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CALIFORNIA STATE MINING BUREAU.

J. J. CRAWFORD, State Mineralogist.

BULLETIN NO. 4. San Francisco, September, 1894.

CATALOGUE

OF

CALIFORNIAN FOSSILS.

(PARTS II, III, IV, AND V.)

BY

DR. J. G. COOPER.

SACRAMENTO:

STATE OFFICE, : : : : : A. J. JOHNSTON, SUPT. STATE PRINTING.

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PREFACE.

The following pages contain papers relating to the Palæontology of California, and may be considered supplementary to the volumes on that subject published by the State Geological Survey, under Prof. J. D. Whitney, as well as to Part I of the Catalogue of Californian Fossils, published in the Seventh Annual Report of the State Mineralogist. While little attention has been devoted to this branch of science by the State Mining Bureau, as compared with more practical matters, it is thought that the contributions thus made deserve to be published. The collections were made by assistants of the Bureau, mainly by W. L. Watts, H. W. Fairbanks, and Dr. Stephen Bowers. Some interesting specimens were also contributed by Mrs. N. Barton Williams.

J. G. COOPER.

San Francisco, September, 1894.

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CATALOGUE OF CALIFORNIAN FOSSILS.

By DR. J. G. COOPER.

PART II. BIBLIOGRAPHY AND REFERENCES.

The palæontology of California differs from that of the States north of the Potomac and Ohio Rivers in the existence of more of the Neozoic formations (including Miocene, Pliocene, and Quaternary) than those of older date, showing that the elevation of this coast above the ocean was chiefly since the Mesozoic ages, and much of it took place as late as the Quaternary, or a little before the era of man.

The consequence of this late uplift is that nearly all the coast ranges and the low foothills of the Sierra are covered by strata, in some places thousands of feet thick, and often containing solid beds of fossils several feet thick, of which the greater part are identical with living species, besides others, of forms similar to those now living farther north or south, but extinct on this part of the coast.

The most interesting conclusions derivable from these facts are connected with the changes of temperature in the ocean currents, which must have occurred during the gradual elevation of the land, indicating a range from tropical to arctic, with various oscillations at intervals, each of which must have existed a long time to allow of the colonization of species from a long distance, for varying periods of time.

Other questions of much scientific interest, and perhaps leading to practical results, are connected with the study of these late fossils. Having been the subjects of investigation (in their living forms) since the time of Linnæus, about one hundred and thirty years ago, their descriptions are scattered through numerous books by European and American authors, who have often described the same species under different names, or from distant regions where some of our fossils are also found living. The identification of these descriptions is yet only partly accomplished, and the discovery of living species in a fossil state is still progressing.

Much was done in this line of study by Mr. Gabb, as published in the "Palæontology of California," but nearly as much has been discovered since. A great difficulty in the study has been the want of a complete catalogue of authors and books, with reference of each species to the first description and figure. The confused and scattered notices

given by Carpenter, in the "West Coast Mollusca," were the chief sources of information on the subject at the time, and to find a grain of information required hours of search, often with negative results. The present bibliography, besides condensing the subject into system, adds very much from many sources, and is believed to be a nearly complete catalogue of the original authors and their works.

Of the authors treating only of fossils of the formations older than Miocene there are but few, and little mention has been necessary, as they are fully referred to in the "Palæontology of California." For the same reason, most of the fossils of those formations being described as new by Meek or Gabb, it is not necessary to repeat the catalogues of them given in the Report of the Mining Bureau of 1887.

As to the new species, described since that date by Dr. C. A. White in publications of the United States Geological Survey, they are also easily accessible, and do not need further cataloguing.

Some of the different groups of fossils probably indicate that they lived at different depths before the upheaval of the land, but that does not explain the facts of distribution of species now found on seashores in other regions, but extinct here.

The fresh-water deposits usually found with lignite beds in strata of various ages are of special interest, on account of their indications of the existence of dry land, as well as being proofs that the lignite is of little extent or value.

Their uplifted position also exhibits the effect of volcanic forces, and shows in arid regions what changes in climate have occurred since the period when abundant rainfall caused lakes to exist where little or no water now remains.

BIBLIOGRAPHY OF FOSSIL MOLLUSCA.

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ADAMS, HENRY and ARTHUR. Various articles published in the Proceedings of the Zoölogical Society of London, 1835 to 1876. (Proc. Zoöl. Soc. Lond.)

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BINNEY, W. G. A supplement to the Terrestrial Mollusks of the United States, forming vol. IV. From the Boston Journal of Nat. Hist., vol. VII, 1859. Continues descriptions, and plates from Nos. 72 to 80, with many more West Coast species. (Suppl. Terr. Moll.)

Proceedings of Acad. of Nat. Sciences of Philadelphia (new series), 1857, p. 18, to 1876, forming three volumes.

Issued also as "Notes on American Land Shells," in combination with articles from the Annals of the Lyceum of Nat. Hist. of New York, vol. IX, 1870; vol. X, 1873. American Jour. of Conchology, vol. I to VII, 1865 to 1873.

Smithsonian Miscellaneous Collections, 1865. The latter also contain the volumes on "Land and Fresh-Water Shells of North America," in three parts, with wood-cuts. A catalogue of seventy-five of his publications (partly in connection with T. Bland) is given in vol. III of the notes from the Bulletin of the Museum of Comparative Zoölogy, Cambridge, Mass., vol. V, 1879, p. 351.

Bibliography of North American Conchology, published by the Smithsonian Institution, compiled by Mr. Binney, with catalogues of all the American species named by the authors quoted, Washington, D. C., 1863–64, 2 vols., 8vo, is very useful for books printed before 1860. (Bibl. of N. Amer. Conch.)

The Terrestrial Air-Breathing Mollusks of the United States, vol. V, being a bulletin of the Museum of Comp. Zoöl. of Harvard College, Cambridge, Mass., 1878; contains all the essential facts of previous volumes, with additions bringing it up to date, and a volume of plates, reprinted from the first four volumes; also, many others giving anatomical details from the author's later publications.

A Manual of American Land Shells, published by the United States National Museum, Bulletin No. 28, Washington, D. C., 1885, is a condensed and remodeled epitome of the subject, giving Mr. Binney's conclusions up to date. (Binney's Manual.)

A supplement to the fifth volume of Terrestrial Air-Breathing Mollusks, issued as a bulletin of the Mus. of Comp. Zoöl. at Harvard College, vol. XI, No. 8, 1883, and 4 plates, is embodied in the Manual of Amer. Land Shells, excepting some details.

A second supplement to same work from same series of bulletins, vol. XIII, No. 2, 1886.

A third supplement from vol. XIX, and No. 4, of same, 1890, contains all the information on the subject so far published. (Binney, Suppl. to Terr. Moll.)

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BLAND, THOMAS. See complete list of the scientific papers of T. Bland, F.G.S., from 1852 to 1883, by A. F. Gray, C.E., Salem, Mass., 1884. (Died August, 1885.)

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BROWN, THOMAS, Captain. Recent Conchology of Great Britain. 1 vol., 4to, 62 colored plates, Edinburgh, 1827. Second edition, London, 1844.

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BRODERIP, W. J., and SOWERBY, G. B. (Generally quoted together; the latter author preparing the plates, but sometimes each describes species separately.)

Zoölogical Journal, London, 1829, vol. IV, p. 359, descriptions. Plates of same in Zoölogy of Captain Beechey's Voyage to the Pacific and Behring's Straits, in the ship "Blossom," 1825 to 1828; published 1839, London, and with the aid of Dr. J. E. Gray. (Zoöl. of Beechey's Voy.)

Proceedings of the Zoölogical Society of London, 1832 to 1835, contain several descriptions of West Coast species by these authors. The most ornamental species have been figured by later authors quoted hereafter. (See Sowerby, Reeve, Adams, H. and A., Chenu, Tryon, etc.)

Species Conchyliorum. Monographs of various genera, 4to, 14 colored plates. London, 1830.

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Two new species and two varieties described. Twenty-two are fossils in Quaternary beds, eighteen others now living.

CARPENTER, PHILIP P. See Smithsonian Miscellaneous Collections, No. 252, Washington, D. C., 1872, for titles of his papers on American mollusca previous to that date. It contains the full supplementary report on the Mollusks of Western North America, reprinted from the report of the British Association for the Advancement of Science for 1863–64, together with twelve other papers, describing many species. (Moll. of West. N. Amer.)

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Report on the present state of our knowledge with regard to the Mollusca of the West Coast of North America. From report of British Association, etc., for 1856, with 4 plates, showing variations in species of Arca, Cyrena, Gadinia, Glyphis, Fissurella, Crepidula, Crucibulum, Cœcum, Neritina. (Report to British Assoc., 1856.)

Catalogue of the Reigen Collection of Mazatlan Mollusca in the British Museum, 1855 to 1857. (Catal. of Mazat. Moll.)

Proceedings of the Zoölogical Society of London, 1855–1856, 1858–1865. Chiefly articles on West Coast shells.

Proceedings of California Academy of Sciences, III, 1864, pp. 155, 175, 207. Descriptions of new marine shells from the coast of California. (Carp., Calif. Moll.)

Journal of Acad. Nat. Sciences of Philadelphia (new series), 1865, p. 54, on New Species and Varieties of Mollusca Collected by the late Dr. Kennerly, in Puget Sound. (Carp., N. W. Bd'ry Moll.)

American Journal of Conchology, vols. I to VII, 1865 to 1873, Philadelphia. Several articles on West Coast shells.

CHEMNITZ, J. H. (Martini and Chemnitz). Conchylien Cabinet, Nurnburg, 1769 to 1795. 4to. The last date is that of vol. XI, the only one in which the binomial nomenclature is used, Martini not being an authority under Linnean rules. (Chem. Conch. Cab.)

A new edition begun in 1844 by Kuster. Monographs of all known species of each genus are given, with figures. Continued by W. Kobelt and Weinkauff to 1887. Nurnburg, 4to, 1,988 colored plates.

CHENU, J. C. Illustrations Conchyliologiques, etc. Living and fossil shells, colored plates. Paris, 1843, 79 numbers, folio. Bibliotheque Conchyliologique, a reprint of older authors and their illustrations, including works by Say, Leach, Rafinesque, Conrad, Martyn, etc.

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CONRAD, TIMOTHY A. Fossil shells of the Tertiary formations of North America (Eastern). Philadelphia, 1832, 1 vol., 56 pages, 18 plates. As many West Coast fossils are very near, or identical with Eastern, they need close comparison. (Conrad's Tertiary Shells.)

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Report on Explorations and Surveys for a Railroad to the Pacific Coast, vol. V, appendix 2. Fossil Shells (Miocene, Eocene), and Recent, with 9 plates, Washington, D. C., 1856. Same report, vol. VI, app., p. 69, 5 plates of Miocene and Pliocene fossils. Same, vol. VII, part 2, p. 189, with 10 plates of Miocene and Pliocene species. (Conrad, Pac. R. R. Rep't, vols. V, VI, VII.)

American Journal of Conchology, vols. I to VII, 1865 to 1873, Philadelphia. Several articles on West Coast Shells. (See "The Writings of T. A. Conrad," Bulletin U. S. Nat. Mus., No. 30, 1885.)

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Vol. VI, p. 12, 1875, The Origin of California Land Shells; p. 14, on Shells of the West Slope of North America, No. 3.

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American Journal of Conchology, Philadelphia. Vol. IV, 1868, p. 209, on a New Californian Terrestrial Mollusk, plate 18, figure 1. Page 211, on the Distribution and Localities of West Coast Helicoid Land Shells.

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Vol. VI, p. 42, 1870, Notes on Mollusca of Monterey Bay, California. 247 species. Page 319, Note on Gadinia and Rowellia. Page 320, Note on Waldheimia pulvinata. Page 321, Additions and Corrections.

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Seventh Annual Report of the State Mineralogist, William Irelan, to the California Legislature, 1887, Catalogue of Californian Fossils, compiled by J. G. Cooper.

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Proceedings of U. S. National Museum, Washington, vol. I (1878–1879), pp. 1, 3, 10, 26, 281, contain articles on Living and Fossil West Coast Mollusca, with new species described and partly figured. The living species are chiefly Chitons, with 60 pages and 5 plates of dentition, etc. Vol. IV, p. 279 (1881–1882), on the Genera of Chitons; 12 pages, and analytical key. Vols. VII and VIII, 1883–1884, contain lists of papers by Dall, on West Coast and other Mollusca. Catalogue of Shell-Bearing Marine Mollusks, etc., of Southeastern Coast of the United States, in Bulletin of U. S. Nat. Mus., No. 37, Washington, 1889. Figures of a few West Coast species, mostly copies of those in Binney's Ed. of Gould's Invert. of Mass. Preliminary Report on the Collection of Mollusca, etc., obtained in 1887–1888, by the Fish Commissioners' steamer "Albatross." From Proceedings of Nat. Mus. XII, No. 773, Washington, 1889. Contains descriptions and figures of 10 new species from California coast.

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Revue Zoölogique, Paris, 1839, contains descriptions of 14 species supposed to be new, from our West Coast, most of them figured in Magazin de Zoölogie, Paris, 1840, plates 14 to 48; also, six previously described by Conrad. Catalogue of the Conchifera in the British Museum, vol. I, 1853; vol. II, 1854. A few species from the West Coast.

Eocene Fossils of Paris. 5 vols. 4to. 1866.

DIXON, GEORGE, Captain. A Voyage Around the World. London, 1789. Appendix, p. 355, fig. 2.

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ESCHSCHOLTZ, J. F. (Kotzebue's Voyages.)

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Proc. Bost. Soc. Nat. History, vol. IV, 1851, p. 87, and Boston Journal of Natural History, vol. VI, p. 374, 1853, on Shells from the Gulf of California and the Pacific Coast, with plates 14, 15, 16, and figures of 26 species found in California, by Major Rich, U. S. A., Lieutenant Green, U. S. N., and Colonel E. Jewett, during the Mexican War. (Separates called Mex. and California Shells.)

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Figures of Molluscous Animals, by Mrs. Emma Gray (text by J. E. Gray), 418 plates, 8vo, London, 1859. (Gray, Fig. of Moll. Anim.)

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Same, second edition, by George W. Tryon, Philad., 1871, enlarged and corrected to date; 2 vols., many plates. (See Tryon.)

Proc. Acad. of N. S., Philad., vol. I, p. 103, 1841, on Species of Sphærium. (Hald. Mon.)

HANLEY, SYLVANUS. An Illustrated and Descriptive Catalogue of Recent Bivalve Shells, with 960 figures, by Wood and Sowerby (forming an appendix to Wood's Index Testaceologicus, ed. 3, 1856), London, 1842 to 1856; 8 plates of bivalves. The third edition of Wood's work is mostly on Univalve Shells, and 50 West Coast species are mentioned in the two volumes, chiefly the larger kinds, of which twelve or more are figured. Nearly all had been before figured by authors, and nothing is original on West Coast forms. The figures are, however, generally good. See W. Wood, Mawe, Carpenter, etc. (Hanley Bivalve Shells, or Wood's Index.)

Ipsa Linnæi Conchylia, the shells of Linné determined by his collections and manuscript. London, 6 colored plates, royal 8vo, 1855.

HAUER, T. von. Many papers and books on living and fossil Cephalopoda (chiefly those of Austria, the Alps, etc.). Vienna, 1845 to 1866.

HINDS, RICHARD B., Surgeon, R. N. Annals of Nat. History, London, vol. X, p. 81, pl., 61 new Shells from California; and vol. XI, p. 255; vol. XII, p. 479; vol. XIII, pp. 137 and 468; vol. XIV, pp. 9 and 64, 1842 to 1844. In last three volumes, copied from Proc. Zoöl. Soc. of London, 1843 and 1844. All are republished with figures, in the Zoölogy of the Voyage of the "Sulphur," Captain Sir Edward Belcher, 1836 to 1842, Mollusca; London, 1844, with 21 plates. Over 20 new

Californian species are described and illustrated; also many Mexican. (Hinds, Zoöl. of "Sulphur.")

JAY, Dr. J. C. A Catalogue of Recent Shells in his Cabinet, with References and Synonyms. New York, 1835; edition second, 1836, and third, 1839, 4to, contain descriptions of new species and colored plates; fourth edition, 1850, 479 pp., also contains a catalogue of conchological books (Jay's Catal.). About 12,000 species are named.

. Expedition to Japan under Commodore M. C. Perry, in 1852 to 1854. In vol. II, p. 289, 1856, is a list of shells, with descriptions and figures of new species by Dr. Jay. Five represent Alaskan species or varieties, and four are also found on our West Coast. See Carpenter, W. C. Moll. (Jay, Perry's Japan Exp.)

JEFFREYS, J. G. British Conchology, London, 1862–1869, 5 vols., 8vo, 147 plates. The latest and most complete general work on the subject. Many articles on special genera, etc., in various journals relate to species found in California. (Jeff. Brit. Conch.)

KEEP, JOSIAH. Common Sea Shells of California, San Francisco, 1881, 64 pp., 95 figures. (Keep's Common Shells.)

West Coast Shells, 1887, about 200 wood-cuts, much better than in Com. Shells, and include the land species. (Keep, W. C. Shells.)

KIENER, L. C. Species Generales et Iconographie des Coquilles Vivantes, 4to, Paris, 1834 to 1879; 12 volumes, containing monographs of the showy species. Continued by P. Fischer. (Kiener, Coq. Viv.)

KUSTER, H. C., Editor. Martini & Chemnitz, Conchylien Cabinet, 2d edit., begun in 1837; Nurnburg, 4to, plates. Continued by W. Kobelt and Weinkauff, Nurnburg, to 1887. (See Chemnitz.)

LAMARCK, J. B. P. de. Histoire Naturelle des Animaux sans Vertebres, Paris, vol. V, Conchifera, 1818; vols. VI and VII, Mollusca, 1822. A few circumboreal and Mexican species included, that extend to California. Second edition by G. P. Deshayes, Paris, 1835–1836, contains a few more.

Vol. VIII, 1843, quotes some Californian species from other authors. Third edition, Brussels, 1839, adds more. B. Delessert published 40 or more additional plates of Lamarck's species in Paris, 1841. (Lamarck, Hist. Nat.)

LEA, ISAAC, LL.D. A full bibliography of his numerous works on land and fresh-water mollusca, some marine shells, and many fossils of Eastern United States has been published. They began in the Transactions of the American Philosophical Society, Philadelphia, 1830, vol. IV, and were also issued as "Observations on the Genus Unio, etc.," with separate paging, but the same plates, up to vol. X. Most of the West Coast species collected by Nuttall are in vol. VI

(II) and IX (V), 1839–1844. In 1858, they were continued, in the same style, in the (4to) Journal of the Acad. of Nat. Sciences of Philadelphia, vol. III. Diagnoses of new species were usually first published in the "Proceedings." (Lea, Observ.)

LEACH, Dr. WILLIAM E. The Zoölogical Miscellany, 3 vols., 150 plates, 1814–1817. The conchological parts also translated into French by Chenu, in Bibl. Conch. (Leach, Zoöl. Misc.)

LINNÉ or LINNÆUS, CARL (Author's Editions). Systema Naturæ, 10th edition, Halle et Magdeburg, 1760. Vol. I. A few of his Arctic and Pelagic species reach the North Pacific.

See Hanley's Ipsa Linnæi Conchylia, the Shells of Linnæus, determined from his manuscript and collections, with an exact reprint. London, 1855. Species described by Gmelin and other authors of later editions are often credited to Linnæus, whose latest authorized edition is the 12th, 1766–1768. (Linn., Syst. Nat.)

MARCOU, JULES. See "The Writings of Jules Marcou," in Bulletin of U. S. Nat. Mus., No. 30, by J. B. Marcou, Washington, 1885, on Mesozoic and Tertiary Geology of America, with some plates of fossil shells.

MARTYN, THOMAS. The Universal Conchologist. London, 1784, 1 vol., 4to, 77 colored figures. Ten species from California and northward were first described and figured in this work, according to Carpenter, but some were assigned to New Zealand, and others had names preoccupied. The figures are said to be very fine, and were reproduced by Chemnitz.

A reprint is in Chenu's Bibliotheque Conchyliologique, Paris, 1846. (Martyn, Univ. Conch.)

MAWE, J. (See Wood's Index Testaceologicus.) The Linnæan System of Conchology, 3d ed., with additions by Mawe, and 7 colored plates. London, 1825. Most of his West Mexican species are credited to Wood, a prior author.

MEEK, FIELDING B. Geological Survey of California, by J. D. Whitney. Palæontology, vol. I, Carboniferous and Jurassic Fossils, by F. B. Meek, 1869. 6 plates. See "The Published Writings of F. B. Meek," in Bulletin No. 30, U. S. Nat. Museum, compiled by J. B. Marcou, Washington, 1885.

MENKE, C. T. Synopsis Methodica Molluscorum, Pyrmont, 1830, 2d ed.——Zeitschrift fur Malacozoölogie, 1844–1853.

MIDDENDORF, A. TH. von. Memoirs des Sciences Naturelles de l'Academie Imperiale des Sciences, St. Petersburg, 1847–1849. Also, separate as Beiträge zu Einer Malacozoölogie Rossica, part I, 1847; parts II, III, 1849. Also, in "Reise in Sibiriens," vol. II, 1851. A

very full synopsis of the Shells of the Arctic regions of both continents as then known, with many supposed Alaskan species reported as being from South America and elsewhere. See Carpenter's Moll. of Western North America, p. 533. (Midd., Beitrage.)

MÖLLER, H. P. C. Index Molluscorum Grœnlandiæ, Copenhagen, 1842. New species described. A few of the species reach California. (Möller, Moll. Grœnl.)

MONTAGU, G. Testacea Britannica, or Natural History of British Shells, London, 1803, 2 vols., 4to, 16 colored plates. Several of the species are found on the West Coast of America.

Account of New or Rare British Shells, London, 1815, 4to, 3 plates.

MORCH, O. A. L. Malakozoölogische Blätter, vol. VI, 1859, etc. Proceedings Zoöl. Soc. of London, 1861, pp. 145–181, Review of the Fam. Vermetidæ; 2d part, p. 326; 3d part, 1862, p. 54. Novitates Conchologicæ, Series II, 1858–1870, Sitka Shells, by Morch & Dunker.

MORSE, E. L. Proceedings of Boston Soc. of Natural History, vol. VI, p. 128; vol. VIII, p. 28, 1857–1859. See W. G. Binney's Manual of American Land Shells for further references.

MÜLLER, O. F. Vermium Terrestrium et Fluviatilium Historia, Copenhagen, 1773–1774, 2 vols., folio, with colored plates. Circumboreal Shells.

Zoölogia Danica, 4 vols., folio, Copenhagen, 1788–1806, 160 colored plates. (Müll. Zoöl. Dan.)

NEWCOMB, WESLEY, M.D. Annals of the Lyceum of Natural History of New York, vol. VII, 1860, p. 146; and 1861, p. 287, on New Pupillæ.

Proceedings California Acad. Nat. Sciences, 1862, vol. II, p. 91, on New California Pulmonata; 1863, vol. III, pp. 115, 121, on Land and Marine Mollusca.

NUTTALL, THOMAS, Professor Natural Sciences, Harvard University. The collections already mentioned as described by Conrad and Lea, from the Pacific Coast in 1837 and 1839, were collected by Nuttall in 1834 and 1835. He gave manuscript names to many of his species, which were distributed as labeled, but not described, and some of them appear thus in Jay's catalogues, but are only synonyms, chiefly of the species described by Middendorff, as well as by later authors. A few were named by Reeve from Nuttall's labels. (See Reeve.)

Carpenter did the same for species of Nuttall described in Proc. Zoöl. Soc., 1856, and apparently Phillipi, also. See "The Mollusca of Western North America," pp. 636 to 663; also, descriptions reprinted from Jour. de Conch. in Appendix.

PETIT, L. (de la Saussaye.) Journal de Conchyliologie, Paris, 1850–1853 (first series), including both recent and fossil shells (colored plates). Continued by P. Fischer, A. C. Bernardi, and H. Crosse.

PFEIFFER, C. and L. On Land and Fresh-Water Mollusca only; numerous publications between 1821 and 1870. As the references to United States species are all quoted by W. G. Binney, in the Manual of American Land Shells, and elsewhere in works easily accessible, it is unnecessary to quote all original publications here. (Novitates Conchologicæ. See Dunker.)

PHILLIPI, R. A. and E. B. Abbildungen und Beschreibungen Conchylien, etc., Cassel, 1842 to 1851. Published in parts, with 144 plates, 3 vols., 4to. (Phil. Abbild.)

In Kuster's edition of Martini and Chemnitz's Conchylien, 1844 and later, monographs of various genera. Also in German and English scientific journals, 1845 to 1853. Most of his Western United States species (according to Carpenter), as well as the Mexican, had been before described.

PRIME, TEMPLE. Monograph of American Corbiculadæ, Recent and Fossil, with wood-cuts of all living species. Washington, D. C., 1865. Smithsonian Miscellaneous Collections. References given to all prior descriptions. (Prime, Mon. Corbic.)

American Journal of Conchology, vol. VI, 1869, Catalogue of the Corbiculadæ. Report of the U. S. Geog. Surveys west of longitude 100°, under Captain G. M. Wheeler, Washington, 1875, Vol. V, p. 949. Mollusca, by Dr. H. C. Yarrow. Note by Prime. (Latest publication, 1878.)

QUENSTEDT, F. A. Petrefactenkunde Deutschlands, Tubigen, 1849, 8vo; atlas, 36 plates, folio. (Quenst. Petrifact.) Die Fossilen Brachiopoden, Leipsic, 1871, 8vo; atlas, 25 plates, folio. (Quenst. Foss. Brach.) Die Ammoniten des Schwabiens Juras, Stuttgart, 1883–1887, 8vo; atlas, 78 plates, folio. (Quenst. Ammonit.)

RECLUZ, M. C. (see Petit). Journal de Conchyliologie, Paris, 1853 to 1872, first series. See Index Generale et Systematique des Vingt Premiers Volumes, etc., Paris, 1878. The Journal is still issued, by Crosse and Fischer. (Recluz, Jour. de Conchyl.)

REDFIELD, JOHN H. Annals of New York Lyceum of Nat. Hist., vol. IV, p. 163, and later articles on Marginella.

REEVE, LOVELL A. (and G. B. Sowerby). Proc. Zoöl. Soc. of London, 1842–1846 (repeated in Annals of Nat. Hist.) A few West Coast Shells.

Conchologia Iconica, 4to, London, 1843 to 1878. Illustrations of Shells, classified, with monographs by various authors. The figures

are very fine, but errors occur in the text, many of which are corrected by Carpenter in Moll. of Western North America, p. 562. Over 2,700 plates have been issued. Continued since 1865, by Sowerby. (Reeve, Conch. Icon.)

REMOND, AUGUSTE. Proceedings of the Cal. Acad. of Nat. Sciences, vol. III, 13–52, 1863, on New Tertiary Fossils (two Mollusks, five Radiata). See also his Geological Explorations in Northern Mexico, on p. 244 of same volume, March, 1886. See also Palæontology of California, vol. II, p. 270, and figures of his new species, by W. M. Gabb.

ROEMER, Dr. FERDINAND. Texas, Mit Einem Naturwissenschaftlichen Anhange, Bonn, 1849. Catalogues of Mollusca and Fossils given, but none of his new living species extend to California. (Roemer, Kreidebild.)

ROWELL, Rev. JOSEPH. (See Newcomb.) Proceedings California Acad. Nat. Sciences, vol. III, p. 21; 1863, p. 353. Mr. Rowell also collected largely at Panama, etc. See Carpenter's Moll. of Western North America.

SARS, M. and G. O. Works on Mollusca of Norway, issued from 1835 to 1838, 8 vols., and many plates. Bergen and Christiania. Some Arctic species also found in California.

SAY, THOMAS. (Reprint of works by Binney.) The complete writings of Thomas Say, on the Conchology of the United States, edited by W. G. Binney, New York, 1856 to 1858, with 75 plates, mostly from originals on copper; a few fac similes of lithographs. 1 vol., 250 pp. The species extending to the West Coast are all small land and fluviatile mollusks. One or two by older authors are figured that may be identical on both shores of North America. The fossils especially need close comparison. His writings date from 1817 to 1834, he being the first American conchological author.

SHUMARD, B. F. See writings of B. F. Shumard in Bulletin of U. S. Nat. Mus., No. 30, Washington, D. C., 1885.

SOWERBY, JAMES, and JAMES De CARLE. The Mineral Conchology of Great Britain, 12 vols., 8vo, 648 colored plates, London, 1812–1829. (Sby. Min. Conch.)

The Genera of Recent and Fossil Shells, London, 1820–1824, 2 vols., 8vo, and Zoölogical Journal, 1825–1835, 5 vols., 8vo, both with colored plates, illustrate several West U. S. Coast species of other authors, as well as their own new ones. (Sowerby, Genera.)

SOWERBY, GEORGE B. (See Broderip.) A Catalogue of the Shells in the Collection of the Earl of Tankerville, with an Appendix, describing new species. Small 4to. 9 plates, colored. London, 1825.

Ten or more Californian species are named, and some described. See Carpenter's Moll. of West Amer., p. 522, showing enormous prices set on some common Californian shells, then rare. (Sby. Tank. Catal.)

The Malacological Magazine. Part II. London, 1838–1839. Monograph of Genus Margarita (figured in next work).

SOWERBY, G. B. and G. B., Jr. The Conchological Illustrations, colored figures of all hitherto unfigured recent shells. London, 1832–1841, 2 vols., 12mo, 200 plates. Several Californian and Mexican species (chiefly described by other authors) are figured. (Sby. Conch. Ill.)

A Conchological Manual, illustrated by 500 figures of shells. London, 1839. (Sby. Conch. Manual.)

Thesaurus Conchyliorum, or Figures and Descriptions of Shells. Published in parts, 1842 to 1859. Excellent illustrations of all the new species obtained, with monographs of many genera by A. Adams, Hanley, Hinds, etc. See also Reeve, Conchologia Iconica. (Sby. Thes. Conch.)

STEARNS, ROBERT E. C. Proc. Cal. Acad. Nat. Sciences, vol. III, pp. 275 to 384. Several Catalogues of West Coast Shells, and notes on habits, etc. Vol. IV, p. 226, 1872, various papers on distribution of shells. Vol. V, 1873–1874, pp. 77 and 78, New Marine Mollusks from the West Coast of North America. Several papers on other subjects. Later papers and descriptions of New Mollusca from the West Coast will be found in current Eastern journals. Several new species were described in loose sheets issued as "Conchological Memoranda."

STIMPSON, WILLIAM. Proc. Bost. Soc. of Nat. History, vol. III, 1850, vol. IV, 1851–1852, contain descriptions of many Eastern Marine Mollusks, with some also found in the North Pacific.

Proc. Acad. Nat. Sciences of Philad., 1855, p. 375. Descriptions of some of the New Marine Invertebrates from Chinese and Japanese Seas, etc., all being species without external shells, need comparison with those of Western North America. Also, papers in the American Journal of Conchology, 7 vols., 8vo, 1865–1872.

SWAINSON, WILLIAM. Zoölogical Illustrations, including Figures and Descriptions of Birds, Insects, and Shells, 6 vols., 8vo, 318 colored plates. The Shells in 5 parts, 40 colored plates, 4to, London, 1820 to 1833. (Sw. Zoöl. Ill.)

Exotic Conchology, or Drawings of Rare Shells, etc., 48 plates, 4to, London, 1834. Also, 2d ed. by Hanley, 1841. (Sw. Exot. Conch.)

TRASK, J. B. (first State Geologist of California). Proc. Cal. Acad. Nat. Sciences, vol. I, 1855, pp. 27–29, Descriptions of New Species of Naiades. p. 39, Description of Ammonites Batesii. p. 40, Description

of Fossil Shells. p. 85, New Species of Ammonite and Baculite. p. 93, Descriptions of New Species of Plagiostoma.

TRYON, GEORGE W. A Monograph of the Order of Pholadacea, etc., 1 vol., 8vo, 1 plate, Philadelphia, 1862.

Editor of the American Journal of Conchology, Philadelphia, 1865–1872, 7 vols., 8vo. Numerous plates.

Monograph of the Fresh-Water Univalve Mollusca of the United States, a new edition of Haldeman's work, with many additions, 2 vols., 8vo, with colored plates. Philadelphia, 1871. (Tryon's Ed. Hald. Monog.)

American Marine Conchology, Philadelphia, 1873–1874 (Atlantic Coast only), 1 vol., 8vo, 208 pp., 44 plates. (Tryon's Marine Conch.)

Manual of Conchology, Structural and Systematic. Philadelphia, 1879 to 1888, 11 vols. (five on Land Shells). This most complete and perfect general work on Mollusca, with figures of all known species, finely colored by hand, is being continued by Mr. H. A. Pilsbry. (Tryon's Manual.)

VALENCIENNES, A. Recueil d'Observations de Zoölogie, etc., par Al. de Humboldt et A. Bonpland. Vol. II. Paris, 1833.

Voyage autour du Monde sur la "Venus" pendant les Anneés 1836–1839, par M. du Petit Thouars. 24 plates; issued in 1846. (Val. Voy. "Venus.")

WHITE, C. A. On Invert. Foss. from Pacific Coast, from Bull. of U. S. Geol. Survey, No. 51, Wash., 1889. Contains descriptions and figures of seventeen Cretaceous and two Eocene species from California, with plates; also several others from Oregon and Washington, with older Mesozoic species from Alaska. See Catalogue of the published writings of Dr. White, on Fossils, 1860 to 1885, by J. B. Marcou, in Bulletin of U. S. Nat. Mus., No. 30, pp. 103 to 181.

WOOD, SEARLES V. Monograph of the Crag Mollusca. 5 parts. London, 1886–1887, 4to, 81 plates.

Eocene Bivalves, 1 vol., 1860 to 1877, 4to, 28 plates. (Wood, S., Crag Moll. and Eocene Biv.)

WOOD, WILLIAM. General Conchology, royal 8vo, 59 colored plates. London, 1859. Index Testaceologicus; Catalogue of Shells according to the Linnæan System, 8vo, 2,300 colored figures; same date. See also Hanley's third edition, 1856. (Wood's Index Test.)

WOODWARD, S. P. A Manual of the Mollusca; Recent and Fossil Shells, London, 1851, 1 vol., 12mo, 25 plates, and many wood-cuts. Also a later edition by R. Tate, with additions. Contains figures of some West American shells. (Woodw. Man.)

PART III.

ADDITIONS TO THE CATALOGUE OF CALIFORNIAN FOSSILS OBTAINED SINCE 1888.

TERTIARY AND QUATERNARY MOLLUSCA.

A supplementary list is here given of the additions made to the described species of fossils found in the State since 1888. Many others are still undetermined. It has been possible to identify several of the species described by Conrad, which were marked in the Catalogue of 1888 as "not identified," fresh specimens of them having been obtained by Dr. Bowers near the original localities. These are named in the following list, but in some cases will probably be found to be synonymous with species before named:

1. *Arcopagia unda* Conr.
2. *Dosinia longula* Conr.
3. *Ostrea panzana* Conr.
4. *Ostrea subjecta* Conr.
5. *Pecten deserti* Conr.
6. *Pecten discus* Con.
7. *Pleurotoma transmontana* Conr.
8. *Purpura petrosa* Conr.
9. *Saxicava abrupta* Conr.
10. *Venus pajaroensis* Conr.

Of these, numbers 1, 2, 3, 4, 6, 7 may prove good species, but the specimens are scarcely good enough to decide as yet. Nos. 8, 9, 10 are probably the species suggested in the Catalogue of 1888.

In quoting original descriptions and figures the full synonymy is not given, but merely the first author, and one or more later or easily found descriptions or figures, when any such is known.

Of Cretaceous and Eocene fossils many additional localities have been found, and the list of species occurring in the Santa Ana Mountains of Orange County was much increased by the collections of Dr. Bowers. Several more species have thus been added to the list of those also found in Northern Mexico, Texas, and more eastern states, showing a connection of the oceans before the Tertiary age.

ADDITIONS TO TERTIARY AND QUATERNARY FOSSILS.

Acmæa? instabilis Gould.

U. S. Expl. Exp'd., Moll., p. 9.
Living—Straits of Fuca to Monterey.
Quat.—San Nicolas I. (Bowers).

Amiantis callosa Conrad.

Jour. Acad. Nat. Sc. Phil., vol. VII, 1837, p. 252.——Keep, Common Sea Shells, 1881, pl. 14, f. 5.
Living—Santa Barbara to Cape St. Lucas.
Quat.—Orange County (Bowers).

Arca ponderosa Say?

Jour. Acad. Nat. Sc. Phil., vol. II, p. 267, 1822.
Living—Southern U. S. Coast.
Pl.—Same coast (and West Coast?).

Calliostoma supragranosum Carpenter.

Moll. of W. North Amer. (1864), p. 139, 653.——Carpenter, Proc. Cal. Acad. Sc., vol. III, p. 214, 1865.
Living—Monterey to San Pedro? San Diego.
Pl.?—Ventura County (Bowers).

Pterorhytis foliatus Martyn.

Univ. Conchol., No. 66, pl. 24, f. 1, 1784.——Keep, Common Shells, p. 21, pl. 3, f. 6.
Living—Sitka to Santa Barbara. Asia.
Quat.—San Joaquin Bay, Orange County (Bowers).

Chama exogyra Conrad.

Jour. Acad. Nat. Sciences, Philad., 1837, p. 256.
Living—Bodega Bay to San Diego. Mazatlan?
Quat.—Santa Barbara to San Pedro. San Nicolas Island (S. Bowers).

Chama pellucida Sowerby.

C. spinosa Broderip, var. 2. Proc. Zoöl. Soc. Lond., 1834, p. 150.——Carp., Moll. of W. N. America, p. 641 (127).——Keep, West Coast Shells, p. 182, f. 155.

These two forms seem to intergrade, and are often hard to separate, especially the fossil specimens.

The former also runs into *C. exogyra* Con., which sometimes has dextral and sinistral shells together in one group. Whether any of them are identical with the tropical species of same names or not is

still uncertain, or the two former may be dwarfed varieties of other species.

Living—*C.* "*pellucida*," Farallon Islands to San Diego. South America. *C.* "*spinosa*," Catalina I. to San Diego. Mexico. Galapagos Is.?

Pl.—Ventura County (S. Bowers).

Chama spinosa Broderip.

Proc. Zoöl. Soc. Lond., 1834, p. 150.——Reeve, Conch. Icon., pl. 7, f. 35.

Living—Catalina I. to San Diego. Mexico.

Mioc.?—Ventura County (Bowers).

Chrysodomus spitzbergensis Reeve.

Fusus spitzbergensis Reeve. Last of the Arctic Voyages (Belcher's), 1855, vol. II, p. 359, pl. 32, f. 6, a, b.——W. Cooper, Pac. R. R. Report, vol. XII, p. 370.

Living—Spitzbergen I., Arctic Sea. Norton Sound, Alaska (Murdock).

Quat.—Santa Barbara (S. Bowers). A very small specimen, identified by Mr. Dall. (Comp. *Siphonalia fuscotincta* Carp.)

Conus brunneus Wood.

Index Testac. Suppl., 1828, pl. 3, f. 1.

Living—Cape St. Lucas and West Mexico.

Mioc.—Simi, Ventura County (S. Bowers).

Cyathodonta undulata Conrad.

Proc. Acad. Nat. Sc. Phil., 1854, p. 121.

Living—Santa Barbara to Gulf of California.

Pl.—Ventura (S. Bowers).

Cylichna inculta Gould.

Pac. R. R. Rept., vol. V, app. p. 330, pl. XI, f. 27, 28, 29.

Living—San Diego.

Quat.—Ventura County (Bowers).

Cypricardia pedroana Conrad.

Petricola pedroana Con. Pac. R. R. Rept., vol. V, app. p. 324, pl. III, f. 24. Identified by Dall from type.

Quat.—"Recent Formation, San Pedro" (W. P. Blake). Los Angeles City, about 20–30 feet below surface (Mrs. M. B. Williamson). Large colonies of this fossil were found in making excavations into the terraces north of the city.

From their fragile condition it was impossible to preserve entire specimens, though the shells were from one eighth to one sixth inch thick, long soaking by rain water having softened them.

All differ from "*P. pedroana*" as figured, in the absence of concentric ridges and radiating lines. Although called "recent" by Blake and Conrad, this is certainly an extinct species, and from those associated with it seems Pliocene, or at least Quaternary.

Fusus ambustus Gould.

Proc. Bost. Soc. Nat. Hist., 1851, in part, Mexican and Californian Shells, p. 12, pl. 14, f. 18.

Living—Southern California? Mazatlan.

Pl.—Dead Man's Island, San Pedro Bay (Mrs. Williamson). Ventura County (Bowers).

Fusus corpulentus Conrad.

U. S. Expl. Exp., Geology, p. 728, pl. 20, f. 4.——Amer. Jour. of Conch., 1865, p. 150.——Dall, Proc. U. S. Nat. Mus., vol. XIV, 1891, p. 179.

Mioc.—Astoria, Oregon. Dead Man's Island, San Pedro Bay, Cal. (Miss Monks and Mrs. M. B. Williamson).

Plioc.?—Mr. Dall calls this island Miocene, but the proportions of living species found there do not indicate older strata than Pliocene. The upper layers seem to be Quaternary.

Mr. Gabb also considered the lower beds Miocene, but many more species have been collected since he was there.

Fusus dupetithouarsi Kiener.

Coq. Vivants, No. 11, p. 15, pl. 11 (date?).

Living—Cape St. Lucas and West Mexico.

Quat.—Santa Barbara to Dead Man's I., San Pedro Bay (S. Bowers). Specimens obtained by Whitney's Geological Survey were referred to this species, but were too imperfect for certainty. Dr. Bowers' better ones, compared with recent Mexican shells, show no difference.

Gadinia reticulata Sowerby? (var. *radiata*, J. G. Cooper).

Proc. Zoöl. Soc. of Lond., 1835, p. 6, Mouretia.——Carp., Shells of West N. America, p. 152, 651.——Gabb., Proc. Cal. Acad. Sc. 3, p. 188. (*Rowellia radiata* J. G. Cooper.) Dall, Amer. Jour. Conch., VII, 1870, pl. 2 and 4.——Keep, West Coast Shells, p. 98, f. 83.

Living—Farallon I. to San Diego. Mexico.

Quat.—San Nicolas I. (S. Bowers.)

Glyphis densiclathrata Reeve.

Conch. Icon., *Fissurella*, pl. 9, sp. 64.
Living—Ballenas Bay to San Diego.
Quat.—San Joaquin Bay, Orange County (Bowers).

Lottia gigantea Gray.

Philos. Trans., 1833, p. 800.——Sby. Gen., pt. 42, fig. 1.——Reeve, Conch. Syst., II, f. 1.——Carp., Jour. de Conchyl., XII, 1865, p. 140.——Moll. of West N. Amer., p. 309.——Dall, Amer. Jour. of Conch., VI, 1871, pp. 238, 290.——Keep, Common Shells, p. 40, pl. XI, f. 1.——West Coast Shells, p. 98, f. 84.
Living—Farallon Is. to Lower California. South America?
Pl.?—Santa Rosa I. (C. D. Voy).
Quat.—San Nicolas I. (S. Bowers).

Lucapina crenulata Sowerby.

Tank. Catal., 1825, VI, No. 796. Conch. Ill., No. 19, f. 31, 38.——Keep, West Coast Shells, p. 95, f. 79.
Living—Monterey to San Diego.
Quat.—San Joaquin Bay, Orange County, and Ventura (S. Bowers).

Macron kelleti A. Adams.

Pseudoliva kelleti, Proc. Zoöl. Soc. Lond., 1853, p. 185.——Carpenter, Moll. of West Amer., 1863, p. 664 (150).
Living—Catalina I. to Lower California.
Quat.—San Joaquin Bay, Orange County.
Pl.—Ventura (S. Bowers).

Mangilia angulata Carpenter.

Ann. and Mag. Nat. Hist., 1865, p. 182.——Moll. of West N. Amer., p. 284.
Living—Straits of Fuca to San Diego.
Quat.—San Joaquin Bay, Orange County (Bowers).

Mangilia hexagona Gabb.

Proc. Cal. Acad. Sc., III, 1865, p. 185.
Living—Monterey to Catalina Island.
Quat.—Sta. Barbara (S. Bowers).

Margarita cidaris Carpenter.

Ann. and Mag. Nat. Hist., XIV., 1864, p. 426.——XV, 1865, p. 29. Moll. of West N. Amer., p. 238.——*Solariella oxybasis* Dall, Proc. Nat. Mus., 1889, p. 352, pl. XII, f. 6, young.
Living—Neeah Bay, Wash. (J. G. Swan).

Quat.—Dead Man's Island, San Pedro Bay (Mrs. M. B. Williamson).

Carpenter describes this shell, but gives it as named by A. Adams. No reference to Adams' works is given. Identified by Mr. Dall, from types.

Note.—The locality for the fossil shell quoted in the Catalogue of Fossils, 1888, "San Marcial." cannot be found in California. Such a place is on the peninsula, east side, near latitude 25° 30′, where fossils were collected by Aug. Remond, and is in the belt of Tertiary according to Gabb.

Modiola modiolus Linné.

Syst. Nat., No. 1158.——Binney, Gould's Moll. of Mass., p. 186, f. 485.

Living—Circumboreal, south to San Pedro in Calif.

Mioc.—Ventura County (S. Bowers).

Monoceros lapilloides Conrad.

Jour. Acad. Nat. Sc. Phil., VII, 1837, p. 265, pl. 20, f. 18.——Keep, Common Shells, p. 19, pl. III, f. 1.

Living—Monterey to Santa Barbara.

Quat.—Ventura County (Bowers).

Murex radix Gmelin (var. *nigritus*, Phillipi).

Syst. Nat., p. 3527, No. 10.——Reeve, Con. Icon. Murex, pl. 17, f. 69, 1845.——Phil., Abbild., 1845, p. 1, pl. 1.——Carp., Mazat. Shells, p. 521, 525 (*M. princeps* Brod., 1832).

The Rev. J. Rowell compared the specimens with a large series of the above forms from west tropical America, and considers them between *nigritus* and *princeps*. They doubtless represent an ancestral form, now more or less divided into sub-species. *M. radix* was also found fossil by H. Hemphill, in Southern or Lower California. (Catal. of N. Amer. Shells, 1890.)

Living—Margarita Bay, Lower California, to Panama (and South America?).

Mioc.—Foothills of Orange County at over 1,000 feet elevation (S. Bowers).

Murex trialatus Sowerby? (not of Kiener or of other authors).

The synonymy is very unsettled. Not found in tropical America?

Living—San Diego and southward. Determined by Mr. Dall.

Pl.—Ventura (S. Bowers). Except in absence of a spur, smaller mouth, and various color-bands, this shell does not differ much from *Pterorhytis foliatus*, and may be only a southern variety of that variable shell.

Muricidea subangulata Stearns.

Proc. Cal. Acad. Sciences, vol. V, p. 81, pl. 1, f. 4, 1873.

Living—San Miguel Island, Santa Barbara County (W. G. W. Harford).

Quat.—San Nicolas Island, Ventura County (S. Bowers).

Mya arenaria Linné.

Syst. Nat., p. 1112.——Dall, Shells of S.E. Coast of U. S., 3 figures.

Living—Circumboreal; south to England, South Carolina, Sitka, Japan. Naturalized in San Francisco Bay.

Pl.—San Joaquin Valley. Not on coast nor in Quaternary beds. Specimens of this familiar species have long been suspected to occur in the valley, but only in 1893 was their identity established by many perfect specimens brought by Mr. Watts from west of Tulare Lake. Their absence from the Quaternary along the coast, and the cause of their extinction at present between San Joaquin Valley and Sitka, while they have increased enormously in San Francisco Bay since reintroduction in 1869, are problems which deserve thorough investigation. Not the slightest specific difference exists between these fossils and recent specimens from San Francisco Bay, Eastern U. S., and England.

Nassa californiana Conrad.

Schizopyga californiana Con. Proc. Acad. Nat. Sc. Phil., 1850, p. 315–; Pacif. R. R. Rep., VI, p. 69, pl. 2, f. 1, 1857.——Dall, Proc. U. S. Nat. Mus., 1891, p. 177 (Nassa). *N. fossata* var., Gabb, Pal. of Cal., vol. II, p. 47, 74, 1869, and of authors.

Living—Drake's Bay to Cedros Is., Lower Calif., in 25–65 fms. U. S. Fish Comm. (Dall).

Pl.?—Dead Man's I., San Pedro, and Los Angeles City (Miss Monks, Mrs. Williamson, etc.).

Mioc.—Sta. Clara County, and other localities. Mr. Dall separates this from *N. fossata* as the "ancestor," although it is also found living, and is more probably a deep-water form connected by intergrades. They were combined as *N. fossata* in Pal. of Cal., vol. II.

Natica russa Gould.

Proc. Bost. Soc. Nat. Hist., 1859, Expedition Shells.——Otia, p. 109, 1862.——Carp., Moll. of West Amer., 1863, p. 586 (72).

Living—Arctic Ocean, Pacific side (Stimpson).

Quat.—Sta. Barbara (S. Bowers). Separated by Dall from *N. clausa*, as given by Gabb in Pal. of Calif., p. 77.

Ocinebra circumtexta Stearns.

"Occasional papers," May, 1871.——Amer. Jour. of Conch., March, 1872, vol. VII, p. 172, pl. 14, f. 14 (not 15).——*O. lurida*, var. d. Carp., Mss.——No. 762 (J. G. Cooper), Geog. Catal., part.——Keep, West Coast Shells, p. 24, f. 6.

Living—Monterey to San Miguel I.

Quat.—San Joaquin Bay, Orange County, and San Nicolas Island (S. Bowers).

Ocinebra poulsoni Carpenter.

Jour. de Conchyl., XII., 1865, p. 148.——Moll. of West. Amer., p. 151, 316.

Living—Santa Barbara to San Diego.

Quat.—Ventura, Calif. (S. Bowers).

Ostrea palmula Carpenter.

O. conchaphila, var. *palmula*. Carp., Mazatlan Shells, p. 163, 1857; "A distinct species," in Appendix, p. 550. Also, in Proc. Zoöl. Soc. Lond., 1863, p. 364.——Moll. of West. Amer., pp. 199, (646), (132).

Living—San Diego to Panama.

Pl.—Ventura County (S. Bowers). Identified by Dall. This is one of the marine plicated forms like *O. vespertina* Conrad, and several others of my former Catalogue, that will probably be united as one species.

Ostrea subfalcata? Conrad.

Foss. of Med. Tertiary Formation, p. 50, pl. XXV, f. 2.——Heilprin, in Foss. Ost. of N. Amer. Geol. Rept., 1884, p. 313, pl. 68, f. 1, 2, 3.——C. R. Orcutt, "The Colorado Desert," in 10th Annual Report of the State Mineralogist, 1890, pp. 839–916.

Carrizo Creek, San Diego County (C. R. Orcutt). The "expert" of the U. S. Geol. Survey, who named the specimens sent from Carrizo Creek by Orcutt, may have easily mistaken those of *O. vespertina* Con. for the above-named fossil, before known only from Virginia, though there are some strong differences in the types as described by Conrad, who also remarks on their resemblances. It might be supposed that if *O. virginica* can have existed on this coast, any other Eastern species could also. This is quite possible, and some of those described by Carpenter as now living on the west Mexican coast may prove to be the connecting links. The species called *O. veatchii* by Mr. Orcutt is probably *O. heermanni* Con., the former not having been before recognized at Carrizo Creek. Still they may be identical species.

Ostrea virginica Gmelin.

Syst. Nat., p. 3336, No. 113.——Binney, Gould's Moll. of Mass., p. 202.——White, Foss. Oysters, in 4th Report of U. S. Geol. Survey, 1884, p. 284, 314, pl. 77 to 81.——Carp., Moll. West. Amer., p. 306.

Living—Gulf of St. Lawrence to Central America. Panama (C. B. Adams, ident. by Carpenter). Margarita Bay and Cape St. Lucas, Lower Cal., Mazatlan, Honduras, Guayaquil, S. A. (Also, China and Australia?)

Pl. and *Mioc.*—N. Jersey to Florida (White).

Pecten expansus Dall.

Proc. U. S. Nat. Mus., vol. I, p. 14, 1878.

Pl.—San Diego (omitted in Catal., 1888).——One of the links between the *Miocene P.* (*Amusium*) *propatulus* Con., and the *Living* (*P. caurinus* Gould).

Pecten floridus Hinds.

Zoöl. Sulphur, p. 246, pl. 17, f. 6.

Living—Monterey to San Diego.

Quat.—Ventura and Springville, California (S. Bowers).

Ranella californica Hinds.

Ann. Nat. Hist., XI, p. 255, 1843.——Zoöl. Sulphur, p. 12, pl. 2, f. 4, 5.——Keep, West Coast Shells, p. 44, f. 24.

Living—Monterey to San Diego.

Quat.—Dead Man's Island, San Pedro (S. Bowers).

Scala hindsi Carpenter.

Proc. Zoöl. Soc. Lond., 1856, p. 165.——Moll. of West. Amer., p. 146 (660).——*S. subcoronata*, Keep, West Coast Shells, p. 49, f. 31.

Living—Bodega Bay to San Diego. Panama.

Pl.—San Diego well. Given in Catal. of 1888 as *S. subcoronata*, which is now called a variety of the Panama shell, though specimens have not been found in Mexico.

Quat.—Sta. Barbara to San Pedro.

Stenoradsia magdalensis Hinds.

Zoöl. of Sulphur, 1844, p. 54, pl. 19, f. 1.——Carpenter, Moll. of West. Amer., p. 135 (649).——Dall, Proc. Nat. Mus., vol. I, p. 330, 1878.——Keep, West Coast Shells, p. 107, f. 94.

Living—Monterey to Mazatlan, Mexico.

Quat.—San Nicolas I. (S. Bowers).

Tellina idæ Dall.

Proc. U. S. Nat. Mus., vol. XIV, p. 183, 1891, pl. 6 and 7.——*Tellinella*, No. 63, Geog. Catal., 1867 (J. G. Cooper).

Living—Catalina Island, 16 to 38 fms, young (Dall). San Pedro Bay and Long Beach (Miss Ida Shephard, etc.).

Mioc.?—San Diego, Dall. The young valves found by me in 1863 looked like thin specimens of *T. bodegensis*.

T. diegoana Conrad, fossil, looks like a deformed specimen of this species.

Triton gibbosus Broderip.

Proc. Zoöl. Soc. Lond., 1833, pl. 7.——Tryon, Manual of Mollusca, vol. III, p. 23, f. 103.

Living—West tropical America. Panama.

Quat.—San Pedro? (Found in the bay, and named by Dall as "probably fossil.")

Turcicula bairdi Dall.

Proc. U. S. Nat. Mus., vol. XII, p. 346, pl. VII, 1889.

Living—"Off San Clemente Island, in 414 fms." (Dall).

Quat.—Dead Man's Island, San Pedro Bay (Miss Monks). The specimen sent me is twice the size of Dall's type figured, but otherwise seems to agree closely.

Turritella sanguinea Reeve.

Conch. Icon. Turrit., No. 27, pl. 6, "California," probably meaning Lower Cal.

Living—Cape St. Lucas (Carpenter).

Quat.—San Pedro (Mrs. Williamson and Miss Monks, coll.). Some still retain color, and may be recent. Like enormous *T. jewetti*, one I have being over four inches long.

Pl.?—Sta. Rosa I. (Voy). Specimens appear to run very close to *T. inezana* Con., which was before found there.

RADIATA.

Strongylocentrotus drobachiensis A. Agassiz.

Living—Circumpolar, south to coast of Mexico.

Quat.—San Nicolas Island (Bowers).

ADDITIONS TO CRETACEOUS CATALOGUE.

Actæonina californica Gabb.

Cret.—Near Yreka. Oregon. Benicia, Solano County. Martinez, Contra Costa County.

Asaphis multicostata Gabb.

Pal. of California, vol. II, p. 189, pl. 29, f. 70.

Cret.—Crooked River, Eastern Oregon (Gabb). Santa Ana Mts., Orange County (S. Bowers).

Clisocolus cordatus Whiteaves.

Geol. Surv. Canada, vol. I, p. 157, pl. 18, f. 3.——White, Bulletin U. S. Geol. Survey, No. 51, p. 41, pl. VI, f. 89, 1889.

Cret.—Vancouver I., etc. Santa Ana Mts., Orange County (S. Bowers).

Galerus excentricus Gabb.

Pal. of Cal., vol. I, p. 136, pl. 20, f. 95; pl. 29, f. 232 (omitted in Catalogue of 1888).

Cret. B.—Martinez, Contra Costa County, to Tejon, Kern County (Gabb). Santa Ana Mts., Orange County (S. Bowers).

Pholadomya sonorensis Gabb.

Pal. of Cal., vol. II, p. 265, pl. 36, f. 12.

Cret.—Arivechi, Sonora, Mexico (A. Remond). Santa Ana Mountains, Orange County (S. Bowers).

Tapes hilgardi? Shumard.

Trans. St. Louis Acad. Sciences, 1860, p. 601.——Gabb, Pal. of Cal., vol. II, p. 265, pl. 36, f. 13.

Cret.—Texas (Shumard). Arivechi, Mexico (Remond). Santa Ana Mts., Orange County (S. Bowers). There is some uncertainty as to this being Shumard's species, and also as to the genus to which it belongs, the hinge being yet unknown. (See also the new species described in the last part of this Bulletin.)

PART IV.

REMARKS ON THE FOSSILS COLLECTED BY DR. S. BOWERS, IN ORANGE COUNTY.

In relation to Dr. Bowers' collections the following observations seem necessary, being called for on account of my identification of the fossil mollusca collected by him:

(1) *Quaternary Deposit.*—That of San Joaquin Bay, containing 60 species, all of which are living along the coast, is undoubtedly of very late date, almost recent enough to be called a raised beach. It is the only deposit of large extent without some extinct species known on the mainland, San Nicolas Island, eighty-seven miles farther west, being the only locality apparently as recently elevated.

(2) *Pliocene Deposit.*—The great shell-bed at El Toro Station, 600 feet higher, appears to be an older uplift, and will probably prove to contain enough extinct species to be called Pliocene, though such have not been identified on account of the bad condition in which they are, the lime being mostly dissolved out of the upper layers. Similar beds exist farther south and north.

(3) *Miocene Deposits.*—The remaining foothills west of Santiago Cañon seem to be decidedly of Miocene age, with numerous characteristic fossils. At one point only, about three miles above El Toro, Alisos Creek has cut down into the Cretaceous formation, and there I found the characteristic Cretaceous fossils given (in part) as from the Santa Ana Mts., in the Catalogue of 1888. (Three Tertiary species from beds above them are also given there.) A portion of them were, however, obtained by Professor Davidson's Coast Survey assistants, on or near the summit of Santa Ana Peak (Mt. Downey), about 1871.

(4) *Eocene (or Cretaceous B).*—While only one out of twelve species obtained in the collections of 1872–1874 could be doubtfully referred to this formation, Dr. Bowers' collection contains twelve or more. As, however, he did not observe any line of division separating the strata containing them from the Cretaceous, it is doubtful whether they can be as well distinguished in these uplifted and disturbed strata, as in those at San Diego. where they lie nearly horizontally on inclined Cretaceous.

(5) *Cretaceous (A).*—These beds, apparently rich in fossils, seem to contain species from several divisions older than the so-called "Chico-Tejon" groups, but there is a very small proportion of Ammonitidæ,

thus proving them later than the Shasta group, or even that exposed in the old coal mine on Point Loma, San Diego. The *Nautilus texanus* indicates a near approach to the Eocene, *Aturia zigzag*. From the published lists, Dr. C. A. White considers these Chico beds.

Several other Texan and Mexican species seem to occur, confirming the belief in a free connection of the two oceans existing across Northern Mexico, if not Arizona, in the Cretaceous age. Further collections may prove some of these to be distinct species. It is proper to mention that Professor Davidson's party gave the first notice of Cretaceous fossils on the Santa Ana Mountains to Professor Whitney, then State Geologist, who directed Mr. Goodyear and myself to look for all fossil localities during a rapid journey we were to make by wagon through the Julian gold mines, and thence north to Los Angeles. On account of the suspension of the Survey, no account of these and other discoveries was published until 1888, when Mr. Goodyear gave his observations in the Report of the State Mineralogist, p. 335, including the determinations of the geological age of the strata along the route as shown by the fossils, etc. Alisos Creek was the only locality north of San Diego where any Cretaceous (or Eocene) fossils were seen. Limited time did not permit of much exploration, nor of making large collections.

Dr. C. A. White is of the opinion that the Cretaceous fossils of the West Coast are all distinct species from those of the Atlantic Slope, and that no connection between the oceans existed in North America during that era.

But the many species of fossils which are so closely allied as to appear merely varieties of each other on the two slopes, and some even identical, the near approach of Cretaceous strata together from each side, and the general law of geology that the oldest formations contain the most widespread species, seem strong arguments against such a conclusion. The same theory was once held by Dr. Gould and others regarding living species, but time has disproved it, and shown that even the narrow barrier of the Isthmus of Panama did not exist until the Pliocene epoch, at least as far as the evidence of Miocene fossils then uplifted can be conclusive.

PART V.

DESCRIPTIONS AND FIGURES OF NEW SPECIES OF CRETACEOUS AND CRETACEOUS B (OR EOCENE) FOSSILS OF CALIFORNIA, WITH NOTES ON TERTIARY SPECIES.

With six plates, and a Catalogue of San Diego County Cretaceous and Cretaceous B or Eocene Species.

I. CRETACEOUS AND CRETACEOUS B OR EOCENE.

REMARKS ON THE FOSSILS COLLECTED BY W. L. WATTS.

The first group of species here described and figured belongs to the division named by Professor Gabb, "Cretaceous B," which has been generally considered by other authorities as representing or including all of the "Eocene" yet discovered along the West Coast. There is, indeed, no constant line of division either in the stratigraphy or the palæontology, by which Div. B can be constantly separated from the undoubted Cretaceous strata beneath it, unless we make an arbitrary rule excluding from the Cretaceous all strata in which no Ammonitidæ are found. There we find the difficulty confronting us that a large number of species of other families of shells seem to be identical on both sides of this line of division. It is, however, possible that comparison of better specimens may yet prove some of these species to be different, and that others have been accidentally buried in the newer strata by being washed out of the older ones where before imbedded. It is certain at least that the two localities from which Mr. W. L. Watts obtained the specimens described, furnish no Ammonitidæ, but this may be explained on the theory that they represent shallow water deposits close to a seashore or estuary, in which large quantities of vegetable matter from the land were accumulated. Both the probable habits of the species found at the coal mines near Huron, Fresno County (as compared with nearly related species), and the presence of coal in the rocks containing them, point to such a conclusion, and the occurrence of many of the same species, together with a thin bed of coal somewhat farther away, indicate that the species from Marysville Buttes inhabited a similar but somewhat deeper sea. There is much reason to believe that it was a deep inlet like the Gulf of California, or perhaps a more open channel connected with others running among islands which formed the commencement of the present Coast Range.

There are several other species believed to be new in the collection, which are not perfect enough for description. It is a notable fact that in both localities mentioned the conditions for perfect preservation of specimens are much better than usual in the Cretaceous strata, as little or no metamorphism has occurred, and softening of the shells is quite moderate, though rather troublesome at the coal mines. The presence of Conrad's "finger-post of the Eocene" (*Cardita planicosta* Lamarck, as recently confirmed by Dr. White, from Oregon specimens) abundantly, at Marysville Buttes, is a strong mark of the Eocene age, and it was not found at the Huron coal mines, though it is given by Gabb as from New Idria, Tejon Pass, etc. I found it myself at San Diego in strata quite above the ammonite-bearing coal mine, and unconformable with it.

ON COLLECTIONS BY H. W. FAIRBANKS.

After the preceding remarks were written, and while the new species were being prepared for illustration, Mr. Fairbanks brought in his large collection from Cretaceous (Eocene?) and Tertiary strata of San Diego County, containing large additions to the known lists from that county, and a considerable number of new species in the Cretac-Eocene divisions. Having carefully avoided mixing those from various localities, Mr. Fairbanks' collections proved of great value as evidence in the much-debated question as to the continuity of the two formations referred to, and I have therefore tabulated the results, so as to show how far each species is found to be contained in the true Cretaceous or ammonitiferous beds. The extent of the Cretaceous B, or Eocene strata of different authors, is not great in that county, but they are very productive of species of fossils, and therefore seem to indicate the lapse of a long period of time during their deposition—as long, perhaps, as the whole of the Tertiary and Quaternary epochs combined, as demonstrated by the marine deposits hitherto known on this coast. The only "Cretaceous" fossils previously published as from San Diego County were those which I collected, described by Mr. Gabb in the Palæontology of Whitney's Geological Survey of California. They were obtained: First—From a shaft sunk for coal near the lighthouse on Point Loma; a *Heteroceras*, preserved and presented by E. W. Morse, Esq. Second—*Baculites chicoensis*, found by me loose on the surface near the lighthouse (where I searched unsuccessfully for others). Third—A few species presented by Mr. Morse from an unknown locality, and which were perhaps in part Tertiary. Fourth—Over 20 species collected by me at one locality, a branch of Rose Cañon, seven miles north of Old San Diego, but which were all included by Gabb as Cretaceous fossils. It must also be noticed that in Vol. I of Pal., p. 220, Mr. Gabb tabulated twenty-one of these, and gives seven of them

as from "Cret. A" beds, while in fact all but the two named above, and "*Gryphœa vesicularis* Lamk," were from the one bed mentioned, and therefore of "Cret. B." Ten of these species are not contained in Mr. Fairbanks' collection, although large, and from very near to the same localities, showing what a great variety may be found in a very limited range. On a second visit to the region in 1872 I collected another series only three miles northward, where Rose Cañon enters Soledad Cañon, and all I could identify of them were included in the localities given with the Catalogue of Californian Fossils, published in the Report of the State Mineralogist for 1887. Nine of these were also absent from Mr. Fairbanks' series from six localities. In order to exhibit the subject in full I have added these 19 species to the table, in columns headed "Cooper's Collection," and "Near Soledad." His additions to the true Cretaceous fossils were the most important, being 44 from the west base of Point Loma and from La Jolla, besides 10 supposed to be new species. To the 37 before known from Div. B he added 15, and 6 new ones. The proportions are now 51 in Div. A and 57 in Div. B, a very close balance for comparison of the two, but it does not exactly express their numbers, as several (about 10) are found in both, and this table only shows how they appear successively in ascending from the lowest bed at Point Loma to the highest northward. In other parts of the State many of the same species have been found in different beds, as referred to in the Catalogue of Californian Fossils mentioned above. These references are included in the first two columns of the table.

In the Catalogue I also mentioned three Cretaceous species which I found near San Luis Rey, and these were the first found so far north of San Diego Bay (belonging to Div. B); but they were so imperfect as to cause doubts of their true age until confirmed by the finding of 6 more species there by Mr. Fairbanks. From there the Cretaceous strata strike due north through the Santa Ana Mountains, being concealed along the coast by Tertiary beds, except at one spot on the west slope of the mountains, where Alisos Creek cuts through the Tertiary, eight or ten miles from the beach in Orange County. Dr. Bowers found fossils of both Div. A and B in the Santa Ana range, but could not perceive any line of demarkation or unconformability between them.

Though he met with four or five new Cretaceous species, the specimens are generally too imperfect for description or illustration, only two being here described.

CRETACEOUS AND EOCENE (CRET. B) FOSSILS.

Terebra wattsiana n. sp. (Pl. I, Fig. 1.)

Whorls regularly tapering, about fourteen (upper three or four lost); flattened, slightly turreted by narrowing in front, the highest with about twenty-three narrow, close-set riblets crossing their whole width vertically, and increasing to about fifty on body-whorl. Base and columella smooth, mouth normal, canal much twisted, notch deep. Length, about 1.75 inch; breadth, 0.45; mouth, 0.4; width, 0.10. More robust, larger, and fewer-whorled than *T. californica* Gabb, also of Div. B, but nearly allied to that species. A single specimen only was found at Marysville Buttes by Mr. W. L. Watts.

Surcula crenatospira n. sp. (Pl. I, Figs. 2, 3, 4.)

Nuclear whorls three, smooth, large, the apical immersed; other spiral whorls five, turreted, gradually enlarging, each with about nine rounded tubercles horizontally flattened, forming a chain around the middle, and connected by two strong revolving ribs, making a sharp angle. Above this are five or six fainter ribs, crossed by strong sinuated lines of growth, and below a similar sculpture, the whole surface being thus divided by strong reticulations, extending forward on body-whorl about half its length. Mouth simple, sinus moderate above angle, canal long, straight, aperture as long as spire. Length, about 1.75 inch; breadth, 0.80; mouth and canal, 1 inch long, 0.40 wide.

Not very near any of Gabb's species of the family, except in the long canal, which seems to have been more common in the fossil than in living *Pleurotomidæ*. The character of the sinus and sculpture ally this and some of the following to the sub-genus *Clathurella*, though according to those who classify by the soft parts, such divisions are of little value. They must be taken for all they are worth in fossil species, as necessary divisions, in the absence of better ones.

Quite common at Marysville Buttes, where Mr. Watts and Mr. Ullrey obtained 35 specimens. A very similar species inhabits the West Coast of Mexico at present (*S. olivacea* Sby.).

Surcula monilifera n. sp. (Pl. II, Figs. 28, 29.)

Fusiform; nuclear whorls three, smooth, conical; the next crossed by twelve or more strong, oblique riblets, which change on fourth or fifth into a row of beaded knobs, forming an angle along middle of whorls, increasing to thirty-five on ninth or body-whorl. Above this angle are nine or ten fine revolving riblets, and three or four below it, the two posterior being longest, and imperfectly beaded at the suture. On the anterior whorls the medial knobs are sometimes doubled, and on the body-whorl the revolving riblets are alternately large and

small. Canal straight, equaling the sub-oval mouth in length. Sinus deep, situated at the angle. Length, 0.60 inch; breadth, 0.08; mouth and canal, 0.34 long.

Five specimens obtained, agreeing well in characters, at Marysville Buttes, by Mr. Watts. This is quite near to Gabb's "*Turris claytonensis*," from near the Mt. Diablo coal mines, but a comparison with his description shows marked differences. Figures twice the natural size.

The occurrence of seven new *Pleurotomidæ* without many other univalve shells, and especially the absence of the many forms of genera allied to *Fusus* described by Gabb, is a condition of distribution indicating probably that a warmer sea existed where they are found, than at most localities of similar age in California.

Surcula inconstans n. sp. (Pl. II, Figs. 20, 21.)

Shell long, fusiform, whorls about ten, the first two turbinate, smooth; third to sixth with ten or twelve transverse close-set ribs, which, on the other four whorls, show only on the posterior half of each, being replaced by eight or ten revolving riblets, forming a cancellated sculpture near middle, and toward the canal appearing alone. Mouth narrow, sinus at angle, canal long. Length, 1.10; breadth, 0.25; mouth, 0.50 inch. The figure is double the natural size.

Pleurotoma perkinsiana n. sp. (Pl. II, Figs. 23, 24.)

Very long and slender; whorls about ten, rounded, the first two turbinate, smooth; third with ten or twelve close-set vertical riblets, crossed by eight or ten revolving ones, the vertical gradually increasing to twenty-six on the body-whorl, forming a close beaded sculpture as far as the middle of body-whorl, while the revolving ribs continue alone on the body to canal. Varies also in relative strength of the two series of riblets, at different portions of spire. Sinus close to suture, canal straight, columella simple. Length, 0.60 inch; breadth, 0.15; mouth, about 0.25 long, 0.09 wide. This and the preceding have many characters alike, and are both variable in similar directions, so that at first they seemed varieties of one species, but the position of the sinus and differences in size and form distinguish them. Two specimens found at Marysville Buttes by Mr. Watts are figured; twice the natural size.

Pleurotoma decipiens n. sp. (Pl. II, Fig. 32.)

Outline rhomboid; whorls seven (the first two imbedded in rock), fifth to seventh sharply angled near middle, concavely sloping to the suture behind the angle, flattened in front, body-whorl rounded in front, forming nearly half of total length, and suddenly narrowing into a canal as long as body-whorl; surface crossed by numerous vertical raised lines, curved backward above the angle, straight below

it, and crossed by three or four fainter revolving raised lines. On body-whorl the latter are stronger, about ten below the angle, and continue spirally to the end of the long canal. Mouth not seen. Length, about 0.85 inch; breadth of body-whorl, 0.35; canal, 0.25, with body-whorl, 0.50.

This shell appears much like some of the family *Aporrhaidæ*, but no evidence of expansions around the mouth was found, and it has a distinct sinus above the angle. Only the one figured had shell remaining, but several casts were also found in Rose Cañon by Mr. Fairbanks.

Drillia ullreyana n. sp. (Pl. II, Figs. 25, 26.)

General form oblong-rhombic; first three whorls smooth, conical; fourth with seven strong knobs crossing it, and continuing on the six following at regular intervals; crossed by about ten fine revolving riblets above the middle, and four stronger ones below, increasing to about thirty of uniform size on the body-whorl and canal. Mouth nearly half of whole length, acute posteriorly, with a slight angle on upper third. Canal tapering, straight, sinus deep behind angle. Length, about 0.66 inch; breadth, 0.30; mouth and canal, 0.35 long, 0.12 wide. Marysville Buttes, Mr. Watts; four similar specimens.

The canal is long for a *Drillia*, but not more so than in *D. raricostata* Gabb, which this much resembles, differing in having the knobs more numerous, shorter, and broader. The figures are twice the natural size.

Mangilia suturalis n. sp. (Pl. II, Fig. 27.)

Form lanceolate; nuclear whorls three, fourth with ten strong vertical riblets, continuing on next five whorls, but decreasing to six on body-whorl; crossing entire whorl, but higher at middle, forming an obtuse angle, marked by a strong revolving riblet; one strong riblet parallel to this close to the suture, and one below angle. On the body they increase to over twenty of uniform size. Strong lines of growth cross these throughout, showing a deep sinus, mostly posterior to the angle. Canal slightly twisted. Length, 0.55 inch; breadth, 0.08; mouth, 0.29 long, 0.06 wide. Two specimens found at Marysville Buttes by Mr. Watts, and one illustrated here of twice the natural size.

Cordiera gracillima n. sp. (Pl. II, Fig. 22.)

Very slender, fusiform; first two whorls smooth, turbinate; third with about twelve oblique subvertical riblets, which decrease to seven on sixth whorl, narrow, meeting at sutures, and with four revolving riblets crossing them, one along suture. A wide interval between this and the next anterior, forms an obtuse angle on whorls, continuing to the upper third of body-whorl, below which the vertical ribs disappear. On body-whorl about eight revolving riblets cross these, with three or

four fine ones between each, and twelve to fifteen others below angle pass around the canal. (The shells being imbedded in rock the exact number of vertical ribs cannot be distinctly seen, whether seven or eight, and the outer lip is too much broken to see the form of the sinus, but it must be very shallow.) Mouth very narrow, sharp above, widest at angle of lip, below curving to the left, gradually forming the canal. Columella with four plaits at middle, the upper one strongest. Length, 0.48 inch; breadth, 0.09; mouth, 0.14 long, 0.03 wide; canal, 0.10 long.

The figure is twice the natural size of the one specimen found at Marysville Buttes by Mr. Watts. This is a decidedly different shell from the two species figured and described by Mr. Gabb, both of which were also found in Santa Ana Mountains, Orange County, by Dr. Bowers, but in a very poor condition.

Cancellaria irelaniana n. sp. (Pl. I, Fig. 5.)

Shell oblong fusiform; spire of eight whorls, the first three nuclear, smooth, conical; fourth with nine prominent vertical ribs, abruptly truncate at sutures, and continuing thus on next three whorls, but on eighth whorl becoming conical, tubercles at posterior margins, more distinct on body-whorl, the ribs disappearing. The three anterior whorls show strong vertical lines of growth, or irregular sculpture, which above the tubercles is crossed by three or four revolving raised lines. (Outer lip broken off for about half an inch.) Columella with four very strong and three fainter oblique folds (or ribs). Length, about 1.75 inch; breadth, 0.75; mouth, 0.87; width, (?).

Only one specimen found at Marysville Buttes by Mr. Watts. This shell is nearer to the sub-genus *Narona* than to any of the allied forms, and in its spire much resembles the species living on our coast, *C.* (*N.*) *cooperi* Gabb. Though Mr. Gabb described a Tertiary species as *C. vetusta*, thus suggesting its absence from the Cretaceous strata, we have here a proof of its presence in the Eocene or Cret. B strata.

Genus, **Ancilla** Lamarck. **Oliverato,** nov. sub-genus.

Sub-Generic Characters.—Young shell resembling an *Oliva*, with three nuclear turbinate whorls, the next three rapidly enlarging, forming a conical spire, which becomes nearly buried by callus in the adult; the seventh whorl as in young *Cyprea*, etc. The eighth whorl, instead of growing longer, increases chiefly by enveloping and thickening the body of the shell, the deposit of callus forming two thickened layers on the sides of shell, extending toward the middle of back as the animal grows older, but rarely meeting, or only as a thinner layer in the middle, and burying half the spire in its growth. Section of shell thus forms an obtuse triangle as in some *Cypreas* (one specimen only

being circular in section). Surface smooth, often retaining high polish, even in the fossils. Outer lip thickening moderately, leaving the mouth lateral, much as in *Erato*, differing in non-crenulated lips, and in the form of anterior notch, peculiar dorsal canal, etc. Its relations to other genera are evident, and show very interesting stages of development between them. No distinct folds or denticles on columella or lip at any age.

The animal evidently widened the mouth by absorption while thickening the shell on outside, and finally attained nearly the form of *Erato*. Posterior angle of mouth deeply notched, and anterior end forming a deeply notched canal, slightly turned upward. Found only near Marysville Buttes, Sutter County, by Mr. Watts and Mr. Ullrey. Eight specimens obtained. "*Ancillaria glandiformis*" Lamarck, fossil, may be congeneric.

A. (Oliverato) californica n. sp. (Pl. I, Figs. 6 to 10.)

About half of spire (the nuclear whorls) invisible in adult; mouth with lips nearly parallel at middle; narrower at ends in the young, with about ten faint ridges along columella, not passing inside; no umbilicus. Dorsal surface marked by ridges from irregular thickness of the callus, and a deep oblique furrow running from the anterior notch toward the left, as in *Pseudoliva*, etc. Parallel to this, about six light ridges remain permanent behind it, thickened but not obscured by callus. General form becoming more ovate with age, but always narrower in front. Length, about 1.50 inch; breadth, about 0.85; mouth, 1.12 inch long, 0.50 wide. Eight specimens examined.

Four of the specimens are polished and colored a fine brown, just as in the living *Erato vitellina*. This color is confined to a thin outer layer of the callus, as shown in the dorsal figures.

Bittium longissimum n. sp. (Pl. II, Fig. 30.)

Exceedingly long compared to its diameter; first three or four whorls regularly convex, smooth; the remaining thirteen with ten to fourteen vertical riblets crossed by three revolving ones, which cancellate the surface uniformly; the anterior riblet largest, thus giving the whorl a turreted form; mouth quadrilateral, simple (the basal surface cannot be seen). Length, 0.45 inch; breadth, 0.06; mouth, 0.03. The shell had at least sixteen whorls, and the smoothness of the upper ones may be due to erosion. It much resembles the living *B. asperum* Gabb (stouter with thirteen whorls), a variety of which is also turreted. (See Pal. of Cal., II, p. 12, pl. 2, f. 20.) Marysville Buttes, only found by Mr. Watts. Figure twice the natural size.

Cerithium fairbanksi n. sp. (Pl. I, Fig. 12.)

Shell large, turreted, (first two or three whorls wanting); next rounded, with about nine vertical ribs, very prominent at middle, and crossed by six or seven revolving grooves. Three anterior whorls so broken that the vertical ribs are gone, except at sides where they appear as sharp varices, the eight or nine grooves crenulating their edges, and well separated by the sutures; the revolving grooves extend to base of shell at edge of canal (which is broken off). Base with four or five unequal ribs.

Mouth sub-oval, outer lip crenulate; columella, ——. Length, nearly 2 inches; breadth, 0.85; mouth, 0.40; width, 0.35. This was one of the tropical forms, and more ornamented than the *C. mexicanum* Gabb, from Sonora. It seems likely that varices extended the whole length on each side, as in *C. echinatum*, but were not continuous. Only one specimen found, half imbedded in hard rock, and the surface much worn off. It was discovered by Mr. Fairbanks, at the west side of Point Loma, San Diego, in the stratum of Cretaceous A.

Potamides carbonicola n. sp. (Pl. I, Figs. 14 to 19.)

Form columnar, slowly tapering (first whorls eroded); third or fourth strongly sculptured, with twelve to fifteen subvertical ridges, curved toward the left, and crossed by three revolving ridges, causing a cancellated surface. The ridges vary in development on different parts of one shell, as well as on different specimens. Sometimes one and sometimes the other set of ridges has the most strength, and often one or two of the revolving ones being higher than the third, causes an angular projection either at middle of whorl or along the suture, the whorls being flat when all are equal, and twelve or more in number. No thickening of lips or varices shown in the specimens. Length, 1.50 inch; breadth, 0.50 to 0.75; mouth, 0.12 long and wide.

This shell, like other Potamides, evidently inhabited a muddy bay, in which fragments of coal were mixed with mud, and the matrix now contains them in great quantity, the shells being often filled with the black mixture.

They were also gregarious, as is *P. californica* in our bays, but from their fragility it is very difficult to obtain whole ones. Several are figured to show the variations of surface.

Head-wall of "California Coal Mine," near Huron, Fresno County, east slope of Mt. Hamilton range. Cret. B, Mr. Watts.

Potamides? davisiana n. sp. (Pl. I, Fig. 13.)

First three whorls convex, turbinate, smooth; the next six turreted, increasing rapidly by wide, flattened expansions of the upper surface of whorls, with a sharp raised carina half-way between the sutures,

from which the surfaces above and below diverge at a right angle. Fourth whorl ornamented with about forty fine sharp riblets, strongly curved to the left, above the carina, and giving it a serrate edge, then passing down to the next suture. On the sixth whorl they are crossed by two revolving riblets below the carina, and on the seventh or body-whorl these increase to fifteen or more, with many intermediate smaller ones, which finally entirely efface the vertical lines. Mouth triangular, simple, inner edge of outer lip crenately notched, thin; (columella and canal lost). Length, 1.16 inch (or more); breadth, 0.70; mouth, 0.50 long, about 0.35 wide. The backward curve of the growth lines above the carina suggests a Pleurotomoid shell, which is partly confirmed by the curve forward of the posterior margin of outer lip remaining, but the general form is so similar to that of Gabb's *Potamides diadema*, that I have placed it in that genus until better known. (See Pal. of Cal., I, p. 130, pl. 20.) Resembles *Pleurotoma* (*Perrona*) *spirata* Lamk. Marysville Buttes, one specimen from Cret. B, Mr. Watts.

Fusus supraplanus n. sp. (Pl. II, Fig. 31.)

Slender, whorls ten, rounded, regularly tapering to an acute point; the ninth with five revolving ribs, deeply separated by narrow grooves; upper fourth of whorl smooth, and slightly concave-tabulate; body-whorl over half of length, with ten revolving ribs, and tabulated above; canal as long as body-whorl, straight, acute. The matrix of the seven upper whorls shows traces of obliquely vertical embossed sculpture, forming about twelve knobs on the seventh. Some traces of them are also preserved on another specimen retaining more of the shell, from which the sculpture of the body-whorl is also taken. Mouth imperfect. Length (of figured one), 1.15 inch; breadth, 0.32; canal, 0.28. Nearest to *F. flexuosus* Gabb, with more and narrower whorls, straight canal, and different sculpture. Many casts occurred in the Rose Cañon bed, but none quite perfect. The best as to surface characters, but with only four whorls, must have been twice as large as that figured. Mr. Fairbanks also found some in the False Bay bed, San Diego. Cret. B.

Mitra simplicissima n. sp. (Pl. III, Fig. 41.)

Shell fusiform, whorls six or seven; body-whorl about equal to spire, sutures lightly impressed; surface shining, with very faint revolving striæ, stronger toward the canal. Mouth narrow, acute above, with three or more strong columellar folds near its middle. (The one figured is broken, but a smaller one gives a dorsal view of the anterior end.) Canal slightly twisted. Length, about 0.60 inch; breadth, 0.25. No traces of larger specimens occurred, yet they may be expected to be found, as the species is scarcely distinguishable from the young of *M. maura*, a common species living in the same region,

which grows 2½ inches long. Like *M. cretacea* Gabb, which he calls the oldest known of the genus, it is small and even simpler in form than that species. Two only were found in Rose Cañon by Mr. Fairbanks. Cret. B.

Stomatia intermedia n. sp. (Pl. III, Fig. 43.)

Shell haliotiform, whorls two or three, flattened, rapidly expanding, with four strongly carinate ribs revolving above the margin and one or two below it; the outer ones sometimes forming an undulating margin toward the anterior end. Interspaces sub-equal, slightly concave, with revolving ridges near apex, crossed by irregular radiating lines of growth. The sculpture is sometimes scaly or imbricated. Apex distant from margin, the outer whorl forming an expansion along the posterior margin, equal to one sixth of the length of shell. Length, 1 inch or more; breadth, 0.90; height, 0.35. One specimen, half grown, retains a reddish color on the surface, and more perfect sculpture, looking like a *Haliotis rufescens*, without the perforations. Only five specimens found, in Cret. A, at the west base of Point Loma, San Diego.

The figure is made from a combination of three specimens, as none singly shows all the characters of the species.

Resembles the *S. suciensis* Whiteaves, of the Vancouver I. group, and is possibly a connecting link between that and var. *carinata* Wh., but seems more likely to be quite distinct.

Calliostoma kempiana n. sp. (Pl. III, Figs. 33, 34.)

Shell with a conical outline, higher than wide, imperforate; whorls six or seven, flattened, with strong vertical ribs closely arranged. Basal margin crenated by the ribs; the surface with about ten concentric riblets. (Mouth and columellar region concealed by the matrix.) Height, 0.50; breadth of base, 0.44.

Three specimens found at the west base of Pt. Loma, by Mr. Fairbanks. This species seems quite different from *C. radiata* Gabb, which was from still older beds.

By request of Mr. Fairbanks, I have named this handsome species in honor of his wife, formerly Miss Kemp, who has taken much interest in fossils, and assisted him in scientific work.

Tornatella normalis n. sp. (Pl. III, Figs. 36, 37.)

Shell oliviform, whorls six, apical subacute; next four gradually enlarging, with five to ten sharply-impressed grooves parallel with the sutures, which are also rather deeply impressed; body-whorl with about fifty similar grooves, crossed by irregular lines of growth, ending anteriorly in an obtuse point. Mouth subovate, acute posteriorly; columella with one basal plait. Length, 0.65 inch; breadth, 0.25; body-whorl, 0.50 long.

This shell does not closely resemble Gabb's species from the older Cretaceous, nor Dr. White's from the same beds. It is more like the living *T. sulcata* Lamarck, and others. Yet it was found in the Cretaceous A bed, at the west base of Pt. Loma, by Mr. Fairbanks, together with Ammonites, etc. Two specimens are very perfect.

Bulla assimilata n. sp. (Pl. IV, Fig. 46.)

Form oval, narrower anteriorly; mouth little longer than spire; outside smooth, shining; lines of growth faint, slight malleations visible with a lens; color pale brown, with irregular fleckings of darker tint scattered throughout. Length, 0.75 inch; breadth, 0.50.

Very similar to *B. adamsi* Menke, found living in the same region. That is, however, broader anteriorly, as in other living species. The preservation of color is remarkable for a fossil of such age, and although the specimens are imbedded in very hard stone, the single whole one may be a distorted specimen of Quaternary date, from a raised beach which exists above the Cretaceous in spots. Several living species, with their colors, are found in that bed, which cannot be distinguished from the Cretaceous below in lithological characters, among which were identified *Haliotis cracherodi*, *Leptothyra carpenteri*, and others still living. As they do not continue into Div. B, there is no further evidence of their being Cretaceous species. The form of this shell is like that of a young *Cyprea*, but its coloration is that of a *Bulla*.

Tornatina erratica n. sp. (Pl. II, Fig. 35.)

Form cylindrical, whorls five, the first immersed, second helicoid, next two rapidly enlarging, and deeply channeled at sutures; fifth diverging suddenly in a loose spiral, the suture advancing $\frac{1}{4}$ of an inch in one revolution; mouth very long and narrow, lips simple, surface smooth, chalky white. (Anterior end of shell broken off.) Length, 0.70 inch; breadth, 0.25. A thin external layer of shell is gone, as shown in the matrix filling mouth, but this was smooth as far as visible.

Siphonaria capuloides n. sp. (Pl. II, Figs. 38, 39.)

Base broadly oval, dorsally curved backward, beak projecting horizontally beyond posterior margin. Anterior surface with eight radiating ribs, from apex to base, and two or three intermediate short ones. Four or five posterior ribs at wider intervals. Extreme apex broken, but was acute, and slightly turned to right, on which side is a sharper rib, probably marking the siphonal groove; but opposite is also an obtuse angle, the two separating the anterior third from the dorsal two-thirds. The strong ribs on this specimen (which is only a cast) indicate probably a thin shell, with similar sculpture. It has about the form of Say's figure of the Atlantic *S. alternata*. Length, 0.65 inch;

breadth, 0.55; height, 0.25. Two casts found at base of Pt. Loma, by Mr. Fairbanks, in Cret. A. Fragments of shell also found, which seem to have belonged to this species.

Astarte semidentata n. sp. (Pl. III, Figs. 44, 45.)

Subtrigonal, nearly equilateral; posterior margin slightly curved, obtusely angled; basal little more convex, sharply curved upward anteriorly, half the height of shell; thence deeply excavated to beaks, which bend strongly forward. Lunule long and deep, nearly half the length of posterior margin. Hinge-area broad, the posterior half of it a flat, shallow pit (in the left valve); two strong teeth, with the triangular pit filling anterior half. Lateral teeth very weak, pallial line deeply impressed. Surface slightly convex, with shallow transverse grooves near the beaks, becoming obsolete on lower half of disk. Length, 0.90 inch; height, 0.80; diameter about 0.40 (both valves). Three specimens found in Cret. B, in Rose Cañon, by Mr. Fairbanks. This species seems to differ more in the hinge than in other features from some living species. Its hinge approaches that of *Crassatella*, forming a connecting link.

Crassatella lomana n. sp. (Pl. III, Fig. 47.)

Shell large, wedge-shaped, thick, more or less angled on the posterior dorsal surface; disk marked only by coarse lines of growth; anterior end truncated nearly at a right angle to dorsum; umbos nearly meeting, and dorsal area deeply hollowed behind them. Lunule not impressed, lower half of front obtusely rounded, curving under to the nearly straight basal line, which posteriorly bends upward suddenly to form the narrow wedge-shaped extremity. Dorsal ridges forming obtuse angles from the umbos to the upper edge of wedge. Under layer of shell with fine radiating striæ; inner margins of valves coarsely crenulate. Thickness of shell, about $\frac{1}{6}$ inch; at umbos, $\frac{1}{4}$ inch. Length, 3.50 inches; height, 2.20; diameter, 1.38.

Six specimens were obtained at Pt. Loma, in Div. A, by Mr. Fairbanks. At first I thought it a variety of *C. tuscana*, which is found with it, but it shows no trace of the concentric ridges of that species at any age, and differs too much in size and form. The radiated undershell is found in both. I could not obtain a good view of the hinge, but there seems every reason to consider it a *Crassatella*, in which opinion Dr. C. A. White agrees with me.

Cucullæa bowersiana n. sp. (Pl. V, Figs. 61, 62.)

Shell large, thick, nearly equilateral; surface smooth, or with coarse lines of growth; valves very convex, sub-truncate posteriorly, but with edges of valves prominent, rounded; umbonal ridge obtuse, nearly

straight; beaks moderate, meeting in a medial line; anterior outline slightly incurved above, but rounded on lower half; base moderately curved, rounded posteriorly. Length of largest, 2.50 inches; height, 2; diameter of shell, about 1.20. Truncation quite variable. As the many specimens obtained did not agree with any described by Gabb, and were accompanied by many of his *C. inermis* and *C. mathewsoni*, I suspected them to be the *C. æquilateralis* Meek, described from the Cretaceous of Vancouver I., B. C. On sending one to Dr. White, in Washington, to compare, he decided it was different, and could give no name for it. Cretaceous of Santa Ana Mountains, Orange County, Dr. S. Bowers. The collections made in that most southern locality in which Ammonites have been found in California (except the old San Diego coal mine), were enumerated in the Report of the State Mineralogist for 1890. There were several other species which may prove new, but in too imperfect a condition to describe. The "*Exogyra costata* Say" of the list proves not to be that, but the species is uncertain.

Corbula triangulata n. sp. (Pl. IV, Fig. 42.)

Shell doubly trigonal, higher than long, with four nearly equal triangular surfaces. Valves equal, the disks being nearly right-angled triangles, higher than wide; the beaks prominent, acute; anterior margin slightly incurved; posterior straight, more acutely ridged laterally; surface crossed by about thirty undulations, parallel to lines of growth. Basal margin moderately curved. Anterior face of shell triangular-cordate, slightly concave, with edges of valves projecting vertically in upper half. Posterior face similar, but twice as large; concave above, and edges of valves less prominent; central area convex, and umbonal ridges forming a sharp raised margin on each side. Hinge unknown. Length of base, 0.30; anterior height, 0.30; posterior, 0.40; breadth, 0.30; at umbos, 0.20.

This curious shell was found by Mr. Fairbanks only at base of Pt. Loma, in Cret. A, and only the entire shell described occurred, with one other broken valve. I was therefore doubtful whether to call it a *Corbula* or *Nucula*, or something else, but finding that Conrad has described somewhat similar Tertiary species, as *Corbula curta* and *C. elevata*, from Maryland, I venture to propose the above name. When the hinge can be examined, a subgeneric name will probably be found advisable.

Mytilus dichotomus n. sp. (Pl. V, Fig. 64.)

Very similar to "*Septifer dichotomus*" Gabb, but without any trace of a septum inside the beaks. Outside also sculptured, as in *Modiola ornata* Gabb, and in several Tertiary or living species of this family. (Unfortunately the umbonal end of the specimen figured was broken

off after it was arranged for drawing.) I illustrate this shell to show that such a *Mytilus* existed in the latest stage of the California coal-epoch, with a strong suspicion that it has already one or two names. Gabb's *Septifer* was described from one young specimen found at Tejon, very nearly in the same strata, and it is not unlikely that he was mistaken in the generic character, but if proved correct the specific name suits this species as well. There is also Conrad's *Mytilus inezensis*, assigned to the Miocene Tertiary, which *prima facie* seems most probable, though there is room for doubt. This has not lately been confirmed among large numbers of Miocene fossils handled by me, and if found in the Miocene will probably be found to be the living *M. bifurcatus*, which also has its *Septifer bifurcatus* coexisting. In doubt as to the true value of the slight distinction between the two genera, I leave their correct names to be decided by future discoveries.

Several valves found in the head-wall of the California Coal Mine, near Huron, Fresno County, associated with *Gyrodes dowelli* White, and other species of Cret. B. They had a brown color externally, but were much broken up and fragile, so that no good one could be illustrated.

Crenella santana n. sp. (Pl. III, Fig. 40.)

Shell modioliform, with forty to fifty faint ribs, radiating from the beaks toward the periphery. Beaks about one sixth of total length from anterior end, a little raised; dorsal margin slightly convex; basal a little concave at middle; ends broadly rounded. Length, 0.32 inch; height, 0.20; diameter, 0.12. From base of Pt. Loma; Cretaceous, Div. A; two found by Mr. Fairbanks.

Apparently the same species was found in the Santa Ana Mts., by Dr. Bowers, but they were so eroded that no definite sculpture could be seen, and were three or four times the size of the San Diego specimens.

Megerlia dubitanda n. sp. (Pl. IV, Figs. 48, 49.)

Lower valve transversely oblong, moderately convex; its anterior or basal margin nearly straight; rayed with forty to fifty close-set ribs; outer margins curved downward, chiefly opposite beaks, for one fourth of the circumference. Upper valve more convex, with coarser ribs, only about half as many as above. Beak unknown, not very prominent. A shallow median furrow, with low ridges at sides. Some of the ribs become divided near margin. Height from base, 1.12 inch; length, 1.12; diameter, 0.50. One lower valve is 1.75 long (transversely), 0.50 deep.

The genus is, of course, only surmised from external characters. It is probably different from that of the next species, but both occurred together, especially at La Jolla, in Cret. A, though this was commonest at base of Pt. Loma, Mr. Fairbanks finding six or more valves.

Waldheimia imbricata n. sp. (Pl. IV, Figs. 50, 51.)

Lower valve subquadrate, moderately convex, a little more prominent at middle; basal margin nearly straight; about thirty low ribs diverging from apex; crossed beyond the middle by six or seven concentric furrows, marking stages of growth, and giving an imbricated appearance. Lateral margins at right angles to anterior, and nearly straight; posterior margin gently rounded, and slightly undulated by the median furrow. Upper valve more convex; ribs fewer and stronger, the median six or seven ribs depressed. Length of base, 0.90; of shell, 1.00 inch; height, 0.50; diameter, 0.50.

The same remarks given with the last apply to this, but it looks very much like some *Waldheimias* now living on the coast. It was found only at La Jolla, by Mr. Fairbanks. At that place a Quaternary raised beach, of materials similar to those of the Cretaceous beds, again encroaches on the latter, containing *Donax californicus*, etc., and the two formations can only be separated by the species of fossils found in them, as far as lithological, if not stratigraphical, characters go. The fossils of Cret. B are, however, mostly absent, and Ammonites are found there.

II. TERTIARY-MIOCENE, AND PLIOCENE.

A. FROM KERN COUNTY.

Mr. Watts collected a large number of specimens in this county, many of which were identified with species still living on the coast; others, with supposed extinct species, already described as fossils, and several appeared to be new. So many Tertiary species are, however, known to still exist on the coasts of Lower California, and to have been described from the living shells, that it is not considered advisable to describe the fossils until they have been compared with the living species from the south, which are imperfectly known, and besides this the fossils were usually in poor condition. A few are excepted, which have before been imperfectly figured, and some described by Conrad. The reasons are given under each species described or figured. There are also two species of *Pinna*, of which descriptions were first published in the Catalogue of Fossils, 1888.

B. FROM SAN DIEGO COUNTY.

The "mesa," or table land, which rises gradually with a gentle slope from San Diego Bay for eight miles northeast, and is then suddenly uplifted by recent volcanic action, its eastern edge resting against igneous rocks, contains abundant fossils, but in such a poor state of preservation where exposed, that it is usually impossible to do more

than to ascertain their Tertiary character. The Quaternary fossils near the beach, and the Pliocene obtained from the "San Diego Well," are indeed very perfect, but older ones from farther inland are very poor. From previous collections of these, geologists have classed them as Miocene, arguing that the most inland must be the oldest. Mr. Fairbanks found some very good specimens along the eastern escarpment of the mesa, which seem to show that the whole of it may be considered Pliocene, or at least as belonging to the intermediate beds passing into Miocene. The slightly disturbed strata all along the coast are usually found to be of later date than those much uplifted, judging from the proportion of living to fossil species in them. The large fossil oysters found at the eastern edge of the mesa have been hastily referred to that truly Miocene species, *O. titan* Conrad, but Mr. Fairbanks' numerous and good specimens show that they are as near to the Pliocene species described by Rémond as *O. bourgeoisi*, tending to show a derivation of the latter from the former. I observed a similar form in the Tertiary beds of Alisos Creek, Orange County, in 1872, and gave it the latter name in the Catalogue of Fossils. With this, Mr. Fairbanks found specimens of *Pecten expansus* Dall, which was first described from the San Diego Well, and is also found in another "Pliocene" bed at Soledad Cañon, twelve miles north. There is nothing in the known fossils of the mesa elsewhere to forbid the reference of the whole to the Pliocene.

Another bed of very perfect oyster shells occurs about fifty miles north of the boundary line, and three east of Oceanside, above the Cretaceous (B) strata. These resemble small *O. titan*, but connect it with Gabb's *O. tayloriana*, under which name I catalogued it in 1887 from San Juan Capistrano, twenty-five miles farther northwest. About the northern boundary of San Diego County the Tertiary begins to be more uplifted, and forms short ridges along the coast, in which the strata are much broken up as if by eruptive action. In these the true *O. titan* appears, of its usual enormous size, and other characteristic fossils appear also; the Miocene strata forming several lower ridges, and a great part of the Santa Ana Mountains. It now appears that the *Ostrea tayloriana* is only the young form of *O. titan*. *O. bourgeoisi* approaches the large species of Western Mexico, which has been called a variety of the Atlantic *O. virginiana*.

C. FRESH-WATER SHELLS FROM A LIGNITE BED.

These three species were found by me several years ago, beautifully preserved between the layers of lignite, to which the white shells form a fine contrast. They could be easily outlined on tracing-paper, though perhaps slightly deformed by pressure.

Agasoma Gabb.—This group of species, although not very well defined, and made by its author to include very dissimilar forms, seems to be a good division of what might otherwise be retained in *Purpura*. I propose to add a species, and a sub-genus with another species, possibly however, of different affinities.

Agasoma barkerianum n. sp. (Pl. V, Fig. 63.)

Pyriform, nuclear whorls immersed, smooth, next five ornamented by eighteen to thirty-six vertical riblets, crossed by three to eight revolving ridges, giving them a closely beaded surface. On the sixth whorl the vertical are more distant, and change into blunt tubercles at the suture, ten such forming a serrated crown. On the body-whorl this is stronger, forming a series of sharp folds turned back at irregular intervals (which were posterior notches as the mouth grew), and varices running forward from each to the canal, about fifteen in number. The tubercles of the fifth whorl continue in a row around middle of body-whorl, making an angle at each varix. Two other ridges cross the anterior third of dorsum to the end of beak. The whole of the fifth and body whorls are also traversed by fine ridges, both vertical and revolving, forming a fine cancellation, less strong than on the spire. Mouth simple, oval; length, 1.75 inch; breadth, 1.15; mouth, 1.25; width, 0.50; canal, 0.24 wide.

This species much resembles a cast figured in Prof. Blake's report (Pac. R. R. Rept., vol. V, foss. pl. VII, f. 63), except in the canal, given there as straight, and that may perhaps rather be *A. gravida* Gabb, as suggested by him. Fig. 66 resembles the dorsal varices of my species, which are like those often found on *Purpura crispata*. Only two specimens found, on John Barker's ranch, Kern County.

TROPHOSYCON NOV. SUBG.

General form fig-shaped, with a strongly twisted canal; suture plain, no posterior notch. This shell is perhaps as nearly allied to the *Fulgurs* of the east coast as to *Agasoma*, and two fossil species of Florida have a similar double row of knobs, but in the canal it is very unlike them.

Agasoma? (Trophosycon) kernianum n. sp. (Pl. III, Fig. 52.)

Shell pyriform, spire very short, first two whorls smooth (eroded), next two lightly sculptured, with revolving ridges from sixteen on the third, to eleven on the upper surface of fourth. A row of about nine prominent vertical tubercles around posterior angle of body-whorl, and seven alternating with them around lower angle, the interval nearly

flat. Anterior end strongly twisted in a wide canal (the aperture filled with a hard matrix). Two revolving ridges between tubercles, and six principal ones anterior to them; also two or three fainter ones between each pair, making thirty in all, crossed by the faint lines of growth. Spire, 0.40 inch high; mouth, 1.50 inch long, 0.75 wide; canal 0.40 wide (broken off short). In surface characters it resembles *Fulgur*, with the thick shell and canal of some *Trophons*. The great variations found in different species of *Fulgur*, however, show us that this might as well belong to *Agasoma*. It also resembles some of Gabb's Cretaceous genus *Eripachya* in outlines, but is decidedly Tertiary. It is apparently the fossil figured in Prof. Blake's Report, pl. VIII, figs. 64, 65, and *a*, which Conrad did not venture to name, casts only being figured. Figs. 72 and 72*a*, which he named "*Syctopus ocoyanus*," may represent *a* cast of a young shell, but it is too uncertain a name to be retained. (This is given as *Ficus ocoyanus* in Gabb's list of unidentified fossils, and *Ficula ocoyana* in my Catalogue of Fossils, 1888.) Only one fair specimen found, by Mr. Watts.

FRESH-WATER FOSSILS.

Limnea contracosta n. sp. (Pl. V, Fig. 59.)

Form broadly ovate, whorls five, rapidly enlarging from an obtuse apex, and with convex outlines, to the very large body-whorl, which forms three fourths of the total length, no umbilical fissure visible. Length, 1.20 inch; breadth, 0.75; spire, 0.30.

Specimens found with the two next species in a bed of laminated lignite, discovered about 1868, along the westerly branch of San Pablo Creek, on the stage road just south of Rocky Mound. A thin stratum of lignite underlies several square miles around that locality, but its exact age is still unsettled. On the east are deposits of marine Miocene fossils, on the west altered Cretaceous rocks with "*Aucella piochii*." The lignite may therefore be a deposit formed in a Pliocene lake. None of the other Tertiary fresh-water deposits yet examined in California contain fossils like this. The coal-strata have evidently been uplifted to an angle unusual in Pliocene deposits, but there is nothing to fix the date of the volcanic outburst which is seen in Rocky Mound, three and a half miles distant.

Planorbis pabloanus n. sp. (Pl. V, Fig, 57.)

Form regularly cylindro-spiral, whorls three and a half, slowly increasing, without sculpture, size moderate. Greater diameter, 0.60 inch; lesser, 0.48. The absence of distinctive characters in most of the species of this genus, together with the flattening caused by pressure in

the lignitic laminæ, make it impossible to separate this from some other species, but more specimens may distinguish it better.

Anodonta (nuttalliana) lignitica n. var. (Pl. V, Fig. 58.)

Form oblong-ovate, the ends rather obtusely pointed near their middle, dorsal line straight along the hinge-margin for about one third the total length; anterior end truncately sloping to an obtuse angle of about forty-five degrees near the middle, then curving gradually to the rounded basal margin; posterior end curving upward more abruptly and forming a more obtuse angle above the middle, then concavely incurved upward to meet the straight hinge-margin. Beaks one third the distance from anterior end, umbonal ridge slight, with a narrow compressed area above it, extending backward to posterior angle. Length, 3 inches; height at umbos, 1.50; breadth unknown, but was apparently very slight.

I have made this description as full as possible to show the differences between this and the living *Anodontas* of this State, which I think are well marked, though they are so variable. Some of the fossil forms from the Quaternary of Nevada come nearer to this, however. It is, of course, still uncertain whether it is an *Anodonta*, the hinge not having been examined, but most probably it is a Pliocene Tertiary fossil.

Amnicola yatesiana n. sp. (Pl. V, Fig. 60.)

Small, sub-globular, slightly tabulated at the upper part of the whorls, spire acute, conical, whorls four and a half, the body-whorl forming two thirds of whole length, obtusely rounded at base. Mouth suboval, a deep umbilical pit behind columellar lip. Length, 0.11 inch; breadth, 0.08; spire, 0.04; mouth, 0.06 long, 0.04 wide. (Figure five times natural size.)

This little shell is found in great numbers in Pliocene deposits on both sides of San Francisco Bay—at Mission San José on the east, also near Stephen's Creek, and near Los Gatos on the west. *Carinifex newberryi* and other living species occur with it in localities, also some species that may, like this, be extinct. It differs from the *A. longinqua* Gould (found lately living at Lake Pt., Utah), in the tabulated whorls. Mr. Watts obtained specimens taken from an artesian well at Lambertson's, Tulare Co., 1,058 feet deep, with *Sphaerium dentatum* Hald., a species still living east of the Sierra Nevada.

FOSSILS DESCRIBED BY OTHERS, NOT FIGURED BEFORE, ETC.

Pinna alamedensis Yates. (Pl. IV, Fig. 53.)

[Report of the State Mineralogist of Calif. for 1887, p. 259.]

This species has nine concentric inequidistant rounded wrinkles emanating from the open side, and turning toward the hinge at nearly right angles, the entire shell marked by longitudinal narrow ribs (about forty), which, radiating from apex, extend to the basal margin, becoming more indistinct as they approach the lower margin. These ribs, at their intersection with the lines of growth, are ornamented by slight elevations, forming zigzag markings along the lines of growth. The hinge side is straight the entire length, the opposite side running parallel for about one half the distance from base to apex, where it makes a sharp curve, thence at an angle of about forty-five degrees to the apex. Length 9, width 5, and thickness about 2 inches. Locality, Alameda Creek, Alameda County. Only one specimen found, and that a very fine one, in the center of a round sandstone bowlder. Miocene.

The above is the original description. Specimens have also been found by Dr. Bowers, in Ventura County, and the one here figured was found by Mr. Watts, in Kern County. It retains more of the shell than usually found, most of the specimens being casts.

Pinna venturensis Yates. (Pl. V, Fig. 54.)

[Report of the State Mineralogist of Calif. for 1887, p. 259.]

From the hinge side about two thirds of the width of this shell is marked by nine well-developed, narrow ribs, radiating from the apex to the basal margin; the other portion shows rounded, concentric inequidistant ribs, extending only to the line of the radiating ribs, so that about two thirds of the surface is covered by the radiating smaller ribs, and one third by the curved, concentric, rounded ribs or wrinkles, very like *Pinna pectinata*, figured in "Brown's Recent Conchology." *Pinna venturensis* is short and thick compared with its length. The largest specimen found was about five and one half inches long, three and one half in width, and one and three fourths in thickness, the hinge side considerably shorter than the other. Locality, several specimens collected by the writer in Casitas Pass, Ventura County. Pliocene.—L. G. Yates.

This is the original description, and photographs of both the species kindly furnished by Dr. Yates, show that those here figured represent his species. All seen of this species only show the internal cast of the shell, and, as in living species, the external sculpture may have been quite different. There is also but little to distinguish it from the Cretaceous *P. breweri* Gabb.

Pecten discus Conrad. (Pl. V, Figs. 55, 56.)

The original description and figure having been from a cast "beautifully preserved in indurated clay" (which is a very unreliable kind of specimen to describe, especially in this genus), I have here given figures from shells found by Mr. Watts in Kern County. This is about ninety miles northeast of the locality of its discovery, but the species found at the two places are to a great extent the same. The present specimens differ from the original type in having about three more ribs, in which they are intermediate between that and *P. deserti* Con. (of which Mr. Fairbanks also brought many good specimens from the Carrizo Creek locality). Clay casts, like the original, are common in Ventura County, and were collected by Dr. Bowers, but none with shell remaining were found there. It seems likely that the species named will have to be combined as one, the differences being within the range of variation in many other species. The internal view of the larger valve was necessary, because it is so incrusted on the outside with hard rock that it cannot be separated without probable fracture. The small one is about equally convex on both sides, as in *P. deserti*. The original type very much resembled the convex valve of *Vola bella* Con.

Liropecten estrellanus Conrad. (Pl. V, Figs. 65, 67.)

Pallium estrellanum Con., Pacif. R. R. Rept., vol. VI, 1850, p. 71, pl. 3, fig. 15. Vol. VII, p. 191, pl. 3, figs. 3, 4.

P. crassicardo Con., Proc. Phil. Acad. Nat. Sc., Dec. 1862, p. 291.

Spondylus estrellanus Con., Pac. R. R. Rept., vol. VII, p. 191, pl. 1, fig. 3.

Liropecten estrellanus Con., *L. crassicardo* Con., *L. volæformis* Con., Proc. Phil. Acad. Nat. Sc., 1862, p. 291.

Pecten pabloensis? Con., Pac. R. R. Rept., VI, p. 71, pl. 3, f. 14.

Specimens were collected by all the assistants in the Coast and San Joaquin Valley counties, from Solano to Orange Counties; also by Mr. Lockwood, in Napa County, etc., showing every variation.

Although Mr. Gabb admitted all four of Conrad's supposed species here named, I am satisfied from much more and better materials than he had, that they only represent various ages and conditions of only one, or possibly two, if *Pecten pabloensis* can be maintained; if not it will have priority as the specific name. The specimen figured shows nearly all the characters of the various forms combined, admitting that *P. pabloensis* is only the young stage. The ribs vary from sixteen to nineteen, though given as seventeen in all except the last by Conrad, who gives them as eighteen to twenty in that. The intermediate riblets are at first one in each space, but between the six anterior ribs on the lower (right) valve and nine on the upper, they increase, as the shell grows, to four and six, the two latter being on the sides of the ribs.

When still larger the whole of the ribs and interspaces are covered with riblets, as in *P. subnodosus* (*Liropecten veatchii* Gabb), and many others. Conrad's supposition that "*L. volæformis*" must have one flat valve, i only based on the fact that his convex valve was unusually convex, as often found in this species, while the transverse lines on the ribs are also found where the shells grew too crowded. His "*L. crassicardo*" was an old specimen, having more riblets and a stronger hinge, and really represents the left valve of the species. In the one figured here there is scarcely any difference in the convexity of the two valves, but it is rarely found with both together, and sometimes they occur unequal or both much flatter, which often arises from pressure since fossilization. The distinctive characters of *Liropecten* are in the strongly-toothed hinge, approaching that of *Spondylus*, and this was finally admitted by Conrad as a character common to them all, when he included them in that new genus. The great convexity of the valves in two of his "species" is due to what he calls "undulation," but is a kind of imbrication, as shown in the figure. It is not a natural character, being never twice alike, but seems to have been caused by some unfavorable condition of growth. It is sometimes seen in living species, and on the other hand fossil *Liropectens* sometimes grew without it, as shown in his figure of *L. crassicardo*.

The pair of valves is well represented just as it was found; the ears are from another specimen, which is of the original estrellanus form. Found in Coast Range Tertiary from Oregon to Santa Rosa Island, Calif., but not farther southward.

Note.—In the Catalogue of Californian Fossils, published in the Seventh Annual Report of State Mineralogist, 1887, p. 246, the form *Liropecten volæformis* Con. is given as living on west coast of Mexico, and probably the same as *L. subnodosus* Sowerby, 1835. This reference was intended for *L. veatchii* Gabb, but was accidentally misplaced.

FOSSILS FROM COLORADO DESERT, COLLECTED BY H. W. FAIRBANKS.

These were collected only near Carrizo Creek where it emerges from the mountains forming the western rim of the desert, and are of more than usual interest. Many collectors have been to the same locality and obtained the Tertiary species described by Conrad thirty-six years ago, as well as the Quaternary fresh-water shells of the recent lake-bed, most of which still live elsewhere. Loose species of fossiliferous rock of Carboniferous age are also found, but none in place, in that vicinity. The chief interest of Mr. Fairbanks' collection is the discovery of what may be called fossil coral-islands, the coral forming extensive beds about the summits of short isolated ridges detached from the mountains

of the western rim, and consisting at their bases of granitic or metamorphic rocks. The ridges appear to have been islands when the desert formed part of the Gulf of California, or of the Pacific Ocean, and were at the right depth beneath the surface for coral growth on their summits for a long period. With the coral occurred several fossil shells of forms quite unlike those of the late Tertiary of Carrizo Creek beds, and apparently unlike those now inhabiting the Gulf of California. They are not perfect enough for description, but may be identified with some, of which the age is known, from farther east, and for that purpose have been sent to the U. S. Nat. Museum, where eastern species are preserved. They certainly do not resemble any of the fossils yet described either from the Cretaceous or Tertiary beds of California, and suggest that they lived in the period of which fossils are wanting west of the Sierras, namely, the Eocene, or its later divisions following the Cretaceous B deposits. There is an absence of anything characterizing the secondary period. The shells resemble species of Cytherea, Dosinia, Axinæa, Pyrula, and Tritonium of large size; also an oyster, thicker and heavier than the living, or Pliocene fossil species, approaching *O. titan*, but strongly ribbed on upper valve. It is near *O. herrmanni* Conrad, but seems distinct. Further collections from such coral-islands, of which there may be many in the desert, will prove very important in unfolding the geological history of the region, but the want of water and feed for horses makes it very difficult to explore them, unless it is done in the winter. Dr. E. S. Clark, who is familiar with the fossil corals of the Eastern States, informs me that the species found by Mr. Fairbanks cannot decide the age of their growth, being widely spread in Mesozoic and Tertiary formations.

By late letters from Dr. White it appears that the specimens mentioned above as sent for identification cannot be confidently named as being any contained in the U. S. Nat. Museum.

CATALOGUE OF CRETACEOUS (AND EOCENE?) FOSSILS OF SAN DIEGO COUNTY.

Chiefly Collected by Mr. H. W. Fairbanks.

	Before Classed with "Div. B," or Eocene.	Before Classed with "Cretaceous Div. A."	West Base of Pt. Loma.	Near La Jolla.	Near False Bay.	Rose Cañon.	Cooper's Collection.	Near Soledad.	Near Kelly's.	Near San Luis Rey.	Remarks. For localities elsewhere see Catal. of Fossils in Report of the State Mineralogist for 1887.
	B	A	A	A	B	B	B	B	B	B	
Actæonina pupoides Gabb		*	*								
Ammonites hoffmani? Gabb		*	*	*							
whitneyi Gabb		*	*								
Ampullina striata Gabb		*	*								
Ancillaria elongata Gabb	*				*		*				
Angaria ornatissima Gabb		*	*								
Arca breweriana Gabb		*	*			*			*		
Architectonica horni Gabb	*				*						
Astarte mathewsoni Gabb		*	*								
semidentata J.G.C.						*					
Avicula pellucida Gabb	*	*			*						
Axinæa sagittata Gabb	*					*					S. D. specimens probably all this sp.
veatchii Gabb	*?	*	*	*			*?				
Baculites chicoensis Trask		*	*	*			*				
Barbatia morsei Gabb	*						*			*?	Found by Mr. E. W. Morse.
Bulla assimilata J. G. C.					*						
Calliostoma kempiana J.G.C.			*								
Cardita planicosta Lamk.	*				*	*		*			Merced Falls, Watts; Oregon, (White).
Cardium cooperi Gabb	*				*	*	*				
placerense Gabb		*	*								
Caryatis nitida Gabb		*				*					
Cerithiopsis alternata Gabb	*					*					
Cerithium pillingi? White		*									Ensenada, Lower Cal.
fairbanksi J.G.C.			*								
Chione varians Gabb		*	*	*							
angulata Gabb		*							*		
Cinulia obliqua Gabb		*	*	*							
Conus horni Gabb	*				*						
remondi Gabb	*				*		*				
Coralliochama orcutti W'te		*	*	*							Ensenada, Lower Cal.

CRETACEOUS (AND EOCENE?) FOSSILS OF SAN DIEGO COUNTY—Continued.

	Before Classed with "Div. B," or Eocene.	Before Classed with "Cretaceous Div. A."	West Base of Pt. Loma.	Near La Jolla.	Near False Bay.	Rose Cañon.	Cooper's Collection.	Near Soledad.	Near Kelley's.	Near San Luis Rey.	REMARKS. For localities elsewhere, see Catal. of Fossils in Report of the State Mineralogist for 1887.
	B	A	A	A	B	B	B	B	B	B	
Corbula parilis Gabb	*				*	*	*				
triangulata J.G.C.			*								
Crassatella tuscana Gabb		*	*								*Astarte tuscana* Gabb.
uvasana Gabb	*				*	*		*	*		
lomana J.G.C.			*								
Crenella santana J.G.C.			*								
Cylichna costata Gabb	*	*	*		*	*		*	*		
Dentalium cooperi Gabb	*	*			*		*				
stramineum G'b	*	*	*			*	*				
Dosinia elevata Gabb	*							*			
gyrata Gabb	*				*	*	*				
Euspira alveata Gabb	*	*					*				
Fasciolaria læviuscula G'b	*	*					*				
sinuata Gabb	*						*				
Ficopsis cooperi Gabb							*				
remondi Gabb	*				*	*		*			
Fusus diaboli Gabb	*				*	*					
tumidus Gabb		*	*			*					
martinez Gabb	*						*				
supraplanus J.G.C.					*	*					
Galerus excentricus Gabb	*				*	*	*			*	Omitted in Catal.
Goniomya borealis? Meek			*								
Gryphœa vesicularis Lamk.		*	*	*			*			*?	
Hamites vancouverensis Meek		*	*	*							Var. **fremonti** Marcou.
Helcion dichotomus Gabb		*	*								
Heteroceras cooperi Gabb		*	*								
Inoceramus vancouverensis Shum.		*	*	*							*I. ellioti* Gabb and *I. whitneyi* Gabb. Very large.
Leda gabbi Con.	*		*		*						
Lima appressa Gabb		*	*								
microtis Gabb		*	*								
Lithophagus oviformis G'bb		*	*								
Litorina compacta Gabb	*	*			*		*				Omitted in Catal.
Loxotrema turrita Gabb	*							*			
Lucina postradiata Gabb		*	*								Pal. of Cal., vol. II, p. 189.

CRETACEOUS (AND EOCENE?) FOSSILS OF SAN DIEGO COUNTY—Continued.

	Before Classed with "Div. B," or Eocene.	Before Classed with "Cretaceous Div. A."	West Base of Pt. Loma.	Near La Jolla.	Near False Bay.	Rose Cañon.	Cooper's Collection.	Near Soledad.	Near Kelley's.	Near San Luis Rey.	REMARKS. For localities elsewhere, see Catal. of Fossils in Report of the State Mineralogist for 1887.
	B	A	A	A	B	B	B	B	B	B	
Lunatia (Gyrodes) conradiana Gabb		*	*								Omitted in Catal.
Lunatia horni Gabb	*							*			
Lunatia nuciformis Gabb	*						*?				
Margaritella crenulata G'b	*	*					*				
globosa Gabb		*			*?						
Megistostoma striatum G'b	*							*			
Megerlia? dubitanda J.G.C.			*	*							
Meretrix arata Gabb		*	*								
horni Gabb	*				*	*		*			
uvasana Con.	*				*			*			
Mitra simplicissima J.G.C.						*					
Morio tuberculatus Gabb	*				*	*	*				
Mytilus ascia Gabb	*			*							
pauperculus Gabb		*	*						*		
quadratus Gabb		*	*	*							
Naticina obliqua Gabb	*					*		*			
Neptunea cretacea Gabb	*							*			
supraplicata G'b	*						*				
Nerita triangulata Gabb	*							*			
Neverita globosa Gabb	*				*	*					
secta Gabb	*		*			*					
Nucula truncata Gabb	*	*	*			*					
Olivella mathewsoni Gabb	*				*	*		*			
Ostrea idriaensis Gabb	*							*		*	
Patella traskii Gabb		*	*								
Pecten californicus Con.		*	*								
traskii Gabb		*	*	*							
N. Sp?			*	*							Perhaps a *Spondylus.*
Perissolax blakei Gabb	*					*		*			
brevirostris G'b		*	*								"Intermediate strata" Gabb.
Pholadomya breweri Gabb		*	*								
Placunanomia inornata G'b										*	Omitted in Catal.
Pleurotoma fairbanksi J. G. C.						*					
Rimella simplex Gabb	*						*				

CRETACEOUS (AND EOCENE?) FOSSILS OF SAN DIEGO COUNTY—Continued.

	Before Classed with "Div. B," or Eocene.	Before Classed with "Cretaceous Div. A."	West Base of Pt. Loma.	Near La Jolla.	Near False Bay.	Rose Cañon.	Cooper's Collection.	Near Soledad.	Near Kelly's.	Near San Luis Rey.	REMARKS. For localities elsewhere see Catal. of Fossils in Report of the State Mineralogist for 1887.
	B	A	A	A	B	B	B	B	B	B	
Septifer dichotomus Gabb	*			*							
Siphonaria capuloides J. G. C.			*								
Solen diegoensis Gabb	*		*	*	*	*					
parallelus Gabb	*			*							
Stomatia intermedia J. G. C.			*	*							
Surcula preattenuata Gabb						*					
Tapes quadrata Gabb	*		*								
Tellina æqualis Gabb		*	*		*				*		
ashburneri Gabb		*			*						
decurtata Gabb		*	*								
horni Gabb	*				*						
longa Gabb	*									*	
ovoides Gabb		*	*							*	
whitneyi? Gabb			*	*							
Tornatella normalis J. G. C.			*								
Tornatina erratica J. G. C.						*					
Tritonium californicum G'b	*							*			
diegoensis Gabb	*						*				
whitneyi Gabb	*	*					*				
Trapezium carinatum Gabb		*									
Turritella chicoensis Gabb		*			*	*			*		
uvasana Gabb	*					*		*			"Cret." in Catal. by error.
Urosyca caudata Gabb		*	*								
Venus æquilateralis Gabb	*				*			*		*?	
Waldheimia? imbricata J. G. C.				*							

EXPLANATION OF PLATES.

Plate	Figure	A and B, Div. of Cret. M B, Marysville Buttes. C M, Coal Mines. D, San Diego. Other localities (in table). T, Tertiary. M, Miocene. P, Pliocene. K, Kern County.	Formation and Locality.			
			Cret.		Tert.	
			A	B	M	P
1	1	*Terebra wattsiana.* Part of anterior whorl is broken off		M B		
	2–4	*Surcula crenatospira.* Fine sculpture not represented		M B		
	5	*Narona irelaniana.* Half of anterior whorl broken off		M B		
	6–11	*Ancilla (Oliverato) californica.* In Fig. 7 the anterior face of shell is much worn, showing the edges of incrusting layers		M B		
	12	*Cerithium fairbanksi.* Very little of the external surface remains to show details of sculpture	D			
	13	*Potamides? davisiana.* Most of aperture wanting		M B		
	14–19	*Cerithidea carbonicola.* The variations of sculpture in the six examples are not wholly represented		C M		
2		*The figures 20 to 30 in Pl. 2 are double the natural size.*				
	20–21	*Surcula inconstans.* Varieties described in text		M B		
	22	*Cordiera gracillima.* Plications are not well figured		M B		
	23–24	*Pleurotoma perkinsiana.* Figures too wide		M B		
	25–26	*Mangilia suturalis.* The nodules too prominent		M B		
	27	*Drillia ullreyana.* Outline not very correct		M B		
	28–29	*Surcula monilifera*		M B		
	30	*Bittium longissimum.* See description for details of form		M B		
	31	*Fusus supraplanus.* Apical whorls from mould	D			
	32	*Pleurotoma? decipiens*	D			
	33–34	*Calliostoma kempiana.* The last shows basal surface				
	35	*Tornatina? erratica*	D			
	36–37	*Tornatella normalis.* Shows variations in width	D			
	38–39	*Siphonaria capuloides.* Both from one specimen	D			
	40	*Crenella santana.* Also in Orange County. (Bowers.)	D			
	41	*Mitra simplicissima.* Similar to *M. simplex*	D			
	42	*Corbula triangulata.* The oblique lines on the anterior end were intended for shading	D			
3		*The figures are all of natural size from 43 to 60.*				
	43	*Stomatia intermedia.* Details of sculpture, compiled from three specimens	D			
	44–45	*Astarte semidentata.* Umbonal angle of 45 too narrow	D			
	46	*Bulla assimilata.* The spire is not prominent, the posterior angle of mouth being highest	D?			

EXPLANATION OF PLATES—Continued.

Plate	Figure		Formation and Locality.			
			Cret.		Tert.	
			A	B	M	P
3	47	*Crassatella lomana.* For fine sculpture see description	D			
	48–49	*Megerlia dubitanda.* Upper and lower odd valves	D			
	50–51	*Waldheimia imbricata*	D			
	52	*Agasoma* (*Trophosycon*) *barkerianum.* Mouth imperfect				K
4	53	*Pinna alamedensis.* Yates' type was nearly twice as long as this, and complete in form				K
	54	*Pinna venturensis.* Three fourths the size of largest found, and with fewer ribs. Ventura County				
	55–56	*Pecten discus* Conrad. From the shells. Lately received specimens from Tar Cañon, Kern County, on the W., have ears nearly perfect. They are nearly of the outline given by Conrad, and have about six delicate riblets radiating from the umbo, crossed by lines of growth. One valve was flatter, as in *P. latiauritus*, but that has 14-16 ribs.				K
5	57	*Planorbis pabloanus*				
	58	*Anodonta lignitica*				
	59	*Limnæa contracosta*				
		The outlines are correct as copied from the fossils, but the surface restoration is a fancy of the engraver. Contra Costa County.				
	60	*Amnicola yatesiana.* Magnified five diameters				
	61–62	*Cucullæa bowersiana.* From Orange County				
	63	*Agasoma kernianum.* Very well represented				K
	64	*Mytilus dichotomus.* Umbonal end perfect when described, but broken before figuring		C M		
6	65–67	*Pecten* (*Liropecten*) *estrellanus* Conrad. From two specimens, to show the combination of characters assigned by Conrad to three species				

It should be stated that while the figures represent the best of each species, many points of the descriptions have been supplied from other specimens, that are not shown in the figures.

PLATE I.

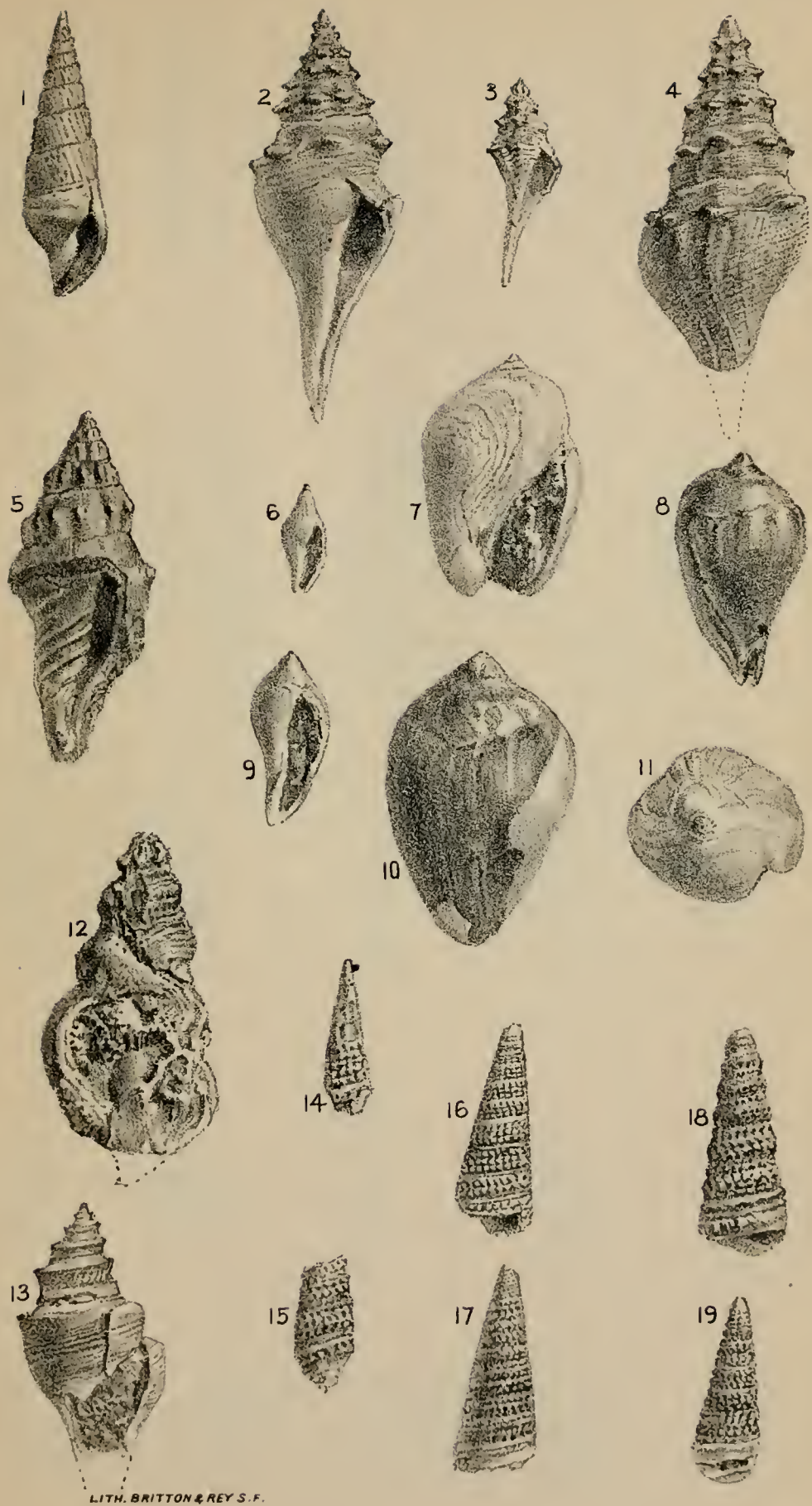

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PLATE 2.

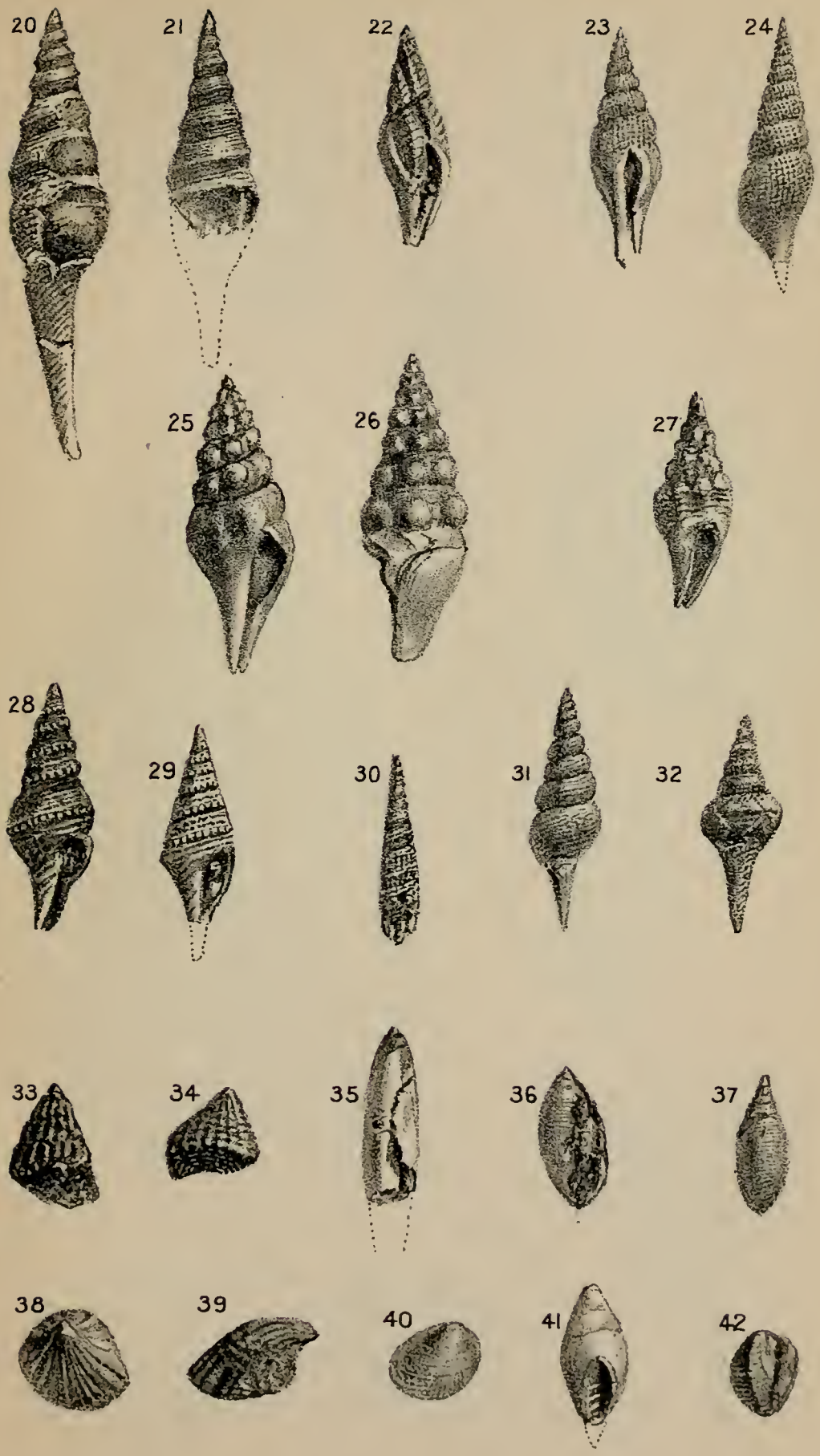

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PLATE 3.


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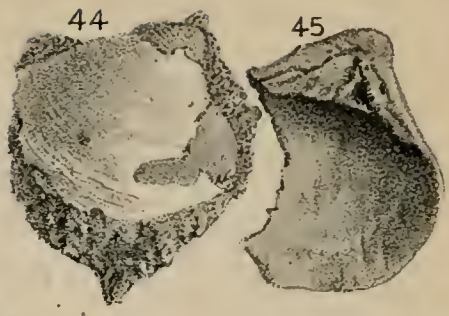
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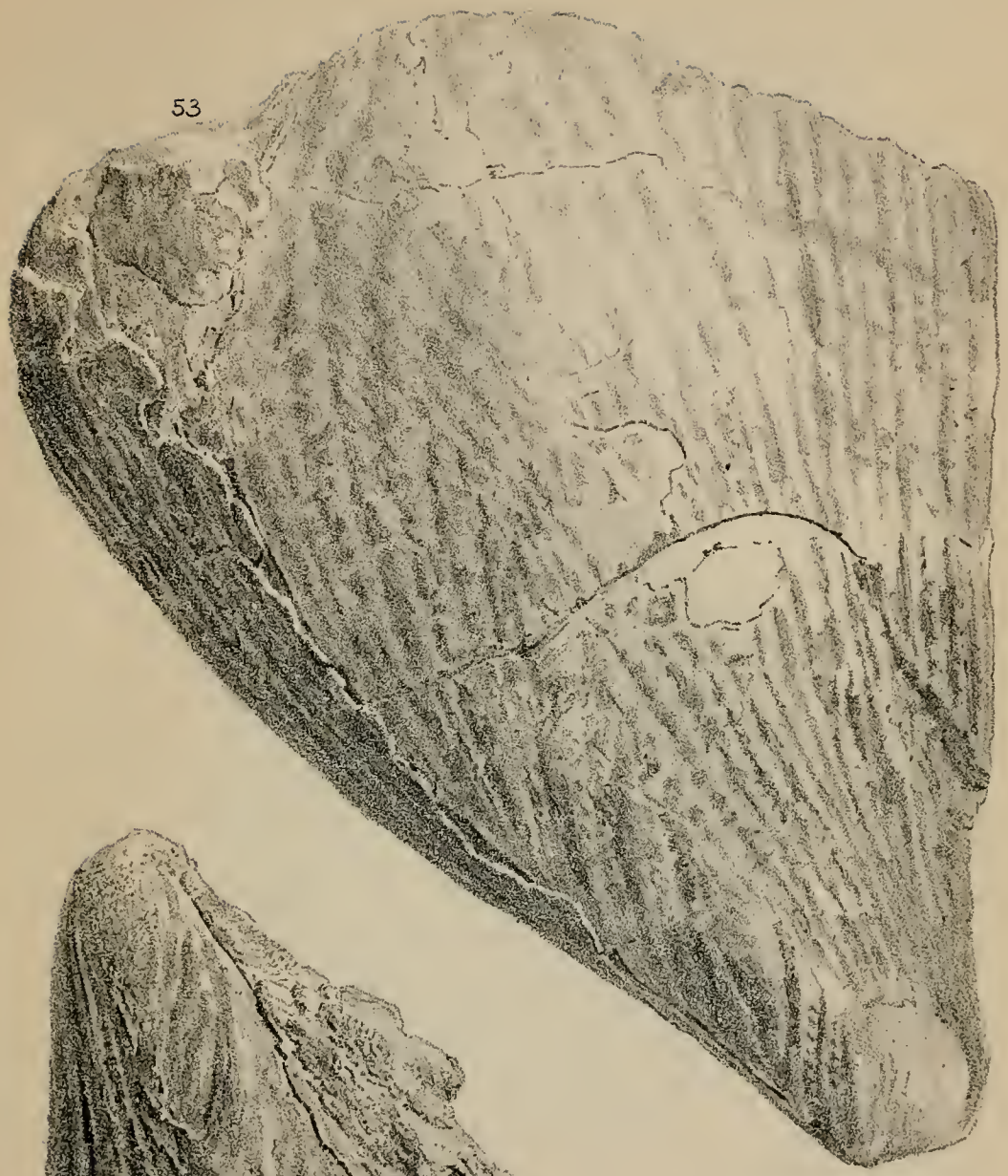
PLATE 4.



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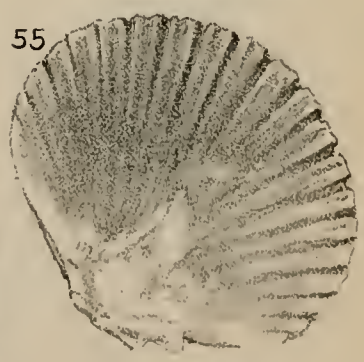

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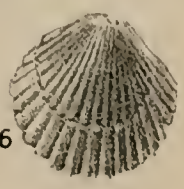

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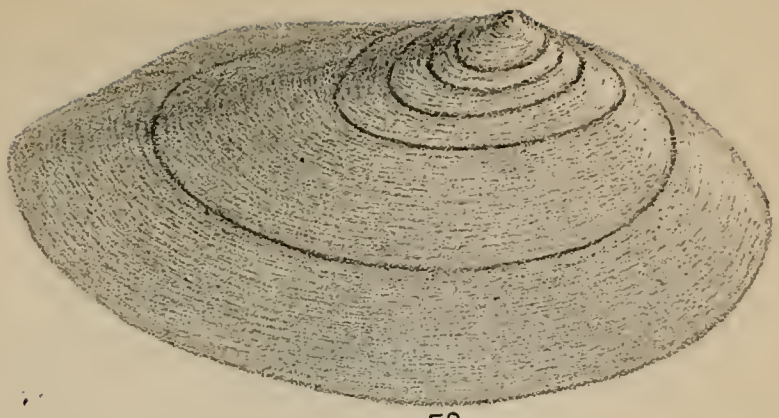

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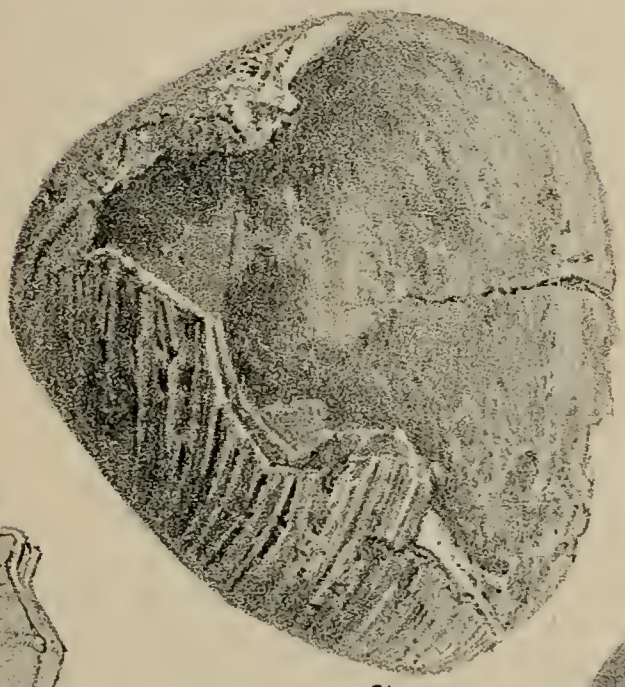

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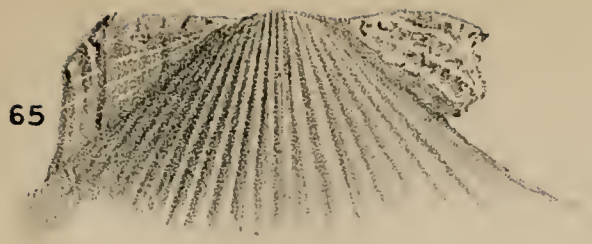

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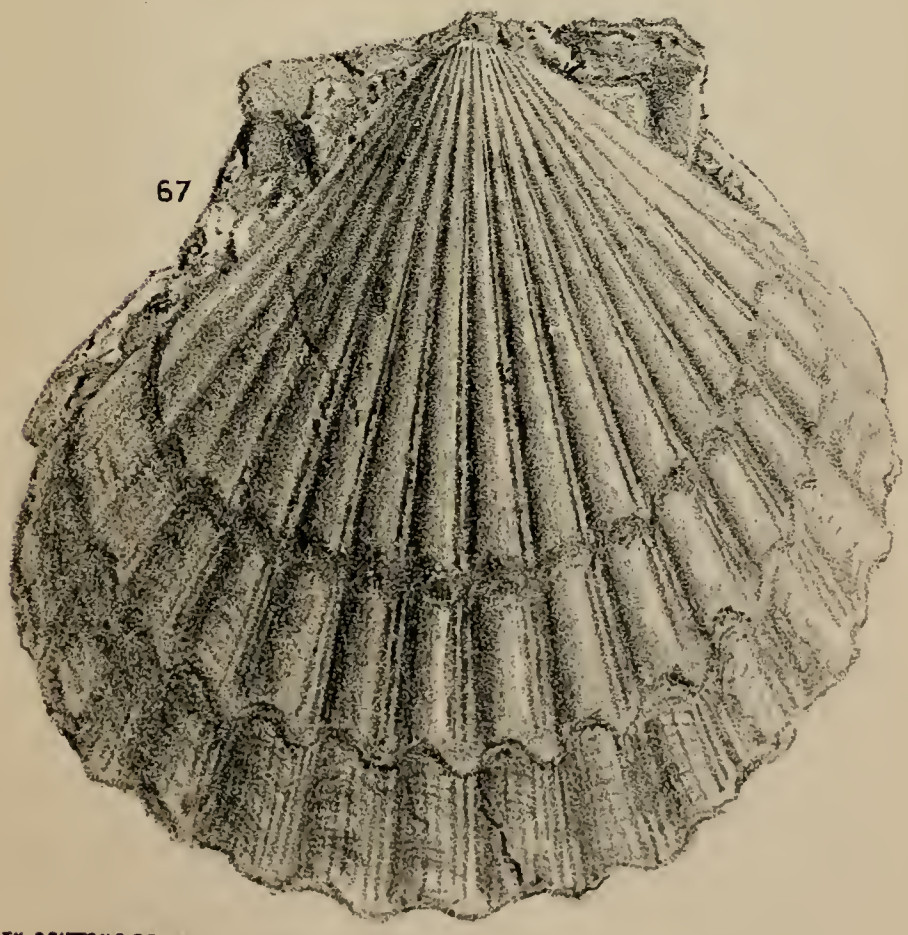

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