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WEST AMERICAN MOLLUSKS OF
THE GENUS *CONUS*

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INTRODUCTION

The magnificent series of shells belonging to *Conus* and obtained by the two expeditions of the New York Zoological Society to west American tropical waters is one of the most complete ever assembled from the area. Since the bottom work was largely confined to dredging operations in depths less than 100 fathoms, large numbers of some species were obtained which were previously considered to be rare and conversely several of the intertidal species usually common in collections were found in limited numbers or not at all.

Since material from previous collecting expeditions through the area was made available for the study, there was also an abundance of shallow water forms on hand. Therefore, it seems probable that the authors have had a greater assemblage of specimens for comparison than has previously been available at one time from the region.

Excluding the older western collections, consisting more or less of random lots of specimens, the following is a list of the late expeditions which have been sent out for the express purpose of collecting research material:

1. The California Academy of Sciences expedition to the Gulf of California in 1921; Dr. Fred Baker, collector.
2. The California Academy of Sciences expedition to Guadalupe Island and the west coast of Lower California, 1922; G. D. Hanna, collector.
3. The California Academy of Sciences expedition to the Revillagigedo Islands, 1925; G. D. Hanna and E. K. Jordan, collectors.
4. The G. Allan Hancock expedition to the Galapagos Islands and Central America for the California Academy of Sciences in 1931-1932; L. G. Hertlein, collector.
5. The Templeton Crocker expedition to the Galapagos Islands and Central America for the California Academy of Sciences in 1932; Templeton Crocker, collector.
6. Two expeditions down the coast to Panama by H. N. Lowe, primarily for shore collecting, the material having been deposited in the San Diego Society of Natural History.
7. The Templeton Crocker expedition to the Gulf of California for the New York Zoological Society in 1936; William Beebe and Templeton Crocker, collectors.

The Templeton Crocker expedition to Central America for the New York Zoological Society in 1937; William Beebe and Templeton Crocker, collectors.¹

All of the material obtained by these expeditions has been used in the preparation of the present report. In addition to the above mentioned col-

¹ For data on localities, dates, dredges, etc., see: Beebe, William, *Zoologica*, vol. xxii, pt. 1, no. 2, April 5, 1937, pp. 33-46, and vol. xxiii, pt. 3, no. 14, Sept. 28, 1938, pp. 287-298.

lections, full use has been made of the great series of Galapagos Islands shore-dwelling species obtained in 1905-1906 by the expedition sent out by the California Academy of Sciences, W. H. Ochsner, collector; 18 months were spent in the field.

Furthermore, expeditions sponsored during the past few years by Captain G. Allan Hancock for the University of Southern California have covered much of the area and very large collections of *Conus* have been obtained. This material has been available for consultation and comparison through the kindness of Dr. Irene McCulloch.

A few years ago Mr. George Willett made a trip through a part of the area as a member of an expedition conducted by Mr. J. R. Pemberton. A considerable amount of dredging was done and some very rare species of *Conus* were obtained. These were made available for this report through the courtesy of Dr. Howard Hill of the Los Angeles Museum of Science, History, and Art.

The identification of the species found in the region began in 1921 by the senior author and Dr. Fred Baker at the conclusion of the latter's collecting trip through the Gulf of California. As the work progressed and more material accumulated many difficulties were encountered. Failing health necessitated that Dr. Baker withdraw at an early stage but his keen judgment of obscure points and enthusiasm continued to be an inspiration until just prior to his death.

Without the technical assistance of numerous individuals the completion of the report in acceptable form would not have been possible and the authors take the greatest pleasure in expressing their indebtedness to Dr. L. G. Hertlein, Dr. U. S. Grant IV, Dr. Howard Hill, Dr. Myra Keen, and the late H. N. Lowe.

To Dr. Paul Bartsch all conchologists will be duly grateful for having made available for publication at this time, photographs of several previously unillustrated species, the types of which are in the U. S. National Museum.

We are indebted to Mr. R. Wright Barker, Shell Oil Company, Houston, Texas, for records of species which he collected at Santa Elena, Ecuador. In several cases these mark extensions of range, not previously known and the records have been incorporated in the text.

It was found necessary at the start of the work to compare the collections with original descriptions and figures because many species have been so variously interpreted that subsequent citations must be considered unsafe. Fortunately, west coast libraries are well supplied with literature.

The University of California at Berkeley and at Los Angeles, Stanford University, San Diego Society of Natural History, California Academy of Sciences, U. S. Grant IV, and H. N. Lowe were able to furnish everything needed except the important monograph by Küster and Weinkauff; this was

borrowed from the John Crerar Library in Chicago. We wish to thank the librarians in charge of these institutions for their cooperation and especially Miss Veronica Sexton of the Academy Library, who handled most of the correspondence.

West American species appear in all of the important post-Linnaean monographs and some were noted earlier than that. Most of these works appeared in parts and more or less irregularly, so that dates of publication are extremely important. During the heyday of commercial collecting there was a scramble to get names into print and, as a consequence, it sometimes happened that only a few days intervened between the appearance of two names for the same species. Until these works were carefully collated it was impossible to tell which name had priority, and as a consequence some species have gone by later names through the years. Unfortunately, zoologists have no workable machinery for conserving an established nomenclature but prefer to adhere blindly to the rule of priority. This has necessitated several regrettable changes herein.

The dates of publication of the parts of most of these early works have been carefully deciphered by persons connected with the British Museum (Natural History). The published notes are scattered widely, however, and are not accessible to many students. Therefore, it seemed desirable to reproduce the essential information herein as a sort of annotated bibliography.

Some of the publications listed show evidence of haste and carelessness in preparation of text and illustrations; others were obviously prepared with great care. In the last category certainly belongs the work of Dillwyn, and the finest colored pictures of the group as a whole, are those of Kiener, nearly a century ago.

No attempt is here made to subdivide the genus into groups of species. This has been tried sporadically in the past, but with little success. The subdividers² differ radically among themselves. If such divisions should ever be made upon a logical basis, it seems that a vast amount of additional information must be accumulated, or the currently accepted system of nomenclature must be abandoned. In contrast with the urge to sectionize genera on one pretext or another, the views of five well known authorities are as follows:

Bergh³ worked on the anatomy of thirty-three species of *Conus* and found no character of value for the recognition of the subgroups which had already

² See for example:

Montfort, D., *Conch. Syst.*, 1810, pp. 391-410.

Swainson, W., *Treat. Malac.*, 1840, pp. 311-312.

Mörch, O. A. L., *Cat. Conch. Yoldi*, Fasc. 1, 1852, pp. 64-71.

Woodring, W. P., *Carnegie Inst. Washington*, Publ. no. 385, 1928, pp. 201-218.

Iredale, T., *Mem. Queensland Mus.*, vol. 10, pt. 1, 1930, pp. 79-80.

Cotton, B. C., *Records of the South Australian Museum*, vol. 8, no. 2, June 30, 1945, pp. 229-280, 5 pls.

³ Bergh, R. *Beitrag zur Kenntniss der Coniden*. *Nova Acta Acad. Caesareae Leopoldino—Carolinae Germanicae naturae Curiosorum*. Abh. Kais. Leopoldinisch—Carolinischen Deutsch. Akad. d. Naturfor., Bd. 65, Nr. 2, Halle, 1895, pp. 67-214, pls. 1-13.

been established, on shell characters or others which could be based upon the anatomy alone.

Dall⁴ recognized the soundness of these investigations, and did not adopt any of the names of subdivisions.

Vredenberg⁵, working on the Indian Tertiary stated: "A study of the numerous forms of *Conus* which occur in the Indian Tertiary, clearly reveals the want of sharpness between the various subdivisions of this genus, which all grade into one another so completely that they can only be regarded at most as sections. They never seem sufficiently sharply contrasted to rank as subgenera."

In his excellent monograph of western Atlantic species of *Conus* Clench^{5a} recognized the confusion existing in regard to the various divisions of the genus and stated that the entire family would have to be studied as a whole before any stability could be reached and the complex relationships worked out.

Finally, Strong^{5b} in preparing a preliminary list of west American species and without a copy of this manuscript available at the time, cited the ranges of the species and gave a key but did not adopt any subdivisions of the genus.

In an excellent article on the radulae of *Conus* Peile⁶ has discussed the various groupings which this organ suggests and the groups do not necessarily follow those suggested by shell characters. He figured thirty species and discussed others in groups, yet he did not propose generic or subgeneric names for them. If this had been done it would have necessitated considerable readjustment of the genus-names proposed by Iredale, for instance.

Unfortunately, nuclear whorls are very often eroded or so covered with extraneous growth that the characters cannot be made out. Evidently good specific criteria are present, not only in these earliest whorls, but also in several of those which follow. In many species the shoulder bears a row of closely-placed beads on the early whorls. This is a character which persisted throughout life in most of the western Eocene species but in the living forms it was lost by mid-growth or earlier. This row of beads is not morphologically related to the coronal spines which decorate some of the living forms. Von Linden⁷ and later Burnett Smith⁸ made attempts to establish the characters of the young stages of several species of *Conus* on a more solid basis but their work has not been followed extensively.

4 Dall, W. H. Summary of the shells of the genus *Conus* from the Pacific coast of America in the U. S. National Museum. Proc. U. S. Nat. Mus., vol. 38, 1910, pp. 217-228.

5 Vredenberg, E., Records, Geol. Surv. India, vol. 53, pt. 2, 1921, p. 133.

5a Clench, W. J. Johnsonia, no. 6, Dec. 5, 1942, p. 36.

5b Strong, A. M. Minutes, Conch. Club, Southern California, no. 48, May, 1945, pp. 24-27.

6 Peile, A. J., Proc. Mal. Soc. London, vol. 23, pt. 6, Nov. 28, 1939, pp. 348-355, 30 text figs.

7 von Linden, Gräfin Maria. Die Entwicklung der Skulptur und der Zeichnung bei den Gehäuseschnecken des Meeres. Zeitschr. f. Wissenschaftliche Zoologie, vol. 61, Feb. 1896, pp. 261-317, pl. 11.

8 Smith, Burnett. Young stages of *Conus adversarius* Conrad. Proc. Acad. Nat. Sci. Philadelphia, vol. 81, 1929, pp. 659-663, 2 text figs. Some specific criteria in *Conus*. Same serial, vol. 82, 1930, pp. 279-288, 12 text figs.

The photographs reproduced herewith are the result of careful work done by Mr. F. L. Rogers, a member of Works Progress Administrations assigned to the California Academy of Sciences. As black and white reproductions, they leave little to be desired, but of course, full justice to cones can only be done with color.

Most species, when living, are covered with a horn-colored periostracum, which more or less conceals the color pattern on the shell itself. It is customary to remove this coating for illustration. For this purpose, the shells were immersed in a solution of chlorine in sodium hydroxide (a commercial preparation termed "Clorox"). A few minutes to two or three hours is usually sufficient, depending upon the thickness of the covering.

Apparently most species of the genus have a small, slender, non-calcareous operculum with a terminal nucleus. This offers little protection to the retracted animal. Collectors seldom preserve it. Hemphill⁹ has given important notes on the habits and external anatomy of *Conus californicus* which are quoted in part under that species.

The northernmost limit of the genus in California is the Farallone Islands where *Conus californicus* has been reported. During the Miocene fossil forms had about the same northern limit as at present but so far as Pliocene records show the genus did not extend beyond Santa Maria Valley, California. During early Tertiary, however, the range was much wider and species are fairly common in the Eocene of Washington. The northernmost west American record is that of Dall who found the genus in material supposed to be Eocene and which was collected by Martin¹⁰ at Point Hey, Alaska.

Conus californicus is all alone as far south as Cedros Island. From there on to Panama, the group forms a conspicuous part of the molluscan fauna¹¹. No center of distribution can be indicated and no provinces or sub-provinces seem to exist. There is a mingling of elements from waters near and far, and this leads to speculation on problems of migration. Thus, there are representatives of species, scarcely or not at all distinguishable from collections from the south seas, Indian Ocean, Caribbean Sea, etc. In most cases, when west coast species have analogues elsewhere and have been given local names, we have retained these, although with a certain amount of misgiving in some instances. In order that this relationship may be made obvious, comparative notes have been inserted under the discussions of the species concerned.

Many writers have commented on the centers of distribution from which the west American molluscan fauna was derived. If all such remarks were

⁹ Hemphill, H., Zool., vol. 3, no. 4, 1893, p. 351.

¹⁰ See, Martin, G. C. Geology and Mineral resources of the Controller Bay Region, Alaska. U. S. Geol. Surv. Bull. 335, 1908, p. 30.

¹¹ We do not mean to infer, however, that species are as abundant as in some other parts of the tropics. We have recognized only twenty-nine and this seems to be an insignificant number compared, for instance, to the one hundred and sixty-eight recently listed by Faustino from the Philippine Islands. (L. A. Faustino. Summary of Philippine marine and fresh-water mollusks. Monog. 25, Phil. Bur. Sci., 1928, pp. 327-344).

combined and the theory carried to its logical conclusion it would have to be assumed that the time was not very distant, geologically, when this region lacked mollusks altogether. It does not seem to have been accepted as possible that there might have been migration the other way. The genus under review lived as long ago in California as middle Eocene and the derivation of living species in some cases is as likely to have been local as otherwise.

The largest member of the genus in the area here considered is *Conus fergusonii*; a specimen of this is at hand from the ocean shore at Magdalena Bay, Lower California, 150 mm. in length. Other species found elsewhere are larger. A specimen of *Conus litteratus millepunctatus* in the California Academy of Sciences, presented by Mr. T. T. Dranga, is 180 mm. long and 112 mm. in diameter; this came from Waimanalo, Oahu (Hawaii) in 1-2 fms. A shell, probably the same species and collected by the late Eric Jordan in Hawaii, is slightly larger; and a specimen, (Loc. No. 31578 C. A. S.), recently collected by Mr. V. D. P. Spicer on Midway Island is 197 mm. long.

The smallest living west American species is *Conus nux* Broderip, but this is more than twice as large as *Conus micarius* which Hedley¹² stated to be the smallest species of the family, with the possible exception of *Conus parvus* Pease^{12a}; there is little information concerning this one. The size of Hedley's species was given as: length, 6 mm.; diameter, 3.5 mm.

In the descriptive notes following, we have given the synonymy of published figures, and such other references as seemed especially important. Records from distributional lists, and other sources, unsupported by taxonomic information, have been omitted usually, because, in this group, it is often impossible to determine the species an author had in hand.

Collecting stations are listed under each species from north to south. Usually, only the shells which have passed through our hands have been so recorded. Original author's localities are cited in the synonymy.

Thus, an attempt has been made to prepare a report which would include sufficient information to permit the identification of any of the described living species of *Conus* of western America. Two fossil species from the Pliocene of Imperial County, California, have been included because of the close relationship shown to living species and to show that the groups to which they belong are not recent migrants to the west American region.

Some species of *Conus* are known to inflict painful and poisonous wounds, which may prove fatal. Although we know of no injuries thus having been received on the west coast of America it is significant to point out that Iredale¹³ has recorded a death from the bite of *Conus textile*. The west

¹² Hedley, C., Rec. Austral. Mus., vol. 8, 1912, p. 147, pl. 43, fig. 32. Cape York, Australia.

^{12a} This has been renamed *Lovellona peaseana* by H. J. Finlay, Trans. & Proc. New Zealand Inst., vol. 57, 1927, p. 519.

¹³ Iredale, T., Nautilus, vol. 49, no. 2, Oct. 1935, p. 41. See also, Journ. Conch., vol. 20, no. 6, Dec. 4, 1935, p. 166.

American representative of this species, *Conus dalli*, is scarcely distinguishable by shell characters and both *lucidus* and *californicus* appear to be distant relatives.

An additional fatality in Australia, recorded by Roughley¹⁴, occurred in June, 1935. In this account it is stated that the proboscis ". . . . is provided with a number of sharp teeth, each of which has a venom gland at the base." The species illustrated, and presumably the one which inflicted the injury is *Conus striatus* Linnaeus.

Several deaths were recorded recently by Hirotaka Yasiro¹⁵, and for one of these he was able to secure details of the symptoms. The article is written in Japanese and a resumé, based upon a translation by Miss A. Ichiyasu, follows:

A man, 32 years old, was gathering shells along the southeastern shore of the Bay of Chujo when he was wounded on the right thumb. No ill effects were felt at first but within half an hour intense pain was felt. He collapsed after walking a short distance and a doctor, who was called, noted the following symptoms: Pulse regular but slow. Temperature normal, 36.7°. Breathing was very difficult; something similar to Lunstock's disease. Lost consciousness. Feet and hands turned purple. The thumb looked more like it had been bruised than otherwise injured. The man died three hours after having been injured. The species which inflicted the wound was *Conus geographicus*, 135 mm. long.

That the injury resulting from an attack is not always fatal, however, is evident from an account given by Adams in the Zoology of the Voyage of the *Samarang*¹⁶ of a painful bite received by Sir Edward Belcher. This occurred at Mayo Island, Molucca Group and the species was stated to be *Conus aulicus*.

Peile¹⁷ has given an account of the anatomical features of the poison apparatus and later^{17a} illustrated many of the singularly adapted radular teeth used for injecting the poison. Members of the genus are said to feed on annelid worms.

Most of the literature pertaining to this interesting subject up to date has been examined and quoted by Clench^{17b}. In his work, which is partly a republication of an earlier paper by him, there is a great deal of valuable information, including four plates of drawings of the anatomy of *Conus striatus* Linnaeus by Yoshio Kondo. This paper should be consulted by those who are further interested in the subject.

14 Roughley, T. C., Wonders of the Great Barrier Reef, 1937, p. 113, pl. 19, fig. 2.

15 Yasiro, Hirotaka, Venus, vol. 9, nos. 3-4, Oct. 1939, pp. 165-166.

16 Adams, A. and Reeve, L. A., Zool. Voy. H.M.S. Samarang, Moll. 1848, p. 19.

Tryon, G. W., Man. Conch., vol. 6, 1884, p. 5.

17 Peile, A. J., Journ. Conch., vol. 20, 1937, p. 301.

17a Peile, A. J. Radula notes VIII. 34. *Conus*. Proc. Mal. Soc. London, vol. 23, pt. 6, Nov. 28, 1939, pp. 348-355, 30 text figs.

17b Clench, W. J. The Poison cone shell. Occ. Pprs. on Mollusks, Mus. Comp. Zool., vol. 1, no. 7, March 15, 1946, pp. 49-80, 5 plates.

There is much scattered information on the general anatomy of various species of *Conus*. In addition to the work of Bergh and Peile, to which reference has already been made, the latter cited several articles of especial importance. In addition he stated that each tooth is "—a rolled up plate, as pointed out by Troschel; the barbs and serrations, when present, are formed by indentations on the sides of the plate, verified by myself recently for teeth of *C. miles* and *C. zonatus*. To prepare for action, one tooth is detached from the bunch, enters the pharynx and is held, projecting, in the end of the proboscis, which then seizes a tooth by the barbed end. The proboscis, when everted would hold the tooth in the required position."

"A hollow, muscular bulb (called by previous authors the poison gland) is connected to the pharynx by a very long, convoluted tube (called previously the poison duct), the highly specialized epithelium of which, in Hermitte's opinion, actually secretes the poison. At the moment of attack, by contraction of the bulb, poison is driven through the proboscis into the tooth, which enters the prey and probably remains there by virtue of its barbs."

Peile further stated that the word "radula" is quite inappropriate as applied to the highly specialized offensive weapon found in other genera of *Toxoglossa* as well as in *Conus*. We agree, but an applicable term seems not to have been proposed thus far.

BIBLIOGRAPHIC NOTES

In this study it has been necessary to examine critically some of the more important publications relating to *Conus* and notes thus assembled have proved to be so useful that their publication seems warranted. Numerous other references which are probably equally valuable but are better known, are cited under the various species.

Broderip, W. J., and Sowerby, G. B. In the early volumes of the Proceedings of the Zoological Society of London, these authors described several species of west American cones. The dates of the various parts (1830-1859) with pages included therein, have been published by Sclater¹⁸.

Bruguère, J. G. Encyclopédie Méthodique Hist. Nat. des Vers; Text vol. 1, pt. 1, 1792, pp. 586-597; pt. 2, 1792, pp. 598-757; pls. 315-348, Liv. 64, An. VI, [1798].

This important work was issued rather irregularly and apparently an entirely satisfactory collation is impossible. The best and most complete are those published by Sherborn and Woodward, 1893, 1899, 1904, and 1906¹⁹.

¹⁸ Sclater, P. L., Proc. Zool. Soc. London, 1893, pp. 435-439.

¹⁹ Sherborn, C. D., and Woodward, B. B. On the dates of the Encyclopédie Méthodique (Zoology). Proc. Zool. Soc. London, 1893, pp. 582-584; 1899, p. 595.—Cat. Library, British Museum (Nat. Hist.) vol. 2, 1906, pp. 527-528.—On the dates of publication of the natural history portions of the Encyclopédie Méthodique. Ann. Mag. Nat. Hist. ser. 7, vol. 17, 1906, pp. 577-588.

From these, especially the last, it appears that the article on *Conus* was prepared in part by C. H. Hwass²⁰, and was published in volume 1, part 1 of the "Histoire naturelle des Vers," which appeared in 1792. The same authors (see their footnote 10, 1906 collation) learned from a note published on p. 598 of part 2 of the same volume, that Hwass was responsible for the definition of the genus and its divisions and the Latin diagnoses of the species and varieties. "Deshayes" supplied the general observations, synonymy, and French descriptions. The plates of these forms (315-348) were prepared by Hwass from the specimens, according to Lamarck, 1822²¹ and Deshayes, 1845²². The latter stated emphatically that Bruguière described the species, using to a large extent, the beautiful collection of Hwass and to whom he referred as a wealthy amateur.

The conflicting statements by Deshayes and the note on page 598 of part 2, volume 1 of the Encyclopédie Méthodique are very confusing. According to the one, Bruguière should be cited as the author and according to the other it should be Hwass. This matter has not been entirely cleared up in the literature.

Further difficulty arises because the plates, which were issued as a part of Liv. 64 "An. VI" [1798], were not supplied with explanations or names for the figures, and in the text there are no references to them. This discrepancy has been supplied to a large extent by later authors, two of whom were in a position to express expert opinion, Deshayes (1845) and Dautzenberg, 1937²³. The first attributes the species to Bruguière without qualification; the last accredits them to Hwass in headings but cites them in synonymy as "Hwass in Bruguière, Encycl. Méthod." following Sherborn, Index Animalium. Tomlin²⁴, however, has followed Deshayes and cited Bruguière as author of all of the species.

Reeve²⁵, who undoubtedly had first hand knowledge stated: "In this species, of which Mr. Cuming has obtained two specimens without any information as to their locality, we may fairly recognize the *C. fulgurans* described in the Encyclopédie Méthodique, in 1792, by Bruguière, from the manuscript of M. Hwass of Copenhagen."

²⁰ For biographical notes on the life and work of Hwass and also Bruguière, see: Maton, W. G., and Rackett, T. An historical account of Testaceological writers. Trans. Linnaean Soc. London, vol. 7, 1804, pp. 119-224. [This valuable commentary on early writers goes back to Aristotle.]—Gosch, C. A. Christian Hee Hwass, 1731-1803. Journ. of Conchology, vol. 11, 1906, pp. 311-332.—Lamy, Edouard. Les Conchyliologues Bruguière et Hwass. Journ. de Conchyl., vol. 74, 1930, pp. 42-59.—Iredale, Tom. The truth about the Museum Calonnianum. Festschrift, zum 60 Geburtstag von Prof. Dr. Embrik Strand, vol. 3, 1937, pp. 408-419.—Dodge, Henry. A letter concerning the Cones of Hwass and other collections in Switzerland. Nautilus, vol. 59, no. 3, Jan. 1946, pp. 97-101.

²¹ Lamarck, J. B., Anim. s. Vert., Tom. 7, 1822, p. 422.

²² Deshayes, C. P., Hist. Nat. Anim. sans Vert., ed. 2, vol. 11, 1845, pp. 2-4.

²³ Dautzenberg, Ph., Rés. Sci. Voy. Indies Orientales Néerlandaises. Mem. Mus. Roy. d'Hist. Nat. de Belgique, vol. 2, fasc. 18, 1937.

²⁴ Tomlin, J. R. Le B. Catalogue of recent and fossil cones. Proc. Mal. Soc. London, vol. 22, 1937, pts. 4, 5, and 6.

²⁵ Reeve, L. A., Conch. Icon., Suppl., *Conus*, Feb. 1848, pl. 1, sp. 271.

Clench^{25a} in dealing with east American forms used the combination "Hwass [in] Bruguière" and quoted an English translation by Bequaert of Bruguière's remarks upon the authorship.

In view of the difficulty in finding any common ground for agreement or any basis for positive opinion, we have followed the usage of Tomlin in the present report, chiefly because his "Catalogue" will doubtless continue to be used as a checklist for the genus for many years.

In order that the student may have as much information as possible and thereby arrive at an independent conclusion, we have critically examined a copy of the work, which, fortunately, may be found in the Library of the University of California (Biology Branch). The title page is as follows: "Encyclopédie Méthodique/Histoire Naturelle/des Vers./Tome premier/Par M. Bruguière. Paris/ MDCCXCII." Signatures are marked: "Historie Naturelle Tome VI. Vers." (A note opposite the title page indicates that "Tome VI" is an error and that that volume actually pertains to insects.) The first part, pp. 586-597, contains 146 species of cones with common names and short descriptions in French. General considerations occupy pp. 598-602 and the remainder of the chapter, pp. 602-757, contains scientific names, Latin descriptions, resumé of previous literature and synonymy, varieties, descriptions and observations in French, location of specimens, rarity and range of the 146 species. The French text seems to indicate preparation by Bruguière because reference is often made therein, to Hwass. However, the first paragraph of this section contains important information, indicating that the portion in Latin was from the manuscript of Hwass.

Crosse, H. Observations sur le genre Cone et description de trois espèces nouvelles, avec un catalogue alphabétique des Cônes actuellement connus. (Pl. II.) Revue et Magasin de Zoologie pure et appliquée, ser. 2, vol. 10, 1858, pp. 81, 113-127, 150-157, 199-209.

This is the first attempt to make a complete catalog of names which had been applied in the genus and forms a very valuable list. Some of the locality records are not good but they were obviously taken from the literature then available. The increase in number of names is shown by a tabulation as follows:

Linnaeus	35 species	
Bruguière	146 species	
Lamarck	190 species	(9 fossil)
Deshayes	242 species	(14 fossil)
Reeve	268 species	
Kiener	324 species	
Sowerby (Thesaurus)	404 species	

In this enumeration there were listed 455 names of living species, considered valid, 27 doubtful, 62 possible varieties, 76 synonyms (listed twice),

^{25a} Clench, W. J. The genus *Conus* in the western Atlantic. *Johnsonia*, no. 6, Dec. 5, 1942, p. 3.

88 fossils and 13 names either synonyms or incorrectly referred to the genus. This makes a total of 645 specific names which had been used in the genus up to 1858. By 1937 this figure had so grown that Tomlin required 2719 headings to record the names of living and fossil species he had found. Crosse gave a resumé of various schemes of classification and finally decided that the genus was closer to *Pleurotoma* than to *Strombus*. Nineteen sub-genus names had been used up to that time, to which, however, he did not attach much importance. The list is as follows:

<i>Rhombus</i> Montfort	<i>Coronaxis</i> Swainson
<i>Stephanoconus</i> Mörch	<i>Cylindrella</i> Swainson
<i>Puncticulus</i> Swainson	<i>Nubecula</i> Klein
<i>Tuliparia</i> Swainson	<i>Pionoconus</i> Mörch
<i>Rollus</i> Montfort	<i>Phasmoconus</i> Mörch
<i>Lithoconus</i> Mörch	<i>Cylinder</i> Montfort
<i>Rhizoconus</i> Mörch	<i>Textilia</i> Swainson
<i>Dendroconus</i> Swainson	<i>Hermes</i> Montfort
<i>Leptoconus</i> Swainson	<i>Theliconus</i> Swainson
<i>Chelyconus</i> Mörch	

It may be of interest in this connection to record that we have noted incidentally, 48 super-specific names in the family in the preparation of the present report.

In the discussion of the synonymy and relationships, west American species received very little attention.

Dillwyn, J. W. A descriptive catalogue of recent shells, arranged according to the Linnaean method; with particular attention to the synonymy. London, vol. 1, 1817, pp. 1-580; vol. 2, 1817, pp. 581-1092 + 29 pp. of index. For *Conus* see pp. 352-435. This work is extremely valuable when the tracing of names through pre-Linnaean literature is attempted.

Kiener, L. C. *Spécies général et iconographie des coquilles vivantes. Famille des enrouleés. Genre Cône.* 379 pp. 111 plates.

This volume of the *Iconographie* was prepared entirely by Kiener. A part of the set to which it belongs was finished by P. Fischer. It contains the most exquisite illustrations of *Conus* which have appeared. Sherborn and Woodward²⁶ have published a collation which shows that the text and plates dealing with cones appeared as follows:

Livraison	Pages	Plates	Date
105-112		111	1846
113-116	1-64		1846
117-123	65-176		1847
124-126	177-224		1848
127-129	225-272		1849
130-137	273-379		1849-50

²⁶ Sherborn, C. D., and Woodward, B. B., *Proc. Mal. Soc. London*, vol. 4, 1901, pp. 216-219.

The date 1846 assigned to the plates seems very doubtful; they probably appeared along with the text through a period of years.

Küster, H. C., and Weinkauff, H. C., Systematisches Conchylien—Cabinet von Martini und Chemnitz. In Verbindung mit Dr. Philippi, Pfeiffer, Römer, Dunker, Kobelt, H. C. Weinkauff [*sic.*], S. Clessin, Brot und von Martens neu herausgegeben und vervollständigt von Dr. H. C. Küster. Vierten Bandes zweite Abtheilung. Nürnberg, 1875.

Die Familie der Coneae oder Conidae. I. *Conus* Linné angefangen von Dr. Küster, durchgesehen, ergänzt und vollendet von H. C. Weinkauff in Crueznach. Nürnberg, 1875.

Apparently a complete collation of this large monograph has not been published. The text on cones contains 413 pages and there are plates A and 1-71. The first 124 pages and 24 + A plates were prepared by Küster, beginning in 1837, according to Woodward²⁷. Pages 125-413 and plates 25-71 are by Weinkauff and were published in 1873-1875. A collation appears as follows in Bib. Zool., vol. 4, 1894, p. 2791:

Band	Abt.	Heft.	Bogen	Pages	Plates	Date
IV	2	10	17-21 [25]	[125-196]	25-29	1873
IV	2	11	26-28	[197-220]	30-35	1873
IV	2	12	29-31	[221-244]	36-41	1873
IV	2	13	32-34	[245-268]	42-47	1874
IV	2	14	35-38	[269-300]	48-53	1874
IV	2	15	39-42	[301-332]	54-59	1875
IV	2	16	43-47	[333-374]	60-65	1875
IV	2	18 [17]	48-50*	[375-413]	66-71	1875

*Plus index and title page for Bd. 4, Abt. 2 Comprising Bogen 51-53.

A critical examination of the only copy of the work available for this study²⁸ shows that pages 1-124 and plates A+1-23 form a unit printed with similar type and on the same kind of paper. Pages 125-413 and plates 25-71 are likewise a unit, printed with different type and on different paper. Plate 24, while differing in minor details from either of the two groups was drawn by Küster but was probably issued by Weinkauff.

Von Martens²⁹ reviewed the work and stated that it was resumed in 1873 after having been commenced 33 years before. This would place the beginning of Küster's part in 1840, not 1837 as indicated in the Catalog of the Library of the British Museum. He further stated that Weinkauff issued "parts 66 & 70, pp. 105-124 (old)," presumably meaning the latter part of the material prepared and printed by Küster. This belief is substantiated

²⁷ Woodward, B. B. Catalogue of the Library of the British Museum, p. 1252. A collation, published by C. H. Oostingh (Meded. van de Landbouwhoogeschool te Wageningen (Nederland), Deel 29, Verh. 1, 1925, p. 336), indicates that pages 1-24 and plates 1-6 appeared in 1837, and pages 25-124 with plates A, 7-24 appeared in 1838.

²⁸ This copy was kindly lent to the Library of the California Academy of Sciences by the John Crerar Library.

²⁹ von Martens, E., Zool. Record, 1874, p. 134, 1875, pp. 132, 160.

by the fact that he indicated pp. 125-300 as "new" and that for 1873 plates 19-53 appeared. He noted the completion of the work in the Zool. Record, 1875, (pp. 132-160), when he reviewed the part, pp. 309 [300] - 413, pls. 54-71.

The collation printed by Woodward³⁰ is very complete so far as entire Abteilung are concerned, but he did not give details of the dates of appearance of the separate parts of Lieferungen, Heften, Bogen, etc. Fortunately the printers numbered the signatures "Bogen," each of which consists of eight pages. To add to the confusion which exists regarding the set, the part on *Conus* was further subdivided into sections, probably for commercial purposes. The following information pertaining thereto was found in the Bib. Zool., vol. 4, 1894, p. 2791:

Sec. II	1873	15 text Bogen	17 pls.
Sec. III	1874	10 text Bogen	18 pls.
Sec. IV	1875	15 text Bogen	18 pls.

If this information be correct Küster did not issue all of the material he had printed and left manuscript which was edited (very considerably) and printed by Weinkauff.

A resumé of the above information, the best obtainable at this time and that which has been cited in the present report is as follows:

Author	Date	Pages	Plates
Küster	1837-1840	1-104	A+1-18
Küster	1873	105-124	19-23
Weinkauff	1873	125-139	24-26
Weinkauff	1873	140-244	25-41
Weinkauff	1874	245-300	42-53
Weinkauff	1875	301-413	54-71

Sherborn used the part published by Küster in the preparation of Index Animalium, 1800-1850, but there was only one new species name to cite, namely: *Conus caeruleus*, p. 85, pl. 14, fig. 34. For this he gave the date as 1838 and the part of *Conus* as "(6)." For this reason we have cited the Küster part of the monograph as 1837-1840 rather than accept von Marten's statement regarding the beginning of the work.

The monograph is extremely difficult to use. Citations are often incomplete, misleading, or erroneous. The figures are poorly drawn and greatly over-colored especially in the early part of the copy examined. Nevertheless we have attempted to use it to the extent of our ability in connection with this study of west American *Conus*.

Weinkauff (pp. 174-175) in a footnote explained that the publisher had had difficulty with the draftsman who was responsible for the incorrect figures which appeared up to that time. He added further that Dr. Kobelt had consented to prepare those for the remaining Lieferungen and that in itself

³⁰ Woodward, B. B., Cat. Lib. British Mus., vol. 3, pp. 1252-1253.

was a guarantee of their exactness. This is at the beginning of signature 23. The last plate cited in the old Küster text (pp. 1-124) is no. 24, an odd plate. The highest number cited on any of the Weinkauff text before page 174 is no. 35. Kobelt's name appears only on plates 38-41. These bear a decidedly different style of lettering and incidentally are wrongly labelled [vol.] III [Abt.] 3 instead of "IV 2" which is consistently used elsewhere. In resumé it appears that:

Küster drew plates	A, 24
Another draftsman drew plates	1-23
A third draftsman drew plates ,	25,26
A fourth draftsman drew plates	26-35
A fifth draftsman drew plates	36,37
Kobelt drew plates	38-41
A seventh draftsman drew plates	42-71

Mermod, G. Catalogue des types et des exemplaires des cônes figurés ou décrits par Hwass, Bruguière, Lamarck, de Lessert, Kiener et Chenu, se trouvant au Musée de Genève. *Revue Suisse de Zoologie*, tome 54, no. 5, Jan. 1947, pp. 155-217, 4 text figs.

Detailed information is given here on 196 classical species described or figured by the authors named in the title. A large number of the specimens discussed were those actually used for original descriptions and illustrations and therefore they are properly considered to be types. The formal selection of them as neoholotypes or neosyntypes would seem to be in order. Much additional information is given about the early authors, their work and their collections. Also, under each species, there is often valuable taxonomic data.

Only six of the species listed are of special concern to students of west American cones, namely, *tessulatus* Born; *vittatus* "Hwass in Bruguière" (as Mermod consistently cites such species); *monilifer* Broderip; *purpurascens* Broderip; *ebraeus* Linnaeus and *vermiculatus* Lamarck.

Reeve, Lovell Augustus. *Conchologia Iconica: Or, Illustrations of the Shells of Molluscous Animals*, vol. 1, 1843, 1844, and supplement, 1848, 1849.

This great monograph covering many volumes has a primary title page for the entire work as follows: "Conchologia Iconica: A complete repertory of species. Pictorial. Descriptive." And on this page there is a beautiful figure in colors of *Conus gloria-maris*. Both title pages bear the date 1843. The first 47 plates of the first volume deal with *Conus*. Each plate with its descriptive text was issued separately and the first page of each of the texts is dated with month and year, except for plates 1, 2, and 3, covering species nos. 1-14. [Plate 1 of the copy at the California Academy of Sciences has "Jan. 1843." at the bottom of the first page of text but this has obviously been stamped.] Plate 4 is dated "Jan. 1843," also so it seems safe to assume that 1, 2, and 3 appeared during that year. If this be true then 1843 is the proper year to cite for plates 1-39 inclusive, species 1-216. Plates 40-47,

species 217-268, appeared in 1844. The colored figures on these plates are excellent examples of lithography; they are usually signed by Sowerby and Reeve, sometimes by Sowerby alone.

The supplement is not so well known as the general work and copies of the set have been seen in which it is missing. It came out without a title page and was intended to correct some errors which had been detected in his own as well as the work of others and to put some new species on record. The corrections and comments take up seven pages, dated June, 1849. The dates on the explanations of the nine plates are as follows:

1. February, 1848	6. June, 1849
2. April, 1848	7. June, 1849
3. April, 1848	8. June, 1849
4. June, 1849	9. June, 1849
5. June, 1849	

There is an unfortunate error in the numbering of the species on the plates and in the explanations, starting with plate 4. The numbers from 237 - 283 should have been 287 - 333. This is noted by Reeve at the end of the work but he printed the last figure as "337" by mistake.

Sowerby, G. B. Jun. The conchological illustrations. This important work appeared in 200 parts between 1832 and 1841. Sherborn and Shaw³¹ have published a very valuable history of the work with a collation as complete as was possible. The essential data in connection with *Conus*, follow:

Part	Date	Figures
24	March 29, 1833	1-7
25	April 12, 1833	8-14
28	May 10, 1833	15-21
29	May 17, 1833	22-29
32	May 17-July 12, 1833	30-33
33	May 17-July 12, 1833	34-41
36	July 19, 1833-January, 1834	42-49
37	July 19, 1833-January, 1834	50-58
54	April 15, 1834	59-67
55	April 15, 1834	68-75
56	April 30, 1834 }	76-91
57	April 30, 1834 }	
147	December, 1838 }	92-102
148	December, 1838 }	
151	December, 1838-April 15, 1839 }	103-111
152	December, 1838-April 15, 1839 }	
153	April 15, 1839 }	112-119
154	April 15, 1839 }	
155	May 15, 1839 }	120-127
156	May 15, 1839 }	
157	June, 1839 }	128-137
158	June, 1839 }	

³¹ Sherborn, C. D., and Shaw, H. O. N., Proc. Mal. Soc. London, vol. 8, 1909, pp. 331-340.

The only text for the above consists of four pages issued in 1841. The copy of the volume in the library of the California Academy of Sciences was bound, presumably, according to the instructions issued to the binder with part 200. The text is assembled in the front, that pertaining to each genus being paged separately, in most cases. The total number of pages is 120 and these have the appearance of the reprinted issue, not the original sheets which accompanied the plates. *Conus* text, however, does not seem to have been reprinted. Plates were numbered as issued, each plate apparently being equivalent to one part. Consequently, when bound consecutively, the material for each genus is scattered through the work.

Sowerby, G. B. Jun. [Completed by G. B. Sowerby III.] Thesaurus Conchyliorum or monographs of genera of shells. vol. 3, 1855-1866. *Conus* occupies the first part of this volume, pages 1-56 and plates [I] 1-24. The plates are numbered consecutively for the genus and also 187-210 for the entire work. Figures are numbered consecutively beginning with 1 and extending to 601. Each plate is accompanied by one page of explanatory text. Supplementary text entitled "Appendix to monograph of the genus *Conus* comprises pages 325-331, plates 25-28 (genus numbers), 286-289 (whole numbers). Figures 602-652 are included on these plates. A "Second supplement to monograph of the genus *Conus*" is found in volume 5. The text includes pages 249-279 and plates 29-36 (genus numbers), 507-512, 512 bis, 512* (whole numbers). Figures 653-761 are included on these plates.

This important work has been collated by Woodward³², the essential information pertaining to *Conus* being as follows:

Volume	Part	Pages	Plates	Date
3	17	1-24	187-195	1857
3	18	25-56	196-210	1858
3	19			
3	24-25	277-331	266-290	1866
5	44	248-305	507-512*	1887

Tomlin, J. R. le B. Catalogue of recent and fossil cones. Proc. Mal. Soc. London, vol. 22, pt. 4, March 13, 1937, pp. 205-236; pt. 5, July 21, 1937, pp. 237-330; pt. 6, November 15, 1937, p. 333.

This paper is invaluable to any one contemplating a study of this group of mollusks. It is not a bare list of names alphabetically arranged, but has thorough bibliographic references, some notes on synonymy, localities from which the species were described and the disposition of the type specimens when this was known.

Tryon, George W. Jr. Manual of conchology; structural and systematic, [ser. 1], vol. 6, 1883-1884; Conidae, Pleurotomidae. The part of this monograph which deals with *Conus* takes up the first 150 pages and 31 plates of

³² Woodward, B. B., Cat. Library, British Mus. (Nat. Hist.), vol. 5, 1915, p. 1981.

the volume. The title page is dated 1884, but the work was issued in parts at irregular intervals. Vanatta³³ has published a list of all of the parts of the first series of the Manual (17 volumes) giving dates and inclusive pages. The essential data for volume 6 follow:

Part	Pages	Date
21	1-64	December 27, 1883
22	65-150	April 18, 1884
23	151-214	June 10, 1884
24	215-413	October 2, 1884

No information is available to show the allocation of plates to each part. Many of the figures are copied from former works and the complicated system of citing authorities makes it difficult to use as an original source of information. However, once this system is mastered almost every name of living species in the literature up to that time can be found, usually with a reference of some sort. The figures are colored, and in most cases the work is well done.

³³ Vanatta, E. G., *Nautilus*, vol. 40, 1927, pp. 96-99.

CLASS GASTROPODA
ORDER CTENOBRANCHIATA
SUPERFAMILY TOXOGLOSSA
FAMILY CONIDAE

Genus *Conus* Linnaeus

Conus LINNAEUS, Syst. Nat., ed. 10, 1758, p. 712.—MONTFORT, Conchyl. Syst., vol. 2, 1810, p. 406. "Espèce servant de type au genre Le Cône flamboyant. *Conus fulgurans*" [Bruguière.] As Iredale³⁴ pointed out, this is not a valid type designation because *fulgurans* was not in Linnaeus' list of species. However, Montfort included *Conus generalis* Linnaeus as a synonym, and this is in the original list.—CHILDREN, Quart. Journ. Sci. Lit. Arts, vol. 16, 1823, p. 69, Reprint, 1823 p. 107 [143]. Type cited, *Conus marmoreus* Linnaeus, which was in the original list and, therefore, is valid. For good illustrations of the species see: Reeve, Conch. Icon., vol. 1, 1843, pl. 14, sp. 74; or Tryon, Man. Conch., vol. 6, 1883, p. 7, pl. 1, fig. 1.—SWAINSON, Treat Malac., 1840, p. 148. Swainson's type designation is contained in the following: "Nothing additional, in fact, can be added to separate, for instance, the subgenus of *Conus*, whose type is *C. litteratus*, from its representative, *C. marmoratus*, in the genus *Coronaxis*: so perfect are these resemblances, that we do not actually know where the two groups join and unite." On page 312 of the same work, *Conus litteratus* is listed as the second species under *Conus*, not under one of the many subgenera which he established. Iredale³⁴ considered Swainson's designation of type species the earliest valid one and he was followed by Cotton.—GRAY, Proc. Zool. Soc. London, 1847, p. 135. Type, "*C. marmoreus*" Linnaeus.

Type (designated by Children): *Conus marmoreus* Linnaeus

The above brief synonymy is only that which has a bearing on the selection of the proper species to serve as the type of the genus. It is obvious that there has been considerable divergence of opinion in this regard and we feel that a final solution may not yet have been suggested. At present we favor following Children in the selection of *Conus marmoreus* as the genotype, a conclusion which was reached independently by Keen^{34a}, Cox^{34b}, Stewart^{34c}, and Kennard, Salisbury and Woodward^{34d}.

³⁴ Iredale, T., Mem. Queensland Mus., vol. 10, 1935, p. 79; — Cotton, B. C. Rec. S. Australian Museum, vol. 8, no. 2, June 30, 1945, p. 231.

^{34a} Keen, A. Myra. Min. Conch. Club Southern California, no. 48, May 1945, p. 23.

^{34b} Cox, L. R. Rept. Paleo. Zanzibar Protectorate, Sept. 1927, p. 92.

^{34c} Stewart, R. B. Proc. Acad. Nat. Sci. Philadelphia, vol. 78, 1926, p. 415.

^{34d} Kennard, A. S., Salisbury, A. E., and Woodward, B. B. Smithsonian Misc. Coll., vol. 82, no. 17, 1931, p. 35.

KEY TO WEST AMERICAN SPECIES OF *CONUS*

A. Shoulder ornamented with a row of nodes or blunt spines

- a. Basic color, uniform pink when epidermis is removed
 - b. Marked with longitudinal brown lines or stripes
 - c. Longitudinal markings about 1 mm. broad.....*princeps*
 - cc. Longitudinal markings reduced to hair-lines.....*p. var. lineolatus*
 - bb. Without markings, uniform pink.....*p. var. apogrammatum*
- aa. Basic color reddish brown to white
 - d. Lower end of body whorl bright purple; white, with brown, zigzag stripes and blotches, very small.....*nux*
 - dd. Basic color darker; shell larger; no purple on tip of body whorl
 - e. Basic color reddish brown or reddish purple
 - f. Reddish brown with white blotches.....*brunneus*
 - ff. Reddish purple with spiral rows of rectangular dots and dashes interspersed with white.....*tiaratus*
 - ee. Basic color chestnut brown or cream
 - g. Basic color chestnut brown
 - h. Coronal spines prominent
 - i. Body whorl without pustules.....*diadema*
 - ii. Body whorl more or less pustulose.....*d. var. pemphigus*
 - hh. Coronal spines obscure; body whorl marked with darker brown
.....*gladiator*
 - gg. Basic color light cream with blotches and spiral rows of dark brown dots*bartschi*

B. Shoulder without nodes

- a. Without color markings
 - b. Shape pyriform, spire low.....*patricius*
 - bb. Shape conical
 - c. Size large, spire low, tinted with orange.....*fergusoni*
 - cc. Size smaller, spire high, slightly dome shaped, not separately colored
.....*californicus*
(usual phase)
- aa. Color markings present
 - d. Markings form a network of fine lines
 - e. Meshes of network usually triangular.....*dalli*
 - ee. Meshes of network usually rectangular
 - f. Spire straight; heavily reticulate.....*lucidus*
 - ff. Spire domed; reticulation faint.....*californicus*
(rare phase)
 - dd. Color markings not forming network
 - g. Markings consist of rectangles of color in spiral rows; not pustulose

- h. Markings nearly black and very large, sometimes vermiculate.....*ebraeus*
 hh. Markings, smaller and red.....*tessulatus*
 gg. Color markings irregular
- i. Fine spiral rows of dots predominate
- j. Body whorl pustulose or with spiral ridges
- k. Shell nearly as broad as high.....*perplexus*
 kk. Slender and with high spire.....*tornatus*
 jj. Body whorl smooth
- l. Very fine spiral lines of dots; a central dark band with white blotches
*vittatus*
- ll. No central dark band
- m. With large mahogany red blotches over the fine spiral dotting; interior white.....*mahogani*
 mm. Large blotches pale or absent; interior purple.....*ximenes*
- ii. Color markings, predominately large, cloud-shaped blotches or longitudinal, flame-shaped masses
- n. Spiral grooves over entire body whorl which is short and pinched in below.....*arcuatus*
 nn. No spiral grooves except near tip of body whorl
- o. Spire low; body whorl disproportionately long.....*dispar*
 oo. Spire normal or high
- p. Purple cloud shaped masses predominate.....*purpurascens*
 pp. Orange, yellow, brown and red predominate
- q. Color markings many, broken longitudinal flames and cloud-shaped masses
- r. Spire high; scalariform.....*scalaris*
 rr. Spire normal
- s. Cloud-shaped masses predominate.....*gradatus*
 ss. Markings arranged as irregular flammules or spirals
- t. Spiral arrangements of markings predominate
- u. Only three or four light colored spiral bands
*archon*
- uu. Many spiral bands due to breaking up of flammules*regularis*
 tt. Flammules predominate; often somewhat zigzag.....*incurvus*
- qq. Color markings, few
- v. A few longitudinal stains like brush-marks of color*virgatus*
 vv. Markings consist of a few white blotches in a central band and one near the periphery, predominate color being orange to lemon yellow, entire shell becoming pure white with further growth
*fergusoni*
 (immature)

Conus brunneus Wood

Plate 5, Figures 8, 9, 10

Conus brunneus WOOD, Index Test., 1828, Suppl., p. 8, pl. 3, fig. 1. "Habitat unknown." Ed. by Hanley, 1856, p. 207, suppl. pl. 3, fig. 1, b. "Panama."—SOWERBY, Conch. Ill., Apr. 15, 1834, p. 3 [119], pl. 54, fig. 63. "Galapagos Isl."; Proc. Zool. Soc. London, 1834, p. 18, "Hab. ad Insulas Gallapagos, ad Puertam Portreram et ad Panamam."—REEVE, Conch. Icon., vol. 1, pl. 14, figs. 72-a, 72-b, June, 1843.—KIENER, Icon. Coq. Viv., Genre *Cône*, p. 24, pl. 15, fig. 1, 1-a, 1846.—SOWERBY, Thes. Conch., vol. 3, p. 6, pl. 189 [*Conus* pl. 3], 1857, figs. 47-49.—TRYON, Man. Conch., vol. 6, 1883, p. 28, pl. 7, figs. 36, 37.—STEARNS, Proc. U. S. Nat. Mus., vol. 16, 1893, pp. 384-385.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 220; "Cape St. Lucas to the Galapagos and Clipperton Islands, and on the mainland south to Manta, Ecuador."

Type locality: Unknown. Typical specimens have been collected on Albemarle Island, Galapagos Islands.

Range: San Marcos Island, Gulf of California to "Manta, Ecuador" (Dall).

Collecting stations: Mexico: Many of the islands of the Gulf of California and from Magdalena Bay and Cape San Lucas of the Peninsula, south to Guerrero; Costa Rica: Port Parker; Braxilito Bay; Port Culebra; Bat Islands; Galapagos Islands, Indefatigable; Albemarle; Charles; Narborough; Seymour; Cocos Island. This is one of the most common littoral species of *Conus* along west American shores. Its abundance may be demonstrated by the presence of 28 lots in the California Academy of Sciences from points ranging from Magdalena Bay and San Marcos Island, Lower California to Veragua, Panama. It is especially abundant on the Galapagos Islands.

The dirty brown, coralline incrustated shells of this species, found so abundantly in the intertidal zone of the Galapagos Islands present a very different appearance when stripped of their covering. One of these, from Albemarle Island which is considered typical, has been figured herewith because it agrees in all but minute detail with Wood's original illustration. The white ground color on the body whorl is usually reduced to a few median blotches and may be absent. The remainder is a dark reddish brown with many fine spiral lines of a darker shade. Often these are somewhat broken and of uneven width and shade, occasionally taking the form of spiral lines of fine dots. The amount of white is often greater than shown, there being an irregular zone of blotches below the coronal spines as well as around the center. The interior of the shell is leaden gray in fresh specimens, usually white in those which have weathered. Well worn beach specimens are usually purple with a light median band and white spire. Apical characters are not preserved on any available specimen. The spire otherwise is characterized by the many prominent coronal spines and a number of spiral grooves which may vary from none to as many as nine. The number of coronal spines seems to vary only from 10 to 12 on the last whorl.

The name *diadema* Sowerby was given to a uniformly brown specimen from the Galapagos which the author later referred to *brunneus*. However it seems to be specifically distinct.

Dall gave the varietal name *pemphigus* to a small, somewhat pustulate shell from the Tres Marias Islands. With so large a series for study as we have had it seems that this should be allied with *diadema*. Unfortunately, the type of *pemphigus* appears to be an end member of a variable race, rather than an average as represented by our collection.

Conus diadema Sowerby

Plate 5, Figure 6

Conus diadema SOWERBY, Conch. Ill., p. 3 [119], pl. 57, fig. 88, April 30, 1834. [The Calif. Acad. Sci. copy of Conch. Ill. has as explanation of pl. 57, fig. 88: "*C. brunneus*, Wood. (*C. Diadema*, C. I. list).]"—Proc. Zool. Soc. London, June 17, 1834, p. 19. "Hab. ad Insulas Gallapagos."

Conus prytanis MELVILL in Sowerby, Proc. Zool. Soc. London, 1882, p. 117, pl. 5, fig. 1; "Galapagos Islands."—SOWERBY, Thes. Conch., vol. 5, 1887, p. 267, pl. 512 [*Conus* pl. 34], fig. 732.

Type locality: Galapagos Islands.

Range: Known only from Revillagigedo, Tres Marias, and Galapagos Islands.

Collecting stations: Three lots in the California Academy of Sciences came from the stations indicated in the range. It is a littoral form.

Evidently Sowerby was not at all sure of the validity of the species *diadema* and most subsequent authors have placed the name in the synonymy of *brunneus*. However, the plain chestnut brown shell with light buff central stripe (usually present) and the waxen yellow spire seems to deserve specific separation from *brunneus* and *diadema* is the earliest available name. With such very large collections as have been at hand for this study it would seem that intergradation would be indicated if it actually exists. Another good character for separation is the rich purple interior of *diadema*. The inside of the outer lip of *diadema* is very bright purple with a central area of leaden gray. Usually the yellow spire is quite sharply differentiated from the chestnut brown of the body whorl. No trace of light or dark colored blotches has been seen. Specimens from Cocos Island have several rows of small pustules toward the base, a character which reached extreme development in the variety *pemphigus* from the Tres Marias Islands. The largest *diadema* seen came from Hood or Albemarle Islands, Galapagos (No. 23007 C. A. S.) and measures 51 mm. in length. Normally, the shell is only about half that size.

This species, with *brunneus*, *tiaratus*, and the forms called *miliaris* (= *tiaratus*) constitute a very difficult group but it is believed that the sep-

aration shown herein will not lead to confusion. Just as in the case of some other species of *Conus* this west American one has a closely related form in the south seas, *C. lividus* Bruguière. Except for the purple tip usually present in that form the two would be much more difficult to separate.

***Conus diadema pemphigus* Dall**

Plate 5, Figures 7, 11

Conus brunneus pemphigus DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 220. "Tres Marias Islands, west of Mexico."

Type locality: Tres Marias Islands, Mexico.

Range: Espiritu Santo Island, Gulf of California (W. Williams, coll.), to Cocos Island, Costa Rica (W. H. Ochsner, coll.).

Collecting stations: Indicated under Range.

The type specimen of this variety is apparently pustulose all over and represents an end member in this character. All of the available specimens used in this study are only partly covered with these spiral rows of pustules. Many shells of *diadema* from Clarion Island show no trace of the pustules but otherwise they are typical. The light central band is usually sharply differentiated from the chestnut color of the body whorl. This is well shown in the figure of the type specimen which was made available for publication at this time by Dr. Paul Bartsch.

***Conus bartschi* Hanna & Strong, sp. nov.**

Plate 5, Figure 5

Whorls about ten, ornamented around the periphery with 13 regularly spaced nodes; nuclear characters obliterated; spire low, with gently concave sides and a few very faint gently undulating spiral lines; ground color light cream with a large number of spiral rows of fine, brown, somewhat angular dots; in the center and near the canal there are a few large irregular blotches of the same color arranged roughly in two indistinct spiral zones; interior pure white; there are a few small blotches of reddish brown on the periphery of the last two whorls; some of these extend over and upon the spire. Length, 49 mm.; diameter, 30 mm.

Holotype, No. 9296 (Calif. Acad. Sci. Paleo. Type Coll.), dredged off **Cape San Lucas, Lower California**, August 6, 1932, Templeton Crocker in 20-25 fms. Another smaller specimen was obtained at the same time.

The species evidently falls into the group containing *brunneus* and *tiaratus* and is distinguished from them by the peculiar coloration. In some specimens of *brunneus* there are spiral lines of plain unbroken brown but in no case has one been seen in the collections studied which even remotely approaches the

fine-speckled condition found in this shell. *C. tiaratus* is a smaller species, and is proportionately broader, has a dome shaped spire and purple blotches inside the aperture. The color pattern of *bartschi* is probably closest to that of the non-coronate *ximenes* of the west American species.

The species is named for Dr. Paul Bartsch of the U. S. National Museum to whom we are indebted in many ways in connection with the preparation of this paper and in others dealing with the molluscan fauna of the same region.

Conus tiaratus Broderip

Plate 7, Figure 12; Plate 8, Figure 18

Conus tiaratus BRODERIP in Sowerby, Conch. Ill., p. 1 [117], pl. 25, fig. 10, April 12, 1833. "Galapagos Islands."—Proc. Zool. Soc. London, May 24, 1833, p. 52.—KIENER, Icon. Coq. Viv., Genre Cône, p. 50, pl. 11, fig. 2.—SOWERBY, Thes. Conch., vol. 3, 1857, p. 9, pl. 190 [*Conus* pl. 4], fig. 80.

Conus miliaris HWASS, Tryon, Man. Conch., vol. 6, 1883, p. 21, pl. 5, fig. 85.—DALL, Proc. U. S. Nat Mus., vol. 38, 1910, p. 220. "Clipperton and Galapagos Islands, Ecuador and Peru."—Not *Conus miliaris* BRUGUIÈRE, Enc. Method. Vers., 1792, pl. 319, fig. 6.

Conus coronatus DILLWYN, WEINKAUFF, Martini & Chemnitz, Conch. Cab., ed. 2, vol. 4, pt. 2, 1873, p. 131. Not *C. coronatus* GMELIN.

Conus minimus LINNAEUS, var B, Reeve, Conch. Icon., vol. 1, pl. 26, fig. 143 *b*, September, 1843. "Galapagos Islands."

Conus inconstans SMITH, Ann. & Mag. Nat. Hist., Ser. 4, vol. 19, 1877, p. 224.—SOWERBY Thes. Conch., vol. 5, 1887, p. 261, pl. 510 [*Conus* pl. 32], fig. 700. "Panama."—TOMLIN, Proc. Mal. Soc. London, vol. 22, pt. 5, 1937, p. 261. "Hab.? Types: three in B. M. = *magellanicus* Kstr. not Brug."

Conus roosevelti BARTSCH & REHDER, Smithsonian Misc. Coll., vol. 98, no. 10, 1939, p. 3, pl. 1, figs. 4, 7. "Clipperton Island on rocks along the shore south of the landing place." Type, U.S.N.M. no 472854.

Type locality: Galapagos Islands.

Range: Revillagigedo Islands, Tres Marias Islands, south to Galapagos Islands and "Ecuador and Peru" (Dall).

Collecting stations: Mexico: Clarion Island; Socorro Island; Tres Marias Islands; Cape San Lucas (Lowe Coll. labelled *tiaratus*): Galapagos Islands: Indefatigable; Albemarle; Charles; Tower: Costa Rica: Port Culebra; Cocos Island.

Evidently the species is seldom found on the mainland; the Port Culebra record above and a lot labelled *tiaratus* from Cape San Lucas by H. N. Lowe are the only ones which have been seen in connection with the present work.

Although *Conus miliaris* is a highly variable shell, numerous sets of specimens from south sea localities are constantly lighter in color and lack the prominent spiral rows of red and white dots so characteristic of Galapagos

shells. That the two species are closely related, there can be no doubt, but the material available for this study does not permit us to unite them as several other authors have done. In view of the confusion which has existed between the names, Dall was perhaps justified in including *tiaratus* under *brunneus* as a variety.

Stearns³⁵ also included *tiaratus* under *brunneus* as a variety but the species seem to be constantly separable. The interior surface of the outer lip of *tiaratus* bears a large brownish-purple blotch above, and a similar, but smaller one below, the two being separated by a zone of leaden gray. The same area in *brunneus* is a uniform light bluish gray, tinged with yellow toward the canal. Also the spire of *tiaratus* is more dome-shaped and spiral markings predominate. The specimen figured herewith is representative of the large series available, and, using the characters noted, no considerable difficulty has been experienced in placing any of the lots.

Sowerby's colored figure of *C. inconstans* has about the same shape as *tiaratus* but the middle of the body whorl is marked by a sharp band of white with sparse markings. Some specimens from Cocos and the Galapagos Islands are similar, but do not agree exactly. Dall considered the species to be equivalent to *milaris* [= *tiaratus*]. Tomlin, however, questioned the locality record, Panama, and added that the three types in the British Museum are *Conus magellanicus* Küster, not Bruguière.

With over a hundred specimens for study, including a very large series from the Galapagos Islands, the type locality, it becomes possible to indicate some of the wide variation the species undergoes. The background color varies from light brown to dark chocolate brown then through various shades of flesh color to bright pink. *C. roosevelti* falls readily into the series. Shape is not at all constant. The spire in some shells is nearly flat; again it is high and dome shaped with intergrades having concave sides to the spire. The spiral striation may vary from strong to weak on the same shell and there is no constancy to the strength of the small tubercles on these cords. However, the species is usually short and broad and has a pinched in zone toward the canal somewhat after the manner of *C. arcuatus*.

Conus gladiator Broderip

Plate 7, Figure 5

Conus gladiator BRODERIP, Proc. Zool. Soc. London, May 24, 1833, p. 55. "Hab. ad Panama."—SOWERBY, Conch. Ill., p. 2 [118] pl. 33, fig. 34, May 17-July 12, 1833.—REEVE, Conch. Icon., vol. 1, Aug. 1843, pl. 22, fig. 127. "Panama."—SOWERBY, Thes. Conch., vol. 3, 1857, p. 6, pl. 189, [*Conus* pl. 3], figs. 59, 60.—KIENER, Icon. Coq. Viv., Genre *Cône*, 1846, p. 25, pl. 15, fig. 4.—WEINKAUFF, Martini & Chemnitz, Conch. Cab., ed. 2, vol. 4, pl. 2, 1873, p. 196, pl. 30, fig. 10.—TRYON, Man. Conch.,

³⁵ Stearns, R. E. C., Proc. U. S. Nat. Mus., vol. 16, 1893, p. 385.

vol. 6, 1883, p. 28, pl. 8, fig. 38.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 221. "Gulf of California to the Galapagos Islands."—PEILE, Proc. Mal. Soc. London, vol. 23, 1939, p. 354. (*Radula*).

Conus tribunis CROSSE, Journ. de Conchyl., vol. 13, (ser. 3, vol. 5), no. 3, 1865, p. 312, pl. 10, fig. 2. "Hab. California (Coll. Cuming)." See Tomlin, Proc. Mal. Soc. London, vol. 22, pt. 5, 1937, p. 323.

Type locality: Panama.

Range: San Lazaro Point (Lowe Coll.), Lower California, to Santa Elena Bay, Ecuador, (Lowe Coll.).

Collecting stations: Costa Rica: Piedra Blanca Bay; Port Parker; Gulf of Fonseca and several stations off Panama.

The H. N. Lowe collection in the San Diego Society of Natural History contains specimens from the extremes of range given above. Many other intermediate points and the Galapagos Islands are also represented. The California Academy of Sciences, likewise has it from several stations within that range. Being a shallow water and littoral form, shore collectors often obtain it but dredging expeditions such as those conducted by Messrs. Beebe and Crocker for the New York Zoological Society seldom encounter it.

Many authors have indicated a similarity of this species to *Conus brunneus* of the same general area, but Dall stated that they were in "no way closely related"; he considered *gladiator* to be an analogue of the Atlantic *C. mus*, an opinion which a study of the present collections substantiates. The spire of *gladiator* is lower than in *brunneus*, has straighter sides and the coronal nodes do not show on it to an appreciable extent. In *brunneus* these nodes roughen the spire greatly. Moreover, *brunneus* is normally a much larger shell and much darker in color. This species is believed to be closer to *diadema* than to *brunneus* because of the chestnut-brown ground color and the central, light cream-colored band. The spiral ridges and threads, the dark umber-colored spire with heavy spiral threads are some of the distinguishing characters which separate it from *tiaratus*.

The type of *Conus tribunis* Crosse is in the British Museum and Tomlin stated that it is *gladiator*.

Conus nux Broderip

Plate 7, Figures 6, 7

Conus nux BRODERIP, Proc. Zool. Soc. London, May 24, 1833, p. 54. "ad Insulas Gallapagos."—SOWERBY, Conch. Ill., May 17-July 12, 1833, p. 2 [118], pl. 32, fig. 31.—REEVE, Conch. Icon., vol. 1, August, 1843, pl. 20, fig. 110. Suppl. June 1849, p. 5.—KIENER, Icon. Coq. Viv., Genre *Cône*, 1846, p. 47, pl. 11, fig. 3.—SOWERBY, Thes. Conch., vol. 3, p. 10, 1857, pl. 192 [*Conus* pl. 6], fig. 135.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 224. "Ballenas Lagoon, Lower California, south to Panama and the Galapagos Islands."—SORENSEN, Nautilus, vol. 57, no. 1, July, 1943, pl. 1, fig. 10 [13 shells.] "Guaymas, Mexico."

Conus pusillus GOULD, Journ. Boston Soc. Nat. Hist., vol. 6, Oct. 1853, p. 388, pl. 14, fig. 22. "Mazatlan." [Not *Conus pusillus* Lamarck, 1810, a shell reported from west Africa.]

Conus ceylanensis BRUGUIÈRE, TRYON, Man. Conch., vol. 6, 1883, p. 23, pl. 6, fig. 95. [Not *Conus ceylanensis* Bruguière.]

Conus nanus BRODERIP, [SOWERBY], PILSBRY & VANATTA, Proc. Washington Acad. Sci., vol. 4, 1902, p. 555. "Iguana Cove, Albemarle Island."

Type locality: Galapagos Islands.

Range: Magdalena Bay and the Gulf of California south to the Galapagos Islands, Panama and Santa Elena, Ecuador.

Collecting stations: Mexico: San Francisco Island; Espiritu Santo Island; Ventana Bay; Magdalena Bay; Cape San Lucas: Nicaragua: Corinto; San Juan del Sur: Costa Rica: Port Culebra; Piedra Blanca: Panama: Bahia Honda; Isla Parida, Gulf of Chiriqui: Colombia: Gorgona Island: Galapagos Islands: Indefatigable; Albemarle; Chatham; Hood; Duncan. The species has been taken near Cape San Lucas in a depth of 25 fathoms but usually it is found in less than 10 fathoms. It is abundant on the Galapagos Islands.

The species is easily identified by the purple zone at the lower end of the aperture and the arrangement of the central white area or zone into a series of more or less zigzag markings against the chestnut brown above and below. The white spiral band just below or including the periphery is very sharply defined from the brown zone below.

Melvill and Standen³⁶ recorded *Conus pusillus* Chemnitz from Mazatlan and Cape San Lucas in a list of mollusks of Madras.

Tryon united the species with *Conus ceylanensis*, from the south seas, an extremely variable form or group and it is doubtful if with a large series of specimens from that region it would always be possible to make a separation. In general, however, west American *nux* are somewhat darker and broader in comparison to height.

Tomlin³⁷, who examined the type specimens reported that *Conus nanus* Sowerby was equivalent to *C. ceylanensis* Bruguière. It seems probable that Pilsbry & Vanatta had *C. nux* when they recorded *C. nanus* from the Galapagos.

Conus princeps Linnaeus

Plate 7, Figures 10, 11

Conus princeps LINNAEUS, Syst. Nat. ed. 10, 1758, p. 713 "Habitat . . ."—WOOD, Index Test., ed. 2, 1828, p. 69, pl. 14, fig. 25. "Asiatic Ocean."—BRODERIP, Proc. Zool. Soc. London, 1833, p. 55. "Hab. ad Sanctam Elenam."—REEVE, Conch. Icon., vol. 1, March, 1843, pl. 7, fig. 36a, "Bay of Panama."—SOWERBY, Thes. Conch., vol. 3, 1857, p. 5, pl. 188 [*Conus* pl. 2], fig. 31. "Panama."—WEINKAUFF, Martini &

³⁶ Melvill, J. C., and Standen, R., Journ. Conch., vol. 9, no. 2, 1898, p. 36.

³⁷ Tomlin, J. R. Le B., Proc. Mal. Soc. London, vol. 22, 1937, p. 279.

Chemnitz, Conch. Cab., ed. 2, vol. 4, pt. 2, 1873, p. 155, pl. 9, fig. 3.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 224. "Cape San Lucas to Panama."—STEINBECK & RICKETTS, Sea of Cortez, (Viking Press, N. Y.), 1941, p. 517, pl. 34, fig. 1. "Pt. Lobos, Espiritu Santo Id.; Port San Carlos, Sonora."—SORENSEN, Nautilus, vol. 57, no. 1, July, 1943, pl. 1, fig. 1 [7 shells].

Conus regius CHEMNITZ, Conch. Cab., vol. 10, 1788, p. 138, pl. 138, fig. 1276.—KIENER, Icon. Coq. Viv., Genre *Cône*, 1846, p. 15, pl. 3, fig. 2. "Habite l'océan Pacifique, les côtes du Mexique, la baie de Panama."

Type locality: Unknown. Typical specimens have been collected at San Carlos Bay, Sonora, Mexico.

Range: Cape San Lucas and Gulf of California south to "Punta Carnero, Ecuador," (Barker).

Collecting stations: Mexico: Angeles Bay; Santa Inez Bay; Port Guatulco; Tangola-Tangola Bay; San Carlos Bay; Tepoca Bay; Mulegé; Cape San Lucas; San Jose, Monserrate, San Marcos, Ceralvo, San Diego, Maria Madre and Maria Magdalena Islands: Costa Rica: Uvita; Ballenas Bay; Gulf of Nicoya.

In the typical form of *princeps*, the axial stripes are about a millimeter broad. The two named varieties noted below, *lineolatus* with narrow hair-line stripes and *apogrammatus* without such markings, are usually not so common, at least north of Panama, but all three occupy the same general province. Biologically, the variants are probably of no great importance, but collectors seem to favor recognition of them. In fresh, live specimens, such as Messrs. Beebe and Crocker obtained in Santa Inez Bay, Lower California, the heavy periostracum is so dense that the pink ground color and all markings are obscured; the horn-colored covering then forms a series of sharp nodules, arranged in regular spiral rows.

The species was formerly very rare and because of the unique color it was eagerly sought by collectors. It was mistakenly recorded as having come from China when prices were high.

Peile³⁸ indicated that radular characters would place *princeps* close to *C. virgo*, perhaps intermediate between that form and *vexillum*.

Mr. Andrew Sorensen collected living specimens at Guaymas, Mexico, in January, 1942 and very kindly brought back two, preserved in alcohol. The animals were deeply retracted but one shell was opened by making a diamond saw cut through about half the circumference just below the shoulder, then by breaking the shell apart with a wedge, the soft parts were removed. After extraction of the animal, the shell was cemented together without greatly marring its value as a specimen. Both of these shells have the characteristic heavy periostracum, nearly completely obliterating the underlying color pattern; the spiral rows of raised tufts are very conspicuous.

³⁸ Peile, A. J., Proc. Mal. Soc. London, vol. 23, 1939, p. 350.

The animal extracted, a male, showed considerable red color on the foot (July, 1946), with wavy lines of black. The verge is a fluke-shaped organ on the right side of the head and about 5 mm. long. The head tapers outwardly to a blunt cone, evidently being capable of extension a considerable distance in life. Eyes are on or very near the ends of short tentacles and far out toward the end of the head.

The operculum is thick, tongue-shaped, chitinous, with chevron markings on the attachment side. It is about 13 mm. long. A free end projects about 3 mm. beyond the attachment and this is covered with short, blunt and heavy hair-like projections similar to the periostracum. These projections extend downward toward the point of the operculum on the thicker edge, gradually diminishing in size.

This animal had 24 "radular" teeth grouped in two equal bundles in a closed sheath which was attached to the base of the proboscis just forward

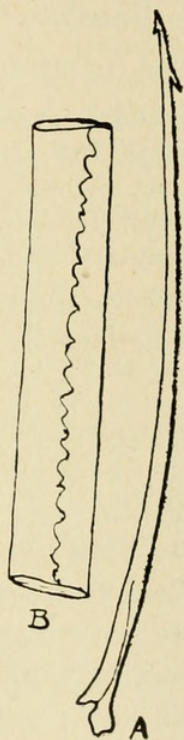


Fig. 1. *Conus princeps* LINNAEUS. A.—Complete tooth, length 2.92 mm. B.—Enlarged section of the shaft showing longitudinal serrations. Hypotype, no. 9344 (Paleo. type coll.), from Loc. 31699 (C.A.S.), San Carlos Bay, Mexico, A. Sorensen, Coll., Jan. 1942.

of the neural ring. Within this sheath there was a small quantity of reddish granular matter, the exact nature of which is unknown. There is no true "radula" as this term is usually applied in Gastropoda.

The "head" is really a sheath through which the very powerful proboscis is protruded. The latter is composed of several layers of muscular tissue,

some circular, some longitudinal. The color was still a livid orange after long preservation in alcohol. The extreme tip was acorn-shaped.

Just back of the attachment of the "radular" sheath is the termination of a long and highly convoluted duct, which is generally referred to as the "poison duct." At its distal end it bears a long, highly muscular, tongue-shaped organ which is usually called the "poison gland" in this group. The neural ring surrounds the oesophagus immediately behind the attachment of the poison duct.

The individual teeth are very long and slender (length, 2.92 mm.) with a knob shaped base. All are very weakly attached and appear to be hollow. They end in very sharp points, each tooth having two barbs near the outer end. A single row of fine serrations extends from the base to the base of the outermost barb. It is indeed, a formidable looking weapon.

***Conus princeps lineolatus* Valenciennes**

Plate 7, Figure 8

Conus lineolatus VALENCIENNES, Zool. Humboldt & Bonpland, Rec. Zool., vol. 2, 1832, p. 336. "Habitat ad Acapulco."—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 224. "the prevailing form from Panama to Peru."—FISCHER-PIETTE & BEIGBEDER, Bull. Mus. Nat. d'Hist. Natur. ser. 2, vol. 16, Nov. 1944, p. 461. An individual marked "type" is preserved in the Muséum at Paris.

Conus princeps LINNAEUS, SOWERBY, Conch. Ill., p. 2 [118], 1833, pl. 32, fig. 30 *a*, *b*.—REEVE, Conch. Icon., vol. 1, March, 1843, pl. 7, fig. 36 *b*.—SOWERBY, Thes. Conch., vol. 3, 1857, p. 5, pl. 188 [*Conus* pl. 2], fig. 33.—WEINKAUFF, Martini & Chemnitz, Conch. Cab. ed. 2, vol. 4, pt. 2, 1875, p. 302, pl. 54, fig. 13.

Conus regius CHEMNITZ, Kiener, Icon. Coq. Viv., Genre *Cône*, 1846, p. 15, pl. 11, fig. 4.

Type locality: Acapulco, Mexico.

Range: Acapulco, Mexico, to "Peru" (Dall).

Collecting stations: Costa Rica: Cedro Island; Panama: Bahia Honda.

Few specimens of this variety have appeared in the collections studied. According to Dall it is the prevailing form south of Panama. The brown axial stripes are reduced to hair lines; otherwise it does not differ from typical *princeps*.

***Conus princeps apogrammatus* Dall**

Plate 7, Figures 9, 13

Conus princeps var. *apogrammatus* DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 224. "Panama."

Conus princeps Linnaeus, SOWERBY, Conch. Ill., p. 2, [118], 1833, pl. 32, fig. 30.—REEVE, Conch. Icon. vol. 1, March, 1843, pl. 7, fig. 36 *c*.—SOWERBY Thes. Conch., vol. 3, 1857, p. 5, pl. 188 [*Conus* pl. 2], fig. 32.

Type locality: Panama.

Range: Gulf of California to Panama.

Collecting stations: The variety is present in the collection of the California Academy of Sciences (Hemphill, coll.) from the Gulf of California, and from San Juan del Sur, Nicaragua, and Panama, in the San Diego Society of Natural History (H. N. Lowe, coll.).

Axial stripes are entirely missing from this variety; otherwise it does not differ from typical *princeps*.

Conus gradatus Mawe

Plate 6, Figure 1

Conus gradatus MAWE, Linn. Syst. Conch., 1823, p. 90. "California."—WOOD, Index Test., Suppl., 1828, p. 8, pl. 3, fig. 6—REEVE, Conch. Icon. vol. 1, Sept. 1843, pl. 25, fig. 140. "Salango, South America (found on the sands); Cuming."—KIENER, Icon. Coq. Viv., Genre *Cône*, p. 140, 1847, pl. 94, fig. 6. "Habite les côtes du Mexique."—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 221. "Gulf of California."

Conus scalaris VALENCIENNES, SOWERBY, Thes. Conch., vol. 3, 1857, pl. 195 [*Conus* pl. 9], fig. 192.—TRYON, Man. Conch. vol. 6, 1883, p. 35, pl. 10, fig. 83 [?] Not *Conus scalaris* VALENCIENNES, Humboldt & Bonpland, Reise, 1832, p. 338.

Type locality: Unknown, not "California" as cited by Mawe. Typical specimens have been collected at Cedros Island, Lower California.

Range: Cedros Island to Clipperton Island.

Collecting stations: Mexico; Santa Inez Bay. (Sta. 142, D-1, 30 fms.); Mulegé; Abreojos Point and Cedros Island, Lower California; Clipperton Island.

Usually this species has a moderately high spire as in *scalaris* but when fully grown it is larger and the yellow color is much more extensive. This color is arranged roughly in a series of large blotches, flammules and stripes so that the white ground color forms several variable and indefinite spiral bands. In *scalaris* the white ground color predominates. *C. regularis* is about equal in size to *gradatus* and the two are often hard to separate. The former usually has a lower spire and the color markings are not so dominant. The indefinite white spiral bands are more prominent and numerous and the blotches of color are more nearly rectangular in shape.

The name *gradatus* is the oldest of a group of very variable forms. Whether *regularis*, *scalaris*, and *dispar* should be considered varieties or separate species or not recognized at all depends upon the viewpoint of the student. They have been segregated here because, in a majority of cases, collections can be satisfactorily placed.

Reeve and Kiener attributed the name *gradatus* to "Gray" and their figures show somewhat differently shaped and marked shells from the original of Mawe. Hanley, however³⁹, indicated that they are the same.

³⁹ S. Hanley in Wood, Index. Test., Rev. ed. 1856, p. 208, suppl., pl. 3, fig. 6.

Two very fine specimens referred to *gradatus*, were collected by E. H. Quayle in the Pleistocene at Punta Santa Rosalia, west coast of Lower California; these have been placed in the collection of the San Diego Society of Natural History.

Conus recurvus Broderip

Plate 6, Figures 7, 8, 13

- Conus recurvus* BRODERIP, Proc. Zool. London, vol. 1, no. 4, May 24, 1833, p. 54. "Hab. in Americâ Meridionali, (Monte Christi)."—KIENER, Icon Coq. Viv., Genre *Cône*, p. 132, 1847, pl. 97, figs. 4, 4-a. "Habite les mers des Antilles."
- Conus incurvus* BRODERIP, in Sowerby, Conch. Ill., June or July, 1833, p. 2 [118], pl. 33, fig. 36. [No locality cited].—SOWERBY, Thes. Conch., vol. 3, 1857, p. 16, pl. 195, [Conus pl. 9], fig. 194. "Monte Christo, West Columbia." [This figure may represent *C. regularis*].—(?) DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 222.
- Conus arcuatus* BRODERIP & SOWERBY, Gray, Zool. Beechy's Voy., 1839, p. 119, pl. 36, fig. 22. [Not *Conus arcuatus* Broderip & Sowerby].
- Conus emarginatus* REEVE, Conch. Icon. vol. 1, Jan. 1844, pl. 43, fig. 232. "Pacific Ocean." [Copy of Gray's fig. of *C. arcuatus*].—SOWERBY, Thes. Conch., vol. 3, 1857, p. 15, pl. 202, [Conus pl. 16], fig. 387. "Pacific Ocean." [Probably not *emarginatus*].—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 222.
- Conus zebra* LAMARCK, REEVE, Conch. Icon., vol. 1, June, 1843, pl. 16, fig. 87. "Salango, Central America."—SOWERBY, Conch. Ill., March 29, 1833, p. 1 [117], pl. 24, fig. 4. [Not *Conus zebra* Lamarck, Anim. sans Vert., vol. 7, 1822, p. 481. "Habite l'Ocean asiatique?"].
- Conus scariphus* DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 225. "Off Cocos Island, Gulf of Panama, at station 3368, in 66 fathoms, rocky bottom, one specimen with hermit crab, by the U. S. Bureau of Fisheries steamer Albatross." Type No. 123085 (U.S.N.M.)
- Conus magdalenensis* BARTSCH & REHDER, Smithsonian Misc. Coll., vol. 98, no. 10, 1939, p. 11, pl. 1, figs. 5, 9. "Magdalena Bay, Lower California, in 10-15 fathoms on sandy weedy bottom, at the entrance to the bay between Belcher Point and the anchorage." Type No. 472,521 (U.S.N.M.)

Type locality: "Monte Christi," Ecuador.

Range: Magdalena Bay and Gulf of California, south to Panama and the west coast of Colombia.

Collecting stations: Mexico: Santa Inez Bay, three dredgings; Arena Bank, 11 dredgings; Gorda Bank, two dredgings; Magdalena Bay (Orcutt Coll.); Cape San Lucas; Concepcion Bay; Acapulco; Manzanilla: Costa Rica: Judas Point; Port Parker; Port Culebra; Between Punta Arenas and Bat Islands: Panama: Gulf of Chiriqui; Hannibal Bank: Colombia: Isla Parida.

The species is fairly common along the coast in moderately deep water, 20 to 80 fathoms. Shore collectors seldom find it.

The shells of this group comprise a maze of variations, exceedingly difficult to understand. On the one hand they trend toward the *regularis-gradatus*-

scalaris complex and on the other toward *perplexus*. The involved nomenclature does not simplify the problem. Under the name *recurvus*, however, there have been assembled in the present study those specimens with a moderately elevated spire and the body whorl marked by long flammules of reddish brown. These axial stripes are often broken and discontinuous thus suggesting the *gradatus* group and there is no constancy in the height of the spire.

The earliest name for the species has been used. *Conus recurvus* and *Conus incurvus* appeared almost simultaneously; either one may have been a misprint but there is no published information to suggest which was the original. The part of the Proceedings of the Zoological Society of London in which *recurvus* appeared was distributed on May 24, 1833 according to the collation published in the same journal for 1893, p. 436. Part 33 of the Conchological Illustrations came out between May 17 and July 12, 1833; during that interval, six parts, 29 to 34, appeared so it is highly probable that part 33 was not distributed before late June or early July. This gives precedence to "*recurvus*." These dates are taken from Shaw, 1909⁴⁰.

Weinkauff's⁴¹ treatment of the species is highly indefinite. He referred *incurvus* of Kiener (Icon.) and Sowerby (Thes.) to *regularis* and apparently referred *incurvus* Broderip to *cingulatus* Lamarck, an entirely distinct species. This latter is referred to plate 40, fig. 9, but the illustration there is *gabrielii* (Chenu) Kiener, duly accredited on page 243. Apparently he did not figure *cingulatus*.

In addition to the names mentioned above, *lorenzianus*⁴² and *flammeus*⁴³ have been mentioned by Dall in discussing the *recurvus* group. These appear to be otherwise involved, for a discussion of which see under *Conus virgatus*.

Very often the markings on all of the shell, or some restricted portion, assume a roughly zigzag form. There is no constancy in this character, even in lots from the same dredge haul. Again the surface may be all or partly covered with roughly triangular spots of white or cream color. A mixture of these combinations appeared on the specimen to which the name *C. scariphus* Dall was applied. The proportion of colored area to light varies fully 75 percent and *C. magdalenensis* Bartsch & Rehder was applied to a shell in which the two are about equal. The figure of that form shows a slightly rounded shoulder and a central band, across which the color areas do not pass. Sometimes this band is present on one half of the shell absent on the other. Again there may be two, three, or many. The variation and intergradation is such that some justification could be found for giving nearly

⁴⁰ Shaw, H. O. N. On the dates of issue of Sowerby's "Conchological Illustrations," from the copy preserved in the Radcliffe Library, Oxford. Proc. Mal. Soc. London, vol. 8, no. 6, Oct. 5, 1909, pp. 333-340.

⁴¹ Weinkauff, H. C., Conch. Cab., vol. 4, pt. 2, 1873, pp. 262, 263, pl. 40, figs. 9, 10.

⁴² *Conus lorenzianus* Chemnitz, Neues Syst. Conchylien Cab., vol. 11, 1795, p. 51, pl. 181, figs. 1754-1755.

⁴³ *Conus flammeus* Lamarck, En. Méthod. Vers., liv. 3, 1798, pl. 336, fig. 1—Lamarck, Ann. du Mus., vol. 15, 1810, p. 279.

every specimen a separate name. This, however, would lead to confusion. In some cases our lots of 50 or more specimens from one dredge haul contain shells which will match all the hitherto named forms of this protean species and many more.

Conus regularis Sowerby

Plate 6, Figure 2

Conus regularis SOWERBY, Conch. Ill., p. 2 [118], pl. 29, fig. 29, May 17, 1833, and pl. 36, fig. 45, July 19, 1833.—REEVE, Conch. Icon., vol. 1, Sept., 1843, pl. 26, fig. 146. "Gulf of Nicoya, Panama."—SOWERBY, Thes. Conch. vol. 3, 1857, p. 16, pl. 195 [*Conus* pl. 9], figs. 208-210. [Probably also fig. 195 which is called *dispar*.]—TRYON, Man. Conch., vol. 6, 1884, p. 37, pl. 11, figs. 98, 99.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 221.—TOMLIN, Proc. Mal. Soc. London, vol. 22, pt. 5, July 21, 1937, p. 302.—PEILE, Proc. Mal. Soc. London, vol. 23, 1939, pp. 350, 354, (radula).—SORENSEN, Nautilus, vol. 57, no. 1, July, 1943, pl. 1, fig. 4 [9 shells] "Guaymas, Mexico."

Conus angulatus A. ADAMS, Proc. Zool. Soc. London, 1853 [No. 14, 1854], p. 118. "Hab.?" Tomlin, (Proc. Mal. Soc. London, vol. 22, pt. 4, Mar. 13, 1937, p. 212) stated that the type in the British Museum "measures 39x22 mm. and is a rather squat ex. of *regularis* Sow."

Conus monilifer BRODERIP, Proc. Zool. Soc. London, 1833, p. 54, "in Americâ Meridionali. (Salango.)"—SOWERBY, Conch. Ill., May 17-July 12, 1833, p. 2 [118] pl. 33, fig. 37.—REEVE, Conch. Icon., vol. 1, Sept. 1833, pl. 26, fig. 144.—KIENER, Icon. Coq. Viv., Genre *Cône*, p. 141, 1847, pl. 91, fig. 1.—SOWERBY, Thes. Conch., vol. 3, p. 14, 1857, pl. 202 [*Conus* pl. 16], figs. 380-382.—WEINKAUFF, Martini & Chemnitz, Syst. Conch. Cab., ed. 2, *Conus*, vol. 4, pt. 2, 1875, p. 361, pl. 67, figs. 1, 3.—TRYON, Man. Conch. vol. 6, 1883, p. 63, pl. 20, fig. 3; [as *Conus interruptus* Broderip.].—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 222. "Magdalena Bay, Lower California, south to Peru."—TOMLIN, Proc. Mal. Soc. London, vol. 22, pt. 5, July 21, 1937, p. 278. "Types (4) in B. M.=*regularis*."

Conus syriacus SOWERBY, Conch. Ill., pl. 36, fig. 45, 1833. No locality cited. Tomlin (Proc. Mal. Soc. London, vol. 22, 1937, p. 317), stated that this was "altered to *regularis* in large list." The figure bears the latter name in our copy of the Conchological Illustrations.

Type locality: Unknown. Typical specimens have been collected at San Carlos Bay, Sonora, Mexico.

Range: Magdalena Bay and Gulf of California south to Panama and "Peru" (Dall).

Collecting stations: Mexico: Punta Penasco (Lowe Coll.); San Luis Gonzaga Bay; Pelican Islands; Guaymas; Rocky Point (Gifford Coll.); Angel de la Guardia Island; Tepoca Bay; Gorda Banks; Santa Inez Bay; Santa Cruz Bay; Port Guatulco; Chamela Bay; Tenecatita Bay; Tangola-Tangola Bay; Manzanillo: Costa Rica: Port Culebra.

Shore collectors often find *regularis*; therefore it is common in most collections from west Mexico. Messrs. Crocker and Beebe collected it in abundance by dredging, the greatest depth recorded for it being 55 fathoms.

In the present series, *regularis* is not very distinct and intergrades with *gradatus*, *scalaris* and *recurvus*. It has a relatively low, non-scalariform, slightly concave spire and the color markings are usually well broken up into spiral rows of square spots, variable in size in different rows. Dall's mention of "longitudinal brown nebulous streaks" does not fit the original figure in the Conchological Illustrations, although it must be admitted that shells with such markings, otherwise referable to *regularis* are not uncommon; these trend in variation toward *recurvus*. Three immature specimens from the Gulf of California, received by the California Academy of Sciences with the Hemphill collection are almost entirely devoid of color markings.

The name *monilifer* has been a source of confusion to most writers on *Conus* and would doubtless have remained so had not Tomlin found the four types in the British Museum and determined that they were *regularis*. It is not at all certain that the references to figures given above in the synonymy correctly pertain to the real *monilifer*, because it would have been logical for anyone to interpret Sowerby's first figure as something akin to *tornatus*.

A specimen collected at Guaymas, Mexico, by Mr. A. Sorensen, has a thin, brown operculum, approximately 4 mm. long and 2 mm. wide. An attempt to find the teeth failed through unfamiliarity with the anatomy. Peile, however, in referring to Bergh's figure remarks upon the fine serrations and the double barb in place of a blade; in this respect it resembles *C. inscriptus* and, in a general way, *C. californicus*.

Conus scalaris Valenciennes

Plate 6, Figures 3, 4, 5, 6

Conus scalaris VALENCIENNES, Zool. Humboldt & Bonpland, Rec. Zool., vol. 2, 1832, p. 338. "Habitat ad portum Acapulco."—[?] KIENER, Icon. Coq. Viv., Genre *Cône*, p. 158, 1847, pl. 88, fig. 5.—REEVE, Conch. Icon., Suppl. June, 1849, p. 6. [Compared to *C. acutangulus*.]

Type locality: Acapulco, Mexico.

Range: Gulf of California and north along the outer coast of Lower California to Magdalena Bay.

Collecting stations: Mexico: Mejia Island; Espiritu Santo Island; Concepcion Bay; Arena Bank, eight dredgings 40-50 fathoms; Santa Inez Bay, four dredgings, 50-60 fathoms; Gorda Banks, four dredgings, 56-80 fathoms.

The species is rare in most collections because it is not often found on shore or between tides. However, the various dredging expeditions have obtained it in very large numbers, the series collected by Messrs. Beebe and Crocker in Santa Inez Bay being especially good.

Shape is fairly uniform, slender, with a high scalariform, slightly concave spire. Color markings trend to yellows and are usually cloud shaped masses

rather than square spots or stripes. It varies imperceptibly into the *gradatus-regularis* complex, however, and some specimens can be placed by arbitrary means only.

Sowerby⁴⁴ evidently considered this to be an aberrant form of *Conus gradatus* although he gave a figure and a species heading to it. The figure undoubtedly represents *gradatus* and this was copied by Tryon⁴⁵ who further stated (page 122) that Kiener's *scalaris* was equivalent to *arcuatus* Broderip. This seems doubtful although it is not at all certain that Kiener's figure represents the species here considered. It develops that there is no illustration which can be cited to represent what turns out to be a fairly common, high-spined, Gulf of California shell. Valenciennes' description, locality, and the name itself fit this form very well so it seems probable that he had a representative of it.

Conus dispar Sowerby

Plate 6, Figure 11

Conus dispar SOWERBY, Conch. Ill., July 19, 1833, p. 3 [119], pl. 37, fig. 57. [No locality cited].—KIENER, Icon. Coq. Viv., Genre *Cône*, p. 211, 1848, pl. 101, fig. 3. "Habite la mer des Indes."—REEVE, Conch. Icon., Suppl., pl. 4, June 18, 1848, sp. "238" [288]. [No locality cited].—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 222. "Gulf of California."

Type locality: Unknown. Typical specimens have been collected at Cape San Lucas, Lower California.

Range: Gulf of California.

Collecting stations: Mexico: Santa Inez Bay, Lower California (Sta. 142, N. Y. Z. S. D-3, 40 fms.). The species was also dredged by Mr. Crocker in 1932 at a point about 10 miles due east of San Jose del Cabo, Lower California.

Although Sowerby gave no locality for *dispar* and Kiener assigned it to the Indian Ocean, Dall recognized that it was a west American species. It appears to be rare. Tryon⁴⁶ was evidently much confused about the species because he placed it in synonymy of *C. regularis* and the figure he assigned to the name is very different from the two cited above. He may have been misled by Sowerby⁴⁷ whose later figure of *dispar* certainly represents a member of the *gradatus-regularis* group. The species is very small and slender, smooth and polished except for the usual spiral ridges near the canal and nearly microscopic growth lines. Ground color is white; scattered small yellow blotches and a few spiral rows of fine sparse dots complete the ornament. The blotches extend over the angled shoulder and

⁴⁴ Sowerby, G. B., Thes. Conch., vol. 3, 1857, p. 14, pl. 195, fig. 192.

⁴⁵ Tryon, G. W., Man. Conch., vol. 6, 1883, p. 35, pl. 10, fig. 83.

⁴⁶ Tryon, G. W., Man. Conch., vol. 6, 1883, p. 37, pl. 11, fig. 2.

⁴⁷ Sowerby, G. B., Thes. Conch., vol. 3, 1857, p. 16, pl. 195, fig. 195.

upon the polished spire. Nuclear whorls two, smooth, white and polished; the first two post-nuclear whorls with quite indistinct beading around the angle; suture channeled. The coloration suggests *scalaris* of the west American fauna more than any other species, but the elongated shape, low nearly straight spire, and slightly channeled suture distinguish it.

Conus archon Broderip

Plate 6, Figure 1

Conus archon BRODERIP, Proc. Zool. Soc. London, May 24, 1833, p. 54. "Hab. In America Centrali. Bay of Montijo."—SOWERBY, Conch. Ill., May 17-July 12, 1833, p. 2 [118], pl. 33, fig. 38.—REEVE, Conch. Icon., vol. 1, March, 1843, pl. 6, fig. 35.—KIENER, Icon. Coq. Viv., Genre *Cône*, p. 146, 1847, [pl. 75, fig. 3?], pl. 104, fig. 4.—SOWERBY, Thes. Conch., vol. 3, p. 16, 1857, pl. 198, [*Conus* pl. 12], fig. 252.—TRYON, Man. Conch., vol. 6, 1883, p. 27, pl. 7, fig. 26; (not figs. 27-29).—WIENKAUFF, Martini & Chemnitz, Syst. Conch. Cab., ed. 2, vol. 4, pt. 2, 1875, p. 362, pl. 67, figs. 2, *a*, *b*.—DALL, Proc. U. S. Nat. Mus., vol. 38, June 6, 1910, p. 223.

Conus sanguineus KIENER, Icon. Coq. Viv., Genre *Cône*, p. 356, 1849-50, pl. 111, fig. 2. "Habite."

Type locality: Bahia Montijo, Panama.

Range: Gulf of California to Panama.

Collecting stations: Mexico: 10 miles east of San Jose del Cabo, Lower California, 20-220 fathoms.; Acapulco; Manzanillo. Arena Bank, Lower California, 45 fms.; (Sta. 136, N. Y. Z. S., D-2, 16); Costa Rica: Port Culebra, 14 fms.

Dall stated that the shells figured by Kiener and Reeve are not identical with the one Sowerby published and which, presumably, was authentic. Kiener's pl. 75, fig. 3 may represent a different species; if so, it is unknown to us; specimens in the collections studied resemble his pl. 104, fig. 4. Dall made no suggestion as to where those he thought were not *archon* should be placed.

The species bears a strong resemblance in shape and color to *Conus recurvus* Broderip, but in the latter, when fully adult, there are irregular, white bands among the brown blotches and the suture line on the spire is raised into a sharp carina.

It seems highly probable that *C. sanguineus* Kiener is a synonym of *archon*, as Weinkauff indicated. Kiener himself pointed out the similarity of the two. However, the same author's *C. castaneus*, also from an unknown locality, appears to differ too much in the form of the spire to be included here where Weinkauff put it.

Recent collectors have failed to find many specimens of this robust species; either it is rare or has become localized in distribution.

The spire is usually low, sharply pointed and deeply concave; suture line scarcely impressed. The shoulder of one adult specimen is rather sharp; in another it is much more rounded. Evidence of evenly spaced nodules on the periphery are plainly visible along the suture line on the otherwise nearly smooth spire, up until about half adult size is reached. Twelve whorls are visible on the figured specimen but the nucleus is eroded. The sides are straight with a few very indefinite spiral lines near the canal; growth lines heavy. Periostracum dark brown and thin. Color markings consist of very dark, reddish brown, irregularly shaped dots and blotches on an almost white background, the proportion of dark to light being quite variable. The color is very roughly arranged in bands on one adult specimen but on another these coalesce into two. The interior of the aperture is white. The brown blotches extend over the periphery forming a series of flame-like markings on the spire.

Occasional specimens of *perplexus* Sowerby show a strong resemblance in coloration to this species but in every case noted these bear raised spiral ridges or threads.

Reeve⁴⁸ stated that *Conus granarius* Kiener⁴⁹ was a "fine *C. archon*" and that the latter approached *C. cedo-nulli* by "easy transition." In spite of the fact that he had examined Kiener's type specimen, it does not seem possible, with our material, to reduce *granarius* to the synonymy of *archon*. It is much more likely that it is a synonym or variety of *cedo-nulli* of the West Indian region, a highly variable form to which *archon* bears some similarity.

Conus ximenes Gray

Plate 8, Figure 17

Conus ximenes GRAY, Zool. Beechey's Voy., Moll., 1839, p. 119. "Panama."—SOWERBY, Thes. Conch., vol. 3, p. 22, 1857, pl. 199 [*Conus* pl. 13], fig. 285. "Mazatlan, West Columbia." [Printed "*C. ximenes*" in exp. of pl.]—WEINKAUFF, Martini & Chemnitz, Conch. Cab., ed. 2, vol. 4, 1873, p. 231; [as a synonym of *C. interruptus* Broderip & Sowerby.]—TRYON, Man. Conch., vol. 6, 1883, p. 63, pl. 19, fig. 100; [as a synonym of *C. interruptus* Broderip & Sowerby.]—DALL, Proc. U. S. Nat. Mus., vol. 37, 1909, p. 165.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 220. "Gulf of California to Sechura Bay, Peru."

Conus interruptus BRODERIP & SOWERBY, Zool. Journ., vol. 4, 1829, p. 379. "Dredged in the Pacific near Mazatlan."—GRAY, Zool. Beechey's Voy., Moll., 1839, p. 119, pl. 33, fig. 2. "Inhab."—REEVE, Conch. Icon., vol. 1, August, 1843, pl. 22, fig. 125. "Pacific Ocean near Mazatlan."—KIENER, Icon. Coq. Viv., Genre *Cône*, p. 152, 1847, pl. 54, fig. 2.—Not *Conus interruptus* WOOD, Index Test., Suppl., 1828, p. 8, pl. 3, fig. 2.—SOWERBY, Thes. Conch., vol. 3, 1857, p. 7, pl. 189 [*Conus* pl. 3], figs. 43, 44.

Conus tornatus BRODERIP, KIENER, Icon. Coq. Viv., Genre *Cône*, 1847 p. 153, pl. 59, fig. 5; [not of Broderip].

⁴⁸ Reeve, L. A., Conch. Icon., Suppl., p. 4, June 1849.

⁴⁹ Kiener, L. C., Icon. Coq. Viv., Genre *Cône*, p. 215, pl. 98, fig. 1. [No locality cited.]

[?] *Conus pusillus* LAMARCK, KIENER, Icon. Coq. Viv., Genre Cône, 1846, pl. 43; according to Reeve, Conch. Icon., Suppl., p. 5, June 1849.

[?] *Conus mahogani* REEVE, SORENSSEN, Nautilus, vol. 57, no. 1, July, 1943, pl. 1, fig. 6 [11 shells.] "Guaymas, Mexico."

Type locality: "Panama" (Gray).

Range: "Gulf of California to Sechura Bay, Peru" (Dall).

Collecting stations: Mexico: Angeles Bay; Punta Penasco; Libertad; Tepoca Bay; San Luis Gonzaga Bay; Cape San Lucas; Santa Inez Bay; Concepcion Bay; Acapulco Bay; Panama: (Hemphill Coll.).

The collections show that it is found from the littoral zone down to 50 fathoms.

It does not seem possible to arrive at an entirely satisfactory conclusion regarding the name *ximenes*. Gray did not indicate in his text that he had illustrated it, but his fig. 2, pl. 33, certainly fits the description as well or better than it does *C. interruptus* Broderip & Sowerby, to which it was referred. Moreover, Sowerby in the explanation of his plate 199 cited references to the literature under each name and for *ximenes* he has "Gray, Beech. Voy. pl. 33, fig. 2.—*C. interruptus* (preoccupied), Brod. Z. Journ. IV, p. 379." It seems as if Sowerby should have been in the best position of anyone to determine the characters of Gray's shells because he edited a portion of the manuscript for publication in Beechey's Report. (See Introduction, p. viii and note by Sowerby p. 143.) The purple interior of *ximenes* mentioned by Gray and so well shown in the figure is certainly characteristic of *interruptus* Broderip & Sowerby, not Wood.

Sowerby was the first, apparently, to point out that two species had been named *interruptus*; also that the name *pulchellus* Sowerby⁵⁰ was a synonym of *interruptus* Wood, and that this in turn is equivalent to *varius* Linnaeus. This synonymy was adopted by Tryon⁵¹. Whatever the status may be, that species does not appear to be an inhabitant of west American waters. On the other hand the form Broderip & Sowerby called *interruptus* is a common Gulf of California shell distinguishable from *mahogani* Reeve by its larger size, lighter color, more distinct rows of brown, spiral dots and the interior is pinkish to purplish.

Dall⁵² suggested that *C. catenatus* Sowerby, 1878, appeared to be *interruptus* but the figure cannot be distinguished from many *tornatus* seen in the present study.

The shells illustrated by Sorensen from Guaymas, Mexico, are probably all *ximenes*; since the color of the interior is the chief distinguishing feature from *mahogani* it is not possible to determine from the figures alone. The shells came from the area supposedly occupied by *ximenes*.

⁵⁰ Sowerby, G. B., Conch. Ill., p. 3 [119], pl. 54, fig. 61, 1834.

⁵¹ Tryon, G. W., Man. Conch., vol. 6, 1884, pp. 110, 120.

⁵² Dall, W. H., Proc. U. S. Nat., Mus. vol. 38, 1910, p. 228.

Mr. Sorensen very kindly supplied us with two of his shells, preserved in alcohol. They were collected at Guaymas in January, 1942. The animal of one of these, a male, was extracted. Except for a few scattered streaks of black on the foot and the tip of the siphon, it was colorless (July, 1946). There was no operculum.

The verge is a large, fluke-shaped organ, apparently highly extensible. The head is narrow and long. The proboscis, although greatly contracted, can probably be extended an inch or more in life. It is highly muscular and terminates outwardly in a rounded tip. The organ, as contracted, is somewhat grub-shaped with the thin body wall attached to the posterior end. The "radular" sheath and "poison duct" are attached to the posterior end

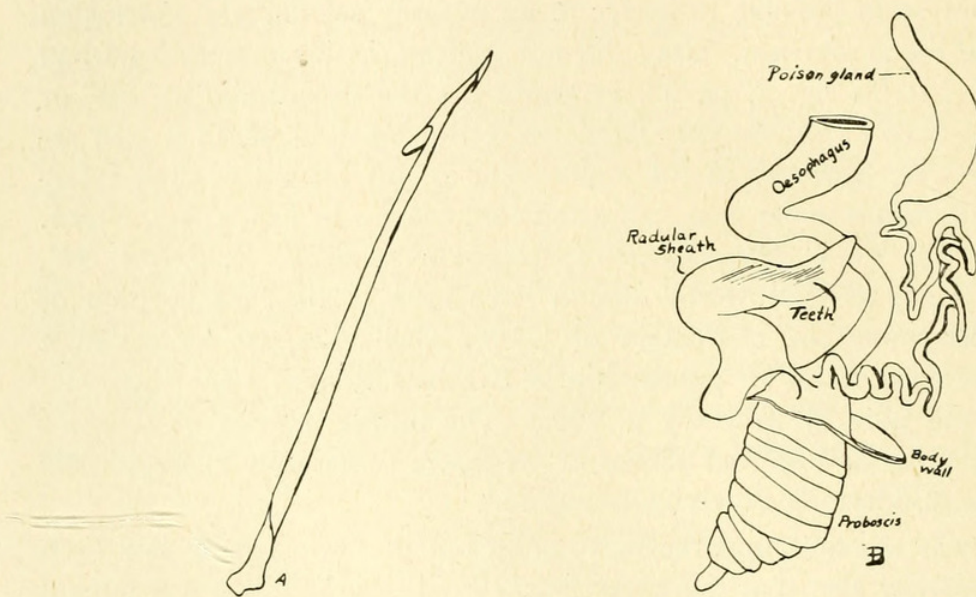


Fig. 2. *Conus ximenes* GRAY. A.—Complete tooth. B.—Dorsal view of proboscis and associated organs. Hypotype, no. 9338 (Paleo. type coll.), from Loc. 31699 (C.A.S.), San Carlos Bay, Mexico, A. Sorensen, Coll., Jan. 1942.

just back of the body wall and in front of the neural ring. The teeth are clustered in the tip of the sheath and about half of them pointed one way, the other half the opposite. A small brown mass of granular tissue was associated with them. A side pouch is located near the aperture of the sheath. Attachment to the proboscis is by means of a relatively short duct. The "poison duct" is very long and highly convoluted. Its walls appear to be glandular and, as has been suggested by Hermitte in Peile, the duct itself may be the source of the poison. The so called "poison gland" is a massive, very highly muscular organ and contains no recognizable glandular tissue on gross dissection.

The length of an individual tooth is 1.16 mm. It has no serrations on the shaft but at the tip there is a small barb; just back of this a short distance is a large spade-shaped "blade."

Conus mahogani Reeve

Plate 8, Figure 16

Conus mahogani REEVE, Proc. Zool. Soc. London, 1843, p. 169. "Salango, West Columbia (found in sandy mud); Cuming"—REEVE, Conch. Icon., vol. 1, August, 1843, pl. 22, fig. 126. Suppl. June, 1849, p. 5.—REEVE Ann. Mag. Nat. Hist., N.S., vol. 14, Sept. 1844, p. 206.—KIENER, Icon. Coq. Viv., Genre *Cône*, p. 170, 1847, pl. 74, fig. 3.—SOWERBY, Thes. Conch., vol. 3, p. 22, 1857, pl. 199 [*Conus* pl. 13], figs. 283, 284.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 219. "Magdalena Bay, Lower California, to Panama."

Type locality: Salango, Ecuador.

Range: "Magdalena Bay" (Dall), to west Colombia.

Collecting stations: Mexico: Carmen Island; Santa Inez Bay; Acapulco Bay; Port Angeles Light; Nicaragua: Corinto; Costa Rica: Punta Arenas; Port Culebra; Golfito; Panama: Venado Island and Flats; Taboga Island; Galapagos Islands: Albemarle Island.

The range of this species is chiefly from the southern end of the Gulf of California southward to Panama and the Galapagos Islands. No specimens have been seen during the preparation of this report to substantiate either the Magdalena Bay record of Dall or the west Colombia record of Reeve. Only one lot among a large number in the California Academy of Sciences came from the Gulf of California and that from no farther north than Carmen Island (Loc. 23798 C. A. S.).

Dall considered this to be an extreme mutation of the *Conus interruptus* of Broderip and Sowerby and Reeve and used it as the oldest available name for the species, *interruptus* having been previously used by Mawe [Wood] for an entirely different shell. It is a small, slender form with the dark mahogany color frequently covering the entire surface. The interior is usually pure white. The form recorded herein as *ximenes* Gray is the one usually found in the Gulf of California; it is larger, lighter in color and has a purple interior.

C. mahogani and *C. ximenes* are very similar and it probably would be appropriate to call the first a variety of the second as Reeve suggested in his Supplement on *Conus*. We have retained them as distinct species because in most cases they are readily separable.

Conus perplexus Sowerby

Plate 8, Figures 1, 2, 3; Plate 8, Figure 4

Conus perplexus SOWERBY, Thes. Conch., vol. 3, p. 20, 1857, pl. 200 [*Conus* pl. 14], fig. 324. "Gulf of California, West Columbia."—WEINKAUFF, Martini & Chemnitz, Conch. Cab., ed. 2, vol. 4, pt. 2, 1873, pp. 150, 230, pl. 38, fig. 2b; [as a var. of *C. puncticulatus*.]

"*Conus puncticulatus* HWASS, and Var. B," REEVE, Conch. Icon., vol. 1, August, 1843, pl. 20, fig. 116. "Salango and St. Elena, West Columbia." [Not *C. puncticulatus* of BRUGUIÈRE, WOOD, KIENER and pre-Linnaean equivalents.]—TRYON, Man. Conch., vol. 6, 1883, p. 62, pl. 19, fig. 91. "Cerros Island."

"*Conus comptus* GOULD," DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 219.—Not *C. comptus* GOULD, Journ. Boston Soc. Nat. Hist., vol. 6, Oct. 1853, p. 387, pl. 14, fig. 23.—SORENSEN, Nautilus, vol. 57, no. 1, July, 1943, pl. 1, fig. 5 [11 shells.] "Guaymas, Mexico."

Type locality: Gulf of California.

Range: Magdalena Bay and Gulf of California, south to Gorgona Island, Colombia.

Collecting stations: Mexico: Kino Bay; Cape San Lucas; Mazatlan; Acapulco; Chamela Bay; Tenacatita Bay; between Isabel Island and Mazatlan: Guatemala: Seven miles west of Champerico: El Salvador: La Libertad: Costa Rica: Port Parker; Port Culebra: Panama: Taboga Island: Colombia: Gorgona Island.

The greatest depth recorded for any of these localities is 20 fathoms. It is obviously a shallow water form. Tryon's record from "Cerros [=Cedros?] Island" has not been confirmed.

The name *perplexus* seems to have been well chosen for this highly variable form. Normally the surface bears many spiral rows of pustules but even in the same lot there may be every gradation from densely pustulose individuals to those completely lacking such ornament; some specimens are half pustulose, half smooth.

Conus puncticulatus of the older writers is certainly not a west American species and therefore the name cannot be made available in the present case. The true *puncticulatus* probably inhabits West Indian waters. Dall proposed to substitute *C. comptus* Gould for the Pacific species but the original figure of that form is so close to abundant *C. purpurascens* material in the collections studied that this course seems unsound.

The species is short and stout with usually a low straight sided spire. The latter has about 10 whorls, the first two (nuclear) being almost glassy transparent and none of them with beading; the sutures are slightly channelled, spiral striation weak; irregular blotches of reddish brown are scattered over the spire. The ground color is pale cream, the markings being reddish brown; these take the form of spiral rows of square dots over most of the shell but near the shoulder and the center of the body whorl there are irregular shaped patches and flammules of the same color. The inside of the aperture is usually colored purple but specimens are at hand which are pure white.

A very large specimen was collected at San Jose Island, Panama Bay, by W. D. Clark. It is 41.5 mm. in altitude and 22 mm. in diameter. Color-

ation is nearly identical with specimens in the N. Y. Zoological Society collection from Port Parker, Costa Rica. Brown spots and flammules predominate as in *C. archon* but there are spiral rows of fine brown dots on a nearly white background; spiral threads are well developed but are not nodulous. This specimen was presented to Stanford University and through the courtesy of Dr. A. Myra Keen, it is illustrated herewith.

Conus tornatus Broderip

Plate 8, Figures 4, 5, 6, 7

Conus tornatus BRODERIP, in SOWERBY, *Conch. Ill.*, p. 2 [117], pl. 29, fig. 25, May 17, 1833. "Panama."—BRODERIP, *Proc. Zool. Soc. London*, May 24, 1833, p. 53. "in Americâ Meridionali. (Xipixapi)."—REEVE, *Conch. Icon.*, vol. 1, pl. 13, fig. 68, May, 1843.—SOWERBY, *Thes. Conch.*, vol. 3, p. 16, 1857, pl. 202 [*Conus* pl. 16], fig. 375, pl. 104 [204] [*Conus* pl. 18], fig. 425, 1858; the last from "West Columbia."—DALL, *Proc. U. S. Nat. Mus.*, vol. 38, 1910, p. 219, "Cedros Island, Lower California, to Gulf of California and south to Ecuador."—Not "*Conus tornatus* BRODERIP," KIENER, *Icon. Coq. Viv.*, Genre *Cône*, p. 153, pl. 59, fig. 5; [= *Conus ximenes* GRAY.]

Conus interruptus BRODERIP & SOWERBY, *Tryon, Man. Conch.*, vol. 6, 1883, p. 63, pl. 20, fig. 4; copied from REEVE.

Conus catenatus SOWERBY, *Proc. Zool. Soc. London*, 1878, p. 796, pl. 48, fig. 3. "Hab Panama? (ex coll. Sir E. Belcher)."—DALL, *Proc. U. S. Nat. Mus.*, vol. 38, 1910, p. 228. "Appears to be a variety of *C. interruptus* BRODERIP."—TOMLIN, *Proc. Mal. Soc. London*, vol. 22, pt. 4, 1937, p. 226. "Type in Coll. Tomlin."—Not *Conus catenatus* SOWERBY I, *Quart. Journ. Geol. Soc.*, vol. 6, 1850, p. 45, pl. 9, fig. 2. Tertiary, San Domingo.

Conus concatenatus SOWERBY III, *Thes. Conch.*, vol. 5, 1887, p. 249, pl. 507, (*Conus* pl. 29), fig. 654 [As *catenatus* in exp. of pl.].—Not *Conus concatenatus* KIENER, *Icon. Coq. Viv.*, Genre *Cône*, 1849-1850, p. 362, pl. 110, fig. 1.

Conus desmotus TOMLIN, *Proc. Mal. Soc. London*, vol. 22, pt. 4, March 13, 1937, pp. 206, 226.

Type locality: Xipixapi, Ecuador.

Range: "Cedros Island, Lower California, to the Gulf of California, and south to Ecuador" (Dall).

Collecting stations: Mexico: Santa Maria Bay; Santa Inez Bay; Santa Cruz Bay; Acapulco; Port Guatulco; La Paz: Nicaragua: Corinto: Costa Rica: Port Parker: Panama: Bahia Honda; Chagame Island.

The species has been dredged in shallow waters, under 20 fathoms, in large numbers by numerous expeditions; only occasionally is it found on shore or in the intertidal zone.

The spiral rows of regularly spaced, square, rectangular dots of dark reddish brown make it difficult to separate from some young forms of *regularis*, particularly those which formerly would have been called *monilifer*. Part of the difficulty is due to the inability to determine from some of the

older illustrations whether the spiral markings are merely color dots or pustules. In the case of the original *tornatus* they are evidently definitely dots because it was Sowerby⁵³ himself who later pointed out that there are two forms, one smooth and the other "granulose." As a matter of fact there is every conceivable variation between heavily pustulose shells through those partly of that form to those which have no trace of such structure. Some shells are pustulose on one side, smooth on the other. In this respect the species parallels *Conus perplexus*, which it also resembles in color markings but the shape of *tornatus* is decidedly much more slender.

Dall, following a suggestion by Tryon, pointed out that *C. catenatus* Sowerby III was probably *interruptus* (= *ximenes*) and Sowerby himself indicated the close affinity of the species of this group although the locality was uncertain. The figure is indistinguishable from many specimens of *tornatus*. Tomlin, however, who possesses the type, considered Sowerby's shell distinct and renamed it "*desmotus*" a course which might not have been necessary had large series of specimens been available for comparison. If the species is not *tornatus* it is probably not west American.

Conus arcuatus Broderip & Sowerby

Plate 5, Figures 2, 3, 4

Conus arcuatus BRODERIP & SOWERBY, Zool. Journ., vol. 4, no. 15, Oct. 1828-Jan. 1829, p. 379. "Pacific Ocean, near Mazatlan."—SOWERBY, Conch. Ill., April 12, 1833, p. 1, [117], pl. 25, fig. 9. "Bay of Montija."—REEVE, Conch. Icon., vol. 1, June 1843, pl. 15, fig. 77 *b*. "Mazatlan."—KIENER, Icon. Coq. Viv. Genre *Cône*, p. 157, 1847, pl. 72, fig. 5.—SOWERBY, Thes. Conch. vol. 3, p. 12, 1857, pl. 202, fig. 384.—TRYON, Man. Conch., vol. 6, 1884, p. 75, pl. 24, fig. 98.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 223.

Not "*Conus arcuatus* BROD. & SOW.", GRAY, Zool. Beechey's Voy., Moll., 1839, p. 119, pl. 36, fig. 22; renamed, *Conus emarginatus* REEVE, Conch. Icon., pl. 43, fig. 232, 1844. "Pacific Ocean." [= *Conus recurvus* BRODERIP.]

Conus borneensis ADAMS & REEVE, Zool. Voy. H.M.S. *Samarang*, Moll., 1848, p. 18, pl. 5, figs. 8 *a-d*. "Hab. Northeast coast of Borneo (in ten fathoms, sandy and stony bottom)."

Type locality: Mazatlan, Mexico.

Range: Gulf of California to Panama.

Collecting stations: Mexico: Santa Inez Bay; Arena Bank; Port Guatulco; Acapulco Bay, Oaxaca and between Isabel Island and Mazatlan, Mexico; Costa Rica: Port Barker; Port Culebra; Gulf of Nicoya; Judas Pt.; Panama: Gulf of Chiriqui.

Reeve and others have pointed out the discrepancy in Gray's figure, and, although the former attempted to rectify matters, it appears that his

⁵³ Sowerby, Thes. Conch., vol. 3, 1857, p. 16, pl. 104, [204], fig. 425.

emarginatus is the same shell that was called *recurvus* by Broderip in 1833. The true *Conus arcuatus* has been well figured by several authors; it has strong spiral striations in many specimens and some spirals in all. The nucleus is smooth and polished; four post-nuclear whorls are strongly beaded on the carina and the upper whorls of the spire are nearly always brown. The sharply carinate periphery continues throughout the growth of the shell; the subsutural area is gently curved. Twelve and 13 whorls have been counted. Periostracum, light lemon yellow, very thin, with the scattered brown or yellow spots showing through; these are arranged roughly in three zones but the proportion of the white background covered is highly variable. The spiral grooves are very strong toward the canal but gradually weaken and disappear before the periphery is reached.

The species has been collected in large numbers and is not likely to be confused with any other of the west American fauna. Within its range Mr. Crocker collected it at nine additional stations on previous expeditions, in each case, however, with the dredge or trawl. It evidently does not frequent the littoral often if at all.

Adams and Reeve remarked upon the similarity of their species, *borneensis* to *arcuatus* after a comparison of type specimens and found them scarcely separable. Their excellent illustrations show shells which are practically identical with many in the collections studied from tropical west America. It seems obvious that some error in locality was made in the study of the collections of the *Samarang*. This is further suggested by three other species of *Conus* which were described in the same report immediately adjacent to *borneensis*. These were collected on the voyage of H. M. S. *Sulphur* and have unknown localities. Captain Belcher was on both expeditions and since it was admitted that some of his material became mixed it seems reasonable to suppose that the same happened in this case. No further record of *borneensis* having been found in Borneo has been seen. Two additional species treated in the *Samarang* report appear to be in the same category, *Dosinia dunkerii* Philippi and *Diplodonta sericata* Adams & Reeve.

Conus commodus A. Adams⁵⁴ was described without illustration from an unknown locality. Weinkauff, according to Tomlin⁵⁵, considered the species to be the one Kiener⁵⁶ figured as *Conus ambiguus* Reeve. Neither Kiener nor Reeve had any locality information and, upon comparing the figures it is obvious that the two are not the same species. The reason this concerns us is that Pilsbry & Vanatta⁵⁷ recorded *commodus* questionably from Wenman Island, Galapagos, from a much worn specimen taken by Snodgrass and Heller from the stomach of a shark. We have found nothing in any of the

⁵⁴ Adams, A., Proc. Zool. Soc. London, 1853, [Nov. 14, 1854], p. 117.

⁵⁵ Tomlin, J. R. le B., Proc. Mal. Soc. London, vol. 22, pt. 4, 1937, p. 230.

⁵⁶ Kiener, L. C., Icon. Coq. Viv., Genre *Cone*, 1847, p. 150. pl. 70, fig. 3.

⁵⁷ Pilsbry, H. A., and Vanatta, E. G., Proc. Washington, Acad. Sci., vol. 4, 1902, p. 555.

collections studied, which resembles Kiener's plate 70, figure 3, and if Weinkauff was right in determining this figure as *commodus* it seems doubtful if it is a west American species. Just what form is concerned in the Wenman Island record is equally uncertain. The Kiener figure is a plain olive colored shell with a sharp concave spire and angulated shoulder. The base is slightly pinched in as in *arcuatus*.

Conus fergusonii Sowerby

Plate 7, Figures 1, 2, 3, 4

Conus fergusonii SOWERBY, Proc. Zool. Soc. London, 1873, p. 145, pl. 15, fig. 1. "Panama."
—SOWERBY, Thes. Conch., vol. 5, 1887, 2nd Suppl. to *Conus*, p. 256, pl. 508
[*Conus* pl. 30], fig. 675.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, pp. 218-227.

Conus xanthicus DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 220. "Off Guaymas, Mexico, at station 3011, in 71 fathoms, sand, U. S. Bureau of Fisheries steamer *Albatross*." [Also reported from Panama Bay in 7 fathoms.]

Type locality: For *fergusoni*, Panama; for *xanthicus*, off Guaymas, Mexico.

Range: Turtle Bay and Magdalena Bay (outer coast), Lower California and Gulf of California, Mexico, south to "Santa Elena, Peninsula, Ecuador," (Barker), and the Galapagos Islands.

Collecting stations: Mexico: Arena Bank, Lower California, (Sta. 136, D-11, 24, 27, 30 to 50 fms.); Santa Inez Bay, Lower California, (Sta. 142, D-4, 40 to 50 fms.; Sta. 147, D-2, 60 fms.); Gorda Banks, Lower California, (Sta. 150, D-13, 16, 25, 56 to 80 fms.); off Pyramid Rock, Clarion Island, (Sta. 163, D-4, 50 fms.); Chamela Bay, (Sta. 182, D-4, 16 fms.; Costa Rica: Port Parker, (1 to 90 fms.); 14 miles SxE of Judas Pt., (Sta. 214, D-1, 2, 3, 4, 42 to 61 fms.); Panama: Hannibal Bank, (Sta. 224, 35 to 40 fms.). Above are New York Zoological Society Stations. Additional Calif. Acad. Sci. localities are Turtle Bay, Santa Maria Bay, Magdalena Bay and Cape San Lucas, Lower California; Clarion Island.

It seems remarkable that this huge species, sometimes over five inches long, should have remained undiscovered until 1873 but a search of the literature has failed to disclose a name for either the white adult form or the colored juveniles.

Dall suggested that *C. coelebs* Hinds⁵⁸ might be the young of *fergusoni* although both Hinds and Reeve came to believe their shell to be the young of *C. terebellum*, while Tryon⁵⁹, after copying Reeve's figure, considered it to

⁵⁸ Hinds, R. B., Ann. Mag. Nat. Hist., New ser., vol. 11, no. 70, April 1843, p. 256. "Ambo, Feejee Islands."—Reeve, L. A., Conch. Icon., vol. 1, May 1843, pl. 13, fig. 64. Suppl. June 1849, p. 4.—Hinds, R. B., Zool. Voy. *Sulphur*, Moll. pt. 1, July 1844, p. 7.

⁵⁹ Tryon, G. W., Man. Conch., vol. 6, 1884, p. 80.

be *C. terebra*. de Barros e Cunha⁶⁰ followed Tryon and cited *terebra* from the Philippines and North Australia. Hinds stated explicitly that *coelebs* was found on a Fiji coral reef and his localities are usually trustworthy.

Conus quercinus Bruguière⁶¹ is very similar to the large *fergusoni*; specimens in the California Academy of Sciences labelled from Mauritius, can hardly be distinguished. *Conus virgo* Gmelin⁶² from the same region is also similar but is shaded with purple on the interior of the lower end of the aperture.

A magnificent series of growth stages has enabled us to state with assurance that *C. xanthicus* Dall is the young of *fergusoni*. Without such a series it would not be suspected that the bright yellow or orange small shells could possibly be the same as the huge white ones so familiar to beach collectors at Magdalena Bay and vicinity. For a long time we were puzzled that no small white ones ever turned up in any of the collections. It develops that when *xanthicus* reaches a length of 60 mm., the colored bands become very faint yet upon closer inspection it is found that they still persist in specimens which are unquestionably called *fergusoni* 95 mm. long. Shape, sculpture and number of whorls all point to the identity of the two forms.

We are deeply indebted to Dr. Paul Bartsch of the U. S. National Museum for the photograph of the type specimen of *xanthicus* which is reproduced herewith. Fresh shells are covered with velvety periostracum which is very tenacious and increases in density with age; it almost obscures the color markings and when imperfectly removed leaves the ground color (white bands in this case) a pale yellowish green. These light colored bands are not at all constant; the one near the shoulder may be scarcely visible, and even the middle one may be broken up into a series of cloudy areas. The colored bands vary from light lemon-yellow to orange-yellow with occasionally a trace of brown. The color fades with increasing size so that when fully adult, that is when the length reaches 150 mm. or more, not a trace can be seen, even in living specimens. The largest specimens (alt. 150 mm.) seen came from Magdalena Island, outer coast; the species does not appear to occur in Magdalena Bay at the present time but we have fossils from the Pleistocene deposits just north of the village. Another large specimen, (alt. 128 mm.) is from Tagus Cove, Albemarle Island, Galapagos.

Passing to the fossil forms, *fergusoni* was recorded from the Pliocene, Imperial County, California, by Hanna⁶³. *Conus mollis* Brown & Pilsbry⁶⁴ from the Miocene, Gatun formation, Panama, is hardly separable. This, in

60 de Barros e Cunha, J. G. Catalogo descritivo das Conchas exóticas da coleção Antonio Augusto de Carvalho Monteiro, Memórias e Estudos do Museu Zoológico da Universidade de Coimbra sér. 1, no. 71, 1933, p. 183.

61 Bruguière, J. G., Encycl. Méth. Vers, vol. 1, pt. 2, 1792, p. 681. An earlier name for the species seems to be [*Conus*] *cingulum* MARTYN, Univ. Conch., vol. 1, 1784, fig. 39. "Friendly Isles."

62 Gmelin, J. F., Linn. Syst. Nat. ed. 13, 1789, p. 3376.

63 Hanna, G. D., Proc. Calif. Acad. Sci., Ser. 4, vol. 14, 1926, p. 446, pl. 21, figs. 6, 7.

64 Brown, A., and Pilsbry, H. A., Proc. Acad. Nat. Sci. Philadelphia, 1911, p. 343, pl. 23, fig. 1.

turn, is very similar to *Conus haytensis* Sowerby⁶⁵ from the Miocene of Santo Domingo. The similarity of *Conus hayesi* Arnold⁶⁶ from the Temblor Miocene of the San Joaquin Valley, California, to *C. fergusonii* was pointed out by Arnold.

Dall gave the range of the species as from Magdalena Bay to Ecuador and for *xanthicus*, Guaymas to Panama.

Conus vittatus Bruguière

Plate 8, Figures 8, 9; Plate 10, Figures 6-9

Conus vittatus BRUGUIÈRE, Enc. Méthod. Vers., 1798, pl. 335, fig. 3.—LAMARCK, Anim. sans Vert., vol. 7, 1822, p. 470. "Habite l'océan asiatique."

Conus vittatus BRUGUIÈRE, REEVE, Conch. Icon., vol. 1, June, 1843, pl. 14, figs. 75 a, b. "Bays of Panama and Montija, West Columbia."—KIENER, Icon. Coq. Viv., Genre *Cône*, p. 110, 1847, pl. 63, fig. 5. "Habite l'océan asiatique."—SOWERBY, Thes. Conch., vol. 3, p. 18, 1857, pl. 199, [*Conus* pl. 13], fig. 274; pl. 203 [*Conus* pl. 17], fig. 410, 1858.—WEINKAUFF, Martini & Chemnitz, Conch. Cab., ed. 2, vol. 4, pt. 2, 1873, p. 226, pl. 37, figs. 5, 6. "Grosser Ocean an der Küste von Central - America (Carpenter) und Panama (Bernardi)."—TRYON, Man. Conch., vol. 6, 1883, p. 43, pl. 13, figs. 41-44.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 221. "Acapulco to Panama."

Conus orion BRODERIP, Proc. Zool. Soc. London, 1833, p. 55. "In America Centrali. (Real Llejos)."—SOWERBY, Conch. Ill., p. 2 [118], pl. 33, fig. 40, May 17 - July 12, 1833. —SOWERBY, Thes. Conch., vol. 3, p. 19, 1857, pl. 195, fig. 200.—WEINKAUFF, Martini & Chemnitz, Conch. Cab., ed. 2, vol. 4, 1875, p. 364 pl. 67, fig. 7.—TOMLIN, Journ. Conch., vol. 18, no. 6, 1927, p. 154. "Gorgona Island, Colombia."

"*Conus fumigatus* BRUG. var.," KIENER, Icon. Coq. Viv., Genre *Cône*, pp. 103, 104, 1847, pl. 50, fig. 2 a.

[?] *Conus perplexus* SOWERBY, *archon* BRODERIP and *gladiator* BRODERIP, SORESENSEN, Nautilus, vol. 57, July, 1943, pl. 1, figs. 7, 8, 9, [9 shells]. Guaymas, Mexico.

[?] *Conus henoquei* BERNARDI, Journ. de Conchyl. vol. 8, Oct. 1860, p. 380, pl. 13, fig. 4; no locality cited.

Type localities: For *vittatus*, "Indian Ocean," [probably an error]; for *orion*, Realejo, near Corinto, Nicaragua.

Range: Santa Inez Bay, Lower California and Guaymas, Mexico, south to Gorgona Island, Colombia.

Collecting stations: Santa Inez Bay, Lower California; Costa Rica; Port Culebra; Panama: Bahia Honda.

In addition to these stations specimens from Mazatlan, Mexico, Port Parker, Costa Rica, and several places in Panama Bay have been studied.

The species is one of the most beautiful of the genus. Ground color is usually white and shows as blotches and spots through the reddish brown to orange color markings. These latter are present in variable amount, sometimes almost obliterating the white base and again they may be broken up

⁶⁵ Sowerby, G. B., Quart. Jour. Geol. Soc. London, vol. 6, 1850, p. 44.

⁶⁶ Arnold, R., U. S. Geol. Surv., Bull. 396, 1909, p. 62, pl. 6, fig. 3.

into scattered blotches irregularly shaped and spaced. There is usually a central band, lighter marked with color than the remainder of the shell. The spire is gently rounded, heavily marked with blotches of color and with a sharp apex. Sutures are raised into ridges, usually with spiral lines between. The shoulder is most often somewhat angulated as in Sowerby's figure in the *Theasaurus* but in older specimens it becomes rounded. The body whorl is marked throughout by equidistant raised spiral threads, sometimes with fine dots of darker color, and minute spiral striation between.

The periostracum is rough, horn colored, and so dense the color markings can barely be seen.

The original figure of *vittatus* is a black and white engraving and the specimen which was probably used for it was photographed by Dr. Mermod who very kindly permitted it to be published herein. From this photograph it seems now to be certain that the species is a west American form and not Asiatic or Indian Ocean as cited by early authors.

In the identification of the collections used for this report those which belong to this species or group of species have caused much trouble. Only a few specimens have been available, all taken in the littoral zone. These either belong to one highly variable form or there are three or more, *vittatus*, *orion* and one or more unnamed. The course chosen has been the conservative one for several reasons. One is the very great variability of most of the west American species; this appears especially when large numbers of specimens become available. Another is the scarcity of material. Also there is reason to be doubtful if an unnamed littoral species of *Conus* exists in the vicinity of Panama although this is by no means certain. Our treatment of the subject is not satisfactory to ourselves or our colleagues but under the circumstances we feel that it will cause less future confusion than any other action we could take.

We are under obligations to Dr. Howard R. Hill, of the Los Angeles Museum for much assistance with this species and to him and Dr. A. Myra Keen of Stanford University for the privilege of studying the beautiful shells they have received from Panama from Mr. W. D. Clark.

The shells illustrated by Sorensen under the names *perplexus*, *archon*, and *gladiator* are probably all *orion* or *vittatus*; certainly some of them are. In two cases, shadows cast by the shells make it difficult to determine exactly what the shape and markings may be.

Many authors have placed *C. henoquei* Bernardi^{66a} in synonymy of *vittatus* and it seems probable that this is correct. Others have placed *orion* also in synonymy but there has evidently been some hesitation in this respect because of the apparently erroneous locality originally cited for *vittatus*.

^{66a} The holotype of this species is preserved in the Museum National d'Histoire Naturelle, Paris. See Fisher-Piette & Beigbeder in Bulletin of that Museum, ser. 2, vol. 16, no. 6, Nov. 1944, p. 461.

Conus purpurascens Broderip

Plate 8, Figures 19, 20; Plate 9, Figures 1, 2, 3

Conus purpurascens BRODERIP, in SOWERBY, Conch. Ill., April 12, 1833, p. 1, [117], pl. 25, figs. 13, 13*.—BRODERIP, Proc. Zool. Soc. London, May 24, 1833, p. 54. "Hab. ad Panamam."—REEVE, Conch. Icon., vol. 1, July, 1843, pl. 19, fig. 105.—KIENER Icon. Coq. Viv., Genre *Cône*, p. 189, 1848, pl. 39, fig. 2, pl. 61, fig. 3.—SOWERBY, Thes. Conch., vol. 3, p. 28, 1858, pl. 195, [*Conus* pl. 9], fig. 204, pl. 201, [*Conus* pl. 15], fig. 346.—WEINKAUFF, Martini & Chemnitz, Conch. Cab., ed. 2, vol. 4, pt. 2, 1873, p. 211, pl. 54, figs. 1, 2.—TRYON, Man. Conch., vol. 6, 1883, p. 64, pl. 20, figs. 15-17, pl. 27, fig. 9.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 219. "Magdalena Bay, Lower California to Manta, Peru."—PEILE, Proc. Mal. Soc. London, vol. 23, 1939, p. 349, fig. 5 (radula). "Panama." SORESEN, Nautilus, vol. 57, no. 1, July, 1943, pl. 1, fig. 2 [7 shells]. "Guaymas, Mexico."

Conus luzonicus LAM? SOWERBY, Conch. Ill., April 20, 1834, p. 3, [119], pl. 57, fig. 91.—SOWERBY, Thes. Conch., vol. 3, p. 281, 1858, pl. 201 [*Conus* pl. 15], fig. 344. "Panama."—SOWERBY, Proc. Zool. Soc. London, June 17, 1834, p. 18, "Hab. ad Insulas Gallapagos." Not *Conus luzonicus*, BRUGUIÈRE, LAMARCK and KIENER.

Conus purpurascens var. *rejectus* DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 219. "Port Escondido, Gulf of California."

Conus regalitatis SOWERBY, Conch. Ill., April 30, 1834, p. 3, [119], pl. 57, fig. 87.—SOWERBY, Proc. Zool. Soc. London, June 17, 1834, p. 19. "Hab. ad littora Americae Centralis. (Real Llejos)."—REEVE, Conch. Icon., vol. 1, January, 1844, pl. 40, fig. 218.—KIENER, Icon. Coq. Viv., Genre *Cône*, p. 237, 1849, pl. 39, fig. 3.—SOWERBY, Thes. Conch., vol. 3, 1858, p. 28, pl. 201 [*Conus* pl. 15], fig. 345.

Conus purpurascens var. *regalitatis* SOWERBY, DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 219. "Cape San Lucas and southward to Peru, the Galapagos and Clipperton Islands."

Conus comptus GOULD, Journ. Boston Soc. Nat. Hist., vol. 6, Oct. 1853, p. 387, pl. 14, fig. 23. "Inhabits Santa Barbara. Col. Jewett." Not *Conus comptus* A. ADAMS, Proc. Zool. Soc. London, 1853 [Nov. 14, 1854], p. 117, from Natal and which Sowerby. (Thes. Conch., vol. 3, index, p. 50, 1858), stated was *Conus castus* Reeve.

[?] *Conus cinctus* VALENCIENNES, Zool. Humboldt & Bonpland, Rec. Zool., vol. 2, 1832, p. 337. "Habitat cum praecedente ad Acapulco."—Not *Conus cinctus* SWAINSON, Zool. Ill., Ser. 1, 1823, p. 110, which Tryon (Man. Conch., vol. 6, 1884, p. 100), placed in the synonymy of *pulchellus* SWAINSON.

Type locality: Panama.

Range: "Magdalena Bay, Lower California to Manta, Peru" (Dall).

Collecting stations: Sets of specimens have been available for this study as follows: Mexico, 14; Nicaragua, 2; Costa Rica, 10; Panama, 1; Colombia, 1; Galapagos Islands, 7.

Thus, from the abundance of material this must be considered to be the most common cone along the west American coast. It normally inhabits rocky shores and tide pools from mid-tide down to a few fathoms.

The typical form of the species is a shell with a low spire and strongly shouldered whorls. From this to the rounded form called *regalitatis* there is

endless variation. In addition there are color combinations too numerous to be enumerated. The general predominance of purple, however, shows that the species is well named. The large number of specimens available for this study has convinced us that the named varieties and many others equally distinct have no biological significance. They merely appear to be variants of a somewhat plastic species.

Valenciennes compared his *cinctus* with *hyaena* Bruguière which, with the locality, would indicate that he probably had *purpurascens*. Dall suggested that *cinctus* Valenciennes and *emarginatus* Reeve might be the same but there is not sufficient information published to permit the definite assignment of Valenciennes' name anywhere. Weinkauff (p. 394) stated that *Conus neglectus* A. Adams⁶⁷, was the young of *purpurascens* and that the name should be added to the synonymy. However, the description and Sowerby's figure seem to imply a very different shell and this, together with the unknown habitat of *neglectus*, has caused us to omit it.

Conus luzonicus Bruguière⁶⁸ is an entirely different species, judging by the original figure, and it is difficult to understand Sowerby's confusion of the shells. Kiener⁶⁹ has given a beautiful figure which resembles the one in the Encyclopedia very closely and it may have been made from an original specimen; he gave the locality as "les côtes des îles Philippines."

The variety *rejectus* has not been figured. It was described as having the spire somewhat lower and the shoulder more angular than usual. The color pattern is in small patches, with some pale brown thread-like, articulated spiral lines. There is little in the description to distinguish the form from the original figure of *purpurascens*.

The figure of *comptus* Gould can be matched almost exactly in any large collection of *purpurascens*, in which specimens have been preserved which are not fully grown, the heavy blotches being very distinctive. Carpenter⁷⁰ and Cuming, who had studied Gould's type of *comptus* pronounced it to be *purpurascens* and were followed by Sowerby in 1856 and Tryon in 1883. However, Dall in 1910 considered it to be the oldest available name for *Conus puncticulatus* Wood (not Bruguière) [= *perplexus* Sowerby].

Gould⁷¹ stated that *purpurascens* was equivalent to "*Conus achatinus* Menke." Menke⁷² merely listed the name from west America and attributed it to Bruguière. It is probably a case of mistaken identification or mixing of collections (as suggested by Carpenter)⁷³ because *achatinus* Bruguière⁷⁴ is a

⁶⁷ Adams, A., Proc. Zool. Soc. London, 1853 [November 14, 1854], p. 117; "Hab.?"—Sowerby Thes. Conch., vol. 3, 1858, p. 25, pl. 203 [*Conus* pl. 17], fig. 404; Hab.—?"

⁶⁸ Bruguière, J. G., Enc. Méthod., 1792, p. 706, pl. 338, fig. 6.

⁶⁹ Kiener, L. C., Icon. Coq. Viv., Genre *Cone*, 1848, p. 180, pl. 83, fig. 3.

⁷⁰ Carpenter, P. P., Proc. Zool. Soc. London, 1856, p. 206.

⁷¹ Gould, A., Otia Conch., 1862, p. 187.

⁷² Menke, K. T., Zeit. f. Mal., Jahr. 4, 1847, p. 183.

⁷³ Carpenter, P. P., Rept. Brit. Assoc. Adv. Sci., 1856, [1857], p. 236. [Carpenter added that the species was "*purpureus* or *regalitis*," evidently meaning *purpurascens*].

⁷⁴ Bruguière, J. G., Enc. Method, 1792, p. 672, pl. 330, fig. 6 [= Hwass of authors].

decidedly different shell, with a predominance of spiral sculpture; it is supposed to be found in Asiatic waters.

Krebs⁷⁵ has listed *Conus purpurascens* Broderip from the island of Guadeloupe, West Indies, on the authority of "Bean." It seems reasonable to assume now that this was an error of locality or identification.

Conus patricius Hinds

Plate 6, Figure 12; Plate 9, Figures 6, 7, 8, 9

Conus patricius HINDS, Ann. & Mag. Nat. Hist., N.S., vol. 11, no. 70, April, 1843, p. 256. "Gulf of Nicoya, Central America. Dredged from sandy mud in 7 fathoms."—REEVE, Conch. Icon., vol. 1, May, 1843, pl. 13, fig. 63.—HINDS, Zool. Voyage Sulphur, vol. 2, no. 6, July, 1844, p. 7, pl. 1, figs. 1, 2.—KIENER, Icon. Coq. Viv., Genre Cône, p. 350, 1849-1850, pl. 88, fig. 4.—SOWERBY, Thes. Conch., vol. 3, p. 12, 1857, pl. 202, [*Conus* pl. 16], fig. 355.

Conus pyriformis REEVE, Conch. Icon., vol. 1, May, 1843, pl. 13, fig. 70. "Bays of Caracas and Montija, West Columbia."—TRYON, Man. Conch., vol. 6, 1883, p. 17, pl. 4, figs. 60, 61.—KIENER, Icon. Coq. Viv., Genre Cône, p. 275, 1849-1850, pl. 44, fig. 4.—SOWERBY, Thes. Conch., vol. 3, p. 24, 1857, pl. 197 [*Conus* pl. 11], fig. 238, pl. 201 [*Conus* pl. 15], fig. 354.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 226. "Nicaragua south to Panama and the Galapagos Islands."

Type locality: Gulf of Nicoya, Costa Rica (*patricius*); Caracas, Ecuador, and Montijo Bay, Panama (*pyriformis*).

Range: Nicaragua south to Punta Carnero, Ecuador.

Collecting stations: Costa Rica: Port Culebra.

No specimens have been seen in the collections studied in connection with the present report which confirm Dall's record of the species at the Galapagos Islands although it may reasonably be expected to live in those waters.

Young shells are beautifully coronated with a row of symmetrical beads, but the periphery is gently rounded in adult specimens. Mr. H. N. Lowe collected living shells at San Juan del Sur, Nicaragua, and these are covered with a horn-colored epidermis, the color of the under shell, showing through on the body whorl in the aperture, and on the lower part of the spire. When the epidermis is lost and the shell is weathered, it becomes entirely white. Available material from six localities indicates that this is not only one of the most beautiful of all of the cones but also one of the rarest. However, Mr. R. Wright Barker found it to be one of the most common forms on Santa Elena Peninsula, Ecuador, in 1931 where it lived in tide pools among the rocks. (Letter, March 19, 1940).

The identity of *Conus patricius* and *pyriformis* has been generally recognized since 1883 (Tryon), the first name having been based upon an im-

⁷⁵ Krebs, Henry. The West Indian Marine Shells with some remarks, 1864, p. 6. [A copy of this rare document has been consulted in the private library of Dr. L. G. Hertlein. For comments regarding the circumstances of its publication, see letter from Krebs published by Dall, U. S. Nat. Museum, Bull. 37, 1889, p. 20.]

mature specimen. The name *patricius* clearly has priority, having appeared first in April, 1843, while Reeve has the date printed on the explanation of the plate bearing *pyriformis* as May, 1843. Even if there should have been doubt as to the correctness of these printed dates, Reeve included *patricius* on the same plate with *pyriformis*, the first as figure 63, the second as figure 70. There seems to be no good reason for the continued acceptance of the name *pyriformis* for the species.

Usually the shells are characterized by being pyriform, rather thin and uniform pale waxy yellow. However, Mr. W. D. Clark recently collected one on Venado Flats, Panama Bay, which has an extremely heavy, thick shell with a thick horny periostracum. The coating tends to peel off when dry. It is the largest individual of the species which we have seen and measures: Length, 140 mm.; greatest diameter, 89.5 mm. The apex is somewhat worn but shows 13 whorls, the first 8 or 9 being beaded around the periphery. The operculum is thick and horny, spatulate, pitted on the underside at the attachment; length, 22.0 mm.; width, 18.5 mm.; thickness, 3.3 mm. The thin membranous object shown in figure 9 was said to be an egg case of this individual; it consists of 8 leaf-like sacks, now empty. This marvelous specimen was presented to Stanford University (no. 31642) and was made available for this study through the kindness of Dr. A. Myra Keen.

Another giant specimen was collected by Mr. R. Wright Barker several years ago on Santa Elena Peninsula, southwest Ecuador. It measures at least 100 mm. in length and was sent to Mr. J. R. leB. Tomlin.

Conus virgatus Reeve

Plate 6, Figure 10; Plate 9, Figure 5

Conus lorenzianus CHEMNITZ, KIEFNER, Icon. Coq. Viv., Genre Cône, 1847, p. 139, pl. 55, fig. 1. "Habite la Mer du Sud, les côtes d'Acapulco."—Not *Conus lorenzianus* CHEMNITZ, Neues Syst. Conch. Cab., vol. 11, 1795, pl. 181, figs. 1754, 1755. ". . . ostindischen Meeren."

Conus cumingii REEVE, Conch. Icon., Suppl., pl. 8, figs. 277 a, b, June, 1849.—Not *Conus cumingii* REEVE, op. cit. pl. 3, fig. 282, April, 1848.

Conus sanguinolentus REEVE, (?) Conch. Icon., Suppl., pl. 8, fig. 274, June, 1849. [No locality cited.]—SOWERBY, Thes. Conch., vol. 3, 1857, p. 18, pl. 203 [*Conus* pl. 17], fig. 409.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 225. "Guaymas, Mexico to coast of Ecuador."—Not *Conus sanguinolentus* QUOY & GAIMARD, Voy. *Astrolabe*, Zool., vol. 3, 1834, p. 99, pl. 53, fig. 18. "New Guinea."

Conus virgatus REEVE, Conch. Icon., Suppl., p. 1, June, 1849. Name proposed for pl. 16, fig. 87 (*zebra* from Salango, Central America.)—SOWERBY, Thes. Conch., vol. 3, p. 17, pl. 195 [*Conus* pl. 9], figs. 190, 193, 1857. "Salango, West Columbia."—WEINKAUFF, Martini & Chemnitz, Conch. Cab., ed. 2, vol. 4, pt. 2, 1875, p. 308, pl. 49, figs. 4, 5. "westküste von Central - und Südamerika."—TOMLIN, Proc. Mal. Soc. London, vol. 22, pt. 5, 1937, p. 328.—SORENSEN, Nautilus, vol. 57, no. 1, July, 1943, pl. 1, fig. 3 [7 shells.] "Guaymas, Mexico."

Conus signae BARTSCH, Nautilus, vol. 51, no. 1, July, 1937, p. 3, pl. 2, fig. 8. Figured specimen from Guaymas, Mexico; also recorded from Cedros Island and from Panama.

Type locality: Salango, Ecuador.

Range: Cedros Island, Lower California, to Ecuador.

Collecting stations: Mexico: Arena Bank, (Sta. 136, D-4, 55 fms.); San Carlos Bay; Guaymas. A living specimen from the last locality, collected by Mr. A. Sorensen, was used for dissection of the radula figured herewith.

Other expeditions, the material from which has been available for this study, shows that the species occurs as far north in the Gulf of California as San Carlos Bay. Apparently the first west American specimen of this group of *Conus* to be noted in the literature was the one figured by Kiener from Acapulco, Mexico. It resembles some of the recent collections very strongly. Kiener referred the shell to Chemnitz's name, *lorenzianus*, the specimens of which came from the East Indies and the name was not validated according to the rules, until Dillwyn⁷⁶, 1817. Meanwhile, Lamarck⁷⁷ in 1810 had described *Conus flammeus* from "Africa" which, from Kiener's and other figures, is identical. This name, however, had been previously used by Bolten⁷⁸ under *Cucullus* for a species figured by Martini⁷⁹ as *Conus leoninus*. Tomlin⁸⁰, therefore renamed Lamarck's *flammeus*, "*phlogopus*" but it would seem that *lorenzianus* Dillwyn would be available.

It was necessary to make this somewhat cursory examination of the literature because the species involved in the above complex of names is extremely close to the west American form. In fact the only differences noted (and these may be inconstant) are the heavier coloring of the more numerous stripes which are somewhat broken into spiral rows of spots near the base on the form from the Indies and Africa. It is another case of similarity of the *Conus* fauna from this region to that of very distant areas.

It seems clear that Sowerby, in 1857 attempted to correct the slip made by Reeve in naming two distinct shells for Cuming; he substituted Reeve's earlier name *virgatus* for the west coast species and was followed in this action by Weinkauff, Tryon and Tomlin. Dall made no comment on this procedure, but substituted another of Reeve's earlier names, *sanguinolentus*, for the later *cumingii*. Quoy and Gaimard, however, had previously used *sanguinolentus* for another species of *Conus*. Furthermore Tomlin⁸¹, stated that Reeve's shell of that name was equivalent to "*dacus* Brug." a West Indian species.

⁷⁶ Dillwyn, L. W., Desc. Cat. Rec. Shells, vol. 1, 1817, p. 370.

⁷⁷ Lamarck, J. B., Ann. du Mus. H. N. Paris, vol. 15, 1810, p. 279.

⁷⁸ Bolten, J. F., Mus. Bolt., 1798, p. 44.

⁷⁹ Martini, F. H., Conch. Cab., vol. 2, 1771, pl. 55, figs. 606, 607.

⁸⁰ Tomlin, J. R. le B., Proc. Mal. Soc. London, vol. 22, 1937, p. 206.

⁸¹ Tomlin, J. R. le B., Proc. Mal. Soc. London, vol. 22, pt. 5, 1937, p. 305.

The problem finally becomes one of determining if Reeve's pl. 16, fig. 87 is equivalent to his Suppl. pl. 8, fig. 274. From an examination of the figures, Bartsch was evidently unable to reconcile them, a doubt which we shared for a long time, and he renamed the second *cumingii*, *signae*. However, it seems open to question if there be two very similar species belonging to this group in this region; if so we do not know how to distinguish them at present. Moreover, Sowerby was in an excellent position to know details regarding Reeve's material, and Tomlin's⁸² remarks are nearly conclusive where he says regarding the second *cumingii* " ? Types (3) : all much bigger than Reeve's figure. = *virgatus* Rve." Chiefly, for this reason, the name *virgatus* has been chosen for the western shell.

The species is of medium size, rather plainly colored, with dark brown longitudinal stripes on a lighter pinkish ground color. Brown spiral lines are usually present and the exceedingly fine wavy spiral sculpture gives to the shell, a silky texture unlike any other western species.

The collections obtained by the various expeditions to Central American waters of late years, have contained very few specimens of the species so that the range of variation cannot be indicated with any great degree of completeness. However, it will be noted from our figures that this is considerable, the front of one specimen being exceedingly close to the figure of *C. signae* while the reverse side shows pronounced zigzag flammules similar to the original shell Reeve called *zebra* from "Salango" and later renamed *virgatus*. Some specimens are practically without any trace of the brown stripes, thus paralleling, in a way, the condition found in the variety of *princeps* called *apogrammatus*.

The published records, the material noted above and five specimens in the San Diego Society of Natural History (Lowe, coll.) from Carmen Island, Mexico, Socorro Island, Mexico and San Juan del Sur, Nicaragua, show the range to be from Cedros Island to Ecuador. The San Diego Society collection was made available for this study through the kindness of the late Director, Mr. Clinton G. Abbott.

An unusually heavily marked specimen was collected by Mr. W. D. Clark on rocks at Bruja Point, Panama Bay. Through the courtesy of Dr. A. Myra Keen, of Stanford University, to whom the shell was presented, we are able to illustrate it herewith. It measures 33 mm. in altitude, 17.3 mm. in diameter.

One of the animals collected by Mr. Sorensen at Guaymas, Mexico, in January, 1942 was a male and except for black blotches around the margin of the foot and the tip of the siphon, no color was preserved (July, 1946). The head, or snout, is long and slender and evidently capable of great extension. Eyes are near the outer ends of slender tentacles.

The operculum is small (length, 4.5 mm., width, 1.75 mm.), oval in shape, with the apex subcentral. In comparison with other species examined,

⁸² Tomlin, J. R. le B., Proc. Mal. Soc. London, vol. 22, pt. 4, 1937, p. 236.

the proboscis is not so highly developed as a muscular organ but it is obviously capable of great protrusion. The "poison gland" is massive and pinkish and discharges into the base of the proboscis through an extremely long and greatly convoluted duct, just in front of the neural ring. Immediately in front of this is the attachment of the "radular" sheath, a rather slender pointed tube with a somewhat elongated pouch near the base. There are many teeth

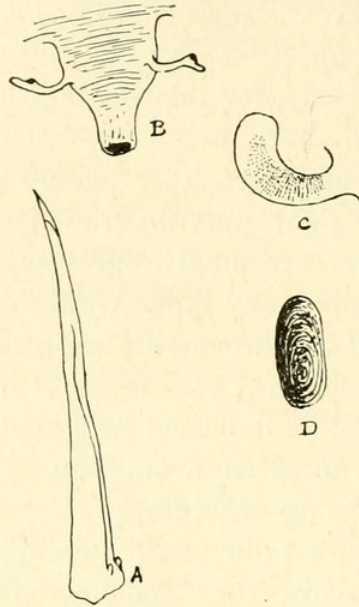


Fig. 3. *Conus virgatus* REEVE. A.—Complete tooth. B.—Dorsal view of head. C.—Verge. D.—Operculum. Hypotype, no. 9343 (Paleo. type coll.), from Loc. 31699 (C.A.S.), San Carlos Bay, Mexico, A. Sorensen, Coll., Jan. 1942.

arranged with the points all toward the aperture of the duct. They are weakly attached to the wall of the duct and each has what appears to be a very fine tube attached to the base. Each tooth is a slender, slightly curved shaft with no well-defined barbs. The base is swollen and a line extending nearly to the tip appears to be the edge of this rolled up plate. The length of an average tooth is .62 mm.

Conus dalli Stearns

Plate 5, Figure 12

Conus dalli STEARNS, Proc. Calif. Acad. Sci., vol. 5, 1873, p. 78, pl. 1, fig. 1. "Gulf of California, from whence specimens are occasionally brought to San Francisco on vessels in the Gulf trade. It is not common."—STEARNS, Proc. U. S. Nat. Mus., vol. 17, 1894, p. 169.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 226.—HERTLEIN, Proc. Amer. Phil. Soc., vol. 78, no. 2, 1937, p. 306, pl. 1, fig. 18.—DAUTZENBERG, Mem. Mus., Roy. d'Hist. Nat. Belgique, vol. 2, fasc. 18, 1937, p. 252.

Conus omaria BRUGUIÈRE, Menke, Zeit. f. Mal., Jahr. 8, 1851, p. 23. "Mazatlan."

Type locality: Gulf of California.

Range: Gulf of California to Panama.

Collecting stations: Mexico: Tres Marias Islands; Costa Rica: Port Parker; Cocos Island; Galapagos Islands: Albemarle; Hood.

Most of the specimens (six lots) in the California Academy of Sciences came from the Tres Marias, Galapagos and Cocos Island.

The species is the west American representative of the *Conus textile* group and it is scarcely separable from some members or "varieties" of that great assemblage. Although Stearns stated in 1894 that the differences between immature shells of *dalli* and *textile* were greater than in adult forms, after studying a fairly large series we have been able to indicate no single character which can be relied upon to distinguish the American form in every case. As a general rule specimens of *C. dalli* have the brown blotches of a darker brown and the interior a faint rose pink instead of white, but some finely preserved shells agree in detail to a most remarkable extent with what Reeve^{s3} called the true *textile*.

Many variations of the *textile* group have been named and Melvill^{s3a} has given a review of the group; he considered *dalli* to be a variety. Dautzenberg has given very extensive synonymy for *textile* and some of its varieties and discussed their relationship. He considered *dalli* to be a distinct species, partly because of its range and also because the shell is "constamment teinté de rose dans l'intérieur de l'ouverture."

It seems unnecessary here to attempt to unravel the intricacies of the nomenclature. To do so would require the examination of a considerable amount of pre-Linnaean literature because the name was originally founded on several existing figures. It is first necessary to fix upon a definite type form of color pattern for *textile* and from that, work through the various named varieties. It seems probable that when this is done, many names will have to be thrown into synonymy; but until such a study is made we feel that the best course to follow will be to recognize the name *dalli* as applied locally to the west American form. A consideration of the manner in which such representatives of south sea species have been dispersed to American waters, or vice versa, leads to interesting speculation, but there are few facts available to justify positive opinions. However, in the case of *Conus omaria*, a member of the *textile* group, Ostergaard^{s3b} has observed that the veliger larvae have no free-swimming stage under laboratory conditions. If this be true under natural conditions, and this seems probable, one of the usually cited methods of distribution in the Mollusca is certainly eliminated.

^{s3} Reeve, L. A., *Conch. Icon.*, vol. 1, Dec. 1843, pl. 38, fig. 209.

^{s3a} Melvill, J. C., *Journ. Conch.*, vol. 9, no. 10, 1900, pp. 303-316.

^{s3b} Ostergaard, L. M., *Bernice P. Bishop Museum, Bull.* 131, 1935, p. 24.

The apical whorls are a light purplish-pink, those of the nucleus (about 2) being smooth and the succeeding three or four being each marked by a spiral row of about 30 rounded beads. The remainder of the spire is low, sides nearly straight to gently convex, suture faint, and with a few fine, spiral striations. Specimens of *textile* from Mozambique are practically identical. Depth of color tone varies considerably. The darkest ones seen came from Panama (Stanford University Coll.) and Costa Rica. Fresh living shells from farther north are nearly as dark. The interior of all specimens examined, except beach worn ones, show at least a trace of rose color or purple and some are very dark. Available specimens of *textile* do not show this character in so pronounced a degree and some are definitely white, perhaps due to fading with age.

The extreme similarity of *Conus dalli* to some other members of the group to which it belongs but which now live in far distant places has given rise to the belief that the species is a comparatively recent migrant to American shores. However, the finding of a fossil species in Imperial County, California, with color markings preserved, which obviously belongs to the same group refutes such a supposition and may even suggest to some that migration has been in the opposite direction. (See *Conus durhami* below.)

***Conus durhami* Hanna & Strong, sp. nov.**

Plate 5, Figure 16

Shell broad, spire low with straight sides, suture lightly impressed with a non-striated groove; whorls about eight; shoulder rounded; color markings consisting of a series of network of brown, lines enclosing roughly angular areas of light cream. Length 39.5 mm., diameter 25.5 mm.

Holotype, No. 34200 (Univ. Calif. Mus. Paleo.), from Loc. A 1269 (U. C.), "south side of **Carrizo Mountain, Imperial County, California**; Pliocene; in small canyon about $\frac{3}{8}$ mile east of mouth of Alverson Canyon in small draws cut in basal conglomerate in west side of canyon, 100-200 yards from its mouth." (Bramkamp.)

The species is named for Dr. J. W. Durham, paleontologist of the University of California, who made a large collection of fossils in the region in 1934. The specimen is not remarkable solely for the preservation of the color markings but indicates a relationship with the *textile* group of cones. This shows that such forms as *Conus dalli* need not be recent migrants from other seas because in this case as well as others, the group has been here for a comparatively long time. A similar case is presented in connection with *Conus tessulatus* and *bramkampfi*.

Conus lucidus Wood

Plate 5, Figure 13

Conus lucidus WOOD, Index Test., Suppl., 1828, p. 8, pl. 3, fig. 4. "M. Cab. South Sea."—WOOD, Index Test., Hanley Ed., 1856, p. 208, Suppl. pl. 3, fig. 4. [The name is followed by "/" which, according to a note on p. 197, indicates that the specimens are from the collection of Mawe and that such names were chiefly manuscript ones of that collector. [In synonymy: "Mawe, Conch. 90 (no desc.)—*C. reticulatus*, Sow. (as of Wood!) C. I. Con. f. 86, S. Seas."]—SOWERBY, Thes. Conch., vol. 3, p. 43, pl. 110 [210] [*Conus* pl. 24], fig. 581, 1858. [Name erroneously attributed to "Mawe, Conch. 90."]—WEINKAUFF, Martini & Chemnitz, Conch. Cab., ed. 2, vol. 4, 1873, p. 238, pl. 39, figs. 9, 10.—TRYON, Man. Conch., vol. 6, 1884, p. 91, pl. 30, fig. 11.—DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 226. [Name attributed to "Mawe, 1828."] "Magdalena Bay, Lower California to the Galapagos Islands."

Conus reticulatus MAWE, Linn. Syst. Conch., 1823, p. 90. "South Seas."—SOWERBY, Conch., Ill., p. 3 [119], pl. 57, fig. 86, April 30, 1834, [As "*Conus reticulatus* WOOD."]—REEVE, Conch. Icon., vol. 1, "June, 1843," pl. 11, fig. 52. [In synonymy: "*Conus lucidus*? WOOD (undescribed)."] "Island of La Plata found in coarse sand."—KIENER, Icon. Coq. Viv., Genre *Cône*, 1847, p. 145, pl. 66, fig. 5. [Name attributed to Sowerby.]—Not *Conus reticulatus* BORN, Index, Mus. Caes. Vind., 1778, p. 139.

Type locality: Unknown; not "South Sea" as originally cited. Typical specimens have been collected at Magdalena Bay, Lower California, outer coast.

Range: Magdalena Bay to "Santa Elena Peninsula, Ecuador," (Barker).

Collecting stations: Costa Rica: Port Parker and Port Culebra; Panama: Bahia Honda; Colombia: Gorgona Island (Sta. 232, N. Y. Z. S., D-1, 2 to 8 fms.).

The species is present in the collection of the California Academy of Sciences from Magdalena Bay (outer coast, several lots) and from five localities in the Galapagos Islands.

Although Mawe's name *reticulatus* has clear priority over *lucidus*, as shown in the above synonymy, it is invalidated by earlier usage. Pre-Linnaean writers used *reticulatus* extensively for a variety of *Conus mercator* Linnaeus and it was subsequently validated by Born⁸⁴ in 1778. Also the name was presumably applied to another species by Meuschen⁸⁵ in 1787. This information was derived from Sherborn, Index Anim., 1758-1800; the original works were not available. However, since Martini⁸⁶, 1771, used the name as a species and such post-Linnaean writers as Dillwyn⁸⁷, 1817, definitely placed the reference in the synonymy of *Conus mercator*, further tracing of the name seems unnecessary.

⁸⁴ Born, I., Index Mus. Caes. Vind., 1778, p. 139.

⁸⁵ Meuschen, F. C., Mus. Gever., 1787, p. 366.

⁸⁶ Martini, F. H. W., Neues Syst. Conch. Cab., vol. 2, 1771, pp. 261-262, pl. 56, figs. 619-621.

⁸⁷ Dillwyn, L. W., Desc. Cat. Recent Shells, vol. 1, 1817, p. 391.

It was necessary to determine these facts, however, because the names *lucidus* and *reticulatus* have been variously substituted in the literature for the west coast species and there seems to be no agreement as to the authorship of either one. We have followed Sherborn, (*Index Animalium*) in crediting *lucidus* to Wood, 1828, because there is nothing in the original citation to show that it was Mawe's manuscript name; not until the Hanley edition of Wood, in 1856, was there an indication that this might be the case, and even then there is no certainty regarding it.⁸⁸

There is considerable variation in the shape and coloration shown in the various figures, particularly in the height and concavity of the spire. The one published by Kiener agrees very closely with the specimens dredged by the Crocker Expedition of 1932, 13 miles southeast of Cape Tosco, Santa Margarita Island, Lower California, (Loc. 27588 C. A. S.). Reeve's figure fits specimens from the Galapagos Islands more closely than any of the others.

Galapagos beach shells and a set from Magdalena Bay, presumably from shallow water, in the Hemphill collection, are all heavier, shorter and broader than the dredged material. It is possible that some of the differences in the figures may be attributed to the habitat of the shells.

The species has been considered to be one of the rare forms of the west coast, but the collections available for this study have contained numerous specimens.

Conus californicus Hinds

Plate 5, Figures 14, 15

Conus californicus HINDS in Reeve, *Conch. Icon.*, vol. 1, Jan. 1844, pl. 42, fig. 224. "California."—HINDS, *Zool. Voy. Sulphur*, pt. 1, July, 1844, p. 7, pl. 1, figs. 3-5. "Bay of Magdalena, California."—SOWERBY, *Thes. Conch.*, vol. 3, 1857, p. 31, pl. 200 [*Conus* pl. 14], fig. 332.—COOPER, *Geol. Surv. Calif. [Spec. Publ.] Geog. Cat. Moll. W. of the Rocky Mts.*, 1867, p. 33. "Farallone Islands to San Diego, Lower California."—TRYON, *Man. Conch.*, vol. 6, 1883, p. 17, pl. 4, figs. 62, 63.—DALL, *Proc. U. S. Nat. Mus.*, vol. 38, 1910, p. 220.—ROGERS, *The Shell Book* 1913, p. 116, fig. 1, [opp. p. 118.].—GRANT & GALE, *Mem. San Diego Soc. Nat. Hist.*, vol. 1, 1931, p. 472, pl. 24, fig. 21.—PEILE, *Proc. Mal. Soc. London*, vol. 23, 1939, p. 350, fig. 8, (tooth).—BURCH, SMITH and KEEN, *Min. Conch. Club Southern California*, no. 48, May, 1945, p. 23.

Conus ravus GOULD, *Jour. Boston Soc. Nat. Hist.*, vol. 6, Oct. 1853, p. 386, pl. 14, fig. 21. "Santa Barbara."

Conus dealbatus A. ADAMS, *Proc. Zool. Soc. London*, 1853, p. 117. "Hab?"—SOWERBY, *Thes. Conch.*, vol. 3, p. 31, 1857, pl. 191 [*Conus* pl. 5], fig. 103.—WEINKAUFF, *JAHRB. Deutsch. Malak. Gesell.*, vol. 1, 1874, pp. 248, 291. "Californiens."

⁸⁸ J. Mawe's copy of his *System of Conchology*, 1823, is in the library of the California Academy of Sciences and is of very considerable interest. It is untrimmed; bound rather cheaply in rough boards, with a cloth backing. Alternate sheets are blank, and upon these Mawe has written a great many notes in a very legible script. Thus, there are additions, corrections, sources of information, and a few original drawings. In no place in this book, however, does the name *lucidus* appear, either printed or in manuscript.

Conus californicus fossils T. S. OLDROYD, Nautilus, vol. 34, no. 4, April, 1921, p. 116, pl. 5, fig. 9. "Lower San Pedro Series, Nob Hill Cut, San Pedro."

Type locality: Magdalena Bay, Lower California.

Range: Farallone Islands, California, south to Cape San Lucas, Lower California.

Collecting stations: This is a common littoral and shallow water species in California. Specimens from south of San Diego from the following localities have been studied in connection with the present report: Guadalupe Island; San Benito Islands; Cedros Island; San Roque Island; San Martin Island; Abreojos Point; San Hipolito Point; Magdalena Bay; Cape San Lucas; San Quentin Bay (Pleistocene).

Long ago, Cooper gave the range of this species as being from the Farallone Islands off San Francisco, to Lower California. It is common from Monterey southward. Immature specimens often show a faint, brown reticulation or spiral striation under the periostracum. This is sometimes retained to the adult stage as shown by specimens in the California Academy of Sciences, one of which is illustrated here. These markings, together with the shape of the shell suggest relationship with *Conus lucidus* and, to a lesser extent with *Conus dalli*.

Few collectors have published notes on the appearance and behavior of the animals of *Conus* in life. The only instance of this having been done for a west American species which has come to our attention is the record made by Hemphill⁸⁹ for *Conus californicus*. This is so informative that it is fully quoted below.

The body of this mollusk is whitish in color, and profusely dotted over with black specks that frequently coalesce near the margin of the mantle. When the animal is in motion the foot extends about $\frac{1}{4}$ of an inch beyond the anterior and posterior ends of the shell. It is truncated in front and bluntly pointed behind. The sole is white and sparsely sprinkled with black specks. The motion of the animal is a constant glide. The proboscis is black, and about $\frac{1}{2}$ inch long when fully extended, and seems to be a specialized portion of the animal's mantle, rolled together with the lower edges in contact but not joined. It curves over and above the back of the shell, as the animal moves forward. Two small tentacles, of a dark color, each 5 millimeters long, protrude from the head near the base of the proboscis, bearing two small keen eyes, which are separated about half way between the tips and the base of the tentacles.

The operculum is horn-color and claw shaped, a portion of the lower or sharp end being free from the animal. [See Pl. 5, fig. 14, one of Hemphill's specimens.]

When the animal is in motion this operculum lies transversely across the upper side of the posterior part of the animal's foot.

⁸⁹ Hemphill, H., Zoe, vol. 3, no. 4, Jan. 1893, pp. 351-352. Reprinted, Orcutt, Moll. World, vol. 1, (West Amer. Sci., vol. 20), 1915, pp. 200-201.

The nucleus of the young shell is white and glassy, and after a few turns the spire resembles a bluntly pointed, round peg. After this the upper end of the whorls rapidly enlarge, as also does the length of the whorls from the anterior end of the shell to the shoulder.

In the adult the body of the shell is covered with numerous revolving lines, more prominent near the anterior end of the shell.

On the spire of some specimens there are also strong revolving lines, while on others these lines are entirely obsolete. The shoulder of the last whorl is rather concave and forms a shallow subcanal around the shell at the base of the spire, but this, like all other characters of shells, is very variable and in some individuals it is absent.

The whole shell is covered with a dirty yellowish epidermis that frequently darkens into chestnut color. The shells are quite brittle and very frequently broken, which perhaps is due to the thin, sharp outer lip, and an excessive amount of carbonate of lime in their composition. The bungling manner in which the animal repairs these fractures does not add to the beauty or attractiveness of the shell, which even in its perfect state is not very inspiring, especially when we consider the beauty of many other cones.

The species has been reported from shell heaps left by the Indians, but we have not learned if these people actually used it for food.

A living specimen of this species was collected at low tide at Monterey, California, February 23, 1945 by Mr. H. B. Truett (Cat. No. 32128-a C. A. S.). In this the mantle margin was pink, body white with black flecks scattered sparingly over the surface, much denser, nearly black, at the lower 5 mm. of the siphon. The shell is 33.7 mm. long, 18.2 mm. in diameter and deep purple inside of the aperture. The operculum is horn colored, 8.2 mm. long and 2.3 mm. wide. Upon dissection the radula was missed due to un-



Fig. 4. *Conus californicus* HINDS. Complete tooth. Hypotype, no. 9345 (Paleo. type coll.), from Loc. 32128a (C.A.S.), Monterey, Calif., H. B. Truett, Coll., Feb. 23, 1945.

familiarity with the anatomy. Subsequent treatment of the alimentary organs with sodium hydroxide solution, although carried rather too far, detached the radula and it was found among the residual fibers as a mass of clear, needle-like teeth. The exact form of the entire organ was lost. Individual teeth are hollow and have a canal almost the full length, with a terminal aperture near the outer end. This may function in the injection of poison into an attacked animal although there is no known evidence of such action by this species. However, food habits and general behavior have not been observed, or at least not published. The teeth are sharply pointed, even under high magnification. They each bear five or six very sharp, recurved barbs arranged around the circumference. The terminal aperture of the canal is beneath the second or third barb from the outer end. The canal follows a spiral course through the tooth which seems to agree in general with the direction taken by a buttress on the outside. The canal expands into an elongated bulb toward the base, readily outlined by the enclosed air bubble of a dry tooth, but not very easy to see in the mounted specimen. Altogether, one of these individual teeth has the appearance of a wicked weapon.

Two previous illustrations of teeth have appeared, one by Peile^{89a} and one by Tom Burch^{89b}. Both of these show very close resemblance to our specimen.

T. S. Oldroyd described a large form as *Conus californicus fossilis* from the Pleistocene of San Pedro, California. The height was given as 40 mm. Living specimens in the California Academy of Sciences from San Pedro exceed this dimension and there appear to be no other stable characters for recognition of the fossil form. Many specimens from Morro Bay, San Luis Obispo County, California, are 40 to 42 mm. in altitude.

A larger fossil species, *C. okhotskensis*, from the Okhotsk Sea⁹⁰ bears some resemblance to *californicus* but the spire is lower and the figure shows no spiral striae.

Conus ebraeus Linnaeus

Plate 8, Figures 12, 13

Conus ebraeus LINNAEUS, Syst. Nat., ed. 10, 1758, p. 715. "*Habitat in India.*" Ed. 12, 1767, p. 1169.—GMELIN, ed. 13, vol. 6, 1790, p. 3384.—DILLWYN, Desc. Cat. Recent Shells, vol. 1, 1817, p. 398. [As *Conus ebraeus*. Excellent early synonymy. Seba is cited as authority for the occurrence of the species in America.]—LAMARCK, Anim. sans Vert., vol. 7, 1822, p. 451. "Habite les mers des chauds de l'Asie, de l'Afrique et de l'Amerique." [As *Conus hebraeus*.]—WOOD, Index, Test., 1828, p. 73, pl. 15, fig. 77. [As *Conus ebraeus*.]—REEVE, Conch. Icon., vol. 1, July, 1843, pl. 19, figs. 104 a, b. [As *Conus hebraeus*.] [Fig. 104 a is referred to "*C. vermi-*

^{89a} Peile, A. J., Proc. Mal. Soc. London, vol. 23, pt. 6, November, 1939, p. 350, fig. 8.

^{89b} Burch, Tom. Minutes Conch. Club, Southern California, no. 42, December, 1944, p. 29, fig. 23.

⁹⁰ Dall, W. H. A subtropical Miocene fauna in Arctic Siberia. Proc. U. S. Nat. Mus., vol. 16, 1893, p. 47, pl. 56, fig. 4.

culatus Lamarck."—KIENER, Icon. Coq. Viv., Genre *Cône*, 1846, p. 45. pl. 4, fig. 2, pl. 8, figs. 3, 3-a. [As *Conus hebraeus*.]—HERTLEIN, Proc. Amer. Phil. Soc., vol. 78, no. 2, 1937, p. 306, pl. 1, figs. 1, 2.—DAUTZENBERG, Mem. Mus. Roy. d'Hist. Nat. Belgique, Hors Ser., vol. 2, fasc. 18, 1937, pp. 81-88.—PEILE, Proc. Mal. Soc. London, Vol. 23, 1939, p. 352, fig. 16 (radula). "Malindi."

Conus vermiculatus LAMARCK, Enc. Méth. Vers., livr. 3, 1798, pl. 321, fig. 1.—LAMARCK, Ann. du Mus., vol. 15, 1810, p. 34.—LAMARCK, Anim. sans Vert., vol. 7, 1822, p. 451. "Habite les mêmes mers que le précédent" [*hebraeus*.]—DAUTZENBERG, Mem. Mus. Roy. d'Hist. Nat. Belgique, Hors Ser., vol. 2, fasc. 18, 1937, pp. 88-92. [As var. of *ebraeus*.]

Cucullus chaldaeus BOLTEN, Mus. Bolt., 1798, p. 42.

Type locality: "India," (Linnaeus).

Range: Generally distributed in the south seas and extending to Clipperton Island and the Galapagos.

Collecting stations: Hood Island, Galapagos Islands (28347 C. A. S.) and Clipperton Island (23000 C. A. S.). Numerous specimens of both typical *ebraeus* and the variety *vermiculatus* [= *chaldaeus* Bolten] were collected by W. H. Ochsner of the 1905-1906 Expedition of the California Academy of Sciences to the Galapagos Islands.

Seba, Dillwyn, Lamarck and Kiener all recorded this species from American seas, yet it does not seem to have been recognized subsequently until recently. This seems remarkable in view of the striking characters of the shells and the fact that it is not as rare as some others.

The names *ebraeus*, *haebraeus* and *hebraeus* have been used interchangeably through the literature. Linnaeus and Gmelin used the first consistently. Born⁹¹ changed it to "*hebraeus*" and Bory⁹² spelled it "*haebraeus*"; both have been followed extensively. No reason has been found for the displacement of the original spelling.

Both color forms, *ebraeus* and *vermiculatus* and intergrading specimens between them, are found together and have been recorded repeatedly in the literature. Some authors prefer to drop the last name, others prefer to call it a variety while others, as Ostergaard⁹³ for instance, suggest that it be considered a distinct species. Iredale⁹⁴ found the two forms living separately at Lord Howe Island and the Kermedecs and pointed out that the oldest available name for the vermiculate one is *Cucullus chaldaeus* Bolten. Our material indicates the identity of the two.

All of Mr. Ochsner's shells were collected on the beach and are somewhat worn; the largest (from Clipperton) is 31.5 mm. in altitude. A specimen in Stanford University collected by E. K. Jordan in Hawaii is 45 mm. in alti-

⁹¹ Born, I., Test. Mus. Caes. Vind. 1780, p. 159.

⁹² Bory, J. B., Tableau Enc. Meth., Livr. 10, p. 158, pl. 321, fig. 2, 1827.

⁹³ Ostergaard, J. M. Recent and fossil marine Mollusca of Tongatabu. Bernice P. Bishop Museum, Bull. 131, 1935, pp. 21-22.

⁹⁴ Iredale, Tom, Mem. Queensland Mus., vol. 9, pt. 3, 1929, p. 282.

tude; other specimens in the California Academy of Sciences collected by Dr. C. H. Edmondson, also in Hawaii, are 55.5 mm. in altitude. No available material from other localities exceeds the last figure.

As demonstrated to us by Miss Myra Keen of Stanford University, the symmetry of this species makes it one of the best for top spinning and this feature is used for amusement by the younger generation of natives in some parts of the world.

Dautzenberg has traced the history of *ebraeus* and *vermiculatus* through the literature back to 1684 giving excellent synonymy and a great many collecting stations.

Conus tessulatus Born

Plate 8, Figures 10, 11, 15; Plate 10, Figures 1-4

Conus tessulatus BORN, Index Rer. Nat., Pt. 1, Test., 1778 [1780], p. 131.—Born, Test. Mus. Caes. Vind., 1780, p. 151.—[According to Iredale, (Mem. Queensland Mus., vol. 9, pt. 3, June 29, 1929, p. 281), both of Born's publications appeared in 1780.]—TOMLIN, Proc. Mal. Soc. London, vol. 22, pt. 5, July 21, 1937, p. 321.—PEILE, Proc. Mal. Soc. London, vol. 23, 1939, p. 352, fig. 23 (radula). "Mombasa."

Conus tessulatus BORN, DILLWYN, Desc. Cat. Rec. Shells, vol. 1 1817, p. 358.—SOWERBY, Conch. Ill., Dec. 1838, p. 120, pl. 148, figs. 27, 28.—REEVE, Conch. Icon., vol. 1, Oct. 1843, pl. 28, fig. 163.—KIENER, Icon. Coq. Viv., Genre *Cône*, 1847, pl. 17, fig. 1.—SOWERBY, Thes. Conch., vol. 3, 1857, p. 24, pl. 198 [*Conus* pl. 12], figs. 250, 251; "Ceylon, Mauritius, Philippines."—TRYON, Man. Conch., vol. 6, 1883, p. 11, pl. 2, figs. 26, 27.—DAUTZENBERG, Res. Scient. Voy. Ind. Orient. Néerlandaises, vol. 2, fasc. 18, 1937, pp. 240-245, pl. 2, fig. 12.

Conus edaphus DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 223. "Off Clarion Island in 31 fathoms, sand."

Type locality: Unknown.

Range: West coast of Mexico, Japan, and Hawaii, through the south seas to Australia and east Africa.

Collecting stations: The species was not obtained by the expeditions of either the Academy or the New York Zoological Society but Mr. George Willett of the Los Angeles Museum collected one specimen at Clarion Island, Revillagigedo Group. Length, 21.3 mm.; diameter, 12.7 mm. 20-40 fms.; March 24, 1938.

This specimen has been illustrated beside a specimen of *tessulatus* of comparable size from Huaheine Island, South Pacific, received from Garrett through the Hemphill collection. Exhaustive search for distinguishing characters for the American form has been without success. Through the kindness of Dr. Paul Bartsch of the U. S. National Museum a photograph of the holotype of *Conus edaphus* Dall is published herewith.

Dautzenberg has lately given an excellent synonymy covering four pages and showed the distribution to be very wide in tropical and subtropical seas.

The nearest records to Clarion Island are Hawaii, Japan, Guam, Loo Choo Islands, etc.

Born originally spelled the species name "*tessulatus*" but subsequent authors have mostly followed Bruguière and Lamarck in writing it "*tesselatus*."

The group to which *tessulatus* belongs inhabited American waters as early as the lower Pliocene, as shown by the following species, and cannot be considered a recent migrant into this area.

Conus bramkampii Hanna & Strong, sp. nov.

Plate 8, Figure 14

Conus regularis SOWERBY, HANNA, Proc. Calif. Acad. Sci., Ser. 4, vol. 14, 1926, no. 18, p. 447, pl. 21, fig. 8.

Spire low, gently concave, suture lightly impressed, without groove, whorls about 10; shoulder rounded; color markings consist of a uniform series of square brown spots in spiral rows, rather distantly spaced. Length 48 mm., diameter 30.5 mm.

Holotype, No. 34199 (Univ. Calif. Mus. Paleo.), from Loc. A-1269 (U. C.), "south side of **Carrizo Mountain, Imperial County, California**; Pliocene; in a small canyon about $\frac{3}{8}$ mile east of the mouth of Alverson Canyon in small draws cut in basal conglomerate on west side of canyon, 100-120 yards from its mouth." (Bramkamp).

The species is named for Mr. R. A. Bramkamp, Paleontologist, California Arabian Standard Oil Company, who collected the specimen along with many other forms. The well preserved type specimen shows the color markings better than a previous lot which was identified by one of the present authors as *Conus regularis* when adequate comparative material and literature were not available. The relationship is plainly with *tessulatus* and it indicates that the group is no late migrant into the region, as might be supposed from the rare occurrence of living specimens here.

UNVERIFIED RECORDS

In the preceding pages an attempt has been made to allocate the records found in the literature to the proper species. As usual in such studies this has not always been possible and there remains a residue of references, the taxonomic information pertaining to which, is simply insufficient to enable a reasonable evaluation to be made. In order that the student of the fauna may have these records assembled in one place, they have been collected and are presented herewith. Additional work in the future may permit the finding of those which are purely erroneous as well as those which may, perhaps, pertain to west American species. Annotations have been added in some cases but it must be emphasized that expressions of opinion have very little in way of facts to bear them out.

1. *Conus concinnus* BRODERIP, Proc. Zool. Soc. London, 1833, p. 53. "Gulf of California." Renamed *C. concinnulus* by Crosse, Rev. Mag. Zool., Ser. 2, Vol. 10, 1858, p. 200. According to Dall, (Proc. U. S. Nat. Mus., Vol. 38, 1910, p. 227), this is not a *Conus* but a *Meta* of Columbelloidea.
2. *Conus dupontii* KIENER, Icon. Coq. Viv., Genre Cône, 1849, p. 273, pl. 61, fig. 2. This species is a common Gulf of California shell and belongs to the Columbelloidea.
3. *Conus exquisitus* SOWERBY, Thes. Conch., Vol. 3, 1887, p. 274, pl. 36 [512], fig. 757. "Hab. California." According to Dall, (Proc. U. S. Nat. Mus., Vol. 38, 1910, p. 228), this is almost certainly not west American.
4. *Conus ferrugatus* SOWERBY, Proc. Zool. Soc. London, 1834, p. 19. "Hab. ad Sinum Californiae et apud Insulam Guaymas." Sowerby, (Thes. Conch., Vol. 3, 1857, p. 51) said the shell was unknown to him. Tryon, (Man. Conch., Vol. 6, 1884, p. 106), however, stated that the shell was a var. of *C. cingulatus* Lamarck. Weinkauff made the same suggestion.
5. *Conus fusiformis* MAWE, Linn. Syst. Conch., 1823, p. 87. "California." Tryon, (Man. Conch., Vol. 6, 1884, p. 93), stated that Lamarck's *fusiformis* was indeterminate; Tomlin, (Proc. Mal. Soc. London, Vol. 22, 1937, p. 251), however, renamed it *atractus* because of prior usage. Lamarck gave no locality. If Kiener's figure, (Icon. Coq. Viv., Genre Cône, 1848, p. 194, pl. 76, fig. 3), can be relied upon as authentic, and his specimens apparently came from the Lamarck collection, nothing similar has been found in the present study. Kiener gave the locality, questionably as Pacific Ocean. It is not believed to be part of the west American fauna.
6. *Conus hieroglyphus* DUCLOS, Mag. Zool., Ann. 2, pl. 23, 1833. "California." According to Dall, (Proc. U. S. Nat. Mus., Vol. 38, 1910, p. 228), the species is Indo-Pacific.

7. *Conus philippii* KIENER, Icon. Coq. Viv., Genre, *Cône*, 1848, p. 213, pl. 98, fig. 2. "Habite les côtes du Mexique." Tryon, (Man. Conch., Vol. 6, 1884, p. 118), and Tomlin, (Proc. Mal. Soc. London, Vol. 22, 1937 p. 291), placed this species in synonymy of *Conus tornatus* Broderip. We have found no specimens in the collections studied which approach Kiener's figures very closely.
8. *Conus scalptus* REEVE, Conch. Icon., Vol. 1, 1843, pl. 37, sp. 203. "Hab." WEINKAUFF, (Jahresb. d. Deutch. Mal. Ges., Vol. 1, 1874, pp. 247-291), recorded the species from California. It is undoubtedly an error so far as California is concerned and probably was not found in Lower California or the Gulf.
9. *Conus sieboldii* REEVE, Conch. Icon., Suppl. *Conus*, pl. 1, sp. 269, Feb. 1848, "Japan." Dall, (Proc. U. S. Nat. Mus., Vol. 38, 1910, p. 226), listed the species questionably from a fragment dredged near the Galapagos Islands in 300 fathoms.
10. *Conus unicolor* SOWERBY, Conch. Ill., 1834, pt. 54, fig. 59; no locality given; not *C. unicolor* SOWERBY pt. 28, 1833, fig. 20. According to Tomlin, (Proc. Mal. Soc. London, Vol. 22, 1937, p. 325), the 1834 figure was renamed *concolor* in "large list." Dall, (Proc. U. S. Nat. Mus., Vol. 38, 1910, p. 226), stated that Stearns' shell from Acapulco agreed with the original figure.
11. *Conus unifasciatus* KIENER, Icon. Coq. Viv., Genre *Cône*, 1849, p. 361, pl. 110, fig. 4; no locality cited. Tryon, (Man. Conch., Vol. 6, 1883, p. 18), suggested that this may be *Conus californicus*. The figure is dark brown with a lighter colored band around the shoulder. We have seen no specimen of *californicus* which suggests union although the shape is similar.

EXPLANATION OF THE PLATES

PLATE 5

Fig. 1. *Conus archon* BRODERIP. Hypotype, no. 9300 (Paleo. type coll.), from Loc. 27584 (C.A.S.), Lat. 23°03' to 06'N., Long. 109°31'W., off Cape San Lucas, Lower California, 20-220 fathoms. Templeton Crocker Exp., 1932. Length 63 mm., diameter 33.5 mm.; p. 285.

Fig. 2. *Conus arcuatus* BRODERIP. Hypotype, no. 9298 (Paleo. type coll.), from Loc. 27574 (C.A.S.), Lat. 18°33'N., Long. 103°45'W., 47 miles southeast of Manzanillo, Mexico, 52 fathoms. Templeton Crocker Exp., 1932. Length 31 mm., diameter 14.5 mm.; p. 292.

Fig. 3. *Conus arcuatus* BRODERIP. Hypotype, no. 9299 (Paleo. type coll.), from same locality as fig. 2. Length 33.5 mm., diameter 15 mm.; p. 292.

Fig. 4. *Conus arcuatus* BRODERIP. Hypotype, no. 9297 (Paleo. type coll.), from Station 135-D-18 (N.Y.Z.S.), Lat. 23°30'N., Long. 109°25'W., Arena Bank, east coast of Lower California, 40 fathoms. Length 40.5 mm., diameter 20 mm.; p. 292.

Fig. 5. *Conus bartschi* HANNA & STRONG, sp. nov. Holotype, no. 9296 (Paleo. type coll.), from Loc. 27587 (C.A.S.), 20-25 fathoms off Cape San Lucas, Lower California. Templeton Crocker Exp., 1932. Length 49 mm., diameter 30 mm.; p. 271.

Fig. 6. *Conus diadema* SOWERBY. Hypotype, no. 9295 (Paleo. type coll.), from Loc. 23777 (C.A.S.), Clarion Island (Revillagigedo Group), Mexico, between tides. G. D. Hanna and E. K. Jordan, Colls. Length 33.5 mm., diameter 20 mm.; p. 270.

Fig. 7. *Conus diadema pemphigus* DALL. Hypotype, no. 9294 (Paleo. type coll.), from Loc. 23004 (C.A.S.), Cocos Island, Costa Rica, between tides. W. H. Ochsner, Coll. Length 28.5 mm., diameter 14 mm.; p. 271.

Fig. 8. *Conus brunneus* WOOD. Hypotype, no. 9293 (Paleo. type coll.), from Loc. 28187 (C.A.S.), Albemarle Island (Galapagos Group), Ecuador, between tides. W. H. Ochsner, Coll. Length 58.5 mm., diameter 36 mm.; p. 269.

Fig. 9. *Conus brunneus* WOOD. Hypotype, no. 9291 (Paleo. type coll.), from Loc. 23005 (C.A.S.), Hood Island (Galapagos Group), Ecuador, between tides. W. H. Ochsner, Coll. Length 44.5 mm., diameter 26 mm.; p. 269.

Fig. 10. *Conus brunneus* WOOD. Hypotype, no. 9292 (Paleo. type coll.), from same locality as fig. 8. Length 56 mm., diameter 37 mm.; p. 269.

Fig. 11. *Conus "brunneus" [diadema] pemphigus* DALL. Holotype, "Cat. no. 37449a (U.S.N.M.), from Tres Marias Islands, west of Mexico." Length 26 mm., diameter 17 mm. Photograph published through the courtesy of Dr. Paul Bartsch; p. 271.

Fig. 12. *Conus dalli* STEARNS. Hypotype, no. 9290 (Paleo. type coll.), from Loc. 24108 (C.A.S.), Maria Magdalena Island (Tres Marias Group), Mexico; beach shell. G. D. Hanna and E. K. Jordan, Colls. Length 50 mm., diameter 26.8 mm.; p. 304.

Fig. 13. *Conus lucidus* WOOD. Hypotype, no. 9303 (Paleo. type coll.), from Loc. 1337 (C.A.S.), Magdalena Bay, Lower California. Henry Hemphill, Coll. Length 50.3 mm., diameter 27 mm.; p. 307.

Fig. 14. *Conus californicus* HINDS. Hypotype, no. 9304 (Paleo. type coll.), from Loc. 13988 (C.A.S.), San Pedro, California, between tides. Henry Hemphill, Coll. Length 40 mm., diameter 20.5 mm., length of operculum 9.5 mm.; p. 308.

Fig. 15. *Conus californicus* HINDS. Hypotype, no. 9305 (Paleo. type coll.), from Loc. 27600 (C.A.S.), dredged in 25 fathoms "above long spit," San Martin Island, west coast of Lower California. Templeton Crocker Exp., 1932. Length 21.2 mm., diameter 13.2 mm.; p. 308.

Fig. 16. *Conus durhami* HANNA & STRONG, sp. nov. Holotype, no. 34200 (Univ. Calif. Mus. Paleo.), from Loc. A1269 (U.C.), south side of Carrizo Mountain, Imperial County, California, Pliocene. Length 39.5 mm., diameter 25.5 mm.; p. 306.

All of the specimens illustrated on this plate, except the ones shown as figures 11 and 16, have been deposited in the type collection of the California Academy of Sciences.

PLATE 6

Fig. 1. *Conus gradatus* MAWE. Hypotype, no. 9306 (Paleo. type coll.), from Loc. 1338 (C.A.S.), Scammon Lagoon, Lower California, Henry Hemphill, Coll. Length 55.5 mm., diameter 27 mm.; p. 279.

Fig. 2. *Conus regularis* SOWERBY. Hypotype, no. 9307 (Paleo. type coll.), from Loc. 28186 (C.A.S.), Kino Bay, Sonora, Mexico, H. N. Lowe, Coll. Length 59 mm., diameter 32 mm.; p. 282.

Fig. 3. *Conus scalaris* VALENCIENNES. Hypotype, no. 9308 (Paleo. type coll.), from Loc. 27587 (C.A.S.), off Cape San Lucas, Lower California, 20-25 fathoms, Templeton Crocker Exp., 1932. Length 37.7 mm., diameter 15.4 mm.; p. 283.

Fig. 4. *Conus scalaris* VALENCIENNES. Hypotype, no. 9309 (Paleo. type coll.), from Sta. 142-D-1 (N.Y.Z.S.), Lat. 27°05'N., Long. 111°56'W., Santa Inez Bay, Lower California, 30-54 fathoms. Length 64.5 mm., diameter 25 mm.; p. 283.

Fig. 5. *Conus scalaris* VALENCIENNES. Hypotype, no. 9310 (Paleo. type coll.), from Sta. 136-D-16 (N.Y.Z.S.), Lat. 23°29'30"N., Long. 109°25'30"W., Arena Bank, east coast of Lower California, 45 fathoms. Length 47 mm., diameter 17 mm., p. 283.

Fig. 6. *Conus scalaris* VALENCIENNES. Hypotype, no. 9311 (Paleo. type coll.), from same locality as fig 4. Length 64.5 mm., diameter 25 mm.; p. 283.

Fig. 7. *Conus recurvus* BRODERIP. Hypotype, no. 9312 (Paleo. type coll.), from Loc. 27584 (C.A.S.), Lat. 23°03' to 06'N., Long. 109°31' to 36'W., off Cape San Lucas, Lower California, 20 to 220 fathoms, Templeton Crocker Exp., 1932. Length 50.8 mm., diameter 22.5 mm.; p. 280.

Fig. 8. *Conus recurvus* BRODERIP. Hypotype, no. 9313 (Paleo. type coll.), from Sta. 214-D-1 to 4 (N.Y.Z.S.), Lat. 9°19'32" to 17°40'N., Long. 84°29'30" to 27°30'W., 14 miles S x E of Judas Point, Costa Rica, 42 to 61 fathoms. Length 85 mm., diameter 41.8 mm.; p. 280.

Fig. 9. *Conus recurvus* BRODERIP. Holotype of *Conus scariphus* DALL, no. 123085 (U.S. Nat. Mus.), from U.S. Bureau of Fisheries steamer *Albatross* Sta. 3368, 66 fathoms, off Cocos Island, Costa Rica. Length 41 mm., diameter 15 mm. Photograph published through the courtesy of Dr. Paul Bartsch; p. 280.

Fig. 10. *Conus virgatus* REEVE. Hypotype, no. 9314 (Paleo. type coll.), from Loc. 24085 (C.A.S.), San Carlos Bay, Sonora, Mexico, Fred Baker, Coll., 1921, between tides. Length 56.8 mm., diameter 28.7 mm.; p. 301.

Fig. 11. *Conus dispar* SOWERBY. Hypotype, no. 9315 (Paleo. type coll.), from same locality as fig. 7. Length 22.5 mm., diameter 9 mm. The specimen is intermediate between *Conus regularis* and *Conus scalaris*; p. 284.

Fig. 12. *Conus patricius* HINDS. Operculum of specimen illustrated on plate 9, fig. 8. Length 22 mm., width 18.5 mm., thickness 3.3 mm.; p. 300.

Fig. 13. *Conus recurvus* BRODERIP. Copy of photograph of holotype of *Conus magdalenensis* after Bartsch & Rehder, (Smithsonian Misc. Coll., vol. 98, no. 10, 1939, p. 4,

pl. 1, fig. 9). No. 472521 (U.S. Nat. Mus.), from Magdalena Bay, Lower California, 10-15 fathoms, Waldo L. Schmitt, Coll. Length 33.6 mm., diameter 15.3 mm.; p. 280.

All of the specimens illustrated on this plate, except those shown as figures 9, 12, and 13, have been deposited in the type collection of the California Academy of Sciences.

PLATE 7

Fig. 1. *Conus fergusonii* SOWERBY, [*xanthicus* DALL]. Hypotype no. 9318 (Paleo. type coll.), from Station 163-D-2 (N.Y.Z.S.), Lat. 18°19'N., Long. 114°45'W., 55 fathoms, 3 miles off Pyramid Rock, Clarion Island, Mexico. Length 29.2 mm., diameter 14 mm.; p. 294.

Fig. 2. *Conus fergusonii* SOWERBY, [*xanthicus* DALL]. Hypotype, no. 9317 (Paleo. type coll.), from Station 150-D-16 (N.Y.Z.S.), Lat. 23°02'N., Long. 109°30'30"W., 67-75 fathoms, Gorda Banks, Gulf of California, periostracum intact. Length 44.0 mm., diameter 21.3 mm.; p. 294.

Fig. 3. *Conus fergusonii* SOWERBY. Hypotype, no. 9319 (Paleo type coll.), from Loc. 27587 (C.A.S.), 20-25 fathoms off Cape San Lucas, Lower California, Templeton Crocker Exp., 1932. Length 81 mm., diameter 46.4 mm.; p. 294.

Fig. 4. *Conus fergusonii* SOWERBY. Holotype of *Conus xanthicus* DALL, no. 111236 (U.S. Nat. Mus.), from off Guaymas, Mexico, 71 fathoms. Length 42 mm., diameter 22.5 mm. Specimen illustrated through the courtesy of Dr. Paul Bartsch; p. 294.

Fig. 5. *Conus gladiator* BRODERIP. Hypotype, no. 9323 (Paleo. type coll.), from Loc. 27563 (C.A.S.), Gulf of Fonseca, Salvador-Honduras boundary, littoral; Templeton Crocker Exp., 1932. Length 36.7 mm., diameter 22 mm.; p. 273.

Fig. 6. *Conus nux* BRODERIP. Hypotype, no. 9324 (Paleo. type coll.), from Loc. 28346 (C.A.S.), Academy Bay, Albemarle Island, Galapagos; W. H. Ochsner, Coll., 1906. Length 19.5 mm., diameter 12.6 mm.; p. 274.

Fig. 7. *Conus nux* BRODERIP. Hypotype, no. 9325 (Paleo. type coll.), from Loc. 28346 (C.A.S.), Academy Bay, Albemarle Island, Galapagos; W. H. Ochsner, Coll., 1906. Length 21.9 mm., diameter 13.5 mm.; p. 274.

Fig. 8. *Conus princeps* var. *lineolatus* VALENCIENNES. Hypotype, from Las Perlas Islands, Panama Bay, in the collection of Los Angeles Museum of History, Science and Art; W. D. Clark, Coll. Length 57.4 mm., diameter 34.4 mm. Specimen illustrated through the courtesy of Dr. Howard Hill; p. 278.

Fig. 9. *Conus princeps* var. *apogrammatus* DALL. Holotype, no. 37404 (U.S. Nat. Mus.), from Panama. Measurements not recorded, presumably natural size. Specimen illustrated through the courtesy of Dr. Paul Bartsch; p. 278.

Fig. 10. *Conus princeps* LINNAEUS. Hypotype, no. 9326 (Paleo. type coll.), from Santa Inez Bay, Lower California, N. Y. Zool. Soc. 1938 Exp., Coll.; showing periostracum. Length 54.6 mm., diameter 33.5 mm.; p. 275.

Fig. 11. *Conus princeps* LINNAEUS. Hypotype, no. 9331 (Paleo. type coll.), from Loc. 1259 (C.A.S.), Gulf of California; Henry Hemphill, Collector. Length 81.5 mm., diameter 48.8 mm.; p. 275.

Fig. 12. *Conus tiaratus* BRODERIP. Hypotype, no. 9312 (Paleo. type coll.), from Loc. 28348 (C.A.S.), Albemarle Island, Galapagos; W. H. Ochsner, Coll., 1906. Length 30.5 mm., diameter 18.2 mm.; p. 272.

Fig. 13. *Conus princeps* var. *apogrammatus* DALL. Hypotype, in Los Angeles Museum of History, Science and Art, from Venado Island, Panama Bay, W. D. Clark, Coll. Length 44.2 mm., diameter 25.5 mm.; p. 278.

All of the specimens illustrated on this plate, except those shown as figures 4, 8, 9, and 13, have been deposited in the type collection of the California Academy of Sciences.

PLATE 8

Fig. 1. *Conus perplexus* SOWERBY. Hypotype, no. 9321 (Paleo. type coll.), from Loc. 27581 (C.A.S.), between Isabel Island and Mazatlan, Mexico; Templeton Crocker Exp., 1932. Length 29.4 mm., diameter 16 mm.; p. 289.

Fig. 2. *Conus perplexus* SOWERBY. Hypotype, no. 9320 (Paleo. type coll.), from Loc. 27849 (C.A.S.), Lat. 23°12'N., Long. 106°29'W., Gulf of California, 12 fathoms; Templeton Crocker Exp., 1932. Length 26.2 mm., diameter 15.5 mm.; p. 289.

Fig. 3. *Conus perplexus* SOWERBY. Hypotype, no. 9322 (Paleo. type coll.), from Loc. 27226 (C.A.S.), Corinto, Nicaragua, L. G. Hertlein, Coll., 1932. Length 24.9 mm., diameter 18.5 mm.; p. 289.

Fig. 4. *Conus tornatus* BRODERIP. Hypotype, no. 9329 (Paleo. type coll.), from Loc. 27588 (C.A.S.), Lat. 24°14'-18'' N., Long. 111°28'-29''W., about 13 miles southeast of Cape Tosca, Santa Margarita Island, Lower California; Templeton Crocker Exp., 1932. Length 22.3 mm., diameter 10.0 mm.; p. 291.

Fig. 5. *Conus tornatus* BRODERIP. Hypotype, no. 9330 (Paleo. type coll.), from Loc. 27588 (C.A.S.), Lat. 24°14'-18''N., Long. 111°28'-29''W., about 13 miles southeast of Cape Tosca, Santa Margarita Island, Lower California; Templeton Crocker Exp., 1932. Length 23.4 mm., diameter 9.8 mm.; p. 291.

Fig. 6. *Conus tornatus* BRODERIP. Hypotype, no. 9328 (Paleo. type coll.), from Loc. 27527 (C.A.S.), Acapulco, Mexico, dredged in Bay; Templeton Crocker Exp., 1932. Length 23 mm., diameter 9.8 mm.; p. 291.

Fig. 7. *Conus tornatus* BRODERIP. Hypotype, no. 9327 (Paleo. type coll.), from Loc. 27569 (C.A.S.), Gulf of Tehuantepec, Mexico, 28 fathoms; Templeton Crocker Exp., 1932. Length 22.5 mm., diameter 9.7 mm.; p. 291.

Fig. 8. *Conus vittatus* BRUGUIÈRE. Hypotype, no. 9348 (Paleo. type coll.), from Loc. 20439 (C.A.S.), Mazatlan, Mexico; A. Russell Crowell, Coll., 1920. Length 35.8 mm., diameter 21.9 mm.; p. 296.

Fig. 9. *Conus vittatus* BRUGUIÈRE. Hypotype from Maria Magdalena Island, Mexico, No. A1207, Los Angeles Museum of History, Science and Art. Length 32.0 mm., diameter 17.5 mm. Specimen illustrated through the courtesy of Dr. Howard Hill; p. 296.

Fig. 10. *Conus tessulatus* BORN. Holotype of *Conus edaphus* DALL, no. 130305 (U.S. Nat. Mus.), from Clarion Island, Mexico, 31 fathoms. Length 25 mm., diameter 14 mm.; p. 312.

Fig. 11. *Conus tessulatus* BORN. Hypotype from Clarion Island, Mexico, no. A 375, Los Angeles Museum of History, Science and Art; 20 to 40 fathoms, George Willett, Coll. Length 21.3 mm., diameter 12.7 mm. Specimen illustrated through the courtesy of Mr. George Willett and Dr. Howard Hill; p. 312.

Fig. 12. *Conus ebraeus* LINNAEUS. Hypotype, no. 7056 (Paleo. type coll.), from Loc. 23000 (C.A.S.), Clipperton Island; W. H. Ochsner, Coll., 1906. Length 31.9 mm., diameter 20.5 mm. After Hertlein, Proc. Amer. Phil. Soc., vol. 78, no. 2, 1937, p. 306, pl. 1, fig. 2; p. 311.

Fig. 13. *Conus ebraeus* LINNAEUS (var. *chaldeus* BOLTEN). Hypotype, no. 7058, (Paleo. type coll.), from Loc. 23001 (C.A.S.), Clipperton Island; W. H. Ochsner, Coll., 1906. Length 24.5 mm., diameter 16.3 mm. After Hertlein, Proc. Amer. Phil. Soc., vol. 78, no. 2, 1937, p. 306, pl. 1, fig. 7; p. 311.

Fig. 14. *Conus bramkampii* HANNA & STRONG sp. nov. Holotype, no. 34199 (Univ. of Calif. Mus. Paleo.), from south side of Carrizo Mountain, Imperial County, California; Pliocene., R. A. Bramkamp, Coll. Length 48 mm., diameter 30.5 mm.; p. 313.

Fig. 15. *Conus tessulatus* BORN. Hypotype, no. 9332 (Paleo. type coll.), from Loc. 1224 (C.A.S.), Huaheine Island, Garrett, Coll. Length 28 mm., diameter 16 mm.; p. 312.

Fig. 16. *Conus mahogani* REEVE. Hypotype, no. 9333 (Paleo. type coll.), from Loc. 28365 (C.A.S.), Puntarena, Costa Rica; H. N. Lowe, Coll. Length 38.5 mm., diameter 17.5 mm.; p. 289.

Fig. 17. *Conus ximenes* GRAY. Hypotype, no. 9337 (Paleo. type coll.), from Loc. 24077 (C.A.S.), Angeles Bay, Lower California; Fred Baker, Coll. Length 43 mm., diameter 21.2 mm.; p. 286.

Fig. 18. *Conus tiaratus* BRODERIP. Holotype of *Conus roosevelti* Bartsch & Rehder, (Smith. Misc. Coll., vol. 98, no. 10, 1939, p. 3, pl. 1, fig. 7), from Magdalena Bay, Lower California. Length 15.3 mm., diameter 9.6 mm.; p. 272.

Fig. 19. *Conus purpurascens* BRODERIP. Hypotype, no. 9334 (Paleo. type coll.), from Loc. 27527 (C.A.S.), Acapulco Bay, Mexico; Templeton Crocker Exp., 1932. Length 49.4 mm., diameter 28.4 mm.; p. 298.

Fig. 20. *Conus purpurascens* BRODERIP. Hypotype, no. 9335 (Paleo. type coll.), from Loc. 27223 (C.A.S.), Mazatlan, Mexico; L. G. Hertlein, Coll., 1931. Length 30.5 mm., diameter 17.7 mm.; p. 298.

All of the specimens illustrated on this plate, except those shown as figures 9, 10, 11, 14, and 18, have been deposited in the type collection of the California Academy of Sciences.

PLATE 9

Fig. 1. *Conus purpurascens* BRODERIP. Holotype, of var. *rejectus* Dall, no. 34710 (U.S. Nat. Mus.), from Escondido Bay, Lower California. Specimen illustrated through the courtesy of Dr. Paul Bartsch; p. 298.

Fig. 2. *Conus purpurascens* BRODERIP. Hypotype, no. 9336 (Paleo. type coll.), from Loc. 1306 (C.A.S.), Magdalena Bay, Lower California; Henry Hemphill Collection. Length 54.5 mm., diameter 32.0 mm.; p. 298.

Fig. 3. *Conus purpurascens* BRODERIP. Hypotype from Venado Island, Panama Bay, W. D. Clark, Coll.; specimen in the collection of Stanford University and illustrated through the courtesy of Dr. A. Myra Keen. This is an immature shell and shows an extreme in coloration. Length 30.9 mm., diameter 16.5 mm.; p. 298.

Fig. 4. *Conus perplexus* SOWERBY. Hypotype from San Jose Island, Panama Bay, W. D. Clark, Coll.; specimen in the collection of Stanford University and illustrated through the courtesy of Dr. A. Myra Keen. Length 41.5 mm., diameter 22 mm.; p. 289.

Fig. 5. *Conus virgatus* REEVE. Hypotype from Bruja Point, Panama Bay, W. D. Clark, Coll.; specimen in the collection of Stanford University and illustrated through the courtesy of Dr. A. Myra Keen. Length 36 mm., diameter 17.3 mm.; p. 301.

Fig. 6. *Conus patricius* HINDS. Hypotype, no. 9346 (Paleo. type coll.), from Loc. 27332 (C.A.S.), San Juan Del Sur, Nicaragua, H. N. Lowe, Coll. Length 51 mm., diameter 29.5 mm.; p. 300.

Fig. 7. *Conus patricius* HINDS. Hypotype, no. 9347 (Paleo. type coll.), from Loc. 27332 (C.A.S.), San Juan Del Sur, Nicaragua, H. N. Lowe, Coll. Length 57 mm., diameter 31 mm.; p. 300.

Fig. 8. *Conus patricius* HINDS. Hypotype from Venado Flats, Panama Bay, W. D. Clark, Coll.; specimen in the collection of Stanford University and illustrated through the courtesy of Dr. A. Myra Keen. Length 140 mm., diameter 89.5 mm.; p. 300.

Fig. 9. *Conus patricius* HINDS. Dried egg capsules from specimen illustrated in fig. 8; p. 300.

The specimens illustrated by figures 2, 6, and 7 have been deposited in the type collection of the California Academy of Sciences.

PLATE 10

Fig. 1. "*Conus tessulatus* HWASS. Type ? 326/7. Length 49.5 mm., diameter 32 mm. Coll. Hwass." Mermod; p. 312.

Fig. 2. "*Conus tessulatus* HWASS. Diameter 31.5 mm.; 11 tours di spire. Coll. Lk." Mermod; p. 312.

Fig. 3. "*Conus tessulatus* HWASS. Coll. Lk." Mermod; p. 312.

Fig. 4. "*Conus tessulatus* HWASS. Coll. Lk." Mermod; p. 312.

Fig. 5. "*Conus tessulatus* HWASS. Coll. Hwass." Mermod; p. 312.

Fig. 6. "*Conus vittatus* HWASS. Type de Hwass?" Mermod; p. 296.

Fig. 7. "*Conus vittatus* HWASS. Coll. Hwass." Mermod; p. 296.

Fig. 8. "*Conus vittatus* HWASS. Coll. Hwass. Delessert. Length 38 mm., diameter 20.5 mm." Mermod; p. 296.

Fig. 9. "*Conus vittatus* HWASS." Same specimen as fig. 8. "Greatest diameter 22-75 mm." Mermod; p. 296.

The specimens illustrated on this plate are from the original collections of Hwass and Lamarck and are now deposited in the Muséum d'Histoire Naturelle, Geneva, Switzerland. The photographs were made available for this report by Dr. G. Mermod of that institution.



Hanna, G Dallas and Strong, A M. 1949. "West American mollusks of the genus *Conus*." *Proceedings of the California Academy of Sciences*, 4th series 26, 247–322.

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