius sp.

A species of *Stercorarius* was observed on one occasion in the month of May at Unalashka, but specimens were not obtained, nor did the natives appear to be familiar with the bird, which was probably an accidental visitor.

Larus glaucescens, Licht. (657.)

This gull is a resident of the islands wherever I have been, and is by far the most abundant and prevalent species, others being only occasionally observed. The habit of this and other species in breeding on isolated rocks and small islands, is accounted for by the immunity thus gained from the ravages of foxes on the eggs and young brood. On the 2d of June, 1872, many eggs in a pretty fresh condition were obtained on the Chica Rocks and islets in the Akutan Pass. The eggs were very abundant, more than three being rarely found together, and were laid on almost any little depression of the ground, with little or no attempt at a lining. About the 18th of July, in the Shumagins, at Coal Harbor, on a peculiar high, round island, abundance of eggs were found, but most of them pretty well incubated. In this case, the island being covered with tall, rank grass, the nests were almost concealed; and, either from the dead grass naturally occurring in the depressions, or otherwise, all of them had more or less dry grass in and about them. The gulls built solely on the top of the highest part of the island, in the grass, and never on the lower portion, near the shore, nor on the shelves of the rocky and precipitous sides. It is a resident throughout the year. The young, in down, were obtained July 16th, and the iris of these specimens, as well as the beak and feet, was nearly black. The iris of the adult bird is a clear gray, the bill chrome yellow with a red patch anteriorly, and the feet flesh color.

Rissa Kotzebui ?

This species frequents the region about the peninsula of Aliaska at all seasons, but seldom comes into the harbors except in storms. A pair came into Iliuliuk harbor, Unalashka, whenever in the winter a severe gale was blowing outside, but they were never seen at any other time. They are quite different in appearance from the next species, and from *R. brevirostris*, which is common in the Pribyloff Islands.

Rissa tridactyla, Bon. (672.)

Iris of adult dark gray, bill lemon yellow, feet black; edges of eyelids, corners of mouth and fauces, scarlet. Young in down: feet lead-color, bill and eyes black. The nest, eggs and young in down were all obtained about July 11th, 1872, at Round Island, Coal Harbor, Unga Island, Shumagins. They were also common at Delaroff Harbor, Unga, and seen at Kadiak, but not at Unalashka, or to the west of Unimak Pass. On entering Coal Harbor, Unga, we were at once struck with a peculiar white line which wound around the precipitous cliffs of Round Island, and was seen to be caused by the presence of birds; and as soon as an opportunity was afforded, I took a boat and went to the locality to examine it. The nests, in their position, were unlike anything I had ever seen before. At first it appeared as if they were fastened to the perpendicular face of the rock, but on a close examination it appeared that two parallel strata of the metamorphic sandstone of the cliffs, being harder than the rest, had weathered out, standing out from the face of the cliff from one to four inches, more or less irregularly. The nests were built where these broken ledges afforded a partial support, though extending over more than half their width. The lines of nests exactly followed the winding projections of these ledges, everywhere, giving a very singular appearance to the cliff, especially when the white birds were sitting on them. The nests were built with dry grass, agglutinated together and to the rock in some unexplained manner; perhaps by a mucus secreted by the bird for the purpose. The nests had a very shallow depression at the top, in which lay two eggs. The whole establishment had an intolerable odor of guano, and the nests were very filthy. The birds hardly moved at our approach; only those within a few yards leaving their posts. I reached up and took down two nests, one containing two young birds, and the other empty. Wind coming up, we were obliged to pull away, and the bird, which came back, lighted on the rock where her nest and young had been, with evident astonishment at the mysterious disappearance. After flying about a little, she again settled on the spot, and suddenly making up her mind that foul play on the part of some other bird had taken place, she commenced a furious assault on her nearest neighbor. As we pulled away the little fellows began to be affected by the motion of the boat, and with the most ludicrous expression of nausea, imitating as closely as a bird could do the motions and expression of a sea-sick person, they very soon deposited their dinner on the edge of the nest. It was composed of small fishes or minnows, too much disorganized to be identified. Eggs, in a moderately fresh condition, were obtained about the same time, but most of them were far advanced toward hatching.

These birds are very curious, and scouts are always seen coming from a flock of them when a boat or other unusual object approaches. These scouts very soon return to the flock if not molested, and the whole flock then proceeds to investigate the phenomenon.

They have a shrill, harsh cry, as well as a low whistle; the former being the usual expression when they are disturbed or alarmed, and the other to their young, or in communicating with each other. They leave the harbors after the young are fully fledged, and are found off shore during the winter, except in heavy storms.

At Delaroff Harbor, the nests were also attached to the sides of the bare rocks and pinnacles of scoriaceous lava, near the entrance. The irregularities which assist in supporting the nest are not disposed regularly, as at Coal Harbor, and therefore the arrangement of the nests is less uniform. The slight ledges and projections being so small as to be invisible at a short distance, the nests appear to be fastened like swallow's nests, to the perpendicular faces of the rocks, and present a remarkable and peculiar appearance.

Sterna macrura, Naum. (690.)

This beautiful little tern is abundant in the Shumagins, in some localities, and especially on a small island in Popoff Strait, called by us Range Island. Here a large number of eggs, mostly incubated, were obtained in the months of June and July. We did not notice it in Unalashka, nor were we fortunate enough to obtain the interesting species described by Prof. Baird from Kadiak, *Sterna aleutica.*

Colymbus torquatus, Brünnich. (698.)

One specimen seen dead on the beach of Simeonoff Island, the most eastern of the Shumagins, Sept. 2, 1872.

Podiceps Cooperi, Bd.

Eye with a narrow, pale yellow iris. Obtained through Mr. Bendel, at Unalashka, Dec. 14, 1871. Not common, but said to be a resident.

Mormon cirrhata, Bon. (713.)

Seen abundantly in Unalashka on the outer rocks and cliffs (where it breeds in inaccessible situations), but never in the harbor. A resident. Not seen at the Shumagins.

Mormon corniculata, Naum. (713.)

Rare at Unalashka; very common in the Shumagins, where it appears to fill the place of the last mentioned species. A resident. It breeds in holes and crevices in the cliffs of Round Island, Coal Harbor, Unga; and the eggs were obtained there, and the parent bird, though caught on them, managed to escape; though well identified. The eggs were single, one in each nest, of a mottled, rusty color, with dark spots, though we had previously supposed them to be white.

Phaleris (*Thyleramphus*) *cristatella,* Bon. (719.)

Iris white. Abundant in very large flocks outside of Captain's Bay, Unalashka, but very rarely found inside the bay except during severe storms. A resident here and at the Shumagins.

Uria californica, Bryant.

With the preceding at Unalashka, but much less common. Eye black. The remarks under *P. cristatella* will apply, except that this species was not noticed at the Shumagins.

Uria columba, Cas. (727.)

This bird was not observed at Unalashka, but was very common at the Shumagins. The eye of the adult is brown, that of the young in down, black. The feet of the young birds are also dark, and only assume the coral-red tint at maturity. It is an expert diver, very quick in its motions, and very hard to kill. The eggs were obtained June 24, 1872, at Popoff Island, Shumagins. They are two in number, and the nest is in a burrow or hole under rocks near the water's edge. Several were caught alive on their nests at Coal Harbor, Unga. The young in down were obtained there, July 16, 1872. All the eggs obtained were more or less developed. It is presumed to be a summer visitor.

Brachyrhamphus Wrangelli, Br. (733.)

Eye black. With *P. cristatella*, and quite common. Not recognized at the Shumagins, but probably abounds there.

Synthiliborhamphus antiquus, Brandt. (736.)

This species was obtained breeding, with the eggs, at the Chica Islets, Akutan Pass, near Unalashka, June 2d, 1872. They were caught sitting on their nests, which are in holes in the bank, similar to those of the petrels (*T. furcata*), previously described. There were two eggs in a nest, and in several cases the male bird was sitting on the eggs. Not recognized elsewhere, though it may be abundant.

Museum students can hardly realize the difficulty which lies in the way of obtaining the eggs, and even the birds of this family. The mormons build in most dangerous and usually inaccessible places, except when they happen to find an isolated rock or islet off the coast, which seems to promise protection, from its position. These islets are usually surrounded by breakers, and difficult of access except in unusually calm weather. There are few of the species which ever approach the more sheltered bays and harbors except when a severe gale drives them in, and then it is very difficult, even in the harbors, to go out shooting. For assistance in making my collections I am indebted to Mr. B. Bendel, Mr. B. G. MacIntyre, residents of Unalashka, and to Mr. M. W. Harrington, Capt. W. G. Hall, Mr. A. R. Hodgkins and the other members of the party, for assistance in obtaining specimens. As all my work was done in the very scanty leisure afforded by a surveying party actively engaged in the field—the hours devoted to the preparation of specimens being usually stolen from sleep—the circumstances will excuse any paucity in the results.

Regular Meeting, March 3d, 1873.

President in the Chair.

Thirty-eight members present.

John H. Carmany and Robert Robinson were elected resident members, and W. N. Lockington a corresponding member.

Dr. Kellogg submitted the following:

Descriptions of New Plants from the Pacific States.

BY A. KELLOGG, M. D.

Grindelia latifolia, Kellogg.

Stem stout, perennial branching, glabrous; radicle leaves spatulate, very large, 6 to 10 inches in length, blade 2½ to 3½ inches in breadth, decurrent into a very narrow (⅛ to ¼ of an inch) petiole, blade and petiole about equal, the latter successively shortening as the leaves ascend the stem, subcrenate serrate, obtuse on tips teeth with a callous mucro, margins scabrous, veins all decurrent nerved along the broadening midrib into the many-nerved winged petiole; cauline leaves oblong, often somewhat oblique, broader and cordate at the base, clasping often beyond the stem, many-nerved, and strongly decurrent-nerved along the stout midrib, obtuse, margins crenate, with mostly truncate teeth; 3 to 6 inches in length and 3 broad, becoming ovoid-cordate, or cordate, serrate, above; leaves of the branches also broad and obtuse, but successively diminished, serrate, clasping and more densely set, to the imbricated and clustered tips; heads large, sessile or sub-sessile; glandular and glutinous, involucre hid by a few broad, subacute, subtending, bractoid leaves; scales broadly linear acute, subulate pointed, but scarcely appendaged. Five-awned; often inserted below the crown.

The Academy is indebted to the U. S. Coast Survey for this new acquisition. Found by Mr. W. G. W. Harford, on the island of Santa Rosa. The plant is not liable to be mistaken for *inuloides*, as that is pubescent or hirsute-pubescent, and 1–3-awned, etc. *G. robusta* is more nearly allied; that has 2 (or more?) bristles — this, distinctly 5 — broadly leafy *below* the base, the subulate appendages obsolete—in both of those, conspicuously characteristic.

Lupinus sellulus, Kellogg.

Stem suffrutescent, much branched from the base, subdecumbent, the ascending stems 1 to 4 (rarely 6) inches in length, somewhat silvery-silky-pubescent throughout, chiefly below. Leaves numerous toward the base, size very variable, petioles slender, 2 to 3 inches long, leaflets 7 to 8, usually 7, oblanceolate, acute, mucronate, narrowed at the base, silvery-satiny alike above and below, ¼ to ⅓ the length of the petiole; spike 6 to 10 inches (including peduncle), rachis strict; peduncles longer than the leaves. Flowers numerous and small, purple blue, densely set, mostly scattered or subverticillate above, pedicels short; bracts subulate, hirsute, twice the length of pedicels, extending to about half the length of the lower lip, persistent; upper lip 2-cleft, $\frac{2}{3}$ the length of the usually 2-toothed lower lip; wings glabrous, oblong, obtuse; keel acute, somewhat woolly ciliate, chiefly near the dark purple apex: vexillum shorter than the wings, equalling the keel, banner shading to a white centre. Legumes hirsute, 2-seeded.

A very neat, symmetrical stool, of deep lilac blue spikes involved in dense clustered foliage of much beauty, with the aspect of an annual. Found at Donner Lake, summit of Sierra Nevada mountains, California, July 14th, 1870.

This cannot be *L. lepidus*, for that is herbaceous, without bracteoles, nor do the lips agree. It would seem nearer *L. meionanthus*, Gray., found about the same altitude (7,000 feet), and near the same region; but that has obtuse leaflet, and the calyx is without bracteoles — lips "nearly entire," while these are for the most part conspicuously cleft or toothed — *that* with an inflexed keel, with a broad, obtuse apex, *this* is very sharp, and can only be said to be erect. *L. Torreyi* has a red brown pubescence, and dense, long bracted racemes; should it even eventually prove a variety. we have as yet no adequate description of that species, to warrant the reference. Found near Lake Tahoe.

In many respects it is closely allied to *L. holocericus*, found on the islands and gravel banks of the Wahlamet, by Nutt.; but the pods of that have 3 or 4 seeds, *this*, 1 to 2; in this, the lower lip we have never found "entire," but with 2 rather cleft teeth (and rarely 3). In the remarks upon this species, of Nutt., it is stated that the upper leaflets are as long as the leaf stem (petiole).

Lupinus lacteus, Kellogg.

Stem annual, fistulous, the elongated central peduncle from a mere depressed crown, mostly solitary, spike 4 to 8 inches long, lateral radicle branches 2 to 6 inches long, with secondary clusters of leaves and (when present) shorter spikes, soft pubescent throughout, with white hairs. Leaves mostly clustered at the base, petioles membraneously expanding toward insertion and conspicuously 3-nerved, stipules adnate, subulate; leaflets 6 to 10, $\frac{1}{2}$ to 1 inch in length, or about $\frac{1}{3}$ the petiole, complicate-carinate, arcuate, spatulate, obtuse and slightly retuse, attenuate at base, sparsely appressed, pubescent above near the margins, glabrous toward the midrib, silky-pubescent beneath, colored at the point of insertion. Flowers large, white, somewhat distant, verticillate, chiefly by sixes, pedicels short, rather more than half the length of the persistent, subulate bracts; calyx ebracteolate, hirsute, scarious chiefly above, upper lip 2-cleft (rarely entire), about $\frac{1}{3}$ the length of the lower lip, lower lip straight, herbaceous, 2-toothed, about $\frac{1}{4}$ of an inch long; vexillum glabrous on the back, ciliate at the marginal junction of the claw, face marked by a row of dark oblong spots along each side of the central fold, (rarely a few scattering dots,) banner, wings and keel about equal, wings oblong, obtuse, somewhat spatulate, about equal.

margins ciliate at the base or origin of the claw; keel ciliate at the upper inside margin toward the base, acute. Legume very hirsute, 2-seeded.

In habit and general appearance this species resembles *L. brevicaulis*, but is rather more robust, the flowers much larger and not "deep blue," but quite *white;* besides, the truncate upper lip is a peculiar distinguishing feature of that species — that has bracteoles on calyx, this *none*, etc. It is closely allied to *L. Menziesii*, but the relatively shorter pedicels, and much longer petioles, and both lips lacking the "entire" character and relative proportion, would strongly tend to exclude it; admitting *L. densiflorus* to be the same as *L. Menziesii*, "with variations," it would then bring us a "*dense*, subsessile spike," an *emarginate* upper lip, and 3-*toothed lower one*, with which to contend. If these and many more varieties prove ultimately to run into one, it is not our fault; as the literature now stands, we are obliged, in self-defence, to set it apart, when called upon for determinations. Specimens collected by Mr. S. Brannan, Jr., on Oak Creek hillsides, Kern county, 14 miles from Tejon Pass.

Lupinus luteolus, Kellogg.

Stem 1–2 feet high, suffruticose, glabrous below, bark light creamy hue, satiny fibrous; minutely pubescent above, upright, flexuous and numerously branched towards the top, forming a very symmetrical, rather wheel-shaped cone; clothed with minute villi of white hairs. Leaflets about 8, oblanceolate, abruptly acute, attenuate at base, about ½ the length of the petiole, silky above and below; stipules setaceous, ¼ of an inch or more in length, adnate pubescent with longer hairs. Flowers light yellow, verticillate on short, stout pedicels, in a densely crowded spike 6 to 12 inches in length, the central terminal one straight and longest, those of the branches slightly incurved; bracts persistent, subulate, silky pubescent, mostly somewhat reflexed with the points ascending, as long, or extended beyond the lower lip of the calyx; calyx-tube scarious, very short and widely gaping, 2-bracteolate, bracts setaceous, ½ the length of the upper lip; upper lip ovate-lanceolate acute entire; lower lip herbaceous, 3-toothed, slightly deflexed and sub-saccated at the junction of the scarious portion, hirsute throughout. Banner glabrous, wings broad and somewhat inflated, glabrous, with scarcely a few hairs on the margins at the base; keel acute villous on the margins above at the lower third. Legumes very villous, 2-seeded.

Found on the Coast range of mountains, near Senal, Mendocino County, Cal., 1872.

This species does not seem likely to be confounded with any other in California. Few species in the *genus* have the *entire upper lip*. Donn describes *L. Sabinii* (a yellow Lupin of similar habit) *thus:* But that is described by all authors accessible to me, as *without bracteoles to the calyx*. Hooker says that has "*acuminate*" leaflets—*yellow* silkiness, and that the bracts are "*deciduous*," whereas, these are *persistent;* nor has our plant the upper lip "*bified*," as some describe it; besides, this is 2-*bracteolate*, a fact that cannot be overlooked; nor have these specimens "elongated" pedicels, etc. It does not even rank in the same section. One of the most beautiful Lupins known to us.

Stephanomeria (?) *intermedia*, Kellogg.

Stems caulescent, one to four or more, from a fusiform perennial root (crowned by membranous relics of former radicle leaves), simple, or branches alternate, loosely erect, somewhat canescent pubescent, or puberulent, chiefly below; or sub-glabrous and glaucous, ½ to 1 foot high. Leaves variable; radicle ones lanceolate acute or acuminate, pinnatifid or laciniate toothed; lobes linear, acuminate; or in one variety entire; triplinerved or pseudo-triplinerved, blade decurrent into a long, slender winged petiole, 3-nerved at the base; cauline leaves at the 1st and 2d bifurcations on short petioles, 4th sessile sub-acute or obtuse, and the last on the terminal peduncle—when present—often scale-like or bractoid; peduncles axillary and terminal, mostly naked, long and slender; flowers large (for the genus) yellow, nodding before expansion; involucre ½ to ¾ of an inch in length, proper scales 7 to 9 in 2-series, herbaceous tips weak, waved acuminate, scarcely a little ciliate, membranaceous and finely nerved below; the short calyculate scales 6 to 11, in about 3 sub-series; florets 9 to 20 or more; ligules about ½ an inch in length, or ¼ of an inch longer than the exserted style and stamen-tube; achenia short truncate, scarce at all narrowed at the summit, glabrous, striæ very minute or obsolete, color dark brown, pappus *white*, of 20 plumose bristles, slightly thickening below and expanded into a broad hyaline base.

Two varieties are seen—one with more simple stem, smooth green and glaucous hue, leaves entire, rather smaller heads, fewer scales, florets, etc., appears to be a form with little else than reduced number of parts. Found by Mr. S. Brannan, Jr., myself, and Prof. Bolander, at Cisco, June, 1870. It was presumed to be *Crepis glauca*—by examination we find that it has neither the scabrous pappus, nor receptacle of crepis; but both the plumose pappus and favose or scrobiculate receptacle of *Stephanomeria*, although not agreeing in all points of the genus—as, *e. g.*, the "strongly 5-angled or 5-grooved achenia," yet it is thought best to place a plant of such doubtful character provisionally here, in company with *S.* (?) *chicoracea*, (See Proceedings American Academy of Arts and Sciences, May 30th, 1865, p. 552–3 of Prof. Gray), not doubting that it will ultimately form a new genus, or serve to revise those already existing. That it cannot be an *Apargedium*, as at present constituted, is evident, because it has not the "barbellate-denticutate capillary bristles * * * scarcely thickened downwards and *brownish*." This plant has also a proper stem, and not a "scape."

Pentstemon—Kingii var. *glauca*, Kellogg.

Plant glaucous throughout, and puberulent, not glandular; leaves obscurely 3-nerved and triplinerved above, mucronate apex recurved, decurrent winged petioles connate-clasping; anthers quite entire on the margins.

Found near the summit of Sierra Nevada Mts., July 10th, 1870.

Garrya Veatchii, Kellogg.

Shrubby, leaves thick, coriaceous, oblong or sub-ovate acute, mucronate, margins revolute, subentire, or obsoletely denticulate (?), upper surface sub-glabrous, often slightly frosted, hoary with short stellar wool, or shining minutely shagreened surface; beneath densely white lanose, 1½ to 2 inches long, ½ to ¾ of an inch broad, petioles short (1-7 to 1-8 the length of the blade). Young branches hoary. Fruit sessile on the rachis, in crowded, simple or compound racemes, densely lanuginous, 1½ to 3 inches in length; bracts subulate, apex elongated, but shorter than the fruit; male flowers not seen.

Collected by the late Dr. John A. Veatch, on Cerros Island, about 1858 or '9.

The President announced to the Academy that the recent donation of a valuable building site by James Lick had been promptly acknowledged by the Board of Trustees, and the following minute of proceedings, appropriately engrossed and framed, had been presented personally to Mr. Lick, accompanied by a letter from the President:

"At a special meeting of the Trustees of the California Academy of Sciences, held at their rooms February 18th, A.D. 1873, to take action upon the deed of property made by James Lick, of the county of Santa Clara, the following expression of the sentiments of the Academy was adopted.

"The unexpected and unsolicited gift of our fellow-member, James Lick, to the California Academy of Sciences, is so far beyond our sanguine expectations, that we cannot express to him in adequate words our heartfelt thanks for this maturely considered and munificent act.

"It emulates the richest bequests of Europe and the United States for assisting the pursuit of knowledge, and places every devotee of science throughout the world, and for all time, under the deepest obligations to the donor.

"The California Academy of Sciences accepts the deed with its conditions, and every member will strive to prove by his unremitting efforts to fulfill them, that the desire of James Lick 'to promote the diffusion of science' is deeply appreciated. Having struggled unaided, but hopefully, for twenty years in the cause of science on this coast, the members of the Academy are inspired with renewed faith in their efforts, and believe there is an awakened thirst for scientific research and knowledge, which will prompt our citizens to emulate the noble example of James Lick.

"The Trustees in a body will wait upon our benefactor to present these sentiments, and to offer the sincere thanks of the Academy for this exhibition of his munificent liberality, with the assurance of the personal efforts of every member to faithfully endeavor to carry out his wishes in the spirit in which they are made.

"George Davidson, President; John Hewston, Jr., Vice-President; Charles G. Yale, Secretary; Elisha Brooks, Treasurer; Robert E. C. Stearns, Oliver Eldridge, Thos. P. Madden, David D. Colton, Trustees."

The President, in remarking upon the subject of Mr. Lick's gift to the Academy, mentioned the sum of $200,000 as being needed to erect a suitable building, and to maintain the same when completed; and expressed the hope that the necessary amount can be obtained by the time specified in Mr. Lick's deed.

Dr. Hewston referred to a parasite in a *Haliotis* shell, from Pigeon Point, which had a specimen of the officinal sponge attached to it.

Prof. Davidson, in referring to a paper read at a previous meeting by Dr. Willey, on the gravels of Placer County, said that the writer thought that it was not the water alone that caused the gravel. Prof. Davidson thought that the occasional overflows of tufaceous lava had blocked the river and caused new channels, which were again similarly blocked, and opened; or that glacial action had aided the water in causing such large deposits of "cement" and partially worn gravel. A chemical analysis was needed to determine the nature of the "cement."

Dr. Willey said he meant it was not by water alone, but spoke of the immense deposits, and could not see that the ancient river system was so clearly marked out as was supposed. He was at a loss to tell how the cement could be formed by the mere action of rivers. Mr. Hanks had examined the cement and found that it contained the elements of granite. A reason of its formation might be found in glacial action. Another point he noticed was, the total disappearance of everything but quartz in that part of the country. The cement may possibly represent the pulverized granite. Many forces had been at work.

Prof. Davidson thought that if the cement should prove to be decomposed quartz, we could account for it by glacial action; but how can we account for the great abundance of rounded pebbles? Prof. Whitney's determinations of the elevations of the different gravel deposits above the American, and other rivers, had been plotted in sections, and exhibited an almost identical slope for the ancient river beds with that of the present beds of the American, and other rivers; although the positions of the last were from 1,200 to 1,500 feet below the former.

The President, for Mr. F. E. Durand, read a paper (translation from the Archives Neérlandaises of Harlem, by H. Vogelsang and

H. Geissler) "On the Nature of Liquids contained in some mineral substances."

A communication was received in reference to *Manna* and *Honey-Dew*, based upon the observations of Mr. John Applegarth, a farmer, long resident in the San Joaquin Valley. Specimens of honey-comb taken from the hives on his ranch near Woodbridge, were submitted. Mr. Applegarth being interested in subjects of this nature, has collected much information in regard to manna and honey-dew, which occurs at certain seasons in the region above-named. The appearance of manna is comparatively rare, as he mentions detecting it twice only—the fall of 1861 or 1862, and at the same season, 1872—both of these periods are coincident with and following summers of abundant verdure; these fertile summers were consequent to wet seasons after long continued drouths. The manna was discovered early in the mornings of the first cool weather in the fall, and covers the foliage and fences somewhat like frost—in the form of small, roundish, whitish grains or particles, quite sweet to the taste, and altogether agreeing with the description in Exodus, and in the writings of Josephus, of the manna upon which the Israelites subsisted during their sojourn in the wilderness; the honey-dew closely resembles that described by Josephus, even including the latter's remarks on honey-dew, which he says Moses found on his hands, and so described its nature, on the occasion of its descent on the Jewish host.

The honey-dew never fails to come in the early fall, covering the leaves and foliage of shrubs and trees with a thick, viscid, sticky substance, which soils the clothes and adheres to the hands and face, in passing through the thickets; it is sweetish, of a ranker taste, and not so agreeable as the manna.

The bees, however, busily collect both, and the comb-cells are found filled with both substances, at the close of the season. The honey-dew and manna, however, are never found in the same cells, but only in groups or patches (of cells), interspersed together in the combs.

In this connection, the idea that prevails among the farmers as to the origin of the honey-dew is not without interest; they account for it on the supposition that it arises from the sweet aroma of the countless wild-flowers which cover not only the plains, but the hills and valleys of the adjacent mountains; said aroma being carried up by the rarified atmosphere, and condensed in the fall by the evening dews; the manna they think may be the pollen of flowers, and carried to the localities where it is found by the wind; not considering the fact that the manna occurs whether there is wind or not; and that it is altogether different in its essential features, such as weight, solubility, etc. It seems impossible, when its abundance is considered, and the wide area over which it is spread, that it could be deposited or caused by insects, as is generally believed.

Mr. Lorquin gave a description of a species of California vulture, recently captured by him. It differs from those described in the Pacific Railroad Reports and other works, having down upon its neck, instead of the neck being bare. The specimen measured nine feet ten inches, from tip to tip.

Regular Meeting, March 17th, 1873.

Vice-President in the Chair.

Thirty members present.

R. B. Irwin, J. H. Blumenberg, John J. Haley, A. B. Forbes, John F. Miller, J. A. W. Lundborg, M. D., I. C. Woods, S. D. Field, J. H. Smyth, O. P. Evans, W. A. Aldrich, Jacob Best, Michael Deering, A. W. Von Schmidt, Jourdan W. Roper, J. D. Howell and Laurence Kilgour were elected resident members.

James T. Boyd, Richard H. McDonald, M. D., Louis Sloss, William B. Hooper, F. Locan, F. E. Wilke, E. E. Eyre, Mark L. McDonald, Coll Dean, Horace L. Hill and E. J. De Sta. Marina were elected life members.

W. Lindeman, Phil. D., Otto Finsch, Phil. D. of Bremen, Germany, and Alexander Willard, U. S. Consul, Guaymas, Mexico, were elected corresponding members.

Donations to Museum: Egg of *Emeu*, from Australia, by W. N.

Fisher; specimen of a worm drawn from the pipes of the Spring Valley Water Company, by A. Gros.

Mr. S. C. Hastings stated, in correction of remarks made by him at a previous meeting, that he intended to say with emphasis, that he would unite with other gentlemen and be one of twenty, to raise the sum of $200,000 for building purposes, and that in pursuance of his proposition, he had placed his funds ($10,000) in the hands of one of the trustees on the terms proposed.

Descriptions of New Plants from the Pacific States.

BY A. KELLOGG, M. D.

Hesperochiron latifolia, Kellogg.

Root perennial, fusiform, fleshy, simple (or rarely subterraneously branched, 1–2 inches below the surface), leaves radicle, somewhat rosulate-clustered from the crown, ovate, obtuse, or ovate-oblong, sub-acute; blade cuneate and decurrent into a rather slender, slightly margined petiole, somewhat expanded at the base, 3 to 5-nerved, sub-glabrous, except near the hirsute and ciliate margins, and often along the petioles, more or less glandular above and below, or throughout, entire, or slightly repand sub-dentate, matured or fully developed petioles about as long as the blade (leaves 1 to 3 inches long, and ¼ to 1 inch broad); peduncles or pseudo-scapes, numerous (½ to 2 inches long), shorter than the leaves, compressed or sub-ancipital, nerved, chiefly hirsute along the edges, naked, or a single (reduced petiolate linear-lanceolate) leaf attached near the base or on the lower third; calyx deeply 5-parted, united from the adherent neck of the capsule into a broadly obconic base, unequal in width; base oblique, imbricate, 1 to 3 outer much larger, (at least twice the width of the inner) ovate sub-obtuse; 2 to 3 inner segments, oblong-ovate sub-acute, sub-pubescent on the back, united base often hirsute, pubescent within, nerved, margins ciliate, apex rather hispid; corolla large, broadly tubular-funnel-form or narrowly campanulate, border 5-lobed, lobes oblong-oval, often sub-acute (purplish-veined); corolla (sometimes somewhat irregular, but scarcely sub-labiate, whitish or pale bluish) longer than the calyx; stamens 5, unequal, filaments flattened (purplish) longer than the style, attenuated upwards, glabrous above, hirsute at the base together with the base of the tube; anthers introrse, oval, etc. Styles two, united or confluent below, (deeply 2-parted?) stigmas depressed-capitate, often slightly hirsute, (rarely obtuse and glabrous, and still more rarely with a 3-lobed style); capsule ovoid, or ovoid-oblong acute, apex hirsute, base obscurely glandular-2-valved, 2-celled, loculicidally dehiscent 20 or more seeded, seeds obovate, somewhat angled, papillose, and slightly crested at the hilum.

Found on the alluvial banks of the Yuba River, subject to annual overflows, damp, sandy and grassy plats at Cisco, C. P. R. R., Sierra Nevada Mountains, at an altitude of 6,000 feet. Flowers sometimes purplish blue. June 19th, 1870, Kellogg.

Our reasons for making a distinct species from *H. Californicum* are, that the flowers are much larger — stigmas capitate — distinct leaves — two-edged peduncle often leafy—glandular character throughout, and calyx segments 2 to 4 times the size of Watson's species.

Henchera rubescens—Torr. var. *glandulosa*, Kellogg.

Suffruticose base, scapes nearly naked or 1 to 3 subscarious hispid and ciliate scales of about 3 subulate setaceous lobes, middle lobe longest, bracts mostly similar, uppermost simply setaceous, shorter than the pedicels, a few scattered glandular hairs below, stipitate glandular chiefly above; leaves sparsely hirsute throughout, subcordate, subacute, slightly 5 to 7-lobed, unequally cut-dentate, setosely-mucronate, teeth acute; margin cilliate, petiole more hirsute with white spreading hairs, rather longer than the blades; panicle narrow, loosely many-flowered, somewhat secund, (?); calyx obconically campanulate, lobes erect, about equal, subspatulate, oblong, obtuse, as long as the tube, densely stipitate-glandular (a few long white hairs intermixed) colored, petals very narrow, linear-lanceolate, recurved, unginculate by a long, very fine filliform claw, longer than the genitals, stamens and styles exserted, filaments subulate, anthers roundish (colored), styles divergent, about the length of the stamens, immature ovules smooth?

Collected on Stanford Peak, C. P. R. R., at an altitude of 10,000 feet—July 29th, 1870.

Gnaphalium Nevadense, Kellogg.

Stem perennial, from a creeping rhizome, erect or somewhat ascending by the leading floral shoot, cluster branched at the base, barren branches secondarily clustered about 1 inch from above the crown, arenose-sating throughout; leaves below, and on the terminal tufts of barren branches spatulate, or subacute, mucronate 2–3-nerved, densely arachnoid-tomentose above and below, leaves of the scapoid or proper leading stem linear, acute, mucronate; 3 to 4 reduced bractoid leaflets at the base of the capitate crowded corymb; heads subsessile or on short pedicels; involucral scales oblong spatulate, obtuse, mostly lacerate-dentate, or sub-entire, exterior lanose-tomentose, somewhat herbaceous below; interior oblong scarious pink-tinged; pappus longer than the involucre and flowers, dense capillary very soft, white; achenia sub-glabrous, compressed.

It is thought that it cannot be the common G. *purpureum*, as it has no "axillary flowers," nor leaves "tomentose" only underneath, nor are the leaves at all "undulate," and by no means "obtuse," "green above," "racemose," or "spicate"—indeed, the achenia seems to be rather glabrous; if so considered, the description requires much amendment.

Œnothera quadrilvulnera, var. *hirsuta*, Kellogg.

Stem ascending, much branched above, shreddy fibrous bark splitting and exfoliating into thin papery lamina, short, somewhat appressed canescent pubescent toward the top and branches ; leaves on very short petioles or subsessile, entire (rarely dentate) ; calyx densely canescent hirsute; capsules very densely canescent hirsute, with rather long hairs ; stigma purple, also the tips of the four shorter filaments.

Found by Mr. W. G. W. Harford, at Petaluma, June 7th, 1870.

Gilia capillare, Kellogg.

Stem annual, subsetiform, 2 to 3 inches high, simple, erect, or branching and somewhat flexuous, stipitate-glandular throughout, slightly viscid ; leaves linear-lanceolate entire, or incisely lobed, oftener filiform, opposite below, alternate above, about ½ to 1 inch long, ¼ of a line wide. Flowers solitary, axillary and terminal, white ; pedicels very slender, short (or rarely twice the length of the calyx) funnel-form, nerved, 5-lobed, lobes ovate, subacute, entire ; filaments slightly shorter than the limb, inserted at the sinuses, anthers roundish (verditer blue), stigmatic lobes closed (?) ; calyx lobes subulate, about equal the proper glandular tube of the corolla, or half the length of the flower, and scarcely longer than the obconic calyx tube. Capsule glabrous, ovate, 4-seeded (2 in each cell), seeds elliptic-oval, membranous-margined, without spiracles or mucilage.

Found at Cisco, C. P. R. R., Sierra Nevada mountains, July 6th, 1870.

Hymenopappus Nevadensis, Kellogg.

Root perennial, caudex thick and branching, crowns often produced from a half an inch to an inch or so ; leaves clustered, and either radicle or subradicle, woolly-canescent, sparingly glandular, pinnatifid, rachis and petiole alike in breadth, equal in length, lobes spatulate, sub-lobed, toothed or entire ; scapes 1–2 inches high, short-canescent-pubescent and stipitate-glandular, naked or leafy at the base, 1-flowered ; heads large, cylindrical-campanulate, scales of involucre in 2-series, appressed, herbaceous, linear-oblanceolate, or narrowing toward the base, subacute or obtuse, sub-canescent-pubescent and glandular on the back, margin ciliate with frosty hairs and stipitate glands, tips lanuginous tufted, (half an inch in length or) shorter than the (yellow) florets, 10–14 ; receptacle naked, scrobiculate ; achenia somewhat linear, compressed, sub-quadrangular, tapering to the base, striate, hirsute, apex not dilated, nor base constricted, (⅜ of an inch long), somewhat callous but no stipe, about 20 ; pappus scales 13, obtuse, somewhat spatulate, nerveless, equal, margins denticulate, chiefly toothed at the top, or emarginate with 2 conspicuous teeth, shorter than the achenia ; florets of nearly uniform size, scarcely a little contracted below into the proper tube, sparsely hirsute and stipitate-glandular, 5-toothed, border revolute, teeth bearded on the back, branches of the style often unequal, revolute and with the stamens exsert, tipped with a short cone, obtuse, or one branch with a long, slender, filiform, hirsute acumination.

This plant is at variance with this and the allied genera—as is too often the case—but so closely allied to *Chænactis* it seems a pity to exclude it, yet it has no rays ; and scales of the involucre only about half the required number ; the receptacle also is not "alveolate" but scrobiculate.

The strange combination of a *Chænactis* stigmatic appendage on one branch of the style, and Hymenopappus on the other, of the self-same style, occurs so often that it is truly puzzling to the student. It should also be noted, that the pappus is scarcely more than half the length of the achenium.

On the other hand, as H., the achenia should be turbinated and contracted into a stipe. It does not, therefore, exactly tally with the generic description of H.; besides, the scales of the involucre are not (white) or petaloid, but strictly herbaceous. Having indicated its characteristics, it may repose provisionally here.

Macrorhynchus Harfordii, Kellogg.

Scapes wooly when young, more or less deciduous with age, or dispersed in growth, naked, or an occasional leaf upon the scape, several from a perennial, fusiform root, 12 to 18 inches high, a single large yellow flower, ligules often purplish on the back; fistulous, striate, subglabrous or sparsely pubescent, somewhat woolly at the base and summit. Leaves oblanceolate, subacute or obtuse, nerved and pseudo-triplinerved or twice triplinerved, nerves decurrent along the broad midrib, tapering into a long, winged petiole, more or less pubescent, ciliate more conspicuously near the base, pinnatifid, lobes short, remote, the very open sinuses often with a few intermediate teeth, about half the length of the scape—terminal lobe short, subacute or obtuse; scales of the involucre nerved, oblong-oblanceolate or sublanceolate, acute, entire, hirsute, and minutely glandular on the back, pubescent within above, outer herbaceous calyculate scales none, or rare; inner subscarious series linear lance-pointed, pubescent on the back toward the tip, margins and lower portion scarious, nerved, equalling the discoid pappus. Achenia obcompressed, lanceolate, apex acuminate, as long as the setiform beak, 8 or 9 obtuse ribs, deeply striate-sulcate, creamy white; persistent capillary pappus somewhat tawny, as long or longer than the stipe, outer and inner seeds similar and alike fertile. Receptacle alveolate, naked.

Found by Mr. W. G. W. Harford, at Petaluma, May 21st, 1870.

If this be supposed to be allied to *heterophyllus*, it must be remembered *that* is an annual plant, of dwarf habit, with a scape scarcely longer than the leaves, with an achenia undulate winged, and $\frac{1}{3}$ the length of the filiform beak; a plant 4 or 5 inches high, slender, etc.

Macrorhynchus angustifolius, Kellogg.

Scape wooly-pubescent with articulated hairs, chiefly at the base and summit, erect or ascending, from a perennial slenderly fusiform root, 10 to 12 inches high, head cylindraceous, (slightly expanding in the dawn of sunny days,) rachis and lobes somewhat linear-attenuated, retrorsely-pinnatifid with deep broad rather uniform sinuses, lobes linear-lanceolate entire, commonly curved with an ascending sweep, lobes tipped with a (purplish) callous, or pseudo-gland, petioles slender, and like the base and summit of the scape wooly, mostly glabrous above, terminal lobe long (2 to 3 inches, or longer than the petiole), linear-attenuated; involucral scales acute, or sub-acute, the exterior foliaceous series short, half as long as the 2 or 3 inner sub-scarious series, lanceolate, or rarely ovate-lanceolate, glabrous, canescent ciliate with articulated hairs; interior linear-lanceolate, acuminate, ⅓ longer than the pappus, obscurely herbaceous above, about 1 inch in length; receptacle alveolate, naked; achenia oblong, obcompressed, cuneate, glabrous and obscurely ribbed, the upper broader end abruptly narrowed into a (purplish) beak, scarcely longer than the achenium (or about 1 line); pappus of soft finely attenuate hairs equal or unequal, outer series successively shorter, inner nearly ½ an inch in length; florets with a long filiform tube often longer than the ligule, hirsute chiefly at the point of expansion. Flowers yellow. Mature achenia not seen.

Found at Cisco, C. P. R. R., Sierra Nevada Mts., at an altitude of about 6,000 feet, by Kellogg and S. Brannan, Jr., May 19th, 1870.

Probably most nearly allied to *M. retrorsus*, but in that the beak is "more than thrice the length of the achenium," or "¾ of an inch long"—a stouter plant than this every way. It also combines some of the characteristics of *M. humilis;* but that has entirely "hirsute" scales which are also "obtuse"; and a beak "more than twice as long as the achenium"—or "thrice," which would make that species *M. Lessingii;* but that is said to have a caducous pappus, etc., consimular scales, elongated ligules, etc.

Calais gracililoba, Kellogg.

Stems several from the same fusiform perennial root, branching, flexuous, puberulent and pearly-glandular throughout, few to many long axillary 1 flowered peduncles, with usually one or two simple linear-bractoid leaves, flowers nodding before expansion; radicle leaves with a linear-lanceolate narrowed rachis, very openly pinnatifid, or sub-bipinnatifid, lobes long and slender, sub-filiform, these again irregularly sub-lobed, the terminal one much attenuated (3 to 4 inches long), membranous expanded base sheathing, (about 6 inches in length, lobes 2 to 4 inches long); cauline leaves similar, upper and terminal lobes relatively longer; involucre cylindrical, scales in 3-series, bractoid scales ovate-acuminate 6—second or middle bractoid series 6, twice the length of the first or 2 to 3 lines, the proper involucral scales 8 to 12 in a double row, thrice the length of the last, lanceolate oblong acuminate, 7 to 9-nerved, short pubescent on both surfaces, chiefly on the back above, hairs black, margins scarious, ciliate; all minutely glandular on the back; achenia, somewhat obtusely 10-ribbed, very minutely scabrous, sub-villous near the crown, not at all rostrate, base short-attenuate terete (23 or 4); pappus of 9 to 20 or more minute lance-linear entire scarious chaff, plumose awned from between the minutely bifid or toothed apex — pappus longer than the achenia — plume 8 or 9 times longer than scarious chaffy portion, slightly united into an extremely narrow ring at the lowermost base, requiring a little force to detach them; receptacle alveolate. Flowers pale yellow.

Found near Cahto, Long Valley, on Dry Creek banks, May 27th, 1869, Mendocino Co., Cal.

Probably a rare plant in that vicinity, as we have since searched diligently in order to obtain a supply for exchanges: it was recognized as new at the time, and then diligent search was made, but only three specimens obtained.

Calycadenia plumosa, Kellogg.

Stem annual, 2 to 3 feet high, bark creamy-white, villous and setose-scabrously hispid, fastigiately panniculate at the top, heads small ($\frac{1}{4}$ of an inch in diameter) densely set on subracemose erect pseudo-simple branches, subsessile or sessile, subtended by numerous imbricated or crowded very minute leaves, or bractoid leaves (1 to 2 lines long), oblong or subspatulate, margins revolute, back margins, and apex above, hispid and glandular, a few large stipitate cup-shaped glands chiefly at the apex, always tipped with a similar gland. (The dry fragile proper cauline leaves at the base of the branches crumbled and lost.) Involucral scales (about 9), setose and scabrously hispid with white hairs, a few large cup-headed stipitate glands intermixed on the back mostly above; rays 7 to — (?), ligule broadly expanded, 3-lobed cuneate base attenuate to a slender hirsute and glandular tube; gray achenia obovoid attenuate towards the substipitate incurved base, obcompressed and obscurely triangular, grooved longitudinally, or about 10-angled, hirsute in lines, or along upon the ridges, gibbous above on the back, or oblique at the apex; chaff between the ray and disk flowers united nearly to the top into a 9-fold cup, acute hirsute on the back above, about 2 large stipitate cup-shaped glands at the summit; central disk achenia many (about 11) linear-oblong somewhat obcompressed, hirsute, 7-nerved; pappus of about 20, rather strong plumose seta in a simple series, gradually thickening from apex to base and slightly adherent in a ring at the point of insertion; disk florets (yellow), tube glabrous, sparsely pubescent above, 5-toothed; teeth erect, acute, stipitate-glandular on the margins, pistils included in the purplish stamen tube, or exsert, lobes erect spreading.

Receptacle flattish (but at maturity the accessories are deciduous, leaving it free to inspection, and in drying becomes convex), areolate and pseudo-pitted, the achenia being imbedded in the densely *villous* disk. Flowers yellow.

A plant sent to us from Stockton, by Express—friend and collector unknown, being absent in Mendocino Co. at that time: have learned nothing further.

Bahia cuneata, Kellogg.

Stem suffrutescent, decumbent, with numerous annual erect shoots and final ascending apex, white arenose-tomentose, also somewhat floccose throughout. Leaves opposite, cuneate-oblong, lower somewhat trilobed, lobes mostly dentate, 3-nerved; above and on the younger branches often simply tridentate, or more or less toothed at the top or upper third; uppermost alternate, base entire, tapering into a clasping petiole, rarely (1 or 2 in 200 or 300) palmately trilobed below the panicle, segments acute, more densely white lanose beneath. Peduncles rarely naked, comparatively stout (or about the size of the stem), 1 to 4 inches in length, more subarachnoid, 2 to 4 times the length of the leaves; involucre campanulate, scales in 2-series, ovate-oblong, acute or subacute, 8 or 9, equalling the rays, rays oblong-ovate, half an inch or more in length, orange yellow. Receptacle alveolate, not at all fimbrillate (margins of alveoli being quite entire); ray achenia minutely subvillous at the angles above, or subglabrous, scales of pappus about 5, very short, acute, finely and deeply laciniate toothed, its ligule cilliate at the base, glandular; disk achenia very slightly villous upwards on the angles, chaff about 7 to 10, mostly acute, deeply laciniated, with very unequal sharp teeth, florets viscidly hirsute below, glandular above.

Found at Cisco, C. P. R. R., Sierra Nevada mountains, in January, 1870, by Kellogg and Brannan.

This Bahia seems nearest allied to an unknown or not sufficiently verified species, described by Nuttall, the *B. oppositifolia.* We have not been able to ascertain whether this is an annual or perennial — this point of comparison, therefore, must be waived. In this specimen, out of several hundred leaves, we find only *two* "palmately trilobed," and in these, the lobes are not "*obtuse*," "ligulate," etc., but *lanceolate*, and the middle lobe of *one*, *dentate*, as in the normal foliage; the peduncles are not "filiform," nor "*scarcely longer than the leaves*," the involucre of our plant is not even *cylindrical*, much less "oblong cylindrical," nor are the rays "*very* short"; these heads are strictly campanulate, as we approach the central and more perfect parts, the minute chaff of the seed is exceedingly *lacerate and acute;* finally, the plant has no special bitterness, to speak of. I have not been able to find any other species that so nearly approaches it as this, that would seem to require a further comparison.

Crepis occidentalis, var. *subacaulis*, Kellogg.

Leaves chiefly radicle, about the length of the perennial scapoid stem (3 to 4 inches high), simple (?) hirsute with scattering hairs, and short canescent pubescence, bearing a single head; leaves deeply pinnatifid, lobes toothed, points tipped with short, sharp, subspinous, corneous mucros, petioles about ⅓ the length of the blade, ⅓ cauline, the uppermost a sessile rudiment; involucre of 6 or 7 short, calyculate, appressed, lance-subulate scales, interior of 13 linear-lanceolate acuminate scales, margins scarious, nerved, canescent pubescent, tips hirsute; receptacle subalveolate chiefly at the margin; achenia 9 to 10-ribbed, tapering about equally to both ends, scarcely a little constricted or subrostrate, base slightly callous, outer fertile achenia about equal to the pappus, inner central shorter.

Found on the high peaks at Cisco, C. P. R. R., Sierra Nevada mountains, about 7,000 feet, June 27th, 1870, by Mr. S. Brannan, Jr., and myself.

This may prove to be a var. of *Nevadensis*, mostly with fewer parts and depauperate influences, owing to habitat.

Crepis occidentalis, var. *Nevadensis*, Kellogg.

Stem perennial, dwarfish, branching, panniculate-corymbose, canescent-floccose throughout; radicle leaves runcinate-pinnatifid or pinnatifid, deeply lobed, irregularly sub-lobed or toothed, teeth mucronate, consimilar rachis and petiole nerved, the margined petiole undulate near the expanded base, half the length of the blade (1–2 inches), cauline successively reduced. Involucre cylindrical, with a somewhat swelled base, the very short calyculate series (7), subulate from a broad base; interior (13) proper scales linear-lanceolate acuminate, foliaceous with scarious margins, sub-ciliate, canescent-pubescent, scarcely equal to the pappus disk. Receptacle sub-alveolate, naked: achenia compressed, 9 to 10-ribbed, pappus scarcely a little thickened at the base, rigid, *shorter than the achenium; achenia* very minutely hirsutish and serrulate scabrous upwards, about 30, gradually tapering upwards, but not rostrate. Flowers persistently yellow, floret tubes glandular, peduncles 3 to 5, 1–3 inches long, often with a minute bractoid leaflet, or sub-naked from the axils of leaves. Plant about a span high.

Found at the summit of Sierra Nevada mountains, June 16th, 1870. Altitude 7,000 or 8,000 feet.

This plant varies from the generic description of *Crepis*, for the inner proper scales are not in a simple series, but *double;* this is unimportant compared with the receptacle, which is that of a *Troximon*, being sub-alveolate; it agrees better with this in the rather rigid pappus, and decidedly in the large 5-crenated or lobed callous base; but then the pappus is not "longer," but *shorter* than the achenium. Yet, with these discrepancies, having the branching habit, and persistent yellow flowers — granting some future revision of the generic description — it is thought properly to belong to *Crepis*.

Although closely allied to *C. occidentalis*, it differs in not having "sessile cauline leaves" nor "blackish hairs"; besides, *C. occidentalis* has not a "striate achenia" as this has—the relative length of achenia and pappus is not sustained by our plant—some features are not wholly recognized in any allied genera or species—yet as this *C. occidentalis* is given a *variable latitude*, it is preferred to leave it here provisionally.

Nama racemosa, Kellogg.

Stem annual, 3 to 6 inches high, simple, erect, glabrous below, glaucous, purplish; branches opposite, decussate; at the second internode duplicate branches from each axil; divisions above naked or alternate from the axils of the leaves, second internode enlarging above, ancipitally expanded at the base of the leaves or compressed, and with the branches decurrent winged; stem leaves opposite, lanceolate acute or subacute, fleshy or succulent, subentire or slightly uneven outline, subwinged petioles very short, amplexicaule connate at the base, 3-nerved, subpubescent and pulvurulent, margins minutely scabrous ciliate, first and second pairs alternating or decussate (rarely a few other rudiments of leaves in the axils); first or primary raceme of the stem and branches mostly naked or bractless, emerging from one line to an inch below and opposite the leaf, simple (or branched?), a solitary axillary or subaxillary flower, distant and sometimes attached to the base of the common coiled peduncle, (1–2 inches long) flowers secund, pedicels short, or subsessile; calyx lobes unequal, sepals somewhat dilated upwards, short hispid and stipitate glandular (as throughout most of the summit of the plant) capsule globular, sparsely hispid above, 2–4-seeded, 1–2 in each cell—rarely less than 4-seeded.

Flowers tubular-campanulate, scarcely longer than the calyx, border 5-parted, lobes obovate, stamens somewhat unequal, and with the styles included. Flowers pale blue, verging to white.

Found by Kellogg and Brannan, at Cisco, Sierra Nevada mountains, July 6th, 1870.

The plant occasionally (in robust specimens) is doubly branched from each axil of the lower pair of leaves; leaves 1½ inches long to 2, and ½ an inch broad, repand subdentate. Rarely more than six inches in height.

Hedeoma (?) *purpurea*, Kellogg.

Stem about 1–2 feet in height, much branching from a ligneous base, quadrangular with prominent, rounded or obtuse angles and sulcate sides, angles somewhat retrorsely hoary-pubescent.

Leaves lanceolate, acuminate, sharply serrate, subpubescent above, pubescent beneath, glandular punctate, the sharpened base 3-nerved and triplinerved above, margin ciliate: 1–2 inches in length, ¼ to ½ an inch in breadth; petiole about 1-fifth the blade, hirsute; peduncles axillary, opposite, length variable, as long as the petiole, pedicels subsessile or even sessile, ¼ to ½ an inch in length, subdivided or mostly forked, bracts foliaceous linear lanceolate, hispid; bracteoles setaceous, former 2–4, latter 2–5; pedicels fasciculate-corymbose, 20 to 30 on each side, or flowers 40 to 60 in a whorl, longer than the calyx, subhispid; calyx tubular, prismatic, not gibbous at the base, hispid and glandular, bilabiate, 13-nerved (rarely less or more), upper lip 3-toothed, lower 2-toothed shorter, subulate from a triangular base, teeth hispid, throat naked; corolla bilabiate, upper lip flat, rather straight, 2-toothed or sublobed; lower lip 3-lobed, flat, lance-linear about equal, spreading, hirsute and glandular on the back, throat and middle lobe somewhat bearded or villous, genitals subexsert, style sub-2-lobed, equal, stigmas sub-glabrous with scarcely a few hairs; stamens, upper abortive pair often about equal, lower filaments always longest, being inserted lower, incurved at the apex. Flowers purple blue; calyx often colored.

Found at Webb's landing, on an island of the San Joaquin River, fall of 1872. A stout or robust species, much branched; with the usual strong odor and carminative properties of the common Pennyroyal; perhaps from a perennial root; seeds ovate, truncate at the hilum; surface minutely thimble-pitted or superficially scrobiculate.

This plant, it may be said, cannot belong to *Hedeoma*, for the throat of the calyx is not bearded. Nor can it be a *Pogogyne*, for that has the regular *four-stamened* character, and the tube of the corolla is naked inside. My own judgment is, that the genus *Hedeoma* should be so reconstructed as to receive this and some others; I therefore place it provisionally here, as indicated. It cannot be a *Keithia*, for although that has a naked throat in some species, it has not even a vestige of upper or posterior abortive stamens, as this has. Nor can it belong to *Gardoquia*, for similar reasons.

In the new genus *Poliomintha*, Gray., the calyx still has the villous ring — this, none; that, like this plant, has a somewhat pilose throat of the corolla, but the stamens are not incurved—cells are spreading, and the sterile pair *very short* — seeds smooth, etc. There are often seen fragments of abortive anthers on the short pair of anthers of this plant.

Heuchera Californica, Kellogg.

Scapoid-panicle ascending from a perennial creeping rhizom, 1 to 2 feet high, 2 to 3-leaved, large (5 to 7-lobed) below; fimbriate-bracted above on the rachis, floral top elongated, narrow, loose, lateral peduncles bi-ortrichotomous; cymules very short; plant hirsute, with long spreading glandular hairs throughout; radicle petioles and base of the nerved and sulcatescape, rather hispid; hairs somewhat fulvous, or dirty white. Leaves roundish-cordate 5 to 12 or more lobed, lobes short, obtusish, crenate-serrate, teeth abruptly acute, mucronate, margins minutely ciliate, sparsely appressed-hirsute above (with white hairs); hirsute beneath, chiefly along the veins; the radicle leaves on long petioles (3 to 6 inches), base short expanded, strongly nerved. and scarcely at all membranous (lamina about 2 to 3 inches broad); bracts fimbriate, very attenuate filiform lobed (colored reddish); rachis, peduncles, pedicels, calyx and capsules, stipitate glandular; calyx colored (white), large, spreading, bell-form, nodding, segments ovate, sub-acute, somewhat unequal, ciliate with stipitate-glands; petals (white) filiform attenuate-acuminate (about equal, finer than filaments,) persistent; filaments (8 to 10) unequal, anthers roundish; styles long, and with the stamens exserted; capules ovate-acumnate densely stipitate-glandular.

Found by Kellogg and Brannan, on the San Gregorio Creek, San Mateo Co., Cal., May 2d, 1870.

This species is not liable to be confounded with other allied forms; at least, with any of the *naked scape* species, as this plant has 3 large well-developed leaves of the scape on petioles, from ¼ to about an inch in length; besides, *H. cylindrica, hirtiflora,* or var. *pilossima, H. bracteola,* or *H. rubescens,* etc., have stamens and styles too short or included, or if not altogether naked, the rudimentary leaves are mere lacineæ or abnormal leaves. It would be useless to draw parallels in details, where the special differences seem so numerous.

Lagophylla minima, Kellogg.

Stem annual, erect, simple, or sub-simple, densely hirsute with long spreading articulated hairs throughout, low and slender (4 to 6 inches); early radicle and lower cauline leaves spatulate-lanceolate, acute, decurrent into narrowly winged petioles, about as long as the blade, base clasping, very minutely and remotely cut-dentate, obscurely 3-nerved and tripli-nerved above, silvery shining, somewhat appressed satiny-hirsute, lower leaves opposite; upper alternate sub-sessile and sessile, linear-acute, apex callous, surface pappilose (*cutis-anserina*) roughened.

Heads terminal (rarely a few axillary at the summit) short peduncled (or subsessile). Involucral leaves of the *first series* similar to, but reduced form of upper cauline, or pseudo-bractoid 5, spatulate-cuneate, flat, loosely erect, spreading, densely hirsute, chiefly so along the margins (hairs long and beautifully jointed), few large glands along the lamina above; *second series* also of 5, ovate-lanceolate, infolding entirely the ray achenia; rays pale yellowish, 3-toothed, 3-nerved (indigo-purple) broadly fan-shaped; cuneate base somewhat abruptly narrowed into a short pubescent tube; third series also 5, (the proper chaff) linear-lanceolate, acuminate, the cuneate base colored, somewhat scarious margins ciliate villous on the back at the tips, slightly carinate, distinct, central florets about 5, staminate, and pistillate, abortive, 5-toothed, stamens purple, tip of filaments purpled below as if articuluted. Receptacle conic (?), fimbrillate (?), punctate, apex or centre hirsute (with a pencillate cluster of hairs). Pappus none.

A small slender annual of micropoid similitude, with opposite dentate lower leaves, and remarkable jointed or articulated hairs, with the general aspect of a *Filago, Calymandra* or dwarfed forms of *Gnaphalium.* Found by Mr. S. Brannan, Jr., at Oakville, Napa Co., Cal., May 2d, 1870.

This little plant will now enable us to arrange and separate true generic characteristics from the adventitious, reverting the partial and subordinate only to specific importance, *e. g.*, "perennial" (?), "glabrous," "sessile-heads," "involute margins," etc., will only apply to *L. ramossima* of Oregon, but not to our plant—description provisionally well enough when one species of a new genus is known. The fact of an extra pseudo-series of involucral envelopes would do little violence to nature should others view them as merely bractoid.

Trifolium pauciflorum (?) var. *parvum*, Kellogg.

The following species or form does not well agree with the description; *e. g.*: The plant is by no means "glabrous," but hairy throughout, or nearly so; nor are the upper leaves "lanceolate-linear acuminate," nor "*distantly* and minutely spinulose-serrulate," nor involucre "many-cleft," but only 5 to 6 — much less "12–16," etc. Therefore we give the following description, as notes to further comparison; to wit:

Root perennial.

Stem very slender, ascending or somewhat erect, much branching or spreading from the base, sparsely soft silky hairy nearly throughout, 4 to 6 inches high.

Leaves very long petioled (6 to 7 times the length of leaflets), 2–3 inches; leaflets obovate obtuse, or upper short acute, base cuneate, spinulose-serrate, often toothed at the apex, strongly pinnate veined, glabrous except the pubescent midrib beneath, short-petiolulate (1-line); blade 3 lines to half an inch long, 2 to 3 lines broad; *petioles* very slender, about as long as the peduncles, *peduncles* axillary, filiform, hairy; *stipules* lanceolate acuminate, from a rather broad base, lacineate-dentate or entire; *involucre* monophyllous, 5 to 6-cleft, lance pointed, spinulose-mucronate, 9-nerved at the membranaceous base of the cup, 1–2 florets, rarely more; *calyx* on a short, hirsute pedicel (about 1 line), tube sparsely hirsute, membranous at base, pubescent, 10-nerved, (marginal nerves meeting at the axils of the teeth and confluent into the more obscure alternate nerve,) teeth lanceolate-subulate-pointed, upper pair shorter, or subequal; *corolla* tube rather more than twice the length of the calyx, pubescent with long silky hairs; *banner* large straight ovate limb longer than the narrow oblong wings. and both ochroleucus or whitish; *keel* very short abruptly acute point, subincurved, deep purple or varying to indigo blue. *Pistil* clavate, point incurved above, beak retrorse.

Damp, sandy or springy and somewhat half shady places; Cisco, altitude 6,000 feet, Sierra Nevada mountains. July 6th, 1870.

Solidago elongata, var. *microcephala*, Kellogg.

Stem subglabrous below, pubescent with white jointed or frosty hairs above, strict, somewhat obtusely angled by the decurrent strongly 3-nerved midrib of the expanded base of the leaves, 3 to 5 feet high; racemose branches erect, at length somewhat recurved, and subsecund, forming a dense, large, broadly pyramidal panicle (6 by 8 inches or so,) leafy, with the reduced lance-linear leaves intermixed at the base.

Middle and upper cauline lanceolate acute or subacuminate, cuneate base 3-nerved, sessile, subamplexicaule, strongly triplinerved above, these and midrib sharply prominent below; lateral nerves of the base obscure finely reticulate veined, to the unaided eye, more manifest by transmitted light, subglabrous above and below, sparsely scabrous pubescent along the veins and midrib; margins densely incurved-ciliolate scabrous, doubly serrate, alternate or interrupted teeth long narrow, or lobe-toothed, teeth subulate pointed with a callous mucro, short apex and longer base entire, upper surface slightly shagreen roughened, racemose branches pubescent, pedicels minutely scabrous-pubescent, bracts and bracteoles filiform subulate; heads very small, rays exsert but verging to invisible; involucre scales 15 to 22 or more, exterior shorter subulate acute, interior linear subacute, minutely pubescent on the back, ciliate pubescent at the tip, scarious margins laciniated, colored (yellowish), often a few conspicuous teeth at the apex; rays 15 to 16; disk florets 9 to 10, achenia pubescent, disk pappus about the length of the forests, or about twice as long as the achenia; receptacle alveolate, naked.

Found at Webb's Landing, Island of San Joaquin River, late in fall of 1872.

Triplinervæ, section *Solidago*.—As the relative number of parts, etc., are not given in descriptions of *S. elongata* and some of its allies, as *S. serotina*, *S. Canadensis*, *S. gigantea*, etc., it was deemed best to give ample details, if need be, for comparison or amendment. Although placed under *S. elongata* (Nutt.) it is by no means "*obscurely* triplinerved," for the triple nerves and midrib are conspicuously and sharply prominent beneath; the expanding base of the midrib is strongly 3-nerved and thence decurrent along the stem; heads remarkably small (little more than a line in diameter,) for such a large and vigorous plant; involucral scales more than 20 (15 to 22); rays numerous, exsert but indistinct, except by careful inspection; or in general, the exceeding number of parts, though common to all, attain to the rank of distinctive characteristics where disparity is so great; added to special points, it is thought to entitle it to the consideration, at least, of a variety. It is hoped some simpler and more generous revision may be adopted, which will include all these in one, with due recognition of sub-species and varieties.

Erigeron discoidea, Kellogg.

Stem strict, sulcate-striate, hirsute-pubescent throughout, branches erect, densely racemose-paniculate into an oblong pyramidal top, leafy throughout, 2 to 3 feet high. Leaves oblong-spatulate-cuneate, sessile or with a short winged petiole, obscurely triplinerved above, 3-nerved, decurrent parallel with the mid-rib at the base, sub-clasping, lower cauline pinnately-lobed, pinnatifid-toothed above, lobes and teeth subulate-mucronate with a callous point, margins pubescently-ciliate, hirsute below, pubescent above, upper leaves successively reduced to lance-linear, linear, and final filiform bracts; lamina thin, flaccid; involucral scales in 2 to 3 series, linear-lanceolate acuminate very attenuate, hirsute on the back, inner series with scarious margins, minutely laciniate-toothed, shorter than the white pappus; rayless, nodding before expansion, at length erect; florets 4 to 5-toothed, tube filiform, throat and border campanulate, lobes lanceolate acute recurve-spreading, often stipitate-glandular, as also the tube; stamens and style somewhat exsert, about as long as the pappus; achenia sparsely pubescent and glandular chiefly above, those of persistent florets, both pistiliform and stameniferous but abortive, densely clothed with pappilose glands, short-stipitate callous base, or neck and base constricted compressed, oval-oblong slightly broader above, white scabrous pappus simple; receptacle scrobiculate, naked at length produced into sharpened points.

Found on an island of the San Joaquin River, Webb's Landing, late in autumn of 1872. At first it was thought to be a variety of *E. Canadensis*, but a more thorough examination seems to warrant a new species. Heads evidently hermaphrodite, the central florets masculine, this portion of the receptacle being simply areolate, the outer florets feminine and fertile; more closely allied to *E. rivularis*, D. C. Prod., vol. 5, p. 288.

Mr. Dall read and submitted the following paper in behalf of the author:

Note on the Scombrocottus salmoneus of Peters, and its identity with Anoplopoma fimbria.*

BY THEODORE GILL, M. D. PH. D.

The distinguished zöologist of Berlin, Dr. Wilhelm Peters, has recently published a communication on a supposed new generic type of "Cataphracti," from Vancouver's Island, which he has named *Scombrocottus salmoneus*. This form was regarded as possessing the highest interest, on account of a combination of characters which allied it to the Scombroids, and thus corroborated Dr. Günther's views respecting the affinity between the Cataphracti and Scombroids of Cuvier.

It was at once apparent, after a perusal of the good description, that the supposed new type was identical with the form first discovered and named by Pallas, *Gadus fimbria*; and subsequently by Dr. Ayres, *Anoplopoma merlangus*. And it was with special interest that I also recalled the fact that both its former describers had failed to perceive any resemblance to the Scombroids (they

* Printed in advance, April 9, 1873.

equally failed, however, in detecting the relations to the Cataphracti), and both had believed they could perceive a resemblance to the Gadoids;* this was the more noteworthy, as the later observer was ignorant of the labors of his predecessor; and it was also with interest that I perceived that Dr. Peters had likewise been struck with a resemblance of the same form to the trout; naming the species *S. salmoneus*, and describing it as trout-like (Habitus forellenähnlich). Now it is evident from a study of the anatomy, that these several forms are very dissimilar in fundamental characters; and most of them, at least, quite distantly allied. A likeness which is so ambiguous as to mislead persons equally familiar with the external appearance of the several forms, and to lead to such dissimilar results, must be of very slight importance. At any rate, the affinities of the form in question (*Anoplopoma fimbria*) with the Cataphracti—and more especially the Chiridæ—are evident from an examination of the external and internal structure; and I am unable to appreciate the likeness which others have seen to the cods, the mackerels, or the trout.

The synonomy of the species will now stand as follows:

ANOPLOPOMA FIMBRIA, Gill, *ex* Pallas.

Gadus fimbria, *Pall.* Zoög.—Ross.As., III, 200, 1831.

Anoplopoma merlangus, *Ayres*, Proc. Cal. Acad. N. S., II, 27, 1859.

Merlucius (?) [fimbria], *Grd.*, Expl. P. R. R., VIII, Fishes, 141, 1858.

Merlucius [fimbria], d. sp., *Gthr.*, Cat. Fishes, IV., 344, 1862.

Anoplopoma [fimbria], *Gill*, Proc. Acad. N. S. Phila., 1863, 247.

Scombrocottus salmoneus, *Pet.*, Monatsb. Pr. Akad. Wiss. Berlin, 1872, 569.

Mr. Stearns read a paper, illustrated by drawings, on certain Xylophagous, or wood-eating animals, referring especially to the *Teredines* or ship worms, among the mollusks, *Limnoria* and *Chelura* (gribbles) among the crustaceans, which occupy marine stations, and the *Termites* or white-ants among the terrestrial Xylophaga. Mr. Stearns called the attention of the Academy to the importance of the cultivation of the *Eucalyptus marginata*, as the wood of this tree is exempt from the attacks of all the above species, and therefore particularly adapted to structures of wood for marine positions.

Descriptions of New Species of Mollusca from the Coast of Alaska, with notes on some rare forms.†

BY W. H. DALL, U. S. COAST SURVEY.

While the final description and thorough examination of the collections of marine invertebrates, made by me on the coast of our new Territory, are necessarily delayed, it seems desirable to put on record a few of the more striking

* Dr. Ayres noticed the enlarged suborbitals, but referred the genus near to Stizostedion (Lucioperca Cuv.).

† Printed in advance, April 9, 1873.

facts, and to describe some of the more remarkable forms which have thus come under my notice. I have already given to the Academy preliminary descriptions of a few of the species which appear to have been hitherto unknown, and this paper contains additional material of the same kind, though my time has been so much engaged by other and more pressing duties, that a very large amount of work of this kind still remains unfinished.

In the matter of distribution it has been pretty well demonstrated by our researches that three faunæ come together and are more or less intermingled in the region between Unalashka and the Shumagins. The Shumagin group of islands, jutting out from the main land and deflecting the coast current more or less to the southward off shore, acts toward the Oregonian fauna (which I extend from Monterey to the Shumagins), as Cape Cod on the east coast of North America does to the fauna which characterizes the coasts of the Middle and Southern States.

In this group many of the characteristic animals of the Oregonian fauna, such as *Mytilus californicus, Purpura lactuca, Amphissa corrugata, Mœra variegata* and *Petricola carditoides,* attain their most western limit. The Arctic fauna which characterizes the shallow waters of Bering Sea and the Arctic Ocean, is well represented by forms of *Astarte, Buccinum glaciale, cyaneum* and *ciliatum, Scalaria grönlandicum, Cardium islandicum, Lacuna vincta,* several species of *Bela, Admete* and *Odostomia,* and many others which pass, in most cases, but little to the eastward. The typical Aleutian fauna, which was (up to the commencement of our researches in 1865) almost unknown, is characterized here by such species as *Pecten alaskensis, Drillia Kennicottii, Rictocyma mirabilis, Voluti Stearnsii, Magasella aleutica, Litorina aleutica, Acmæa sybaritica, peramabilis* and *Nacella rosea, Heliotropis harpa,* and other forms described in this paper. Much remains to be done in tracing the course and characteristics of this fauna to the westward, which I hope during the coming season to elucidate to some extent. The following species possess peculiar interest as being unlike the forms which would be expected in so high a latitude, and as an earnest of what may be looked for in future explorations.

Cancellaria (Trigonostoma) unalashkensis, n. s. Pl. II, fig. 1.

Shell slender, acute, of six whorls, with a minute, smooth, white nucleus and solid texture. Color whitish with traces of a nut-brown epidermis. Sculpture of strong revolving ribs, of which the posterior three are crossed by rather strong transverse riblets which rise into beaded nodules on the intersections. The whorls are turrited by the prominence of the posterior revolving rib, between which and the suture the transverse riblets are oblique and rather strong. Three of the revolving ridges are apparent on the upper whorls and seven on the last whorl. Aperture about two-fifths the whole length, white, with a pink throat, and the outward lip somewhat thickened and internally grooved, corresponding with the external ridges, which are also apparent on the inner lip. Canal short, straight, shallow and rather narrow. Two or three plicæ on the columella. Animal whitish with no operculum. Lon., 0.75 in.; lat., 0.3 in.; defl. 35°.

Habitat.—30 to 60 fathoms stony mud in Captain's Harbor, Unalashka, Aleutian Islands; three living specimens. *Cancellaria modesta*, Cpr., was also found here, but not in the deeper water.

Cancellaria (Trigonostoma) circumcincta, n. s. Pl. II, fig. 2.

Shell similar in form to the last, with six whorls, nucleus minute and nearly smooth; thin and delicate; whorls sculptured with strong revolving ridges, generally subequal, but with a few more slender intercalary threads; turns gently rounded with a very slight tendency to tabulation toward the posterior third of the whorl; crossed by very faint transverse irregular riblets, which are most evident on the apical whorls and evanescent on the body whorl, and show a slight tendency to granulation at the intersections only on the first two or three whorls. Color rose pink, strongest on the ridges. Outer lip thin, delicate, the sculpture of the exterior showing through; inner lip not thickened; columella white with two or three very faint plicæ. Animal slate color. Canal short but deeper than in the last species. Lon., 0.82 in.; lat., 0.37 in.; defl., 40°.

Habitat.—Popoff Strait, Shumagin Islands, in ten fathoms stony mud about the reefs.

Sipho Hallii, n. s. Pl. II, fig. 3.

Shell fusiform, solid and heavy, of five and a half whorls, the last much the largest; suture subcanaliculate, not deep, but very distinct; whorls moderately convex, somewhat appressed toward the suture. Canal rather long, much recurved; aperture elongate, acute behind; inner lip much thickened, white; outer lip hardly thickened, posteriorly waved. Shell covered with a yellow-brown epidermis, with very faint revolving striæ, crossing the slightly evident waved lines of growth.

Lon., 1.7 in.; lat., 0.8 in.; lon. apert. 0.95 in.; defl. 45°.

Habitat.—Sanborn Harbor, Nagai; three dead specimens, with *Paguri*, found by Capt. W. G. Hall, sailing master of the U. S. C. S. Schr. Humboldt, to whom I am indebted for many valuable additions to our collections.

This species is smaller and more solid than most of the genus, and does not resemble any of the east coast species closely enough to require a comparison. It has a little the aspect of a *Campeloma*, in some of its characters.

Margarita vorticifera, n. s. Pl. II, fig. 4, *a, b, c*.

Shell depressed, with three flattened, rapidly expanding whorls, which have a tendency, in old individuals, to overhang the suture anterior to them. The upper surface is traversed by numerous slender, slightly elevated, revolving threads, which are crossed by faint lines of growth. Outer edge of whorls subcarinate. The basal surface is less flattened, but similarly sculptured, except that the very wide and funnel-shaped umbilicus is destitute of revolving striæ, and the lines of growth are here a little stronger. Aperture excessively oblique, with the anterior angle much produced; lips hardly thickened, and but slightly interrupted at the junction with the body whorl. Nacre, salmon-color; external surface pinkish white, brilliantly pearly where eroded. Lat. of largest specimen, 0.85 in.; alt., 0.5 in.; defl. 88°.

Habitat.—Iliuliuk Harbor, Captain's Bay, Unalashka; and larger specimens in the Akutan Pass, from ten to sixty fathoms, on stony bottom. Not found in the Shumagins.

This species is more flattened than any species except *M. helicina*, which it somewhat resembles in form, though more carinated, and otherwise widely differing in character. It is not allied to any West American species known to me, though it may have relations in some Japanese form. It is a thin and light shell.

Volutopsis Beringi, Midd., var. *regularis*, Dall. Pl. II, fig. 6.

Shell of four whorls, obtusely fusiform, and with the last whorl somewhat inflated. Nucleus mammillated, whorls smooth, moderately convex, with a distinct, though not channelled suture. Aperture eleven-seventeenths the length of the shell, elongate, produced in front, with the outer lip moderately thickened and the inner lip without callus. Canal almost straight; short, narrow. Lon., 1.8 in.; lat., 0.9 in.; defl. 65°. Color white, or light pinkish.

Habitat.—Unalashka, to the Shumagins; rare. This form may be a distinct species, but I have preferred to indicate it as a variety, for the present. It differs from the normal form in being smooth and regular, without the lumps or irregular ribs which are common in the *V. Beringi;* it is smaller in size, when adult, by one-half; it is never of the dark livid chestnut color which invariably characterizes *V. Beringi.* The outer lip is less patulous, the canal proportionately narrower, and the aperture shorter, compared with the whole length of the shell. Moreover, the specimens are remarkably uniform in their characters, and the *V. Beringi*, though very variable as a whole, is equally constant in the differential characters alluded to. I have come to this conclusion only after a careful examination of over a hundred specimens of *V. Beringi*, and a good series of this form. The former is much more common in the localities alluded to.

In Dunker's portion of the *Novitates Conchologicæ*, pp. 1–7, 1858, and plates I and II, a number of species are described and figured as new, and stated to be from Sitka. The references to the plates are erroneous throughout, as pointed out by Dr. Carpenter, and the names on the plates do not always agree with those in the text. Of the six species described here, only one is new. As the paper is not accessible to most students, I here give the corrected synonymy of the suppositious species, none of which are found at Sitka.

1. Buccinum glaciale, Stimpson. (Mon. Northern Buccinums.)

{ *Tritonium carinatum*, Dkr., p. 1, pl. 2, f. 3–4.=
{ *Tritonium angulosum*, Mœrch. (on plate.)

Tritonium mœrchianum, Dkr., p. 2, pl. 2, f. 1–2.

Tritonium rutilum, Mœrch., p. 3, pl. 1, f. 5–6.

Tritonium rombergi, Dkr., p. 4, pl. 2, f. 5–6.

All these varieties of the well known *Buccinum glaciale,* are beautifully and thoroughly connected by the really magnificent series of that species obtained by us during the season of 1871–2, in the Aleutian Islands. It belongs to the Arctic fauna.

2. *Volutopsis Beringi* (Midd.) A. Ad.

Tritonium Beringi, Midd. Mal. Ros. p. 147, pl. iii, f. 5–6. 1849.

(? *Volutopsis norvegica,* Chemn., N. European seas.)

Neptunea castanea, Mœrch., p. 7, pl. 1, f. 1–2.=

Neptunea badia, Mœrch. (on plate.)

This species, if not identical with the European form, is a member of the typical Aleutian fauna.

3. *Chrysodomus* (*Heliotropis*) *harpa,* Dall, *ex* Mœrch.

Neptunea harpa, Mœrch., p. 2, pl. 1, f. 3–4.

This is an Aleutian species, found from the Shumagins to Unalashka, but everywhere very rare.

It belongs to a group characterized by thin sinistral shells, with mammillated apices; an operculum very small when compared with the size of the animal; solitary ovicapsules of hemispherical form, attached by the entire base, smooth above, and maturing only two or three individuals to each sac, although of much greater size than the ovicapsule of any other species of mollusk in the region; and, probably, by dentition. This group may take the sub-generic name of *Heliotropis.* Our largest specimen exceeded six inches in length. *Fusus contrarius,* of authors, of the North European seas, may also belong to this group.

Buccinum Dalei, Sby., or a related form, was found by us at the Shumagins.

Pleurotoma circinata, n. s. Pl. II, f. 5.

Shell slender, elongate, covered with a brownish epidermis; whorls six, with a single, sharp, narrow carina, about the middle of the whorl, in the upper whorls; this carina does not interrupt the even rotundity of the whorls so as to produce any flattening of the latter, but appears as if it had been placed upon the equator of the whorl, after the latter had been completed. The posterior surface of the carina and that part of the whorls behind it, are destitute of any but the most microscopic revolving striæ, though plainly marked by the deeply notched lines of growth. The anterior surface of carina and whorls is covered with sharp, revolving grooves, with wider interspaces, being about twelve on the body whorl, between the posterior edge of the aperture and the carina. The notch is deep, and about one-third of the way from the carina to the suture. Aperture and canal long and narrow; outer lips, before the carina, effuse. Nucleus, white. Lon. 3.0 in.; lat. 1.0 in.; defl. 42°.

Habitat: Nateekin Bay, Captain's Bay, Unalashka; one specimen, dead on beach.

This species was at first supposed by me to be the adult form of *Drillia Kennicottii,* Dall, but on comparison, I find them distinct, as the latter has nearly as many whorls in less than a third of the length, and the carina is duplicated in the last whorl. The latter comes from the Shumagins. The present species is one of the peculiar species which combine to form the Aleutian fauna.

Plate ii, fig. 7, represents *Clathurella affinis*, Dall, Am. Journ. Conch., Vol. VII., p. 102, 1871, a hitherto unfigured species from Cape St. Lucas, also from San Miguel Island, off the southern coast of California, where it was detected by Mr. Harford.

Regular Meeting, April 7th, 1873.

President in the Chair.

Thirty-five members present.

Samuel F. Reynolds, Henry H. Haight, and Samuel C. Gray, were elected resident members.

Donations to Library: Washington Zones, 1846–1849, from the U. S. Naval Observatory, 2 vols. Proc. de la Societie Malacologique de Belgique, pp. 83–98, 1872. Proc. Acad. Natural Sciences of Phila., 1873, pp. 1–40. On the Right Ascension of the Equatorial Fundamental Stars, etc., by Simon Newcomb, from U. S. Naval Observatory, Washington, D. C. Uber die Salzseen des Westlichen Tibet, Allgemeiner topog. Erlanterung Hochasiens; von Hermann Schlagintweit—Sakunlunski. Supp. Cat. Lib. Co., of Phila., Jan. 1873. Sveriges Geologiska, Undersökning, parts 42–45, with four charts from Bureau Géologique de Suède. Select Plants, eligible for Victorian industrial culture, etc., etc., by Mueller, presented by Edward Bosqui. Bull. of Mus. of Comp. Zoölogy, Vol. III, No. 6, Notes of an Ornithological Reconnoissance in Kansas, etc., by J. A. Allen. Vol. III, No. 5, Fossil Cephalopods of the Mus. Comp. Zool., by Alpheus Hyatt. Proceedings Boston Society Nat. His., Vol. XV, Part I, Jan.–Apl., 1872. Eng. and Mining Jour. Am. Jour. Science and Arts, Jan., Feb. and Mch., 1873. Am. Naturalist, Jan. and Feb., 1873. Am. Chemist, Dec. 1872. Overland Monthly, Mch., 1873. California Horticulturalist, Jan., Feb. and Mch., 1873. Monatsbericht der Konig. Preuss. Akad. der Wiss., zu Berlin, Aug., Sept., Oct., 1872. Review of Lyell's Elements of Geology, by John B. Perry, pamph., 8vo., 1872. Monographie des Chrysomélides de l'Amerique, par C. Stal, from the author. Forest Culture in its relation to Individual Pursuits, by F. Von Mueller, pamph., 8vo., 1871. Kingsborough's Mexican Antiquities, 9 vols., imp. folio, half Turkey morocco, gilt, presented by George C. Hickox, Esq.

Donations to the Museum: Two species of Crustaceans, a large snake, barnacles (*Coronula*), also specimen of land shells (*Bulimus pallidior*, Sby.,) from George Davidson. Skull of Porpoise

(*Lagenorhynchus albirostratus*, Peale,) caught by Captain Marston on a voyage from Tahiti (Lat. 13 deg. N.) to San Francisco, presented by the proprietors of the "Daily Alta California." Specimens of Lizard, Scorpions, Hermit-crab and Cuttle-fish (*Decapod*) from San José del Cabo, by U. S. Consul Gillespie. Branch of Mangrove covered with oysters (*Ostrea conchaphila*) from Magdalena Bay, Lower California, by Samuel Hubbard. Specimen of Deer's head, showing arrested development of the antlers, presented by Mr. C. D. Cleveland, through Dr. Henry Gibbons. Specimens of Sea-mosses (*Algæ*) from San Pedro, presented by Capt. Jos. A. Wilson. Marine Shells from the Shumagin Islands, presented by W. H. Dall. Echinoderms, Gorgonia, etc., from Mazatlan, presented by Henry Edwards.

Prof. Davidson remarked, in connection with the specimens presented by him, that the smaller crustaceans were caught at night in Cape St. Lucas Bay, Lower California, the sea at the time being white with phosphorescence; two individuals of this species would light up a bucket-full of water; the phosphorescence was particularly vivid at each joint of their bodies; the largest specimen, which is of a different species, was taken from the stomach of a *Boneta* caught off the coast of Lower California, in about lat. 23½°. The snake and the land shells were from San José del Cabo, and the specimen of *Coronula* were from the back of a green turtle from Mazatlan.

The following, relating to the deer's head presented by Mr. Cleveland, is taken from a note from that gentleman, which accompanied his gift:

"The specimen I procured two miles from Tejon Pass, San Bernardino county. The deer was killed within a few miles of this locality about one year ago, and on inspection was found to have been castrated, in what manner this was done it is impossible to say. The hunter who killed the animal and from whom I received the specimen asserts that it was an accident of combat. The physiological connection which exists between the testes and the development of the antlers is here * * set forth. * * The deer when killed was thought to be five or six years old. It suffered a rude castration doubtless about the time the horns commenced to grow and" as a result of the injury, "we find the antlers in their present abortive stage of development."

Remarks on the Death of Prof. John Torrey.

BY W. H. DALL.

Prof. John Torrey, well known throughout the world for his attainments in botany and chemistry, the most eminent man of science in New York, and one of the most eminent in America, died in the city of New York on the tenth of March, at the age of seventy-seven.

Born in New York in the year 1796, and connected, from his boyhood to the present time, with all persons or institutions in his native place, whose aims included the advancement of science and learning; his earliest work was the preparation of a flora of Manhattan Island, especially the portion immediately about the suburbs of old New York, a region which he lived to see covered with stately structures of brick and stone.

Taking his medical degree in 1818, he occupied his leisure in the preparation of botanical matter in relation to the Northern States of the Union, east of the the Mississippi River. His publications on this subject, during the six years succeeding, insured him a high rank among the more eminent students of botany.

Shortly after his marriage in 1824, he was called to the professorship of chemistry at West Point; in 1827 he accepted the chair of chemistry and botany in the College of Physicians and Surgeons of New York, and a few years later a similar position at Princeton College. About the year 1853, at the urgent solicitation of the Secretary of the Treasury, he was prevailed upon to take charge of the United States Assay Office, in which he labored up to the time of his death. During this period he was also a trustee of Columbia College, to which the medical school had been annexed, and to him the college owes, beside many years of earnest study and work, the priceless gift of his superb botanical collection and library.

Up to the day before his death he was at his post, signing the daily reports of the Assay Office, and then calmly and peacefully passed away to his rest, so well earned. While devoting his days to chemistry, in which he attained a high rank, thus securing that maintenance for which most scientific students are obliged to struggle so painfully, Botany was the mistress of his heart, to which his leisure and his evenings were devoted, so that it is said that even a few weeks before his death, his light could be seen till nearly midnight in the herbarium of Columbia College.

His writings are to be found in the transactions of nearly every scientific association of America, and among them we may especially enumerate the Report on the plants collected by Dr. James, on Long's Expedition, on the plants collected by Wright in Texas, and by Fremont in California, the Flora of the State of New York, and his unfinished Flora of North America; while his assistance had been secured in the preparation of the Manual of California Botany, now in press by the Geological Survey of this State.

Dr. Torrey twice visited California, once in 1865 and more lately in 1872, and on both occasions was present at the meetings of this Academy, in whose welfare he took an earnest interest.

While he was most widely known by the published results of his scientific researches, the most precious memory which he has left to those who were fortunate enough to know him personally, is that of a man simple in his tastes and manners, cordial and earnest in his efforts to assist all who might seek his aid or counsel, with the keenest sense of honor and justice, and with a tender, generous and open heart. No man was ever more widely beloved. No man had ever a juster claim to the esteem and affection of all who knew him. He has left behind him an enduring record of faithful, earnest and successful work, and a spotless and honorable name.

Mr. Dall moved that the Chair appoint a committee to draw up suitable resolutions expressing the Academy's sense of the loss which science and humanity have sustained in the death of Dr. Torrey, a copy to be forwarded by the Secretary to the family of the deceased.

Dr. Henry Gibbons also briefly alluded to the estimable character and important services of the deceased, and the loss which science and humanity had sustained by his death.

The president appointed Messrs. Stearns, Dall and John Hewston, Jr., as a committee on resolutions, as suggested by Mr. Dall.

Professor Davidson read a paper giving in detail the results of his examinations for determining the geographical position of the Transit of Venus Station at San José del Cabo, Lower California, occupied by the French Astronomer, M. Chappe d'Auteroche, in 1769.

No information beyond the meagre details given in M. Cassini's account could be obtained in Europe, although personal efforts had been made last season in Paris by Prof. J. E. Hilgard of the Coast Survey. M. Chappe died from a prevailing epidemic soon after observing the transit of Venus, and one of his assistants also died, so that his note books were doubtless defective in detail, and no plans of the building or of the locality have been given in the published account. The evident accuracy of his observations of the phenomenon, and his known skill as an observer, warranted the present undertaking by the Coast Survey to render his results of practical value in the discussion of the sun's parallax.

In Cassini's record it is incidentally mentioned that "the Mission of San José is situated about one league from the coast, upon a little river which empties into the Vermillion Sea," p. 112 ; and also that the final latitude adopted, "established very accurately," (although the two determinations differ 31″.5) was 23° 03′ 20″. In the detailed description of mounting the instruments, their position is placed within the walls of a "large granary" from which he removed the roof; and "pedestals of masonry" were erected upon which to place the instruments. The relation of this granary to the church is never referred to, nor when the church was built, its character, or even on which bank of the river.

Upon my arrival at San José del Cabo, in March, I learned there had been no less than four buildings and locations of the church known by the above name, from the erection of the first in 1728 or 1730—for authorities differed even in the date of the foundation. Nor could the dates of the changes be ascertained, as the records of the church had been carried away.

The first was the "Mission Viejo," about five miles from the shore of the bay, and the location of whose site was visited. The present occupant of the house stated that he had found the foundations of the church and granary thirty-five years ago, when he built the present houses. The second was the "Mission," reported near the present cemetery and not half a mile from the bay. The third and fourth locations are identical and in the present town of San José del Cabo, erroneously designated as Salatea on the English charts. (Saláte is the rancho three miles westward of the town.) I was satisfied that neither the first nor second locations was the Transit of Venus Station, both from a study of the ground and the latitudes. From the present priest, an uneducated Indian, but one item of value was gathered ; he pointed out the foundations of the third church and the traditional position of the granary always attached or adjacent thereto. Both were much smaller than the present edifice.

Sifting this evidence and studying the topography of the site and the requirements of the problem, I became satisfied that the Venus Station was near the present church. I traced the old foundations to their limit on the north side of the church ; but the present church covers the greater part of them. The foundations of the old granary lie to the southeast of the present sacristy, and between it and the wall, which is twenty-four feet distant and on the line of the street, they have been covered with débris to bring the surface of the ground to the level of the top of the wall. I think it is safe to say that the position of M. Chappe's instruments has been recovered within a space of twenty feet square. This has been referred to the southeast corner of the present church, which was included in the scheme of triangulation to connect it with the astronomical station near the present landing. The "Mission Viejo" and the cemetery were also included in the scheme.

The geographical position of the astronomical station had been been determined under my directions by Mr. W. Eimbeck, of the U. S. Coast Survey, about a fortnight before my arrival. The longitude is determined by the transmission of twenty-four chronometers from and to San Diego, which had been connected with San Francisco by telegraph. The latitude was determined by the zenith telescope method of the Coast Survey.

Thus after an interval of one hundred and four years, we have been able to make available the observations of one who gave his life a sacrifice to scientific pursuits.

Of the position of Velasquez's station for observing the same phenomenon at the "village of Santa Anna, a position which is not placed on the charts," I could gather no clew whatever. In endeavoring to reconcile the two disjointed remarks of Cassini (pp. 43 and 112), it would appear to have been at some rancho on the shores of Ceralvo Bay, about thirty leagues northward and eastward of San José del Cabo, following the coast line.

A search of the archives at Madrid last season had failed to elicit any knowledge of Velasquez's records or report.

Mr. Stearns referred to the valuable and acceptable present of Mr. Hickox as an important acquisition to the Academy's library, and on motion, a special vote of thanks was unanimously tendered to that gentleman for this very handsome gift.

Mr. Gutzkow read the following, describing a new process for the extraction of Boracic acid, and illustrating by a working model the method pursued by him.

A New Process for the Extraction of Boracic Acid.

BY F. GUTZKOW.

I beg to bring to the notice of the Academy a process for the working of Borate of lime, which, besides that I consider it to have some claims as to practicability, presents also some scientific points, which may be sufficiently interesting to some of the members as to warrant me in drawing their attention thereto.

The Academy has already been made aware before of the fact, that in the State of Nevada, lately, large masses of borate of lime have been discovered in different places in Churchill, Esmeralda and other counties. It is interesting, because boracic acid is by no means very profusely distributed on the earth's surface, and borate of lime in particular has, until now, only been found near the celebrated nitrate of soda deposits of Iquiqui in South America. The mineral found in Nevada is the same as the South American. It is not the true borate of lime, but the boronatrocalcite, a combination of borate of soda with borate of lime. An analysis made by myself gave, in round numbers:

42	Boracic acid,
8	Soda,
13	Lime,
37	Water.

There appears to be some difference in the impurities found with it. In Nevada they appear to be principally clay, while in South America gypsum is always more or less found intermixed.

Owing to those impurities, there have been experienced some difficulties in working the mineral in England and France; but still more has the expectation that the South American borate of lime would give a prolific source of borax been reduced by the circumstance, that the shipments from Iquiqui turned out to be of very unequal nature as to quality, which with the difficulty of ascertaining the true proportion of boracic acid by an easy assay, rather demoralized the market for the substance in question.

In this country the process used for working it consists in a kind of concentrating operation, by which, with an enormous loss in substance, the borate of lime is freed from the impurities. Then it is boiled with a solution of carbonate of soda, and the solutions obtained worked for a crude borax, to be refined afterward by recrystallization. This process has several important drawbacks. In the first place, the high price of soda on this coast interferes seriously. Although the State of Nevada possesses large deposits of crude soda, it becomes so dear by the high cost of transportation, that in this city it is about as advantageous to employ the English sal-soda, which is, besides, a much purer article. Furthermore, the decomposition of the borate of lime is not complete by soda, and the residue will always contain some undecomposed mineral, unless a very large quantity of water is used. As the borate of lime is not insoluble in water, it is possible to extract by water alone all traces of the mineral; but on the large scale this is, of course, not feasible. In the third place, the clay mixed with the mineral, and the carbonate of lime formed by the soda, make the residue extremely bulky. It takes a long time to make it settle into a pulp of some reasonable thickness; therefore several washings are required to wash the absorbed borax-solution out, thus yielding weak solutions which have to be worked up and concentrated.

In view of these facts I thought it advisable to devise a better process than the one described.

My process is based upon the volatilization of boracic acid by water vapors; a fact which nature itself proves, by furnishing in that way all the boracic acid manufactured in Tuscany. But by my own experiments I discovered that that volatilization can be made complete, that is, that a given quantity of boracic acid can be completely volatilized by steam alone.

The plainest experiment which laid the foundation to my process is this: To melt in a platinum crucible some boracic acid into a glass, weigh the crucible with contents, and conduct steam by a brass tube into the crucible while the latter is heated to redness. By weighing from time to time, the progress of volatilization may be observed. After two hours continuing the experiment, more or less, the crucible will be found entirely empty. Other experiments by which I suspended a weighed platinum wire, on to which a pearl of boracic acid was molten, in an iron gas-pipe, and conducted steam of different temperature through that apparatus, showed that the speed of the volatilization is entirely depending on the temperature of the steam. Steam of 212° F., is not capable of removing more than traces, unless the reaction is allowed to continue for a very long time. If the gas pipe surrounding the boracic acid pearl is however, heated to redness, the volatilization is most rapid.

The rather surprising fact that the steam of 212° F. has so little power for the purpose, caused me to experiment on some statements made by Henry Rose, the celebrated chemist to whom we are mostly indebted for our knowledge of the element *Boron* and its combinations. Rose states that it is not possible to concentrate a solution containing free boracic acid without loss of substance. I found this correct when the solution is evaporated in an open dish, but not so when the concentration takes place in a glass flask. On concentrating a quite concentrated solution of boracic acid in a glass flask over a moderate fire, I never could condense more boracic acid than the mechanical carrying off by the vapors would account for, that is a trace. In an open dish, however, in the progress of concentration, a ring of boracic acid separated on the dish, which boracic acid is heated much more than the solution and is exposed to the action of the steam rising from the liquid. In that case a volatilization takes place.

Having found out that superheated steam is much more powerful in carrying off boracic acid than steam of 212° F., it was easy to conclude that the condensation of the volatilized boracic acid could not present great difficulties. The boracic acid volatilized in the apparatus described before, that is, in a heated iron pipe, was found condensed in the colder portion of the pipe. By regulating the length and temperature of the pipe, the fact resulted that the steam could be deprived nearly entirely of its percentage in boracic acid.

From these facts the following process of working borate of lime suggested itself:

The borate of lime can be used as found on the borax marshes, or more or less purified if it has to be transported some distance. It is placed into a lead-lined, shallow pan, covered with half the weight of water, and allowed to stand for a day, or longer, in order to allow the lumps to dissolve. Then from one-quarter to one-half the weight of sulphuric acid is added and the whole well stirred into a stiff pulp, which is taken out and thrown in a heap. After some days the mess has become hard, as the gypsum formed commences to set. With this first operation the mass is ready for the second operation—the distilling with steam. It is done in an iron retort with an arrangement for heating it. An ordinary gas pipe, 12 feet by 1½ feet, would answer very well. It ought to stand in an upright position, in order to facilitate the charging and discharging, as also to cause an equal action of the steam. When the pipe is sufficiently heated that no condensation of steam can take place, steam is admitted. It becomes superheated within the retort and carries along the boracic acid, leaving a porous mass of gypsum, etc., which, when the operation is continued sufficiently long, will be found entirely free from boracic acid. It has been mentioned before that the rapidity of the action depends only on the heat employed. If the temperature of the retort is near the red heat, from one to two hours will suffice to finish the operation in the lower part of the retort. At a temperature of only say 400° F., which is very easily reached within the retort, about four hours will be required.

The details of the apparatus which allows a continuous working, and by withdrawing only half the contents every few hours, allows the mass to be exposed twice as long, that is eight hours, to the action of the steam, I will omit here.

The steam which leaves the retort is highly charged with boracic acid. It can be made to absorb not less than the fourth part of its weight of the hydrated boracic acid. From the retort it passes into a brick or lead-lined wooden chamber where most of the hydrate of boracic acid will deposit. Thence it passes another chamber, or better, a long flue provided with some metal grating, before it escapes into the atmosphere. Also a worm condenser can be used, and with it a strong solution of boracic acid will result. It may also pass through a coil of lead or other metal, which utilizes the waste heat. There are numerous devices to remove, by partial condensing, the last traces of boracic acid if desired.

Most of the boracic acid is, however, found in the first chamber, as hydrate. $BO_3 + 3\,HO$, and can be from time to time removed. It can be easily melted into a glass, taking care to condense the fumes during melting, and is then absolutely pure. In the state as found in the chamber, it may contain a little sulphuric acid, but by admixture of some coke or charcoal with the top layer in the retort, the sulphurous acid can be entirely converted into sulphurous gas, which escapes uncondensed from the chambers. There is no other substance present to interfere with the purity of the product obtained. In a mechanical way nothing can go over, as the mass within the retort gets all glazed over by boracic acid.

The advantages of the process are, that with very little labor in one single and short operation, the mineral can be exhausted. There are no rich residues left to be worked over nor liquors to be concentrated, which makes the lixiviating process so complicated. Besides, the boracic acid, and particularly the boracic acid glass, can bear the high cost of transportation from the borax marshes much better than the borax or the borate of lime. To bring one pound of borax from the marshes to the market, that is, New York or European ports, costs now from six to seven cents. To transport the molten boracic acid, which gives three pounds of borax nearly, would reduce the cost for one pound of borax by two-thirds.

Regular Meeting, April 21, 1873.

President in the Chair.

Forty members present.

J. B. Cox, Frank F. Taylor, Charles B. Brigham and D. S. Hutchinson were elected resident members.

The name of Mr. S. B. Boswell, elected resident member on the sixth of January, was transferred to the list of life members, he having paid the required fee.

Donations to Library: Proceedings of Agassiz Institute, pp. 25–48. Overland Monthly, May, 1873. Bacon & Company presented a Hand-stamp.

Donations to Museum: Fossil shells from Santa Rosa Island by W. G. Blunt. Tooth of Elephas from Scalchet Head, Puget Sound, also Elk horn wedge from same place, found near the preceding specimen, at the foot of a bluff 250 feet high, presented by J. S. Lawson of U. S. Coast Survey. Fossil mollusks from near Mount St. Helena, by Col. C. L. Bulkeley. Egg of a species of Fish, probably allied to the Rays, from Newport Bay, fourteen miles south of Anaheim, presented by Dr. David Taylor. Portion of tooth of Elephas, supposed to have been found near Sitka, from L. W. Ransom. Specimen of saw of saw-fish from west coast of Mexico, presented by Adolph Hartman, through Mr. A. Cooper. Tooth of fossil Elephas from Santa Barbara Island, by W. G. Blunt. Fossil barnacles, found at foot of gravel bluff, forming west bank of Salinas River, in T. 21 S., R. 9 E., about sixty miles south of Salinas City, County of Monterey, from Michael Deering.

Notes on the Honey-Making Ant of Texas and New Mexico, Myrmecocystus Mexicanus of Westwood.

BY HENRY EDWARDS.

The natural history of this very curious species is so little known, that the preservation of every fact connected with its economy becomes a matter of considerable scientific importance, and the following observations, gleaned from Capt. W. B. Fleeson of this city, who has recently had an opportunity of studying the ants in their native haunts, may, it is hoped, be not without interest.

The community appears to consist of three distinct kinds of ants, probably of two separate genera, whose offices in the general order of the nest would seem to be entirely apart from each other, and who perform the labor allotted to them without the least encroachment upon the duties of their fellows. The larger number of individuals consists of yellow worker ants of two kinds, one of which of a pale golden yellow color, about one-third of an inch in length, acts as nurses and feeders of the honey-making kind, who do not quit the interior of the nest, "their sole purpose being, apparently, to elaborate a kind of honey, which they are said to discharge into prepared receptacles, and which constitutes the food of the entire population. In these honey-secreting workers the abdomen is distended into a large, globose, bladder-like form, about the size of a pea." The third variety of ant is much larger, black in color, and with very formidable mandibles. For the purpose of better understanding the doings of this strange community, we will designate them as follows:

No. 1—Yellow workers; nurses and feeders.

No. 2—Yellow workers; honey makers.

No. 3—Black workers; guards and purveyors.

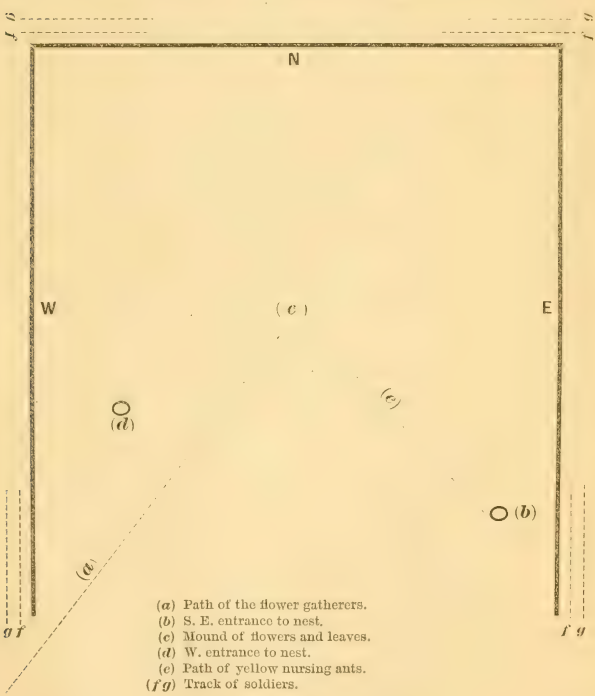
The site chosen for the nest is usually some sandy soil in the neighborhood of shrubs and flowers, and the space occupied is about from four to five feet square. Unlike the nests of most other ants, however, the surface of the soil is usually undisturbed, and but for the presence of the insects themselves, presents a very different appearance from the ordinary communities, the ground having been subject to no disturbance, and not pulverized and rendered loose as is the case with the majority of species.

The black workers (No. 3) surround the nest as guards or sentinels, and are always in a state of great activity. They form two lines of defence, moving different ways, their march always being along three sides of a square, one column moving from the SE to the SW corners of the fortification, while the other proceeds in the opposite direction. In most of the nests examined by Captain Fleeson, the direction of the nest was usually towards the north; the east, west and northern sides being surrounded by the soldiers, while the southern portion was left open and undefended. In case of any enemy approaching the encampment, a number of the guards leave their station in the line and sally forth to face the intruder, raising themselves upon their hind tarsi, and moving their somewhat formidable mandibles to and fro as if in defiance of their foe. Spiders, wasps, beetles and other insects are, if they come too near to the hive, attacked by them in the most merciless manner, and the dead body of the vanquished is speedily removed from the neighborhood of the nest, the conquerers marching back to resume their places in the line of defence, their object in the destruction of other insects being the protection of their encampment, and not the obtaining of food. While one section of the black workers is thus engaged as sentinels, another and still more numerous division will be found busily employed in entering the quadrangle by a diagonal line bearing NE, and carrying in their mouths flowers and fragments of aromatic leaves which they deposit in the centre of the square. A reference to the accompanying sketch will give a more clear understanding of their course; the dotted line (a) representing the path of this latter section, while the mound of flowers and leaves is marked (c). If the line (a) be followed in a SW direction, it will be found to lead to the trees and shrubs upon which another division of the black workers is settled, engaged in biting off the petals and leaves to be collected and conveyed to the nest by their assistants below. On the west side of the encampment is a hole marked (d), leading down to the interior of the nest, which is probably chiefly intended for the introduction of air, as in case of any individuals carrying their loads into it, they immediately emerge and bear them to the common heap, as if conscious of having been guilty of an error. A smaller hole near to the SE corner of the square, is the only other means by which the interior can be reached, and down this aperture, marked (b), the flowers gathered by the black workers are carried along the line (e), from the heap in the centre of the square, by a number of the smaller yellow workers (No. 1), who, with their weaker frames and less developed mouth organs, seem adapted for the gentler offices of nurses for the colony within. It is remarkable that no black ant is ever seen upon the line (e), and no yellow one ever approaches the line (a), each keeping his own separate station and following his given line of duty with a steadfastness which is as wonderful as it is admirable. By removing the soil to a depth of about three feet, and tracing the course of the galleries from the entrances (b) and (d), a small excavation is reached, across which is spread in the form of a spider's web, a net work of squares spun by the insects, the squares being about one-quarter inch across, and the ends of the web fastened firmly to the earth of the sides of the hollowed space which forms the bottom of the excavation. In each one of the squares, supported by the web, sits one of the honey-making workers, (No. 2), apparently in the condition of a prisoner, as it does not appear that these creatures ever quit the nest. Indeed it would be difficult for them to do so, as their abdomens are so swollen out by the honey which they contain, as to render locomotion a task of difficulty, if not to make it utterly impossible.

The workers, (No. 1), provide them with a constant supply of flowers and pollen, which, by a process analogous to that of the bee, they convert into honey.

The fact that the remainder of the inhabitants feed on the supply thus obtained, though it is surmised, has not been established by actual observation : indeed, with reference to many of the habits of these creatures, we are at present left in total ignorance, it being a reasonable supposition that, in insects so remarkable in many of their habits, other interesting facts have yet to be brought to light respecting them. It would be of great value to learn the specific rank of the black workers (No. 3), and to know the sexes of the species forming the community, their season and manner of pairing, and whether the honey-makers are themselves used as food, or if they excrete their saccharine fluid for the benefit

DIAGRAM OF THE EXTERIOR OF THE NEST OF MYRMECOCYSTUS MEXICANUS.



(*a*) Path of the flower gatherers.
(*b*) S. E. entrance to nest.
(*c*) Mound of flowers and leaves.
(*d*) W. entrance to nest.
(*e*) Path of yellow nursing ants.
(*fg*) Track of soldiers.

of the inhabitants in general, and then proceed to distil more. I regret that at this time I am only able to bring before the notice of the Academy, specimens of the honey-makers (No. 2), the other members of the community, except from Captain Fleeson's description, being quite unknown to me. It is, however, my hope that at a future meeting I may be enabled to exhibit the other varieties, and to give some more extended information upon this very interesting subject. The honey is much sought after by the Mexicans, who not only use it as a delicate article of food, but apply it to bruised and swollen limbs, ascribing to it great healing properties. The species is said to be very abundant in the neighbourhood of Santa Fé, New Mexico, in which district the observations of Capt. Fleeson were made.

On the connection between the Atomic Weights of Substances and their Physiological Action.

BY JAMES BLAKE, M. D.

In a communication to the Academy of Sciences, of France, read February 10th, Messrs. Rabuteau and Ducondray state that the poisonous effects of metals is greater as their atomic weights increase. Having been engaged for many years in experimenting on the physiological effects of organic compounds, I find myself in possession of a number of facts bearing directly on this interesting question. In a paper read before the Royal Society of England in 1841, I stated that isomorphous substances, when introduced directly into the blood, produce analogous physiological reactions. Since this time a widely extended series of experiments with these substances has confirmed the truth of this fact.*

I shall not now enter into a general review of the facts I have already published, but would state that when the different elements are grouped according to their isomorphous relations, I find, evidently, a close connection between their physiological action and relative atomic weights, and it is only with this restriction that the statement of Messrs. Rabuteau and Ducondray is even approximately applicable. That no absolute connection exists between the atomic weight of a metal and its physiological action, is evident. For instance, the salts of potassium, the atomic weight of which is thirty-nine, are far more poisonous than the salts of ferrous oxide, the atomic weight of iron being 56, and the salts of beryllium with an atomic weight of 9.3 are more poisonous than the salts of silver, with an atomic weight of 108. As an example of the connection between the atomic weights and the poisonous qualities of a substance, the accompanying table affords strong evidence that such a connection exists when the substances belong to the same isomorphous group. The experiments were performed on rabbits, by injecting solutions of some salt of the metal directly into the jugular vein.

* An account of many of these experiments is contained in the Reports of the British Association for the Advancement of Science, from 1845 to 1850, and in 3d, 4th and 5th vols. of the *Journal of Anatomy and Physiology*.

NAME OF SUBSTANCE.	ATOMIC WEIGHT.	QUANTITY FATAL.
Lithium	7	40 grs.
Sodium	23	20 grs.
Rubidium	65	6 grs.
Cæsium	133	9 grs.
Thalium	204	3 grs.

These substances all belong to the same isomorphous group, their distinctive physiological action being that they are all lung poisons, as they kill by the action they exert on the lungs, either by suddenly arresting the pulmonary circulation or by causing changes in the lung tissue which prevent the aeration of the blood. Having experimentally investigated the physiological action of most of the more important groups of inorganic compounds, comprising about forty of the different elements, I would bring forward a large amount of evidence, showing that to a certain extent a connection exists between the relative atomic weight of substances in the same isomorphous group and their physiological action, and this I propose to do on some future occasion. At present I will cite one more striking example furnished by the salts of iron. This metal, as is well known, furnishes two classes of salts, in one of which the molecule is bivalent, the atomic number being 56, in the other class the molecule becomes quadrivalent, with a combining number of 112. Of the former class of salts, 30 or 40 grains can be introduced into the veins (in dogs) without destroying life, whilst 3 or 4 grains of the quadrivalent compounds are fatal. The extremely poisonous effects of the metals of the platinum group with their high atomic weight, is another instance of the connection of atomic weight with physiological action. The above observations tend to confirm an opinion I expressed in a paper read at the meeting of the British Association for the Advancement of Science, in 1845, when I stated: "In considering the action of inorganic compounds on living beings, it is clear that our attention must not be directed exclusively to the chemical properties of these substances; it must not be as acids or alkalies or salts that their action on living beings must be investigated, but as regards their isomorphous relations, or those properties which are evidently connected with the form they assume."

In our ordinary chemical reactions, the greater the atomic weight of a body the larger the quantity that must be used to form the different compounds into which it enters; whilst the above facts show that with certain restrictions the very reverse of this is the case in the reactions it produces in living beings. The above facts, together with those already published, justify the conclusion that, first: when introduced directly into the blood, each member of an isomorphous group gives rise to analogous reactions, both on the tissues and on the blood, and second: that the intensity of these reactions is in some way connected with the relative atomic weight of the substance in the group to which it belongs. Exceptions undoubtedly present themselves to the above generalizations, nor is it at all surprising that in the present imperfect state of our knowledge as regards atomic physics, that such should be the case; but still, the number of instances in which a well marked connection is found between isomorphism, atomic weight and physiological action, is so large, that that there can be no doubt that these molecular properties of inorganic elements are closely connected with their physiological action.*

Mr. Stearns, after describing the general characteristics of the Nudibranchiata, submitted the following.

Descriptions of a New Genus and two New Species of Nudibranchiate Mollusks from the Coast of California.

BY ROBERT E. C. STEARNS.

Genus LATERIBRANCHIÆA, Stearns.

Animal like *Triopa*, with a single series of gills on each side, central or subcentral and opposite.

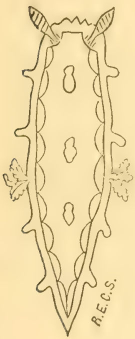


FIG. 1, ($\frac{2}{1}$).

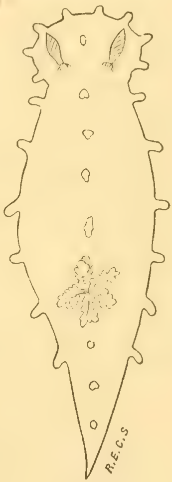


FIG. 2, $\frac{2}{1}$).

LATERIBRANCHIÆA FESTIVA, Stearns, FIG. 1.

Body slug-shaped, about one inch long; of a *translucent* cream white color on back, ornamented with looped linear markings on each side, of an opaque *chalky*

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*NOTE.—In these experiments which were conducted to ascertain the general effects of the substances used, the quantities employed were usually injected in four or five doses, and therefore do not probably indicate the minimum doses that would be fatal.

white, and three irregular, ring-shaped markings of the same color, nearly equidistant and along a central line on the back, also marked with a few inconspicuous irregularly placed orange spots; cephalic tentacles short, clavate, stumpy, fringed at base, branchial orifices on each side, sub-central, with short arborescent plumes.

Habitat.—Point Pinos, near light house, Monterey, California, on the under side of granite boulders at extreme low tide; detected by Mr. Harford and myself in March, 1868.

TRIOPIDÆ, Gray.

TRIOPA, Johnston.

TRIOPA CARPENTERI, Stearns, FIG. 2.

Animal slug-shaped; anteriorly obtusely rounded, posteriorly pointed, somewhat attenuated; cephalic tentacles clavate, upper part of same of an orange color, below white; gill plumes five, arborescent, resembling fern leaves, tipped with orange; plumes and tentacles 1–16 inch in length; the former situated in middle of the back somewhat posterior to centre. Six tentacular processes on each side, tipped with orange and 1–32 inch long; also short tentacular processes in front of the head; body one and one-half inches in length, translucent white, covered with fine papillæ of an orange color.

Habitat.—Monterey, at Point Pinos near the light house, on the under side of granite rocks at edge of laminarian zone, where the above was collected by Mr. W. G. W. Harford and myself in March, 1868.

This species is named for my friend Dr. P. P. Carpenter of Montreal, whose thorough work in connection with the mollusca of W. North America has been of great service to investigators.

The above descriptions, though somewhat meagre from lack of the proper instruments for more careful diagnosis, are nevertheless adequate to a ready determination of both of the above well marked and elegant species.

Descriptions of New Marine Mollusks from the West Coast of North America.

BY ROBERT E. C. STEARNS.

CONUS DALLI, Stearns. Plate I, fig. 1.

Shell conical, robust with a smooth surface faintly marked with incremental lines; lower third portion of shell obscurely spirally ribbed and the spire elevated and indistinctly grooved on the top of each whorl; body whorl and spire moderately convex, the latter with a distinct sutural line and a faint sulcation parallel to the same; outer lip simple, aperture linear, internally of a delicate rose-pink tinge; surface of shell marked with irregular longitudinal stripes of reddish brown and sienna yellow, the former color predominating and blending in more or less and glazing the yellow; the longitudinal markings are interrupted by a series of four revolving bands (of which the two lowest are the widest,) composed of numerous whitish spots of irregular size and shape but generally small, rounded or angular; occasionally whitish subangulate spots of larger size than those included in the bands occur between the same, and in line with the longitudinal markings.

Dimensions of largest: Long. 2.35; lat. 1.22 inches. Another specimen measures: Long. 2.15; lat. 1.1 inches.

Habitat.—Gulf of California, from whence specimens are occasionally brought to San Francisco on vessels in the Gulf trade. It is not common.

Figure 70 in Sowby's Conch. Illustr. without habitat, and named " C. textile var." resembles this species. Specimens are in my collection and in that of Mr. Fisher of San Francisco.

This shell belongs to the group of so-called " embroidered cones" of which *C. textile* is the most common illustration, and it might carelessly be mistaken for that species; in *C. textile* however the white (in cleaned specimens) is the dominant color, and the triangular blotches of white are large and sharply defined by a line of brown, and there is but little blending or coalescing of the brown and yellow lines, which are much sharper and more distinct as well as of a lighter shade and narrower than in *C. Dalli*. *C. textile* is of a clear whiteness interiorly, while the shell described herein has a delicate pinkish interior; in *textile* the spire is somewhat *concave*, in *Dalli* it is moderately *convex;* and the latter in outline is a less graceful shell, and belongs to a widely separated zoölogical province.

Ptychatractus occidentalis, Stearns.

P. occidentalis, Stearns, Prel. Descr. August 28, 1871.

Shell elongated, fusiform, rather slender, whitish, traversed by narrow, revolving, brownish threads and much wider intervening spaces; suture distinct, spire tapering; aperture oblong-oval, about half the length of the shell; within white, polished; canal short, nearly straight; columellar obliquely, not strongly plicated; length about three-fourths of an inch.

Habitat.—Near the Island of Nagai, one of the Shumagin Islands, where it was hooked up attached to a rock from a depth of forty fathoms, by Captain Prime of the California Fishing fleet; through the kindness of Mr. Harford to whom it was given, it is now in my cabinet.

This shell in its general features resembles the North Atlantic *P. ligatus* of Mighel and Adams, *vide* Boston Jour. Natl. Hist., IV, 1842, p. 51, pl. IV., fig. 17. It is a more delicate shell than the Atlantic species, though my solitary specimen, judging by the thinness of the outer lip, is not quite mature. I regret that I am unable at present to furnish figures of this and the succeeding species, the specimens having inadvertently been mislaid.

Fusus (Chrysodomus?) Harfordii, Stearns.

F. (C.) Harfordii, Stearns, Prel. Descr. August 28, 1871.

Shell solid, elongate, regularly fusiform; spire elevated, whorls six or seven, moderately convex, slightly flattened (in outline) above, with a groove or channel following the suture; color, chocolate brown; surface marked by numerous narrow revolving costæ, which alternate in prominence on the body whorl, and longitudinally by fine incremental striæ, and on the upper whorls by obtusely rounded ribs of more or less prominence; aperture ovate, about one-half the length of the shell, polished, white and finely ribbed within; (the outer lip in perfect specimens is probably finely crenulated); canal short, nearly straight. Lon. 2.1; lat. .94 in. Number of specimens, three; two mature, dead, one junior, fresh.

Habitat.—Coast of Mendocino County, near Big Spanish Flat, California, where it was detected by Mr. Harford.

Though almost typically fusiform, except in the brevity of the canal, I am disposed to place it in *Chrysodomus* rather than with *Fusus*. Dr. Carpenter is inclined to believe that certain specimens collected at Monterey by the late Dr. C. A. Canfield and at Catalina Island by Dr. Cooper, are identical with the above. I am of the opinion that it is rather a northern form, exceedingly local in its distribution and more nearly allied to some of the later fossils of the coast described by Mr. Gabb.

PLEUROTOMA (DRILLIA) MONTEREYENSIS, Stearns. Plate I, fig. 2.

P. (*D.*) *Montereyensis*, Stearns. Prel. Descr. August 28, 1871.

Shell small, rather solid, elongate, slender; spire elevated, sub-acute; whorls, seven to eight moderately rounded; upper portion of larger volutions somewhat concavely angulated; suture distinct; color, dark purplish brown or black; surface covered with rather coarse, inconspicuous, revolving costæ, interrupted on the body whorl by rude incremental lines; middle of upper whorls and upper part of body whorl displaying fourteen to fifteen equidistant, longitudinal, nodose, slightly oblique ribs, which are whitish in the specimen before me (being somewhat rubbed) on the larger whorls; on the smaller volutions of the spire a puckering at and following the suture suggests a second indistinct series of nodules; aperture less than half the length of the shell; canal short; terminal portion of columella whitish, slightly twisted; posterior sinus, rather broad rounded, and of moderate depth. Long. .67 in.; lat. .24 in.

Habitat.—Monterey, California, where the single specimen in my cabinet was collected by Mr. Harford and myself in March, 1868. The shell, in its general aspect, resembles the sombre colored species of the Gulf of California and Panama.

In the cabinet of the Rev. J. Rowell is a specimen perhaps of this species, but not in sufficiently perfect condition to admit of certainty.

PLEUROTOMA (DRILLIA) HEMPHILLII, Stearns. Plate I, fig. 3.

P. (*D.*) *Hemphillii*, Stearns, Prel. Descr. August 28, 1871.

Shell small, smooth, slender, polished; spire long, subacute, rounded at apex; longitudinally marked with inconspicuous, oblique ribs, which are nearly obsolete on the body whorl; number of whorls seven, with well defined sutural line, and just below it a parallel impressed thread-like line; shell of an opaque dingy horn color; incremental lines fine, marked in some specimens with dingy white; mouth obliquely ovate, about one-third the length of the shell; labrum produced, anteriorly somewhat thickened; sinus sutural, deep, calloused; columella thickened at base; canal very short, somewhat produced and twisted; one specimen shows obscure, revolving, impressed lines below the swell of the body whorl; size quite uniform. Long. .26; lat. .09 inch.

Habitat.—Todos los Santos Bay, Lower California, where several specimens were obtained by Mr. Hemphill, for whom I have named this well marked species.

MURICIDEA SUBANGULATA, Stearns. Plate I, fig. 4.

Shell small, abbreviated fusiform, dingy white and marked spirally by an inconspicuous band formed of three reddish-brown lines more or less interrupted on the basal and the preceding volution; whorls five, angulated above and on the basal whorl rounded below the angle, with a shallow sulcation beneath; surface covered with rounded and irregular costæ, which are inconspicuous or obsolete on the upper whorls; longitudinally marked with from seven to nine irregular rounded ribs, which at the edge of the angle (which is somewhat carinated) are broken into angular or pointed knobs or blunt spines; aperture ovate, angulated above and white within; the outer lip with five or six tubercles internally; canal moderately prolonged, slightly curved and open in the two specimens before me. Dimensions of largest: Long. .89; lat. .41 inch.

Habitat.—San Miguel Island, off the southern coast of California, where the specimens from which this description is made were obtained by Mr. W. G. W. Harford.

ASTYRIS VARIEGATA, Stearns. Plate I, fig. 5.

Shell small, elongated, acutely conic, light rufous-brown or sienna-yellow under a thin brownish or greenish epidermis; with whitish median and sutural bands more or less interrupted; in some specimens these bands are connected by waved lines of a darker brown; surface of shell when free from epidermis, smooth and shining, marked with delicate incremental lines, and on the lower portion of the body whorl with narrow grooves; apex rounded, whorls seven, convex; suture well defined, aperture ovate, about one-third the length of the shell; outer lip simple, in some specimens a little thickened with small tubercles on the inner side.

Dimensions: Long. .3; lat. .12 inch.

Habitat.—San Diego, California, where numerous specimens were collected by Henry Hemphill, Esq. This beautiful species resembles some forms of *Nitidella* and *Truncaria*; it differs from *Astyris tuberosa*, in the greater convexity of the whorls, and especially in being without the angularity or concavity which is displayed in the lower part of the body whorl in the latter species; it is a more delicate and graceful shell than either of the other forms of *Astyris* found on the coast, many of which have been distributed as "*Amycla*" or "*Columbella*" *gausapata*, *Californiana*, *carinata*, and var. *Hindsii*.

PHOLAS PACIFICA, Stearns. Plate I, figs. 6, 6a, 6b, 6c.

P. Pacifica, Stearns, Prel. Descr. August 28, 1871.

Shell oblong, beaks two-fifths of length of shell from anterior end; anterior end of valves triangular, pointed; anterior dorsal edge of valves reflected and folded down on the umbos; lower anterior margin curved, forming a large elliptic-oval gape; posterior end of valves squarely rounded; shell dull chalky white, sculptured in concentric lines, which anteriorly are laminated and posteriorly become extinct; valves radiately ribbed, which also become obsolete at the posterior end; at the intersection of the radiating and concentric lines the sculpture is pectinated; an area below the umbos nearly or quite destitute of sculpture, which varies much in prominence in different specimens; accessory plate sublanceolate and bent down on the beaks, anteriorly prolonged, but not wholly covering the ante-umbonal gape; figs. 6a, 6b, show the variation in the shape of the dorsal plate in different specimens; interior of valves white, enamelled; internal rib short, curved and flattened. Largest specimen, two and six-tenths inches in length, and one and five-tenths inches in height.

Habitat.—Alameda, San Francisco Bay, California, where in some places it is common in sandy mud between tide marks. Numerous specimens collected by Messrs. Harford, Hemphill, Drs. Kellogg and W. P. Gibbons.

This shell is the West Coast analogue of the Atlantic *P. truncata*, Say, which it resembles; it is however a much longer shell for its width, and the portion of the valves posterior to the beaks, very much longer than in Say's species. Specimens of this species have been distributed as *Zirphæa crispata*, which also is found upon the coast, though quite distinct from *P. Pacifica*, which latter comes within Mr. Tryon's subgenus *Cyrtopleura*.

According to the Messrs. Adams in the genus *Pholas*, there are *two* dorsal plates; yet they have included in their list of the species under that genus, *P. truncata*, Say, which has only *one*.

Dr. Kellogg read a description of a new species of native cotton found by Professor Davidson at San José del Cabo, Lower California, lat. 23° 3′, a plant about four or five feet high, flowers bright straw yellow with purple centre, fruit not seen, and which may be called *Gossypium Davidsonii*, Kellogg. Also a new species of *Convolvulacœ* or Golden Morning Glory, *Aniseia aurea*, Kellogg; a beautiful perennial twining vine, collected at the same locality with the preceding by Prof. Davidson in March, 1873.

Descriptions of New Plants from the West Coast of America.

BY A. KELLOGG, M. D.

Gossypium Davidsonii, Kellogg.

On the branches bark cinnamon brown, puberulent and sparsely stellate throughout, the extremities villous or short hirsute and somewhat stellate, with black spots and dark glands intermixed on twigs, petioles, leaves, peduncles and floral envelopes and flowers; upper leaves roundish-cordate, entire, or sub-entire, (or with an occasional tooth, indicative of a pseudo 2 to 3-lobed disposition), acute, or abruptly acuminate, 5-palmate-nerved, densely velvety hirsute on both surfaces; a single oval gland on the mid-rib beneath, petioles short (about half the length of the blade). Peduncles short, not articulated, bracts minute, linear, opposite at the base of junction with the stem, early deciduous.

Involucels 3-leaved, somewhat unequal, cordate, acute, cleft-dentate (7 to 10 teeth) or cleft-lobed towards the apex, 7-nerved or more; (½ to ¾ inch long and ½ inch wide), calyx cup-shaped, border repand-dentate or sub-5-toothed, dotted throughout with black glands mostly in parallel longitudinal lines, hirsute in lines (about 20) along the minute and somewhat obscure ridges, lobes of the style 3, coherent, stamens about midway below the stigmas.

Flowers bright lemon yellow, with a purple spot at the base of each petal, petals oblique, purplish tinged on the outer margin above (owing to exposure in the convolute state of æstivation), flower about 1½ inches or so in expansion. Petals hirsute on the back, chiefly at the outer exposed margin and edge. Capsules not seen—and the specimen too fragmentary for fuller description.

Closely allied to the Java cotton tree—a shrub about 5 feet high (*G. Javanicum*=a *sida* of some authors); but that is "quite smooth," besides the long peduncles, etc.

This closely approximates the Nankeen cotton of India or China, but this—the *Gossypium religiosum*—the sacred or religious cotton, differs from the *Davidsonii* in having 3 to 5-lobed leaves, and white flowers, instead of yellow and purple spotted—as the plant before us.

In the absence of capsules and seeds, with only a single flower for external inspection; a question might arise whether this may not prove another species of the new genus *Thurberia* of Gray. It may be proper to say, the plant upon which that genus is founded is evidently of the tribe *Hibisceæ*, having the peduncle articulated in the middle, which is not the case with this—of minor specific import is its glabrous character—narrowly lanceolate entire involucels, of barely 3 or 4 lines in length, or twice the length of the cup-shaped truncate entire calyx, etc., hence we see no reason, as yet, for separating it from *Gossypium* as indicated.

I take great satisfaction in dedicating this plant to the worthy President of the Academy, as an act of justice to the discoverer, and in consideration of his zeal to promote the cause of science by every opportunity and means in his power. These evidences are well known and multiply—and are, we trust, duly appreciated—our admiration is enhanced by a knowledge of his arduous official duties, sufficient to excuse any one from further cares, who was less devoted to the cause of science.

Aniseia aurea, Kellogg.

Stem perennial herbaceous twining, (from right to left, or against the sun) somewhat pentagonally striate, subglabrous, or slightly puberulent, (scarcely a few scattering hairs); leaves alternate super-pedunculate, or the axils reversed, quinate-digitate, leaflets rhombic (rarely obovate) entire, subrepand, apex mucronate or sub-cuspidate, sessile or subsessile, long (½ to 1 inch, or twice the length of the petiole, which is persistent while the leaflets are deciduous), subglabrous above, slightly rugose-pitted beneath, somewhat lighter green, and of rather unequal size.

Peduncles sub-axillary (by reversion ?), about equal the petioles, but stouter, articulated with the pedicel close below the flower, 2 or 3 very minute bracts or scales at or near the articulation ; calyx of 5 or 6 unequal sepals, outer lower (¼ shorter than the 3 succeeding) sub-cordate-carinate at the base, flattened membranaceous above to the scarious mostly entire margin, oval-oblong, obtuse, sometimes apiculate, notched ; the three succeeding a little broader and longer, more oval, inserted higher ; the fifth scale or lobe narrower ; the sixth inmost highest scale, hyaline, acute from a broad base, short (about ¼ of an inch long, or ¼ to ⅓ the length of the outer sepals .

Flowers large, (3 inches or more in expansion) golden yellow, 5 broad strap-like bands of about equal width radiate the widely expanding funnel-form flower corolla, each band 5-nerved, the bell-shaped throat rather abruptly narrowed into a short purple tube; stamens 5, sub-equal, short, somewhat unequal filaments (purple almost to black) subulate, glabrous above, bearded at the extreme base, about half the length of the (yellow) anthers, which are fixed by the sub-cordate-hastate base, introrse oblong gradually attenuate above, in the dry state twisted from left to right or contrary to the stem ; style short, glabrous (purple), stigma 2-lobed, stigmatic-lobes cerebriform-folded ; capsule with an annulate base, 2-celled, cells 2-seeded, seeds sub-angular or rounded on the back with two flatish faces, glabrous.

Occasionally a small scale a little below and apart from the proper calyx is seen, not included in the six segments enumerated. A plant perhaps nearest allied to *Spomœa quinata*, Br., a New Holland plant, but quite distinct, for in that the inner 2 calyx lobes are twice the length of the outer three, leaflets "lanceolate," etc. *I. pentaphylla* has a lobed border, red and white flower, small rough exterior calyx lobes, etc.

Found by Prof. Geo. Davidson, U. S. Coast Survey, lat. 23° 03′, at San José del Cabo, Lower California, March, 1873.

Mr. Hastings read a paper on pavements, and gave descriptions of the pavements in use in ancient and modern times.

Dr. Stout exhibited specimens of the stone used in the construction of the U. S. Branch Mint in this city, and which was obtained at Vancouver Island ; the iron contained in the stone becomes oxydized after a brief exposure to the weather, and changes from a bluish gray to a dingy yellow ; the two pieces submitted for the inspection of the members were formerly in one piece, which was cut into two equal parts for the purposes of the experiment. Dr. Stout had experimented to see if the faulty color could be corrected, and the specimens before the Academy showed the result of his experiment. He had immersed the face of one of these pieces in sulphuric acid to a depth of an inch, and a comparison of the two pieces shows that the process employed was successful; it would involve great expense to apply it to the Mint building, but could be used economically if applied to each separate dressed stone before being placed in the walls.

Dr. Stout suggested that a collection of samples of building stone should be made for the Academy's museum.

Mr. Stearns, on behalf of the special committee appointed at the last meeting, submitted the following:

Resolutions on the Death of Dr. John Torrey.

WHEREAS, the California Academy of Sciences has learned of the death of the eminent Doctor and Professor John Torrey, an honorary member and warm friend of this Academy, as well as personal friend of many of its members, and a distinguished scientist: it is

Resolved—That the California Academy of Sciences hereby express the profoundest regret at the death of its esteemed friend and late member, Prof. John Torrey, and lament his loss, not alone in its public aspect, from his high scientific attainments, but for the purity of his private character and the many estimable qualities which endeared him to his fellow-men.

Resolved—That the California Academy of Sciences extend to the family of their deceased friend the warmest regard and sincerest sympathy.

Resolved—That a copy of these resolutions be engrossed, and forwarded to the family of the deceased.

REGULAR MEETING, May 5, 1873.

President in the Chair.

A. P. Moore and Wm. W. Hollister were elected life members, and O. C. Pratt and Charles V. B. Keading were elected resident members.

Donations to the Museum: The first shad (*Alausa prœstabilis*, De Kay) caught in the waters of California was presented by the Board of Fish Commissioners of California, through S. R. Throckmorton. Specimen of *Orchilla* from Magdalena Bay, presented by George Davidson. Specimens of Fishes, Crustaceans, Gorgonia, Silver ore, etc., from the late Lieut. Erasmus Dennison, through and in behalf of the messmates of the deceased, by Lieut. L. E. Chenery, U. S. N.

Donations to the Library: Washington Astronom. and Meteorol. Observations, 1870. Results of Washington Observations, 1853 to 1860. Memoir of the Founding and Progress of the U. S. Naval Observatory, by Prof. J. E. Nourse. Report on the Difference of Longitude between Washington and St. Louis, by Wm. Harkness; all of the above from the U. S. Naval Observatory, Washington, D. C. American Naturalist, Vol. VII, Parts 3–4. Am. Jour. Science and Arts, Vol. V, No. 28. Catalogue of Photographs from the Collections of the British Museum. A Contribution to the Icthyology of Alaska, by E. D. Cope, Pamph. 8vo. Const. and By-Laws of Acad. Nat. Sciences of Minnesota. Monatsbericht der Kögnig. Preuss. Akad. der Wissenschaften zu Berlin, Nov. and Dec. 1872. Proc. Royal Geog. Society, Vol. XVI, No. 5, and Vol. XVII, No. 1. Annalen der Physik und Chemie, 1873, Leipzig, Nos. 1 and 2. Canadian Naturalist, Vol. VII, No. 1. Cosmos di Guido Cora. Vol. 1, Part 1, Turin, 1873. Cal. Horticulturist, April, 1873, from J. H. Carmany & Co. Proc. Acad. Nat. Sciences, Phila., Part 3, Oct., Nov. and Dec., 1872; also Part 4, pp. 57–200. Eng. and Mining Jour., Vol. XV, Nos. 10, 11, 12, 13 and 14.

Additions to Library by purchase: Popular Science Monthly, No. XII, No. XIII, 1873. Journal of Botany, London, Jan., Feb., March and April, 1873. Annals and Mag. of Nat. History, Jan., Feb., Mar. and April, 1873. Quarterly Jour. of the Geolog. Society, Vol. XXIX, Part 1, London, Feb., 1873. Quarterly Jour. of Micro. Science, London, Jan. and Apl., 1873. Bulletin of Essex Institute, Vol. IV, Nos. 9–10, 1872. Nature, Jan. 2 to April 3, 1873.

In connection with the specimen of Shad presented this evening, Mr. Throckmorton said that on the 27th of June, 1871, this shad was three-quarters of an inch in length, and was put into the Sacramento River at Tehama, after making a trip across the continent. One of the first efforts of the Commissioners was to get shad from the eastern coast, because it was emphatically a food fish; and the desire was to ascertain whether it could be propagated on this coast with success. The Commissioners opened correspondence with Mr. Seth Green on the subject of bringing over the ova of the fish. He discouraged the Commissioners at once, from the fact that the shad is hatched in from thirty-six to forty-five hours.

The Commission then tried to obtain a supply of water for transit of breeders, and the railroad companies were kind enough to give them the use of a construction train for the purpose. Mr. Green said it was impossible to bring the adult fish across the continent, and it was useless to try. The Commissioners experimented on the last alternative. They sought from Mr. Green to ascertain whether it was possible for the young fish to live in fresh water instead of salt, long enough to cross the continent. They did not hear from Mr. Green for three months, and he stated that he had spent that time in experiments. He had hatched young fish, had kept them in glass jars, and had ascertained that life could be preserved for several weeks, and he could transport any number required.

He brought on to this coast 15,000. They were hatched in the Hudson on Saturday night, they arrived here on Tuesday week, and at nine o'clock that night they were placed in the Sacramento above Tehama. Mr. Green examined the water there and pronounced the conditions favorable. He afterwards examined the mouth of the harbor and found the feed good on the coast. No fish were lost on the way except those removed from the water for experiments. Above Tehama last year an Indian caught a little fish, and no one could tell what it was. Mr. Throckmorton had not seen it. The first which had been presented was caught recently in a trap below Vallejo. It was a male and was not full grown. The fish would be at maturity next year, and they might be expected in the harbor from the sea by the month of April. They would be full-sized breeding fish, and if a quarter of the 15,000 came back as breeding fish, they would be sufficient to stock our coast.

Last year the Commissioners had sent East for 50,000 fish, but the very hot weather which prevailed broke up the arrangement. This year the Commissioners have made ample arrangements for a supply of Eastern fish. They have now at Charlestown, New Hampshire, a full-sized car, which they have obtained from the Central Pacific Company. The car was being fitted up with all the appliances for the conveyance of a large consignment of fish; which will consist of black bass, white perch, yellow perch, and glass-eyed perch, eels, cat-fish and lobsters; and when it arrived at the Hudson River it would stop long enough to take in 100,000 shad. The car would arrive in California by the middle of June. From this consignment the Commissioners hoped to make a fair start in stocking this coast with food fishes. They had taken no account of fancy fishes, but had endeavored to spend the moderate appropriation of the State for some permanently useful purpose. The reports as to other shad having been caught, the Commissioners have not been able to authenticate.

This season the Commissioners had brought across the continent a large number of white-fish eggs, and had succeeded in hatching about 25,000. They were now alive and well in Clear Lake, removed from all risk, having been placed there three weeks ago in a healthy condition. These fish had come from the northern lakes of New York.

Dr. Stout exhibited specimens of *Orchilla* and of a liquid dye from the same, which he had prepared by a peculiar process, and exhibited specimens of goods which had been dyed with this preparation.

Dr. Kellogg submitted specimens and descriptions of new plants, *Lilium Bloomerianum* var. *ocellatum* and *Aniseia azurea.*

Descriptions of New Plants from the West Coast of America.

BY A. KELLOGG, M. D.

Lilium Bloomerianum var. ocellatum, Kellogg.

Bulb purple, scales as in the original species, but the bulb often compound, 3 to 6 inches in diameter.

Stems 1 to 5 from a single or compound conglobate bulb; 5 to 7 or 8 feet high, sub-glabrous or slightly striguloid-scabrulose above, more or less purplish tinged; flowering at the summit only; 3 to 8 blossoms on somewhat erect-spreading peduncles, 3 to 6 inches in length, bent down and shortly curved at an abrupt angle beneath the flower, rarely bracted, except at the base.

Leaves in whirls of 5 to 10, sessile, lanceolate, 4 to 4½ inches long, ¾ to 1 inch in breadth, 5-nerved, glabrous above, lamina densely sub-discoid scabrulose beneath, and scabrous along the mid-rib below, margins waved scabrous, tips and upper margins usually purplish tinged. Flowers stiffly nodding. Campanulate, sepals many crested at the base chiefly on the inner series, 3 outer sepals plain above, at length more revolute than the inner series, claw 1-5th to 1-6th the blade; inner sepals somewhat broader, claws much shorter, 1-9th to 1-10th the blade, or longer than the mountain form, a double folded medium elevation marks the face, and a truncate slightly grooved ridge along the back the entire length; base reflexed, the upper 2-3ds gently recurved and aspiring aloft; all the sepals at the margins above and apiculate tips papillose. Color light orange ground, studded with ocellate blotches as if spattered with a dark purple pigment that had spread and tinged an areola around the spots, the lower third or base being spotted with more numerous darker or nearly black and clean well-defined dots; stamens shorter than the style; the curved ascending style slightly streaked with broken purple lines, apex triangular-clavate, stigma undivided.

There are two varieties of *L. Bloomerianum* found growing together in the interior; one with bold, distinct and well-defined dark dots and spots, with longer sepals more attenuated above; the other with ocellate or nipple-like blotches, being broader and of more continuously oblong form. The same distinction into masculine and feminine forms is observed among these maritime lilies. The Island lily has slightly scabrulose stems, and more discoidly-scabrulose under surface to the leaves, and are always scabrous along the mid-rib beneath; whereas the Sierra Mountain lilies are mostly glabrous—sometimes pubescent on both mid-rib and nerves, but never scabrous; they also sport more leaves in the whorls, etc.; these also are broader, hence the greater number of nerves; the numerous flowers are usually (if not always) alternately distributed on longer and more divaricate peduncles. The slightly purplish scales of those of the mountains become very remarkably purple on the islands. The enormous gregarious bulb, with its numerous stems, is a peculiar feature not observed in the thousands of specimens hitherto examined.

Found by Mr. W. G. W. Harford, of U. S. Coast Survey, on Santa Rosa Island, growing on the west side of deep sheltered ravines, trending nearly north and south, hence, only where they get the *morning sun;* but are shaded from the ardent meridian, or post-meridian heat, which burns the leaves and kills them out on opposite exposures of the same locality. They are found growing in loose gravelly detritus of sweet, freshly made soils, on the high and dry well-drained or leaching benches, or steeper declivities, where thus sheltered they thrive the best, mid fogs and fierce cold winds.

We find no evidence of any proper description of this lily. The catalogue refers to scores of new lilies from this coast, among which is *L. Humboldtii.* It is proper to say, this has been kindly figured and sent to me by Max Lichten, of Baden; but that drawing is certainly our *L. pardalinum;* so far as our translation of the remarks of the author enables us to judge—together with the excellent painting — there can be no doubt as to the correctness of this conclusion.

Aniseia azurea, Kellogg.

Stem (perennial?) twining, terete, sub-striate, densely canescent-hirsute throughout. Leaves alternate, cordate, acute and acuminately mucronate, silvery alike above and below, petioles short, or about half an inch long, or half the length and breadth of the blade (in full grown leaves), slightly decurrent, base 5-nerved, alternate veined above, margins sometimes slightly repand, and somewhat oblique. Long axillary peduncles spreading at a right or depending obtuse angle, rarely deflexed with a somewhat ascending sweep, 2 to 2½ inches in length, terminated by a short cymule or condensed raceme. Calyx of 5 unequal sepals, persistent, enveloping the capsule, 2 or 3 outer sepals much larger, ovate acuminate filiform-attenuate, 2 inner smaller, ovate-lanceolate filiform subulate, sub-scarious below, chiefly the 3 outer with a rigid chartaceous concave glabrous central pitted portion, the flaccid herbaceous surrounding parts partially hirsute on the face, and altogether so on the back.

Bracts, and intermixed bracteoles, similar, or subulate-filiform, 1 or 2 at the base of each articulated pedicel, very hirsute, ¼ to ½ an inch in length, or longer than the pedicels. Flowers small, tube very short, funnel-form border nearly entire, or emarginated, glabrous, (æstivation plicate) ¾ to 1 inch expansion, bright blue, star bands whitish taper-pointed, genitals exsert. Stamens short, flattened filaments attenuated upwards, ciliate below, inserted into the base of the tube. Style 1, somewhat longer than the stamens, stigma 2-lobed, lobes ovate, flattened, spread at a right angle. Capsule conoidal sub-prismatic, 2-celled (perhaps at length becoming 1-celled?) 2 seeds in each cell, or 4-seeded, 2 to 4-valved, splitting also at the nerves as well as opening at the angles; seeds roundish on the back and sub-plane on the face, smooth (?) [It is difficult to make out the character of the capsule to entire satisfaction, for want of the mature fruit.]

As D. C. gives the complanate stigma place in his description of *Aniseia*, we place our plant here provisionally.

Found by Prof. Geo. Davidson of U. S. Coast Survey, on his recent (March, 1873) visit to San José del Cabo, near Cape St. Lucas, Lower California, in lat. 23° 03′.

The Abrasions of the Continental Shores of N.W. America, and the supposed Ancient Sea Levels.

BY GEORGE DAVIDSON.

In continuing my examinations of the well marked benches or plateaus bordering the Pacific Coast northward of Cape San Lucas, I have been constrained to doubt their marking the ancient sea levels arising from an elevation of the coast line, or that they were the work of water alone.

That some few of the smaller ones, which are composed of gravel, etc., were made by the action of water, and may mark ancient sea levels, I think may be admitted; but those that exhibit, on an extended scale, level plateaus of rock, which has every degree of inclination or contortion of stratification, and an infinite variety of texture, cannot have been so wrought.

Other forces more powerful and more uniform and constant in action than water, shaped these flat-topped rocky benches or plateaus; and those forces, if more than one, abraded the present continental line of our coast and the larger islands of the Santa Barbara Channel.

The terraces may have been formed at the surface of the sea, or above it, but more likely beneath it, and subsequent elevation of the land brought them to their present positions.

Much of the sharp outlines of this abrasion and terrace-forming has been obliterated by subsequent causes; principally by water from precipitation, alternations of heat and cold, and the action of waves.

I will enumerate the principal examples which I gathered on my recent trip to Mexico, together with those which I have examined in past years, to the northward and southward of San Francisco, and offer some examples from my sketches and from photographs.

Commencing at the southward I could, in my trip of last March, detect no lines of terraces or plateaus whatever at the extremity of the Peninsula of Lower California, if we except the peculiar form of the summits of two or three mountains to the eastward of San José del Cabo. Thence towards Magdalena Bay I had no view of the coast; but on the island of San Margarita, and the great headland of Cape Lazaro, forming the ocean bulwark to Magdalena Bay, and reaching 2,500 feet elevation, I discovered no signs of terraces on the ocean or bay sides.

Of the coast from Cape Lazaro to Cape Colnett, in latitude 31° north, I cannot speak, except of a long table ridge lying inland from Point Abreojos, in about latitude 27°. It had the same peculiar features as the mountains referred to near San José del Cabo.

Northward of Cape Colnett I had very favorable opportunities to study the coast line, and made many views to illustrate the numerous and very marked examples of terraces that are cut and planed in the flank of the high rocky coast barrier. Vancouver has a view of the mesa or table forming Cape Colnett, with the strata inclined at a large angle and the surface cut off quite level.

The Point near Solitarios Rocks, in about lat. 31° 32′ is a well marked table of about 150 feet elevation, with a lower table towards the extremity of the point, visible when it bears E. S. E.

Five miles southward of Point Grajero, about latitute 31° 35′, a deep, cañon-like valley opens upon the ocean, and exhibits numerous and very sharply marked rock terraces on both sides and at all elevations, reaching nearly a thousand feet. The cañon stretches well back into the mountains.

The northernmost of the Todos Santos Islands, about latitude 31° 40′, and not laid down on recent charts, is itself a well marked, rocky, horizontal plateau, thinly covered with soil; whilst the southern island has two terrace marks, the lower corresponding to the level of the top of the northern islet, another higher one, near the summit of the islet, about twice the height from the sea. Even a lower terrace line may be traced about 15 feet above the present sea level.

When passing abreast the northern point of Todos Santos Bay, no less than four well marked terrace rocky points, projecting into the ocean, were sketched in the same view. Each point had other terraces of greater elevations rising inland; whilst to the northward stood out the well known Table Mountain with its remarkable flat top, 2,244 feet above the sea, and having a breadth of 4,800 feet. On this single view no less than fourteen terrace markings are exhibited, including Table Mountain. The vicinity is the best marked terrace formation that I know of on the coast. They are not made in soft soil, but appear as if a planing machine had cut them out of the solid rocks.

The coast line just south of the boundary of California and Lower California exhibits a single terrace stretching some distance southward.

Northward, between Point Loma and San Juan Capistrano, a broad table land of 100 to 300 feet elevation and many miles long, is familiar to all who have traversed that country by stage; at certain points there are, over the plateau, gravel deposits of peculiar shape, for which I have in vain endeavored to find a cause in the movement of water. Their low rounding summits are about two feet above the general level, from twelve to twenty feet in extent, and lie contiguous to each other over occasional large areas, ceasing suddenly and giving place to the very flat table. The fullest effect of their shape is seen at sunrise, with the long shadows filling the intervening depressions.

On passing San Pedro hill the lines of the terraces were peculiarly well marked by the brighter lines of gay flowers seen from seaward on their comparatively level surfaces. The traces of these terraces are cut in rock, and are readily traced in the detailed topographical map by the Coast Survey. The view made by me shows five principal terraces which the contour sheet of topography indicates.

The lowest terrace is about 65 feet above the sea; 2d, 140; 3d, 260; 4th, 360; 5th, 580; several smaller ones about 700 and 800, and other especially marked ones at 900, 1,000 and 1,200 feet. The hill itself is rounded, and at its highest point is 1,478 feet above the sea. The five principal terraces are on the southwest face, but the greater number on the northwest end of the hill.

The "mesa" lying fifteen miles to the northwest of Point Vincente, is a capital example of the flat terrace, and is reproduced on the coast line under the southern flank of the Santa Monica range, at a point about twenty miles westward of Los Angeles. At the mouth of the Arroyo Santa Monica, the table, several miles in extent, has an elevation of about 90 feet, and terminates as a bold rocky bluff on the sea. Within this arroyo are several smaller terraces which may have been formed by water.

Point Dume, lying about 25 miles W.N.W. from Point Vincente, is another well defined table, where a projecting spur from the mountains has been planed off for two or three miles, whilst towards the extremity a deeper grooving has been ploughed out and left the head as a dome-shaped point.

At San Buenaventura, and hence toward Point Concepcion, we find numerous narrow rocky plateaus, but most markedly exhibited in the vicinity of Point Concepcion, where the bluff exhibits every inclination of stratification; but the top is flat and comparatively smooth. It is a counterpart of Point Dume, but more extended.

Among the islands of the Santa Barbara Channel, San Clemente and San Nicolas are both long, comparatively flat topped mountains; but the principal feature of the southern group is the remarkable parallelism of their longer axes, and also of the channels which have been cut through the group lying off the Santa Barbara shores; and this parallelism is continued in the coast line of the Santa Lucia mountains, Mount Buchon, Point Arguello to Concepcion and San Pedro hills.

Anacapa Island, lying in the throat of the Santa Barbara channel, and directly abreast the opening of the extensive valley of Santa Clara, consists of a very narrow five mile ridge of coarse dark gray sandstone; two-thirds of the length, reckoned from the eastern extremity, has been planed off. The sides are perpendicular, and the summit of the eastern part about 300 feet above the sea, whilst the western part rises to 930 feet in height, but the line of the level of the summit of the eastern parts is marked around the flanks of the western, notwithstanding the deep gulches, with almost vertical sides, which cut from the summit to the top of the bluff.

On the northwestern flank of the Monte del Buchon, lying between San Luis Obispo Bay and Los Esteros, although cut by deep gulches, there are three very plainly marked terraces, each of several hundred feet in height; no other point is more plainly marked.

The seaward flanks of the Santa Lucia range, between San Simeon Bay and Monterey Bay have occasional terrace markings, but the precipitous and high face of the mountains has apparently permitted less marked abrasions than at other points, or subsequent causes have obliterated them. This range contains the highest peaks along the immediate coast of California or Oregon, some of them reaching 5,700 feet elevation.

At Santa Cruz Point, and hence to the northwestward, a pretty table bluff exists. Thence to San Francisco we have several examples of the flat-topped rocky terrace. Before reaching the Pescadero "the general formation of the immediate seaboard for twelve miles is that of a table land of three terraces, the lowest gradually sloping from the base of the second to the coast, which is exceedingly rocky and forbidding."

But it is not necessary to multiply instances. Passing rapidly to the northward as far as Point Arena, in latitude 39°, I have examined the plateau at the lighthouse point, as well as the others towards Arena Cove, but I bring the former to your notice, because a photograph of the point exhibits the stratification as almost perpendicular, and shows the present broken condition of the bluff and low water level, arising from the action of water and weather. The terrace at the Point is about 40 feet above the sea, covered with a very thin stratum of soil, and for a distance of half a mile a base line was measured by the Coast Survey with a difference of level on the plateau of about two feet; the same level is maintained among the timber.

In this, as in most of the other cases I have mentioned, the rock appears to have been absolutely planed off, and that the different degrees of hardness of the stratification had no apparent influence upon the mechanical causes at work. Other terraces near the cove reach over 200 feet elevation, and whilst the bluffs for miles exhibit every contortion of stratification and every degree of hardness, the surfaces of the terraces are planed off.

The shores of Mendocino Bay, Points Cabrillo, Delgado, Table Bluff, and Cape Orford tell the same story. The latter bears a marked resemblance to Points Concepcion and Dume. Three miles south of the Cape the terrace is a fine blue sandstone, full of fossil shells. Thence northward the signs are few.

About Capes Mendocino and Fortunas are one or two slight indications of terraces as viewed from seaward, but northward of these Capes the climatic conditions of the seaboard change, and they appear to have acted more energetically than to the southward. Nevertheless,as we approach the Strait of Fuca we have evidences of a single line of flat topped rocky terrace, from Point Grenville to Tatoosh Island.

Destruction Island, in latitude 47° 41′, is one or two miles in extent, rocky, bold and flat-topped, about 75 feet above the sea. The bluff of the adjacent main shore possesses the same characteristics, as shown by the view on the Coast Survey chart.

Off Cape Flattery, in latitude 48° 24′, lies Tatoosh Island, 108 feet high, bold, rocky, and flat-topped. Fuca's Pillar and other rocks off the Cape have the same elevation.

With the outer shores of Vancouver and Queen Charlotte's Islands I am not familiar, but I have failed to find, among the views and descriptions of the old or recent navigators, any indications of terrace formation. Nor have I found them for certainty among the inner passages of the great archipelago extending from Olympia, in 47°, to the mouth of the Chilkaht in 59°, although I have discovered and measured the direction and depth of the markings of ice action among the islands of Washington Sound and the adjacent parts of Vancouver Island, both in the clean cut and very deep groovings, and in the presence of large numbers of huge erratic boulders.

Of the topographical or geographical details of the shores of the Gulf of Alaska, we know very little. La Perouse, in approaching the coast under Mt. St. Elias, thus describes it: at the same time I must confess to receiving all his descriptions with a certain amount of reservation : "The mountains appeared to be at a little distance from the sea, which broke against the cliffs of a table land 300 or 400 yards high. This plain, black as if burned by fire, was totally destitute of verdure. * * * As we advanced we perceived between us and the elevated plateau, low lands covered with trees which we took for islands. The table land serves as a base to vast mountains a few leagues within. Approaching the coast we saw to the eastward a low point covered with trees, which appeared to join the table land, and terminate at a short distance from a second chain of mountains."

Middleton Island, in the Gulf of Alaska, in latitude 59° 30′, is the only flat-topped rocky island mentioned or depicted by any of the navigators. It is about seven miles long, north and south, with a breadth of three miles. The surface of the island is comparatively low, quite level, and destitute of trees; the shores are craggy. Belcher says it does not exceed thirty feet in height, and has a very soft spongy soil over micaceous shale, interspersed with quartz dykes.

The southern point of Kayak Island, in 59° 49′, is a high table rock, as described by Belcher.

Long Island, off the harbor of St. Paul's, Kadiak, and Chiniak Point are flat-topped and rocky, but not well marked.

Among the Aleutian Islands or along the Peninsula of Alaska, I saw no terrace formations such as I have before described, and I fail to find amongst the navigators, up to 1855, views that indicate such features. To the far north, in the Behring Strait, the English views represent the rocky Diomede Islands as bold, high and flat-topped, as well as the east cape of Asia.

In all these instances, and in others not enumerated, we find a prevailing feature, regardless of the dip or direction of the stratification of the rocks. A nearly level surface of rock with a comparatively thin layer of soil thereon; the plateaus sometimes miles in extent, bordering the coast line with jagged cliffs, which illustrate the action of water and weather. Above these plateaus are frequently others stretching inshore, and reaching elevations of certainly 1,200 feet, and probably more.

Whilst the general plateau is level, or nearly so, there are numerous indications that broad groovings have been made across them, as exhibited in the views of Points Dume, Concepcion and Orford, and across the ridge of Anacapa Island. And it is noticeable that these ploughings or groovings are across the points and across the islands, and run with the general trend of the Coast line.

These prominent features are sufficient to satisfy us that more effective and more regular agencies were at work to form them than are at work on such a vast scale to-day.

The upheaval of the continental shores by subterranean action can not produce such terraces and plateaus; if the shores of the Pacific were to-day to be raised, say 200 feet, we know from the depths bordering it, that such results would not be one of the consequences. The action of water will not account for them. Whether by "continual dropping" or by storms, it first wears away the soft and more friable parts, leaving the harder; it destroys shores by undermining, and then grinding it leaves irregular jagged surfaces. These irregular surfaces, if upheaved above the level of the sea, would not wear away regularly by the weather; the inequalities would in time be filled by disintegrated material, but the surface of the rock would not bear the impress of a planing machine. We must be guided in great measure by experience, and judging by our knowledge of present local glacier action, I think we can appeal to the action of ice, moving slowly but surely, as a great planing or moulding machine; its lines of movement perhaps controlled by masses and elevations of land not now existing as such, and by forces no longer acting on such a scale. We may suppose a great ice belt to have existed contiguous to the continent and moving parallel with it; and existing at the same period with the ice sheet that covered the continent or the lower parts thereof. Some of the mechanical effects of this belt may be those we see exhibited upon the islands and the general coast line; the effects of the latter in the gorges opening upon the shores in the interior valleys, and on the mountain flanks when at right angles to the coast line.

All the groovings on Vancouver Island and the islands of Washington Sound, at the southern extremity of the Gulf of Georgia, point to the agency which causes them as moving southward, and if we accept an ice sheet over the continent, or a part thereof, and an ice belt contiguous to the continental shores, we can readily understand from the manner of the formation of glaciers that it moved as a great stream, or, more likely, in currents, from the north; probably with extreme slowness, but with certainty.

Moreover, a body of ice contiguous to the shores of the continent will do its work more or less effectually and at greater or less depths, in proportion to its rate of progress and its thickness; so that we can understand how terraces of different elevations may have been formed during that period, without any relative change of the level of the sea and bordering land, although the same general effects would have been produced if the land had been rising or subsiding.

Moreover, the mass of ice resting on the land may have done similar work above the level of the sea, to what may have been beneath it.

Thus these terraces may not indicate the different steps of the elevation of the continental shore; and instead of resorting to the theory of great and violent upheaval, *per saltum*, we see how the elevation may have been gradual, and even after the terraces have been formed. This gradual movement of elevation is indicated by the present level character of the plateaus, or when very broad, by their slight inclination.

I do not propose to offer any explanation as to how the ice belt was formed, or how it acted; whether as a great body, disconnected from the continental ice sheet, it moved slowly down the coast line by the combined forces of ocean currents and the pressure of the greater masses from the northward; or whether it moved as a part of the great ice sheet from the northward.

The evidences of these terraces seem to be found in greater proportion between latitudes 30 and 42 than further to the north, and this may, in a measure, be thus accounted for.

Since the period of upheaval succeeding the terrace formation, general and local climatic changes have doubtless taken place, tending to the destruction of the terraces, and as they were formed in sedimentary rocks, most of their finer markings have been obliterated. Throughout the coast line, below latitude 40°, we find that after the terraces have been elevated, the disintegration of higher lands took place with greater activity than at present, and yet the material was carried downward without great violence, and formed long, gently inclined slopes from the base of the mountains towards the shores or into the valleys. One of the finest examples of this is in the Valley of the Santa Clara, east of San Buenaventura; another is the Valley of San José, Lower California, whilst innumerable examples abound on a smaller scale along the flanks of our mountains. Such results may have taken place under a climate of great heat and excessive moisture, with unceasing precipitation, but without violent rains to create torrents, and assisted by the colder weather of winter. Subsequently these gently sloping deposits were cut through by torrential forces, which are yet at work, but on a decreased scale.

On the coast line many cases can be seen where these long sloping deposits of disintegrated material have been cut through by subsequent torrents, and are now being undermined and washed away, so as to expose the flanks of the mountains behind them. A notable example is that just north of Judas Head, on the Island of Margarita.

To the northward it is reasonable to suppose that the ice belt lingered longer than at the south, and that when it was dissipated, the destructive agencies of great climatic changes and excessive rainfall were much more active and wearing. Above latitude 40° we do not find the long, gently sloping surfaces of disintegrated material; as we advance, even the steep sloping hill sides give way to the fiord-like coasts of Vancouver, and the Archipelago Alexander. There violent storms, excessive moisture and precipitation, and great thermal changes, are producing a hundred-fold greater effect than to the southward, and obliterating whatever evidences existed of the terrace formation. The terraces may have been but partially developed on account of the direction of the movement of the ice-belt not following the trend of the coast line from the westward; or there may have followed a subsidence instead of an elevation of the continental shores of Alaska, as I have elsewhere indicated.

For illustrations to this article, see Plate V.

Regular Meeting, Monday, May 19th, 1873.

President in the Chair.

Twenty-three members present.

Major-General J. M. Schofield, Eusebio Molera, and Prof. D. McClure, of Oakland, were elected resident members; and Dr. Franz Steindachner, of Vienna, Austria, a corresponding member.

Donations to the Museum: Specimen of a Hawk; also specimens of a species of Fox (*Vulpes littoralis*, Baird), the latter from Santa Rosa Island, by W. G. W. Harford. Specimen of Trunk-fish (*Ostracion*), from Enderbury's Island, Lat. 3° S., Long. 176° W., found under the edges of coral reefs; presented by C. A. Williams, of Honolulu. Specimens of *Velella*; also fishes, from off Cape St. Lucas, Lower Cal., by Dr. Schlatter, of the P. M. S. S. Co. Infusorial Earth from Catalina Cove, Santa Barbara channel; also specimens of Gypsum, from Santiago Cañon, Los Angeles County, presented by A. W. Chase, U. S. Coast Survey.

Dr. James Blake read the following:

On the structure of the Honey-bag in the Honey-making Ant Myrmecocystus Mexicanus.

BY JAMES BLAKE, M.D.

Having prepared the two specimens of the honey-making ant that were exhibited in connection with Mr. Edwards' paper at a previous meeting of the Academy, I have been enabled, by preserving them in a solution that renders the sack containing the honey perfectly transparent, to ascertain the curious fact that the intestine of the insect is not continued beyond the thorax, so that there is no way in which the remains of the food can be expelled from the body, except by the mouth. The honey-bag is evidently formed by the expansion of the abdominal segments, as the remains of the four chitinous rings in which it was originally enclosed are still visible. The first ring anteriorly retains its connection with the thorax, the posterior part being split so as to expand. The remains of the other rings are seen as small scales on the dorsal and ventral surfaces of the honey-bag. The expansion of the abdominal cavity has not taken place evenly, as the orifice of the *cloaca* with the *ovipositor*, which in the ant is situated at the end of the abdomen, is now found at some distance from the end on the ventral surface, so that the expansion of the abdomen has evidently been greater on the dorsal than on the ventral surface. One curious fact resulting from the want of connection between the intestine and the cloaca is, that all the food the animal takes must go to form the honey, with the exception of the small quantity consumed in keeping up the functions of the body. This is the more singular, when we consider the habits of the insect as described by Mr. Edwards, as these would apparently render it almost impossible that they should be supplied exclusively with nectar from the flowers.

New Problems in Mensuration.*

BY GEORGE DAVIDSON.

XIII. Having given the sides of a rectangle, determine, in terms of those sides, the sides of a required consecutive series of interior hollow rectangles and central rectangle, into which it may be divided, having equal areas with each other.

To divide it into n hollow rectangles, and the central rectangle; call l the length and b the breadth of the given rectangle; x, y, etc., the required lengths next interior; x', y', etc., the corresponding breadths; $(w-1)$ and w the last two lengths, and $(w'-1)$ and w' the last two breadths; then

$$x^2 = \frac{(n-1)\,l^2}{n},\quad x'^2 = \frac{(n-1)\,b^2}{n};\quad y^2 = \frac{(n-2)\,l^2}{n},\quad y'^2 = \frac{(n-2)\,b^2}{n};\ \text{etc.}$$

*In continuation of former problems in this and in Vol. IV.

$$(w-1)^2 = \frac{2\,l^2}{n}, \ (w'-1)^2 = \frac{2\,b^2}{n} \ : w^2 = \frac{l^2}{n}, \ w'^2 = \frac{b^2}{n}$$

XIV. Having given the sides of a hollow rectangle, determine, in terms of those sides, the sides of a consecutive series of similar hollow rectangles, of equal areas with each other, into which it is required to divide the given hollow rectangle.

To divide it into n hollow rectangles, let l' represent the outer and l the inner lengths of the given hollow rectangle; b' the outer, and b the inner breadths; x, y, z, etc., the consecutive lengths, reckoning from l' to l; x' y', z', etc., the corresponding consecutive breadths; $(w-1)$ and w the last two lengths, and $(w'-1)$ and w' the last two breadths; then

$$x^2 = \frac{l'}{b'}\left\{\frac{b\,l + (n-1)\,b'\,l'}{n}\right\}, \quad x'^2 = \frac{b'}{l'}\left\{\frac{b\,l' + (n-1)\,b'\,l'}{n}\right\}$$

$$y^2 = \frac{l'}{b'}\left\{\frac{2\,b\,l + (n-2)\,b'\,l'}{n}\right\}, \quad y'^2 = \frac{b'}{l'}\left\{\frac{2\,b\,l + (n-2)\,b'\,l'}{n}\right\} \ : \text{etc.}$$

$$(w-1)^2 = \frac{l'}{b'}\left\{\frac{(n-2)\,b\,l + 2\,b'\,l'}{n}\right\}, \quad (w'-1)^2 = \frac{b'}{l'}\left\{\frac{(n-2)\,b\,l + 2\,b'\,l'}{n}\right\}$$

$$w^2 = \frac{l'}{b'}\left\{\frac{(n-1)\,b\,l + b'\,l'}{n}\right\}, \quad w'^2 = \frac{b'}{l'}\left\{\frac{(n-1)\,b\,l + b'\,l'}{n}\right\}$$

XV. Having subdivided the hollow rectangle, as in problem XIV., determine, in terms of the given sides thereof, the sides of a consecutive series of similar hollow rectangles inside the given rectangle, and having areas equal with those of the prescribed subdivisions.

Suppose the given hollow rectangle is subdivided into p hollow rectangles, and there are required n inner hollow rectangles of equal areas; let l', l, b', b, x, y, z, etc., x', y', z', etc., represent quantities as before; and i', i'', i''', etc., the consecutive lengths, reckoning from l toward the center; $\mathbf{i}'$, $\mathbf{i}''$, $\mathbf{i}'''$, etc., the corresponding consecutive breadths; then

$$i^2_n = \frac{l}{b}\left\{\frac{(n+p)\,b\,l - n\,b'\,l'}{p}\right\}$$

$$\mathbf{i}^2_n = \frac{b}{l} \frac{(n+p)\,b\,l - n\,b'\,l'}{p}$$

XVI. Having subdivided the hollow rectangle, as in problem XIV., determine, in terms of the given sides thereof, the sides of a consecutive series of similar hollow rectangles, outside the given rectangle, and having areas equal with those of the prescribed subdivisions.

Suppose the given hollow rectangle is subdivided into p hollow rectangles, and there are required n outer hollow rectangles of equal areas; let l', l, b', b, x, y, z, etc., x', y', z', etc., represent quantities as before; and o', o'', o''', etc., the consecutive lengths, reckoning from l outward; $\mathbf{o}'$, $\mathbf{o}''$, $\mathbf{o}'''$, etc., the corresponding consecutive breadths; then

$$o^2_n = \frac{l'}{b'} \left\{ \frac{(n+p)\,b'\,l' - n\,b\,l}{p} \right\}$$

$$\mathbf{o}^2_{\overline{n}} = \left\{ \frac{(n+p)\,b'\,l' - n\,b\,l}{n} \right\}$$

Descriptions of a New Genus, and two new species of Plants from the Pacific Coast of America.

BY A. KELLOGG, M. D.

The following plant has somewhat the appearance of a very branching specimen of *Helianthus giganteus*, and is closely allied to *Parthenice* of Gray.

Generic Description.

Parthenopsis, Kellogg.

Heads broadly campanulate, with loosely sub-imbricated foliaceous and membranaceous involucral scales, many-flowered, elongated pistillate ray flowers, about 11 or 12 from the axils of each of the inner hyaline involucral scales, but entirely free; those of the disk tubular and perfect, about 60. Involucre in somewhat several merging series, outer more loosely spreading; the two outer sub-series leafy; and about 2 to 3 inner membranaceous series slightly colored (greenish yellow), the two outmost marrow scales short, distinct, lanceolate acute (3-nerved), the other 3 or 4 of this foliaceous series larger, very broadly ovate sub-imbricated and coherent into the broad united or entire base of the common involucre (5 to 7-nerved). The more or less membranous colored (greenish yellow) series consists of about 5 very broadly ovate obtuse membrano-coriaceous serrate scales narrowing into about 5 or 6 oval-oblong subobtuse serrate and more scarious scales; and successively into final hyaline acutish serrate series of about 10 or 12 flat and perfectly free persistent scales. Receptacle broad (about ½ an inch or so) flat, naked, or only subpubescent, areolate. Rays about 11, oblong-lanceolate about 3-toothed (3–5?—middle tooth longest) tube very short hirsute with white jointed hairs, pistils much exserted, lobes recurved, tipped with a short cone; disk florets 50 to 60, tubular slightly dilated below, abruptly narrowed into a very short tube also hirsute with white jointed hairs and stipitate glands 5-toothed recurve spreading border, and glabrous teeth; filament stipitate-glandular; style bulbous at the base, deeply divided above, recurved and with the yellow staminal tube exsert, lobes tipped with a very short sub-obtuse cone, hispid on the back. Achenia of disk and ray similar, free, oblong, obcompressed narrowing towards the base, sub-3-sided, glabrous or a few scattered striguloid-tubercles and broken crenulated lateral margins, slightly incurved, a little convex, carinated and 3-nerved on the back; face 1-ridged and 5-nerved, apiculate, all naked, being neither toothed nor notched (not a vestige of rudiments seen).

A perennial branching maritime shrub 6 to 8 feet high, with bright yellow helianthoid flowers, about 2 inches in diameter; on terminal naked peduncles, usually, if not always, in pairs opposite the final mature leaf—strong Artemesia odor.

Parthenopsis maritimus, Kellogg.

A woody perennial; broadly branching alternately above, erect, (bark of body pearly grey—twigs dark madder-purple), puberulent in the young state, 6 to 8 feet high, ½ to 1 inch in diameter. Leaves deciduous, cordate-deltoid and deltoid acute, ovate, and ovate-oblong acute or acuminate, base rarely subcuneate or oblique serrate, dentate or repand-dentate 3–5-nerved or triplinerved close above the (sometimes obscurely) 3-nerved base, margins slightly scabrous; lamina thin, green above and pea-green beneath; sparsely pubescent on both sides, petioles slender, ¼ to ½ or so the length of the blade, sub scabrous, alternate, rarely the upper pairs opposite, 2–6 inches or more in length, 1 to 4 inches in breadth; peduncles in pairs, or di-ortrichotomous, opposite the extreme developed leaves, naked, as long, and one usually longer, than the petiole (or 1½ to 2 inches in length). Involucre in 2-many series; outer leafy, several from the first broadest colored series, successively diminishing to hyaline marginal discoid (?) scales. Rays an inch or more in length (or about twice or thrice the disk) oblong-lanceolate 3 or more toothed, middle tooth longest, etc. Flowers yellow, 2½ to 3 inches in diameter; disk florets with a cylindrical prolonged throat, slightly swelled pubescent and stipitate-glandular below, 5-toothed glabrous border, teeth short, triangular-acute recurve-spreading, abruptly narrowed into a short tube, hirsute with unequal massed white frosty jointed hairs, and stipitate glands intermixed; style exsert (purplish lobes) revolute, cone tipped, pappillose and hispid on the back, base bulbous and glabrous; (florets and anthers yellow), lance-pointed united, filaments stipitate-glandular, (rarely a little hirsute also); achenia of disk and ray similar, all naked and free, the firtile very dark purple, and less striate but more tuberculate throughout. Receptacle not at all chaffy, scarcely puberulent, flat, areolate.

Found by Mr. W. G. W. Harford, on Santa Rosa Island, off the coast of Santa Barbara, 1872–3. A very showy plant but having a rather too strong *Artemesia* odor to be agreeable. Similar to *Euphrosyne.*

Closely allied to *Parthenice*, Gray, Pl. Hort., p. 85, but that has a hemispherical head—oval and orbicular obovate convex receptacle, doubly dentate leaves; founded on a plant with heads 2 to 3 *lines* in diameter.

Dendromecon Harfordii, Kellogg.

Stem shrubby, branches glabrous, whitish or creamy bark obtusely angled by the decurrent mid-ribs, (axillary buds conspicuous).

Leaves variable, from roundish to sub-cordate-ovate, ovate, or ovate-oblong-obtuse, mucronate with sub-cuneate base; or elliptic, short or abruptly cuspid, ate-acuminate, 3 to 5-nerved or more (7), and triplinerved above (mid-rib often colored orange) margins entire, denticulate or serrate, petioles very short, decurrent-winged; foliage large (1–3 inches long, ½ to 1½ inches wide) densely crowded or imbricated, thick, coriaceous, rigid and tough, strongly reticulated light greenish yellow, peduncles very short with many leafy bracts, mostly in pairs or solitary; style one, stigma 2-lobed, lobes sub-sessile or on short limbs (about ½ a line long) each irregularly 4-lobed (purple); pods 10-ribbed; seeds fig-shaped ribbed longitudinally, a placentiferous like pseudo-arillus on the funiculus between the seed and point of attachment (often bright orange colored).

Found by Mr. W. G. W. Harford on the Island of Santa Rosa, off the coast of Santa Barbara, April, 1872.

Dr. Kellogg presented specimens, accompanied by a painting, of *Antigonum Leptopus* var. *splendens*, Kellogg, collected by Prof. Geo. Davidson, of U. S. Coast Survey, at San Jose del Cabo, near Cape St. Lucas, Lower California, at. 34° 03′, in March, 1873.

This specimen combines the characters of several species, besides we have the seeds not before sufficiently noted. The flexuous branches are pentagonally striate ridged, and the whole plant remarkable for its densely villous, or short ferrugio-canescent-hirsute character throughout, with no appreciable approach to smoothness; the leaves are not "entire" but emarginate, acute, mucronate, not "acuminate," nor decurrent; but like *A. Guatamalense* the racemes are axillary, not "opposite the leaves," and the tendrils both lateral and terminal; pedicels sessile or sub-sessile on short stipes and in fasicles of 1 to 4 (not 1 to 3) articulated below the middle; bracts minute, pseudo-bracteoles (several from abortion of pedicels) rather more ovate-acuminate; filaments stipitate-glandular, sometimes extending to the base of the investing stamenal cup, with numerous sessile glands, a few of which are scattered over the inner face of the (quincun cially imbricated) sepals; stigmas depressed-capitate both reniform and bilobed; stamens longer than the styles, these, like the sepals, enlarge after infloresence, becoming very dark purple almost black; styles 3 (rarely confluent into one, at the base); the margins of the obtuse (or subacute) sepals minutely ciliate (the 2 lesser inner only on one edge) mucronate. Capsule (not "achenium?") three-seeded; seeds not "pyramidal," but sub-triangular, *i. e.*, with two plane faces, and the back convex.

All climbers have peculiar claims to a beauty of their own, but this, with its large terminal clusters of brilliant carmine flowers, is the most striking of them all.

Regular Meeting, June 2d, 1873.

Vice-President in the Chair.

Thirty members present.

W. W. Montague and A. W. Chase were elected resident members.

Donations and Additions to Library: Smithsonian Reports (3 vols.), for 1863, 1866, 1867. Lists of Elevations in that portion of the U. S. west of the Mississippi river, by Henry Gannett, for Department of the Interior. Nature, Nos. 181–3. California Horticulturist, May, 1873. Engineer and Mining Journal, Vol. XV., Nos. 16–19. Astronomical Register, for May, 1873. Bulletin of the Essex Institute, Vol. IV., Nos. 11 and 12; and Vol. V., Nos. 1, 2. Bulletin of the Buffalo Society of Natural Sciences, Vol. 1, No. 1. Catalogue of the Pyralidæ of California, etc., by A. S. Packard, Jr., from the Author. Proceedings Academy Natural Sciences of Philadelphia, pp. 201–332. Views of Nature, etc., by Ezra C. Seaman, from the Author. American Journal of Science and Arts, Vol. V., No. 29. Annals and Magazine of Natural History, Vol. II, No. 65, May, 1873. De la Composition des Eaux Minerales de Spa, by Messieurs Chandelon, Donny, Kupfferschlager, and Swarts. Dijon, 1872, from the Authors. Catalogue of the Echinodermata of New Zealand, with Diagnoses of the Species, by F. W. Hutton, F. G. S., from the Author. Sixth and Seventh Annual Reports on the Colonial Museum, etc., of New Zealand; also, Reports of Geological Explorations of New Zealand during 1871–2, from the Director, James Hector, M.D., F.R.S. On a Method of Detecting the Phases of Vibration in the Air, surrounding a Sounding Body, etc. On a Method of Measuring the Wave-lengths and Velocities of Sounds in Gases, etc. On the Experimental Determination of the Relative Intensities of Sound, etc. On a New Form of Lantern Galvanometer. On a Method of Tracing the Progress and of Determining the Boundary of a Wave of Conducted Heat; 5 pamphlets, 8vo., by Alfred M. Mayer, Ph. D., from the Author. American Chemist, Vol. III, No. 2, May, 1873. Ornithology of Samoa, etc., by Dr. O. Finsch. Temperature Chart of the United States, from Smithsonian Institution.

Donations to Museum: Shells from near Anaheim, from A. W. Chase, U. S. Coast Survey. Reptiles, several species, from Inyo county, by H. G. Hanks; Borate of Lime, from the Lone Ranch Borate Mining Company.

Mrs. E. S. Carr, in behalf of Mr. John Muir, read a paper on "Explorations in the Great Tuolumne Cañon." [This paper was not submitted for publication, but was subsequently published in the *Overland Monthly*.]

Regular Meeting, June 16th, 1873.

Mr. Stearns in the Chair.

Twenty-one members present.

George W. Lewis, Cutler McAllister, John R. Jarboe and Agapius Honcharenko were elected resident members, and W. C. Ralston life member.

Donations to the Museum: Specimens of *Gorgonia* from Cerros Island, and skull of a fish, presented by Capt. J. A. Wilson, of San Pedro. Skull of mountain sheep, (*Ovis montana*, Cuv.) from E. Wasserman. Two specimens of Crustaceans, from San Francisco Bay, presented by Henry Chapman.

Mr. A. W. Chase read the following on the artesian wells of Los Angeles County:

On the Artesian Wells of Los Angeles County.

BY A. W. CHASE.

The subject of water in sufficient quantity to irrigate land for the purposes of cultivation of the cereals on an extended scale, as well as fruit trees and vines, is one of great importance to the inhabitants of that portion of California known as the semi-tropical. The uncertain quantity of the rainfall and the recurrence of droughts every few years, renders any extended cultivation of the soil impossible without recourse to artificial means of procuring and storing water.

The plains of Los Angeles county, which form the most considerable portion of its area, slope gradually from the sea coast northward to the foot-hills of the Sierra Madre. This mountain range rises abruptly from the plain to a height approximating 10,000 feet; and is distant about forty miles from San Pedro Bay.

The general trend of the coast line, as well as of the Sierra, is east and west. During the winter season the highest points of the Sierra are covered with snow.

Even during a dry season, the quantity of water brought down from this extensive water-shed is great; the three principal rivers which carry it off, viz: the New and Old San Gabriel, and the Santa Ana, being swollen into torrents. During the summer, however, these streams dwindle into rivulets, frequently sinking in their sandy beds and becoming lost before reaching the sea.

The gardens and orchards of Los Angeles are watered from a ditch cut from the Los Angeles river, a branch of the San Gabriel; and the vineyards of Anaheim derive their supply in a similar manner from the Santa Ana. This supply is, however, even at the present time, limited, and should these towns grow to any considerable size, other means will have to be devised.

Artesian well borings were commenced some years since. They have been a success, according to my observation, only in a narrow belt extending across the plain in a direction parallel with the coast line and the mountain range.

In presenting the few facts which I have gathered, I wish more particularly to invite attention to the subject by others better informed, than to present any theory of my own.

Lying immediately on the coast line of Los Angeles county are a succession of isolated hills. The principal of these, San Pedro Hill, lies west of Wilmington, and attains an altitude of 1,473 feet. The first east of Wilmington, and down the coast, is Los Cerritos, 355 feet; the second, Landing Hill, 63 feet; the third, the Bolsas Chica, 61 feet, and the fourth, the Bolsas Grande, 119 feet. At the base of these hills, east of Wilmington, are strong springs of soft water, which may be called natural artesian wells.

The most remarkable of these is at the rancho or farm house of the Alamitos. It is a circular opening, about five feet in diameter. The water comes up in considerable force, the center of the spring being at times several inches above the edges.

The temperature of the water is 64° Fahr., being almost undrinkable when taken from the spring. It brings up in suspension particles of mica and sand.

Similar springs are found at the Bolsas Chica and the other small hills, the temperature of the water being the same in all, and corresponding with that of the artesian wells.

Thirteen miles from the sea coast is located the town of Anaheim. Here an artesian well was sunk to a depth of 200 feet through sand and clay, finally encountering a bed of boulders. Here the work was stopped, no water having been obtained. A well was sunk near the town of Wilmington, to a depth of over 400 feet, without success. Half way between the town of Anaheim and the sea coast, lies the hamlet or town of Westminster. Here some 34 artesian wells have been bored, all of which are now flowing. These wells supply sufficient water for the use of the thirty four families comprising the settlement, and for the irrigation of their land, which, previously of little value, has now considerably enhanced in price.

As these wells are similar in character, a description of two of them will suffice:

No. 1. Well on farm of Mr. Edwards, five miles from the sea. Well 171 feet deep. Pipe projects 2½ feet above surface. Water flows three inches above the edge of the pipe. Temperature of the air at time of observation, 71° Fahr., and of water, 64°. Water soft, and brings up mica and sand in suspension. The pipe is of the ordinary character, viz: Seven inches in diameter and one sixteenth of an inch in thickness, and is double all the way down, the outside pipe being one thirty-second of an inch larger than the inside, in diameter. The pipe is forced down in sections of eight feet.

The following strata were passed through in boring:

Sand and loam	3	feet.
Tough blue clay	23	"
Alternate layers of clay and sand	67	"
Stiff blue clay	40	"
Quicksand and fine gravel	38	"
Total	171	"

At the depths of 140 and 150 feet, holes 1½ inches long, and one-sixteenth of an inch wide, were pierced in the pipe, through which the water enters from the strata of quicksand. The water from this well irrigates 160 acres.

No. 2. Stevens' well. This well is 94 feet deep, and is situated about eight miles from the sea. The pipe projects 3 feet above the ground, and the water flows over the pipe 1¼ inches. Temperature of water at time of observation, 65° Fahr.; of the air, 69°. Water similar in character to the Edwards' well, and also bears mica and sand in suspension. This well passes through—

Heavy loam	10	feet.
Pliable blue clay	7	"
Alternate layers of sand and clay	61	"
Gravel (with water)	5	"
Tough clay and cement	10	"
Quicksand	1	"
Total	94	

The other wells resemble these closely, the water being of the same temperature and only flowing to the surface after the layer of tough blue clay or cement had been penetrated and the strata of quicksand reached. This strata was found at varying depths of 90 to 180 feet.

Between the town of Wilmington and Los Angeles is situated the settlement known as Compton. Here are a number of flowing wells. One of these, bored through 85 feet of sand and clay, struck the quicksand at that depth, through which it was continued 10 feet further. This well was piped up 12 feet above the surface, the water then rose four feet above the pipe.

Other wells here are of the same character, the temperature of the water being between 64° and 65° Fahr., and presenting the same characteristics as the wells at Westminster.

Going from Compton towards Wilmington a ridge is passed, beyond which no water has been struck, although at the base of Dominguez Hill several natural artesian outflows occur.

At the settlement of Los Nietos, lying between Los Angeles and Anaheim, flowing wells have also been obtained. The borings passed through the same strata and the water is similar in character to that of the wells at Compton and Westminster.

By reference to the county map, you will see that this artesian water has been struck in a line parallel with that of the mountain ranges and the coast, but cutting the water courses at right angles.

The question is, does a subterranean basin exist under these plains, fed by the rainfall in the mountains, which finds its way in through crevices in the foot-hills, and is confined in place by the strata of clay and cement, discharging its surplus through the springs or natural artesian wells on the coast? Or is there a subterranean river, running through a bed of quicksand, filling what was perhaps an old cañon or barranca, and having spurs or offshoots to the natural springs mentioned, but emptying its main volume of water under the sea?

Since the boring of these wells no sensible diminution has been noticed in their flow, nor has the volume of water lessened in the natural springs.

Were some definite idea formed of the character and extent of this subterranean water, so that boring might be prevented in localities where no water will be found, it would be of great benefit to the people of these counties.

If, also, a careful record were kept of the number, position and average flow of the wells from year to year, it would go far towards proving whether the supply could be diminished by an increased number of wells, and whether this means of obtaining water could be depended on for the cultivation of the soil on a large scale.

Mr. S. C. Hastings read a paper upon the action of frost on grape vines, and certain apparent eccentricities in its action, in injuring vines in portions of Napa county, while others similarly situated, and directly adjoining, were comparatively uninjured. All of the vines were of foreign varieties, and those unaffected by the frost were trained to willow-stakes two and a half feet above the ground; the others were not so trained. The subject was further discussed by Messrs. Dameron and Hastings.

Regular Meeting, July 7th, 1873.

President in the Chair.

Twenty-nine members present.

F. A. Bishop, John C. Robinson, George H. Mendell, F. A. Miller, and O. Button, were elected resident members; William S. Chapman was elected a life member; and J. W. Glass, of Denver City, Colorado, a corresponding member.

Donations to the Library: Washington Catalogue of Stars, 1845–71, from U. S. Naval Observatory. Smithsonian Contributions to Knowledge, Vol. XVIII. Compendium of the Ninth Census of the U. S., 1870. Engineering and Mining Journal. Odd Fellows' Lib. Assoc., 17th and 18th Ann. Rep's. Monatsbericht der Königl. Preuss. Akad. der Wissenschaften zu Berlin, Jan., 1873. Proceedings Acad. Nat. Sci. of Phila., Jan. and Feb., 1873; also pp. 233–248, 1873, of same Proceedings. Am. Jour. of Science and Arts, June, 1873. Am. Naturalist, June, 1873. Quarterly Journal of Geolog. Society of London, Vol. XXIX, No. 114. Cal. Horticulturist, June, 1873. Annalen der Physik und Chemie, No. 3, Leipzig, 1873. Overland Monthly, July, 1873.

Additions to Library by Purchase: Cosmos di Guido Cora, II, Turin, 1873. Nature, Vol. 8, Nos. 184–189. Annals and Mag. Nat. Hist., London, June, 1873. Astronomical Register, London, June, 1873. Weigmann's Archive für Naturgeschichte, Berlin, 1873. The Journal of Botany, London, May and June, 1873. Popular Science Monthly, July, 1873.

Donations to Museum: Specimens of a species of *Virgularia* from San Diego, by Henry Hemphill. Specimens of rocks from near San Francisco, presented by C. B. Turrill. Egg case of a species of Skate, from J. P. Dameron. Tarantula and Tarantula nest from Mexico, presented by W. J. Fisher. Specimen of Duck (*Harelda glacialis* Leach) from Arctic America, presented by W. G. Blunt. Specimens of mounted birds: Sharp-shinned Hawk (*Accipiter fuscus*), Blue-winged Teal (*Querquedula discors*), Avoset (*Recurvirostra Americana*), Green black-cap Flycatcher (*Myiodioctes pusillus*), and a species of Graculus (*G. Carbo*), presented by E. F. Lorquin.

Mr. Stearns remarked that he had not determined whether the species of Virgularia presented by Mr. Hemphill was new, or the same as previously described by Mr. Gabb.

The following paper in behalf of Mr. Edwards was submitted by the President:

Pacific Coast Lepidoptera.—No. 1. Description of some new or imperfectly known Heterocera.

BY HENRY EDWARDS.

Fam. SPHINGIDÆ.

Genus Sphinx.

Sphinx perelegans, n. sp.

Head pale, silvery gray, black on occiput. Thorax with the tegulæ and sides gray; disc velvety black, uniting with the black on upper side of head, and forming, when viewed from above, a long, triangular patch; centre of thorax gray at the base. Abdomen dark gray, sprinked with black, with narrow black dorsal line. The five basal segments are equally divided into black and white demi-bands, the black being very intense and glossy. Under surface of thorax gray, with central interrupted black line. Antennæ white above, dark gray beneath. Tibiæ grayish brown, with tarsi paler.

Primaries, fuscous with many paler waved lines, and a whitish space reaching from the base over half-way along the costa, but not extending to its edge. Resting upon this pale space are five bent black lines of unequal length, and a bent line at the apex reaching to the tip. Along the margin, from internal angle to apex, is a pale submarginal band, very faintly dentate externally, running parallel with the margin until it reaches the apex, where it spreads into a wider space, receiving the before-mentioned bent apical line. At the base of interior margin is a clouded black patch. The fringes are brownish black, dotted on their edges with six conspicuous white patches, which do not, however, entirely cross the fringe. The whole of the fringe on the interior margin is brownish black.

Secondaries, black, with brownish tinge; a broad, whitish band at the base, widest posteriorly; a narrow grayish-white band crossing the wing obliquely, almost parallel with the margin, but slightly bent a little behind the middle. Fringes white, intersected with brown. (Coll. Hy. Edw.)

Expanse of wing, 3.64 inch.

Length of body, 1.52 inch.

Gilroy, Santa Clara County, Cal. G. R. Crotch, Esq.

This beautiful specimen closely resembles *Sp. eremitus*, Walk., of the Atlantic States, but is readily known by its more brilliant gray coloring, by the very sharply defined demi-bands, and by the strongly marked whitish submarginal band of the fore-wings.

Sphinx oreodaphne, n. sp.

Head wanting in my specimen.

Thorax pale, ashy gray, slightly sprinkled with black hairs, and with a well-defined triangular black mark, the vertex of which rests on the prothorax, its sides reaching to and joining the basal black demi-band of the abdomen. The area inclosed by the triangle is pale gray. Abdomen, above, gray sprinkled with black, with narrow black dorsal line, and seven demi-bands of rich velvety black, the basal one becoming almost circular in form, and uniting with the triangular mark on the thorax. Thorax and abdomen, beneath wholly pale gray, as also are the legs, the tarsi being very faintly sprinkled with black.

Primaries, wholly pale gray, with narrow black longitudinal lines, only slightly bent, the two largest resting on the centre of the median nerve. Along the posterior margin is a whitish, irregular, submarginal band, not reaching to the internal angle.

Secondaries, blackish fuscous, with two undulating whitish bands, the outer one not quite reaching to the apex. Fringes of primaries brownish, sprinkled with gray; those of the secondaries white, very indistinctly mottled with brown. (Coll. Hy. Edw.)

Expanse of wings, 3.40 inch.

Length of body, 1.50 inch.

Taken on the wing, about flowers of California Laurel (*Oreodaphne Californica*), near St. Helena, Napa County, in June, 1872. A strongly marked species, readily distinguished by its pale fore-wings, and by the triangular mark of the thorax. The head was, unfortunately, broken from my unique specimen before it reached my hands.

Sphinx Sequoiæ, Boisduval, Lepid. Calif., 1869.

Head and thorax light gray, sprinkled with black, with two indistinct black lines on the occiput, reaching to prothorax, and thence spreading toward the sides of the tegulæ. Abdomen gray, with black dorsal line. The segments are whitish at their base, the five posterior with a black sub-linear patch on their outer edges. Antennæ white above, gray beneath. Feet wholly gray, spotted with black.

Primaries, gray, indistinctly dotted with black, with four or five very faint black lines, the longest near the apex. Fringes grayish brown, intersected with white.

Secondaries, grayish fuscous, entirely without bands. The fringes are white intersected with brown, except toward anal angle, where they are wholly whitish.

Expanse of wings, 2 inches.

Length of body, 1 inch.

(Coll. Bois., Hy. Edw.)

Grass Valley, M. Lorquin. Bear Valley, Sier. Nevada, H. E.

I had the good fortune to take a fine ♂ of this rare species in Bear Valley, in June, 1872. It was hovering at mid-day over a pool of water, darting down occasionally to drink. The specimen from which Dr. Boisduval made his description was captured by the late M. Lorquin, at Grass Valley, resting on the bark of a Redwood tree, (*Sequoia sempervirens*—Lamb.)

Sphinx Vancouverensis, n. sp.

Head dull gray, brownish on the occiput, and sprinkled with brown hairs. Eyes dull black, surrounded by a blackish ring of hairs. Tegulæ wholly cinereous. Abdomen blackish gray, with narrow black dorsal line, and six rather broad demi-bands of dirty white, blackish on the posterior margins of segments. Thorax and abdomen, beneath dull brownish gray.

Primaries, fuscous, with a grayish space running from base to about half way along the middle of wing, and an irregular submarginal band from internal angle to apex, the outer edge of which is deeply dentate. Near the median nerve are three straight black dashes, and a bent one toward the apex. Fringes brown, sprinkled with gray.

Secondaries, fuscous, with two dull whitish bands, slightly waved, the outer one parallel with the margin of the wing for three-fourths of its distance.

Expanse of wing, 3.55 inch.

Length of body, 1.50 inch.

Esquimault, Vancouver Island. (1 ♂ Coll. Hy. Edw.)

Taken in August, 1871, by Dr. Bremner, of H. M. S. Zealous.

Fam. ZYGÆNIDÆ.

PSEUDALYPIA, nov. gen.

Head small, front very long, densely pilose. Clypeus very long, smooth, triangular, notched on each side in front, and, when viewed from above, concealing the palpi, which are short, pilose, the third joint longest, the whole palpus straight, and shorter than the head. Antennæ simple, not thickened as in Alypia. Eyes small, not prominent. Tongue more than half as long as the body. Thorax pilose, the hairs of patagia especially long. Abdomen short, stout, covered with close, glossy pubescence. Abdominal tuft long. Wings short and broad.

Primaries, with apical angle much rounded. The nervules are very thick; neuration similar to Alypia.

Secondaries ample, very much rounded, especially toward the anal angle. Fringes of both wings very long. Legs long, only slightly pilose, wanting the bunches of hair observable in Alypia; hind pair with two very nearly equal pairs of spines, terminal pair very slightly the shorter.

This genus differs from its near ally, Alypia, by the longer tongue, shorter palpi, stouter and more glossy abdomen, simple antennæ, and by the absence of the dense tufts of hair on the fore tibiæ. The system of coloration is also essentially different; as in Alypia it consists of a series of spots variously arranged, while in the present genus it forms a simple band, crossing the fore-wings near the middle.

Pseudalypia Crotchii, n. sp.

Head, thorax, patagia, and abdomen, deep glossy black, with a slight bronze tinge. Collar, base of palpi, and abdominal tuft, golden orange. Antennæ glossy black, with short scales. Palpi, black above, golden orange beneath. Feet wholly black, with some small white patches arranged in circular form on the hind tarsi.

Primaries, glossy black, with a greenish metallic tinge. The costa, for about three fourths of its length, and a narrow, slightly curved band crossing the wing beyond the middle, cream white. Apical edge of fringe white, the remainder glossy black.

Secondaries, dull black, with a slight brownish hue. Fringe cream white, except toward the anal angle, where it is black. Under side similar to the upper, with the band of primaries more broadly defined, and with a whitish tinge toward their base. (2 ♀ Coll. Hy. Edw.)

Expanse of wings, 0.85 inch.

Length of body, 0.35 inch.

Warner's Ranch, San Diego, Cal., May 8, 1873.

This exquisite insect was discovered by my friend, Mr. G. R. Crotch, whose enthusiastic labors have added so much to our knowledge of the insect fauna of California, and to whom I regardfully dedicate the species. It was flying in the heat of the day, alighting frequently on flowers, and manifesting much the same habits as the various species of Alypia.

Genus Cteuncha. Kirby.

Ctenucha Walsinghamii, n. sp.

Size and aspect of *C. multifaria.*

Head, collar and patagia bright crimson, the latter narrowly edged with black, as in *C. multifaria*; palpi also crimson, with the terminal article black. Antennæ long, bluish black, closely bipectinate. Thorax with the disc greenish black. Abdomen very glossy, bluish black, with a faint greenish tinge. Legs bluish black, with the anterior coxæ distinctly white. Fore tibiæ with a few white scales.

Primaries, bluish black, with a greenish tinge, most vivid toward the base. Costal edge entirely dull black. Fringe white at apices, the remainder black.

Secondaries, bluish black, with a purple tinge. Fringe white at apices, rest entirely black.

Expanse of wings, 1.90 inch.

Length of body, 0.60 inch.

Fort Crook, Oregon, June, 1872. (1 ♂ Coll. Hy. Edw.)

I owe the possession of this beautiful specimen to Lord Walsingham, who found it in the above locality during his recent tour through Southern Oregon, where it appears to be very rare. At first sight, this species may be confounded with *C. multifaria*, but differs in having the costa entirely black, and the apices of the wings *only* with white fringe.

Fam. EPIADIDÆ.

Genus Epialus. H. G.

Epialus modestus, n. sp.

Head, thorax, and abdomen dull fawn color; thorax with rather long hairs

Eyes black. Feet chestnut, with long hairs. Primaries, wholly fawn colored; scales thinly scattered over the surface, a few of them having a reddish tinge.

Secondaries, pale fuscous, fawn color at the base.

Expanse of wings, 0.60 inch.

Length of body, 0.28 inch.

(1 ♂ Coll. Hy. Edw.) San Miguel, Cal., April, 1873.

The smallest species of the genus yet known to me. It was taken at rest in the flowers of *Compositæ*.

LIST OF SPECIES.

Sphinx perelegans, n. sp. .... Gilroy, California.
" *Oreodaphne*, n. sp. .... S. Helena, California.
" *Vancouverensis*, n. sp. ...... Esquimault, Vancouver Island.
" *Sequoiæ*, Bois. .... Bear Valley, California.
Pseudalypia (n. gen.) *Crotchii*, n. sp. Warner's Ranch, California.
Ctenucha Walsinghamii, n. sp. ..... Fort Crook, Oregon.
Epialus modestus, n. sp. .... San Miguel, California.

Professor Davidson said that having been disappointed in not receiving the drawings for his improvement on the telemeter, he would review what had been done on the subject by the various inventors to date. He explained the methods available, and the accuracy of those in use on the Coast Survey, where the chain was almost abandoned in filling in the details of topographical work. He said that the land surveys of the United States, especially in the hilly sections, could be done with greater rapidity, and far greater accuracy, by the Coast Survey methods and instruments, than by those yet in use. The great object of military and civil engineers has been to determine the distance of an object by means within the instrument itself; this has been partially accomplished, and the proposed improvement is believed to be another step forward.

Aboriginal Shell Money.*

BY ROBERT E. C. STEARNS.

Of the numerous objects or substances which exist in a natural state, and which require little or no mechanical preparation for adaption for use as money, the shells of many of the marine *mollusca*—or shell-fish, so called—furnish at once an excellent and appropriate material. Where the metals do not exist, or the knowledge of manipulating them is wanting, no substance or form can be named which is at once so available and convenient. Thus we find that certain

* See also *Overland Monthly* for October, 1873.

forms of shells have been used by the aborigines of both shores of our own continent; and, though the forms used by the Indians of the Atlantic Coast were quite different, according to the authors whom we have consulted, from that of the money of the West American tribes, yet this can not be accounted for on the supposition that a similar form is not found on the Atlantic Coast, for such is not the fact. It is not unreasonable to suppose that they had but little, if any, knowledge of each other, and more likely none at all. Being separated by the breadth of a continent, with many wide and rapid rivers and several lofty mountain ranges intervening, and the intermediate country occupied by numerous and distinct tribes quite as jealous of any invasion of their territory as are the civilized nations of to-day, the use or the knowledge of the use of any substance or particular form for money by the tribes of either coast, was probably unknown to those of the opposite trans-continental shore.

The Pilgrim settlers of the Massachusetts Colony at Plymouth found a form of money in use among the Indians of New England; and in the Historical Collections of Massachusetts, and from other sources as recorded by Governor Winthrop and Roger Williams, we are informed as to its character and substance. One of the most common bivalve mollusks (clams) of that coast is the *Venus mercenaria*, or *Mercenaria violacea*, (Plate VI, fig. 1,) as it is now called by naturalists; it is the "hard-shell clam" of the New York market, and in the markets of Boston is known as the "quahog." The valves or shells of this species frequently display an interior purple edge—varying in this respect, it is said, in different localities—the rest of the shell being of a clear white. From the darker colored portion the Indians made their purple money, or *wampum*, as it was called; while from the axis of a species of *Pyrula* or conch, and from other shells, they made their white money, or white *wampum*. In reference to the first shell, and its use as a substance from which the *wampum* was made, we have the following: "The quahaug (*Venus mercenaria*), called by Roger Williams the *poquau* and the *hen*, is a round, thick shell-fish, or, to speak more properly, worm. It does not bury itself but a little way in the sand; is generally found lying on it, in deep water; and is gathered by rakes made for the purpose. After the tide ebbs away, a few are picked up on the shore below high-water mark. The quahaug is not much inferior in relish to the oyster, but is less digestible. It is not eaten raw; but is cooked in various modes, being roasted in the shell, or opened and broiled, fried, or made into soups and pies. About half an inch of the inside of the shell is of a purple color. This the Indians broke off and converted into beads, named by them *suckauhock*, or black money, which was twice the value of their *wampom*, or white money, made of the *metauhock*, or periwinkle (*Pyrula*).*

"As to the derivation of the word 'quahog,' Governor Winthrop refers to it as '*poquahauges*, a rare shell and dainty food with the Indians. The flesh eats like veal; the English make pyes thereof; and of the shells the Indians make money.' He says of the money, 'It is called *Wampampeege*. † Also,

* Massachusetts Historical Society's Collections, VIII, 192 (1802).

† Journal Royal Society, June 27, 1634.

called by some English *hens-po-qua-hock*; three are equal to a penny; a fathom is worth five shillings.' *

" *Poquahock*, corrupted into *quahaug* or *quahog*."

The money or *wampum* made from the shells above referred to, was not only in use among the Indians, but among the Whites also. Col. T. W. Higginson, of Massachusetts, in one of his *Atlantic Essays*, "The Puritan Minister," says: "In coming to the private affairs of the Puritan divines, it is humiliating to find that anxieties about salary are of no modern origin. The highest compensation I can find recorded, is that of John Higginson, in 1671, who had £160 voted him in 'country produce,' which he was glad, however, to exchange for £120 in solid cash. Solid cash included beaver-skins, black and white *wampum*, beads and musket-balls, value one farthing."

In Cadwalader Colden's *History of the Five Indian Nations* (p. 34), he says that *wampum* is made of the large whelk-shell *Buccinum*, and shaped like long beads; it is the current money of the Indians. Whether the shells of the true *Buccinum* (*B. undatum*, Linn., or *B. undulatum*, Mull.), or those of *Busycon* (*B. canaliculatum* and *B. carica*), is not satisfactorily explained.

In Major Rogers' *Account of North America* (London 1765), in alluding to the *wampum* of the Indians, he says: "When they solicit the alliance, offensive, or defensive, of a whole nation, they send an embassy with a large belt of *wampum* and a bloody hatchet, inviting them to come and drink the blood of their enemies. The *wampum* made use of on these and other occasions, before their acquaintance with the Europeans, was nothing but small shells, which they picked up by the sea-coast, and on the banks of the lakes; and now it is nothing but a kind of cylindrical beads, made of shells, white and black, which are esteemed among them as silver and gold are among us. They have the art of stringing, twisting, and interweaving them into their belts, collars, blankets, moccasins, etc., in ten thousand different sizes, forms, and figures, so as to be ornaments for every part of dress, and expressive to them of all their important transactions.

"They dye the *wampum* of various colors and shades, and mix and dispose them with great ingenuity and order, so as to be significant among themselves of almost everything they please; so that by these, their words are kept and their thoughts communicated to one another, as ours by writing. The belts that pass from one nation to another in all treaties, declarations, and important transactions, are very carefully preserved in the cabins of their chiefs, and serve not only as a kind of record or history, but as a public treasure."

Colden is the only author in whose writings we find any allusion to the use or manufacture of money or *wampum* by any of the *interior* tribes, and the tribes of the Five Nations were not remote from the Atlantic shore.

How far to the south of New England this *wampum* money was used, we do not know. The shells of which it was made are abundant in the neighborhood of New York and Philadelphia, and are the common clam in the markets of those cities. A closely related form (*Mercenaria præparca*, Say), is found on the shores of Florida, and attains an exceedingly large size; specimens collected in

* Vide *Invertebrata of Massachusetts*, Binney's edition, p. 134.

Tampa Bay frequently weigh as much as three and a half pounds after the animal is removed. Explorations made by us in that State in the year 1869, in the course of which many of the ancient shell-heaps and burial-mounds on both shores of the peninsula were examined, resulted in the obtainment of much interesting material, but no specimens were found of forms which suggested their possible use for money.

Crossing the continent to the north-western coast of North America, we find that the sea-board aborigines had, and in a decreasing degree still use, a money of their own—a species of shell, though of a widely different form from that used by the natives of the Atlantic coast. The money of the West-coast Indians is a species of tusk-shell (*Dentalia*), resembling in miniature the tusks of an elephant, (Plate VI, fig 2). Mr. J. K. Lord, formerly connected, as naturalist, with the British North American Boundary Commission, refers to the use of these shells as money "by the native tribes inhabiting Vancouver's Island, Queen Charlotte's Island, and the main-land coast from the Straits of Fuca to Sitka. Since the introduction of blankets by the Hudson's Bay Company, the use of these shells has to a great extent died out; and the blankets have become the money, as it were, by which everything is now reckoned and paid for by the savage. A slave, a canoe, or a squaw, is worth in these days so many blankets; it used to be so many strings of *Dentalia*." Mr. Lord also remarks: "The value of the *Dentalium* depends upon its length. Those representing the greater value are called, when strung together end to end, a *Hi-qua*; but the standard by which the *Dentalium* is calculated to be fit for a *Hi-qua* is that twenty-five shells placed end to end must make a fathom, or six feet in length. At one time a *Hi-qua* would purchase a male slave, equal in value to fifty blankets, or £50 sterling.*

Mr. Frederick Whymper, speaking of an Indian muster of various tribes at or near Fort Yukon, Alaska, in 1867, says: "Their clothing was much befringed with beads, and many of them wore through the nose (as did most of the other Indian *men* present) an ornament composed of the *Hya-qua* shell (*Dentalium entalis*, or *Entalis vulgaris*). Both of the fur companies on the river trade with them, and at very high prices. These shells were formerly used, and still are, to some extent, as a medium of currency by the natives of Vancouver Island and other parts of the North-west Coast. I saw on the Yukon, fringes and head-ornaments, which represented a value in trade of a couple of hundred marten-skins.† Mr. Whymper further remarks that "These shells are generally obtained from the west coast of Vancouver Island," and that his spelling "*Hya-qua* conveys a "closer approximation to the usual pronunciation of the word" than Mr. Lord's "*Hi-qua*."

The use of these shells for nasal ornamentation by the Indians, as observed by Mr. Whymper at Fort Yukon, attracted our attention while at Crescent City, in this State, in the year 1861. A medicine-man, belonging to one of the neighboring tribes, had perforated the partition which separates the nostrils, and, into

* Proceedings Zoological Society, London, March 8th, 1864.

† Whymper's *Alaska*, Harper's edition, 1869, p. 255.

the hole thus made, had inserted from each side, point by point, two of these shells, which decoration was further increased by sticking a feather of some wild-fowl into the large end of each of the hollow shells.

As to the length of the shells, as implied by Mr. Lord's statement "that twenty-five shells placed end to end must make a fathom or six feet," we are inclined to believe there is some mistake, as the shells would have to average very nearly three inches in length. Of the great number which we have seen of the species mentioned by Lord and Whymper (*Dentalium entalis*, or *Entalis vulgaris*), but very few attain a length of two inches; the great majority averaging much less. As to the specific names of the shells used as above, and the localities from which they are obtained, it may be well to state that the "west coast of Vancouver Island" form is the *Dentalium Indianorum** of Dr. P. P. Carpenter; but probably the greater part of the tusk-shells which are or have been in circulation, do not belong to the American species, but to the common European *Dentalium*,† referred to by the gentleman, and which closely resembles the American. The foreign species has been extensively imported for the Indian trade, and we have noticed at different times large numbers of the imported shells displayed for sale in the fancy goods stores in San Francisco, together with beads and other Indian goods. The use of the *Dentalia* for money among the Alaskan tribes is also corroborated by Mr. W. H. Dall, whose extensive travels and thorough investigations in that territory are well known. It is highly probable that the use of these shells in that region will soon become a story of the past, and the money of the Pale-faces will supersede among the Red-men the shells of the sea.

The Indians of California, or the tribes inhabiting the northern portion of the coast and the adjoining region, also use the tusk-shells for money; either the shells or the shell-money is called *alli-co-cheek*, or *allicochick*—the latter being the orthography, according to Mr. Stephen Powers, whose valuable papers upon "The Northern California Indians," in the *Overland Monthly*, are an important contribution to American aboriginal history.

"For money, the Cahrocs make use of the red scalps of woodpeckers, which are valued at $5 each; and of a curious kind of shell, resembling a cock's spurs in size and shape, white and hollow, which they polish and arrange on strings, the shortest being worth twenty-five cents, the longest about $2—the value increasing in a geometrical ratio with the length. The unit of currency is a string the length of a man's arm, with a certain number of the longer shells below the elbow, and a certain number of the shorter ones above. This shell-money is called *allicochick*, not only on the Klamath, but from Crescent City to Eel River, though the tribes using it speak several different languages. When the Americans first arrived in the country, an Indian would give from $40 to $50 in gold for a string of it; but now it is principally the old Indians who value it at all." ‡

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* Supp. Rep. Brit. Ass'n, 1863, on Mollusca of W. N. America, p. 648.

† *Antalis entalis*, *Vide* Adams' *Genera*, vol. I, p. 457.

‡ *Vide Overland Monthly*, vol. VIII, pp. 329, 427, 535.

In speaking about marriage among the Eurocs, he says: "When a young Indian becomes enamored of a maiden, and cannot wait to collect the amount of shells demanded by her father, he is sometimes allowed to pay half the amount, and become what is termed 'half married.' Instead of bringing her to his cabin and making her his slave, he goes to live in *her* cabin and becomes *her* slave." Again, he says: "Since the advent of the Americans, the honorable estate of matrimony has fallen sadly into desuetude among the young braves, because they seldom have shell-money now-a-days, and the old Indians prefer that in exchange for their daughters. . . . (The old generation dislike the white man's money, but hoard up shell-money like true misers)," etc. Among the Hoopas, "murder is generally compounded for by the payment of shell-money." *

In connection with the use of money in traffic among the interior Indians, it appears that "all the dwellers on the plains, and as far up on the mountain as the cedar-line, bought all their bows and most of their arrows from the upper mountaineers. An Indian is about ten days in making a bow, and it costs $3, $4, or $5, according to the workmanship; an arrow, 12½ cents. Three kinds of money were employed in this traffic. White shell beads, or rather buttons, pierced in the centre and strung together, were rated at $5 per yard; periwinkles, at $1 a yard; fancy marine shells at various prices from $3 to $10, or $15, according to their beauty." †

The shell-money here referred to is not sufficiently particularized to admit of a determination of the species to which the shells belonged. In connection with the treatment of the sick among the Meewocs, Mr. Powers says: "The physician's prerogative is, that he must always be paid in advance; hence, a man seeking his services brings his offering along—a fresh-slain deer, or so many yards of shells, or something—and flings it down before him without a word, thus intimating that he desires the worth of that in medicine and treatment. The patient's prerogative is, that if he dies, his friends may kill the doctor."‡

Among the Moädocs, or Modocs, "when a maiden arrives at womanhood, her father makes a kind of a party in her honor. Her young companions assemble, and together they dance and sing wild, dithyrambic roundelays, improvised songs of the woods and the waters:

> "'Jumping echoes of the rock;
> Squirrels turning somersaults;
> Green leaves, dancing in the air;
> Fishes white as money-shells,
> Running in the water, green, and deep, and still.
> Hi-ho, hi-ho, hi-hay!
> Hi-ho, hi-ho, hi-hay!'

This is the substance of one of the songs, as translated for me." §

Among the Yocuts, another California tribe, whose dominion covers "the Kern and Tulare basins, and the middle San Joaquin," etc., "their money consists of the usual shell-buttons, and a string of them reaching from the point of

* *Overland Monthly*, vol. IX, p. 156.

† *Id.*, vol. X, p. 325.

‡ *Id.*, vol. X, p. 327.

§ *Id.*, p. 541.

the middle finger to the elbow is valued at twenty-five cents. A section of bone, very white and polished, about two and a half inches long, is sometimes strung on the string, and rates at a 'bit.' They always undervalue articles which they procure from Americans. For instance, goods which cost them at the store $5, they sell among themselves for $3."*

We have no authentic *data* as to whether the value of the shell-money, properly so-called, among the California Indians, and those farther north, was graduated by the color, or whether they generally used other than the *hya-qua* or *allicochick* (*Dentalia*), which are white and have a shining surface; for though, as above, "periwinkles" and "fancy marine-shells" are mentioned as used in trade, these may have been regarded more as articles of ornamentation, and esteemed among the interior Indians particularly as precious, the same as diamonds and fine jewelry are among civilized people. In this view, the interior Indians of California are probably not unlike the more southern Indians of New Mexico, for a friend of ours (Dr. Edward Palmer of the Smithsonian Institution) informed us a few years ago, that while traveling in that territory he was witness to a trade wherein a horse was purchased of one Indian by another, the price paid being a single specimen of the pearly ear-shell (*Haliotis rufescens*), or common California red-back *abalone* or *aulon*.

As to the value of the tusk-shells among the California Indians, the method of reckoning the same is by measuring the shells on the finger-joints, the longest being worth the most.

We have been informed that the Indians who formerly resided in the neighborhood of the old Russian settlement of Bodega, used pieces of a (bivalve) clam-shell (*Saxidomus aratus*†) for money, but we have been unable to obtain a specimen, or to verify the statement. Recently, our friend Mr. Harford, of the Coast Survey, has discovered in some Indian graves, on one of the islands off the southerly coast of this State, beads, or money, of a different character from any heretofore observed. These were made by grinding off the spire and lower portion of a species of univalve shell (*Olivella biplicata*, Sby., Plate VI, Fig. 3), so as to form small, flat, button-shaped disks with a single central hole. These much resemble in form some of the *wampum* of the New England tribes. Another variety was found in the same places by the gentleman named, which was made of a species of key-hole limpet-shell (*Lucapina crenulata*, Sby., Plate VI, Fig. 6), of much larger size than that first mentioned. So far, however, as we have investigated, these last described forms of shell-money are not in use among the California Indians of the present day. Plate VI, Figures 6ª and 6ᵇ represent beads or money made from *Lucapina*.

The use of shells for money is not peculiar to the natives of North America. The well-known and exceedingly common money *cowry* (*Cypræa moneta*, Plate VI, Figs. 5, and 5ª) or "prop-shell," an inhabitant of the Indo-Pacific waters, "is used as money in Hindostan and many parts of Africa.... Many tons are .... imported to.... Great Britain and.... exported for barter with the native tribes of western Africa." ‡

* *Overland Monthly*, vol. II, p. 108.

† S. aratus+S. gracilis, Gld.

‡ Baird's *Dictionary of Natural History*, p. 193.

Reeve mentions in the second volume of the *Conchologia Systematica*, that "a gentleman residing at Cuttack, is said to have paid for the erection of his *bungalow* entirely in these *cowries* (*C. moneta*). The building cost him about 4,000 *rupees sicca* (£400 sterling), and, as sixty-four of these shells are equivalent in value to one *pice*, and sixty-four *pice* to a *rupee sicca*, he paid for it with over 16,000,000 of these shells."

Though the number above mentioned is very large, the prop-shell is an exceedingly abundant form. We have received in a single box from the East Indies not less than 10,000 specimens at one time. "In the year 1848, sixty tons were imported into Liverpool, and in 1849, nearly three hundred tons were brought to the same port."

The following extract from a paper by Prof. E. S. Holden, on *Early Hindoo Mathematics*,* justifies the inference that the use of the *Cypræa moneta* for money has a very considerable antiquity, and quite likely extends back to a period many centuries earlier than the date of the treatise.† "The treatise continues rapdly through the usual rules, but pauses at the reduction of fractions to hold up the avaricious man to scorn : 'The quarter of a sixteenth of the fifth of three-quarters of two-thirds of a moiety of a *dramma* was given to a beggar by a person from whom he asked alms ; tell me how many cowry shells the miser gave, if thou be conversant in arithmetic with the reduction termed subdivision of fractions.'" These shells are also known as "Guinea money," and, it is said, have been used as a financial medium in connection with the African slave-trade. Doubtless many a poor negro has been sold, and has lost his liberty, for a greater or less number of these shells.

Another species of *cowry* of small size, and which inhabits the Indo-Pacific province, called the "ringed cowry" (*Cypræa annulus*), the back or top of the shell being ornamented with an orange-colored ring, "is used by the Asiatic islanders to adorn their dress, to weight their fishing-nets, and for barter. Specimens of it were found by Dr. Layard in the ruins of Nimroud."

According to the relation of a recent voyage, transactions are performed in Soudan by barter, or by means of small shells picked up in the Niger, which are called *oudâas* or *woodahs*.‡

It will be seen, therefore, that shells have been and are still used as money by portions of the human race, but to an extent much less than formerly. It would be quite difficult to point out any other natural production which is more appropriate, when size, shape and substance are considered.

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* *Popular Science Monthly*, July, 1873, p. 337.

† "This treatise, the *Lilivati of Bhascara Acharya*, is supposed to have been a compilation, and there are reasons for believing a portion of it to have been written about A. D. 628. However this may be, it is of the greatest interest, and its date is sufficiently remote to give to Hindoo mathematics a respectable antiquity."

‡ *Science Gossip*, Dec., 1866, p. 283.

Mr. Stearns submitted the following communication for Dr. Cooper:

On the Law of Variation in the banded California Land Shells.

BY J. G. COOPER, M. D.

1. *ARIONTA Leach.*

In studying further the species referable to this genus in California, together with their geographical distribution, some curious generalizations are arrived at, hinted at in a former article by me in the American Journal of Conchology, Vol. IV, p. 211, but not then so fully understood.

The close relationship and probable identity of some assumed species has been long apparent to all who have examined them, but from paucity of specimens, or reasons by which to account for their differences, they have been allowed to retain their rank as species until more numerous intermediate forms should establish their position as varieties.*

Though these connecting links are very few, and from the peculiarly local distribution of the chief forms are not likely to be found numerous, yet I think it can be shown that these local forms are not entitled to higher rank than that of sub-species which have had a common origin. By gradual divergence from one or a few centers of distribution, and being brought under the influence of different climates, they have assumed their present conditions, which are still subject to many variations, showing a tendency to the production of other forms. The systematic arrangement of these species and varieties, or sub-species, in connection with their distribution, can be best shown by a diagram. See Plate VII.

The plan here given shows the position and extent of range of each form allied to *Arionta*, the range north and south being shown by the parallels of latitude, and that east and west by the length of the brackets enclosing or adjoining the names, which may be compared with the scale given. It will be observed that the additions to our knowledge of their range has not much increased since the publication of the map given in the Amer. Jour. of Conch., Vol. IV, p. 211, though some doubtful points have been settled.

The chief centers of distribution are around San Francisco Bay, on the Santa Barbara islands, and near San Diego, whence one species follows up the Sierra Nevada to near lat. 40°. As this species has so wide a range, and presents nearly as many varieties as are found in the other groups, it becomes a question whether it is not the (Darwinian) progenitor of those along the coast which occupy regions of later geological age. Though the group around San Francisco Bay is one hundred miles distant from the nearest of that species, it must be remembered that the rivers all converge toward the bay, and that the floods

*Most of the names in use will no doubt be always retained for convenience in distinguishing between the various races, etc.

sometimes convert the entire interval into a lake, over which the species might have been spread, and since modified in its new localities. The chief argument to the contrary may be in the fact that no specimens are known to have been lately transported in this way. The most limited local varieties are indicated by names placed horizontally, and they usually differ more than others, being also more distant geographically.

As I have hinted at the probability of *A. tudiculata* being the progenitor of the coast forms, I may remark that the fossil form found at the foot of the Sierra Nevada, by Mr. Gabb, has the very high imperforate character of specimens now living close to the coast, and may have existed in the Miocene epoch when the San Joaquin valley was an arm of the sea, in which lived the sharks, etc., whose remains now abound not far from the Helix locality. It would then have lived close to the edge of this sea, and before the greater part of the coast range was elevated above it. The transplanting of the Arionta form to the latter may have been after the salt water was replaced by fresh, or in the Pliocene epoch.

Omitting for the present a critical comparison of the species and varieties which I have made ready for future publication, I intend here to point out only the geographical reasons for the conclusions to which I have arrived, as indicated in the diagram.

Around San Francisco Bay we have three well-marked, and always separable, species, viz: *arrosa*, *exarata*, and *Californiensis*, all living together on the west side, and at nearly equal distances north and south. Rare hybrids only exist as connecting links.

The last also extends to the east side of the bay, where it produces three varieties which mix together, and also with the typical form on the west side. *Var. nemorivaga* is almost equally common on both sides, and extends further south than any, there meeting (but not mixing) with *var. vincta*, at Monterey. (I omit "*Nickliniana*," as it seems founded upon a combination of the characters of these with *tudiculata*.)

Now, all these varieties of *Californiensis* follow certain definite rules in their divergence from the typical form, according to the amount of heat, moisture, fog, and wind they are subject to. *A. arrosa* and *exarata*, having only a narrow range close to the coast, are subjected to little difference in these conditions, and accordingly vary but little. *Californiensis* and varieties, on the contrary, spreading twice as far inland, gradually change from a high, imperforate form to depressed and umbilicate, as they pass into drier and hotter regions, with so many intermediate forms that their specific identity and the causes of variation can scarcely be doubted. A similar variation, but in less degree, occurs in the two others mentioned.

The next centre of distribution for *Arionta*, is that of *tudiculata* and varieties on the west slope of the Sierra Nevada, one hundred miles east of the preceding, and separated by wide alluvial valleys, in which no specimens of *any* species have ever been found.

This species presents a series of varieties analogous to those of *Californiensis*, but much less extreme, and scarcely definable, as they run together very closely. This is a consequence of its distribution being continuous from north to south along a mountain range, and not interrupted by alternating mountains, valleys, and bays, as is that of the preceding. It is always recognisable by fixed characters permanent through great extremes of size.

At the south end of the range of *tudiculata* we meet with another species, in range somewhat intermingled with it, but always distinct, viz: *A. Kellettii Fbs.*, which centres around San Diego Bay and the neighboring islands, from lat. 34° southward to lat. 28°, or perhaps 26°, in Lower California, four hundred or five hundred miles. The various forms found within this vast range, and which have been described as *Kellettii, redimita, Tryoni, intercisa, crebristriata*, and *Stearnsiana*, pass so insensibly from one to another that they must be considered merely varieties analogous to those of *Californiensis*. The most northern is the most different from the type which was from the most southern part of their range, but intermediate forms connect them all.

The parallel between the varieties of the two species is well shown by the following table:

A. Form elevated, imperforate. Inhabit cool, foggy exposures.

b. vincta Val.	*Tryoni Newc.*
c. nemorivaga Val.	*redimita W. G. B.*
a. CALIFORNIENSIS Lea	*KELLETTII Fbs.*

B. More depressed, perforate. From warmer localities.

d. ramentosa Gld.	*crebristriata Newc.*
e. reticulata Pf.	*intercisa Newc.*
f. Bridgesii Newc.	*Stearnsiana Gabb.*

Though of course not strictly parallel, many points of resemblance can be seen between the forms thus compared. Thus the varieties *d.* and *e.* of each have similar relations *inter se* as to sculpture, while *f* is in each very similar to the type; the "circular" arrangement being well represented in each group.

All these banded species and varieties are connected so closely together by their banded character, that a common origin in the dim periods of the past seems highly probable, and yet their parallelism with another large series existing in the same regions, but always distinguishable, indicates that some common physiological law, still unknown, is connected with this character. In the form of shell and animal, as well as in its anatomy, they seem more closely connected with the Lower Californian group embracing *areolata, Pandoræ, levis*, etc., which vary from colorless to many-banded or blotched, showing a relationship similar to that held by "*Arionta candidissima*" of Palestine to *A. arbustorum* of Europe, a species between *Californiensis* and *Kellettii*.

II. LYSINOE H. and *A. Adams.*

A comparison of the distribution of the species which I have referred to this group with that of the *Ariontas*, presents one very striking difference at first view, namely, that the former do not occur in localized groups widely separated, but in linear series following the mountain ranges from north to south, or the chains of islands either in the same or the opposite direction. As with *Arionta*, however, a few isolated forms occur like extreme local developments of varieties, perhaps depending for their characters on local influences, though these are not always so easily understood. See Plate VIII.

Two new elements of specific distinction also occur, viz: angulation of the periphery, and more or less pilosity of the epidermis.*

I have before pointed out the apparent relation between angulation and shaly mountains, as well as between pilosity and arid climate. Though connecting links are not known between the forms showing these characters, and their nearest allies without them, (except in the case of *infumata* and *fidelis*) I am now decidedly of the opinion that they will be found between *Mormonum* and *Hillebrandi* (being already imperfectly indicated), and between *Dupetithouarsi* and *sequoicola*.† Three of these therefore will have to take rank as varieties of the others, and more such instances will doubtless occur. There is some evidence that *L. Mormonum* was the geological progenitor of the forms living near the coast, in the fact that a variety, nearly intermediate between it and *fidelis*, occurs at the Dalles of the Columbia, where *fidelis* passes eastward through the gap of the Cascade mountains. Some varieties also approach quite near *L. Traskii*, which meets it southward.

The varieties of the species of this group, corresponding to *a*, *b*, *c*, etc., of the former, are not so distinctly marked, and have not received so many distinctive names, except in the following cases:

b. *AYRESIANA Newc.*..............................*REMONDII Tryon.*
c. *DUPETITHOUARSI Val.*..............................*rufocincta Newc.*
a. *FIDELIS Gray.*..............................*TRASKII Newc.*
d. *infumata Gld.*..............................*ROWELLII Newc.*
e. *MORMONUM Pf.*..............................*Lohrii Gabb.*
f. *sequoicola Cp.*..............................*Gabbii Newc.*

Those best entitled to specific rank being in capitals, it appears that the divergences of these forms are greater than in the former case.

The groups *d* and *e* are mostly flattened, angulated, and hirsute, at least when young, while *f*, as before, returns by the "circular" method toward the characters of *b*.

No certain instances of specific intergradation between members of *Lysinoe* and *Arionta* are known. Though I formerly supposed some varieties to be intermediate, or hybrids, I am now inclined to consider them instances of mimetic resemblance, as species of one group are well known to approach those of another where their geographical limits approach each other. We find, however,

**L. Traskii*, as well as the allied forms, is hirsute up to the size of three or four whorls in Ventura county.

† Mr. G. W. Dunn has lately found specimens of *sequoicola* very black and *without band*, though not angled like *infumata*. *Hab.*, north of Santa Cruz.

members of each living together in numerous localities throughout the range of both, without intermediate forms.

THE LAW OF VARIATION.

The biological law deducible from the preceding facts is, that those species, sub-species, and varieties living in cool, damp situations, become more highly developed (but not always larger) than the others, the shell assuming a more compact (imperforate) form, and losing those indications of immaturity referred to, viz: sharp, delicate sculpture, bristles, and angular periphery.

These characteristics, however, remain more or less permanently for indefinite periods, and give that fixedness to the various forms, even when living under the same conditions, which enables us to retain them as *sub-species*, differing from *varieties* in permanency, and from *races* in not inhabiting distinct regions. *Arionta arrosa* and *Lysinoe Dupetithouarsi* are thus the highest developed of either group in California.

The President informed the Academy that Mr. C. E. Watkins, the well-known photographer, had generously offered to make photographs, cabinet size, of all the members, and present a copy of each to the Academy, provided that they would furnish a suitable album for their preservation.

Regular Meeting, July 21st, 1873.

President in the Chair.

Thirty-six members present.

Dr. J. C. Horner de Tavel, of Oakland, and A. Gros, were elected resident members, and H. H. Moore and D. O. Mills, life members.

Donations to Library: Société des Arts et des Sciences of Batavia, Verhandelingen, Vol. XXXIV et XXXV; Tijdschrift XVIII, 1, 2, 3, XX, 1, 2; Notulen VIII, 3, 4, IX, 1871. Beitrag zur Kenntniss der Insekten-Fauna des Kantons Zürich; Käfer von Kaspar Dietrich; 4to., Zürich, 1865; from H. Erni, U. S. Consul. The Principle of Least Action in Nature, etc., etc., by the Rev. Samuel Haughton, pamph. 8vo., London, 1871; from the author. R. Comitato Geologico d'Italia, Nov. and Dec., 1872, Jan. and Feb., 1873. Rapport sur les Progres recents des Sciences Zoologiques en France, par M.

Milne Edwards; 8vo., Paris, 1867; from the author. Journal de Conchyliologie, Tome X, 1870, and Tome XI, 1871; from Messrs. Crosse and Fischer, publishers, Paris. Bulletin de la Société des Sciences Historiques et Naturelles de l'Yonne, Vol. 26, anneé 1872. Société des Arts et des Sciences of Batavia; Tijdschrift XIX, 1–6, 1869–70. Notulen VII, 2, 3, 4; VIII, 1, 2. Verhandlungen des Hist. Vereins von Oberpfalz und Regensburg, 8vo., Stadtamhoff, 1872. Crustaces divers et Poissons des depots Siluriens de la Bohême par Joachim Barrande, 8vo., Prague, 1872; from the author. Bulletin de la Société Imperiale des Naturalistes de Moscow, 1872, Nos. 2 and 3. Jahrbuch der k. k. Geolog. Reichsanstalt, Oct., Nov., and Dec., Wien, 1872. Verhandlungen der k. k. Geolog. Reichsanstalt, Nos. 12–18, Wien, 1872. Schriften der Natur-Gesellschaft in Danzig; 4to., Vol. I, Part I, Danzig, 1872. Société Entomologique de Belgique, (Bulletin) No. 78, 1872. Sitzungsberichte der K. Akad. der Wissenschaften, Erste Abtheilung, Band LXV, Heft I, II, III, IV, V; Zweite Abtheilung, Band LXV, Heft I, II, III, IV, V; Dritte Abtheilung, Band LXV, Heft I, II, III, IV, V. Wien, 1872. Denkschriften der Kaiserlichen Akad. der Wissenschaften, (Vol. XXXII) Wien, 1872. Index of Articles in Vols. 61–64 of Akademie der Wissenschaften, Wien, 1872. Verhandlungen der k. k. zoologisch-botanischen Gesellschaft in Wien, Band XXII, Wien, 1872. Memoires de la Société de Physique et d'Histoire Naturelle de Geneva, Tome XXI, seconde parte, 1872. Jahresbericht VIII und IX des Vereins für Erdkunde zu Dresden, Pamph. 8vo., 1872. Bericht über die Senckenbergische Naturforschende Gesellschaft, 1871–72. Sitzungsberichte der Akademie der Wissenschaften zu München, 1871, Hefte I, II, III, 1872, Hefte I, II; also, Inhaltsverzeichniss zu 1860–1870. Die Aufgabe des chemischen Unterrichts, etc., von Dr. Emil Erlenmeyer, pamph. 4to., München, 1871. Annalen der Königlichen Sternwarte bei München, Band XVIII, 1871; also, Supplement, bad XI, 1871, and XII, 1872. Jahrbücher des Nassauischen Vereins für Naturkunde, Jahrgang XXV und XXVI, 1871–72. Bulletin de la Société des Sciences Naturelles de Neufchatel, Tome IX, Deuxieme cahier, 1872. Oversight over det Kongelige Danske Videnskabernes Selskabs Forhandlinger og dets Medlemmers Arbedjder, 1871, Nov. and Dec., 1872, Jan., Febr., and March. Der Zoologische Garten, Frankfurt a. M. July–Dec., 1872. Zeitschrift der Deutschen Geol. Gesellschaft, Band XXIV, Heft 3, May, June, and July, Berlin, 1872. Zoologische Miscellen, XVI, XVII, 1872; Phylloxera vastatrix; by G. R. von Frauenfeld; from the author. Zeitschrift für die Gesammten Naturwissenschaften. Band V, VI, Berlin, 1872. Schriften der Gesellschaft zur Beförderung der gesammten Naturwissenschaften zu Marburg, Band IX and Band X, parts 1, 2, 3 and 4; also Sitzungsberichte, 1869–71. Nachrichten von der k. Gesellschaft der Wissenschaften und der George-August Universität, Göttingen, 1872. Annales de la Société Entomologique de Belgique, Tome quinzième, Brussels, 1871–72. Annalen der Sternwarte in Leiden, 4to., third volume, Haag, 1872. Verslagen en Mededeelingen der Koninklijke Akademie van Wetenschappen, 1872; also Jaarbock of same for 1871, and Processen verbaal, 1871–72, Amsterdam.

Jahresbericht der Naturforschenden Gesellschaft in Emden, 1871. Kleine Schriften der Naturforschenden Gesellschaft zu Emden, XVI, 1872. Verhandlungen der Schweizerischen Nat.-Gesellschaft in Frauenfeld, August, 1871. (54 Jahresversammlung.) Abhandlungen des Nat. Vereins zu Bremen; Beilage No. 2, Bremen, 1872. Overland Monthly, August, 1873; from J. H. Carmany & Co.

Donations to Museum: Crustaceans (Humpback whale-food) from lat. 24° 27′ N., long. 111° 58′ W. Also, specimens of *Velella* and of *Lepadidæ*, collected in lat. 29° 52′, N. long. 116° 15′ W.; presented by Capt. William Metzgar. Fossil Shells, from an elevation of 800 feet on Cerros Island, Lower California, presented by Lieut.-Com. C. W. Kennedy, of the U. S. C. S. steamer *Hassler*. Two specimens of Ancient Pottery and Twine, from Inca graves, Peru, presented by C. A. Wetmore. Samples of Paper made of the wood of the American Poplar, from Alexander Austin. Specimen of *Cuproscheelite*, from the Green Monster Mine, Kern County, Cal., presented by Henry G. Hanks.

The President read the following, being an additional gift from James Lick:

THIS INDENTURE, made this eleventh day of July, in the year of our Lord one thousand eight hundred and seventy-three (1873), by and between JAMES LICK, of the city of San Jose, in the county of Santa Clara, in the State of California, the party of the first part, and the CALIFORNIA ACADEMY OF SCIENCES, a corporation organized and existing under and by virtue of the laws of the State of California, and having its principal place of business in the City and County of San Francisco, in said State, the party of the second part, WITNESSETH: that the said party of the first part, in consideration of the desire he has to promote the diffusion of science, and the prosperity and perpetuity of the said party of the second part, hath given, granted and confirmed, and by these presents doth give, grant and confirm unto the said party of the second part and its successors, all that certain parcel of land situate in said City and County of San Francisco, in the State of California, and bounded and described as follows, to wit:

Beginning at a point on the southeasterly line of Market street, distant one hundred and fifty-five (155) feet southwesterly from the southerly corner of Market and Fourth streets, and running thence southeasterly and parallel with said Fourth street one hundred and fifty-five (155) feet; thence at an angle of forty-five degrees (45°) southerly fifty-six and fifty-six one hundredths (56 56-100) feet, more or less, to a point which is one hundred and ninety-five (195) feet distant from the southwesterly line of said Fourth street, and one hundred and ninety-five (195) feet distant from the southeasterly line of said Market street;

thence northwesterly and parallel with said Fourth street one hundred and ninety-five (195) feet to the southeasterly line of Market street; and thence northeasterly along said last-mentioned line forty (40) feet to the point of beginning; being a portion of the lot known and designated on the official map of said City and County of San Francisco as "Hundred-vara lot number one hundred and twenty-six (126);" reserving and excepting out of and from said granted premises, all buildings, tenements and improvements of any of the tenants of said party of the first part that now are, or may be, situate thereon at the time when said party of the second part shall be entitled to the possession of said premises; and excepting and reserving out of and from this grant and conveyance the right to possess, use and occupy said premises for the period of two (2) years from the date hereof, unless sooner determined, as hereinafter provided; which right of possession, as aforesaid, said party of the first part hereby reserves unto himself, his heirs and assigns:

To HAVE AND TO HOLD, all and singular, the premises hereby given and granted unto said party of the second part and its successors, upon the following terms and conditions, nevertheless; which terms and conditions shall be binding and obligatory upon said party of the second part and its successors, that is to say:

First—That said premises shall be used and devoted solely and exclusively for scientific purposes and for none other, and shall never be used for political or religious purposes.

Second—That said premises shall never be incumbered by said party of the second part, or its successors; and shall never be allowed or suffered by said party of the second part, or its successors, to be sold for any taxes, assessments, or other charges levied or placed, or suffered to be levied or placed thereon.

Third—That said premises shall never be alienated by said party of the second part during the life of any of the existing members of said California Academy of Sciences.

Fourth—That said party of the second part shall never lease said premises or any part thereof, or any edifice or any part of any edifice erected or to be erected thereon; and said party of the second part shall never permit or suffer any person to possess, use or occupy the whole or any part of said premises, or any edifice or any part of any edifice, erected or to be erected thereon, save for its own proper purposes.

Fifth—That the building required to be erected by the conditions of the former deed of conveyance made by the said party of the first part to the said party of the second part, of a piece of land adjoining the aforesaid granted premises (which deed is dated the fifteenth day of February, A. D. one thousand eight hundred and seventy-three, and is recorded in the County Recorder's office of said San Francisco) shall, when erected, be made large enough to cover, and shall cover, all of the land hereby granted, besides covering the land by said former deed required to be covered by a building; and such building shall be forever maintained on both said parcels of land by the said party of the second part, and shall be of the following description, that is to say: A substantial and elegant brick edifice, three (3) stories in height, with a substantial granite front, faced with appropriate scientific emblems. The structure and design of the edifice shall be classic, and such as will readily distinguish it from buildings used for business or commercial purposes. The style of architecture of said edifice shall be chaste and appropriate, and the same style and order of architecture shall be preserved throughout in its purity.

Sixth—In order to render this gift and conveyance effectual, said party of the second part must, within two (2) years from the date hereof, secure the necessary funds to commence and to complete said edifice; and must commence the erection of this edifice and complete the same with all reasonable dispatch; and as soon as said party of the second part shall secure the necessary amount of funds, at any time within said period of two (2) years, upon thirty (30) days' written notice of that fact to said party of the first part, or his heirs or devisees, the said party of the second part shall be entitled to the possession of said premises, and the right of possession of said premises hereby reserved to said party of the first part shall thereupon cease and determine. The said party of the first part hereby reserves to himself and his heirs and assigns the right to use and possess, and occupy said premises, until said party of the second part shall have secured the aforesaid necessary amount of funds, and until notified of that fact as aforesaid; but said funds must be secured, and the erection of said edifice be commenced, within a period of time not exceeding two (2) years, as aforesaid. At least one (1) apartment of said edifice shall be constructed suitably for, and devoted to, the purposes of a library; another apartment thereof shall be constructed suitably for, and devoted to, the purposes of a museum; and a third apartment thereof shall be suitably constructed for, and devoted to, the purposes of a hall for lectures.

Should said party of the second part, or its successors, violate or fail to fulfill any of the foregoing terms or conditions, then and immediately thereupon the estate and all interest hereby given and conveyed shall cease and determine, and the same, to wit: All interest and estate hereby given and conveyed shall immediately revert to and revest in said party of the first part, his heirs and assigns, without any previous entry to assert such failure or breach.

In Witness Whereof, the said party of the first part hereunto sets his hand and seal the day and year first herein above written.

[Signed] JAMES LICK. [L. S.]

Signed, sealed and delivered in the presence of:

Sam'l Hermann,
D. J. Staples,
John O. Earl.

STATE OF CALIFORNIA, CITY AND COUNTY OF SAN FRANCISCO, } ss.

On this eleventh day of July, A. D. 1873, before me, Samuel Hermann, a Notary Public in and for the said city and county, duly commissioned and sworn, personally appeared James Lick, known to me to be the person whose name is subscribed to the within and foregoing instrument, and he, the said James Lick, duly acknowledged to me that he executed the same.

In witness whereof, I have hereunto set my hand and affixed my official seal the day and year in this certificate first above written.

[L. S.] [Signed] SAM'L HERMANN,

Notary Public.

Recorded in the office of the County Recorder of the City and County of San Francisco, July 26th, A. D. 1873, at 12 M., in Liber 712 of deeds, page 233.

[Signed] A. R. HYNES,

County Recorder.

After reading the deed, Prof. Davidson recalled the terms of the previous deed of February, in which the Academy was obligated to raise funds sufficient to complete the building, and commence its erection within two years; and in case of subsequent non-fulfilment of any of the conditions imposed upon us, the property was to revert and revest in James Lick and his heirs and assigns. The members had thought it possible to raise the money if the conditions were lightened; and he had conferred with Mr. Lick upon the subject, with a reasonable prospect of effecting a modification of the conditions.

This new deed continued and enforced the same obligations; and, from the increased size of the building, and the eastern side being intended to face a block comparatively open, the cost of erection would not be less than $300,000, whilst the taxes and assessments would amount to at least $5,000 per annum. These and other objections to the project were fully stated as insuperable; yet, notwithstanding this fact, Prof. Davidson urged the Academy to accept the new deed, and await the result of future conferences with Mr. Lick, who was really anxious to benefit the Academy. It was no burden to them, as the taxes and assessments were paid by the donor. He would call a special meeting of the Trustees at once, and embody the objections to the conditions of the deeds in a practical shape for discussion by the Trustees, that they might submit their views to Mr. Lick.

It was moved by Dr. George Hewston, that the Trustees be authorized to receive the additional donation of Mr. James Lick, and return the thanks of the Academy. After some discussion, the motion was seconded and unanimously carried.

Mr. Stearns submitted the following papers:

Shells collected at San Juanico, Lower California, by William M. Gabb.

BY ROBERT E. C. STEARNS.

The species contained in this and the succeeding list, were collected in the month of February, 1867, by Prof. Gabb, who kindly submitted the same to me for examination. As the knowledge of Lower California Mollusca is exceedingly limited, the publication of these lists may be of some benefit to students, and of value as data bearing upon geographical distribution. San Juanico is on the east side of the peninsula of Lower California, in latitude about 27° north.

Solecurtus Californianus, *Conr.*
Periploma argentaria, *Conr.*
Standella planulata, *Conr.*
Amphichæna Kindermanni, *Phil.*
Peronæoderma viriditincta, *Cpr.*
Donax flexuosus, *Gld.*
Semele bicolor, *C. B. Ad.*
Fulvia aspersum, *Sby.**
Cyclas dentata, *Wood.*
Mysia orbella, *Gld.*
Crassatella gibbosa, *Sby.*
Lazaria radiata, *Brod.*
Arca Pacifica, *Sby.*
Anomalocardia grandis, *Brod. & Sby.*
" multicostata, *Sby.*
" tuberculosa, *Sby.*
Vola dentata, *Sby.*
Chione fluctifraga, *Sby.*
Chione succincta, *Val.*
Chione simillima, *Sby.*
Callista chionæa, *Mke.*
Tivela radiata, *Sby.*
Dosinia ponderosa, *Gray.*
Cardium senticosum, *Sby.*
Omphalius fuscescens, *Phil.*
Crucibulum imbricatum, *Sby.*
Haustator goniostoma, *Val.*
" tigrina, *Kien.*
Cerithidea albonodosum, *Cpr.*
Trivia radians, *Lam.*
Strombus granulatus, *Swains.*
Neverita Recluziana, *Rve.*
Malea ringens, *Sby.*

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*In Adams's Gen. Moll. this species is catalogued as "aspera, *Sby.*;" but in Sowerby's Conch. Illustr. (Fig. 15) it is "C. aspersum, *Sow.*, Zool. Proc. 1833, p. 85," and is credited to "St. Elena, Mr. Cuming." It is strikingly like its Caribbean analogue *F. bullatum*. St. Elena is on the coast of Guayaquil, in latitude about 2 deg. south. If Mr. Cuming's "habitat" is correct, it shows a wide range, and the two species mentioned herein may have descended from the same ancestors.

Chiton (Lepidoradsia) Magdalensis, *Hinds.*
Fissurella volcano, *Rve.*
Callopoma tessellatum, *Kien.*
Lagena nodosum, *Chemn.*
Tritonidea insignis, *Rve.*
Cassidulus patula, *Brod.* and *Sby.*
Harpa crenata, *Swains.*
Oliva venulata, *Lam.*
Macron Æthiops, *Rve.**
Fusus Dupetithouarsii, *Kien*
Phyllonotus bicolor, *Val.*
Murex plicatus, *Sby.*

Shells collected at Loreto,† Lower California, by W M. Gabb, in February, 1867.

BY ROBERT E. C. STEARNS.

Cyathodonta undulata, *Conr.*
Semele bicolor, *C. B. Ad.*
Chione succincta, *Val.*
Callista chionæa, *Mke.*
Tapes (Cuneus) grata, *Say.*
Cyclas dentata, *Wood.*
Pecten subnodosus, *Sby.*
Bulla Adamsi, *Mke.*
Acmæa fascicularis, *Mke.*
Crucibulum spinosum, *Sby.*
Neritina picta, *Sby.*
Luponia Sowerbyi, *Kien.*
Trivia Solandri, *Gray.*
Surcula funiculata, *Val.*
Architectonica granulata, *Lam.*
Pyrazus incisus (dwarf variety).
Natica Pritchardi, *Fbs.*
Mamma uber, *Val.*
Neverita Recluziana, *Rve.*
Oliva (Ispidula) venulata, *Lam.*
Olivella dama, *Mawe.*
" intorta, *Cpr.*
Purpura (Stramonita) biserialis, *Blainv.*
" " triangularis, "
Sistrum carbonarium, *Rve.*
Engina crocostoma, *Rve.*
Columbella fuscata, *Sby.*
Conella cedo-nulli, *Rve.*
Nassa tegula *Rve.*
" versicolor, *C. B. Ad.*
Anachis lyrata, *Sby.*
" nigricans, *Sby.*
" serrata, *Cpr.*
Strombina maculosa, *Sby.*
Murex plicatus, *Sby.*

**Macron* (a subgenus of *Pseudoliva* made by the Adams's), includes three species all peculiar to the west coast of North America, and inhabiting a semi-tropical and littoral station from (and including) San Diego in California proper, thence southerly, and both coasts of Lower California; also at "Cedras" or Cerros and other islands along the outer coast of the peninsula; all of the species are covered with a thick, black epidermis; *M. Æthiops*, the largest, is traversed spirally by broad, moderately deep grooves from apex to base; while *M. Kellettii*, A. Ad., has generally only three below the middle of the body whorl, otherwise being nearly smooth. The most northern and smallest of this group is *M. lividus*, A. Ad., which seldom attains the length of an inch, the average of many measurements being .77 inch; this latter species is proportionately less inflated than either of the others, and is not uncommon at San Diego; the other species are comparatively rare.

†Loreto is in latitude twenty-five degrees fifty-nine minutes N.; longitude 113 degrees twenty-one minutes W.; Lower California.

Notes on Cuproscheelite.

BY HENRY G. HANKS.

Several months ago, Mr. J. B. Treadwell handed me a mineral for examination which he found at the Green Monster Mine, Kern County, twelve miles east of White River Postoffice, a specimen of which I present this evening. At the first glance I supposed it to be *Sulphate of Baryta*, colored by an admixture of some foreign substance; but to my surprise I found it to contain no trace of baryta. I then submitted the mineral to a physical and chemical examination, of which the following is the result: The mineral is *massive and homogeneous; color*, yellowish-green; *lustre*, vitreous; *hardness*, 5.5; *streak*, white; *specific gravity*, 5.863+; *anhydrous; fusible*, after heating turns purple; *not magnetic*; B. B. dissolves in borax to an opaque white bead; B. B. dissolves in microcosmic salt, color, green, hot and cold; gives a reaction of *copper;* not soluble in *water*, *hydrochloric acid*, or *aqua regia*, even after fusion with *bi-sulphate of potash*; a dense, golden-yellow powder remains in every case; *in a closed tube* no sublimate, *absence of sulphur*; does not blacken; *absence of carbon*; *heated with cyanide of potassum and water*, gives no reaction of silver in the filtrate, while white residue treated with sulphide of ammonium does not blacken, *absence of lead.* The powdered mineral found by the above treatment to be free from *sulphur*, *carbon*, *silver*, and *lead*, was fused with the following flux: 1 part *nitrate of potash*, 2 parts carbonate of potash, 2 parts carbonate of soda, by which means it was brought into solution, the residue, undissolved by water, being wholly soluble in hydrochloric acid. Although this mineral strongly resembles scheelite, yet the presence of copper and its inferior specific gravity separate it from that species. I then made a microscopical examination of the mineral to ascertain if the copper might be a mechanical mixture, but found it perfectly homogeneous.

Believing it to be new, I set it aside for a careful analysis at my leisure. Not long since I showed the specimen to Prof. Whitney, who recognized it as *Cuproscheelite*, described by him in Vol. 3 of this Society's proceedings, page 287.

Although not new, it is still interesting to science as coming from a new locality, and being found in abundance.

As a source of tungstic acid it will be valuable to the arts, as according to the analysis of Prof. Whitney it contains 79.69 per cent. of that rare acid, and is easily decomposed.

With this I present a sample of Tungstic acid, obtained by simply boiling the mineral in hydrochloric acid.

Scheelite has been observed in the Mammoth District, Nevada, and *Cuproscheelite* in several mines in Lower California, but I am not aware that there is any other known locality in which Tungstate of Lime in either form is found in any considerable quantity.

According to Prof. Whitney. Cuproscheelite has the following composition :

Tungstic acid	79.69
Oxide of copper	6.77
Lime	10.95
Protoxide of iron	.31
Water	1.40
	99.12 per cent.

Mr. S. C. Hastings read a paper on Climatic Changes.

Mr. Wetmore submitted, for the inspection of the members, several skulls taken from ancient graves in the upper table-lands of the western slope of the Andes, in Peru. These skulls presented some marked cranial differences, indicating different races. Some of these presented the peculiarities of the Inca type, while others point more to that of the aboriginal Indian, and show a marked flattening of the frontal section, which, in one specimen, is traversed by a median suture from above the nasal orifice backward, dividing the frontal bone equally.

Mr. Stearns announced to the Academy the death of Col. John W. Foster, the distinguished geologist and ethnologist, and President of the Academy of Sciences of Chicago.

On motion of Dr. George Hewston, Mr. Stearns was appointed a committee to prepare resolutions appropriate to the event.

On an Improved Telemeter for Reconnaissance, Engineering, and Military Purposes.

BY GEORGE DAVIDSON.

The fundamental idea of this telemeter is credited to General Clerk, R. A., F. R. S., etc., who designed it for military purposes, and had one, of two feet in length, made by Pastorelli & Co., of London, (*Engineering* for November 15, 1872, p. 333, vol. II), with a mirror at each end and two in the center. With the micrometer eye-piece he "obtained great accuracy up to 600 feet distance," and the results were "tolerably certain up to 3,000 feet." A similar instrument of six feet in length gave good results at three thousand yards.

The improvement which we have made, in addition to some matters of detail, is what may be called a repeating micrometer, with a screw of much finer thread than used in the above instruments, where one micrometer division was eleven seconds of arc. In the micrometers of the Coast Survey Field Transits, Zenith Telescopes and Theodolites, the micrometer divisions range in value from four-tenths of a second of arc to six-tenths, and are read to one-tenth of a division, or six-hundredths of a second of arc. For work with this instrument the micrometer may be divided to seconds of arc, and read to half seconds or less.

Figure 1 exhibits, without details of bars or adjustment, a plan of the tube *A B*, carrying the base bar of six feet, the object glasses *O* and *O′* of two telescopes with micrometer eye-piece *E*, common to both, and the prisms *L*, *R*, and *C*, *D*. This tube will be about three inches in diameter; the object glass about two and a half inches, and the powers of the eye glass from twenty to fifty. An opening can be made in the center of the tube in front of the prisms for illumination at night; and above the eye tube a short outside director to rapidly obtain the direction of the object to be observed upon.

Instead of reflectors, right-angled prisms are prepared and arranged for each telescope, with their hypothenusal sides parallel to each other at an angle of forty-five degrees with the base. Necessarily the central prisms, *C* and *D*, are placed one above the other, but touching. With this arrangement a ray of light from an infinite distance, or from a star, after entering the object glass, *O*, follows the direction of the line, *a*, *a*, *a′*, in the left-hand telescope to the point, *X*, in the focus of the telescope, and also entering *O′*, follows the line, *b*, *b*, *c′*, in the right-hand telescope to the same point. If the prisms are in adjustment, the image of a star through each telescope will be seen as a single object at *X*. And this last condition is the test of adjustment. In using a star the adjustment would necessarily be made at night, but the test could be frequently made during the day by similar observations upon the border of the sun, or upon some well marked spot on its disc. If it is desired to test the adjustment upon a near object, say at one hundred yards, then after the adjustment upon a star or the sun, the micrometer difference of the two images of an object at that distance must be determined (or may be computed) and used thereafter as a constant from which to make the necessary adjustment for infinite distance. But this method would require the change of focus of the telescope, whence would arise change of the arc value of the micrometer divisions.

If the prisms are in adjustment and the object observed upon is not at an infinite distance, the rays of light from it will not enter the two object glasses in parallel lines, but at angles varying with a function of the distance, and will follow the lines, *c c c′* and *d d d′*, so that the images, *P* and P′, of the same object will be formed at the common focus of the two telescopes. The horizontal distance apart of these images is measured by the micrometer, and the distance of the object deduced therefrom.

With the ordinary micrometer this separation of the images can be measured by single readings only, but with the proposed micrometer the measure may be repeated any number of times, thereby virtually increasing the length of base used, by each repetition. Thus, by repeating the measure ten times, we have, as it were, increased the case from six to sixty feet; whilst a second set of ten repetitions serve not only as a test of the first set, but give an accuracy approximating that obtainable with a base of one hundred and twenty feet.

Figure II exhibits the repeating micrometer, which essentially consists of three frames. The first, *F*, is attached by screws to the eye tube of the telescope. At the left-hand end it carries a moderately fine micrometer screw, *G*, which moves the two frames, *H* and *I*, which are themselves attached to each other by the fine micrometer screw, *J*, bearing the micrometer head, *K*, and carrying the micrometer thread, *N*. The springs, *S* and *S'*, between *F* and *H*, are for keeping a constant strain between the two frames; and the springs, *L* and *L'*, between *H* and *I*, are for a similar purpose. The frame, *H*, carries the micrometer rack, *M*, by which the whole turns or revolutions of the micrometer head of *J* are noted.

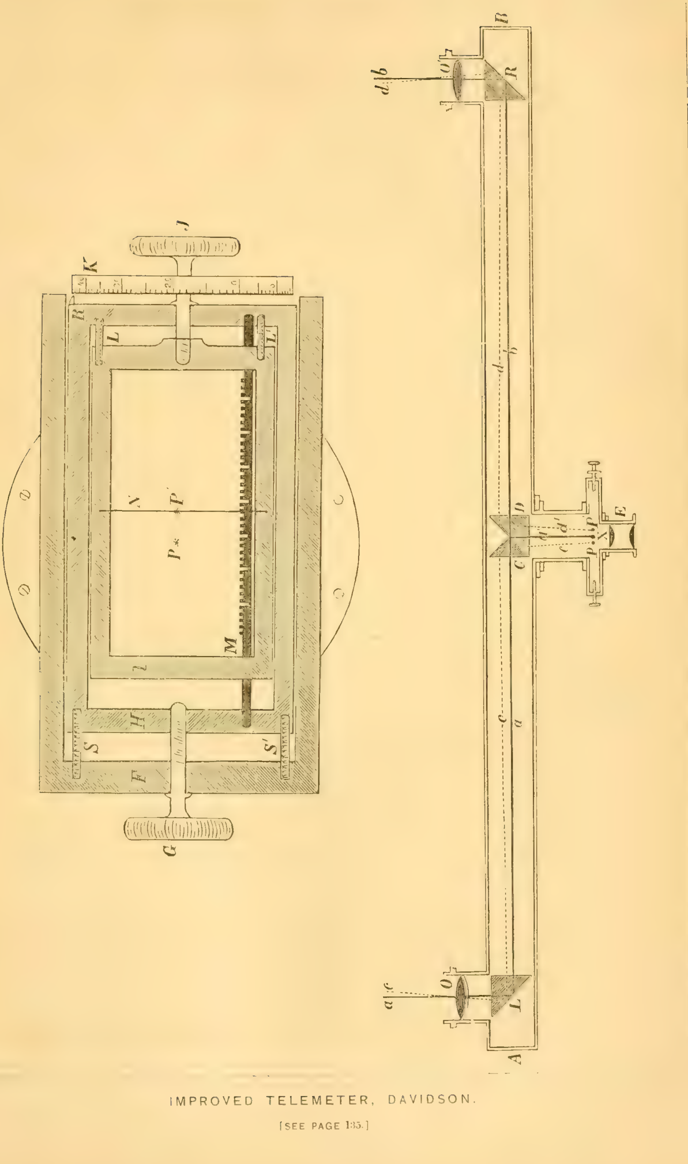
The action of the micrometer is therefore readily seen, and the operation of observing is as follows:

P and *P'* (in both figures) are the two images of the object to be observed upon. The micrometer *J* may be turned until the zero of the head is opposite the pointer *R*, then the micrometer *G* is turned (moving frames *H* and *I*) until the thread *N* bisects the left-hand image *P*; the micrometer *J* is then turned, moving the rack *I* only, until the thread *N* bisects the right-hand object *P'*, and the micrometer read off for the divisions less than one hundred, whilst the whole turns are noted on the rack, which has a notch for each turn of the micrometer; this difference of the two readings gives the distance apart of the two images of the object in terms of the micrometer, and constitutes one measure. The micrometer *G* is now turned, and carries both frames *H* and *I* until the thread *N* is brought back to bisect the image *P*; then the micrometer *J* is turned until the thread *N* bisects *P'*, and read off, as before, for a second measurement; and so for subsequent measures. The measures can be read off after each repetition; or, in rapid work, only the readings of the first bisection and the last in a set, and the micrometer divisions passed over, divided by the number of repetitions. And any number of sets may be made to test or increase the accuracy of the work.

If the images of the object to be observed upon are small, clear, and sharply defined, the probable error of the individual micrometer measures should not exceed half a second of arc, but, on account of the lack of definiteness and sharpness of most terrestrial objects, this probable error will be larger; nevertheless, it is perhaps a large allowance to assume that a probable error of one second of arc may exist in the mean of ten repetitions. At the distance of one mile this would involve an error of little more than two feet; and at five miles, of only fifty-five feet.

Of course, another function of the accuracy of the distance is the accuracy of the base-bar itself in the instrument; but this can be obtained with great precision. And as the base changes its length by changes of temperature, tables of distances for a series of micrometer differences, with the base-bar at different temperatures, can be readily constructed.

Upon the upper and middle part of the bar-tube a small prismatic compass was placed by General Clerk, to obtain the magnetic bearing of the object. In



IMPROVED TELEMETER, DAVIDSON.

[SEE PAGE 135.]

addition to this we propose to place a small vertical arc and attached level, to give the angle of inclination; by which, with the distance, the difference of height between the object and observer may be obtained.

Regular Meeting, August 4th, 1873.

Prof. J. D. Whitney in the Chair.

Thirty-two members present.

David J. Staples, Solomon Goldsmith, Alfred Wheeler, Albert Williams, Jr., and R. D. Plummer, M.D., were elected resident members.

Donations to Library: Proceedings of Royal Geographical Society, Vol. XVII, No. II. Proc. Boston Nat. Hist. Society, Vol. XV, Part II. Memoirs of Boston Nat. Hist. Society, Vol. II. Catalogue of the Museum of the Chicago Medical College. Transactions of the Academy of Science of St. Louis, Vol. III, No. I, 1873. Proc. Acad. Nat. Sciences, Phila., pp. 249–280, 1873. Sixth Annual Report of the Peabody Institute of Baltimore, 1873. California Horticulturist, July, 1873, from Publishers. American Journal of Science and Arts, July, 1873. American Naturalist, July, 1873. American Chemist, June, July, 1873. Climats, Geologie, Faune et Geographie, Botanique du Brésil, par Emmanuel Liais, 8vo., Paris, 1872, from the Brazilian Legation to the United States. Engineering and Mining Journal (5 papers) for July, 1873. Mittheilungen der Deutschen Gesellschaft fur Natur und Völkerkunde, Ost-Asien's, Yokohama, Mai, 1873. Report of the Geological Survey of New Hampshire for 1872, from C. H. Hitchcock, Ph. D. Monatsbericht der Könighlich Preuss, Akad. der Wissenchaften zu Berlin, Feb., 1873. Yale College in 1873, Pamph., 8vo. Catalogue Library Company of Philadelphia, July, 1873. Publications of the Geological Survey of the State of California, as follows: Mining Statistics, No. 1, 1866; Geographical Catalogue of the Mollusca, 1867; Catalogue of the Invertebrate Fossils of the Western Slope of the United States, Part II, 1871; The Yosemite Guide Book, 1870; The Yosemite Guide Book (Pocket Ed.), 1871. Palæontology, Vol. I, 1864; Vol. II, 1869. Geology, Vol. I, 1865. Ornithology, Vol. I, 1870. Map of the region adjacent to the Bay of San Francisco, 1873. Topographical Map of Central California, etc., 1873; all of the above presented by the State.

Additions to Library by Purchase: Journal of Botany for July, 1873. Annals and Magazine of Natural History, July, 1873, Popular Science Monthly, August, 1873. Nature, June 5th, 26th, July 3d, 10th, 1873. Annalen der Physik und Chemie, No. 4, Leipzig, 1873. Quarterly Journal of Microscopical Sciences, London, July, 1873.

Donations to Museum: Nest and eggs of Marsh Wren (*Troglodytes palustris*, Aud.), found in the tules of the San Joaquin River, presented by C. D. Gibbes. Specimens of *Chimæra Collei*, male and female, from J. P. Dameron. Specimen of a species of *Pennatula* (probably *P. tenua*, Gabb); also, a specimen of a *Virgularia* from the Gulf of Georgia, presented by Dr. James Blake.

Mr. Gibbes said that the nest and eggs presented by him this evening were those of the Marsh Wren (*Troglodytes palustris*, Aud., Vol. II, p. 135, pl. 123). These nests are abundant throughout the swamp lands; are purse-shaped, about seven inches in length, by four and five inches in diameter, composed of flexible grasses ingeniously woven together, suspended three or four feet from the ground, attached to the upright tules by being woven around them, a small entrance is left near the top, and is lined with soft grasses and down, from the plant known as the "cat-tail."

This nest was found in April, in the tules of the San Joaquin River, and had but three eggs in it; but I suppose they lay more, as the brown-headed Wren has six. These eggs are of a light brown mahogany color, with darker dashes, varying in intensity of shade. Although I have seen many nests, this is the only one in which I have discovered eggs. I hope in another year the Society will have a good collection of the eggs of the California birds, particularly of such nests as display ingenuity in construction.

Dr. Blake presented to the Academy a specimen of a *Pennatula*, which had been taken by Captain Dane about one mile S.E. of Cape Roberte, in the Gulf of Georgia, in about seven fathoms water. Captain Dane states that "they were kept some days in a large tub of water, the water being changed frequently. They stretched out to about thirty inches in length, the fringed part forming about half the length and being five inches in diameter, the smooth part three inches. They seemed to have no powers of locomotion, but were entirely at the mercy of the currents." The external form of this specimen differs from the ordinary *Pennatula* in having four rows of *pinnæ*, two of which are much more developed and support the polyps, whilst the other two rows are very much smaller, and apparently are free from polyps. In its present contracted state the animal measures about ten inches long, one and seven-tenths inches across in one direction, and one and one-tenth inches the other. The free edge of the larger polyp-bearing *pinnæ* measured two and a half inches; that of the smaller *pinnæ*, six-tenths of an inch. The cavities with which these different sets of *pinnæ* communicate are apparently totally distinct, being separated by a mesentery which is attached to an axis running the whole length of the body. This axis is firmly calcified in its middle portion, the two ends being formed of a softer, chitonous substance. This axis, except as regards its length, is apparently the counterpart of the long twigs that were received some months since from Burrard's Inlet. As regards the functions of the smaller sets of *pinnæ*, I think they are connected with the water supply to the somatic cavities, as they contain numerous tubes. Should this be the case, a connection must exist between the cavities on each side of the mesentery. These *pinnæ* are thickly studded with calcareous *spiculæ*.

Mr. Stearns said that the larger of the specimens presented by Dr. Blake was undoubtedly a *Virgularia*.

Dr. Cooper suggested that it might be the adult of the species described by Mr. Gabb in the Academy's proceedings, some years ago.

Mr. Goodyear read the following paper:

On the Situation and Altitude of Mount Whitney.*

BY W. A. GOODYEAR, C. E.

On the 27th day of July, 1873, Mr. M. W. Belshaw, of Cerro Gordo, and myself, rode our mules to the highest crest of the peak southwest of Lone Pine, which, for over three years now, has been known by the name of Mount Whitney, and which was ascended and measured as such by Mr. Clarence King, in the summer of 1871. A full account of Mr. King's ascent of this peak is given in his "*Mountaineering in the Sierra Nevada*," pp. 264–281.

I know this peak well, and cannot be mistaken as to its identity. As seen from Lone Pine, it appears perhaps the most prominent peak in the whole Sierra; and during the summer of 1870, when, in company with Mr. C. F. Hoffmann and Mr. Alfred Craven, I made a trip for the State Geological Survey through Owen's Valley and the Inyo Mountains, this peak was the object of constant observations by us for a month or more, under the name of Mount Whitney, —which we then supposed it to be. Moreover, since Mr. King's ascent of it in

*Published in advance, August 6th, 1873.

1871, the half dollar which he left at the summit has been found there, with his name inscribed upon it. There can, therefore, be no mistake as to the identity of this peak with the one ascended and measured by Mr. King in 1871.

I do not mention the fact that Mr. Belshaw and myself reached its summit in the saddle as being one of any new or special interest; for Mr. Sheriff Mulkey, of Inyo County, accomplished the same thing on the 6th day of August, 1872, with his family (*i.e.*, his wife and daughter), and since that time it has also been done by several other parties.

But there is some interest in the fact discovered by Mr. Belshaw and myself, when we reached its summit—that *this peak is not Mount Whitney.*

It is by no means the highest among the grand cluster of peaks which form this culminating portion of the Sierra Nevada; *nor is it the peak which was discovered by Prof. W. H. Brewer and party, in* 1864, *and then originally named by them Mount Whitney.*

For the truth of such a statement as this, after the mountain has become so famous, I shall of course be expected to produce my evidence.

How, then, in the first place, do I know that this so-called Mount Whitney is *not the highest peak* in this vicinity?

First, because on reaching its crest, the fact is at once not only apparent, but very striking, even to the unaided eye alone, that a peak which bears N. 67° W. magnetic, distant between five and six miles from the observer, is considerably higher than the one on which he stands.

To this it will, perhaps, be objected that it is extremely difficult to judge accurately of relative heights with the eye alone; and that, in so judging, the best observers are liable to be deceived. But while, of course, admitting the truth of this statement, as a general fact and within certain limits, I still reply that no *good* eye is ever deceived as to which is the higher of two culminating peaks among such a mass of mountains, when the observer is standing on the lower peak, with a perfectly clear atmosphere between, and nothing to obstruct the vision—the distance between the peaks not exceeding half a dozen miles, and the actual difference of altitude between them being anywhere in the vicinity of a hundred feet to each mile of the distance.

My second proof of the relative altitude of these two peaks is the following:

I had no spirit-level with me; but I did have this miner's compass, 3¾ inches square, with a clinometer attached. On setting the index of the clinometer at zero, and then sighting along the upper edge of the plate, the line of sight struck far below the summit of the other peak. Then, on reversing the instrument end for end, setting the clinometer again at zero, and sighting along the upper edge of the plate as before, the line of sight, though it struck a little higher than before (thus showing a slight error in the instrument), nevertheless still struck far below the peak. This, if the sighting along the edge of the plate was correctly done, is proof positive that the distant peak is the higher.

But we applied still a third test. While I was busy with my notes, Mr. Belshaw improvised a still more perfect level, by taking a pint cup, four inches in diameter, and filling it *heaping full* of water—*i. e.*, so that the water stood higher then the edge of the cup all around the rim, yet without overflowing When this was done, it became at once evident, on sighting across the smooth surface of the water, that the other peak was higher than the one on which we stood by an amount which we both of us estimated to be *not less than* 500 *or* 600 *feet.*

As to the proofs that the peak which we climbed *is not the one originally named Mount Whitney by Professor Brewer's party, in* 1864, they are numerous; and among them are the following:

In the first place, Mr. Clarence King, in 1864, on reaching the summit of Mount Tyndall, remarks as follows, in the *Geological Survey Report* (Geology, vol. I, p. 386):

"On setting the level, it was seen at once that there were two peaks equally high in sight, and two still more elevated—all within a distance of seven miles. Of the two highest, one rose close by, hardly a mile away; it is an inaccessible bunch of needles, and we gave it the name of Mount Williamson. The other, which we called Mount Whitney, appeared equally inaccessible from any point on the north or west side; it is between seven and eight miles distant, in a south-southeast direction, and, I should think, fully 350 feet higher than our peak." (Further investigation showed that it was really 600 or 700 feet higher than Mount Tyndall.)

Now, the peak which we climbed is certainly not 350 feet higher than Mount Tyndall, but very nearly the same altitude. In fact, as closely as we could judge by our water-level at such a distance, Mount Tyndall appeared a *trifle* the higher of the two. Moreover, this peak, instead of being between seven and eight miles distant in a south-southeast direction from Mount Tyndall, is between twelve and thirteen miles distant from it, in a direction about S. 37° E. true course; while the genuine Mount Whitney (*i. e.*, the highest peak) is actually distant from Mount Tyndall only about seven and one quarter miles in a direction about S. 26° E. true course—thus corresponding exactly with this remark of King's in 1864. It is evident enough that this difference between seven or eight and twelve or thirteen miles of air-line distance involves an error which Mr. King would have been by no means likely to make in his estimate of the distance in 1864; while the direction S. 26° E. also corresponds far more nearly to Mr. King's words, "a south-southeast direction," than the course of S. 37° E. does.

Again, after Mr. King's ascent of Mount Tyndall, and the return of the party to Visalia, Mr. King made another excursion into the mountains, leaving Visalia July 14, 1864, for the purpose of making an attack on Mount Whitney. He followed from Visalia a trail which appears, so far as his description and my information give the means of identifying it, to have been the present Hockett Trail, to the point where it crosses the main Kern River. From this point Mr. King followed some route among the upper branches of the Kern River, which he has not described with sufficient clearness to enable it to be accurately traced on any map with which I am acquainted in the Geological Survey Office, or elsewhere, to the base of Mount Whitney. In his attempt to scale the summit of the mountain, he did not at that time succeed. But the highest point which he reached, as indicated by his barometric observation, was "according to the most reliable calculations, 14,740 feet above the sea-level." And "at the point where this observation was taken, he was, as near as he was able to estimate, between 300 and 400 feet lower than the culminating point of the mountain, which, must, therefore, somewhat exceed 15,000 feet in height."

Now, although I do not recollect the exact figures which Mr. King's observations in 1871 gave for the height of the peak which he then measured as Mount Whitney, and to whose summit Mr. Belshaw and I rode the other day in the saddle, I do recollect, with certainty, the fact that these figures were a little less than the altitude of the point which he actually reached in 1864, when he was still, according to his own estimate, "between 300 and 400 feet lower than the culminating point" of Mount Whitney.

Here, then, there was a discrepancy of at least 300 or 400 feet, and probably somewhat more, between Mr. King's barometric results in 1864, and his results in 1871: a discrepancy hitherto utterly unaccounted for, and, if the two peaks were identical, unaccountable, except by supposing the existence of errors of a magnitude which is, to say the least, extremely improbable, in the whole method of computing high altitudes from barometric observations. This strange discrepancy vanishes at once, when the fact is recognized that in 1864, Mr. King was attempting a different and a higher peak than the one he climbed in 1871.

Moreover, the shape of the peak and the surrounding country fully justifies me in making the statement that neither Mr. King, nor any other good mountain climber, would ever have reached a point within three or four hundred feet of the summit of the peak which he measured in 1871, and then have given it up in despair. If he had approached this mountain from anywhere on the north or northwest sides, he could never have reached a point so near the summit; for the precipices in these directions are tremendous, for at least a thousand to fifteen hundred feet below the crest; and on the other hand, if he had approached it anywhere from W. S. W., around by south to southeast, he would have gone directly to the summit with no difficulty whatever; for in all these directions the slopes are comparatively smooth and easy.

The following remarks from the Geological Survey Report (Geology, vol. I, pp. 390 and 391), and for which Mr. King's notes of 1864 also furnished the material, will be sufficient additional proof, I think, of the fact, that the peak which for three or four years has borne that name, is not the one originally named Mount Whitney.

"Mount Whitney is a ridge having somewhat the outline of a helmet, the perpendicular face being turned toward the east. There is snow on its summit, which indicates that there must be a flat surface there. The mountain is the culminating point of an immense pile of granite, which is cut almost to the centre by numerous steep and almost vertical cañons, ending in high-walled amphitheatres. Southward of the main peak, there is a range of sharp needles, four of which are over 14,000 feet high. The general aspect of the group is much like that of Mount Tyndall. This mountain has been approached on all sides except from the east, and found to be utterly inaccessible. Mr. King thinks it possible, however, that some route may yet be found by which the summit can be reached."

Now, this description corresponds in every respect, so far as Mr. Belshaw and I could see and judge, with the grand peak to the northwest of us — the original Mount Whitney; and it does not correspond at all with the one we were on, and which by mistake has borne the name so long.

Mount Whitney, having "its perpendicular face turned toward the east," looks from Lone Pine like a pretty sharp conical peak. The other peak shows the "helmet outline" from Lone Pine, and its perpendicular face is turned toward the north and northwest instead of the east; while the true Mount Whitney, as seen from the summit of this peak, assumes again the "helmet outline," with the steepest bluff to the eastward.

Again, the peak we climbed is not cut anywhere near to the centre by cañons, either numerous or steep, on the south or southwest sides. Furthermore, there is no vestige of a range of "sharp needles" to the south of it, or of anything that could suggest such an idea; while immediately to the south of the towering peak, northwest from the one we climbed, there is precisely such a range of tremendous and utterly inaccessible crags and turrets, and sharp and lofty pinnacles.

The mountain which we climbed also, instead of being inaccessible "on all sides except from the east," is, as already stated, very easily accessible from anywhere from W. S. W., around by south to southeast.

In the face of all these facts, though it may be possible, yet it certainly seems hardly credible, that Mr. King, familiar as he was, or at least ought to have been, long previous to 1871, with the general appearance of the whole region of country immediately to the north and northwest of Mount Whitney should, on reaching in 1871 the summit of the peak to whose crest Mr. Belshaw and I lately rode our mules, have failed to recognize at once the fact that he was on a lower and a different peak from the one he had attempted in 1864. And yet, on the other hand, if he did recognize this fact, then why, on his return from the trip which he made in the summer of 1871 for the special purpose of climbing and measuring Mount Whitney, did he not make it known and give it publicity?

In any case, the fullness of detail with which Mr. King, in "*Mountaineering in the Sierra Nevada*," (pp. 277 and 278)—while standing, in reality, on a peak over five miles distant from the one which he says was under his feet—appears to recognize all the topography of the scenes of his earlier struggles, and of his attempts to reach the summit of Mount Whitney, in 1864, is something interesting.

Certain it is, however, that the peak which for over three years has borne the name of Whitney, has done so only by mistake, and that a new name must be found for it; while the name of Whitney must now go back to the peak to which it was originally given in 1864, and which is, in reality, the highest and grandest of this culminating cluster of the Sierra Nevada.

Furthermore, it appears that Mount Whitney not only retains its claim to being the highest point of land in the United States of America, but that its claim to over 15,000 feet of absolute altitude above the sea is still indisputable; while, up to the present time, it also retains the prestige of the fact that, in all probability, no human foot has ever trodden its summit.

If Mr. King's descriptions, in 1864, of the appearance and surroundings of this mountain on the north and northwest can be relied upon, it is safe to say that no man will ever ride a horse or mule to the summit of *that* peak, unless it be by a costly as well as a dangerous trail.

Whether the peak is utterly inaccessible or not, is still a question. I am disposed to think that it can be climbed; but it will certainly involve a great deal of hard, and very possibly, some dangerous work for anybody who shall attempt to reach its gigantic crest.*

Mr. Stearns, of committee, reported the following resolutions on the death of John W. Foster:

Resolved, That the California Academy of Sciences has learned with exceeding sorrow of the death of Dr. John W. Foster, late President of the Academy of Sciences of Chicago, and that we heartily sympathize with the members of said Academy in this latter affliction, as well as in the many other calamities which have recently befallen them.

Resolved, That in the death of Dr. John W. Foster, we recognize the loss of a man whose nobility of character, scientific labor and high attainments — exalted humanity, and endeared him to his fellow-men.

Resolved, That the California Academy of Sciences sincerely sympathizes with the family of the deceased.

Resolved, That a copy of these resolutions be forwarded to the family of the late Dr. Foster; also to the Academy of Sciences of Chicago.

Prof. Whitney read communications announcing the deaths of Professors Christopher Hansteen and Axelius Jonas Boeck, of Christiana.

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*Note.—Aug. 6: I have just received from Mr. Belshaw the results of a rough triangulation made by him from Cerro Gordo to the summits of the two peaks in question, since my return.

The figures given by this triangulation, though not to be relied upon as very accurate, are still sufficiently so to show clearly the relative situation of things, and to furnish additional confirmation of the facts as stated in the above paper.

He makes the air-line distance from Cerro Gordo to the peak measured by Mr. King, in 1871, in a course S. 72° W. magnetic, 25 miles, and the altitude of this peak 14,033 feet. The distance to the genuine Mount Whitney he makes 30.18 miles, in a direction S. 80° 5. W. magnetic, and its altitude 14,930 feet.

Both these altitudes are probably too low; but there can be no question as to which is the higher peak.

Regular Meeting, Monday, August 18th, 1873.

President in the Chair.

Twenty-six members present.

Charles Stephens, E. D. Farrington, Frederick Gutzkow, Lewis Locke, J. H. Locke, Charles L. Weller, and Edward W. Corbett were elected resident members, and Leland Stanford and Irving M. Scott, life members.

Donations to Library: Nature, Vols. I and II, from R. E. C. Stearns. D'Orbigny's Dictionnaire Universel d'Histoire Naturelle, text, 13 vols., atlas, 3 vols., hf. mor. (by purchase).

Donations to the Museum: Ferns, collected by Rev. J. Buchanan in Natal, South Africa, presented by H. N. Bolander. Specimen of Tunny? caught in San Francisco Bay, from S. R. Throckmorton. Specimens of *Pavonaria* (*Verrillia Blakei*, Stearns) from Burrard's Inlet, Gulf of Georgia, presented by J. S. Lawson, U. S. C. S.

The President remarked that the Academy had obtained the skin and skeleton of a Sea Elephant from the coast of Lower California, which made a valuable addition to our collection.

Mr. Stearns called the attention of the Academy to the handsome and appropriate black walnut case for the crystal models, which had been devised and presented to the Academy by their fellow-member Dr. A. B. Stout, who also had been to the trouble and expense of having the models repaired and whitened.

The President also called attention to several specimens of birds belonging to the Academy, which had been mounted by Mr. W. G. Blunt.

Professor Davidson read the following:

On the Auriferous Gravel Deposits of California.

BY GEORGE DAVIDSON.

At the regular stated meeting of February 3rd, our fellow-member Dr. Willey called attention to the auriferous gravel deposits of Placer County, to doubt the sufficiency of water to disintegrate the quartz ledges containing the gold, and to round the quartz pebbles and boulders. He suggested volcanic agency, and the possibility of glacial action.

During this summer, I have visited some of the "hydraulic diggings," in counties to the south-east and to the north-west of Placer; and so far as I have examined them, I see in these great gravel deposits the results of one mode of production.

The "hydraulic" method of working is being pursued systematically and with increased intelligence, so that in a few years we shall be able to trace the bed-rock over areas sufficient to determine what was the power of disintegration and of subsequent movement.

My examinations were made incidentally in the course of more urgent duties, and were limited; but, so far as they went, I became satisfied that the chief power in disintegrating the materials and moving them was that of glaciers, aided in small amount by the water from the ice.

At Smartsville, there is a hill of auriferous gravel over 400 feet in height, lying between the hills of rock that have not "the color" of gold about them; these rocks are not of a character to retain for ages the marks of ice-action, and are moreover rarely exposed. The gravel about Smartsville is cemented together so compactly as to require the use of gunpowder to shake and shatter great masses sufficiently to be acted upon by hydraulic piping with a head of two hundred and fifty feet. Through the cemented mass are found fossilized oak trees of two and three feet diameter, and a close-grained tree, completely blackened, and reaching fifteen feet in diameter. Specimens of these I have brought for microscopic examination by our members.

So far as I could judge from its position and configuration, this hill formed a great glacial terminal moraine. I could not see how the action of water could produce it, or leave it where it was: the gravel, boulders, and cement do not bear the appearance of being formed by moving waters; and the gold particles, instead of being rounded, are flattened. Nor could I see how volcanic action could account for it; tufaceous lava may be part of the cementing material, but I could not appreciate it. Higher up this ancient bed, there are said to be no gravel deposits for fourteen miles; when they commence they are continuous for miles; but I had neither time nor opportunity to examine their relation to the adjacent hills.

At Cherokee Flat, Dr. Waldehr, superintendent of one of the gravel mines, assured me that in running a tunnel for their work upon the bed-rock, he has detected well-marked glacial markings.

There are doubtless many facts that can be aggregated to develop a theory to account for these deposits, which when gathered and fairly discussed may guide us aright. But we can only arrive at a safe and sound deduction by a study of the rock of the ancient bed when it shall have been exposed, and by an exhaustive orographical and geological survey of an extended line of these deposits and the adjacent country. And for this and similar ends, our State Government should be petitioned to grant more liberal appropriations to our State Geological Survey.

Description of a New Genus and Species of Alcyonoid Polyp.*

BY ROBERT E. C. STEARNS.

At a meeting of the California Academy of Sciences, held on the third day of February, 1873, a paper was read by me, entitled "Remarks on a New Alcyonoid Polyp, from Burrard's Inlet;" † in which I gave a *resumé* of the discussions, notices, etc., in this country and in England, arising from the examination by several naturalists, of certain "switch"-like forms, which had been received by different parties from the Gulf of Georgia (more particularly from Burrard's Inlet, in said gulf); several specimens of said "switches" being in the Museum of the California Academy.

These "switches," or rods, were referred by Dr. Gray, of the British Museum, to his genus "Osteocella," and by Mr. Sclater's correspondent stated to belong to "a sort of fish"; but by the majority of scientific gentlemen who had seen these "switches" they were regarded as belonging to a species of Alcyonoid Polyp. I expressed the belief that they belonged to a species of *Umbellularia.*

At a meeting of the California Academy, held on the evening of August 4, 1873, Dr. James Blake presented a specimen of the polyp of which these so-called switches are the axes, which had been sent to him from the Gulf of Georgia by his friend, Capt. Doane. This specimen was one of six or seven sent at the same time, all of which were in a tolerable state of preservation, though, as might have been anticipated, the more delicate tissues of the polyps are somewhat decomposed, and some of the specimens are in some places lacerated. They all are, however, sufficiently perfect to determine the true position, and show that the "switches" are, as was supposed, the supporting stalks or axes of an Alcyonoid Polyp "related or pertaining to the group *Pennatulidæ.*"

At the last meeting I referred the specimen before the Academy to that division of the *Pennatulidæ* known as *Virgularia,* but upon a subsequent examination of the authorities, I find that those forms in which the axis is unilateral, or on one side, come within the Genus *Pavonaria* of Cuvier.

The only species heretofore described so far as I can learn, and on which this genus is based, is *P. quadrangularis,* of which a lengthy and interesting description from Prof. Forbes, is given in Johnston's British Zoöphytes (Vol. I, pp. 164–166). In that species, however, the axis is "acutely quadrangular," and the polyps are arranged in three longitudinal series, corresponding to three of the "angles of the stem."

In the specimen presented by Dr. Blake the style or axis is round, and the polyps are arranged in two longitudinal unilateral series, which conform to the convexity of the external fleshy covering. With these differences, I think I am justified in placing it in a new sub-genus for which I propose the name of *Verrillia,* in honor of Prof. Verrill of Yale College.

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*Printed in advance August 20th, 1873.

† *Vide* Proc. Cal. Acad. Sciences, vol. V, part I, pp. 7–12.

Genus PAVONARIA, Cuvier.

Sub-genus VERRILLIA, Stearns.

Polypidom linear-elongate, round, oval or ovate in cross-section. Axis round, slender, bony; polyps arranged in two unilateral longitudinal series.

Verrillia Blakei, Stearns; n. s.

Polyp-mass or polypidom, of a flesh or pink color, linear, elongate, attenuate; polypiferous portion about three fourths of the entire length, rounded oval to ovate-elliptic in cross section, and from three fourths to one inch in greatest diameter, flatly tapering toward the tip, as well as decreasing in the opposite direction to where the polypiferous rows terminate or become obsolete. From this latter point to the beginning of the base or root, a portion of the polypidom, equal to about one sixth of its entire length, is quite slender, being only about twice the diameter of the naked axis, and the surface quite smooth; said portion, as well as the base, is round (in cross section); the basal part is from one ninth to one eleventh of the entire length, and about one inch in diameter, with the surface longitudinally wrinkled or contracted, presenting a ridged or fibrous appearance.

Style or axis long, slender, white, hard, bony, somewhat polished, about three sixteenths (3-16) of an inch in diameter in the thickest part, tapering gradually toward the tip, and attenuated, with surface somewhat roughened toward the basal extremity. Enclosed in the polyp-mass or polypidom, the axis is central from the base to where the polyp-rows begin, when it soon becomes marginal or lateral, forming a prominent rounded edge (free from polyps) on one side of the polypiferous portion of the whole.

From near the sides of the axial edge the polyp-rows start, and run obliquely upward to the opposite side, where they nearly meet, presenting, when that side is observed from above, a concentric chevron or Λ-like arrangement, modified by the convexity of the polypidom. The more conspicuous polyp-rows show from nine to fourteen polyps, with occasional intermediate rows of three or more polyps.

The length of the most perfect of Dr. Blake's specimens was sixty-six (66) inches; of which, commencing at the tip, a length of forty-eight and a quarter (48¼) inches was occupied by the polyp-rows, which numbered two hundred and forty-five (245), or twice that number when both sides or arms of the chevron or Λ are considered. The number of polyps in each row was, in this specimen, from eight (8) to eleven (11), with occasional intermediate shorter rows of from three (3) to seven (7). Estimating ten to the row, this specimen exhibited about *five thousand* polyps, all of which, as well as the polyps in the other specimens, were filled with ova, of an orange color. In the next section of this specimen, the length between the last polyp-row and the swell of the base or root, is eleven and one quarter (11¼) inches; thence to the termination of the base, six (6) inches.

In some specimens, the polypiferous portion makes from one to two turns around the axis in its entire length. Plate IX, fig. 1, exhibits the general aspect of the species, reduced to a scale of one inch to the foot; fig. 2, a section of the polypiferous part of one of the oldest and largest specimens.

The average dimensions of thirty-six (36) of the axes in the Museum of the California Academy is five feet six and one third inches in length, and the diameter of the largest, nine thirty-seconds of an inch; diameter of smallest specimen, one sixteenth of an inch.

Dr. Blake's specimens were preserved in a mixture of glycerine and alcohol, and the more delicate tissue of the polyps appears to have been somewhat injured by the latter ingredient.

Additional specimens of the above species, from the same locality, have been received from J. S. Lawson, Esq.,* of the U. S. Coast Survey, by George Davidson, Esq., President of the Academy. These latter were put in glycerine only, and are in better condition than those received by Dr. Blake. Of the specimens received from Mr. Lawson, some individuals are younger than either of Dr. Blake's. In these the polyp-rows are farther apart, and there are not so many polyps in the row; neither do the ends of the rows approximate so closely on the side opposite the axial edge; the polyps being not nearly so many in the same length, or presenting (as do some of Dr. Blake's specimens) so crowded an appearance. In cross-section through the polypiferous portions, the younger individuals are less oval or acutely-ovate than in the older specimens. A comparison of individuals indicates an external differentiation, analogous to that displayed by specimens of the same species in Virgularia. The general aspect of this species, judging from the figure in Plate XXXI of Johnston's British Zoöphytes (2d ed.), is like *P. quadrangularis* from Oban, only in that species the rows of polyps, it is stated, are composed of "four, five or six polyps in a row," one figure showing seven.

I have named this species for Dr. James Blake, of San Francisco, author of many valuable scientific papers, to whom I am indebted for numerous courtesies.

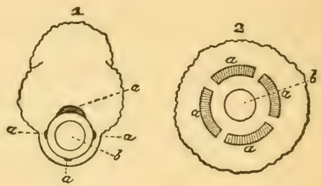
On the Structure of Verrillia Blakei.

BY JAMES BLAKE, M. D.

When engaged in examining the dry rods of the cœlenterate animal which has now been shown to be the axis of a *Pavonaria*, I found adhering to the basal extremity of some of the rods a portion of the soft parts, which in section presented a quadrate form somewhat resembling a Maltese cross. An examination of the specimens recently received affords an explanation of this form assumed by the basal portion of the animal, and shows how the symmetrical basal portion has given rise to the exceedingly unsymmetrical production

*The following remarks accompanied the specimens received from Mr. Lawson: "Obtained from fishermen by J. C. Hughes, Esq., of Burrard's Inlet, (Gulf of Georgia), at the request of Jas. S. Drummond, Esq., of Victoria, who kindly and keenly interested himself for me. JAMES S. LAWSON."

of the polypodion, which characterizes the more developed animal. A section of the basal portion a few inches from the lower end, and where the fleshy mass has attained its average thickness, shows that it consists of an ectoderm and endoderm, the latter surrounding a gelatinous mass immediately around the axis, which mass constitutes by far the larger part of this portion of the animal. The space between the two membranes is divided up into four distinct compartments, the division being formed by portions of the outer membrane, or ectoderm, dipping in and becoming attached to the inner membrane. An examination of the surface corresponding to the place where these processes are given off, shows that they correspond to a line of minute dots, arranged longitudinally, and which are either the remains of aborted polypes or possibly water pores, the rather imperfect state of the specimens not enabling me to determine this point. These canals are continuous the whole length of the stem, three of them in a very rudimentary condition, viz: those corresponding to the sides and free edge of the polypodion; whilst the fourth cavity contained in the large portion of the polypodion remains of a considerable size. [Fig. 1, cross-section through polypiferous portion; *a*, *a*, *a*, *a*, canals. Fig. 2, section through basal part or root; *a*, *a*, *a*, *a*, canals, *b*, axis.] From this arrangement of the basal portion of the animal, I have no doubt that it commences its existence as a symmetrical quadrangular polype, with the polypes arranged linearly on the angles of the stem; and that this form continues as long as it does not grow more than a few inches above the bottom of the ocean. As, however, the stem becomes lengthened, its upper part is exposed to currents which would tend to bend the stem in one direction, and this would be followed by the abortion of the polypes growing on the most exposed side, and the subsequent development of the animal unsymmetrically.



Regular Meeting, Monday, September 1st, 1873.

President in the Chair.

Thirty-one members present.

Andrew F. Craven and John T. Brady were elected resident members, and Dr. Horatio S. Gates a life member.

Donations to the Museum: Specimen of a young *Octopus* (*O. punctatus* Gabb.), presented by Henry Chapman. Specimen of a young "Blue Shark," caught in San Francisco Bay, from S. R. Throckmorton. Bottle of Water from the Warm Springs at Point Isabel, Sonora (Mexico), presented by Capt. McDonald of the steamer "Newbern." Specimens of Reptiles and Wasp's Nest from Vancouver Island, by Henry Edwards; also, specimen of a Snake, presented by Mrs. Henry Edwards. Specimen of White Sandstone from Merced Lake, by George Davidson.

Professor Davidson remarked that the sandstone presented by him was from an extensive deposit in the neighborhood of Merced Lake, which is being worked; large quantities are taken out and shipped to the Eastern States for use as a polish; it was found superior to rotten stone for that purpose.

The following remarks were made:

On an Improved Leveling Rod.

BY GEORGE DAVIDSON.

In the regular work of the Coast Survey upon this Coast, but especially in some special examinations connected therewith, it became patent that the ordinary wooden leveling rod was inadequate to give perfectly reliable results. The defects are inherent in the instrument; the principal ones are:

a. inaccuracy of graduation;
b. uncertainty of the standard with which it was (if ever) compared;
c. no rate of expansion of the rod for changes of temperature;
d. no knowledge of the effect of hygrometric changes;
e. no means in the rod itself for adjusting the verticality;
f. no tangent motion.

For all ordinary work of leveling, the best made rods are sufficiently accurate; but where investigations are to be made for the coëfficient of refraction, so important in the hypsometrical of large triangulations, they do not afford the desired precision. In the reference of the mean level of the sea, at any point where years of continuous tidal observations have been made to some well-marked bench mark, the utmost precision is demanded, because by such observations, through a series of years or of centuries, we shall be able to measure the rising or subsidence of the shores of the Continent. When the hypsometrical work of a triangulation is carried across the country with the same precision as that of the sides and geographical positions, future observers will be able to determine the changes, if any, in the elevation of the interior of the Continent.

To effect this, I have devised a three-sided, hollow, rectangular metal casing, to fit over the graduated part of the "Boston rod." This casing is made up of three side and two end pieces of bell metal, planed to the thickness required, and brazed together. After all mechanical work is done upon it, the graduation is made and compared with the same standard of the United States as the measures of length are compared with. Its standard length is therefore determined for a specified temperature.

This casing fits over the front, sides and ends of the front part of the ordinary rod, and secured only at the bottom, so that it is free to change its length by changes of temperature, and is guided at the upper end by studs standing through in slots.

The extent of graduation is the same as that of the ordinary rod, and the verniers read to 0.001 foot, although they could be made to read to 0.0001 foot. To determine the temperature of the casing, a thermometer is set in a long slot in the front part, and the thermometer is read at each reading of the rod.

That the rodman may be able to keep the rod vertical, two small circular levels are attached to the back of the rod, one for the direct, and the other for the inverted position.

The ordinary back part of the rod is retained, and this compels to the assumption that the change of its length between any two sights, on account of change of temperature, is inappreciable, and this will virtually be the case in all except extraordinary changes of temperature, and even then effects will be much less than ordinary errors of observation.

The next important improvement I have added is a tangent screw; but this I will explain and exhibit at another meeting.

Mr. Stearns called attention to the fossil Tooth of a species of Elephant from Santa Rosa Island, presented some time ago by Mr. W. G. Blunt, as it proved that the island was formerly a portion of the main land. He had been informed by Mr. Blunt, that the tooth had been found *in situ*, and near it was embedded the tusk of an elephant; the latter so far decomposed that it crumbled, in the attempt to get it out.

Professor Davidson said that since the last meeting of the Academy he had examined the partially exhumed remains of a large animal near Lake Merced, which had previously been referred to by Mr. Hanks and other members, and which were supposed by some parties to belong to a whale; steps had been taken to secure the same for the Academy's museum.

The President stated that the Trustees had under advisement the questions arising from the terms of Mr. Lick's gifts to the

Academy, and had addressed to that gentleman a letter embodying their views. The Trustees desired Mr. Lick to remove some of the restrictions. Mr. Lick has as yet made no specific reply to the letter, but there is reason to hope that he will modify some of the terms.

Regular Meeting, Monday, September 15th, 1873.

Mr. Stearns in the Chair.

Twenty-six members present.

Louis Gerstle and Simon Greenwald were elected life members.

Donations to the Library: Am. Jour. Science and Arts for Aug. and Sept., 1873. U. S. Geological Survey of Montana, Idaho, Wyoming, and Utah, 1872; Hayden; from Dept. of the Interior. Monatsbericht der Konig. Preuss. Akad der Wiss. zu Berlin; Feb., March, and April, 1873 (two parts). American Naturalist, Aug. and Sept., 1873. First Ann. Report Public Library of Chicago, June, 1873. Sixth Annual Report of the Trustees of the Peabody Museum of American Archæology and Ethnology, 1873. California Horticulturist for Aug. and Sept., 1873. Bulletin of the Buffalo Society of Nat. Sciences; Vol. I, No. 2. Bulletin of the Essex Institute; Vol. V, No. 3. Am. Chemist, Aug., 1873. Engineering and Mining Journal, for Aug. and Sept. 2d, 1873. Proc. Acad. Nat. Sciences of Phila., 1873; pp. 281–296. Facsimile copy of the Maryland Journal and Baltimore Advertiser, for Friday, Aug. 20, 1773; also, copy of the Baltimore American of Aug. 20, 1873; from S. C. Gray.

Additions to Library by purchase: Zoölogical Record, Vol. VIII, 1871. Popular Science Monthly, Sept., 1873. Annalen der Physik und Chemie, No. 5; Leipzig, 1873. Annals and Mag. of Nat. History; London, Aug., 1873. Philosophical Magazine; London, Aug., 1873. The Journal of Botany; London, Aug., 1873. Astronomical Register; London, Aug., 1873. Nature; July 17, 24, 31, and Aug. 7, 14, 21.

Donations to the Museum: Specimens of Fossil Shells discovered while digging a well in the city of San Diego, presented by Henry Hemphill. Specimens of Shells and Pebbles, also portions of Skull of a Fish, from Pigeon Point and Pescadero; and twig of the California Nutmeg (*Torreya Californica*), from Redwood forest, on stage road between Redwood City and Pescadero; also specimens of *Algæ;* presented by C. D. Gibbes. A pair of Japanese Vases, also a specimen of *Rupicola Peruviana*, Dumont, or "Cock of the Rock;" from Dr. F. Steindachner. Specimen of *Ceryle alcyon*, Boie., or Belted Kingfisher; presented by H. G. Bloomer. (This last specimen is preserved by Mr. Crane's embalming process, by Mr. Gruber.) Specimem of Cloth, being a piece of a garment found around an Indian skeleton, on Santa Rosa Island; presented by W. G. Blunt. Specimens of *Pimelodus Wagnerii*, Gunth, also *Basiliscus mitratus*, from the Isthmus of Darien; presented by S. A. L. Brannan. Specimens of fresh-water *Algæ*, from Mammoth Springs, Lassen County, Cal., persented by S. V. Blakeslee.

Mr. Bloomer remarked, that the specimens of *Algæ* presented had been found growing twelve feet under the surface of clear spring water.

Mr. Stearns, referring to the fossils presented by Mr. Hemphill, stated that the collection was exceedingly interesting, and numbered about sixty species, some of which are still living along the coast, while others are extinct. In a letter recently received from Mr. Hemphill, he says: "The new Water Company here has been sinking a well, twelve feet in diameter. At the depth of 100 feet they came upon a compact sedimentary deposit, such as is found on the bars in the bay at the present time; at the depth of 120 to 140 feet, a number of fine fossil shells were found, and my attention was called to them by Mr. D. O. McCarthy, one of the parties connected with the Water Company. I immediately began to prospect the dirt two or three hours each day, until a depth of 165 feet was reached by the diggers. The result has been 58 species. The collection shows the forms which existed in the bay when, very probably, its area was much greater than at the present time. The well is situated in a gulch about one mile from the bay, and back from the city."

Mr. Stearns remarked that no opportunity had occurred, since the receipt of the parcel on Friday last, to make a critical examination of the fossils presented by Mr. Hemphill. A partial inspection shows that they belong to the post-pliocene subdivision of the tertiary period. He proposed to determine the species, and publish a list at an early day.

Remarks on the Upper Tuolumne Cañon.

BY ROBERT E. C. STEARNS.

Recent numbers of the *Overland Monthly* have contained contributions by Mr. John Muir, descriptive of the upper valley of the Tuolumne, and that portion of said valley known as the Hetch-Hetchy.

It is gratifying to know that Mr. Muir has found the valley not difficult of access, though at one time supposed to be so, after a partial effort made from an inaccessible point, by Mr. Clarence King.

In the above publication for August last, Mr. Muir says:

"Sometime in August, in the year 1869, in following the river three or four miles below the Soda Springs, I obtained a partial view of the Great Tuolumne Cañon, before I had heard of its existence. The following winter I read what the State Geologist wrote concerning it."

He here quotes from Prof. Whitney as follows:

"The river enters a cañon which is about twenty miles long, and probably inaccessible through its entire length. * * * It certainly cannot be entered from its head. Mr. King followed this cañon down as far as he could, to where the river precipitated itself down in a grand fall, over a mass of rock so rounded on the edge that it was impossible for him to approach near enough to look over. Where the cañon opens out again twenty miles below, so as to be accessible, a remarkable counterpart to Yosemite is found, called the Hetch-Hetchy Valley. * * * * Between this and Soda Springs there is a descent in the river of 4,500 feet; and what grand water-falls and stupendous scenery there may be here it is not easy to say. * * * Adventurous climbers * * * * should try to penetrate into this unknown gorge, which perhaps may admit of being entered through some of the side cañons coming in from the north."

Mr. Muir here resumes:

"Since that time I have entered the Great Cañon from the north by three different side cañons, and have passed through from end to end, entering at the Hetch-Hetchy Valley and coming out at the Big Meadows, below the Soda Springs, without encountering any extraordinary difficulties. I am sure that it may be entered at more than fifty different points along the walls, by mountaineers of ordinary nerve and skill. At the head, it is easily accessible on both sides."

I do not intend to question the motive or the taste of Mr. Muir's remarks, which might be regarded as a commentary on his quotation from the State Geologist, or to explain why Mr. King did not explore the valley *at the time* referred to. It seems to me reasonable to suppose that, upon the line pursued by Mr. King, the valley *was* inaccessible; and it is unreasonable to suppose that, if an experienced mountain-climber like Mr. King had really desired to enter the valley, he would have been deterred from doing so by obstacles of an ordinary character, as no person can with truth deny to him the possession "of ordinary nerve and skill."

This interesting region has been again visited this summer by Mr. Muir and several other persons, and will soon become familiar to an increasing number of tourists, from year to year.

On pages 428–9 of Volume I (Geology), in his "Report of Progress and Synopsis of the Field-work" of the Geological Survey, "from 1860 to 1864," Prof. Whitney, in commenting on the main geological and topographical features of this region, remarks:

"The vicinity of Soda Springs, and indeed the whole region about the head of the Upper Tuolumne, is one of the finest in the State for studying the traces of the ancient glacier system of the Sierra Nevada. The valleys of both the forks * * * * * exhibit abundant evidences of having, at no very remote period, been filled with an immense body of moving ice, which has everywhere rounded and polished the surface of the rocks up to the height of at least a thousand feet above the present level of the river at Soda Springs. This polish extends over a vast area, and is so perfect that the surface is often seen from a distance to glitter with the light reflected from it as from a mirror. Not only have we these evidences of the former existence of glaciers, but all the phenomena of the moraines—lateral, medial, and terminal—are here displayed on the grandest scale."

In a foot-note, on page 429, Prof. Whitney says:

"These glacial markings were *first noticed* by Mr. J. E. Clayton, and the fact of their existence was communicated by him to the California Academy of Natural Sciences, *several years ago*."

(The italics are mine.)

At a meeting of this Academy, held on the 21st of October, 1867,* Prof. Whitney exhibited some photographs and stereographs,

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* Vide Proc. Cal. Acad. Sci., vol. III, page 368; see also San Francisco *Evening Bulletin* of October 22d, 1867.

taken for the Geological Survey by Mr. W. Harris, in the Upper Tuolumne Valley, near Soda Springs, Mount Dana, Mount Hoffmann, and Mount Lyell. He also presented an account of a remarkable portion of the Tuolumne Valley (Hetch-Hetchy Valley), which forms almost an exact counterpart of the Yosemite, written by Mr. C. F. Hoffmann, the head of a party of the Geological Survey, by which it was explored the previous summer.

Dr. A. W. Saxe called the attention of the Academy to a locality which, from an archæological point of view, is very interesting, and which has never been examined to any extent. It is situated just south of the mouth of Laguna Creek, six miles north of Santa Cruz. Here is a mound, standing from 50 to 70 feet above the ocean level, composed of material which was in all probability collected by the aborigines of the country. It has a depth of from twelve to fifteen feet. He had examined only those parts which open towards the gorge. He had found deposits of various eras interspersed with what he regarded as drift sand, in which were to be seen all kinds of implements used by the aborigines, including the regular arrow-head, the crescent-shaped knife, and the long spear-head, in all styles of manufacture. What was of especial interest to him, was the discovery of tons upon tons of chalcedony rock, lying in the immediate vicinity, of the kind that is found below Monterey and about Pescadero. These boulders had an average diameter of four inches, the limits being two and a half and five inches. He thought that a ship-load of these rocks might be collected thereabouts. They were evidently carried thither from a very long distance, and he could form no conjecture as to where the aborigines got them from. They were probably obtained for the sole purpose of manufacturing implements.

Dr. George Hewston said the English sparrow had been a subject of inquiry. He could not see the reason for the introduction of a foreign sparrow which had some objectionable habits, when we had a most valuable native sparrow that should be protected—the Western white-crowned finch or sparrow. It frequents the neighborhood of gardens, builds in the city, and has a beautiful, sweet song. It is a little bird, often found sitting on the top of cedar trees and whistling at night. On Folsom Street, in his neighborhood, through the spring and the early part of the summer, and often well through the year, this bird was to be found. It destroyed caterpillars innumerable,and it could be familiarized and made quite a domestic bird. A pair built in his garden some years ago, and reared a brood of four. He kept the brood in his study for some time, and the old birds fed them with caterpillars. During the whole time, the garden was free from noxious insects and worms. Afterwards the cats killed the birds, and the following season the garden suffered greatly from insects. Subsequently another brood located in the garden, and for two years he has not been troubled with insects.

Mr. Stearns said he believed that the reason why the English sparrow was preferred in the East, was that it destroys certain caterpillars, and especially the canker-worm, which some native birds will not touch.

Dr. Henry Gibbons, Sr., made some remarks in reference to ærial currents, and explained by illustrations on the blackboard his reasons for believing in a permanent upper current from the west towards the east; this is demonstrated by the course of high cirrus clouds; without discussing the proposed balloon voyage across the Atlantic, he thought the experiment of a voyage across the continent from the Pacific to the Atlantic should first be tried.

Mr. Stearns remarked that a similar suggestion had been made by Professor Henry to the æronaut Mr. Wise; but the latter had replied to the effect, that if an accident should occur, he preferred to fall into the water rather than upon the land.

Regular Meeting, October 6th, 1873.

President in the Chair.

Forty-three members present.

Dr. J. D. B. Stillman and George S. Ladd were elected resident members, and William Kohl a life member.

Donations to the Library: Catalogue of the Marine Mollusca of New Zealand, etc., Wellington, 1873, by F. W. Hutton, from James Hector, M. D., F. R. S., Director of the Colonial Museum. The Quarterly Journal of the Geological Society, London, August, 1873. Bulletin of the Essex Institute, 1873, Nos. 4 and 5. Arrangement of the Families of Mollusks, by Dr. Theodore Gill; Arrangement of the Families of Mammals, etc., by Dr. Theodore Gill; Arrangement of the Families of Fishes, etc., by Dr. Theodore Gill (3 pamphlets, 8vo.), Washington, November, 1872; prepared by Dr. Gill for, and presented by, the Smithsonian Institution. Engineering and Mining Journal for September, 1873. Overland Monthly for October, 1873, from the publishers.

Additions to Library by purchase: The Astronomical Register, London, September, 1873. Archiv für Naturgeschichte, Berlin, 1873. Annalen der Physik und Chemie, Leipzig, 1873, No. 6. The Annals and Mag. of Nat. History, London, September, 1873. The Journal of Botany, London, Sept., 1873. Nature, Vol. 8, Nos. 200, 201, 202.

Donations to the Museum: Carapace of the Tortoise-shell Turtle (*Caretta fimbriata ?*); also, specimens of the Pearl-oyster (*Margaritifera fimbriata* Dkr.) from the Gulf of California, and *Haliotis splendens* Rve., from the Coast of Lower California; presented by Capt. William Metzgar. Specimens of California Fishes (*Chimera Collei* and *Anarrhichthys felis* Gird.), from Capt. C. W. Scammon. Specimen of Tarantula, from near Mount Diablo, California, by George W. Warfield. Skull of Flat-head Indian, from Kilisut harbor; specimens of Star Fishes; also, specimen of a Mollusk (*Eolis*), from Budd's Inlet, W. T. Petrified Wood, and Cast of Fossil Shell, from Neeah Bay, W. T. Sponges, from Cape Flattery, W. T. Specimens of Pecten (*Amussium caurinum*, Gould); *Machæra patula*, Dixon; *Hinnites giganteus*, Gray; *Placunanomia macrochisma*, Desh.; *Purpura crispata*, Chemn.; *Schizothaerus Nuttalli*, Conr.; and Chiton (*Mopalia Merckii*, Midd.), by James S. Lawson. Tarantula (living) and Nest, from Chinese Camp, Cal.; presented by Edward W. Harral. Piece of Wood from the Weskie Tunnel, Placer County, Cal.; also, portions of the Root of a Tree (petrified), from same locality; presented by

B. F. Ellis. Shells from San Pedro, Cal.; presented by George Davidson. Double-headed Snake, from Tuolumne County, Cal.; also, specimen of Petrified Wood (Mesquit?), from Prescott, Arizona; presented by Henry Edwards. Branch of California Nutmeg Tree (*Torreya Californica*), with Fruit, by A. R. Sausman. Specimens of California Fishes: *Chiropsis pictus*, Girard; *C. constellatus*, Girard; and *Pleuronichthys cœnosus*, Girard; presented by Dr. F. Steindachner. Lithographic Limestone, from Solenhofen, Bavaria; presented by Jacques J. Rey.

In connection with the piece of wood from the Weskie Tunnel, the donor states that "it is a portion of a log which was cut off in driving the tunnel, 350 feet from its mouth and 750 feet vertical distance from the surface of the ground. The log lies in auriferous gravel close to the bed-rock, and the portion not removed to make way for the tunnel still remains." The above specimen, which is exceedingly light, not being petrified, appears to be redwood (*Sequoia*). Of the portions of (petrified) root presented with the above, it is stated that they are "from the same tunnel, and within a few feet of the log"; and were found "imbedded in a seam of slate bed-rock," and "were broken from a root which had every appearance of having grown where he found it."

Mr. Stearns referred to the turtle-shell presented by Capt. Metzgar as belonging to the family *Cheloniidæ* and the genus *Caretta* of some authors (*Eretmochelys* of others); the carapace before us belongs to the so-called "hawk-bill turtles," and the large scales furnish the tortoise-shell so highly prized in the arts. The shelly-plates, preparatory to being manufactured, are washed, boiled, and steamed, and while moist and flexible are flattened by pressure. From the hole near the anterior portion of the shell, and just below the ridge, it is supposed that the turtles are procured by means of a spear, as other shells from the same region are similarly perforated. The flesh of the above species is not esteemed as highly as that of the green turtles (*Chelonia*) which belong in the same family, and are also found in the Gulf of California.

The President stated that the fossil remains near Lake Merced, referred to by him at a previous meeting, had been secured for the

Academy's museum, and had been recognized by Capt. Scammon as being the back portion of the skull of a hump-back Whale; it weighs 850 pounds.

Mr. Durand submitted a statement of daily thermometrical readings at Camp Cady, Cal., from and including May 25th to October 1st, 1872, showing the mean temperature for June to have been 101.5; July, 104.9; August, 105.1; September, 96.1 (Fahr.); the minimum being 80°, and the maximum reaching 114°. Camp Cady is on the Mohave River, in lat. 35 deg. N., long. 116½ deg. W.

Pacific Coast Lepidoptera.—No. 2. On the Transformation of the Diurnal Lepidoptera of California and the adjacent Districts.

BY HENRY EDWARDS.

In the hope of calling the attention of observers to the earlier stages of our butterflies, I have compiled from my own researches and from the best published material at my command, descriptions of all the larvæ and chrysalides of species belonging to the Pacific Coast, with which entomologists are at present acquainted. It is to be regretted that the list is so small, and that so little attention has hitherto been given to this interesting branch of study; out of 200 species of diurnal Lepidoptera inhabiting the Coast, only about 20 being known in the larval condition, and these being for the most part very briefly and imperfectly described. Thus, no species of either *Pieris, Anthocaris, Argynnis, Thecla, Lycæna, Satyrus*, or of any of the numerous forms of the *Hesperidæ*, has yet been noticed in its earlier stages, and the caterpillar of our common swallow-tailed butterfly (*Papilio Rutulus*), so abundant in every cañon during the spring and summer, is as yet unregistered and undescribed. The importance of these earlier conditions of insect life, in the discrimination of closely allied species, cannot be over-estimated, and it will be seen from the poverty of our present knowledge how large a field of interesting observation is open to the entomological student. The subjoined descriptions have been, in most cases, drawn up by myself from personal investigation of each species; but in one or two instances I have availed myself of the labor of others, for which due credit has always been given. A few species, such as *Vanessa californica, Pyrameis caryæ, Thecla californica*, and *Thecla irioides*, are well known to me, but I must defer their descriptions until some future day, as my notes upon these species have been mislaid or lost. In the Eastern States, the transformations of *Pieris protodice* and *Colias coesonia* are well known, though I cannot find any published description of either of them; while my friend Mr. T. L. Mead of New York was fortunate enough to raise the larvæ of *Pieris* *occidentalis* and *Anthocaris ausoniedes*, descriptions of both of which species will shortly appear from the pen of Mr. W. H. Edwards of West Virginia, in his exquisite work on the Butterflies of North America. In the mean time, I respectfully ask the co-operation of all persons on this Coast, who are interested in the study of entomology, towards a better understanding of the transformations of these beautiful denizens of our woods and fields, assuring them that I will cheerfully credit them with any information they may supply to me.

The following species are noticed in the present paper:

Papilio Philenor,	Larva and	chrys.
" *Zolicaon,*	"	"
" *Asterias,*	"	"
" *Eurymedon,*	"	"
" *Rutulus,*	Chrysalis.	
Neophasia menapia,	"	
Colias enrytheme,	Larva and	Chrys.
Terias nicippe,	"	"
Danais Archippus,	"	"
Melitæa chalcedon,	"	"
" *Editha,*	"	"
Melitæa palla,	Larva and	Chrys.
Phyciodes mylitta,	"	"
Grapta satyrus,	"	"
" *zephyrus,*	"	"
Vanessa antiopa,	"	"
" *Milberti,*	"	"
Pyrameis Huntera,	"	"
" *Cardui,*	"	"
" *Atalanta,*	"	"
Junonia coenia,	"	"
Limenitis Lorquini,	Chrysalis.	
Limenitis Californica,	Chrysalis.	

Papilio Philenor. Fabr.

Larva. Head blackish brown. Body very dark brown, slightly shining, with two dorsal rows of long, fleshy processes, those near the anal extremity being the longest, bright orange red. A lateral row of processes, brown, reddish at base; those anteriorly being the longest. On the first segment are three orange red blotches, arranged almost in the form of a triangle. Spiracles orange red. Feet brown-black, red at their base. Under side dull flesh color. Retractile tentacles, bright orange.

Length, 2 inches. Width, 0.25 inch.

Food plant, *Aristolochia serpentaria.*

Chrysalis. Rather short, extremely broad in the middle, stone color, with a slight violet tinge. Truncate in front, with a very high protuberance on the thoracic region, two smaller ones on its sides, directed towards the head, and a double row of short dorsal protuberances toward the posterior region of the abdomen. Scattered over the upper surface are some pale, golden yellow patches.

There are two broods of this species; the first appearing toward the end of May, and the latter in August. From eight specimens of larvæ obtained at Saucelito, near this city, in April of the present year, I have had the following results:

Changed to chrysalis, May 11th–24th.

Imagos appeared, June 4th–14th.

3 ♂. 3 ♀. Two specimens are now alive in the chrysalis state, and will probably make their appearance early in the coming spring. The species is

remarkably common on Angel Island, near Saucelito, and throughout Napa and Sonoma Counties.

Papilio Zolicaon. Bdv.

Larva. Head pale bluish green, yellowish in front; eyes black with two black stripes in front, between each of which is a small black spot. General color of entire upper surface, pale, but very bright apple-green; slightly paler on the sides. First segment with one transverse black band and the suture black, with two small yellow points on each side before the anterior band, plate above the horn dusky. Second segment, with broad transverse black band, broadest on the back, with four anterior scallops, and a small yellow dot in each scallop, a long, transverse, lateral spot, yellow at the top. Third segment similar to second, except that the yellow spots on the transverse band are larger. Segments four and five, with transverse black band broken on each side by three yellow spots, below which is a rounded black spot. Segments six to nine inclusive, same as four and five, except that instead of the subventral round black spot there are two near the edges of the segments, with a third on the outside of each leg. Segments ten and eleven same as four and five. Segment twelve with a black anterior transverse line, with two yellow spots on the anterior margin, two rounded black dorsal spots, a posterior band, and a long black lateral spot over the anal feet. Prolegs pale bluish, black at tips, with black spot at the base of each. Anal feet dusky. Beneath pale bluish green, with broken median line of dusky marks, most prominent on the leg-bearing segments.

Length, 2.00 inches. Body tapering each way from the fourth segment, when seen from above. Viewed sidewise, the three anterior segments taper toward the head. I owe the above description to my friend Mr. R. H. Stretch, who has made an admirable figure of the larva. I find, however, that the insect is very liable to variations in its larval state; the transverse bands in many specimens becoming very broad, and the yellow spots obsolete in some of the segments, while in others the whole upper surface is pale green, with very faint black bands, and the yellow markings considerably larger. The above form may, however, be taken as the type.

Food plants. Various species of *Umbelliferæ*, but particularly *Fœniculum vulgare.* In confinement, the caterpillars will feed readily upon the common carrot of the gardens. There appears to be but one brood of this species, the larvæ being fully fed about the middle of September, and the imago appearing in the following May.

Chrysalis. Fawn color, shading into blackish brown at the sides and dorsal region, and mottled irregularly underneath with the same color. Head deeply notched in front, thus forming two protuberances on the sides in front, these being very rough, and intensely black in color. Thorax also with black dorsal protuberance, and a lesser one on the sides. On the fifth, sixth, seventh, and eighth segments are two small, black points, convergent toward the anal extremity. The chrysalis, like the larva, is subject to great variations, some specimens being almost wholly black, with shadings of fawn color, while others lose the black altogether, and are fawn color, with pale brown markings.

Papilio Asterias. Fab.

"*Larva.* Apple green, with a transverse band on each segment, formed of alternate bands of black and yellow, excepting on the first three, where the black band is interrupted by the yellow points only toward the spiracles; whilst on the back, the yellow points are placed before the black band; three black points on the anterior part of the first segment, and two black lines on the head. The feet have black points at their base.—Feeds on *Daucus carota*, *Anethum fœniculum*, and other umbelliferous plants."—Boisduval.

Chrysalis. Very similar in size and shape to that of *P. Zolicaon*, but differing in its lighter color, and the absence of the dark shading on the dorsal and lateral regions.

The perfect insect has occurred in Marin County, and a fine specimen was taken some years ago near Oakland by Mr. Jas. Behrens; so that the larva may be sought for in these localities.

Papilio Eurymedon. Boisd.

Larva. Head pale brown, with a fleshy tinge. Entire upper surface of body pale apple green, with the following markings. The first segment has its anterior margin broadly yellow. The third segment is much thickened, with its posterior margin broadly yellow, surmounted by a row of small black dots, and in front with a series of about six irregular yellow patches, edged with black, enclosing a black spot with a yellow centre. Between the third and fourth segments is a broad black band, which is concealed by the margins of the segments at the will of the insect. On the fifth and sixth segments are two blackish dots, and on the seventh, eighth, and ninth are four black or purplish dots. Feet, prolegs, and entire under surface, greenish white. Body tapering very much posteriorly from the third segment. Retractile horns bright orange. When irritated, the insect draws in its head, folding it almost so as to be concealed by the first segment, and swelling out the third in front, it presents a most grotesque appearance: the horns being protruded, and the curious yellow markings, which have some resemblance in form to a pair of spectacles, representing eyes. It must under these circumstances be a very formidable looking monster to its insect enemies.

Food plant, *Frangula californica.*

Chrysalis. Long, tapering very much toward the anal extremity, which is very sharply pointed. Color, pale fawn color, with dashes of black and brown very irregularly scattered over the entire surface, a little more intense and connected at the sides. The protuberances of the head and thorax are brown, mottled with dirty white, and the seventh, eighth, and ninth segments have each two raised black dots. The spiracles, which are distinctly seen, are dark brown. The under side is marked with dashes of brown and black, irregularly placed. In some individuals, the ground color of the chrysalis is very pale green. Larvæ found in August changed to chrysalis in September, and the perfect insects appeared in the following Spring, one specimen emerging as early as the 23d of February.

Papilio Rutulus. Bois.

I regret that at present I can say nothing with certainty respecting the larva of this very common species, but it is reasonable to expect that our ignorance of its transformations cannot long continue.

Chrysalis. Remarkably like that of *Eurymedon.* The markings are, however, certainly more regularly disposed, and assume the form of stripes and rows of spots and lines. On the seventh, eighth, and ninth segments also, the raised black dots are distinctly larger, and a double row of them is invariably plainly visible. I remark this character in five specimens of the chrysalis which I have found, all of which have produced the true typical *P. Rutulus.* Beyond the more regular arrangement of the markings, and the presence of two black, raised dots on the segments referred to, I can discern no difference in the chrysalis state of *P. Rutulus* and *P. Eurymedon.*

Neophasia menapia. Felder.

Larva, ignota.

Chrysalis. Very long and tubular, with the beak sharply pointed, slightly thickened toward base of abdomen. A small ridge-like protuberance on the thorax, and a smaller one near the head. Color immediately after change, pale yellowish green, with three narrow dorsal stripes, silvery white. The lateral stripes enclosing the stigmata, are a little broader, and bent upward anteriorly. Stigmata brownish. The neuration of the wings is plainly seen, and at their base is a well-defined black spot. Toward the period of emergence, the chrysalis loses its bright green color, and becomes of a dark olive hue, almost black above, the silvery tone of the stripes changing to dirty white, the coloration of the wings and various organs being more distinctly seen. The chrysalis is attached to the trunks of pine and fir trees, with the head invariably directed upward, and to the fronds of *Pteris,* with the head always toward the point of the frond.

Length, 0.80 inch. Width, 0.15 inch.

I was fortunate enough to discover the chrysalis of this highly interesting species during a recent trip to Vancouver Island, but the most diligent search did not reward me with the caterpillar. It doubtless feeds upon the Douglas spruce fir (*Abies Douglassii*), and should be sought for in the early part of July.

Colias eurytheme. Bois.

With reference to this species, I extract the following from Mr. W. H. Edwards' "Butterflies of North America."

" *Colias Eurytheme.* From Mr. Hayhurst I have received an admirably executed drawing of the egg, larva and chrysalis of this species. The egg is long, fusiform, and ribbed longitudinally. Length of mature larva, 1.4 inch ; cylindrical, tapering posteriorly from eleventh segment ; head green, translucent, body dark green, somewhat pilose, each segment transversely creased ; a narrow, white, lateral band, from second to last segment, through the middle of which runs a broken line of vermillion red. The larva is a little longer and larger than that of *C. Philodice*, which it much resembles, but is without the series of semicircular black spots next under the lateral band, usually seen on the latter. The eggs were deposited on Buffalo grass (*Trifolium reflexum*), and the larvæ fed thereon. Chrysalis .95 inch in length, cylindrical, tapering to a point posteriorly ; the head case also produced to a point ; mesonotal process rounded and not very prominent, a whitish lateral line runs from wing cases to extremity of abdomen, above which is a black stripe that crosses two or three of the upper abdominal segments. The shape differs from that of *Philodice*, in the attenuation of the head case and lesser prominence of the process; also in the absence of the abdominal markings. This description, however, is given from the drawing."

Terias nicippe. Fabr.

" *Larva.* Pale green, with a dorsal ray more obscure, and a lateral white band, marked before with five yellow points."—Boisduval.

Food plants, various species of *Cassia* and *Trifolium.*

Chrysalis. Dull pale green, with the beak very sharply pointed, the entire surface sprinkled over with ferruginous spots. Wing region largely developed, the edges forming a sharp arcuate protuberance.

This species, so common in the Southern States and Mexico, must now be included in the list of Californian Butterflies, Mr. J. Behrens having during the past Summer received several specimens from San Diego.

Danais Archippus. Fabr.

Larva. Dull cream white, each segment banded regularly with black and yellow, thus forming alternate bands of black, yellow and white throughout the entire length, the white bands being broadest, and crossed transversely at their middle by the black bands. The yellow bands are also crossed transversely by a narrow line of black. The head and two posterior segments are devoid of white. The second segment has two long, black, fleshy processes, and the eleventh segment two shorter ones of similar form. Feet black, whitish at their sides. Under side of body dirty white.

Food plants, various species of *Asclepias.*

Chrysalis. Bright yellow green, almost pellucid, and resembling green ice. Short, and very much rounded. Thoracic protuberances small. In front on the third segment are some small golden points, and behind the middle is a semicircle of gold, bordered below by a range of small, black dots.

Melitæa chalcedon. Bois.

Larva. Velvety black, finely irrorated with white. From third segment to last, seven rows of thick, many-branched spines, the dorsal row orange, the others blue-black, those of second lateral row rising from tuberculated orange spots.

Head black, bilobed, compressed, furnished with simple black spines. Feet and prolegs black. Under side of body dull flesh colored.

Food plants, *Scrophularia Marylandica* L., *Diplacus glutinosus*, *Mimulus luteus*, *Lonicera sp.*, and the various species of *Castelejia*.

Length, 1.05 inch.

Chrysalis. Pearl-white, irregularly marked with points and patches of dark brown. On the abdominal region are several rows of orange spots, the same color appearing in the covering of the wings.

Melitæa Editha. Bois.

Larva. Dull black, with seven rows of many-branched spines, all of which have a bluish tint. Those of the second lateral row arise from tuberculated orange spots, as in *M. chalcedon*, but the dorsal row of orange spines, so characteristic of that species, is wanting in *Editha*. Feet and prolegs brown, inclining to a fleshy tinge.

Food plants, *Erodium Cicutarium*, various species of *Trifolium* and *Viola*.

Chrysalis. Cylindrical, shorter and rounder than *M. chalcedon*. Ground color dull cream-white, each segment with a transverse regular row of orange spots, bordered anteriorly by black dashes. On the wing covers are some broad, black, waved lines, and some black patches about the head and thoracic region.

Melitæa palla. Boisd.

Larva. Dull black, with a double dorsal row of orange spots, forming, when viewed longitudinally, two interrupted lines. In the spaces between the spots, are some irregular white patches. Along the sides are two similar double rows of orange blotches, with white spaces about the spiracles. The spiracles themselves are black. Each segment is provided with five rather long spines, from each of which project about sixteen or eighteen long black hairs. The base of each spine is surrounded by a dirty white ring, and some minute white irrorations are scattered over the whole upper surface between the spines.

Head rather small, black, very glossy. Feet ash color, banded with black.

Length, 1.05 inch.

Food plant, *Castelejia breviflora*.

The caterpillars feed chiefly on the flowers, and are solitary in their habits, only one being usually found on each plant. From ten larvæ taken in May, 1873, I obtained the following results:

Changed to chrysalis, May 16th–23d.

Imago, June 4th–13th.

Five ♂, four ♀; one died in chrysalis state.

Chrysalis. Fawn color, very faintly marked with pale brown dots and dashes over the entire surface. On the thorax are two raised, shining points, and each of the segments, except the two last, possesses a treble row of small, shining tubercles.

Phyciodes mylitta. Edw.

Larva. Head small, bronze black, entirely covered with short black hair. Viewed from above, the whole upper surface is velvety black, each segment being provided with six tubercular spines, very hairy to their tip. The lateral row of spines is dull ash color, with black hairs, the spines being shorter than those of the dorsal region. Feet and prolegs dull ash color, the under side of the body with a fleshy tinge.

Length, 0.75 inch.

Food plants, various species of *Carduus.*

This species is gregarious in its habits, and terribly destructive to the plant on which it may be hatched, in many cases only the nerves of the leaf remaining. The caterpillars spin a small web, and draw the leaves of the plant together.

Chrysalis, ash color, with a slight metallic reflection. Dorsal region with three rows of slightly raised tubercles. Anal extremity much incurved. Out of sixteen specimens taken on May 8th, three died in larval state, the rest transformed as follows:

Chrysalis, May 26th–June 5th.

Imago, June 6th–19th.

Ten ♂, three ♀.

Grapta satyrus. Edw. (Figured in "Edwards' Butterflies of North America.")

"*Larva:* Head black, angular, bilobed, spiny, and with a spiny tubercle at each of the upper angles; color of body black, with a broad greenish white dorsal stripe, which on the anterior segments is clouded with black; on each segment, on this stripe, is a fine V-shaped black mark, having its angle at the dorsal spine. The spines form seven rows, the dorsal greenish white, wanting on the first four segments, the first lateral row of same color, present on all segments from the second; the second lateral row black, the third greenish white, wanting on the first four and terminal segments, and springing from an infra-stigmatal line of the same color; and the spines are thinly covered with short, bristling, concolored hairs, except that those near the tips of the white spines are blackish."—R. H. Stretch.

Food-plant, *Urtica sp.* (Stinging Nettle.)

The above description was taken by Mr. Stretch from some specimens found by me at Congress Springs, Santa Clara County, in June, 1871. I only raised one specimen out of three; but the following year I was fortunate enough to perfect three other specimens, and recently, in Vancouver Island, four others, the markings of the larva state being remarkably constant in every instance.

Chrysalis, fawn-color, with a few darker markings irregularly placed. On each side of the abdomen, near its base, are three small semi-oblong silver spots, the posterior one with a trace of gold upon it. Thoracic protuberance large. Beak produced into a sharp point.

Changed to chrysalis, June 20th–26th.

Imago appeared July 4th–18th.

Grapta zephyrus. Edw.

Larva: Body furnished with six rows of many-branching spines; the segments, from second to eighth inclusive, bright buff inclining to orange, remaining segments pure white. Along the sides are two waved orange lines, uniting irregularly; the interspaces, which are buff or white according as they are anterior or posterior, are marked with black dots; above the orange lines are some faint black lines, and some black patches are discernible at the base of lateral spines. Spiracles black, broadly bordered with white. Head black, with short black spines at vertices. Under side of body dull flesh-color. Feet and prolegs with pinkish tinge. Length, 1.05 inch.

Food-plant, *Azalea occidentalis.*

Chrysalis, pale brown, the general shape as in *Comma*, but the mesonotal process more prominent and rounded, the palpi cases more produced and compressed at the base, the upper tubercles silvered.

The larva from which the above description was taken was found by me in the Yosemite Valley, July 3d, 1871. Changed to chrysalis July 29th, the perfect insect emerging on the 15th of August. The species is very common near Virginia City, Nevada, and in many of the warm valleys of the Sierra.

Vanessa antiopa. Linn.

Larva, velvety black, entire surface covered with white irrorations. A deep black dorsal line; each segment provided with four spines, the inner ones being branched, the outer ones simple; the second segment is, however, destitute of spines. At the base of the seven middle bundles of spines is a reddish-chestnut tubercular patch. Head black; prolegs black; feet chestnut, fleshy beneath.

Length, 2 inches.

Food-plants, various species of willows, and occasionally on rose-bushes.

Chrysalis, brownish gray, with some darker markings. Palpi cases produced into a sharp spine. Thorax with three spines on its dorsum, the middle one large and slightly recurved, two minute ones near its base. The sides of the thorax are produced into a ridge, armed with two spines. Wing-cases also with a small spine toward their extremities. The third and fourth segments are provided with two spines each, the fifth, sixth, seventh, and eighth with three spines, the middle row being extremely small.

Length, 1 inch.

Vanessa Milberti. Godt.

Larva, dull olivaceous, with blackish tinge, whole surface covered with indistinct black dots. A narrow, black dorsal line. The sides below the stigmata are stone color. Each segment is armed with five black spines, from which spring some short black hairs. Stigmata inclosed in waved, irregular black band, with a pale pinkish space above and below it. Stigmata black, encircled with dull white, or stone color. Head and prolegs black; rest of the under side stone color.

Length, 1 inch.

Food-plant, *Urtica sp.* (Stinging Nettle.)

Chrysalis, dull ash color, with darker dots scattered irregularly over the whole surface. Thoracic protuberances almost obsolete. Palpi cases produced into a short, sharp spine. Abdominal region with three rows of short, shining points, slightly silvered at the tip; there is also an indistinct dash of silver at the base of the head. Wing cases paler in color than the rest of the body. Length, 0.75 inch.

Pyrameis Huntera. Sm. Abb.

Larva, blackish gray, striated with yellow, the first four segments more obscure than the remainder. Along the feet, and below the stigmata, is a yellow lateral ray, and above these is another yellow ray, marked with a small orange spot above each stigma. Stigmata brownish. All the spines are yellow.

Food-plants, various species of *Gnaphalium.*

" *Chrysalis*, yellowish, moderately angular, scattered with a large number of golden spots."—Boisduval.

Pyrameis Cardui. L.

Larva, brownish, with four yellow interrupted lines, two dorsal and two lateral. Head greenish black. The third and fourth segments have four spines each; the fifth to the eleventh, inclusive, have seven spines each; the twelfth has four spines, and the thirteenth only two. The spines are brownish black." —Staniton.

Food plants, various species of thistles. (*Carduus, Cnicus.*)

The larva is solitary in its habits, and draws up the leaves on which it is feeding with its threads.

" *Chrysalis*, grayish brown, angular, scattered over with golden spots, which sometimes cover nearly the whole surface."—Morris.

Pyrameis Atalanta. Linn.

Larva, yellowish gray, with a pale yellow lateral line. Third and fourth segments with four moderate blackish spines; the fifth to twelfth segments, inclusive, with seven spines. Between the second and third row of spines is a row of black V-like marks. Head and legs black; prolegs reddish. The ground color is rather inclined to vary, being frequently of a violet hue; it then appears as if powdered with gray.

Food-plant, *Urtica sp.* (Stinging Nettle.)

The caterpillar, according to Sepp, shortly after it is hatched, selects a nettle-leaf, which it draws together with threads into a roundish hollow form, leaving for the most part an opening into the interior both before and behind—thus serving both for shelter and food until almost devoured, when it selects a fresh leaf, and proceeds with it in the same manner; one caterpillar only being found on a single leaf—thus indicating a peculiar liking for a solitary life; a circumstance confirmed by the eggs being laid solely and apart, whereas caterpillars hatched from eggs deposited in clusters are gregarious. The caterpillar state lasts about five weeks.

"*Chrysalis*, blackish, moderately angular, covered with a grayish efflorescence, and ornamented with golden spots."—Boisduval.

Junonia coenia. Hubner.

Larva, blackish, pointed with white; lower side of abdomen and feet fulvous. It has two lateral white lines, of which the upper is marked with a row of fulvous spots.

"*Chrysalis*, like those of *P. cardui* and *P. Huntera*, but blackish, varied, and whitish, without any metallic spots."—Boisduval.

The above description is too brief, but, in the absence of specimens from which to draw up a more complete one of this familiar insect, I am for the present compelled to be contented with it.

Limenitis Lorquini. Bois.

Chrysalis, dull fawn color; shining. Palpi cases very short. Thoracic protuberance rather short, triangular. The two basal segments of abdomen produced dorsally into a high semicircular process, flattened at the sides. The fifth, sixth, seventh, and eighth segments have each a black, shining, raised point at their posterior margins, and a black oblique dash is also seen at the junction of the wing cases with the abdomen. Length, 0.85 inch.

Limenitis Californica. Butler.

Chrysalis, short; very much thickened over the wing cases, tapering abruptly to the anal extremity. Dark fawn color, with occasional brown markings. The palpi cases are long, curved downward in front, and black at their tips. Wing cases broadly margined, especially toward their extremities. Thorax with very short, blunt process. On the base of the abdomen is a high protuberance, notched in front, which runs into a longitudinal ridge toward the anal extremity. Wing cases pale, showing the coloring of the wings. The chrysalis is attached to the trunks of trees by a large silken web, not less than half an inch in diameter.

Length, 0.80 inch.

Dr. Blake exhibited the fossil-tooth of a species of Shark, which was found near Martinez, probably in the cretaceous rocks. The tooth belonged to a species of *Carcharodon*, and its specific characters indicated *C. subauricularis;* when entire, this tooth probably measured five inches in length on the edges and three and a half inches broad; the animal to which the tooth belonged quite likely measured as much as sixty feet in length.

Mr. Bloomer read the following:

Note on Alexia setifer and its Allies.

BY J. G. COOPER, M. D.

In vol. IV of our Proceedings, pp. 150 and 171, I described some new Californian Mollusca very briefly, and referred to others by name, as " soon to be published with illustrations." Having some months before sent the manuscript and figures to the *American Journal of Conchology*, Philadelphia, I supposed that they would be published before the notices in our Proceedings. It happened, however, that they were delayed so long on the way that the Journal completed its seventh volume and was then suspended, the Philadelphia Academy of Sciences assuming the publication of such articles as had been published by the Conchological Section in the form of a special journal. It thus happened that the notices in our Proceedings had priority of publication by nearly or quite six months, as far as the *Alexia* is concerned; while the meeting at which the description was presented took place six months before its publication. The other species referred to were named *without description*, at a meeting held Dec. 19th, 1870, and published in April, 1871, fifteen months before their appearance in the Philadelphia Proceedings. I merely refer to these dates, not as a question of doubtful priority, but to show why no reference is made in either publication to the other, and to indicate the difficulties a describer meets with in having his work published two thousand miles away.

Another more important object is, to explain why a very serious error may have been committed in describing the *Alexia* as new. The latest work on American species was W. G. Binney's compilation on " Land and Freshwater Shells," Part II, Sept., 1865, (Smithsonian Institution, Washington, Misc. Coll., No. 143), which was supposed to contain all references bearing on the species of the North Atlantic, together with full descriptions. It appears, however, from the last volume of " Jeffreys' British Mollusca," which had not reached us at the date of first publication, that the European *A. myosotis*, considered by Binney identical with the New England form, has the same character in the young on which I relied for distinguishing *A. setifer*, namely, a row of bristles near suture, and that it had even received long ago the name of *Melampus ciliatus* in France, from that character. This fact being omitted by Binney led me to distinguish our form as new; but I confess that there is no other character sufficient to distinguish so variable a shell from the European form of *A. myosotis*, although it may still prove that the Eastern American species, described as *Melampus turritus*, Say, *M. borealis*, Conrad, *Leuconia, Sayi*, Kuster, etc., is distinct.

Professor Davidson exhibited his improved leveling-rod, and described the method of operating it.

The President called attention to a new and improved sounding apparatus, invented by Commander George E. Belknap, of the U. S. steamer *Tuscarora;* by the method employed, a quantity of the bottom mud can be brought up, as well as a sample of water from the lowest depths. This has heretofore been difficult, if not impossible.

*On the Height of Mount Whitney.

BY W. A. GOODYEAR, C. E.

Mr. M. W. Belshaw, who on the 27th day of July, 1873, climbed with me the mountain which for several years has been taken for Mt. Whitney, has since then succeeded in obtaining a barometric measurement of the altitude of the genuine peak, Mt. Whitney itself.

He volunteered to pay the expenses of a party to attempt the ascent, and that party reached the summit of Mt. Whitney on the sixth day of September, 1873, and obtained a series of ten observations there, extending from 9.20 A.M. to 2 P.M., taken by Mr. Charles Rabe, an attaché of the State Geological Survey.

On the same day a series of observations, nearly simultaneous, was taken at Lone Pine with another barometer.

The altitude of Mt. Whitney above Lone Pine, as computed by me from the mean of these observations, is 10,981.5 feet.

Add to this the best determination of the altitude of Lone Pine yet made,

* The accompanying sheets give the observations from which I computed the altitude of Mt. Whitney at 10,981.5 feet above Lone Pine. That result was obtained with Williamson's tables, in the following manner:

In the first place, all the observations were reduced to 32° F., and the correction of No. 1358 to standard on Sept. 6th then determined. This correction was —.003. The correction of No. 1554 to standard was then determined for August 31st, the middle day of the period over which the comparisons with this instrument extended. This correction was +.013. There which is also barometric, and which is 3,917 feet, and we have 14,898.5 ; or say in round numbers, 14,900 feet for the absolute altitude of Mt. Whitney above the sea.

I wish to correct one error in my article of August 4th, read before the Academy.

The magnetic bearing from the peak which Mr. Belshaw and I climbed to Mt. Whitney, is there given as N. 67° W.

It appears from subsequent comparisons with the maps, and with other observations, that that bearing, together with five or six others out of some twenty which I took at that time, was affected by a large local attraction due to magnetic iron, distributed with great irregularity through the granite.

Not being able to see from any one point on that peak all the points to which I wished to take bearings, I moved the compass two or three times within a radius of 25 or 30 feet. But the compass always rested on the rock. The result happened to be that all the bearings taken from one of the points (that to Mt. Whitney included), were affected by local attraction, while the rest were not. The real magnetic bearing to Mt. Whitney is about N. 53° W.

This error affects also the triangulation by Mr. Belshaw, whose results are given in the note to that article, and which was based upon the bearing of N. 67° W.

The barometric altitude of Mt. Whitney, as given above, should be subject to slight correction, owing to the fact that I do not know the horory curve for Lone Pine, and that nobody knows the horory curve for the summit of the peak ; but any correction from this cause would be small.

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being no further comparisons with this instrument, which is a short one, it was assumed that its correction remained the same on the 6th of September.

Next, in the series of readings at Lone Pine, I interpolated other readings, both of the barometer at 32°, and of the detached thermometer, so as to obtain a series of ten readings for Lone Pine at times respectively simultaneous with the observations on the peak. The remaining readings at Lone Pine were rejected in the computation. The series of ten readings for Lone Pine so obtained, together with the series of observations on the peak, were then corrected to standard. This done, the mean of all ten readings for each locality was taken, both of the barometer and the detached thermometer; and from these means, the altitude in question was computed. These means were as follows :

	Barometer.	Detached Thermometer.
At Lone Pine	26.362	89.2
On Mt. Whitney	17.835	35.3

If, instead of taking the mean of all ten observations, the successive pairs of simultaneous readings be taken separately, and the computation made for each pair respectively, there will be found to be at different hours a large variation in the "temperature term" of the formula, and the results so obtained will range through something like a hundred feet variation of altitude, or from about 10,900 to a little over 11,000 feet. This is due to the large range of the thermometer in the valley, which was far greater than on the peak, The result given by the mean is much nearer the highest than the lowest of the individual results, because during the first hour of observation on the peak, the thermometer in the valley rose rapidly, while after 10.30.A. M., the change was not so rapid.

The altitude of Lone Pine itself—3,917 feet—was obtained from Prof. Whitney, and is the result of our observations there for a week or so in 1870. The altitude of the peak above Lone Pine, obtained in the manner indicated above—10,981.5 feet—is probably as close an approximation as these observations give the means of making, without a knowledge of the horory curves or monthly variations at the localities.

BAROMETER NO. 1358
AT
LONE PINE,
September 6th, 1873.

Observations by R. A. Loomis.

Time.	Barometer.	Attached Thermometer.	Detached Thermometer.
A. M.			
6.45	26.464	60.	62.
10.00	.518	83.	82.
10.30	.516	87.	88.
11.00	.520	89.	90.
11.25	.518	91.	91.
P. M.			
12.45	.516	92.	92.
1.35	.484	93.	94.
2.45	.462	91.	92.
3.15	.450	90.	91.
4.10	.444	89.	90.
5.45	.426	84.	86.

BAROMETER NO. 1554
AT
SUMMIT OF MOUNT WHITNEY,
September 6th, 1873.

Observations by C. Rabe.

Time.	Barometer.	Attached Thermometer.	Detached Thermometer.
A. M.			
9.20	17.848	38.	33.
10.00	.836	37.	33.5
10.30	.835	37.	34.5
11.00	.836	38.	35.
11.30	.840	40.	34.5
M.			
12.00	.848	42.	36.
P. M.			
12.45	.846	41.	36.
1.00	.840	42.	36.5
1.30	.838	43.	38.
2.00	.838	42	36.

The President reported progress in the matter of the modification of the terms of the deed from James Lick to the Academy, and stated that Mr. Lick had so changed the conditions of the first deed, that the Academy would have several years, and therefore ample time, to raise the money for the erection of a proper building.

REGULAR MEETING, MONDAY, OCTOBER 20TH, 1873.

President in the Chair.

Thirty-three members present.

Dr. H. Behr, W. W. Russell, Isaac E. Davis, Philip Caduc and C. H. Whitesides were elected resident members; Andrew B. McCreery a life member; and Stephen Powers, of Sheridan, Placer County, a corresponding member.

Donations to the Library: California Horticulturist for October, and Overland Monthly for November, 1873, from J. H. Carmany & Co. Engineering and Mining Journal, October 7th. Nature (No. 204). Catalogue of New York State Library, 1872. Twenty-fourth Annual Report of the New York State Museum of Natural History. Twentieth, Twenty-first and Twenty-second Annual Reports of the Regents of the University of the State of New York, on the Condition of the State Cabinet of Natural History. Fifty-fifth Annual Report of the Trustees of the New York State Library.

Donations to the Museum: Specimen of Cloth from a submerged wreck, bored by the Teredo, presented by D. J. Staples; also, a similar specimen from Dr. George Hewston. Specimen of *Tarantula* from ———. Specimens of pre-historic Stone Implements, from near Mount Shasta, presented by B. P. Avery. Coal from the Rocky Mountain Coal Co.'s Mine, also a piece from Fort Scott Coal mine, Kansas, presented by D. D. Colton. Specimens of *Octopus;* also of *Chimera* and other fishes from San Francisco Bay, by S. R. Throckmorton.

Mr. B. P. Avery remarked that the specimens of Stone Implements presented by him were from Strawberry Valley, at the southern base of Mount Shasta. One, a pestle, made from the trachyte of which the bulk of the mountain is composed; the other, a smooth oblong stone used in dressing skins, made of the red lava overlying the trachyte, and covering the flanks of the mountain. These implements were dug up from a slight depth by J. H. Sisson, the Shasta guide, while cutting a ditch. Mortars and pestles of trachyte have frequently been found along the banks of the upper Sacramento; but no other instance is known of the use of lava in the manufacture of Indian implements. Obsidian, however, is largely employed, or used to be, for arrow- and spear-heads.

Professor Davidson delivered a lecture on the discovery and progress of Spectrum Analysis; and Mr. Hanks explained the construction of the Spectroscope, illustrating the remarks of Professor Davidson and himself, by numerous experiments.

Regular Meeting, Monday, November 3d, 1873.

Vice-President in the Chair.

Forty-five members present.

Robert W. Andrews, E. G. Waite, Thomas Adam, and Henry Michaels were elected resident members, and Joseph A. Donohoe life member.

Donations to the Library: De la Nature et Povrtraict des Poissons, by Pierre Belon; a curious old work, printed in 1554 by Henry Estienne; presented by Rev. Albert Williams. Voyage de découvertes de l'Astrolabe, twenty-two parts (text) and five folio volumes of atlas and plates; also, Voyage autour du Monde sur la corvette La Bonite, in seventeen parts (text) and three folio volumes of plates; the latter including plates of the expeditions of the frigates *Venus* and *Ocean*. The above valuable addition to the Library is made by a "Friend" of the Academy through Dr. George Hewston, who remarked: "one of the difficulties which all students of natural history have to encounter on this coast is the deficiency of works of reference. Having stated this fact to a friend, whom I accidentally met in a book store, he with his accustomed liberality, which only equals his modesty, at once responded to my solicitation, and has afforded me the pleasure of donating this magnificent set of voyages to the Library of this institution; and I regret that he has placed a ban upon my announcing his name to the Academy. Hoping that these beautiful drawings will add to the advantages of our institution and assist the student of nature in his pursuits, I commit them to your care." A special vote of thanks was unanimously voted by the Academy, and Dr. Hewston was requested to present the same to the donor.

Donations to the Museum: Skull (of a Kanaka?) from an old battle ground on Mauna Loa, S. I. Five specimens (two species) of Crabs, from near Shanghai, China; presented by Henry Edwards. Jacket, made from skins of the entrails of seals, from

Alaska; presented by B. R. Swan, M. D. Fossil Wood, from the "petrified forest" at Calistoga; by S. A. L. Brannan. Natural Sugar, exuded from the butt of a fallen sugar pine (*P. Lambertiana*) from West Point, Calaveras County; presented by Ira H. Reed. Quartz crystal in Malachite, from Australia; by Rev. Albert Williams. Frontal portion of Skull, with horns, of *Bos (latifrons?)*, from Alaska; presented by the Alaska Commercial Company. Minerals and Fossils, from Colorado Territory; by F. W. Van Reynegom. Fossil cast, from near Searsville, San Mateo County; presented by A. G. Walton. Portion of Tusk of a species of *Elephas*, from Lat. 69 deg. 22 min.; Head of male Walrus (with skin, for mounting); also, Skin of a small dark Seal; Skull of female Walrus; specimens of *Margarita*, and the opercula of *Natica*, and other mollusks, also, a Pebble taken from the stomach of a Walrus; Lice (small crustaceans) from Walrus; specimen of *Natica* (with Hermit Crab), and another crustacean; Parasites from Cod-fish caught in Ounimak Pass, Alaska; specimens of *Tunicates*, *Nereis*, and other marine forms, taken from stomach of Walrus; specimen of Coal from Point Belcher. All of the above collected and presented by Captain T. W. Williams. Specimens of Pods and Seeds of ("Monkey Pods") a leguminous plant; also, Pods of *Bombax pentandrum*, the cotton tree of India, from Sandwich Islands; numerous specimens of Seeds of eight species of plants; Bark of "Paper Mulberry," from which the native cloth *Kapa* is made; portions of the aerial roots, or descending stalks, of the Banyan Tree; small greenish Pebbles; specimens (fragments) of a species of Seaworm (*Nereidæ?*), called by the natives "Palolo," from the Navigator Islands; Oil, or Fat, from cocoa-nut eating Crab; also, specimen of (Amber?) Resin, thrown up by the sea, from the Caroline Islands; Gum (of a tree), called "Tutui"; also, Lacto-resin, and Inspissated Juice of a species of (*Artocarpus*) Bread-fruit Tree, from Hawaiian Islands. All the above collected and presented by W. R. Frink. Capsules and Seeds of a species of *Romneyia*, from Lower California; collected and presented by G. W. Dunn. Specimens of Minerals, from Cerro Gordo, Inyo County, California; from Carl Rabe. Minerals and Fossils (numerous specimens), from the Geysers and vicinity, Sonoma County; also, from Penitentia Creek, Santa Clara

County; presented by C. B. Turrill. Section of Baleen, from the Humpback Whale, Monterey, California, showing the arrangement of the plates of baleen. (This specimen, which is unique, was obtained by purchase.)

Mr. Stearns stated, in connection with the valuable contribution to the Academy's Museum made by Captain Williams, that last spring Professor Davidson solicited the Captain to make a collection in natural history for the Academy, and he cheerfully consented, and had brought us the interesting material which had been presented this evening; the male walrus head and the seal are preserved in salt, and are now stored at the Coast Survey office. Captain Williams reports the season as having been a very open one, and unfavorable for collecting, as he was unable to obtain a single whale, etc.

He went as high as latitude 72 deg. 15 min., and could have gone much further; and several of the whalers were as far east as Smith's Bay, in 153 degrees east, and could have gone even farther, had they not been afraid of the ice coming down and cutting off their retreat.

Mr. Frink stated in reference to the "gum" or resin of the Bread-fruit Tree, presented by him, that it is obtained by cutting through the bark, when a juice runs out, of the color, consistence and taste of ordinary milk; in the course of twenty-four hours it ferments, and the gum separates, like butter in the churning of cream; it can be obtained in large quantities on some of the islands of the Pacific; it is used by the natives to fill the seams of their canoes, and for plasters for cuts, sores, etc. For the latter use he had found it exceedingly valuable, and his opinion had been confirmed by the few surgeons to whom he had given samples for experiment. It is soluble in several fluids, and may yet come into extensive use for making fabrics water-proof.

The marine worm, "Palolo," which he had presented, is seen floating in early morning in certain channels near Savai and Upolo, Navigator Islands; it is seen (as it is stated) on only two days in the year; its return is calculated by the natives with astronomical precision; it appears in great abundance, and is caught only before sunrise, for as soon as the sun shines it disappears, to return only at neap-tides in the month of October or November. It is esteemed by the natives a great delicacy; hence "Palolo" days are days of festivity, and thousands repair to the channels to gather it; it is of all colors, and the surface of the water at the time of its occurrence presents the most gorgeous hues. Last year the "Palolo" days were the 23d days of October and November.

Mr. Stearns remarked that the specimens were too imperfect to determine their true relations; the fragments appear to be portions of marine worms allied to the *Nereidæ*, and which resemble the terrestrial *myriapods*, of which the centipede was a common illustration.

Mr. Stearns, referring to the specimen of resin (amber?) from the Caroline Islands, which had been given to the Academy by Mr. Frink, said that the origin of Amber had caused a great deal of discussion; it is believed to be the fossilized resin of species of coniferous trees, allied to the pines; it must not be confounded with ambar or ambra, (*Ambarum griseum*) or ambergris, as the latter was of animal origin, being the product of the sperm whale, and found in its intestines; both *a-m-b-ĕ-r* and *a-m-b-ā-r* are sometimes found floating in the sea; the former on the coast of Samland, Prussia, and the latter in parts of the Pacific Ocean.

Notes on the High Sierra south of Mount Whitney.

BY W. A. GOODYEAR.

The following observations relating to the region south of Mount Whitney, and traversed by the Hockett Trail, between the Kern River and the eastern foot of the Sierra Nevada, were made during my trip with Mr. Belshaw into the mountains last July, when we climbed the supposed Mount Whitney, and discovered the mistake respecting it.

It is well known that at about the head waters of King's River, the summit of the Sierra Nevada forks into TWO GREAT RIDGES of nearly equal height and grandeur, which then extend far south-east toward Walker's Pass, though gradually diminishing in altitude after passing the summits of Mount Whitney and Kaweah Peak.

For a long distance the crests of these two ridges vary from ten to fifteen miles apart, and are separated from each other by the tremendous cañon of the Kern River, which lies between.

The culminating points of the eastern ridge are the Kearsarge Mountain, Mount Tyndall, Mount Williamson, Mount Whitney, the peak which has been mistaken for Mount Whitney, and a few other unnamed peaks. Those of the western ridge are Mount King, Mount Gardner, Mount Brewer, Kaweah Peak, etc.

The Hockett Trail crosses the summit of the eastern ridge at an altitude of probably a little over 11,000 feet, at a point nearly opposite the centre of Owen's Lake, and a few miles south-east of the peak which has been mistaken for Mount Whitney.

We followed this trail to the locality known as Soda Springs, upon the main Kern River, which here flows at an altitude of between 6000 and 7000 feet above the sea.

Throughout this section of the country, the mountains, so far as seen, consist entirely of granitic rock, with the exception of a single, isolated and somewhat remarkable cluster of volcanic outbursts, at an altitude of about 9000 feet above the sea. This cluster consists of four crater cones of moderate size, resting on the granite, and one basaltic lava-flow of considerable magnitude. The first of these outbursts seen in following the trail from Lone Pine, is some five or six miles east of the Kern River, and its altitude is probably a little over 9000 feet. It forms the whole western half of a hill some 300 or 400 feet high, and reaches to its summit; while the whole eastern half of the same hill is naked, solid granite. This outbreak seems to be small and local, being apparently but a few hundred yards in extent in any direction; its length north and south, however, being considerably greater than its breadth east and west. Its situation on the hillside is peculiar. It appears as if a short fissure had opened here in a northerly and southerly direction along the western slope of this hill, pretty well up toward its summit, and just enough material been ejected through it to cover the whole western half of the hill, without, however, sufficient explosive force to scatter it much in any direction.

About a mile to the south of this hill are two twin crater cones, which I did not visit, standing close together, and nearly equal in height.

Following along the trail, we find at the distance of about a mile westerly from the first hill mentioned above another crater cone, some 400 or 500 feet in height, and perfect in form except that a breach has been made in its north-east side and deepened nearly to its base. From the immediate vicinity of the base of this cone a lava stream has issued and flowed for some four or five miles in a nearly true west course, following the valley of a pre-existing creek to the main Kern River, where it now ends in a bluff facing the river, but high above its bed.

Appearances indicate that in this case the lava stream issued first, and that after it had ceased to flow, the cinder cone was piled up over it at the point of ejection, the completion of the cone finishing the eruption.

The valley followed by the flow was rather broad, and the quantity of lava was large, filling the bottom of the valley, spreading out in places to half or three quarters of a mile in breadth, and varying in depth from a few feet to two or three hundred feet at different points. The valley had a rapid fall toward the Kern River, and the bluff, which now forms the end of the flow, is 1500 feet or more below the point of issue.

This eruption is of very recent geological age, far subsequent in date to the great volcanic period which covered the northern Sierra with such vast quantities of eruptive matter; for, throughout the central counties of the State, this period was substantially closed before the excavation of the modern cañons began; while this eruption occurred very late in the history of the formation of these cañons. Yet, if we could determine the years that have passed, we should find it old enough as compared with the life of a man; for since it happened, the little stream whose bed it followed has not only cut through it here and there, but near its mouth has eaten its way two or three hundred feet deeper than before into the solid granite under it. How far down the cañon of the Kern River itself the flow may have originally extended it is impossible to tell; for the river, in deepening its own cañon, has here swept it all away.

For a considerable portion of the way where the bottom of the lava is now exposed, it rests upon heavy masses of calcareous tufa, previously deposited by mineral springs; and I noted, as an interesting fact which I do not pretend to explain, that at a point where I examined the tufa, in immediate contact with the overlying solid lava, I could detect no physical change in it, such as might have been expected from the heat to which it must have been exposed; but it appeared just like the same tufa in other places where the lava had not touched it. Neither shall I attempt to answer the puzzling question, *why* this little cluster of volcanic outbreaks should occur away up here, in the heart of the solid granite range, 9000 feet above the sea, and with nothing else volcanic, so far as I know, within less than thirty or forty miles of it in any direction. I only note the fact.

Another point of some interest is the fact that, though I hunted for them, I found no glacial scratches, nor any other evidence of the former existence of glaciers anywhere in this portion of the mountains; not even on the peak which has been mistaken for Mount Whitney, and which is over 14,000 feet high; nor on the top or sides of another peak which I climbed in the *western* summit, four or five miles northwest of Soda Springs, and which cannot be much less than 12,000 feet high; nor in the cañon of the Kern River—which I followed for four or five miles—nor anywhere I went, did I find any traces of glaciers. This is certainly somewhat remarkable, when we consider the fact that the mountains only twenty miles to the north, though no higher than some of these, are, according to all accounts, full of glacial markings. It is true that much of the granite in the region where I traveled is comparatively soft, and disintegrates rapidly from weathering; but this is by no means the case with all of it, and much of it is as hard, and as well adapted to preserve such markings, as any in the Sierra. The fact, therefore, of their general if not total absence from this region certainly means something. It does not, of course, prove that glaciers have never existed here, nor that they may not have existed here for a very long time; but it does argue that if they have, then, owing to some cause not yet explained, they disappeared from this region long before they did from the mountains a few miles further north.

The general character and appearance of that noblest portion of the Sierra, a few miles to the north of the peaks I climbed, have been already described in the Geological Survey Report and elsewhere; but no words can convey an adequate idea of its wild and majestic grandeur. It must be seen in order to be understood. I will only add, that its topography has never yet been worked up with anything like the accuracy of detail which is desirable for California's sublimest peaks, and it would be well if the Geological Survey had the means to send a party to spend a whole summer there, to do it.

In behalf of Mr. Edwards, who was absent, Mr. Stearns submitted the following:

Pacific Coast Lepidoptera.—No 3. Notes on some Zygœnidæ and Bombycidæ of Oregon and British Columbia; with descriptions of New Species.

BY HENRY EDWARDS.

I have brought together the following notes on species observed during a recent tour through Oregon, Washington Territory, and Vancouver Island, in the hope that they may prove interesting as regards the geographic range of the insects observed; while the new species described—which were collected during a somewhat hurried trip, and under many unfavorable circumstances—will serve to show the richness of the region traversed, and probably to call the attention of entomologists therein to a closer investigation of the many beautiful forms by which they are surrounded.

Fam. ZYGŒNIDÆ.

Alypia Sacramenti. Grote.

A fine specimen of this insect was taken by me at the Dalles, Oregon, in July, and another by Mr. G. R. Crotch at Lake Quesnelle, B. C., in August; so that it appears to have a far wider range than has hitherto been ascribed to it. I may add, that I again observed the habit cited by Mr. Stretch, in his "Bombycidæ of North America," of feigning death when captured. My present specimen had flown through an open door of a house in the town (no doubt attracted by some flowers in the window) and was found by me resting against the wall. Having no net with me, I placed a large pill-box under it, intending to shut it in; but, to my astonishment, before I could get the lid of the box above it, the insect fell backward into its prison, and lay as if dead until I reached my hotel, a distance of some three hundred yards. This habit is the more remarkable, as the other species of the genus are remarkably restless insects, taking flight at the smallest noise or other disturbing cause.

Alypia Ridingsii. Grote.

Four specimens taken near Cariboo, B. C., in May, by Mr. Crowley, who told me that it was quite common in that locality.

Alypia, sp.

In a small collection made by Mr. Crowley, in British Columbia, I noticed a very remarkable new species of *Alypia*, in which the hind wings were nearly wholly yellowish white, with very long fringes. The specimen was unset, and the case sealed up, so that I could not obtain access to it for the purpose of description.

Scepsis Matthewi, n. sp.

♂. Head dull black. Tongue chestnut brown. Palpi dull yellow, black at their tips. Antennæ bluish black, much longer than those of *S. fulvicollis*, with the pectinations larger and more distinct. Prothorax yellow, differing in tint in different individuals, and apparently fading with the age of the specimen. Thorax and patagia smoky drab, with a slight blackish tint in front. Abdomen bluish black above and below. Legs bluish black. Anterior wings perfectly opaque in fresh specimens, smoky drab, with a slight golden reflection. The costa is a very little paler, and the whole of the nervures are blackish, distinctly marked. Posterior wings, bluish black, with a broad longitudinal hyaline patch extending, in most specimens, through the whole extent of the wing, and even passing through the margin.

♀. Same as the ♂, but with the pectinations of the antennæ more simple, and the abdomen more robust.

Expanse of wings, 1.60 inch. Length of body, 0.55 inch.

Vancouver Island. August. Common.

The pale color of the upper wings, the length of the antennæ, and the more extended hyaline patch of the posterior wings, as well as the larger size of the entire insect, will serve to distinguish this species from *Scep. fulvicollis*.

It was taken in some abundance at Skinner's Bottom, near Victoria, by myself and my friend, Mr. Gervase Mathew, of H. M. S. *Repulse*, to whom I have great pleasure in dedicating it. Its habitat was the side of a lagoon overgrown with rushes. When disturbed, it flew slowly for a short distance, alighting again on the stems of the reeds, and was by no means difficult of capture. In this respect it differs exceedingly from *S. fulvicollis*, as that species, so far as my experience goes, has a rapid and continuous flight.

Fam. NYCTEOLIDÆ. H. S.

Sarrothripa Columbiana, n. sp.

Head dull white beneath, pale sea green above. Palpi dull white. Eyes brownish black. Antennæ brownish beneath, greenish white above. Feet wholly greenish white. Thorax pale sea green, with three black spots placed triangularly in front, and a large black blotch (in the center of which is a grayish green space) at the base. Prothorax velvety black, narrowly edged behind with sea green. Patagia sea green, blotched with white, with a double black line posteriorly. Abdomen smoky white, concolorous with the posterior wings.

Anterior wings pale sea green, indistinctly blotched with white toward the middle of the costa and the posterior margin. The velvety black markings, which give so beautiful an appearance to this insect, are very variable in their intensity; but the following may be regarded as their normal form. Central fascia much waved posteriorly, in its middle approaching the disc, and inclosing a clouded patch near the costa, which surrounds a deep black discal spot. Anteriorly, the central fascia is only slightly waved, very distinct on the outer edge, but shading to a black cloud on the inner margin. At the base of the wing are four more or less waved black lines, the two broad ones being most distinct, and the others broken up into irregular patches. Near the posterior margin is a notched line of black, which joins the central fascia on the interior margin, and on the posterior margin itself, is a row of nine minute angular patches, also velvety black. Fringe gray, mottled with sea green.

Posterior wings, smoky white, clouded toward the outer margin, which has occasionally some faint black lines at the base of the fringe. Fringe smoky white.

Expanse of wing, 1.10 inch. Length of body, 0.40 inch.

The ♀ is a little larger than the ♂, but is in every other respect quite similar.

Victoria, V. I., at rest on palings. August. Not rare.

I at first thought that this insect might be one of the numerous varieties of the European *S. Revayana*, but a comparison has convinced me that they are distinct. The present species may be known by its beautiful pale but rich sea green color, by the distribution of the markings of the thorax, and by the greater width and more rounded apices of the fore wings. It does not appear to be rare, though its habit of sitting in close proximity to lichens resembling it in color renders it liable to be overlooked.

Fam. LITHOSIDÆ. H. S.

Lithosia candida, n. sp.

Head and thorax silvery drab. Antennæ and palpi chestnut brown, whitish at base. Eyes large, black, with white reticulations. Abdomen silvery white, above and below. Feet smoky. Anterior wings clear silvery white, with a very faint yellowish tinge on the costa. Posteriors dull creamy white, slightly smoky toward their costal margins.

Under side, with the whole of the anterior wings and the costal margins of posteriors, smoky. Fringes white throughout.

Expanse of wings, 1.45 inch. Length of body, 0.55 inch.

This beautiful species was taken by me at a gas-lamp, in Victoria, V. I., in August. It is abundantly distinct from any North American species known to me.

Clemensia irrorata, n. sp.

Head, thorax, patagia, and abdomen, chalky white, with a few grayish brown hairs. Antennæ white, brownish at their tip. Palpi yellowish brown at base, black at their tips. Anterior tarsi with blackish patches, remainder of feet and legs chalky white. Anterior wings cream white, covered over the entire surface with black irrorations. Along the costa are six well-defined sub-triangular patches, brownish black, almost equidistant, the basal one being the smallest. On the posterior margin are also seven equal brownish spots, the apical and middle one of which extend into the white fringe. At the base are two indistinctly waved lines of brownish black, two others near the middle extending from the costa to the median nerve, a brownish discal patch, and some irregular brownish blotches, toward the apex and posterior margin. On the first dorsal nerve are three small brownish spots. Posterior wings smoky white; fringes white, blotched with brown on the anterior angle.

Under side. Anterior wings smoky, darkest toward the costa, with some fawn-colored blotches toward the apex.

Posteriors smoky white, with a tuft of fawn-colored hairs on the anterior margin, and a small clouded discal spot. Margins of both wings with an interrupted black line.

Expanse of wings, 0.85 inch. Length of body, 0.25 inch.

Victoria, V. I.

Taken at rest on trunks of pine trees, by myself and Mr. G. R. Crotch, in August. This is now the third species known of this interesting genus. *Clemensia albata*, Pack, is somewhat common in the Atlantic States. *C. umbrata*, Pack. is known only through a unique specimen taken by myself at Congress Springs, Santa Clara County, which was, unfortunately, destroyed in its passage through the post from Dr. Packard's hands to mine. Luckily, however, an excellent drawing of it was obtained by Mr. R. H. Stretch, which has appeared in his "Bombycidæ of North America," and will serve to keep the species in remembrance until its capture can be again recorded. Our Coast will probably furnish other species, which may be sought for in pine woods, sitting on the trunks of trees during the day.

Fam. ARCTIIDÆ. H. Sch.

Epicallia virginalis. Bdv.

Apparently abundant in Oregon and Vancouver Island. I saw many specimens in the collections of Mr. Cox and Mr. Harvey, of Victoria, and took a few fine specimens in Portland, Oregon, in July, when it flew in some numbers about the streets of the city.

Epicallia guttata. G. and R.

This form, which, according to the observations of Mr. Stretch and myself, can only be regarded as an extreme variety of *E. virginalis*, was taken by me in both the above localities, equally common with the typical form, and manifesting precisely the same habits.

Leptarctia. Stretch.

I saw three distinct varieties of this genus in the small collection of Mr

Harvey, of Victoria; but I am unable to say to what species they belong, as I could not obtain them for comparison.

Arctia Americana. Harr.

During my stay in Victoria, I took four specimens of this beautiful insect, and examined five others, all of which were distinguished by the white margins of the prothorax and patagia, and by the absence of black spots on the sides of the abdomen.

Arctia achaia. Bdv.

Rather common in Portland, Oregon; coming freely to light, and not unfrequently found at rest on walls and palings.

Arctia, sp.

A very beautiful species of this genus—in which the male has stone-colored markings to the hind wings, like *A. Quenselii,* and the female bright orange patches—is not uncommon in May, in Victoria; but I could not obtain a specimen for description.

Other *Arctias* will probably be found in the regions treated of; one exquisite species recently described by Mr. Stretch as *A. superba,* having been taken at Esquimalt, V. I., by Dr. Bremner, of H. M. S. *Zealous,* and by him kindly presented to me.

Leucartia acræa. Pack.

Seven specimens taken at gas-lamps, in July, at the Dalles, Oregon.

Pyrrharctia Isabella. Pack.

A fine ♂, in no respect differing from my specimens from the Atlantic States, taken at Portland, Oregon, in July.

Spilvosoma virginica. Walk.

Eleven specimens, at Portland, Oregon, in July, presenting very slight variations among themselves in the number and size of the black spots.

Hyphantria textor. Harr.

Two ♀ taken on the wing at Portland, Oregon, in July.

Halesidota Agassizii. Pack.

I found two specimens of the larva feeding, as usual, upon willows; and saw in a small collection, in Victoria, two examples of the perfect insect.

Halesidota argentata. Pack.

Two fine ♂ of this beautiful species were taken in the streets of Victoria during my stay.

Antarctia punctata. Pack.

Not rare in Oregon. I saw several specimens, of as many varieties, in a small collection belonging to Mr. O. Johnson, of Portland.

Phragmatobia, sp.

A specimen in the collection of Mr. Cox, of Victoria, certainly in no respects different from the European *P. fuliginosa.*

Fam. EPIALIDÆ. H. Sch.

Epialus modestus. Hy. Edw.

A specimen taken by Mr. G. R. Crotch, near Gold Stream, V. I., and by him kindly added to my collection.

Fam. LIPARIDÆ. Bdv.

Orgyia badia, n. sp.

Egg. Ovate, flattened at the upper end, chalky white, with dark spot at the apex; attached in large masses, and surrounded by the hairs from the body of the mother.

Larva. ♂. Deep velvety black, with a double dorsal yellowish stripe on the three posterior segments. From the head spring two black plumose series of hairs, and one of the same description form the posterior segment. On the dorsal region are four shorter plumes of hairs, dark buff, shaded with brown, and behind these are two naked scarlet tubercles. The rest of the body is covered with long yellow spines on the sides of the dorsal plumes, springing from scarlet tubercles, and near the lateral region are four yellow tubercles, below which is a slightly waved interrupted stripe of bright yellow. Head black, shining. Under side smoky. Feet and prolegs yellow.

. Same as the ♂, but larger, and with the plumose tufts much shorter.

Food plant, *Rubus* of various species. Fully fed in the early part of August, spun their web from the 4th to 11th, and the perfect insects emerged from the 18th to 30th.

Imago. ♂. Head, thorax, palpi, and antennæ chestnut brown. Abdomen with a blackish tinge. Feet and legs fawn color, the anterior tarsi banded with brown.

Anterior wings rich deep chestnut, with a rather broad band of pale yellowish brown crossing them near the middle, attaining its greatest width anteriorly. Near the posterior angle is a well defined clear white spot. Fringes dark brown. Posterior wings rich chestnut, a little paler towards the base. Fringes bright chestnut. Under side entirely rich chestnut brown, with a darker blotch toward the anterior margins.

Expanse of wings, 1.30 inch. Length of body, 0.50 inch.

♀. Entirely light drab. Wings rudimentary. Tarsi pitchy.

Length of body, 0.60 inch.

Victoria, V. I. Quite common about the streets of the city, where it appears to take the place of *O. antiqua* of Europe.

Fam. BOMBYCIDÆ. Bdv.

Clisiocampa. Curtis.

I obtained four species of this genus; three from Oregon, and one from Vancouver Island, all of which appear to me to differ from our California species. A monograph of the group is much needed.

Fam. SATURNIDÆ. Bdv.

Telea polyphemus. Hbn.

Apparently not rare in Vancouver Island. I detected some seven or eight specimens in the small collections of Messrs. Cox and Harvey. This insect, though one of our Pacific Coast varieties, has nevertheless a wide range. I have seen specimens from Victoria, northern and middle California, San Diego, Cape St. Lucas, and San Blas, Mexico.

Pseudohazis eglanterina. Bdv.

Rare in Vancouver Island, abundant on the main land near New Westminster, and not rare at Portland, Oregon.

Fam. DREPANULIDÆ. Bdv.

Drepana siculifer. Pack.

Two specimens, ♂, ♀, in all respects agreeing with the California form described under the above name by Dr. Packard, were taken by Mr. Crotch in Vancouver Island.

Fam. NOTODONTIDÆ.

Lacinia expultrix. Grote.

One specimen exactly agreeing with those sent me by Mr. Graef, and taken by that gentleman in New Jersey, was obtained by Mr. Crotch near Cariboo, B. C.

Fam. CYMATOPHORIDÆ. H. Sch.

Thyatira derasa. Brd.

Some time since, Dr. Behr gave me a specimen of this insect from Alaska, and I myself took a solitary example in the streets of Victoria. Our specimens are rather smaller than those in my cabinet from Europe, and have a more rosy tint on the upper wings; but the difference is not sufficient even to hint at the existence of a second species.

Cymatophora improvisa, n. sp.

Head gray with a rosy tinge, palpi short, dark brown, black at their tips. Antennæ light chestnut brown, whitish above. Tibiæ and tarsi light brown, banded with black, with a rosy hue at their base. Thorax and prothorax velvety black. Patagia gray. Abdomen olive gray above and below, tip rosy.

Anterior wings rich olive brown, with a yellowish-green blotch at the base, and an oblong one at the apex, which latter rests on a narrow waved line of the same color running to the interior margin. Central fascia smoky gray, broadest toward the costa, and much notched anteriorly, the brown spaces on each side being traversed by several indistinct waved black lines. On the costa toward the apex are some minute rosy streaks directed toward the center of the wing. Posterior margins with a row of velvety black, lunate marks. Fringes rosy gray. Posterior wings very glossy, with a rosy hue, and a row of indistinct lunate black marks along the margin. Fringes rosy gray. Under side dull smoky gray, darker toward the margins, with a waved brown line across the middle of the lower wings.

Expanse of wings, 1.60 inch. Length of body, 0.65 inch.

From chrysalis found under a log at Cascades, W. T., in July. The moth emerged in September. The chrysalis was a bright chestnut brown, enclosed in a thin web, with which a large number of particles of sand had been incorporated.

LIST OF NEW SPECIES.

Scepsis Mathewi,....................................Vancouver Island.
Sarrothripa columbiana,.............................Vancouver Island.
Lithosia candida,...................................Vancouver Island.
Clemensia irrorata,.................................Vancouver Island.
Orgyia badia,.......................................Vancouver Island.
Cymatophora improvisa,..............................Washington Territory.

Mr. Dameron made a few remarks on Fish culture, and the ova and young of Salmon.

The Secretary read the minutes of the meeting of the Trustees relating to their action in accepting the deed of James Lick (of date October 3d, 1873), which deed was read in full at said meeting; the Secretary then read to the Academy the following deed:

This Indenture, made and entered into this, the third day of October, A. D., one thousand eight hundred and seventy-three, between James Lick, of the County of Santa Clara, State of California, party of the first part, and the "California Academy of Sciences," a corporation formed and existing under the laws of the State of California, and having its principal place of business at the City and County of San Francisco, the party of the second part.

Witnesseth: Whereas, said party of the first part, heretofore executed and delivered to the party of the second part, a certain deed, dated on the fifteenth day of February, A. D., 1873, which said deed was duly recorded in the office of the County Recorder, of the City and County of San Francisco, on the twentieth day of February, A. D., 1873, in Liber six hundred and ninety-six of deeds, on page three hundred and sixty-four, which said deed conveyed the following described piece or parcel of land, situated in said City and County of San Francisco, State aforesaid, circumscribed by a line commencing at a point on the southeasterly line of Market Street, distant one hundred and ninety-five feet southwestward from the southwesterly corner of Market and Fourth Streets, and running thence southeasterly, and parallel with said Fourth Street, one hundred and ninety-five feet; thence southwesterly, at an angle of forty-five degrees, to a point two hundred and seventy-five feet from said southeasterly line of Market Street, which last mentioned point constitutes the southwesterly corner of the hundred-vara lot hereinafter mentioned: thence northwesterly, and parallel with said Fourth Street, two hundred and seventy-five feet to said southeasterly line of Market Street; thence northesterly, and along said last mentioned line of Market Street, eighty feet to the point of commencement, said parcel of land being a portion of that certain lot of land laid down, and commonly known upon the official map of said City of San Francisco, as hundred-vara lot number one hundred and twenty-six.

Now, therefore, in consideration of the premises, and of the respect and esteem said party of the first part has, and bears to the said party of the second part, and the desire of the said party of the first part to further promote the prosperity of the party of the second part, and for the benefit of the sciences in general, and in order to relieve the said party of the second part from all the terms, provisos and conditions contained in the said deed, and of all disabilities, if any exist: Hath granted, given and conveyed and confirmed, and by these presents, doth give, grant and convey and confirm unto the said party of the second part, all the lands and premises described in said deed, hereinbefore mentioned, reserving and excepting out of said granted premises, all buildings, tenements and improvements of any of the tenants of the said party of the first part, that now are, or may be situated thereon, at the time when said party of the second part shall be entitled to the possession of said premises, and excepting and reserving from this grant and conveyance, the right to possess, use and occupy said premises, until such time as the party of the second part shall become entitled to the possession thereof, as hereinafter provided for, which right of possession, as aforesaid, said party of the first part hereby reserves unto himself, his heirs and assigns.

To have and to hold, all and singular, the premises hereby given, granted and conveyed unto said party of the second part and its successors, upon the following terms and conditions, subsequent nevertheless, which terms and conditions subsequent shall be binding and obligatory upon said party of the second part and its successors, that is to say:

First—That said premises shall never be encumbered by said party of the second part, or its successors, and shall never be allowed or suffered by said party of the second part, or its successors, to be sold for any taxes, assessments, or other charges levied or placed, or suffered to be levied or placed, thereon by the said party of the second part.

Second—That said premises shall not be alienated by the said party of the second part, or its successors, during the lifetime of any of the existing members of the said party of the second part.

Third—That said party of the second part, or its successors, shall never lease said premises, or any part thereof, or any edifice or part of any edifice erected, or to be erected, thereon; and said party of the second shall never permit or suffer any person to possess, use, or occupy the whole or any part of said premises, or any edifice, or any part of any edifice erected, or to be erected thereon, for any religious or political purpose, nor save for the proper purposes of said society, and for which it was organized, and has been heretofore conducted, but nothing herein contained shall be so construed as to prevent the said party of the second part from letting, temporarily, any hall or room in such edifice, for literary or scientific lectures, or as a depository for the exhibition of paintings, sculpture, and other works of art.

Fourth—That said party of the second part shall, within a reasonable time from the execution and delivery hereof, erect and forever maintain upon said premises an edifice of the description hereinafter mentioned, which shall cover all of said premises, except that portion thereof hereinafter described, which shall be devoted to the purposes of furnishing light and ventilation to said edifice.

Fifth—That said party of the second part shall erect upon said premises, except that portion thereof hereinafter described, a substantial and elegant brick edifice, three stories in height, with a substantial marble or free stone front, faced with designs and emblems appropriate to and for an edifice devoted to the use and for the benefit of Science. The structure and design of the edifice shall be classic, and such as will readily distinguish it from buildings used for business or commercial purposes. The style of architecture of said edifice shall be chaste and appropriate, and the same style and order of architecture shall be preserved throughout in its purity and with regularity.

Sixth—That at least one apartment of said edifice shall be constructed suitably for, and devoted to the purposes of a Library, and another apartment thereof shall be constructed suitably for, and devoted to the purposes of a Museum, and a third apartment thereof shall be suitably constructed for, and devoted to the purposes of a Hall of Lectures.

Seventh—That the following portion of said premises shall never be built upon, but shall forever be kept for the purposes of affording light and ventilation to said edifice, that is to say, all that portion of said parcel of land in said deed hereinbefore mentioned, particularly described, circumscribed by a line commencing at the most southwesterly corner of said hundred-vara lot, numbered one hundred and twenty-six; thence running northeasterly, and parallel to said Market Street fifty feet; thence northwesterly and parallel with said Fourth Street fifty feet; and thence running at an angle of forty-five degrees southwesterly to the point of commencement.

Eighth—That said premises shall be used and devoted (subject to the right of lease hereinbefore mentioned), solely and exclusively for the purposes of the incorporation of the party of the second part, and for none other. That said edifice hereinbefore mentioned shall be commenced and completed as soon as practicable after the necessary funds for the erection thereof shall be furnished to, or obtained by, the said party of the second part; and whenever said funds shall be so furnished or obtained, and the said party of the second part shall be ready to proceed with the erection of said edifice, it shall give written notice to the said party of the first part, or his executors, and at the expiration of thirty days after such written notice, the said party of the second part shall be entitled to the possession of said premises, and the right of possession of said premises, hereinbefore reserved to the party of the first part, his heirs or assigns, shall cease and determine; provided, however, the said party of the second part shall commence the erection of the said edifice within ten years from the date hereof; else these presents shall, as to said second party, be absolutely void.

Ninth—That if the said party of the second part, or its successors, shall violate or fail to fulfill any of the foregoing terms or conditions subsequent, then and immediately thereafter, the estate and all interest given and conveyed as aforesaid, shall cease and determine—in which event, the said party of the first part, does hereby give, grant and convey the said premises and appurtenances unto the State of California, party hereto of the third part, in consideration of the love, esteem and desire to promote the general good of the said party of the third part, by the said party of the first part, to have and to hold forever; expressing the hope, but not imposing the condition, that the law-making power will devote the same to such uses and purposes as will best promote the objects and designs indicated by the articles of association and incorporation of the party hereto of the second part, and this and the said deed hereinbefore described.

In witness whereof, the said party of the first part, has hereto set his hand and seal, the day and year first hereinbefore written.

Signed, sealed and delivered in presence of Samuel Hermann.

JAMES LICK. [SEAL.]

STATE OF CALIFORNIA,
CITY AND COUNTY OF SAN FRANCISCO, } *ss.*

On this third day of October, A. D. 1873, before me, Samuel Hermann, a Notary Public in and for the said city and county, duly commissioned and sworn, personally appeared James Lick, known to me to be the person whose name is subscribed to the within and foregoing instrument, and he, the said James Lick, duly acknowledged to me that he executed the same.

In witness whereof, I have hereunto set my hand and affixed my official seal the day and year in this certificate first above written.

[L. S.] SAM'L HERMANN,
Notary Public.

Endorsed—Recorded in the office of the County Recorder of the City and County of San Francisco, October 14th, 1873, at 45 mins. past 1, P. M., in Liber 718 of Deeds, page 387.

A. R. HYNES,
County Recorder.

Per RICHARD D. BLAUVELT, JR., Deputy.

On motion of Dr. George Hewston, the action of the Trustees and also the above deed was unanimously accepted and approved.

REGULAR MEETING, NOVEMBER 17TH, 1873.

President in the Chair.

Forty-two members present.

William Harney, T. H. Blythe, M. W. Belshaw, G. L. Murdock, M. D., Newton Booth, William Murray, Joseph Perkins, and W. H. Moor were elected resident members; L. L. Robinson, life member, and W. M. P. Martin, D. D., LL. D., and S. W. Williams, LL. D., both of Pekin, China, corresponding members.

Donations to Library: Horti Elthamensis Plantarum Rariorum, etc., in two volumes, large 4to, half-bound (1774); also, Florilegium Amplissimum, etc., by Emanuele Sweertio, Autore, etc., large 4to, hf. bd., published in 1612–14, two rare old works, presented by Thomas C. Lancey. Monographie der Scydmaeniden Central-und Südamerika's von Dr. L. W. Schaufuss, small 4to, muslin, Dresden, 1866, presented by S. A. L. Brannan. Cabinet-Photograph-Album, turkey-mor., a gift from A. Roman & Co.

Donations to Museum: Crustaceans from San Diego, by Henry Hemphill. Specimens of Scorpions from Panama, by S. A. L. Brannan. Sample of granulated Beet Sugar made by the Sacramento Beet Sugar Company, from Robert E. C. Stearns. Two photographs of Hieroglyphics from Easter Island, presented by

Thomas Croft. Echini shells, from Mrs. William Shelley. Specimen of Piano wire that has been used in deep sea soundings, from Commander George E. Belknap, U. S. N. Specimen of fossil Fish from Sidney Station, U. P. R. R., presented by Oliver Eldridge. Piece of Beeswax from the wreck of a Japanese junk on the California coast, south of the Columbia River, by James S. Lawson. Specimen of Coal found at Cook's Inlet, Alaska Territory, presented by Captain Fisher, of whaling bark *Alaska*. Head of a Fish found on beach at Neeah, W. T., from William J. Fisher. Boots of dressed sealskin, Eskimo, of Cape Prince of Wales; Moose skin Shirt, Indians of Upper Yukon; Bar of native Copper from Indians of the Upper Tananah R., Yukon district of Alaska, presented by Major J. H. Simpson, through D. J. Staples.

Professor Davidson exhibited the Photographs of Hieroglyphics sent to the Academy by Mr. Thomas Croft, of Papeete, Tahiti. They were accompanied by a letter stating that these photographs were taken from the two sides of a thin block of wood, sent from Easter Island, latitude 27° 08′ S., longitude 109° 17′ W., to the Roman Catholic Mission at Tahiti. Some years ago the priest at Easter Island sent to the Bishop at Papeete, as a curiosity, some cord made of human hair, wound around a flat piece of wood about three inches wide and eight inches long, but jagged at the end as if it had been broken. This bore marks of age, decay, and hard usage. After removing the hair cord, it was found to be completely covered with beautifully cut hieroglyphics, which, from their regularity in lines, were evidently intended for the purpose of a written language. Subsequently five other blocks were obtained, but with different legends thereon, and bearing evidence of different ages. The Bishop, Monseigneur F. T. Janssen, has ascertained that these characters have, until lately, been taught to a few favored persons, and the knowledge of them transmitted through the heathen priests and rulers to their successors. The last King of Easter Island who was familiar with their meaning was Maurata, seized with others, in 1863, by the Peruvian brig *Mercedes*, and carried to Callao, and sold into slavery.

It is easy to trace the manner in which the reading of these hieroglyphics is effected. Commence at the left and read along one line, and then turn the block end for end, and commence the next line at the left, etc.—thus:

CALIFORNIA
ACADEMY
OF SCIENCES.

He said that he would write to Mr. Croft and the Bishop to obtain photographs of the other blocks, and endeavor to get one for the Academy; and also reminded the Academy of former communications from Easter Island in relation to the large statues, causeways, and other signs of a prehistoric civilization on this small island in the South Pacific, and quoted extracts from Jacob Roggewein's voyage there in 1721, where the statues are referred to, the large stature of the people, and the presence of white men as priests among them. He hoped that some of our citizens would furnish funds to have a thorough examination made of the prehistoric remains upon this island.

On Further Examinations of the Amaknak Cave, Captain's Bay, Unalashka.

BY W. H. DALL, U. S. COAST SURVEY.

I brought before the notice of the Academy, last winter, some facts in relation to the exploration of a cave containing prehistoric remains, situated on Amaknak Island, in Captain's Bay, Unalashka, Aleutian Islands.

Further examinations this year have developed still more interesting results. The removal of a bed of 18 or 20 inches of mould, chiefly decayed organic matter, which contained the human remains and implements described in my previous paper, revealed a bed of shingle similar to the beach shingle of the adjacent shore, and which we then supposed to be the natural bottom of the cave.

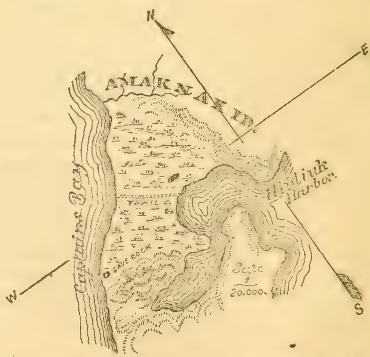

FIG. 1.—Reduced chart of the locality of the cave, showing the low isthmus between the higher portions of the island north and south.

This year, however, we ventured to remove a portion of this shingle, and to our surprise found a further deposit underneath it containing prehistoric remains. We then proceeded to clean out the cave to the bed-rock underneath, excavating the entrance sufficiently to admit the light of day upon our work. This afforded the additional information that the whole interior of the cave had been daubed or painted over with a red pigment or chalky ore of iron.

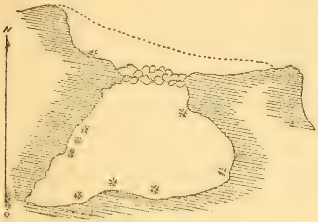

FIG. 2.—Horizontal section of the cave, showing the wall across the entrance. The asterisks show the positions of the skeletons in the upper stratum, and the dotted line the extent of the rock overhanging the entrance.

The upper stratum, removed the previous year, was from 18 to 25 inches in depth, and consisted of a fine brown mould, evidently resulting from the decay of animal and vegetable substances which had been deposited there. The remains found were scattered, or in groups on the surface, or covered by the mould. All the crania not decayed had been removed before we examined the cave in 1872. Below this was a stratum of shingle in beach-worn pebbles, weighing from a few ounces to several pounds, which had every appearance of having been deposited by water. The mouth of the cave is only a foot or two above the level of the highest part of the sea beach a few rods off, which is exclusively composed of similar shingle.

Below this we found a layer of six inches or less in thickness, of refuse material, the remains of repasts on marine animals, shell-fish, fish and echini. Scattered irregularly through this were broken and worn implements of quite a different character from those found with the dead. The cave is situated on an isthmus, across which from time immemorial has been a portage over which canoes were carried on the journey from one village to another; this cut-off saving a pull of several miles. From its dampness the cave could hardly have been used as a dwelling place, and the inference is that this deposit was the refuse of parties who, unable to launch their canoes into the heavy surf on the shingly beach, were obliged to camp in the vicinity and await calmer weather before continuing their journey.

Below this stratum was another bed of mould of organic origin, about two feet in its greatest depth, in the middle of the cave. Here, surrounded by a rough sarcophagus, built of the jaws and ribs of whales, we found three skeletons in a very fragile and almost decayed condition. Around these were found an abundance of implements, especially stone knives, similar to those found in the uppermost stratum, and described in my first paper. Then came the bed of the cave, a somewhat concave and irregular surface of soft porphyritic rock.

I believe these skeletons to be the oldest yet discovered in this region, though not approaching the Table Mountain or Neanderthal crania in antiquity. First the cave was used as a burial place for the three skeletons. Then over these two feet of mould accumulated by decay of animal matter and of rubbish, perhaps brought in by foxes for their nests, or rarely finding an entrance through the contracted aperture of the cave. This must have taken a long time. The great antipathy of these natives to approaching a burial place, not to say using it as a camping ground, leads to the belief that this use of the cave for interments must have passed out of the memory or tradition of the natives of the region before its occupation as a temporary camp could have commenced. Then the six inches of débris from the repasts of occasional visitors must have accumulated very slowly. It will be necessary to bear in mind that the cave is not open to the air in such a way as to admit the wind or rain, and the shingle of which the isthmus is composed is too porous to form a channel by which stuff might wash into the cave, even had its cavity been lower than the surrounding ground, which it is not.

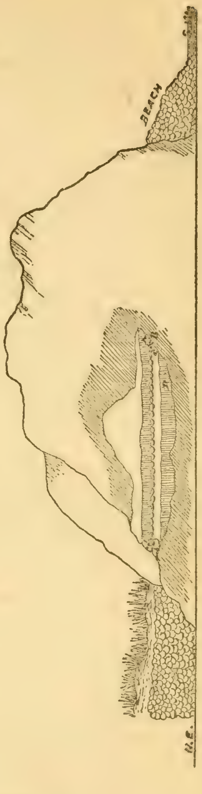

FIG. 3.—Vertical section of the Amaknak Cave, showing the rock, the beach southwest of it, and the flat isthmus formation northeast of it. A, upper stratum of brown mould. B, layer of shingle or beach-worn stones. C, stratum of "kitchen refuse," shells, etc. D, lower stratum of organic mould with skeletons.

Then it would seem as if some unusual storm, tidal or earthquake wave, was instrumental in forcing a layer of heavy shingle stones into the cave from the adjacent sea beach. After this had been accomplished, the use of the cave must again have been as a refuge for the dead, and the length of time this has been going on cannot have been small, from the number of remains of separate individuals discovered by us, and the great depth of the accumulated mould.

All the material found herein is of a date coëval with or antecedent to the earliest Russian navigators, nothing whatever bearing the impress of the more modern tools or methods introduced with the first rude efforts of civilization. About this time, to avoid the desecration of their burial place, or for some other reason, the mouth of the cave was walled up. On the arrival of the Americans in the Territory, some one heard of a tradition connected with this singular and isolated rock, which rises like a tumulus from the level surface of the isthmus. A fox had forced a passage into the cave and used it as a lair. It was then opened, and a few crania and some implements which lay upon the surface were removed by curiosity hunters.

The natives, who still retain some of their old superstitious feeling about the burial places of their ancestors, are said to have secretly removed and buried the few remaining relics of humanity which were exposed to view. M. Pinart, the ethnologist, after a casual glance at the cave, satisfied himself that it contained nothing, and then informed me of the locality, and the results of my examination have been detailed in my previous and present papers.

In my first paper I remarked upon some other caves on the island of Unga, and figured some wood carvings from one of them. These caves had been well ransacked by curiosity hunters, including M. Pinart, who carried off the better preserved and more accessible crania and carvings before we had an opportunity of visiting it in 1872. A storm interfered with our operations on that occasion, and we were obliged to leave the cave with only a handful of the collections we had extracted from its recesses. On revisiting it this year we found everything as we had left it in 1872, and proceeded to clean it out thoroughly, as well as several others which we discovered near by. We succeeded in obtaining a rich harvest of carvings, fourteen well preserved crania, and various remains of mummies. These had been so injured by dampness as to afford only fragments and pieces of exquisitely woven grass matting, in which—and in otter and fox skins—they had originally been enveloped, and then suspended in cases similar to a hanging cradle.

We obtained in the Islands this year thirty-six strictly prehistoric crania, and one of later date, several hundred bone, ivory, and stone implements, at least three hundred carvings of wood, most of which had been gaily painted with mineral earths of red, blue, green, white, and black colors.

We obtained evidence of the existence of large and flourishing communities numbering thousands of inhabitants, where now none, or only small remnants of population exist.

Underneath the old villages were found still more ancient kitchen-heaps of echini, fishbones, and edible shell-fish, many feet in thickness; the age and time taken in forming them hardly to be approximated or counted even in centuries. It is only in the upper strata that we find the indications of progress in hunting and fishing, afterwards so notable that even the sperm whale succumbed to the attacks of these hardy canoe-men. Their progenitors were content to pick echini from the shore and mussels from the rocks, and hardly any implements could be found in the refuse of their repasts, the accumulation of centuries. After them large villages of solidly constructed houses rose; and probably at the height of their progress and numerical increase, the almost equally barbarous Russian of Siberia fell upon them, and almost swept them from the face of the earth. Even under Russian influences they continued to advance until more than half civilized, and it has been reserved for Americans to deny them schools, laws, or protection, and to cast them on the tender mercies of unscrupulous traders.

On Nickeliferous Sand from Fraser River.

BY JAMES BLAKE, M. D.

This sand, which was obtained in the gold washings on Fraser River, has very much the appearance of small particles of iron pyrites, being of decidedly a yellowish color. Under the microscope it is found to consist of two distinct substances, one of which is evidently magnetic oxide of iron, or the common black sand of our gold deposits; the other is of a yellow color, in the form of small scales, without any well marked crystaline structure, and the edges of which have been rounded by abrasion. The whole of the sand is strongly magnetic, so that with the exception of a few scales of gold, it contains nothing that is not taken up by the magnet. An analysis of the sand shows that it contains nothing but the oxides of nickel and iron. 0.9153 grains of the sand yielded 0.256 sesquioxide of iron, and 0.6548 oxide of nickel, which would give, supposing the iron to be in the state of magnetic oxide 0.231 of oxide of iron, and if we suppose an analogous oxide of nickel to exist we should have 0.702 of the magnetic oxide of nickel.

Thus making 0.931 instead of 0.9153 the quantity used, the excess of 0.016 being undoubtedly due to the nickel, from the difficulty of freeing it completely from the potash with which it is precipitated.

Although I can find no mention of such a compound of nickel, either in Watts' Dictionary of Chemistry, or in Dana's Mineralogy, yet I have no doubt that the form in which the nickel exists in this sand is an oxide with the composition $Ni^3 O^4$, analogous to the magnetic oxide of iron, $Fe^3 O^4$, thus establishing another relation between the compounds of nickel and iron. From the large proportion of it in the sand, fully 75 per cent., it is strange that its presence has not been before noticed.

On the Spontaneous Combustion of Hydro-Carbon Vapors.

BY I. C. WOODS.

During the years 1870–1871, and a portion of 1872, at the wood preserving works of which I am the manager, we had several instances of the spontaneous combustion, accompanied by explosions, of hydro-carbon vapors; some of the particulars of these accidents, and a statement as to the remedy I successfully applied, may be interesting to the members of the Academy, and useful to the public.

The hydro-carbon vapors we use for the preservation of wood are obtained by the distillation of coal tar. A brick pit is attached to each two stills, to hold the hot pitch product as it runs from them. This pit has an opening on the side for access, and a ventilating chimney through which the vapors from the pitch pass off into the atmosphere. The opening for access into the pit is closed by an iron door.

The tar we use is made at the gas works in this city. We use stills of 1,200 to 1,800 gallons capacity. In the progress of our work the still containing the coal tar is run until the thermometer on the top near the man-plate indicates a heat 420° Fahrenheit, when we cease firing. The still and contents are then allowed to stand and cool, until the same thermometer indicates a heat of 200° to 212° Fahrenheit. At this heat the liquid pitch is allowed to run from the still into the pitch pit. As it cools it becomes solid. From the time the thermometer in the still indicates a heat of 420° Fahrenheit, until and after the time of letting out the pitch, the cocks remain open in the vapor pipe connecting the still with the wood-preserving tank.

Until April, 1872, this letting out of the hot pitch was attended with danger of fire, because of the tendency of its vapors to spontaneous combustion. If running the still daily, such accidents would occur three or four times a year. The vapors from the pitch in the pit, as they passed out of the ventilating chimney, were yellow, being the vapors of the napthalin oil contained in the coal tar. The combustion would take place after the pitch had been running freely from the still for some minutes. It was always accompanied by an explosion, loud enough to be heard across the street, and powerful enough to force away the wooden braces placed against the iron door. Pieces of timbering in the pitch pit would take fire, and burn until extinguished.

From the time the fire is extinguished under the stills, to the time of letting out the pitch, there is always an interval of fourteen hours. The furnace of the still is always closed with an iron door, and clayed up. There is a strong draft up the chimney of the still.

The top of the ventilating chimney of the pitch pit is as high as that of the fire chimney to the still, and there is always a strong draft up this chimney through the cracks between the iron door and the brick work of the pitch pit. A person standing at the iron door would not smell any of the vapor of the pitch. The distance from the outlet of the pitch pipe of the still to the furnace door of the still, is not less than twenty-two feet. At the time of our last explosion, the furnace of the still had been carefully examined before the pitch was let out. No remains of fire were found there, nor was there any other fire in the building. The hour was 10 A. M., Sunday morning—the works not in operation.

This property of heated hydro-carbon vapors to spontaneously ignite after absorbing a certain quantity of atmospheric air, is not laid down in any work to which I have had access. A number of scientific gentlemen to whom I have mentioned the above facts, were as ignorant as myself of their having that property. The remedy I have devised, after experience, is simple and complete. It is the introduction of a small quantity of water into the pitch pit while the pitch is running from the still. The hot pitch vaporizes the water, the yellow vapor from the chimney is turned to white vapor, and the desired safety is obtained. Too much water must not be put into the pit at one time, or the pitch will boil over; not a dangerous but a troublesome result.

I had noticed that the hydro-carbon vapors would eat away, in holes, the seat and valve of composition globe valves; also, that whenever this took place, steam was liable to leak into the wood-preserving tank during the process of vaporizing the wood, and that whenever the steam did so leak, that the influence of the hydro-carbon vapors on the wood was destroyed. This led me to try with success the experiment of the effect of steam on the vapors of the pitch. Since April, 1872, when I first applied this remedy I have described, not a single explosion has occurred at our works. I apply the water through a half-inch iron pipe, connected with the Spring Valley mains, and regulated by a cock.

I have reason to believe that the vapors from a combination of coal tar and petroleum, are more liable to spontaneous combustion than the vapors from coal tar alone.

Mr. McChesney called the attention of the Academy to a conspicuous Indian mound existing near Oakland, about two and a half miles from Broadway Station, and about 300 feet from the water's edge. It was circular in form, about 175 feet in diameter, with sides sloping from 45 to 50 degrees; it is, so far as he had examined it, composed of shells and other debris, and was now covered with shrubbery. The upper surface was somewhat hollowed.

Mr. Dameron referred to certain mounds that he had examined near Alameda Point, and which contained stone implements, shells and bones.

The President stated that this is the condition of nearly all these mounds; but in many, skeletons are found in a sitting posture.

Mr. D. J. Staples said that he did not deem the little information he had to offer of much importance, unless the fact of witnessing burials in the winter of 1849–50 may aid in the solution of the question "Whether the bones found in these mounds are of prehistoric age?"

In the winter of 1849–50, on the Mokelumne River, fourteen miles northeast of Stockton, I witnessed the burial of several Indians, three of whom had died in one night from the effects of bad whisky. These were placed in the ground near the tents or houses occupied by the tribe, and burned in sitting position, surrounded by their personal property, consisting principally of beads, trinkets, etc., the graves being made in the depression of the rancheria where formerly stood a sweat-house. The following year I saw the same ceremony performed, on one occasion, at the same rancheria, and another time at a place some miles farther up the river. In my opinion, the reason for the Indians burying their dead so near the habitations of the living, is found in their indolence and filthy habits, and in part, perhaps, to the desire to often visit the graves of the departed. A number of mounds which I have examined on the Upper Sacramento and American Rivers, appeared to have been partially thrown up with the earth; and I am of the opinion that the Indians designed them to raise their brush huts above the encroachments of the spring floods. I feel quite confident that scientific men will not discover anything in the Indian mounds of California to connect them with a prehistoric age.

The President said, that up north the Indians seldom bury their dead near their homes. They sometimes put them in trees, sometimes in canoes, and sometimes in the ground. In Sitka, however, the graves are all very near the homes of the living.

Mr. Ellis called attention to a large mound in the southern part of the city. He said perhaps the Indians, being too indolent, had buried their dead where it was easiest to dig. As to the hollow in the center, they perhaps threw up dust around the edges to protect themselves from the wind.

Mr. Dameron said that in early days in the Sacramento Valley, they burned their dead. Perhaps the mounds were built to keep them from the floods.

Regular Meeting, Monday, December 1st, 1873.

President in the Chair.

Forty-one members present.

Henry Kimball, W. N. Lockington, S. P. Carusi, J. R. Scupham, and E. J. Fraser, M. D., were elected resident members.

Dr. C. M. Hitchcock, resident member, having paid the required sum, became a life member.

Donations to Library: U. S. Naval and Astronomical Expedition, 2 vols., 4to., Washington, 1855, presented by Mrs. Mary Swift. Revision of the Echini by Alex. Agassiz, 2 vols., 8vo., Cambridge, Mass., 1872, presented by Prof. Louis Agassiz. Proc. Acad. Nat. Sciences of Philadelphia, pp. 205–360, March–Sept., 1873. Catalogue of the Mollusca of Rhode Island, pamph., 8vo., by Horace F. Carpenter, Jan., 1873, from the author. Cal. Horticulturist, Nov., 1873, from publishers. Fifth Annual Report, Peabody Acad. of Science, for 1872, Salem, Mass. Bulletin of Buffalo Society Natural Sciences, pp. 129–184, 1873. Proceedings Royal Geographical Society, Vol. XVII, Nos. III, IV, V, London, 1873. Report of the U. S. Commissioner of Education for 1872, pamph., 8vo., Washington, 1873. American Naturalist, Oct. and Nov., 1873. American Chemist, Sept., Oct., and Nov., 1873. Societie Entomologique de Belgique, No. 91, 1873. Trans. and Proc. of the New Zealand Institute, Vol. V, 1872, Wellington, 1873. Canadian Naturalist, Vol. VII, Nos. 2–3. Engineering and Mining Journal, Vol. XVI, No. 16–21. Mittheilungen der Deutschen Gesellschaft, Yokohama, July, 1873. Nature, Sept. 18–Nov. 6, 1873. Am. Jour. Science and Arts, Oct. and Nov., 1873. Monatsbericht der Konig, Preuss. Akad. der Wissenschaften zu Berlin, Mai, 1873.

Additions by purchase: Popular Science Monthly, Nov., Dec., 1873. Journal of Botany, London, Oct. and Nov., 1873. Annalen der Physik und Chemie, Bands VI and VII, Leipzig, 1873. Annals and Magazine of Nat. History, London, Oct. and Nov., 1873. Astronomical Register, London, Oct., Nov., 1873. Journal of the Microscopical Society of London, Vols. 1–8, 8vo., mor. hf. bd.

Donations to the Museum: War-costume or armor of Japanese Daimio and attendant, presented by F. Castle, through Dr. George Hewston. Two specimens of a large Pinna, from Espiritu Santo, Lower Cal., by Capt. William Metzgar. Specimen of Coal from the Chase River seam, Nanaimo, B. C., presented by Comdr. Geo. E. Belknap, U. S. N. Specimens of Ferns from Norway, presented by Mrs. Emeline M. North. Three photographs of the Moon, by S. W. Shaw. Specimen of Fishing-dress worn by natives of the Fiji Islands, presented by Henry Edwards.

Remarks on the Genus Lilium.

BY H. N. BOLANDER.

The genus Lilium is represented in the State of California by the following distinct species, and several well-marked varieties:

1. Lilium Washingtonianum, Kellogg.
2. Lilium Humboldtii, Roezl.
    L. Bloomerianum, Kellogg.

3. Lilium Canadense, Linn.
var. *L. parviflorum*, Hook.
var. *L. pardalinum*, Kellogg.
var. *L. Californicum*, Hort.
4. Lilium parvum, Kellogg.

§. Bulbs ovoid, outer scales largest, fleshy, imbricated, lanceolate.

1. Lilium Washingtonianum, Kellogg,

Occurs on the Cuyumaca Mountains, in San Diego County, its most southern limit known at present; northward along the western slope of the Sierra Nevada, between 3,500 to 6,000 feet altitude; in Oregon to the Columbia River, and on the Coast Ranges north of San Francisco, especially in the eastern parts of Mendocino and Humboldt Counties. In all localities named, it occurs either on ridges or on lightly shaded slopes of ridges, having a porous loose soil, resting on a gravelly subsoil. At no time have I met with a plant of this species in a soil whose drainage was not perfect; and, when found on a slope, did not face towards some point between east and south. The pale, loosely-scaled, ovoid bulb is generally found at a depth of from twelve to twenty inches. The height of the stem, the number of whorls and flowers on a single stem, vary very much according to soil, exposition, and age of the bulb.

Much has been said about the difficulty of cultivating this beautiful species. I willingly confess that I have also met with many reverses, until I paid proper attention to its habits and habitats. If the bulb is planted at a depth of from eight to twelve inches in a loose, somewhat gravelly soil, having perfect drainage, there is no difficulty in obtaining satisfactory results. Although there is positively no specific difference between bulbs and plants, collected either on the Sierras or on the Coast Ranges, yet I found that bulbs from the Coast Ranges would always bloom more readily in San Francisco (in cool houses) than those from the Sierras. The reason is obvious; but it would be interesting to know if the same holds good at other places than San Francisco. The flowers are very fragrant, and change gradually from a pure white to various shades of purple or lilac; the purplish-red spots are rather minute. The figure given in Mons. Louis van Houtte's Flore (Vol. XIX.) is a very correct representation of this species.

2. Lilium Humboldtii, Roezl.
L. Bloomerianum, Kellogg.

This large species has apparently a far less wider range than the preceding. It occurs mainly on the more elevated portions of the foot-hills of the Sierras, from 2,500 to nearly 3,500 feet altitude, evidently requiring a greater amount of heat to develop its full size and beauty than the first-named species. The soils in which its bulb is found are of a rather compact nature, consisting of clay, with an admixture of broken rocks, and a small portion of vegetable mould. Growing in open park land or land entirely cleared off, and therefore exposed to a hot and burning sun, and surrounded by a dry and exsiccating air, we find its bulb also at considerable depth. Its ovoid bulbs are very large and strongly built; its outer scales are largest, imbricated, lanceolate, tinged with purple, and very fleshy, well calculated to hold a large supply of moisture.

A short time ago, this species was also found by Mr. Harford, on the island of Santa Rosa, opposite Santa Barbara. As far as I know, it has not yet been found on any part of the Coast Ranges belonging to the main land. The plant found on Santa Rosa island differs but slightly from that on the foot-hills of the Sierras. Its leaves are of a brighter green, acuminate, and its whorls are denser and more regular, while the leaves of plants from the Sierras are rather spathulate, and terminating blunt with a point; their green is also of a less vivid color. The former is exposed to sea breezes and fogs; the latter, to a dry and exsiccating air.

It may be stated in connection with the above remarks, that bulbs from Santa Rosa Island do far better with us here than those from the Sierras. The reason is plain.

The figure in the Flore of Mons. Louis van Houtte (Vol. XIX.) represents the Santa Rosa Island form as truthfully as a representation can be made.*

§. Bulbs rhizomatous, with short fleshy scales.

3. Lilium Canadense, Linn.
a. var. *L. parviflorum*, Hook.
b. var. *L. pardalinum*, Kellogg.
var. *L. puberulum*, Torr.
c. var. *C. Californicum*, Hort.
var. *L. Walkeri*, Wood.
var. *L. Hartwegii*, Baker.

The above enumerated varieties of this species demonstrate the influence of soil, location, and climate more forcibly than any other species of our lilies, because it is more generally distributed, and has a wider range throughout the entire State. It is, therefore, not to be wondered at, that so many excellent botanists described different forms of this variable species under so many different names.

a. The form of *L. Canadense*, var. *parviflorum*, Hook, occurring largely in boggy soil west of the great redwood belt, and on the immediate coast, presents even there differences in size and form, well calculated to lead astray. Here, wherever exposed to the daily continuous westerly winds, it attains hardly two feet in height, bearing often but a single small flower, of a deep red color, with the sepals but slightly recurved towards the tip; but wherever sheltered, either by trees or shrubbery, it attains a height of from three to five feet, bearing numerous flowers of a less reddish tint, and arranging its leaves, at least a part of them, in whorls; while those of the exposed plant are all scattered, and few in number.

* In the "Notes on Lilies and their Culture," by Messrs. Teutschel & Co., I find this species wrongly enumerated as one of the Canadense lilies. Its root is ovoid, not rhizomatous; nor does it ascend as high as Devil's Gate. What Roezl found there, was one of the *Canadense* varieties, and not *M. Humboldtii.*

This form extends along the immediate coast from Vancouver's Island to Oregon and California. This long linear extension and range is common to many plants of the immediate western coast.

b. Proceeding, however, eastward along a stream into the interior to a point where the coast climate changes gradually into that of the inland-coast valleys, and where an abundance of sunshine and shelter is added to that of moisture, we find the beautiful and charming form described by Dr. Kellogg under the name of *L. pardalinum.* Here, in deep recesses, on the banks of streams—in such favorable localities—the plant attains a height of from six to nine feet. Here its rhizomatous bulb ramifies and multiplies rapidly, forming clusters several feet in diameter. Stems shoot up side by side, from every terminating point of the ramifying or radiating bulb, giving the plant a gregarious appearance. Perhaps nowhere in this State is this gregarious character so well and plainly exhibited as in Bear Valley, on the Sierras, at an altitude of 4,000 feet, where acres of a wet meadow are densely covered by this magnificent form. The whorls are here usually broken up, and the large leaves are indefinitely scattered all over the huge stems, which are variously branched, bearing numerous flowers, with strongly recurved perianths of a bright yellowish-red color, copiously spotted with purple spots on the face.

But if we proceed from the inland coast valleys farther eastward, and enter the large valleys of the interior, where the climate is hot and the air dry, we soon lose sight of this plant, even on the banks of streams. Crossing the valleys and ascending the foot-hills of the Sierras, to an altitude of from 2,500 to 4,000 feet, we meet it again, in all its glory, in wet localities.

Growing in wet, boggy soil, mostly subject to overflowing at some time during the year, its bulbs are imbedded but a few inches beneath the surface of the soil. At San Francisco it blooms readily in cool houses.

c. The next marked form *L. Californicum*, Hort, (*L. Walkeri*, Wood ; *L. Hartwegii*, Baker ; *L. puberulum*, Torr.), differs very strikingly from the preceding variety in the form and arrangement of its leaves, and in habitat. The leaves are usually arranged in dense and numerous whorls, only the uppermost are scattered, linear-lanceolate, acuminate, and of a *dull* green color ; while those of the preceding form are mostly spathulate, or oblanceolate, and of a *bright* green color.

This form we find on moist slopes of the lower foot-hills of the Sierras as well as of those of the Coast Ranges, where the climate approaches more or less in character that of the interior valleys. In these thus characterized localities, the plant is neither copiously supplied with moisture by heavy dews or dense fogs, nor by an abundance from below.

4. Lilium parvum, Kellogg.

The specific name of this species refers solely to the small size of the flower ; for, in every other respect, this plant attains as large a size as any other of our lilies, if not larger. It begins at an elevation in the Sierras where, to my knowledge, *Lilium pardalinum* ceases to grow, namely, at an altitude of 4,000 feet, and extends upwards to 8,000. It is found growing exclusively on the banks of mountain streams, or in shady swampy places, through which a constant stream of cold water runs. The leaves are mostly scattered over the entire stem, spathulate, or oblanceolate, and somewhat glaucous. The ramifications of the branches, and the number of flowers, depend upon the size to which the plant develops. The perianth is of an orange yellow, spotted with purple, and but slightly recurved at the tip. Its cultivation seems to offer more difficulties than any other of our species.

Botanists, either collecting or studying California plants, cannot bestow too much care upon their habitats; and can never possess of one and the same species too large a suit of specimens, collected at different localities. In a country like this, where there are, in fact, but two seasons, the wet and the dry, passing abruptly from one into the other, the proximity to or the distance from the foggy coast, the general physical and mechanical properties of the different soils, the elevation, the exposition (whether west and north, or east and south), and the distance from the rainless belt bordering this State in the south, or from the rainy belt approaching it in the north, must be carefully taken into consideration.

Omitting for the present any remarks on those parts of California situated south of latitude 35°, and those north of latitude 40°, there are distinguishable in Middle California the following ten well marked botanical regions or belts, from west to east: 1. The immediate sea-coast belt; 2. The redwood belt; 3. The hilly or mountainous park and chaparral belt; 4. The Sacramento and San Joaquin Valleys; 5. The lower foot-hills of the Sierra Nevada to 2,000 feet altitude; 6. The Middle Sierra belt, between 2,000 to 4,000 feet; 7. The higher Sierra belt; 8. The Alpine region; 9. The eastern slope; and 10. The eastern basin.

The characteristic plants of these various regions or belts, and their climates and their influence on plants, will be the subject discussed in the next article.

Regular Meeting, Monday, December 15th, 1873.

Vice-President in the Chair.

Forty-five members present.

On motion the regular business of the Academy was suspended, and the matter of an appropriate Memorial observance of the death of Professor Agassiz was considered.

It was voted that a committee be appointed to arrange for a special meeting of the Academy, to be called for the foregoing purpose, and the following gentlemen were elected to serve as said committee: Prof. George Davidson, Robert E. C. Stearns, Prof. D. C. Gilman, James Blake, M.D., Prof. E. S. Carr, Prof. H. N. Bolander, S. C. Hastings, and subsequently Dr. Franz Steindachner and W. H. Dall were added to the Committee; and on motion of Dr. Stout, it was

"*Resolved*, That to facilitate the action of the Committee on the memorial to Professor Agassiz, the Board of Trustees be invited to co-operate with the said Committee, to fulfil the wish of the Academy."

The regular business being resumed, F. Hiller, M. D., P. C. Lander, Daniel Swett, John Muir, John Lewis, Jason Springer, Gen. B. S. Alexander, U. S. A., were elected resident members, and J. H. Stearns life member.

Donations to the Museum: Specimens of Fishes, *Ptychocheilus grandis*, Grd., *Siboma crassicauda*, Grd., *Catostomus occidentalis*, Ayres, *Pogenichthys inæquilobus*, Bd., Grd., all from the Sacramento River; also, *Metrogaster aggregatus*, A. Ag., and *Micrometrus minimus*, A. Ag., from San Francisco Bay. Specimens of Humming Birds, *Ornismya mesoleuca* ♂, *Chrysolampis moschita*, Gray, from Brazil, and *Lesbia amaryllis*, Rchb., ♂, Central America; all of the above presented by Dr. Franz Steindachner. Specimen of Coal, found at Katmay Bay, Alaska, from Samuel Sussman. Whale Lice, from Right whale, taken near Kodiak Island; presented by Capt. C. M. Scammon. Seeds of *Nicotiana quadrivalvis*, Gray, from A. W. Chase. Specimens of Plants from San Jose del Cabo, Lower California, presented by E. Gillespie, Esq., U. S. Consul.

Donations to the Library: Narrative of a Voyage to the N. W. Coast of America, in the years 1811–14, etc., by Gabriel Franchere; 12mo, New York, 1854. The Little Things of Nature, etc., by Leo Hartley Grindon; 12mo, Boston, 1866. Hysteria, etc., six Lectures by F. C. Skey, F. R. S.; 12mo, New York, 1867. Currents and Counter Currents in Medical Science, etc., by Oliver Wendell Holmes; 12mo, Boston, 1861. Bee-Keeper's Directory, etc., by J. S. Harbison; 12mo, San Francisco, 1861. Martyria, or Andersonville Prison, by Augustus C. Hamlin; 12mo, Boston, 1866. The Industrial Progress of New South Wales, etc.; 8vo, Sydney, 1871. History of the U. S. Sanitary Commission, etc., by Charles J. Stillé; 8vo, Phila., 1866. A Journey to Ashango Land, etc., by Paul B. Du Chaillu; 8vo, New York, 1866. Smithsonian Reports, for the years 1866 and 1869. Savage Africa, etc., by W. Winwood Reade; 8vo, New York, 1864. Arctic Researches and Life among the Esquimaux, etc., in the years 1860–62, by Charles Francis Hall; 8vo, New York, 1865. Missionary Travels and Researches in South Africa, etc., by David Livingstone; 8vo, New York, 1858; all of the above presented by Benj. P. Avery. A set of the Pacific Railroad Reports was presented by Col. R. S. Williamson.

A special vote of thanks was tendered to Frederick Castle, Esq., for his valuable donation of two suits of Japanese Armor, presented at the last meeting through Dr. George Hewston.

The following paper was read by Dr. Blake:

On the Puebla Range of Mountains.*

BY JAMES BLAKE, M.D.

The Puebla range of mountains, situate in the northern part of Humboldt County, Nevada, extends in a direction nearly north and south for a distance of about sixteen miles. It is formed in the principal part of its extent by two ridges, separated by a valley, this valley again being divided into three smaller valleys by means of divides running between the two ridges. The waters from these smaller valleys escape by ravines cut through the eastern ridge, and after getting into Puebla Valley, run north to join the waters of Trout Creek. The eastern ridge is formed of metamorphic rocks, principally micaceous and talcose schists, with some metamorphic limestones. These have a dip of about 78° E., with a strike generally north 16° E. They appear to have been thrown up by an eruption of porphyry, which now forms the crest of the ridge. The western ridge has the shape of an arc, of which the eastern ridge forms the chord. It overlaps the eastern ridge both at its north and south ends, the two ridges being separated in the middle by about a mile. This western ridge is composed entirely of volcanic rocks, arranged in regular strata, with a dip of 20° to the west. They form perfectly conformable layers, and extend from its base to the summit of the ridge, a height of more than 1,200 feet, 6,000 feet above the level of the sea. The beds are composed of many varieties of volcanic rock, as can be seen by the specimens I have brought this evening. The rocks are arranged in strata of from 2 or 3 feet to probably 100 feet thick. As they are composed of materials of different degrees of hardness, some of the rocks weather much more easily than others, the harder strata being left, forming escarpments in some instances many feet in height. These harder strata could be traced projecting along the side of the mountain as far as the eye could reach, following its contour with perfect regularity. From the top of these escarpments the surface of the hill always falls off for some distance conformably to the dip of the beds. This volcanic ridge attained its greatest elevation opposite the main transverse ridge between

*See Plate X.

the two ranges. This ridge had evidently been formed by an eruption of trachyte, after the main volcanic beds had been elevated. Masses of green trachyte were found on its crest, and the older volcanic rocks were thrown up almost perpendicularly along its flanks. The main ridge here attained a height of 7,500 feet, falling off rapidly to the north and south. On crossing the summit, at about two miles from the south end of the ridge, and descending about a quarter of a mile on its western slope, strata were met with, evidently of aqueous origin. They were laying perfectly conformable on volcanic rocks, and were covered in by a layer of gray trachyte, also perfectly conformable with these aqueous beds. The beds were about 200 feet thick, consisting of strata of white and red argillaceous rocks, rolled conglomerate, and were all evidently formed from the debris of volcanic rocks, the conglomerate being made up principally of rolled pumice. The west slope of the range gradually descended to the valley on the west side without any apparent disturbance, the slope of the surface during the whole of the distance being about conformable to the strata.

As before stated, this volcanic ridge bends to the east at each end, overlapping the ends of the east range. At the north end, these erupted rocks extend about three-quarters of a mile beyond the metamorphic rocks, and are here composed principally of grey and red trachytes, the extreme north point, however, being formed by vesicular basalts. At the S. end of the range, the whole mass of the mountain appears to have been thrown to the east for a distance of five or six hundred yards. There the metamorphic and volcanic rocks are in contact for a distance of three-quarters of a mile, the porphyritic axis of the latter not reaching the surface. It is directly opposite and to the east of this great dislocation that the hot spring breaks out with a temperature of 165°, from which were obtained the interesting specimens of diatoms, a description of which I submitted to the Academy in 1871. To the south of this dislocated portion of the range is a deep ravine, and beyond this, and in a line with the axis of the metamorphic range, is a range of hills running south about three miles, and gradually disappearing by the dip of the strata to the south. These hills present an almost perpendicular escarpment to the east, forming a cliff about 900 feet high. The lower part of the cliff is covered up by a mass of talus, which itself is so steep and loose as to prevent investigation of the structure of the rocks, and extends to a height of 300 feet above the base of the cliff. The rocks, however, are evidently stratified, of aqueous origin, and composed of volcanic materials that would appear to have been cemented together by a siliceous cement, rendering them almost proof against the action of the elements. The strata were very numerous, as I counted six different strata in a distance of about ten feet. They were of different colors, white, red, yellow, and some of the more well-marked beds could be traced along the whole face of the cliff, getting lower towards the south. At one part there was evidence of a fault, the beds having been broken off, and the south end falling about fifteen feet. This was the only disturbance that showed itself in these beds. The cliff itself was evidently the result of a vast fault, by which the ground in front of it sunk at least 900 or 1,000 feet. The cliff is terminated towards the south apparently by a dislocation analogous to that which pushed forward the end of the main Puebla Range, throwing the whole mass of the mountain to the east. At this point the height of the stratified beds was about 400 feet. By this dislocation a pass was formed, by which I was able to reach the upper portion of the beds; they were found covered by a layer of trachyte, and over this again were strata of basalt. The probable age of these erupted rocks is the early Miocene. The eastern range is probably Triassic, as are the other analagous ranges in this part of the country. It undoubtedly, at an earlier period, extended to join the Vicksburg Mountains to the south, and, as before stated, formed part of the eastern shore of a vast basin, in which the beds of melted rocks were poured out in eruption after eruption, until they had attained a thickness of at least 1,500 feet, and possibly even a greater thickness still, as in no place are the lowest of these erupted beds exposed; in fact, the mineralogical character of the lower beds would indicate, according to the generally received views of geologists, that these beds are but the upper strata of a far more extensive eruption. Probably during the latter part of the Miocene era, a suspension of volcanic activity occurred, the surface became cooled, and the depressed portions of these beds formed the basins of lakes, in which the detritus from the surrounding mountains accumulated until it had formed deposits of many hundred feet in thickness. After this the strata became displaced, as we now find them. This displacement was caused, I think, by a sinking to the west, by which the eastern edge of the beds were tilted up, and a fracture was produced along the line where they were in contact with the schists and porphyries of what now forms the eastern ridge. The valley between the two ridges was thus made, and a subsequent volcanic outburst, the axis of which was from east to west, threw up a ridge dividing the valley into two parts, and elevating that part of the volcanic range, under which it occurred, some 800 or 1,000 feet, without apparently disturbing the older range to the east. Subsequently, this valley has suffered considerable erosion, and at one time must have been filled by a vast glacier, which flowed out over the southern part of the eastern range, depositing a moraine 250 feet thick, which extends a mile and a half into the plain beyond the base of the mountain.

Such is a general outline of the more marked geological features of the Puebla Range, and I now shall proceed to offer a few remarks on the mineralogical character and chemical composition of the erupted rocks which constitute its western ridge.

As before stated, this ridge is composed of different beds of erupted rocks, which are perfectly conformable, and have evidently been ejected at different periods of what must be considered the same volcanic era. Their number it is difficult to state, as the softer of them, by their more rapid disintegration, have covered the side of the mountain for considerable space with fine ash-like powder, which, as it never rains in these regions, has no chance of being washed away, and can only be removed in the form of dust by the wind. It is only the harder and more resisting layers that are exposed, as from these the decomposed rock is blown away as fast as it is formed. As well as I could judge, I think there must have been more than a hundred of these different eruptions. The beds vary much in thickness, some being not more than two or three feet thick, whilst other present escarpments fifty feet high. As will be seen from the specimens I have placed on the table, these rocks differ much in their appearance, although, for the reasons before stated, specimens of the harder rocks were mostly obtained. The specimens numbered from one to six (see woodcut) were collected in about a space of 400 yards, towards the foot of the mountain; from seven to eleven, about half way up; and from twelve to fifteen, within 100 yards of the summit. As will be seen, the rocks present many varieties, the greater number, however, resembling anamesite. The true basalts were not often found on the surface, as they were generally so decomposed that the position they occupied was only indicated by the surface being covered with bright red dust, containing a large quantity of zeolites. Interstratified with these basaltic rocks, we find beds of diabase and labrador porphyry, and towards the top we find vesicular trachyte and porphyritic obsidian. These beds seem to follow no regular order: for instance, between two beds of anamesite is a bed of diabase. The labrador porphyry is in contact with true basalt, and immediately above the vesicular trachyte, is a bed of anamesite, forming the crest of the ridge; below it, is a bed of porphyritic obsidian; then, apparently for some distance, a bed of true basalt, the surface being covered with red dust, mixed with a large quantity of zeolites; and cropping out below this, is another bed of anamesite. There is a general mineralogical resemblance between the different beds, with the exception of the true basalts and the trachytic rocks. The others are composed almost entirely of labrador and augite, in varying proportions, and contained under different forms in the different varieties of rocks, the labrador being sometimes in large twin crystals, and in other rocks forming a complete network of minute crystals, which so thoroughly pervade the rocks as to prevent any other form of crystal being made out, although the presence of augite is rendered almost certain by polarised light. In the labrador porphyry, the crystals of labrador are sometimes an inch long. The augite is sometimes in grains, but more frequently in crystalline plates; it is usually green or brown. Magnetic oxide of iron is present in most of the rocks, although not in any large quantity, except in the true basalts, and in some of the darker anamesites. Sanadine has been found in the trachytes and in the basalts. Olivine, as usual, is met with in the basalts, and in most of the rocks micro-crystals are met with in large quantities. In general, the rocks are so completely formed of crystalline elements, that vitreous matter exists in but small quantities; it is generally pellucid and colorless, but in some instances green. On account of the only specimens obtainable being generally so much weathered, the exact determination of their crystalline structure was difficult. The chemical composition of some of these rocks has been determined, and furnishes quantities of the different substances of which they are composed, which vary considerably in the different specimens; for instance, in the red vesicular trachyte, the amount of silica is 56.2 per cent.; in the labrador porphyry, 49 per cent.; in the diabase, No. 6, 51 per cent.; in the green trachyte, 72 per cent.; in the black porphyritic obsidian, 63 per cent.; and in the anamesite, No. 4, 44 per cent.

It is evident from the above facts that the relative position of these different beds is not in accordance with the views advanced by Richthofen, in his memoir, which was published by the Academy in 1868. In this memoir it is stated that in massive eruptions, of which the Puebla volcanic range presents so striking an example, the basaltic rocks are always the last to be thrown up, so that they invariably form the upper beds in all such eruptions. Here, however, we find true basaltic beds, occupying positions below other erupted rocks, occurring between beds of porphyry and diabase, and even directly under beds of a trachytic character. There can be no doubt but that Richthofen's system of volcanic rocks is but an expression of facts, as presented by a large part of the massive eruptions whose geological history has been carefully investigated. That the system, however, does not apply to the Puebla range of mountains, is, I think, beyond a doubt; and I expect the geological formation of this range will be found repeated in the vast outflows of volcanic rocks that cover so large a portion of eastern Oregon, extending north beyond the Columbia River.*

The mineralogical character and chemical composition of these Puebla beds is so interesting, that I hope at some future time to bring before the Academy a more complete account of my investigations on this subject.

Professor Joseph Le Conte read the following:

On the Great Lava-Flood of the Northwest, and on the Structure and Age of the Cascade Mountains.

BY JOSEPH LE CONTE,
Professor of Geology in the University of California.

ABSTRACT.

I.—Lava-Flood of the Northwest.

The author stated, that in the summers of 1871 and 1873 he made a geological tour through portions of Oregon and Washington, the object of which was to study the lava-flood of this region, and especially the structure of the Cascade range. He attributes much of his success to the kind assistance of Rev. Mr. Condon, the geologist of Oregon.

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* From the highest point of the ridge, as far as could be seen, the country to the north and west presented the appearance of a purely volcanic country. Vast faults were visible to the west, and when near enough to be made out, presenting sections of horizontal strata analagous to those at the south end of Puebla range. To the northwest was a high range, presenting a steep escarpment to the southwest, the top forming a table land, with a gradual slope to the north. Still farther to the north is the high range of Stein's mountain, on the top of which, I am informed, a large table land is found.

He describes the lava-flood as probably the greatest in the world. Issuing from fissures in the Cascade and Blue Mountain ranges, it spread over nearly the whole of Oregon, Washington, and Idaho, and far into California on the south, Montana on the east, and British Columbia on the north. Its area is certainly 200,000 to 300,000 square miles. Its thickness in the axis of the Cascade Mountains, where it is cut through by the Columbia River, is more than 3,500 feet. The section shown by the Des Chutes River, fifty miles from the axis, is 2,000 to 3,000 feet. The average thickness over the whole Cascade region (100,000 square miles) is probably not less than 2,000 feet.

II.—Structure of the Cascade Mountains.

The Columbia River, on its way to the Pacific, cuts through the Cascade range almost to the sea level. Its magnificent cañon reveals the structure of this range for nearly 100 miles. Except 120 feet at the base and in the axis, the whole range consists of layers of lava, piled one on top of another to the thickness of about 3,700 feet. The lava is cut entirely through only in the axis of the range, and there only for two or three miles; at this place, therefore, is revealed the old ground surface upon which the lava was first outpoured.

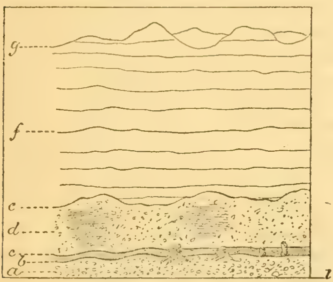

Fig. 1.

The river at this place (Cascades of the Columbia) washes against the southern cliff, and makes a fine section. The best place to examine is nearly opposite the lower steamboat-landing. The diagrams, figs. 1 and 2, represent the front view and a section of the cliff at this place.

From the water level to fifteen feet above, there is a coarse conglomerate (*a*) of porphyritic pebbles and boulders in a cemented earthy paste. This is limited above by an irregular dark line (*b*), a veritable ground-surface. On this stood silicified stumps, with roots ramified in the boulder soil beneath. Above this ground-surface lay a stratified sandstone (*c*), two feet thick, filled with leaf impressions. Above this lay a conglomerate (*d*), irregularly stratified in spots, like modified drift, containing scattered fragments of silicified drift-wood. Upon the uneven surface (*e*) of this rested lava layers, one above another, to the height at this point of about 3,000 feet.

That there might be no uncertainty about the actual relation of the lava to the conglomerate, several of the stream-beds running into the Columbia at this point—and making actual sections similar to the ideal section, fig. 2—were ascended. In several instances, in the stream-beds as well as on the Columbia River at Tooth Bridge, the actual contact of the lava with the underlying conglomerate was seen. Undoubted evidence was also found that the upper surface of the conglomerate (*e*) was an old eroded land-surface, upon which the lava was outpoured.

There can be no doubt, therefore, that (*b*) marks the place of an old forest ground, upon which grew the trees, whose stumps still remain in a silicified condition, before the lava was outpoured ; and that the leaves of the stratum (*c*) are those of these or contemporaneous trees. The order of events seems to have been : 1. A forest of oak and conifers. 2. The destruction of the trees by water, the shedding and burying of the leaves, and the rotting of the trunks to stumps. 3. The covering of the place several hundred feet with coarse deposit (*d*). 4. The erosion of this second land-surface (*e*) into hill and dale. 5. The outpouring of the lava, layer upon layer, for a long period of time. 6. Finally, the erosion of the streams—whether as ice or water, or both—through the 3,000 feet of lava into the underlying soil. It is this last fact, viz : the cutting through the lava into the softer underlying conglomerate, which determines the existence of the cascades of the main river, and also the perpendicular falls at the heads of the tributary stream gorges.

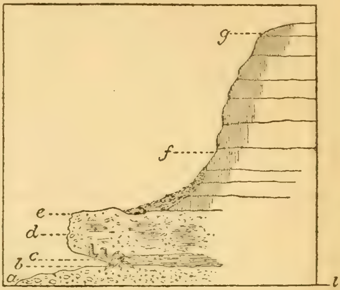

Fig. 2.

III.—Age of the Cascade Range.

There has been much doubt as to the age of the Cascade Mountains. The author thinks the leaf bed (*c*) furnishes the means of determining this question with considerable certainty. A number of specimens of leaf impressions and silicified wood, gathered by him, were sent to Prof. Lesquereux. According to this high authority, they are leaves and wood of species of oak and conifers, which indicate certainly Tertiary, most probably Miocene. The lava-flood, therefore, occurred during or after the Miocene. But since the upper surface of the conglomerate is an old eroded land-surface, requiring much time for its erosion, it is most probable that the lava flood occurred, or began to occur, *at the end of the Miocene.* This would make it *coincident with the formation of the Coast range.* It *began* to occur then ; but it continued by the outpouring of successive layers, building higher and higher, probably, until the end of the Tertiary.

The height of the passes of the Cascade range is not more than 4,000 or 5,000 feet ; but the lava is 3,000 to 4,000 feet thick. Evidently, then, the great bulk of this range is of late Tertiary origin. But the range probably existed before this as a low range of granite and slate, like the Sierras, and of the same age.

The evidence of this is seen in the granite and slate peaks, which still rise above the lava flood, along the skirts or thinner portions of the lava. This underlying portion, therefore, is of the same age as the Sierras; while the great bulk, *i. e.*, the lava portion, is probably of the same age as the Coast range.

IV.—Theory of the Ejection of the Lava Flood, and of the Formation of the Cascade Mountains.

Scattered over the surface of the Cascade lava-flood there are ten to twelve snow-clad volcanic peaks, and probably many other smaller cones. It is simply incredible that this immense mass of lava has issued from these craters—that the force of ejection has been only steam generated by the contact of percolating meteoric waters with incandescent fluid subterranean masses. The ejection of the lava-flood cannot be accounted for except by more general causes, affecting the whole earth—except by those great agencies by which mountain chains themselves are formed. It has been squeezed out through fissures by powerful lateral pressure produced by the internal contraction of the whole earth, as already described in a previous article.*

But there seems to be an inverse relation (recently pointed out by Dana †) between the amount of lateral mashing and folding of strata in mountains and the amount of fissure eruptions. I explain this as follows: Mountain ranges are formed by lateral crushing together and vertical upswelling of lines of thick sediments; but the ranges thus formed became afterwards subject to successive elevation by the action of the same force which first formed them. But there is this difference between the first formation and the subsequent increase: The yielding of the *softer sediments* is quite *gradual* and with little resistance, and therefore with little heat by transformation of mechanical energy (according to Mallet's pregnant idea), producing only *metamorphism*, *but not fusion* of the strata; while in the subsequent increase the yielding of the already *hardened land surface* is with *much resistance*, and therefore with much heat, even to the *fusion of strata*, and also paroxysmal with formation of great fissures, and the out-squeezing of the fused matter through the fissures as great sheets of lava. In the first process there is upswelling or *uplifting* of the stratified surface; in the second, an *upbuilding on* the stratified surface by the out-squeezing of liquid. In both cases increase of height is the same, being measured by the amount of lateral crushing,

Thus, to give examples: The Apalachian was formed by the first process—*i. e.*, by crushing together horizontally and upswelling vertically of thick sediments, at the end of the Coal period; its subsequent increase at the end of the Jurassic was with great fissure eruptions. The Sierras were formed by the first process, at the end of the Jurassic. A second elevation, with great fissure eruptions, took place at the end of the Tertiary. The Coast chain was formed by the first method, at the end of the Miocene; while its great fissure ejections

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* Am. Journal of Science, Vol. IV., p. 470. † Am. Journal of Science, Vol. VI.

took place at the end of the Tertiary, or later. So also with the Cascades. This range was first formed like the Sierras, and by the same method, at the end of the Jurassic; while its great subsequent increase, at the end of the Miocene, was by floods of ejected matter. In the first three cases the range was born, nearly full-grown, by the first method; while in the case of the Cascades the great bulk was produced by the second method.

The main point of this theory is equally tenable, whether we regard the sub-mountain liquid as locally formed by transformation of mechanical energy into heat, as maintained by Mallet, or whether we regard it as a remnant of the original sub-crust fire-sea of Dana.

V.—Some Points suggested by Previous Discussion.

The author then mentioned briefly several important subjects, which require additional observation.

a. The successive flows by which the Cascade Mountains are built up, are in many cases easily detected. In the section made by the Columbia River, the lava is arranged in layers, one above the other; ten or twelve may be counted, and many others are concealed by *débris.* In the Des Chutes River cañon at least thirty may be detected, and doubtless many others are concealed by *débris.* These layers sometimes evidently indicate separate flows; sometimes more doubtfully.

b. The sections made by the Columbia and Des Chutes rivers afford a splendid opportunity of testing the truth of Richthofen's view, that there is *an invariable order of succession in the appearance* at the surface, by fissure eruption, of *the different kinds of eruptive rocks.* The author made some observations which seemed to confirm, and others which seemed to oppose, Richthofen's view. He does not, however, consider his observations conclusive.

c. Formation of Columbia River cañon. The lava-flood was formed by fissure eruptions, which continued, probably, through the later Tertiary period, and then continued, in spots, by crater eruption almost till now. The erosion of the cañons took place subsequently to the lava flood. The Columbia River and Des Chutes River cañons, like nearly all our great cañons, were formed since the Tertiary. The author thinks that in the cañon of the Columbia the work of the post-Tertiary may be distinguished from the work of the present epoch. Fig. 3 is a diagramic section across the Columbia River cañon at the Cascades.

Fig. 3.

The wide part inclosed between the cliffs *a a* (which is about five miles wide) he thinks has been made during the post-Tertiary, either by ice or swollen waters, or both. During the present epoch the greatly shrunken river has cut its way into the underlying conglomerate, moving meanwhile steadily to the south, and making there a perpendicular cliff. If so, then the recession of the perpendicular falls of the tributaries back to their present position, about two or three miles from the main river, has also been the work of the present epoch.

VI.—Prairie Mounds.

Oregon and Washington are covered with a drift ten to thirty feet thick, composed of impalpable, unsorted earth (rock meal), mixed with pebbles and rounded boulders. The upper portion of this earth is finer, the pebbles becoming more numerous and larger as we pass downward. Thus it may be regarded as consisting of two parts—a finer and more movable layer above, and a coarser and less movable one below, graduating more or less perfectly into each other.

Again: At the southern extremity of Puget Sound, in the midst of the dense fir forests, and separated from them by the sharpest line of definition, there are remarkable narrow, irregularly ramifying glades, or prairies, entirely destitute of trees or shrubs. These are doubtless old bottoms of Puget Sound, made dry by elevation. They are covered with drift-soil. These grassy prairies are covered as thickly as possible with mounds, about three to four feet high, and thirty to forty feet diameter. There are probably millions of them. The general appearance is that of almost perfect regularity of size and shape. The soil of the mounds is a rather fine drift, with pebbles not larger than a pigeon's egg. The intervals between the mounds are strewed with larger pebbles. The mounds are occupied by ferns, the intervals only by grass. These treeless spaces are called "mound-prairies."

There has been much speculation as to the origin of these remarkable mounds. Some suppose them burial-mounds, and that we have here veritable *cities of the dead*; others, that they were raised as foundations for huts, on a wet soil; others, that they were made by a species of fish, when these spots were still the shallow bottom of the Sound—that they are huge fish-nests. No careful observer can for a moment entertain any of these views. The mounds have been frequently explored, and although from time to time there have been reports of relics having been found in them, the author feels quite confident that nothing has ever been found.

The author states that his observations in Eastern Oregon—where they occur in every variety of form, size, and regularity—and in California, convince him that they are the result of surface erosion under peculiar conditions; these conditions being a *bare country* and a *drift-soil more movable above* and less movable below. Erosion removes the finer top-soil, leaving it, however, in spots. The process once commenced, weeds, shrubs, and ferns take possession of these spots as the better soil, or sometimes as the drier soil, and hold them, and by their roots retard the erosion there. In some cases a departing vegetation—a vegetation gradually destroyed by an increasing dryness of climate—is an important condition.

Certain it is that in all the treeless regions of California and Oregon, that have not been touched by the plow, the same phenomenon may be observed, to a less extent. In California they are called "hog-wallows." The hog-wallows of California may be traced by insensible gradations into the larger mounds of Eastern Oregon, and these, in their turn, into the more perfect mounds of Mound Prairie; they are all evidently due to the same cause. If the mounds of Mound Prairie were a unique phenomenon, we might resort to exceptional causes; but a phenomenon so wide-spread must be due to a wide-spread agent.

Special Meeting, Monday, December 22d, 1873,

AT MERCANTILE LIBRARY HALL.

The President stated that at the last regular meeting of the Academy, this special meeting was called as a tribute to the memory of Professor Agassiz; and the programme, as arranged by the Committee, will consist of short addresses by its members, Professors Gilman and Joseph Le Conte, Rev. Drs. Stebbins and Scott, Mr. Stearns and myself.

Remarks of President George Davidson.

In his own handwriting, upon a souvenir of his Pacific Coast visit, is the legend "L. Agassiz, born May 28th, 1807." On the 14th of December, 1873, the telegraph flashed to the uttermost parts of the earth that he was no more; and we meet to-night to render homage to his memory.

After a few occasional meetings, from my first acquaintance with him twenty-seven years since, it happened to my lot last season to introduce him to the Academy and its friends, after his voyage of twenty thousand miles, undertaken at a time of life when most of us look forward for rest from life-toiling. You saw that his old enthusiasm was still ablaze; you felt the peculiar charm of his presence and voice, and were happier and better in knowing that you had come into personal relations with one who commanded such influence and power for good. So it has been through a busy, earnest life, devoted to but one object; to see him was to love him; to know him was to willingly promise service to science for all time, and to feel amply repaid in fulfilling that promise.

Learned men and statesmen, and educated, brilliant women, had hung on his words, and had paid the same tribute: all mourn with the same sorrow. In our hearts he can never be forgotten; in the centuries hence, his influence and labors will assure students there were intellectual giants in these days.

To others, more intimate with his daily life and thoughts, must be left the analysis of that powerful hold which he maintained on all classes of men. Simplicity and purity of character, singleness of purpose, directness, and comprehensiveness of the highest order, were the bases for that subtle power which gathered facts from observation, combined and correlated them, thence deduced order; and placed them so lucidly and attractively before the learned and the unlearned.

With the permission of the Academy, I make this the occasion to say a few words upon the impetus, direction, and steadily preserved influence which he exerted upon scientific study in the United States; not only in his particular lines of investigation, but upon every other branch of knowledge. In 1846, fresh from contact with the advanced scientific men of Europe, and endowed with the amplest powers of body and mind, he saw and was delighted with the broad and untrammeled field in the country of his adoption. One rule he at once established for himself—that the results of all his investigations should be given to American, and not to foreign institutions; and to the day of his death he broke not the self-imposed obligation. He had cast his life and lot amongst us; and the communication of discoveries to others abroad—who, however, were no less his friends, admirers, and co-laborers—he deemed a special act of treason.

The many wants he discovered, upon assuming his professorship in Cambridge, would have disheartened and dismayed others less ardent and self-reliant. You recollect with what quaint and good humor he described the few dried fishes forming the collection of natural history, by which he was expected to illustrate his lectures and investigations. That want aroused in his mind the desire, and fixed the purpose, to found a museum of zoölogy which should surpass the most complete in Europe—not as a mere measure of vastness, but as the only proper means of affording the necessary material for the use of students, and for aiding the broader studies of the advanced naturalist. With constant thinking, the plan grew in scope and definiteness. Here men high in their special studies could thoroughly describe and classify every obtainable specimen, and designate their relation with each other; whilst the fossils of buried ages should reveal their story, and exhibit their correlation with the present epoch. From a critical discussion of such aggregated results, we may be assured that the law of development in the natural history of the world, whatever it may be, would be demonstrated.

He has not lived to see it. For a quarter of a century he has fought to obtain the means to perfect it, and has really succeeded as no other man upon this continent could have hoped for. But he has infused among our people the sentiment of more liberal assistance to science, and the full fruition of his labor will come to his successors.

It seems a marvel how much of the enthusiasm and industry of Agassiz has been developed among those who have studied or come in contact with him. I there were any that became weary with the heat and burthen of the day, they have dropped by the way-side. The young, the earnest, the ambitious, are scattered over the globe, searching, working, and studying to increase our knowledge. The men of mark who have been students under him are not few; although, perhaps, differing from many of his views, they are working with his indomitable ardor. From him they have learned that their real student life but just commences when they quit the college halls for the broader and more suggestive fields where animal life exhibits itself in a thousand new relations, and suggests new methods and solutions.

In the last quarter of a century there has arisen in America a large body of the ablest naturalists, geologists, and palæontologists; and I attribute the thoroughness of their investigations, their enthusiasm and success, to the direct and reflected example of Agassiz.

But the impetus which he gave to the interesting study of natural history, to fossil icthyology, to geology, and especially to glacial action, had its effect upon all other branches of science. Remarkably well versed in every science, and intimate with the scientists in their specialties, he imparted to them, as the magnet to the steel, an equal amount of his force, directness, and thoroughness; he cheered the struggling, reinvigorated the diffident, and diffused a halo of attractiveness around each one's study.

He was especially earnest and forcible in expressing his views of scientific education. He contended for broader studies than those prescribed in the old, dogmatic curriculum; for something more than heavy, reiterated book-learning. He demanded original research, exhaustive observation, and rigorous comparison. And whilst garnering the treasures, he was peculiarly chary of propounding hypotheses and theories. To him the time had not come for laying down the law of development. He could not bear with superficial study: a man should give his whole life to the object he had undertaken to investigate. He felt that desultory, isolated, spasmodic working avails nothing, but curses with narrowness and mediocrity. Although strongly wedded to his particular objects and course, he fully realized and ably advocated the equal value and importance of the other special branches. He appreciated the fact that the tastes and peculiar mental fiber of others would lead them in other channels, and he looked forward to the time when their results should be brought into harmony with his own.

We hear so much of weak, inconsequent condemnation of specialists, that an erroneous but wide-spread misapprehension would appear to exist upon the subject. In every-day life, who hesitates to measure out commendation to the blacksmith, the printer, the farmer, the jeweler, the artist, the merchant, for excellence in their specialties? The steamship, the mansion, the bridge, are but the carefully combined results of men's labors in many special trades; and the strength and beauty of every structure and work are great and pleasing just in proportion as the special workmen are skilled. The moulding of all their results into one harmonious body is the work of another specialist, who has the comprehension to properly adjust and aggregate them.

The case is not at all dissimilar with the specialists of science. Each is gathering and logically arranging all the details of his examinations and study; whilst others are endeavoring to blend and harmonize, so far as practicable with yet incomplete observations, the results in the different branches of science. So delicate have become the means and methods of examination, so extreme the range of subjects, so intimate their correlation, that we are perforce compelled to confine our special investigations to single and very narrow lines of research. The geologist, botanist, chemist, physiologist, mathematician, subdivide their labors; cosmical physics attract one astronomer, observations of the planets another, spectrum analysis another. As the results in particular branches are announced, special discussions are entered upon to evolve the law which entwines and embraces them all. These discussions must conform to and be governed by mathematical processes. No indeterminate solutions can be admitted; for their presence indicates the necessity for more tangible facts.

It was the realization of this requirement for labor in specialties in natural history and its cognate branches, that impressed Agassiz with the necessity of a museum that should be complete in its absolutest sense; and to accomplish this he undertook his exploration on the Amazon, his voyage round Cape Horn, and had projected a voyage this coming May through the labyrinth of waters extending from Puget Sound to the Chilkaht River, in Alaska.

On the Pacific Coast we are full of faith that such a museum will be gathered by the Academy, and that, from the ample means of her benefactors, original researches in special branches of science will be systematically carried on, and the results be regularly made known in series of lectures. For general information, this method has had no abler exponent than Agassiz; in fact, he was the father of the method of popularizing science by lectures of the highest order by the investigators themselves. In the present flush of scientific lecturers we are too apt to forget that when he, many years since, commenced giving his series of lectures on natural history, fossil fishes, the glaciers, etc., freed from the usual flood of cold technicalities, he was looked upon as an innovator, and as degrading science. Fortunately, his conception of its value was the true one. A deep and abiding yearning for fresh, living information has been diffused, and, one by one, even the learned men of Europe have yielded to the pressure, and given of their abundant stores of knowledge to the humble as to the rich.

We cannot yet measure the full value of this new means of diffusing the results and methods of scientific investigations. It humanizes and expands the minds of men of power whose business, habits and pursuits have kept them apart from study since their school-boy days; it quickens the memory of the student and reader; and from the humbler walks of life it will call out the latent talent of many a gifted but timid youth, whose instincts and aspirations would have been chilled by the esoteric system of the old formal school.

In the introduction of this method of popularizing science, it was peculiarly fortunate that Agassiz had the rare power of stating so clearly and so logically, and of illustrating so rapidly and cleverly, the processes and deductions of his investigations. It was all new knowledge—not gleaned from encyclopedias or composed of the unverified statements of others. It was mental food for the acutest thinker; it was comprehended by the youngest student. In his lectures his diction was a model of English; no straining for effect, no struggling for words, but the right word always in the right place. "I never think of the words I am to use," said he. "I arrange the matter, order, and method of statement and illustration clearly in my mind before I begin, and then the words come of themselves."

It was fortunate, also, that he had that charm of manner—modesty, simplicity, manliness, and kindness for others—which attracted and captivated his audience. In fact, it was fortunate for popular science that he was—Agassiz; for men with such a rare combination of good qualities, and such a position, come but seldom in a century.

One of the branches of scientific investigation to which he gave much actual examination and earnest thought, and by which he will be known as the great expounder, was the extent of glacial action during the period when the greater part of the northern and southern continents was under an ice-sheet of immense thickness. He first grasped the full force of the problem, and enunciated it; and his demonstrations have made clear many existing conditions on the surface of the earth, which had baffled the skill of others. Perplexities melted before it, and from chaos are emerging order and consecutiveness. In his visit to this Coast, he was particularly gratified and excited with the evidences of glacial action which mark our Sierras, and which I have shown to mark our coast-line. These, the existence of the great living glaciers of British Columbia and Alaska, and the evidences of glacial action through the thousand miles of ocean Yosemites stretching from latitude forty-seven to sixty, were some of the inducements that led him to acquiesce in the projected trip of this season. He had studied the glacial action through similar geological formations from Cape Horn northward, and, from his comprehensive knowledge and grasp of the subject, was peculiarly fitted for the discussion. Even among those who may be capable of seizing the minutiæ of evidence and realizing the magnitude of the powers which performed that work, it may be many years before any one can command the means and the time for their examination and elucidation. It requires a rare combination of qualifications for its solution, particularly that of the mechanical faculty; and we can but hope that from among our young students of California will come those who can demonstrate it successfully.

I close with a few words of a power which he possessed, so unusual among scientific men, yet so absolutely necessary for the development of science as understood by the specialists, and of knowledge as taught by the colleges, that we can but pray without ceasing his mantle may fall and cover many shoulders. Others possess it—perhaps only differing in degree—or the magnificent endowments which have been made to our higher seats of learning would have been devoted to other purposes. Yet he first made the claims of science a demand upon the affluent who had grown wealthy through the practical applications of scientific investigations and discoveries. He would admit of no compromise measures—science had taken a back seat too long; her votaries had been sneered at as particularly deserving reprobation for lack of the money-making faculty; and he repudiated the supposed eleemosynary character of the gifts grudgingly made to her. He boldly stood forth as the champion of the self-sacrificing devotees of science. For the benefit of human knowledge he had given, with unsparing prodigality, the mental and physical activity of a life noted for its remarkable vigor, endurance, and consecutiveness; and his sense of justice was aroused to appeal for help to those who could so easily and so largely endow our colleges and universities, our museums and academies of science. You have listened to these appeals, and know that even in our midst they have not been in vain. Throughout our country the leaven has reached the treasures of large-minded men who, during their life-time, wish to see the fruition of their nobler instincts. In the last ten years, millions of dollars have been devoted to learning and science; but many more millions are needed, and the apostles of science must cease not urging and proving her claims. Our University alone needs its million for buildings, apparatus, and museum; and another million for the endowment of professorships. Our Academy needs as much for buildings, collections, and for foundations for original research. And in our midst we need an amply endowed Institute of Technology.

The interest which he imparted to science on this Coast, in one short visit, has steadily increased. The cheering words which he spoke in our behalf have fallen upon the hearts of our people, and awakened their sympathy. The Academy certainly has cause to rejoice in its benefactions; but we need still more freely the helping hand of endowment, to realize what he prophesied.

We can listen no more to the magic of his voice; but his example is ever before us. Words of praise can add nothing to his glory; but we can honor his memory by imitating his fervid devotion to science, and its diffusion among mankind. It never faltered; it pervaded his being.

He was the incarnation of Science; and greater love hath no man than this —he laid his life down for it.

He has gone; but his name will be a land-mark in human knowledge through the long roll of centuries.

Remarks of Professor D. C. Gilman.

The name of Agassiz does not belong to the learned alone, though it is honored most by the wise and the profound; it likewise belongs to the common people, for it is a household word throughout the land.

Few men, while they live, attain renown among the multitude, and also retain their eminence among philosophers; but he wore fitly this double crown —"the praise of praised men," which is gold, and the applause of the unlearned, which is silver. How few of those whom we call distinguished, whether writers, teachers, statesmen, merchants, scholars, or leaders in arms, are equally known and honored with this college professor, this comparative zoölogist, this interpreter of nature! The news of his decease has brought to learned societies and to common schools, to universities and to fishermen's cottages, the sense of a personal bereavement, for it tells of the loss of a guide, the death of a friend.

To these twofold aspects of his character, your attention will now be directed; the speaker who follows,* by our mutual understanding, rehearsing the claims of Agassiz to scientific renown, while I am to dwell upon his claims to popular regard, or rather upon his character as a teacher, and the influence he has exerted upon American Education.

It will be generally admitted that, among all the teachers of the land, he has held the foremost place. Notwithstanding that ours was to him a foreign tongue, that he grew up to the prime of life under European institutions, and that the subjects which he taught were quite remote from what are called the "practical" wants of the Americans, he always spoke among us with that extraordinary power of adaption, that easy self-possession, that rare adjustment of thoughts and words to the occasion, which constitutes true eloquence—which attracts, enlightens, delights and persuades. Before the Legislature of Massachusetts or the National Academy of Sciences, in the college lecture-room or in the teachers' institute, on the public platform or in the private parlor, in the open field or on the vessel's deck, he was always the same—ready, graceful enthusiastic, earnest, suggestive, and instructive. He delighted to learn, that he might teach; to teach, that he might learn.

When such a man departs, old, honored, unsullied, and beloved, it is well to inquire into the antecedents of his character, the elements of his renown.

It is not every teacher who is endowed with a good constitution, neither too nervous, nor too phlegmatic. Agassiz was fortunate in his physical character, his noble figure, his beaming countenance, his elastic step, his excellent health. He was not of that type of scholars whose shriveled faces and whose withered forms declare the neglect of exercise, and the misuse of food; nor was he one who gained by stimulants extraordinary force. He possessed what might be called a commanding presence, a favorable personal equation, a magnetic influence, a manly beauty, or an easy dignity—a quality not to be defined, but everywhere appreciated, which may be in-bred, yet must be first in-born. He came of good descent, having a mother of rare intellectual qualities, and on his father's side an ancestry of six generations of Protestant ministers, going back to the Huguenot refugees. But his was not the parentage of wealth or fashion, and the narrow circumstances of his early life quickened his industry, his patience, and his persistence, and fitted him forever after to sympathize with and encourage those who have high aims and shallow purses.

His early culture was most liberal. In many countries, and through many years, his studies were prolonged. Four years, the record runs, in the gymnasium at Brienne, two years in college at Lausanne, two years in the medical school at Zurich, five years in the universities of Heidelberg, Munich, and Erlangen, that is, thirteen years, at least, of preparation in the period of youth.

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* Prof. Joseph Le Conte.

Thus he came in contact with some of the most renowned naturalists in Europe—Cuvier, Humboldt, Martius, Spix, and a host besides—and received that intellectual impress from superior minds which is far more influential than a library full of books, or a city full of museums.

Hence he laid a broad basis for his scholarship. Ancient and Modern Languages, Philosophy, Human Anatomy and Physiology, Botany, Mineralogy, Geology, and Zoölogy, were all pursued with such enthusiasm, that in any of these departments he might have been distinguished.

So was he qualified to teach—by natural endowments, personal presence, honorable ancestry, narrow circumstances, prolonged culture, and broad foundations. What, now, were the consequents of such antecedents—the superstructure on such a foundation?

There was supreme kindliness or self-control in his disposition, which led him to be patient with ignorance, and what is harder yet, with arrogance; which made him generous in bestowing his time, his learning, and his letters upon others; which made him accessible to the most timid student, or the most humble discoverer of a curious bug.

To this was added a charming enthusiasm, which gushed forth in no spasmodic intermittence, but bubbled up perpetually with refreshing effervescence. He captivated all whom he met. He made them believe that his work was his play; that they might engage in it with a surety of reward. He seemed to say perpetually to his associates, as Faraday said to Tyndall, under untoward circumstances: "Our subjects are so glorious, that to work at them rejoices and encourages the feeblest; delights and enchants the strongest."

Genuine gratitude was also conspicuous in all he did. The school-boy who brought him an uncommon fish, or the farmer who sent him a nest of turtle's eggs, or the woodsman who favored him with a family of little rattlesnakes, was as sure of his hearty acknowledgments as the millionaire of Boston who endowed his museum, or the tobacconist of New York who bought for him Penikese Island, or the officers of the Government who placed at his command the resources of the Coast Survey. No emperor or king ever received such homage, voluntarily bestowed by high and low alike, or such tributes from the united realms of earth, and air, and sea; none return such gratitude. This gratitude was marked by unmistakable sincerity. His looks, and tones, and the pressure of his hand, all confirmed the utterance of his lips. No one need fear that when the private letters of Agassiz are made public there will be anything to regret, as there was in the posthumous revelations of one of his most illustrous contemporaries.

There was, moreover, a hearty co-operation with other workers, and in other spheres—a friendly indorsement of their efforts which was free from the tone of patronage or of interference. The members of this Academy must well remember the generous words which he uttered on the evening when he first set foot in San Francisco—his congratulations at the success of the Academy, his words of encouragement for the University, and his eulogy of the Geological Survey, the pride of all the science of the State.

Still more remarkable in Agassiz was his readiness to aid in the diffusion of knowledge. Devoted as he was to scientific researches—to the advancement of learning by investigations of the most profound sort, extending down to the lowest organisms at the bottom of the sea, and back to the remotest æons of geological history—he was always ready to come before the public and bring the newest and the best of his acquisitions. There are such men as intellectual misers, but he was not of that race. There are also those who are deaf and dumb, but he used all his faculties. He did not wait for costly diagrams or extraordinary specimens. A blackboard and a piece of chalk were all the apparatus which he required for a lecture on Natural History. At the oldest University in Cambridge, or at the newest in Ithaca, through the *Atlantic Monthly* or the extra *Tribune*, in the National Academy, or on Penikese Island, in the State-house at Boston, or in Pacific Hall at San Francisco, he was ready to teach all who wished to be taught. The wisest would enjoy the clearness, the liveliness, and the method with which he told his tale; and the uninformed would think they were growing wise, because they could follow so agreeably and intelligently the utterance of a master. He believed in the Public Schools; and the newspapers say that one of the last acts of his public life was to give a lecture at a teachers' meeting.

As a popular teacher, Agassiz was undoubtedly aided by his devout reverence, which saw in Nature something more than a force or law, or rather, which believed all law and force to emanate from a Law-giver and a Ruler. He did not obtrude these opinions. He was not more fortunate than other men of science in escaping the attacks of bigotry and superstition; but now and then, like a church-bell tolling on a Sabbath morning, deep utterances would come forth expressive of his faith. For example, at the close of his essay on "Classification," occurs this passage: "All the facts proclaim aloud the one God, whom man may know, adore, and love; and Natural History must in good time become the analysis of the thoughts of the Creator of the universe, as manifested in the animal and vegetable kingdoms." (*Contribution to Natural History of the United States.*)

Thus we see that the supreme kindliness, charming enthusiasm, genuine gratitude, unmistakable sincerity, uniform co-operation, incessant desire to diffuse as well as to advance knowledge, and devout reverence, were among his most conspicuous qualities as a teacher. I do not dwell upon his love of truth, for that is fundamental with all real men of science; nor on his abstinence from money-making, for all legitimate university life precludes the professor from wild speculations on the one hand, or from regular business responsibilities on the other; nor do I dwell upon his love of studies remote from their practical bearings, for the student of Nature never knows what profound benefits to mankind may proceed from the most abstract research. In these respects I do not know that Agassiz differed much from other naturalists, but in native gifts, and in the acquisitions of varied culture, there are but few to be compared with him.

Hence he has exerted a powerful influence upon American education. It is true that he was fortunate in colleagues and in circumstances. Guyot came with him to this country from Switzerland, and in a different sphere, and with different intellectual endowments, has shown many of the qualities which distinguish his life-long associate. Their united work among the teachers of Massachusetts will always be gratefully remembered by the friends of popular education. Dana, when Agassiz arrived, had recently returned from his voyage around the globe, laden with rich treasure of thought and observation, and in his enlightened and impartial conduct of the *American Journal of Science,* was a powerful ally in the promotion of all departments of scientific education and research. Bache and Henry, at the head of two great departments of the Government, the Coast Survey and the Smithsonian Institution, were able to turn the national resources toward the same great purposes. Torrey and Gray had already given world-wide reputation to American Botany, and Pierce had advanced the science of Mathematics. The gifts of Lawrence, and Sheffield, and Peabody, successively brought new and advantageous impulses to the study of Natural History. The explorations of the Western States and Territories, the settlement of California, and the surveys of the Pacific Railroad route, created a demand for trained geologists and naturalists. Young men were attracted to Cambridge by the renown of the Swiss professor, and, after learning wisdom in his laboratories, went off to found and develop new institutions in Salem, Boston, New Haven, Ithaca, and Oakland, or offered themselves to the service of the State or nation. Teachers in the common schools, especially in New England, learned how to awaken an interest in the study of Nature. Congress, in 1862, made a generous provision for scientific schools; and now, a quarter of a century from the coming of Agassiz, scientific courses run parallel with classical courses in most of the colleges of the country. I am far from attributing all this progress to any individual. It is the movement of science, in a new country, and in the nineteenth century; but I do not hesitate to say that among all the great and serviceable men who have helped on this spirit of research and of investigation, none is more worthy of grateful homage than Louis Agassiz. Especially was he noteworthy for his opposition to the rote-teaching in scientific text-books; for his encouragement of local studies—researches about home; and for his persistent employment and recommendation of the art of drawing as an indispensable aid in scientific research.

If I may be allowed to make an allusion to my own relations with Professor Agassiz, I will say that the greeting which you gave him, and the greeting which he gave me in the halls of the Academy, fifteen months ago, filled me with assurance and courage. It was not long afterward, before his visit here bore fruits, and the liberality of Edward Tompkins, of Oakland, endowed in the University of California a professorship which is to bear in all time the name of Agassiz. Scarcely two months ago I sat in his study at Cambridge, and answered his inquiries about California, and the friends whom he met here. I congratulated him on the recovery of his health, and heard his declaration that he had at his command all the funds which he could well employ for two years to come. Scarcely ten days have passed since I received from an Eastern society a request, which was made at the suggestion of Agassiz, that I would prepare, or cause to be prepared, a paper on the commerce of the Pacific in its relations to San Francisco. Then came the telegram that he was gone.

Agassiz is gone! His name is henceforth enrolled among the immortals. Whatever personal deficiencies he may have had, whatever of the imperfections or weaknesses which belong to humanity, will soon be forgotten, and his worth will be more apparent as the years roll on. Hereafter he will be remembered with Linnæus, and Cuvier, and Humboldt, and others, whom the world delights to honor for their scientific researches; with Franklin, and Rumford, and Faraday, who have made popular the sciences which they have likewise advanced. So we lay upon his tomb our perishable garland, and say, Farewell, philosopher and philanthropist! Farewell, our teacher and our friend!

Remarks of Professor Joseph Le Conte.

Mr. President and Gentlemen, Members of the Academy of Sciences: I respond the more willingly to your invitation to say something in honor of Professor Agassiz, because I owe personally so deep a debt of gratitude to him as my teacher. For some fifteen months in the years 1850–51, as his private pupil, I spent the whole working hours of nearly every day by his side, either in the laboratory, or else in excursions along the shores of Massachusetts, or over the mountains of New York, or on the reefs and keys of Florida. The result of this long intimate association was, on my part, a great and ever-increasing love, admiration and reverence for him, both as a scientist and as a man, and on his part, I am sure, a very strong and affectionate regard. It would be very pleasant to me to linger here a moment—to speak of him as a man and a teacher; the contagiousness of his enthusiasm, the abundance and suggestiveness of his thoughts, the greatness of his intellect, far greater even than his work, and, therefore, contrary to what we find in little great men, the increase of his intellectual stature as you approached him nearer and nearer. It would be pleasing to me to linger here, but I have a higher duty to perform, and one which I am sure would be more pleasing to him. In speaking of a man of science, before a scientific body, it seems to me peculiarly appropriate that I should try to show the *true grounds of his great reputation, and the reasons for believing that it will be permanent.*

In the noble army of science—that army so compactly organized for the conquest of darkness and the extension of the empire of light—there are many valiant fighters, but there can be but few *leaders.* In the construction of the great temple of science—that eternal temple made without hands—the only temple ever erected by man worthy to be dedicated to the great Author of nature—there are many busy, eager, joyous workmen, but there can be but few *master-builders.* Now, I wish to show that in the construction of the temple of science, Agassiz was not only an indefatigable worker in all the lowest details, with chisel and hammer and trowel, in brick and stone and mortar, but also a great *master-mason;* that in the army of science he was not only a valiant fighter in the very front rank, but also a *great leader.* In a word, I wish to show that he was not only an indefatigable enthusiastic worker in all the lowest details of his chosen science, observing, collecting, arranging, analyzing, classifying, but also a *great philosophic thinker*—that his life and work form an epoch in science—that in looking back over the track of time, his gigantic stature will remain for many ages to come a conspicuous landmark.

As we look back over the history of science, we see, at long intervals, certain men who seem to tower far above their fellows. In what consists their greatness? They are men who have introduced *great ideas* or *new methods* into science—ideas which extend the domain of human thought, or methods which increase our power over nature, facilitate the progress of discovery, and thus open the way to the conquest of new fields. Such men were Copernicus, and Galileo, and Kepler, and Newton, and Herschell, in astronomy: such were Linnaeus, and Buffon, and Cuvier and Agassiz, in organic science.

Let me illustrate the effect of the introduction of great ideas into science. I will select one example from astronomy, and one from geology.

Before the time of Copernicus and Galileo, this, our earth, was *all of space* for us. Sun, moon, and stars were but little satellites revolving about us at inconsiderable distance. Astronomy then was but the *geometry* of the heavens, the geometry of the curious lines traced by these wandering fires on the concave board of heaven. But with the first glance through the telescope, the phases of Venus and the satellites of Jupiter revealed the existence of other worlds beside our own. In that moment the fundamental idea of modern astronomy, the idea of infinite space filled with worlds like our own, was fully born in the mind of Galileo. In that moment the intellectual vision of man was infinitely extended.

Again, before the time of Buffon and Cuvier, this, our human epoch, the history of our race, was *all of time* for us. Shells and other remains of marine animals had, indeed, been found far in the interior of the continents, and high up the slopes of mountains, and there had been much speculation as to the origin of these. Some may have thought by means of these to extend the limits of our epoch, but none dreamed of other epochs. Some may have thought they were discovering new coast islands along the shores of time; but none dreamed that these were the evidences of new worlds in the infinite abyss of time. It was reserved for Buffon and Cuvier first to recognize the entire difference between fossil and living species. In that moment was born the fundamental idea of geology, the idea of infinite time containing many successive epochs, or time-worlds like our own. In that moment the intellectual horizon of man was again infinitely extended.

These two are the grandest moments in the history of science; yea, in the intellectual history of our race. The one opened the gates of infinite space, and showed us many space worlds; the other opened up the gates of infinite time, and showed us as many successive creations or time-worlds.

We see, then, the intellectual impulse communicated by a great new idea. The introduction of a new method, though less striking to the imagination, is perhaps even more important. We will illustrate it presently. Now, I wish to show that Agassiz, too, was the originator of new ideas, and the introducer, or at least the perfecter, of new methods in science. Yes, Agassiz was the originator of a great new idea in geology, and the introducer or perfecter of a new method in organic science.

For nearly a century past, glaciers, their structure, their mysterious motion, and their effects, have been the subject of the intensest interest to scientists; an interest which is deepened by the splendors of mountain scenery and the perils of mountain travel. The most eminent men have successively expended their energies upon these problems: De Saussure, and Charpentier, and Huger, and Agassiz, and Guyot, and Forbes, and Tyndall. To the physicist, the two points of greatest interest are, the *law* of glacier motion and the *theory* of glacier motion. Now, in the din and confusion of discussion, as to whether Agassiz or Forbes first discovered the true *law* of glacial motion, and as to whether Forbes or Tyndall advanced the true *theory* of glacial motion, it seems to have been almost forgotten that to Agassiz and Guyot is due the credit of something far greater than either the law or the theory of glacial motion. I put aside with bare mention the immense mass of accurate observations accumulated by Agassiz, and embodied in his great works—the "Etudes des Glaceers" and the "Systême Glacière," a treasury from which all subsequent writers have drawn. I put aside also all questions as to the laws and the theories of glacial motion, important as they are, as trifling in comparison. I desire to fix your attention on only one great idea introduced by him, viz: the idea that glaciers are now, and have been to a much greater extent in a previous epoch, *a great geological agent*, sculpturing our mountains and determining the forms of our continents.

Let me trace the history of this great idea. Agassiz and Guyot had studied minutely the evidences of the former extension of the glaciers of Switzerland. Guyot had even traced the outlines of these ancient glaciers, and thus established the existence of a glacial epoch in that country. With these results still fresh in his mind, Agassiz visited England in 1844 or 1845 (I know not the exact date, nor is it important), and quickly recognized the footprints of glaciers all over the mountains of Wales and Scotland, and astonished the world by announcing that these regions were moulded beneath an ice-sheet. In 1846 he came to this country, and again tracked the steps of glaciers all over the surface of New England, and again astonished the world by announcing that all the northern portions of the United States were also moulded beneath an ice-sheet. It is unnecessary to trace the extension of this idea from country to country; suffice it to say, that it was soon recognized that there was a glacial epoch not for Switzerland only, but for the whole earth. Before Agassiz, the study of glaciers was the study of nice questions in physics, and of interest principally to special physicists. Agassiz transferred the whole subject into the broad domain of geology, and gave it a far deeper, broader, and more general interest. The result was not only a powerful impulse to the study of glaciers, but a flood of light shed upon the whole later geological history of our earth, and thus an enormous impulse to geology also.

But I said that Agassiz was a great reformer in zoölogy also—that he was also, if not the first introducer, at least the perfecter of the great method of organic science. This must ever remain the chiefest glory of Agassiz. Yes, far greater than all his great works in zoölogy—as great as these are, a monument of industry and genius—far greater than these is the *method* which underlies them, and which has impregnated all modern zoölogy.

Let me pause a moment, in deference to the intelligent but unscientific of this audience, to explain the meaning and show the power of scientific methods. Scientific methods bear the same relation to *intellectual* progress which machines, instruments, tools, do to *material* progress. The civilized man is not superior to the savage in physical strength. The wonderful mechanical results achieved by civilized man are possible only by the use of *mechanical contrivances.* So, also, the scientists differ from the unscientific not by any superior intellectual power. The astounding intellectual results achieved by science have been attained wholly by the use of *intellectual contrivances*, called methods. As in the lower sphere of material progress, the greatest benefactors of our race are the inventors or perfecters of new mechanical contrivances or machines; so in the higher sphere of intellectual progress the greatest benefactors of our race are the inventors or perfecters of new intellectual contrivances, or methods.

To illustrate the necessity and power of method, take, for example, the method of *notation*, characteristic of mathematics. How simple the contrivance, and yet how powerful! Nine numeral figures, having each a value of its own, and also a value depending upon its position: a few letters—a and b, x and y, connected by the symbols $+$ and $-$: that is all. And yet by the use of this simple contrivance the dullest boy in your public schools may accomplish intellectual results which the greatest philosophic genius could not otherwise attain. As soon as we leave the field of abstract thought and rise into the field of phenomena, *observation* commences. But as in the field of pure thought, thought can accomplish little without method; so in the field of phenomena, observation can accomplish little without the assistance of method. The phenomena of the external world are so complex, so affected by disturbing forces and conditions, that in order to be understood, they must first be simplified. The scientist, therefore, by *experiment,* removes one condition after another, and one disturbing force after another, until the true cause and necessary condition is perceived. This is the great *method of experiment*, upon which rests the whole fabric of physics and chemistry. But when we rise still higher into the field of organized bodies, the phenomena become infinitely more complex and infinitely more difficult to understand without the assistance of method, and yet, just here, the method of experiment fails us, or, at least, can be used only to a very limited extent. The conditions of life are so complex, so nicely adjusted, so delicately balanced, that when we attempt to introduce our rude hands in the way of experiment, we overthrow the equilibrium, we destroy the very conditions of our experiment, viz: life. In this dilemma what shall we do? Fortunately, nature herself prepares for us a most elaborate series of experiments. The phenomena of life in the higher animals and plants are indeed far too complex to be understood; but if commencing with these we go down the scale, we find these phenomena becoming simpler and simpler until they reach the simplest expression in the microscopic cell or microscopic spherule of protoplasm. The equation of life is reduced to its simplest terms, and then, only, we begin to find the value of the unknown quantity. This series I will call *the natural history series*. Again, nature prepares for us another series of experiments. Commencing with the *mature* condition of the higher animals, and going backwards along the line of individual history through the stages of embryo, egg and germ, we find again the phenomena of life become simpler and simpler, until we again reach the simplest condition in the microscopic cell. This, I will call the *embryonic series*. Again, that there might be no excuse for man's ignorance of the laws of life, nature prepares still another series of experiments. Commencing with the fauna and flora of the present time, and going back along the track of geological history, through Tertiary, Secondary, Palæzoic and Eozoic, to the very *dawn* of life, we find a series of organic forms becoming simpler and simpler, until we again reach the simplest term in the lowest conceivable forms of life. This I will call the *geological* or palæontological, or evolution series.

Now it has been by extensive comparison in each of these series up and down, and by extensive comparison of the three series with each other, that our knowledge of organisms has gradually become scientific; that mere accumulation of facts and phenomena has grown with science; that a mere heap of useless rubbish has been changed into a beautiful edifice. This is what is called the *method of comparison*—the great method used in the science of life. Yes, anatomy only becomes scientific through *comparative* anatomy. Physiology only becomes scientific through *comparative* physiology; and I may add, psychology will never become scientific except through *comparative* psychology.

So much I have said to show you the nature and power of scientific methods and especially of that method—the method of comparison—upon which rests the whole fabric of the science of organisms. Now what has Agassiz done in perfecting this method? I will attempt to explain.

We have seen that this method consists of *three subordinate* methods which lead to similar results, viz: comparison in the three series, the natural history series, the embryonic series, and the geological series. Now Cuvier and his colaborers introduced and perfected comparison in the natural history series and thus laid the foundation of scientific zoölogy; but Agassiz and Von Baer and their co-laborers extended the method of comparison into the embryonic and geological series, and also into the relation of the three series to each other; and thus greatly perfected the method and increased its power. Others, no doubt many others, assisted in the great work, but Agassiz was unquestionably the leader in the movement. For forty years Agassiz worked incessantly, enthusiastically—even to the breaking down of his strong physical constitution and the sacrifice of his life—on the ideas and the methods conceived in his youth. *Is not this a great life?*

Finally, let us glance at some of the results of Agassiz' method. The *direct* result is too familiar and obvious to dwell on. We see it in the amazing impulse given to Biology and its consequent great and ever-increasing progress in recent times. I will only very briefly draw your attention to the *indirect* results, *i. e.*, results which were not in the mind of Agassiz nor aimed at by him.

1. Agassiz' work and Agassiz' method prepared the whole ground and laid the whole foundation for the modern doctrine of evolution. The idea of the *similarity* of the three series mentioned above—the natural history, the embryonic, and the palæontological—and therefore *the light which each sheds on the others*, a view so long insisted on by Agassiz and so tardily and grudgingly accepted by zoölogists, forms the whole scientific basis, and comparison in these three series, the whole scientific method, of the theory of evolution. Evolution is development. Evolution of the organic kingdom is development of the organic kingdom through geologic times. No one insisted so long and so strongly on development of the organic kingdom through geologic times, as did Agassiz. All that is grandest and most certain in evolution, viz: development from lower to higher, from simpler to more complex, from general to special by a process of successive differentation, has always been insisted on by Agassiz, and until recently only grudgingly accepted by English zoologists and geologists. In this sense, therefore, Agassiz is the great apostle of evolution. It was only the *present theories* of evolution, or *evolution by transmutation*, which he rejected. His was an evolution not by *organic forces within*, but according to an *intelligent plan without*—an evolution not by *transmutation* of species, but by *substitution* of one species for another. In the true spirit of inductive caution, perhaps of excessive caution, he confined himself strictly to the *formal laws* of evolution, and no man has done so much in establishing these as he; but he regarded the *cause* of evolution as beyond the domain of science, and all attempts at a *causal* theory as at least premature if not altogether vain.

2. Agassiz' work and Agassiz' method has laid the only foundation of a possible scientific sociology. Society also is an organized body, and therefore subject to the laws of organisms. Society, too, passes by evolution from lower to higher, from simpler to more complex, from general to special, by a process of successive differentitation. Society *progresses, develops.* This is the most glorious doctrine of modern times. The phenomena of society, however, are even more complex than those of organisms, and therefore still more in want of a method. But we have already seen that phenomena which are too complex to be analyzed by experiment can only be brought into subjection by the method of comparison. If, then, there shall ever be a scientific sociology, it must be by the use of the same methods which are used in biology; it must be by the comparison of social institutions, governments, civilizations, etc., in all stages of development; it must be by extensive comparison of social phenomena in *three series*, first, as exhibited in *different races and nations* in various stages, as now existing in different places, corresponding to the natural history series; second, as exhibited in various stages of advance of the *same nation* from barbarism to civilization, corresponding to the embryonic series; third, as exhibited in the slow onward progress of the *whole race* through rude stone age, polished

stone age, bronze age, and iron age, corresponding to the palæontological series. It is by comparisons of this kind that Herbert Spencer is now attempting to lay the foundations of a scientific sociology. I repeat it: if sociology ever becomes a science it will owe much to the genius and the method of Louis Agassiz.

Owing to the illness and consequent absence of Mr. Stearns, the following from him was read by Prof. E. S. Carr:

Remarks of Robert E. C. Stearns.

Mr. President.—It has pleased you to insist that I should add something to the general expression of sorrow and of eulogy. It is in no spirit of reluctance that I hesitate to bear testimony to the merits of him to whose voice it was so pleasant to listen, and in whose presence it was a pleasure to be; but rather from the fear of my inability to render an even measure of justice to the dead.

Without enlarging upon those exterior characteristics by which he was known, and which, ennobled by a generous nature, gave grace and dignity to his person, we find with and above these attractions a moral and intellectual greatness and simplicity, which endeared him to his fellow-men.

I cannot recall the name of any other scientific man, which has been so often spoken, and with so much respect and affection, in the homes and families of our people, as that of Agassiz.

This respect and affection arose, not alone from his intellectual achievements or from the popularity of his lectures and writings, but from that large-heartedness which made him accessible to all.

In his intercourse with his fellow-men, he graduated his speech not by the rank or station of the person, for each and all were received with unmeasured courtesy and kindness.

Such intellectual breadth, moral excellence, and estimable qualities as he possessed, are seldom found in the same person; and these made him not only an impressive and attractive teacher, but, combined with enthusiasm, inspired all with the desire to serve and assist him; hence, in part, that vast aggregation of material at Cambridge, beyond the capacity of the present building for its proper arrangement and display.

What wonderful progress has been made in our country since the arrival of Agassiz, in 1846! Its material wealth how enormously increased, broad areas peopled, new States established, and the march of empire pushed westward to the sea. At that time for the year of his arrival may be regarded as a notable and important event in the history of the country, within a few rods of this spot, the waters of the Bay rippled along an almost untrodden beach. Do you remember his concluding remarks at the Academy's rooms, on that September evening, a little more than a year ago? He said: "When I saw to-day, for the first time, San Francisco through the Golden Gate, I was amazed. I look upon it as one of the marvels of modern times that there should be a city standing upon these shores, so grand, so prosperous, so rich, and so young." Great and manifold as are the changes we have noticed, great also has been the progress of science and intellectual advancement in the nation. The increased and constantly increasing interest in scientific study and literature is most marked and astonishing.

I cannot but remember, and with regret, that when a boy some thirty years ago, when first I became interested in the study of natural history, there were neither books nor teachers. How often have those early disadvantages been brought to mind, from time to time, as in after years I added to the muster roll of friends, the names of younger men who were privileged to sit under the teachings of the great master.

As some good mother, by the fireside's glow, spreads the new book upon her lap, and, calling her children near, points out the pictures and explains their meaning ; so he, with radiant face and winning voice, gathered around him those nature-loving boys, and, opening wide the book of the greater mother, page by page, pointed to its living illustrations—explained their history and their relations, their beauty and their use.

How shall we estimate the value of early training under such a teacher?

Of the earlier students, Stimpson has passed away. He had accumulated, though but forty years of age, the ample store of more than twenty years' investigation. His manuscripts and plates were destroyed by the great fire in Chicago. Of this sad event and its effect upon him he wrote : " My own books, collections, manuscripts, and drawings—twenty years' work—all gone." What a pang must have shot through his heart as he wrote that line! " His old teacher offered him all the resources of the museum at Cambridge, but, with all his old love for the work, his strength was gone."

We may speak freely of the dead, if no evil is in our speech ; but delicacy suggests that we should cautiously praise the living.

Other members of the earlier classes are professors and teachers in various colleges and schools throughout the country, or faithfully toiling in some field of investigation. I may not call their names. Many have already acquired distinguished reputation, and all are contributing to " the sum of human knowledge." Some of them are borne upon the roll of this Academy, and share with us the duties of this occasion.

A few days more than eighteen months have gone since Stimpson died ; and now the illustrious teacher has followed his old-time pupil, on the same inevitable path.

Shall we not pause, before we say farewell, and review the labors and services of the master, since the day when he made our country his own?

How much, what part of our intellectual growth and material advancement, with its resulting higher and expanding civilization, is due to him?

Of those lofty qualities which lift man above the merely imitative and sensual animal, and place him nearer the divine—in all which makes a people wise and virtuous and a nation great—who has done more to disseminate the seed and encourage the growth than Louis Agassiz?

And now we say, good-bye! The form we knew and called by his name will soon fade away; but the effacing fingers of decay can never mar the record of his noble life.

At the conclusion of Mr. Stearns' paper, Dr. Carr remarked as follows:

Yes, Mr. President, Agassiz is not dead. He has gone to sit with Humboldt and Cuvier, with Plato and Aristotle, among the stars; the voice of humanity, echoing down the corridors of time, and gathering fullness through the coming ages, will ever proclaim as long as a love of knowledge endures—*Agassiz still lives.*

Remarks of Rev. Dr. Horatio Stebbins.

Mr. President, Ladies and Gentlemen: It would not be appropriate to me in this presence, and after what has been said by those who have preceded me, to undertake to give a *resumé* of Agassiz' scientific thought, or to sketch his career as one of the great interpreters of Nature's law; but while I have been sitting here listening to the words of others, and looking into your faces, I have been impressed anew by that cheerful, harmonious accord of reason, intelligence, and all magnanimous sentiments with which we acknowledge human greatness. With what refreshing admiration—with what proud, grateful, sympathizing joy do we stand on these level plains of existence and look up to those vast mountain ranges whose solitary summits attest man's intellectual and moral grandeur, and the permanence of truth! It is the felicity of the scientific man, that the truth he seeks is cosmopolitan. It knows not state or nation, tribe or race, but is world-truth and world-law. The distinguished representatives of that truth have a clear atmosphere, and if their moral nature is strong enough to sustain itself in those rarified heights, they lead a life of singular dignity and freedom, their minds dashed with no color of prejudice or passion—seeking what is. To know what is in the world of things, is the vocation of the man of science. His reputation is the reputation of truth, strong and still as the sun; and his name is the property of mankind. In the enthusiasm of admiring grief, we accord to our late illustrious fellow-citizen and cosmopolite such a place and such a name.

Far back, ascending the centuries, in the very horizon of man's intellectual history, is Aristotle, in whose mind the seeds of the universe were planted, who compassed all the knowledge of his time, and gave the hint to future ages. Two thousand years later is Humboldt, who, with matchless wonder of comprehension and penetration—with a persistency of purpose and idea, pursued, without a parallel in the life of man, through a period of nearly seventy years of original research—constructed a "Cosmos," the science of the relation of things, which is perhaps the source of more of the knowledge of the modern time than has come from any other single mind. In our own time, and in the near distance of the present, is Agassiz, who, coming forward at a period when science was so complex as to render universality impossible, devoted himself to the investigation of the living forms upon the surface of our globe, and to finding the thread of order and law running through all organized beings. His mind was at once incisive and comprehensive, analytic and synthetic; while a fine glow of poetic insight and feeling suffused his whole intellectual and moral frame. It was this poetic nature, expressed in elevated, restrained enthusiasm of purpose and idea, that enabled him to give such an impulse to scientific studies in America. He had the rare ability of pursuing original research and of transforming it into popular knowledge—a hazardous undertaking for some, inasmuch as the popularization of science is accomplished through dense and refracting media, which impair intellectual rectitude and degrade the scientific standards of truth to practical and economical relations. To extend the domain of science is one thing, to diffuse science is another thing; and the two are rarely united.

Agassiz claims my admiration for the firmness and simplicity with which he maintained the right of science to pursue its own investigations in its own domain, without controversy, and without reference to any prejudices or opinions that might be held in any other department of knowledge or experience. With the old conflict between science and religion he had nothing to do. He had frankness and truth enough to confess that there is as much dogmatism in science as in religion; but he knew that essentially there is no conflict between them, and never can be. Their boundaries are undefined, as the boundaries between the known and the unknown, the apprehended and the comprehended, always will be. It is one of the infirmities of the human mind to become provincial in its conceptions of truth, and to judge the universe of things by the standards of its own village experience. Agassiz did much to enlarge and enlighten the mind, by teaching that the outward world is an expression of the thought of God, and that man's science is the discovery of God's law.

He was indeed a light and a life! That life has finished its earthly course, and that light is extinguished from our earthly horizon. It must be considered a happy event to us here, that he visited once these western shores. It is a privilege to have seen him; as it is a profound satisfaction to feel that the distinguished expressions of human nature are of kindred blood with ourselves. As I looked on him and called to mind the recollections of former days, admonished of the malady that was destroying him, I grieved for living men; but I did not grieve for him—there was so little of him that could die.

Remarks of Rev. Dr. W. A. Scott.

Mr. President, Ladies and Gentlemen: I did not know till I entered the hall this evening, that I was expected to have the honor of saying a word to you on this interesting occasion, but being urged to appear on the platform I could not absolutely refuse, because as a citizen it was in my heart to honor, as far as in me lay, this memorial meeting, and as a member of this Society to aid in tendering our respects to the memory of our illustrious dead. Another reason for opening my lips is to endorse the sentiments of Rev. Dr. Stebbins, just uttered in regard to the alleged or supposed antagonism of science to revealed religion. Believing as I do, as intimated in the reference made to the opinions of the late Louis Agassiz, that there is as much *dogma* in science, or even more than in religion, I am ready to say and boldly maintain that there is not, and cannot be, any real antagonism or controversy between true science and true religion. All truth is of God and is a unit. Science and religion are twin sisters from the throne of the Eternal Lawgiver. There is no real controversy between them—no strife but as to which branch of knowledge can do most for mankind. Properly interpreted, they come from the same glorious hand and tend to the same result—the happiness of mankind and the glory of the Creator. I honor science, and heartily bid God-speed to every honest investigator of the laws of the universe. As a theologian I have never had the slightest fear concerning the advance of true science. Our natural philosophers cannot travel so far but they will find the Creator has been there before them; and as they climb through space and journey among planets and systems unnumbered, they will all find that the ladder by which they have ascended to the very outposts of the universe was built for them by the hand of an all-wise Lawgiver possessed of supreme intelligence, will, and power. No, ladies and gentlemen, there is no real controversy between true science and religion. Their mission is one—the progress of mankind to a higher degree of knowledge and sincere purity. I have ever believed in free thought, free speech, and a free press—not *toleration*, but absolute freedom. It is thought that governs the world.

But he must be a braver man than I claim to be, who would undertake to entertain such a presence as this at such a late hour, and especially after the learned and eloquent remarks that have been made by the gentlemen who have preceded me, even if I had an address prepared, which I have not. All I can venture to say is, that in doing honor to our distinguished fellow citizen, we honor ourselves. Some nations honor their dead in one way, some in another. Some build monuments or found institutions to perpetuate their names to coming generations. The eloquent addresses already delivered have told us of the exalted character of our great scientist as a man, a citizen in all the walks of life, of the magnetism of his presence and speech, and of his wonderful abilities as a teacher, and of the results or net gains to the scientific world, as the perfecter, if not the original proclaimer, of a *new thought* and of a *new method* of scientific experiments, which are revolutionizing many of the departments of scientific philosophy. We need not then offer a hecatomb at his tomb. It may be true, in a limited sense, as the heathen sages have said, "Those whom the gods love die early," and for us, too early has *Louis Agassiz* passed from us through glory's morning gate to the *great majority* gathering on the shores of "the beautiful river," where the flowers never fade. But not too early for himself, nor for the cause of science to which his whole nature was consecrated. You have been told that the telegraph wires flashed to us the sad intelligence "Agassiz is no more." This is a popular but an erroneous announcement. True, he is no longer on earth to be seen in the high places he so long honored. We shall look no more here upon his noble form, nor hear his eloquent and burning words, but *he still lives.* He is one of those men who possess two immortalities—one, his own individuality, which he has carried with him to the future state, and the other remains with us in our hearts and in the annals of science to the end of time.

Reference has been made to personal acquaintance with the deceased. I was not as highly favored as some of the gentlemen who have spoken, but happily not altogether without being able to record with gratitude my knowledge of him, and the benefits derived from his lectures. As a disciple, I once enjoyed two full courses of his lectures, on Fishes and Geology, and then sat at the feet of Professor Mitchell, of the Cincinnati Observatory, and afterwards at the feet of Professor Guyot, of Princeton College, so honorably mentioned in your presence. And from these masters of scientific lectures I derived views of the laws of Nature and the works of God, for which I desire to acknowledge my deepest gratitude.

Let us then thank our Heavenly Father for the advance of Science, and for the life, character, labors, and contributions to true science of Louis Agassiz. And as it is a true saying, "They mourn the dead aright who live as they would wish us to live," so let us in our several spheres endeavor to imitate the noble deeds of our illustrious dead; remembering that he said "he had no time to make money." And he was right. Thank God he gave his time, strength, genius, and heart to a far nobler purpose. To make money requires time, skill, and talent. It is a trade—a business—and in its place all right; but it is not the highest calling of man. It is not in itself the greatest good. What is gold, gold to thought, to the enjoyments of a cultivated mind? Like him, then, let us go forth from this memorial meeting to give more of our time, and strength, and substance, to the enlightenment, mental culture, and advancement of our fellow-men, in the knowledge of all truth.

The following from our fellow member, Mr. Henry Edwards, whose engagement elsewhere prevented his attendance, was inadvertently omitted:

Remarks of Henry Edwards.

"O! what a noble heart was here undone,
When Science self destroyed her favorite son."

From a seat of learning in the North has gone forth a wail of sorrow, a wail which echoes not only through the length and breadth of our own land, but in every place in which refinement and culture have found a home, and which will thrill for years to come in many a heart at the mention of the name of the departed. Agassiz is dead. The mighty brain in which grand thoughts were kindled, is, as far as our earth is concerned, at rest for ever; the smile which ever shone on modest merit beams for us no more; the kind and gentle voice which spoke in earnest sympathy with even the meanest endeavor, is hushed and still, and memory is all that is left us of one so loved. To speak in praise of his vast acquirements would be but

"To guard a title that was rich before."

The history of his adopted country will inscribe them on its brightest pages, and his works will be forever cherished amid the records of the nation. But apart from the homage which the worshippers of his genius will surely lay before its shrine—apart from the consideration of the labors which have rendered him immortal, and enrolled his name among the deathless few—there steals into the thought the recollection of that tender and gentle nature which was so magnetic in its association, and which shed so pleasing an influence upon all which came within its contact. Involved in his own cherished pursuits, he scorned the mean pretenses of the world, and being, as he himself declared, "Too busy to make money," he was utterly free from the taint of selfishness, and lived less for his own advancement than for the good of others, preferring the calm enjoyment of a studious and retiring life to the tinsel glories of wealth and display. Mindful of the difficulties which beset the student of Science, and well knowing how willingly the world will sneer at what it cannot comprehend, his hand was ever extended to help the seeker after truth, and to place his feet upon a firm foundation. A father among the young, a brother among the mature, and a kind and gentle friend to all, the name of Agassiz will be loved as his genius is honored, and his childlike nature cherished as his mental powers are valued and esteemed. Above the earth which covers his remains will be mingled the bitter regrets for the loss of one so gifted, and the sighs of sympathy for those who will miss the communion of a loving heart. As on and on we journey towards the end, the pathway of our life is strewn with sorrowing memories; but the blossoms of existence diffuse their fragrance by the wayside, and teach us that all is not sad for those who mourn. The incense of good deeds ascends to Heaven, and the place which so glorious a soul as his filled on earth, becomes a monument for after time, and points to the generations which follow, the shining remembrance of his power. For over fourteen years the writer has held pleasant intercourse with him; has profited by the varied store of knowledge he was ever so ready to impart; and with a saddened soul would add this poor tributary leaf to the garlands which will deck his tomb. He is but one among the many who have felt the friendly interest which Agassiz was wont to display to all who needed the help of such a teacher, and who, in the years to come, will sigh

"For the touch of a vanished hand,
And the sound of a voice that is still."

Mr. W. H. Dall, of Committee, submitted the following resolutions:

Resolutions of the Academy.

Whereas, we, the members and associates of the California Academy of Sciences, have learned that it has pleased Divine Providence to call our friend and fellow-member, Prof. Louis Agassiz, away from his earthly labors; Therefore be it

Resolved, That in the death of Prof. Agassiz we recognize the loss of one whose life was passed in earnest devotion to the advancement of Science and the cause of liberal education; whose labors in this field have won for him an enduring fame throughout both hemispheres ; whose efforts in this his adopted country have, more than those of any other individual, contributed to a wide popular appreciation of the dignity, value, and importance of scientific research, and to the necessity of incorporating in our schemes of education, instruction in those laws which form the foundations of the Natural Sciences and are inseparably connected with our material and intellectual prosperity ; whose geniality and enthusiasm in the pursit of his favorite studies, and whose unequaled power of presenting the results of those studies to the public in a simple and attractive form, have endeared to the hearts of this nation, and especially to us and others, who are more or less individually concerned in the pursuit of scientific truth.

Resolved, That we believe that to Prof. Agassiz and the pupils whom he influenced by his teachings and example, we largely owe the adoption of that wise liberality, exhibited by the government and by many private individuals, in matters relating to scientific exploration and research, which is so justly the pride of American citizens.

Resolved, That the visit of Prof. Agassiz to this community, his genial presence, and his address before the Academy and its friends, will always be held by us in grateful remembrance.

Resolved, That we deeply regret the bereavement of Prof. Agassiz' family and would offer them our sincere and respectful sympathy.

Resolved, That these resolutions be printed in the Academy's Proceedings, and that the Secretary be directed to forward an engrossed copy to the family of the deceased.

NOTE.

In order to complete the text of the Proceedings for the year 1873, the above fractional page is inserted ; it will be repeated and the page completed with the succeeding signature, commencing 1874.

enduring fame throughout both hemispheres; whose efforts in this his adopted country have, more than those of any other individual, contributed to a widely popular appreciation of the dignity, value, and importance of scientific research, and to the necessity of incorporating in our schemes of education, instruction in those laws which form the foundations of the Natural Sciences, and are inseparably connected with our material and intellectual prosperity; whose geniality and enthusiasm in the pursuit of his favorite studies, and whose unequaled power of presenting the results of those studies to the public in a simple and attractive form, have endeared him to the hearts of this nation, and especially to us and others who are more or less individually concerned in the pursuit of scientific truth.

Resolved, That we believe that to Prof. Agassiz and the pupils whom he influenced by his teachings and example, we largely owe the adoption of that wise liberality, exhibited by the government and by many private individuals, in matters relating to scientific exploration and research, which is so justly the pride of American citizens.

Resolved, That the visit of Prof. Agassiz to this community, his genial presence, and his address before the Academy and its friends, will always be held by us in grateful remembrance.

Resolved, That we deeply regret the bereavement of Prof. Agassiz' family, and would offer them our sincere and respectful sympathy.

Resolved, That these resolutions be printed in the Academy's Proceedings, and that the Secretary be directed to forward an engrossed copy to the family of the deceased.

Annual Meeting, January 5th, 1874.

President in the chair.

Sixty-four members present.

Matthew Turner, Levi M. Kellogg, and A. P. Elfelt, were elected resident members.

Donations to the Museum: From A. Roman & Co., a large piece of coral; from W. G. W. Harford, specimens of algæ from Japan.

The President delivered his annual address, showing the progress of the Academy during the past year, and the gratifying additions to its library, museum, and membership.

The reports of the Director of the Museum, Secretary, and Librarian, were presented and accepted.

The Treasurer presented his report for the past year, of which the following is a summary: Amount received for monthly dues, life memberships, interest, and balance from the preceding year, \$7,386.15; disbursements during the same year, \$2,823.43, leaving a balance on hand of \$4,562.72.

On motion, the report was accepted and ordered filed.

The annual election being now in order, the following gentlemen were declared elected officers of the Academy for the current year:

PRESIDENT.
GEORGE DAVIDSON.

VICE PRESIDENT.
JOHN HEWSTON, JR.

CORRESPONDING SECRETARY.
R. E. C. STEARNS.

LIBRARIAN.
DR. H. BEHR.

TREASURER.
ELISHA BROOKS.

RECORDING SECRETARY.
CHAS. G. YALE.

DIRECTOR OF THE MUSEUM.
H. G. BLOOMER.

TRUSTEES.

D. D. COLTON.
GEORGE E. GRAY.
HENRY EDWARDS.
OLIVER ELDRIDGE.
R. E. C. STEARNS.
THOMAS P. MADDEN.
DR. A. B. STOUT.

On motion, a vote of thanks was made to H. M. Newhall, for his liberality in regard to the rental of the building soon to be occupied by the Academy, on the corner of Dupont and California Streets, and for the further donation of one hundred dollars per month during the time that the Academy may continue to occupy said building.

On motion, the rules were suspended, and Henry M. Newhall was unanimously elected a life member of the Academy.

On motion, a vote of thanks was tendered to President Davidson, for the active part he had taken in the affairs of the Academy, and the manner in which he had presided at the meetings during the past year.

The Director of the Museum presented a list of the Algæ in the Academy's collection.

Regular Meeting, January 19th, 1874.

President in the chair.

Thirty members present.

George W. Smiley, and L. Livingston, were elected life members; Judge S. S. Wright, W. H. L. Barnes, Dr. A. S. Hudson, Dr. Gustave Eisen, August Drucker, Charles Schultze, Everard Stiele, E. E. Haft, and A. B. Paul, were elected resident members.

Donations to the Library: It was announced that the Academy had received from Prof. Henry, of the Smithsonian Institution, a large collection of standard works of reference, proceedings of learned societies, etc.—in all about two thousand volumes—of which a catalogue is in preparation. For this magnificent donation a special vote of thanks was tendered by the Board of Trustees, and also by the Academy.

Donations to the Museum: From E. P. Upton, of Castle Brothers, specimens of Japanese manufacture, embracing seventy-five varieties of tanned and preserved skins; *Trapa bicornis*, an edible Chinese water nut; linen cloth with fiber; sample of tea from Mount Mohea, in China, said to be the finest made, and to have been sold in this city for twenty-five dollars per pound, at wholesale; also a quantity of seeds of the tea-plant in the capsules; from E. T. Lorquin, stuffed specimens of *Pelecanus fuscus*, from the Bay of San Francisco; also, specimens of *Cupidonia cupido*, purchased in this market, probably from the Rocky Mountain region; from J. P. Dameron, specimens of lignite from Lincoln, and Mount Diablo coal; from Captain John H. Mortimer, of the ship "Isaac Webb," specimens of *Halobatis sericeus; Phyllosoma commune*, or glass crab; *Leptocephalus*, or ribbon fish; *Litiopa bombyx*, with fiber and ova attached; *Fucus navalis*, or Sargasso weed, entangled with byssus threads spun by the *Litiopa bombyx;* three specimens of birds caught at sea; a flying fish; *Salpa pinnata; Velel-*

la, and various marine specimens; from L. H. Thompson, Buff Cochin chickens, preserved in alcohol, and remarkable for having four legs.

Mr. Chase read a paper on the auriferous sands of Gold Bluff, illustrating it by drawings and sections of the locality, and arriving at the following conclusions:

First, that the gold evidently comes from the bluffs. This no one can doubt after once viewing them. Secondly, that after caves, the gold obtained is much coarser in character. Thirdly, that it is only after a continued succession of swells that cut the beach at an angle, that the rich sands are found. When the surf breaks squarely on, let the storm be ever so heavy, it simply loads the beaches with gravel. Fourthly, that no one witnessing the power of the surf, breaking as it does, with no rocky headlands, points, or rocks to deaden it, can doubt that it must have an immense grinding force. Hence, Mr. Chase believes that the gold follows the first two or three lines of breakers, and will never be found in paying quantities beyond.

Mr. Chase sent Prof. J. D. Dana specimens of the sands of Gold Bluff, and that gentleman, in speaking of the sands, says: "The red grains in the sand are garnets. It is altogether probable that the deposit dates partly from the close of the glacial era; that is, the time of melting of the ice in the early part of the Champlain period, when floods and gravel depositions were the order of the day, and partly from the later part of the Champlain period, when the floods were but partially abated, yet the depositions were more quiet."

Mr. W. H. Dall presented the following papers:

Catalogue of Shells from Bering Strait and the adjacent portions of the Arctic Ocean, with descriptions of three new species.*

BY W. H. DALL, U. S. COAST SURVEY.

Having had occasion to examine several collections of shells brought down by whalers from the Arctic Ocean in the autumn of 1873, I was struck by the fact that there does not appear to be any catalogue of the species of that vicinity. Indeed, the region has been visited by but few collectors, and the species have been commonly described among a crowd of others from all sorts of localities. The collectors upon whose localities dependence can be placed are rare, and mostly of modern date. I have therefore prepared this catalogue as a kind of preliminary basis for a better one. The authorities are chiefly as follows: Gray and Sowerby in the voyage of the *Blossom*, Captain F. Beechey; Gould on the shells collected by the late Dr. Wm. Stimpson of the North Pa-

*Published in advance, February 26th, 1874.

Figure 1.

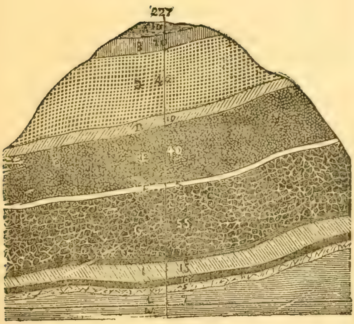

Figure 2.

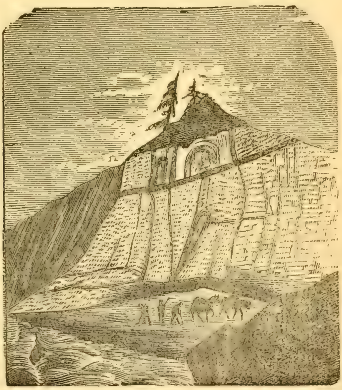

Figure 3.

FIGURE 1.—The beach at Gold Bluff, looking south.

FIGURE 2.—Section of the Bluff. A, loam, ten feet; B, yellow clay, twenty feet; C, yellow gravel, ten feet; D, brownish sandstone, ten feet; E, red and yellow gravel, forty feet; F, blue sandstone, five feet, containing numerous fragments of wood, partially transformed into lignite; G, coarse red and yellow gravel, fifty-five feet; H, very fine blue gravel, five feet; I, indurated sand, fifteen feet; J, gravel, stained red with oxide of iron, ten feet; K, blue sandstone with lignite, five feet; L, sandstone without lignite, five feet; M, gravelly beach, seven feet to low water mark. Total, about 227 feet.

FIGURE 3.—View of the mine, where the black sand is collected on the beach and transported to the works on the backs of mules.

These figures are from drawings by Mr. Chase.

cific Exploring Expedition under Captain (now Admiral) John Rodgers; Dr. P. P. Carpenter's Reports to the British Association; my own collections from Plover Bay, and Norton Sound, and southerly, from 1865 to 1873; collections from Cape Espenberg and Grantley Harbor by Captain E. E. Smith, and from Icy Cape by Captain T. W. Williams, in 1873. A few other species known to be found in that region have been added from various sources. Synonymy, in general, has been waived, except for the purpose of referring to a figure. The region is probably a rich one, especially in forms of the *Buccinoid* and *Chrysodomoid* types, and it is to be hoped that it may be more thoroughly explored before long. The large collections of species made by Dr. Stimpson in this region were lost in the Chicago fire, and contained many unpublished forms. It is, therefore, particularly desirable that more material should be obtained, and no one is better able to contribute to our knowledge in this respect than our hardy whalers. Doubtfully identified species and those which may be synonymous with others, are marked with an asterisk. Those species which may have been erroneously attributed to the region referred to, have in general been omitted. St.=Stimpson; W.=Williams; B.=Beechey; S.=Smith; D.=Dall; collectors.

MOLLUSCOIDEA.

Class Tunicata.

1. *Chelysoma Macleayanum*, Brod.; Arctic Ocean; B.

2. *Cynthia pyriformis*, Lin.; Plover Bay; Avatcha Bay; south to the Aleutians; D.

3. *Boltenia Beringi*, Dall; Bering Sea; Pribiloff Islands; D. There are also a large number of species of tunicates in my own collection not yet identified.

Class Brachiopoda.

4. *Rhynchonella psittacea*, Lin. (var.?); Seniavine Str., St.; Plover Bay; Norton Sound, D.; south to Sitka, D.

5. *Terebratella frontalis*, Midd.; Ochotsk Sea; Attu Id. Aleutians, D. (Probably an arctic species).

MOLLUSCA VERA.

Class Acephala.

6. *Saxicava pholadis*, Lin.; Plover Bay; Norton Sound; universal in colder water; D.

7. *Mya præcisa*, Gld.; Plover Bay; Avatcha Bay; Norton Sound; south to Sitka; D.

8. *Mya truncata*, Lin.; Cape Espenberg, S.; Plover Bay; Norton Sound; south to Sitka, D.

9. *Cyrtodaria siliqua*, Blainv.; Plover Bay; Norton Sound; south to Aleutians; D.

10. *Corbula gibbosa*, Brod.; Icy Cape (?); B.

11. *Lyonsia norvegica*, Chemn.; Arctic Ocean; S.

12. *Lyonsia flabellata*, * Gld.; Arctic Ocean; S.

13. *Siliqua media*, Dall ex Gray; Cape Espenberg, S.; Norton Sound, D. (*S. borealis*, Conr.; and *costata*, Midd. non Say, pars.).

14. *Tellina alternidentata*, Brod.; Icy Cape, B.; Cape Espenberg, S Avatcha Bay; Aleutians, D.; south to Sakalin Id., Schrenck. (*Tl. utea*; Gray; *Guilfordiæ*, Gray; *venulosa*, Schr.).

15. *Macoma nasuta*, Conr.; Plover Bay, D.; south to Monterey, Cal.; D.

16. *Macoma edentula*, Brod.; Bering Strait, B.; Aleutians, D.; south to Oregon, D.

17. *Macoma inconspicua*, Brod.; Icy Cape, W. B.; Grantley Harbor, S.; Plover Bay; Norton Sound; Aleutians, D.

18. *Macoma proxima*, Brown; Arctic Ocean, B.; Norton Sound; Aleutians, D.

19. *Standella falcata*, Gld.; Cape Espenberg, S.; Aleutians; and south to California; D.

20. *Liocyma fluctuosa*, Dall ex Gld.; Ochotsk Sea, Midd.; Aleutians, D.

21. *Liocyma Beckii*, Dall; Plover Bay, D.

22. *Liocyma viridis*, Dall; Arctic Ocean, St.

23. *Liocyma arctica*, Rve.; Arctic Ocean (ubi ?).

24. *Astarte semisulcata*, Leach (teste Stm.); Plover Bay; Norton Sound; Aleutians; Avatcha Bay, D.; Cape Espenberg, S.; Icy Cape, B.; (*A. lactea*, Brod.; *crassidens*, Brod., Voy. Blos.).

25. *Astarte Banksii*, Gray; Norton Sound; Plover Bay; Aleutians, D.; Arctic Ocean, B.

26. *Astarte striata*, Gray; Arctic Ocean, B.

27. *Venericardia borealis*, Conr.; Plover Bay; Norton Sound; Aleutians, D.; Arctic Ocean, St.; south to Catalina Island, Cal., Cooper.

28. *Cardium islandicum*, Chemn.; Cape Espenberg, S.; Norton Sound; Aleutians; south to Sitka, D.

29. *Cardium boreale*, * Brod.; Icy Cape, B.

30. *Serripes grönlandicum*, Chemn.; Icy Cape, B. W.; Cape Espenberg; Grantley Harbor, S.; Plover Bay; Norton Sound; Aleutians; south to Oregon, D.

31. *Serripes Laperousii*, Desh.; Plover Bay; Avatcha Bay; Aleutians; Kadiak; Sitka, D.

32. *Lucina borealis*, Lin.; Aleutians; Sitka; Catalina Id., D.; probably arctic also.

33. *Turtonia occidentalis*, Dall; Plover Bay, D.

34. *Mytilus edulis*, Lin.; Cape Espenberg, S.; mouth of the Mackenzie River; McFarlane (whole Arctic Ocean probably).

35. *Modiola modiolus*, Lin.; Plover Bay; Aleutians; south to Monterey, Cal.; D.

36. *Modiolaria lævigata,* Gray ; Plover Bay ; Norton Sound ; Aleutians, D.; south to Oregon.

37. *Modiolaria marmorata,* * Forbes; Arctic Ocean.

38. *Modiolaria nigra,* * Gray ; Arctic Ocean, St.

39. *Modiolaria corrugata,* Seniavine Strait, St.

40. *Yoldia myalis,* Couth.; Seniavine Strait, St.

41. *Yoldia limatula,* J. Sby.; Arctic Ocean, St.

42. *Yoldia truncata* (Cpr.) ; Norton Sound, D.

43. *Yoldia siltqua* (Cpr.), Norton Sound, D.

44. *Yoldia intermedia* (Cpr.), Norton Sound, D.

45. *Leda arctica,* Brod.; Seniavine Strait, St. (*L. lanceolata,* J. Sby.).

46. *Leda minuta* (Gld.) ; Bering Strait ; Seniavine Strait, St.

47. *Nucula tenuis,* Mont. ; Seniavine Strait, St. ; Plover Bay ; Norton Sound ; Aleutians ; ? south to Sitka, D.

48. *Nucula expansa,* Rve.; Plover Bay ; Aleutians ; Sitka, D.

49. *Pecten islandicus,* * Chemn.; Arctic Ocean, St.

Class Gasteropoda.

50. *Cylichna triticea,* Couth. ; Seniavine Strait, St.

51. *Chiton vestitus,* Sby.; Seniavine Strait, St.

52. *Chiton albus,* Lin.; Seniavine Strait, St.; Plover Bay ; Norton Sound ; Aleutians ; Sitka ; Catalina Id., D.

53. *Chiton lineatus,* Wood ; Plover Bay ; Norton Sound ; Pribiloff Islds. ; Aleutians ; Kadiak ; Sitka ; Monterey, D.

54. *Collisella testudinalis,* Müll. ; Plover Bay ; Norton Sound ; in deep water south to Sitka, D.

55. *Cryptobranchia concentrica,* Dall ex Midd. ; Bering Sea, D.

56. *Cryptobranchia alba,* Dall ; Plover Bay, D.; Seniavine Strait, St.

57. *Margarita umbilicalis,* * Brod. "Northern Ocean." (ubi ?)

58. *Margarita striata,* Leach ; Seniavine Strait, St.

59. *Margarita argentata,* Gld.; Seniavine Strait, St.

60. *Margarita ianthina,* * Gld.; Arctic Ocean, St.

61. *Margarita albula,* * Gld.; Arctic Ocean, St.

62. *Margarita helicina,* Mont.; Plover Bay ; Norton Sound ; Aleutians ; Sitka, D.

63. *Margarita obscura,* Couth. ; Cape Espenberg, S. ; Aleutians ; Norton Sound ; Sitka, D.

64. *Crepidula grandis,* Midd. ; Plover Bay ; Norton Sound ; Aleutians, D. (not *princeps* of Conr. fossil).

65. *Mesalia polaris,* Beck ; Cape Espenberg, S. ; Plover Bay, D.

66. *Mesalia lactea,* Möll.; Plover Bay, D.

67. *Mesalia reticulata,* * Migh.; Seniavine Strait, St.

68. *Litorina tenebrosa,* var. ? Plover Bay ; Norton Sound ; Aleutians, D.

69. *Litorina squalida,* * Gray ; Icy Cape, B.

70. *Lacuna vincta*, Mont.; Plover Bay; Norton Sound; Aleutians; Sitka, D.

71. *Admete viridula*, Couth; Seniavine Strait; St. Aleutians; D.

72. *Admete arctica*,* Midd.; Arctic Ocean; Seniavine Strait; St.

73. *Trichotropis cancellatus*, Hinds; Norton Sound; Aleutians; Sitka; D.

74. *Trichotropis insignis;* Midd.; Seniavine Strait; St. Plover Bay; Norton Sound; Aleutians; D.

75. *Trichotropis borealis*, Lin.; Melville Ids.; Icy Cape; B.; Plover Bay; Aleutians; D.

76. *Trichotropis bicarinatus*, Sby.; Cape Lisburne; Icy Cape; B.; Plover Bay; D.

77. *Trichotropis bicarinatus*, var. *alta*, Dall; Plover Bay; D.

78. *Trichotropis bicarinatus*, var. *spectabilis*, Dall; Seniavine Strait; St.

79. *Iphinoë coronata*, Gld.; Seniavine Strait; St.

80. *Bela lævigata*, Dall; Norton Sound; D.

81. *Bela tenuilirata*, Dall, Norton Sound; Aleutians; D.

82. *Bela turricula*, Mont.; Seniavine Strait; St.

83. *Bela rufa*, Mont.; Seniavine Strait; St.

84. *Bela decussata*, Couth; Seniavine Strait; Avatcha Bay; St.

85. *Bela harpularia*, Couth; Seniavine Strait; St.

86. *Odostomia Beringi*, Dall; Norton Sound; D.

87. *Scalaria grönlandica*, Chemn.; Cape Espenberg; S.; Seniavine Strait; St.

88. *Natica clausa*, Brod.; Plover Bay; Aleutians; D.

89. *Natica russa*, Gld.; Plover Bay; Norton Sound; Aleutians; De.; Arctic Ocean; St.

90. *Lunatia septentrionalis*,* Beck.; Seniavine Strait; St.

91. *Lunatia pallida*, Brod. & Sby.; Cape Espenberg; S.; Icy Cape; B.; Plover Bay; Norton Sound; Aleutians; D.

92. *Amauropsis purpurea*, Dall; Grantley Harbor; S.; Icy Cape; W.; Norton Sound; Plover Bay; D.

93. *Velutina haliotoidea*, Fabr.; Plover Bay; Norton Sound; Aleutians; Sitka; Monterey, Cal.; D.; Seniavine Strait, St.; Catalina Id., Cal.; Cooper.

94. *Velutina zonata*, Gld.; Seniavine Strait; St.

95. *Velutina cryptospira*, Midd.; Norton Sound; Pribiloff Ids.; Aleutians; Sitka; D.

96. *Velutina coriacea*, Pall.; Cape Lisburne Bay; B.

97. *Purpura canaliculata*, Ducl.; Plover Bay; Norton Sound; Aleutians; Sitka; D.

98. *Buccinum ciliatum;* Icy Cape, W.; Cape Espenberg; S.

99. *Buccinum tortuosum*, Rve.; Seniavine Strait; St.

100. *Buccinum polare*, Gray; Icy Cape; B.; Plover Bay; Norton Sound; D.

101. *Buccinum tenue*, Gray; Icy Cape; B.; Plover Bay; D.

102. *Buccinum angulosum*,* Gray; Icy Cape; B. (*Stimpsoni*, Gld.; Bering Strait; St.)

103. ** *Buccinum glaciale*, Stm.; Icy Cape; W.; Seniavine Strait; St.; Plover Bay; Norton Sound; Aleutians; Kadiak; D.

104. *Buccinum tenebrosum*, Hancock; Arctic Ocean; B. (*borealis*, B. & S.; same locality).

105. *Buccinum Fischerianum*, Dall; Pribiloff Ids.; D. (probably also Arctic).

106. *Buccinum Mœrchianum*, Dall ex Fischer; Norton Sound; Aleutians; Sitka; Kadiak; D.; *B. cyaneum*, Hanc. var.

107. *Buccinopsis canaliculata*, Dall, n. s.; Cape Espenberg; S.

108. *Volutoharpa ampullacea*, Midd.; Seniavine Strait; St.; Plover Bay; Aleutians; Kadiak; Sitka; D.

109. *Chrysodomus liratus*, Mart., var. *tornatus*, Gld.; Cape Espenberg; S.

110. *Chrysodomus fornicatus*, Gmel.; Icy Cape; W. B.; Seniavine Strait; St.; Cape Espenberg; S.; Mouth of the Mackenzie River; McFarlane; Plover Bay; Norton Sound; D. (*deforme*, Rve.)

111. *Chrysodomus glacialis*,* Gray; "Arctic Ocean."

112. *Chrysodomus Schantaricus*,* Midd.; Seniavine Strait; St.; Ochotsk Sea; Midd.

113. *Chrysodomus islandicus*, Chemn.; Seniavine Strait; St.

114. *Chrysodomus terebralis*, Gld.; Icy Cape; W.; Cape Espenberg; S.; Aleutians; D.

115. *Heliotropis harpa*, Dall, ex Mœrch; Icy Cape; W.; Shumagins; Unalashka; D.

116. *Volutopsis Beringi*, Midd.; Icy Cape; W.; Aleutians; D. (Captain William's specimens were very strongly shouldered, short spired, heavy, and large).

117. *Volutopsis attenuata*, Dall, n. s.; Cape Espenberg; S.; Cook's Inlet; D.

118. *Trophon clathratus*, Lin.; Seniavine Strait; St.

119. *Trophon multicostatus*, Esch.; Norton Sound; Plover Bay; Aleutians; Sitka; D. (*lamellosus*, Gray ?).

120. *Trophon lamellosus*,* Gray; Icy Cape; B.

121. *Trophon Orpheus*, Gld.; Plover Bay; D.

Buccinopsis canaliculata, n. s.

Shell solid, livid white, covered with a strong, dark brown pilose epidermis; whorls moderately rounded; suture deeply channelled; surface of the whorls covered with fine, spiral thread-like ridges, with still finer ones intervening between them, lightly decussated by the fine, but distinct lines of growth, to which the epidermis especially adheres; the coarser ridges are about seven in number, between the posterior end of the aperture and the edge of the suture

**This species is exceedingly variable in every respect. *B. angulosum*, Gray, is probably an extreme variety of it; *B. Rodgersi*, of Gld., *Stimpsoni*, Gld., *carinatum*, *Mœrchianum* and *Rombergi*, of Dunker, and *angulosum* and *rutilum*, of Mœrch, besides some of Middendorf's species which I cannot now specify, are all forms of this protean species.

behind it. Whorls 5½, aperture half as long as the shell; internally polished; outer edge somewhat thickened; inner lip callous; collumella strongly twisted; canal short, rather wide. Lon. 1.33 inches, lat. 0.75 inches; defl. 55°. This species is much less inflated, and proportionally longer than *B. Dalei*, Sby., which is nearly smooth, and has not the deeply channelled suture. *S. striata*, Jeffreys, (if this be a true *Buccinopsis*, which I doubt) has a straight columella, and proportionally larger body whorl; the present species is a neater and more fusiform shell, with much finer sculpture.

Captain Smith obtained but one tolerably fresh adult specimen, of this interesting shell, on the beach at Cape Espenberg.

Volutopsis attenuata, n. s.

Shell solid, pinkish white, much attenuated before and behind; spire one-quarter shorter than the aperture. Whorls six, apex mammillated. Posterior surface of the whorls flattened toward the suture, where they are somewhat wrinkled and appressed. Surface of the whorls completely covered with fine, even, spiral lines. Aperture long and narrow, a thickened callus on the inner lip, and the outer lip slightly reflected. Canal long, nearly straight, rather narrow. Lon. shell, 2.33 inches, of aperture 1.4 inches, lat. shell 1.0, of aperture 0.5 inches; defl. 40°.

This very interesting species is at once distinguished from any of the described species, by the spiral sculpture, and otherwise by its elongated and slender form. *V. regularis*, Dall, from the Aleutians, is a much more robust shell, and of the same color, but quite smooth. One specimen, in good order, was all that Captain Smith obtained. It has also been obtained at Cook's Inlet.

85a. *Pleurotoma vinosa*, n. s.

This shell is closely allied to *P.* (*Surcula*) *perversa*, of Gabb, from the Straits of Fuca and Catalina Island, but differs in the following particulars: *P. perversa* has a light olivaceous epidermis, which gives a livid appearance to the light reddish brown of the whorls outside; and a broad, white band, with ill-defined edges, passes round the periphery of the shell, just covered by the suture in the upper whorls. The columella, end of the canal, and tip of the shell, are also white. The present form is of a uniform deep winebrown, or claret color; is shorter and much less slender, with a shorter canal and proportionately much larger aperture. Both shells are reversed, and covered with fine, somewhat irregular spiral lines, not mentioned by Gabb in his diagnosis. My specimens were obtained in Kyska Harbor, Great Kyska Island, Aleutians. My largest shell has nine whorls, and is a quarter of an inch shorter, and one-fifth of an inch broader, than a specimen of *P. perversa* of exactly the same number of whorls. It probably belongs to the Aleutian fauna, but may go northward to the Straits.

On New Parasitic Crustacea, from the N. W. Coast of America.*

BY W. H. DALL, U. S. COAST SURVEY.

More than a year ago, I submitted to the Academy descriptions of three new species of Cyami, from as many species of Pacific Cetacea. On examination of a small collection of parasites, in the collection of the Academy, (presented by Captain C. M. Scammon, and reported to have been procured from a Pacific Right Whale, near the Island of Kadiak, Alaska, in 1873) I find that it contains two species, both apparently undescribed. It is to be presumed that each species of whale has parasites peculiar to itself, and those who have the opportunity of collecting these interesting animals should lose no opportunity of examining the rarer cetacea, and should preserve the parasites of each species carefully by themselves. As there are many species from which no parasites have yet been collected, there are doubtless as many kinds of Cyami which are still unknown.

The species described on pp. 281-3, Vol. IV of the Academy's Proceedings, have been well figured on plate X of Captain Scammon's Marine Mammals of the N. W. Coast of America, and, in default of a figure of the present species, I have preferred to give a comparative diagnosis, by which they may be more readily distinguished from the figured and other described species.

Cyamus tentator, n. s.

Species in size and general form resembling *C. Scammoni* Dall, (Scammon, loc. cit. pl. X, figure 2) of a pale, waxy yellow, with the tips of the branchiæ purplish. It differs from *C. Scammoni* in the following particulars: Head proportionately smaller, not constricted behind the eyes, terminating in a point in the median line behind, which point overlaps a median channel in the body segment. Second pair of antennæ proportionately much longer, equaling twice the length of the head. Second pair of hands, with two sharp, spike-like tubercles in place of the two rather short and blunt tubercles of *C. Scammoni*. Hands otherwise very similar. Second segment with a broad channel in the median line, widening backward from the head, and rather shallow. Third segment not rounded at its outer ends, but furnished with very prominent knobs, at the anterior and posterior corners on each side. The outer edges of the fourth segment are also knobbed before and behind, but the anterior knobs are less prominent. The branchiæ are not spirally twisted, but are straight, laterally extended cylinders, nearly as long as the width of the segment to which they are attached. There are two pairs on each side of the third and fourth segments in the male. The upper pair on each side are not of equal length, as in *C. Scammoni*, but the inferior branchia of this pair is much shorter than the other; both are straight or slightly curved upward and forward. The lower pair exist only in the males, they are very slender, and filiform, and quite short.

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*Published in advance, March 3d, 1874.

In the female they seem to be changed into pouches for the development of the ova. Posterior part of the body as in *C. Scammoni*, but there are no serrations on the anterior edge of the seventh segment. Length of largest specimen, 0.8 inches. Domicile on *Balæna Siebodii*, Gray ; North Pacific Ocean.

This is readily distinguished from *C. mysticeti* Dall, by its spiked "hands" and knobby branchial segments ; and from *C. Scammoni* by its straight unequal branchiæ, long antennæ, knobs, and the shape of the head.

Cyamus gracilis, n. s.

This species is of a pale, waxen yellow, of elongated and slender form, and small and slender limbs. It more nearly resembles *C. suffusus* Dall, (Scammon loc. cit. pl. X, figure 3) than any of the other described species. It differs from that species in the following particulars: It is smaller, the largest specimen measuring only 0.5 of an inch in length. It wants the purple color, and is more compact and solid. The second pair of antennæ are much shorter, being only equal to the first segment and half of the next segment of the corresponding members in *C. suffusus*. The branchiæ, though similar, are proportionally one-third shorter. The posterior limbs are shorter and much more weak and slender than in *C. suffusus*. The first pair of "hands" are slenderly pyriform, instead of quadrate. The second pair are simple, without the tubercles between the articulation of the limb and the "finger ;" or, at most, in the largest specimens, the termination of the hand under the articulation of the hook, or finger, is slightly produced into a point. The head is shorter, sub-triangular instead of elongated. Lastly, the segments of the body are more or less closely appressed against each other before and behind, instead of being laterally attenuated, and separated as in *suffusus*. They are also proportionately less wide from side to side than in *suffusus*. Habitat, with the last.

The prominent features of this species are its slender and compact form, short antennæ, and weak and inconspicuous posterior limbs.

Captain T. W. Williams brought down from the Arctic Ocean, in 1873, some parasites from the walrus, which he presented to the Academy. These parasites are of a very dark brown color, almost perfectly round in shape, with an indistinctly segmented abdomen, somewhat roughened with short hairs ; three pairs of short, bristly legs, a distinct but small throat, and very small and short head. There is one pair of short, stout antennæ, with four joints; the mouth is suctorial. There are no other appendages to the abdomen or head. The want of books of reference prevents my being able to refer these creatures to their proper generic position ; and it would be, in any case, inadvisable to describe them as new, as parasites from the walrus of the North Sea have been recently described by a Swedish naturalist, and they may be identical with the present form.

Mr. Stearns, reporting for the Publication Committee, spoke of the large amount of work accomplished by the Committee during the past year, and stated that the Proceedings of the Academy, for 1873, would be ready for distribution at the next meeting.

On motion of Mr. Dall, a vote of thanks to Mr. Stearns was adopted, in consideration of the large amount of labor and time which he had personally devoted to the publications, during the year.

The President announced the following appointments, made by the Board of Trustees at their last meeting:

CURATORS.

General Zoölogy	GEORGE HEWSTON, M. D.
Ichthyology	W. H. DALL
Conchology	W. G. W. HARFORD
Ornithology	WILLIAM BLUNT
Entomology	HENRY EDWARDS
Palæontology	W. A. GOODYEAR
Mineralogy	THEO. A. BLAKE

COMMITTEE ON PUBLICATIONS.

GEORGE DAVIDSON. CHARLES G. YALE.
R. E. C. STEARNS. HENRY EDWARDS.
ALBERT KELLOGG, M. D.

COMMITTEE ON FOREIGN PUBLICATIONS.

A. B. STOUT, M. D. J. F. LEWIS.
H. N. BOLANDER. H. BEHR, M. D.
EMILE DURAND. J. M. SMYTHE.

The President also stated that the Academy, having effected a lease of the church on the corner of California and Dupont Streets, would hold their next meeting in their new quarters.

Regular Meeting, February 2nd, 1874.

President in the chair.

Forty-eight members present.

A. S. Hallidie, A. D. Smith, and W. M. Wherry, were elected resident members, and Albert H. Harris, life member.

Donations to the Library: Overland Monthly, February, 1874; also California Horticulturist, for January, 1874, from J. H. Carmany & Co. American Naturalist, January, 1874. Monatsbericht der Konig. Preuss. Akad. der Wissenschaften zu Berlin, Sept., Oct., 1873. American Journal of Science and Art, Jan., 1874. Catalogue Library Co., of Philadelphia, Jan., 1874. Proceedings Academy Natural Sciences of Philadelphia, pp. 361–408, 1873. Ueber eine Vogelsammlung aus Ostasien von O. Finsch, und P. Conrad, pamphlet, 8vo., 1873, from Authors. Engineering and Mining Journal, Jan. 10th and 17th, 1874. Biennial Report, Regents of the University of California. Catalogue of the Land Mollusca of New Zealand, etc., Wellington, 1873. Critical List of the Mollusca of New Zealand contained in European collections, etc., by E. Von Martens, Wellington, 1873; also, Catalogue of the Tertiary Mollusca and Echinodermata of New Zealand, in the Colonial Museum, by F. W. Hutton, Wellington, 1873, Dr. James Hector, Director, etc. American Chemist, Philadelphia, Jan., 1874. Ueber das Funkeln und Auf blitzen des Mittelmeeres, etc., pamphlet, 4to, Berlin, 1873; also, Das unsichelbar wirkende Leben der Nordpolarzone, etc., pamphlet, 8vo., Berlin, both from Author, C. G. Ehrenberg. Bulletin of the U. S. Geological and Geographical Survey of the Territories, No. 1, Washington, 1874, from Department of Interior. Bulletin of the Essex Institute, Vol. V., Nos. 9 and 10. Engineering and Mining Journal, Jan., 24th, 1874.

By purchase: Nature, Jan. 1st, 1874. Journal of Botany, London, Jan., 1874. Annalen der Physik und Chemie, Leipzig, (No. 9) 1873. Archiv. für Naturgeschichte, Berlin, 1873–4. Astronomical Register, Jan., 1874. Quarterly Journal of Microscopical Science, London, Jan., 1874. Annals and Magazine of Natural History, Jan. 1874.

Donations to the Museum: Mr. Henry G. Hanks presented specimens of borax from the crude to the finished product. There were nine different samples in this donation, as follows: Bi-borate of soda, crude, from Nevada; bi-borate of soda, refined by Pacific Chemical Co.; bi-borate of soda, native, from Borax Lake; tincal, or crude borax, from Slate Range, Cal.; tincal from Thibet Lakes; crypto-morphite (borate of lime) from Oregon; ulexite (borate of lime) from Nevada; individual borax crystals, from Pacific Chemical Co.; residual crystals from vats.

Mr. I. C. Woods presented specimens of *Limnoria*, a species of wood-eating crustacean, from piles in the wharves of the bay. They were taken from near high water-mark when the tide was out, and lived twenty-four hours in the wood after being removed from the piles. A sample of wood accompanied them to show how they penetrated it.

Mr. P. S. Shoaff presented ten samples of ores from mines in Humboldt County, Nevada.

Mr. S. G. George, of Portersville, Montana, sent to the Academy the head and horns of a Rocky Mountain Goat. It has a musk sack behind each horn, and resembles the Thibet Goat, the wool of which is so highly prized. Several of the animals have been captured alive, and one will shortly be exhibited in this city. It is designed to cross the species with the Angora Goat, in expectation of producing a valuable hybrid.

Capt. J. H. Mortimer presented marine invertebrates (*crustacea* and *salpæ*) from the Atlantic Ocean. Lat. 30° N., and Lon. 55° W. G.

Dr. Blake exhibited the cast of a skull that had been taken out from the Ophir mine, on the Comstock Lode, Nevada. The skull had been brought up with some dirt from the 400-foot level; but it is probable that it had been carried down in dirt from a neighboring ravine, which, at an earlier period, had been used to stop some of the former workings. But, independently of its history, the skull presents some features which render it extremely interesting, from an ethnological point of view. The principal of these, were the presence of a large interparietal bone, extending almost to the occipital protuberance, the heavy superciliary ridges, the very low forehead, and great development of the posterior portion of the skull, the peculiar position of the socket for the articulation of the lower jaw, and the great development of the processes for the attachment of muscles. Unfortunately the whole of the palatal portion below the orbits and a large part of the base of the skull were missing; but from what remained, the Doctor considered that it presented a form more removed from that of any existing race of human beings than that of any skull that had heretofore been found. It was submitted to Dr. Blake by Professor Whitney. The original skull was covered with a thin metallic scale deposited by water, and it had been somewhat broken by the pick-axe in being excavated.

Dr. Blake stated in reference to a paper read by him at a former meeting, on the "Nickeliferous sands of Frazer River," that having ascertained from Prof. Wolcott Gibbs, that the mineral he obtained from Frazer River sands, and described as magnetic oxide of nickel, had never before been discovered, he would propose for it the name of "Frazerite."

At a meeting of the Academy in November last, photographs of hieroglyphics, cut in wood, and found on Easter Island, were received from Mr. Thomas Croft, of Papeite, Tahiti. From vague traditions among the natives, they were supposed to represent the written language of some pre-historic nation. The stone idols, and other relics found there, indicate that the present population is lower in the scale than its predecessors. In the letter accompanying the hieroglyphics, Mr. Croft stated, from the best information he could obtain, that none except the priests, and a chosen few, could decipher these strange characters. A letter was now read by the President from Mr. Croft, in which he stated that he had found a native of the island who could read them, and who was going to teach him the language, so that he will shortly be able to translate them. Mr. Croft thinks that he has discovered the relics of a Malayan empire, which extended over that part of the world at some former period.

Regular Meeting, February 16th, 1874.

President in the chair.

Forty-nine members present.

George W. Beaver, George Oulton, and G. Niebaum, were elected life members. Dr. J. C. Moore, John C. Merrill, Carlton Newman, Thos. B. Bishop, Frederick Mason, John R. Sharpstein, J. E. Squire, H. F. Cooper, Emanuel Newman, F. C. DuBrutz, and James S. Gillam, were elected resident members.

Donations to the Library: American Journal of Science and Arts, Feb., 1874. Dreiunddreissigste Versammlung, am 20 Dec., 1873. Verhandlungen der Gesellschaft für Erdkunde zu Berlin, Dec., 1873. American Chemist, Jan., 1874. Annals and Magazine of Natural History, Jan., 1874. Annalen der Physik und Chemie, Band VI, No. 10, Leipzig, 1873. Annals of the Lyceum of Nat. History of New York, Vol. X, Nos. 6, 7, 8, 9, 10, 11, 1872–3. American Naturalist, Vol. VIII, No. 2, Feb., 1874. Proceedings of the Boston Society of Natural History, Vol. XVI, Part 1, May, June, 1873. Mittheilungen der Deutschen Gesellschaft für Natur und Völkerkunde Ostasiens, 3tes, Heft, Yokohama, Sept., 1873. Proceedings American Academy of Arts and Sciences, Vol. VIII, May, 1868–73. The Engineering and Mining Journal, Vol. XVII, Nos. 5 and 6. Nature, Vol. IX, Nos. 220, 221.

Donations to the Museum: From W. H. Dall, large collection of Fossils of the post-pliocene period, from Esmeralda, Equador, collected by Captain A. R. Hodgkins, of the schooner "Urania"; from Prof. Davidson, a crustacean from the Island of San Miguel; from Captain E. E. Smith, specimens of Coal from the Arctic coast, near Cape Lisburne. The coal was observed in that locality for a distance of thirty to forty miles, and crops out in veins of great thickness; from Mrs. James McEwen, an object supposed to be a petrifaction, obtained on the Poso Caliente Rancho, Sonoma county, in a portion known as the Indian Garden.

The following paper was read by the President:

On Improvements in the Sextant.

BY GEORGE DAVIDSON.

The sextant is the most universal of instruments in the hands of the geographer, navigator and astronomer, because it alone is available at sea as well as on land. To the navigator it is invaluable; and in the special work of hydrography along a coast line, where the position of the boat or vessel is generally determined by observing from the boat, the sextant is the only instrument of precision in use; and yet in its present forms, it has certain deficiencies which prevent its universality of application. It fails to measure the angles between one hundred and forty and one hundred and eighty degrees; and the hydrographers of all countries have studied to remedy this defect with only partial success.

M. Daussy, the French hydrographer, measurably solved the problem by a device as simple in construction and beautiful in theory as it is difficult in practice. By means of a second horizon glass, he added, as it were, a constant angle of about ninety degrees to that measured by the index and horizon glasses, and thus obtained any angle from naught to one hundred and eighty degrees. In observing large angles he reflects both objects, which increases the difficulty of manipulation by the observer even when on land, with well defined objects; but when the observer is in a boat, disturbed by the waves, and both objects indistinct, it is next to impossible to see them; and certainly not with any degree of quickness, which such operations especially demand. Daussy's instrument has not come into practical use.

Pistor & Martins, of Berlin, have also partially solved the same problem with the prismatic sextant bearing their name. This instrument will measure

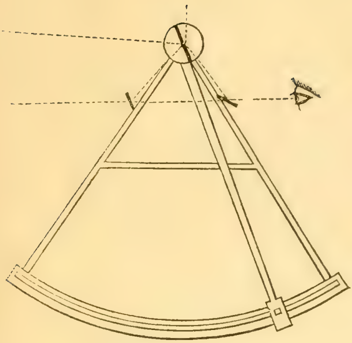

Figure 1.

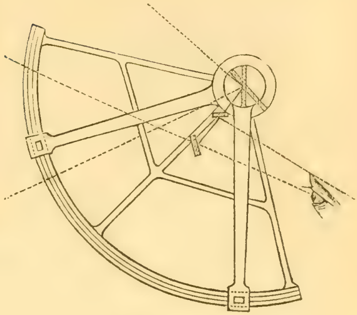

Figure 2

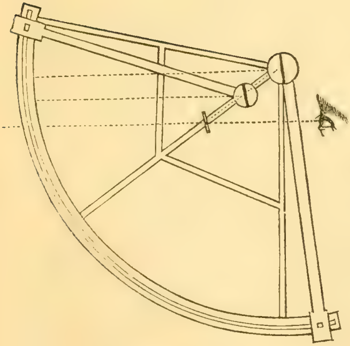

Figure 3.

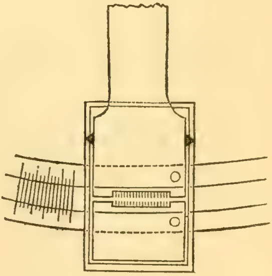

Figure 4.

Diagrams Illustrating T. J. Lowry's Improvements on the Sextant.

any angle from naught to one hundred and eighty degrees, while reflecting but one object; but in measuring the angles from about one hundred and forty to one hundred and eighty degrees, the sextant must be inverted, and the manipulation is therefore embarrassing. Their sextant is too heavy for practical use, and has not been largely adopted.

The improvements to be referred to are very important, making the sextant better adapted to hydrographic work than it has heretofore been. Mr. Lowry has solved the problems very ingeniously, and I have had models made to exhibit their practical application. In studying the subject, several other problems which occur to the practical hydrographer have been very well solved. In the work of the U. S. Coast Survey, and in the hydrographic surveys conducted by the navies of all countries, demands daily arise for such instrumental aid to solve these problems; and it is believed that most of these devices of Mr. Lowry are novel. Very few can thoroughly appreciate their value, unless they be practical hydrographers.

Mr. Lowry has given the following statement of the requirements of the hydrographer in his work, and the solutions of them:

Problem I. To measure with a sextant, any angle from naught degrees to one hundred and eighty degrees, without inverting the instrument, and while reflecting but one object.

This may be solved in the following manner: The front and back faces of index glass (of ordinary sextant) are made reflectors, and a second horizon glass placed on the line of sight, (behind the index glass) and at such an angle as to reflect the rays, which are reflected first from the back face of the index glass, parallel to the line of sight. Fig. 1 illustrates this form.

We here have an arc of only sixty degrees, graduated as usual from naught degrees to one hundred and twenty degrees, with a second reading of the same arc, commencing at naught degrees as one hundred and twenty degrees, and numbered to two hundred and forty degrees at one hundred and twenty degrees. This adaptation may be designated as the "double reflecting index glass."

Problem II. To make the sextant capable of measuring two angles, one to the right and the other to the left of an object, *at the same instant;* either angle being any number of degrees from 0 degrees to 120 degrees.

In practice, the hydrographer sets his index arm so that the reflected and direct images of the objects (say left hand and middle) of one of the angles which he is to measure, are not coincident, yet approaching on account of the progress of the boat; then with the second index glass he makes the direct and reflected images of the middle and right hand objects coincident, and keeps them coincident with tangent screw until the first two objects are coincident.

Problem II may be solved in four different forms of the sextant. In Fig. 2, there are one horizon glass and two index glasses; one of the latter mounted directly over the other; but each attached to distinct index arms, which have a common center of motion. The arc is 120 degrees instead of 60 degrees, as in the ordinary forms, and the graduation is numbered in opposite directions, from 0 degrees to 120 degrees (actually at 60 degrees from each zero).

A modification of this form is given, by making each index glass half the width of the ordinary form, their inner edges meeting, as it were, over the center of the instrument, and thus allowing them to move in the same horizontal plane.

Figure 3 exhibits the next solution of this problem, and affords a much more stable instrument, suited to the rough usage of boat duty. This form is unique. There are two index and one horizon glasses, whose center of motion are in the same straight line and in the same horizontal plane; but the index glasses have independent centers of motion, so that the arcs of graduation, although of one piece and in the same plane, have different radii. The graduation is from 0 degrees to 120 degrees from each end to the theoretical junction of the arcs. The index glass nearest the horizon glass, is one-half the height of the other one.

The fourth solution gives to the ordinary sextant an extra index glass, which may either move in the same or a parallel plane to that of the other index glass —and this extra index glass has an arm which moves on the under face of sextant, but its extremity is curved so as to bring its vernier upon the same graduation as the upper index arm.

Problem III. To make the sextant capable of measuring two angles, one to the right and the other to the left of the central object, in quick succession, without previously estimating their relative magnitudes or inverting the sextant or lengthening its arc. This is done by using the ordinary sextant with the addition of a second index glass secured upon the usual index glass, and at an angle of 60 degrees therewith. It is thus evident that when one index glass measures an angle of 120 degrees, the other is at the zero of the first. The index glasses may be placed one above the other, or in the same horizontal plane. With this, there is also added a detachable stop, with vernier at the extremity of the index arm bearing its usual vernier: this stop to be so adjusted that, when clamped, it will allow the index arm to move freely for the next angle.

The ordinary sextant may be made to measure an angle, and give an inter-range, at the same instant, by placing a low mirror upon the frame, and in a line joining the centers of motion of the index and horizon glasses, and at such an angle as to reflect the rays, parallel to the line of sight, from the back object, into the horizon glass. This is a modification of Daussy's improvement, but fulfills many conditions which his will not.

The following paper by Mr. Henry Edwards was presented:

Pacific Coast Lepidoptera.—No. 4. Descriptions of some New Genera and Species of Heterocera.*

BY HENRY EDWARDS.

Family ARCTIIDÆ. H. S.

Spilosoma (*Diaphora*, St.) *pteridis*, n. sp.

Caterpillar. Head very shining, bright chestnut brown. Body dirty white, mottled with black patches, giving a slate colored tinge to the surface, with three indistinct lines of yellowish-white, two lateral, and one dorsal. Hairs springing from small tubercles, orange-brown, inclining to chestnut, entirely hiding the ground color of the body. Feet and prolegs pale chestnut.

Length, full grown, 1.80 inch.

Food plant, *Pteris aquilina.*

Changed to chrysalis, August, September. Imago appeared, February.

Chrysalis. Formed usually at the base of the fern fronds, a few leaflets being loosely drawn together, and connected by a rather stout web, through which the chrysalis is indistinctly seen. Chrysalis short, rounded in front, blackish-brown, with a few pale brown hairs about the posterior segments.

Imago. ♂. Head, thorax, and abdomen fawn drab, covered with long hairs. Antennæ bright fawn color above, with black pectinations, wholly black beneath. Palpi brownish-black. Wings with the whole upper surface dull smoky-brown, a little darker towards the margins, and with a black discal spot on each. Primaries slightly waved in front on the posterior margin. On the interior margin of the secondaries is a row of hairs of the same color as the abdomen. Feet and legs fawn drab. Fringes blackish.

Under side, wholly fawn drab, reddish along the costal margins, with the discal spot very distinctly shown.

♀ Head and thorax red brown, the former almost scarlet in front. Antennæ and palpi orange red. Abdomen yellowish fawn-color. Feet and legs chestnut brown, with bright red scales above, especially on the middle pair. Fore wings slightly hyaline, reddish chestnut, immaculate, with the nervures very distinctly marked. Costa more decidedly reddish. Fringe chestnut, marked with blackish atoms. Lower wings smoky, with black spot beyond the disc. Fringes pale chestnut, marked with blackish streaks. Under side, wholly dull buff. Costa reddish chesnut. On the disc of each wing is a black lunate mark. The ♀ of this species bears a remarkable resemblance to many specimens of the European *Phragmatobia fuliginosa*, as well as to the same sex of the California *Antarctia punctata.* It may, however, be readily distinguished by its more delicate form, by the absence of spots or other markings, and by the paler color of the under side.

Length of body, 0.50 inch. Expanse of wings, 1.05 inch.

Vancouver Island. (Coll. Hy. Edw.)

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*Printed in advance, February 19th, 1874.

Fam. EPIALIDÆ. H. S.

Epialus Mathewi, n. sp.

♂. Head dark brown, pale above. Thorax and abdomen chestnut, inclining to orange. Antennæ and feet reddish-brown. Fore wings luteous, palest at their margins. At the base is a reddish-brown patch, out of which proceeds a silver-white streak, (edged outwardly and inwardly by a narrow black line) which for a short distance follows the course of the subcostal nerve, then gradually widens and touches the interior margin near the middle, spreading thence upward and outward toward the anterior angle, but becoming obsolete before reaching the extremity, and passing off into irregular black patches with white centers. The edges of this streak are very irregular in outline. Near the disc is a small and indistinct white spot, edged with black, and another is situated near the middle of the interior margin, while the posterior margin is marked with a row of black blotches, not extending to the anterior angle.

Secondaries clouded with fuscous at the base, reddish chestnut toward the margin, with two fuscous submarginal bands united near the middle to the fuscous basal cloud. Fringes of both wings entirely reddish-chestnut.

Under side, pale yellowish-brown, irregularly blotched with fuscous, with the white streak of the upper side very imperfectly seen.

♀ A little larger than the ♂, paler in its general color, with the markings considerably fainter.

Length of body, ♂, 0.70 inch ; ♀, 0.80 inch.

Expanse of wings, ♂, 1.40 inch ; ♀, 1.65 inch.

Vancouver Island. Mr. Gervase Mathew, of H.M.S. *Repulse*, has kindly added this beautiful and interesting species to my collection.

Fam. BOMBYCIDÆ. Bdv.

Thauma, nov. gen.

Head small, almost concealed by the long hairs which cover all parts of the thorax. Antennæ of the ♀ serrated from base to apex, the serratures largest beyond the middle. Palpi very short, concealed. Thorax densely covered above and below with long hairs, which extend over the base of the wings. Abdomen extending as far as the margin of the hind wings, covered with short hairs, and with a short anal tuft. Legs stout and rather short, of almost equal thickness throughout their entire length. Middle and hind tarsi five-jointed, the last joint receiving and almost concealing the claws. Wings ample, opaque, straight in front, slightly curved outwardly toward their tip, and considerably rounded on their posterior angles. Discal cell very large, subcostal vein reaching the costa a little beyond the middle. The nervures are widely separated toward the posterior margin, gradually decreasing in the width of their interspaces as they approach the anterior angle. This genus is in many respects allied to *Endromis* of Europe, but differs somewhat in the neuration, and in the longer and less pilose abdomen. Perhaps its nearest relations will be found in the South American genera *Ormiscodes* and *Podalia*.

Thauma ribis, n. sp.

♀. Head dull smoky-brown. Thorax smoky in front, chestnut towards its base, hairs very long, smoky, interspersed with gray. Abdomen bright chestnut, darkest toward the anal extremity. Antennæ pale straw color. Feet and legs smoky. Primaries smoky, darkest along the costa. A little distance from the base is a waved whitish line, extending to the costa, broadest at this extremity, and gradually becoming obsolete as it reaches the interior margin. Resting on this is a large white triangular mark, filling up a considerable portion of the discal cell, and looking, when viewed with the wings folded, like the letter V. The right branch of this mark touches the basal fascia, and the left one the subcostal nerve, while its base rests upon a distinct and slightly notched whitish band extending entirely across the wing, widest at the costa, and most deeply notched at its junction with the above V-like mark. The posterior margin broad, smoky, with the nervures yellowish-brown. Both the fasciæ are bordered (the basal one inwardly, and the marginal one outwardly) with blackish scales.

Secondaries, dull smoky, inclining to chestnut towards their base. A little below the disc is a small linear whitish patch, and beyond a waved line of dull smoky black, edged interiorly with whitish scales. Fringes of both wings very short, concolorous.

Under side, primaries with the markings of the upper side indistinctly seen, the marginal fascia becoming smoky black, and the white V-like mark of the upper side a dull yellowish-brown. Secondaries with the waved line very distinctly marked, whitish, bordered externally with black.

Length of body, 1.05 inch.

Expanse of wings, 2.70 inches.

Esquimault; Vancouver Island; Mr. G. Mathew.

This magnificent addition to our insect fauna was raised from the caterpillar stage by my friend Mr. Mathew, who may justly be complimented on the discovery of so remarkable a species. Mr. Mathew describes the caterpillar as being black, with dense and strong spines. It was feeding upon *Ribes divaricatum*, Dougl. Changed to chrysalis in September · Imago appeared October. I hope at some future time to be able to give a more extended description of the earlier stages of this fine insect.

Fam. NOTODONTIDÆ. B.

Stretchia, nov. gen.

Head small, tufted in front. Palpi short, stout, porrect, not extending beyond the head. Proboscis moderate. Thorax slightly crested in front. Abdomen pilose, extending for one-third of its length beyond margin of secondaries. Antennæ rather coarsely pectinate. Tibiæ with long hairs. Tarsi simple. Primaries with the costal edge straight, acute at its tip. Posterior margins rounded interiorly. Interior margins oblique, tufted in the middle. Some plumose tufts are also visible along the costa and subcostal vein. Secondaries small, with the margins much rounded. Larva unknown.

This genus, which appears to bear a close relation to *Edema*, Walk., I have dedicated to my friend, Mr. R. H. Stretch, whose exquisite work on the "Bombycidæ of North America" is an honor to entomological literature.

Stretchia plusiæformis, n. sp.

Head and palpi brownish-gray, sprinkled with white. Thorax gray, mottled with black, with the anterior edge bright reddish-brown. Abdomen brownish stone color, with a black transverse streak, edged with white on the basal segment. Feet and legs brownish-gray, mottled with black. Antennæ dull fawn color. Primaries cinereous, sprinkled over the whole surface with black irrorations. Following the costa, and reaching a little below the subcostal vein, is an irregular pale-gray patch, clouded with black and reddish-brown, reaching its greatest width near the disc, and then becoming paler and more distinct, so as to resemble the markings of many species of *Plusia*. Near the posterior margin is a faint brownish waved line, edged near the interior angle with black. The nervures are black, interruptedly marked with gray. Interior margin with a grayish tuft beyond the middle. Fringes short, brownish-gray, mottled with black. Secondaries pale fuscous, with the nervures very distinct. Fringes a little darker anteriorly.

Under side entirely fuscous, the primaries darker towards the costal margin, and with a very faint brown discal spot. Secondaries covered with paler irrorations and with a well defined lunate discal mark. Abdomen beneath dark brown.

Length of body, 0.60 inch.

Expanse of wings, 1.35 inch.

White Pine, Nevada. Taken on the wing, in August, by Mr. W. S. Edwards.

LIST OF NEW SPECIES.

Spilosoma pteridis................Vancouver Island.
Epialus Mathewi.................Vancouver Island.
Thauma ribis...................Vancouver Island.
Stretchia plusiæformis.........White Pine, Nevada.

Professor Davidson announced that he had received permission from Commodore Ammon to inform the Academy of the important results of the soundings made by Captain George E. Belknap, of the United States Steamer *Tuscarora* during last year, with reference to the projected laying of a telegraphic cable from this coast to Japan. This he proceeded to explain with the aid of a series of large charts and profiles prepared for the occasion. This work exhibited, in a remarkable manner, the depths of the Pacific Ocean, which had no parallel in the plateaus of the

Atlantic. The *Tuscarora* had first started in her line of soundings from the entrance of the Straits of Fuca, across that portion of the North Pacific designated as the Gulf of Alaska, toward the Asiatic coast. After leaving the entrance to the straits, the bottom slopes gradually to a depth of 100 fathoms, and then a sudden descent occurs, which reaches a depth of 1,400 fathoms, at a distance of 150 miles from the coast. The temperature of the water at the greatest depth on this line of survey was 34 degrees.

Commander Belknap then returned, prosecuting soundings off and on, along the coast to the entrance of San Francisco Bay. This work determined the fact that the sudden descent of the bottom of the Pacific to a great depth is continuous down the entire coast, varying from twenty to seventy miles out. In the latitude of San Francisco Bay, the great bench is reached a short distance off the Farallones, where the bottom suddenly descends to a depth of two miles. Off Cape Foulweather the bottom descends precipitately from 300 fathoms to a depth of 1,500 fathoms, and then the plateau continues westward for hundreds of miles, and comparatively as level as a billiard-table. Off Cape Mendocino, where shoals have been erroneously supposed to exist from the seaward jutting of the mountains, a depth of 2,200 fathoms is reached eighty miles from the shore. Thirty miles off the Golden Gate the bottom is reached at 100 fathoms; at 55 miles it has descended to 1,700 fathoms; and 100 miles out, the enormous depth of 2,548 fathoms has been measured without reaching bottom.

Regular Meeting, March 2nd, 1874.

President in the chair.

Sixty-six members present.

A. G. Stiles, Frederick Castle, and Charles Troyer, were elected life members; James Behrens, C. E. Gibbs, John McHenry, Jr., Walter Van Dyke, Carlton W. Miller, Edward Steele, James Mc-

Kinley, William H. Sharp, and Josiah Belden, were elected resident members.

Donations to the Library: Catalogue of the Phalænidæ of California, No. 2, by A. S. Packard, Jr., M.D., from the author; Proceedings of the Academy of Natural Sciences, of Philadelphia: pp. 409–424; Overland Monthly for March, 1874, from publishers; Transactions of the American Institute of Mining Engineers, Vol. I, May, 1871, to February, 1873; California Horticulturist, February, 1864, from publishers; Monathsbericht der Königlichen Preuss. Akad. der Wissenschaften, zu Berlin, November, 1873; Annual Meeting of the Am. Geogr. Society, January, 1874; American Chemist, Philadelphia, February, 1874; Map of the Sources of Snake River, from the Dept. of Interior; Engineering and Mining Journal, New York, February 14, 1874.

By purchase: Popular Science Monthly for March, 1874; Journal of Botany, London, February, 1874; Annals and Magazine of Natural History, London, February, 1874; Proceedings of the Royal Geographical Society, London, January, 1874; Annalen der Physik and Chemik, No. 11, Leipzig, 1873.

Professor Davidson announced that he had received a letter from Alexander Agassiz, offering the Society, according to the expressed wish of his deceased father, a set of the *Flora Braziliensis*, which work, in thirty-four volumes, was now upon the shelves of the Society.

Donations to the Museum: From I. W. Raymond, specimens comprising walrus teeth, fishing implements, carvings, costumes, etc., from Alaska, and spears, war clubs, hunting implements, from the South Sea Islands; from Mrs. Capt. Shelley, samples of Tapa or Kapa, a cloth manufactured by natives of the Samoan Islands; also specimens of the bark from which it is made; from Capt. Oliver Eldridge, specimen of *Diomedea exulans*, and a paroquet, both stuffed and mounted; from Vicente Denis, of the Coast Survey, four species of shells, from the kelp off San Miguel Island, in Santa Barbara channel; from W. W. Russel, specimens of *Lycopodium* from Sandwich Islands; from Alfred Gros, skeletons of male and female otter, with numerous shells, sponges, corals, and other specimens from Alaska; from Mrs. A. McF. Davis, several curiously formed bricks, which have apparently been subjected to the action of fire, each bearing strange hieroglyphics; they were dug up near Saucelito. From Judge Ford, of Martinez, through Barry & Patten, a fossil tooth of an extinct species of shark (*Carcharodon*). It was found imbedded in the rock at Martinez, from which it was taken with hammer and chisel. This is the same tooth which was the subject of a paper by Dr. Blake, at a recent meeting. Mr. G. F. Barker also sent through the same gentlemen a small tooth, procured while digging a well at San Bruno. The tooth is supposed to be that of an extinct species of buffalo, (*Bison latifrons?*) A medal was also received from the Royal University of Christiania, celebrating the thousandth anniversary of the Norwegian Kingdom.

Dr. H. C. Sill exhibited skins of *Aplocerus montanus*, from Montana.

Mr. W. H. Dall presented the following paper:

Notes on the Avifauna of the Aleutian Islands, especially those West of Unalashka.*

BY W. H. DALL, UNITED STATES COAST SURVEY.

The following notes are the result of observations made during the season of 1873, on board the United States Coast Survey cutter *Yukon*, engaged in surveys among the Aleutian Islands, west of Unalashka. That they are not more extensive, is due to the very engrossing nature of our work in other directions; yet I am inclined to believe that nearly, if not quite, all the species common to this part of the chain, have been detected. There may be occasional visitors which we did not obtain; there are, perhaps, one or two species of Alcidæ which, from their habit of living for the most part off shore in the summer, were not recognized; and doubtless the range of many species might, by careful observations on each island, during the winter, be much extended; yet it is probable that the information here collected approximates more nearly to a correct statement of the geographical distribution of the Aleutian birds, than anything previously published.

I have preferred, for the sake of uniformity in my papers on Alaskan birds, to retain a nomenclature which, though more widely recognized than any other in America, is rapidly becoming obsolete, and which I would not be understood as accepting in its present condition. I trust eventually to review the whole subject in one comprehensive memoir, when I shall be able to have access to all the later literature of the birds of the more northern regions of the world, which is not now the case; and then I hope to reconcile the discrepancies, and correct the errors, of the nomenclature which I have made use of for the present.

I have been struck with the fact, that during successive seasons, in the same locality, the local Avifauna has presented different aspects—species abundant one season being absent during another; and I had intended to prepare a series of tables, showing the mean distribution of the Aleutian birds, and some of

* Printed in advance, March 14th, 1874.

their fluctuations in range. On reconsidering the matter, I have become convinced that it would be better to wait as long as possible before attempting this work, and until I have finally closed the investigations now in progress. Each year has presented new facts, and modified our views of old ones ; and, as our field may be still further enlarged, and our observations supplemented to a considerable extent, a reasonable delay may add a good deal to the accuracy and value of the tables indicated.

I would call special attention to the fact that no intrusion of Asiatic forms occurs toward the western end of the chain ; and also, that the birds of that region are reinforced by several Arctic forms, not included in that part of the archipelago near the continent to the eastward. This peculiarity in distribution is more marked when we regard the plants, coleoptera, and marine invertebrates, as well as the birds, all of which groups present the same peculiarity in a more striking manner than the birds themselves. This may be due, in part, to the temperature, which is affected by the Arctic current which sweeps down the Kamchatka coast, although it passes some distance west of the islands.

We noted that on those islands, such as Attu and Atka, where the Arctic fox and other land animals have been introduced by the Russians, the birds preferred to build on islets and rocks off shore, or not accessible from the beaches. But on those islands where there are no such animals, the habits of the same species are quite different. They build, without fear, on the banks and hillsides of the main island, and are not found on the rocky islets at all. This indicates not only a change in habits brought about within historic times, by the struggle for existence, but also, that the progeny of individuals probably continue to reside on the same islands as their progenitors.

On Amchitka, a low island, which was abandoned by the Russians in 1849—and which has not been visited since, except by our party—the birds were remarkably bold and fearless, scarcely stirring at our approach, and confidently disporting in the water close to the vessel. This was especially noticeable in shy and timid birds, such as the loons.

The numerous species of small auks and puffins for which this region is famous, are peculiar in their habits. They spend the larger part of the day, at a distance from shore, varying from two to fifteen miles ; enormous flocks covering acres sociably sitting on the water close to one another, feeding or sleeping, even in rough weather. They prefer places where the currents form streaks on the water, or narrow eddies, as here are collected much of the wash from the shores, small pieces of sea-weed, and the small crustacea feeding on the decaying sea-weed, which form the principal food of the birds. The birds also eat a good deal of sea-weed, their stomachs always containing more or less of it mixed with fragments of crustacea. The auks, puffins, and smaller divers, seem to subsist entirely on these matters. I have never seen them eat mollusks, echini, or other invertebrates, even when the shore was strewn with them. The murres, puffins, and larger divers, consume a great many small fish, but never any dead matter, so far as I could observe. On the contrary, the gulls and crows perambulate the sand with fantastic motions, watching the ebb of the tide, and eagerly seizing on anything which may be stranded, dead or alive. They are particularly expert in seizing the large common echini, (*S. Dröbachiensis*) breaking them on a stone, and devouring the well-filled ovaries.

While off shore, the flocks of auks may be seen leisurely swimming in groups of thousands, against the current; occasionally, if it is too strong for them, rising all together and settling down in their old position relative to the shore. The murres sometimes intrude among the smaller auks, but, as a general proposition, each species keeps strictly by itself, though there may be several species, in flocks of thousands, within a few yards of one another. I believe they obtain most of their sleep in this manner. Towards evening, they all come in shore together, as the sun goes down, and remain on the edges of bluffs and high banks, or in the still waters of the harbors, screaming, whistling, quarrelling, and making a great disturbance, all night. With the first gleam of dawn, they go out to sea again. I believe, also, that with these birds the male does a large proportion of the incubation; I have rarely found a female on the nest; especially in the day-time, I do not remember a single instance. This holds true of the mormons, urias, small auks, and both species of the petrels.

For the convenience of those who may find it difficult to recognize the geographical names of localities, (seldom given, and when given, usually misspelled on the ordinary maps) I add a list of the approximate positions of our stations in the islands during the past year:

	Lat. N.	Lon.
Chichagoff Harbor, Attu Id..........	52° 55′ 57″	173° 12′ 22″ E
Kyska Harbor, Great Kyska Id.......	51° 59′ 00″	177° 30′ 00″ E
Constantine Harbor, Amchitka Id.....	51° 23′ 33″	179° 12′ 12″ E
Bay of Islands, Adakh Id.............	51° 49′ 16″	176° 52′ 00″W
Nazan Bay, Atka Id.................	52° 10′ 30″	174° 15′ 00″W
Iliuliuk Village, Unalashka...........	53° 52′ 57″	166° 31′ 36″W
Popoff Strait, Shumagin Ids...........	55° 19′ 17″	160° 31′ 14″W
Sannakh Reefs......................	54° 28′ 00″	162° 52′ 00″W

1. *Falco gyrfalco,* Linn. Jerfalcon.

The form of Arctic falcon, referred to under this name, is, according to Professor Baird, the true *gyrfalco*, as distinguished from *candicans*, and *islandicus*, and is now obtained, for the first time, in American territory. A male was obtained in the harbor of Kyska, June 30th, 1873, being one of several which had their nests on the brow of a precipitous and inaccessible cliff at the west end of the harbor, perhaps a hundred and fifty feet above the water. The same species was observed flying over the low island of Amchitka, a little later in the season. It does not appear to be common, but was the only hawk observed in the islands west of Unalashka. It appeared to pass most of its time near the nest, and raised a loud outcry when any one approached the base of the cliff, on the beach below. The fragments of several ptarmigan, probably remnants from some of its meals, were noticed at the foot of the bluff below the nest. Shot, as it was, in the head, I was unable to determine the color of the eyes in the specimen obtained. I presume the bird to be, like the species found at Unalashka, a resident.

2. *Haliaëtus leucocephalus*, Sav. (43). Bald Eagle.

Observed at Attu, and a resident throughout the Aleutian chain; everywhere occurring in the greatest abundance. So far as my observations go, it does not confine its diet to fish, but also destroys grouse and other birds. At the time when we left the islands, in October, the young of the year were still unable to fly. *H. pelagicus* has not yet been obtained from American territory. It is found at Petropavlovsk, Kamchatka; but I believe that it cannot properly be included in our fauna. *A. canadensis* was not observed to the westward.

3. *Brachyotus palustris*, (52). Short-eared Owl.

Observed in all the islands from Attu eastward. A resident. Nests in burrows, in hill-sides or grassy banks.

4. *Hirundo horreorum*, Barton. (225). Barn Swallow.

This species was obtained abundantly at Unalashka, on and after June 9th, 1873. It is said to nest in the upper portion of the church and other buildings at the village of Iliuliuk. A swallow is also reported as occurring at Atka, which is probably the same species. It does not occur at Attu. A summer resident.

5. *Troglodytes hyemalis*, var. *alascensis*, Bd. (293). Wren.

Obtained in Attu and the Pribyloff Islands, a resident throughout the Aleutian chain, and everywhere very abundant and tame; but we have not yet been able to discover the nest and eggs, though the young birds were very plentiful in Amchitka in July.

6. *Leucosticte griseinucha*, Bon. (323). Gray-necked Finch.

The westernmost point at which this species was obtained was Kyska. It was not observed at Adakh or Amchitka, but occurs in all the larger islands east of Kyska. It is a resident, and breeds in May. I have observed no transitional forms in the Aleutian Islands which would connect this race with *littoralis*.

7. *Plectrophanes nivalis*, Lin. (325). Snowbird.

A resident; universal throughout the Aleutian and Pribyloff Islands. A nest with five eggs, in a fresh condition, was obtained on a low grassy bank, June 20th, 1873, at Chichagoff Harbor, Attu. Another nest, with four much developed eggs, was obtained June 23d, in a similar locality.

8. *Plectrophanes lapponicus*, Selby. (326). Lapland Longspur.

A nest with four much-incubated eggs was obtained at Attu, June 18th, and the bird was abundant. It builds in the same localities as *nivalis*. This bird was obtained in Attu, Kyska, and Adakh, but not in Amchitka, which is a low island. We did not see it at Atka, and I am certain that it does not occur in Unalashka, or the islands east of the latter point. In the localities where it is found, it is a summer visitor only, disappearing after the young are able to fly.

9. *Passerculus sandwichensis*, Bd. (333). Sparrow.

Abundant, as usual, in Unalashka, but not passing west of that island. A summer resident.

10. *Melospiza insignis*, Bd. (362*). Song Sparrow.

A resident during the year throughout the Aleutian Islands. The young had obtained a considerable size early in July, at Kyska. There appear to be two tolerably well-marked varieties of this bird, found in the same localities; one of pure ashy tints, and the other much tinged with rufous brown.

11. *Corvus carnivorus*, Bartr. (423). Raven.

A resident throughout the islands, but does not occur in the Pribyloff group, and is less abundant where there is no population. A few young ones were taken to St. Paul Island in the spring, in the hope that they might be of use in devouring the remains of the seals killed there, which cause a very offensive odor during the hunting season.

12. *Lagopus albus*, Aud. (467). Ptarmigan.

More or less abundant in all the Aleutian Islands. The eggs are numerous, and laid in a rounded depression in the upland turf, or moss. June 21st we obtained nine much incubated eggs, at Attu; and young grouse were abundant at Kyska, July 8th. We endeavored to rear some, but could not induce them to eat anything.

From careful examination of many specimens, most of which were killed for the table, I feel sure that this is the only species of grouse found on the islands, and I believe there is no authenticated instance of the occurrence of *L. rupestris* west of the 156th meridian.

13. *Hæmatopus niger*, Pallas, (513). Oyster-Catcher.

Very abundant at Adakh; seen at Kyska and Amchitka. A summer resident, arriving in May, and breeding in the islands. It is probably found at various times on all the islands, though frequenting some more than others. We did not see or hear of it at Attu.

Iris of a rich orange color; edges of eyelids scarlet.

14. *Lobipes hyperboreus*, Temm. (520). Northern Phalarope.

This species was obtained, breeding, at Kyska, June 30th, 1873. The number of eggs varied from two to four. The nests were rounded depressions in the turf, usually found in low and marshy localities. It is a summer visitor, and we were unable to find it anywhere in the islands except at Kyska—a somewhat singular fact. Had it occurred at any of the other stations visited, we should probably have detected it. It is not found at Unalashka.

15. *Tringa maritima,* Brün. (528). Purple Sandpiper.

A summer resident, breeding throughout the Aleutian and Pribyloff Islands. Obtained from Attu eastward.

16. ——— ———?

A species of plover, or sandpiper, with a nearly white body and dark wings, about the size of the last species, was seen on two occasions at Attu, in June. Unfortunately we were unable to obtain a specimen, and we did not see it anywhere else.

17. *Limosa uropygialis,* Gld. (549[a]). Godwit.

This species was, on the 9th of June, again obtained at Unalashka, where it breeds. It is a summer resident, and has not been observed to the westward of this point, though it ranges north to the Yukon.

18. *Cygnus americanus,* Sharpless. (561[a]). Swan.

Mr. Thompson, an otter-hunter who wintered in Sannakh Island, 1872–3, reports that he killed three of these birds in September, 1872, and that they were not uncommon during the autumn. They have not been reported from any part of the Aleutian chain proper.

19. *Anser Gambellii,* Hartl. (565). White-fronted Goose.

These birds are reported as occurring in small numbers, spring and fall—during their northern and southern migrations—at Attu, Unalashka, and Sannakh. I have not heard of them at intermediate points, and as they make no stay, they can only be regarded as casual visitors.

20. *Bernicla nigricans,* Cas. (571). Black Brant.

This bird, like the last species, passes the islands in its annual migrations, and does not breed to the eastward of Amchitka. Unlike the *Gambellii,* however, a small number do remain and breed on the Semichi Islands near Attu, Kyska, and Amchitka. Eggs of this species were obtained on the Semichi Islands, June 15th, and young, unfledged goslings on Kyska, July 10th. It is not abundant, however, and breeds on the highest hill-tops, and not, as in more northern regions, on the lowlands. It has also been reported as a casual visitor at the Pribyloff Islands. On our return to the coast of California, in the latter part of October, enormous flocks of this species were seen about 100 miles off shore, from the vessel, flying south, frequently alighting in the water near the ship.

21. *Philacte canagica*, Ban. (573). Emperor Goose.

This species—rarely found in winter near Unalashka, and not at all to the westward—is reported by Thompson to congregate in great numbers on the low, marshy island of Sannakh, during the entire winter. To these birds he and his companion owe their preservation during an attack of the scurvy, which nearly proved fatal to them both. They migrate northward in May.

22. *Nettion carolinensis*, Bd. (579). Green-winged Teal.

A resident throughout the islands as far west as Kyska; casual, in summer, at Attu. This species was one of the two or three upon which we principally relied for supplying our table during the season of work amongst the islands. Young ones were abundant at Amchitka, in July.

23. *Harelda glacialis*, Leach. (587). Old Squaw.

A resident as far west as Kyska, not seen or heard of at Attu. Individuals are less plentiful as we go west from Unalashka, and it is nowhere very abundant.

24. *Polysticta Stelleri*, Eyton. (298). Steller's Eider.

This species is reported by Thompson as wintering abundantly at Sannakh Island. As an illustration of the irregularities which obtain in the range of migration of birds in different seasons, it may be mentioned, that while in May, 1872, this species was very abundant at Unalashka, together with the next species, yet in May, 1873, not a single one of either was observed, though the season was later by a month than the previous one, and the birds in question winter in large numbers at Unalashka.

25. *Somateria v-nigra*, Gray. (607). Pacific Eider.

Apparently a resident in the islands. Wintering abundantly at Unalashka, it seems to seek its breeding-grounds in those islands to the westward which are not inhabited. At least, it seems quite certain that the large flocks which winter in Captain's Bay do not breed in the immediate vicinity; while it is the most common duck in the western islands during the summer.

26. *Mergus serrator*, Lin. (612). Saw-bill. Water-hen.

Obtained at Amchitka, the only locality in the islands where it has yet been observed, and rare there—apparently breeding. A summer visitor.

27. *Graculus bicristatus*, Pallas. (627*). Shag.

Resident in the Aleutian and Pribyloff Islands. The following notes were made from two fresh specimens killed at Amchitka, July 27th, 1873.

No. 1. (290.) ♀ Iris pale olive brown; base of mandibles and culmen bright blue, remainder of naked space scarlet. Two pronounced tufts on the head.

No. 2. (291.) ♂ Iris olive brown; base of mandible dull ashy blue, with a narrow orange border to the naked membrane, which was much more invaded by scattering feathers than the other, and dull colored. Tufts ill-defined, or none.

28. *Graculus Bairdii*, Gruber. Lesser Cormorant.

This bird, which resembles what has been supposed to be a variety of *violaceus*, Gray, is also a resident of the Aleutian chain. Specimens from Kyska, July 8th, ♀ had a brown iris, and the naked membrane somewhat carunculated, and of a coral red, mandible nearly black. Others from Amchitka, July 26th, had a dark green iris, and a similarly colored gular sac. One obtained in 1872, at Unalashka, had a dark, nearly black, iris, with the gular sac flesh color, passing into ashy gray above. All appear to possess small white feathers scattered through the plumage in the breeding season, but I am not sure that the white thigh patches are always of this character. There appears to be some variation also in the shade of green of the plumage; in some specimens it is much more rusty than in others. I am informed by traders who visit Copper and Bering Islands, that there are several varieties of cormorants and small auks found there, which they have not seen in the Aleutian chain. Some of these may be included, as well as some from the Kurile Islands, in the old descriptions, with an erroneous Aleutian habitat assigned to them.

29. *Diomedea brachyura*, Cas. Mottled Albatross.

Abundant off shore throughout the Aleutian Islands, where it takes the place of *D. nigripes*, which seldom ventures north of lat. 50° north. It probably breeds in the islands, as we saw the mutilated carcass of a very young one, in August, at Atka. Its bones were tolerably abundant in the Aleutian "Kitchen midden," or ancient shell heaps. It is much larger than *D. nigripes*, and never follows a vessel, as is the custom of that species. Apparently a resident from Attu eastward, as we saw a dead specimen on the beach, in the winter of 1871-2, in Unalashka.

30. *Diomedea nigripes*, Aud. (633ª). Gony.

Full notes have been given on this species in previous catalogues, and our observations during the past season confirm, without adding anything to our information already published. It has always been a question where this species breeds, and I am glad to be able to state, on the authority of Captain Geo. Holder, that it nests on the coral island of Gaspar Rico, near the equator, in the winter season. This gentleman, who is an intelligent and trustworthy observer, informs me that on a voyage in search of new guano islands, he touched at Gaspar Rico, and found this bird, together with a species of petrel, and a tern, breeding abundantly in a low scrubby growth of bushes, which are the only representatives of trees on that island. His impression was that it laid but one moderately sized, white egg, in a depression in the soil, around which a little sea-weed or dry herbage was gathered. It is not known to breed anywhere on the northwest coast of America, or the northern Pacific islands.

31. *Thalassidroma Leachii*, Temm. (642). Petrel.

This species, not noticed east of Amchitka, breeds abundantly on the rocky islets off Attu, and on the highlands of Kyska and Amchitka. As in the next species, the male seems to do a large proportion of the incubation, and, as a rule, they lay only one small, white egg, in a burrow from six inches to a foot in horizontal length. This burrow is often curved considerably to one side, and I have never seen one absolutely straight. The burrow is usually in the side of a turfy bank. This, and the next species, have the habit, when handled, of disgorging a reddish, oily fluid, of strong and disagreeable musky smell; and one can tell, by the odor of the burrow alone, whether it is tenanted by a petrel, or one of the *Alcidæ*. From this habit, the petrels (of which species I am not certain, but think it to be this one) which breed off the coast of Mendocino County, California, have received there the name of "Musk Birds." While breeding, they are largely nocturnal in their habits. We found fresh eggs from June 10th to the end of July. The eye of both these petrels is of a dark brown, almost black after death. The specimens from the islands are darker than those from Sitka. They can be considered as summer residents, going south in winter, and arriving at the islands in May.

32. *Thalassidroma furcata*, Gld. (643). Gray Petrel.

The remarks under the head of the last species will generally apply to this one also, but it is found breeding on all the less populated islands, as far east as Unalashka. Unlike the reported habits of the North Atlantic petrels, they are never seen in stormy weather at sea; nor do they ever follow in a vessel's wake, as far as my observations go. They are occasionally seen flying about in calm, fine weather, throughout the North Pacific.

33. *Lestris parasiticus*, Temm. (654). Skua.

These birds were obtained in the breeding season at Kyska and Amchitka, and in winter at Unalashka, rarely. They are nowhere common; nor have we ever obtained any in completely adult plumage. All our specimens are of a nearly uniform dark slate color. They are probably residents. The eye is nearly black.

34. *Larus glaucescens*, Licht. (557). Glaucous Gull.

The common and only gull of the islands; resident throughout the chain, but more abundant to the eastward. Breeds in May and June. We obtained nearly fledged young at Kyska, early in July. The eye is of a lighter or a darker steel gray.

35. *Rissa tridactyla*, Bon. (672). Kittiwake.

Rare in the western islands, not venturing into the protected bays and harbors much, but apparently a resident. No other species of kittiwake was observed west of Unalashka.

36. *Sterna macrura*, Naum. (690). Arctic Tern.

The only point at which this beautiful little tern was observed west of the Shumagins, was at Amchitka, where it was abundant.

37. *Colymbus torquatus*, Brün. (698). Loon.

Breeds at Kyska, abundant at Amchitka in July. Not seen elsewhere, except at the Shumagins. A summer resident.

38. *Colymbus septentrionalis*, Lin. (701). Red-necked Diver.

Very abundant at Amchitka in July, where it was breeding. Seen nowhere else in the Aleutian chain. A summer resident. We observed six or eight of them at a time in the harbor of Amchitka, quite bold in their behavior, usually appearing in the early morning, or the dusk of evening. Crossing the island one day, we observed a female of this species with one young one, swimming in a pool of fresh water. Alarmed by our approach, the mother did not attempt to fly, but settled down in the water, until only her neck appeared above the surface, while the little one immediately took up its position on her back. Wishing to obtain the early stage of the bird, we shot the young one, and picked it up. Soon after, the male arrived from the west coast of the island with a small fish in its mouth, evidently intended for the young one. Not seeing it, he uttered a mournful cry, which was replied to by the female, who had remained in the pool without attempting to escape. For some minutes the conversation was kept up, and then both took wing, and disappeared, still uttering low moaning cries at intervals.

I have never seen loons, of either species, as abundant anywhere else as they were at this island, which had not been visited by a vessel since 1849.

39. *Mormon cirrhata*, Bon. (712). Tufted Puffin.

A resident; abundant throughout the islands, more especially the unfrequented ones, but more rare as we go east from Unalashka. The skins of this species are used for making long coats, or hunting shirts, by the western Aleuts; and the light feathers frequently used in their embroidery are mostly taken from its long tufts. They appear to lay two eggs, and we found fresh eggs of this and the next species from May to the end of July.

40. *Mormon corniculata*, Naum. (713). Horned Puffin.

A resident; abundant from Attu to the Shumagins, and having habits similar to those of the last species. The eyes of both have the iris of a clear, dead white color.

41. *Uria columba*, Cas. (727). Red-footed Diver.

Abundant anywhere from Attu to the Shumagins, but not seen in winter. The young have dark bluish-black eyes and feet.

42. *Uria californica*, Bryant. (730[a]). Murre.

Abundant, and apparently a resident all through the islands. Less common and more shy than the last, but, unlike *U. columba*, congregating in immense flocks a few miles off shore. I have never seen the last species going in a large flock; there are seldom more than two or three together.

43. *Ombria psittacula*, Cassin. Parroquet Auk.

Not uncommon at Amchitka, but not seen anywhere else. A resident. The iris is white. I think Brandt is mistaken in supposing the peculiarly shaped bill is used in prying open bivalve shells. I have never found anything in its crop except fragments of crustacea, and I think that the bird uses its sharp, recurved, lower mandible in tearing out the softer parts of the larger Isopods, and in picking them out of crevices in the rocks, and from under round stones.

44. *Phaleris cristatella*, Bon. (719). Sea-quail.

Abundant in large flocks, covering acres, off shore; from Kyska eastward, but very rarely seen in the bays and harbors. A resident.

45. *Brachyrhamphus antiquus*, Br. (736). Ancient Auk.

Abundant throughout the islands, especially in certain localities; we obtained it from Kyska eastward. While this species also congregates off shore in very great numbers, it yet frequents the bays and harbors much more than any of the other small auks. The iris is white. From observations of many specimens and large numbers of the living birds of all ages, I have become satisfied that the young of this species is the bird obtained by me in Unimak Pass, in 1865, and which was described by Dr. Coues as *Simorhynchus Cassini*. Brandt refers *Cassini* to the immature form of *Kamchaticus*, but *Kamchaticus* has never been authentically identified from the Aleutian chain, and I doubt its occurrence there. I think it quite probable that many species, properly belonging to the Kurile and Commander's Islands, and to the coast of Kamchatka, have, in confusion of geographical names, and ignorance of these rarely visited regions, been attributed erroneously to the Aleutians.

It is quite likely, also, that the young of several of these small auks may closely resemble one another. However, it is certain that I have never seen nor obtained *S. Cassini*, except where *antiquus* was abundant. I have seen it among the flocks of *antiquus* on the water, and shot it out of these flocks. Every one who has carefully watched the different species of small auks, has observed that each species keeps strictly to itself; large flocks of each may be feeding adjacent to one another, but they never mingle. The only exception to this rule is the murre, which sometimes intrudes into a flock of the smaller auks. Lastly, the plan of color in *Cassini* is the same as in *antiquus*; and the advancing stages of the former approximate more and more closely to the latter. No doubt remains in my own mind in regard to their identity.

Among other specimens of the young form, one was obtained at Amchitka, with a curious malformation of the lower mandible, which was nearly one-half shorter than the upper one. The bird, however, was healthy and fat.

In closing this list, which I believe to be very nearly a complete one of the birds west of Unalashka, I have to thank Messrs. Frost and McCarty, of the A. C. Co., agents at Attu and Atka, respectively; and Captain E. P. Herendeen, and other members of my party, who made the most of the scanty leisure afforded by our summer's surveying work, in assisting to make the collection as complete as possible.

Mr. Stearns read a translation from the reports of the Society for the Preservation of Norwegian Antiquities; describing the excavation of an ancient vessel, of the Viking period, found in the parish of Tane, Norway.

Judge Hastings read a paper on the "creeping" of railroad tracks.

The President made the following remarks in addition to the paper on deep sea soundings, read in the last meeting:

In the communication made at the last meeting upon the subject of the deep sea-bottom of the Pacific, I omitted to mention the fact that the average depth of this ocean, on a direct line between Japan and California, had been determined in 1855, by Professor Bache, of the Coast Survey, from the discussion of the observations of the transmission of the great earthquake waves of December, 1854. The matter is not new, but is worth repeating in connection with the present subject.

The character of these waves being ascertained, and also the time of their transmission, the average depth of the ocean in their path can be determined. The rate of motion of the crest of the wave from Simoda to San Diego, was 370 miles per hour, or 6.2 miles per minute; to San Francisco, 355 miles per hour, or 6 miles per minute. The duration of an oscillation on the San Diego path was 31 minutes; the duration of an oscillation on the San Francisco path 35 minutes.

These data yield, for the length of the wave on the San Diego path, 186 to 192 miles, and on the San Francisco path, 210 to 217 miles.

Now, a wave of 210 miles in length would move in a velocity of 6.0 miles in a depth of 2230 fathoms, and a wave of 217 miles in length would move with a velocity of 6.2 miles per minute, in a depth of 2500 fathoms.

In a similar manner was derived the average depth of 2100 fathoms on the San Diego path.

Regular Meeting, March 16th, 1874.

Vice President in the chair.

Forty members present.

James Whartenby was elected a life member, and Edwin Merrifield, John H. Bostwick, G. W. Dunn, Benjamin Roop, and Lovell Squire, resident members.

Donations to the Library: Geological Survey of Missouri, one volume, 1872, and atlas; one volume of Reports on the same, 1855–1871, presented by G. C. Broadhead; System of Entomology, a continuation of Buffon's Natural History, by Gustav Jablonsky, Berlin, 1783; presented by James Behrens; Engineering and Mining Journal, New York, 1874, Vol. XVII, Nos. 8, 9, and 10; Societié Entomologique de Belgique, No. 95; Nature, Vol. IX, Nos. 224 and 225; Quarterly Journal Geological Society of London, Vol. XXX, Part 1st, 1874; Astronomical Register, London, February, 1874; Report of the Chief of Ordnance, 8vo., Washington, 1873; Annalen der Physik und Chemie, Leipzig, No. 12, 1873; American Naturalist, March, 1874; American Journal of Sciences and Arts, March, 1874; Proceedings Philadelphia Academy of Natural Sciences, 1873, pp. 425–470; Verhandlungen der Gesellschaft für Erdkunde, Berlin, 1874, No. 1.

Donations to the Museum: From W. J. Fisher, skull of an *Orca*, or killer-whale, from the Arctic Ocean; from W. H. Dall, ear-bone of *Megaptera versabilis* Cope, skull of *Lagenorhynchus obliquidens* Gill, and of the California Gray Whale, *Rhachianectes glaucus* Cope, all from Monterey, California. The cranium last mentioned is about eight feet long, and (with the exception of one collected at the same time, and presented to the National Museum at Washington) is the only bone of this gigantic and formerly abundant animal, in any museum in the world. Mr. Dall also presented a very old prehistoric Aleutian cranium from the Amaknak Cave, a record of the exploration of which has already been published in these Proceedings; from Jas. E. Perkins, a specimen of *Octopus;* basalt from Olompali Rancho, Marin County, California, from W. A. Goodyear; from Dr. Behr, a specimen of salamander, *Batrachoceps attenuatus* Bon.; five species of birds from Mr. F. Gruber: *Melospiza fallax*, *Paroaria dominica*, *Calypte anna*, *Sialia mexicana*, and *Agelaius gubernator*.

Mr. Stearns read the following paper:

Remarks Suggested by Dr. J. E. Gray's Paper on the "Stick Fish," in "Nature," Nov. 6th, 1873.

BY ROBERT E. C. STEARNS.

At a meeting of this Academy on the 3d of February, 1873, certain switch-like rods, being the axes of some polyp-form, as well as the general characters of Alcyonoid Polyps, were considered and discussed, for the purpose of tracing by analogy and determining the relations and position of the specimens under consideration at that time; and it may be remembered that a paper was read, in which was given at considerable length a resumé of what had appeared in the columns of *Nature*, in the way of notes and comments by several learned gentlemen.

These rods, switches, or wands, as the specimens had been variously called, were first brought to the notice of the Academy on the 5th of June, 1871, when specimens were presented to the Museum, and, so far as an opinion was expressed at that time in a general way, the specimens were placed near the group to which it has been subsequently proved that they belong.

On the 4th of August, 1873, Dr. James Blake submitted an entire specimen of the polyps, of which the rods, etc., are the central stalks or axes: that is, one of these rods or switches was presented by him, with the investing soft or fleshy covering, which proved it to be either a *Pavonaria*, or closely related to that genus. Accordingly, I published a description placing it in the genus *Pavonaria*, and gave it the specific name of "Blakei," (*Pavonaria Blakei*) and the same was printed in the *Mining and Scientific Press* of this city, August 9th, 1873.

Before the succeeding regular meeting of the Academy, which took place August 18th, 1873, through access to more recent literature bearing on the subject, I perceived at once that not only was the species new, but that its separation generically was warranted, and the sub-genus *Verrillia* was made by me to receive it; and a description of the genus and species was read at that meeting, and printed copies of my paper (dated August 20th) were sent to various authors, societies, and scientific journals, in advance of the regular publication of the Academy's Proceedings.

Among the many scientific gentlemen who had discussed the character and relations of the so-called switches, Dr. P. L. Sclater, of the Zoölogical Society, kindly gave publicity to *Verrillia Blakei*, in *Nature*, for October 9th, 1873.

In the same journal, of date Nov. 6th, 1873, Dr. J. E Gray, of the British Museum, publishes a communication "On the stick-fish, (*Osteocella septentrionalis*) and on the habits of sea-pens," in which he refers to a specimen presented to the Museum by Mr. Coote M. Chambers, and of which he says: "Unfortunately the specimen did not arrive in a good state for exhibition. The greater part of the animal portion had been washed off, probably by the motion of the solution during the transit; only about a foot of the flesh which was loose on the axis, and the thick, swollen, naked, club-shaped base, without polypes, remained; but it was in a sufficiently good state to afford the means of determining its zoölogical situation, and of examining its microscopical and other zoölogical characters."

In the next paragraph, of which I quote a portion, Dr. Gray says: "Mr. Chambers' specimen is the animal of the axis or stick, that I described as *Osteocella septentrionalis,* (Ann. and Mag. Nat. Hist., 1872, p. 406) * * * * * and is evidently the same animal as *Pavonaria Blakei,* described by R. E. C. Stearns."

"Two days after I received this specimen, I received by post Mr. Stearns' description of the stick fish, (*Pavonaria Blakei*) from the San Francisco *Mining and Scientific Press,* August 9th, 1873."

Towards the close of his article, Dr. Gray writes: "Mr. Stearns' paper, in the Proceedings of the California Academy of Sciences, is a reprint of the paper in the San Francisco *Mining and Scientific Press,* with a few additions, and the addition of a new sub-genus, *Verrillia,* although he quotes *Osteocella.*" In this paper Mr. Gray gives what he considers "the synonymy of those animals"; first, the genera, and next, the species; placing my first generic determination, *Pavonaria,* and my subsequent sub-genus, *Verrillia,* in the order as recited, as synonymes of his genus *Osteocella.*

I would ask Dr. Gray by what warrant, either of science or justice, he places *Pavonaria* or *Verrillia,* definitely described genera, as synonymes of his indefinite and vague *Osteocella,* which latter he *publishes* as a genus, for it cannot be said he *describes* it, in the "Catalogue of Sea-Pens—or Pennatulidæ—in the British Museum" 1870, page 40. Gray's genus *Osteocella* is based upon a "bone," (probably the axis of a polyp) which was sent to the British Museum "many years ago," from Australia, by a gentleman named Clifton. The investing fleshy substance, or soft portion of the animal, of which said bone formed a part, had not been seen by Dr. Gray at the time he invented the name *Osteocella,* and even to this date no additional light has been furnished by him regarding the Australian form. He was not even *positive* that the "bone" belonged to a zoöphyte, for he says: "or, it may be the long conical bone of a form of decapod cephalapod which has not yet occurred to naturalists, as Mr. Clifton spoke of its being a free marine animal: it has a cartilaginous apex like the cuttle fish."

In which of the great divisions of the animal kingdom does Dr. Gray place it, or did he place his Australian bone in 1870?

Courtesy and fairness suggest that as he printed it in the Catalogue of *Pennatulidæ,* it should be conceded, as I have written, in a previous paper, "that, in his mind, the balance of reasoning tends in that direction."

Admitting this latter, what then? The Australian bone upon which rests his genus *Osteocella* is described by Dr. Gray as being "thick, about eleven inches long, tapering at each end." Subsequently he has received one of the stalks, or axes, of what I have named *Verrillia Blakei;* of the latter, he says it is "long, slender, about sixty-four inches long, attenuated at the base, and very much attenuated and elongated at the other end." "Mr. Carter" examined both of the bones referred to, microscopically, and "finds them" to "present the same horny structure," etc. An examination with acid was made, but as it would be rather difficult to comprehend in what way generic or specific determinations within any related groups could be determined by *acid*, this test may be allowed to pass.

The reference of *Verrillia* to *Osteocella* as a synonyme, or otherwise, must rest on this microscopic test, as the soft investing portion of the animal, the perfect or complete polyp or polypidom of the Australian form, to which the bone, if the axis of an alcyonoid, belongs, and upon which Dr. Gray made his genus *Osteocella*, has not, as yet, been seen by him, or brought under scientific observation. He cannot aver, because he does not know, but that it may be a species which belongs to some genus already described, or that it may properly fall in as a sub-genus of some of the genera of Alcyonoids previously known; he does not know but what its relationship may be nearer to any of the other groups than to *Pavonaria*. No description sufficiently accurate to be worthy of consideration can be made from the axial rods or bones alone, of this class of animal forms, nor can species be satisfactorily determined without the fleshy portion; nor, in the present state of our knowledge, can the microscope determine these points.

In his genus *Osteocella*, which, it must be borne in mind, rests solely on the *naked* Australian bone or axis, which he says is "thick," "eleven inches long," as published in the British Museum Catalogue of *Pennatulidæ*, no information is furnished as to the soft investing portion, for the very good reason that it had not been seen by him; yet in the number of *Nature* last quoted, he speaks of "the complete polyp-mass," thus clothing his west Australian *Osteocella* with the fleshy covering of the west North-American *Verrillia*. So much for his generic synonymy. As to the species, the North-American form, as referred to by him, could not be definitely placed, by anything written by Dr. Gray prior to the date of my description.

This is a matter, not of personal pride, but of scientific accuracy; and scientific naturalists should not lose sight of, or be diverted from, this *sine qua non*, or palliate individual idiosyncracies which involve integrity, and which should not be allowed to pass without challenge or comment.

The following paper was presented by Dr. J. G. Cooper:

The Influence of Climate and Topography on our Trees.

BY J. G. COOPER, M. D.

While making geological explorations through the region embraced on the Bay Map, during some months past, for the purpose of completing the geological map, under direction of Prof. Whitney, I had unusual opportunities for observing the distribution of the native trees in all kinds of localities, except the portions embraced in about fifteen miles square in the southeastern, and as much more of dry land in the northeastern corners of the "Bay Map Region."

On comparing my results with the series of careful observations on plant-distribution, given by Prof. Bolander, in our Proceedings, and Prof. Brewer, as given in the first volume of Geology of California, I have been able to arrive at the following interesting conclusions, tending to indicate the laws governing our tree-growth.

FORESTS AND TREES OF THE BAY MAP REGION.

In traveling around the Bay, the most notable fact in Botanical Geography likely to attract the observer's notice, is the comparative scarcity of the trees and small number of species, as compared with the regions either northward, at Russian River, or southward, at Monterey Bay. After careful study of the subject, the conclusion is inevitable that the chief cause of this deficiency is the prevalence of the strong winds, which, throughout the dry season, blow so steadily into the Golden Gate from the northwest, and are drawn by the ascent of heated currents far into the interior, following, generally, the course of the valleys *upward* from the Bay.

As to the prevalence of these winds, we have natural records of centuries past, in the trees themselves, bent almost to the ground in numerous places. Going beyond the vicinity of this Bay, we find a low tract of hills lying between Petaluma and Tomales Bay, where, for a distance of ten miles square, the Coast Range is depressed to an average height of three hundred and fifty feet, with passes through it only one hundred and fifty feet above the sea. Here, the winds blow inland with sufficient force to have limited the tree-growth to scattered groups on the eastern slopes of the hills.

That soils are only secondary in their influence, is shown well around this city, where every variety of metamorphic rock and tertiary sandstones occur, as well as abundant alluvium in the valleys. Much the same variety is seen in the low hills west of Petaluma, while other openings along the coast to the south, such as Salinas Valley, and those along the coast south of Ventura, (known to sailors as "Wind Gaps," on account of the strong sea-breezes drawn inland where they occur) all prove the prevalence of the same laws.

Elevation above the sea, of course, has some influence, but less than would be expected; for we find a large number of the forty species of trees found in these limits, growing with scarcely any difference in size or luxuriance, from the sea-level up to 4,500 feet. Others, however, show a preference for mountains or valleys alone, and all are influenced by the effect of the mountains in moderating the winds, intercepting fogs and rain-clouds, and producing more extreme degrees of cold and heat than prevail in the valleys. The studying out of all these influences, as relating to each species, would be a very slow process, and I need not attempt more now than to mention such as seem to have a peculiar effect on certain species. The general unfavorable influence of the absence of mountains on tree-growth in our climate, is shown by the usual bareness of our valleys, and of the lower hills, where unsheltered from the wind.

The trees are probably affected more by the wind than any other vegetation, on account of their height not permitting them to be sheltered behind hills which would protect shrubs or herbs. Thus we find some species becoming trees elsewhere, which, on the exposed portions of this peninsula, are only shrubs, as well as on some mountain ridges, assuming the aspect of trees stunted by the cold on Alpine summits. Dryness, however, is still more influential than cold, as seen in many inland localities, especially in the Chestnut, and some other species, which are lofty trees or stunted shrubs, according to their water supply. One shrub—not rare here—the Juneberry, (*Amelanchier alnifolia*) becomes a tree in the moister but cold climate of Montana. It is therefore inadvisable to include the shrubs and trees together; the former being influenced by quite different laws of distribution.

From the general course of the mountain ranges, being nearly northwest in this region, while the wind strikes their southwest slopes obliquely, and the sun in its daily course shines most intensely and longest upon the same exposure, it follows that this slope is almost everywhere destitute of trees, though along the coast exposed to the greatest rainfall and the most fog. The opposite, or northeast slopes, therefore, usually have the greatest tree-growth; though, in some cases, especially south of this latitude, they have less than the southeast, on account of the "drawing" of the wind up valleys, and upon them. Were it not for the "Tomales Wind Gap," we should doubtless find more species of trees growing in the shelter of Mount Tamalpais, thus approaching us nearer from the north than from the south, on account of this protection, and the greater rainfall northward. These winds seem to act in two ways: First; by their drying power; as seen in the absence of trees on slopes of hills exposed to them, while trees may abound on the opposite slope, though facing the south, and more exposed to the sun. Second; by their coolness not permitting the sun's heat to produce a tree-growth, even where moisture is abundant. This acts chiefly on the seedling tree, as many species are found to do well when planted out where they do not exist naturally, if protected when very young.*

The nature of the soil, or geological formation, influences them secondarily, and chiefly in proportion to the amount of moisture retained; flat, swampy lands, and impervious rocks covered by a deep soil, being most favorable. Many low lands, however, though very wet in winter, become too dry in summer. The summer fogs, also, have some influence.

From these facts, it results that the forests are chiefly most extensive on the northeastern mountain slopes, or those nearest the ocean, in exact proportion to their extent, altitude, and latitude.† The only tracts within our limits, which can properly be called forests, are: First; the tract covered by the Santa Cruz Mountains, of which about half is covered by coniferous trees, an area of about 1,080 square miles. Second; a tract of less than half this extent, northward

* The effect of wind in spreading fires in former dry seasons may also have had an influence in destroying ancient forests.

† The Sierra Nevada, from their greater altitude, catch the moisture passing east of the Coast Range on southwest slopes, while the sea-breeze does not affect them.

of Mount Tamalpais. Third; the oak-groves of San José Valley, covering about 250 square miles. Fourth; mixed groves of oaks and pines on the easterly slopes of the Contra Costa and Mount Hamilton Ranges. Fifth; similar groves on the ranges north of the Bay, forming the continuation of those mountains.

The modifications caused in the course and force of the wind by the various gaps referred to, are the chief causes of local peculiarities in the distribution of trees. The shelter afforded by the intervening mountain ranges, and by others, farther inland, together with the directions and width of the valleys, so modify the distribution of species, that instead of being in semi-circles concentric to the "Golden Gate," they are found to be arranged in semi-ellipses, with curves nearly parallel to that of an arc drawn from Point Reyes, through the Golden Gate, to Pigeon Point.

Of course, the general law of increase in number of species and individuals toward the north, in direct proportion to the increase of moisture, and their decrease toward the south and east (at the sea-level) from the contrary conditions, has its full effect in this region.

We thus have three primary groups of trees — the Northern, Southern, and Eastern; but within the limits mentioned, only two are exclusively northern, if, indeed, more than varieties of southern forms (*Cup. Macnabiana* and *Pinus contorta*). Those confined to the south are but three, of which two, the Grape and Sycamore, go north in the Sacramento Valley; while the Pine (*P. insignis*) has been confounded with northern forms, and may be only a local variety.

The Eastern Group contains four species, *Juglans rupestris, Juniperus,* (sp.) *Pinus Sabiniana,* and *P. Coulteri,* of which the second is a rare straggler; and the fourth closely allied to the third. To counterbalance this, is a group confined to the Coast, not found east of the Bay, consisting of four or five species: *Fraxinus Oregonus, Quercus chrysolepis, Torreya Californica,* and *Taxus brevifolia;* probably, also, *Cupressus macrocarpa.*

The remaining twenty-seven are found around three sides of the Bay, and, therefore, show most strongly the influence of the sea-breeze in limiting their approach to its mouth. Fourteen of these may be considered as scarcely limited by it at all, since they are found within the most windy portion wherever hills furnish a little shelter. From their adaptation to the extremes of our climate, they are characteristic of nearly all the mountain ranges of the Bay Region. The Fir alone is very rare east of the Bay; while the Willows and Poplars belong to low, wet grounds. Six, being broad-leaved evergreens, and one coniferous, show the characteristic proportion of those groups in a region almost without frost, but with very moderate summer heat. It is, however, to be observed, that nearly all of them flourish more luxuriantly where the summer is warmer, even if the winter be colder.

They are the following:

Group I.—Growing within ten miles of the center of San Francisco county:

1. Ceanothus thyrsiflorus, *Esch.* Wild Lilac.

2. Æsculus Californicus, *Nutt.* California Buckeye.
3. Cerasus ilicifolia, *Nutt.* Hollyleaved Plum.
4. Photinia arbutifólia, *Lindl.* Photinia Laurel.
5. Arbutus Menziesii, *Pursh.* Madroña.
6. Sambucus glauca, *Nutt.* Blueberried Elder.
7. Oreodaphne Californica, *Nees.* California Bay Tree.
8. Quercus agrifolia, *Nees.* Hollyleaved Live Oak.
9. Alnus viridis, *D. C.* Alder.
10. Salix lucida, *Muhl.* Shining Willow.
11. Salix longifolia, *Muhl.* Longleaved Willow.
12. Salix lasiolepis, *Beuth.* Wooly-scaled Willow.
13. Salix brachystachys, *Beuth.* Shortspiked Willow.
14. Populus monilifera, *Ait.* Cottonwood.
15. Tsuga Douglassii, *Lindl.* Red Fir.

Group II.—Found from ten to twenty miles from the center of San Francisco county:

16. Vitis Californica, *Benth.* California Grape.
17. Acer macrophyllum, *Pursh.* Large-leaved Maple.
18. Negundo aceroides, *Mœnch.* Box Elder.
19. Fraxinus Oregonus, *Nutt.* Oregon Ash.
20. Platanus racunosa, *Nutt.* Sycamore.
21. Quercus Gambelii, *Nutt.* Upland White Oak.
22. Quercus densiflora, *Hook.* Tan-bark Oak.
23. Castanea chrysophylla, *Dougl.* California Chestnut.
24. Pinus tuberculata, *Don.* Tubercled Pine.
25. Cupressus Macnabiana, *Murr.* Tamalpais Cypress.

Of these ten, only two are broad-leaved evergreens, and two, coniferæ, indicating increased additions from northern families; all of them belong to the mountainous districts, except, perhaps, the Ash, a rare tree in this region.

Group III.—Found twenty to thirty miles from the center of San Francisco county:

26. Juglans rupestris, *Engl.* California Walnut.
27. Quercus Sonomensis, *Beuth.* Black Oak.
28. Quercus lobata, *Nees.* Valley White Oak.
29. Populus tremuloides, *Mich.* American Aspen.
30. Pinus muricata, *Don.* Bishop Pine.
31. Pinus Sabiniana, *Dougl.* Digger's Pine.
32. Juniperus occidentalis ? Western Juniper.
33. Torreya Californica, *Torr.* California Nutmeg.

Of these, all are deciduous, except the coniferæ, and are also mountain trees. Three are confined to the drier eastern ranges; one to the moist coast range; and the Aspen is a rare straggler from the north.

Group IV.—Found thirty to forty miles from the center of San Francisco county:

34. Quercus chrysolepis, *Lieb.* Gold-scaled Oak.
35. Pinus Coulteri, *Don.* Great-coned Pine.
36. Pinus ponderosa, *Dougl.* Yellow Pine.
37. Pinus insignis, *Dougl.* Monterey Pine.
38. Pinus contorta, *Dougl.* Twisted Pine.
39. Taxus brevifolia, *Nutt.* Oregon Yew.

Only one is a broad-leaved evergreen, replacing the common Live Oak on some of the drier mountains. Of the Pines, the first is confined to the dry, eastern hills; the second, rare, if found at all, on the Mount Hamilton Range, though common north and south, at forty miles distance. The third, is only found south; and the fourth, north.

Group V.—Found forty to sixty miles from San Francisco:

40. *Cupressus macrocarpa*, Hartw. Monterey Cypress.

This tree barely comes within the sixty-mile limit to the north, growing inland, near Mt. St. Helena, but southward, only near Monterey, as far as known; though a similar form occurs dwarfed on mountains as far south as Anaheim, where, at 2,000 feet elevation, it grows about four inches thick, and twenty feet high. At Cypress Point they grow four feet thick, and sixty, or more high, but flat-topped, and reduced in height by the winds. The influence of fogs and clouds seems more marked on the growth of this tree than on any other, though affecting the Redwood and Pines to some extent. The influence of peculiarities of climate and soil in producing some of the local forms of this genus now called species, will probably, in time, be determined by their cultivation together. A form, still undetermined, is found growing on Cedar Mountain, thirty-six miles east, apparently most like *C. Macnabiana.*

TREES FOUND OVER SIXTY MILES TO NORTH AND EAST.

Rhamnus Purshianus, *Hkr.* Bearwood.
Acer glabrum, *Torr.* Smooth Maple.
Acer circinatum, *Pursh.* Round-leaf Maple.
Cercis occidentalis, *Torr.* Western Judas Tree.
Pyrus rivularis, *Dougl.* Oregon Crab-apple.
Quercus Wislizeni, *Engl*? Wislizenus Oak.
Quercus Douglassi, *Hkr* ?=Q. Garryana?
Pinus Lambertiana, *Dougl.* Sugar Pine.
Picea grandis, *Dougl.* White Fir.
Abies Menziesii, *Dougl.* Black Fir.
Abies Mertensiana. Hemlock Spruce.
Thuja gigantea, *Nutt.* Oregon Cedar.
Cupressus Lawsoniana, *Murray.* Port Orford Cypress.
Libocedrus decurrens, *Torr.* California Cedar.

TREES FOUND OVER SIXTY MILES TO SOUTH AND EAST.

Cupressus Goveniana, *Hartw.* Goven's Cypress.
Picea bracteata. Leafy-cone Fir.
Quercus crassipocula. Thick-cup Oak.

Proposed amendments to the Constitution, submitted by Dr. Blake, were referred to the Trustees.

Regular Meeting, April 7th, 1874.

President in the Chair.

Fifty members present.

Manuel Aspiroz, Rev. Frederick E. Shearer, William C. Gibbs, Ferdinand Lantern, and George W. Dietzler were elected resident members.

Donations to the Museum: Dr. D. E. Hungerford presented a large collection, mostly from Lower California, consisting of about sixty species of shells, with many duplicates; specimens of *Gorgonia;* two specimens of Coral, one form new to the Academy's collection. Nine Star-fish, with several duplicates. Three specimens of fish (skeletons). Skull of wild cat (?). Two specimens of Crustacea (*Calappa*). Vertebræ of Shark. Six fine specimens of tortoise shell (*Caretta fimbriata*). Copper ore from near Loreto, Lower California. Steatite, from La Paz, Lower California. Fish-hooks used by Sandwich Islanders. Curious molluscan Egg-cases, with seven cigar boxes of duplicate shells. Dr. Marshall presented the cast of a Mastodon's tooth, from San Mateo. Captain D. C. Woods presented the snout of a Saw-fish, caught off the coast of Mexico, and a pair of Cow-Walrus tusks, taken from the animal at Cape East, Behring's Strait. Mr. W. G. Blunt presented a case of twenty-five species of eggs, named, with the localities. From F. Gruber, specimens of mounted birds, as follows: *Psittacula passerina*, or little green paroquet; *Cistotharus palustris*, or long-billed marsh wren; *Turdus ustulatus*, or Oregon thrush; *Procnias ventralis*, or swallow-tailed fruit eater; *Icterus Jamaicaii*, Black-banded Troupiale; *Rhamphocelus Brasilica*, Crimson Tanajer. Judge Ford, through Barry & Patten, presented the Skull of a marine animal (not determined). J. W. Michael presented a fossil Sea Lion's skull, washed out of a clay bank on Chorro Creek, San Luis Obispo County, twelve miles from the coast. Six specimens of ore from Utah and Colorado were received, from Hon. Samuel Purdy. Henry Edwards presented specimens of scorpions, tarantulas, and lizards, collected on the Colorado River, Arizona. H. G. Bloomer donated a specimen of the Australian Carpet Snake. From Mr. Button, two alcoholic specimens of Lizards. A specimen of Tapa, or native cloth, from the Pacific Islands, varnished, and of a peculiar pattern, differing from any in the collection of the Academy, was received from Mr. Raymond. Mr. McHenry presented some fossil leaves, from Seattle, Washington Territory.

Dr. Behr exhibited and described the nature of a species of *mangrove*, (*Avicenus officinalis*) adapted to this State, and found in New Zealand. He had, after considerable difficulty, procured some of the seed in a perfect condition, and was experimenting in raising the tree. It is used to protect plantations against tides. The trees grow in the sea, as far out as the low-tide mark. The seeds are never dormant, but begin to germinate as soon as mature, whether in air, earth, or water. They always grow where not wanted, and do not always grow where they are wanted.

S. C. Hastings read a short paper on "Correlation of Forces, and the Indestructibility of Matter."

Reclamation of Swamp Lands.

BY CHAS. D. GIBBES, C. E.

The various modes by which swamp and overflowed lands may best be reclaimed and brought into a state of cultivation will of course depend on many circumstances, of which the nature of the soil is one of the chief considerations; also, the rise and fall of the tides, together with sluices of sufficient capacity properly placed to drain the land in the interior, at least eighteen inches below the general level of the surface. These are essential conditions, on which alone the work of reclamation can be commenced with any hope of success.

This subject divides itself into so many branches, minute in themselves, yet each in its place important to the whole, that we can only give a few condensed remarks, in the hope of their being useful to those who are reclaiming, and to show some of the errors in the present manner of draining.

DRAINAGE.—The first thing to be examined is the difference of level between the interior of the land to be leveed, and the bank of the river or slough on which the dike is to be constructed; and in order to know the required depth of the ditch to enable it to keep the waters down to a level of 18 or 20 inches below the surface of the interior.

Frequently, however, one or more small sloughs extend into the interior, which are of great advantage, forming a natural reservoir and drain for discharging the surplus water at every low tide.

The difference in the level of the land is frequently two or three feet.

TIDES.—The next thing to be considered is the tides. In each lunar day of 24 h. 50 m., there are generally two high and two low tides, which are unequal in height and occur at unequal intervals.

In a series of observations on the tide, taken by me last summer on the coast in San Mateo County, the result of one day shows thus: Commencing at low water large, it rose 4.1 feet to high water small, then fell 1.7 to low water small, then rose again 1.3 feet to high water large, making a total rise 6.7 feet, then fell 7.5 to low water large.

Now, for some distance above the confluence of the Sacramento and San Joaquin Rivers, the greatest rise and fall of the tide is about 6 feet; high water small would average perhaps 3½ feet above low water large; and low water small about two feet above. A flood-gate at a level with the lowest water would be most of the time under water, and therefore afford but a very short run in the discharge of the water.

FLOOD GATES.—In the attempt to reclaim our tule lands, the flood gates have been a great source of trouble and expense, from the imperfect manner in which they are constructed and secured. In many places, no calculation having been made for the amount of pressure they have to sustain, they frequently give way, and the sluice box is sometimes canted with one end 4 or 5 feet lower than the other. The reason is evident. I speak now more particularly of the large sluices at the mouth of sloughs that are dammed; they have generally been made of an open box twenty or thirty feet in length, ten or twelve feet wide, and placed at the level of low tide; the levee being five or six feet high gives a gate, say ten feet wide, twelve feet deep, and three or four inches thick. This heavy gate, equal to about one-half a ton, is placed in the center of the box. Consider, now, what a loss of power a small body of water, perhaps only one or two feet in depth, has to raise the gate in discharging. But this is not the only error—we come now to the

PRESSURE OF WATER.—The weight of a cubic foot of fresh water is 62½ pounds. Water standing in an enclosure presses with equal force on the bottom and the sides at the junction, but the force on the sides will be in compound ratio of its depth. The pressure of a column of water a foot square and six feet deep = 375 pounds, but the side pressure = 1,312½ pounds.

Suppose we have an open sluice box twenty feet in length by ten feet wide with the gate in the center, 10x10 the square of the bottom outside of the gate = 100 square feet × 375 pounds = 37,500 pounds or 18¾ tons; and the pressure of each column, 1,312½ pounds, × 10 feet wide = 13,125 pounds or 6½ tons on the gate; width of water has no influence on side pressure.

Now, we generally find that these sluice boxes stand for some time until the water inside is reduced to the level of low tide, when there being no resistance on the inside of the gate to counteract the enormous pressure outside, it gives way gradually day by day, until at last it is not surprising that it sinks outside and cants up inside; particularly when there is is no sheet piling, only some inch or 1½ inch boards 6 or 7 feet long put in the mud and tacked on at each end.

The same case occurs with the dams unless made sufficiently strong to stand the pressure, which against a dam one hundred feet in length is at high tide about 65½ tons.

We have been referring to quiescent water; but in considering the force of waves driven by wind, the pressure of flood tides, or the strength of a strong current against the embankment or flood-gates, a large allowance must be made; it is scarcely possible, however, to reduce them to calculation, but we may safely add one-fourth to the pressure.

Great care should therefore be taken in selecting a site for a dam or flood-gate, to avoid those spots that are exposed to any great currents or rush of tidal waters, particularly where a stream suddenly narrows, as there the tide comes up very strong; and also to its exposure with respect to the prevailing winds.

Where fresh-water swamp lands are adjacent to high land, catchwater drains should be made to intercept the upland or external waters and conduct them off to a separate outlet.

The small sluices from the ditches or drains inside of the levee should be placed, if possible, sufficiently above the ordinary low water to allow it to have five or six hours run between tide and tide, beginning at half ebb and continuing to half flood tide; if placed at low water, the gate would be shut sooner by return of tide, although so long as the weight of the water inside is greater, so long will it continue to run.

The best level, therefore, to afford the longest run, is probably between the mid-tide level and the lowest low water, or in fact as high as it will admit to drain the low land in the interior, 18 or 20 inches.

The trunk or box sluice has been used in the rice fields of South Carolina upwards of a hundred years, and has been found to answer better than any other. A good size for our use is about six feet wide by eighteen inches deep, with self-acting tide gates; if made of redwood, and put in properly, they would last a long time, stand firmer, and are not liable to be thrown out of level by the pressure of water. They should be put down while you are making the embankment, as it is useful in keeping the land drained, and so facilitates the work.

It is now more than twelve years since I furnished these plans to a gentleman on the San Joaquin, who found them to work well on his place.

The trunk dock connecting the outer end of the trunk with the river should be wider than the sluice-box, so as to allow the free egress of the water, and should also be deeper than low tide.

The flood-gates now being in place, we can proceed to build the

Levee.—The materials of which the embankment is to be constructed will govern in a great measure the other requisites to be attended to in its formation.

These materials differ essentially on the San Joaquin and Sacramento Rivers in different localities. On the San Joaquin, we generally find a sod or turf of a peaty formation, which shrinks when dry about one-third, becomes very light, and can either be burnt up or floated away; while on the Sacramento it is composed of two kinds. In some places the turf has a sedimentary deposit of clay, which makes it firmer, heavier, and not so liable to burn. In other places, the banks of the river are sandy, which is the most difficult material to manage, and the least to be depended on; it melts away like sugar in water.

The first consideration is to determine the height of the levee to keep out the ordinary summer freshets, but it will not answer to have the levee of the same level, for in certain places it will be found necessary to raise it; for instance, I examined the water marks of the flood of '71 and '72 on trees about a mile apart on the same island, where the bank was apparently the same height above ordinary tide, and found a difference of six to eight inches, which was caused by the confluence of two currents backing the water above.

Having determined the height that you wish to construct your levee, add at least one-fifth for shrinkage, and build it the proper height at once.

The distance from the ditch to the inner slope of the levee should be at least twelve or fifteen feet, and from the outer margin to the river not less than thirty feet, and in some cases more; but it will depend a great deal on the formation of the bank, exposure to currents and winds.

The inner slope should be $1\frac{1}{2}$ to 1; and the outer slope not less than 3 to 1; or follow nature as far as possible, as the downward pressure of the water will assist to keep the levee in place, and the broader the base will enable it to resist the inward pressure, which, with a flood of five feet on the levee, will equal $45\frac{3}{4}$ tons on every hundred feet in length, without allowing for the force of the current or wind.

While the levee is yet wet, sow mesquit or bermuda grass seeds on it, either of which will form a good sod to protect and bind the levee together and prevent it from cracking; also, would form a good pasture for a few sheep or Angora goats.

Care should be exercised in running ditches into the interior; first, the ground should be examined that you do not cut through float land, second, to ascertain the level; for I have known a contract let to Chinamen to dig a ditch three feet deep, and when completed the water ran back and flooded the low land. Unless your levees and flood gates are properly constructed it is only a waste of money to attempt reclamation.

I would strongly urge the attention of the farmers in our swamp lands to the cultivation of the upland rice. The yellow or golden rice is best adapted both to wet and dry culture. It produces from fifty to one hundred bushels of rough rice to the acre; prospers best on a level, sandy soil, inclined to moisture.

Bois d'Arc.—I would call attention also to the Bois d'arc, or Osage orange (*Maclura aurantiaca*). I have seen it in its native state, in the swamps of the Bois d'arc fork of Trinity River, Texas, where it grows to the height of sixty or seventy feet, with a diameter of two or three feet, and is one of the most beautiful of the native trees; the wood is one of the most durable in the world, and is remarkably strong, elastic, and tough; of a beautiful yellow color, close grain, receiving the finest polish, making it valuable for furniture, and is used in Texas for wagon wheels, as not liable to shrink. For ship-building, it is esteemed preferable to live oak; and by the Indians is preferred for bows to all other woods. It also yields a yellow dye. For an ornamental tree, it is most graceful, with its dark green foliage, hard smooth bark, drooping branches, and large orange-colored fruit.

It forms a good belt or hedge row for sheltering gardens, vineyards, or orchards, is of a rapid growth, and has formidable thorns for hedges. A plantation of Osage orange, set out now, would in a few years afford most valuable timber, that would pay well; and sprouts grow rapidly from the stumps, soon renewing the timber cut.

Notes on some Tertiary Fossils from the California Coast, with a List of the Species obtained from a Well at San Diego, California, with Descriptions of two New Species.*

BY W. H. DALL, U. S. COAST SURVEY.

The following list comprises the majority of the forms presented by Mr. Hemphill to the Academy, which were collected by him from the *débris* brought up in sinking a well at San Diego. Most of them are from a depth of 140 to 160 feet below the surface. They are generally in very good preservation, the matrix being a fine sand, in some cases hardly consolidated at all, and in others quite hard from infiltration of lime and other minerals.

The important bearing which the careful determination of all our tertiary fossils has on questions of the present and past geographical distribution of the mollusca, I need hardly impress on the attention of the Academy:

1. *Glottidia albida*, Dall ex Hinds.
2. *Xylotrya*, sp. indet. Tube only.
3. *Cryptomya Californica*, Conr.
4. *Solen rosaceus*, Cpr.
5. *Solecurtus Californianus*, Conr.
6. *Macoma* (var.?) *expansa*, Cpr.
7. *Callista*, sp. indet. Smooth, inflated, thin; much like *Callista Newcombiana*, erroneously described as *Lioconcha* by Gabb.

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*Printed in advance, March 26th, 1874.

8. *Cardium centifilosum*, Cpr.
9. *Venericardia borealis*, Conr.
10. *Lucina Nuttallii*, Conr.
11. *Lucina borealis*, Linn.
12. *Lucina tenuisculpta*, Cpr.
13. *Cryptodon flexuosus*, Mont.
14. *Modiola recta*, Conr.
15. *Arca microdonta*, Conr.
16. *Nucula*, sp. n. according to Dr. Cooper; named in MSS. by Carpenter. Looks much like *N. tenuis*.
17. *Acila Lyallii*, Baird. This species has been frequently reported as *castrensis*, Hds.
18. *Leda coelata*, Hinds.
19. *Pecten hastatus*, Sby.
20. *Amusium caurinum*, Gld.
21. *Janira florida*, Hds.
22. *Ostrea conchaphila*, Cpr.
23. *Placunanomia macroschisma*, Desh.
24. *Tornatina eximia*, Baird.
25. *Cylichna cylindracea*, Linn.
26. *Dentalium hexagonum*, Sby.
27. *Dentalium semipolitum*, B. and S.
28. *Siphonodentalium pusillum* (?), Gabb.
29. *Calliostoma annulatum*, Mart.
30. *Galerus filosus*, Gabb, as *Trochita*.
31. *Crepidula navicelloides*, Nutt.
32. *Crepidula princeps*, Conr. This is not *grandis* of Midd.
33. *Turritella Jewettii*, Cpr.
34. *Bittium asperum*, Cpr.
35. *Myurella simplex*, Cpr.

36–39. *Drillia*, sp. indet. This and three other forms of *Drillia* so closely resemble Gulf forms, that it is inadvisable to describe them without a comparison of specimens.

40. *Surcula Carpenteriana*, Gabb, and variety *Tryoniana*, can hardly be separated as species. The transition is very gradual and complete.
41. *Mangelia variegata*, Cpr.

42–45. *Mangelia*, spp. indet. The same remark applies here as to No. 36.

46. *Clathurella Conradiana*, Gabb. The specimens are slightly stouter than Gabb's figure, but vary among themselves in this respect, and in other characters are similar to his species.
47. *Odostomia straminea*, Cpr. var.
48. *Odostomia*, sp. indet. Very imperfect.
49. *Chemnitzia torquata*, Cpr.
50. *Eulima rutila*, Cpr.
51. *Scalaria subcoronata*, Cpr.

52–55. *Cancellaria*, 4 spp. indet. Most of them, as far as memory serves, resemble southern forms not at hand for comparison.

56. *Neverita Recluziana*, Petit.

57. *Sigaretus debilis*, Gld.
58. *Ranella Mathewsonii*, Gabb.
59. *Olivella bætica*, Cpr.
60. *Nassa fossata*, Gld.
61. *Nassa mendica*, Gld.
62. *Astyris tuberosa*, Cpr.
63. *Astyris*, sp. indet. jun.
64. *Ocinebra lurida*, Cpr.
65. *Pteronotus festivus*, Hinds.
66. *Trophon orpheus*, Gld.
67. *Fusus* (*Colus*) *Dupetit-Thouarsi?* Kien.
68. *Chrysodomus*, n. s. Too imperfect for description, but very distinct; perhaps a *Volutopsis*, as the nucleus would indicate.
69. *Chrysodomus Diegoënsis*, n. s.

Shell large, solid, fusiform; apparently, when fresh, of a brownish yellow color; sculpture consisting of regular, even, rounded, spiral ridges, slightly larger toward the anterior end of the last whorl, with from two to four sharp grooves intercalated between each two of the primary ridges, forming fine and small secondary threads of spiral sculpture. On the posterior whorls these are crossed by slightly oblique waves or plications, evanescent toward the sutures and strongest on the apical whorls. On the last whorl and a half these are absent. The posterior fourth of the whorls slightly impressed and the sutures appressed. Whorls eight and a half, periphery rounded. Canal short, recurved, siphonal fasciole short and strong. Outer lip slightly thickened behind the edge, inner lip covered with an even callus. Columella smooth, slightly arched; throat with internal sharp threads, as in *C. dirus*, ending some distance behind the edge of the outer lip.

Length, 4.0 inches; width, 1.75 inches. Length of aperture, 1.8 inches. Deflection, 42°.

The upper whorls of this shell bear a slight resemblance to *Siphonalia Kellettii;* though the transverse waves are very different from the knobs of that species. There appears to be no special reason for referring the present form to *Siphonalia*, while it presents so great a resemblance to many *Chrysodomi.*

Habitat, with other tertiary fossils, in a sand-bed cut through by a well-shaft, at San Diego, California, at a depth below the surface of about one hundred and fifty feet.

Besides these are several small bivalves, which belong to different species; but the specimens are too imperfect for description, or even recognition.

On an examination of the list it will be seen, that of sixty-nine specimens only three are strictly Miocene, while many are reported by Gabb as extending from the Miocene to the present epoch. Of fifteen indeterminate species, some will probably prove to be new, though I have only felt justified in describing one species, from the lack of specimens for comparison.

The age of the deposit, in general terms, may be taken as Pliocene; though it is evident that the different epochs of the Tertiary are not as sharply separated on this coast as in some other parts of the world.

Among a number of Tertiary fossils from Cerros Island, Lower California, presented to the Academy by Lieut.-Commander Kennedy, of the U. S. C. S. steamer *Hassler*, are a number of brachiopods. These vary very widely in form and sculpture, some being ovoid and perfectly smooth, except for lines of growth, while others are much more transverse, and provided with radiating ribs varying in number and strength. The extreme forms appear very distinct; yet, so perfectly is the transition expressed in the large number of specimens before me, that I cannot consider them as forming more than one species. In most of them an internal septum is evident externally through the shell, indicating that they belong to the genus *Waldheimia*. This is rendered certain by an examination which I made of the interior of several specimens, and in which I discovered the loop, more or less injured, but unmistakably that of a *Waldheimia*. Having submitted specimens to Thomas Davidson, F.R.S., of Brighton, England—the most eminent authority on fossil brachiopoda—he has kindly informed me that he considers the species to be new. The following description will serve to characterize it:

Waldheimia Kennedyi, n. s.

Shell solid, ovoid to transverse in form, moderately inflated; surface roughened by lines of growth, occasionally forming slight ridges; generally furnished with radiating, rounded ribs, growing coarser toward the margin, but in some instances totally destitute of them. These ribs may be as few as six in number, and very coarse; or may be much more numerous, and nearly evanescent, which is the usual form. The perfectly smooth ones are less common. The anterior margin of the valves is more or less flexuous, the convexity being in the neural valve. The beak is prominent, and much recurved, usually rather short. The foramen, when not broken or eroded, is small, and closed below by very small deltidia, which are usually lost or broken away. The area is ill defined, except in the most transverse specimens, and is marked by two and sometimes three grooves radiating toward the hinge margin from the foramen. The internal septum extends from one-third to one-half the distance from the hinge margin to the anterior edge of the hæmal valve. The cardinal border is strongly arched. The cardinal teeth are stout and short, and there are no pits behind or below them. The dimensions of one of the most transverse specimens are as follows:

Lon., 1.10 in. Lon. of hæmal valve, 0.97 in. Lat., 1.15 in. Diameter, 0.65; while one of extreme ovoid form measures as follows: Lon., 1.15 in.; of hæmal valve, 1.03 in.; lat., 1.10 in.; diameter, 0.83 in.

Habitat, in beds of Miocene age, Cerros Island, Lower California, associated with *Ostrea Veatchii*, Gabb, and *O. gallus*, Val., *Pecten subnodosus*, var. *Veatchii*, Gabb, and *P. Cerrosensis*, Gabb.

Dr. Gibbons made some brief allusions to the reported volcanic action at Bald Mountain, which, he believed, was the result of chemical actions, similar to those at our own Geysers.

The Corresponding Secretary read a circular from the Agassiz Memorial Committee, urging scientific men everywhere to assist in placing the museum founded by Agassiz on a permanent financial footing.

Some discussion ensued concerning the preparation of a new Constitution, and a resolution was adopted authorizing the Trustees to select such assistance, from the Academy at large, as they thought proper, and prepare a Constitution, to be presented to the Academy within six months from date.

Regular Meeting, April 20th, 1874.

Vice President in the Chair.

The election of new members was postponed until the next meeting.

Donations to the Museum: Dr. George W. Woods, Surgeon U. S. Navy, presented through his brother, I. C. Woods, the following articles, which were collected during four years' cruising in our naval vessels in the Pacific Ocean: Ball of Sennit, made from cocoanut fiber, from Ponape, Ascension Island; Mat made from banana leaf, from Mulgrave Island, Atoll of Milii; Belt made from banana leaf, from Mulgrave Island, Atoll of Milii; Matting made from the leaf of the banana, from Ponape, Ascension Island; Rope made from cocoanut, covered with banana fiber, from Mulgrave Island, Atoll of Milii; Cocoanuts for carrying water, from Ponape, Ascension Island; Head decorations, from Navigator Islands; Belts made from banana leaf, woven in native loom, from Caroline Group; Belts made from banana leaf, woven in native loom, worn by the chiefs of Ponape, Ascension Island; Neck decorations, from Butari Tari, Marshall Islands; Grass skirt, from Ponape, Ascension Island, made from banana leaf, worn by the females of all the islands of Micronesia, except the Marshall group; Bustle, worn with the grass skirt, by the males of Mulgrave Island, Atoll of Milii; Grass skirt made of pandanus leaf, worn over bustle, by the males of Mulgrave Island, Atoll of Milii; Suit of armor, made from fiber of the cocoanut, from Island of Apaiaing, Gilbert group, Micronesia; Head-dress, from Ponape, Ascension Island; Head-dress, from Mulgrave Island, Atoll of Milii; Fish-hooks made from pearl oyster shell, Mulgrave Island, Atoll of Milii; Neck Decorations of Shells, from Mulgrave Island, Atoll of Milii; Two Bats, from Kusai, or Strong's Island, Caroline group; Head-scratcher, from Marshall Island, worn over the ear; "Kawa" cup, from Council House, Island of Ascension—the Kawa is chewed in the mouths of young girls, expectorated into these cups, where it ferments, becomes intoxicating, and is drank by the men in their revels; Water-dipper made from the bill of an Aquatic bird, from northwest coast of America; Basket, from Puget Sound, made by the natives; Model of a Canoe, from Neah Bay.

From E. Gruber, the following birds (stuffed): Mussel Thrush, (*Turdus viscivorus*) Chestnut-back Titmouse, (*Parus rufescens*) Black-cap Titmouse, (*Paraus ater*) Chaffinch, (*Fringilla cœlebs*) Pied Wagtail, (*Motacilla alba*) House Sparrow, (*Passer domesticus*) Bay-breasted Warbler, (*Dendroica castanea*) Song Thrush, (*Turdus musicus*).

From J. C. Merrill & Co., a collection of fishing implements, lines, bows, bundle of arrows, and a rock with a polished groove, supposed to have been used for sharpening spears and other implements, from the South Pacific Islands.

From W. W. Russel, a cluster of Barnacles, from bottom of ship *Miliceti*, after a voyage of six months and three days, from Bombay to Liverpool. Thirteen tons of these barnacles were taken from the bottom of the ship. Also, from same gentleman a Rock-boring Mollusca, from the Choumagin Islands; also, Egg of small black terrapin.

From E. F. Lorquin, rare specimen of Crab, (*Loxorhynchus grandis*, Stimpson) from Santa Barbara.

W. N. Lockington presented a specimen of *Cancer magister* of Dana, the common edible crab of San Francisco; *Palinurus interruptus*, the crawfish of the markets; two species of *Orchestia*, or sandhoppers; two species of lizards; a fresh water salamander;

a curious insect found running on dry sand, among the debris left by the tide near Fort Point.

Donations to the Library: Monatsbericht der Konig. Preuss. Akad. Wissenschaften zu Berlin, May, 1873, and Jan. 1874; Archiv fur Naturgeschichte Viertes Heft, Berlin, 1873; Canadian Naturalist, Vol. VII., No. 4, Montreal, 1874; American Naturalist, April, 1874; California Horticulturist, April, 1874; Nature, Vol. IX., Nos. 228, 229; Popular Science Monthly, April; American Journal of Science and Art, April, 1874; Descriptive Catalogue of Photographs of the U. S. Geological Survey of the Territories, 1869 and 1873; Bulletin Minnesota Acad. Nat. Science, 1874; Proc. Acad. Nat. Sciences of Philadelphia, Oct., Nov., and Dec., 1873; Engineering and Mining Journal, Nos. 12, 13, 14, and 15, Vol. XVII.; Bulletin of the U. S. Geological and Geographical Survey of the Territories, No. 2, Washington, D. C., 1870.

Dr. Fourgeaud read a paper entitled "General scientific hypothesis, as an introduction to a work on evolution of the organic and inorganic world." A resolution was passed by the Academy, requesting Dr. Fourgeaud to deliver a copy of his paper to the Secretary, so that the matter will not be lost, if not published in the contemplated work.

The following is an abstract of a paper read:

On Shell Mounds in Oakland, California.

BY A. S. HUDSON, M. D.

Some two miles north of the City Hall, Oakland, on the shore of the bay, are conspicuous two tumuli, which are composed of shells. They are situated on a low, level tract of alluvial land. On one of these, which is some 300 feet in diameter at base, the dwelling house of Mr. W. stands, surrounded with shrubbery. The shells are so much decayed on the surface, that plants and trees find perpetual moisture and grow without irrigation. A well 30 feet deep sunk in this ancient pile passed through a layer of shells 12 feet deep before the native black soil was reached. A vault dug 10 feet went through shells interpersed with layers of ashes and charcoal. Back and west of the house is a bold tumulus of more strength of feature. It is within a few yards of the shore of the bay; the shore or west side of the mound is thickly belted with willow trees. No deep exploration into this mound has been made, but it seems composed wholly of shells, a few animal bones, and occasional fragments of charcoal. It it 240 feet in diameter at the base and circular in shape, truncated at the summit, which is 150 feet in diameter. Without accurate measurement, it is estimated to be 35 to 40 feet high. From the north side runs an arm or a kind of pan-handle, 270 feet long, and originally 5 or 6 feet high. About two feet of the surface of this pan-handle has been scraped off by the proprietor of the land, to fill up a "pond hole" which lay immediately at the east side of it. A few human bones, and some mortars and pestles, were exhumed by the plow and scraper.

The mound now occupied for a dwelling-place is analagous to the kitchen-middens of Denmark. Not so with the neighboring tumulus, which evinces design. The pyramidal mound—represented in the accompaning sketch—cannot be looked upon as the result of accident. It is as shapely in outline as a well laid pile of brick or stone. Abbe Domenech, who spent seven years among the aboriginal inhabitants of the Pacific, says: "Indians do no special work for mere whim or pastime—they have a definite object in their labor." This mound bespeaks a similar sentiment. It conveys the idea that human hands gave it existence and figure, for a purpose. That purpose may have been for an oratory, for sacrificial customs, or feasts for the tribal chiefs.

Dr. Gibbons called the attention of the Academy to some potatoes, which had grown from last year's crop, coming to maturity this year, without throwing up any shoots above ground. He stated that last year he communicated the fact to the Academy, that in the spring of the year some potatoes were found in the ground, the tubers having apparently developed during the winter, without a stem. In Dr. Gibbons' garden there are now quite a number of different sized potatoes of recent formation, without stems, or with very little stem. How they got into the earth and how they were produced is the question. Last summer there were small potatoes left in the ground from the growth of the season. During the winter they probably passed into maturity, until they had attained the size of an egg and larger, when they throw up a stem. It is a strange fact in vegetable economy, if not in agriculture. I recently noticed a statement concerning volunteer potatoes, perhaps like these, to the effect that they were watery. These, though large, are not very good. As soon as they begin to throw up a shoot, they stop growing. It then takes the place of a tuber and throws out roots.

Mr. Gibbes announced that Major Sparrow Purdy, a corresponding member of the Academy, now at the head of a large expedition in Upper Egypt, had been making an extensive collection of curiosities for the museum of the Academy. Major Purdy may be able to ship his collection so that it will arrive in August.

Regular Meeting, May 4th, 1874.

Vice-President in the Chair.

Fifty members present.

The following gentlemen were elected resident members: Robert C. Rogers, Solomon Heydenfeldt, Jr., William C. Randolph, William T. Reilly, Dr. W. J. Younger, G. W. Anthony, Stephen H. Phillips, B. B. Redding, T. J. Lowry, J. Stephen Jones, William Brooks, W. C. Burnett.

Dr. D. E. Hungerford was elected a corresponding member.

Donations to the museum: Specimen of Spanish moss, presented by Mrs. Richard Chenery. Piece of Tapa cloth, presented by Mrs. Bridges.

Donations to the Library: From Mrs. Bridges, ancient book, printed in the Spanish language, published at Lima. Bulletin Essex Institute, Vol. VI., Nos. 1 and 2, Salem, Mass., 1874. Proceedings Boston Society Natural History, Vol. XVI, Part II, June, 1873, Jan. 1874. Bulletin of Buffalo Society of Natural Sciences, Vol. I, No. 4. Quarterly Journal of Microscopical Society, London, 1874. Annals and Magazine of Natural History, London, April, 1874. Annalen der Physik und Chemie, Leipzig, 1874. Astronomical Register, No. 136, London, 1874. Journal of Botany, London, April, 1874. Société Entomologique de Belgique. Proceedings, No. 97, Brussels, 1874. Nature, Vol. IX., Nos. 227, 230, and 231; American Chemist, Vol. IV., No. 10, Phila., April 1874. Bulletin Essex Institute, Vol. V, Nos. 11 and 12, Salem, 1873. Société Entomologique de Belgique, No. 96. Scientific papers by Isaac Lea, 8vo., Phila., 1874. Twenty-first Annual Report Mercantile Library Association. Astronomical Register, March, 1874. Journal of Botany, March, 1874. Annals and Magazine of Natural History, March, 1874. California Horticulturist, 1874. Overland Monthly for April, 1874. American Chemist, March, 1874. Monatsbericht der König Preuss Akad. der Wissenschaften zu Berlin, Dec., 1873. Report of State Board of Health for years 1871-2-3, from A. B. Stout.

S. C. Hastings read a paper "On the alleged mysterious occurrences at the Clarke mansion, in Oakland."

Mr. J. P. Dameron made some verbal remarks on radiates.

Dr. Fourgeaud read a continuation of his paper, read at the preceding meeting.

Rev. Albert Williams and Mr. Bloomer took exceptions to some assertions in Dr. Fourgeaud's paper, and after some discussion on the subject, the Academy adjourned.

Regular Meeting, May 18th, 1874.

Vice–President in the Chair.

Fifty-three members present.

Rev. E. L. Greene and Robt. T. Van Norden were elected resident members.

Donations to the Museum: Prof. Bolander donated a valuable collection, embracing two packages of plants from the Cape of Good Hope, and four packages from Europe, all identified and labeled. G. W. Michael, Jr., presented silicious petrifications of roots, from San Luis Obispo County. S. R. Throckmorton presented a specimen of *Rhinobatus productus*, caught in the bay off Black Point. This fish is described by Dr. Ayres in the second volume of the Proceedings of the Academy. Henry Edwards presented twenty-six specimens of crustacea, from the coast of Mexico. A specimen of petrified oak, found 100 feet below the surface, at Dutch Flat, was presented by a member.

Donations to the Library: Transactions of the Academy of Sciences of St. Louis, Vol. III, No. 1, 1873. Statistisches Jahrbuck der Stadt Pest Erster Jahrgang, Pest. 1873. Viehrzenter Bericht der Oberheisischen Gesellchaft fiër Natur und Heilkunde, Geissen, Apl. 1873. The Ancient Vessel found in Norway, Christiana, 1872. Manuel Elementaire de l'Art Heraldique, par Madame M***, Brussels, 1840. Notions Elementaires des Sciences Naturelles, etc., in 3 parts, par Chas. Morren, 12mo., Tieze, 1822. Palines et Couromnes de l'Horticultural de Belgique, etc., par Chas. Morren, Liege, 1851. La Maladie Actuelle des Pommes de Terre, etc., par Chas. Morren, Paris, 1845. Notice sur Chas. Morren, par Ed. Morren, 12mo. Bruxelles, 1860. Rapport Seculaire sur les Travaux de Botanique, 1772—1872, 8vo., par Ed. Morren. L'Horticulture a l'Exposition Universelle de Paris de 1867, par Ed. Morren. Bruxelles, 1870. Memorial der Naturaliste et au Cultivateur, par Ed. Morren et Andre de Vos, 8vo., Liege, 1872.

In addition to the usual exchanges, seven volumes of the "Phytologist," a standard botanical work, were added, by purchase, to the Library.

Dr. Fourgeaud read a paper on "Some of the relations of matter and space."

Dr. Fourgeaud also read a paper in reply to the exceptions taken by members to certain statements made by him in a paper read at the meeting of May 4th, 1874.

S. C. Hastings read a paper "On Electrical Phenomena on this Coast."

A member submitted for inspection shells of the Eastern transplanted oyster, which were covered with the spat of young oysters. It was a question whether the spat was that of the native California oyster or the propagation of the transplanted bivalve, and oystermen, whom he had consulted, were unable to determine the point. Mr. Throckmorton, State Commissioner of Fisheries, stated that he had investigated the matter, and found that the spat was that of the California oyster. It was found on the shells of Eastern oysters only where they had been transplanted in the vicinity of native beds. As yet, the Eastern oyster had developed no tendency to increase in these waters. They were short-lived here, becoming very fat, and dying within a year after being placed in the bay. The experiment of transplanting Eastern oysters thus far has been a failure.

Regular Meeting, June 1st, 1874.

Vice-President in the Chair.

Forty-five members present.

John H. Saunders, G. Parker Cummings, and Wm. Dutch were elected resident members.

Donations to the Museum: A collection of ancient pottery, the specimens artistically wrought and perfectly preserved, was exhibited. The Vice President stated that the collection had lately been consigned to him for the Academy, but no communication in reference thereto had yet reached him. It was believed that the specimens came from Peru, and had been sent by Benjamin Smith or James Freeborn, two members of the Academy who are now traveling in South America. W. H. Turner presented the pupa of a large species of beetle, native of Mexico. Mr. Chapman presented specimen of Suisun marble. W. N. Lockington donated three cases of insects. D. W. C. Gaskell, of Forbestown, left on exhibition remarkably well-preserved teeth of the mastodon; also, tusk of a fossil elephant, found at New York Flat, Yuba County, found in auriferous gravel, on the bedrock, fifteen feet below the surface.

Donations to the Library: George C. Hickox presented an antique volume entitled, "A Catalogue and Description of the Natural and Artificial Rarities belonging to the Royal Society, and Preserved at Gresham College, by Nehemiah Grew, M.D., Fellow of the Royal Society and of the College of Physicians, London. Printed by W. Rawlins for the author, 1681."

Improved Method of Observing Altitudes of the Sun at Sea.

BY T. J. LOWRY, U. S. COAST SURVEY.

The science and art of navigation stand among the proudest achievements of modern thought and research. The accurate determination of the places of the fixed stars, and of the motion and position of the members of the solar system, gave the navigator numerous well determined points for observation. But the attainment of a corresponding perfection in fashioning instruments has ever baffled human skill, and ever will. For although we are entitled to look for wonders at the hands of the artist, we cannot expect miracles! And we hence see that the demands of the astronomer, and even the nautical astronomer or navigator, will always surpass the power of the instrument maker. They must therefore so combine their observations, so familiarize themselves with all the causes which may produce instrumental derangement, and with all the peculiarities of structure and material of each instrument used, as not to allow themselves to be misled by its errors, but to extract from their indications all that is true and reject all that is erroneous.

It is true that the astronomer can so weigh his observations in the balance of the method of least squares, and so thoroughly sift them by Pierce's criterion, that hardly the trace of a large error remains ; and the more minute errors, being casual and accidental, sometimes lie one way, sometimes the other ; sometimes diminishing and sometimes tending to increase the results. And, inasmuch as the theory of probabilities tells us that these accidental errors are as liable to lie one way as the other, we hence have but to greatly multiply our observations under varied circumstances and take the mean or average of the results obtained, and we have this class of errors so far subdued, by thus setting them to destroying one another, that they no longer sensibly vitiate our practical results.

This principle of repetition, though so simple in theory and so beautiful in practice, when the instrument and observer are upon a firm basis, utterly fails of application where the observer and his instrument are tossed alike on the ocean's wave, and the object observed is " on wing." It becomes therefore imperative upon the navigator, if he would trace accurately his ship's path over the trackless ocean, that he attain rigorous correctness in the results of " each " of his instrumental measurements ; and to this end, his constant care and vigilance must be directed to the detection and compensation of errors, either by annihilating or taking account of and allowing for them. This latter method of taking account of and allowing for errors, is that ordinarily pursued by the navigator; but it has navigated so many noble ships to the bottom of the sea, that the voice of humanity and the interests of commerce alike demand such a modification of the methods of observation, and the forms of the instruments, as to annihilate effectually and alike errors inherent in the observer, in the instrument, and in the atmosphere.

In the method of taking observations now generally practiced by the navigator, instrumental adjustments, atmospheric refraction, and the impressibility of the optic nerve, are all depended upon as constant and invariable during the observations ; while, in fact, they all are ever fluctuating. The ever-varying fluctuations of heat and cold are continually changing the amount of atmospheric refraction, as also that of every instrumental adjustment. And it is a well known fact in optics that the irradiation (which causes bright objects to appear larger than they really are) varies with the length of time during which we look upon the object, during the first few moments of observation gradually decreasing ; and then, as the optic nerve becomes fatigued, the optical illusion (irradiation) reappears magnified ten-fold. These are not mere speculative sources of errors, but practical annoyances, which every observer has to contend with—the incompetent navigator, of course, slurring them over as refinements too delicate to deal with, while he attributes the error thus introduced into his position to the action of imaginary ocean currents ; but the thorough navigator meets these errors fairly, and sets about annihilating them. Yet it may be interesting to those navigators who insist on neglecting these finer instrumental errors, to know that very many of the sextants used in navigating vessels have an eccentricity ranging from one to four minutes, which is often aggravated by parallax of index-glass ; and his positions are vitiated to the full extent of these neglected errors.

By the ordinary method of observing successive contacts of the opposing limbs of the sun with the horizon, even if the mind from one observation to the other retains fresh and full the vision of the contact, still the observer will fail to make the contact of the horizon with the perimeter of the sun at equal distances from its center, because he makes these contacts at different instants of time, when the eye is differently affected by irradiation and fatigue. And hence, what would appear one moment a delicate contact, would one minute afterward be wide of the mark. And thus it is, in the observations thus made with an instrument that is varying, with a vision that is varying, and through an atmosphere that is varying, we can clearly see the source of the errors which have lured many an unsuspecting ship fatally onward against rocks and reefs.

By the method which I now propose, and with the form of instrument herein designated, we avoid in part, and in the remainder essentially annihilate, these most fruitful sources of errors. By placing within the instrument itself the means of self-correction, we have the most effectual checks upon its errors of construction and the changes of its adjustments. Thus, from very simple geometrical considerations, it may be easily shown that the errors of eccentricity and of graduation are totally eliminated by the mean of the readings of two verniers 180 deg. apart, and by measuring the angles on different parts of the arc; and by using an index-glass susceptible of reversal between the parts of a set of observations, we banish every trace of error from parallax of index-glass from our results. And every error of observation—such as arise, for example, from inexpertness, defective vision, slowness in seizing the exact instant of occurrence of a phenomenon, and from atmospheric indistinctness, and insufficient optical power in the instrument—are all alike essentially checked by observing the contacts of the two opposing limbs of the sun with the horizon *at the same instant.*

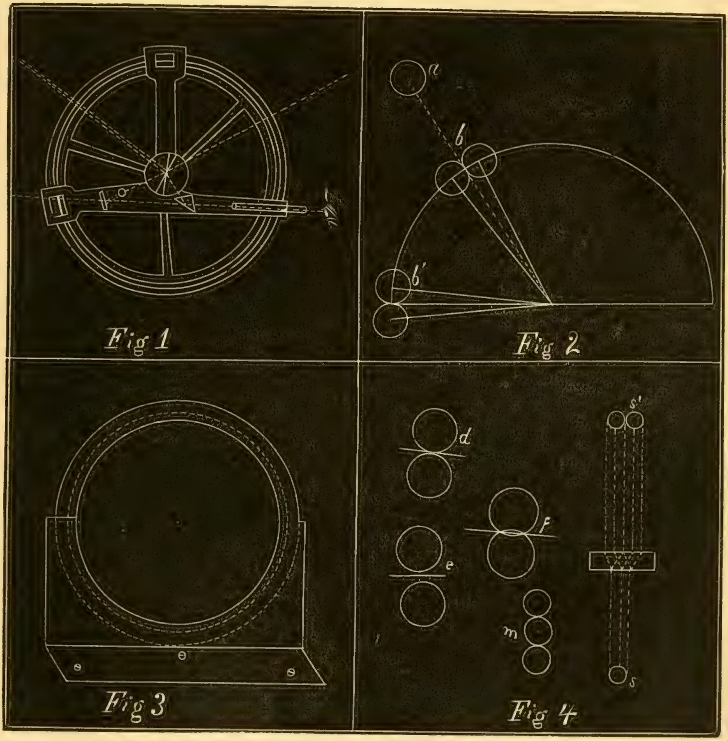
Now, since we have the contacts of the upper and lower limbs of the sun in the field of view at the same moment, we have before our eyes a most thorough check on the character of the contacts, since by direct and instantaneous optical comparison we make each of them equally well. And, moreover, since we make the contacts of both limbs of the sun with the horizon at the same instant, we have in "each sight" an altitude, complete in itself, without the aid of a supposition of the constancy of atmospheric refraction, or the stability of instrumental adjustments, or the constancy of the impressibility of the optic nerve, or the aid of memory.

But, as we cannot measure what we cannot see, it is obvious that by the ordinary method of successive single contacts, those errors, too minute for low optical powers, enter and vitiate the results to their full extent. But by this method of double contacts at the same instant, we detect and avoid these errors, which would otherwise elude our vision. As for example, suppose we make what appears to be a contact of the upper limb of the sun with the horizon, and then by glancing at the other contact, of the lower limb and the horizon, in the same field of view, it will appear a contact equally nice as the other, if the first contact was exact, but if it was at all *in error*, then the second will be in error *twice* as much as the first; and thus it is *by doubling these errors,* *which the eye cannot discern nor the touch perceive,* are we *enabled to sift them from our observations.* Still, the observer should use the most powerful telescope available. The improvement which I now propose, (besides a few other matters of detail) in the ordinary reflecting angular instruments, is a device for *duplicating the image of an object* by optical means.

This I accomplish by fixing an extra index-glass directly above, or in the same plane with that of the ordinary one of the reflecting repeating circle, and at an angle therewith equal to the apparent semi-diameter of the sun ; or perhaps, a more complete solution of the problem, is to fix a small sphere of Iceland spar on the direct line between the index and horizon glasses, (see Fig. No. 1) and thus obtain two images of the sun equally distinct (see *s s'*, Fig. No. 4). This sphere to be mounted in a light metallic frame, so connected with a micrometer that its most delicate movements can be read off. In Fig. No. 2, *a* is the sun, and *b* its duplicated image, as seen in the horizon glass ; and *b* is this same duplicated image brought in contact with the horizon ; *c* is the position of the observer. Now, in observing, it makes but little difference whether these duplicated images are exactly tangent, slightly overlapping, or slightly separated, (as shown at *d, f,* and *e,* in Fig. No. 4) for in the first case we have but to bring the horizon to the point of tangency ; in the second, to bisect the two exterior angles ; or in the third, to bisect the space between the adjacent limbs of the sun. It is obvious that this method of observing the contacts of both limbs of the sun at the same instant is equally well adapted for double altitudes ; the appearance of the images then is shown at *m*, in Fig. No. 4. Other improvements which I have devised are : 1st. A reversable double reflecting index-glass, (see Fig. No. 3) which eliminates the error due to its parallax ; and 2d, making both faces of index-glass reflectors, and fixing a glass prism, with silvered hypothenuse, on the line of sight behind the index-glass, and at such an angle as to reflect the rays first reflected from the back face of index glass parallel to the line of sight. This device enables us to measure any angle (shown in Fig. No. 1). It is obvious that any two-angle reflecting instrument may also be made to give this duplication of images ; and also give an altitude and its supplement at the same instant, and thus give us the algebraic sum of the existing refraction and dip. These improvements are all equally adapted and easily applied to any reflecting angular instrument.

By making these attachments to the French reflecting, repeating circle, (see Fig. No. 1) we have an instrument capable of not only eliminating its own errors, but those of observation, as well as those due to sudden atmospheric changes, and we have an instrument theoretically almost perfect.

Through the efforts of Laplace, Newton, and Pierce, the theory of nautical astronomy has reached a point of perfection that only awaits the determination of the true dimensions of the solar system, (which it is hoped the next transit of Venus will give) to make it all that can be desired. The invention of the chronometer has practically solved the problem of longitudes. And the needle of the mariner's compass has felt the touch of a Ritchie, and trembles no more ; whilst Beecher and Davidson have given the navigator artificial horizons that



IMPROVED METHOD OF OBSERVING ALTITUDES OF THE SUN AT SEA, LOWRY.

(TO FACE PAGE 310.)

leave but little to be desired in that direction. But still improved methods of observation are wanted to decrease the frightful number of marine disasters. And though the ideas here advanced are believed to be a step in the right direction, yet they are also thrown out with a hope of eliciting from others a more complete solution of this problem, than which none other more interests mankind. And the complete solution of it—that would make practical navigation one of the exact arts—would evoke the lasting gratitude of civilized man the world over.

Regular Meeting, June 15th, 1874.

President in the Chair.

Forty-six members present.

A. E. Head was elected a life member, Charles T. Dake and James W. Winter resident members, and J. G. Lemmon and H. W. Howgate corresponding members.

Donations to the Museum: W. N. Lockington presented several cases of insects, and some alcoholic specimens. Mr. Dameron presented a lizard, from China, used for medicinal purposes; also, a fossil, from Forest Hill, Placer County. Major William Ford presented, through Messrs. Barry & Patten, a supposed weight for distension of thread, used in spinning, an aboriginal stone implement, found twenty feet beneath the surface, in cement gravel, at Martinez, Contra Costa County, California.

Mr. James Lick presented some fragments or pieces of the battle-flag which waved over Fort McHenry, during its bombardment, on the 13th and 14th of September, 1814. Accompanying this gift was a letter from Mr. Lick, and one to him from Commodore George Henry Preble. Also, a pamphlet, containing description of flag, entitled, "Three Historic Flags, and Three September Victories," a paper read before the New England Historic Genealogical Society, July 9th, 1873, by George Henry Preble. The correspondence referred to is as follows:

COMMANDANT'S OFFICE, NAVY YARD,
PHILADELPHIA, June 6th, 1874.

JAMES LICK, ESQ.

Dear Sir: Seeing in the paper this morning an account of your having left several thousand dollars to the city of San Francisco for the purpose of erecting a monument to the author of the "Star Spangled Banner," I am prompted to send you a copy of my pamphlet, "Three Historic Flags," which will give you a history of the flag of Fort McHenry, and a heliotype of the flag. I also enclose a few fragments of the flag itself, which is now in my charge, at the rooms of the New England Historic Genealogical Society, to which my friend, Captain William C. Parker, U. S. N., not long since proposed you as a corresponding member. Excuse this intrusion from a stranger in admiration of your noble generosity, and I am,

Very truly, yours,

GEO. HENRY PREBLE,

Commodore U. S. N., Commandant Naval Station, Philadelphia, Penn.

PROF. GEO. DAVIDSON, PRESIDENT CALIFORNIA ACADEMY OF SCIENCES.

Dear Sir: Through the kindness of Commodore George Henry Preble, Commandant of the Naval Station at Philadelphia, I am favored with three small fragments or pieces of the battle-flag which waved over Fort McHenry, at Baltimore, during the bombardment, on the 13th and 14th of September, 1814; and, in presenting them to the Academy, I do so, regarding them as precious mementoes of a great event, and trust they will be carefully preserved and cherished by the Academy as among their most interesting relics.

That they will be so preserved I am assured, as well from the fact of their being portions of the original Star Spangled banner, which floated so triumphantly over Fort McHenry, "Amid the rocket's red glare and bombs bursting in air," and which inspired Francis Scott Key in writing our noble anthem, as for the thoughtful kindness of Commodore Preble in presenting them.

Yours respectfully,

JAMES LICK.

Donations to the Library: Professor Davidson presented "Comparison of the methods of determining heights by means of leveling, vertical angles, and barometrical measures, from observations at Bodega Head and Ross Mountain, by George Davidson and Charles A. Schott, Assistants U. S. Coast Survey." Professor Edward S. Morse presented "Remarks on the Relations of *Anomia*"; "On the Tarsus and Carpus of Birds"; "On the Systematic position of the *Brachiopoda*"; "Embryology of *Terrebratulina*"; "On the Early Stages of *Ascidian*"; "On the Early Stages of *Terebratulina septentrionalis*." From

Charles L. Weller, one hundred books, as follows : Pacific Railroad Reports (10 vols.) ; Perry's Japan Expedition (2 vols.) ; Naval Expedition to Chile (2 vols.) ; Military Commission to Europe, 1856 ; Congressional Globe and Appendix, (34 vols.) ; Life and Works of John Adams, (10 vols.) ; Byron's Works ; Rambles in Egypt and Candia ; Travels in Central America, by John L. Stephens (2 vols.) ; Journals of California Legislature, (5 vols.) ; Dictionaries—French, German, and Spanish ; Cyclopedia of History ; Benton's Thirty Years in United States Senate, (2 vols.) ; Campaigns of Lieutenant-General Forrest ; San Francisco Municipal Reports ; Fleetwood's Life of Christ ; Barnard's Commission to Isthmus of Tehuantepec ; United States Finance Report, 1868 ; Expedition down Colorado River ; Expedition to Great Salt Lake Valley ; California State Register, 1859 ; Sear's Pictorial Annual, 1849 ; General McClellan's Report and Campaigns ; Gil Blas ; Inskip's Methodism ; Notes on Duels and Dueling ; Life of Nicholas I. of Russia ; Administration of John Adams ; German Reader ; Latin Reader ; Spanish Grammar ; Sportsmen's Manual (Forrester) ; Mill on the Floss ; Guizot's Civilization in Europe ; Eulogies on Webster ; Travels in Western Mexico ; Exploration of the Amazon ; Mother's Recompense ; The Last Days of Lee ; Owen's Geological Survey of Iowa, Wisconsin, and Minnesota. The following periodicals were also received : Nature, Vol. X., Nos. 237 and 238, May, 1874 ; American Naturalist, June, 1874, Vol. VIII., No. 6 ; American Journal of Science and Arts, June, 1874, Vol. VII., No. 42 ; Engineering and Mining Journal, May 30, 1874, Vol. XVII., No. 22 ; Bulletin of the Essex Institute, March, 1874, Vol. VI., Nos. 4 and 6 ; Entomological Contributions, No. 3, by J. A. Lintner, from the 26th Annual Report of the New York State Museum of Natural History, for 1872 ; Cosmos Comunicryioni sui Progressi pici regenti e note voti, della Geografica e delle Scienze de Guido Cora, Vol. II., 1874 ; No 99 of Société Entomologique de Belgique.

S. C. Hastings read a paper in reference to the late alleged manifestations in Oakland.

Dr. Fourgeaud read a paper, a continuation of previous papers, "On Evolution."

The President called the attention of the members to some phenomena which he observed at the Naval Observatory, while looking at an artificial transit of Venus. At the time of the earlier observations of this planet, there was a doubt as to a phenomenon which showed an apparent adherence of the limb of Venus to the edge of the sun in the internal contact. This was known as the "black drop," when Venus showed an irregular spherical condition. As soon as I saw the artificial Venus, I recognized the cause of this thing. We see it every day in the work of the Coast Survey. It is simply the undulation of the atmosphere when it is surcharged with aqueous vapor. At an elevation of seven thousand or ten thousand feet, where the atmosphere is attenuated, this is not apparent. In observations taken by me lately in the Sierras, the sun was sharply outlined, but this was at a high elevation. I have no hesitation in saying that former theories on this subject were incorrect, and that the undulation of the atmosphere when filled with aqueous vapor is the true cause. If the morning is dark and cloudy, the artificial Venus can be seen with a sharp contact; but, when the clouds broke away, and the aqueous vapor was heated up, the "black drops" could be seen. The transit of Venus must accordingly be observed at a high elevation, for there they will be enabled to determine within eight or ten seconds the actual time of contact.

The President also called the attention of the members to the admiration of James Lick's generosity which scientific men in the East hold. These actual deeds were not known when I left Washington, but some of the facts were made known in his will and had been spoken of. Some of his donations he has changed, but he has given for the observatory a sum adequate for erecting the largest observatory in the world with the finest instruments. There will be plenty of money left to provide observers and assistants, and for publishing the results of the work accomplished. In some observatories they have to solicit funds to publish the results of their work. Mr. Lick did not want any such drawback in this instance. He has given enough to carry it on properly in every respect. His gifts have excited unbounded admiration among the physicists and astronomers in the East.

The President also stated that Mr. Mumford, of the Telegraph Company, had shown him an instrument for the transmission of musical sounds along a telegraph wire. He himself heard distinct musical sounds sent 800 miles. He has asked Mr. Mumford to extend a wire to the Academy's building, so as to show the members this remarkable invention. A detailed description of the instrument could not be given until patents were obtained.

Professor Edward S. Morse was introduced by the President, and congratulated the members on the prosperity of the Academy, comparing it with respect to means to similar societies in the Eastern States. Professor Morse, in speaking of the earlier efforts of our Academy, said: "In the East we are familiar with your publications; I wish to tell you that when the first 'proceedings' came along, we were somewhat amazed, and thought that some young men were starting it, and the Society would only last a year or so. From year to year you kept on, and we saw that the papers you published showed reasonable research. We saw that you did not decay and were getting on; but we never dreamed that you would get an amount of money more than that all of our Eastern Societies put together."

He then spoke of the different scientific societies in the Eastern States and their pecuniary resources, enumerating the sums of money given to the prominent ones, and said: "Add all these sums together, and the sum given to the Academy of Sciences by Mr. Lick exceeds all the endowments of the natural history societies in the Eastern States. The California Academy now starts with a sum equal to all. Mr. Lick has gone ahead of Peabody, as far as science is concerned, for Mr. Peabody endowed educational institutions liberally, but gave only about $300,000 to purely scientific societies. The position occupied on the globe by the California Academy is a fine one, as it is the only endowed society on the Pacific Ocean. It has plenty of money and a large area for investigation."

Professor Morse in the course of his remarks said: "Science has changed a great deal in the last ten years. Our old proceedings of societies were merely technical; now they are broader. As your President said in his last report, 'There is no money in this country for individual pursuits.' In Europe this is done, but not here. There large sums are appropriated to assist Professor Blank in his investigations. In this country our naturalists are poor. So in a society they must label specimens, and do miscellaneous work, and get no time for investigation. The primary object of your Society is to furnish original investigators. Now you have ample funds to employ specialists, and you must impress upon them that they must give the results of their investigations to you. Do not let them be too practical. Do not let the bread-and-butter idea preponderate. There are other things for men to do beside to eat and drink and make money."

The President announced the death of M. Adolphe J. L. Quetelet, an honorary member of the Academy, and also the death of Leander Ransom, a resident member. In speaking of the latter, he said: "Col. Leander Ransom's name appears on the records at the second meeting after the organization of the Academy of Sciences, April 11th, 1853, and from that time onward he took an active part in the work of the Academy. On January 5th, 1854, he was elected Second Vice President; on January 7th, 1856, elected President, and continued to preside as first officer until January, 1867—eleven years.

"His scientific papers were few, yet his labors in the cause of science and his warm sympathy and support of those more actively engaged in natural history studies, call forth our admiration, more especially when we consider that in those early days of gold-seeking and local excitements of one kind and another, came the cares of settling a family in an unbuilt city; and when we find him regularly and punctually attending the weekly meetings of the Academy for so many years, we can but poorly award him the meed of praise. We might go on in words to extol his geniality, gentleness, and liberality, yet we leave the records of the Academy, the objects he presented to the museum, and books he contributed to the library, to be a constant memorial of his worth to our institution."

Regular Meeting, July 6th, 1874.

President in the Chair.

Forty-five members present.

The following resident members were elected: William B. May and C. H. Wakelee.

Donations to the Museum: Ore from the Little Giant mine, San Juan, Colorado. The dark line in the specimens is said to yield $20,000 per ton. Also, specimens of argentiferous galena, and of silver associated with heavy spar. T. J. Butler, of Redding, pre sented a specimen of *kaolin* (?) from the banks of Pitt River, Shasta County; a piece of lava from Siskiyou County. Also, specimens of copper, coal, and iron, from Shasta County. W. G. W. Harford presented a pair of slippers such as are used by fishermen on the Japanese island of Strick. Henry Edwards presented twenty-six specimens of crustacea, two of them from Canton, China; three chrysalis cases (*Oiketicus*) from Mazatlan; one specimen of *Echinoderms*, Vancouver Island, three from Mazatlan, and one from Panama; seven specimens (six species) *Ophiernidae* (?) Mazatlan; *Gorgonia* and corallines from Mazatlan; two nests of tarantula with the spiders from Calaveras County; Ten species of *Cirrhipedes* from various localities. Dr. Kellogg presented specimen of *Amorpha*.

The President donated a series of photographs (25) of the hieroglyphic inscriptions on the blocks found on Easter Island. A letter was read on the subject of these hieroglyphics from Mr. Crofts as follows:

PAPEETE, Tahiti, April 30th, 1874.

DEAR SIR: Your very complimentary letter, of February 4th, was received by me at a moment when I was prostrated by a severe illness; but I availed myself of the first hours of convalescence, *con amore*, to attend to your very natural, and indeed, somewhat anticipated requests. Being informed by Monseigneur Axieri that it would be impossible for him to let you have one of the blocks, I have spared no exertions to obtain for you two good sets of photographs of all of them, in accordance with your desire.

The Bishop, owing in part to his desire to ameliorate your disappointment in not being able to see and handle one of the coveted articles, and partly owing to his own innate good nature, has done all he could to assist me, lending me the blocks (some of them twice over) to be taken to the photographer, and also loaning me the manuscript chart of Easter Island, and a lithographic view of some of the statues, (or rather "busts") together with other assistance.

Mr. De Greno, a Swede, now residing in Papeete, who was passenger in a ship which was sunk at Easter Island, having been run in there in a sinking condition, and who was obliged to stay there some months until taken off by a brig calling there on her way here from Valparaiso, and who takes an interest in everything referring to that island, has kindly lent me part of a *Harper's Weekly* of April 26th, 1873, from which I have had photographed a portion of an engraving of a scene in Easter Island. I should advise you to obtain a copy of the said *Weekly*, and see the whole picture, and read the account accompanying it. I have submitted it to the examination of a number of Easter Island natives, and they inform me that it is a very true representation of the actual state of things, both with reference to the "statues," and to the dress, dances, and appearance of their people at home. Mr. De Greno also substantiates their statement.

I have numbered and otherwise classified the "photos," (ordering the photographer to preserve the margins for that purpose) so that I think you will be enabled, from the directions written by me on them and in the letter accompanying them, to arrange them properly. One of the blocks is more than a yard long, and I was obliged to have the "photo" taken in six sections—three on each side—in order to have the characters sufficiently large and distinct to enable you to read them.

The blocks are of different sizes and shapes. I will explain why they are so. Many long ages ago, (according to the account the natives of Easter Island, now living in Tahiti, give me) the population of that island had grown to be very great, numbering some thousands; and as the island is small, being only about twenty miles long, they found it was necessary, on account of having to depend entirely on their own resources, to cultivate every spot of land that was capable of cultivation. For this reason they destroyed all the trees, and planted sweet potatoes, yams, etc., where those trees had grown. From that time to this, they have never had a tree more than say two inches in thickness, and that of a soft, quick-growing kind, which they were obliged to use before its wood had time to harden. Owing to this circumstance, after they had consumed all the wood from their ancient forests, they were obliged to pick up the driftwood cast on their shores by the ocean, and collect, from whatever other source they could, any kind of hard wood they could procure in order to record whatever they wished to record. This accounts for the varieties of wood, the singular shapes, and the variable thickness of the blocks.

These records or blocks, they say, were extremely numerous in former times; but a great many were destroyed during their frequent wars, when each party would, in their anger, injure the valuables of the opposing party. Some of the natives, however, have told me, with what truth I know not, (for the natives of all these islands cannot be depended upon for the truth) that soon after the Catholic missions were established on their island, the missionaries persuaded many of their people to consume by fire all the blocks in their possession, stating to them that they were but heathen records, and that the possession of them would have a tendency to attach them to their heathenism, and prevent their thorough conversion to the new religion, and the consequent saving of their souls. Others of the natives deny this statement altogether, and are very strenuous in saying that it is false. I may here mention that the latter are Catholics, and are living with the Bishop. Their statements should be taken with some allowance. Those who make the charge, on the other hand, are employed by Mr. Brander, a merchant and planter here, and are not subject to the control of the Catholics.

Mr. De Greno, the Swede before spoken of, tells me that when he first landed on the island, the natives showed him and his friends quite a number of the records, and they seemed to attach a great value to them; for some three or four months after, when he was about leaving, and desired to take one or more of them away with him, he found it impossible to get one by any means, and, indeed, many of the natives denied having any. The captain of the sunken ship, however, managed to get two or three of them, which he has taken to Europe.

Mr. Calligan, mate of an American vessel from your port, which vessel was lately wrecked on Easter Island, where he and his friends built a boat from the remains of the wreck, and came down in it to Tahiti, (and who now commands a small schooner sailing among the islands here) also managed to get one of the blocks, which, he has told me, (he is absent just at the present writing) he has sent to his wife, somewhere in California, I think. When he returns, I will try to find out where, and inform you, so that you may have an opportunity to see and probably obtain it, or at least to obtain a photographic representation of its characters.

Mr. Parker, a merchant of this place, informs me that some three or four years ago, when nearly three hundred of the Easter Island natives were brought to Tahiti, (as laborers for a term of years, which are now expiring) they had a number of blocks in their possession which they tried to sell; but they charged such a high price for them that no one bought them. He says that *they* seemed to think that they were very valuable, but they could not bring any one else to their way of thinking. Mr. Parker says that he thought (not understanding their language) that they were mere bits of wood on which they had tried their skill at carving, and that the characters were merely ornamental, and that he did not sufficiently admire such ornaments to cause him to invest any money in it—at any rate, as much as they demanded. Had he known that they were portions of their records, inscribed in an ancient and peculiar language, he would have bought all he could get at any price. Although I was present here, myself, in Papeete, at the time, these blocks entirely escaped my notice, nor did any one give me the slightest hint of their presence. Had I had Mr. Parker's opportunity, it is quite probable that I should have laid this matter before the scientific world years ago. It is barely possible that there may be some of these blocks now in the possession of some one in Tahiti—Easter Island natives or others; and I am making inquiries for the purpose of obtaining, if possible, one or more of them for you.

In reference to my translation of the inscriptions, I am sorry to inform you that I was cruelly disappointed in my interpreter. On the day on which he was brought to my residence by his countryman, who had recommended him as competent to give me a translation of the characters, I wrote down part of what he pretended to interpret for me, and my hopes were raised to the highest pitch. This day was Sunday, the only day when he was at leisure to attend to such things. During the following week I had mislaid the manuscripts, and when he came again on the succeeding Sunday, I thought it best to begin anew with the translation, and I proceeded to again write down his interpretation, both in his own dialect and in the Tahitian dialect of the Malay language. As I proceeded, however, it struck me that the second translation of the same characters differed materially from the first. This thought kept growing upon me more and more as I advanced, until at last I became convinced that he was deceiving me, and that he did not or could not truly interpret the characters. I concluded, however, not to be too hasty in the matter; and so I gently told him to go away for the present, and to come back again on the following Sunday. He did not come again on that day, and not until the next Sunday. In the meantime, however, I had found the first manuscript, and having compared it with the second, I found that they differed very greatly. When he finally came again, I requested him to again go over his former translation, so that I might correct the errors and omissions in my manuscript. He did so, and I found that his third pretended interpretation again differed from either of his former translations. I then called his attention to these facts—told him that it was impossible that the same characters should have three different meanings on three different Sundays; that he knew nothing, probably, of the meaning of the characters; that he was trying to deceive me, and that he had better leave. He left.

The Bishop has also been trying his hand in translating the inscriptions. He showed me a manuscript book of considerable thickness, which he thought contained an interpretation of most of the characters on the "photos" marked Nos. 5 and 6 on our list, being the two sides of one of the blocks. In this work he says he was assisted by one of his own people, (a native of Easter Island now in the employ of the Mission) who acted as interpreter. I advised him to subject him to a similar test to that to which I had subjected mine, when I fear he will be undeceived as I was. He promised to do so when opportunity occurred.

Mr. De Greno informs me that when he was on Easter Island he saw two very old, decrepit natives, whom he was told were taught, in their early youth, to read and inscribe the records, and thought that it was quite probable that they could do so.

In regard to the great stature which you say in your letter is mentioned by Roggewein, I have noticed that their stature was rather small than great—seldom exceeding six feet, and rarely attaining that. I made inquiries of them as to the probable cause of this difference between the stature of their ancestors and their present height. They stated, in answer, that some twelve years ago their island was visited by a number of Peruvian vessels, as many as nine at one time. These vessels sent a part of their crews on shore, armed, and then the vessels surrounded their island, firing on them with cannon, while the boats' crews, combined, were driving and firing upon them with muskets. In this manner a number of them were killed, for they had no firearms, and were too timid to make close work of it. The consequence was, they were obliged to surrender, and after being all collected in one place, their pitiless conquerors proceeded to select all the largest and most powerful men, and after securely putting them in irons, took them on board the vessels and carried them off into slavery, to carry heavy sacks of guano on the Chincha Islands. They have some boys, however, growing up, and who promise to make large men. I have had one of them photographed for you (No. 17) by himself, and again in the groups, (Nos. 10 and 11) where he is the central figure, being already taller than the full-grown men beside him.

You ask, also, for photographs of the scenery of Easter Island. I have no means by which I could obtain a photographic view of that kind. But after somewhat lengthy conversations with the natives, Mr. De Greno, and others on that subject, I think I can give you a pen-picture of some of the scenery. Fancy an island which raises smoothly from the principal portion of the shore to hills of moderate height, divested for the most part of rocks and roughnesses. In three parts of the island are extinct volcanoes, as laid down in the chart. Their craters, however, have been rounded down by time and the "elements," and the whole appearance of the island indicates great age, much older than Tahiti and its surrounding islands. There is not a tree or bush to be seen on the island, except some few that have been planted near the residence of Mr. Dutron-Bornier, a French sea-captain now residing on the island, and who is connected with Mr. John Brander, of this place, in sheep and cattle-raising there.

In reference to your question, "How do the natives of Easter Island obtain fire?" I have to answer that they cannot tell. Their forefathers, like the ancient Romans, had their "vestal" fires, preserved from ancient times; but the "*Vestal Virgins*" of Easter Island were gray-headed and gray-bearded old heathen priests. It was a part of their duty, sacredly attended to, to guard the eternal fire, which was neutral, together with its guardians, in all wars. From this sacred fire the whole community—at one time a large one—could obtain that useful "element" from time to time, as they needed it, for culinary and other purposes. This custom is still kept up by a portion of the community, while another portion rely on the matches of Mr. Dutron-Bornier for their supply. Another portion of the community have learned from Gambier Islanders (who were sent there by the Catholics, to assist the priests) how to make fire: not by rubbing two sticks together, as you ask in your letter, but by rubbing the point of one stick on the side of the other, until it makes a hot groove and eventually fire—a work generally of from five to ten minutes. In order to illustrate this, I have had a photograph taken for you, showing you the natives in the very act of producing fire, and have also sent you the identical sticks used on that occasion. You will notice that the wood is of a soft and spongy nature. It grows abundantly on these islands, and is a variety known as the *Hibiscus tiliacus*, and called by the natives "*Purau*" and "*Fau*," pronounced "*Purow*" and "*Fow*," "*ow*" being sounded as in the word "*how*." You can, if you wish, obtain large quantities of it, by going on board the vessels carrying oranges from these islands to San Francisco; the orange crates are mostly made of it. And you could also get one of the Tahitian or other islanders, sailors on board of such vessels, to make fire for you by the aid of these sticks, and thus practically or ocularly answer your own question, as they are all experienced in the art.

As to the cord of human hair, it is no doubt of very modern origin, and therefore of no value in investigating the age of the inscriptions or the origin of the language. I have, therefore, not sent you any of it. The natives of the islands are all the time making it, and it is of no value in reference to matters of antiquity.

I spoke to the natives about the *white* men seen by Roggewein. They state that some of their people are very light-colored when they are not much exposed to the sun's rays. And it may have been much more so formerly, and the lighter portion may have been readily mistaken for white men; for they were quite as light as some white sailors who are much exposed to the sun.

Mr. Calligan, before spoken of in this letter, informs me that during his forced stay on Easter Island he kept a journal, noting down things which came under his observation, and that he has sent it to his friend, Mr. MacCrellish, of the San Francisco *Alta California*, who will doubtless publish extracts from it. You will thereby, perhaps, be able to learn much about the island, written upon the spot, with all the freshness of narrative that usually accompanies articles so written.

Mr. Viaud's work, though in French, will also be interesting, being, like Mr. Calligan's, so very modern, and written upon the spot. You will find it noticed in *Harper's Weekly* of April 26th, 1873, before mentioned in this letter.

I am very anxious to see whether the characters on the blocks agree with those on the sculptures on the island of Java and other East Indian islands on the coast. If you have now, or can get a chance to see, a work on East Indian sculptures, please consult it and inform me of the result.

Yours in haste,

THOMAS CROFT.

PROFESSOR GEORGE DAVIDSON,

President California Academy of Sciences, San Francisco.

PAPEETE, Tahiti, April 30th, 1874.

PRESIDENT CALIFORNIA ACADEMY OF SCIENCES.

Dear Sir: Yours of the 4th ult., requesting me to procure for you photographs of all the blocks of characters in the possession of the Mission here, and also the scenery, monuments, people, etc., of Easter Island, was duly received by me, and I hasten to comply with your requests. Accompanying this letter you will receive 52 photographs in duplicate, as follows: Nos. 1 and 2 back each other; Nos. 3 A, 3 B, and 3 C, and Nos. 4 A, 4 B, and 4 C, also back each other; the block from which they were taken is over a yard long, and I was obliged to have it taken in six sections, three on each side, in order that the characters should be large enough to enable you to see them distinctly. Nos. 5 and 6 back each other—that is, the one was taken from one side of the block, and the other from the other. No. 7 is taken from a lithograph in possession of the Bishop. No. 8 is taken from a manuscript chart of Easter Island, also in the possession of the Bishop. This chart was made by the officers of the Chilian corvette *O'Higgin* in 1870, as stated on the chart; the names having been corrected by the Bishop personally, from information derived from the islanders themselves now in his employ here. No. 9 was taken from part of an engraving contained in *Harper's Weekly* of April 26th, 1873, which please see, as it is interesting and truthful; it and the lithograph were taken by Lieutenant Viaud, of the French frigate *La Flore*, Admiral de Lapelin, on the occasion of said Admiral's conveying away one of the busts from Easter

Island, and which he brought here, afterwards took to France. I called him Admiral Rousséo, in mistake, in my first letter to the California Academy of Sciences. No. 10 and No. 11 are two groups of natives of Easter Island, differently taken, on account of the imperfection of the camera used, which was a French instrument. The photographer is about to receive an American camera from California, when he hopes to take the large photographs in a better manner. Nos. 12 are two different photographs of the natives in the act of making fire, taken just at the moment of producing fire. One of them holds his hat to prevent the wind from cooling the groove and blowing away the fine wood dust which is produced by the rubbing, and which forms the tinder; another holds the stick rubbed, to prevent its being disarranged, and the third has just finished the rubbing. Nos. 13 and 14 back each other, and are similar to those in the archives of the Academy. Nos. 15, 16, 17, 18, 19, and 20, are portraits of Easter Island natives as they now dress, in the employ of the mission here. Nos. 21 and 22 back each other. No. 23 is a photograph taken at the request of the Bishop, some time since. I have procured two copies to send to you, because it is interesting. The gray-bearded priest in the center is one of two priests who were formerly on Easter Island, and who are accused by a portion of the islanders of causing that act of vandalism, the destruction of a great many of the records. On each side of him stand the two husbands of the two women, and the fathers of the two small children, whose mothers hold them in their arms. I have had the portraits of the two women taken larger, (Nos. 19 and 20) so that you can better see their features, and also the husband of one of them, (No. 19) who is No. 16, in order that you may see his features. The other one refused to be taken. In No. 23 you also may see, in the hands of another priest, one of the blocks from which I have had two of the photographs taken. You may also see in the hands and on the persons of different natives, some of the idols, paddles, and implements used by the heathen priests in their worship.

Both the Bishop and myself would be extremely pleased if you would send us a copy of the Proceedings of the California Academy of Sciences, containing my letters on this affair, to be preserved as a souvenir of passing events, and as containing in a printed form the information which I and others have collected.

Mr. C. B. Hoare, the photographer here, wishes me to state that he will preserve the negatives from which all these photographs have been taken, and if you or any of your friends wish any more, he will be able to furnish them at a much lower price than he is obliged to charge for these.

I have presented to the Bishop, in your name, a copy of each of the photographs, as some compensation to him for his kindness and trouble. I feel certain that I shall receive your approbation for so doing.

I have retained a copy of each of the photographs, numbered and marked precisely like yours, so that if you need any more explanations, or wish to order any one or more of them, you need but state its number, when I will look at mine, and understand you perfectly.

My charge for my services is nothing. The photographer's bill amounts to seventy-five dollars, ($75) he tells me, which you will please pay to A. Crawford & Co., as you suggested. Yours, etc.,

THOMAS CROFT.

Mr. F. Gruber presented the following specimens of birds stuffed: Swallow Fruit-eater, (*Procnias ventralis*) male and female. Long-billed Marsh Wren, (*Cistothorus palustris*). Song Thrush of Europe (*Turdus musicans*). House Sparrow of Europe (*Passer domesticus*). European Jay, (*Corvus glandarius*). Green Paroquet, (*Psitacula passerina*) from South America. Crimson Tanager, (*Ramphocilis brasilica*). Black cap Titmouse, (*Parus ater*). Four species of Brazilian humming birds; Bay-breasted Warbler from Pennsylvania; Black-banded Tanager from Central America; Toucan, from the Islands of New Guinea; Australian Bee-eater; Black-banded Troupiale; Oregon Thrush. Several other specimens of bird skins were also presented by Mr. Gruber.

Donations to the Library: Astronomical Register, No. 138. Annals and Magazine of Natural History, Vol. XIII, No. 78. Monatsbericht der Königlicht Preussischen Akademie der Wissenschaften zu Berlin, Marz. 1874. Annals der Physik und Chemie, No. 3, 1874. Proceedings of the American Academy of Arts and Sciences, Vol. IX. Instructions for observing the Transit of Venus, Dec. 8 and 9, 1874, (from the Naval Observatory). The Journal of Botany, No. 138, London. Nature, No. 239, Vol. X, May, 1874. Verhandlungen der Gesellschaft Erdkunde zu Berlin, No. 4, 1874. Entomological Contribution, No, 3, by J. A. Lintner, 1872. Cal. Horticulturist, No. 6. Report of Board of Officers on the Gatling Gun, Washington, D. C., 1874. Observations on the genus Unio, Vol. XIII, Philadelphia, presented by Dr. Isaac Lea. Geographical and Geological Surveys west of the Mississippi, Washington, May, 1874. Engineering and Mining Journal, May and June, 1874. Catalogue of Birds ascertained to occur in Illinois, by Robert Ridgway, 1874. Birds of Colorado, by Robt. Ridgway. Mittheilungen der Deutschen Gesellschaft für Natur und Völkerkundi ostasiens Herausgegeben von den Vorstandt Yokohama, Jan., 1874. Overland Monthly, Vol. XIII, No. 1. Proceedings of the Academy of Natural Sciences of Philadelphia. Geological Survey of Hok Kaido. Popular Science Monthly, No. 27. Descriptions of New North American Phalænidae and Phyllopoda, by A. S. Packard, Jr. "On the Transformations of the common House Fly, with notes on allied forms," by A. S. Packard, Jr. Seventh Annual Report of the Provost to the Trustees of the Peabody Institute, Baltimore, 1874. Prof. Davidson presented "Field Catalogue of 983 stars," by Geo. Davidson. Also, Report of B. A. Gould, of the Argentine National Observatory, Cordova, Jan. 31st.

The President communicated the results of some observations on the comet, with respect to its exact position, stating that he had made observations for its position on the 28th of June and 2d of July. The approximate position on the latter date was, Right Ascension, 7 h. 38½ m. and 63° 59′ north declination.

Pacific Coast Lepidoptera, No. 5—On the Earlier Stages of some Species of Diurnal Lepidoptera.

BY HENRY EDWARDS.

Since the publication of my last paper on this most interesting branch of entomological research, I have been fortunate enough to make myself acquainted with the earlier stages of some of our butterflies, previously unknown to me, and have, in addition, received from friends some MS. notes on other species; while from various publications I have gleaned a few particulars concerning others The whole of this information I have endeavored to place in a concise form before the student, and I believe that the present and previous articles will be found to contain all the knowledge we possess concerning the earlier stages of our diurnal Lepidoptera. It will readily be seen how small is its amount, and how grand a field for observation is still open to those who desire to pursue so interesting an inquiry. To those living in the country a more agreeable and fascinating amusement cannot well be conceived, than the watching and rearing the larvæ of insects; and a very little practice in the matter will serve to increase its charm, while it will make the task more easy, and, at the same time, render almost incalculable benefit to those scientific observers who, living in cities, have not the time and opportunity at their command to devote to this branch of study.

As previously stated, I shall be happy to afford any information in my power, and will at all times gladly award to any who may assist me, all the credit due to their discoveries.

Papilio Daunus.

Chrysalis. General shape the same as *Rutulus* and *Eurymedon*, but a little shorter and stouter proportionately, and considerably darker in color, which is dark greenish-drab, with the dorsal region broadly and distinctly shaded with black. The mesonotal process is very rough, and the antennal cases decidedly black. The wing cases are streaked with blackish-brown. The head is marked with a broad, fawn-colored patch, and a streak of the same color is along each side of the abdomen, indicating the pale yellow stripes on each side of the body of the imago.

Length, 1.60 inch.

I regret to be able to add little with reference to the larval state of this beautiful insect. I am informed by Mr. W. T. Eaves, of Virginia City, (to whom I am indebted for a number of specimens of the chrysalis) that the caterpillar is dull green, with some yellowish stripes, and that it feeds upon a species of wild cherry, common in Nevada. Those found by Mr. Eaves changed to chrysalis late in April, and from ten specimens presented to me, I was fortunate enough to raise six males and four females, all in perfect condition. They emerged from the 27th of May to the 8th of June.

Pieris protodice.

Larva. "Average length when full grown, 1.15 in. Cylindrical, with the middle segments largest. Most common ground color, green, verging on blue, sometimes clear pale blue, and at others, deep indigo or purplish blue. Each segment has six transverse wrinkles, (of which the first and fourth are somewhat wider than the others) four longitudinal yellow lines equidistant from each other, and each interrupted by a pale blue spot on the before mentioned first and fourth transverse wrinkles. There are traces of two additional longitudinal lines below, one on each side, immediately above the prolegs. On each transverse wrinkle is a row of various sized, round, black, polished, slightly raised piliferous spots, those on wrinkles one and four being largest and most regularly situated. The hairs arising from these spots are stiff and black. Venter rather lighter than ground color above; and minutely speckled more or less with dull black. Head same color as the body, covered with black piliferous spots, and usually with a yellow or orange patch on each side, quite variable. The black piliferous spots frequently have a pale blue annulation around the base, especially in the darker specimens. When newly hatched, the larvæ are of an uniform orange color with a black head, but become dull brown before the first moult, though the longitudinal stripes and black spots are only visible after that moult has taken place.

"*Chrysalis.* Average length, 0.65 inch.

"It is as variable in depth of ground color as the larva. The general color is light bluish-gray, more or less intensely speckled with black, with the edges and prominence marked with buff or flesh color, and having large, black dots." C. S. Minot in *Am. Entomologist,* vol. II, p. 77.

The caterpillar of this common species feeds on various cruciferous plants, and may be sought for in the San Joaquin and other valleys, where the butterfly occurs in great abundance, though it is somewhat periodical in its appearance. It is probable that it will one day become a serious pest to our market gardener, as cabbages and other allied plants suffer largely from its attacks.

Anthocaris ausoniedes. Bdv.

"*Larva.* Head round, green, speckled with black. Body long, slender, dotted with black granules, and marked with three lead-colored stripes. Between these are two yellow stripes of similar width. The lateral lead-colored ones are edged below with white shading into yellow. Under side, bluish-green. Feeds on cruciferæ, the larva attaining its growth early in July, and changing to a curiously-horned chrysalis, which tapers gradually and almost equally towards each extremity. At first glance, it much resembles a brown and curled-up leaf. The perfect insect escapes the following season."—T. L. Mead.

I am indebted for the above description to my friend Mr. Mead, of Cornell University, who discovered the larva of this somewhat rare species in his tour through Colorado, and who was successful in raising it to maturity.

Colias coesonia. Godt.

This species has been found near San Diego by Mr. James Behrens, and must, therefore, be included among our California butterflies. The following brief description is the only one at my command:

"*Larva.* Green, with a lateral white band, punctured with yellow; besides this band, there is on each segment a transverse black band, bordered with yellow. Feeds on different species of *Trifolium.*"—Boisduval.

Terias lisa.

This and the following species have also been taken near the Mexican border. The descriptions of the larvæ, by Boisduval, are very vague and unsatisfactory, but I append them, having at present no better to offer:

"*Larva.* Green, with four longitudinal white rays. Feeds on *Cassia* and *Glycina.*

"*Chrysalis.* Green."—Boisduval.

Terias delia. Cramer.

"*Larva.* Green, with a longitudinal white line on each side, above the feet. Feeds on *Cassia, Glycina,* and *Trifolium.*

"*Chrysalis.* Green."—Boisduval.

Danais Berenice. Cramer.

"*Larva.* Whitish violet, with transverse stripes of a deeper color, a transverse band of reddish brown on each ring, divided in its length by a narrow yellow band. Along the feet, a longitudinal band of citron yellow. Long, fleshy processes of brown purple are disposed in pairs on the second, fifth, and eleventh rings. Feeds on *Nerium, Asclepias,* etc.

"*Chrysalis.* Green, with golden points on the anterior side, and a semi-circle of the same color on the dorsal side, a little beyond the middle, separated from a blue band by a row of three black dots."—Boisduval.

Found, but rarely, in the vicinity of San Diego.

Agraulis vanillæ. Bois.

"*Larva.* Cylindric, pale, fulvous, with four blackish longitudinal bands, of which the two dorsal are sometimes obsolete; furnished with ranges of blackish ramose spines, of which two are placed on the summit of the head. Head with a whitish ray on each side, lined with black; feet, black. Feeds on *Passifloræ,* etc.

"*Chrysalis.* Russety brown, with some paler shades."—Boisduval.

Abundant in Lower California, and occasionally straying beyond the border. It has been taken on several occasions in the foothills near San Diego.

Argynnis myrinæ. Cram.

This species, which occurs somewhat abundantly in Alaska and British Columbia, has been reared from the egg by Mr. Sanders, who thus describes its various stages:

"*Egg.* Pale green, elongated, shaped something like an acorn, with the base smooth, convex, and the circumference striated longitudinally, with about fourteen raised striæ, which are linear and smooth; the spaces between are about three times wider than the striæ, depressed, concave in the middle, and ribbed by a number of cross-lines, fifteen to twenty between each striæ, and distinctly indented. The egg is contracted at the apex, the striæ protruding at the tip a little beyond the body of the egg. The eggs were deposited June 24th, and hatched in six or seven days. When fresh from the egg, the larvæ were about one-tenth of an inch long.

"*Larva* (young). Head medium-sized, black, and shining; the body above is dark brown, with transverse lines of a paler color, especially on the anterior segments; it is thickly covered with short hairs of a pale brownish color. Between the first and second moult it is one-fourth of an inch long. The head is bilobed, shining, black, and hairy, and the body above is greenish black, the greenish tinge most apparent on the second and third segments, with a few small yellowish dots along each side, and transverse rows of strongly elevated, black tubercles, emitting numerous short, black, hair-like spines. The under surface is similar to the upper; the feet are black and shining, and the prolegs are black, tipped with a paler hue. After the second moult, there are two fleshy tubercles on the second segment much longer than the others, which are covered throughout with small, hair-like spines. The yellowish spots along the sides of the body assume more of an orange tint, and there are one or two faint longitudinal streaks of the same color along the sides close to the under surface, and between the rows of large raised tubercles are many smaller ones, which are also black, and appear but slightly raised.

"*Larva* (full-grown). Head, slightly bilobed, black, shining, and covered with short, fine, black hairs. The body above is dark grayish-brown, beautifully spotted and dotted with deep, velvety black; the second segment has two long, fleshy horns, yellowish white at the base, black above, covered with minute, blackish, hair-like spines. The third and fourth segments have each four whitish spines, tipped with black, those on the sides placed on the anterior portion of the segment, those above, about the middle. All the other segments have six whitish spines, except the terminal one, which has four. All the spines have five branches, of a black or brownish-black color, and one about one-third the length of the fleshy horns on the second segment. A pale line extends along each side, from the fifth to the terminal segments, close to the under surface. The under side is brownish-black, darker on the anterior segments; feet black and shining; prolegs brown, with a shining band of brownish-black on the outside."—W. SANDERS, in *Packard's Guide*, p. 254.

"*Chrysalis.* This has two large, conical tubercles in front of the insertion of the antennæ, and two acute tubercles on the thorax. The thorax is acutely bi-tuberculated on the sides, with an acute thin dorsal ridge, on each side of which are two small, sharp tubercles. Along the back of the abdomen are two rows of tubercles, those on the third abdominal ring being much larger. It is half an inch long, pale ash, with black dots and irregular lines."—PACKARD, *loc. cit.*

Pyrameis Caryæ. Hubn.

Larva. On exclusion from egg, almost wholly black, with faint yellow irrorations. After the first moult, the head is black, shining, densely and rather coarsely punctured. Body black, transversely mottled with lemon yellow, with a black dorsal line, and lateral waved lines of yellow, enclosing the stigmata. Spines black, ramose, those of the dorsal region yellow at their base. With each succeeding moult, the black gradually disappears, and the yellow markings acquire a paler shade.

Mature Larva. Head, brownish-black, thickly covered with whitish hairs. Ground color of the body, pale greenish-yellow, mottled irregularly with black and olive patches, and with a broken, black, dorsal line. The spines of the first four segments are black, with white branches, the whole of the remaining spines being dull fawn-color, darkest at their bases, with concolorous branching hairs. The stigmata are yellowish-white, surrounded by a black ring, and enclosed in a waved, mottled, black and olive band, from which proceed some narrow, oblique branches, joining the base of the lateral series of spines. Under side olivaceous, dotted with yellow. Feet and prolegs pitchy, with chestnut hairs.

Length, 1.25 inch.

Food plants, various species of *Malvaceæ.*

Chrysalis. Rather short, fawn color, covered over the whole surface with black dashes and dots, darkest about the thorax. The head is truncate in front, with two small, angular protuberances beyond the eyes. Mesonotal process rather short, angular, directed backwards. There are also two rather acute angular processes at the sides of the thorax. Abdomen, with three raised points on each segment, palest at their apex. At the junction of the thorax with the abdomen, are two small, subcordate patches of pure white, resting on two other small white spots at the base of the abdomen. Wing cases fawn color, with a few black streaks, and a submarginal row of six minute white dots, edged with black. Antennæ plainly visible, with the articulations distinctly marked. There are no gold or silver marks whatever.

Length, 0.85 inch.

Changed to chrysalis, July 2d. Imago, July 24th.

Limenitis misippus. Fabr.

"*Larva.* Cylindrical. General color, whitish. Head, dull olive, with dense minute prickles, its vertex bifid and terminating in a pair of prickly cylindrical horns, transversely arranged, and each about 0.03 inch long. Back, speckled and mottled with olive of different shades above the line of the spiracles, except joints 2 and 8, and upper part of 7 and 9, but with a continuous pure white line above the spiracles, beneath which white line, on the fourth to tenth joints, is a large olive patch, extending on joints 6–9 to the external tip of the prolegs. A pair of black, transversely arranged dorsal dots in the suture behind joint 2, and a less obvious lateral one above the second and fourth pair of prolegs, surmounting the lateral white line. Joints 3–7 and 9–11 with more or less shining, elevated, blue dots. On joint 2, a pair of prickly, cylindrical, black horns, transversely arranged, and 0.16 inch long. On joints 3, 10, and 11, a pair of large, dorsal tubercles, transversely arranged, each crowned by a little bunch of 8–12 robust prickles. On joint 5 a pair of similar tubercles, but still larger, of a yellowish color, and mamma-like. On joints 4, 6, 7, and 9, tubercles similar to those on joints 3, 10, and 11, but smaller. On joint 12, four black, prickly, dorsal horns, quadrangularly arranged, and each about 0.03 inch long. Spiracles and legs blackish."—American Entomologist, 1869, vol. I, p. 193.

Chrysalis. Russety, with the sides of the abdomen varied with white, and with a thin, prominent projection on the back.

This insect occurs sparingly in British Columbia, and in Oregon. I saw it flying at the Dalles in July, and found a specimen in the collection of Mr. Johnston, of Portland; so that the earlier stages may be sought for in those districts.

Limenitis Lorquini. Bois.

Larva. General color, olivaceous, shading abruptly into stone-drab in the middle of the dorsal region. Head, deeply furrowed in front, dark fawn-color, covered with small warts, with two protuberances on crown, very rough, the apex of all the warts paler than their base. Second segment, whitish, with olive tint, with three irregular longitudinal blotches of black, not extending into either of adjoining segments; stigmata of this segment large, black, with white center. Third segment, pale olivaceous, swollen into two lumps, from which proceed two horns, very rough and warty, brown in color, and in shape very like small branches of coral. Fourth segment, greenish white, blotched with olivaceous, with two small black spots in front of the center. This segment is produced into two swollen lumps, crowned with a stellar tubercle. The stigmata of three and four are whitish. Fifth segment, olivaceous, with darker patches, wrinkled transversely, with a number of minute metallic blue dots, scattered irregularly. Sixth segment, whitish olivaceous, swollen into two mammiform protuberances, with stellar tubercles on the apex, a greenish dorsal line, and a few metallic, bluish spots, scattered over the disc. Seventh segment, olivaceous, striped longitudinally with paler shades, bituberculated, and with a few metallic blue dots. Eighth segment, whitish, the olivaceous patch here only visible on the anterior portion of the sides, with a small, darker blotch, dorsally edged with two faint, dark lines. Ninth segment, whitish, with green tinge, a dark blotch at base, and two or three faint, blackish dashes. The olive lateral patch is wanting.

Tenth segment, whitish dorsally, olivaceous at the sides. In the white patch are some black waved lines, directed posteriorly, and in the olive parts of this segment are some four or five metallic blue dots. Eleventh and twelfth, exactly alike, olivaceous, with a few paler lines, and two stellar tubercles on each segment, between which are about five metallic blue dots. Thirteenth, olivaceous, with paler stripes, and a rough double tubercle on the anal extremity, brown, warty, similar in color to the head. The stigmata from 5–12 are black, with whitish center. Above them, on 7, 8, and 10, is a black, velvety, ovate spot, and beneath them, commencing at 5, and extending to anal extremity, is a milk-white, waved, lateral line. Under side of body, pale greenish-brown, palest near the junction of the segments. Feet, brownish, with black rings, and with some white bristles springing from their base. Abdominal legs brownish, with very minute white tubercles.

Length, 1.20 inch.

Food plant, willows, and occasionally on oak.

Changed to chrysalis, June 12th. Imago emerged, July 6th.

Thecla halesus. Bdv.

This magnificent insect, the most showy and the largest of our Theclas, is met with occasionally in several localities near San Francisco. The following brief description of its early stages is appended :

"*Larva.* Green, slightly pubescent. Head and scaly feet testaceous. On the back there is a small ray, and on the sides, nine oblique bands of obscure green. At the base of the feet, a marginal ray of greenish yellow. Feeds on *Quercus.*

"*Chrysalis.* Russety, pointed with brown."—Boisduval.

Thecla arsace. Bois.

"*Larva.* Reddish ; back, white from the second to the ninth ring, and divided by two parallel, interrupted lines of obscure green. Near the base of the feet, there is a marginal ray of the same color, bordered with white below, and between that and the dorsal rays, a row of seven or eight oblique streaks.

"*Chrysalis.* Reddish before, and the wing envelopes greenish."—Boisduval.

Found, though rarely, in Vancouver Island.

Thecla mopsus. Hubn.

"*Larva.* Greenish, with the back a little more whitish. The anterior and dorsal part has a brown quadrangular space, bifid behind, and marked with four white spots. The three hind rings have a wide white border, edged with brown. Head and feet brownish. Feeds on *Eupatorium coelestinum*.

"*Chrysalis.* Grayish-brown, with a row of yellow, ferruginous points on the sides."—Boisduval.

Found sparingly near Portland, Oregon; at the Dalles, and on Vancouver Island.

LIST OF SPECIES NOTICED IN THIS PAPER.

Papilio Daunus	Chrysalis.
Pieris protodice	Larva and Chrysalis.
Anthocaris ausoniedes	" "
Colias caesonia	Larva.
Terias lisa	"
" *delia*	"
Danais Berenice	Larva and Chrysalis.
Agraulis Vanillæ	" "
Pyrameis Caryæ	" "
Limenitis Misippus	" "
Limenitis Lorquini	Larva.
Thecla halesus	"
" *arsace*	"
" *mopsus*	"

A Tribute to the Memory of George Robert Crotch.*

BY HENRY EDWARDS.

"Died, on the 16th of June, 1874, of consumption, at the house of Professor Lesley, 1008 Clinton Street, Philadelphia, where he passed the last six weeks of his life, George Robert Crotch, M. A., Cantab, son of Rev. Wm. R. Crotch, M. A., Oxon, aged 32 years. Interment at Woodland Cemetery, Philadelphia, U. S. A."

Such was the intelligence conveyed a short time since in the letter of a mutual friend—intelligence which has brought a gleam of sadness to many a heart, and caused a tear to start to many an eye. Though not a member of this Academy, Mr. Crotch was well known to some assembled here to-night, and his early death deserves a passing tribute of respect at our hands. As a naturalist, in his own particular branch of science, he stood deservedly high; and from his young life, just opening as it were with promise, much and valuable work might reasonably have been expected. He has been stricken down in the midst of his enthusiasm, and adds one more name to the long list of those who, while devoted to science, have become its martyrs.

George Robert Crotch was born and educated in Cambridge, England, where his father was a distinguished divine, he himself having also in early life been intended for the church; but when quite a boy he manifested that earnest love for Entomology which in after years became the ruling passion of his life, and unfitted him for other labors. He graduated with considerable honors and became an admirable classic and modern linguist, abilities which won for

* Printed in advance.

him the position of librarian of one of the colleges of his native city. A life of confinement was, however, irksome to him, and giving the rein to his love of adventure, he wandered over the best part of Europe in search of insects, visiting Spain, Portugal, Italy, and the isles of the Mediterranean. He also once undertook a collecting tour through the Canary Islands, and ascended the Peak of Teneriffe in search of specimens, his labors being rewarded by the discovery of many species new to science. In the fall of 1872 he came to America, passing some time in Philadelphia, examining and determining species in various collections, and arrived in California, full of health and spirits, early in the last year. After thoroughly exploring the immediate neighborhood of San Francisco, walking nearly every day for several weeks upwards of twenty miles, he started on a tour through the southern part of the State, taking Santa Barbara, Fort Tejon, San Bernardino and San Diego in his way, wandering even across the boundary into the Mohave Desert, sleeping for several nights after the day's fatigue in the open air, with no other covering than the clothes he wore. Returning to San Francisco early in May, he spent some time at various points of the Sierra Nevada, and in June started on a prolonged tour through Oregon and British Columbia, during which he contracted the disease which has now carried him away. He trusted to his training as a gymnast and to his naturally strong constitution to bear him through the hardships which he encountered, but he was deceived. Nights and days of rough life, with poor and uncertain food, sometimes in cold and inhospitable weather, proved too much even for his strong frame, and soon after his return to the Eastern States his malady declared itself. He had accepted an invitation from Professor Agassiz to take charge of a portion of the insects in the Museum at Cambridge, and was assiduously employed upon their determination and arrangement when he was stricken down. Returning to Philadelphia in April last, he grew gradually worse, and though he himself had hope that the summer would bring a change for the better in his condition, his friends immediately around him knew and felt otherwise. In the last letter I ever received from him, which is dated the fourteenth of May, he says: "No leaving here this summer. I have written for my brother, who I hope will come to me. At present things look bad, and though I eat and drink well, yet the average effect is weaker, and the expectoration won't slacken. This may be a serious thing, though, of course, my constitution is in my favor. Please keep my net and use it—it will be long before I need it again. I should like to see you once more; I shall, some day, I hope. If I could only be out collecting, somewhere, I am sure I should get well." Then, with the ruling passion still strong within the shadow of death, he adds in a P. S.: "Let me know what new things you have taken this year." The iron hand was too strongly pressed upon him, and even his brother and sister arrived too late to receive his parting words. It is, however, gratifying to know that his last hours were soothed by the presence of kind and gentle friends, and that all that earthly love and attention could do was done, to render his passage from the world tranquil and full of peace.

Mr. Crotch was the author of a vast number of papers in various scientific periodicals on the different families of Coleoptera, his knowledge of this extensive and difficult order of insects being wide in the extreme, while his "Revision of the Coccinelidæ" may be regarded as the standard of all the information we possess upon the species of that group. Just previous to his death he had undertaken the revision of the North American Phytophaga, and had already published some valuable information concerning this family. His energy and enthusiasm in the pursuit of the objects of his special study knew no bounds, and the knowledge he possessed of their habits enabled him always to discover new species, even in localities which had previously been subjected to a somewhat strict and careful search. As an instance of his skill as a collector, it may be stated that during the few months he passed on this coast, he added between three and four hundred species to our collections. He had planned a trip to Central America, and subsequently one to the Islands of the Pacific, and to Australia, both of which have been cut short by his untimely death. The grass which covers the grave of George Robert Crotch will grow above the remains of a most able naturalist, a true and generous friend, and an accomplished and genial man.

On the Use of Giant Powder (Dynamite) for Obtaining Specimens of Fish at Sea.

BY A. W. CHASE, U. S. COAST SURVEY.

During the winter of 1873, I made some experiments off the island of Santa Catalina with giant powder, which have some points of interest. They were not undertaken at first as offering any field of research, but for the more utilitarian purpose of obtaining fish for "chowder."

I was, however, so much struck with the variety and number of fish procured, and also with some curious facts connected with the suspension of animation in the nerve centers of the fish stunned, that I wrote to the late lamented Agassiz on the subject. In his reply, which is dated June 18th, 1873, he states that the letter is full of interest, and that the experiments should be continued and varied, and, of course, asked me to send specimens, etc. But further correspondence on a subject which, to me, promised to be exceedingly interesting, was cut short by his death, and the specimens I afterwards obtained are lying in alcohol with the exception of a few that Dr. Steindachner took with him to Vienna.

As you are all doubtless aware, giant powder No. 1 is simply nitro-glycerine, with the addition of an absorbent earthy powder, an infusorial earth obtained in Europe being the principal material used in the factory here. The powder thus prepared has the appearance and consistency of soft putty, and is put up in cartridges the length and shape of an ordinary candle. In using it for explosion in water, the cap is fitted on the end of the fuse, and both buried deep in the soft powder, a string being then tied tightly around the fuse where it comes in contact with the edges of the paper wrapper. The top of the cartridge is then tallowed, and it is ready for use.

I have found that the ordinary water-proof fuse will burn about one foot to every twenty-five seconds, and, by experiment, that a cartridge will explode in from four to six fathoms with from three to four inches of fuse. I have, however, made no exact experiment on the subject. The shock of the explosion is most severely felt downwards, as the resistance is greater; and the different varieties of sea fish found near the rocky shores of the islands, as a rule, being found on or near the bottom, it is desirable to explode your cartridge about midway between the surface of the water and the rocks beneath, as you thus reach both the deep-lying fish and those, like mackerel and smelt, which swim between.

Let me now describe to you the modus operandi, as practiced by myself off Catalina. I would take a small skiff and pull off to the kelp beds that surround the island. Here, in six or eight fathoms of water the bottom is distinctly visible, the water, owing to the absence of currents or of sedimentary deposits around the rocky shores, being beautifully clear and limpid. Fastening my skiff to the floating weed, I would part the stems and look down into the depths below. It is a most wonderful and interesting study. You see the stems of the kelp rising up from the bottom like twisted pillars, often many being twined together. Through these submarine forest aisles you see great numbers and variety of fish and crustacea. The large vieja, or red-fish, so-called (totally distinct from the red-fish of our markets); the splendidly colored red perch, or mullet, a vivid scarlet; the elegantly-shaped sea bass; the pompino; the smelt and mackerel, in schools, darting hither and thither; and occasionally a great conger eel, uncoiling itself from around some stone that it had selected as an ambush wherein to wait for prey. I have often been so much interested in watching the movements of these finny tribes, that I have forgotten the errand I came on.

But when an unusually large school of fish would swim by, I would quietly light the fuse and drop the cartridge into the water gently.

If the water was, say eight fathoms deep, I would graduate the fuse for explosion at four. The cartridge would slowly sink—generally in a spiral—and a few bubbles of air or smoke arise to the surface.

The fish did not seem, as a general rule, to be much alarmed. Once I remember a large red fish took the cartridge for something good to eat, and reached it just in time to allow a small portion of his tail to reach the surface. When the fire reached the fulminate of mercury, there would be a sudden white flash, then a quick, sharp detonation, the blow striking the bottom of the skiff as if some one had struck it with a hammer.

Then, in a space of time varying from eight to ten minutes, every fish within a radius of forty or fifty yards would slowly come to the surface. Those within the immediate vicinity of the explosion, of course, were killed by bursting the bladder and injury to the large intestines, and had to be speared up from the bottom. Those, however, at a greater distance, would be simply stunned, and could be taken in with a net. Care had to be taken to avoid touching those only slightly stunned until the net was fairly around them, as the slightest blow would arouse them from their torpor.

I found that an ordinary sized red-fish, weighing say five or six pounds, which happened to be ten or twelve yards from the explosion, would remain thoroughly stunned about twenty-five or thirty minutes; then, reviving, would die from asphyxia, in a similar manner as if caught with hook and line. Many curious varieties of the smaller fish, many of them of brilliant color, that live around the kelp stems, would be secured by the explosion. These, I do not think could be taken in any other way. The kelp would interfere with nets, and they never take bait. The brilliant red mullet, for instance, (I give only the common names) will not touch bait, and lives in hollows in the rocks or around the kelp, where nets could not be dragged. This fish is far handsomer than the gold-fish of our aquariums.

I am now about to relate what will, perhaps, be called a genuine "fish story"; but as I have, in addition to my own, the testimony of my men to the fact, I give it as it occurred.

I had brought up by an explosion a number of yellow bass fish, weighing about four pounds each. These are delicious in chowder, and so, instead of putting them in alcohol, I had them cleaned, which was done by scaling, removing the intestines, and cutting off the fins and tail. The head, however, still remained joined to the backbone. These fish, from the time they had been taken from the water up to the time of cleaning, remained apparently lifeless. Nor did the removal of the intestines arouse them. They were then taken up to the old barracks, where I was temporarily camped, and hung upon nails driven in the clapboards. Some little time after they had been thus disposed of, one of the men came in and asked me to go out and look at the fish. I did so, and found every individual bass slapping around in as lively a manner as if he had been freshly caught and hung up.

They had, in fact, recovered from the explosion, and proceeded to die in the common fashion. I took one down and broke the backbone where it joined the head. Its struggles ceased instantly, thus showing that the vital force had been arrested in the nerve centers and brain at the time of explosion, and when the effect had passed away that the fish had resumed a galvanic life.

It was probably about half an hour from the time of explosion when this occurrence took place. I have not been able since, however, to secure the same result, although I must state that the only time since then that I have tried the experiment was on the Oregon coast, where I brought up a school of salmon, all of which were pickled for Agassiz. These fish were, however, too close to the explosion, as they were killed outright.

In referring to the use of these cartridges, I would state that I have carefully avoided transgressing any of the laws on the subject against destruction of trout or other valuable fish of the fresh water streams; but as the fish of the sea are unlimited in number, I do not see that any objection, beyond the danger of accident to the operator, can be urged against their use in the ocean, and it certainly offers a means of securing rare specimens not obtainable by net or line.

In reference to the fishing off Catalina Island, I would state that it in my mind constitutes one of the principal values attached to this property so lately deeded by Mr. Lick for benevolent and scientific purposes.

There are two excellent harbors, one on each side of the tranverse gap in the mountain chain traversing it, called the Isthmus. On this is located a large frame building, erected by the Government during the late war, which might be converted into a hotel, and with boats in each harbor, and a little steamer to ply back and forth to San Pedro, be made a place of great resort. There is excellent sea bathing from several of the sandy beaches in the little coves, and the dreaded stingaree, the pest of the main shore, is not found there. For a school of natural history like that at Penikese, the island would be excellently adapted.

The President announced that at a future meeting he would communicate in detail the results of the sounding expedition to Japan from San Diego. Commodore Belknap had forwarded to him all the information necessary.

The President stated that George H. Mumford had telegraphed to him, stating that he is making arrangements by which he hopes to be able to accede to the request to transmit musical sounds from the office in New York to the rooms in the Academy.

The President communicated to the Academy some of the results obtained in ascertaining altitudes by leveling, vertical angles, and barometric measures. The experiments were conducted by himself and Charles A. Schott, of the Coast Survey, and they lasted seven days. The altitude of Ross Mount was ascertained from Bodega Head, by the process known as double zenith distances, to be 598.74 metres; by leveling, 598.53 metres; and by barometer, 598.80. The barometer used was the Smithsonian. It was found over the whole series of observations that seven o'clock in the morning was the best time to use the barometer. At one o'clock in the afternoon the difference noted in the barometer, on the average, amounted to thirty-seven feet. The heat radiated from the earth did not appear to affect the atmosphere on the line of sight between the Head and Ross Mount, the air being almost constant in its temperature. Close to the ground, however, the temperature changed considerably. In this respect, varying results might be expected in other localities.

Regular Meeting, July 20th, 1874.

President in the Chair.

Fifty members present.

E. Stevens was elected a resident member.

Donations to the Museum: From J. S. Lawson, of the Coast Survey, specimens of *Verillia Blakei*, preserved in glycerine, in a heavy glass tube, the gift of Professor Davidson. From John Williamson, Secretary of the Acclimatization Society, a collection of fish, embracing eight species, from Lake Tahoe: there are ten varieties of fish found in the lake. From E. Stevens, four specimens of iron ore, and one of fossil earth, from the Sublette mines, Del Norte County, ten miles northeast of Crescent City: the fossil earth occurs in great beds, at about 2,000 feet altitude. From Eugene Gillespie, of Cape St. Lucas, through Mr. Dameron, a box of the leaves and berries of a plant said to be poisonous; accompanying the specimen was a letter describing the plant and the symptoms exhibited by a child whose death was caused by contact with, or eating the berries of the shrub. The Alaska Commercial Company presented a skeleton of a large Alaska seal. Dr. Blake presented specimens of mica, containing potash, lithium, and chromium, with which gold was associated in considerable quantity, found at Granite Creek, near Coloma—the only specimens, he believed, in which gold had been obtained in any other vein of mineral than quartz: the specimens did not occur continuously, but in patches, and occurred in an altered porphyritic rock; they were a very beautiful microscopic study, and the formation indicated that the gold must have been deposited by aqueous solution between the thin flakes of mica. From Professor George Davidson, specimen of *Echinarachnius eccentricus, of* Escholtz. J. P. Dameron presented specimen of *Velella.*

A bottle of Sonorous Sand, from the Island of Kaui, of the Hawaiian group, was received from W. R. Frink, with a letter describing its peculiarities, as follows:

"The bank, which is composed of this sand, commences at a perpendicular bluff at the southwest end of the island, and extends one and a half miles almost due south, parallel with the beach, which is about one hundred yards distant from the base of the sand-bank. This sand-drift is about sixty feet high, and at the extreme south end the angle preserved is as steep as the nature of the sand will permit. The bank is constantly extending to the south. It is said by the natives that, at the bluff, and along the middle of the bank, the sand is not sonorous. But at the extreme south end and for half a mile north, if you slap two handfuls together, there is a sound produced like the low hooting of an owl—more or less sharp, according as the motion is quick or slow. Sit down upon the sand, and give one hand a quick, circular motion, and the sound is like the heavy bass of a melodeon. Kneel upon the steep incline, extend the two hands, and clasp as much sand as possible, slide rapidly down, carrying all the sand you can, and the sound accumulates as you descend, until it is like distant thunder. In this experiment the sound was sufficient to frighten our horses, fastened a short distance from the base of the drift.

"But the greatest sound we produced was by having one native lie upon his belly, and another taking him by the feet, and dragging him rapidly down the incline, carrying as much sand as possible with them. With this experiment the sound was terrific, and could have been heard many hundred yards distant. With all the experiments that were made, it seemed the sound was in proportion to the amount of sand put in motion with a proportionate velocity. Another consideration seems requisite, that is, its perfect dryness. The dry sand would sound on the surface, where six inches beneath it was wet; but if any of the wet sand became mingled with the dry, its property of sounding ceased at once. The sand appears to the eye like ordinary beach sand, but ordinary beach sand will not produce the sounds. It has been said that it lost its sonorous properties when taken away from the bank. But I can discover no diminishing of its sonorous qualities, even with the bottle uncorked, and we have had rain frequently, and an atmosphere more than ordinarily moist for this time of year. Perhaps, if exposed to a very damp atmosphere, it might absorb moisture enough to prevent its sounding."

Donations to the Library: Senator Cornelius Cole presented one hundred volumes of books, and forty pamphlets, mostly public documents. Mr. Amos Bowman presented his report on the Georgetown Divide. D. D. Colton presented Adams' Map of History.

One case of books was received from the Smithsonian Institution, containing the following: Records of the Geological Survey of India, Vol. VI., Parts 1 and 3; Memoirs of the Geological Survey of India, Calcutta, Vol. I, Part 1. Vol. IV., Parts 3 and 4 (Palæontologia, India); Memoirs of the Geological Survey of India, Vol. X., Part 1; Bulletin de la Société Imperiale des Naturalistes de Moscow, No. 2, 1873; Bulletin de la Société des Sciences Historiques et Naturelles de Lyonne, Vol. XXVII., 1873; Two volumes in Russian language; Jahrbuch der K. K. Geologischen Reichsanstalte, Wien, 1873; Oversight over det R. Danske Videns Kabirnes Selskabs Forhandlinger og dits Medlemmers Arbejder i Aarut, Copenhagen, 1873; Les Cristalloids Complexes a Sommit Etoilé, par Le Cti Leopold Hugo, Paris, 1872; Introduction a la Geometrie description des Cristalloides, par Le Cti Leopold Hugo, Paris, 1874; Sitzungs-Berichte der Naturwissenschaftlchin Gesellschaft, Isis en Dresden, 1873; Mittheilungen aus dim Konigl Mineral Museum in Dresden für dii Jahre, 1872 and 1873; Extraite des Annales de la Société Entomologique de Belgique, Vol. XVI., 1873; Journal de la Société d'Horticulture, 1870 and 1872; Achtundfunfziyster Jahrisbericht der Natur, Gesellschaft in Emden, 1872; Bulletin de la Société des Sciences Naturelles de Neuchatel, Vol. IX., 1872; Nachrichten von der G. Gesellschaft der Wissenschaften und der Georg-Augusts-Universitat aus der Jahre 1873, Gottingen. Verhandlungen des Natur Vereins der Preussischen Rheinlande und Westphaliens, Bonn, 1872 and 1873; Archives Neerlandaises des Sciences Exactes et Naturelles, Paris, 1873; Neerderlandsch Meteorolog, 1868 and 1872; Suggestions on a Uniform System of Meterorological Observation, Utrecht, 1872; Verhandlunger des Botanischer Verein der Provinz Brandenburg, Berlin, 1872; Verslagen en Medederlingen der K. Akademie van Westenschappen, Amsterdam, 1873; Jaarbuck van de K. Akademie van Wettenschappen, Amsterdam, 1872; Ganda Domestica, Amsterdam, 1873; Memoires de la Société Nationale des Sciences Naturelles de Cherbourg, Vol. XVII., Paris; Catalogue de la Bibliötheque de la Société Nationale des Sciences de Cherbourg, 1873; Bericht über die Senckenbergesche Naturforschende Gesellschaft, Frankfurt, 1872 and 1873; Tenth Annual Report of the Belfast Naturalist Field Club, 1872–1873; Annales de la Société Malacologique de Belgique. Vols. VI. and VII., 1872 and 1873, and Vol. II., 1873; Memoirs de la Société de Physique et d'Historie Naturelle de Geneva. Vol. XXIII., Part 1; Sitzungsberichte, der K. Akademie der Wissenchaften, Wien, 1872 and 1873; Mikrogeologische Studien, etc., Christian Ehrenburg, Berlin, 1872; Bulletin Meterologique de L'Observatorie de L'Universitie Upsal, 1873, Vol. V.; Nova Acta Regia Societates Scientiarum Upsalensis, Vol.

VIII., fasc. 2, 1873 ; Abhandlungen der Mathematisch-Physikalesahen Classe der Koniglich Bayerischen Akademie der Wissenschaften, Munichen, 1873 and 1874 ; Verzerchniss der Mitzlieder der K. B. Akademie der Wissenschaften, 1873 ; Rede in der öffenthichen Zitzong du K. Akademie der Wissenschaften, am 25 Juli, 1873 ; Der Antheil du K. Bayerischen Akademie der Wissenschaften and der Entwickenblung der Electriutatslchere, Munich, 1873 ; Annalen der K. Sternwarte, Vol. XIX., Munichen ; Sitzungsberechte, der Mathematische-Physikalischen Classe du K. B. Akademie der Wissenschaften, Vol. 1, 2, and 3, Munich, 1872. On some remarkable forms of Animal Life from the Great Deeps off the Norwegian Coast, by George Ossian Sars, Christiania, 1872. Die Pflanzenwett Norwegens, ein beitrag zur Natur- und Culturgeschichte Nord-Europas, von Dr. F. C. Schübeler, Christiania, 1873. Uber die Nervenendigung an den Tasthaaren der, etc., von Dr. J. Schöbl, Prag, 1872. W. G. Horner's eigentliche Aufflösungsweise Algebraischer, etc., von Dr. Wilh. Matzka, Prag, 1871. Ueber Graphische Integration, by Josef M. Sōlin, Prag, 1872. Die Tangentialwage und ihre Anwendung zur Bestimung, etc., von K. W. Zenger, Prag, 1871. Ueber Fruchtsladien Fossiler Pflanzen, etc., by Otaker Feistmantel, Prag, 1872. Ueber die Bestimung der Vergrösserung und der Gesichtsfeldes, etc., by Dr. A. von Waltenhofen, Prag, 1871. Steinkohlenflora von Kralup, in Bohemia. von Otaker Feistmantel, Prag, 1871. Abhandlungen herausgegeben von Naturwissenschaftlichen Vereine zu Bremen, 1873. III. Bd. III. Heft. (Construction of Yachts.) Anvisning til Konstruktion af Lystfartöier og Bade, af C. Archer, Christiania, 1873. Forekomster af Rise I Visse Skifere I Norge, Med 3 plancher og flore træsnit af Amund Heland, Christiania, 1873. Norsk Meteorologisk Aarbog for 1871, Christiania, 1872. Budget for Marine-Afdelingen undr Marine- og Post-Departementet, Christiania, 1872. Lov om Poftvœfenet, Christiania, 1871. Oversigt ober Statstasfens Indtægter og Udgifter, etc., 1872, 1873. Mémoires de L'Academie Imperiale des Sciences de St. Petersbourg, Tome 18, No. 8, 9, and 10 ; Tome 19, No. 1 to 7. Bulletin of same, (17 Feuilles 33–36) (Feuilles 27 to 32) ; Tome 18 (Feuilles 1–7) ; Tome 18 (Feuilles 8–15). Mémoires de la Société de Physique et D'Histoire Naturelle, Geneve, 1873. Elektromagnetische Untersuchungen, etc.. von Karl Domalip, Prag, 1872. Erzeugnisse Mehrdeutiger Elementargebilde, etc., von Dr. E. Weyr, Prag, 1871. Uber einen Satz der Wahrscheinlichkeits-Rechnung, étc., von Dr. J. Dienger, Prag, 1872. Beiträge zur Theorie der Curven 3 und 4 Ordnung, von C. Küpper, Prag, 1872. Bulletins de L'Academie Royale des Sciences, etc., Bruxelles, 1871, Tome 32 ; 1872, Tomes 33 and 34. Acad. Royale de Belgique, extracts, etc. ; Observations des Phenomenes Periodiques Pendant L'Anné 1870. Annuaire de L'Acad. Royale, etc., de Belgique, 1875 and 1872 ; two vol. ; Bruxelles, 1873. Acad. Royale de Belgique, Centiéme Anniversaire de Foundation ; Tome 1st and 2d, (1772–1872) Bruxelles, 1872. Tables de Mortalité et Seur Developpement D'Apres Le Plan d'une Statistique Internationale et Comparée, etc., Bruxelles, 1872. Annales Meteorologiques de L'Observatoire Royale de Bruxelles, by A. Quetelet, Bruxelles, 1871. Norges Officielle Statistik, Christiana, Udgiven I. Aaret. 1870

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Professor Davidson communicated to the Academy the general results of the recent survey made by Commander Belknap, of the United States steamer *Tuscarora*, on the proposed southern route for the telegraph cable from this coast to Japan ; his remarks were illustrated with charts and drawings. In the soundings from San Francisco to San Diego, a great many off-shore lines were run. Ninety miles off Point San Luis the depth increased to 2,000 fathoms, with gray greenish ooze at the bottom, aud a temperature of a little over 32 degrees. Off Cape Mendocino a plateau was found, with a depth of 2,500 fathoms. Off San Nicolas, at the distance of 33 or 34 miles, the depth was 2,000 fathoms. Down the California coast the ooze became greenish, until San Diego was approached, and on the plateau off there a greenish yellowish ooze was obtained. Thence across to Honolulu the ooze was yellowish, then yellowish brown, and finally brown near Honolulu. In all cases the signs of former life brought up were the same as those obtained on the Northern Pacific Coast.

To Honolulu the distance is 2,200 miles. The bottom averages 2,565 fathoms in depth, or 15,510 feet, and the average temperature is 33 6-10 deg. Much more than one-half of this water along the ocean-bed has a temperature of 35 degs. only ; above this came a stratum of water heated to 40 deg., and above this again, water heated to 50 deg. Upon a calculation of the volume of water between this coast and Honolulu, along the line of soundings, he estimated the quantity at 1,858,000 cubic miles. Of this, 1,046,-000 cubic miles range in temperature from 33.6 to 35. Between the temperature of 35 and 40 there are 582,000 cubic miles ; from 40 to 50 degs., 180,000 cubic miles ; and from 50 degs. to the highest temperature, which is found over at Honolulu, 73½ degs., the volume is 100,000 cubic miles. In other words, the film of surface-water ranging from 59 to 73 6-10 is only one-tenth of the mass of water below it. Apparently, the grade is very steep at Honolulu and off San Diego, but in reality it never exceeds one foot in twenty-six ; no greater impediment to cable-laying is encountered from Honolulu to Bonin Island, where there is the greatest depth of the route, 3,262 fathoms, nor thence to Japan. In sounding to Bonin several submarine mountains were discovered, and the lead came up twice in a battered state, as if it had struck rock. The total distances along the route are: From Honolulu to San Diego, 2,240 miles; from Honolulu to Peel Island, 3,273; and from Peel Island to the coast of Japan, 480 miles; being 5,993 nautical miles, or 6,950 statute miles. This does not allow for any slacks in laying the cable.

Pacific Coast Lepidoptera, No. 6.—Notes on the Earlier Stages of Ctenucha Multifaria, Boisduval.

BY HENRY EDWARDS.

Through the kindness of Dr. Blake, of this Academy, I have an opportunity to call attention to the earlier stages of one of our rarer day-flying moths, (*Ctenucha multifaria*) the transformations of which were previously quite unknown. Dr. Blake captured a female recently at Crystal Springs, San Mateo County, in the act of depositing her eggs upon the leaves of the snow berry (*Symphoricarpus racemosus.* Michx). The caterpillar may therefore hereafter be sought for upon that plant.

Egg. Spherical above, much flattened at base, dull cream white, slightly glossy. Attached to the upper surface of the leaf, and deposited separately, in this respect differing from the species known in the Atlantic States as *Ctenucha virginica*, the eggs of the latter being found in small clusters, adhering compactly together. The young caterpillars emerged from the egg in about twelve days, and presented the following appearance:

Head, rather large, pale chestnut brown. Body, dull cream white, with numerous concolorous hairs, those of the extremities being the largest. Along the head in front is a faint, slightly waved black line. Each segment is provided with a row of black dots, about four to each segment, becoming fainter towards the posterior extremity.

Though supplied constantly with fresh food, and watched with every care, I regret to say that my young larva all died within a week, so that the mature caterpillar of this interesting insect still remains unknown; but during a recent visit to Monterey, I found adhering to the trunk of a pine tree a singularly formed cocoon, so remarkable in its construction as to cause me to watch for the emergence of the perfect insect with considerable interest. I had the satisfaction in a few days of discovering that it was the present species, and have pleasure in appending the following description:

Chrysalis. Tubular, slightly thickened about the anterior portion of the thorax. Shining, pitchy, with a double line on the thorax, some streaks on the wing cases, the antennæ, mouth parts, and the base of each abdominal segment, bright chestnut color. A few very short hairs are scattered about the upper side of the abdomen.

Length, 0.75 inch.

The cocoon was formed of rather long hairs, pale fawn color, sparsely mingled with black, which appear to rest on each other, and to be irregularly placed. The upper portion was drawn up into a pointed ridge and gable-shaped, like the roof of a house, while the base was spread out, and attached very loosely to the trunk of the tree, compelling me to cut away a piece of the bark in order to secure the cocoon. The structure of the chrysalis case of this genus appears to be peculiar. According to Dr. A. S. Packard, " it is formed out of the hairs of the caterpillar, without any silken threads being employed, as far as could be observed by microscopical examination. The hairs of these insects are thickly armed with minute spinules, so that by being placed next to each other, they readily adhere together, no silk being spun throughout the entire operation."

This insect, which is at present rare in collections, is found in its perfect state among reeds in rather marshy districts, and may be known by its bright bluish black color, with crimson marks on the head and thorax. Unless in very hot sunshine, it is a remarkably sluggish insect, and feigns death when captured.

A still scarcer, but closely allied species, described by me in these Transactions as *Ctenucha Walsinghamii*, was taken by Lord Walsingham some three years since in Southern Oregon. I have now to record the capture of two other specimens of this rare insect by Mrs. Howard Coit, in Napa County, and by her kindly added to my collection. This indicates rather a wider range than belongs to most members of the genus, as they appear from our present knowledge of them to be remarkably local.

The members of the Academy were invited by Mr. Stearns, on behalf of the Board of Regents of the University of California, to attend the commencement exercises at Berkeley. A vote of thanks was passed to the Regents for their courtesy.

Professor Davidson reported that the trustees had held a number of meetings with regard to framing a new constitution, and had called in to their aid Judge Curry, R. C. Harrison, and Samuel Wilson. They hoped to present to the Academy at the next meeting such amendments to the constitution as were required to guard against mistakes in the management of their property.

Regular Meeting, August 3d, 1874.

President in the Chair.

On ballot, the following resident members were elected: Hon. Cornelius Cole, Prof. T. Guerin, James Faulkner, and Carl I. Schneider.

The following, purchased for the museum by Capt. C. M. Scammon, were submitted. Baleen of the sulphur bottom whale (*Sieboldius sulphureus* of Cope) taken at Santa Cruz; Baleen of Bowhead (*Balæna Sieboldii* of Linnæus). Baleen of Right whale (*Balæna Sieboldii* of Gray). Baleen of California gray whale (*Rachianectes glauca* of Cope). Earbone of a right whale, taken on coast of Alaska in 1873. Earbone of the *Orca* or Killer, a cetacean of the dolphin family. Skull of a dolphin, with several vertebral plates, taken off the coast of California, Oct. 29th, 1873. Skull of porpoise (*Lagenorhynchus obliquidens* of Gill). Skull of porpoise, name undetermined. Skull of Bay porpoise (*Phocæna vomarina* of Gill), the least in size of the entire whale tribe inhabiting the Pacific North American Coast. Jaw of a white-headed or mottled grampus (*Grampus Stearnsii* of Dr. Dall). Bunch of warts taken from the head of *Balæna Sieboldii*. These warts are called by the sailors "rose buds." Piece of the right whale's "bonnet" (*Balæna Sieboldii*) taken on the Northwestern Coast. Two specimens of walrus hide. Fifteen jars of alcoholic specimens of various parts of cetaceans, with many of the parasites peculiar to them; and also specimens of crustaceans, used as food by the whales. Henry Edwards presented specimen of *Myriapod*, from the Hawaiian Islands, and a fresh water crustacean from the Dalles, Oregon. Mr. McHenry presented a piece of wood covered with moss, from King County, W. T. Mr. Lorquin presented *Bucephala albiola*, or butter ball duck, and *Querquedula cyanoptera*, or blue-winged teal. J. R. Scupham presented small shells collected on the Promontory Mountains, Utah. Mr. Gruber presented about twenty specimens of birds.

The order of business was suspended, and the President presented to the Academy on behalf of the Board of Trustees, the amendments to the Constitution heretofore offered, with a report from that Board that they had amended the same, and recommending the adoption by the Academy of the same as amended by them, as and for the Constitution and By-Laws of the California Academy of Sciences, in lieu of those now existing.

The following are the amendments to the Constitution as reported from the Trustees for adoption:

ARTICLE I.

NAME.

SECTION 1. This Society shall be known as the CALIFORNIA ACADEMY OF SCIENCES.

ARTICLE II.

MEMBERS.

SECTION 1. The Academy shall consist of resident, life, and honorary members, who shall be elected in the manner hereinafter prescribed.

SEC. 2. Each applicant for life, or resident membership, must be proposed in writing, at a stated meeting of the Academy, by two or more resident or life members; and the name, occupation, and residence of the applicant thus proposed shall be posted in a conspicuous place in the hall of the Academy for not less than one month from the date of proposing. After the name of an applicant for membership has been so proposed, the Council shall, at its next regular meeting, determine by ballot the eligibility of the person proposed. If the Council shall decide that the person proposed is worthy of membership, it shall so report at the next stated meeting of the Academy, at which time he shall be balloted for by the Academy.

No person shall be elected to membership in the Academy during the month preceding the Annual Election.

Every person elected to membership shall pay the initiation fee and the first quarter's dues within one month after receiving notice of his election, and shall sign the Constitution.

SEC. 3. If any applicant for membership has not been reported upon favorably by the Council, or has been rejected by the Academy, his name may be again proposed at any time after the expiration of one year from the date of his rejection.

SEC. 4. Honorary members shall be elected only at the annual meeting, and must have been proposed by the Council not less than two months before such meeting, and the names of the candidates posted in a conspicuous place in the hall of the Academy for that time.

Each candidate for life, resident, or honorary membership must, to be elected, have received the votes of at least four-fifths of the members voting, and no more than one candidate can be voted for at one ballot. No election shall be declared unless twenty votes have been cast, and in such case the ballot shall be taken at the next stated meeting.

SEC. 5. Any member may, at any time after his election, become a life member by paying into the treasury of the Academy the sum of one hundred dollars, and notifying the Recording Secretary that he desires to be enrolled as a life member. The Council shall have the privilege of nominating for election for life membership at the annual election, such persons as have rendered valuable services to the Academy; such elections not to exceed two annually.

Correspondents of the Academy shall be appointed by the Council for one year, and shall have the privilege of attending the meetings and visiting the library and museum, and of reading and communicating papers to the Academy.

SEC. 6. The business of the Academy shall be managed exclusively by the resident and life members, from whom the officers of the Academy shall be elected.

SEC. 7. The number of honorary members shall not exceed fifty, of which thirty shall be residents and citizens of the United States, and twenty of foreign countries.

SEC. 8. Any member may be expelled from the Academy for cause, and after due hearing, by a vote of two-thirds of the members present and voting. But proceedings for such expulsion can be conducted only at a stated or adjourned meeting. The accused shall have the right to be present at trial, but must withdraw when the vote for expulsion is ordered.

A member shall not be expelled unless at least twenty members vote for his expulsion.

A person expelled from the Academy shall forever thereafter be ineligible for membership.

ARTICLE III.

TRUSTEES.

SECTION 1. There shall be elected annually seven Trustees, who shall have charge and management of the estate and property belonging to this Society, and shall transact all affairs relative to the temporalities thereof.

SEC. 2. Immediately after entering upon their term of office, the Trustees shall organize by selecting one of their number as President of the Board, and shall appoint a Secretary to keep the record of their proceedings, and perform such other duties as they may require.

SEC. 3. The Trustees shall have power to adopt such By-Laws and Rules as shall not be inconsistent with the provisions of this Constitution, for the management and regulations of the affairs and property intrusted to them and under their control; the times and manner of conducting their meetings and of transacting business thereat; and the government and conduct of the persons appointed by them to fill any office or position. They shall require from the Treasurer, Librarian, and Director of the Museum, and from any person who may be appointed by them to any position of trust, such bonds as in their opinion shall be a security to the Society for the faithful discharge by him of his duties.

SEC. 4. The Trustees shall select some bank in the city of San Francisco as the depository of the funds of the Academy, and shall cause all moneys received by them, or by any one of them, to be deposited in such bank in the name of the California Academy of Sciences. The bank selected by them as such depository may be changed whenever the Trustees shall deem it expedient. No moneys shall be withdrawn from said bank except upon the written order and direction of the Trustees, and no disbursement shall be made except upon demands that have been properly audited by them, and for which their warrant shall have been drawn, signed by the President and Secretary of the Board of Trustees, and countersigned by the Treasurer of the Academy. They shall cause suitable books of accounts to be kept, which shall at all times clearly show all their transactions, receipts, and disbursements. At the annual meeting they shall present to the Academy a detailed statement of all their transactions during the preceding year, together with vouchers for all payments made by them, and a full report of all property, real and personal, held by them, and of the condition of the Corporation.

SEC. 5. Whenever the Trustees shall have in their hands funds that in their opinion are not needed for the immediate use of the Academy, they shall have the power to loan the same in the name of the Corporation upon such terms as they may deem advisable.

No loan, however, shall be made except the same shall be secured by mortgage of unincumbered real estate in the City and County of San Francisco, the value of which, exclusive of all improvements, shall in the judgment of the Trustees be twice the amount of the loan ; or by a pledge of bonds of the State of California, or of the City and County of San Francisco, whose par value shall be double the amount of the loan.

The funds of the Academy shall not be loaned to any of its Trustees, nor shall any loan be made except upon the vote of not less than five of the Trustees, entered upon the record of their proceedings, and specifying the amount, terms, and security, and the person to whom the loan is made. If any loan shall be made contrary to the provisions of this section, the Trustees making the same shall be individually and severally liable to the Corporation for the amount so loaned.

SEC. 6. The Trustees shall have power, if in their judgment it is advisable, to invest any of the funds of the Academy not needed for immediate use, in bonds of the State of California, or of the City and County of San Francisco. Such investments, however, shall be made only by the unanimous vote of all the Trustees, entered upon the record of their proceedings, and specifying the amount and character of the investment.

SEC. 7. The Trustees shall have the custody of the corporate seal of the Academy, and shall affix the same to all contracts entered into by them in the name of the Corporation.

ARTICLE IV.

OFFICERS.

SECTION 1. The officers of the Academy shall be a President, First and Second Vice-Presidents, a Corresponding Secretary, a Recording Secretary, a Treasurer, a Librarian, and a Director of the Museum, all of whom must have been life or resident members for three years previous to their election. The officers of the Academy shall constitute a Council for the transaction of such business as may be assigned to it by the Constitution and the Academy. The President of the Academy shall be Chairman of the Council. Surplus publications and exchanges of specimens shall be under the control of the Council.

The Council and officers and members are prohibited from incurring any indebtedness on behalf of this Society, unless authorized by the Trustees.

SEC. 2. The Trustees and Officers of the Academy shall be elected by ballot on the day of the annual meeting, for the term of one year. Their term of office shall commence on the third Monday in January, and continue until their successors are elected and qualified. Before the stated meeting of the Academy on the first Monday of December, the Council and Trustees shall meet jointly to select a Nominating Committee of five persons from among the members of the Academy not holding office, and this Nominating Committee shall prepare and present to the Academy, on the stated meeting of the third Monday in December, a ticket, naming one candidate for each office to be filled for the ensuing year, and thereupon this ticket shall be posted in a conspicuous place in the hall of the Academy. Other tickets may be presented, and other candidates may be balloted for at the annual election. At the stated meeting on the third Monday in December, the Academy shall appoint two Inspectors and two Judges of Election, who shall have the charge of the ballot-box, and shall conduct the election, on the day of the annual meeting. The ballot-box shall be kept open from the hour of nine A. M. to six P. M. to receive the ballots of the members having the privilege of voting, and a register of those who vote shall be preserved. No member shall vote at the annual election who is delinquent in the payment of his dues for any portion of the preceding year. At the close of the election the Judges shall announce the number of ballots cast for each candidate, and the candidate who shall receive a plurality of the votes cast for the office for which he had been nominated shall be declared duly elected.

SEC. 3. The President of the Academy, or in case of his absence or inability to serve, the First Vice-President, or in case of his absence or inability to serve, the Second Vice-President, shall preside at the meetings of the Academy. The President shall name all committees, excepting such as are otherwise especially provided for, and shall have a supervisory direction of the other officers of the Academy. At the annual meeting he shall make a report upon the condition and progress of the Academy, and shall also announce the deaths of members that have taken place during the year.

SEC. 4. The Recording Secretary shall keep a record of the proceedings of the Academy; shall receive and refer to the Publication Committee the papers presented for publication; shall furnish to it an abstract of the proceedings of the Academy; and shall duly engross and sign the minutes of each meeting before the next stated meeting. He shall give suitable notice of the time and place of all meetings of the Academy. He shall keep a duly classified list of the members, and shall attend to such other business in his department as the Academy or President may direct. He shall notify members of their election, and furnish them with diplomas.

SEC. 5. The Corresponding Secretary shall conduct the correspondence with societies and individuals, but shall submit all such correspondence to the President for his approval and signature. He shall preserve copies of the correspondence, which shall be kept in the Hall of the Academy, and shall be at all times open to the inspection of the members of the Academy. He shall distribute the publications of the Academy to the members and to the societies that are entitled to them.

SEC. 6. The Treasurer shall receive all the funds of the Academy, and shall deposit the same, in the name of the California Academy of Sciences, in such bank as may be designated by the Trustees, and shall not disburse any funds except under the direction of the Trustees. He shall collect all dues from members, and keep books showing a full account of receipts and disbursements. He shall furnish the Trustees and the Recording Secretary, whenever required, a list of members entitled to vote. He shall not enter upon the duties of his office until he shall have given such bonds as the Trustees may require. He shall be subject to removal by the Trustees for cause.

SEC. 7. The Librarian shall have charge of the Library, and shall enforce such rules for its management as may be drawn up by the Council. He shall not enter upon the duties of his office until he shall have given such bonds as the Trustees may require, and shall be subject to removal by them for cause.

SEC. 8. The Director of the Museum shall have the general care and oversight of the museum and scientific collections of the Academy, assisted by such curators as may be appointed by the Council. He shall be subject to such rules for the management of the museum and scientific collections as may be prescribed by the Trustees. He shall not enter upon the duties of his office until he shall have given such bonds as the Trustees may require, and shall be subject to removal by them for cause.

SEC. 9. All officers shall make yearly reports to the Academy, to be presented by the President at the annual meeting; and special reports whenever called upon by the Trustees or the Academy.

SEC. 10. In case of vacancy in the office of Trustees, the remaining Trustees shall fill such vacancy. In case of vacancy of any other officer, the Council shall fill such vacancy. The person selected to fill any vacancy shall hold the office until the third Monday in January thereafter.

ARTICLE V.

MEETINGS.

SECTION 1. The Annual Meeting of the Academy shall be held on the first Monday in January; but if that day is a legal holiday, then upon the succeeding Tuesday. Stated meetings shall be held on the first and third Mondays of each month. Field meetings and excursions may be held at such times and places as the Academy may direct. The date of the annual election and meeting shall be advertised for two weeks in a daily paper published in San Francisco. The Council shall meet at least once a month, and whenever the President shall call it together.

SEC. 2. Any annual or stated meeting may be adjourned from time to time for unfinished business only, but not beyond the time of the next stated meeting.

SEC. 3. A special meeting of the Academy may be called at any time by the President, notice of which shall be given by advertising in a daily paper published in San Francisco, and be posted in the hall of the Academy. No business shall be transacted at a special meeting except that specified in the call.

ARTICLE VI.

FEES AND DUES.

SECTION 1. Resident members shall pay five dollars as an initiation fee, and three dollars per quarter in advance. The payment of the quarterly dues of the officers shall be left optional with them.

SEC. 2. Life members shall pay the sum of one hundred dollars in full of all dues and initiation fee.

SEC. 3. Any member who shall be in arrears for dues more than six months, shall take no part in the business of the Academy; and the names of those who shall be one year in arrears shall be presented to the Council by the Treasurer. If the dues of any member who is delinquent for one year shall not be paid within three months after the presentation of his name to the Council, his name shall be stricken from the rolls. A person thus dismissed cannot be again proposed for membership until arrearages have been paid, nor until the expiration of one year from the date of dismissal. A person who shall have been so dismissed a second time shall never again be eligible for membership.

SEC. 4. Members who may remove more than one hundred and fifty miles from San Francisco for one year or more, may continue their membership by the payment of half dues.

SEC. 5. The Council shall be empowered to exempt (*sub silentio*) a member from dues, when, from peculiar circumstances, they may deem it for the interest of the Academy.

SEC. 6. Any member who shall have paid his dues continuously for twenty-five years, shall thereupon become a life member without the payment of further dues.

ARTICLE VII.

SCIENTIFIC COMMUNICATIONS, PUBLICATIONS, AND REPORTS.

SECTION 1. Communications on scientific subjects shall be read at stated meetings of the Academy; and papers by any member may be read by the author or by any other member. If any paper is accepted for publication, the author shall be entitled to fifty printed copies.

SEC. 2. By a vote of the members present, any member of the Academy may read a paper from a person who is not a member. He shall not be considered responsible for the facts or opinions expressed by the author, but shall be held responsible for the propriety of the paper. Persons who are not members may read papers upon invitation of the Academy.

SEC. 3. The Committee on Publication shall direct the publications of the Academy under the general supervision of the Council.

SEC. 4. Each member shall be entitled to receive, free of cost, one copy of all publications issued by the Academy during the time of his membership.

SEC. 5. Medals and prizes may be established, and the means of bestowing them accepted by the Academy upon the recommendation of the Council, by whom all necessary arrangements for their establishment and award shall be made. Bequests and trusts having for their object the advancement of science may be accepted by the Academy.

ARTICLE VIII.

AMENDMENTS AND BY-LAWS.

SECTION 1. This Constitution may be amended on the day of any annual election of the Academy. The proposed amendment shall be submitted in writing at a stated meeting, and, if accepted by a majority of the members then present, shall be referred to the Council, who shall have power to amend the proposition, and shall report the same, as amended by them, to the Academy. The report of the Council, or if no report be made by that body within one month after its reference to them, the original proposition, shall be considered by the Academy at a stated meeting, and may be amended at such meeting. If at this meeting the proposition be adopted by a majority of the members then present, it shall be conspicuously posted in the hall of the Academy from the time of such adoption until the day of the annual election, when it shall be voted upon by ballot, in the same manner as the officers of the Academy. No proposed amendment shall be voted upon on the day of the annual election, unless it has been finally adopted at a stated meeting, and posted in the hall of the Academy at least two months before such annual election.

SEC. 2. The Academy shall have the power to adopt By-Laws, not inconsistent with this Constitution, for the conduct of its meetings, the government of its officers, and management of its affairs. Such By-Laws may be adopted or amended, at any stated meeting, by a two-thirds vote, provided the proposition for such By-Laws or amendment shall have been presented at a previous stated meeting, and posted in a conspicuous place in the hall of the Academy for not less than two weeks; but no by-law or amendment can be voted upon during the month preceding the annual election.

SEC. 3. Nothing in this Constitution or the By-Laws thereunder shall affect the *status* of the present Officers and Trustees of the Academy for the term for which they have been elected, nor until their successors have been elected and qualified hereunder.

The following are the By-Laws, as reported from the Trustees for adoption:

ARTICLE I.

MEETINGS.

SECTION 1. The Stated and Annual Meetings of the Academy shall be held at the hall of the Academy, and the hours of meeting shall be as follows: From the 1st of September to the 1st of May, at half past seven in the evening; and during the remainder of the year, at eight o'clock.

SEC. 2. In the absence of any officer, a member shall be chosen to perform his duties temporarily, by a plurality of *viva voce* votes, upon nomination.

ARTICLE II.

RULES OF ORDER.

SECTION 1. The parliamentary rules, as adopted and practiced in deliberative bodies in the United States, shall be the rules of order in the transaction of business of this Academy, except so far as these are modified by the Constitution of this Academy.

ARTICLE III.

ORDER OF BUSINESS.

1. Reading of the Minutes of the previous meeting.
2. Election and reception of new members.
3. Propositions for membership.
4. Donations to the cabinet.
5. Donations to the library.
6. Written communications.
7. Verbal communications.
8. Reports of Standing Committees.
9. Reports of Special Committees.
10. Unfinished business.
11. Reports of officers.
12. New business.
13. Adjournment.

ARTICLE IV.

MEMOIRS.

SECTION 1. The Secretary shall receive memoirs at any time, and report the date of their reception at the next stated meeting; but no memoir shall be published unless it has been read before the Academy.

SEC. 2. Memoirs shall date in the records of the Academy from the date of their presentation to the Academy, and the order of their presentation shall be that in which they were registered, unless changed by consent of the author.

SEC. 3. Papers from persons not members, read before the Academy, and intended for publication, shall be referred to the Council at the meeting at which they are read. The Council shall report thereon to the Academy no later than the second stated meeting from date of reference.

SEC. 4. All discussion upon the claims and qualifications of nominees, before the Council, shall be held strictly confidential, and remarks and criticisms then made shall not be communicated to any person who was not a member of the Academy at the time of discussion.

ARTICLE V.

COMPLAINTS AND TRIAL.

SECTION 1. Any complaint against a member, or any charge for which his expulsion is demanded, shall be in writing, signed by the member making the charge, and presented to the Council.

If the Council shall deem the matter worthy of investigation, they shall furnish the accused with a copy of the charge, together with a notice that the same will be presented to the Academy for investigation.

The notice shall specify the time at which the charge will be presented to the Academy, and, together with the copy of the charge, shall be served upon the accused at least one week before the time therein specified for presentation.

At the stated meeting specified in the notice, the Council shall present the matter to the Academy, and thereupon the Academy shall fix a time for the trial, which time shall be either at a stated meeting or at an adjourned stated meeting.

The accused shall have the privilege of appearing at the trial with counsel, and of offering witnesses in his behalf; but shall not be present at the discussion or vote of the Academy upon the matter.

Hereupon, upon motion, and after considerable discussion, the Academy, with only one dissenting voice, adopted the amendments as reported from the Board of Trustees, as and for the Constitution and By-Laws of the Academy, in place of those heretofore existing.

On motion, it was ordered that the Constitution be printed at once, and copies of the same be placed in the hands of members for examination with reference to amendments.

Regular Meeting, August 17th, 1874.

President in the Chair.

Fifty-one members present.

Donations to the Museum: Prof. Herst donated specimen of burrowing Mollusca, genus *Zirphœa*, probably *Zirphœa crispata*, found at Victoria; also, from same, a small Fish from the north. An eel-shaped Fish, (*Ophisurus Californiensis*) described and figured in Proceedings of this Society, in September, 1863, by Andrew Garrett; the specimen then noticed was said to have been captured at Margarita Bay; this is from Magdalena Bay, commonly known among the whalemen as Margarita Bay. Specimen of a double-headed Snake, the tail being similar to the head; it is perfectly harmless; collected by Rev. S. V. Blakeslee in the Sierras; it is labeled as *Wenona plumbea* (?) but there is some doubt as to the species. A small Collection of Plants from the Island of Strick, collected by J. C. Werner and presented by W. G. W. Harford; also a piece of Camphor Wood from the wreck of a Japanese junk on the Island of Strick. Kelp used as food by Japanese fishermen of the Island of Strick. Mr. F. P. McLean presented a spherical mass of hard Sandstone found near Saucelito. Dr. Behr presented a Chicken with four legs and four wings. James Behrens presented two specimens of *Estheria Californica*, Packard, a very curious entomostraceous crustacean from Alameda County, Cal. Dr. Blake presented a day-flying Moth. Charles G. Yale presented a branch of *Torreya Californica*, or "California Nutmeg," collected in Santa Cruz mountains from the top of a tree over 100 feet high. Like the so-called "wild coffee," this "California Nutmeg" has no affinity, either in structure or scientific position or qualities, with the plants which the popular name implies. J. W. A. Wright presented a specimen of a Fern, (*Woodwardia radicans*) peculiar on account of its great size. A specimen of the so-called "Wild Coffee Plant" was presented. Mr. Bloomer pronounced it *Frangula Californica*, belonging to the order *Rhamnaceæ*, mostly trees and shrubs, with simple *alternate* leaves. *Coffea arabica* belongs to the order *Cinchonaceæ*, a well marked and large family, containing a very considerable number of important species.

R. E. C. Stearns presented specimens of "Chinese Water Nuts" of the genus *Trapa*. Mr. Stearns said that the Chinese water nuts presented were not uncommon in this city, as he had seen perhaps as many as a bushel in a single lot. They are the fruit or nut of an aquatic plant which grows in lakes and streams, and the species before us is cultivated by the Chinese, and has an extensive sale in that country, being highly esteemed. There are several species of this water nut, and the plant is known to botanists as *Trapa* and are *dicotyledonous* plants, belonging to the natural order *Onagraceæ*. The specimens shown are the fruit of the *Trapa bicornis*, (or two-horned) the propriety of the name being seen at a glance. The nut is sometimes called the water chestnut. The Chinese call them *Ling* or *Links*. Another species, *Trapa natans*, grows in middle and southern Europe, middle Asia, and northern and central Africa, and the fruit or nut has four spines. *Trapa bispinosa* is found in Asia and parts of Africa, and it is said also to be cultivated in Japan. In some of these countries this latter species is an important staple in the way of food to the population. The nuts are held in high estimation by the Hindoos, and are sold in all the shops in India. Quite likely some one of these species might thrive well in this country, and it would be well for some enterprising Californian to experiment with the Chinese species, the seeds of which are easily obtainable in this city.

Donations to the Library: In addition to the usual periodicals and exchanges the Library received: Annual Reports of the Chief Signal Officer to the Secretary of War, for years 1872 and 1873. Weekly Weather Chronicle. Daily Bulletin, synopses, probabilities, and facts of the month of June, 1874. Daily Bulletin of weather reports, Signal Service U. S. A., taken at Washington, with the synopses, probabilities, and facts for September, 1872; all four of these were presented by H. W. Howgate, U. S. A. Dr. M. Linderman Brenan presented the second part of the Report of the last German Polar Expedition. Albert J. Mayer, Chief Signal Officer, U. S. A., presented circular upon the "Practical Use of Meteorological Reports and Weather Maps." Ross' Voyage of Discovery to Baffin's Bay. This book is interesting, as having been found with others, on the 12th of April, 1873, on Ocean Island, North Pacific, remaining from the wreck of the U. S. S. Saginaw, by J. C. Werner, presented by W. G. W. Harford.

On the Structure of the Sonorous Sand from Kauai.

BY JAMES BLAKE.

In order to ascertain, if possible, the cause of the sound that is produced by the sand from Kauai, presented to the Academy at a former meeting, I investigated its structure under the microscope, and I think the facts I have ascertained fully explain the manner in which the sound is produced. As the grains of sand, although small, are quite opaque, it was necessary to prepare them so that they should be sufficiently transparent to render their structure visible. This was effected by fastening them to a glass slide and grinding them down until one flat surface was obtained. This surface was then attached to another slide, and the original slide being removed, the sand was again ground down until sufficiently transparent. The grains were found to be chiefly composed of small portions of coral and apparently calcareous sponges, and presented under the microscope a most interesting object. They were all more or less perforated with small holes, in some instances forming tubes, but mostly terminating in blind cavities, which were frequently enlarged in the interior of the grains, communicating with the surface by a small opening. A few foraminiferæ were also met with, and two or three specimens of what appeared to be a minute bivalve shell. Besides these elements, evidently derived from living beings, the sand contained small black particles, which the microscope showed to be formed principally of crystals of augite, nepheline, and magnetic oxide of iron, imbedded in a glassy matrix. These were undoubtedly volcanic sands.

I have shown some of the principal forms, as seen under the microscope, but such is the beauty and delicacy of their structure that it would be impossible to give anything more than a general idea of it, except with far more elaborate drawing than I am artist enough to make. The structure of these grains fully, I think, explains the reason why sound is emitted when they are set in motion. The friction against each other causes vibrations in their substance, and, consequently, in the sides of the cavities they contain, and these vibrations being communicated to the air in the cavities, under the most favorable conditions for producing sound, the result is the loud noise which is caused when any large mass of sand is set in motion. We have, in fact, millions upon millions of resonant cavities, each giving out sound which may well swell up to resemble a peal of thunder, with which it has been compared; and the comparison—I know from others who have heard it—is not exaggerated. The effect of rain in preventing the sound is owing to the cavities in the sand becoming filled with water, and thus rendered incapable of originating vibrations. The chemical compositions of the sand, with the exception of the volcanic grains, is calcareous, being completely dissolved by chlorhydric acid, although I think it probable that some of the speculæ in the sponges are silicious.

Canals depending on Tide Water for a Supply, or the Supply of Tidal Water to Canals.

BY THOMAS GUERIN, CIVIL ENGINEER.

My attention was first drawn to this question by a survey I have made of a proposed canal which was intended to connect the waters of the Bay of Fundy with those of the Gulf of St. Lawrence. On studying the map of North America, you will perceive that the province of Nova Scotia is connected with the main land by a narrow isthmus called the Isthmus of Chignecto, some eighteen miles across.

Vessels bound from Canada to the United States have to sail round Nova Scotia, thus increasing the sailing distance about 800 miles, which would be obviated if a canal were constructed across the isthmus.

I found during the progress of the survey that there was little or no water on the isthmus which could be made available for feeding the canal, so that the tides of the Bay of Fundy had to be relied upon for the necessary supply.

In questions of this kind it is necessary that the high and low water surfaces of the canal, as well as the level of its bottom, must be at such elevations and its dimensions must be of such magnitude as to enable the tide to fill it to the required level within a reasonable time. It will be necessary to empty the canal occasionally for the purposes of cleaning and repairing; and there must be means at hand to fill it soon again, and maintain its surface at the required level for the purposes for which it is intended.

To know the time the tide will take to fill a canal, then, is one of the great questions which enter into the discussion of this subject.

The time required to fill a canal or reservoir by tide water to a given height, or the quantity poured into it by the tide in a given time, must depend on the elevation of its bottom, and on the velocity with which the tide flows into it. The science of hydraulics in its present state, so far as I know it, does not afford the required assistance in this emergency—new principles must therefore be investigated. I propose to do this, and I submit the investigation for your discussion.

No comparison can be made between the velocity of the tide at sea and its velocity flowing up the bed of a river or through a canal, for the following reasons: The velocity of the tidal wave in the Atlantic Ocean is stated to be about 700 miles an hour, and yet the depth of the moving tide is insignificant; the tidal wave being only two and a half to three feet high.

The general direction of the tidal wave at sea is from east to west; and yet on land it is seen in various places to move up the beds of rivers from west to east. The Gulf of St. Lawrence and Bay of Fundy are on the east and west side of the Isthmus of Chignecto, through which the proposed canal had to pass; they are only some eighteen miles apart at this locality, and yet the tide runs to the east up the beds of streams emptying into the Bay of Fundy, while it runs to the west from the Gulf of St. Lawrence up the beds of streams emptying into the latter.

It is true that high water is earlier at the east side of this isthmus by about two hours and thirty minutes than at the west wide; but it takes about six hours to rise, and hence, during the remaining three hours and thirty minutes the tide is running in opposite directions.

From these facts it would be erroneous to suppose that the velocity of the tide at sea is a function of the velocity with which it moves up the bed of a river. The inland velocity of the tide must therefore depend upon the head or height to which the waters are piled on the adjacent lands which obstruct it in its course from the sea, and hence the vertical and horizontal velocities of the tide must be coördinates of one another.

Let $r =$ the height to which the tide rises in the time, t^{sec}.

Let $v =$ mean horizontal velocity during the same time.

Then we get

$vt =$ horizontal distance advanced.

$\frac{r}{vt} =$ the tangent of the inclination of the thread of the current thus generated.

This inclination varies as the square of the velocity, the section and wetted perimeter being constant, unless the velocity is exceedingly small.

Now, in the present case, it is the velocity of the advancing fillet we are in search of—its wetted perimeter and section do not vary while moving in the same bed; hence, $\frac{r}{vt}$ varies as v^2; and if t is constant, or equal to one hour, r varies as v^3 or v varies as $r^{\frac{1}{3}}$; and hence $v = nr^{\frac{1}{3}}$ where n is a coefficient, which I have determined in the following manner:

There is the bed of a small stream or river in the vicinity of the proposed canal. At a distance of about one and a half miles from the shore I caused a length of 4,148 feet to be measured along the bank of this river, and further on, another distance of 13,040 feet in the same direction. I caused the flowing tide to be watched, and the time to be noted during which the advancing fillet was traversing those latter two distances: the time occupied in moving over 4,148 feet was twenty-five minutes, and over the other distance one hour and twenty minutes, thus giving a velocity in the former case of $2\frac{76}{100}$ feet per second, and in the latter of $2\frac{717}{1000}$ feet. I caused the height to which the tide had risen during those times to be noted by means of gauges: in the first case it amounted to $3\frac{87}{100}$ feet; in the second case it amounted to $11\frac{30}{100}$ feet; thus, r in the one case is nearly $9\frac{30}{100}$, and in the other about $8\frac{50}{100}$. The cube roots of these numbers are nearly in the ratio of $2\frac{76}{100}$ to $2\frac{717}{1000}$, a fact which goes to corroborate the theory just established; hence.

$$\frac{2.717}{(8.50)^{\frac{1}{3}}} = n = 1.3313.$$

This is an important coefficient, and worthy the attention of engineers who may be engaged in similar duties. It is to be hoped that some gentleman will try its correctness in some other locality, so as to verify it, or amend it if necessary.

It may, perhaps, be objected that the value of n, thus obtained, from the movement of the tide up the bed of a river or inclined plane, will be inapplicable in determining the velocity while moving along the bed of a horizontal canal.

Let A B represent the bed of the canal, A C that of the river; suppose A D the velocity of the tide while moving along A B, D T being drawn perpendicular. It is plain that A T will represent its velocity in ascending A C, that is to say: if radius represent the velocity in the horizontal direction, the cosine of the inclination will represent the velocity up an incline.

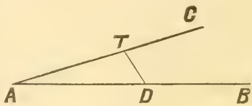


FIG. 1.

The tangent of the inclination of the bed of the river on which I have experimented was found to be .00076; this angle is so small that the cosine may be considered equal to radius; hence, there can be no difference between the velocity of the tide moving up the bed of this river, and that of the same tide moving in a horizontal canal. Indeed, I may assert generally that the inclinations of rivers flowing into the sea are so small that the velocity of the tide flowing up their beds is the same as it would be on a horizontal plane.

Having now ascertained the means by which to obtain the horizontal velocity of the tide, from having its rate of rise, let us next turn to the subject of filling a canal or reservoir from tide water.

Let G A M T be the summit reach of a canal, and A G the lock-gate at the entrance, through which the tide water is admitted; J P being the level of the ebb or low tide, and T G that of flood or high tide.

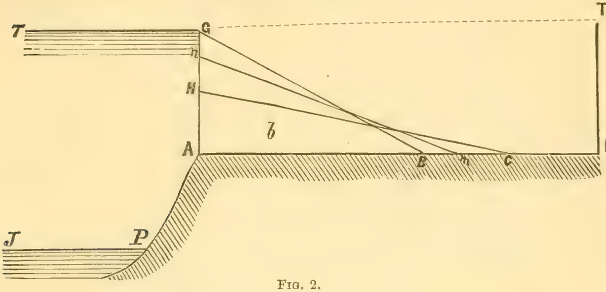


Fig. 2.

Let us suppose that while the tide was rising the distance A G, it had advanced in the canal the distance A B: then the surface of the water in the canal at the end of the first tide will be indicated by the line G B.

While the tide is at the level T G, the gate A G is closed, and the water in the canal will commence to descend from G and advance beyond B. Let us suppose that during a given time it has fallen the distance G H, and advanced the distance B C: then the line G B will conform to H C.

Let $x =$ G H, and $y =$ B C.

$t^{\text{sec.}} =$ time of falling x, or $=$ time of advancing distance y.

$v =$ horizontal velocity of tide at the point B; this can be ascertained by the coefficient already found.

Let $a =$ A G $=$ the distance the tide has risen, from the moment it commences to enter the canal until it reaches flood or high tide.

$b =$ A B $=$ horizontal distance advanced in the same time.

Let G n $= dx$, and B m $= dy$.

Let $r =$ mean velocity with which x is described, and $z =$ mean velocity in describing y.

Now, because the velocity of a current is as the square root of its inclination,

$$\sqrt{\frac{a}{b}} : \sqrt{\frac{a-dx}{b+dy}} :: v : v\sqrt{\frac{a-dx}{b+dy}} \times \frac{b}{a} = \text{velocity at m.}$$

This may be considered the velocity with which dy is described, and multiplying by dt we get $dt\, v \sqrt{\frac{a-dx}{b+dy}\times\frac{b}{a}} = dy = zdt.$

$$\therefore\ v\sqrt{\frac{a-dx}{b+dy}\times\frac{b}{a}} = z, \text{ and } tv\sqrt{\frac{a-dx}{b+dy}\times\frac{b}{a}} = tz = y.$$

$abt^2 v^2 - bt^2 v^2 \ rdx = aby^2 + ay^2 \ dy$. Substitute for dx, and there results

$$abt^2 v^2 - bt^2 v^2 \ rdt = aby^2 + ay^2 \ dy.$$ Integrate, and we get

$$abt^2 v^2 - b v^2 r \frac{t^3}{3} = aby^2 + \frac{ay^3}{3} = abt^2 z^2 + at^2 z^2 \frac{y}{3}$$

$$abv^2 - bv^2 \frac{x}{3} = abz^2 + az^2 \frac{y}{3}$$

$$z = v \sqrt{\frac{b}{a}\left(\frac{a - \frac{1}{3} x}{b + 3 y}\right)}$$

Hence, $tv \sqrt{\frac{b}{a}\left(\frac{a - \frac{1}{3} x}{b + \frac{1}{3} y}\right)} = y$.............................N° 1°.

Again: let MJEG represent a cross section of the canal.

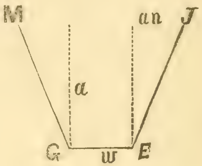


Fig. 3.

w = width at bottom.

a = depth as before.

n = ratio of slopes of banks.

Then the quantity of water received by the summit reach from one tide, whose longitudinal section is AGB and cross section MJEG, will be

$$\left(\frac{w}{2} + \frac{an}{3}\right) \times ab$$

When G has descended to H; then a becomes $a - x$, and b becomes $b + y$, and hence

$$\left(\frac{w}{2} + \frac{an}{3}\right) \times ab = \left(\frac{w}{2} + \frac{(a-x)\ n}{3}\right) \times \left(a - x\right) \times \left(b + y\right) \text{...N° 2°.}$$

From these two equations, when any one of the quantities x, y, t, is given, the other two can be found.

Considering the movement of the tide within the summit reach of the canal, it is manifest that when the reach is long as in the instance I have referred to, the quantity of water poured into it by one tide cannot have come to a level before the next succeeding tide commences to enter the canal. Let us suppose that H (fig. 2) is the point at which this succeeding tide begins to enter: then the time occupied by the tide in flowing into the canal is limited to the time the tide takes to rise from H to G.

Let g = entire rise of tide, = JT, or difference of level between high and low tide.

c = mean vertical velocity of tide.

Then $\frac{2\ g - x}{c}$ = the time that has elapsed from previous high tide until water commences again to enter the canal = t^{sec}.

Equation N° 1° now becomes

$$\frac{2\ g - x}{c} \times v \sqrt{\frac{b}{a}\left(\frac{a - \frac{1}{3} x}{b + \frac{1}{3} y}\right)} = y \text{.....................N° } 1^{\circ}_{a}$$

From Equations N° 1_a and N° 2° we can obtain x and y, and we are thus enabled to ascertain the elevation at which every tide commences to enter the summit reach of the canal; also, the distance each tide has advanced; also, the distance fallen from G towards A before the next succeeding tide commences to enter, etc., etc.

It must be borne in mind that w represents the width of opening of the canal, at the level always at the point H. It is only on the entrance of the first tide that w will represent the width of the bottom of the canal. Similarly, a will represent the distance A G only at the first tide; it will represent H G afterwards.

A canal through the Isthmus of Chignecto, connecting the waters of the Bay of Fundy with those of the Gulf of St. Lawrence, is considered in Canada of great importance to the trade between that country and the Atlantic States of the Union. So the Canadian Government have employed different engineers to report on the best plan.

One plan was adopted at an estimated cost of upwards of six millions, and an order was issued by the Government to call for tenders for the construction of the work; but it was shown by the formula which I have here investigated that it would occupy over four months to fill the canal to the required level if built according to this plan.

Another plan which would cost over seven millions was about to be adopted. The latter plan recommended the construction of reservoirs, so as to store the tide water, and thus assist in filling the canal, and maintaining its water surface at the required level for navigation; but those formulæ have shown that according to this plan, the canal, if filled to the required level, would become unnavigable before one month, owing to the inability of the reservoirs to maintain a sufficient supply.

Professor George Davidson read an exhaustive paper "On the coming transit of Venus," illustrating his remarks with diagrams, etc.

Mr. Stearns made the following remarks on the death of Dr. Ferdinand Stoliczka:

Mr. President: I regret that I have to announce to the Academy the death of a corresponding member of high scientific reputation and distinguished ability, Dr. Ferdinand Stoliczka, of Calcutta, palæontologist, connected for many years and up to the time of his death with the Geological Survey of India; also Secretary of the Asiatic Society of Bengal, and corresponding member of many scientific societies in Europe and America, and of the California Academy of Sciences since December 18th, 1865.

Dr. Stoliczka was born in Moravia in May, 1838, and died on the nineteenth day of June, at Shayrock, between the Karakorum Pass and Lah in Ladak, while on his return from an exploration amid the mountainous regions of the interior of Central Asia.

He commenced his scientific labors when quite a young man, having joined, soon after finishing his University course, the Imperial Geological Institute of Austria, where he soon displayed great ability as a palæontologist, and by his investigations among the recent and fossil Bryozoa. He joined the British Indian Geological Survey corps in 1862, and worked hard and well in this service, both in the field and the closet, as the publications of the Survey and his many papers in the proceedings of various scientific societies attest.

Dr. Stoliczka's researches were not restricted to the testimony of the rocks, as shown in the numerous fossils described by him; for besides his geological memoirs, his numerous papers on the Natural History of India, including all divisions of animal life, from the higher mammals to the Actinozoa, display his varied knowledge and breadth of study.

His prepossessing appearance, amiable and excellent character, and high culture, gave him a *personnel* altogether attractive, and he was much beloved and esteemed by all who enjoyed the honor of his acquaintance. He died while in the prime of life, in the midst of his scientific labors, not full of years, but nevertheless full of honors.

Regular Meeting, September 7th, 1874.

Vice President in the Chair.

Thirty-five members present.

On ballot, the following gentlemen were duly elected: B. F. Sherwood, life member; Charles Wolcott Brooks, James A. Waymire, Frank P. McLean, Abel T. Winn, Fred. T. Newberry, Chas. Sonntag, Charles M. Blake, Dr. R. B. Swan, resident members.

Donations to the Museum: A collection of Shells from Tahiti, embracing 338 specimens, presented by Captain M. Turner; specimens of the Porcupine Fish, from the Society Islands, also presented by Captain Turner; curious deposits from a mineral spring in Lower California, received from David Turner, United States Consul at La Paz; a deep-sea Crab, of enormous size, from the office of the United States Coast Survey; jar of alcoholic specimens of Fish, from Captain Lawson, of the Coast Survey; species of Eel, from Captain Scammon; two aquatic Birds, mounted, from E. F. Lorquin; specimens of Crustacea, from Mr. Burling; curious Larva Cases, collected in a creek at Saucelito, from John H. Turney.

Donations to the Library: Transactions of the New Zealand Institute, Vol. 6, 1873; Quarterly Journal of the Geological Society, No. 119, August, 1874; Overland Monthly, August, 1874; Popular Science Monthly, August, 1874: Seventh Annual Report of Trustees of Peabody Museum: California Horticulturist, 1874; La Naturaleza Periodico Cientifico, No. 42; Journal of Botany, August, 1874; Astronomical Register, August, 1874.

Pacific Coast Lepidoptera, No. 7.—Descriptions of some New Species of Heterocera.

BY HENRY EDWARDS.

Fam. EPIALIDÆ. H. S.

Epialus Tacomæ. Hy. Edw. n. sp.

Head, thorax, abdomen, and wings wholly reddish-brown, darkest upon the thorax and along the costa.

Primaries, with a double oblique row of white spots, narrowly edged with black, forming two interrupted bands. The basal one is the shortest, and is composed of oblong spots divided by the nervures. The outer reaches from the median nerve to the interior angle, where it is broadest. There is a faint white dot between these rows of spots, and traces of some dull yellow blotches toward the apex.

Secondaries, slightly transparent, with the fringes and costal margin brighter than the disc of the wing.

Underside, with the rows of white spots only faintly visible. The costal margin of the primaries is marked with dull yellow blotches, and the whole of the fringes bright reddish-brown.

Exp. of wing, 1.60 inch.

Length of body, 0.65 inch.

Taken at Tacoma, Washington Territory, by Mr. Jas. Behrens. Coll. Hy. Edw.

Nearly allied to *Ep. Mathewi*, Hy. Edw., but the markings more closely resemble those of the European *H. sylvinus.*

Fam. ARCHIDÆ. B.

Halesidota Davisii. Hy. Edw. n. sp.

Head, collar, and patagia cream yellow, the latter fringed internally with grayish-blue, forming a double line upon the thorax. Thorax and abdomen dark buff, the latter deepest posteriorly, white at the sides, with five oblong black spots. Anal segment brown.

Primaries, semi-transparent, cream-color, with a series of five orange blotches along the costa, oblong in shape, edged narrowly with black, and divided by the subcostal nervure. The two nearest the base are connected interiorly by some lines of black, arranged triangularly, the side of the triangle joining the two orange spots, and the apex directed towards the base of the wing. The third spot is small, almost square, and divided by a black line. The fourth is the largest, oblong, joining a bent orange line, which rests on a small triangular mark, behind which is a straight and rather narrow orange patch. The fifth spot is the smallest, almost triangular in form, with a small ovate patch beneath it. The whole of these orange spots are narrowly edged with black. On the disc is a small ring, formed by a black line, and two others, nearly the same shape, on the interior margin. Posterior margin edged with pale buff, most broadly towards the apex. This mark is enclosed in a narrow black line.

Secondaries, very pale buff, hyaline, slightly opalescent. Hairs of the anal angle, deep buff. Fringes of both wings, cream-color.

Antennæ, chestnut. Palpi, deep buff, with the terminal article black. Feet and legs buff, banded with black. Under side of the abdomen, pale cream-color. The markings of the upper side of the wings are seen very clearly beneath.

Exp. of wings, 2.20 inch.

Length of body, 0.85 inch.

Prescott, Arizona. Dr. Davis, U. S. A., to whom I have great pleasure in dedicating this delicate species.

Fam. NOTODONTIDÆ. B.

Heterocampa (?) *conspecta.* Hy. Edw. n. sp.

Head very small, iron-gray. Thorax cinereous, with a waved brown streak in front. Patagia also edged internally with brown. Abdomen long, extending a considerable distance beyond the wings, stone-drab, with a brown shade at the base, and with short, distinct tufts of darker hairs from the sides of the third, fourth, and fifth segments.

Primaries, cinereous at their base, with a slight purplish-red tint, and a brown basal streak, edged interiorly with black. On the disc is a black, semi-lunate streak; behind this, a patch of silver-gray, extending along the costa to the apex, and there enclosing a double black dash. The posterior margin is broadly buff towards the apex, with some black and brown dashes irregularly placed. The buff patch, (which is somewhat similar in form to that of the European *Pygæra bucephala*) shades into brown on the interior angle, and is enclosed by a black line, notched exteriorly, straight for the greatest portion of its length, but bent inwardly on the costa, and not quite reaching the interior margin, which has a narrow streak of pale fawn-color running its whole length. Fringes, fawn-color, intersected with brown. Secondaries, pale drab, with a brownish shade near the costa and the anal angle, and a faint brown medium band. Fringe, whitish.

Antennæ, chestnut-brown, not pectinate to the tip. Palpi, very short, blackish-gray. Tibiæ densely clothed with hairs. Tarsi, rather long and slender.

Under side. Primaries dirty white, with blackish median cloud, widest on the costa, and extending to the base; some dashes of same color on the margins. Secondaries, whitish, glossy; costa and anal angle with blackish patches.

Exp. of wings, 1.35 inch.

Length of body, 0.80 inch.

Napa County, Cal. June. Taken at light.

I have placed this beautiful insect provisionally in *Heterocampa*, at the suggestion of my friend, Mr. Stretch; though it may prove to be the type of a new genus.

NOTE.—I wish to correct an error into which I have been unintentionally led in No. 4 of these papers (Proc. Cal. Acad. Sci., Feb., 1874). I have therein described, as a new species, *Spilosoma pteridis*. Closer investigation by Mr. Stretch and myself convinces us that we have to deal with the second species of *Antarctia*, noticed by Boisduval; but as Mr. Stretch had previously arrived at the conclusion that *A. vagans*, Bdv., *A. rufula*, Bdv., and *A. punctata*, Pack., were all one species, and referred only to varieties of our common Californian form, I was led to believe that my species from Vancouver Island was undescribed. It is now, however, established beyond a doubt, both from a careful examination of the caterpillar and the perfect insect, that we have two distinct species of *Antarctia* already known from our Coast, which have been described by Dr. Boisduval as *Ant. vagans*, and *Ant. rufula*, and that my *Spilos. pteridis* belongs to the former species. The synonomy will therefore stand thus:

1. *Antarctia vagans*, Bois., Northern California.
   Spilosoma pteridis, Hy. Edw., Vancouver Island.
2. *Antarctia rufula*, Bois.
   Antarctia punctata, Packard, San Francisco district.

I trust that the description of the caterpillar and chrysalis, which I have appended to my notice of *Spilosoma pteridis*, will be sufficient apology for my having unwittingly encumbered the synonomy of the genus.

Pacific Coast Lepidoptera, No. 8.—On the Transformations of some species of Heterocera, not previously described.

BY HENRY EDWARDS.

Fam. ZYGŒNIDÆ.

Phryganidea Californica. Packard.

Egg. Spherical, a little flattened above, shining, yellowish white at exclusion—attached in clusters of about ten or twelve to the upper side of the leaves. The third day the apex of the egg assumes a dull orange hue, afterwards changing to a bright reddish purple, and gradually to a duller shade as the young larva emerge. The eggs were laid by a ♀ in my possession, on July 5th. All (about twenty-five specimens) emerged almost simultaneously.

Young larva. Head very large, almost monstrous, pale olive brown, with narrow black line at the base. Body pale canary yellow, with four rows of black spots arranged longitudinally in lines.

The mature form of the larva is noticed in Stretch's "Zygœnidæ and Bombycidæ of North America," but I subjoin the description of one of the many varieties to which it is subject, believing that all information with reference to this species (the position of which in classification has not yet been settled by entomologists) will prove to be of value:

Yellowish-white, shining, head large, round, stone color, with black point on each side of the mouth, a median stripe of reddish brown, and a narrow one of same color on each side. A broad black stripe extends laterally across the second segment at base of the head, and another across the thirteenth segment, which also contains a broken black dorsal line. In the middle of the black lateral stripes is a waved whitish line, enclosing a narrow black one. At the base of the abdominal legs is a waved interrupted yellow line, edged narrowly with black.

Under side yellowish-white, faintly marked with broken brown waved lines; feet pinkish, striped with black; abdominal legs, yellowish-white.

Fam. BOMBYCIDÆ.

Clisiocampa constricta. Stretch. n. sp.

Head, slate-gray, with black spots; mouth parts, black, tipped with dull yellow. Body, slate-gray, covered laterally with black irrorations. Along the middle of the dorsal region is an irregular black stripe, marked on its sides with waved orange lines, and surmounted at the union of the segments by a double tuft of chestnut-brown hairs. On the second and third segment, in the middle of the notched black line, is a stripe of dull white. From the base of the orange brown-tufts spring a few scattered black hairs, longest anteriorly, and from the forepart of each segment arise lateral tufts of white hairs. The stigmata are orange, with black central points. Above the base of the feet is a black interrupted line, out of which spring other white hairs, irregularly disposed. Under side, dull, velvety black, with the anterior portion of each segment whitish. Feet and prolegs black, yellow at their tips. Length, 1.85 inch. Food plant, *Quercus Sonomensis.* Benth.

The larva is frequently attacked by a species of *Ichneumon*, the eggs of which are visible on the head and anterior segments.

Chrysalis. Chestnut-brown, with few hairs along the base of each segment.

Cocoon. Ovo-lanceolate, very silky, yellowish-white, with some portions glued in compact mass, and whiter than the remainder. Chrysalis only imperfectly seen through the web.

Larva, May 22d; changed to chrysalis, May 29th. Imago, June 16th.

Leucarctia acrea. Drury.

Young larva, previous to last moult. Black, with yellow patches, irregular in form, along the sides and at the base of the segments, each of which is provided with seven flesh-colored tubercles, from which spring whitish or stone-colored hairs, sparsely intermingled with black. The hairs of the dorsal region are nearly white. Head, black, shining, with broad yellow stripe in center. Feet, black; abdominal legs, flesh-color, banded with black.

Halesidota sobrina. Stretch.

Larva. Head, rough, deep dull black. Body, velvety black, slightly shining. In the center of each segment, from five to twelve, inclusive, is a raised triangular tuft of rich, velvety black hairs. At the base of these is a double row of tubercles, from which spring radiating spines arranged in circular form, those nearest to the center being bright lemon-yellow, while outwardly they are fawn-drab. Laterally, there is another series of double tubercles, with spines still arranged in circular form, and entirely fawn-color. From the fourth and tenth segments spring two bunches of long black hairs, directed outwardly and anteriorly, like those of the genus *Orgyia.* The yellow spines of the interior dorsal tubercles give the appearance of a rich yellow dorsal line.

Under side, dull black; feet, black; abdominal legs, yellowish, banded with black. Length, 1.70 inch.

Food plant, *Pinus insignis*, Douglas, (Monterey pine).

Larva taken at Monterey May 31st; changed to chrysalis, June 4th—9th. Imago appeared June 16th—20th.

Chrysalis. Bright chestnut-brown, palest towards the head, enclosed in thin web composed of hairs of the larva, through which the chrysalis is indistinctly seen. The transformation is effected under bark of decaying pine trees, and beneath logs.

Halesidota argentata. Pack.

Larva. Precisely similar in size and form to that of *H. Sobrina*, but differing considerably in color. Body, bluish-black, slightly shining. Each segment, from five to twelve inclusive, is provided with tuft of velvety black hairs, as in the last species, while the fourth and tenth are armed with long bunches of black hairs, those of the tenth being decidedly shorter than in *H. Sobrina.* The stellar pencils of the sides are very dark chestnut-brown, instead of stone color, while the yellow spines, which give so bright an appearance to that species, are here only very faintly seen. Under side, dull brown; feet and prolegs with fleshy tinge. Length, 1.70 inch.

Big trees, Calaveras County, June 19th.

Taken on bark of *Pinus ponderosa*, Dougl., (Yellow pine) and *Pinus Lambertiana*, Dougl., (Sugar pine). Crawling restlessly about, and eating little or no food after capture. In five or six days the seven specimens taken spun a thin web similar to *H. Sobrina*, but very much darker in color. The chrysalis itself is, however, paler than its ally, being in all cases the very lightest shade of chestnut. Three of my specimens were attacked by *Ichneumon.* The remainder gave 1 ♂, 3 ♀. It is a source of extreme pleasure to me to be able to prove the distinctness, as species, of *H. Sobrina* and *H. Argentata*, as the fact was one which occasioned considerable doubt to my friend, Mr. Stretch, and myself. My larvæ from Monterey gave undoubted *H. Sobrina*, agreeing in nearly every respect with Mr. Stretch's figure and description. The only point of difference is the color of the abdomen, which is represented by Mr. Stretch as brown. Now, the only specimen known to Mr. S., which was taken by the late M. Lorquin, was very old, and the abdomen may have become greasy or stained from the ravages of time. The antennæ were, I think, also destroyed. In all other characters my specimens agree exactly with the plate and text in the "Bombycidæ of North America." As to *H. Argentata*, there can be little or no doubt. The species has long been known, and the caterpillar was found by me in the Yosemite Valley some years ago. I have also seen it on different occasions at Lake Tahoe, the Dalles, Oregon, and in Vancouver Island, though I have never succeeded in rearing it until the present instance. *H. Sobrina* would appear to be a much more rare and local species than its nearest ally.

Pyrrharctia Isabella. Packard.

Larva. Head black, with the mandibles and mouth parts generally yellowish-white. Body, entirely slaty-black. Spines, very long, arranged in spreading bunches from tubercles. Those of the four anterior segments black, the fifth, sixth, seventh, and eighth bright chestnut-brown, with a few scattered black hairs, while the remainder are black, similar to those anteriorly. Feet, dirty white. Length, 1.25 inch.

Chrysalis. Enclosed in cocoon spun from hairs of caterpillar, those of the anterior segments being so mixed with the others as to give an uniform color of dark-brown.

Changed to chrysalis, July 15th. Imago, August 11th.

Mr. Stretch has raised what appears to be this species from a larva of an "uniform grayish-brown." Does this fact not serve to indicate that *P. Isabella*, Pack., and *P. Californica*, Pack., may be distinct species after all?

Platysamia ceanothi. Behr.

Larva. Pale apple-green, of a very vivid tint throughout, with a slight whitish bloom over the whole surface. Head, with some purplish-black streaks in front and at the sides. Mouth parts, pale-green, pitchy internally. Second segment with four minute black dots, edged with white anteriorly, and two very small white mammiform tubercles on the sides. Third, fourth, and fifth segments, with long raised protuberances, pale yellow, with a black, swollen band in the middle, and each surmounted by six blackish spines. The third segment has also four lateral raised white spots. The fourth and fifth segments have two mammiform white spots, the lateral ones on these segments becoming merely black points. On the sixth segment is a faint white raised spot, in the same position as the white swollen tubercles on the preceding segments. Seventh and eighth, with only black points laterally. Ninth, tenth, and eleventh, without any trace of spots. Twelfth segment bears in the middle a long, raised protuberance, yellow, banded with black, exactly similar to those of three, four, and five. On this segment there are also two lateral points, white, tipped with black. Anal segment with four black dots arranged in a square, and two white and black points as in twelve. Stigmata white, edged anteriorly with black. Below the stigmata, and parallel with them, is a row of very minute black dots, edged with greenish-white. Feet, yellowish-green, with the tips purplish-black. Abdominal legs, greenish-yellow, with the edges purplish-black. Viewed from behind, the anal segment is yellowish-green.

Length, 3.30 inch.

Width, anter. 0.60 inch; post. 0.40 inch.

Food plants, *Ceonothis thyrsiflorus*, Esch.; *Frangula Californica*, Gray; *Rhamnus croceus*, Nutt; *Alnus viridis*, D. C.

When about to undergo its change, the caterpillar attaches itself usually to the under side of a twig, and spins a rather coarse and very compact outer case, with which no leaves or other extraneous substances are incorporated, and within this a reddish-brown cocoon, the filaments of which are strong, rather coarse, but glossy. The cocoon and its outer case are oval, produced into a cone at the end, by which the insect escapes.

Chrysalis. Pitchy, almost black, very short, rounded in front, and much swollen about the abdominal region. Segments rough, and transversely wrinkled.

Length, 1.15 inch.

The caterpillar changes to a chrysalis in September, and the imago appears in the following May or June. This beautiful insect was once remarkably common around the Bay of San Francisco, but the march of improvement has destroyed most of its haunts, and it must now be regarded as one of our really rare species.

Gastropacha. sp.

In August, 1873, I found, in Vancouver Island, a cocoon which I did not recognize, and was surprised at finding that it produced, in April last, a beautiful insect of this genus. Mr. Stretch believes the species to be identical with the European *G. betulifolia*; but as I am not familiar with the transformations of that species, I append the following:

Chrysalis. Black, covered with a dense woolly substance, powdered with a fine dust, and enclosed in a very soft, woolly cocoon, formed, apparently, of very fine silk, with which a few yellowish-brown hairs are intermingled. The cocoon is placed in the angle of a frond of *Pteris*, the frondlets being drawn together at the edges as a covering.

Larva. Some days after the finding of the above-mentioned chrysalis, I discovered a larva at the base of an oak tree, which spun a cocoon precisely similar to that previously described, and I therefore believe it to be the same species; but as the perfect insect has not yet made its appearance, I give a description of the caterpillar, without further reference to its identity:

Black, very minutely spotted with white, each segment with a broad, white, transverse band, slightly triangular dorsally, with the apex of the angle directed anteriorly. The four anterior segments have a number of chestnut-colored hairs, irregularly placed, and on the three anterior segments are a series of red spots. Head pitchy, rather large, shining. Feet and abdominal legs pitchy, blackish towards their base.

Length, 1.10 inch.

The caterpillar spun a very soft, silky web, with some fragments of oak leaves attached, entirely concealing itself from view.

Fam. GEOMETRIDÆ.

Chærodes ægrotata. Packard.

Larva. Varying very much in color, but usually greenish-white with a fleshy tinge, the five anterior segments with a darker cloud. Head with four ovate, blackish-brown marks, two on the sides, and two in front. Second segment with two black spots near the base, above which are some faint yellow dashes. Segments 3 to 7, inclusive, with faint brownish streaks, running longitudinally. Rest immaculate, except the anal, which has four minute black dots. An interrupted, waved, blackish lateral line encloses the stigmata, which are bright orange. Feet and abdominal legs, dull greenish-white, with the claws blackish. Anal feet with a black streak posteriorly.

Length, 1.10 inch.

When fully grown, the caterpillar draws two leaves together, and spins a stout, clear, white, silky web, similar to many *Bombycidæ*, in which to undergo its change. It is remarkably destructive to many garden plants, particularly to ivy, ferns, various species of *Pelargonium*, and the pepper tree (*Schinus Molle*). It is not unusual to see large plants utterly destroyed by their attacks, and the species may be regarded as one of the most troublesome pests with which the floriculturist has to deal. Changes to chrysalis in August and September, and the moth appears in about twenty days.

Chrysalis. Smooth, greenish-white. Eyes, visible pale-brown, sometimes black. Antennæ, distinctly marked, bright chestnut-brown.

Length, 0.75 inch.

LIST OF SPECIES NOTICED.

Phryganidea Californica, Pack. . . . . Egg and Larva.
Clisiocampa constricta, Stretch. . . . . Larva and Chrysalis.
Leucartia acrea, Dewey. . . . . Young Larva.
Halesidota sobrina, Stretch. . . . . Larva and Chrysalis.
" *argentata*, Pack. . . . . " " "
Pyrrharctia Isabella, " . . . . " " "
Platysamia ceonothi, Behr. . . . . " " "
Gastropacha, sp. . . . . Chrysalis.
Chærodes ægrotata, Pack. . . . . Larva and Chrysalis.

Aboriginal Botany.

BY STEPHEN POWERS.

As employed in this paper the word, "botany" is somewhat loosely comprehensive, and is used for the lack of a better. Under it are included all the forms of the vegetable world which the aborigines use for medicine, food, textile fabrics, ornaments, etc. Among savages, of course, there is no systematic classification of botanical knowledge. Every oak, pine, and grass has its separate name; the Indian never groups individuals together, except occasionally, by adding one of the words *cha, doo, popo, com, wi, back,* (tree, bush, grass, seed, root, leaf) or something of that sort. But it is not for a moment to be supposed that the Indian is a superficial observer; he takes careful note of the forms and qualities of everything that grows on the face of the earth. True, he ascribes marvelous and impossible qualities to some plants—frequently those which do not grow in his neighborhood—but that does not blind him to their real properties. And as his perceptions of individual differentations is nice and minute, so his nomenclature is remarkably full. I assert without hesitation that an average intelligent Indian, even if not a medicine-man, knows a much greater catalogue of names than nine-tenths of Americans. Nothing escapes him—he has a name for everything. And, indeed, there is reason. In times of great scarcity they are driven by the sore pangs of hunger to test everything that the soil produces, if perchance they may find something that will appease the gnawings of appetite. They therefore know the properties of all herbs, shrubs, roots, leaves, whether they are poisonous or nutritive, whether purgative, astringent, sedative, or what not, or without any active principle. And they have often found out these things by bitter experience in their own persons. It is surprising what a number of roots, leaves, berries, and nuts the squaw will discover. She will go out in the spring with nothing but a fire-hardened stick, and in an hour she will pick a breakfast of green stuff, into which there may enter fifteen or twenty ingredients, though, of course, they are seldom reduced to this extremity nowadays. Her eye will be arrested by a minute plant that will yield her only a bulbous root as large as a large pea, but which the American would have passed unnoticed. The women are generally best acquainted with the edible matters; while the old men are the authority as to the medicines.

There are seventy-three vegetable substances mentioned in this paper. I am indebted to the kindness of Professor H. N. Bolander, who identified for me many plants that I was unable to determine. There are a few specimens which are so scarce, nowadays, owing to the ravages of stock, or so difficult to find in flower, that it was impossible to give their scientific names.

I will take this occasion to say that there are many substances popularly called "Indian medicines" which are humbugs, and which have been fathered upon the aborigines by patent-medicine men. Whatever is set down in this paper has been learned from the Indians themselves.

In regard to medicinal herbs and plants, their usages are peculiar and sometimes amusing. As the practice of medicine among them is a source of great profit and prestige, it is sought to be invested with mystery. The medicines always are crafty men, keen observers, reticent. An old doctor always clothes his art with a great deal of superstition, secrecy, and pompous solemnity. In answer to impertinent young questioners, he says his simples do not grow anywhere in that neighborhood ; he is obliged to purchase them from tribes living at a great distance. I have known an old doctor and his wife, both as full of guile and subtlety as an egg is of meat, who always arose at the dead of night, crept stealthily out of camp, and gathered their potent herbs, roots, etc., then returned before any one was stirring, and concealed them.

The Indians referred to in this paper are the Neeshenams, of Bear River, and the flora is that of the extreme lower foothills of Placer County. Their general name for "medicine" is *wenneh*, which denotes "good" ; but they frequently use the word "medicine," even among themselves.

To begin with the oaks, the species which produces their favorite acorns is the *Quercus Gambelii*, Indian name, *chacow*. They generally select those trees which have a free, coarse bark and large acorns. About the middle of October the harvest begins, when the Indian, armed with a long, slender pole, ascends the tree and beats off the nuts. A tree which has been well stripped looks as if it had been scourged in a mighty hail storm. The old men generally assist in carrying them home in their deep, conical baskets, and there the squaw's duties commence. Holding an acorn on a stone, she gives it a slight tap with a stone pestle called *sooneh*, to crack the shell, which she strips off rapidly. They are then dried and beaten to powder in small hollows on top of some great rock. The flour is soaked a few hours in a large hollow scooped in the sand, the water draining off and carrying away the bitterness ; after which it is cooked into a kind of mush in baskets by means of hot stones, or baked as bread underground. The acorn which stands second in favor is that of the burr-oak (*Q. lobata*—Indian, *lowh*). In Placer County this oak seems to be more properly *Q. Douglasii*, as its branchlets are erect and rigid. There is an oak which they call *shuheh*, which seems to be something like a cross between the white and burr-oaks, having very white and coarsely rimose bark, and glabrous, shining, deeply *sinuate* leaves. But Professor Bolander pronounces this also *Quercus Gambelii*. The live oak is *haha ; Q. Wislizenia, hammut ;* the black oak, (*Q. Sonomensis*) *hanchu*. The acorns of these last are eaten only when they can procure no others. There is one other very small species called *cheepis*, found growing in the mountains ; but I cannot determine from their description whether it is the chinquapin or the whortleberry oak.

The nut-pine or silver-pine is *toan, toanem cha*. It is a great favorite with them, the most useful tree they have, and they always regret to see an American cutting one down. The nuts are a choice article of food ; and, burned and beaten to powder, or crushed up raw and spread on in a plaster, they form their specific for a burn or a scald. The pitch, and the mistletoe which grows on this pine, are very valuable, in their estimation, for coughs, colds, and rheumatism.

They set them afire, making a dense smudge, and then the patient, wrapped in a blanket, squats over it or stands on all-fours over it, and works and shuffles his blanket, so as to make the smoke circulate all through it, and come in contact with every portion of his body. When an Indian has an arrow-wound, or wound or sore of any kind, he smears it with the pitch of this tree, and renews it when it wears off. In the spring, if food is scarce, they eat the buds on the ends of the limbs, the inner bark, and the core of the cone, (*taeh*) which is something like a cabbage-stalk when green. The cone-core and bunch-grass are boiled together for a hair-dye. They are as proud of their black hair as the Chinese; and when an old chief who is somewhat vain of his personal appearance, or one of the dandies of the tribe, finds his hair growing gray, he has his squaw boil up a decoction of this kind, and he sops his bleaching locks in it. The tar *shindac*, which is worn by widows in mourning, is made of hot pitch and burned acorns, powdered; it is removed by means of soap-root and hot water.

(In adding the word for "tree," or "bush," they generally suffix the syllable *em*, thus: *toan, toanem cha; paddit, padditem doo.*)

Chippa is the willow, the long twigs of which are used both for arrows and basket-making. In making an arrrow, the hunter employs a rude kind of turning-lathe, a couple of sticks held in the hand, between which the twig intended for the arrow is tightly clamped and twisted around, which rubs off the bark and the alburnum, and makes it round. The long, straight shoots of the buckeye, *poaloh, poalem doo*, are used for the same purpose. For the woof in basket-making they employ the wood of the redbud, (*Cercis occidentalis—paddit*) which is split up with flints or the finger-nails into fine strings, used substantially as thread. The willow twig is passed round and round the basket, the butt of one lapping the twig of the other, while the redbud strings are sewn over the upper and under the lower.

Cotoh is the manzanita. Its berries are a favorite article of food, and are eaten raw, or pounded into flour in a basket, the seeds separated out, and the flour made into mush, or sacked and laid away for winter. They also make quite an agreeable article of cider from them, by soaking the flour in water several hours, and then draining it off.

Alder is *shootoom;* poison oak is *cheetoc.* They are less easily poisoned by the latter than Americans; their children handle it a great deal while little. They eat the leaves, both as a preventive, and as a cure for its effects; though it sometimes poisons them internally, The women use the leaves freely in cooking; they lay them over a pile of roots or a batch of acorn bread, then lay on hot stones and earth. The bright red berries of the California holly (*Photinea arbutifolia—yoalus*) are eaten with relish; also, the berries of the elder, *nock*, and wild grapes—*peemen.* They call a grapevine a bush—*Peemenem doo.*

Soap-root, *howh*, is used for poisoning fish. They pound up the root fine, and mix it into pools where the fish and minnows have no way of escape, and at the same time stir up the bottom until the water becomes muddy. The minnows thrust their heads out of the water stupefied, and are easily scooped up. Buckeyes are used in the same manner. Soap-root is also used to heal and cleanse old sores, being heated and laid on hot. Both soap-root and buckeyes are eaten in times of great scarcity; they are roasted under ground thirty-six hours or more, to extract the poison.

For toothache, the remedy is the root of the California buckthorn (*Frangula Californica—luhum doo*). It is heated as hot as can be borne, placed in the mouth against the offending member, and tightly gripped between the teeth. Several sorts of mints, *heesuh*, are used in a tea or decoction for colds or coughs. Ague is believed to be cured by a decoction of the little mullen, (*Eremocarpus setigerus—badah*) which grows on black adobe land in autumn. Colic is treated with a tea made from a greenish-gray lichen, (*Parmelia saxicola—wahattac*) found growing on stones. For rheumatism, they take the leaves and stems of a parasite vine (*Galium—sheshem*) which grows up in the middle of the chaparral bush, heat or burn them, and clap them hot on the place.

Yellow-dock, *heet*, is a valuable specific in their pharmacopœia. In case of acute pain of any description, the root is heated hot, and pressed upon the spot. In the spring, the leaf is eaten boiled, for greens, together with clover and many other things.

Bunch-grass, *boopuh*, is the subject of superstition. They believe that the long, slender stalks of it, discharged as arrows from a little bow against a pregnant woman, will produce a miscarriage; also, that they will hasten the time of maturity in a maiden. There is another thing, which they call *wocoamah*, probably wild parsnip, which they believe to be a deadly poison. It will produce nose-bleed, and the people who keep it in their houses will surely die. I will here state that I cannot discover that the Indians ever used poisons to any considerable extent to rid themselves of enemies; if they did, it was the old medicine men, and they keep the matter a secret. The Indians profess to stand in great and perpetual dread of being poisoned by one another; and no one will taste anything handed to him by one who is not a member of his family, unless the other tastes it first; but they imagine a hundred cases of poisoning where one actually occurs.

Of grasses, they eat the seed of the wild oat, (*tootootem com*) but very sparingly. Wild clover, *cheewee*; alfilleria, *battis*; and a kind of grass growing in wet places, (*Melica—holl*) are all eaten raw when young and tender, or boiled for greens.

There are two kinds of mushrooms which they consider edible. The one of which they are fondest is called *poolcut*, and is a little round ball, from the size of a marble to that of a black walnut, found underground in chaparral and pine thickets. They eat it raw with great relish, or roast it on the ashes. Another kind is the *wachuh*, which grows in the ordinary form, brown on the upper side, chocolate-colored and deeply ribbed underneath, and easily peeled. It is eaten boiled.

Higher up in the mountains they find a root looking somewhat like cork, a piece of which they sometimes wear suspended to their clothing as a charm. It is called *chook* or *champoo.* Indians of other tribes in the State invest different species of *Angelica* with talismanic attributes.

Under the popular name of grass-nut there is included a large number of plants with a small, round, bulbous root, all of which, with one exception, the Indians eat with much satisfaction. They are generally pried out of the ground with a sharp stick and eaten raw on the spot; but sometimes the women collect a quantity in a basket and make a roast in the ashes, or boil them. Most of them are by no means disagreeable to the civilized taste. There is the beaver-tail grass-nut, (*Cyclobothra—wallic*) the turkey-pea, (*Sanicula tuberosa—tuen*) the purple-flowered grass-nut, (*Brodiæa congesta—oakow*) the tule grass-nut, (*coah*) a small bulb, with a single, wiry, cylindrical stalk, growing in wet places, which I could not identify; the climbing grass-nut, (*Brodiæa volubilis—oampoom wi*) sometimes planted by Americans for ornaments; the little soap-root, (*Chlorogalum divaricatum—poyum*) the wild garlic, (*Allium—cooeeh*) the eight-leafed garlic, (*shal*) the five-leafed garlic, (*inshal*) and the three-leafed garlic, (*wookwe*) the yellow-blossom grass-nut (*Calliproa lutea—ustuh*); the long-leafed grass-nut (*Brodiæa congesta,* although the Indians have a different name for it from that mentioned just above, namely, *yoang wi*) the white-flowered grass-nut (*Hesperoscordium lacteum—yowak wi*); and the wild onion (*Allium cepa—chan.*) There is one other grass-nut, with a black bulb, (*Anticlea—haccul*) which the Indians consider poison, although it probably contains no more poison than other members of the liliaceous family.

The list of greens which they eat in the spring is also quite extensive. Besides the grasses and the yellow dock above mentioned, there is the mask-flower, (*Mimulus luteus—pooshum*) two species of the *Angelica,* (*hen* and *oamshu*) which are difficult to determine; the California poppy, (*Escholtzia Californica—tapoo*) either boiled or roasted with hot stones, and then laid in water; the rock-lettuce, (*Echeveris lanceolata—pittitac*) eaten raw; the wild lettuce, (*Claytonia perfoliata—yau*) and a species of *Sanicula,* (*mancoo*) the root of which, long and slightly tuberose, is also eaten. Of the wild lettuce a curious fact is to be noted. The Indians living in the mountains, about at the elevation of Auburn, gather it and lay it in quantities near the nests of certain large red ants, which have the habit of building conical heaps over their holes. After the ants have circulated all through it, they take it up, shake them off, and eat it with relish. They say the ants, in running over it, impart a sour taste to it, and make it as good as if it had vinegar on it. I never witnessed this done, but I have been told of it, at different times, by different Indians whom I have never known to deceive me.

Of seeds, they eat the following: A kind of coarse, wild grass, (*Promus virens—dodoh*) a species of yellow-blooming, tarry-smelling weed, (*Madaria—coamduc*) the seeds of which are as rich as butter; the yellow-blossom or crow-foot, (*Ranunculus Californicus—tiss*) of which the seed is gathered by sweeping through it a long-handled basket or a gourd; a little weed which grows thick in ravines, (*Blennosperma Californicum—poll*) gathered the same way; also a weed (*sheeoo*) with little white blossoms distributed all along the stalks, which are thickly covered with minute prickles—I know not what it is. All these seeds are generally parched a little, and then beaten to flour, and eaten without further cooking, or made into bread or mush. The dry, parched flour of the crowfoot seed has that peculiar, rich taste of parched corn.

There is an umbelliferous plant, (*shokum*) the root of which the Indians esteem very highly for food; more highly than any other, it being their nearest equivalent to potatoes. I know not if it is the true cammas; I think it is at least a species of it. It grows on rocky hill-sides, blossoms in June and July, has an extremely delicate, fringe-like leaf, and a root about an inch long and a quarter as thick, sweetish-pungent and agreeable to the taste. In Penn Valley, Nevada county, they gather large quantities of it.

They are acquainted with the *Yerba santa*, but attach no particular value to it.

Around old camps and corrals there is found a wild tobacco, (*Nicotiana plumbaginifolia—pan*) which they smoke with great satisfaction. They gather the leaves and dry them in the sun in a rude fashion, then cut them up fine. It has a pungent peppery taste in the pipe, but is better than nine-tenths of the Chinese-made cigars. It is smoked in a wooden or stone pipe, which is constructed of a single straight piece, the bowl being simply a continuation of the stem, enlarged. I saw one made of soapstone, about six inches long, five inches of it being the bowl, which was nearly an inch wide at the extremity, so that it would hold enough to last half an hour. It was quite a handsome piece of workmanship, perfectly round and smooth, tapering evenly down to a bulb, which was inserted in the mouth. The tobacco-pipe is called *panemcoolah*.

There are two plants used for textile purposes. One is a kind of tule-grass, or small bulrush, (*Juncus—doccun*) which they hetcheled with flints or with their finger-nails, bleached, and wove into breech-cloths. For strings, cords, and nets, they used the inner bark of the lowland milk-weed (*Asclepias—poo*). When it is dry, the Indian takes both ends of a stalk in his hands, passes it through his mouth, and crushes it with his teeth, or else passes it over a stone while he gently taps it with another; then strips off the bark and twists it into strands, then into cords. The rock milk-weed, (*oampoo*) has a medicinal value; they use the root for the toothache, the same way the root of the buckthorn is used.

It is necessary to state that most of the medicines above mentioned are of the class which the women are allowed to become acquainted with and to employ. There are several other substances which are more rare and valuable, or at least they deem them more valuable, and which the medicine-men alone know anything about. They are found far up in the mountains or in other localities, and may be called the medicines of commerce, having a tolerably well-settled value in shell-money. I regret that I was generally unable to secure sufficiently complete specimens to determine them. For instance, there is a root (*luhno*) which I should call Seneca snake-root, but of which I could procure only a little piece. A root about as large as a pipe-stem, and four inches long, is worth about a dollar. A decoction of it is used for diarrhœa, that scourge of aboriginal life;

also for venereal diseases. There is a bush (*chapum*) found in the mountains, with a very pale tea-green bark, and minute golden specks on the small limbs, which is probably California sassafras, and which is very highly esteemed for coughs and colds, a tea of the bark being given. Another root, (*pallic*) spignet from its appearance, is made into a tea and drunk for diarrhœa; this also is very valuable. There is still another root, (*litway*) found on the Truckee, which is good for the dropsy.

Although it is not strictly germain to the topic, I may be permitted to state that the Indians have names for all the internal organs of the human body; and their ideas of their functions, and of the operations of medicine, are at least as respectable as those of the Chinese.

Regular Meeting, September 21st, 1874.

In the absence of the President and Vice President, Dr. Harkness was called to the Chair.

Thirty-nine members present.

Donations to the Museum: Four jars of alcoholic specimens were received from John C. Merrill. Twenty-one fine specimens of fossils, and six jars of alcoholic specimens from Alaska, were received from the office of the United States Coast Survey; accompanying these specimens was a letter from J. S. Lawson, dated U. S. Coast Survey Brig *R. H. Fauntleroy*, Admiralty Inlet, Washington Territory, August 1st, 1874, as follows:

On behalf of Captain Charles Willoughby, sailing master of this vessel, I send, for the California Academy of Sciences, two cases containing some teeth, portions of tusks and of bones, supposed to be remains of the *Elephas Primigenius*. These were found on the beach at Scatchet Head, Whidley Island; and as their appearance indicates—all being thickly encrusted with small barnacles when picked up—they have been subjected to the action of water for a long time. I am informed that some fourteen years ago a large slide took place at this point, since which time portions of these remains have, from time to time, been picked up. One tooth then found, and now in possession of Arthur Phinney, Esq., of Port Ludlow, shows no sign of having lain in the water.

Captain Willoughby has climbed the bluff in several places whenever he could make an ascent, but could not find any of these remains. Those now sent were wholly, or nearly so, buried in the sand, at a considerable distance below high-water mark.

Cropping out from the bluff at high-water mark is a stratum of a woody fiber—possibly in one of the incipient stages of coal formation. In it are found sticks, knots, etc., of an extremely fine grain. This lignite, if it is such, in drying separates into laminæ, like the layers showing the growth of trees, and when dry makes good fuel. This formation is frequently found here. I have seen large quantities in Useless Bay and on the beach, east side of Bainbridge Island, south of Point Monroe. A specimen of this will be found with the collection now sent.

Immediately above this formation is a concrete, composed of small boulders and cement, showing traces of iron rust. The great body of the bluff is clay.

The portions of a tusk were found in the same fragmentary condition as they are sent. Captain Willoughby has marked some of these pieces, showing the parts belonging to each other.

We hope this collection may prove of interest. In one of the boxes I send several bottles, containing specimens of fish and other marine animals, which we have collected along these shores. The nondescript in the largest bottle was brought in by some fishermen at Port Townsend—I think from the Straits of Juan de Fuca.

On the Crustacea of California.

BY W. N. LOCKINGTON.

Next to the vertebrates, the creatures with an internal skeleton—mammalia, birds, reptiles, and fishes—come the multitudinous species comprised in the articulate sub-kingdom. All articulates possess an external skeleton, which may be leathery, or hard and brittle; a body divided into several segments; and limbs, when limbs are present, formed of several articulations or joints.

This sub-kingdom includes the insects; the arachnida, or spiders and mites; the crustaceans, the myriapoda, or centipedes, and the annelida, or worms.

In complexity and perfection of organization, as well as in general intelligence, the insects, which have a distinct head, with well-developed organs of sense grouped upon it in close proximity, are certainly entitled to rank first.

The crustaceans, or insects of the water, as they may be called—since crabs, lobsters, shrimps, and their congeners fill the same place in the seas and rivers of the globe that the insects fill in the air and upon the land—must be placed lower in the scale of animal life, since their most highly developed forms are not possessed of a distinct head, but have the mouth and organs of sense grouped upon the anterior part of what would, in the insect, be called the thorax. The body of a crustacean, therefore, is not constricted, as is that of the insect, into three distinct portions—a head, a thorax, and an abdomen—but either presents only two such divisions—an anterior one, usually denominated the *cephalo-thorax*, or head-thorax, since it contains the organs found in the head and thorax of an insect, and the abdomen, which corresponds to that of an insect; or else is distinctly divided into several segments, as distinct, though not as numerous, as those of a myriapod. All insects breathe by means of tracheæ, or air passages, which, communicating with the air at various points on the outside of the body, ramify among the internal organs, limbs, and wings, and act the part of the lungs of a vertebrate. All insects are thus air-inhabiting and air-breathing, and although some are adapted to live during the greater part of their lives in the water, they are compelled, like the cetaceans among the mammalia, to come to the surface to breathe. Almost all the crustacea, on the contrary, breathe, like fishes, the air contained in the water, by means of some modification of branchiæ or gills; and although some of them live on the land during the greater part or the whole of their lives, they are compelled to choose damp situations, so that their branchiæ may be kept moist, and thus be enabled to continue their functions.

All insects pass through a more or less complete series of metamorphoses, the three most conspicuous stages of which have received the names of *larva*, or caterpillar, *pupa*, or chrysalis, and *imago*, or perfect insect. All the crustaceans change their form somewhat before arriving at maturity; but it is only in the higher groups that these are sufficiently marked to entitle them to the name of metamorphoses. But there is this difference between the metamorphoses of the insect and those of the crustacean: the insect, whether its metamorphoses be complete, as in the butterfly, or partial, as in the cricket, attains its full size before assuming its imago state; indeed, the caterpillar is generally much larger than the imago. The crustacean, on the other hand, passes through all its incomplete stages while still very small, assumes its perfect form, and, as it grows, throws off its external hard skeleton and secretes another fitted to its increased bulk.

As late as the year 1838, Milne Edwards, in his "Natural History of the Crustaceans," wrote: "We are not acquainted with any crustacean from the western coast of North America." James D. Dana, in his "Crustacea of the United States Exploring Expedition," describes several species found between San Francisco and Puget Sound. J. W. Randall, De Saussure, and other zoölogists, also described other species.

The late Wm. Stimpson, in an article published in the "Boston Journal of Natural History," 1857, describes many new kinds, and catalogues a total of one hundred and thirty species belonging to, and peculiar to, the Pacific Coast. Stimpson, like his predecessor Dana, did not explore south of San Francisco. Since his day no one appears to have given any connected attention to the subject; and when we consider that the unexplored portion extends through Lower California, Sonora, Mexico, and Central America, as far south as the Isthmus of Panama, through a region tropical or sub-tropical in climate, and teeming with life of every kind, we shall, I think, fully endorse Stimpson's opinion, when he says, "We cannot suppose this number to be more than a fourth part of that which will be reached when a thorough search shall be instituted."

Ninety-six of the species enumerated by Stimpson belong to the highest division of the class, viz: the *Podopthalmia*, or stalked-eyed crustaceans; and the remainder, with one exception, to the highest order of sessile-eyed crustaceans, the *Choristopoda*—species with fourteen legs, like the wood-lice, water-slaters, and sand-hoppers.

Below these come the numerous microscopic forms of fresh-water and marine crustaceans, as well as the sucking *Lerneans* and *Caligi*, and the *Cirripedes*, or barnacles, none of which, so far as I know, have as yet received special attention on this Coast. Out of Stimpson's ninety-six stalked-eyed species this collection does not at present possess more than about forty.

Fortunately, however, we have here several species not mentioned by Stimpson. Among these is a swimming crab, of the genus *Amphitrite*, collected at Mazatlan by Mr. H. Edwards. When Stimpson wrote, no species of swimming crab had been found upon the Pacific Coast, but Dr. Cooper informs me that the specimen we have is by no means the first found, as he had previously collected specimens of a species of the family upon the southern coast of California. The swimming crabs, or *Portunidæ*, as they are named, (from the genus *Portunus*, to which many European species belong) may be distinguished by the expansion of the last joint of the hindermost pair of feet into an oar-like form. They are numerous on the Atlantic coast. Only four species belonging to the *Cancridæ*, the typical crabs, are enumerated by Stimpson, and all of these belong to one *genus*—*Cancer*. This genus is distinguished by the extreme narrowness of the front, or space between the eyes, and by antennæ, which project forwards.

The common edible crab of the San Francisco market, *Cancer magister*, belongs to this genus, as does also the edible crab of Great Britain. In this museum we have four Pacific Coast species belonging to another section of the same great family—a section characterized by a front seldom less than one-sixth, and sometimes as much as one-half, the entire breadth of the carapax, or shell.

Another novelty is a species of *Gelasimus*, or fiddler crab, as it is popularly called. The females of this genus have the first pair of feet of ordinary proportions, but the males are blessed with a right hand of amazing size, longer than the width of the body, and terminating in an immense pair of pincers. These *Gelasimi* do not live in the sea, but in salt marshes, where they abide in holes, like toads in the garden—a pair usually inhabiting each hole. When the animal is disturbed or aggressively inclined, this tremendous right hand is brandished aloft in a most comical fashion, and when he has reached his home he bars the entrance with the same useful member.

The specimens are from San Diego.

I have now only to say a few words about some of the species common in or just outside the bay of San Francisco. One little fellow, who has been christened with the "barbarous binomial" of *Pachygrapsus crassipes*, lives in the crevices of rocks at or near high-tide mark. As the last joints, or tarsi, of his four hinder pairs of legs are set with sharp little spines, he can stick pretty tightly to the surfaces of the crevice; moreover, his pincers are sharp, and he knows how to use them, so that it is no easy matter to dislodge him. He keeps a good lookout, and usually sees you before you see him, withdrawing as far backwards into the hole as he possibly can the instant he perceives that you have caught sight of him. He is perfectly ready to do battle with another of his species who may endeavor to trespass upon his cool cavern, and will pursue the trespasser to the limits of his premises.

If you turn over any of the large stones which cover the beach at Black Point, and similar localities, you are sure to disturb one or more of the pretty little crabs belonging to the genus *Pseudograpsus.* Sometimes as many as twenty, of all sizes, from half an inch or under to nearly two inches in width of carapax, will scuttle away from under a single stone. There are two species, but they live together in harmony, as becomes relatives. One species, the *Oregonensis*, is of a bluish-gray tint, and has a thin covering of hairs upon its hinder legs. The other, the *nudus*, is one of the prettiest crabs in existence. Its large pincers are marbled with dark purple spots on a lighter ground; the legs are of glossy smoothness, and the carapax of a dark purplish red.

Several species of hermit crabs—little crabs with a soft abdomen, which they protect by ensconcing it in the shell of a defunct mollusk—are found in and near San Francisco. Each individual chooses a shell to his fancy, and abandons it for a larger as his bulk increases.

There are several genera—those with the right hand largest, and the fingers or pincers pointed and calcareous, from the genus *Eupagurus;* those with spoon-shaped fingers, having horny tips, and the left hand usually largest, are known as *Paguri;* while others, which agree with the last in having spoon-shaped, horny fingers, but have hands of nearly equal size, and fingers opening horizontally, form the genus *Clibanarius.*

Another curious little crab, with a long, narrow body, and a pointed abdomen folded beneath it, is not found alive between tide-marks, but its body is often washed up by the tide on the sandy beaches just outside the bay. I have said its body, but it would be more correct to say its shell, since the body has usually been eaten clean up by a legion of sand-hoppers, which jump out of the shell in all directions when you pick it up. The name is *Hippa analoga.*

Another little crustacean bears the name of *Porcellana rupicola,* the rock-inhabiting porcelain crab. It dwells under rocks, in company with the *Pseudograpsi,* and is abundant at Black Point. The antennæ are very long, and folded backwards ; the carapax is almost circular and flat ; the hands are long, broad, and flat, and the fifth or hindermost pair of legs are very small, and olded up over the shell.

Two other species of *Porcellana,* one of them new to the Pacific Coast, were found at Mazatlan by Mr. Edwards.

The hermit crabs, porcelain crabs, and the long, narrow *Hippa,* unlike as they appear, belong to the same tribe of the ten-legged crustaceans, viz : the *Anomoura,* so called from the usually anomalous condition of the abdomen, which is seldom short and folded under the thorax, as in the *Brachyura,* or true crabs, nor yet long and fully provided with appendages, as in the lobster.

Another singular family, belonging to this tribe, is that of the stone-crabs, or *Lithodia.* In this family the fifth pair of feet are apparently wanting, but are really present, and may be found folded up over the back, but concealed beneath the carapax.

Nine species of this group are known to inhabit California, but this museum only possesses three of them. One of these is as singular as it is rare. Few other collections possess specimens of it, and this has but one. The most striking characteristic of this species is the great development of the carapax, a part which, in most *Anomoura*, is of moderate size, but which, in this case, forms a broad, thin shield, of such dimensions as to completely conceal the legs, antennæ, abdomen, and every other part viewed from above; in fact, this crab presents nothing but an uneven, brown surface of shell, with a hooked rostrum projecting, vizor-like, from its anterior extremity, and enabling the animal to see without being seen. The other two species of stone-crabs belong to a genus peculiar to this Coast, and are among the largest crabs known, attaining a weight of seven pounds, and a width of carapax of ten inches.

Among the long-tailed crabs, or *Macroura*, there is a family differing greatly in habits from our well-known lobsters and shrimps, inasmuch as its members excavate subterranean habitations in the sand of the sea-shore, and are, therefore, not often observed unless properly sought for. A specimen of one of these was obtained upon the beach of San Miguel Island, by one of the Coast Survey, and presented to the Academy by Prof. Davidson, several months ago. It belongs to the genus *Callianassa*, distinguished by its soft, thin shell, and smooth carapax, as well as by the disproportionately large size of one of the hands, which may be either the right or the left in the same species. This species is *Callianassa Longimana*. Two other species of this genus, *C. Californiensis*, of which we possess an example, and *C. gigas*, which is larger than the others, and is yet wanting in our collection, are found on this Coast.

Another digging crustacean, *Gebia Pugettensis*, also found here, may be known by its equal hands and heavy rostrum.

My object in this paper is mainly to draw the attention of the members of the Academy to this branch of Zoölogy, and to induce those who have the opportunity to be on the look-out for crustaceans, as well as for birds and insects.

S. C. Hastings read short papers "On Thunder Storms"; "On Transmission of Musical Sounds by Telegraph"; "On Transmission of Colors by Telegraph"; "On Katie King and the Spiritualistic Theories"; "Questions to the eminent scientist, A. R. Wallace"; "On the Creeping of Rails on North and South Railroad Tracks."

Remarks on California Coal.

Dr. J. G. Cooper made some verbal remarks on California coal as follows:

The papers contain every day several notices of discoveries of coal in California, and always mention them as excellent indications, certain to be rich.

From these one might suppose that California would soon eclipse all other parts of the world in coal production, but the fact is, that in ninety-nine cases out of one hundred these discoveries are of no value whatever. He had examined such coal strata in over one hundred localities between San Francisco and San Diego, besides some in Sonoma and Marin Counties.

Although the unscientific sneer at geological facts and fossils as not practically useful, they are really the only reliable guides in determining the age and probable value of coal deposits. The true coal of the carboniferous rock in other countries was formed from the tree-ferns, algæ, and other plants of low organization.

None such had been found on this Coast, and from the fact that ours contained remains of coniferous and dicotyledonous trees, geologists had long considered it all as lignite; but practically that of Vancouver Island, Bellingham Bay, Coos Bay, and Mount Diablo was as good as much of the older coal. The most northern localities mentioned had been determined beyond doubt by the fossils as of cretaceous age, but there is still some doubt as to those of California, which may be partly or entirely above the cretaceous strata, like the Rocky Mountain coal, which is generally considered eocene.

This, however, does not affect the value of fossil evidence, as the species of both these formations are mostly extinct, and any coal found associated with fossils of living species must be of later date. No paying beds of coal have been found anywhere of later date than these.

It does not follow, however, that because a stratum is cretaceous, it will pay. Numerous strata in that formation in the Coast Range are too thin to pay, though of pretty good quality. None will pay if less than two feet thick, and in most places a thickness of four feet is necessary, if the coal is no better, nor more accessible, than that of Mount Diablo. Much of the cretaceous strata is also so metamorphosed that the coal has been ruined by infiltration of iron and silica, with other minerals, the surrounding sandstones being converted into jasper or serpentine.

The fossil shells found in connection with this coal show that it was formed by accumulation of trees, etc., in shallow bays, at the mouths of rivers in fresh or brackish water, and therefore along the shores of older continents or large islands. Often these deposits have been sunk afterwards, and strata with marine shells have accumulated above them to a great depth, when all would be again raised above the sea. In the Coast Range cretaceous coal-strata exist, above which miocene tertiary strata, full of shells of living kinds, were deposited to a thickness of one thousand feet, but afterwards removed sufficiently to show the coal beneath.

The beds of undoubted tertiary age are numerous in the Coast Range, and usually show the vegetable structure so plainly as to be recognized as lignites by everybody, besides differing from coal in a more or less brown tint. Some lignites may pay for working, for local use especially, as they do in some parts of Europe. Nearly all of that in the coast Range is, however, in either too thin beds, or too full of sulphur and other impurities. In a few places it has been purified and hardened so as to resemble anthracite, apparently by the action of subterranean heat, when the strata are in contact with igneous rock beneath them.

The lignite beds of Ione Valley and Lincoln appear to be of one age. The former is described by Professor Whitney in the State Geology, Vol. I, as being very soft material, approaching peat, and useful only for local consumption. It forms a bed seven feet thick, occupying several small basins in the foot-hills, apparently the beds of former lakes. Numerous fossil plants are found in it, and are considered by him to prove its pliocene tertiary age. The large deposits found near Lincoln, at a much lower elevation, show that this pliocene lignite probably occupies large portions of the Sacramento and San Joaquin Valleys, where marine pliocene fossils have long been known to exist, as well as fresh water and terrestrial fossils, which occupied it successively, as the country rose above the level of the sea. Much of this coal was, no doubt, formed in lakes, which in filling up left the present marshes.

Pliocene coal is also found in the Coast Range, but nowhere in paying quantity. Strata from an inch to a foot thick may be seen by any one visiting Long Beach, south of Lake Merced, where the pliocene strata, full of marine fossils, (which prove their age by the large proportion of living species) are uplifted with a dip of thirty to forty degrees to the northeast.

In an article in the Proceedings of the California Academy, Vol. IV, p. 244, Amos Bowman described and figured this pliocene formation as one of his "terraces," most of which exist only in his imagination. As seen from east of the bay, the top of the ridge at this point appears tolerably level, but the strata along the beach are plainly inclined thirty to forty degrees, and were so described in California Geology, Vol. I. At a distance of ten to twenty miles many such "terraces" may be seen along the ridges around the bay, but none of these ridges are really terraced in the upper strata, which are everywhere highly inclined.

True terraces, probably pliocene, do exist at low levels around the bay and in Livermore Valley, containing fossil remains of land animals. Dr. Cooper was investigating these when the survey was suspended last spring. The marine terraces described by Professor Davidson, in Vol. V, Part 1, do not extend within the mouth of the bay, or very near it.

There is a fresh-water deposit in the basin of San Pablo creek, containing thin beds of good lignite, full of fresh-water shells, indicating a lake deposit of probably the miocene age. The strata have been very much disturbed by volcanic action in all the places where Dr. Cooper has examined them, and are not likely therefore to be profitable.

Indications of the effects of the great volcanic convulsions about the end of the pliocene epoch, which destroyed the then existing tropical fauna and flora of California, (as described by Professor Whitney) are to be seen in the coast strata of all the counties so far explored north of the bay, as well as in the gravel terraces containing the remains of plants and tropical animals, described by Dr. Leidy in a recent publication on the "U. S. Geological Survey of the Territories." Why does not California see the importance of retaining and publishing such interesting discoveries within her boundaries?

The following resolutions offered by the Trustees, were read by the Secretary, and unanimously adopted by the Academy:

WHEREAS, The will of a Divine Providence has taken from our midst our fellow-worker, Hiram G. Bloomer; therefore, be it

Resolved, That this Academy desires to record its sincere and earnest regret at the loss of one of its members, so honored for his gentle and kindly nature, so respected for his principles of truth, so worthy of admiration for his enthusiastic love of science, and his generous desire ever to impart information, as the friend who has been recently called away from us; and its belief that by the unexpected death of Mr. Bloomer a gap has been caused in the ranks of its officers which it will be difficult to fill.

Resolved, That in the loss of Mr. Bloomer we recognize the departure from amongst us of a brave and noble spirit, who, amid many of the hardships of life, clung persistently to the pure love of the beautiful, and who, in his unselfish devotion to his favorite pursuits, has left an impress upon the future of our State which in after years will be more fully recognized and known.

Resolved, That we deeply and sincerely sorrow over the sad and sudden bereavement which Mr. Bloomer's family have sustained, and offer to them our heartfelt sympathy in the hour of their affliction.

Resolved, That these resolutions be printed in the Proceedings of the Academy, and that a copy of them be forwarded to the immediate relatives of the deceased.

In moving the adoption of the resolutions, Prof. Bolander recounted the great services the deceased had rendered the Academy. His devotion to the cause of science had doubtless hastened his death. Mr. Bolander made a supplementary motion that a committee of five be appointed to examine the late Mr. Bloomer's library and herbarium, with a view to purchase. This motion was adopted, and the Chair appointed as such committee, Prof. Bolander, Dr. Kellogg, Henry Edwards, R. E. C. Stearns, and W. G. W. Harford.

REGULAR MEETING, OCTOBER 5TH, 1874.

Vice President in the Chair.

Forty-seven members present.

H. F. Teschemacher, a resident member, was enrolled as a life member, having paid the required fee.

Donations to the Museum: William J. Fisher presented a Collection of Japanese Specimens, including two pair of shoes and a hat; a sample book containing several hundred specimens of fabrics, a water-proof coat manufactured of paper, sponges, etc. W. G. W. Harford presented thirteen species of Crustaceans from the island of Santa Rosa. W. J. Fisher presented twenty-three species of Crustaceans from the Sandwich Islands and Japan. J. L. Bray presented several specimens of Iron Ore from the northern part of Coos County, Oregon; two bottles of Gold-bearing Sand, from the ocean beach of same county, and a bottle of Platinum, found in black sand on the same beach. Dr. Kellogg presented a very extensive collection of Plants. Mr. Hoffman presented the Map of California, issued by the State Geological Survey. Dr. Cooper presented a specimen of a fungoid growth with the following remarks: A fire passing through a grove of willows scorched many without killing them. On the bark of these the sap afterwards exuded of a deep red color, and dried where exposed to the sun in transparent drops, resembling cherry gum but not gummy, bitter like salicine, and of a beautiful blood-red color. Where kept moist by the dews and fogs, this sap-like exudation soon began to vegetate into an orange-red fungus, which grew about two or three inches long, covering the bark which had become dead with a mossy growth. Though it would be supposed, according to scientific belief, that the spores of this lichen or fungus merely found a suitable place to grow in the scorched sap, it looked very much like a case of "spontaneous generation" of fungus from the sap itself.

Donations to the Library: Popular Science Monthly, September, 1874. Nature. Annales Physik und Chemie. Ordinance Mem oranda, No. 18. Commercial Statistics of the Republic of Chile. Astronomical Register, September, 1874. Journal of Botany, September. Engineering and Mining Journal, Sept. 5th, 12th, and 19th. California Farmer. Sept. Proc. Society Entomology, 2d series, No. 2. Magazine Natural History, September. French Catalogue of Collections of Ornithology. Catalogue of Rare and Curious Books, Vol. XVIII, No. 4. Proceedings Royal Geographical Society. American Naturalist, September. California Horticulturist, September.

California during the Pliocene Epoch.

Dr. J. G. Cooper made the following remarks on California during the pliocene epoch :

The map here exhibited is that of California and Nevada, published by the Geological Survey,and of which this new edition, issued by authority of the University of California, is presented to the Academy by the chief topographer, Mr. C. F. Hoffmann. On this there are pinned pieces of orange-colored paper, (chosen from its contrast with the blue and brown tints of the map) to represent the portions now land, but covered by salt or brackish water during the epoch just preceding the age of man. A considerable part of those along the edge of the coast is, however, omitted, being too narrow to show on this small scale at a distance. Probably much of the Coast Range was also under water, of which no evidence from fossil remains is now left, the strata, if any were deposited, having been washed away.

Numerous small fresh-water lakes also existed, which have left deposits, especially on the slope of the Sierra Nevada, but are not yet surveyed enough to define their limits. The Sierra must then have been much lower to allow these lakes to stand where they would now drain out completely. Most of the States of Nevada and Utah were also covered by large-fresh water lakes, filling what is now called the "Great Basin," and which have since evaporated so as to form the salt lakes now existing by condensation of the salts always contained in lakes and rivers. This is shown by the deposits of fresh-water shells at high levels above the present salt lakes, and the absence of salt-water fossils later than the cretaceous in the Great Basin.

In California, the whole great interior basin of the Sacramento and San Joaquin Valleys was occupied by brackish water, as proved by the remains of sharks and porpoises found by Professor Blake and others near Kern River. All the principal level valleys, now forming our best agricultural lands, were also occupied by arms of this island sea or of the ocean. The Gulf of California extended over the desert a hundred miles or more north of its present limits.

The Sacramento basin had other outlets besides the Golden Gate, (if that existed at all) through an inlet opening at Russian River, and another through

Santa Clara Valley into Monterey Bay. Thus, many islands probably existed, which are now joined by the main land, among them the peninsula of San Francisco. Some of the inlets near the coast were occupied by marshes, through which the animals of that period reached the nearest islands, as shown by the remains of the fossil elephant found near this city. Similar remains found by Blunt and Harford, of the Coast Survey, on Santa Rosa Island, show that it was then either joined to the main land by dry ground or marshes, as were probably the whole inner row of islands now forming the south shore of the Santa Barbara channel.

The evidence of all these changes is in the remains of marine, land, and fresh-water animals now found in the valleys mentioned, which have become more or less filled up by deposits from the adjoining hills.

The following are the most striking forms, described by Prof. Leidy in the "Report of the U. S. Geological Survey of the Territories," issued last year.

A tiger (*Felis imperialis*) as large as the Bengal tiger, found in or near Livermore Valley, by Dr. L. G. Yates.

Wolf (*Canis Indianensis*) larger than the existing kinds, from same deposit; also found in the tertiary of Indiana, etc.

Llama (*Palauchenia Californica*) from the foot-hills of Merced County, found by C. D. Voy, larger than the existing camel; also remains of perhaps another species, from Alameda County, by Dr. Yates.

Buffalo (*Bison latifrons*) found in several parts of this State and the Eastern States; larger, and differing from the living form. A very perfect skull was found by Mr. C. Brown, engineer of the Pilarcitos Valley aqueduct, in excavating for that work.

Horse, (*Equus occidentalis*) of which remains are common in most of the States, though no horses existed on this continent when it was discovered by Europeans.

Rhinoceros, (*R. hesperius*) of which teeth were obtained by Prof. Whitney, in the Sierra Nevada.

Elephant, (*E. Americanus*) one of the commonest of the great fossil animals throughout the United States.

Mastodon, (*Americanus M.*) more rare, but also found in many localities.

Another species, (*M. obscurus*) first found in the Gulf States, and since by Dr. Yates in the foot-hills of the Sierra, Alameda County, etc.

A great tortoise, equal to the Galapagos species in size, but probably of fresh water, from a lake deposit of Nevada County. This is still undescribed, being one of the fossils obtained by the University from the Geological Survey.

Remains of palms and other tropical trees, chiefly from the lake basins of the Sierra, were sent by Prof. Whitney to the eminent Prof. Lesquereux, to be described in one of the Geological Reports, that *ought to be* published by the State of California.

From these evidences we perceive that the climate of that day was tropical. The country consisted of peninsulas and islands like those of the present East Indies, resembling them also in climate and productions. From the extent of water surrounding them, there was abundant rainfall and luxuriant vegetation, suitable for the animals mentioned.

It is not unlikely that some of these animals may have existed before and after the pliocene epoch as well as in it, but the explorations are still insufficient to decide this.

VOLCANIC ERA.

The termination of this tropical epoch in California was marked (as described first by Prof. Whitney) by enormous volcanic outbursts, which poured out great streams of lava on the slope of the Sierra Nevada, covering entirely large tracts toward the north. At the same time the whole country was apparently raised by the elevation of new mountain ranges and increase of old ones, causing the lakes to be drained, and their beds filled by washings from the hills, mixed with volcanic materials. This great convulsion, no doubt, exterminated most of the tropical flora and fauna of California, although some of its representatives might have existed later in neighboring regions, and their descendants may still be found in tropical America. That all are not extinct, is probable from the analogy of tertiary species elsewhere, and from the fact that most of the marine and fresh-water shells of the strata deposited at that time are still living; some, however, only south of California.

Many extinct land animals have been found to have lived in Europe since the appearance of man on the earth, and there is strong evidence in the "Calaveras skull," and others, that the same fact is true of California.

It does not, however, necessarily prove that man existed in the pliocene epoch, as his remains may have been buried under volcanic outflows of later date, together with postpliocene animals, or even bones of pliocene species mixed with them by aid of volcanic convulsions.

POSTPLIOCENE EPOCH.

The immense period of time that has elapsed since the pliocene epoch is shown by the vast accumulations of volcanic materials poured out by Mt. Vesuvius on top of marine strata of shells, of which every one of the species is said to be living in the Mediterranean, and therefore of late postpliocene date. Yet history and the evidence of human remains go back through only a thin portion of these volcanic strata! California, before the end of the pliocene, was certainly badly suited for the existence of man. The deposits formed during the convulsive era, to the thickness of hundreds of feet, are themselves almost destitute of all fossils, although burying such a rich collection.

While this was going on in California, there was probably a great geological change taking place in other parts of the world, followed by the glacial era. In this, the northern hemisphere, down to about lat. 41°, was mostly covered by ice, and the great deposit called the "Drift" formed in Europe and the Eastern States.

The Geological Survey proved conclusively that this deposit of erratic boulders did not reach over California, and it is doubtful if even as far south as Vancouver Island. Still, the influence of the frozen period was no doubt exerted here in the forms of extensive glaciers covering the Sierra, at least half way down their western slope, and probably the highest parts of the Coast Range. *Now* we have in summer a mere remnant of that great ice field, which no doubt did a great part in the excavation of the tremendous cañons now cut deep below the previous volcanic deposits of the Sierra. The thawing of such an ice field must have acted much more rapidly in this erosion than the comparatively slight water courses of the present time. There is evidence, also, in the present existence, of far northern land-shells and plants along the whole length of our Sierra Nevada, that the glacial period progressed slowly, allowing them to spread southward before its advance, without being exterminated.

PRESENT EPOCH.

The end of the reign of ice brings us to the present epoch, in which there has been very little change in the outlines of the land of California, although some changes have occurred in the fauna and flora, as well as climate, which are yet undetermined. The volcanic disturbances have continued with decreasing intensity since the advent of man in the postpliocene epoch, and may have elevated considerable portions of land, especially southward, followed by increase of dryness and probably greater extremes of temperature. A rising of land near the Arctic Sea would further decrease the temperature. Judging from the continual discoveries still being made in the study of these latest formations of the earth's surface in Europe and the Eastern States, we may safely say that a vast field still remains open for the investigations of science in California.

Professor Hilgard, of the University of Michigan, and at present delivering a course of agricultural lectures at the State University, was introduced by Mr. Stearns. After congratulating the members on the flourishing condition of their organization, the number present greatly surpassing that of ordinary meetings of scientific bodies in the Eastern States, Professor Hilgard made some reference to the remarks made by Dr. Cooper, and then made a few remarks on the geology of the country north of the Gulf of Mexico, comparing it with the geology of this coast.

The California Aborigines.

BY STEPHEN POWERS.

In the *Atlantic Monthly*, of March, 1874, there was published an article entitled "Aborigines of California," in which I presented facts tending to show that these aborigines are descended from the Chinese. The conclusions which were arrived at in that paper have been questioned, on the ground that, however great may be their likeness to the Celestials, they cannot be descended from them, since they have no pottery, no hieroglyphics, and no monuments; and the time never has been in the historical period when the Chinese were without these. It is argued that no people could lose the art of pottery, or even if they lost the art itself, that the pottery would remain, being almost indestructible. It is not intended to rehearse in this paper the arguments there presented in favor of a Chinese origin, but merely to offer some facts and suggestions as to these Indians and their predecessors on this coast.

The Voy Collection, in the University Museum, contains a large number of pre-aboriginal stone implements; but there is no link to connect the race who made them with the present one except *per deterins.* In fact, since the California Indians of to-day have no monuments or pottery, there is no link except those of language, customs, etc., to connect them with *any* race; hence the consideration of monuments and the like is pretty much eliminated from the discussion, as between them and the Chinese. Even if the very few remains found to-day served to prove that a pre-aboriginal race brought the ceramic art from China and practiced it here, it would still remain to show that that people were the ancestors of the California Indians. There is a gap somewhere, which cannot be passed except *per soltum.*

The simple fact of the almost total lack of ceramic remains, and the character of the relics found in the Alameda and other shell mounds, show that the present race must either have supplanted or descended from one which was little more advanced than themselves. The few and simple stone implements used by the California Indians resemble, in their main purpose and design, those of the extinct races exhumed in the shell-mounds, only they are conspicuously ruder and simpler. Take the stone mortars, for instance. The pre-aboriginal mortar is carefully dressed on the outside, and has three general shapes: either flattish and round, or shaped like a duck's egg, with the bowl on the side, or with the bowl in the large end, and the small end inserted into the ground. But the Indian takes a small bowlder of trap or greenstone, and beats out a hollow in it, leaving the outside rough. Whenever one is seen in possession of a mortar dressed on the outside, he will acknowledge that he did not make it, but found it; in other words, it is pre-aboriginal. The pre-aborigines used handsomely dressed pestles, evenly tapered to the upper end, or else a uniform cylinder for about three-fourths of the length, with the remaining fourth also uniform, but smaller, for a hand-hold; but the squaw nowadays picks up a long, slender cobble, from the brook. The pre-aborigines fought with heavy knives, or swords, carved out of jasper or obsidian, which were, probably, used as daggers rather than as swords; that is, the combatants sought to pierce each other with the point, instead of dealing blows with the edge. The Indians of to-day fight with rough stones, such as they pick up, choosing those which are long and sharp-pointed; and their constant aim is to strike each other in the face with the points, just as their predecessors or ancestors probably did with their carved knives. The pre-aborigines made, out of sandstone or other soft stones, a small and almost perfect sphere, as an acorn-sheller; but the squaw nowadays simply selects a smooth cobble from the brook for this purpose. In the collection of A. W. Chase, Esq., of the U. S. Coast Survey, there are spindle whorls of stone, some of them found in mounds made by extinct tribes, and others found among the Klamath River Indians and the Nome Lackees, all of which bear a close resemblance; and, in this instance, there is no perceptible deterioration in the workmanship. I strongly suspect, however, if the Indians possessing these implements had been closely questioned, they would have acknowledged that they found them, and did not make them, just as they acknowledge in regard of the superior stone mortars and pestles. That is, they are really indebted to their ancestors for them. Near Freestone, Sonoma County, I saw in possession of its finder, what was probably a spindle whorl of pottery—the only instance of the kind I know of. In regard to tobacco-pipes, the deterioration is not so manifest, for I have seen soapstone pipes of as handsome workmanship as any obtained from the mounds. But I still think there is deterioration shown, in the fact that the Indians nowadays use so many wooden pipes of the rudest construction; though we have no means of showing that their ancestors did not use equally poor ones, since their wooden pipes, if they had any, have perished. Then again, as to the shell-mounds themselves. I am of opinion that they are merely the accumulations of a race of men who dived for clams, as the Wintoons of the upper Sacramento do to this day, to a limited extent. In other words, the Wintoons and other tribes are descended from a people who were more energetic and industrious than themselves.

Langsdorff and La Perouse both mention that they saw many Indians with magnificent beards, but now they are almost totally destitute of beards. Whether the ever-increasing drought and dessication of the Pacific Coast, which have swept away the ancient forests, have also destroyed the beards of the aborigines, is a question I am not competent to determine.

The two "Village Sentinels," as the Eurocs call them, at the mouth of the Klamath, and the human head carved in stone near the Geysers, seem to be relics of former idolatry; and indeed the legends connected with the latter state that their ancestors were idolaters. Their religion now, if they can be said to have any, is a near approach to fetichism; that is, the worship of animals, such as the coyote, the white owl, the black eagle, etc. Fetichism is a lower form of religion than idolatry.

There are two legends—one among the Cahrocs of the Klamaths, and one among the Pallegawonaps of Kern River—which, in my opinion, are undoubtedly a corrupted version of some old zodiac-myth, and therefore point to a remotely semi-civilized origin for their narrators.

I might extend these instances and comparisons, but it is not necessary. The California Indians, like their predecessors, belong unmistakably to the Stone Age; and the fact that they have degenerated from a higher to a lower grade in that age, argues strongly that their ancestors, after crossing the sea, might have degenerated from the Bronze Age or the Iron Age of China.

For these reasons, I am disposed to believe that the California Indians have simply deteriorated from what we (perhaps erroneously) call a pre-aboriginal race; and ultimately, from the Chinese. Instances are not wanting where a people have retrograded from civilization almost to barbarism in the course of many centuries. Witness the Fellahs, who are supposed to be descended directly from the ancient Egyptians. China itself, with all its vast populations, has stood still for twenty centuries; and a colony from it wandering into a new land, where the abundance of nature and the genial climate invited them to relax the efforts which a crowded community had necessitated for the maintenance of life, might degenerate to a low point without difficulty. When the Chinese of to-day come to this land of plenty, how poor are the dwellings and implements they construct for themselves, compared with those they used in China. How poor are our own, compared with those we made in the East!

I do not forget that the Indians, almost with one accord, attribute these superior stone implements to a race older and other than their own. There is also a Neestenaw legend which cannot be very well explained, except on the supposition of a reference to an earlier race of cannibals, from whom their forefathers suffered grewsome damage. On the other hand, they all insist that their progenitors were created from the soil where they now live (to take all their accounts, there must have been a hundred of these "special creations" in California); so that their legends are not consistent.

The theory of degeneration above advanced, is quite in accord with the climatic changes and the deforestation which have taken place on this coast, even within the historical period. We know, from the statements of Biscayno and other early Spanish explorers, that extensive forests were flourishing near San Diego and Monterey, three hundred years ago, where now there are none. Biscayno says the natives of Santa Catalina Island had large wooden canoes, capable of sea voyages, whereas that island is now comparatively treeless. Fossil remains have been discovered in Southern California and Arizona, which indicate that there were once heavy forests where now are barren, wind-swept plains. Ruins of great walled cities, and large systems of irrigating ditches, in Arizona and New Mexico, on the Gila, Little Colorado, De Chaco, San Juan, and other streams, plainly show that these regions once contained an agricultural population, who were ultimately driven out by the ever-increasing drought and the failure of the streams. The great sequoias, on the high Sierra, may, perhaps, be the last lingerers of a gigantic race of forest trees, which the changed climatic conditions of California have destroyed from the plains.

We know that the deforestation of Babylonia, Assyria, Palestine, and Greece, has been accompanied by a corresponding deterioration of the inhabitants, and it may have been, also, largely the cause of it.

While there is nothing to show that the present race of California Indians are descended from an agricultural people, like the New Mexican Pueblos, there is much to show that their predecessors were superior to them, and that their predecessors were also their ancestors. The California Indians are simply a poor copy of the people whom we usually call pre-aborigines; but the copy follows the original so closely that there can be little doubt that it is a copy made by transmission.

In New Mexico, there is a large and powerful tribe called the Navajoes. There are good evidences that they are descended from the Hoopaws of this

State, and that they have migrated, within comparatively recent times, from the Trinity or the Klamath. Of these evidences I will here mention only one—the similarity of their numerals, as shown in the following table:

	Hoopaw.	Navajo.
One	Chlah.	Kli.
Two	Nach.	Nahkee.
Three	Tach.	Tah.
Four	Tinckh.	Dteen.
Five	Chwolch.	Estlahh.
Six	Hostàn.	Hostonn.
Seven	Ochkit.	Susett.
Eight	Cahnem.	Seepee.
Nine	Nocostah.	Nastyy.
Ten	Minchlah.	Niznahh.

The Navajoes to-day are superior to the Hoopaws, perhaps not in prowess, but certainly in the arts of peace. They possess the arts of weaving and pottery, which the Hoopaws know nothing about; but it is considered probable that they acquired those arts from the Pueblo Indians since their migration. Hence, the Navajoes offer no argument against the theory of degeneration. If they carried those arts with them from California, they powerfully confirm the theory, so far as the Hoopaws are concerned.

I offer this paper, not as an exhaustive treatise on this subject, but as giving some facts and theories which I hope others, more capable, will work out more fully.

The Committee appointed at the meeting of September 21st, to examine and report upon the library and herbarium of the late Mr. Bloomer, with a view to purchase, reported as follows:

San Francisco, October 5th, 1874.

We the undersigned, the Committee appointed by the Academy to examine the library and botanical collection of the late H. G. Bloomer, desire to make the following report: The books are for the most part in excellent condition, and comprise a number of very valuable illustrated works on botanical science. In all, there are 117 volumes, of which at least half are folio or quarto, with illustrations, The botanical collection is in admirable order, and consists of sixty-six bundles of plants, many of which are rare species, not contained in the herbarium of the Academy. We have estimated the library and botanical collections to be worth at least seven hundred dollars, but in consideration of the inestimable services rendered to the Academy by the late Mr. Bloomer, we recommend that the sum of one thousand dollars shall be paid for the same to his widow and family, in quarterly installments of two hundred and fifty dollars each.

(Signed) HENRY N. BOLANDER.
HENRY EDWARDS.
A. KELLOGG, M. D.
ROBERT E. C. STEARNS.
W. G. W. HARFORD.

On motion of Dr. Fourgeaud, the report of the Committee was unanimously adopted by the Academy, and referred to the Trustees.

Regular Meeting, October 19th, 1874.

Vice President in the Chair.

Forty-five members present.

Donations to the Museum: Dr. R. K. Reid, of Stockton, presented, through C. D. Gibbes, specimens of Wood and Fruit of the Osage Orange (*Maclura aurantiaca*); also, specimens of the Wood of the Walnut, a native of the lower Calaveras. Samuel Purdy, Esq., presented a Collection of Silver Ores from several mines in Colorado. D. D. Colton presented a section of Geode. H. L. Shackelford presented a Skull, supposed to be that of a female Indian, found in a bed of lava near San Francisquito creek. J. P. Dameron presented fifteen specimens of Coal and Lignite, found in various parts of California and Oregon. J. W. Lynch presented, through C. D. Gibbes, three specimens of Cinnabar ore, from Napa County, Cal. W. G. Blunt presented two Skate's Eggs, found on the beach near Point Lobos. Paymaster Stanton, U. S. N., donated specimen of "King Snake," (*Elaps euryxanthus*) from northern part of California. Chas. D. Gibbes presented materials showing the Dye obtained from the wood of the Osage orange. Henry Edwards presented two specimens of Crustacea, genus *Squilla*, from Shanghai, China. Dr. Behr presented specimen of Parasite from the California orange trees, different from any previously described.

The usual exchanges to the Library were received.

J. P. Dameron read a paper on "Coal."

Some months since, Mr. C. D. Gibbes called the attention of Californians, through the Academy, to the Bois d'Arc or Osage orange, (*Maclura aurantiaca*) both for hedges and for timber. The wood is one of the most durable in the world, and is remarkably strong, elastic, and tough. It is of a beautiful yellow color, close grained, and receives a free polish, making it valuable for furniture. In Texas it is used for wagon wheels, as it is not liable to shrink. For ship-building, this wood is preferable to live oak, and by Indians is preferred for bows to all other wood. It also yields a yellow dye. For an ornamental tree, it is one of the most graceful, with its dark-green foliage and hard, smooth bark, drooping branches, and large, orange-colored fruit. It forms a good belt of hedge-row for sheltering gardens, vineyards, or orchards, being of a rapid growth and bearing formidable thorns for hedges. A plantation of Osage orange, set out now, would in a few years afford a most valuable timber that would pay well, as it sprouts rapidly from the stump and soon renews the timber cut.

Mr. Gibbes exhibited some of the wood, which had been sent to the Academy by Dr. R. K. Reid, of Stockton. Some of the wood had been polished, showing a beautiful grain. Some cloth dyed with the dye from this wood was also shown. The dye is of a bright yellow color. Mr. Gibbes again called the attention of our land-owners to the importance and value of cultivating plantations of this tree for timber. In swampy soil it grows very rapidly, and in our swamp land, firm enough to produce sycamore and willow, it would do well. It requires a good, moist soil, but not too wet. This tree could be used to great advantage in strengthening levees on the tule land, where it would not only be valuable for timber, fuel, and shade, but also for forming a substantial protection to the levees, strengthening them and assisting to hold them in position.

Notes on some Aleut Mummies.

BY W. H. DALL, U. S. COAST SURVEY.

I have previously given the Academy some account of the Aleutian method of mummifying their more distinguished dead. Many tales are current among the Aleuts in regard to particular cases of this practice, and among others one has been frequently related to me in regard to some mummies preserved in a cave on one of the volcanic islands known as the "Four Craters," or "Four Mountains." When in the vicinity, in 1873, we were unable to land and test the truth of this history, on account of bad weather and the absence of any harbors. More recently, however, this has been successfnlly done. The Alaska Commercial Company has a standing order to its agents to collect and preserve objects of interest in ethnology and natural history, and the cabinet of the Academy bears witness to the generosity of the company and the value of some of the material thus acquired. Captain E. Hennig, of the company's service, with the company's schooner *Wm. Sutton*, being employed in removing some hunters from the island of the Four Mountains, he was enabled, after seven unsuccessful attempts, to land at the base of the cliff, where the fallen rocks form a kind of cave, and was directed by the natives to the exact spot. Here he obtained twelve mummies, in good condition, besides several skulls of those which, being laid near the entrance of the cave, had become injured by the weather. There was also a moderate number of carvings and implements found, though some natives, less superstitious than the rest, had appropriated a quantity of weapons (reported to have once been there) for use in hunting. The island being volcanic and, in fact, still active, the soil is still warm, and the atmosphere of the cave was quite hot, which accounts for the extremely good preservation of the remains. Most of the bodies were simply eviscerated, stuffed with grass, dried, wrapped in furs and grass matting, and then secured in a water-proof covering of seal-hide. Two or three had much more pains bestowed upon them, and were of course of much more interest. The story of their deposition is too long to be given here, and is not particularly interesting, but it includes the fate of an old chief of the Island of the Four Mountains and his family, all of whom were buried in the cave. Among the others was a female, who died when with child from a premature birth, brought on by an accident, and the essential correctness of the tradition is attested by the presence of a little mummy of the still-born infant. The date of the first interment is very well fixed, by the fact that the old chief died the autumn before the spring in which the Russians made their first appearance at the Four Mountains; and, consequently, none of the bodies are much over 100 years old. Hence, they should not be confounded with the ancient pre-historic remains which I have formerly described in the Academy's Proceedings.

The mummies of real interest were few in number. The most conspicuous was that of the old chief. I am informed that this body was enveloped in furs, dressed in the usual native attire, and furnished with a sort of wooden armor, formerly worn by the Aleuts. The whole was placed in a sort of basket, in a sitting posture, and carefully covered with water-proof skins, secured by lines made of sinew, either braided, or made into what sailors call "square sennit." This line, together with a net made of sinew, in which another of the bodies was secured, were very finely made, and nearly as perfect and strong as when first placed there. The matting, made of prepared grass, was exceedingly fine, in most cases far superior in finish and delicacy to any now made in the islands. One of the smaller mummies, in a triangular-shaped bundle or basket, had a pattern of a Maltese cross worked into a stripe of another color ; this was quite fresh, and the grass still retained its red and yellow tinge. The largest basket has a wooden arrangement fastened with bone buttons, forming a broad hoop, which served it for a base. Most of the more carefully preserved specimens had been once suspended in the air by handles or cords attached to their envelopes.

The other articles found in the cave were stone knives and other implements, and a few carvings, one of which was supposed by the finder to be an idol, but this is probably an error. A child's boot of native make was found in the cave, with the fur perfectly preserved, and in it was a little ivory image of a sea-otter. A number of other bone and ivory toys or trinkets were also found. These articles are expected here on the bark *Cyane* in a few weeks, when those interested in these matters will probably have an opportunity of making a careful examination of them.

[Two of the mummies described above have arrived and are now in the Academy's museum, having been presented to the Academy by the Alaska Commercial Company.]

The following communication was presented by the Corresponding Secretary, on behalf of the writer:

Mesh-knot of the Tchin-cha-au Indians, Port Simpson, British Columbia.

BY GEORGE DAVIDSON.

The Indians of this section of the country use a "square" or "reef" knot in making their fishing nets. Other Indians may do so, but I have not seen them making their nets. This knot does not require the passage of the ball of twine through the mesh at any step of its formation, and therefore obviates the use of a netting needle. The twine is well made and strong, and is formed from the fibrous covering of the tall, rank nettles which abound around all their villages. They collect the nettles, strip off the leaves, dry the stalks, and when brittle, beat them until the woody parts are separated from the fiber. The specimens I obtained were about one-sixteenth of an inch in diameter; two ply, tolerably hard twisted, and fairly smooth. They also make twine from the inner fibrous bark

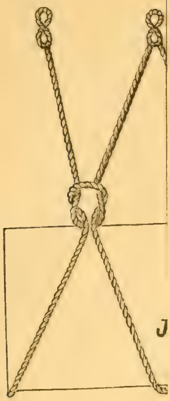
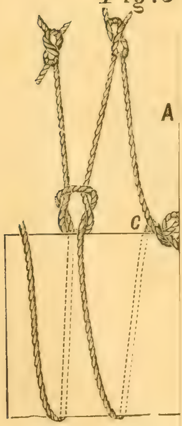
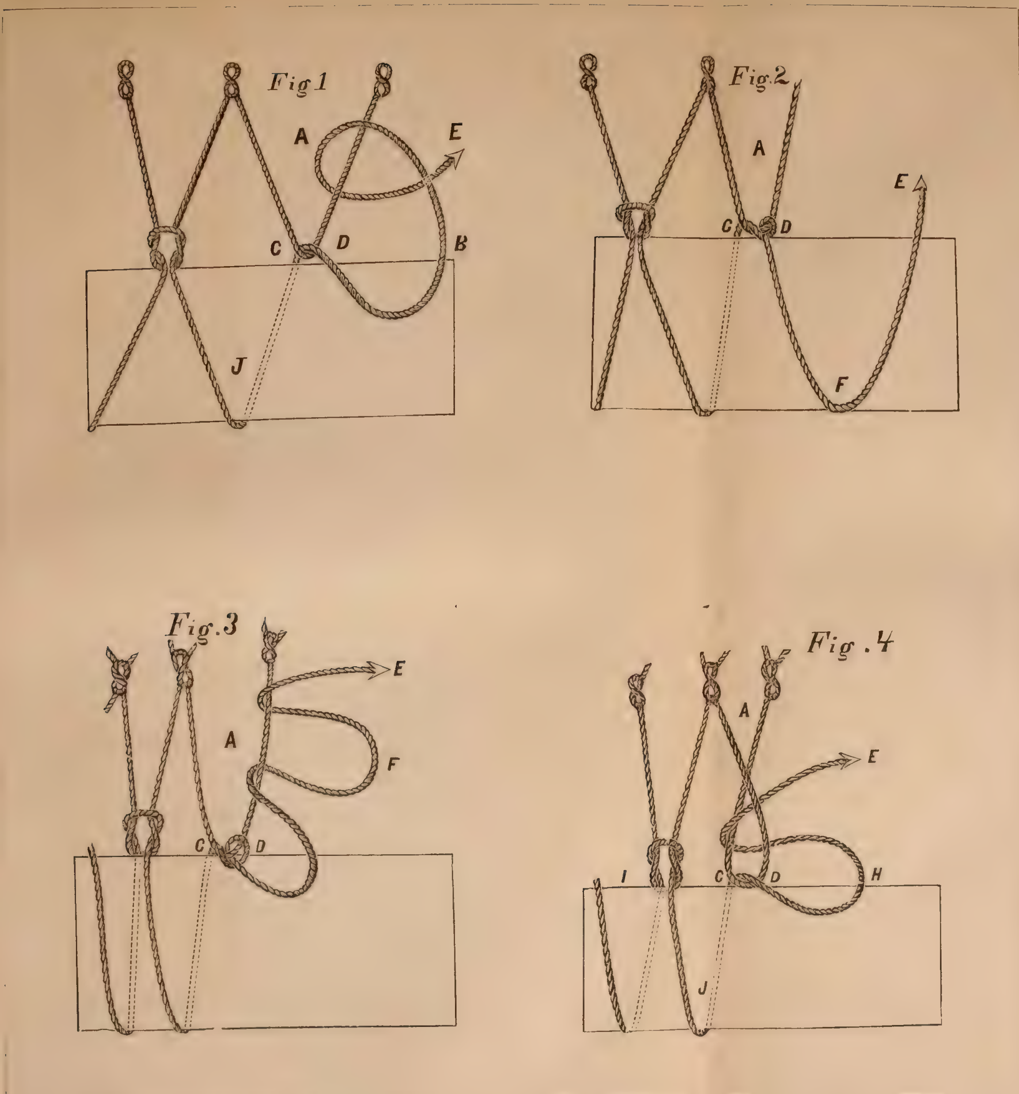


Fig. 3





MESH-KNOT OF THE TCHIN-CHA-AU INDIANS, DAVIDSON.

(TO FACE PAGE 400.)

of the *Epilobium Angustifolium.* Those that I saw at work upon the nets were the dilapidated old women.

The following figures and explanation will show how the knot is made, and it can be very readily done by any one trying the experiment:

Bring the bight B *up* through the mesh A, as in fig. 1; draw the part D tight at C and press the left thumb upon D to keep the part J D around the mesh-block strained; pass the end E *up* through the bight B and haul tight to C, as shown in fig. 2, keeping the thumb as before on the partly formed knot.

With the free part D E of fig. 2, pass the bight F *down* through the mesh A, draw the part G tight upon the loop at C, when it will assume the condition exhibited in fig. 4, slipping the thumb on the part D, to keep tight the loop J around the mesh block. With the process in the condition shown by fig. 4, pass the end E *down* through the loop H and haul it taut, when the square knot, as at I, will necessarily appear by a slight movement of the thumb forward to aid it in settling into place.

Dr. Dall gave a brief synopsis of the results of his recent expedition to Alaska:

The season in the Arctic regions has been an open one and exceedingly auspicious for observations. The expedition has passed a greater portion of the time in the vicinity of Mount St. Elias. The scenery of that region was sublime beyond description, and the greatest glaciers were found there existing outside of the Polar seas. Much attention been given to measuring the altitude of Mount St. Elias and the neighboring peaks by careful triangulations, and it was determined beyond doubt that St. Elias is the most lofty point of land on the North American continent. Its altitude is calculated at 19,000 feet, and that of Mount Fairweather at 15,000. It is impossible, however, to fix the precise height of the lofty peaks until their ascent can be accomplished. Mount St. Elias has been commonly designated in the geographies as a volcanic cone, but an examination of its formation, as far as practicable, determined that this supposition is erroneous. Small volcanic vents are discovered, however, toward the sea. While sailing close in to the shore, a few miles north of Cape Fairweather, an immense glacier was inspected, having a flow from three to six miles in width, and extending inland beyond the reach of vision, which was at least thirty miles. The country was of a rolling formation and no material deviations appeared within the horizon in the direction of the glacier. The ice was clear and blue and glistening in the light, and presented a magnificent spectacle.

California in the Miocene Epoch.

BY J. G. COOPER, M.D.

Unlike the pliocene, which I spoke of at our last meeting, the miocene in California furnishes us, so far, with no *certain* evidence of land animals' existence, and few of vegetable life. It is, however, most probable that such existed, and will in time be determined or distinguished from the pliocene with which they are now mixed. That there was an extensive and most interesting terrestrial fauna in the adjoining regions of Eastern Oregon, Wyoming, and Utah has been proved by the treasures of animal remains found within ten years past in those regions, to enumerate merely the names of which now would take up too much time.

As there was much less land above water in this part of the continent during the miocene, the field for such animals to exist in was much more limited than in the pliocene, and, therefore, their history requires longer time to work out. Besides this, the convulsions and removals of animal relics from their original beds, during the volcanic and glacial periods, were so general as to mix them up in a manner too puzzling to be deciphered for a long time to come. An instance of this is shown by the tooth of an *Archegosaurus*, found by me on Mare Island, some years since, and mentioned in our Proceedings, Vol. V., p. 194. This tooth, identified by the lamented Agassiz, belonged to an animal believed to have been one of the earliest reptilian forms known, and characterizing the carboniferous age. It was an enormous development of the strange "four-legged fish," or larval salamanders still found in the Columbia River and other western waters, but must have been several feet long, and no similar remains are found in any later formations. Though it is not *certain* that they may not be yet found to have existed among the monsters of the pliocene epoch on this Coast, as their supposed descendants live in our fresh waters, still the evidence of this single tooth would have gone far to prove the age of Mare Island to be carboniferous if no other fossils had been found there. As it happens, however, to be one of the richest fossil-beds of pliocene remains in California, the single tooth found on the surface of that formation was probably transported by ice from the Sierra Nevada, where the nearest carboniferous strata are known to exist. Of course, the same may be the case with some of the pliocene remains, and possibly others elsewhere. But the peculiar position of Mare Island makes it the most likely place for such mixtures, as it lies just where the outlet of pliocene or post-pliocene lakes or rivers must once have met a great obstruction to their flow. On this, animals embedded in floating ice would naturally lodge and decay, just as the celebrated extinct elephant of Siberia was carried by ice to its resting place at the mouth of an Arctic river. The obstruction referred to was, no doubt, an elevation of the Mt. Diablo ridge, crossing the Straits of Carquinez at this point, during the volcanic period before mentioned. By this, pliocene beds were made to accumulate to a depth of over fifty feet, which they still show on the adjoining shores, though the rivers have washed away the obstruction itself, and the greater part of these beds also.

The fossil evidence which we possess relating to the miocene epoch in California is, however, abundant and interesting. It so far consists of beds of marine shells, found at short intervals throughout the Coast Range and the foot-hills of the Sierra Nevada, which contain the proper proportion of living species to prove their age as relatively older than the pliocene. From their comparatively recent date, it is not generally difficult to recognize and follow out these beds throughout their extent, though much more disturbed and altered by volcanic action than the pliocene. In some places, however, the contact of eruptive rocks or infiltration of foreign mineral matter by hot springs, has altered them past recognition, though for only limited tracts south of San Francisco Bay.

From these marine beds we find that nearly the whole of the coast ranges south of here were under the sea in the miocene, and the evidences of extensive washing away of the strata are so plain that it is not improbable that the *whole* were submerged.

Beds of excellent miocene, and, possibly, pliocene fossils, are found at the mouth of Kern River cañon, showing that the sea then washed freely against the foot of the Sierra ; there is even reason for believing that it extended far up the Colorado River basin ; and certainly it deposited a thick bed of the enormous miocene oyster, (*O. Titan*) with other remains, along the west shore of the present Colorado desert, now at an elevation of probably 1,000 feet. Of its extent in the northwest quarter of California very little is known, and probably most of that region was above water.

As these changes of level were caused by depression of the land below its present level, our mountains were then probably quite insignificant, and no doubt a much more level and uniform surface prevailed on shore. As the miocene was elsewhere the culminating period of existence for the large and strange tertiary mammals, it is altogether probable that some of them inhabited portions of the dry land of California, connected with the regions in which they were so abundant in the north ; but, so far, the geological surveys have not been sufficient to define their limits, either in time or space, within this State.

That marine monsters frequented our shores is proved by the remains of seals, whales, and still undescribed creatures of enormous size, that have been found in this formation even more abundantly than in the pliocene of the Coast Range. From the great difficulty of obtaining their stone-imbedded relics, there will be work for future generations of students in describing them. From these animal remains (many of which were only of microscopic size) was produced the petroleum of this Coast, a substance so far found only in the miocene strata of California.

Of the miocene flora, as distinguished from the pliocene in California, we know very little. It was apparently of a less tropical character, more like that of the present time, and probably resembled ours now living as nearly as any other. Beds of lignite, four feet thick, but poor in quality, are common near the coast, containing wood and algæ.

The northern hemisphere seems to have had in the miocene epoch a very uniform climate, in which the vegetation of Europe resembled that now in our Eastern States. The most wonderful fact connected with it is, that recent discoveries have proved that Greenland, in lat. 70°, and Spitzbergen, in lat. 78°, 58′, had a rich luxuriant forest of trees, mostly American in character, among them a redwood, undistinguishable from that so common here ! In all, 137 species are known. It is impossible to reconcile this with the existence of even four months' night which we know must prevail so near the pole, even if the climate there were tropical. We are forced to the conclusion, in spite of astronomical opinions, that the poles have changed since then, and this may help to explain many geological puzzles both in California and elsewhere. Among these the supposed absence of all EOCENE animal or vegetable remains on this Coast is one which might be accounted for by supposing that in that epoch California was under covering of polar ice! Such a theory, though it may be called absurd on account of the present flattening of the poles by centrifugal force, is as tenable as that of the well-known alternations of deep ocean and dry land which geology proves to have occurred on our continent. I may mention in this connection, that Prof. Dana, during his explorations of the Oceanic Archipelago, saw reasons to believe that it has been slowly subsiding from the condition of a continent in the tertiary and recent ages, while this Coast has been rising. Thus, alternations of land and ocean have doubtless been going on, usually slow and gradual, since the creation of the world. The changes in fauna and flora, which in our limited field of view seem to have been sudden and convulsive, were probably nearly all through the tertiary, as slow as at present, but from these enormous undulations of the earth's surface, half of their history is for us buried beneath a fathomless abyss.

Would changes of the poles be any more wonderful or impossible?

Observations on the Genus Caprella, and Description of a New Species.

BY W. N. LOCKINGTON.

Among the *Tetradecapoda*, or fourteen-legged crustaceans, the best known forms of which are the pill-bugs, wood-lice, and sand-hoppers, there is no more remarkable genus than *Caprella*. The abdomen is obsolete, or so nearly so as only to be distinguishable by a most careful examination; and the entire body consists of the seven thoracic segments, each of which is exceedingly attenuated, so that the creature resembles, in its general appearance, a long, slender caterpillar more than a crustacean.

Although classed with the fourteen-legged crustacea, the *Caprellæ*, like their near relatives, the *Cyami*, or whale-lice, have really only five pairs of legs, as those pairs which normally spring from the third and fourth segments are absent, their place being filled, in the males, by two pairs of elongated branchiæ. In the females these branchiæ are modified in form and function, becoming four broad plates, which fold securely over each other on the lower side of the third and fourth segments, and thus composing a sac or pouch in which the eggs and immature young are safely carried.

The comparatively great length of the body is still further increased by the long, slender, external antennæ, and the backward direction of the hindermost legs; and the resemblance to a caterpillar is heightened by the mode of progression, which, on account of the absence of legs on the third and fourth segments, is by looping the body in a manner precisely similar to that practiced by the "loopers," or larvæ of the *Geometridæ*.

The first pair of legs is short, but the second makes up by its inordinate length and slenderness; while the three hinder pairs are more nearly equal in size, and are known as "anchoral" feet, since it is by them that the creature attaches itself firmly to the object on which it rests.

All the feet are provided with sharp claws, which fold back upon the preceding joint; but in the last three pairs this joint is furnished with a sharp spine, against which the claw shuts. Thus our *Caprella*, secured by six anchors, can ride safely in spite of waves and currents, its long body swaying to and fro, and its forelegs busy in catching its prey. The *Caprellæ* appear to be parasitic on hydroids and sponges.

The species of which I append a technical description was dredged in about eight fathoms of water, from a bottom of mud and weeds, in Hakodadi Bay, Japan, by W. J. Fisher, naturalist of the *Tuscarora*. Mr. Fisher has presented two specimens, male and female, to this Academy.

I believe the species to be new, although it is just possible that it may have been previously described by some naturalist whose works do not grace the shelves of our Academy. I have named it *C. spinosa*. The male somewhat resembles the *C. attenuata* of Dana, the chief differences being the spines upon the five posterior segments, and the absence of the spine upon the head.

The females differ so greatly from the males in the comparative lengths of the several joints of the body and antennæ, that I was at first inclined to believe they belonged to another species; but since the two forms were always dredged in company, and the specimens of one form are all males, while those of the other are all females, it is evident that they are the two sexes of the same species.

Caprella spinosa. Lockington.

Male. Body very slender; segments elongate, second thoracic segment more than one-half longer than the first, and very slender. No spine on dorsal surface of head. Superior antennæ longer than half the body; first joint little more than half the length of second; third joint nearly as long as second; flagellum rather longer than basal joint. Inferior antennæ reaching to about the first third of the second joint of the superior antennæ. Hand of second pair of legs very narrow, with three teeth on the underside, one a short distance behind the claw, a second close to the first, and a third posterior to the middle. The third and fourth segments have a sharp spine on each side, above the branchiæ and near the hinder margin, and the three posterior segments are furnished with similar spines.

Length of body, 1 11-16 inch. Length of superior antennæ, about 1 inch.

Female. Body less elongated than in the male; third and fourth segments swollen at the sides, and both these segments armed with a long, sharp spine, the point curving towards the head; fifth and sixth segments armed with a straight spine. Second pair of legs about as long as the second segment of the body, the basal joint armed with a sharp spine on the upper side of distal end; hand shorter than basal joint, with a single acute tooth on the posterior third of the under side. Superior antennæ about half the length of the body, the second joint about one-third longer than the basal; flagellum as long as second joint. Inferior antennæ about equal in length to the first two joints of the superior antennæ.

Length of body, about 1 7-16 inch; of superior antennæ, ¾ inch.

Dr. Harkness stated that the Fungus presented by Dr. Cooper, at the meeting of October 5th, was of a somewhat rare species—*Meleancomes Stilbestoma*, Julasne.

Curious Electrical Light Observed during the Storm of September 30th.

BY JAMES BLAKE, M. D.

Being at Placerville, in El Dorado County, on the evening of the 30th of September, I was watching the lightning that was continuously flashing towards the southwest horizon, and I could not fail of remarking that the electrical discharges were the most continuous I had ever seen. About a quarter past seven, I observed a luminous appearance, apparently proceeding from the crest of a range of mountains about six miles to the southwest, the range that overlooks the Cosumnes River. The light was visible through an arc, horizontally, of about fifteen degrees, and extended about eight degrees above the horizon; the highest part was not exactly in the middle, but more towards the western end of the light. The general appearance was somewhat like a faint display of the aurora borealis near the horizon. I watched it about a quarter of an hour; at this time the light was becoming fainter, and on looking for it about twenty minutes later it had entirely disappeared. The light was undoubtedly electrical, and I am inclined to think it was due to the silent escape of electricity from the crest of the ridge, as such appearances have been observed in other mountainous countries during electrical storms; and there can be no doubt but that the storm in question was accompanied by the greatest electrical disturbance witnessed in this country since its settlement by the Americans. I would observe that the storm did not reach Placerville until about 2 A. M. on the morning of Oct. 1st.

Regular Meeting, November 2d, 1874.

Vice President in the Chair.

Forty-three members present.

Dr. Cornelius Herz was proposed as a candidate for membership.

W. H. Dall, having paid the required fee, was enrolled as a life member.

Donations to the Museum: Four specimens of Ores from Rattlesnake Mine, Sonoma Co., Cal., from H. Halsey; the same gentleman also presented two specimens from Mineral King District, Tulare Co. Specimens of Cinnabar ore from Great Western Mine, Lake Co. Specimens of Gravel Cement, containing gold, from L. D. Currie's Cement Mine, under the bed of the Stanislaus River, near Central Ferry, Tuolumne Co., Cal. Specimens of Crystallized Quartz, from the Geyser region. Mr. W. T. Reynolds presented ten specimens of Cinnabar ore, from Oakland Mine, Sonoma Co. Coll Deane presented specimens from the Calistoga Mine, Napa Co. W. G. W. Harford donated specimens of Cuttlefish. W. H. Ford presented several specimens of Cadis Worm, found on the South Fork of the Stanislaus River. Larkyns & Co. presented a large Cuttlefish. W. H. Dall, U. S. Coast Survey, presented a bottle containing a variety of Shells from the South Sea Islands. General Colton presented specimens of Fossil Fish, found in a layer of lime rock at Church Buttes, Wyoming Territory. Mr. John Edwards, of Thompson Flat, about three miles north of Oroville, Butte Co., presented some Fossil Teeth and Leg Bone, found in a hydraulic mine in that location, at a depth of thirty feet, in a stratum of sand, close under a layer of pipe clay, and about ten feet above the bed rock. Many other bones were unearthed, but were very much broken by the hydraulic piping, and were washed away. Also, Bones of some small animal, found in an Indian rancheria.

Donations to the Library: Mining Journal for Oct. 10th, 1874;

Overland Monthly for November; Quarterly Journal of Microscopical Science for October, 1874; Magazine of Natural History, Oct., 1874; Proceedings of Society of Entomology of Belgium; Nature, Oct. 1st.

Two cones of the species of pine called *Sabiniana*, otherwise known as "wet pine," were presented by J. Begg, of Gilroy, through J. M. Willey. These specimens were found in the mountains back of Gilroy, and are peculiar for their symmetry.

Dr. Behr made some remarks on the *Eucalyptus globulus*. He had been informed by an Australian correspondent that the wood made excellent shingles, by reason of its non-inflammable characteristics.

A Recent Volcano in Plumas County.

BY H. W. HARKNESS, M. D.

From time to time, during the period between the years 1850 and 1854, vague rumors had been circulated that evidence of active volcanic action existed in the northern portion of Plumas County, and that strange lights had apparently been seen by different observers, which were referred to by them as the result of an eruption somewhere to the eastward of Lassen's Butte. As the Indians in the immediate vicinity were exceedingly hostile no effort appears to have been made to verify the correctness of these reports, and the subject seems to have dropped from the minds of men.

While traveling in Plumas County, during the past summer, I heard reports of the existence of a lava bed in the vicinity of Lassen, which bore traces of a recent upheaval, the central point of this disturbance being commonly referred to as the Cinder Cone. While camping in the neighborhood I had ample opportunity to make a pretty thorough examination of the locality.

This cone is marked upon the map as being within the limits of Lassen County. This, however, is a mistake, its true location being at a point which would place the whole, or at least the larger portion of the cone, with its outlying lava bed within the limits of Plumas.

Two lakes are laid down upon the State Geological Map as lakes Anna and Louisa; these lakes lie to the eastward and about twelve miles distant from Lassen's Butte, and are known to the residents in that portion of the State as Snag Lake (Anna) and Juniper Lake (Louisa). The Cinder Cone and lava bed which I refer to lie directly across the northern end of Snag Lake.

When viewed from the southern point of the lake—1½ miles distant—the lava bank rises directly from the water to the height of eighty or ninety feet, and extends across the whole breadth for a mile or more, with as regular a gradient and as sharp a definition as a railway embankment. The surface beyond is studded with a few abrupt elevations twenty or thirty feet high, while to the left rises a huge cone with a crater at its summit. On the eastern end this lava embankment turns abruptly to the north as it strikes the lake shore, and from this point the line extends in a northerly direction for a distance of one and a half miles, or more, when it strikes another lake, or as is most likely, what was once the lower end of Snag Lake. At this point the line turns sharply to the west, the lava dyke crossing the lake to its western shore, when it again deviates to the southwest, until it strikes the lake line previously described. Nearly midway, on the western side, the Cinder Cone rises abruptly from the border of the lava bed, one side of it resting upon the plain. It will be seen that, should my estimate prove to be correct, the entire circumference of the lava bed is between four and five miles. For the entire distance, except at the cone, the embankment rises from the plain or water eighty or ninety feet, at a sharp angle of about sixty degrees, and in no instance is there in this border the slightest trace of a lava flow to indicate that it was in a molten state when thrown out.

The surface of the blocks shows a bright metallic luster, the colors varying in different parts of the field from black to a reddish brown. On climbing to the surface of the lava it is found to be very irregular, with ridges and depressions alternately, forming a surface so uneven as to make it very fatiguing to walk for any distance upon it. Near the center of the field I observed a mass of lava which showed signs of having been in a molten state when thrown upon the surface; this was a somewhat narrow strip, a hundred feet or so in length, lying in a horizontal position, but slightly broken, and its rough, uneven, corrugated surface clearly indicating that it had been cooled by contact with the atmosphere. A few sickly-looking pine trees—a dozen or two at the most—were struggling for existence, wherever a little collection of burnt earth rendered such an existence possible. These trees were quite small, being only two or three inches in diameter.

As I before stated, the cone rises from the western side of the field. In making the ascent I selected a point to the southeast of the cone, as the side there rests against the lava, and its level of a hundred feet can be reached without much effort. From this point, however, owing to the loose and sliding material, the ascent proved a very severe task, far exceeding anything I had previously undertaken.

Barometrical measurement showed the summit of the cone to be six hundred feet above the plain at its base, the exact height, I believe, of that of Vesuvius. It possesses a well defined outer rim of some six hundred feet in diameter. Within the rim, after a descent of about sixty feet, a level bench is reached, on which one may walk entirely around the inner crater, which is funnel-shaped, and about ninety or one hundred feet in depth.

The crater exhibits no signs of having contained water. A few small willow twigs are to be seen growing within the outer rim. Judging from the appearance of the lava bed, as viewed from the summit, and the present condition of the material, it would seem that the present cone has thrown out but a small portion, if any, of the lava in view, but rather that it has been elevated by forces acting directly beneath the site it now occupies. The amount of ashes and pumice which have evidently been discharged from this cone is, however, amazing. In the immediate neighborhood of the cone the deposit is from twelve to twenty inches in thickness, and two miles away it is five or six. I traced this deposit for four or five miles to the southwest, and Obed Field, one of my guides, informed me that to the northwest it extends fully ten miles. To the eastward the deposit is not so extensive. Yet it is safe to say that a breadth of eighty or one hundred square miles has been covered by the ashes from this volcano. Small bits of pumice of the size of a bean are plentifully mixed with the deposit.

The ashes are of a dull gray color, differing in this respect from any other I had previously observed in the State; and as they offer but little resistance to the wind no signs of drifting are apparent, and they rest evenly upon the surface as they fell. My reasons for believing this volcano to have been of recent origin may be briefly stated. In Snag Lake, across which the dike of lava extends, there are several dead trees still standing, while on the lake shore are many trees and stumps battered and torn by ice, which have been driven upon the beach by the wind. This is notably the case upon the eastern border of the lake, where they may be counted by the hundred.

These facts clearly indicate that a large portion, at least, of what is now the bed of the lake has but recently been a forest, and that the presence of the lava has been the cause of the change in the level of the water. Again, along the borders of the lava bed there are a number of trees still standing with lava nearly or quite encircling them, their dead and blackened trunks furnishing incontestable evidence that the eruption occurred while they occupied their present positions.

To the west and northwest of the cone an open space exists of a hundred acres or more in extent, the trees upon which have nearly all disappeared. There exists, to my mind, the clearest evidence that the vegetation upon this tract was destroyed by the shower of hot ashes. The trees still standing are burned upon all sides, precisely as a green tree burns, a thin stratum of charcoal still adhering to the surface of the remaining wood. A few trunks have fallen, and they rest on the surface of the heavy ash, not partially buried in it. No traces are perceptible of fallen timber lying beneath the ash, as that would naturally have been entirely burned away.

I observed many concave depressions dotting this field of ashes. These depressions were from six to ten inches in depth and from one to four feet in diameter, with sides sloping towards the center. Where one of these occurred, on digging through the ashes I invariably found traces of a charred or decaying tree stump. In the forest beyond, the trees were invariably surrounded by a zone of ashes. Further evidence of this recent shower may without doubt be obtained by a thorough examination of the living trees in the vicinity. Many small cavities at the point where the branches are thrown off will yet disclose a store of ashes to reward the search.

A large number of trees still living in the adjoining forest show scars, and the new wood formed by the reparative process is apparently of but a few years' growth, although, as I had no ax, I was unable to verify this statement by count of the annular rings in the new wood. I had forgotten to state that there was one living tree in the field of ashes; but it has lost its top, and its scarred trunk indicates a desperate struggle for life.

I have endeavored to place before you this evening all, as I believe, of the more important facts upon which I base the supposition that this volcano has been in active operation within twenty-five years. Much of this evidence will soon disappear. The ice in another winter, perhaps, will have lifted the last tree from its place in the bed of the lake, the concave depressions in the ashes will gradually become less distinct, and the trees encircled in the stony embrace of the lava will soon decay; yet the characteristics of the volcano itself are so marked that it will, for a century to come, be recognized as of recent origin. I had traveled for weeks over a country every inch of which exhibited traces of volcanic action. Yet there always existed something to show that nature was endeavoring to repair the mischief which had been wrought. By disintegration the unsightly lava blocks were being converted into soil, on which vegetation was luxuriating and where animal life can find subsistence. I had climbed very many well wooded volcanic peaks to find that within the very craters large trees were growing, and the sides converted into grassy slopes. Here, however, the lava bed was as sharply defined as though it was a fortress in an open plain; and although surrounded on all sides by volcanic ruins, it appeared as fresh and new as though the creation of but a day.

Since my oral report to this Society four different gentlemen have furnished me with reports which, in my estimation, must be considered as corroborative proof of the existence of an active volcano about the period named. Dr. Wozencraft informs me that during the winter of 1850–51 he was residing at a point some distance above Red Bluffs, when he observed a great fire to the eastward of Lassen, which continued for many nights without change of position. The Doctor states that some of the observers expressed the belief, on the first night of its appearance, that it was the light from a large Indian camp-fire. The reappearance of the great body of flame for so many nights in succession, however, seemed to shake their faith in the camp-fire theory. The Doctor, at the time and since, has earnestly advocated the theory that the phenomenon was the result of a volcano in active operation.

Dr. J. B. Trask also states that at about the same period he was near Rich Bar, on the north fork of the Feather River. He, too, distinctly remembers the display for many nights in succession. From his point of observation the distance cannot be more than forty miles to the cone.

Mr. Charles Gibbes stated that he and a party of miners witnessed the same spectacle while at Angel's Camp, and referred it to an eruption of a volcano. Himself and comrades, in their estimate of the distance to the supposed volcano, placed it at 150 miles; in point of fact, it is about 160.

Mr. Henry Chapman, a member of the Academy, writes that during the summer of 1851 he resided for a short period at a wayside hotel near Georgetown, El Dorado County. One evening two prospectors arrived at the hotel, who stated that they had been since early spring in search of the mythical gold lake. They informed the company that they had traveled toward the north for a distance of more than two hundred miles without discovering gold. They stated that they had, however, discovered a boiling lake and a volcanic mountain, which "threw up fire to a terrible height," and a large breadth of country still on fire, as the result of an eruption. They stated further, that at one point they traveled for a distance of ten miles across a strip of country where the rocks were still so hot as to entirely destroy their boots, they losing a horse and one mule during the transit. They placed the location of the mountain at an estimated distance of 100 to 125 miles in a northerly direction from Georgetown. By referring to the new geological map of the State, it will be seen that the distance from Georgetown to the Cinder Cone I refer to is about 115 miles. If this statement can be relied upon, the burning country they mention must have been the belt of hot ashes which I have described.

The boiling lake referred to is doubtless one which is still in existence, it being located about eight miles to the south of the Cinder Cone.

It is oval in shape, and contains an area of a little more than four acres, with an elevation of 5,976 feet, and is surrounded by hills of 100 feet in height, broken only at one point by a fissure which admits the escape of surplus water. Around the borders of this lake I found a large number of mud cones, from one foot to four feet in height, formed of finely pulverized volcanic rock. These miniature craters were in a state of ceaseless activity, ejecting mud and sulphurous vapors.

The water of the lake itself was hot, of a creamy color, and the surface from time to time disturbed by the escape of gases from the earth beneath.

My guide informed me that the lake is much more tranquil than at the period when he first beheld it, ten or twelve years since; and, indeed, there exists abundant evidence to prove that this district is rapidly cooling. A mile or so to the south of the lake there is a geyser ejecting boiling water to the height of ten feet, and Field assured me that in former times the water was elevated to a height of twenty or twenty-five feet. While three or four miles to the westward there exists a huge geyser cañon with hundreds of springs still in action, yet there are many large cauldrons which have ceased action altogether.

S. C. Hartney read a communication, in the form of a memorial to the trustees of the Lick Estate, relative to the terms of the "Lick Donation," and asking for a modification of said terms.

Dr. Dall moved that the memorial be referred to the Trustees, with power to act. Mr. Dameron moved to amend this by appointing a committee of three to act with the Trustees. The amendment was carried, and the Chair appointed as such committee, S. C. Hastings, R. C. Harrison, and J. H. Smythe.

Pacific Coast Lepidoptera, No. 9. — Description of a New Species of Thyris, from the Collection of Dr. Hermann Behr.

BY HENRY EDWARDS.

Through the kindness of my friend Dr. H. Behr, I am enabled to present the following description of a new species of this very interesting group of insects, examples of which are contained in his collection.

The genus *Thyris*, though of wide geographical distribution, contains but few forms, and perhaps not more than five species are yet known to science. Of these, two are found in Europe, one in India, and two in the United States. The species now noted approaches very closely in coloration to the European forms, but is in many respects abundantly distinct.

Thyris montana. Hy. Edw. n. sp.

Head and thorax, light brown, with yellow reflection. Antennæ, palpi, and tongue, chestnut. Abdomen, yellowish brown, very glossy.

Primaries, tawny, palest at their base, with four waved brownish bands, the two basal narrow and very irregular in form, third broadest, notched inwardly, and spreading out to its greatest width on costa, where it incloses a small triangular yellow patch. Submarginal band, almost equal. On the disc is a minute, subovate, vitreous spot. Fringes, yellowish brown.

Secondaries, tawny, with brownish blotches. In center of the wing is a large vitreous patch, seemingly two oblong patches joined together. Fringes, yellowish brown. Underside, same as the upper, with the brown markings a little darker and the vitreous patches less distinct. Size of *T. lugubris*.

Rocky Mountains, Colorado. Two ♂ in collection of Dr. H. Behr.

Nearly allied to *T. fenestrata* of Europe, but differing by its paler color, and by the smaller size of the vitreous spots.

Specimens of *Thyris maculata*, Harris, are also to be found in Dr. Behr's collection, taken in the same locality as *T. montana*.

Lake Livingstone.

BY H. W. HARKNESS, M. D.

This lake, which has previously been visited only by a few hunters, is situated in the midst of mountains of high altitude, which flank Warner's Valley upon the north and Big Meadows upon the west. In general outline the lake is in the form of a triangle measuring one and three-fourths miles in its two greatest diameters. The barometer marked an altitude of 7,330 feet above the sea level, it being, as I believe, the most elevated of any body of water of such magnitude in the United States, although there are many lakes in the vicinity of a much greater elevation, but of less extent.

I failed to detect the least trace of fish, or, indeed, of any animal life whatever, except upon the northern shore, where in a sheltered inlet I discovered a colony of red cyclops.

The water in August was intensely cold, of a bright green color near the shore line, and a deep blue at a little distance from it.

Mountains of volcanic origin rise somewhat abruptly from the water, yet one may make the circuit of the lake without any difficulty, upon horseback.

The surplus water escapes from the southern extremity into Warner Valley over a sharp declivity of, I should say, more than two thousand feet. At this outlet I discovered specimens of *Spirogyra* and several other varieties of fresh-water *Algæ*. As this lake was comparatively unknown and without name, I gave it that of Livingstone.

On motion of Mr. Brooks, it was resolved that the lake in Plumas County described by Dr. Harkness be called "Lake Harkness" instead of "Lake Livingstone."

Regular Meeting, November 16th, 1874.

Vice President in the Chair.

Thirty-five members present.

Donations to the Museum: Wm. J. Fisher presented a collection of *Crustacea* from Japan and Sandwich Islands. Bradley & Rulofson presented photographs of Indian skulls. F. R. Cassel presented two fish (*Chaetodon*). W. C. Reiten, of Pittsburgh, Pa., donated a case containing a specimen of summer duck (*Anas sponsa*). W. G. Blunt presented a specimen of "Foolish Guillemot" (*Uria lomvia*). Dr. Harkness presented specimens of volcanic ash from the recent volcano in Plumas County, California. Charles P. Kimball donated two slates, on the surface of each of which a fungus (*Penicillium*) had grown, having the appearance of a delicate tracery.

Dr. J. G. Cooper stated that the bird presented by Mr. Blunt, called "Foolish Guillemot" (*Uria lomvia*) by the whalers, was the first of the kind obtained on the California coast. It is common in the Arctic Ocean, and the far north Atlantic, and has been doubtless driven so far south by unusually cold weather. He also stated that Mr. Gruber has lately obtained here the first California specimen of the "Arctic Skua," (*Stercorarius parasiticus*) another evidence of severe weather approaching. The interior papers, about two months since, noticed also the uncommonly early arrival of the wild geese from the north. The unusual amount of rain already fallen is an evidence of cold weather northward, though we have not felt it here, as the upper current of cold north winds condenses the moisture brought to us by the warm south winds. These facts should be recorded, and we may find the "Foolish" Guillemot really a very weatherwise bird.

Description of a New Species of Shell from San Francisco Bay.

BY DR. W. NEWCOMB.

Mya Hemphillii.

Shell, oblong, nearly equivalve, moderately gaping at each extremity, thin, opaque or translucent, white, with margin covered with a light yellow epidermis. Valves, rounded anteriorly, cuneate posteriorly, finely striate transversely and longitudinally, near the extremities becoming coarsely striate; obsoletely transversely rayed with an opaque white. Umbones small, depressed, approximate; hinge-line, arcuate. Left valve, with a spoon-shaped tooth, posteriorly bifid; right valve, excavated for insertion of the ligament, and furnished with a small rudimentary tooth in close apposition with the ligament.

Length, 2 1-10 inch.

Breadth, 1 3-10 inch.

Depth, ¾ inch.

Hab., Bay of San Francisco.

REMARKS.—This shell was discovered by H. Hemphill, Esq., to whom the scientific world is greatly indebted for his extensive researches on our coast and in the interior of our country. The only species with which it can be confounded is the *Mya præcisa* of Gould, which Dr. Carpenter considers as identical with *M. truncata* of the Northern Atlantic.

A specimen of *M. arenaria*, from Puget Sound, in my collection, is quite distinct from this species, and, like many of the circumpolar species, is common to the North Pacific and North Atlantic.

It is quite distinct from the fossil *M. Montereyi*, Conrad, as I am informed by Dr. Cooper, who kindly made for me the comparison of this shell with Conrad's figure and description.

On the Composition of some of the Grapes grown in California, in relation to their Fitness for making Wine.

BY JAMES BLAKE, M. D.

Having while in El Dorado County tasted some wine which evidently was superior to anything I had before tasted as the production of our State, I inquired of the maker the variety of grape from which it was produced, and found that it had been made principally from a grape known in this country as the Zinfindel. Since my return I have made an analysis of the juice of this grape, and also of some others, which are now being propagated for making wine. The grapes were grown at the vineyard of the Vinicultural Society at Sonoma, and were all apparently perfectly ripe. The varieties analyzed, besides the Zinfindel, were the Reimer, a large white grape, the Riessling, also a white grape, and the Mission grape. The method of analysis was to take a portion of the juice, heat it, to coagulate the albuminous matter, filter through a Bunsen filter, and after bringing the juice to the original quantity, to neutralize with a standard solution of potash or ammonia, so as to ascertain the total amount of free acid. Another portion of the juice was evaporated to about one-third, mixed with alcohol and ether, to precipitate the tartrates, and the alcohol and ether distilled off from the filtered juice, which was then neutralized, to ascertain the amount of free acid. The amount of sugar, as indicated by the sp. gr., was controlled by direct analysis of a portion of the juice, cleared by acetate of lead, by means of Fehling's copper test, and the result thus obtained is that recorded:

	Sp. Gr.	Sugar.	Free Acid.	Malic Acid.
Zinfindel	1072	16.6	1.73	0.60
Reissling	1083	18.7	1.10	0.57
Reimer	1057	14.0	1.30	0.80
Mission	1088	21.5	0.60	0.11

As there can be but little doubt that the development of the ethereal substance, on which the aroma of wine depends, is owing to the presence of free acid, and more particularly, I believe, of free malic acid, the above figures explain the cause of the absence of aroma from the wine made from the juice of the Mission grape; for while the three varieties of foreign grapes analyzed contain respectively 60, 57, and 80 parts of malic acid to 10,000 parts of juice, the Mission grape contains but 11 parts. The presence of this comparatively large portion of malic acid in grape juice is a fact which has not, I think, received the attention it deserves. I believe the acid itself splits up into an ether and an alcohol, and this independently of its action on the alcohol already found in the wine. Wislicenus has shown that lactic acid forms an ether, even when being dried at ordinary temperatures, over sulphuric acid, and alcohol is one of the products of the fermentation of malic acid. There would seem to be enough potash in the grape juice to form, with the tartaric acid, the slightly soluble bitartrate of potash, as after this has been precipitated by alcohol and ether, and the juice then nearly neutralized with potash, no more bitartrate is thrown down by again mixing the juice with alcohol and ether, but malate of potash separates as a thick, syrupy deposit.

These figures, as far as they go, give, I think, a satisfactory explanation of the superiority of the Zinfindel as a wine-producing grape, and fully bear out the conclusions I expressed some fourteen years ago in a report I drew up as one of a committee for examining the wines at the Agricultural State Fair at Sacramento, in 1860. As these remarks contain suggestions which, I think, will be useful to our wine-growers, I shall offer no apology for quoting them. After pointing out the great advantages, as regards climate and soil, found in our State for cultivating the grape, and which, I believe, insure its being the finest wine-producing country in the world, I remarked on the imperfect manner in which these advantages had been utilized by our wine-growers, as indicated by the quality of the wines exhibited, and pointed out what I then considered to be the cause of our want of success, observing: "In view of these facts, your Committee believe that they are authorized to call the serious attention of our wine-growers to the necessity of an early introduction into this country of varieties of foreign grapes, which appear to possess those qualities which are wanting in our own, or in other words, which contain less sugar and more free acid." After mentioning some of the varieties of European wine grapes which possessed these qualities, I remarked: "It is highly probable that the grape now cultivated in this State is about the worst that could be selected for making a first-class wine." The truth of this remark is now being realized by our wine-growers, who are replacing as fast as possible the Mission grape by foreign varieties; for it is found that even where a portion of these foreign grapes are used in the manufacture of the wine, it commands a much higher price than that made with the Mission grape. I believe that either of the foreign varieties which I analyzed is capable of making a good wine when the soil and climate to which it is most suited are properly selected.

Of the necessity of paying some attention to the selection of the variety best suited to the very marked varieties of our soil and climate, I quoted the following remarks of Mr. Rendu, Inspector General of Agriculture in France, and author of a work on the vineyards of that country. After describing 144 varieties of grape that are grown for making wine, he says: "Almost every variety of soil is found in our more celebrated vineyards, and appears able to furnish a superior wine when the variety of grape cultivated has been well selected, that is, when it is perfectly appropriate to the soil and climate. The choice of the proper variety of grape that will suit the soil and climate is, after all, the great secret for obtaining superior wines in a climate where the grape flourishes." That so little success has, up to the present time, attended the efforts of our wine-growers to produce a first-class wine, is not surprising, when we consider that not only have they been working with probably the worst grape for the production of such a wine, but have been endeavoring to make the same grape produce good wine in the moist alluvial soil of Los

Angeles and in the heated volcanic hills of the Sierras.* A long experience, however, will be required to discover the most appropriate varieties of grape suited to our varied conditions of soil and climate.

As showing the influence of soil and climate on the qualities of the grape, it is interesting to compare the analysis of the same variety of grape when grown in Germany with those grown here. In Watts' chemical dictionary I find an analysis of the juice of the Riessling, made in Germany, by Fresenius. The quantity of sugar is there given as 15 per cent., and of free acid as 0.53 per cent., while here the juice contains 18 per cent. of sugar and 1.10 of free acid, or three per cent. more sugar and twice as much free acid. Should the presence of the free acid influence the quality of the wine in the manner I have pointed out, it is evident that the Riessling may make a superior wine here to that made from it in Germany, that is, when grown in the localities which suit it.

On a New Species of Alcyonoid Polyp.

BY WILLIAM J. FISHER.

Genus: *Virgularia.* Lamarck.

Virgularia ornata, Fisher, n. sp.

Axis cylindric, slender, calcareous, smooth, and of a bright orange color.

Polyps arranged generally in disconnected groups of seven, but sometimes in clusters of six and eight, and following the axis spirally.

The groups occupy alternate positions upon the polypidom, as will be seen when the latter is viewed in profile, and they are not always equidistant one from another.

Polypidom of a faint flesh color, slightly enlarged in central portion, and gradually tapering towards either end. Above the termination of the axis—which is falciform and naked at its lower extremity—the polypidom assumes an elongated bulbous form, gradually decreasing above to a size not much larger than the axis, until it meets the undeveloped polyp group.

Length of axis, 4.30 inch.

Entire length of polypidom, 3.40 inch.

Length of bulbous portion from base to where polyp-rows commence, 0.65 inch.

Length of portion occupied by polyp-rows, 2.75 inch; but the polyps are most conspicuous on the upper half of polypidom.

These polyps were dredged by me in Hakodade Bay, Japan, in seven fathoms, muddy bottom, and were only obtained in one single cast, although I dredged the bay very thoroughly.

In conclusion, I would express my sincere thanks to Dr. Harkness for his valuable assistance in the microscopical examination of the above species.

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* I would observe that the Zinfindel, from which the wine I tasted was made, was grown near Coloma, and I believe on a soil of decomposed granite.

The Eocene Epoch in California.—Are there Really no Eocene Strata?

BY DR. J. G. COOPER.

In describing the miocene formations of California, I made the remark that no positively eocene fossils had been found here, either marine or terrestrial, indicating a wide gap in the early tertiary age. Two explanations of this have been suggested. One is, that the land embraced in our limits was entirely above the ocean during that epoch, so that no marine deposits could be formed on it. But, if so, the land must have been so extensive that it would almost certainly have had a fauna and flora, like those so richly stored up in the Rocky Mountain eocene, and traces of them would surely be found fossil.

The second theory is, that the present dry land was then sunk so deep beneath the ocean that such marine animals as live near the shores, and have furnished most of the fossils in other formations, could not exist, or that the rapid sinking of the rich cretaceous shores caused so rapid a deposit of sand and mud to accumulate, that marine animals could not flourish. There is some proof that this might have been the case, in the fact that we find great thicknesses of shales and sandstones, above the so-called cretaceous fossils, with no fossils in them except obscure marks, like tracks or burrows of marine worms and casts of seaweeds. If sunk very deep, we should find, however, some of the chalk-forming protozoa, still living in the bed of the Atlantic, which are so abundant in the Old World.

Another cause for scarcity of organic life in these beds is suggested in the greater prevalence of volcanic action on the shores of the Pacific than of the Atlantic, by which, during periods of rapid subsidence, the water was probably heated or poisoned through vast extents of the ocean.

I have before stated the evidence to show that, during the miocene and pliocene epochs, California was constantly rising above the sea, and we have evidence also that this rise was commenced in the cretaceous, from the existence of coal-beds referred to that age, in the strata adjoining to which we find fossil land-plants, and trunks of trees. But as the cretaceous elsewhere was an age of almost general subsidence of the continents, we might rather suppose that after the burying of these coal-beds beneath strata of marine formation, the land would rise still more extensively than before, and, as in Europe, we would have a grand terrestrial eocene fauna, with comparatively narrow deposits of marine fossils along its shores. We find, however, that the old geological divisions of time, founded on studies in Europe, are still less applicable here than in the Atlantic States, and there is reason to suspect that while the great and complete change from the cretaceous to the tertiary ages was occurring there, this Coast was undergoing a very gradual transmutation, with only partial extinction of the cretaceous life, or an evolution of the tertiary therefrom.

The evidence is so far derived from only a few marine fossils which have been referred by different authors to the cretaceous, the eocene, and the miocene.

Conrad, the Nestor of American palæontologists, over twenty years ago, described as unmistakably eocene, a group of fossils, now known as the Tejon group, among which he thought was the *Cardita planicosta*, "that finger-post of the eocene, both in Europe and America." Mr. Gabb, finding from better specimens that this shell differed from *Cardita planicosta*, described it as new, and referred the Tejon group to the cretaceous, finding in it a very few species which he considered identical with the lower beds, proved to be cretaceous by the presence of numerous ammonites. He also stated, in an article in our Proceedings, published November, 1866, that "a solitary ammonite, represented by half a dozen specimens, has been found by myself *in place*, even to the very top of the formation." This slender evidence (which might be rejected after finding a carboniferous fossil in a pliocene deposit) is all the proof we have of the Tejon beds being cretaceous; and that it is quite arbitrary is shown by the other fossils found with it being nearly all different from the lower ones, less than one-tenth of the cretaceous shells being common to both according to Gabb, of which several *may be* distinct. On the other hand, many of the Tejon group are scarcely distinguishable from tertiary and living forms. One, *Aturia Mathewsonii*, is so near the eocene *A. zigzag*, as to have been taken for it, no other cretaceous *Aturia* being known.

I may add that the ammonite (*A. jugalis*, Gabb) was found by me in a stratum just beneath the Mt. Diablo coal, and apparently on the same level as those from Clayton and "Curry's," found by Gabb, so that its existence above the coal, or in the Tejon group itself, is perhaps accidental. But, to pass by this doubtful era, we have still later strata, referred to the eocene by Conrad, near the mouth of the Columbia, where we would expect the first tertiary to rise near the surface, and this time the eocene *Aturia zigzag* again appears, though with a different group of shells. Mr. Gabb, while admitting that this time it is the true *zigzag*, is so opposed to recognizing any eocene here, that he calls the formation miocene! The general character of these fossils, of which there are several in the Academy's Museum, shows, however, that they are of a more tropical group than any of our miocene species, the *Aturia* itself being very similar to the *Nautili* now living in the tropics. Though perhaps mixed with miocene species among the broken rocks so numerous on the lower Columbia shores, it is most probable that true eocene strata exist there, and, as shown by the Academy's specimens, extend south nearly to California, where later strata cover them. From all we yet know, we may assume that the gap between the cretaceous and tertiary, so marked on the Atlantic shores, was bridged over in part by the existence here of the "Tejon Group," continuing cretaceous forms of mollusca down so as to be contemporaneous with the eocene epoch there, or the earlier part of it, just as we find the flora and fauna of Australia resembling forms fossil in the eocene formation of Europe, but continued to the present epoch. After, perhaps, a short geological period of convulsions and death, we find the eocene mollusca appearing in Oregon, just preceding the miocene, nearly like those of the Atlantic basin.

Though I cannot speak positively on the subject, my impression is that the plants found fossile in our coal measures are of a more temperate group than those of the cretaceous coal beds of Vancouver Island, which, if so, will be good evidence of their indicating a newer age.

Have the poles changed? 1. It will appear, from the preceding remarks, that it is not necessary to suppose a change of the poles to account for the absence of eocene fossils in California; but I still believe that the existence of tropical and temperate groups of beings within the Arctic circle, from the miocene back to the carboniferous age, proves either such a change, or the existence of some light-giving medium there in those ages, of which we have no knowledge. It is easy to account for a hot climate there, either by supposing the internal heat of the globe to have been greater, and the amount of radiation less, or by the existence of hotter regions of space through which the solar system was then traveling, but that alone could not produce the vegetation found there.

2. An increase in the obliquity of the earth's position in its orbit could only present each pole alternately to the sun, though more directly than now, so that, while each hemisphere would have six months of greater heat and constant light, they would also have six months of greater cold and darkness.

3. Juding from what we know, a vegetation so much like ours could not exist in a climate very different from ours, for we find entirely different vegetation in regions both north and south of us, having comparatively similar climates. A duration of day or night, for months, would be as great a change as one of many degrees of temperature. A four-months night, with warm climate, would either blanch or decay nearly all growth above ground.

4. The objection that the flattening of the poles proves a permanent position of the earth's axis, although now true, if the earth is nearly solid, need not have been so when it was semi-fluid in the interior, with a thinner crust. Even now, if the earth was to stop revolving, the water must run from the equator towards the poles, and cover them deeply enough to restore nearly the perfect spherical form, at the same time uncovering much of the land now submerged in the tropics. The flattest parts of the sphere would then be the deep bed of the ocean in or near the tropics. The difference between them and the summit of the Andes or Himalayas, is nearly as great as that between the convexities at the poles and the equator.

5. The objection that no cause is known that could produce a change in the earth's axis, is answered by the geological evidence of periodical changes in the elevation of the land, amounting to many thousand feet, which must, it seems, cause a change in the center of gravity of the earth, and a consequent shifting of its axis, not to mention the disturbing effect of the attraction of asteroids, etc.

6. Astronomical observations, extending back only about 4,000 years, may prove that no perceptible change has occurred since then, but cannot concern preceding ages. The earth's present oblique position is itself good evidence that the distribution of land and water has disturbed its axis from a position in which the equator would be always turned directly toward the sun, as in our semi-annual equinoxes.

Regular Meeting, December 7th, 1874.

Vice President in the Chair.

Forty-seven members present.

Donations to the Museum: Dr. Hudson presented four fossils fron Grayson, Stanislaus County. Dr. J. G. Cooper presented specimens of *Crustacea* from Monterey. The Alaska Commercial Company presented a number of shells from Unalashka. W. G. Blunt presented a collection of eggs of California and European birds. Wm. Russell donated specimens of pyrites of iron, found in a piece of West Hartley coal. R. H. Floyd presented fossil bones found in an ancient river bed, 500 feet below the surface, in the blue gravel mines of Placer County.

J. R. Scowden and Horatio Stone were proposed as candidates for resident membership.

Note on Tertiary Formation of California.

BY J. G. COOPER, M. D.

Since making the remarks on the coal and tertiary formations of California, I have obtained the new edition (1874) of Dana's "Manual of Geology." The learned professor, acknowledged leader of American geologists, goes even further than I do in bringing down the age of our Mt. Diablo coal strata in the scale of geological time, for he considers them as belonging to the lignite era of the eocene, as well as that of the Rocky Mountains. Although in both cases there are some cretaceous fossils found in or above it, he considers the presence of lignite as more important, especially as showing the existence of a decidedly tertiary vegetation. He believes that the cretaceous mollusca continued down into the eocene epoch, there having been no important convulsion to destroy them until the middle of the eocene on this side of the continent. This is a confirmation of my statement that there is here a "bridging over" of the gap between the two formations so marked on the Atlantic shores.

Pacific Coast Lepidoptera, No. 10.—On a New Species of Papilio from California.

BY HENRY EDWARDS.

The species of *Papilio* composing the group of which *P. Asterias* and *P. zolicaon* are the best known forms, appear to have obtained their largest representation on the Pacific Coast, as the whole of those known to science, with the exception of *P. Bairdii*, from Texas, are found more or less abundantly from Alaska to the shores of the Gulf of California. That these insects are apt to run into varieties there can be but little doubt, and it has not been without some misgivings that I have ventured to add another to the list. I have, however, carefully studied all the examples in my collection, and can only arrive at the conclusion that I am justified in describing the following as a distinct species:

Papilio Pergamus. Hy. Edw. nov. sp.

♂. Antennæ and head dull black. Thorax, black, with the patagiæ rather dark yellow, orange anteriorly. Abdomen black, with a yellow lateral stripe, becoming obsolete towards the base. Feet and legs entirely black.

Primaries. Rich velvety black, as in *Asterias.* A row of eight cream-yellow sub-marginal spots, of which the one nearest the apex is the largest, and almost round. The second is also nearly round, the remainder becoming somewhat lunate, the last produced into a point posteriorly. The macular band is composed of eight spots, the smallest nearest the costa, and gradually increasing in width to the interior margin. The first spot is oblong, the next five are angular, the seventh is in the form of a parallelogram, and the eighth is a longitudinal streak. Within this band, and closely approaching the costa, is a small angular patch, and a very few yellow scales are visible in the middle of the discal cell, and near the base of the wing. Fringes black, with indistinct white patches between the nervules.

Secondaries. The macular band is wider than is usual in *Asterias*, and perfectly straight on its inner edge, so that when the wings are spread, the band of both wings presents a nearly uninterrupted straight line from the costal nervure of the primaries to the anal margin of the secondaries. The first two spots near the costal margin of secondaries are almost square, slightly notched exteriorly. The third is oblong, divided by the discal nervule. Spots four and five are somewhat angular, produced a little outwardly, thus destroying what would otherwise be a perfectly straight band. The sixth spot is almost a parallelogram, and the seventh is nearly lunate. The submarginal spots are five in number, the first near the costa a mere dot, the second almost oval, and the other three lunate. Margins of the wing broadly notched, emarginations yellow. Tails, wholly black, as long as in *Asterias*, but slightly narrower. Anal spot, large, black, with iris fulvous anteriorly, yellow posteriorly. Between the macular band and the submarginal spots are some bluish scales becoming, as in all allied species, quite obsolete towards the costa, the most distinct being that which surmounts the anal ocellus.

Underside. Similar to the upper, except that the black is duller and less velvety, and the whole of the spots less yellow in color. The blue scales are more regularly defined, and approach the costa, where they are joined by the first submarginal spot, which is here bright fulvous.

Expanse of wings, 3.20 inch.

Length of abdomen, 1.25 inch.

This beautiful insect is closely allied to *P. Indra*, Reakt., but differs from that species by the greater width of the band of the secondaries, by the black anal ocellus simply surmounted with fulvous, and by the length of the tail, which, in *P. Indra*, is spoken of by both Messrs. Reakirt and Strecker as a mere tooth. In Mr. Strecker's drawing of the species, it is represented as shorter than that of *P. brevicauda*, whereas in the present species the tail is quite as long (though perhaps a little narrower) as that of *P. Asterias*. In a ♂ specimen of *P. Indra*, which I received from the high Sierra of Tuolumne County, there is also a decided yellow line on the outer edge of the discal cell, which is nowhere visible in *P. Pergamus*. The latter is also a little larger in size. I am indebted for this most interesting addition to our insect fauna to the late G. R. Crotch, who took one specimen in excellent condition near Santa Barbara, in May, 1873.

I am inclined to believe that *P. Aliaska*, Scud., is identical with *P. Hippocrates*, Feld., from Japan, as between some specimens of the latter in my cabinet, and one of *P. Aliaska*, taken by myself at the Dalles, Oregon, I can perceive no difference whatever. *P. Hippocrates* is stated by Kirby, and other European entomologists, to be only a variety of the European *P. Machon*. This appears to me to be an error, as in a long series of each the points of variation are quite easily distinguished, the shape of the lower wings being a permanent character. They appear to bear the same relation to each other as do *P. Turnus* and *P. Rutulus*. I have little doubt that *P. Asterioides*, Reakt., is the tropical form of *P. Asterias*, Cram.

The species may be thus tabulated :

A.

Macular band of secondaries extending to the base of the wing.

1. Band of primaries narrow on internal margin. Abdomen black, with yellow lateral line.......................... *P. Zolicaon.*
2. Band of primaries very wide on internal margin ; abdomen yellow, with black dorsal line.......................... *P. Aliaska.*

B.

Macular band of secondaries narrow. Base of wing black.

a. Band bent inwardly on secondaries. Abdomen spotted.

1. Tails very short.................................... *P. brevicauda.*

2. Tails long, band of secondaries narrow, fulvous beneath.....*P. Asterias.*
3. Tails moderate, band of secondaries broad, particularly at anterior margin ; underside without fulvous spots....................*P. Bairdii*

b. Macular band perfectly straight on inner edge. Abdomen with yellow lateral line.

4. Tails very short....................................*P. Indra.*
5. Tails long....................................*P. Pergamus.*

I have derived the specific name from Virgil's "Æneid," thus translated by Dryden :

"With eager haste a rising town I frame,
Which from the Trojan Pergamus I name."

—*Æneid, Book III.*

S. C. Hastings read a paper on "The Coming Earthquake"; also one on small mounds of Pacific plains and valleys.

Regular Meeting, December 21st, 1874.

Vice President in the chair.

Thirty-two members present.

Jeremiah Clark was proposed as a candidate for resident membership.

Donations to the Museum : Specimens from the Sulphur Banks, Lake County, Cal. Case of alcoholic specimens from Alaska, from Dr. Jones. Three cases containing specimens taken in deep sea soundings from the U. S. steamer *Tuscarora*, presented by Admiral Rogers, by authority of Commodore Ammon, being the material collected by Wm. J. Fisher, of the *Tuscarora* expedition, under Commander Geo. E. Belknap.

A Device for the Solution of the Problem of Lengthening the Pendulum of an Astronomical Clock without Stopping or Disturbing its Vibrations.

BY T. J. LOWRY.

The mechanism of the astronomical clock, which has so greatly contributed to the accuracy as well of astronomical observations as of the determinations of longitudes, has been carried to a degree of wonderfully delicate perfection. Its correction for varying temperatures has been so complete, and its rate so uniform, that the astronomer has hitherto thought best to let it run without disturbing it by attempting to adjust the length of the pendulum, even though it was uniformly gaining or losing on the time it was desired to keep. Yet the very great inconvenience, to the practical astronomer in the observatory, of having his clock show a different face time from that given by the ephemeris, and the still greater reluctance to stopping his clock when once set going, have awakened the ingenuities of astronomers and artists to devise a means of lengthening and shortening the pendulum without disturbing its vibrations. And success had half crowned their efforts—by fixing a small funnel on the face of the pendulum and dropping small shot into it they succeeded well in shifting the center of gravity up towards the point of suspension, and thus shortened the pendulum without stopping or essentially disturbing its vibrations. But when they attempted to lengthen the pendulum, by extracting shot from the funnel, without disturbing its vibrations, they were baffled in their every effort. To drop the shot into the funnel was easy enough, but to get them out—that was the question. With a pair of ordinary tweezers and various other mechanical devices they attempted to lift out the shot, but these all disturbed the vibrations of the pendulum, and hence were inadequate. Seeing this difficulty, it occurred to me that if instead of using the small lead shots we used iron shots we could pick them up with a magnet: in fact, they will pick themselves up and jump to the magnet if it be held in close proximity to them. Of course, the magnet should be of small diameter and not very powerful, so as to avoid picking all the shot out at once, or essentially disturbing the vibration of the pendulum by its attraction. Thus, we see, gravity aids us in shortening the vibrating pendulum, and magnetism assists us in lengthening it.

This, I believe, will be found a solution of this problem, as effectual as it is simple.

The Nominating Committee appointed by the Council and Trustees in joint meeting, reported as follows:

The Nominating Committee appointed by the Council and Trustees of the California Academy of Sciences, to prepare a ticket for officers to act during the ensuing year, respectfully present to the members of the Academy the following names:

Trustees: David D. Colton, Thomas P. Madden, George E. Gray, John Hewston, Jr., Robert E. C. Stearns, Ralph C. Harrison, William Ashburner.

President, George Davidson; First Vice President, Henry Edwards; Second Vice President, Henry Gibbons, Sr.; Recording Secretary, Charles G. Yale; Corresponding Secretary, Henry G. Hanks; Treasurer, Elisha Brooks; Librarian, William J. Fisher; Director of Museum, Albert Kellogg.

[Signed] H. F. CUTTER,
J. H. STEARNS,
J. H. SMYTHE,
S. C. HASTINGS,
W. G. W. HARFORD.

The report was adopted and the Committee discharged.

On motion, Henry Chapman and J. H. Smythe were elected Judges of Election.

On motion, John Curry and J. D. Pierson, were elected Inspectors of Election.

INDEX OF AUTHORS.—1873-1874.

GENERAL INDEX.

ERRATA.

Page 58, seventh line from end of third paragraph, for "Voluti" read Voluta.

Page 112, twenty-first line from top of page, for "CTEUNCHA" read CTENUCHA.

Page 292, second line, for "*Jamaicaii*" read *Jamaicana.*

Page 292, third line, for "Tanajer" read Tanager.

Page 292, second paragraph, second line, for "*Avicenus*" read *Avicenia.*

Page 301, second paragraph, first line, for "Mussell" read Missell.

Page 301, second paragraph, third line, for "*Paraus*" read *Parus.*

Page 312, second line from bottom, for "Terrebratulina" read Terebratulina.

Page 324, second paragraph, fourth line, for "*musicans*" read *musicus.*

Page 324, second paragraph, sixth line, for "*Psitacula*" read *Psittacula.*

Page 324, second paragraph, seventh line, for "*Rhamphocilis*" read *Rhamphocelis.*

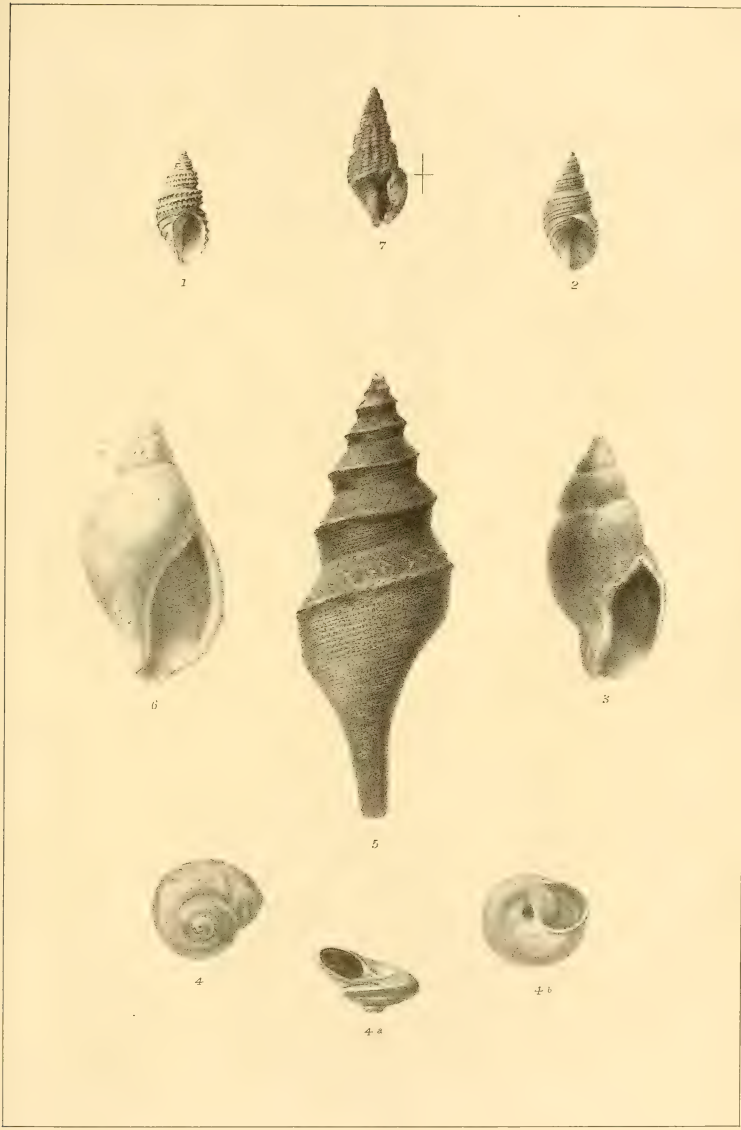
Page 338, sixth line, for "*Verillia*" read *Verrillia.*

Page 338, fifth line from below, for "*eccentricus*" read *excentricus.*

Page 346, seventeenth line, for "*vomarina*" read *vomerina.*

Page 346, fourth line from below, for "*albiola*" read *albeola.*

NEW SHELLS OF THE WEST COAST OF N. AMERICA.



NEW MOLLUSKS FROM THE COAST OF ALASKA.

ANISEA AUREA, KELLOGG.

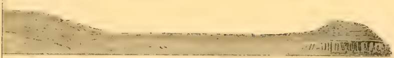
[SEE PAGE 83.]

LILIUM BLOOMERIANUM V

[SEE

LILIUM BLOOMERIANUM VAR. OCELLATUM, KELLOGG

[SEE PAGE 89.]



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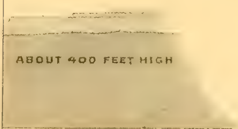

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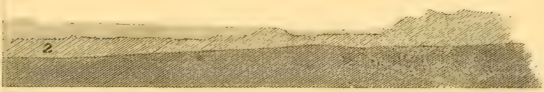

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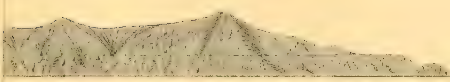


930 FEET HIGH.

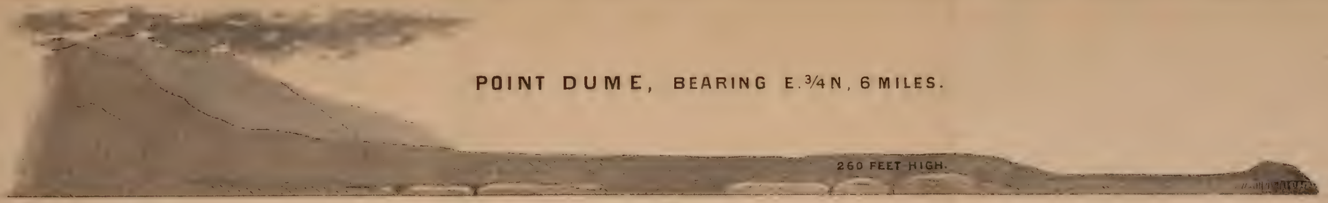
Pt FERMIN.

Pt VINCENTE.

E. 1/4 SOUTH

ABOUT 18 MILES DISTANT.

POINT DUME, BEARING E. 3/4 N, 6 MILES.



VALLEY OPENING ON COAST SOUTH OF TODOS SANTOS BAY (LOWER CALIFORNIA.)

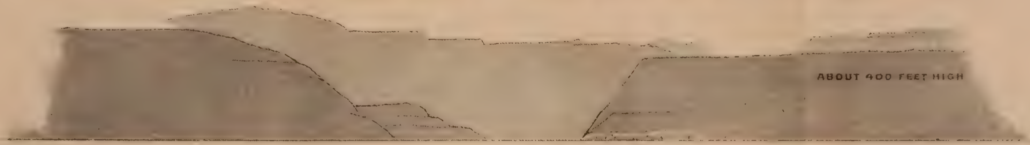
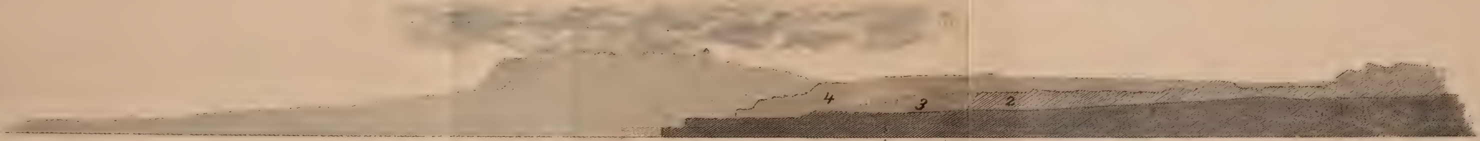
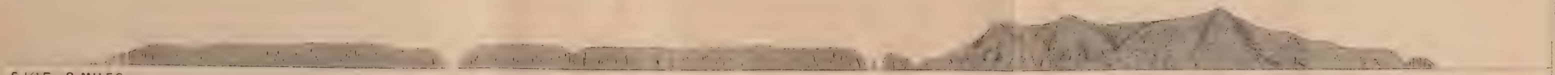


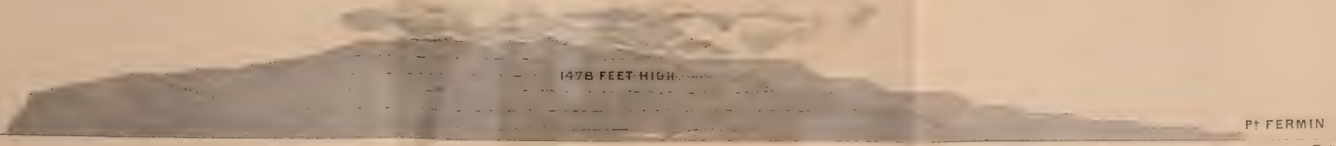
TABLE POINT NORTH OF TODOS SANTOS BAY (LOWER CALIFORNIA.)

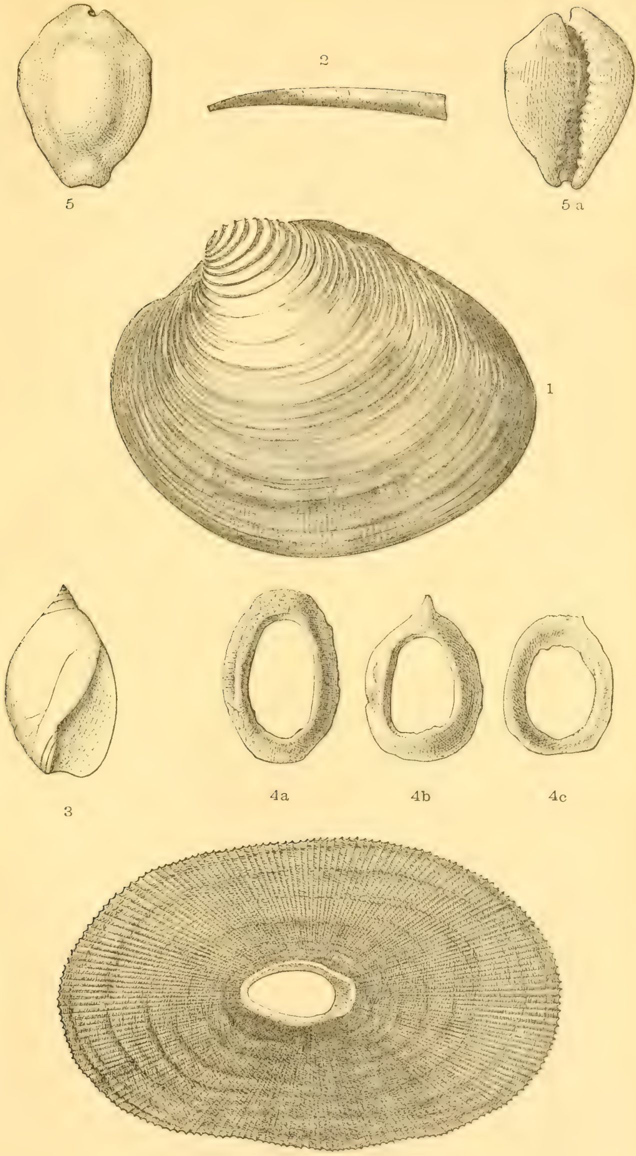


ISLAND OF ANACAPA, CAL.



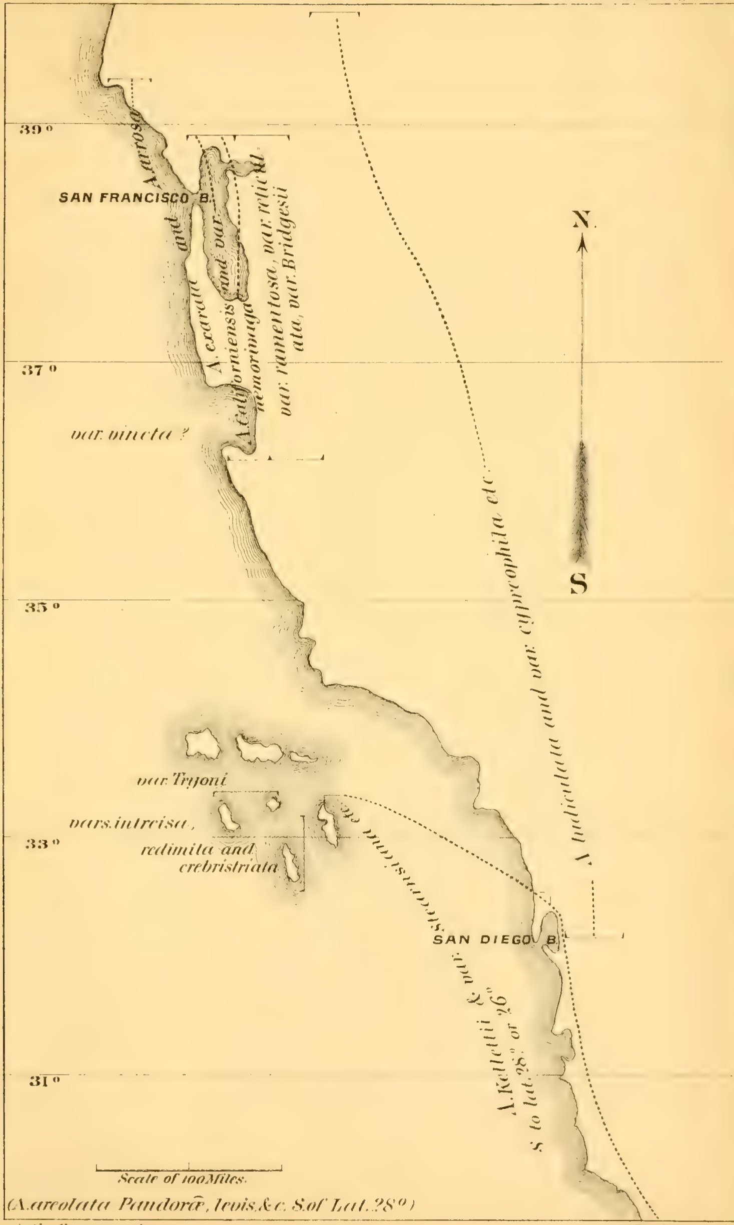
SAN PEDRO HILL.





ABORIGINAL SHELL MONEY.

[SEE PAGE 113.]



J. G. Cooper del.

LITH. B. & R. S. F.

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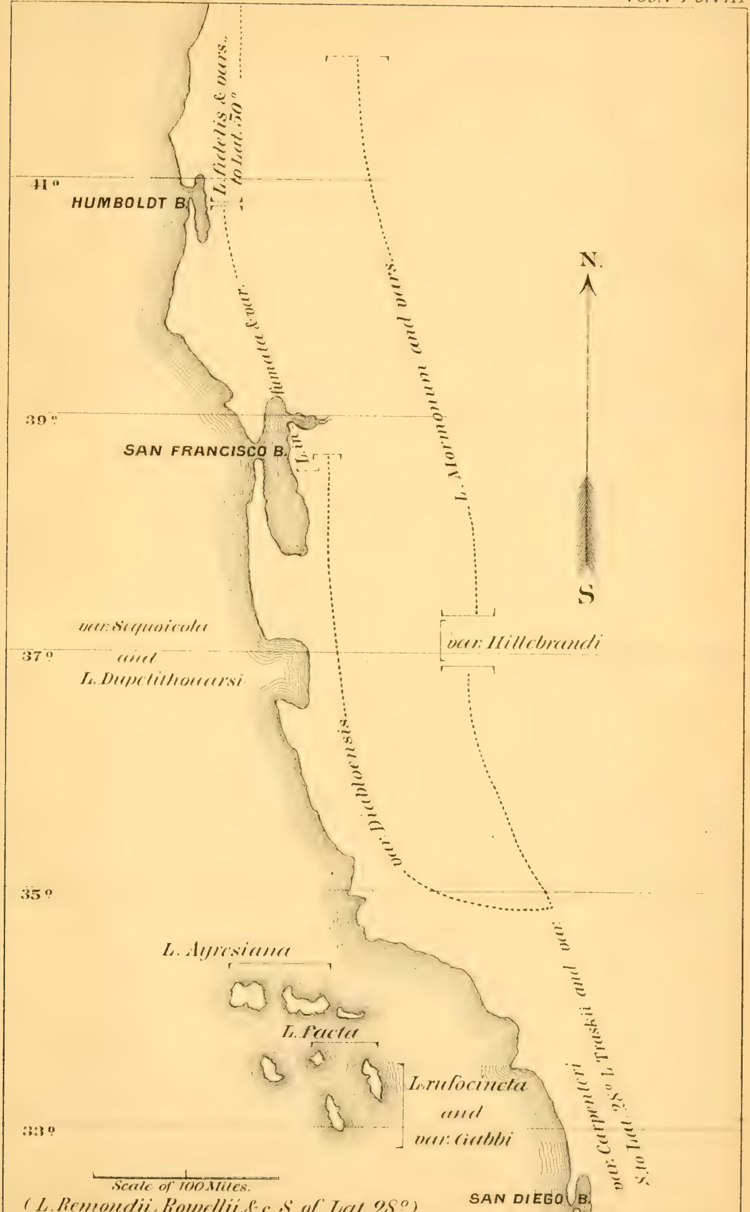


J. G. Cooper del. LITH. B.& R. S. F.

DISTRIBUTION OF LYSINOE, COOPER

INDEX TO PLATE IX.

FIG. 1.—Verrillia Blakei; Stearns. General aspect; one-twelfth natural size; from Dr. Blake's specimens.

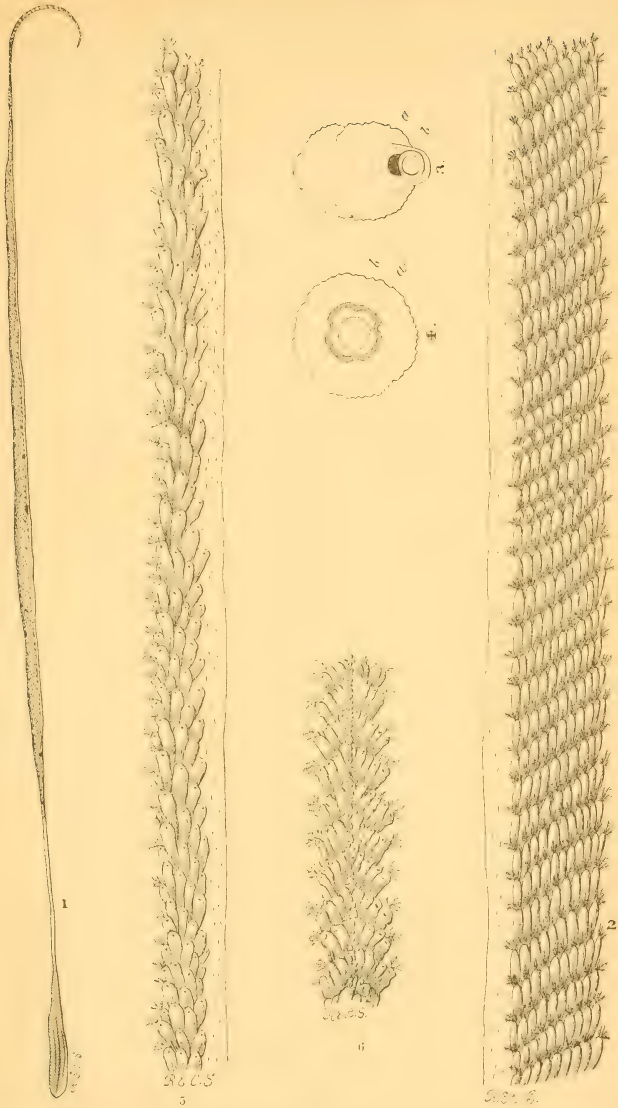
FIG. 2.—Section of Polypiferous portion of one of the largest and most crowded specimens. Natural size.

FIG. 3.—Cross-section through Polypiferous part; *a*, principal longitudinal canal; *b*, axis.

FIG. 4.—Cross-section through basal part; *a*, canal; *b*, axis.

FIG. 5.—Section of Polypiferous portion of a smaller and less crowded specimen, received from J. S. Lawson, Esq. Natural size.

FIG 6.—Section of above; (Fig. 5) showing chevron-like arrangement of Polyp-rows, opposite the axial-side. Natural size.



VERRILLIA BLAKEI, STEARNS

[SEE PAGE 147.]

1 Anamesite.	5 Diabase.	9 Anamesite.	13 Anamesite.	17 Sedimentary Deposits.
2 Anamesite.	6 Anamesite.	10 Labrador Porphyry.	14 Porphyritic Obsidian.	18 Trachyte.
3 Anamesite.	7 Basalt.	11 Anamesite.	15 Vesicular Trachyte.	19 Porphyry.
4 Basalt.	8 Diabase.	12 Basalt.	16 Anamesite.	20 Schists.

The Plate represents only a plan of the order in which the different sorts of rock were found—beds of decomposed rock frequently separating the strata, indicated by consecutive numbers.

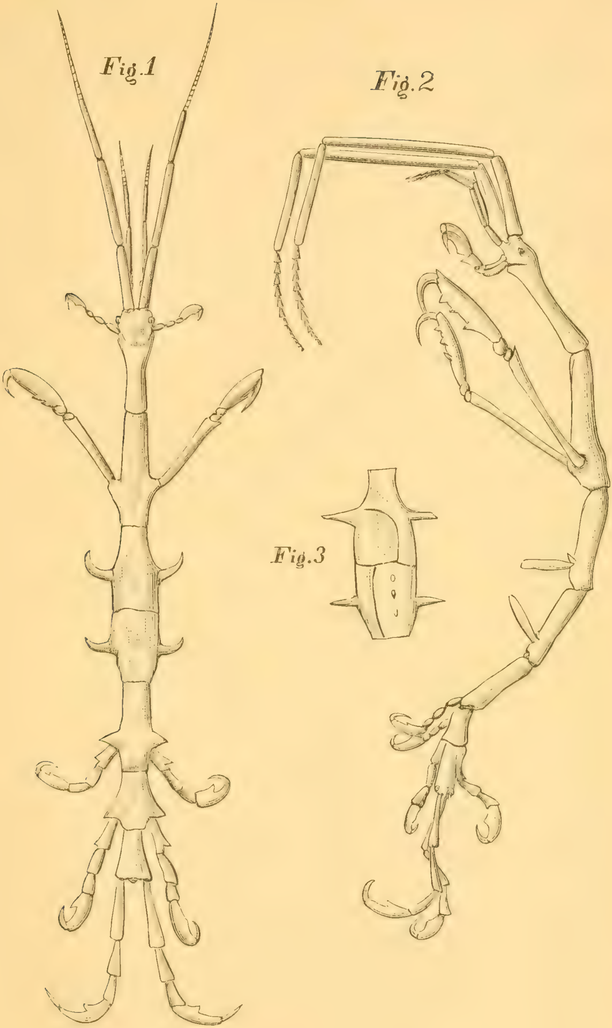


Fig. 1.—Female. Fig. 2.—Male. Fig. 3.—Ovigerous section, under third and fourth segments.

CAPRELLA SPINOSA, LOCKINGTON.

(SEE PAGE 404.)

FIG. 3.

FIG. 1.

FIG. 2.

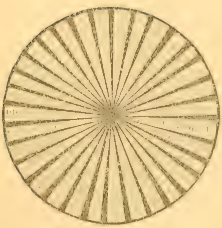


FIG. 4.

FIG. 5.

VIRGULARIA ORNATA, FISHER.

(SEE PAGE 418.)

INDEX TO PLATE XII.

Fig. 1.—Virgularia ornata, Fisher; general aspect; natural size.

Fig. 2.—Section of central portion of one of the largest and most developed specimens; enlarged ten times.

Fig. 3.—Section of central portion, viewed in profile; natural size.

Fig. 4.—Transverse section of axis; enlarged 600 times.

Fig. 5.—Transverse section of polypidom and axis; enlarged 250 times.

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JANUARY, 1874.

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