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**WEST AMERICAN MOLLUSKS**  
OF THE  
**GENUS *CONUS* - II**

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**INTRODUCTION**

The present paper is based largely upon a previous one which was prepared by Hanna & Strong (1949) and published by the Academy. The demand for this earlier one exceeded expectations and it was soon unobtainable. This situation made it seem desirable to reissue it.\*

During the decade since the original issue appeared there have been some additions to the literature on west American *Conus*. Insofar as possible this information has been considered herein. Also some errors which have come to our attention through the interest of our colleagues, have been corrected.

It was stated in the original paper that only color would do justice to illustrations of *Conus*. This has recently become economically feasible through the development of a process by the Research Department of Eastman Kodak Company. The Academy undertook the installation of equipment for this purpose in 1955 and proceeded with the necessary training in technique with the present paper in mind. As a result it has been possible to make new plates in color of the shells illustrated in the first paper plus some additional forms.

In connection with the plates the present writer wishes to express deep appreciation to Dr. Walter Clark and his associates of the Eastman Kodak Company for much advice and the patient help they gave. I am also under deep obligation to Mr. C. E. Crompton, Mr. Maurice Giles, and Margaret M.

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\* Some of the first paper (1949) is here reproduced in its original text and does not conform to the Academy's present editorial style.

A paper by W. K. Emerson and W. E. Old, Jr., dealing with *Conidae* from West Mexico, appeared after the present paper was in page proof. (See American Museum Novitates, No. 2112, pp. 1-44, figs. 1-20, October 29, 1962).

Hanna, who were equally responsible with me for all of the color work. The Academy authorities, and especially the Director, Dr. Robert C. Miller, deserve much gratitude for their encouragement. The Varitype work was all done by Mrs. Dorothy Ludlow.

In taxonomic matters I am indebted to Dr. A. Myra Keen of Stanford University, Dr. Howard Hill, late of the Los Angeles County Museum, and my Academy associates, Dr. Leo G. Hertlein and Mr. Allyn G. Smith.

A considerable number of specimens, including type material illustrated herein belong to other institutions. Those at Stanford University, the Los Angeles County Museum, and the University of California were lent for the purpose of making color transparencies. This was through the courtesy of Drs. Keen, Hill and J. Wyatt Durham respectively. The specimens belonging to the U. S. National Museum were lent through the courtesy of Dr. Harold A. Rehder. Without the cooperation of these four people this paper would certainly have been a disappointment.

Kodachromes of two species named by Born and Hwass and which are in the National Museum of Switzerland were furnished by Dr. K. Bender to whom we are very appreciative.

Some of the eastern Pacific species of *Conus* are exceedingly variable and many of the type specimens which represent named forms are in European museums. Dr. Alan J. Kohn of Florida State University recently made a special effort while in Europe to get Kodachrome transparencies of all of these which could be found. This magnificent series has been made available for this study. Without them it is doubtful if some of the names applied to shells of the west American fauna could have been properly evaluated.

Lastly, and with much sadness, it is necessary to record the death of the co-author of the original paper, Mr. A. M. Strong, July 14, 1951. His keen interest in this group of shells and his broad grasp of the west American marine fauna in general would undoubtedly have increased the value of the present report many fold.

The magnificent series of shells belonging to *Conus* which was 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.

Material from previous collecting expeditions through the area was available for the study, so there was also an abundance of most shallow-water forms on hand. Therefore, it seems probable that a greater assemblage of specimens and species has been available for comparison than has been brought together at one time from the region previously.

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 in the area:

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 Baja 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 Galápagos Islands and Central America for the California Academy of Sciences in 1931-1932; Leo G. Hertlein, collector.
5. The Templeton Crocker expedition to the Galápagos 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 & Templeton Crocker, collectors.
8. The Templeton Crocker expedition to Central America for the New York Zoological Society in 1937; William Beebe & Templeton Crocker, collectors.

All of the material obtained by these expeditions has been used in the preparation of the present report. In addition to the above-mentioned collections, full use has been made of the great series of Galápagos 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 R. Hill of the Los Angeles Museum of Science, History, and Art.

Lately additional material has become available through the efforts of numerous persons working in the Gulf of California under the auspices of the

Belvedere Scientific Fund.

The identification of the species found in the region began in 1921 by the 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 earlier report in acceptable form would not have been possible and the authors took great pleasure in expressing their indebtedness to Dr. Leo G. Hertlein, Dr. U. S. Grant IV, Dr. Howard R. Hill, Dr. A. Myra Keen, and the late H. N. Lowe.

They were indebted to Mr. R. Wright Barker, Shell Oil Company, Houston, Texas, and now with Scripps Institution, La Jolla, California, 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 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.

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 in the 1949 report 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, now nearly a century old.

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 subdividers differ radically among themselves. See for example: Montfort, D., 1810, pp. 391-410; Swainson, W., 1840, pp. 311-312; Mörch, O.A.L., 1852, pp. 64-71; Woodring, W.P., 1928, pp. 201-218; Iredale, T., 1930, pp. 79-80; Cotton, B.C., 1945, pp. 229-280. If such divisions should ever be made upon a logical basis and so as to include fossil species, 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:

Bergh (1895) 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 been established, on shell characters or others which could be based upon the anatomy alone.

Dall (1910) recognized the soundness of these investigations, and did not adopt any of the names of subdivisions.

Vredenberg (1921) 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 (1942) 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 (1945) in preparing a preliminary list of west American species, cited the ranges of the species and gave a key but did not adopt any subdivisions of the genus.

The family Conidae contains so many more or less distinct species living and fossil, that some taxonomists consider this to be a handicap. Therefore, at least 48 generic and subgeneric terms have been created. As usual such grouping is purely subjective, based upon supposed relationships or nonrelationships, and few workers have the same suppositions. Disposition of fossil species leads especially to difficulties. Therefore, in this paper all species are retained under the generic name *Conus*. Kohn (1959) found that

some Hawaiian species have been placed in as many as five separate genera or subgenera in the past.

In an excellent article on the radulae of *Conus*, Peile (1939) 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 west American 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 nodes which decorate some of the living forms. Von Linden (1896), and later Burnett Smith (1929), 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.

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 may be 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, noncalcareous operculum with a terminal nucleus. This offers little protection to the retracted animal. Collectors seldom preserve it. Hemphill (1893) has given important notes on the habits and external anatomy of *Conus californicus* which are quoted, in part, under that species.

Much additional information on this subject has been given by Saunders (1960) and Wolfson (1961).

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 of Eocene age and which was collected by Martin (1908, p. 30) at Point Hey, Alaska.

A list of the species of *Conus* found fossil in California Tertiary deposits has been reported by Keen and Bentson (1944, pp. 147-148), and those of Oregon and Washington by Weaver (1942, pp. 509-513).



At one stage in this study the inclusion of a list of all fossil species of *Conus* of western America was contemplated. However, there are certain difficulties regarding some formations in Central America which may have been deposited when the Atlantic and Pacific Oceans were connected. Also since the species are included in Tomlin's 1937 comprehensive list, the names up to that date are readily available in many libraries.

*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 fauna. It is not inferred, 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 listed by Faustino (1928) from the Philippine Islands. 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, they have been retained, 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 students of *Conus* have remarked upon the similarity or identity of species of this genus inhabiting eastern Pacific waters and those in far distant places. It may be instructive to place this information in tabular form.

## EASTERN PACIFIC SPECIES

## SIMILAR SPECIES ELSEWHERE

<i>tiaratus</i> . . . . .	<i>miliaris</i>
<i>nux</i> . . . . .	<i>ceylanensis</i>
<i>arcuatus</i> . . . . .	<i>cancellatus</i>
<i>archon</i> . . . . .	<i>cedo-nulli</i>
<i>fergusoni</i> . . . . .	<i>quercinus</i>
<i>vittatus</i> . . . . .	<i>benoqueti</i>
<i>virgatus</i> . . . . .	<i>lorenzianus</i>
<i>dalli</i> . . . . .	<i>textile</i>
<i>ebraeus</i> . . . . .	<i>ebraeus</i>
<i>emersoni</i> . . . . .	<i>australis</i>
<i>tessulatus</i> . . . . .	<i>tessulatus</i>
<i>gladiator</i> . . . . .	<i>mus</i>

It is easy to theorize regarding means of distribution in cases such as this, but there really is not enough known of the life histories of the animals to warrant speculation. The term "similarity" seems to express the known facts better than "relationship" which is often used. No actual relationship

between species of *Conus* is known or is likely to be known in the very near future.

Were it not for the fact that *Conus* is very well represented in the geology of western America from the early Tertiary to the present, it might be supposed that at least some of the above species are recent "migrants" into the area. Some of the difficulty in explaining this situation is due to the lack of preservation of color in most fossils and it is upon this that the taxonomy of recent forms is largely based.

Many writers have commented on the centers of distribution from which the west American molluscan fauna was derived. If all such remarks were 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, Baja 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 CAS), recently collected by Mr. W. 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 Hedley (1912, p. 147), stated to be the smallest species of the family, with the possible exception of *Conus parvus* Pease, which has been renamed *Lovellona peaseana* by H. J. Finlay (1927, p. 519); 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, the synonymy of published figures is given along with 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 liv-

ing 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 Iredale (Oct., 1935a, p. 41 and Dec., 1935b, p. 166) has recorded a death from the bite of *Conus textile*. The west American representative of this species, *Conus dalli*, is scarcely distinguishable by shell characters and both *C. lucidus* and *A. californicus* appear to be distant relatives.

An additional fatality in Australia, recorded by Roughley (1937), 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 Yasiro (1939, pp. 165-166), and for one of these he was able to secure details of the symptoms. The article is written in Japanese and a resume, based upon a translation by Miss A. Ichitsu, follows:

A man, 32 years old, was gathering shells along the southeastern shore 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° C. 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 and Reeve (1848, p. 19) in the *Zoology of the Voyage of the Samarang*, 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*.

Peile (1937, p. 301) has given account of the anatomical features of the poison apparatus and later (1939) 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 (1946). 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.

A late review of the subject has been published with five additional references by Keegan (1960, pp. 8-10). Kline (1956, pp. 76-78) described the actual stinging operation as performed by *Conus auratus* and *Conus textile* on other mollusks. And Saunders and Wolfson (1961) have published an excellent account of the feeding habits of *Conus californicus*.

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. 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 of 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*. An applicable term seems not to have been proposed thus far.

In concluding these introductory remarks I wish to emphasize that the present report has been prepared with the hope that it will be of some assistance those in whose care collections happen to fall and that no pretense has been implied that the final word has been spoken in regard to the names for west American *Conus*. Complete acceptance of the classification is not expected. In fact there are several phases which I am not ready to accept myself. Some species are extremely variable in color and shape and how to deal with them has always been a problem. It may be argued that any specimen which shows even a minute difference from others should receive a name. In other cases a broader view may be taken and a species then considered to be an indefinite number of variants. A balance is difficult to achieve.

It is probable that too many named species are recognized in this report, some of them being my own. However, it is hoped that what has been in mind during preparation is sufficiently well illustrated that the user may be able to make an intelligent estimate of the characters of the supposed species.

**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. "Espece servant de type au genre Le Cône flamboyant. *Conus fulgurans*" [Bruguère.] As Iredale 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, so. 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. Iredale (1935, p. 79), considered Swainson's designation of type species the earliest valid one and he was followed by Cotton (1945, p. 231). GRAY, Proc. Zool. Soc. London, 1847, p. 135. Type, "*C. marmoreus*" Linnaeus. DODGE, Bull. Amer. Mus. Nat. Hist., vol. 103, art. 1, 1953, p. 17. 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, but we favor following Children in the selection of *Conus marmoreus* as the genotype, a conclusion which was reached by Keen (1945, p. 23), Cox (1927, p. 92), Stewart (1926, p. 415), and Kennard, Salisbury and Woodward (1931, p. 25).

## KEY TO WEST AMERICAN SPECIES OF CONUS

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

Pl. 3, fig. 1; pl. 4, figs. 4, 6; pl. 5, fig. 1.

*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., April 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, 1845. 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 Clipper-ton Islands, and on the mainland south to Manta, Ecuador." HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, pl. 269, pl. 5, figs. 8-10.

*Conus* cf. *brunneus* WOOD, DURHAM, Mem. Geol. Soc. America, no. 43, pt. 2, 1950, p. 100, pl. 32, fig. 8. "Arroyo Blanco, Carmen Island, Gulf of California. Upper Pliocene."

*Conus (Conus) brunneus* WOOD, KEEN, Sea Shells of Tropical West America, 1958, p. 480, fig. 916.

*Conus andrangae* SCHWENGEL, Nautilus, vol. 69, no. 1, 1955, p. 14, pl. 2, figs. 8-11. "Bahia El Coco, Costa Rica."

TYPE LOCALITY: Unknown. Typical specimens have been collected on Albemarle Island, Galápagos 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; Galápagos 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, Baja California to Veragua, Panama. It is especially abundant on the Galápagos Islands.

The dirty brown, coralline-incrusted shells of this species, found so abundantly in the intertidal zone of the Galápagos 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. Nuclear 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 Galápagos 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.

The holotype of *Conus andrangae* Schwengel (pl. 5, fig. I) is U.S. National Museum No. 617,611 and measures: alt. 47.0 mm.; diam. 33.9 mm. It is a worn beach shell with broken outer lip. Although it may appear to have more light colored markings than usual in *brunneus*, a large series of that species such as from the Galápagos Islands will contain some which are lighter along with intergrades which have practically no light areas. No distinctive characters which hold constant were found in this specimen.

Theodore Dranga (in letter to Dr. L. G. Hertlein, September 17, 1955) expressed the opinion that this shell was a synonym of *Conus bartschi* Hanna & Strong. So few specimens of that species are known that it would seem better for the present to associate *C. andrangae* with the very common *C. brunneus*.

### **Conus diadema** Sowerby

Pl. 3, fig. 7.

*Conus diadema* SOWERBY, Conch. Ill., p. 3 [119], pl. 57, fig. 88, April 30, 1834.

[The Calif. Acad. Sci. copy of Conch. Ill. has an 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: Galápagos Islands.

RANGE: Known only from Revillagigedo, Tres Marias, and Galápagos 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 separation 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* Hwass in Bruguière. Except for the purple tip usually present in that form the two would be much more difficult to separate.

### *Conus diadema pemphigus* Dall

Pl. 3, fig. 8; pl. 9, fig. 1.

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

*Conus diadema pemphigus* DALL, HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 271, pl. 5, figs. 7, 11.

*C. d. pemphigus* DALL, KEEN, Sea Shells of Tropical West America, 1958, p. 480, fig. 918a.

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 holotype of *Conus brunneus pemphigus* Dall (pl. 9, fig. 1) is U. S. Nat. Mus. no. 37,449 and measures: alt. 26.2 mm.; diam. 16.5 mm. It is a brown heavily pustulose shell with the tips of the pustules lighter in color. The basal spiral incised lines are very strong. There is the barest trace of a

colored band around the center of the body whorl. In shape and color this shell is closer to *diadema* than to *brunneus* and we have transferred it. However, among the lots of 36 specimens of *diadema* available we have found none which approach the holotype of *pemphigus* in strength of sculpture. The nearest is the one illustrated. If it were not for the presence of pustules, irregular in strength to none at all in this lot, the holotype could well represent a distinct species. However, since intergradation is indicated it would seem best to retain it as a subspecies for the present.

### *Conus bartschi* Hanna & Strong

Pl. 6, fig. 3.

*Conus bartschi* HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 5, vol. 26, no. 9, 1949, p. 271, pl. 5, fig. 5. DURHAM, Mem. Geol. Soc. America, no. 43, pt. 1, 1950, p. 100, pl. 32, figs. 1, 7. Coronado Island, Gulf of California. Pleistocene. KEEN, Sea Shells of Tropical West America, 1958, p. 480, fig. 916.

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, Baja California, August 6, 1932, by 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.

### *Conus tiaratus* Broderip

Pl. 7, fig. 7; pl. 9, fig. 3.

*Conus tiratus* 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. HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 272, pl. 7, fig. 12, pl. 8, fig. 18.
- Conus (Conus) tiaratus* SOWERBY, KEEN, Sea Shells of Tropical West America, 1958, p. 481, fig. 923.
- Conus miliaris* HWASS in BRUGUIÈRE, TRYON, Man. Conch., vol. 6, 1883, p. 21, p. 5, fig. 85. DALL, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 220. "Clipperton and Galapagos Islands, Ecuador and Peru." Not *Conus milians* HWASS in 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. 143b, 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: Galápagos Islands.

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

COLLECTING STATIONS: Mexico: Clarion Island; Socorro Island; Tres Marias Islands; Cape San Lucas (Lowe Coll. labelled *tiaratus*); Galápagos 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.

Stearns 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 Galápagos Islands are similar, but do not agree exactly. Dall considered the species to be equivalent to *miliaris* [= *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 Galápagos 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. 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*.

The holotype of *Conus roosevelti* Bartsch & Rehder (pl. 9, fig. 3) is U. S. National Museum No. 472,854 and measures: alt. 15.3 mm.; diam. 9.8 mm. It is a very small shell, probably living when collected and excellently preserved. The coronal nodes are very distinct, 11 on the last whorl. Spiral striation is strong over the entire body whorl. There probably would have been pustules on the body whorl if the shell had grown to maturity because they are just starting at the outer lip. The color is brown with a lighter spire and central band. The shell falls readily within the limits of variation of the large series of *C. tiaratus* on hand.

### *Conus gladiator* Broderip

Pl. 2, fig. 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*, 1845, pl. 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., 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). SORENSEN, Nautilus, vol. 57, no. 1, 1943, pl. 1, fig. 7. HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 273, pl. 7, fig. 5.

*Conus (Conus) gladiator* BRODERIP, KEEN, Sea Shells of Tropical West America, 1958, p. 480, fig. 920.

Not *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.), Baja California, to Mancora, Peru, (D. L. Frizzell).

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

Being a shallow water and littoral form, shore collectors often obtain *gladiator* 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 coronal 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* Cross is in the British Museum and according to Tomlin it is *gladiator*. However, Dr. Kohn has made a color photograph of the specimen. It is a white shell marked only by many longitudinal stripes and lacks coronal nodes entirely. The shape is not even close to the other brown striped species of the Gulf of California, *Conus virgatus* Reeve; it is shorter and broader. Thus it seems best to exclude the name *tribunis* from the west American list in spite of its having been definitely recorded from "California"

### *Conus nux* Broderip

Pl. 7, figs. 14, 15.

*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*, 1845, 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, Baja California, south to Panama and the Galapagos Islands" SORENSEN, Nautilus, vol. 57, no. 1, July, 1943, pl. 1,

fig. 10 [13 shells.] "Guaymas, Mexico." HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, pl. 7, figs. 6, 7.

*Conus (Conus) nux* BRODERIP, KEEN, Sea Shells of Tropical West America, 1958, p. 480, fig. 921.

*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 Galápagos 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: Galápagos 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 Galápagos 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 Standen (1893, p. 36), 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.

Tomlin (1937, p. 279), who examined the type specimens reported that Pilsbry & Vanatta had *C. nux* when they recorded *C. nanus* from the Galápagos.

### *Conus princeps* Linnaeus

Pl. 1, fig. 1; pl. 4, fig. 5.

*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. 2, 1857, p. 5, pl. 188 [*Conus* pl. 2], fig. 31. "Panama." WEINKAUFF, Martini & 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]. HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 275, pl. 7, figs. 10, 11. PLATT, Nat. Geog. Mag., vol. 96, no. 1, 1949, p. 53, fig. 15. Acapulco, Mexico. DURHAM, Mem. Geol. Soc. America, no. 43, pt. 1, 1950, p. 100, pl. 32, fig. 15. Marquer Bay, Carmen Island, Gulf of California, Upper Pliocene.

*Conus (Conus) princeps* LINNAEUS, KEEN, Sea Shells of Tropical West America, 1958, p. 481, figs. 922, 922a, 922b. [The forms named *lineolatus* and *apogrammatus* are not to be considered as valid subspecies.]

*Conus regius* CHEMNITZ, Conch. Cab., vol. 10, 1788, p. 138, pl. 138, fig. 1276. KIENER, Icon. Coq. Viv., Genre *Cône*, 1845, 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, Baja 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.

Peile (1939, p. 350), 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.

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 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.

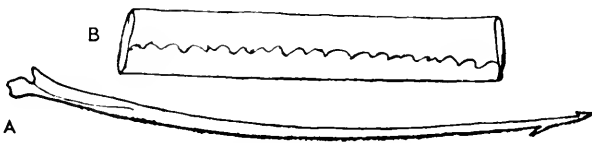


Fig. 1. *Conus princeps* LINNAEUS. A.- Complete tooth, length 2.92 mm. B.- Enlarged section of the shaft showing longitudinal serrations. Hypotype, no. 9344 (Paleo. type coll.), from Loc. 31699 (C.A.S.), San Carlos Bay, Mexico. A.Sorensen, Coll., Jan. 1942.

***Conus princeps lineolatus* Valenciennes**

Pl. 1, fig. 4.

*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 Parris. HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 278, pl. 7, fig. 8.

*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. 36b. 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*, and hardly deserves taxonomic recognition.

***Conus princeps apogrammatus* Dall**

Pl. 1, fig. 6; pl. 5, fig. 4.

*Conus princeps* var. *apogrammatus* DALL, Proc. U.S. Nat. Mus., vol. 38, 1910, p. 224. "Panama." HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 278, pl. 7, figs. 9, 17.

*Conus princeps* Linnaeus, SOWERBY, Conch. Ill., p. 2, [118], 1833, pl. 32, fig. 30. REEVE, Conch. Icon., vol. 1, March, 1843, pl. 7, fig. 36c. 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* and like the preceding, is hardly worthy of a separate name.

The holotype of *Conus princeps apogrammatus* Dall, (pl. 5, fig. 4) is U. S. National Museum no. 36,404 and measures: alt. 35.5 mm.; diam. 22.0 mm. It is a young, somewhat eroded shell without a trace of the characteristic *princeps* markings. Coronal nodes are not well developed but are present.

*Conus emersoni* Hanna, new species

Pl. 1, fig. 2.

DESCRIPTION: Sides of spire straight with nine whorls showing; nuclear whorl smooth, next seven strongly but finely beaded; angle of last whorl sharp and beads becoming weaker toward the aperture. Very weak spiral threads on the deeply curved shoulder as in many Turridae. Body whorl slightly concave, with the tip slightly recurved. Shallow spiral grooves cover the body whorl, weak at the shoulder and becoming progressively deeper downward. Color markings, reddish brown on a light clay colored background; the markings are crowded in three spiral bands, one at the shoulder and two farther down on the body whorl; the bands are made up of lines and spots, irregular in space and direction. Elsewhere on the body whorl the markings are dots and dashes on the ridges between the spiral grooves. The spire has large irregular blotches of reddish brown. Length, 43.0 mm.; diameter, 18.5 mm.

HOLOTYPE: No. 92200 (American Museum of Natural History), paratype No. 12405 (Calif. Acad. Sci. Geol. Type Coll.) from off Los Frailes Cape San Lucas, Baja California in 300 fathoms.

The species is named for Dr. William K. Emerson. It was collected by one of the expeditions of the Scripps Institution of Oceanography, along with other mollusks, some living and some perhaps from a submarine deposit containing fossils. The holotype is a dead shell and appears to be faded. It obviously belongs to the group of species sometimes referred to *Asprella* Schaufuss, 1869, and is reminiscent of Eocene species with beaded spires.

Dr. Emerson examined the fragment of a shell which Dall (1910, p. 226) questionably identified as *Conus sieboldii* Reeve and which was collected in 300 fathoms off Hood Island, Galápagos group. Available illustrations of that species indicate that it has stronger spiral lines, and, as shown by Kira (1959, p. 99, pl. 38, fig. 4) is nearly without color. In coloration and strength of spirals, the Cape San Lucas shell is closer to *Conus australis* Holten of the "south seas" and Japan (Kira, 1959, p. 99, pl. 38, fig. 6) than any other species which has been noted. If a series of specimens were available it is possible that *C. emersoni* is sufficiently variable to be referred to *C. australis*. With only the holotype and a rather poorly preserved younger shell, however, it seems best to separate them at the present time.

A Japanese fossil species, *Conus comitosa* Pilsbry (1904, p. 550) (originally named *C. dormitor* Pilsbry, 1904, p. 6) is also very close to the Cape San Lucas shell. It is from the Pliocene ("probably") of Kikai, Osumi and has no color as figured by Shuto (1961, p. 140, pl. 8, figs. 9, 10). Spiral sculpture is much stronger on this fossil than on either *C. australis* or *C. emersoni*.

*Conus gradatus* Mawe

Pl. 2, fig. 3; pl. 5, fig. 7.

- 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); Cumming." KIENER, Icon. Coq. Viv.; Genre *Cône*, p. 140, 1847, pl. 94, fig. 6. "Habite les côtes du Mexique." DALL, Proc. U. S. Natl. Mus., vol. 38, 1910, p. 221. "Gulf of California." HANNA & STRONG, Proc. Calif. Acad. Sci. ser. 4, vol. 26, no. 9, 1949, p. 279, pl. 6, fig. 1.
- Conus gradatus thaanumi* SCHWENGEL, Nautilus, vol. 69, no. 1, 1955, p. 15, pl. 2, figs. 12, 13. TYPE LOCALITY: "Bahia Salinas, Costa Rica."
- 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, Baja 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, Baja 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*, *recurvus*, *dispar* and numerous other names should be considered varieties or separate species or not recognized at all depends much upon the viewpoint of the student. Some have been segregated here because, in many 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, however (1856, p. 208, suppl., pl. 3, fig. 6), indicated that they are the same.

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

The holotype of *Conus gradatus thaanumi* Schwengel, (pl. 5, fig. 7) is

U.S. National Museum no. 617,607 and measures: alt. 45.5 mm.; diam. 22.4 mm. It is a beach shell with the outer lip slightly broken. The spire is slightly lower than in *scalaris* but the upper surface is similar. The reddish brown markings become spiral rows of irregular sized dots on the last of the body whorl. These are not shown in the illustration. Many *gradatus* also have these more or less developed and the shape of *thaanumi* is typical of that species.

Distinguishing characters for separation of the subspecies seem to be lacking.

### *Conus recurvus* Broderip

Pl. 1, fig. 3; pl. 2, fig. 7; pl. 5, figs. 6, 8; pl. 9, fig. 4.

*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." HANNA & STRONG, Proc. Calif. Acad. Sci. ser. 4, vol. 26, no. 9, 1949, p. 280, pl. 6, figs. 7, 8, 13. DURHAM, Mem. Geol. Soc. America, no. 43, pt. 1, 1950, p. 101, pl. 32, fig. 13. Santa Inez Bay, Lower California. Pleistocene.

*Conus (Lithoconus) recurvus* BRODERIP, KEEN, Sea Shells of Tropical West America, 1958, p. 480, fig. 940.

*Conus recurvus helenae* SCHWENGEL, Nautilus vol. 69, no. 1, 1955, p. 15, pl. 2, figs. 14, 15. Type locality: "...Curu, Gulf of Nicoya, Costa Rica."

*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, Baja 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; 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 (1909).

Weinkauff's treatment (1873, pp. 262, 263, pl. 40, figs. 9, 10) 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 *gabrieli* (Chenu) Kiener, duly accredited on page 243. Apparently he did not figure *cingulatus*.

In addition to the names mentioned above, *lorenzianus* Chemnitz (1795) and *flammeus* Lamarck (1798, 1810) 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 holotype of *Conus scariphus* Dall, (pl. 5, fig. 8) is U.S. National Museum no. 123,085 and measures: alt. 41.0 mm.; diam. 20.6 mm. It was probably a dead shell when dredged and the outer lip is slightly broken below. Ground color is a faded yellow with light spots of variable size except for a central spiral zone where they are axial bars. Shape and coloration of this shell can be matched very closely with numerous specimens of *recurvus* in the Academy's very large series of that species. *Conus scariphus* does not represent an end product in this series by any means. If it be separated from the *recurvus* complex, at least 20 additional species would need to be described.

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 holotype of *Conus magdalenensis* Bartsch & Rehder, (pl. 9, fig. 4) is U. S. National Museum no. 472,521 and measures: alt. 33.0 mm.; diam. 15.2 mm. The shape and coloration are so close to many shells in the *recurvus* complex that its recognition as distinct would lead logically to the addition of many more names of equal status. Rather than do this, even more consolidation than here proposed would be preferable. This could very reasonably be carried to the extent of uniting *recurvus* with *gradatus*, *regularis*, *scalaris*, and *dispar* and might very well serve students of biology better than separating them. It must be admitted that in a very large series there are many shells in this group which are impossible to place with complete assurance.

The holotype of *Conus recurvus belenae* Schwengel (pl. 6, fig. 6), is U. S. National Museum, no. 617,608 and measures: alt. 45.2 mm.; diam. 19.2 mm. It is a beach shell with much of the outer lip lost. The markings are irregular reddish brown wavy bars on the upper surface and these pass over the shoulder and down over the body whorl. Shape and coloration are so easily matched in a large series of *recurvus* that the subspecific name seems to serve no useful purpose.

### *Conus regularis* Sowerby

Pl. 2, fig. 2; pl. 6, fig. 5, pl. 9, fig. 9.

*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." HANNA & STRONG, Proc. Calif. Acad. Sci. ser. 4,  
 vol. 26, no. 9, 1949, p. 282, pl. 6, fig. 2. DURHAM, Mem. Geol. Soc. A-  
 merica, no. 43, pt. 1, 1950, pl. 101, pl. 32, fig. 9. Marquer Bay, Carmen  
 Island, Gulf of California. Lower Pliocene to Recent.

*Conus (Lithoconus) regularis* SOWERBY, KEEN, Sea Shells of Tropical West  
 America, 1958, p. 486, fig. 941.

*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 39x  
 22 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, Baja Cal-  
 ifornia, 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 col-  
 lections from west Mexico. Messrs. Crocker and Beebe collected it in abun-  
 dance 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 men-  
 tion 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 common; 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*.

The species lives in the lagoon at Miramar just north of Guaymas, Mexico. John Strobeen and Andrew Sorensen collected many specimens there and all of them have the last whorl descending sharply at the aperture, (pl. 9, fig. 9). Although this character appears to be constant at this limited locality it is doubtful if it deserves taxonomic separation from *regularis* which it otherwise strongly resembles.

### *Conus scalaris* Valenciennes

Pl. 3, fig. 11; pl. 4, figs. 1, 3; pl. 7, fig. 3.

*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*.] HANNA & STRONG, Proc. Calif. Acad. Sci. ser. 4, vol. 26, no. 9, 1949, p. 283, pl. 6, figs. 3-6. DURHAM, Mem. Geol. Soc. America, no. 43, pt. 1, 1950, p. 101, pl. 32, fig. 17. Coronado Island, Gulf of California. Pleistocene.

*Conus (Lithoconus) scalaris* VALENCIENNES, KEEN, Sea Shells of Tropical West America, 1958, p. 486, fig. 942.

TYPE LOCALITY: Acapulco, Mexico.

RANGE: Gulf of California and north along the outer coast of Baja 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.

Sowerby (1857, p. 14, pl. 195, fig. 192), 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 Tryon (1883, p. 35, pl. 10, fig. 83), 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 the figure represents the species here considered. It develops that there is no early illustration which can be cited to represent what turns out to be a fairly common, high spired, 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

Pl. 7, fig. 18.

*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." HANNA & STRONG, Proc. Calif. Acad. Sci. ser. 4, vol. 26, no. 9, 1949, p. 284, pl. 6, fig. 11.

*Conus (Lithoconus) dispar* SOWERBY, KEEN, Sea Shells of Tropical West America, 1958, p. 485, fig. 937.

TYPE LOCALITY: Unknown. Typical specimens have been collected at Cape San Lucas, Lower California.

RANGE: Gulf of California.

COLLECTING STATIONS: Mexico: Santa Inez Bay, Baja 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. Tryon (1883, p. 37, pl. 11, fig. 2), 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 two cited above. He may have been misled by Sowerby (1857, p. 16, pl. 195, fig. 195), 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 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

Pl. 6, figs. 2, 6.

*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, pl. 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). WEINKAUFF, Martini & Chemnitz, Syst. Conch. Cab., ed. 2, vol. 4, pt. 2, 1875, pl. 362, pl. 67, figs. 2, a. b. DALL, Proc. U. S. Nat. Mus., vol. 38, June 6, 1910, p. 223. HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 285, pl. 5, fig. 1 [cited as pl. 6, fig. 1 by error]; pl. 9, fig. 4 [cited as *C. perplexus* by error.]

*Conus (Lithoconus) archon* BRODERIP, KEEN, Sea Shells of Tropical West America, 1958, p. 484, fig. 935.

*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, Baja 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.

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.

Reeve (1849, p. 4) stated that *Conus granarius* Kiener (1848, p. 215, pl. 98, fig. 1), 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

Pl. 2, fig. 8.

*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." HANNA & STRONG, Proc. Calif. Acad. Sci. ser. 4, vol. 26, no. 9, 1949, p. 286, pl. 8, fig. 17. DURHAM, Mem. Geol. Soc. America, no. 43, pt. 1, 1950, p. 101, pl. 32, fig. 19. Coronado Island, Gulf of California. Pleistocene.

- Conus (Chelyconus) ximenes* GRAY, KEEN, Sea Shells of Tropical West America, 1958, p. 483, fig. 930.
- 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].
- [?] *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, SORENSEN, 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* Sowerby (1834, p. 54, fig. 61), was a synonym of *interruptus* Wood, and that this in turn is equivalent to *varius* Linnaeus. This synonymy was adopted by Tryon (1884, pp. 110, 120). 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.

Dall (1910, p. 228), suggested that *C. catenatus* Sowerby, 1878, appeared to be *interruptus* but the figure cannot be distinguished from many *tor-natus* seen in the present study.

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 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."

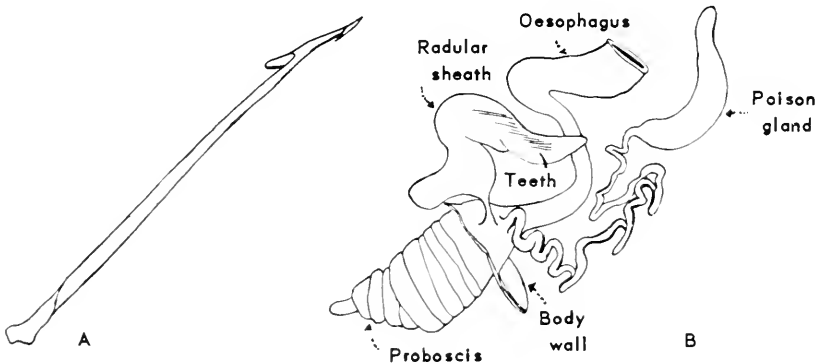


Fig. 2. *Conus ximenes* GRAY. A.- Complete tooth. B.- Dorsal view of proboscis and associated organs. Hypotype, no. 9338 (Paleo. type coll.), from Loc. 31699 (C.A.S.), San Carlos Bay, Mexico, A. Sorensen, Coll., Jan. 1942.

**Conus mahogani** Reeve

Pl. 2, fig. 6.

*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." HANNA & STRONG, Proc. Calif. Acad. Sci. ser. 4, vol. 26, no. 9, 1949, p. 289, pl. 8, fig. 16.

*Conus (Chelyconus) ximenes mahogani* REEVE, KEEN, Sea Shells of Tropical West America, 1958, p. 483, fig. 931.

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 Galápagos 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 of 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 *Conus interruptus* of Broderip, 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

Pl. 3, fig. 9; pl. 7, figs. 5, 8.

*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*.] HANNA & STRONG, Proc. Calif. Acad. Sci. ser. 4, vol. 26, 1949, p. 289, pl. 8, figs. 1-3, pl. 9 [not 8 as cited], fig. 4.

*Conus (Cbelyconus) perplexus* SOWERBY, KEEN, Sea Shells of Tropical West America, 1958, p. 482, fig. 926.

"*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 Mancora, Peru (D. L. Frizzell).

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. 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. Coloration 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

Pl. 7, figs. 10, 11, 12, 13.

*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 America 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, Baja 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.] HANNA & STRONG, Proc. Calif. Acad. Sci. ser. 4, vol. 26, No. 9, 1949, p. 291, pl. 8, figs. 4-7.

*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.

*Conus* (?*Chelyconus*) *tornatus* BRODERIP, KEEN, Sea Shells of Tropical West America, 1958, p. 482, fig. 928.

TYPE LOCALITY: Xipixapi, Ecuador.

RANGE: "Cedros Island, Baja 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 Sowerby (1857, p. 16, pl. 104 [204], fig. 425), 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, 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.

Dr. Kohn found the type of *Conus catenatus* preserved in the National Museum of Wales at Cardiff and photographed it in color. The shell has a straight sided conical spire and spiral rows of small pustules cover the body whorl. These are light in color whereas in most western American collections of *tornatus* studied in connection with this report they are dark. This is not believed to be sufficient reason for taxonomic separation in this highly variable group.

### *Conus arcuatus* Broderip & Sowerby

Pl. 3, figs. 4, 5, 6.

*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. 77b. "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. HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 292, pl. 5, figs. 2-4.

*Conus (Lithoconus) arcuatus* BRODERIP & SOWERBY, KEEN, Sea Shells of Tropical West America, 1958, p. 485, fig. 936.

*C. [onus] (Lithoconus) arcuatus vacuanus* OLSSON, Bul. American Paleo. vol. 27 (106), 1942, p. 201 (49), pl. 19 (6), figs. 11, 12. Quebrada Peñitas, Costa Rica, Pliocene. Quebrada Mellisa and Rio Guanabanon, Panama, Pliocene. At the same time Olsson recorded *Conus arcuatus*, p. 202, (50), pl. 19 (6), fig. 13, from Rio Guanabanon, Panama, Pleistocene.

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 Gualtulo; Acapulco Bay, Oaxaca and between Isabel Island and Mazatlan, Mexico; Costa Rica: Port Parker; 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 *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 *bor-*

*neensis*. 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. Adams (1853 [1854], p. 117), was described without illustration from an unknown locality. Weinkauff, according to Tomlin (1937, p. 230), considered the species to be the one Kiener (1847, p. 150, pl. 70, fig. 3), 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 & Vanatta (1902, p. 555), recorded *commodus* questionably from Wenman Island, Galapagos, from a much worn specimen taken by Snodgrass and Heller from the stomach of a shark. Nothing in any of the collections studied, 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*.

There appears to be very close similarity between *Conus arcuatus* and *Conus cancellatus* Reeve (1843, pl. 30, figs. 171a, 171b). Coloration and size are very nearly the same. The spiral ridges of *cancellatus* are somewhat stronger on specimens available and the body whorl is more "pinched" in although not as much as shown in Reeve's figures. This is another instance of the wide distribution of similar South Pacific and west American species of *Conus*.

It seems odd that Adams and Reeve did not compare their *Conus borneensis* 1848) with *cancellatus* instead of with *arcuatus*.

### *Conus fergusonii* Sowerby

Pl. 2, fig. 4; pl. 4, fig. 2; pl. 5, fig. 5; pl. 7, fig. 9; pl. 9, fig. 10.

*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. HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 294, p. 7, figs. 1-4.

*Conus (Lithoconus) fergusonii* SOWERBY, KEEN, Sea Shells of Tropical West America, 1958, p. 485, fig. 938.

*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), Baja California and Gulf of California, Mexico, south to the Galápagos Islands and Mancora, Peru (D. L. Frizzell).

COLLECTING STATIONS: Mexico: Arena Bank, Baja California, (Sta. 136, D-11, 24, 27, 30 to 50 fms.); Santa Inez Bay, Baja California, (Sta. 142, D-4, 40 to 50 fms.; Sta. 147, D-2, 60 fms.); Gorda Banks, Baja 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 Sx E 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, Baja 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* Hinds (1843, p. 256), might be the young of *fergusoni* although both Hinds (1844, p. 7), and Reeve (1843, pl. 13, fig. 64, Suppl. p. 4), came to believe their shell to be the young of *C. terebellum*, while Tryon (1884, p. 80), after copying Reeve's figure, considered it to be *C. terebra*. De Barros e Cunha (1933, p. 183), 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* Hwass in Bruguière (1792, p. 681), is very similar to the large *fergusoni*; specimens in the California Academy of Sciences labelled from Mauritius, can hardly be distinguished. *Conus virgo* Gmelin (1789, p. 3376); from the same region is also similar but is shaded with purple on the interior of the lower end of the aperture. An earlier name for the species seems to be *Conus cingulum* Martyn (1784, vol. 1, fig. 39).

A magnificent series of growth stages has shown 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.

In addition to being brightly colored with yellow or orange, some young shells have a sprinkling of small dark brown spots in spiral rows. One of these is shown on plate 9 and another much smaller and brightly colored one is in the collection of Dr. Bruce Campbell.

Fresh shells are covered with velvety periostracum which is very tenacious and seems to increase in density with age in some manner; 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 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 fossils have been found in the Pleistocene deposits just north of the village. Another large specimen, (alt. 128 mm.) is from Tagus Cove, Albemarle Island, Galápagos.

Passing to the fossil forms, *fergusoni* was recorded from the Pliocene, Imperial County, California, by Hanna (1926, p. 446). *Conus mollis* Brown & Pilsbry (1911, p. 343), from the Miocene, Gatun formation, Panama, is hardly separable. This in turn, is very similar to *Conus haytensis* Sowerby (1850, p. 44), from the Miocene of Santo Domingo. The similarity of *Conus hayesi* Arnold (1909, p. 62), from the Tumbolor Miocene of the San Joaquin Valley, California, to *fergusoni* was pointed out by Arnold.

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

The holotype of *Conus xanthicus* Dall (pl. 5, fig. 5) is U. S. National Museum no. 111,236 and measures: alt. 42.4 mm.; diam. 22.3 mm. No two young *Conus fergusoni* are exactly alike but this shell is so similar to many others that it can hardly be mistaken, once the early stages of that species are recognized. The yellow of this holotype seems somewhat faded compared to fresh specimens; it may have been exposed to light for some time. Otherwise it is perfectly preserved and was probably living when dredged.

### *Conus vittatus* Hwass in Bruguière

Pl. 1, fig. 7; pl. 3, fig. 10; pl. 11, figs. 2, 6, 7.

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

- Conus vittatus* HWASS in BRUGUIÈRE, REEVE, Conch. Icon. vol. 1, June, 1843, pl. 14, figs. 75 a, b. "Bay 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." HANNA & STRONG, Proc. Calif. Acad. Sci. ser. 4, vol. 26, no. 9, 1949, p. 296, pl. 8, figs. 8, 9; pl. 10, figs. 6-10. KEEN, Sea Shells of Tropical West America, 1958, p. 483, fig. 929.
- "*Conus fumigatus* BRUG. var.," KIENER, Icon. Coq. Viv., Genre *Cône*, pp. 103, 104, 1847, pl. 50, fig. 2a.
- [?] *Conus archon* BRODERIP, SORENSEN, Nautilus, vol. 57, July, 1943, pl. 1, row 8, three lower left figures, Guaymas, Mexico.

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

RANGE: Santa Inez Bay, Baja California and Guaymas, Mexico, south to Gorgona Island, Colombia.

COLLECTING STATIONS: Santa Inez Bay, Baja California; Costa Rica: 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 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 Thesaurus 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 in the 1949 report. From this photograph, another in color by Dr. K. Bender, reproduced herewith, and a later one taken by Dr. Alan Kohn, it now seems to be certain that the species is a west

American form and not from Asiatic or Indian Ocean waters as cited by early authors.

The shells illustrated by Sorensen in 1943 under the names *perplexus*, *archon* and *gladiator* have been donated to the California Academy of Sciences recently. A study of them shows that those called *archon* are *vittatus*.

During the recent photographic work by Dr. Kohn in Europe he obtained an excellent color transparency of *Conus benoqueti* Bernardi in the Museum d'Histoire Naturelle in Paris where it was reported to be by Fisher - Piette & Beigbeder in the Bulletin of that Museum (ser. 2, vol. 16, no. 6, 1944, p. 461). An examination of this photograph is convincing that the species is not *vittatus*. Although it has a central band similar to *vittatus* it also has a very definite shoulder band.

Upon comparing Dr. Kohn's color photograph of the type specimen of *Conus orion* with the one of *vittatus*, I agree with him that the two are distinct.

The numerous brightly colored shells, mostly from Panama, with more angular shoulders and indistinct central bands thus fall under *orion*. In the 1949 report these shells were considered to be variations of *C. vittatus* and we were under obligations to Dr. Howard R. Hill of Los Angeles, California and Dr. A. Myra Keen, of Stanford University for making their material available for study. Most of this was collected by Mr. W. D. Clark. Since then, this form has been named *Conus drangai* Schwengel.

### *Conus orion* Broderip

Pl. 3, fig. 12; pl. 6, fig. 4; pl. 7, figs. 1, 2, 16; pl. 9, fig. 2.

*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." HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 321, pl. 9, fig. 3; (*pupurascens* by error).

*Conus drangai* SCHWENGEL, Nautilus, vol. 69, no. 1, July 1955, p. 13, pl. 2, figs. 1-7. "Bahia Salinas, Costa Rica."

*Conus (Chelyconus) drangai* SCHWENGEL, KEEN, Sea Shells of Tropical West America, 1958, p. 482, fig. 925.

TYPE LOCALITY: Real Llejos.

RANGE: Mazatlan, Mexico south to Gorgona Island, Colombia.

COLLECTING STATIONS: Mexico: Mazatlan; Costa Rica: Salinas Bay; Panama: Chagami Bay; Venado Island.

A specimen of this species was figured in the 1949 report (pl. 10, fig. 3) and erroneously recorded under the name *C. pupurascens*. It was intended



to call it *vittatus* under which name it was discussed but not specifically mentioned. The unsatisfactory state of the taxonomy of the species concerned at that time made it necessary to leave the problem unsolved. Since then the addition of more material and especially the receipt of color photographs of type specimens for study furnish convincing evidence that there are two recognizable species in the fauna, *vittatus* and *orion*. This conclusion is the result of conference with Dr. Kohn who was able to photograph the type specimen of *orion*.

The holotype of *Conus drangai* (pl. 9, fig. 2) is U.S. National Museum, no. 617,612 and measures: alt. 32.9 mm.; diam. 18.5 mm. It is a beach shell but is well preserved. The outer lip is slightly broken. The spire is checked with dark reddish brown spots alternating with white. The brown continues over the shoulder upon the body whorl where the axial bands coalesce above and below an irregular central spiral zone of white.

### *Conus purpurascens* Broderip

Pl. 3, figs. 2, 3; pl. 5, fig. 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*, pl. 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." SORENSEN, Nautilus, vol. 57, no. 1, July, 1943, pl. 1, fig. 2 [7 shells], fig. 9 [3 shells]. "Guaymas, Mexico." HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 298, pl. 8, figs. 19, 20; pl. 9, figs. 1, 2; [fig. 3, cited as *C. purpurascens* is now considered to be *C. orion* Broderip]. PLATT, Nat. Geog. Mag., vol. 96, no. 1, 1949, p. 53, fig. 13. Acapulco, Mexico.

*Conus (Chelyconus) purpurascens* BRODERIP, KEEN, Sea Shells of Tropical West America, 1958, p. 482, fig. 927.

"*Conus luzonicus* LAM?" SOWERBY, Conch. Ill., April 30, 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, Baja 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; Galápagos 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 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. Adams (1853 [1854], p. 117, and Sowerby, 1858, pl. 203 [*Conus* p. 17], fig. 404), 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* Bruguière (1792, pl. 338, fig. 6), is an entirely different species, judging by the original figure, and it is difficult to understand Sowerby's confusion of the shells. Kiener (1848, pl. 83, fig. 3), has given a

beautiful figure which resembled 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 holotype of *Conus purpurascens rejectus* Dall (pl. 5, fig. 3) is U. S. National Museum no. 37, 410 and measures: alt. 49.5 mm.; diam. 30.7 mm. Although the shell is lighter in color than most specimens of *purpurascens* the markings have the characteristic shape of that species. It may be faded with exposure and age.

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. Carpenter (1856, p. 206) 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].

Gould (1862, p. 187), stated that *purpurascens* was equivalent to "*Conus achatinus* Menke." Menke 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 1856 [1857], p. 236. [Carpenter added that the species was "= *purpureus* or *regalitis*," evidently meaning *purpurascens*], because *achatinus* Bruguière (1792, p. 672, pl. 300, fig. 6), is a decidedly different shell, with a predominance of spiral sculpture; it is supposed to be found in Asiatic waters.

Krebs (1864, p. 6), has listed *Conus purpurascens* Broderip from the island of Guadaloupe, 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

Pl. 6, figs. 8, 9, 10; pl. 8, fig. 1; pl. 10, figs. 4, 5.

*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. HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 300, pl. 6, fig. 12, pl. 9, figs. 6-9.

*Conus (Dendroconus) patricius* HINDS, KEEN, Sea Shells of Tropical West America, 1958, p. 484, fig. 934.

*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 (*pyriiformis*).

RANGE: Michoacan, Mexico, 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 Galápagos 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 one of the most beautiful of all of the cones. 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 *pyriiformis* has been generally recognized since 1883 (Tryon), the first name having been based upon an immature 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 *pyriiformis* 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 *pyriiformis*, the first as figure 63, the second as figure 70. There seems to be no good reason for the continued acceptance of the name *pyriiformis* for the species.

Usually the shells are characterized by being pyriform, rather thin and uniform pale waxy yellow. However, Mr. W. D. Clark 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 on plate 6 was said to be an eggcase 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 Dr. 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

Pl. 2, fig. 1; pl. 5, fig. 2; pl. 6, fig. 7.

- 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." HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 301, pl. 6, fig. 10; pl. 9, fig. 5.
- Conus (Lithoconus) virgatus* REEVE, KEEN, Sea Shells of Tropical West America, 1958, p. 487, fig. 944.
- Conus lorenzianus* CHEMNITZ, KIENER, 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 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, Baja 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 Dillwyn (1817, p. 370). Meanwhile, Lamarck (1810, p. 279) had described *Conus flammeus* from "Africa" which, from Kiener's and other figures, is identical. This name, however, had been previously used by Bolten (1798, p. 44), under *Cucullus* for a species figured by Martini (1771, pl. 55, figs. 606, 607), as *Conus leoninus*. Tomlin (1937, p. 206), therefore re-named 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, Tomlin (1937, p. 205), stated that Reeve's shell of that name was equivalent to "*daucus* Brug." a West Indian species.

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 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's (1937, p. 236) 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 holotype of *Conus signae* Bartsch (pl. 5, fig. 2), is U.S. Nat. Museum no. 37,399 and measures: alt. 57.6 mm.; diam. 30.1 mm. It is pale yellow with two faint, white longitudinal bands on the body whorl. The outer lip is slightly broken. The shell is very well preserved although it was collected many years ago at Guaymas, Mexico by the celebrated botanical collector, William Palmer. There is a faint indication of a light central spiral band.

There may be difficulty at times in separating *C. virgatus* (or *signae*)

from young of *Conus fergusonii*. Both are about the same shape but the yellow markings of the latter usually show a spiral arrangement.

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 the 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 *apogrammatatus*.

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, it is illustrated 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, 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 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.



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.

### *Conus dalli* Stearns

Pl. 10, fig. 3.

*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, 1895, 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. HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, no. 9, vol. 26, 1949, p. 304, pl. 5, fig. 12.

*Conus (Cylindrus) dalli* STEARNS, KEEN, Sea Shells of Tropical West America, 1958, p. 484, color plate 9.

*Conus omaria* BRUGUIÈRE, Menke, Zeit. f. Mal., Jah. 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; Galápagos Islands: Albemarle; Hood.

Most of the specimens (six lots) in the California Academy of Sciences came from the Tres Marias, Galápagos 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 (1843, pl. 38, fig. 209) called the true *textile*.

Many variations of the textile group have been named and Melvill (1900, pp. 303-316) 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 in part 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 placed in synonymy; but until such a study is made it is felt 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 (1935, p. 24) has observed that the veliger larvae have no free swimming stage under laboratory conditions. If this be true under natural conditions, one of the usually cited methods of distribution in the Mollusca is certainly eliminated.

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 collection made by Andrew Sorensen contains a very large specimen of *Conus dalli* (Loc. no. 37,037, C.A.S.) from Isla Raza off the east coast of Baja California near Los Animas Bay: alt. 79.4 mm; diam. 41.2 mm. The label with the shell reads, "Isla Raza near San Carlos Bay, Sonora, Mexico."

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

Pl. 10, fig. 1.

*Conus durhami* HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 306, pl. 5, fig. 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 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 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 *bramkampi*.

### *Conus lucidus* Wood

Pl. 6, fig. 1.

*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."] "Madgalena Bay, Lower, California to the Galapagos Islands." HANNA & STRONG, Proc. Calif.

Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 307, pl. 5, fig. 13. PLATT, Nat. Geog. Mag., vol. 96, no. 1, 1949, p. 53, fig. 5, Manta, Peru.

*Conus (Cylindrus) lucidus* WOOD, KEEN, Sea Shells of Tropical West America, 1958, p. 484, fig. 933.

*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, Baja 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 Galápagos Islands.

Although Mawe's name *reticulatus* (1823, p. 90) 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 Born (p. 139) in 1778. Also the name was presumably applied to another species by Meuschen (p. 366) in 1787. This information was derived from Sherborn, Index Anim., 1758-1800; the original works were not available. However, since Martini (pp. 261-262), 1771, used the name as a species and such post-Linnaean writers, as Dillwyn (p. 391), 1817, definitely placed the reference in the synonymy of *Conus mercator*, further tracing of the name seems unnecessary.

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.

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, Baja California, (Loc. 27588 C.A.S.). Reeve's figure fits specimens from the Galapagos Islands more closely than any of the others.

Galápagos 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

Pl. 7, figs. 4, 17.

*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, Baja 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. HANNA & STRONG, *Proc. Calif. Acad. Sci.*, ser. 4, vol. 26, no. 9, 1949, p. 308, pl. 5, figs. 14, 15. ABBOTT, *American Sea Shells*, 1954, p. 265.

*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."

*Conus californicus fossilis* 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, Baja California.

RANGE: Farallone Islands, California, south to Cape San Lucas, Baja 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 Baja 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. An early instance of this having been done for a west American species which has come to our attention is the record made by Hemphill (1893, pp. 351-352) for *Conus californicus*. This is so informative that 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. 7, fig. 4, 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.

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.

An excellent account of the feeding habits with illustration was given by Saunders & Wolfson (1961).

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 unfamiliarity 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. 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.



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.

Two previous illustrations of teeth have appeared, one by Peile (1939, p. 350, fig. 8) and one by Tom Burch (1944, p. 29, fig. 23). 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* Dall (1893, p. 47, pl. 56, fig. 4) from the Okhotsk Sea bears some resemblance to *californicus* but the spire is lower and the figure shows no spiral striae.

### Conus ebraeus Linnaeus

Pl. 9, figs. 6, 7, 8.

*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 ebraeus*.] 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. vermiculatus* 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." HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 311, pl. 8, figs. 12, 13.

*Conus (Conus) ebraeus* LINNAEUS, KEEN, Sea Shells of Tropical West America, 1958, p. 480, fig. 919.

*Conus vermiculatus* LAMARCK, Enc. Méth. Vers, livr. 3, 1798, p. 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, the Galápagos Islands, and Costa Rica where Dranga collected a living specimen.

COLLECTING STATIONS: Hood Island, Galápagos 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. Oschsner of the 1905-1906 Expedition of the California Academy of Sciences to the Galápagos 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. Born (1780, p. 159) changed it to "*hebraeus*" and Bory (1827, p. 158, pl. 321, fig. 2), 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 Ostergaard (1935, p. 21) for instance, suggest that it be considered a distinct species. Iredale (1929, p. 282) 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. Oschsner'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 altitude; 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

Pl. 1, fig. 5; pl. 9, fig. 5; pl. 11, figs. 1, 3, 4, 5, 8.

*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. 23, 1939, p. 352, fig. 23 (radula). "Mombasa." HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 313, pl. 9, figs. 10, 11, 15; pl. 10, figs. 1-5.



*Conus (Lithoconus) tessulatus* BORN, KEEN, Sea Shells of Tropical West America, 1958, p. 487, fig. 943.

*Conus tesselatus* 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, Rés. 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.

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 Burguière and Lamarck in writing it "*tesselatus*."

The holotype of *Conus edaphus* Dall (pl. 9, fig. 5) is U.S. National Museum no. 130,385 and measures: alt. 25.1 mm.; diam. 14.0 mm. It was probably living when dredged and is in excellent condition. It is pale yellow with pale reddish rectangular spots in spiral rows on the body whorl. These extend over the shoulder on the spire. They are more distinct on the back than the front. It is small, young shell and the spire is slightly higher than is shown by the figure of the type of *tessulatus* in the Museum d'Histoire Naturelle, Geneva, (pl. 11, figs. 1, 2). However, except for the pale condition of the reddish spots the specimen is readily matched by others from the South Seas of comparable size.

The group to which *tessulatus* belongs inhabited American waters as early as the lower Pliocene, as shown by the following species.

**Conus bramkampi** Hanna & Strong

Pl. 10, fig. 2.

*Conus bramkampi* HANNA & STRONG, Proc. Calif. Acad. Sci., ser. 4, vol. 26, no. 9, 1949, p. 314, pl. 8, fig. 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. 34198 (Univ. Calif. Mus. Paleo.), from Loc. A-1269 (U.C.), "south side of Cartizo Mountain, Imperial County, California; Pliocene; in a small canyon about 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 the late 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 as *Conus regularis* when adequate comparative material and literature were not available. The similarity is plainly seen 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.

Woodring (Carnegie Inst. Washington, Publ. 418, Jan. 1931, p. 20) suggested the possibility of this species being *Conus proteus*.

## 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 may 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. Mus., vol. 38, 1910, p. 227), this is not a *Conus* but a *Meta* of Columbellidae.
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 Columbellidae.
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 Baja 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 tribunus* CROSSE (1865, p. 312, pl. 10, fig. 2) was stated by Tomlin (1937, p. 323) to be equivalent to *C. gladiator* and that the type was in the British Museum (Natural History). Crosse gave the locality as: "Hab. California (Coll. Cuming)."
11. *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.
12. *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.

## REFERENCES

In the following list of titles only those which bear importantly upon the classification or the distribution of eastern Pacific species have been included. In some cases they have not been cited in the synonymy of the foregoing text under various species. Annotations have been added when it seemed that these might aid the reader in deciding upon further investigation.

## ABBOTT, R. T.

1954. American sea shells, pp. xiv, 1-541, 40 pls., 100 text figs. [Although this important work is indispensable for general identification of American mollusks, there is included only one species of *Conus* from the west coast; namely, *C. californicus* HINDS (p. 265). However, the east American 18 species and subspecies are treated which makes the book a valuable reference for comparison.]

## ANONYMOUS

1951. Archibald M. Strong. Stanford Review, p. 28, October.

## ADAMS, A.

1853. Descriptions of new species of the genus *Conus* from the collection of Hugh Cuming, Esq. Proceedings of the Zoological Society of London, vol. 21, pp. 116-119, November 22.
1854. Descriptions of thirty-nine new species of shells, from the collection of Hugh Cuming, Esq. Proceedings of the Zoological Society of London for 1854, pp. 130-138, pl. 28, June 27.

## ADAMS, A., AND L. REEVE

- 1848- Mollusca. [In Adams, A.] The zoology of the voyage of H.M.S. *Samarang*;  
1850. under the command of Captain Sir Edward Belcher. London, pt. 1, pp. i-x, [i-ii], 1-24, pls. 1-9 (1848); pt. 2, pp. 25-44, pls. 10-17 (1850); pt. 3, pp. 45-87, pls. 18-24 (1850).

## ALLISON, E. C.

1959. Distribution of *Conus* on Clipperton Island. *Veliger*, vol. 1, no. 4, pp. 32-33, April 1.

## ARNOLD, R.

1090. Paleontology of the Coalinga district, Fresno and Kings Counties, California. United States Geological Survey, Bulletin no. 396, pp. 1-173, 30 pls.

## BARROS E CUNHA, J. G. DE

1933. Catálogo descritivo das Conchas exóticas de collecção António Augusto de Carvalho Monteiro. *Memórias e Estudos do Museu Zoológico da Universidade de Coimbra*, sér. 1, no. 71, pp. 7-224. [Família Conidae, p. 183.]

## BEEBE, W.

1937. [For data on localities of the Beebe-Crocker Expedition to the Gulf of California in 1936 for the New York Zoological Society,] see: The Templeton Crocker Expedition. II. Introduction, Itinerary, List of Stations, Nets and Dredges. *Zoologica*, vol. 22, pt. 1, no. 2, pp. 33-46, figs. 1-8 in text.

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- 1938b. *Zaca* Venture. Published under the auspices of the New York Zoological Society, New York. 303 pp., 23 illustrations.
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1895. Beiträge zur Kenntniss der Coniden. *Nova Acta Academiae Caesareae Leopoldino-Carolinae Germanicae Naturae Curiosorum. Abhandlung der Kaiserlichen Leopoldinisch - Carolinischen Deutschen Akademie der Naturforscher...*, Bd. 65, nr. 2, Halle, pp. 67-214, pls. 1-13.
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1798. *Museum Boltenianum...pars secunda continens Conchylia sive Testacea univalvia, bivalvia & multivalvia. (Hamburgi). [Edit. by P. F. Röding, with a preface by A. Lichtenstein.] Pp. I-VIII, 1-99. [Reprint by C. D. Sherborn and E. R. Sykes, 1906. Index by W. H. Dall in Smithsonian Miscellaneous Collections, Publication no. 2360, pp. 1-64, 1915.]*
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1778. *Index Rerum Naturalium Musei Caesarei Vindobonensis. Pars I. Testacea. Verzeichnis der natürlichen Seltenheiten des k. k. Naturalien Cabinets zu Wien. Erster Theil: Schalthiere. Vindobonae (ex officina Krausiana.) [The date of publication is 1778 following Rutsch, R. F., *Nautilus*, vol. 69, no. 3, 1956, pp. 78-79, rather than Iredale, T., *Memoirs Queensland Museum*, vol. 9, pt. 3, 1929, p. 281, and Dodge, H., *Bulletin of the American Museum of Natural History*, vol. 100, 1952, p. 231; and vol. 103, 1953, p. 125, both of whom cite 1780.]*
- BROWN, A. P., AND H. A. PILSBRY  
1911-1913. *Fauna of the Gatun formation, Isthmus of Panama. Proceedings of the Academy of Natural Sciences of Philadelphia*, vol. 63, pp. 336-360 (June 22, 1911), pp. 361-373 (July 27, 1911), pls. 22-29; pt. 2, vol. 64, pp. 500-519, pls. 22-26 (Jan. 30, 1913).
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1789. *Histoire naturelle des Vers. Encyclopédie méthodique*, vol. 1, pt. 1, pp. 1-344, 1789. Vol. 1, pt. 2, pp. 345-757, 1789. [For dates of pages, plates and numbers of plates, see: Sherborn, C. D., and B. B. Woodward, *Annals and Magazine of Natural History*, ser. 7, vol. 17, 1906, pp. 577-582.] [See also, Hwass, C. H.]
- BURCH, J. Q. (ed.)  
1944-1946. *Distributional list of the west American marine Mollusca from San Diego, California, to the Polar Sea. [Extracts from the] Minutes of the Conchological Club of Southern California*, pt. I (Pelecypoda), nos. 33-45 (March 1944-February 1945); pt. II, vols. I-II (Gastropoda), nos. 46-63 (March 1945-September 1946).
1951. A. M. Strong, 1876-1951. *Minutes of the Conchological Club of Southern California*, no. 112, pp. 1-2, August.

1960. Nautilus, vol. 74, no. 2, pp. 81-82, October. [*Conus mus* BRUGUIÈRE is recorded for the first time from the west American coast, "Panama Bay under rocks at lowest tide off Vera Cruz village beach." Technically it may better bear the name *Conus citrinus* GMELIN, 1791 (see: Clench, Johnsonia, no. 5, p. 7). The species is a well known Caribbean form.]
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1857. Report on the present state of our knowledge with regard to the Mollusca of the west coast of North America. Report of the twenty-sixth meeting of the British Association for the Advancement of Science for 1856, pp. 159-368, pp. 1-4, pls. 6-9. Issued 1857.
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1858. Alleged discovery of a fossil *Conus* in the drift of western Canada. The Canadian Journal of Industry, Science and Art, n.s., vol. 3, no. 18, p. 516, November. [This refers to a specimen picked up in a gravel pit of glacial "drift on Grand River near York, (Manatobe?"). It was water-worn and evidently the identity was questionable. F. C. Baker (The Lymnaeidae of North and Middle America, recent and fossil. Chicago Academy of Science, Special Publication, no. 3, 1911, p. 474) seems to have considered the specimen to be a fresh water *Lymnaea*. No additional references to it have been seen. If it should prove to be a *Conus* the locality would be remarkable.]
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1952. A. M. Strong. Nautilus, vol. 65, no. 4, pp. 142-143, April.
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1780- Neues systematisches Conchylien-Cabinet. Nürnberg. 4 to., vols. 4-11.  
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Throughout the work there are many notes on classification of species as well as genera. Many west American records are cited and some synonymy is given for them which differs greatly from any hitherto proposed. In general it seems that the author is more conservative than the present one insofar as the species found in this area are concerned and many names, which we have recognized, are placed in synonymy. Thus *C. tiaratus* SOWERBY is considered to be "*Virroconus coronatus* (GMELIN)", p. 236; *V. citrinus* is listed from San Diego, California, certainly an error, p. 236.

*C. nux* BRODERIP is placed as a synonym of "*Virroconus sponsalis* (BRUGUIÈRE)", p. 237; "*Stephanoconus regius* (GMELIN)" is recorded from "Gulf of California" by error. The record of "*Stephanoconus suffusus* (SOWERBY)" from "California" (p. 240) is also in error.

"*Leptoconus emarginatus* (REEVE)" with *Conus arcuatus* GRAY, 1839, not BRODERIP and SOWERBY, 1829, is recorded only from Brazil, p. 244, but we have considered both names to be synonymous with *C. recurvus* BRODERIP, a west American species. *Conus dispar* SOWERBY and *C. recurvus* BRODERIP are considered synonyms of "*Leptoconus regularis* (SOWERBY)", p. 245.

*C. perplexus* (SOWERBY) is considered a synonym of *Pionoconus interruptus* (BRUGUIÈRE), p. 249. "China" is added to west American localities.

*C. mahogani* REEVE is made a synonym of *Pionoconus interruptus* (BRODERIP and SOWERBY), p. 250.

*Rhizoconus vittatus* (BRUGUIÈRE) is recorded from the Indian Ocean, perhaps from the literature.

*C. dalli* STEARNS is made a synonym of *Dariconus panniculus* (LAMARCK), p. 258.]

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## EXPLANATION OF THE PLATES

## PLATE 1

Fig. 1. *Conus princeps* LINNAEUS. Hypotype, no. 9331, (Geol. Type Coll.), from Loc. 1259 (C.A.S.), Gulf of California; Henry Hemphill, Coll. Length 81.5 mm., diameter 48.8 mm.; p. 21.

Fig. 2. *Conus emersoni* HANNA, n. sp. Holotype, no. 92200, (Amer. Mus. Nat. Hist., Invert. Coll.), from off Cape San Lucas, Baja California. Length 42.5 mm., diameter 18.1 mm.; p. 25.

Fig. 3. *Conus recurvus* BRÖDERIP. Hypotype, no. 9313, (Geol. 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 by E of Judas Point, Costa Rica, 42 to 61 fathoms. Length 85 mm., diameter 41.8 mm.; p. 27.

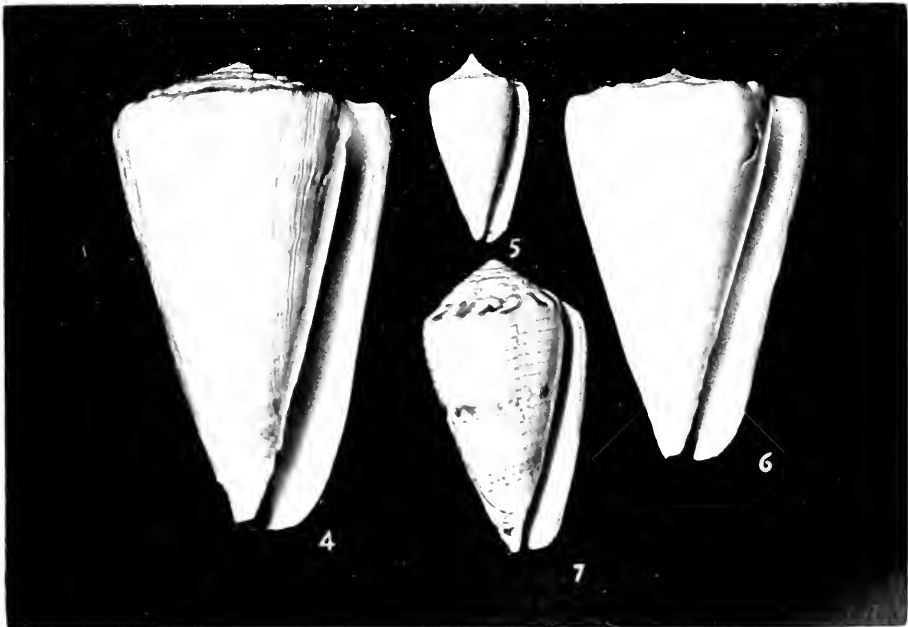
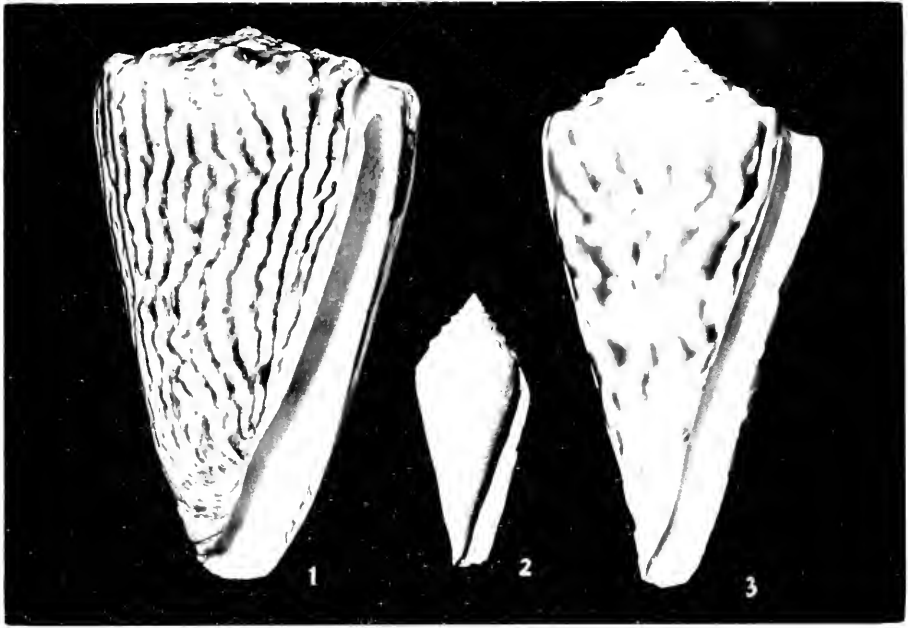
Fig. 4. *Conus princeps lineolatus* VALENCIENNES. Hypotype, from Las Perlas Islands, Panama Bay, in the Collection of Dr. Howard R. Hill; W. D. Clark, Coll. Length 57.4 mm., diameter 34.4 mm. Specimen illustrated through the courtesy of Dr. Hill; p. 24.

Fig. 5. *Conus tessulatus* BORN. Hypotype, no. AB75, (Los Angeles Museum of Science, History and Art), Clarion Island, Mexico, 31 fathoms; George Williett, Coll. Length 21.32 mm., diameter 12.7 mm.; p. 62.

Fig. 6. *Conus princeps apogrammatum* DALL. Hypotype in the collection of Dr. Howard R. Hill, from Venado Island, Panama Bay; W.D. Clark, Coll. Length 44.2 mm., diameter 25.5; p. 24.

Fig. 7. *Conus vittatus* HWASS in BRUGUIÈRE. Hypotype from Maria Magdalena Island, Mexico, no. A 1207, (Los Angeles Museum of History, Science and Art). Length 32.0 mm., diameter 17.5 mm. Specimen illustrated through the courtesy of Dr. Howard R. Hill; p. 44.









## PLATE 2

Fig. 1. *Conus virgatus* REEVE. Hypotype, no. 9314, (Geol. 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. 51.

Fig. 2. *Conus regularis* SOWERBY. Hypotype, no. 9307, (Geol. Type Coll.), from Loc. 28186 (C.A.S.), Kino Bay, Sonora, Mexico; H.N. Lowe, Coll. Length 59 mm., diameter 32 mm.; p. 29.

Fig. 3. *Conus gradatus* MAWE. Hypotype, no. 9306, (Geol. Type Coll.), from Loc. 1338 (C.A.S.), Scammon Lagoon, Baja California; Henry Hemphill, Coll. Length 55.5 mm., diameter 32 mm.; p. 26.

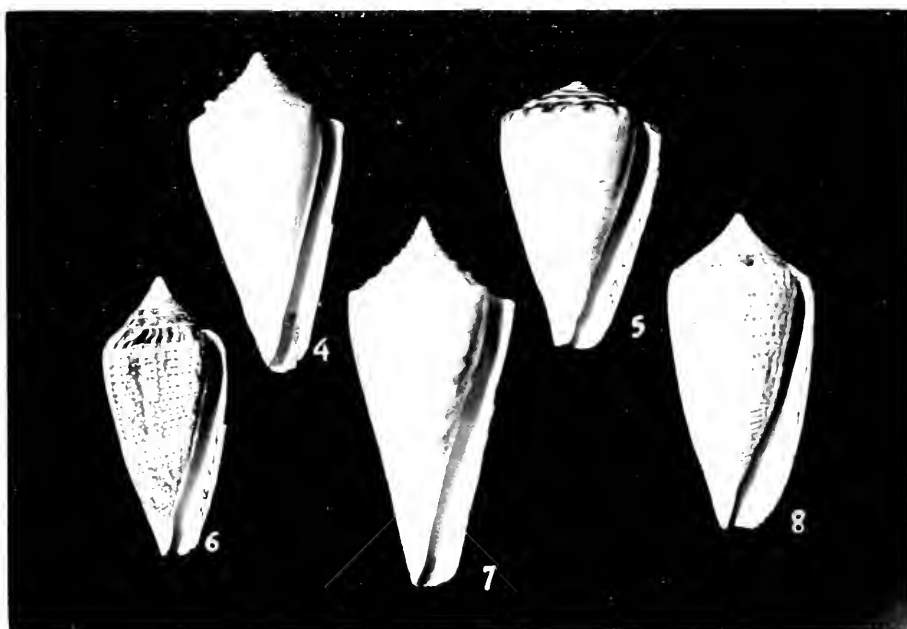
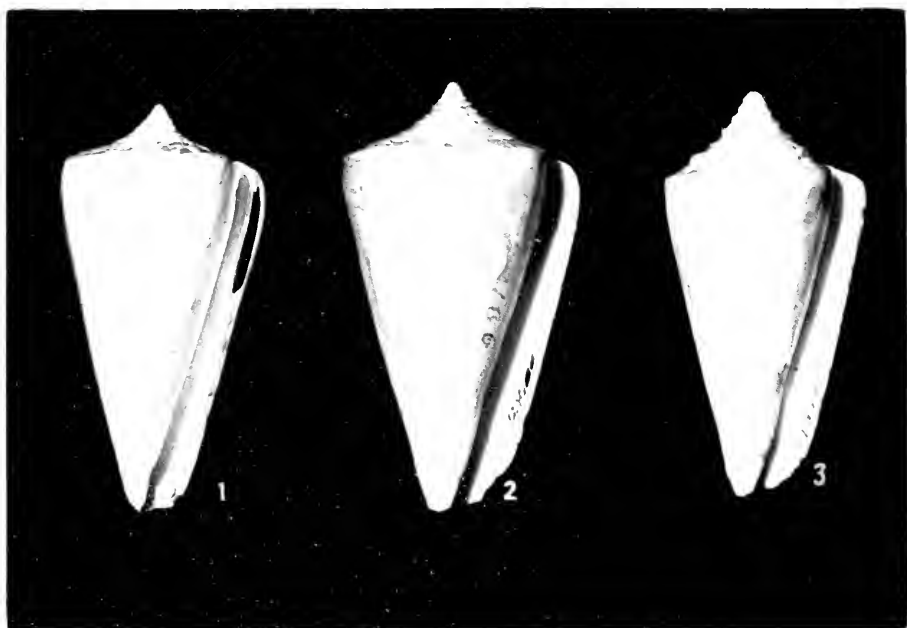
Fig. 4. *Conus fergusonii* SOWERBY. Hypotype, no. 9317, (Geol. Type Coll.), from Loc. 17767 (C.A.S.), Gorda Banks, Gulf of California, 67-75 fathoms. N. Y. Zool. Soc. Sta. 150-D-16. Length 44.0 mm., diameter 21.3 mm.; p. 42.

Fig. 5. *Conus gladiator* BRODERIP. Hypotype, no. 9323, (Geol. Type Coll.), from Loc. 27563 (C.A.S.), Gulf of Fonseca, Salvador-Honduras boundary, littoral, Templeton Crocker Exp., 1932. Length 36.7 mm., diameter 22.0 mm.; p. 19.

Fig. 6. *Conus mahogani* REEVE. Hypotype, no. 9333, (Geol. Type Coll.), from Loc. 28365 (C.A.S.), Punta Arena, Costa Rica; H. N. Lowe, Coll. Length 38.5 mm., diameter 17.5 mm.; p. 37.

Fig. 7. *Conus recurvus* BRODERIP. Hypotype, no. 9312, (Geol. Type Coll.), from Loc. 27584 (C.A.S.), Lat. 23° 03' to 06' N., Long. 109° 31' to 36' W., off Cape San Lucas, Baja California, 20-220 fathoms. Templeton Crocker Exp. 1932. Length 50.8 mm., diameter 22.5 mm.; p. 27.

Fig. 8. *Conus ximenes* GRAY. Hypotype, no. 9337, (Geol. Type Coll.), from Loc. 24077 (C.A.S.), Los Angeles Bay, Baja California; Fred Baker, Coll. Length 43.0 mm., diameter 21.2 mm.; p. 34.







## PLATE 3

Fig. 1. *Conus brunneus* WOOD. Hypotype, no. 9291, (Geol. Type Coll.), from Loc. 23005 (C.A.S.), Hood Island, Galapagos Group, Ecuador, between tides; W. H. Ochsner, Coll. Length 44.5 mm., diameter 26.0 mm.; p. 14.

Fig. 2. *Conus purpurascens* BRODERIP. Hypotype, no. 9336, (Geol. Type Coll.), Magdalena Bay, Baja California; Henry Hemphill, Coll. Length 54.5 mm., diameter 32.0 mm.; p. 47.

Fig. 3. *Conus purpurascens* BRODERIP. Hypotype, no. 9334, (Geol. Type Coll.), from Loc. 27527 (C.A.S.), Acapulco Bay, Mexico; Templeton Crocker Exp., 1932. Length 49.4 mm., diameter 28.4 mm.; p. 47.

Fig. 4. *Conus arcuatus* BRODERIP & SOWERBY. Hypotype, no. 9298, (Geol. 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 31.0 mm., diameter 14.5 mm.; p. 40.

Fig. 5. *Conus arcuatus* BRODERIP & SOWERBY. Hypotype, no. 9299, (Geol. Type Coll.), from same locality as figure 4. Length 33.5 mm., diameter 15.0 mm.; p. 40.

Fig. 6. *Conus arcuatus* BRODERIP & SOWERBY. Hypotype, no. 9297, (Geol. Type Coll.), from Sta. 135-D-18 (N.Y.Z.S.), Lat. 23° 30' N., Long. 109° 25' W., Arena Bank, east coast of Baja California, 40 fathoms. Length 40.5 mm., diameter 20.0 mm.; p. 40.

Fig. 7. *Conus diadema* SOWERBY. Hypotype, no. 9295, (Geol. Type Coll.), from Loc. 23777 (C.A.S.), Clarion Island, (Revillagigedo Group), Mexico, between tides; G D. Hanna & E. K. Jordan, Colls. Length 33.5 mm., diameter 20.0 mm.; p. 15.

Fig. 8. *Conus diadema pemphigus* DALL. Hypotype, no. 9294, (C.A.S.), Cocos Island, Costa Rica, between tides; W. H. Ochsner, Coll. Length 28.5 mm., diameter 14.0 mm.; p. 16.

Fig. 9. *Conus perplexus* SOWERBY. Hypotype, no. 9322, (Geol. Type Coll.), from Loc. 27226 (C.A.S.), Corinto, Nicaragua; L. G. Hertlein, Coll. Length 24.9 mm., diameter 18.5 mm.; p. 37.



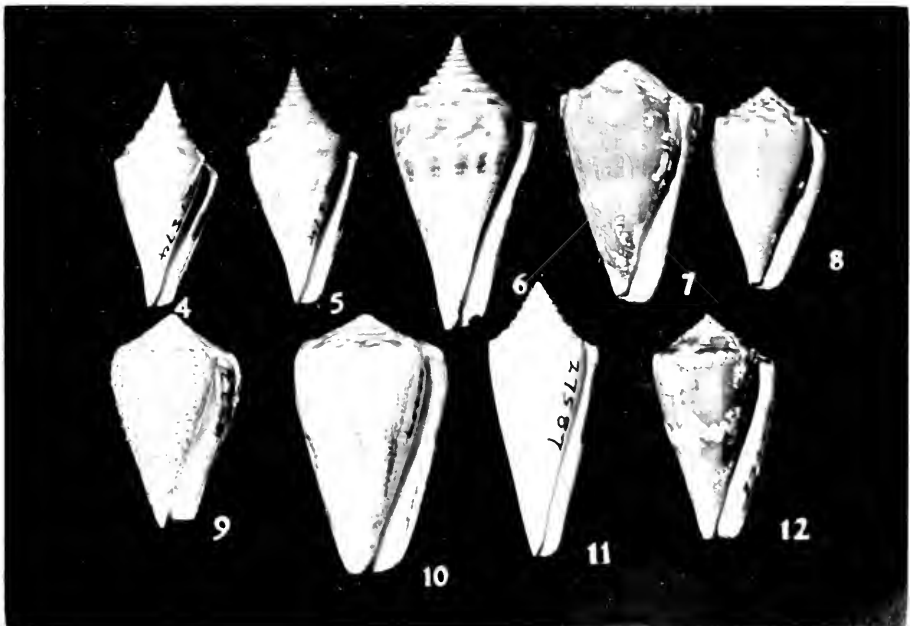
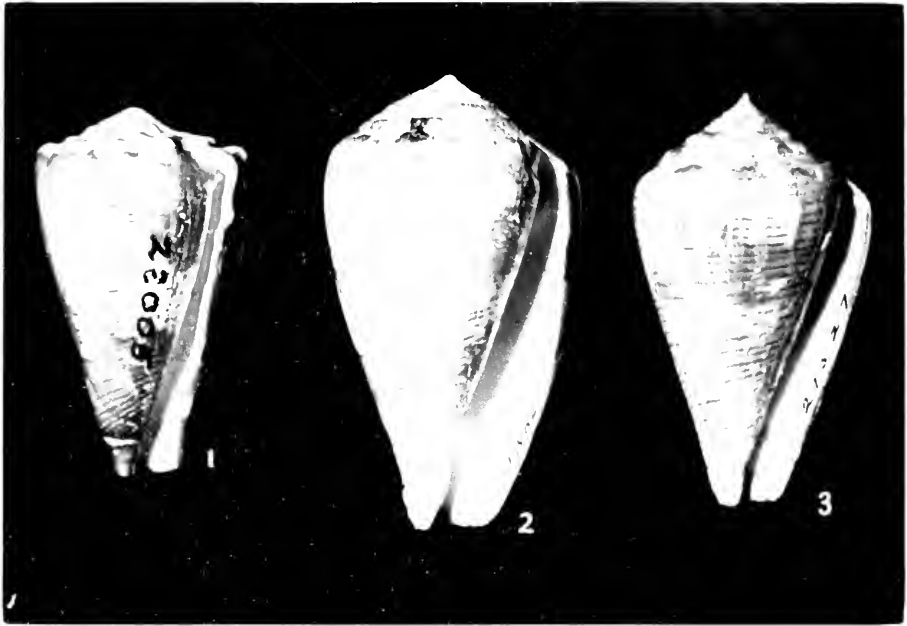




Fig. 10. *Conus vittatus* HWASS in BRUGUIÈRE. Hypotype, no. 9348, (Geol. Type Coll.), from Loc. 20439 (C.A.S.), Mazatlan, Mexico; A. Russel Crowell, Coll. Length 35.8 mm., diameter 21.9 mm.; p. 44.

Fig. 11. *Conus scalaris* VALENCIENNES. Hypotype, no. 9308, (Geol. Type Coll.), from Loc. 27587 (C.A.S.), off Cape San Lucas, Baja California, 20-25 fathoms; Templeton Crocker Exp., 1932. Length 37.7 mm., diameter 15.4 mm., p. 31.

Fig. 12. *Conus orion* BRODERIP. Hypotype, no. 9335, (Geol. Type Coll.), from Loc. 27223 (C.A.S.), Mazatlan, Mexico; L. G. Hertlein, Coll. Cited as *C. purpurascens* by HANNA & STRONG, 1949. Length 30.5 mm., diameter 17.7 mm.; p. 46.

## PLATE 4

Fig. 1. *Conus scalaris* VALENCIENNES. Hypotype, no. 9309, (Geol. Type Coll.), Sta. 142-D-1 (N.Y.Z.S.), Lat. 27° 05' N., Long. 111° 56' W., Santa Inez Bay, Baja California, 30-54 fathoms. Length 64.5 mm., diameter 25.0 mm.; p. 31.

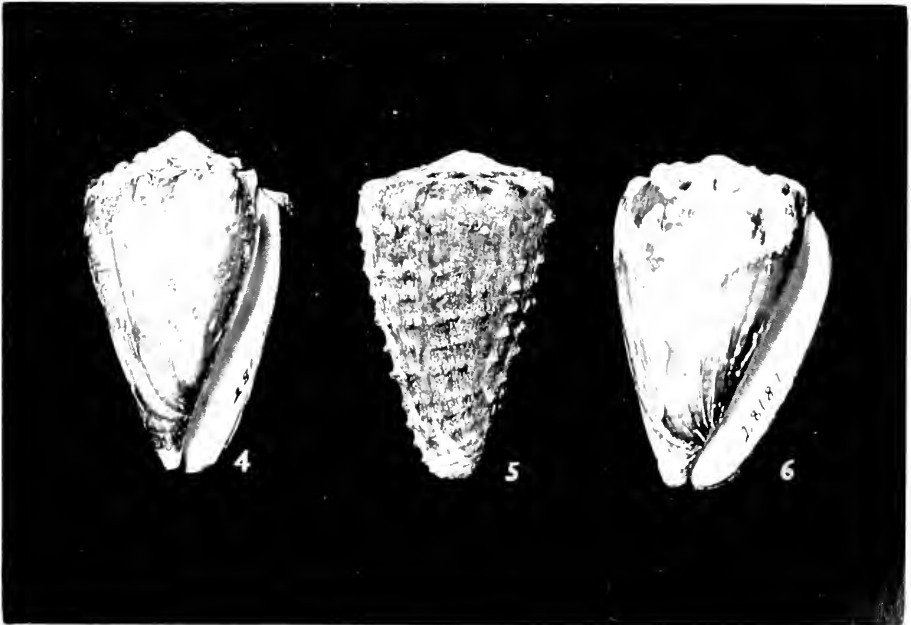
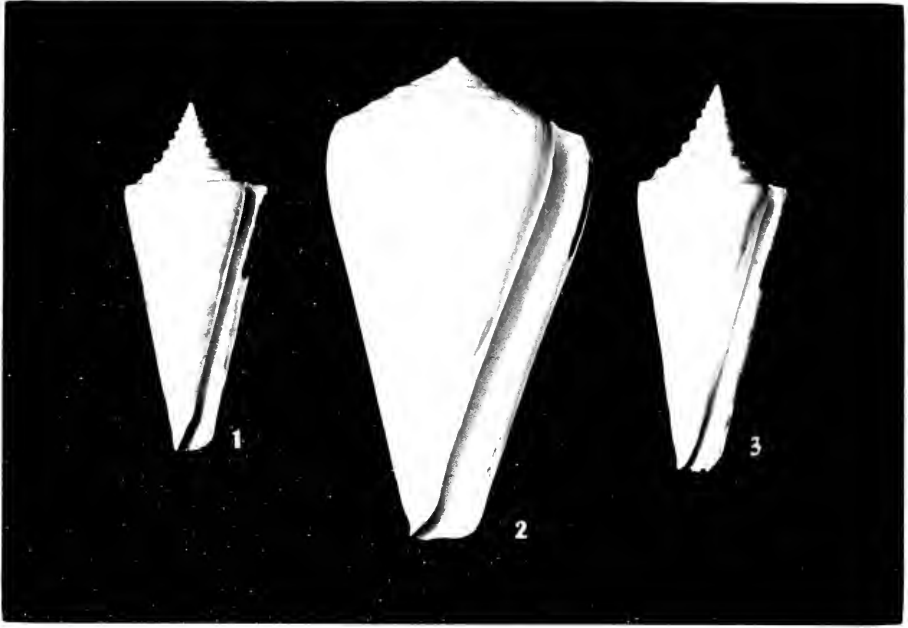
Fig. 2. *Conus fergusonii* SOWERBY. Hypotype, no. 9319, (Geol. Type Coll.), from Loc. 27587 (C.A.S.), 20-25 fathoms off Cape San Lucas, Baja California; Templeton Crocker Exp., 1932. Length 81.0 mm., diameter 46.4 mm.; p. 42.

Fig. 3. *Conus scalaris* VALENCIENNES. Hypotype, no. 9311, (Geol. Type Coll.), from same locality as fig. 1. Length 64.5 mm., diameter 25.0 mm.; p. 31.

Fig. 4. *Conus brunneus* WOOD. Hypotype, no. 9293, (Geol. Type Coll.), from Loc. 28187 (C.A.S.), Albemarle Island, Galápagos Group, Ecuador, between tides; W. H. Oschner, Coll. Length, 44.5 mm., diameter 36.0 mm.; p. 14.

Fig. 5. *Conus princeps* LINNAEUS. Hypotype, no. 9326, (Geol. Type Coll.), from Santa Inez Bay, Baja California. N.Y.Z.S., 1938 Exp., Coll.; showing heavy periostracum. Length 54.6 mm., diameter 33.5 mm. p. 21.

Fig. 6. *Conus brunneus* WOOD. Hypotype, no. 9292, (Geol. Type Coll.), from same locality as fig. 4. Length 56.0 mm., diameter 37.0 mm.; p. 14.







## PLATE 5

Fig. 1. *Conus brunneus* WOOD. Holotype, no. 617611, (U. S. Nat. Mus.) of *Conus andrangae* SCHWENGEL from Bahia El Coco, Costa Rica. Length 47.0 mm., diameter 33.9 mm.; p. 14.

Fig. 2. *Conus virgatus* REEVE. Holotype, no. 37399, (U. S. Nat. Mus.), of *Conus signae* BARTSCH from Guaymas, Mexico. Length 57.6 mm., diameter 30.1 mm.; p. 51.

Fig. 3. *Conus purpurascens* BRODERIP. Holotype, no. 34710, (U. S. Nat. Mus.), of *Conus purpurascens* var. *rejectus* DALL from Port Escondido, "Gulf of California." Length 49.5 mm., diameter 30.7 mm.; p. 47.

Fig. 4. *Conus princeps apogrammatus* DALL. Holotype, no. 37404, (U. S. Nat. Mus.), from Panama. Length 35.5 mm., diameter 22.0 mm.; p. 24.

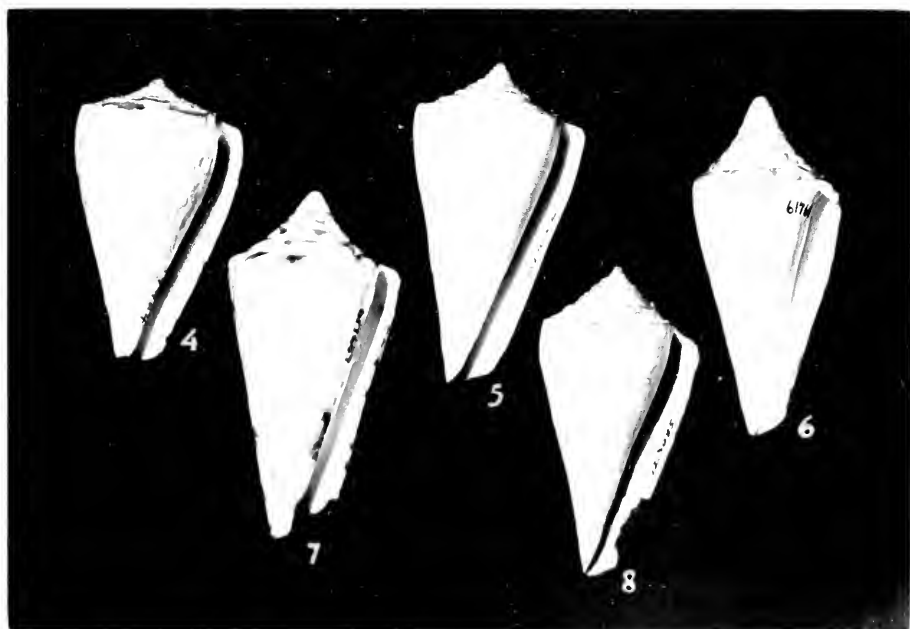
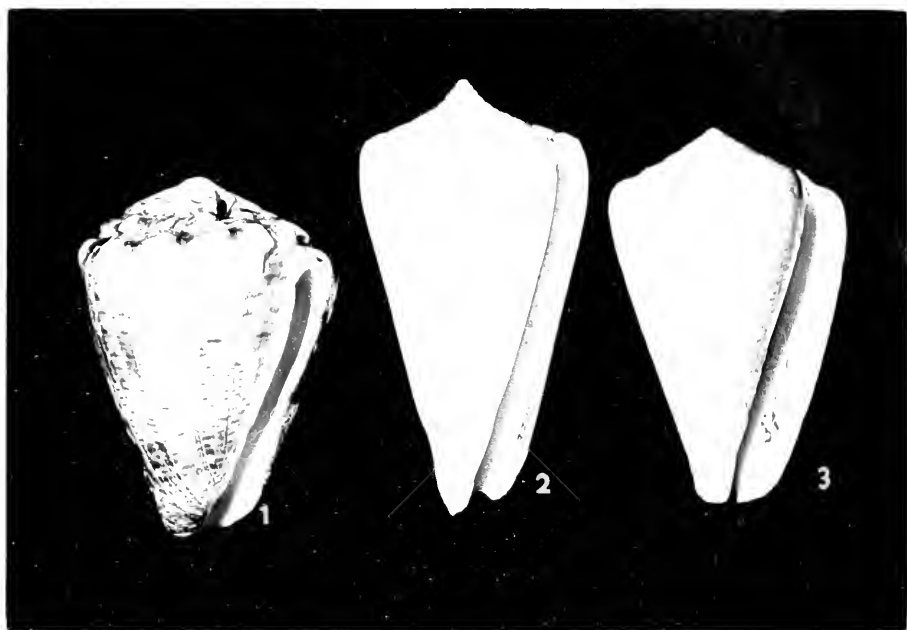
Fig. 5. *Conus fergusonii* SOWERBY. Holotype of *Conus xanthicus* DALL, no. 111236, (U. S. Nat. Mus.), from Sta. 3011, (U. S. Fish Commission, S. S. *Albatross*), off Guaymas, Mexico, 71 fathoms. Length 42.0 mm., diameter 22.5 mm.; p. 42.

Fig. 6. *Conus recurvus* BRODERIP. Holotype of *Conus scalarus belenae* SCHWENGEL, no. 617609, (U. S. Nat. Mus.), from Gulf of Nicoya, Costa Rica. Length 45.2 mm., diameter 19.2 mm.; p. 27.

Fig. 7. *Conus gradatus* MAWE. Holotype of *Conus gradatus thaanumi* SCHWENGEL, no. 617607, (U. S. Nat. Mus.), from Bahia Salinas, Costa Rica. Length 45.5 mm., diameter 22.4 mm.; p. 26.

Fig. 8. *Conus recurvus* BRODERIP. Holotype of *Conus scariphus* DALL, no. 123085, (U. S. Nat. Mus.), from Sta. 3369, (U. S. Fish Commission), off Cocos Island, Costa Rica, 66 fathoms. Length 41.0 mm., diameter 20.6 mm.; p. 27.









## PLATE 6

Fig. 1. *Conus lucidus* WOOD. Hypotype, no. 9303, (Geol. Type Coll.), from Loc. 1337 (C.A.S.), Magdalena Bay, Baja California; Henry Hemphill, Coll. Length 40.0 mm., diameter 20.5 mm.; p. 56.

Fig. 2. *Conus archon* BRODERIP. Hypotype, no. 9300, (Geol. Type Coll.), from Loc. 27584 (C.A.S.), off Cape San Lucas, Baja California; Templeton Crocker Exp., 1932, 20-220 fathoms. Length 63.0 mm., diameter 33.5 mm.; p. 33.

Fig. 3. *Conus bartschi* HANNA & STRONG. Holotype, no. 9296, (Geol. Type Coll.), from Loc. 27587 off Cape San Lucas, Baja California, 20-25 fathoms; Templeton Crocker Exp., 1932. Length 49.0 mm., diameter 30.0 mm.; p. 17.

Fig. 4. *Conus orion* BRODERIP. Hypotype, no. 8039, (Stanford University Coll.), from Venado Island, Panama Bay; W. D. Clark, Coll. Length 30.9 mm., diameter 16.5 mm.; p. 46.

Fig. 5. *Conus regularis* SOWERBY. Hypotype, no. 12302, (Geol. Type Coll.), from Loc. 33266 (C.A.S.), Guaymas, Mexico. Very close to original figure; John Strohbeen, Coll. Length 45.8 mm., diameter 23.0 mm.; p. 29.

Fig. 6. *Conus archon* BRODERIP. Hypotype, no. 8038, (Stanford University Coll.), from San Jose Island, Panama Bay; W. D. Clark, Coll. Length 36.0 mm., diameter 17.3 mm.; p. 33.

Fig. 7. *Conus virgatus* REEVE. Hypotype, no. 8041, (Stanford University Coll.), from Bruja Point, Panama Bay; W. D. Clark, Coll. Length 36.0 mm., diameter 17.3 mm.; p. 51

Figs. 8-10. *Conus patricius* HINDS. Egg capsules and operculum of hypotype, no. 31642, (Stanford University Coll.), from Venado Flats, Panama Bay. See pl. 8, fig. 1, for illustration of shell; p. 49.

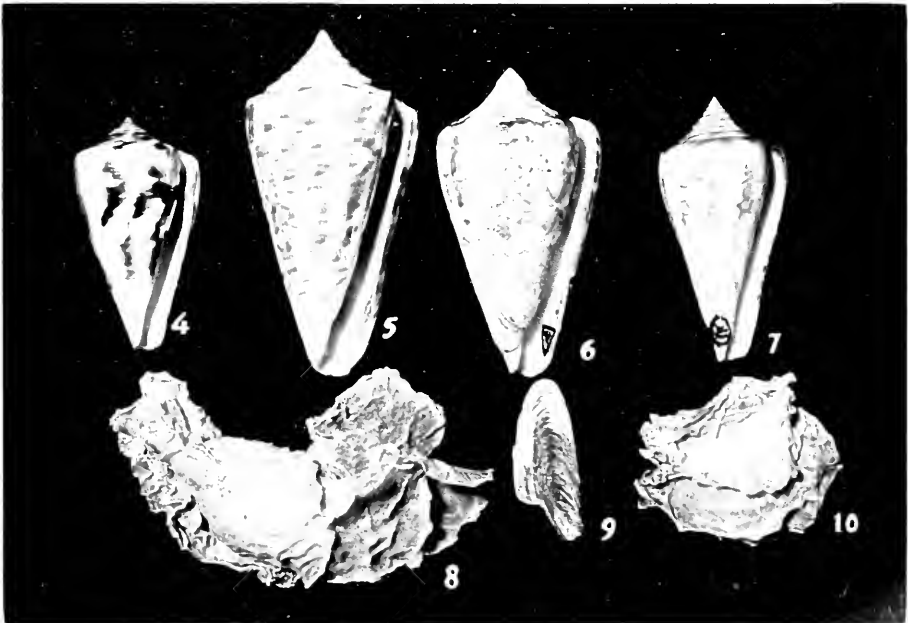
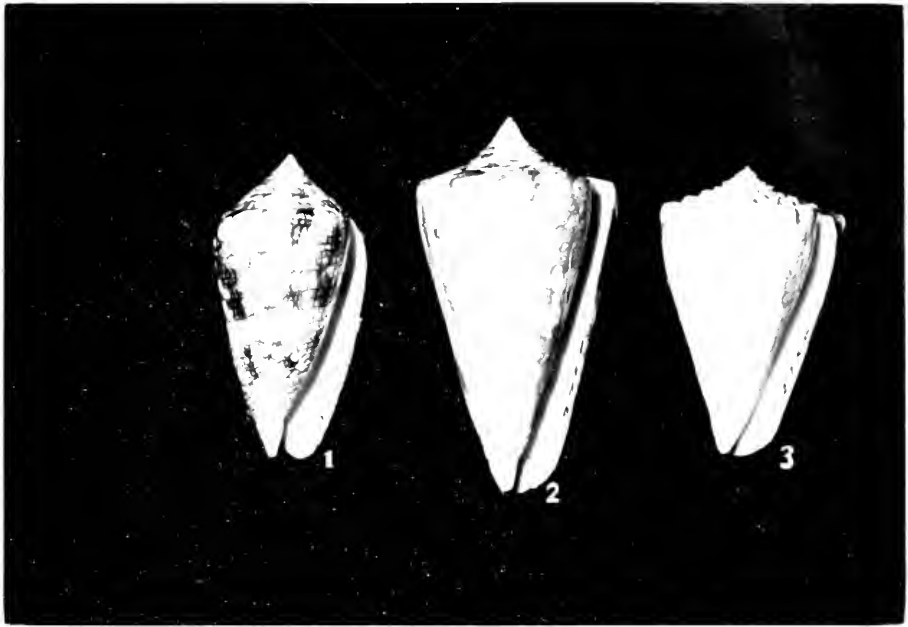




Fig. 10. *Conus tornatus* BRODERIP. Hypotype, no. 9327, (Geol. Type Coll.), from Loc. 27569 (C.A.S.), Gulf of Tehuantepec, Mexico, 28 fathoms; Templeton Crocker Exp. 1932. Length 22.5 mm., diameter 9.7 mm.; p. 39.

Fig. 11. *Conus tornatus* BRODERIP. Hypotype, no. 9328, (Geol. Type Coll.), from Loc. 27527 (C.A.S.), Acapulco, Mexico, dredged in Bay; Templeton Crocker Exp., 1932. Length 23.0 mm., diameter 9.8 mm.; p. 39.

Fig. 12. *Conus tornatus* BRODERIP. Hypotype, no. 9330, (Geol. Type Coll.), from Loc. 27588 (C.A.S.), about 13 miles southeast of Cape Tosca, Santa Margarita Island, Baja California; Templeton Crocker Exp., 1932. Length 23.4 mm., diameter 9.8 mm.; p. 39.

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Fig. 14. *Conus nux* BRODERIP. Hypotype, no. 9324, (Geol. Type Coll.), from Loc. 28346 (C.A.S.), Academy Bay, Albemarle Island, Galápagos Islands, Ecuador; W. H. Ochsner, Coll. 1906. Length 19.5 mm., diameter 12.6 mm.; p. 20.

Fig. 15. *Conus nux* BRODERIP. Hypotype, no. 9325, (Geol. Type Coll.), from Loc. 28346 (C.A.S.), Academy Bay, Albemarle Island, Galápagos Islands, Ecuador; W. H. Ochsner, Coll. 1906. Length 21.9 mm., diameter 13.5 mm.; p. 20.

Fig. 16. *Conus orion* BRODERIP. Hypotype, no. 12304, (Geol. Type Coll.), from Loc. 33144 A (C.A.S.), Venado Island, Panama. Length 28.9 mm., diameter 16.4 mm.; p. 46.

Fig. 17. *Conus californicus* HINDS. Hypotype, no. 9305, (Geol. Type Coll.), from Loc. 27600 (C.A.S.), dredged in 25 fathoms "above long spit", San Martin Island, west coast of Baja California; Templeton Crocker Exp., 1932. Length 21.2 mm., diameter 13.2 mm.; p. 58.

Fig. 18. *Conus dispar* SOWERBY. Hypotype, no. 9315, (Geol. Type Coll.), from Loc. 27584 (C.A.S.), off Cape San Lucas, Baja California, 20-220 fathoms; Templeton Crocker Exp., 1932. Length 22.5 mm., diameter 9.0 mm.; p. 32.

## PLATE 7

Fig. 1. *Conus orion* BRODERIP. Hypotype, no. 12305, (Geol. Type Coll.), from Loc. 33144 (C.A.S.), Venado Island, Panama. Length 36.5 mm., diameter 20.7 mm.; p. 46.

Fig. 2. *Conus orion* BRODERIP. Hypotype, no. 12306, (Geol. Type Coll.), from Loc. 33144 (C.A.S.), Venado Island, Panama. Length 40.7 mm., diameter 25.0 mm.; p. 46.

Fig. 3. *Conus scalaris* VALENCIENNES. Hypotype, no. 9310, (Geol. 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 Baja California, 45 fathoms. Length 47.0 mm., diameter 17.0 mm.; p. 31.

Fig. 4. *Conus californicus* HINDS. Hypotype, no. 9304, (Geol. Type Coll.), from Loc. 13988 (C.A.S.), San Pedro, California, between tides. Henry Hemphill, Coll. Length 40.0 mm., diameter 20.5 mm., length of operculum 9.5 mm.; p. 58.

Fig. 5. *Conus perplexus* SOWERBY. Hypotype, no. 9320, (Geol. Type Coll.), from Loc. 27849 (C.A.S.), Lat. 23° 12' N., Long. 106° 29' W., Gulf of California, 55 fathoms; Templeton Crocker Exp., 1932. Length 29.2 mm., diameter 14.0 mm.; p. 37.

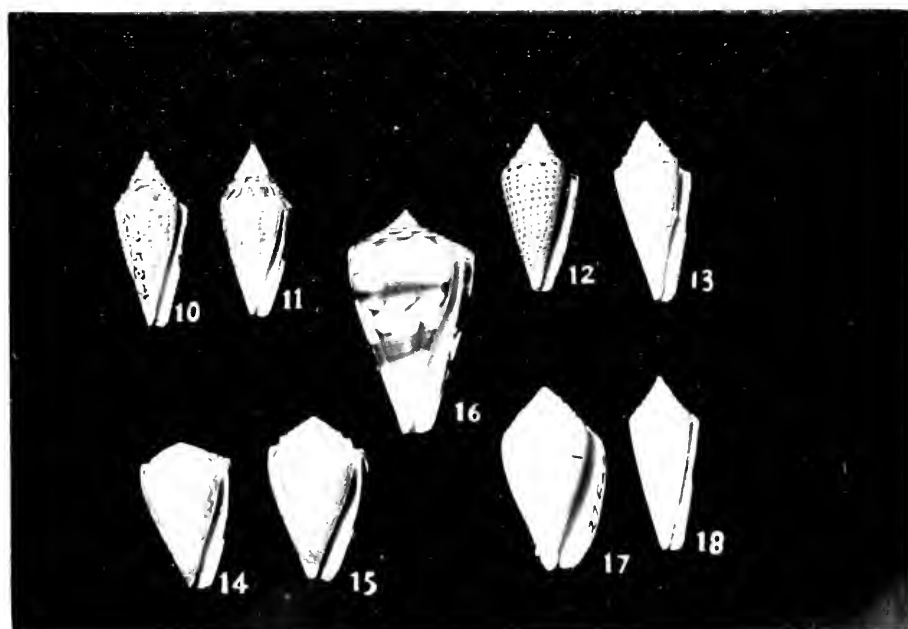
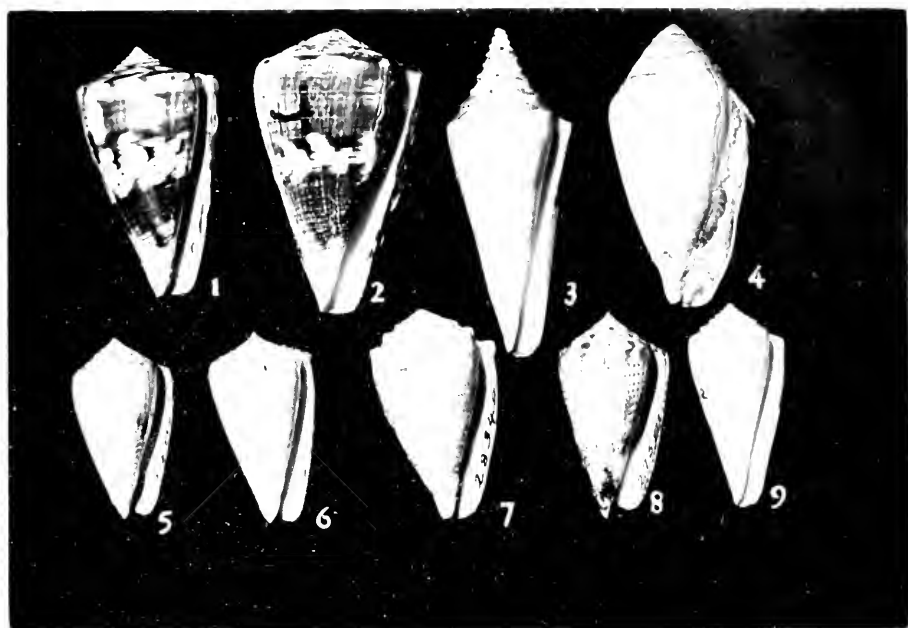
Fig. 6. *Conus tessulatus* BORN. Hypotype, no. 9332, (Geol. Type Coll.), from Loc. 1224 (C.A.S.), Huaheine Island; A. J. Garrett, Coll. Length 28.0 mm., diameter 16.0 mm.; p. 62.

Fig. 7. *Conus tiaratus* BRODERIP. Hypotype, no. 9312, (Geol. Type Coll.), from Loc. 28348 (C.A.S.), Albemarle Island, Galápagos Islands, Ecuador; W. H. Ochsner, Coll. 1906. Length 30.5 mm., diameter 18.2 mm.; p. 17.

Fig. 8. *Conus perplexus* SOWERBY. Hypotype, no. 9321, (Geol. Type Coll.), from Loc. 27581 (C.A.S.) between Isabel Island and Mazatlan, Mexico; Templeton Crocker Exp., 1932. Length 29.4 mm., diameter 16.0 mm.; p. 37.

Fig. 9. *Conus fergusonii* SOWERBY. Hypotype, no. 9318, (Geol. Type Coll.), from Loc. 17789 (C.A.S.), 3 miles off Pyramid Rock, Clarion Island, Mexico, 55 fathoms. Length 29.2 mm., diameter 14.0 mm.; p. 42.









## PLATE 8

Fig. 1. *Conus patricius* HINDS. Hypotype no. 8040, (Stanford University), from Venado Flats, Panama Bay; W. D. Clark, Coll Length 140 mm., diameter 89.5 mm.; p. 49.







## PLATE 9

Fig. 1. *Conus diadema pemphigus* DALL. Holotype of *Conus brunneus pemphigus* DALL, no. 37449 A, (U.S. Nat. Mus.) from Tres Marias Islands, Mexico. Length 26.0 mm., diameter 17.0 mm.; p. 16.

Fig. 2. *Conus orion* BRODERIP. Holotype of *Conus drangai* SCHWENGEL, no. 617612, (U. S. Nat. Mus.), from Salinas Bay, Costa Rica; Ted Dranga, Coll. Length 32.0 mm., diameter 18.5 mm.; p. 46.

FIG. 3. *Conus tiaratus* BRODERIP. Holotype of *Conus roosevelti* BARTSCH & REHDER, no. 472854, (U. S. Nat. Mus.), from Magdalena Bay, Lower California. Length 15.3 mm., diameter, 9.6 mm.; p. 17.

Fig. 4. *Conus recurvus* BRODERIP. Holotype of *Conus magdalenensis* BARTSCH & REHDER, no. 472521, (U. S. Nat. Mus.), from Magdalena Bay, Baja California, 10-15 fathoms; Waldo L. Schmitt, Coll. Length 33.6 mm., diameter 15.3 mm.; p. 27.

Fig. 5. *Conus tessulatus* BORN. Holotype of *Conus edaphus* DALL, no. 130385, (U. S. Nat. Mus.), from Clarion Island, Revillagigedo Group, Mexico, 31 fathoms. Length 25.0 mm., diameter 14 mm.; p. 62.

Fig. 6. *Conus ebraeus* LINNAEUS. Hypotype, no. 12307, (Geol. Type Coll.), from Loc. 37062 (C.A.S.), Clipperton Island, Mexico; E. C. Allison, Coll. Length 41.4 mm., diameter 27.8 mm.; p. 61.

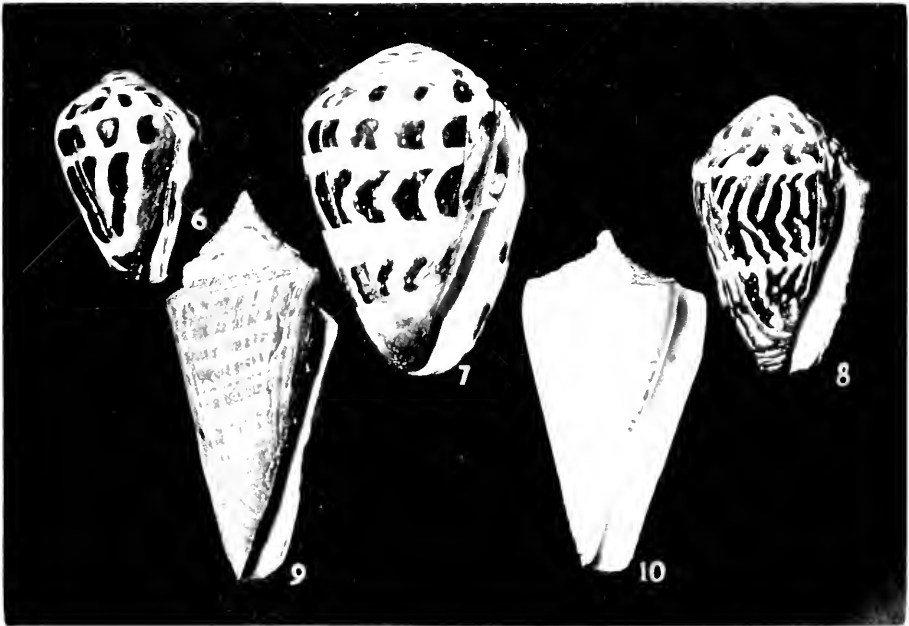
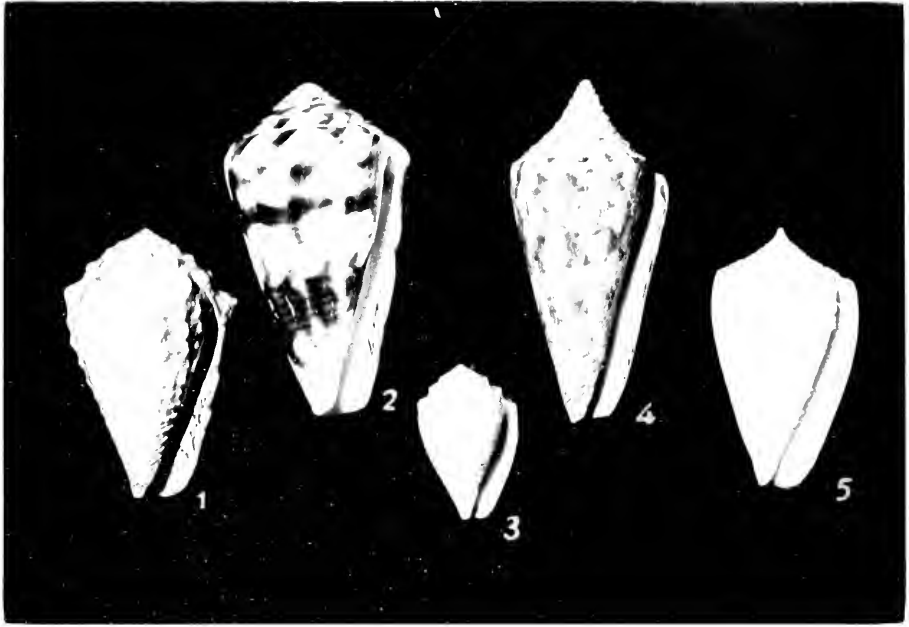
Fig. 7. *Conus ebraeus* LINNAEUS. Hypotype, no. 12308, (Geol. Type Coll.), from locality as fig. 6. Length 35.6 mm., diameter 22.3 mm.; p. 61.

Fig. 8. *Conus ebraeus* LINNAEUS. Hypotype, no. 12309, (Geol. Type Coll.), from Loc. 37062 (C.A.S.), Clipperton Island, Mexico; E. C. Allison, Coll. Length 27.0 mm., diameter 19.3 mm. p. 61.

Fig. 9. *Conus regularis* SOWERBY. Hypotype, no. 12303, (Geol. Type Coll.), from Loc. 33236 (C.A.S.), Lagoon at Miramar, Guaymas, Mexico; John Strohbeen, Coll. Length 48.5 mm., diameter 21.0 mm.; a form characteristic of this locality; p. 29.

Fig. 10. *Conus fergusonii* SOWERBY. Hypotype, no. 12310, (Geol. Type Coll.), from Loc. 17974 (C.A.S.), Judas Point, Costa Rica. (N.Y.Z.S.) Loc. no. 214-D-1. Length 42.8 mm., diameter 23.0 mm.; to show spotting; p. 42.









## PLATE 10

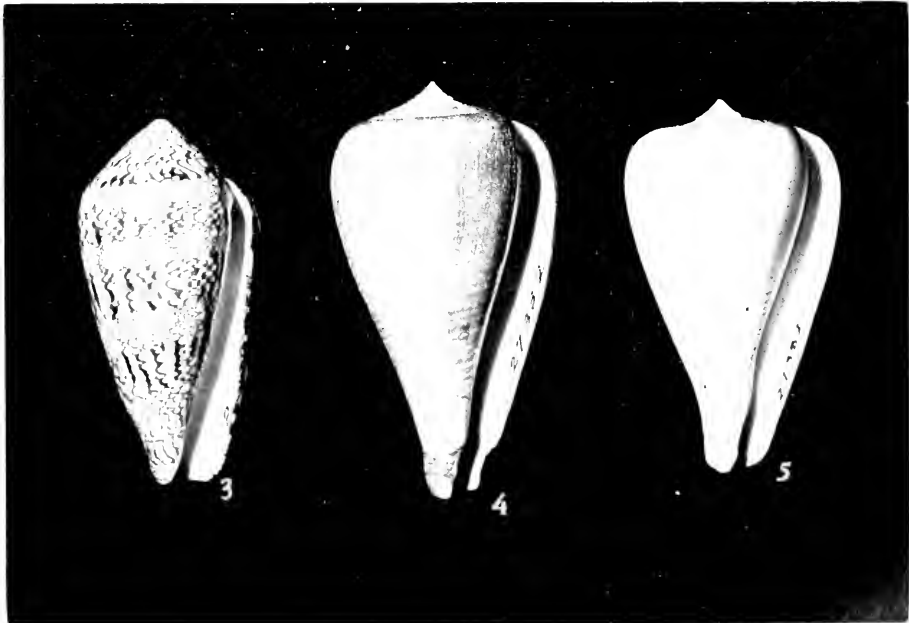
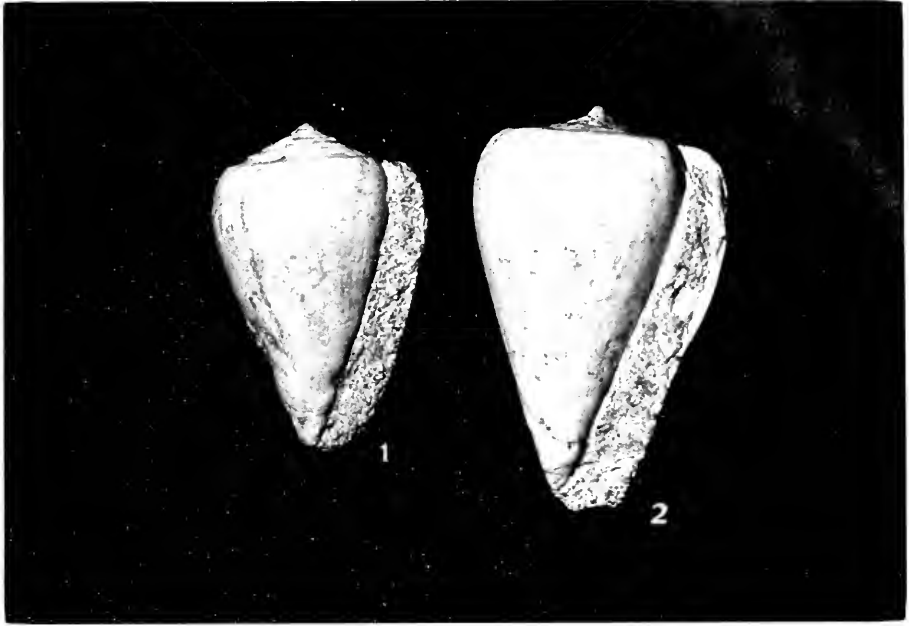
Fig. 1. *Conus durhami* HANNA & STRONG. Holotype, no. 34200, (Univ. Calif. Mus. Paleo.), from Loc. A 1269 (U.C.), south side of Carrizo Mountain, Imperial County, California. Pliocene. Length 39.5 mm., diameter 25.5 mm.; p. 56.

Fig. 2. *Conus bramkampii* HANNA & STRONG. Holotype, no. 34199, (Univ. Calif. Mus. Paleo.), from south side of Carrizo Mountain, Imperial County, California. Pliocene. R. A. Bramkamp, Coll. Length 48.0 mm., diameter 30.5 mm.; p. 64.

Fig. 3. *Conus dalli* STEARNS. Hypotype, no. 9290, (Geol. Type Coll.), from Loc. 24108 (C.A.S.), Maria Magdalena Island, Tres Marias Group, Mexico; G D. Hanna & E. K. Jordan, Colls., 1925. Length 50.0 mm., diameter 26.8 mm.; p. 54.

Fig. 4. *Conus patricius* HINDS. Holotype, no. 9347, (Geol. Type Coll.), from Loc. 27332 (C.A.S.), San Juan Del Sur, Nicaragua; H. N. Lowe, Coll. Length 57.0 mm., diameter 31.0 mm.; p. 49.

Fig. 5. *Conus patricius* HINDS. Hypotype, no. 9346, (Geol. Type Coll.), from Loc. 27332 (C.A.S.), San Juan del Sur, Nicaragua; H. N. Lowe, Coll. Length 51.0 mm., diameter 29.5 mm.; p. 49.







## PLATE 11

Fig. 1. *Conus tessulatus* BORN. From the Hwass collection in the Muséum d'Histoire Naturelle, Geneva, Switzerland. Length 49.5 mm., diameter 32 mm.; p. 62.

Fig. 2. *Conus vittatus* HWASS in BRUGUIÈRE. From the Hwass collection in the Muséum d'Histoire Naturelle, Geneva, Switzerland. Length 38.0 mm., diameter 22 mm.; p. 44.

Fig. 3. *Conus tessulatus* BORN. From the Lamarck collection in the Muséum d'Histoire Naturelle, Geneva, Switzerland.

Fig. 4. *Conus tessulatus* BORN. Opposite side of specimen shown in figure 3.

Fig. 5. *Conus tessulatus* BORN. Top view of specimen shown in figure 1.

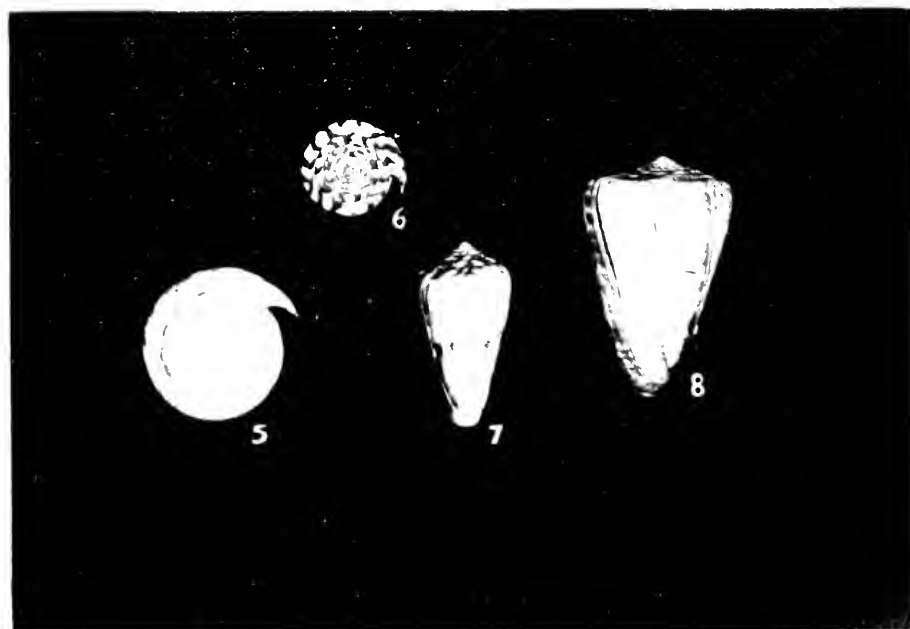
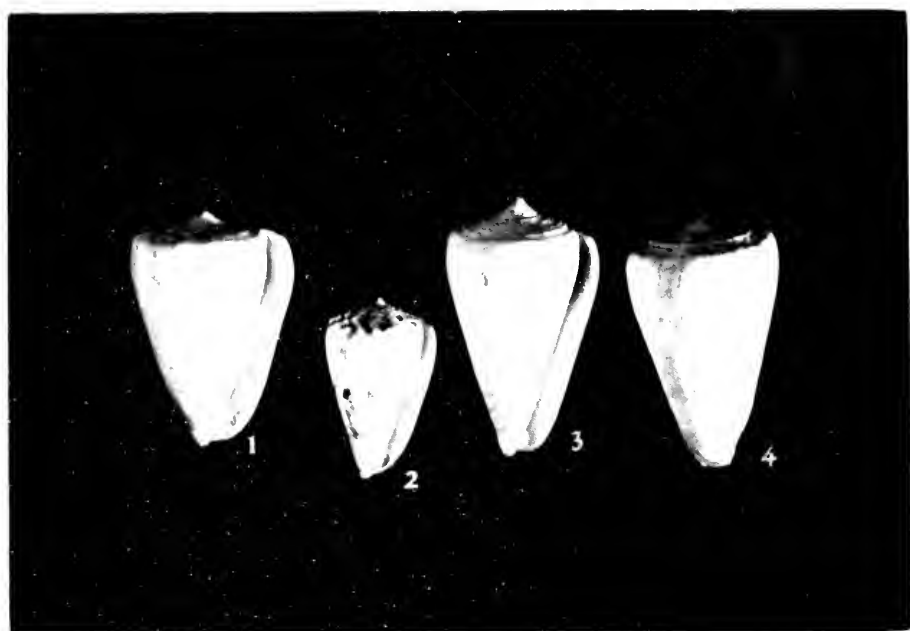
Fig. 6. *Conus vittatus* HWASS in BRUGUIÈRE. Top view of specimen shown in figure 2.

Fig. 7. *Conus vittatus* HWASS in BRUGUIÈRE. From the Hwass collection in the Muséum d'Histoire Naturelle, Geneva, Switzerland. Length 37.2 mm., diameter 20.0 mm.; p. 44.

Fig. 8. *Conus tessulatus* BORN. Opposite view of the specimen shown in figure 1.

The photographs from which all of the figures on this plate were made were furnished by Dr. K. Bender, Muséum d'Histoire Naturelle, Geneva, Switzerland.







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