The Festivus

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THE FESTIVUS

SAN DIEGO SHELL CLUB

FOUNDED 1961 • INCORPORATED 1968

MEETS THIRD THURSDAY, 7:30 P.M.
ROOM 104, CASA DEL PRADO, BALBOA PARK

VOLUME XIII JANUARY - NOVEMBER 1981

no #5 - May 1981

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SAN DIEGO SHELL CLUB

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ROOM 104, CASA DEL PRADO, BALBOA PARK

ANNUAL DUES: Payable to San Diego Shell Club Inc. Single membership: $4.00; Family membership: $5.00; Student membership: $3.00; Overseas surface: $6.00.

CLUB ADDRESS: Address all correspondence to San Diego Shell Club, Inc. c/o 3883 Mt. Blackburn Ave., San Diego, California 92111

VOL. XIII JANUARY 1981 NO. 1

PROGRAM: Peter Williams will give a talk entitled, "Reef Walking on Okinawa." He will accompany his presentation with slides.

Slides of the Christmas party will be shown.

Cypraea and their allied genera will be the featured shells at this meeting. Bring your *Cyphoma*, *Ovula*, *Cypraea*, *Simnia* , and *Jenneria* for display.

Date: January 15, 1981 Time: 7:30 P.M. Room: 104

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OBSERVATIONS ON TWO PROBLEM SPECIES FROM THE INDO PACIFIC

BY

ANTHONY D'ATTILIO

Department of Marine Invertebrates, Natural History Museum, Balboa Park
P.O. Box 1390, San Diego, California 92112

Several specimens each of two species of *Murex s.s.* were submitted to me recently for identification by Manfred Blöcher of West Germany. Precise determination of these two species requires zoogeographic field work and a great deal more material.

The shell characters of one of the species closely resembles *Murex kiiensis* Kira, 1959 (known geographical range from southeastern Japan to the central Philippines). The specimens studied were from Madagascar off southeastern Africa in the Indian Ocean. They were collected by Manfred Blöcher. Figures 1a, 1b, 2a, and 2b are illustrations of two of the Madagascar specimens. The protoconch has 2½ whorls (Figure 3) as in *Murex kiiensis*.

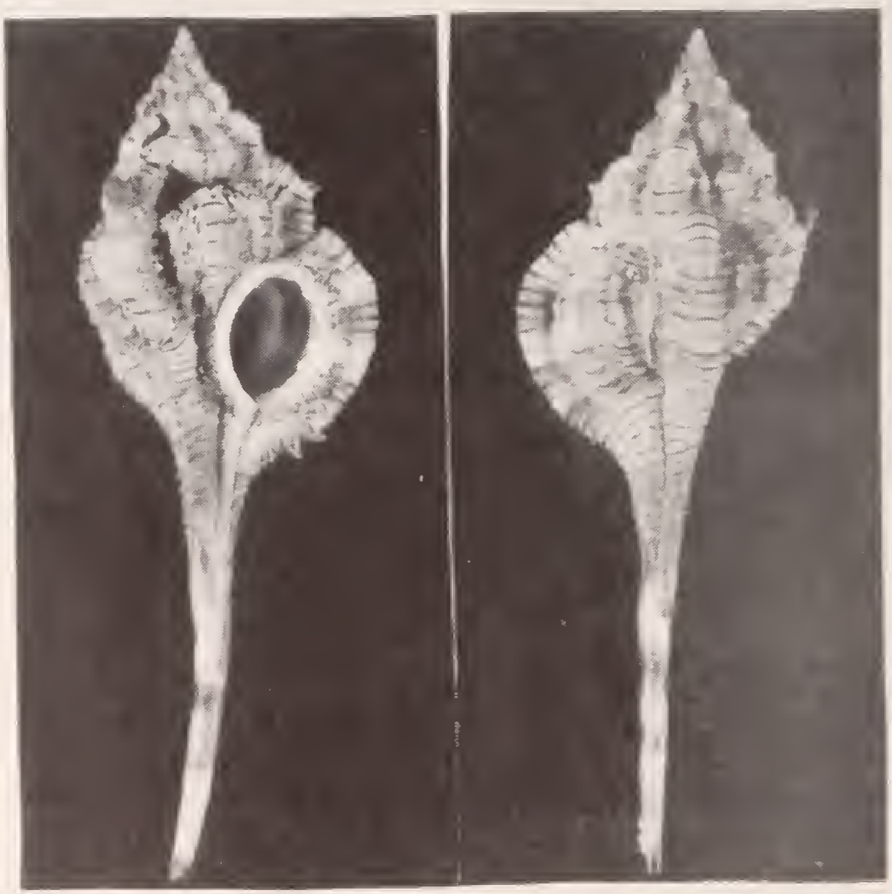

Fig. 1a. Apertural view Fig. 1b. Dorsal view
Specimen from Madagascar showing poor development of spines.

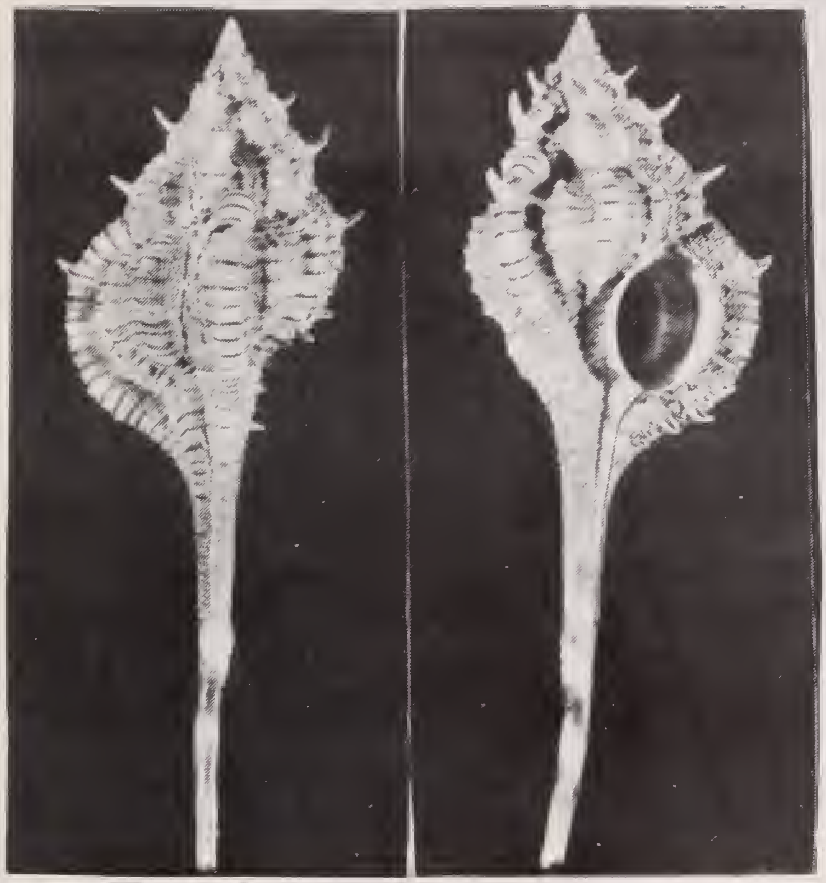

Fig. 2a. Fig. 2b.

Specimen from Madagascar showing small but well developed spines.

The type illustration of *M. kiiensis* is in Kira, 1955:pl. 23, fig. 10. It is listed as a Kuroda MS name. There is no text. It is first illustrated with a description (still referred to Kuroda MS) in 1959. The description is in Japanese and does not describe the protoconch or mention the existence of a holotype. A later edition of Kira's work (1962) is in English with only a few indications of descriptive data.

The presently known range of *Murex hirasei* Hirase, 1914-15 is the same as *M. kiiensis* both being found from southeastern Japan to the Philippines. The specimens I examined were from Mactan Island in the Bohol Straits between Cebu and Bohol. They are Figures 4a, 4b, 5a and 5b. These specimens, outwardly very similar to *Murex hirasei*, have a protoconch of 1½ polished whorls as shown in Figure 6.

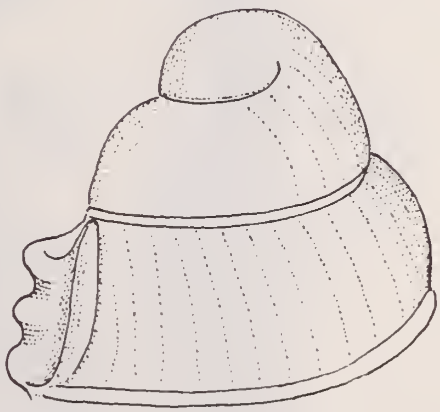

Fig. 3. Protoconch of specimen from Madagascar

Fig. 4a. Apertural view Fig. 4b. Dorsal view

Specimen from Mactan Island with weakly developed spines on canal.

Fig. 5a. Fig. 5b.

Specimen from Mactan Island lacking spines on the canal.

A number of other specimens of *M. hirasei* collected off Japan and the Philippines were studied. They proved that this species has a protoconch of 2½ whorls. Though otherwise apparently similar, the two species are distinctive based on the number of whorls in the protoconch.

At this time I have planned no further studies to resolve the precise identification of these species, since Dr. Winston Ponder is preparing an extensive monograph on *Murex s.s.*

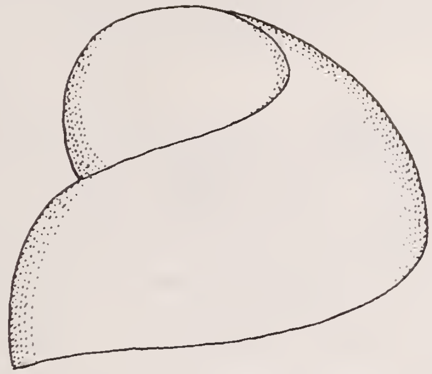

Fig. 6. Protoconch of specimen from Mactan Island.

A NOTE ON THE TYPE FIGURE OF *MUREX HIRASEI* AND ITS AUTHOR YOCHIRO HIRASE

The type of *Murex hirasei* in ILLUSTRATIONS OF A THOUSAND SHELLS by Hirase (1914-1915) is a colored wood block illustration with no description (Figure 7). The name is assigned to Dautzenberg in the index to the volume but was never published by that author. The illustration appears in a series of volumes meant to be of purely artistic value and each volume of the ten promised by Hirase was to contain 100 specimens. However, health and financial problems forced Hirase to cease publication upon completion of the fourth volume. Thus, the work comprises illustrations of only 400 species. The species on each plate of the accordian type ancient Oriental book are organized in a visually pleasing manner with no systematic arrangement. This concept was a deliberate one as explained in a foreward by Yochiro Hirase. The books were meant to be an aesthetic memorial to his life work in malacology. Single-handedly this extraordinary man of dedicated purpose created the science of malacology for his country in the earliest years of this century. These four volumes remain a fitting memorial not only to the man but to the spirit of aesthetic appropriateness characteristic of the Japanese people.

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Fig. 7. *Murex hirasei* from original illustration

Acknowledgments

Mr. Manfred Blöcher of West Germany kindly submitted the specimens studied and Mr. L.J. Bibbey of Imperial Beach and Mr. Don Pisor of San Diego helped with the loan or contribution of comparison material. The excellent photography of the specimens is by David K. Mulliner, Festivus staff photographer.

Literature Cited

Hirase, Yochiro. 1914-1915. ILLUSTRATIONS OF A THOUSAND SHELLS. Parts 1-4 not paginated. [a woodcut illustration in color without description of any kind (pl. 47, fig. 232)]. Kyoto, Japan.

Kira, Tetsuaki. 1955. COLORED ILLUSTRATIONS OF THE SHELLS OF JAPAN. 204 pp., 67 pls. Osaka, Japan. The first Japanese edition. [The species name *Murex kiiensis* is referred to Kuroda MS]. Notes of the plate in Japanese appear on pp. 148-149. Illustration on p. 47, pl. 23, fig. 10.

1959. COLORED ILLUSTRATIONS OF THE SHELLS OF JAPAN. 239 pp., 71 pls. [Species reference still uses Kuroda MS for the author and gives the text and description in Japanese (p. 58, pl. 23, fig. 10)].

1962. SHELLS OF THE WESTERN PACIFIC IN COLOR. Vol. 1. 224 pp., 72 pls. [An enlargement of the original 1955 plate (p. 63, pl. 24, fig. 10) The description is too generalized to further identify the species and there is no indication of the locality of the holotype].

A NEW BOOK ON THE MARINE INVERTEBRATES OF CALIFORNIA

BY

BARBARA W. MYERS

Department of Marine Invertebrates, Natural History Museum, Balboa Park
P.O. Box 1390, San Diego, California 92112

Intertidal Invertebrates of California
by Robert H. Morris, Donald P. Abbott and Eugene C. Haderlie
Stanford University Press, Stanford, California
$30.00. 690 pages, 200 plates.

This is a well researched study of the common marine invertebrate fauna to be found along the coast of California. It covers the major groups with large sections on the mollusks, arthropods, echinoderms and the tunicates.

Robert H. Morris took the majority of the 900 photographs, while Donald P. Abbott and Eugene C. Haderlie were responsible for the text aided by 31 contributing specialists. All photographs are in color with the exception of the Foraminifera and there is at least one photo for every species treated. For some species there are two or three photos to show variation or color forms. Some photos are especially

spectacular, but there are others in which the color seems faded. *Norrisia norrisi* (Sowerby, 1838) pl. 74, fig. 13.30, for instance, which shows up as a yellow shell with a white animal, is a chocolate brown shell with a crimson animal. Most species, however, can be identified from these well executed photographs. *Pteropurpura festiva* (Hinds, 1844) has been mislabelled *Maxwellia gemma* (Sowerby, 1879). Robert H. Morris has done an outstanding job in assembling this collection of fine photographs. Many of the very small pen and ink drawings, also by Morris, did not reproduce well and have limited use as identification aids.

The text is a natural history treatment of the invertebrates rather than a taxonomic or descriptive work. An introduction to each chapter gives general information about each group. In the discussion of each species, the authors, Abbott and Haderlie, have brought together the known information regarding habitat, biology, life history, reproduction, range, etc. This was a prodigious task and merits high praise. References to the pertinent literature both as general information concerning the different phyla and major works relating to each species abound throughout the text and will be invaluable to any researcher in the marine sciences of this coast.

Disclaiming responsibility as a systematic or taxonomic work, the authors have followed their own design in the order in which they have arranged the phyla. For instance, if you turn to the last chapter expecting to find the tunicates, you will be instead reading about the crustaceans. One realizes that continued controversy exists regarding the systematic arrangement of the phyla, but in a book this size a familiar system might have been more convenient. Within the phylum Mollusca, the authors' classification shows careful research. Dr. A. Myra Keen acted as advisor on the gastropods and bivalves and the book closely follows Keen's Sea Shells of Tropical West America (1971). Although the gastropods are classified into superfamilies, the bivalves are not. The opisthobranchs clearly differ from Keen (1971) and the authors refer to other studies for further information regarding their systematic arrangement. The Polyplacophora seem to follow A.G. Smith's work on this group in Treatise on Invertebrate Paleontology (1960).

This is a major work with evidence of intensive scholarly research and I think it will be one of the classic studies of the invertebrate fauna of our coast. The authors received a grant of offset publishing costs and, therefore, can offer this impressive volume at a price most of us can afford. In my opinion this is one of the best book bargains of the year.

LIBRARY NOTES

The Club would like to thank Virginia and George Hanselman for the donation of the following publications to the Club library.

INDO PACIFIC SEA SHELLS, Sally Diana Kaicher, 1956
NATICIDAE, TONNACEA & Cypraeacea, Sally Diana Kaicher, 1956
SHELLS, Mani O'Mara, 1956
SOWERBY ON MUREX (1967 facsimile edition) G.B. Sowerby, 1879
Two new species and a new subgenus of lucinids, SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY, #129, Joseph C. Britton, 1972
CATALOGUE OF LIVING CYPRAEIDAE, Walter Cernohorsky, 1963
LIST OF CHAMPIONS, Lost Operculum Club, 1973.

The following are missing from the library. Their return would be appreciated.

The VELIGER 16(4) and 20 (1)
The FESTIVUS 1978 numbers 1,4,6,8 and 10
1979 numbers 4 and 5

BELLASPIRA GRIPPI (DALL, 1908)(GASTROPODA: TURRIDAE)

BY

BARBARA W. MYERS

Department of Marine Invertebrates, Natural History Museum, Balboa Park
P.O. Box 1390, San Diego, California 92112

Bellaspira grippi (Dall, 1908)

Bela grippi Dall, 1908:137.
Lora grippii (Dall).--Dall,1921:74.
Lora grippi (Dall).--Dall, 1921:pl. 3, fig. 8.
Bellaspira grippi (Dall).--McLean & Poorman, 1970:8,9, figs. 12-15; Abbott, 1974:276, fig. 3131.

Fig. 1 *Bellaspira grippi* (Dall, 1908)

The excellent photographs taken by Festivus staff photographer, David K. Mulliner, show a live specimen of *Bellaspira grippi* (Dall, 1908). The black eye dot at the end of the short tentacle is apparent in Figure 1 and the dark, leaf shaped operculum is clearly visible on the milk white animal as shown in Figure 2. The specimen was collected by David J. Myers in August 1980 at 70 feet off Pt. Loma, San Diego, California, and measures 12 mm by 4.5 mm. This specimen is retained in the Myers' collection.

Dall originally assigned this species to the genus *Bela* Gray, 1847. However, Iredale (1915) and Dall (1918) erroneously concluded that *Bela* was a synonym of *Mangelia* Risso, 1826. This was based on a misconception of the types; they believed the type species was the same for both *Bela* and *Mangelia*. Dall (1921) then reassigned *B. grippi* to the genus *Lora* Gistel, 1848, misspelling the species name (grippii) in the text. Grant and Gale (1931) suggested *Lora grippi* belonged to the genus *Bellaspira* Conrad, 1868. McLean and Poorman (1970) confirmed this generic placement and their four figures show the variability of this species.

Fig. 2 *Bellaspira grippi*

The color ranges from white to

flesh, some having brown banding on the shoulder. Specimens can be strongly tabulate with the axial ribs forming nodes at the periphery. The spiral sculpture in some specimens is of deeply incised lines. Our specimen is flesh-colored with brown banding, not tabulate, the axial ribs are not noded and the spiral sculpture is of faint spiral lines.

Bellaspira clarionensis McLean and Poorman, 1970, from Clarion Island, Revillagigedo Islands, Mexico, seems very similar to *B. grippi*, differing in its larger size (13.5 mm by 5.9 mm), having a narrower shoulder area and more numerous spiral striae. Abbott (1974) states they may be the same.

B. grippi ranges from Redondo Beach, California to Asunción Island, Baja California and Guadalupe Island, Mexico (McLean and Poorman, 1970).

Literature Cited

Abbott, R. Tucker. 1974. AMERICAN SEASHELLS, Second Edition. Van Nostrand Reinhold. 663 pp. 24 pls.

Dall, William H. 1908. Some new California shells. NAUTILUS 21:136-137.

1918. Notes on the nomenclature of the Mollusks of the family Turritidae. PROC. USNM 54:313-333.

1921. Summary of the marine shellbearing mollusks of the northwest coast of America from San Diego, California to the Polar Sea, etc. USNM BULL. 112:1-217. 22 pls.

Grant, U.S.,IV and H.R. Gale. 1931. Catalogue of the marine Pliocene and Pleistocene Mollusca of California and adjacent regions. SAN DIEGO NAT. HIST. MEM. 1. 1036 pp. 32 pls.

Iredale, T. 1915. Some more misused molluscan generic names. PROC. MALAC. SOC. LONDON. 11:291-306.

McLean, James H. and Leroy H. Poorman. 1970. Reinstatement of the turrid genus *Bellaspira* Conrad, 1868 (Mollusca: Gastropoda) with a review of the known species. CONTRIB. IN SCI. LACM(NH) 189: 11 pp. 16 figs.

FOR YOUR INFORMATION

The American Malacological Union will conduct its 50th Anniversary Meeting in Ft. Lauderdale, Fla., 19-25 July 1981. The meeting will include the regular sessions of scientific papers, lectures, and exhibits on molluscan subjects. Field trips encompass freshwater, terrestrial and fossil habitats. A special symposium will be conducted: "Functional Morphology and Ontogeny of Mollusca as applied to Higher Category Systematics," organized and chaired by Richard S. Houbrick. Additional information and registration forms are available from: Richard S. Houbrick, Dep't. of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.

The Western Society of Malacologists (WSM) annual conference will be held in San Diego (at San Diego State University) from June 23-26, 1981. The San Diego Shell Club will host this meeting. Further details will be forthcoming.

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: November 20, 1980

BY

CAROL BURCHARD

Vice President David Mulliner called the meeting to order at 7:50 P.M. and introduced speaker John Duffy, marine biologist with the Department of Fish and Game. He gave an informative slide presentation on diving in Australia. He showed his underwater slides of the flora and fauna of and about Heron Island, Queensland, and Gun Island, Western Australia. John was part of an archeological expedition exploring the 1727 ruin of the Dutch merchant ship 'Zeewyk'.

After the refreshment break the Club officers for 1981 were approved by acclamation. The new officers are: President: Carol Burchard; Vice President: Ron McPeak; Recording Secretary: Marty Schuler; Corresponding Secretary: Marge Bradner; Treasurer: Walter Robertson; Editor: Carole Hertz.

Barbara Myers, Librarian, announced that several *Veliger* and *Festivus* issues are missing and requested that they be returned (see Library News). She also encouraged members to contribute any unwanted back issues of *The Festivus* to the Club Library. The meeting was adjourned at 9:20 P.M.

SAN DIEGO SHELL CLUB CHRISTMAS DINNER: December 13, 1980

BY

CAROL BURCHARD

The annual San Diego Shell Club Christmas party was held at the La Sala Room of the Cafe Del Rey Moro. After a lively cocktail hour at which the thirty-one members and guests attending caught up on holiday events and the pleasure of seeing old friends, all sat down in the beautifully decorated room for a very pleasant dinner.

Marty Schuler presided over the evening's agenda as dapper Master of Ceremonies. Outgoing President Sandie Seckington presented gifts of appreciation to members who had helped her and the Club throughout the year. The 1981 officers were installed and applauded. Following this the popular shell exchange drew much excitement.

A highlight of the evening was the Christmas choral program presented by the very talented Madison High Honor Ensemble under the direction of Mr. Gilbert Sloan. Later Club members gathered around the piano and enthusiastically sang carols and folk tunes as played by Carole Hertz.

The evening passed too quickly and everyone left in the real holiday spirit.

CHANGES OF ADDRESS

Everson, Gene 5224 N.W. 17th Court, Lauderhill, Fla. 33313
Herrmann, Richard c/o U.N.E.X.O., Box F-2433, Freeport, Lucay, Bahamas
Mabry, Billee & Don c/o Bratcher, 8121 Mulholland Terrace, Hollywood, Ca. 90046

NEW MEMBERS

Coan, Eugene V. 891 San Jude Ave., Palo Alto, Ca. 94306
Williams, Loralynn 29841 Knollview Dr., Rancho Palos Verdes, Ca. 90274

DUES ARE DUE. Make checks payable to San Diego Shell Club, Inc. and send to the Club address (See front page).

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President..................Carol Burchard
Vice President.............Ron H. McPeak
Rec. Secretary.............Martin Schuler
Corres. Secretary..........Marjorie Bradner
Treasurer..................Walter Robertson
Editor.....................Carole M. Hertz

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VOL. XIII FEBRUARY 1981 NO. 2

PROGRAM: Carol Skoglund will give a talk entitled, " Dredging for Mollusks." She will accompany her presentation with slides.

Date: February 19, 1981 Time: 7:30 P.M. Room: 104

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Coralliobia fimbriata in shallow waters of Hawaii
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CORALLIOBIA FIMBRIATA IN SHALLOW WATERS OF HAWAII

BY

BEATRICE AND THOMAS BURCH

236 Kuuhoa Place, Kailua, Hawaii 96734

Recently, the JANTHINA VII has dredged several of the interesting coral loving, free living *Coralliobia fimbriata* (A. Adams, 1854). Two large living *Coralliobia* of 27 mm were found on the underside of *Leptoseris scabra* Vaughn, 1907 in 45-50 fathoms near Waikiki in Mamala Bay, Oahu. Figures 1 and 2 show the dorsal and ventral views of an adult *Coralliobia*.

Fig. 1 Dorsal view of adult *Coralliobia fimbriata*, 27 mm

Fig. 2 Ventral view of adult *Coralliobia fimbriata*, 27 mm

The living specimens were found with the siphonal canal facing towards the outer margin of the coral and were creamy tan. The body of the large *C. fimbriata* is white with a faint peach-pink operculum. The black eyes lay at the base of short tentacles. Sculpture of the shell is formed of highly frilled lamellae overlaid by spirally radiating cords. A striking feature of the species is the elaborate layering which surrounds the aperture and which eventually completely encloses the siphonal canal. The aperture is white. Researchers have never found a radula, so it is supposed that feeding is suctorial. The *Coralliobia* formed a depression at their site and modification of the coral growth was quite evident. A fine sprinkling of the sessile foraminifer *Miniacina miniacea* (Pallas, 1766) is on the shell and coral. Occurring inside the mantle cavity of the shell was a translucent white commensal pinnotherid crab which left the shell during photography.

Two recently dead shells, one of 5 mm and the other of 7 mm were taken in coral rubble near Lahaina, Maui in 40 fathoms. Views of the 5 mm specimen are shown in

Figures 3,4, and 5.

Fig. 3 Dorsal view *C. fimbriata*, 5 mm

Fig. 4 Ventral view, *C. fimbriata*, 5 mm

This species of *Coralliobia* was originally described by A. Adams in 1854 from the Cuming collection. Specimens were taken from coral reefs at Cagayan, Philippines. A. Adams referred it to *Concholepas* subgenus *Coralliobia* because of its resemblance with the dilated aperture of *Concholepas* although recognizing its affinities to *Leptoconchus* and perhaps to *Pedicularia*. Tryon (1883) followed H. and A. Adams (1854) who placed it under *Leptoconchus* although their definition of *Leptoconchus* stresses that it lacks an operculum. Smith (1899) illustrated the large specimen, such as we found here in Hawaii, from a specimen in the China Seas and pointed out its differences to the Adams specimen. In 1941, Teng-Chien Yen reviewed the Chinese gastropods in the British Museum and gave the Smith specimen a new species name of *C. smithi*

Fig. 5 Lateral view, *C. fimbriata*, 5 mm

feeling that it differed sufficiently from the original specimen. He may be correct, but following Habe (1971), Smith (1899) and Kay (1979), I place them all as varying forms and ages of *Coralliobia fimbriata*.

D'Attilio (1978) listed 270 species names and 27 genera. In 1979 he further listed 17 more species and two more genera, so this worldwide family is large, but many of those names must be synonyms. D'Attilio (1978) wrote that Coralliophilidae occur in coral from intertidal to more than 1000 fathoms extending back to the Upper Cretaceous with most species having fine or coarse spiral cords crossed by prominent scaly lamellae. Apertures in this family are frequently frilled, some even with internal lirae. Although usually the shells are creamy white, many are in shades of pink, lavender and yellowish orange. D'Attilio (1972) described the protoconch as variably smooth or finely transversely lamellated.

One of the adult specimens Lot#76477 and two juvenile specimens Lot#76478 of the *Coralliobia fimbriata* have been accessioned into the collection of the San Diego Natural History Museum and one adult on its coral will be accessioned into the molluscan collection of the USNM-NH in the Smithsonian Institution.

The earlier specimens found in the National Museum collection were from the Thaanum Hawaiian collection from Waikiki in 22-23 fathoms taken in 1917. The Smithsonian Institution has a small collection of this species from the Bay of Bengal, similar in shape to this and two others similar to those illustrated in Habe (1971) from the Caroline Islands and from Mauritius.

We wish to express our gratitude to Dr. Joseph Rosewater, Division of Mollusks, Smithsonian Institution, for the use of the molluscan facilities and the library. Our thanks go to Debbie Robertson of the Department of Invertebrate Zoology of that same institution, for furnishing identification of the corals, to Anthony D'Attilio, San Diego Natural History Museum, Department of Marine Invertebrates, for his interest and suggestions on this paper.

Table 1

SITES OF *C. FIMBRIATA* DREDGED FROM THE JANTHINA VII

Station	Date	Site	Lat./Long.	Depth in fms	Bottom	Size in mm
79054	9 Sept. 1979	Maui	020°49.3"N 156°42.2'W	40	s., coral rubble	5
"	"	"	"	"	"	7
(specimens found in the coral rubble)						
80010	3 Feb. 1980	Oahu	021°16.5'N 157°51.7'W	40-50	s., coral	27
"	"	"	"	"	"	27
(live specimens on live *Leptoseris scabra*)						

Selected References

Adams, Arthur

1854. Descriptions of a new genus, and of several new species of mollusks from the Cumingian collection. Proc. Zool. Soc. London 1852, Pt. 20:92-95.

Adams, Henry and Arthur

1853-1858. The Genera of Recent Mollusca. Vols. 1-3:1-661, pls. 1-138. London: John Van Voorst.

D'Attilio, Anthony
1972. Remarks on Coralliophilidae (Gastropoda, Muricacea). The Festivus, 3(8):2-5, figs. 1-16.
1978. Superfamily: Muricacea a catalogue of Coralliophilidae. The Festivus, 10(10):69-96.
1979. Corrections and additions to the catalogue of the family Coralliophilidae. The Festivus, 11(10):83-85.

Habe, Tadashige
1964. Shells of the Western Pacific in Color. Volume 2. 233 pp., 66 pls. Osaka: Hoikusha Pub. Co., Ltd. (1971 printing).

Kay, E. Alison
1979. Hawaiian Marine Shells Reef and shore fauna of Hawaii, Section 4: Mollusca. 653 pp., 195 figs. Honolulu: Bishop Museum Press.

Smith, Edgar A.
1899. Notes of marine shells from north-west Australia, with descriptions of a new species. Proc. Malac. Soc. London, 3(6):311-314, figs 1-5.

Tryon, George W.
1881-1884. Structural and Systematic Conchology. 1195 pp., 140 pls. Philadelphia: Author publication.

Yen, Teng-Chien
1942. A review of Chinese gastropods in the British Museum. Proc. Malac. Soc. London, 24:170-289, pls. 11-28.

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: JANUARY 15, 1981

BY

MARTIN SCHULER

The first meeting of the new year was called to order at 7:40 P.M. by the new president, Carol Burchard. Guests and seldom seen members were introduced.

Pete Williams then gave his talk on collecting in Okinawa. It was extremely interesting because it covered all aspects of shelling from reef walking to scuba diving. Several high points of the talk were the fluctuation of the tides around the island, and the fact that anything can be purchased on Okinawa provided that you have the money. A basketball watermelon sells for about $20.00! His talk was profusely illustrated with slides and he also brought many specimens that he acquired while there as well as distributing maps of the area and lists of species collected to the members.

Wally Robertson mentioned several books available to Club members at his cost and reported that Jean Musgrove has the March 1969 National Geographic for sale.

After the break, the November minutes were approved and it was announced that Carol Skoglund would be the speaker for February. The president announced the following committees: Library, Barbara Myers and assistant Margaret Mulliner; Hospitality, John Sage; Telephone, Pat Sage; and David Mulliner as Mentor/ Parliamentarian and Technical Advisor for WSM.

The Club voted to purchase the book, Intertidal Invertebrates of California. Carol Burchard mentioned the immediate and pressing need for a new botanical representative to the Botanical Garden Foundation and Margaret Mulliner graciously volunteered.

Slides of the December and September parties were shown and were enjoyed by all. The shell drawing was won by Marge Bradner. The meeting was adjourned at 9:30 P.M.

TWO PROBLEMATIC CORALLIOPHILID GASTROPODS

BY

ANTHONY D'ATTILIO

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Recently a re-examination of the illustrations of the new species of muricacean gastropods described in the Prosobranchia of the Siboga Expedition by Schepman was undertaken. Of particular interest to me were two species assigned by Schepman to the Coralliophilidae as *Latiaxis sibogae* and *Latiaxis ricinuloides*. Close examination of the figures and subsequent examination of the holotypes led me to believe that both might also be assigned to the Muricidae in the genus *Murexiella s.s.* Clench and Perez Farfante, 1945, type *hidalgoi* Crosse, 1869. Lack of soft parts for a radular examination prevented further examination to indicate the presence or absence of a radula. Its presence would be an unequivocal indication of their assignment to *Murexiella*; the family Coralliophilidae is entirely lacking any trace of a radula.

Because of the ambiguity of their family characters and the limited availability of the Siboga work to most specialists and amateurs, I feel it a worthwhile endeavor to illustrate these two species and include the descriptions by Schepman. Descriptive notes by me are added to indicate morphological characters not cited in the original descriptions.

LATIAXIS SIBOGAE SCHEPMAN, 1911

Stat. 89. Pulu Kaniungan ketjil. Reef. 1 Spec.*

Shell elongately-biconical, white. Whorls about 7, of which the upper one forms a rather smooth but not quite intact nucleus; subsequent whorls angular, obliquely flattened above, contracted towards the deep lower suture. Sculpture consisting of 4 strong spiral lirae on body-whorl and numerous intermediate ones; the strong lirae are spinous, the upper one has long, slender, hollow spines, which are turned up, on the upper whorls is a second row of shorter spines, on last whorl there are five rows at all, of which the third is less conspicuous, one or two rows on the canal are likewise more prominent, moreover the whole shell is covered with lamellae, which in crossing the lirae are squamous, as well on the stronger as on the intermediate lirae. Aperture triangularly rounded, upper margin short, outer one slightly convex, internally with 4 grooves, corresponding to the strong lirae; columellar margin strongly enamellous, canal rather broad, tortuous, with a free lamella and an umbilical slit behind it, bordered by a row of larger scales.

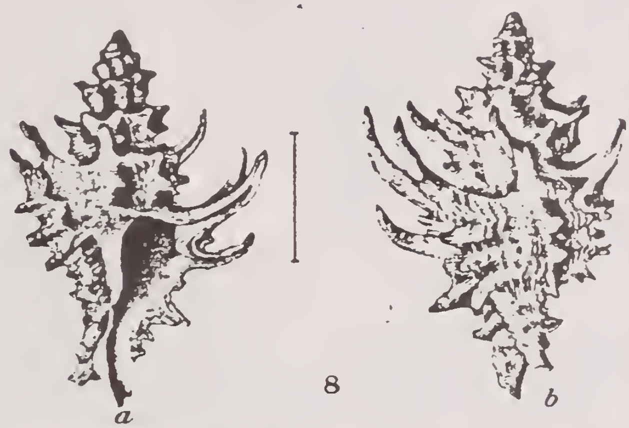
Alt. 17, lat. (without spines) about $7^1/_2$, (with spines 14); apert. alt. (with canal) 8, lat. 3 Mill.

This species belongs to the group of *L. diadema* Adams and seems, according to the figure, to be the nearest ally of *L. exfoliatus* Sow. (Thes. Conch. Vol. V, Latiaxis, p. 3, Pl. 1, fig. 15), it is however considerably less convex, the aperture is consequently narrower, the spines are more slender, straighter, more spreading; it agrees by being nearly without umbilicus.

* original description

Figures 1a and 1b are reproduced from the original Schepman illustration (Plate 21, figure 8). Figures 2a and 2b are photographs of the holotype.

Additional notes by the author- Shell 16 mm, moderately high spired, fusiform, protoconch 1½ whorls (somewhat damaged), teleoconch of five whorls, suture strongly impressed, shoulder weakly angulate, aperture ovate, anal sulcus not differentiated, inner lip very weakly erect mostly below, outer lip with four undulations extending within and reflecting the outer spiral sculpture. Canal moderately long, open, and recurved with five old canal terminations on the fasciole. Axial sculpture on body whorl of seven varices (eight varices on penultimate), ornamented between varices with richly fluted prominent lamellae strongly erect at edge and relatively distantly placed from each other. The same fluted lamellae are found on all spines. Axial sculpture crosses shoulder diagonally to left terminating at the impressed suture. Spiral sculpture consists of a prominent cord at the shoulder terminating at each varix into a long prominent open recurved spine. Three additional scabrous cords are found on the body whorl,



Figs. 1a and 1b. Apertural and dorsal views of *L. sibogae* from Schepman, 1911.

Fig. 2a. Apertural view of holotype of *L. sibogae*.

Fig. 2b. Dorsal view of holotype of *L. sibogae*.

with four to five minor intercalary cords, four additional minor cords occur on the canal. Shell color entirely white, lustrous within.
Discussion- Possibly capable of adding another whorl at maturity. The type possesses in the five existing whorls entirely distinctive characters especially apparent in the nature of the strong fluted axial lamellae with the leading edge well elevated. Only about four or five of these distantly placed lamellae occur between varices lending the shell a very distinctive character.

LATIAXIS RICINULOIDES SCHEPMAN 1911

Stat. 257. Du-roa-strait, Kei-islands. Till 52 M. Coral. 1 Spec.*

Shell shortly biconical, with short spire. pale yellowish-brown with rosy tints. Whorls $6^{1}/_{2}$, of which $1^{1}/_{2}$ form a smooth nucleus, followed by a short bilirate space; subsequent whorls angular, with a row of spines growing gradually larger, 7 on last whorl; these spines are slender, spreading, slightly upturned, hollow, rose coloured in their interior; the upper part of whorls is nearly horizontal, but a little declining, with narrow lirae, occupying also the upper surface of spines and partly squamous, lower part of last whorl with 4 conspicuous lirae, interrupted by varices below each spine; these varices form short spines or scales, about 2 on each crossing-point; moreover fine intermediate lirae and slightly squamous growth-striae give a scabrous appearance to the shell. Aperture elongately-triangular, upper margin nearly horizontal, outer one thin, undulated by the lirae, slightly convex, interiorly of a beautiful rose-colour, with a few grooves, corresponding to the lirae, columellar margin appressed above, free below, at the narrow but conspicuous umbilicus, which is bordered externally by a row of coarse, rosy scales; canal short, wide.

Alt. 14, lat. (without spines) $8^{1}/_{2}$, (with spines 19); apert. alt. (with canal) $8^{1}/_{2}$, lat. $3^{1}/_{2}$ Mill.

Though this specimen is probably not quite adult, it is too beautiful and characteristic to be neglected. I know no species like it.

Figs. 3a and 3b. Apertural and dorsal views of *L. ricinuloides* from Schepman, 1911

* original description

Figures 3a and 3b are reproduced from the original Schepman illustration (Plate 21, figure 7). Figures 4a and 4b are photographs of the holotype of *L. ricinuloides*.
Additional notes by the author- Shell 12 mm, broadly angulately fusiform, spire low, protoconch of $1\frac{1}{2}$ rounded whorls, body with four whorls, aperture narrowly ovate, columella with two swollen cord-like areas posteriorly, inner lip entirely adherent, outer lip undulate, reflecting the spiral cords, and sulcus not clearly defined, canal short, broadly open, very weakly recurved, umbilicate, four previous canal terminations on the fasciole. Axial sculpture of six varices, scabrous on their leading edge. A strong spiral cord at the shoulder terminates at each varix into a long weakly raised open spine, these spines are additionally incised with seven to eight grooves, three spiral cords on the body whorl and one on the canal all terminating at the varices into moderate raised open spines. The minor cords are noticeably scabrous and all axial sculpture crosses the shoulder strongly to the left. Shell color pale ochre yellow, columella flushed with pink.
Discussion- Although without any extraordinary characters the small shell is distinguished by its low spire, the long shoulder spines, and the broad angulate shoulder. The nature of the aperture appears to indicate immaturity within the genus.


Fig. 4a Apertural view of the holotype of *L. ricinuloides*.


Fig. 4b Dorsal view of the holotype of *L. ricinuloides*.

Acknowledgments

I thank Dr. Henry E. Coomans for arranging the loan of the holotype material from the Instituut Voor Taxonomische Zoölogie (Zoölogisch Museum) Universiteit Van Amsterdam and Mr. David K. Mulliner, Festivus staff photographer, for photographing the types.

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EXCERPTS FROM THE 1981 TIDE CALENDAR FOR THE NORTHERN GULF OF CALIFORNIA

The Festivus entries will usually show only periods of low tides of -4.0 feet and below beginning with March 1981.

These tidal measurements for Puerto Penasco are given in Mountain Standard Time. To correct for San Felipe, subtract one hour from listed times (San Felipe is on Pacific Standard Time). For Bahia de los Angeles, add 15-30 minutes to calendar predictions (amplitude there is ½ that of calendar measurements). Tides at Guaymas and Santa Rosalia cannot be estimated using this calendar.

Mar.	4.	-4.5' at 7:00 P.M.
	5.	-5.8' at 8:00 P.M.
	6.	-4.0' at 8:30 A.M.
		-5.9' at 8:40 P.M.
	7.	-4.1' at 9:00 A.M.
		-5.0' at 9:30 P.M.
	8.	-4.2' at 8:30 A.M.
		-3.9' at 9:00 P.M.
	9.	-4.0' at [illegible]:50 A.M.
Apr.	2.	-4.0' at 6:50 P.M.
	3.	-3.9' at 7:10 A.M.
		-5.0' at 6:30 P.M.
	4.	-5.0' at 8:00 A.M.
		-5.3' at 8:30 P.M.
	5.	-5.9' at 8:00 A.M.
		-4.1' at 8:30 P.M.
	6.	-5.7' at 9:00 A.M.
	7.	-4.5' at 9:40 A.M.
May	2.	-4.1' at 6:30 A.M.
		-3.9' at 7:10 P.M.
	3.	-5.8' at 6:40 A.M.
		-3.9' at 7:00 P.M.
	4.	-6.0; at 7:40 A.M.
	5.	-6.0' at 8:30 A.M.
	6.	-5.0' at 9:30 A.M.
June	1.	-5.8' at 6:30 A.M.
	2.	-6.0' at 7:10 A.M.
	3.	-5.9' at 8:10 A.M.
	4.	-4.3' at 9:00 A.M.
	17.	-3.9' at 7:30 A.M.
	18.	-3.95'at 8:00 A.M.
	30.	-4.0' at 7:00 A.M.
July	1.	-4.8' at 7:00 A.M.
	2.	-4.5' at 8:00 A.M.
	3.	-4.0' at 9:00 A.M.
	30.	-4.1' at 7:30 A.M.
	31.	-3.9' at 8:50 A.M.
Sept.	13.	-3.9' at 6:30 A.M.
	14.	-4.0' at 7:50 A.M.
Oct.	12.	-3.9' at 6:00 A.M.
		-4.0' at 7:00 P.M.
	13.	-4.0' at 7:30 A.M.
		-4.5' at 8:00 P.M.
	14.	-3.9' at 8:00 A.M.
		-4.8' at 8:30 P.M.
	15.	-4.1' at 9:00 P.M.
Nov.	9.	-4.0' at 5:50 P.M.
	10.	-5.2' at 6:30 P.M.
	11.	-5.9' at 7:30 P.M.
	12.	-5.8' at 8:10 P.M.
	13.	-5.0' at 9:30 P.M.
Dec.	8.	-3.9' at 5:40 P.M.
	9.	-5.0' at 6:30 P.M.
	10.	-5.9' at 7:00 P.M.
	11.	-6.0' at 8:30 P.M.
	12.	-5.9' at 9:00 P.M.
	13.	-4.0' at 9:00 P.M.

A DAY ON OAHU AT FORT KAMEHAMEHA - SUMMER 1980

BY

MARGE BRADNER

1867 Caminito Marzella, La Jolla, California 92037

The sun broke over the Kaulaus to a sparkling bright morning when Hans Bertsch picked me up in Waikiki for a shelling trip to Fort Kamehameha. We made one stop at Pearl Harbor for Bob Schoening before going to Fort Kam's mangrove bordered beach. The tide was so low that water barely reached our knees as we sloshed through the mud bottomed shallows, passing limu (seaweed) collectors, to a small sand island. Beyond the island the water visibility cleared and the depth increased until we reached the barely submerged reef. Here the gentle lapping of the water rarely reached above our ankles except when the wash from the wake of a warship, excursion boat, or pleasure craft sent ripples over the water surface. We were at the edge of the deep water Pearl Harbor channel. Local legend tells of a 14 foot Hammerhead shark that inhabits these waters, rarely (if ever) seen, but feared by locals and visitors alike.

The reef drops to a plateau four to six feet below the surface before plunging to the channel. This is a good snorkeling depth and I was in my element, turning rocks, looking in crevasses, and admiring the sea life. There were sea urchins in abundance, *Echinothrix diadema*, *E. calamaris*, *Echinometra mathaei*, *E. oblonga*, "Stumpy bumpy" urchins and "sit-upons".

Hans immediately headed for the orange and slate gray sponge-covered canyon walls with his camera looking for two nudibranchs, *Hypselodoris infucata* and *Chromodoris godeffroyana* which were recently reported from this area for the first time in papers by Hans Bertsch and Scott Johnson. Bob's shell searching was limited. The sleeve for his borrowed aqualung tank did not fit nor could it be modified to fit. Bob's aborted attempts to dive were hilarious. Mouthpiece in place, tank tucked under his arm, feet kicking, he was barely able to get below the surface. However, shallow collecting was good. He came back with the most interesting find of the day-- a tiny unidentifiable, golden miter.

We found many common shells: *Morula uva*, *Drupa ricina*, *Nerita ricea*, *Mitra olivaeformis*, *Cypraea caputserpentis*, *C. helvola*, *C. fimbriata*, *C. teres*, *C. maculifera*.

A few days later at the monthly Hawaiian Malacological Society meeting on "buy, sell, and trade" tables, we saw *Cypraea chinensis*, *C. rashleighana*, *C. schilderiana*, and *C. semiplota* crawling up the sides of salt water containers. For gem specimen, live, rare shells "Mo bettah go shell club meeting."

The Veliger Volumes 16(4) and 20(1) are still missing from the Library. If anyone has these sections or would like to donate duplicate copies to the Library, please notify Barbara Myers.

THE FESTIVUS

SAN DIEGO SHELL CLUB

FOUNDED 1961 • INCORPORATED 1968

MEETS THIRD THURSDAY, 7:30 P.M.
ROOM 104, CASA DEL PRADO, BALBOA PARK

ANNUAL DUES: Payable to San Diego Shell Club Inc. Single membership: $4.00; Family membership: $5.00; Student membership: $3.00; Overseas surface: $6.00.

CLUB ADDRESS: Address all correspondence to San Diego Shell Club, Inc. c/o 3883 Mt. Blackburn Ave., San Diego, California 92111

VOL. XIII MARCH 1981 NO. 3

PROGRAM: Dr. Hans Bertsch will give an illustrated talk on "Nudibranchs of Hawaii."

Bring in your minute shells. A display of micromollusks is planned for this meeting. Five microscopes will be available for viewing these tiny mollusks.

Date: March 19, 1981 Time: 7:30 P.M. Room: 204upstairs

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A review of several eastern Pacific *Bittium* species (Gastropoda: Cerithiidae)
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DUES ARE DUE BY JANUARY 1 AND ARE DELINQUENT BY APRIL 1. Please send dues to the Club address or to Walter Robertson, Treasurer, by March 26 so you will be included on the 1981 Club roster.

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: FEBRUARY 19, 1981

BY

MARTIN SCHULER

Carol Burchard called the meeting to order at 7:35 P.M. Guests and new members were introduced. Ron McPeak then presented the evening's speaker, Carol Skoglund who spoke on Dredging for Mollusks. Her talk was profusely illustrated with slides including many pictures of shells that were brought up from the depths. She gave much useful information on the mechanics of dredging presenting her material in such a way that we all wanted to try dredging. (The Festivus will publish her talk in a future issue. Ed.).

After coffee break the January minutes were accepted and Carol Burchard called upon the membership to donate shells to the annual shell auction to be held in April. This auction raises the funds which support The Festivus and all members are urged to donate generously.

The Board recommended raising the annual dues in 1982 to offset the rise in postal rates. The motion was discussed and passed. The dues for 1982 will be as follows. Single member: $5.00, Family membership: $6.00, Overseas surface: $8:00, Student: $3.00.

The Library Committee announced that the library was being reorganized and a list of library holdings would be availble as soon as the project was completed. It was requested that any outstanding books be returned to the library.

Carol Skoglund gave some information on the upcoming WSM meeting to be held in San Diego in June. Details will be sent to the Club shortly.

John Sage won the shell drawing. The meeting was adjourned at 9:00 P.M.

THE ANNUAL AUCTION/POTLUCK

APRIL 25, 1981

The Club's annual Auction/Potluck, our most fantastic social event (and only fundraiser) will again be held at the home of Marge and Hugh Bradner on April 25. A map will be included in the April issue.

The auction proceeds provide the major portion of the Club's operating funds. The Festivus depends on its success for its budget. The Club's purchases for the Library, donations to scientific publications and participation in the Greater San Diego Science Fair depend on the generosity of Club members in their donations and purchases at this auction.

It seems that we have started late this year in requesting donations of quality shells with as much data as possible from our members and friends. Members are urgently requested to bring their shells for donation to the March meeting or to make arrangements with a Board member for their pickup or delivery.

Food signup lists and details of the auction arrangements will be discussed at the March meeting.

The Western Society of Malacologists (WSM) will award a grant of $500 to an undergraduate or graduate student for the academic year 1981-1982. The grant is offered to initiate or further research concerned with molluscs, in systematics, biology, ecology, paleontology, or related fields. Entrants must be undergraduate or graduate students at a college or university, or marine or field station. Completed application and research proposal and outline of academic background with a letter from a faculty member or professional scientist supervising or knowing of the student's work are required. Deadline: May 1, 1981. For application form write to Dr. Vida C. Kenk. WSM committee on student grants, Dept. Biological Sciences, San Jose State University, San Jose, Ca. 95192.

ONE DIVE: SEPTEMBER 24, 1980

BY

ROGER A. EVANS

1900 Camino de la Costa #1
Redondo Beach, California 90277

The cliffs of the Palos Verdes Peninsula in southern California are a formidable barrier to a diver and his gear, but the collecting in the waters below provides incentive to negotiate the steep trails.

On September 24, 1980 I completed a scuba dive off the northern edge of the Palos Verdes Peninsula in an area known as Flat Rock. Surface conditions were ideal and the water visibility was an excellent 25 feet or more. This particular area has several finger reefs running perpendicular to shore in 10 to 40 feet of water. A sandy bottom separates the reefs and the entire area lies under the canopy of a *Macrocystis pyrifera* bed. Live *Norrisia norrisi* are common on the *Macrocystis* as well as on the reefs below. Several live *Astraea undosa*, ranging in size from about 50 to 80 mm, were observed on the reefs in 10 to 20 feet of water. At a depth of 40 feet, *Astraea gibberosa* became fairly common on the sand and ranged in size from approximately 40 to 50 mm. A few live *Pteropurpura trialata* were observed in less than 20 feet of water along rock ledges. These specimens measured up to 60 mm and included the all white variety as well as the usual dark banded form.

My collecting takes place in sand troughs where, at times, large numbers of recently dead shells accumulate. Sand troughs, valley-like depressions in the sand, are commonly found on sandy bottoms and are the result of wave activity. The physical contours of the shallow ocean bottom are constantly changing resulting in fluctuating collecting conditions. The positioning of sand troughs in any one area may vary from dive to dive, as will the contents of those troughs. The trick is to locate sand troughs with recently dead shells in abundance.

The following specimens were trough collected as dead shells in 30 to 40 feet of water. They represent an average dive in this area, not one of my better collecting efforts there. The measurements given represent the greatest dimension of the various species collected, be it height, width, or length.

NUMBER COLLECTED	SPECIES	SIZE
1	*Diodora aspera* (Rathke, 1833)	11 mm
1	*Calliostoma gloriosum* Dall, 1871	15 mm
2	*Norrisia norrisi* (Sowerby, 1838)	46-47 mm
1	*Astraea undosa* (Wood, 1828)	54 mm
2	*Hipponix tumens* Carpenter, 1864	10-16 mm
2	*Crepidula onyx* Sowerby, 1824	20-37 mm
1	*Crepipatella lingulata* (Gould, 1846)	19 mm
4	*Pusula californiana* (Gray, 1827)	8-10 mm
5	*Pusula padreserrai* Cate, 1979	17-20 mm
4	*Cypraea spadicea* Swainson, 1823 (juveniles)	20-26 mm
1	*Simnia vidleri* (Sowerby, 1881)	18 mm
1	*Olivella baetica* Carpenter, 1864	12 mm
1	*Conus californicus* Reeve, 1844	31 mm
1	*Bulla gouldiana* Pilsbry, 1893	26 mm
1	*Acteocina culcitella* (Gould, 1853)	26 mm
1	*Cylichna diegensis* (Dall, 1919)	14.4 mm
1	*Hinnites giganteus* (Gray, 1825) (juvenile)	23 mm
1	*Trachycardium quadragenarium* (Conrad, 1837)	56 mm
2	*Ventricolaria fordii* (Yates, 1890)	33-41 mm

A REVIEW OF SEVERAL EASTERN PACIFIC BITTIUM SPECIES (GASTROPODA: CERITHIIDAE)

BY

JULES HERTZ

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INTRODUCTION

A historical review and status of the genus *Bittium* Leach in Gray, 1847 has recently been presented by Houbrick (1977:101-103). The purpose of this paper is to clarify the nomenclatural and taxonomic problems in some closely related species of *Bittium* from the eastern Pacific. The following valid units of *Bittium* species: *Bittium asperum* (Gabb, 1861); *Bittium rugatum* Carpenter, 1864; and *Bittium subplanatum* Bartsch, 1911 are evaluated, clarified, and summarized with respective synonymies. A conservative approach has been followed concerning generic placement. The subgenera proposed by Bartsch (1911:384-385) are only mentioned from a historical standpoint.

DISCUSSION

Among the *Bittium* of the eastern Pacific are several that have similar sculpture but are quite variable within species. This leads to difficulties in identification. Those to be discussed here are *Bittium asperum* (Gabb, 1861); *Bittium asperum lomaense* Bartsch, 1911; *Bittium rugatum* Carpenter, 1864; and *Bittium subplanatum* Bartsch, 1911. Bartsch (1911:384) placed these as well as others into subgenera based on shell characteristics such as that of smoothness of the nuclear whorl, the presence or absence of varices on postnuclear whorls, and the relative strength of the spiral and axial sculpture. Grant and Gale (1931:759) suggested that many subdivisions of *Bittium* were probably artificial and should be discarded when a natural classification is worked out. Houbrick (1977:102) states that "most of the supraspecific taxa proposed for *Bittium* are parochial in conception and scope, are based on specific rather than generic characters and convey misleading or little phylogenetic information." He suggests that a number of generic and subgeneric taxa be abandoned or synonymized and suggests that species formerly referred to these taxa be considered as *Bittium* species until the entire group is monographed and subgeneric taxa are properly evaluated on the basis of more than shell characters. I concur with this approach.

Specimens examined in this study were obtained from the California Academy of Sciences (CAS), San Francisco, California; Academy of Natural Sciences of Philadelphia (ANSP), Philadelphia, Pennsylvania; San Diego Natural History Museum (SDNHM), San Diego, California; and the United States National Museum collections (USNM) in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Gabb (1861:368) originally described *Bittium asperum* from a fossil shell from Santa Barbara, California and named it *Turbonilla aspera*. In 1866, Gabb provided an additional description, recognized it as a *Bittium*, and figured a specimen. Carpenter (1866:276) wrote that he was informed by Gabb that *Turbonilla aspera* was a *Bittium* and that the type unfortunately was not accessible. Carpenter stated that should the type be recovered and prove distinct from the shell he named *Bittium asperum*, then this latter shell should take the name of *Bittium rugatum*. This confusing occurrence is discussed in greater detail on page 32.

Gabb's original description for *B. asperum* is "Shell elongated acute; expanded

at the inner anterior margin, angulated behind; columella nearly straight. Surface of the whorls most prominent a little below the middle, and marked by about ten very prominent longitudinal ribs not continuous from one whorl to another. These ribs are crossed by three revolving lines, which take the form of acute ribs between the longitudinal ones, but develope into large nodes on their crest; under surface of the body whorl marked by four additional plain revolving ribs, becoming smaller in advance." The shell described was reported as 7.1 mm (0.28 in) long, having a 2.0 mm (0.08 in) wide body whorl, and a mouth length of 1.5 mm (0.06 in). In 1866, Gabb figured a specimen that had a length of about 8.9 mm (0.35 in) and described it as follows. "Shell long, slender; whorls twelve or thirteen; nuclear whorls smooth, others marked by ten or twelve strong, longitudinal ribs, crossed by four or five sharp, filiform, revolving ribs with broad interspaces; suture deep. Under surface smooth, or marked by one or two ribs near the angle. Mouth longer than broad, produced below and slightly expanded at the columellar angle; lips acute." Stewart (1927:357) figured the anterior portion as well as a full apertural view of a specimen of *B. asperum* labelled in Gabb's handwriting "original specimen." These are reproduced here as Figures 1 and 2. The shell, 8.3mm (0.33 in) long, was a little longer that the length given in 1861 and a little shorter than the length given in 1866. He thought it was probably the shell figured in 1866 and designated it as the neotype. Stewart's description of the neotype follows. "The suture is bordered posteriorly by an unbroken prominent spiral; the other four spirals - the posterior one is small - are crossed by eleven axials forming nodes at their intersections. The base has one prominent spiral and two faint ones. The columella is straight and the outer lip is broken." Stewart gives the neotype as ANSP 4333.

Figure 1. Neotype of *B. asperum* (Gabb, 1861), 3X

Figure 2. Anterior portion of neotype of *B. asperum*, 11X

ANSP 4333 was borrowed for study and to my surprise contained 61 specimens. Dr. Bogan (1980) of the ANSP assures me that the neotype had not been stored separately. Among these was one shell that I believe to be Stewart's designated neotype. Photographs of this specimen at a magnification of 13.3X are shown here as Figures 3 and 4. The specimen's nucleus is shown as Figure 5. The nucleus was damaged and the mollusk apparently replugged the apical opening. The protoconch is slightly heterostrophic and submerged. Examination of ANSP 4333 revealed that most of the specimens are probably *Bittium rugatum* Carpenter, 1864 and one specimen markedly different in sculpture has yet to be identified.

Arnold (1903:291) described *B. asperum* from specimens identified by Dr. Dall. A specimen 10.5 mm (0.41 in) long was reported as having nine to ten whorls and sculpture consisting of three spiral ridges crossed by sixteen to eighteen much more prominent ridges. This is vastly different from Gabb's descriptions in which smaller shells had

Figure 3. Apertural view of neotype of *B. asperum*, 13.3X

Figure 4. Dorsal view of neotype of *B. asperum*, 13.3X

more whorls and many fewer axial ridges. Arnold's description is more typical of *B. rugatum* than that of *B. asperum*. His description and figure of *B. rugatum* [in the same paper (1903:295) from shells identified by Dr. Dall] is distinguished by having flattened whorls, a nodose-cancellated sculpture, and approximately 30 axial ribs on the body whorl. As will be shown later, this is quite different from the type of *B. rugatum*. Arnold's figure and description of this latter shell closely resembles the standard form of *Bittium munitum* (Carpenter, 1864).

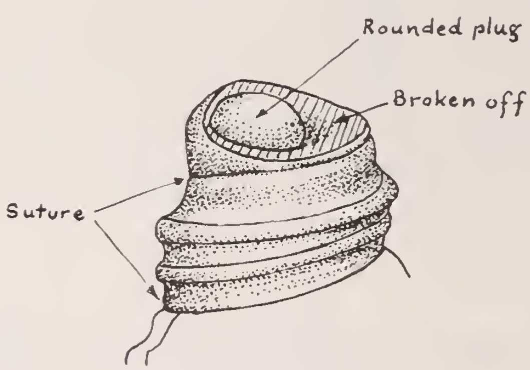

Figure 5. Protoconch of neotype of *B. asperum* (Gabb, 1861), 50X

Bartsch (1911:405) described and figured *B. asperum* from a Santa Barbara fossil,USNM 165231. This is the most thorough description in the literature. The shell he described had lost its nucleus and probably the first postnuclear turn, and therefore his description of the nucleus must have been based on other specimens. His description of the nuclear whorls was as follows: "Nuclear whorls small, a little more than one, marked by two moderately strong spiral cords, one a little posterior to the periphery and the other on the middle of the whorl, otherwise smooth." A photograph of the specimen described by Bartsch is reproduced here as Figure 6. It is

very similar in sculpture to Gabb's neotype (Figures 3,4).

Bartsch (1911:406) named a new subspecies *Bittium asperum lomaense*. He stated that it was similar to *B. asperum* (Gabb, 1861) but differed in being uniformly smaller, more slender, and in having more ribs. He compared a specimen of *B. asperum* having 10 postnuclear whorls that was 8.1 mm (0.32 in) long with a specimen of *B. asperum lomaense* having the same number of whorls. The latter measured only 7.1 mm (0.28 in). The type and 21 specimens were dredged in 71 to 75 fathoms off Pt. Loma Light, San Diego, California. Bartsch claimed that *B. asperum lomaense* is a living representative of *B. asperum*, the latter being a post-Pliocene species. Bartsch also cited a second lot, USNM 23744, of *B. asperum lomaense* containing 24 specimens dredged in 30 fathoms off Santa Catalina Island, California. I studied these and found them consistent in appearance and similar in sculpture to the type figured by Bartsch. Recent photographs of the type specimen of *B. asperum lomaense* are shown as Figures 7 and 8. All of the specimens

Figure 6. Syntype of *B. asperum* described by Bartsch (1911)

Figure 7. Apertural view of type specimen of *B. asperum lomaense*, 13.7X

Figure 8. Dorsal view of type specimen of *B. asperum lomaense*, 13.7X

dredged off Santa Catalina were decollate, Bartsch's type specimen was somewhat worn on the nucleus, and Figure 9 is a drawing of the protoconch.

Figure 9. Drawing of the protoconch of type specimen of *B. asperum lomaense*. 50X. Surface slightly eroded.

Contrary to Bartsch's claim that *B. asperum* is a fossil species, there have been numerous citations of living specimens in the literature. These include Tryon (1887:153), Cooper (1888:230), Arnold (1903:291), Weaver (1909:264), Smith (1912: 175), English (1914:210), Martin in Lawson (1916: 255), T.S. Oldroyd (1925:16), Burch (1945, 54:33), and Hunan (1973:15). Most of the early citations are based on the early reports by Cooper (1871:iv and 1880:230). I have not examined any of the Recent specimens of *B. asperum*. Because of the confusion in the literature on the appearance of *B. asperum* and some species which closely resemble it, I reserve judgement on whether *B. asperum* is a fossil species or both a fossil and a living species.

In order to further study *B. asperum*, I borrowed a large lot of fossil specimens from Dr. Barry Roth of the California Academy of Sciences, San Francisco, California. The following data were provided with this lot (CAS 82). "California: Santa Barbara; pale yellowish gray sandstone interbedded with hard calcareous layers. Collector and date not recorded but probably 1920's or 1930's." Of the 84 specimens in this lot, 36 had good protoconchs. The lot could be separated into two groups by sculpture with a wide range of sculpture within groups. The first group consists of shells which have the general appearance of *B. asperum* and *B. asperum lomaense*. The range of sculpture is illustrated by the shells pictured in Figures 10 and 11. Thirty-three shells fell into this group of which 15 had a complete and recognizable protoconch. The others were decollate. The figured specimens are described in detail in Table 1. The shells of Figure 10 are larger in size for fewer postnuclear whorls than the shells of *B. asperum* and *B. asperum lomaense* described by Bartsch. Specimen 10b more nearly approaches the axial sculpture of *B. asperum* at its extreme. Specimens 10a and 10c look like the neotype of *B. asperum* (Figures 3 and 4) in terms of sculpture. The shells in Figure 11 are much longer than the specimens figured by Bartsch and have about the same number of postnuclear whorls. They have one to two more axial ribs on the body whorl than the type specimen of *B. asperum lomaense*. Since the range of sculpture in this group of fossil shells covers the forms described by Gabb and Bartsch respectively as *B. asperum* and *B. asperum lomaense*, I propose that *B. asperum lomaense* is neither a valid subspecies nor a valid species. Therefore, I have included *B. asperum lomaense* Bartsch, 1911 in the synonymy of *B. asperum* (Gabb, 1861).

The protoconch for specimen 10b is illustrated in Figure 12, and Figure 13 is a drawing of the protoconch of specimen 11a. The protoconch for *B. asperum* is slightly heterostrophic and submerged. This agrees with the protoconch of the type specimen of *B. asperum lomaense* illustrated in Figure 9.

Grant and Gale (1931:760) described and figured a new variety of *B. asperum* from a single incomplete fossil specimen. They named this variety *B. asperum dilatatum*. The shell (SDNHM 210) is "relatively much shorter and broader, with coarser sculpture, fewer spirals, and fewer axials." The shell is decollate and therefore difficult to really evaluate.

TABLE 1. DESCRIPTIONS OF BITTIUM ASPERUM (GABB, 1861)

SPECIMEN	LOCALITY OF SPECIMENS CITED	SHELL SHAPE	NUMBER OF WHORLS	APERTURE	DESCRIPTION OF WHORLS
Gabb(1861:368) *Turbonilla aspera* Holotype	Miocene:Santa Barbara, Ca.	elongated, acute: spire very high - alt. 7.1mm	10 or 11; suture distinct	"ovoid, slightly expanded at the inner margin, angulated behind; columella straight."	"most prominent a little below the middle, marked by about ten very prominent longitudinal ribs not continuous from one whorl to another. These ribs are crossed by three revolving lines, which take the form of acute ribs between the longitudinal ones, but develope into large nodes on their crest; under surface of the body whorl marked by four additional plain revolving ribs, becoming smaller in advance."
Gabb (1866·12) *Bittium asperum* Neotype	Post-Pliocene Marl, Santa Barbara, Ca.	long, slender· alt. 8.9mm	12 or 13	"longer than broad, produced below and slightly expanded at the columella angle: lips acute"	"nuclear whorls smooth, others marked by ten or twelve strong longitudinal ribs, crossed by four or five sharp, filiform, revolving ribs with broad interspaces; sutures deep. Under surface smooth, or marked by one or two ribs near the angle."
Bartsch(1911·405) *Bittium asperum* Fossil specimen	Fossil from Santa Barbara, Ca. (upper Pliocene, Fernando Formation, Bathhouse Beach)	elongate-conic, decollate. alt. 8.3mm	10 postnuclear whorls, specimen decollate	"aperture subquadrate, channeled anteriorly: posterior angle acute: outer lip rendered somewhat sinuous by the external sculpture· columella moderately long, twisted, and reflected· parietal wall glazed with a thin callus."	"Nuclear whorls small, a little more than one, marked by two moderately strong, spiral cords, one a little posterior to the periphery and the other on the middle of the whorl otherwise smooth. Post-nuclear whorls appressed at the summit, strongly, slopingly shouldered, the first marked by two spiral cords like those on the nuclear whorls, the second showing an intercalated cord between the two, leaving the posterior half of the whorls free of sculpture and with a strong, sloping shoulder. On the succeeding whorls the shoulder is crossed by one and two spiral cords, less strong than those anterior to them. In addition to the spiral sculpture the whorls are marked by somewhat curved, almost vertical axial ribs, which begin on the second whorl and rapidly increase in strength. There are 12 of these ribs on each of the second to ninth turns. The intersections of the axial ribs and spiral cords form prominent cusps which are suddenly truncated posteriorly, and slope gently anteriorly until they fuse with the general surface of the shell. Sutures well impressed. Periphery and base of the last whorl well rounded, marked by about nine feeble spiral cords of which the first two immediately below the periphery are the strongest."
Bartsch(1911:406) *Bittium asperum lomaense* Holotype	dredged· U.S. Bur. Fisheries sta.#4310, off Pt. Loma Light, Ca.	uniformly smaller, more slender than *Bittium asperum* - alt. 7.1mm	10 postnuclear whorls		uniformly more slender, smaller, and has more ribs than *B. asperum*
CAS 82 *Bittium asperum* Fossil specimens Figure 10a	Fossils - Santa Barbara, Ca. (Seal Cliff near bath house S.W. of Porter Hotel	elongate-conic; decollate. alt. 7.8mm	6+ postnuclear whorls, nucleus decollate	aperture broken, subquadrate, base eroded, two cords visible on base	First whole postnuclear whorl has two weak, rounded anterior cords and nine to ten axial ribs. Second and third whorls have two strong anterior cords, one weaker cord posterior, and 10 axial ribs. Fourth and fifth whorls have three strong cords and a fourth weaker cord near the posterior margin. Sixth whorl has four strong spiral cords crossed by about 13 axial ribs. Strong peripheral cord on posterior edge of base. Whorls well rounded with sign of thread in deep sutures.
Figure 10b		more slender than #10a alt. 8mm	1¼ nuclear whorls· 8 postnuclear whorls	aperture broken, subquadrate, base eroded	First and second postnuclear whorls have two weak, rounded anterior cords. Third whorl has two strong, rounded anterior cords and eight axial ribs. Fourth whorl has two cords and 10 axial ribs. Fifth whorl has two strong anterior cords and one weaker posterior cord crossed by about 10 axial ribs. Sixth through eighth whorls have three strong, rounded cords and hint of very weak cord on posterior margin. Body whorl has three strong anterior cords, two weak posterior cords, and 10 axial ribs. Whorls well rounded with weak cord in sutures Strong peripheral cord on posterior edge of base. Nucleus submerged and heterostrophic.
Figure 10c		broader on body whorl than #10a and 10b: decollate, alt. 8mm	9 postnuclear whorls: nucleus decollate	aperture more ovate than specimens 10a and 10b, base eroded	Similar in sculpture to specimen 10b. Eighth and ninth whorls have three strong cords and two weaker, posterior cords. No signs of cords or threads in sutures.
Figure 11a		elongate-conic, slender, alt. 9.5mm	2 nuclear whorls 9 postnuclear whorls	aperture subquadrate, basal area eroded, 2 cords on posterior of basal area	First postnuclear whorl has two rounded, heavy anterior cords. Second whorl similar with ten axial ribs crossing cords to form rounded nodes. Third and fourth whorls have two strong anterior cords and two weaker posterior cords. Whorls slope posteriorly with about twelve axial ribs. Fifth through eighth whorls have a weaker anterior cord, two heavy cords, and two weaker posterior cords. Body whorl has five spiral cords. All whorls rounded, slope posteriorly, are separated by narrow, deep sutures. Nucleus smooth and paucispiral
Figure 11b		elongate-conic, slender, alt. 11mm	1+ nuclear whorls, 10 postnuclear whorls	aperture subquadrate, a little more ovate than #11a, basal area eroded, 2 cords on posterior of basal area	First and second whorls have two heavy, rounded anterior cords. Third and fourth whorls have two heavy, rounded anterior cords, two weak posterior cords, and ten axial ribs. Fifth whorl has a weak anterior cord, two strong central cords, and a weak posterior cord. Sixth whorl similar to fifth but has two weak posterior cords. Seventh through ninth whorls have three strong anterior cords and two weaker posterior cords. Weak cord or thread in sutures between eighth and ninth and ninth and tenth whorls. Body whorl has four strong cords and one weak posterior cord. Heavy cord on posterior edge of base. Basal area eroded but shows two posterior cords. Whorls rounded, sloping posteriorly, Sutures deep and wider than in specimen 11a.

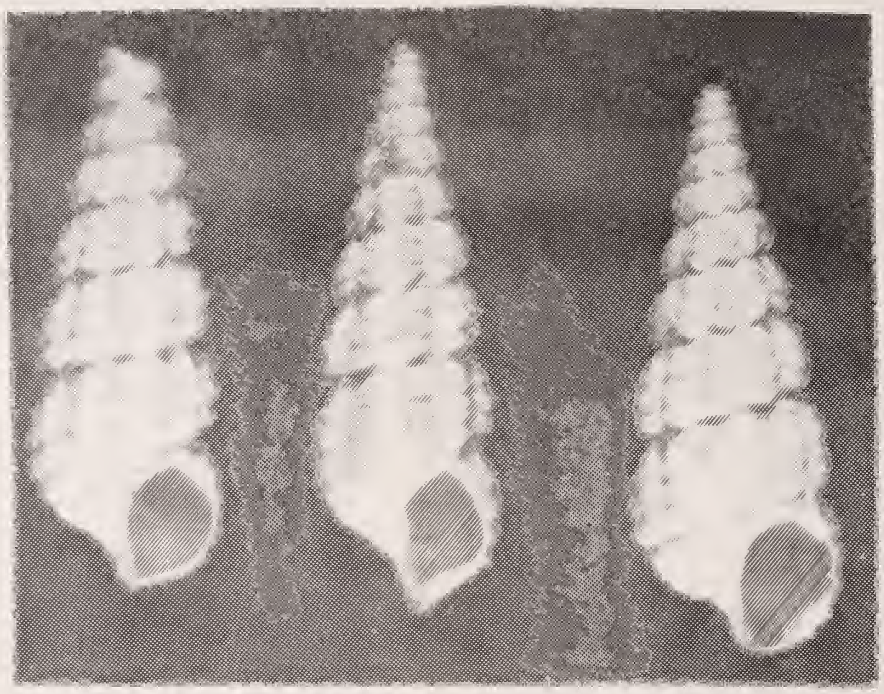

Figure 10. Specimens of *B. asperum* from lot CAS 82. From left to right, specimens 10a, 10b and 10c have respective lengths of 8.0, 7.8, and 8.0 mm.

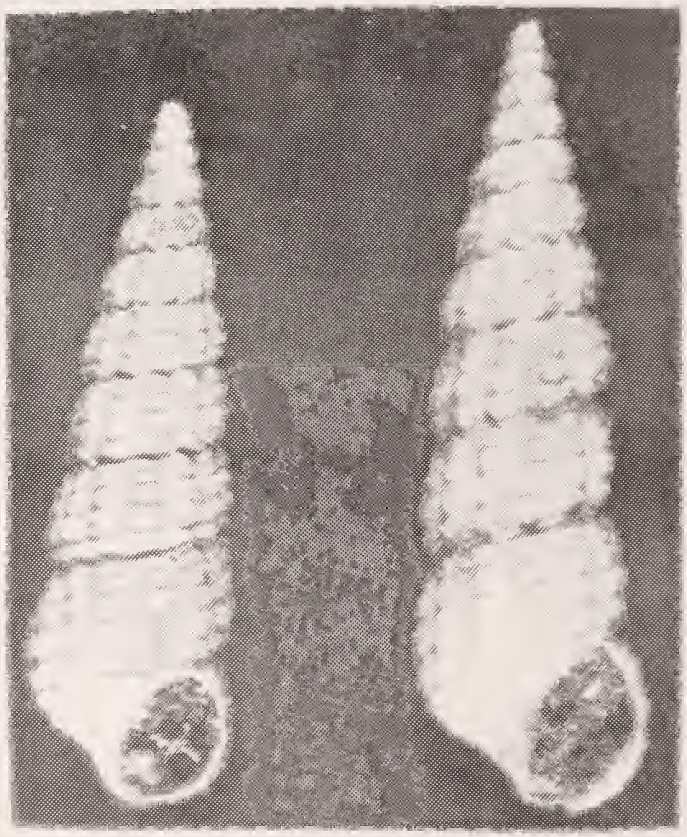

Figure 11. Specimens of *B. asperum* from lot CAS 82. From left to right, specimens 11a and 11b have respective lengths of 9.5 and 11.0 mm.

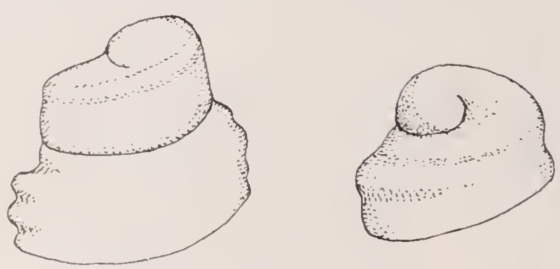

Figure 12. Two views of protoconch of *B. asperum* - fossil specimen (10b) from lot CAS 82, 50X.

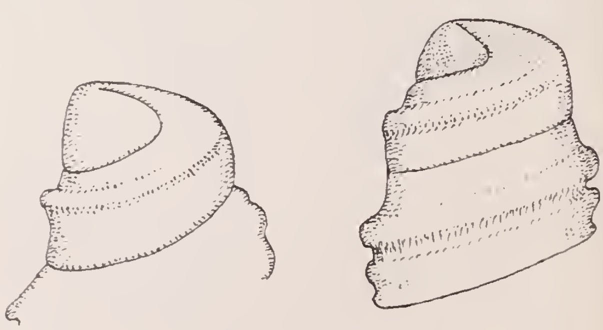

Figure 13. Two views of protoconch of *B. asperum* - fossil specimen (11a) from lot CAS 82, earliest portion of protoconch is at right angle to whorl and submerged, 50X.

The remainder of the shells from CAS 82, although highly variable, appear to be *Bittium rugatum* Carpenter, 1864. Carpenter first proposed the name in 1864 (p. 539). However, in writing the description, he referred it to *B. asperum* (p. 655). The description was brief as follows: "Same aspect: upper whirls [sic] with 2 strong and 2 faint keels over less prominent ribs." The "same aspect" refers to the previously mentioned specimen (*B. quadrifilatum*). Carpenter believed that the nucleus of *B. filosum* Gould (= *B. eschrichtii* Middendorf), *B. quadrifilatum* n.s., *B. asperum* n.s., and *B. armillatum* n.s. were clearly distinguishable from *Cerithium* or *Rissoa*. Carpenter (1866:276) cleared up the confusion with the following statement. "Mr. Gabb informs me that *Turbonilla aspera* is a *Bittium*. Unfortunately the type is not accessible; and as the diagnosis would fit several closely allied species it cannot be said with precision to which it rightfully applies. As this is the commonest of the group, it is presumed that it is the "*Turbonilla*" intended. Should the type, however, be recovered, and prove distinct, this shell should take the name of *B. rugatum*, under which I wrote the diagnosis, and which was unfortunately printed in the Brit. Assoc. Report, p. 539. The fossil specimens are in much better condition than the recent shells as yet discovered." Carpenter also included at this time a more detailed Latin description of *B. rugatum*. The Carpenter description as translated by Col. George Hanselman is included in Table 2. Much of the early literature continued the confusion. Palmer (1958:179) notes that *Bittium asperum* "Gabb," Tryon, 1887, Man. Conch., vol. IX:153 in part, pl. 30, fig. 7 = *B. rugatum* copy from Reeve, 1865, Conch. Icon., vol. 15, *Cerithium*, pl. XIX, fig. 140. Other citations of *B. asperum* Carpenter besides those of Carpenter are Cooper (1867:28) and Cooper in Williamson (1892:205). Arnold's confusion (1903:291) has already been noted.

Bartsch (1911:397) wrote a more detailed description of *B. rugatum* and figured two specimens to point out the large variations in shell characteristics. The Bartsch description is given in Table 2. The specimen Bartsch described is one of six specimens (USNM 7971), from the post-Pliocene of Santa Barbara. One of the specimens he figured was Carpenter's type (USNM 7154), Recent photographs of this specimen are included here as Figures 14 and 15. The major differences in shell characteristics

Figure 14. Apertural view *B. rugatum*, type specimen, 10X.

Figure 15. Dorsal view of *B. rugatum*, type specimen, 10X Hardened mounting wax on dorsum.

TABLE 2. DESCRIPTIONS OF BITTIUM RUGATUM CARPENTER, 1864

SPECIMEN	LOCALITY OF SPECIMENS CITED	SHELL SHAPE	NUMBER OF WHORLS	APERTURE	DESCRIPTION OF WHORLS
Carpenter (1864: 539 *Bittium rugatum* Described under *B. asperum* (1864: 655)	Beach to 40 fms.	Same aspect as *B. quadrifilatum* i.e. broad			"upper whirls with 2 strong and 2 faint keels over less prominent ribs"
Carpenter (1866: 276) *B. rugatum*	Santa Barbara, fossil in Pleistocene formation. San Pedro, San Diego, Catalina Is. 30-40 fms.				*Bittium* shell similar in shape, size and character to *B. quadrifilatum*, but with finer sculpture; the nuclear whorl similarly abnormal; but, instead of threads, spiral riblets preceding spiral ribs, somewhat nodulose; juvenile shell with two riblets, the first larger and the other smaller; thereafter generally four subequal, occasionally three but sometimes others, inserted; basal sculpture finer; radiating ribs somewhat arcuate.
Bartsch (1911:397) *Bittium rugatum* USNM 7971	Post-Pliocene of Santa Barbara, Ca.	Elongate-conic, alt. 10mm	10 postnuclear whorls	"Aperture oval, channeled anteriorly; posterior angle acute; outer lip thin, rendered sinuous by the external sculpture; columella short, twisted, and reflected."	"Nuclear whorls a little more than one, well rounded, smooth. Post-nuclear whorls appressed at the summit, decidedly overhanging, the early ones marked by two strong spiral cords on the anterior half between the sutures, and a third less strongly developed cord at the summit. On the third whorl a fourth spiral makes its appearance between the one at the summit and its neighbor; this fourth spiral soon increases in size, so that on the middle of the shell all four cords are practically of equal strength and spacing. On the last whorl a slender, intercalated cord appears between the anterior two. In addition to the spiral sculpture, the whorls are marked by strong, well-rounded, axial ribs, which are merely indicated on the first two whorls; on the third to sixth turn there are 14, on the seventh there are 16, on the eighth 18, and on the penultimate whorl there are 24. The intersections of the axial ribs and spiral cords form elongated tubercles which have their long axes parallel with the spiral sculpture. The spaces between the spiral cords and axial ribs are elongated, squarish pits. Sutures strongly constricted. Periphery of the last whorl marked by a channel which bears a slender cord. Base well rounded, marked by six spiral cords which grow successively weaker and more closely spaced from the periphery to the umbilical area."
Bartsch (1911:397) *Bittium rugatum* Carpenter type USNM 7154 (Figs. 14 and 15)	Post-Pliocene of Santa Barbara, Ca.	Elongate-conic, alt. 12 mm	9 postnuclear whorls, decollate		"Doctor Carpenter's type (Cat. No. 7154, U.S.N.M.) does not quite represent the norm of this species, the spiral cord at the summit being only feebly developed on the later turns and the basal sculpture being less strong than usual."
CAS 82 *Bittium rugatum* Fossil specimens Figure 16	Fossils from Santa Barbara, Ca. (Seal Cliff near bath house S.W. of Porter Hotel).	Elongate-conic, slender, alt. 11 mm	1¼ nuclear whorls and 9 postnuclear whorls	Aperture oval, outer lip lip rendered sinuous by external sculpture, basal area eroded with 2 spiral cords posteriorly and possibly 4 other cords.	Whorls appressed at summit. First postnuclear whorl eroded with signs of 2 spiral cords anteriorly. Second whorl eroded with 3 spiral cords; 2 anterior, 1 posterior; signs of axial ribs. Third whorl has 3 spiral cords-2 anterior, 1 posterior, approx. 14 axial ribs. Fourth whorl has 4 spiral cords-2 heavy anterior, 2 smaller posterior, slopes start at posterior of heavy cords, deep sutures, thread at base of suture between fourth and fifth whorls. Fifth to eighth whorls similar with heavier thread in sutures. Eighth whorl has approx. 16 axial ribs, ninth approx. 18. Sloping of posterior portion of whorl not as marked as on early whorls. Intercalated thread between 2 anterior threads on body whorl.
Figure 17		Elongate-conic, slender, alt. 12 mm	Nucleus rounded 1½ whorls with width of nucleus about 3 times length of whorl. 10 postnuclear whorls.	Aperture subquadrate; channeled anteriorly; posterior angle acute; outer lip rendered sinuous by external sculpture; columella moderately long, twisted, and reflected.	First whorl slopes strongly to summit, has 2 spiral cords anteriorly. Second and third whorls similar to first with third spiral cord appearing near summit. Axial sculpture begins on third whorl. Fourth whorl has 2 strong spiral cords anteriorly, posterior cord and axial sculpture becoming strong. Fourth spiral cord appears on fifth whorl. Sixth whorl has 4 strong spiral cords and approx. 10 axial ribs. Seventh and eighth similar with 12 to 14 ribs resp. Narrow thread appears in suture at summit. Ninth whorl similar with about 16 axial ribs. Body whorl has 4 strong spiral cords tending toward bands, axial sculpture muted, intercalary cord appears between 2 anterior spiral cords, second intercalary cord posterior to 2 basal cords. Periphery and base of last whorl well rounded.
Figure 18		Elongate-conic, alt. 10 mm	Nuclear whorls 1+, 8 post-nuclear whorls	Aperture similar to specimen 17. Basal area eroded with about 6 cords. Depression along length of columella.	Two heavy, rounded cords on anterior of first postnuclear whorl. Second whorl has 1 additional weaker posterior cord. Third whorl has 3 strong cords and first signs of axial sculpture. Fourth and fifth have 2 strong anterior cords, two weaker posterior cords, and 15 axial ribs crossing to form rounded bumps. Sixth and seventh whorls like fourth with 17 and 19 ribs resp. Eighth has about 22 axial ribs, with rounded thread in suture between seventh and eighth whorls.
Figure 19		Elongate-conic, alt. 12 mm	Nuclear whorls 1+, 9 post-nuclear whorls	Aperture similar to specimen 17. Eroded basal area with 2 prominent cords.	Two heavy, rounded anterior cords on first postnuclear whorl. Second whorl has additional weak posterior cord and start of axial sculpture. Third, fourth, and fifth whorls have 2 heavy, rounded anterior cords, 2 weaker posterior cords, and approx. 14 axial ribs. Whorls slope posteriorly. Sixth and seventh whorls similar with 16 and 18 axial ribs resp. Ninth whorl similar with about 22 axial ribs. Intercalary cords between several of heavy cords.
Figure 20		Elongate-conic, 20a is 10 mm and 20b is 9 mm long	20a is decollate with 8 postnuclear whorls; 20b has 1½ nuclear and 8 post-nuclear whorls	Aperture of specimens similar to specimen 17.	Specimens very similar in sculpture to specimen 19 except early whorls have about 12 axial ribs and later whorls about 18. Major difference is that 20a and 20b have prominent rounded cord in sutures over full length of shells. Specimen 20b considerably more slender than 20a.
Figure 21		Elongate-conic, alt. 8 mm	1½ nuclear and 8 post-nuclear whorls	Aperture of specimen similar to specimen 17. Basal area has 2 strong posterior and 2 weaker anterior cords.	First 3 postnuclear whorls have 2 heavy, rounded anterior cords, 1 weak posterior cord, and about 12 axial ribs. Next 3 whorls similar with 2 weak posterior cords instead of 1. Seventh whorl has 4 rounded cords, 12 axial ribs, and 1 weak posterior cord in suture between sixth and seventh whorls. Eighth whorl similar with 14 axial ribs. Specimen's sculpture very similar to *B. asperum* and can only be separated by examining the nuclear whorls.

between *B. rugatum* and *B. asperum* are the nucleus and the number of axial ribs. The nucleus of *B. rugatum* consists of a little more than one, well rounded, smooth whorl. The shell has about 16 to 20 axial ribs on the penultimate whorl as compared to about 10 to 12 for *B. asperum*. The type of *B. rugatum* has about 20 axial ribs on the penultimate whorl rather than the 24 in Bartsch's description. It is understandable that *B. asperum* and *B. rugatum* have long been mistaken for each other, since they have many outward similarities in sculpture and they are found together as fossil specimens. In CAS 82, 51 of the shells were identified as *B. rugatum*. Twenty-one of these had protoconchs, while the others were decollate. There were large sculptural variations within the group of 51 *B. rugatum*, and some of these are shown by the specimens pictured in Figures 16 through 21.

Figure 16. Specimen of *B. rugatum* from CAS 82, approximately 18 axial ribs on body whorl, intercalary thread on body whorl between two anterior cords. 9.8X.

Figure 17. Specimen of *B. rugatum* from CAS 82, about 16 axial ribs and two intercalary threads on body whorl, 8.4X.

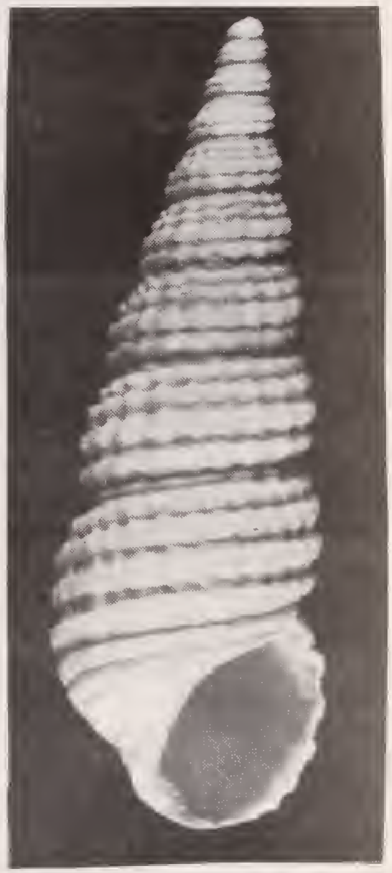

Figure 18. Specimen of *B. rugatum* from CAS 82, about 22 axial ribs on body whorl, depression along length of columella, no intercalary threads, 10.7X.

Figure 19. Specimen of *B. rugatum* from CAS 82, similar to Figure 18, several intercalary threads on body whorl, 9.1X

Figure 20. Two specimens of *B. rugatum* from CAS 82, approximately 18 axial ribs on body whorl, very prominent rounded cord in sutures, 10X.

The protoconch for *B. rugatum* (specimen 17) is illustrated in Figure 22. It shows a well-rounded nuclear whorl rather than the canted appearance of the nucleus of *B. asperum* (see Figures 12 and 13). Woodring, Bramlette, and Kew (1946:67) contrast the "stout rounded nuclear whorls" of *B. rugatum* with "an angulation at the upper edge of the nuclear whorls" for *B. asperum.* They state that "the angulation may be regarded as a spiral; a second spiral is introduced below the periphery, either on the nucleus or at the transition between nuclear and postnuclear whorls."

Bartsch (1911:395-396) described and figured a new species, *Bittium subplanatum,* that is very similar to *B. rugatum* with the exceptions that *B. subplanatum* has more axial ribs and many more intercalated cords. Bartsch's description follows.

Figure 21. Specimen of *B. rugatum* from CAS 82, about 14 axial ribs on body whorl, approaches the sculpture of *B. asperum,* 13X.

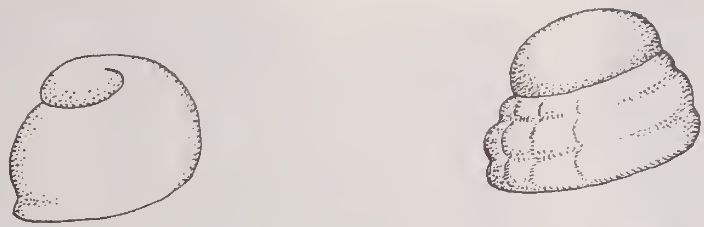

Figure 22. Two views of protoconch of *B. rugatum* - fossil specimen (Fig. 17) from CAS 82, 50X.

> Shell broadly elongate-conic, milk white. Nuclear whorls a little more than one, well rounded, smooth. The first of the post-nuclear whorls well rounded, marked by three spiral cords, one of which is at the summit, another on the middle of the whorl, while the third is a little above the suture. The succeeding turns show four spiral cords of which the one at the summit is a little less strong than the rest; the remaining three divide the space between the sutures into four equal parts. Beginning with the fourth whorl, intercalated cords make their appearance between the primary ones, so that on the last whorl we have an intercalated cord and sometimes two between all the primary cords; these, however, are never quite as strong as the principal ones. In addition to the spiral cords, the whorls are marked by decidedly curved, slender, well-rounded, almost vertical, axial ribs, which are scarcely indicated on the first turn, while 14 of them occur upon the second and third, 16 upon the fourth, 18 upon the fifth and sixth, 22 upon the seventh, 24 upon the eighth, and 26 upon the penultimate turn. The intersections of the spiral cords and axial ribs form weakly developed, rounded tubercles which are truncated on their posterior margin, while the spaces enclosed between them are very shallow quadrangular pits. Sutures strongly constricted. Periphery and base of the last whorl well rounded, marked by slender, spiral cords of which those immediately below the periphery are the strongest and are truncated on the posterior margin, sloping gently anteriorly. Of these cords, seven occur on the base of the type. Aperture rather large, irregularly oval, channeled anteriorly; posterior angle acute; outer lip thin, rendered sinuous by the external sculpture; columella decidedly oblique, strongly curved, and reflected.

Figures 23 and 24 are photographs of the type of *B. subplanatum* (USNM 160076). It has ten postnuclear whorls and measures 10.9 mm (0.43 in) in length and 3.8 mm (0.15 in) in diameter. Figure 25 is a scanning electron micrograph at 120X of the nucleus of a specimen of *B. subplanatum* collected by H.N. Lowe in 1932 off San Benito Island, Baja California, Mexico in 10 fathoms. The specimen is one of 19 shells (SDNHM 19641). The nucleus is similar to that of *B. rugatum*. Figures 26 and 27 are scanning electron micrographs of the apertural and dorsal views of the body whorl of the same specimen at 30X and 45X respectively. These show about 22 axial

Figure 23. Apertural view of type specimen of *Bittium subplanatum*, 9.7X.

Figure 24. Dorsal view of type specimen of *Bittium subplanatum*, 9.7X.

Figure 25. Scanning electron micrograph of *B. subplanatum* nucleus (SDNHM 19641), 120X.

ribs on the body whorl and the preponderance of intercalated threads between the primary spiral cords. Lowe's shells were originally identified as *B. asperum lomaense* and accounts for the reported southernmost occurrence for that species (Burch; 1945,54:33).

The recorded ranges for *B. asperum*, *B. rugatum*, and *B. subplanatum* is difficult to state with assurance because of the early confusion in the identification of these species. The fossil record for *B. asperum* is from Half Moon Bay (Martin in Lawson 1916:243) to San Diego, California (Cooper, 1888:230). Cooper (1867:28) reported the range for *B. asperum* Carpenter as Santa Barbara to Catalina Island. The Recent record for *B. asperum* (unconfirmed by this writer)

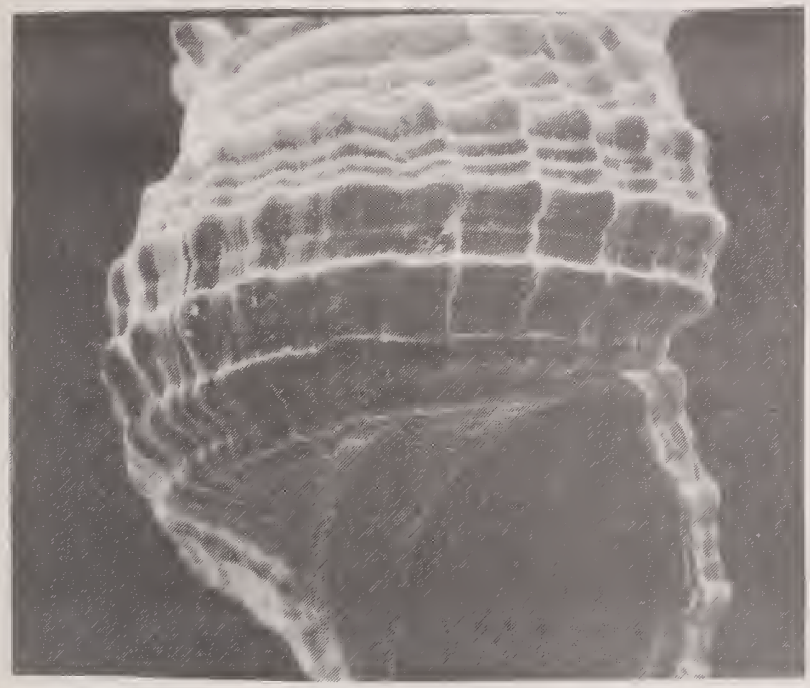

Figure 26. Scanning electron micrograph of apertural view of body whorl of *B. subplanatum* (SDNHM 19641), 30X.

Figure 27. Scanning electron micrograph of dorsal view of *B. subplanatum* (SDNHM 19641), 45X.

extends from Santa Barbara to San Diego (Cooper, 1888:230) and includes recent findings at Redondo Beach and Malaga Cove (Burch;1945, 54:33) and at Paradise Cove, five miles north of Malibu (Hunan,1973:15). *B. rugatum* has been reported in the fossil records as occurring from Santa Barbara to San Quintin Bay, Baja California, Mexico (Jordan, 1926:246), and living specimens have been reported from San Pedro and Catalina Island, California (Dall, 1921:146) to Todos Santos Bay, Mexico (Burch; 1945,54:31). The range for Recent specimens of *B. subplanatum* is from Monterey, California (Dall, 1921:146) to San Benito Island, Baja California, Mexico.

Willett (1946:31) stated that the Los Angeles County Museum collection contained numerous fossil specimens of *B. rugatum* from Los Angeles that seem to be indistinguishable from Recent *Bittium larum* Bartsch, 1911 and also others showing complete intergradation between the two. Woodring, Bramlette and Kew (1946:67) regard *B. rugatum* as a fossil species and state that "*B. subplanatum* and *B. serra* appear to be southern living representatives of *B. rugatum*. For the most part the Recent shells are smaller and have finer sculpture." The lots of *B. subplanatum* that I have examined (SDNHM 19640, 19641, and 19642) from San Pedro, California; San Benito Island, Mexico; and Catalina Island, California have large numbers of specimens with consistent shell characteristics. I therefore believe that *B. subplanatum* is distinguishable from *B. rugatum* by the greater number of axial ribs and the much greater number of intercalary threads. Quite often *B. subplanatum* has two intercalary threads between major spiral

cords. The specimen figured by Woodring, Bramlette, and Kew (1946, pl. 29, fig. 19) as *B. rugatum* (fossil from San Pedro, California) is a typical *B. subplanatum.*

Woodring, Bramlette, and Kew (1946:67,68) agreed with Willett in considering *B. larum* a form of *B. rugatum.* They identified fossils that are generally smaller and more slender than *B. rugatum* and have fewer, more widely spaced, and straighter axials as *B. rugatum larum.* They believe that the Recent species may be distinct but among fossils there appears to be intergrading between the two species. I have not investigated this relationship.

Bittium asperum (Gabb, 1861)

Turbonilla aspera Gabb, 1861:368. - Carpenter, 1866:276 (reprinted 1872:323) (reprinted in Dall, 1909:190).

Bittium asperum (Gabb), 1866:12, pl. 2, fig. 20; 1869:79, pl.2, fig. 20. - not Tryon, 1887:153, pl. 30, fig. 7 (= *Cerithium rugatum* Carpenter, copy from Reeve, 1865, pl. XIX, fig.140). - Cooper, 1888:230; 1896:79,81,86; in Eldridge and Arnold, 1907:26 (sic), 27,153. - Ashley, 1895:342,360. - Merriam in Watts, 1900:220,223, - not Arnold, 1903:25,27,291,293,294 (=? *B. rugatum*). - Arnold, 1906:24,27,30,31, 34,117; 1908:354, pl. XXXIV, fig.6; in Branner, Newsom and Arnold, 1909, pl.2, fig. 76. - Berry, 1908:38. - Weaver, 1909:264. - Smith, 1912:175,182. - English, 1914:210 "cf". - Martin in Lawson, 1914:14. - Martin, 1916:229,233,243,255. - Crickmay, 1920:632. - T.S. Oldroyd, 1925:16. - Stewart, 1927:357, pl. XXXII, fig.7, text fig. 4. - Keen, 1937:30. - DeJong, 1941:237, chart. - J.Q. Burch, 1945 (54):33. - Woodring, Bramlette and Kew, 1946:67,68,89-91,104. - B.L. Burch, 1947 (73):15. - Palmer, 1958:179. - Hunan, 1973:15.

Bittium barbarensis Bartsch, in Arnold, 1907b:424, 446, pl.57, fig.15. (cited as *B. barbarense* - Bartsch, 1911:405. - Grant and Gale, 1931:760).

Bittium (Lirobittium) asperum Gabb - Bartsch, 1911:405, pl.56, fig.3. - Waterfall, 1929:checklist. - Grant and Gale, 1931:759,760.

Lirobittium asperum Gabb - Dall, 1921:147.

Bittium (Lirobittium) asperum lomaense Bartsch, 1911:406, pl.56, fig.2 - Grant and Gale, 1931:760. - I.S. Oldroyd, 1927:34.

Bittium asperum lomaense Bartsch - J.Q. Burch, 1945(54):23,33.

Lirobittium asperum lomaense Bartsch - Dall, 1921:147. - Woodring, Bramlette and Kew, 1946:68,89.

Bittium asperum Gabb, 1861, forma *lomaense* Bartsch, 1911. - Abbott, 1974:107.

Not *Bittium asperum* Carpenter, 1864:613,655 (reprint p.99, 141); 1865:143 (reprint p.311); 1866:276 (reprint 1872:323) =*B. rugatum* Carpenter. - Cooper, 1867:28; 1871:IV; in Williamson, 1892:205. - Dall, 1878:12. - Kelsey, 1907:34. - Abbott, 1974:106.

Bittium rugatum Carpenter, 1864

Bittium rugatum Carpenter, 1864:539 (reprint 1872:25); 1866:276 (reprint 1872:323) (reprint in Dall, 1909:190) (reprint in Palmer, 1958:179). - Tryon, 1887:153, pl.30, fig.7 (erroneously stated as synonym for *B. asperum* = *Cerithium rugatum*: copy from Reeve, 1865, pl.XIX, fig.140). - Arnold, 1903:25,295, pl.IV, fig.11 (probably misidentified); 1906:34. - Kelsey, 1907:34 - T.S. Oldroyd, 1925:16. - Jordan, 1926:246. - Keen, 1937:31. - DeJong, 1941:237, chart. - J.Q. Burch, 1945 (54):23,31; (63):9. - Willett, 1946:31. - Woodring, Bramlette and Kew, 1946:67, 68,89-91,104,129, pl.29, fig.19 (figure shows typical *B. subplanatum*). B.L. Burch, 1947 (73):15. - Valentine, 1956:199. - Rodda, 1957:2483. - Kanakoff and Emerson, 1959:26.

Bittium asperum Carpenter, 1864:613,655 (reprint p.99,141); 1865:143 (reprint p.311); 1866:276 (reprint 1872:323). - Cooper, 1867:28; 1871:IV; in Williamson, 1892:205. - Dall, 1878:12, - Kelsey, 1907:34. - Abbott, 1974:106 (as synonym for *B. rugatum*).
Cerithium rugatum Carpenter - Reeve, 1865, pl.XIX, fig.140.
Bittium rugatum Conrad - Arnold, 1908:355.
Bittium (Semibittium) rugatum Carpenter - Bartsch, 1911:397, pl.56, figs.4,5. - Grant and Gale, 1931:762,930, pl.24, fig.8. - Willett, 1937:398. - Palmer, 1958:179. - Abbott, 1974:106.
Bittium rugatum Carpenter, 1866. - (wrong year for citation), I.S. Oldroyd, 1927:23.
Semibittium rugatum Carpenter, 1866. - (wrong year for citation), Dall, 1921:146.
Not *Bittium asperum* (Gabb, 1861). - see synonymy above.

Bittium subplanatum Bartsch, 1911

Bittium (Semibittium) subplanatum Bartsch, 1911:395,396, pl.57, fig.5. - Grant and Gale, 1931:760,763.
Bittium subplanatum Bartsch - I.S. Oldroyd, 1927:23. - Keen, 1937:31. - J.Q. Burch, 1945(54):23, 30,31; (55):8. - Woodring, Bramlette and Kew, 1946:67. - B.L. Burch, 1947 (73):15. - Smith and Gordon, 1948:196. - Hunan, 1973:15. - Abbott, 1974:106.
Semibittium subplanatum Bartsch - Dall, 1921:146.
Bittium rugatum subplanatum Bartsch - Valentine and Rowland, 1969:518,520,525.

CONCLUSIONS

Bittium rugatum Carpenter, 1864 is a highly variable species which converges in sculptural appearance at one extreme with *Bittium asperum* (Gabb, 1861) and at the other extreme with *Bittium subplanatum* Bartsch, 1911. Several fossil lots from Santa Barbara had mixtures of *B. asperum* and *B. rugatum.* Since many of the specimens in the lots were decollate, early investigators did not realize that the lots contained two species. *B. asperum* and *B. rugatum* have distinctly different protoconchs and are two valid species rather than polymorphic forms of a single species. The early literature was further confused by Carpenter's use of the name *B. asperum.* He proposed the name *B. asperum* not realizing that Gabb's earlier *Turbonilla aspera* was indeed a *Bittium.*

I consider *Bittium asperum lomaense* Bartsch, 1911 synonymous with *B. asperum* (Gabb, 1861). This is based on study of a large lot of fossil shells which encompasses the full range of sculpture and aspect ratio described by Gabb and Bartsch respectively as *B. asperum* and *B. asperum lomaense.*

I consider *Bittium subplanatum* Bartsch, 1911 a valid species. It has the same general nucleus shape of *B. rugatum* but the lots that I examined were consistent in sculpture, had more axial ribs, and had many more intercalary threads than *B. rugatum.* The intercalary threads generally started on earlier whorls than did those of *B. rugatum,* and quite often *B. subplanatum* had two intercalary threads between the major spiral cords.

The literature in many cases appears highly suspect with some figures obviously misidentified. Ranges of the three species are overlapping and it is likely that all three may be found in the center of the range (San Pedro to Santa Barbara, California). Because of the confusion in the early literature, the identification of Recent specimens reported in the literature may also be suspect.

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THE REDISCOVERY OF MUREX CIRROSUS HINDS, 1844

BY

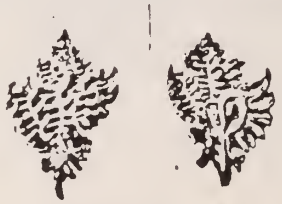
ANTHONY D'ATTILIO

Department of Marine Invertebrates, Natural History Museum, Balboa Park
P.O. Box 1390, San Diego, California 92112

Introduction

Murex cirrosus, referable to the genus *Favartia* and cited originally as occurring in the Straits of Macassar had been poorly known until its recent rediscovery in the central Philippines. This genus is notable for the large increase of newly described species especially in the last decade. Species occur in tropical seas in depths ranging from shallow or subtidal to approximately 100 meters. The deep water species, beyond the reaches of normal collecting, have remained obscure. The recent spate of new species that have been described may be an indication that the genus is more numerous and widespread than previously supposed.

The original description of *Favartia cirrosa* appeared in 1844 in The Zoology of the Voyage of H.M.S. Sulphur. Typical of that period, the description is of modest length and the figure is drawn actual size. See Figures 1a and 1b. Subsequent works dealing with this species are all illustrated with small, life-size figures approximately 10 to 15 mm. Because these early drawings were not enlarged, the normal intricate sculpture of these muricids was easily misunderstood.



17 18

Figures 1a and 1b. Dorsal and apertural views of *F. cirrosa* (Hinds, 1844) from the original Plate III. fig. 17,18.

Discussion

Favartia cirrosa (Hinds, 1844)

The following is Hinds' original description.

14. MUREX *cirrosus*, Hinds, l. c. p. 128, (Plate III. fig. 17, 18.) Testâ fusiformi, ventricosâ, pallidè carneâ, formosissimè multivaricosâ; suturâ profundâ, propè nigricante; varicibus nonis sexfariam laciniatis; laciniis fistulosis, albis, respectantibus, gradatim minoribus; interstitiis costis rotundatis lacinias incurrentibus; aperturâ ovali; labro intùs lævi; canali gracili, recurvo, ferè clauso, dorso bifariam laciniato, serie superiore geminâ.

Inhab. Straits of Macassar. In fifteen fathoms, among sand and fine gravel.

An uncommonly beautiful species, both from the delicacy of its colour and the rich, varied, and elaborate character of its sculpture.

A single specimen from the Hinds collection (Figures 2a, 2b, 2c) is in the British Museum (N.H.) and is the holotype, Reg. no. 1844.6.7.90. Another specimen (Figures 3a, 3b) was found in the Calvert collection and is figured here with the preserved label (Figure 4). The Calvert collection formed in mid 19th century England was brought to the United States in 1939 and subsequently dispersed mainly to collectors. The Calvert specimen of *F. cirrosa* is now in the collection of Mr. and Mrs. Don Pisor of San Diego. This same specimen was figured in Murex Shells of the World, Radwin and D'Attilio, 1976 on plate 25, figure 13.

Figure 2a. View of spire of holotype of *F. cirrosa*

Figure 2b. Apertural view of holotype

Figure 2c. Dorsal view of holotype

Figure 3a. Apertural view of specimen of *F. cirrosa* from the Calvert collection

Figure 3b. Dorsal view of specimen from the Calvert collection

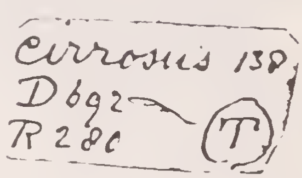


Figure 4. Xerox of preserved label from Calvert collection specimen.

Figure 5. Xerox of figure of *F. cirrosa* in Reeve, 1845, plate 29, specimen 138.

In 1845, the year following the description by Hinds, a probable third specimen was used to illustrate the species (Figure 5) in the Conchologica Iconica of Reeve (plate 29, specimen 138). Thus, in spite of its small size, this species seemed to be well established in the literature.

Recently, a number of specimens referable to *F. cirrosa* have been taken in tangle nets in about 100 meters off Mactan Island, Bohol Straits between Cebu Island and Bohol Island, Philippines. These have found their way into amateur collections. Figure 6a,

6b, 6c are views of a specimen from the collection of Mr. Victor Dan of Manila, P.I. and figures 7a, 7b, 7c are views of a specimen from the collection of Mr. and Mrs. Robert Janowsky of New York. The dominant color of the *F. cirrosa* specimens examined are light to medium shades of umber brown. The Janowsky specimen (Figure 7) is remarkable not only for its large size but for the dark umber brown with white varical spines.

Figure 6a. Spiral view of Victor Dan specimen

Figure 6b. Apertural view of Victor Dan specimen. Length: 18.75 mm

Figure 6c. Dorsal view of Victor Dan specimen

Figure 7a. Apertural view of Janowsky specimen of *F cirrosa*.

Figure 7b. Dorsal view of Janowsky specimen. Length: 24.5 mm

Figure 7c. View of spire of Janowsky specimen.

Figure 8 shows the protoconch of the Janowsky specimen of *F. cirrosa*.

Figure 8. Protoconch of *F. cirrosa* greatly enlarged.

Favartia cirrosa bears some resemblance to *F. pelepili* D'Attilio and Bertsch, 1980 and has similar coloring. *F. cirrosa* differs by its smaller size, relatively broader shoulder, and less elaborate and intricate varical sculpture. Both species occur in the same depth and geographical area in which the following additional *Favartia* species are found.

F. dorothyae Emerson and D'Attilio, 1979
F. judithae Bertsch and D'Attilio, 1980
F. cyclostoma (Sowerby, 1841)
F. tetragona (Broderip, 1833)
F. (Murexiella) mactanensis Emerson and D'Attilio, 1979
F. jeanae Bertsch and D'Attilio, 1980

Favartia brevicula (Sowerby, 1834) is the type of the genus with a distribution throughout the Indo-Pacific. It is a shallow water species and probably occurs in the same general area as *Favartia cirrosa*.

Acknowledgments

In addition to Messrs. Victor Dan, Don Pisor, and Robert Janowsky who generously lent specimens for study, the following people have been most helpful in the preparation of this paper: Ms. Kathie Way of the British Museum (N.H.) who kindly sent me the type to examine; Mr. David K. Mulliner, staff photographer for The Festivus, who did all the photography; and Carole M. Hertz who assisted with many editorial suggestions.

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FOR YOUR INFORMATION

The Western Society of Malacologists (WSM) Meeting will be held at San Diego State University from June 23-26, 1981 with the San Diego Shell Club as hosts. There will be symposia, contributed papers, workshops, field trips, exhibits, a shell auction, banquet and other activities. Deadline for reservations is May 10. For further information contact Dave Mulliner 488-2701.

The Tidepool Gallery in Malibu, California is having its Fourth Annual Rare Shell Show from May 16-24. This year there will be an additional special display of "Shells Through the Ages."

MURICIDAE OF MIDWAY

BY

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Of the eight members of the Muricidae found in the Hawaiian chain (as listed in HAWAIIAN MARINE SHELLS by E. Alison Kay, 1979), three have been found in Midway's waters. They are *Aspella producta* Pease, 1861; *Chicoreus insularum* Pilsbry, 1921; and *Homolocantha anatomica* Perry, 1811. These were the only three muricid species I found on Midway's islands. Midway Atoll is made up of two islands, Sand Island and Eastern Island and are the second to last set of islands in the Hawaiian chain.

Aspella producta Pease, 1861 is a relatively small species the largest being 20 mm in length. Figure 1 is a 19.3 mm specimen and the only live one I found. My wife did find a beach specimen measuring 16.7 mm which is typical size for this species. Both specimens were found in the same general location on the south side of Sand Island, inside the reef. The live specimen was collected in two meters depth under coral rubble. Considering that I only found one live specimen in all the time I spent shell collecting, I speculate that this is an uncommon species in Midway's waters.

Figure 1. *A. producta*
Length: 19.3 mm

Chicoreus insularum Pilsbry, 1921 is one of the Hawaiian endemics which can be found in sufficient quantities outside the reef on the south side of Sand Island at depths of 10 to 20 meters. Diving outside the reef was only authorized for an eight month period

Figure 2. *C. insularum*
Length: 50.3 mm

Figure 3. *C. insularum* Length: 72.7 mm

from June 1977 to January 1978 and then only to those with advanced, or higher, SCUBA certificates. The *C. insularum* were easy to find during June and July of 1977. They were right on top of the reef in plain sight (if you consider a heavily encrusted lump easy to spot). Not knowing their identity or the many hours required to clean them, one new shell collector picked up 17 in one dive.

The younger specimens were found in the deeper water. They required very little cleaning and were much harder to find because they were under coral rubble in much the same type of habitat as cowries. None were found inside the reef and they disappeared from outside the reef after July 1977.

In January 1978 Midway Islands' commanding officer re-evaluated the hazards of diving outside the reef without a decompression chamber available and limited diving to areas inside the reef where the deepest spot is approximately 26 meters and the average depth is about three meters.

The disappearance of *C. insularum* was unexplainable unless they were just abundant during mating season. However no eggs were observed. No more specimens of *C. insularum* were found during the rest of my stay on Midway which lasted until August 1978. Figure 2 is one of the younger specimens measuring 50.3 mm. It shows the shell the way it was when I brought it out of the water. It required no cleaning except removal of the animal. I use a microwave oven for this. Figure 3 shows one of the older specimens measuring 72.7 mm after three hours of cleaning with dental picks and a wire brush. I have an eight shell growth series of this species with the smallest being 5.25 mm.

Homolocantha anatomica Perry, 1811 known to most Hawaiians by its synonym, *Murex pele* Pilsbry, 1920, is not very common on Midway but those found have one notable characteristic. They are giants. I found two, both of which exceeded the world size record of 63.4 mm as listed in Wagner and Abbott's STANDARD CATALOG OF SHELLS (1977).

I found my first specimen outside the reef in eight meters of water on the productive south side of Sand Island. Figuring I would find more, I traded it for an offer I couldn't refuse. Later when diving was no longer authorized outside the reef I lost hope of replacing it. But during my last month on Midway at 1:00 P.M. on a warm, calm, afternoon in July 1978 in the middle of the lagoon in three meters of water, at the end of a track in the sand I found the 74.65 mm monster pictured in Figures 3a, 3b, 3c. Some of my

Figure 3a. Apertural view of *H. anatomica* Length: 74.65 mm.

Figure 3b. Dorsal view of same specimen.

Figure 3c. Side view of same specimen.

shell collecting friends who left Midway a few weeks after I did reported finding better than a half dozen specimens of comparable size in roughly the same location but in holes in the coral heads.

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: MARCH 19, 1981

MARTIN SCHULER

Carol Burchard called the meeting to order at 7:45 P.M. Ron McPeak introduced the evening's speaker, Hans Bertsch, who talked on Hawaiian nudibranchs. (Hans and Scott Johnson have written a book identifying the many nudibranchs of the Hawaiian group in color and it should be available shortly). His talk was extremely well organized and illustrated with many color slides of the species found there. "Oohs" and "aahs" were heard as the spectacular nudibranchs were displayed before our eyes. Hans also showed examples of the varied underwater environments in Hawaii and the species likely to be found in these areas.

During the mid-evening break, members and guests were able to view a wide variety of minute species, some live, under the four stereo microscopes brought to the meeting by members. Delicious refreshments of sausage in blankets and small cakes made by Sherry Schuler were greedily enjoyed by all.

After the break, Wally Robertson reported the deadline for 1981 dues. Carole Hertz called for the donation of auction shells. These shells are needed to give The Festivus its budget until May 1982 as well as make the auction the resounding success it always has been. (For Auction information see last page of this issue).

The Club voted to obtain Jerome Eisenberg's new book, "A Collector's Guide to Seashells of the World."

The shell drawing was won by Hugh Bradner. The meeting was adjourned at 9:45 P.M.

MINUTE SHELLS

KURTZIELLA ?ATROSTYLA (TRYON, 1884)

JAMES KEELER

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JULES HERTZ

Department of Marine Invertebrates, Natural History Museum, Balboa Park
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The specimen shown in Figure 1 was collected and photographed by the senior author. The 4 mm milky white shell was found at the Inlet, Bonita Beach, Florida in April 1973. The shell figured has brown stains on the columella and below the sutures (in the valleys between the axial ribs). Two other specimens collected at the same time and place also have stains on the columella, but the brown sutural stains vary. The largest and most beachworn specimen has a patch of brown on the inside of the outer lip and the subsutural brown stain is almost continuous, fading out as it crosses the axial ribs. The columella stain in this specimen is faint.

Figure 1. Apertural view of *K. ? atrostyla.* 16X

The shell figured here is very similar to the one figured by Abbott (1974:281, fig. 3243). He specified that the species gets to a size of 7 mm and that the range for *K. atrostyla* is North Carolina to Florida and Texas as well as the West Indies. Abbott describes the species as "milky-white with a brown-stained columella, a brown subsutural band and sometimes brown on the thickened outer lip. Rarely all-brownish. 6 whorls, keeled at the shoulder; 8 to 10 axial riblets and fine spiral striations. Aperture and short anterior canal slightly oblique; outer lip with a shallow, rounded, posterior turrid notch. Moderately common: from intertidal to 48 fathoms." He lists *K. ephamilla* Bush, 1885 and *Mangilia*(sic) *atrostyla* Dall, 1889 as synonyms.

Perry and Schwengel (1955:185, pl.38, fig.266) figure a specimen for "*Kurtziella atrostyla* (Dall)" which is significantly different in appearance than the one figured here or that figured by Abbott (1974). It is assumed that the Perry and Schwengel specimen is very mature since the aperture has the "hooded" appearance of an older turrid. This latter specimen has sharper axial ribs, more pronounced spiral sculpture, and a much more keeled appearance at the shoulders of the whorls. The species description by Perry and Schwengel is almost identical to the Abbott description quoted above. The *K. atrostyla* figured by Perry and Schwengel is very similar to Abbott's figure 3242 of *Kurtziella limonitella* (Dall, 1883). The latter is supposed to have strong, rounded, axial ribs with numerous rows of microscopic, opaque-white punctations between the ribs.

The species *atrostyla* first appeared in print in Tryon (1884:310) as *Daphnella atrostyla*, Dall, MS. Dall's first published work on *atrostyla* was in 1889 (pp 11, 111) when he referred to it as *Mangilia atrostyla*. Dall (1889b) figured (pl XLI, figs. 4, 4a) *Mangilia atrostyla*. Tryon (1884) considered *D. atrostyla* a slight variety of *Daphnella*

cerina Kurtz and Stimpson, 1851 and figured both species (pl.22,fig.43: pl. 34, fig. 100). Tryon's description of *D. cerina* was "Yellowish white, columella sometimes tinged with black; surface covered by very fine revolving lines crossing the ribs." The range reported for this species was New England to Tampa Bay, Florida, mostly southern in distribution. Tryon differentiated *D. atrostyla* as having a dark columella and being from the west coast of Florida. His figure of *D. atrostyla* is very small and difficult to use for comparative purposes, while his figure of *D. cerina* is similar to Perry and Schwengel's figure of *K. atrostyla* except that the former has more rounded whorls. Abbott's figure of *Kurtziella cerina* (fig. 3248) shows a stouter and heavier looking shell than his figure of *K. atrostyla* although both are very similar.
Kurtz and Stimpson (1851:115) described *Pleurotoma cerinum*. Their original Latin description for the species translates roughly as follows: Shell fusiform-turrited, waxen, actually ashen, about 10 longitudinal ribs, elevated, numerous transverse striae; 7 distinct turns; aperture oblong; lip simple; canal very short.

Stimpson (1851:49, pl. II, fig. 2) gave the original illustration of *Pleurotoma cerinum*, and this was the figure later used by Tryon (1884, pl. 22, fig. 43). Holmes (1860:77, pl. XII, figs. 9,9a) also figured *Pleurotoma cerinum* and his figure differed significantly from the Stimpson illustration. Holmes' illustration showed a stouter shell with a strongly recurved apertural canal. He noted that *P. cerinum* had been found as far north as New-Bedford harbor, and that it is common on the Carolina coast and abundant in the Post-Pleiocene beds.

It is obvious from the literature that more work, probably anatomical, is needed to eliminate the confusion and finally determine whether *K. atrostyla* and *K. cerina* are distinct species. If they are indeed the same, then the name *Kurtziella atrostyla* (Tryon, 1884) would become a synonym of *Kurtziella cerina* Kurtz and Stimpson, 1851.

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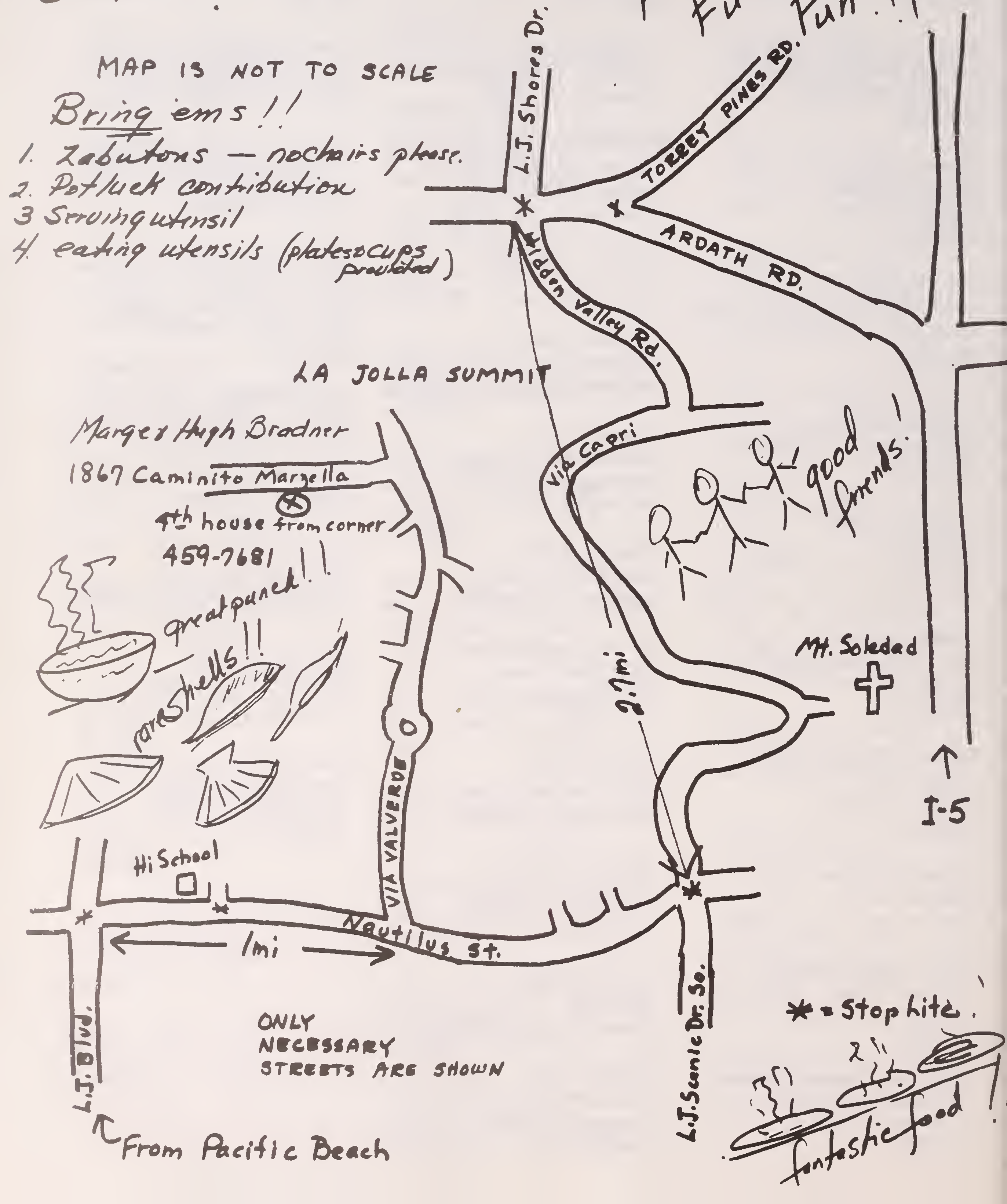
Sat. Apr 25 1981
6 P.M. — ?



THE FESTIVUS

SAN DIEGO SHELL CLUB

FOUNDED 1961 • INCORPORATED 1968

MEETS THIRD THURSDAY, 7:30 P.M.
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Editor.....................Carole M. Hertz

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VOL. XIII JUNE 1981 NO. 6

THERE WILL BE NO JUNE MEETING

Because our Club is involved in hosting the Western Society of Malacologists (WSM) meeting from June 23 to June 26, 1981 at San Diego State University, the regular June meeting will not be held.

Registration: Tuesday, June 23 at 10:00 A.M. in the lobby of Olmeca Hall, located near the southwest corner of the parking lot.

Club hosted Wine and Cheese Get Acquainted party: Tuesday evening, June 23 in the lobby of Olmeca Hall.

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MINUTE SHELLS

WESTERN ATLANTIC CAECIDS

BY

JAMES H. KEELER

30 Park Lane, Chagrin Falls, Ohio 44022

In several issues of The Festivus (January 1978, January 1979 and April 1979) Jules Hertz featured some species of the family Caecidae from southern California and Baja California, Mexico. This note will cover some of the more common western Atlantic species of the family.

In 1962, Moore proposed placing the Caecidae in the superfamily Rissoacea based upon the similarity of soft parts rather than in the Cerithiacea as proposed by Clark (1855). Moore found no close relationship between the Caecidae and the Vermetidae or other Cerithiacea. As pointed out by Hertz, there is considerable confusion in the literature concerning the genera of the caecids. In this note the treatment by Moore in Abbott's AMERICAN SEASHELLS, Second Edition will be followed and all caecids will be classified under the single genus, *Caecum.*

A larval coil and protoconch of the initial growth stages of *Caecum* is shown in Figure 1 and an intermediate growth stage is shown in Figure 2. Figure 3 is an angled view of the horny circular operculum in the opening of *C. bipartitum* Folin, 1870.

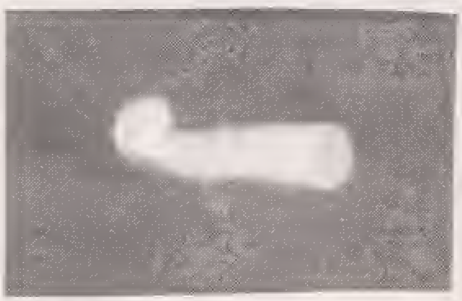

Fig. 1. Larval coil and protoconch. Length: 1 mm

Fig. 2. Intermediate growth stage. Length: 1.2 mm

Figure 4 is a sketch illustrating the features by which the mature shells are identified.

Caecum pulchellum Stimpson, 1851 (Figure 5) with 20-30 axial rings and no terminal varix, *C. bipartitum* (Figure 6) lacking axial rings toward the anterior end, and *C. textile* Folin, 1867 (Figure 7) with 35-40 low, close set axial rings were collected in Florida by the writer. These should be contrasted with *C. tornatum* Verrill and Bush, 1900 (Figure 8) with its widely spaced axial rings. *C. tornatum* is found only in Bermuda.

Fig. 3. Angled view of horny operculum in opening of *C. bipartitum.*

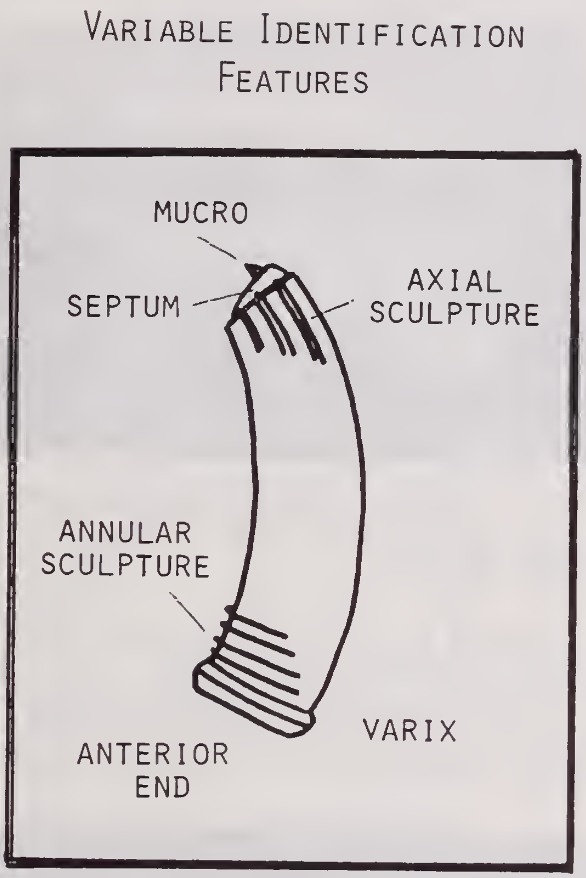

Fig. 4. Identification features

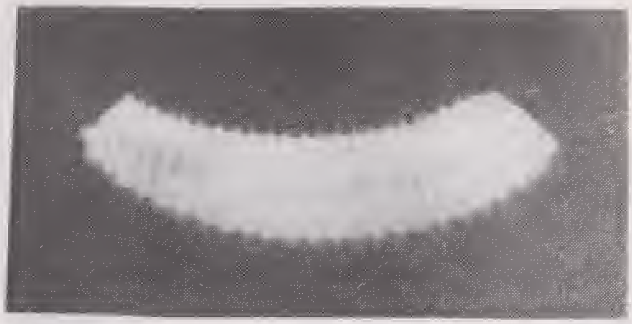

Fig. 5. *C. pulchellum* Length: 2.5 mm
Base of reef, Marathon, Florida Keys

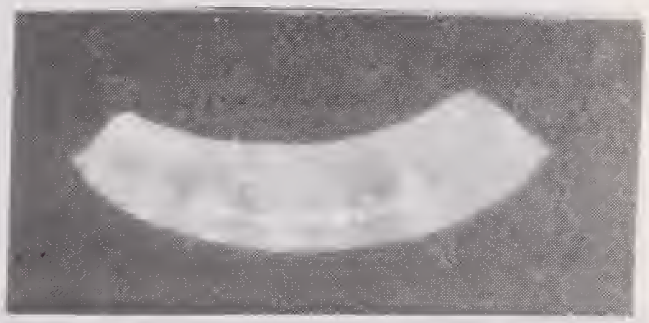

Fig. 6. *C. bipartitum* Length: 2 mm
Inlet, Bonita Beach, Florida

Fig. 7. *C. textile* Length 2 mm
Base of reef, Marathon, Florida Keys

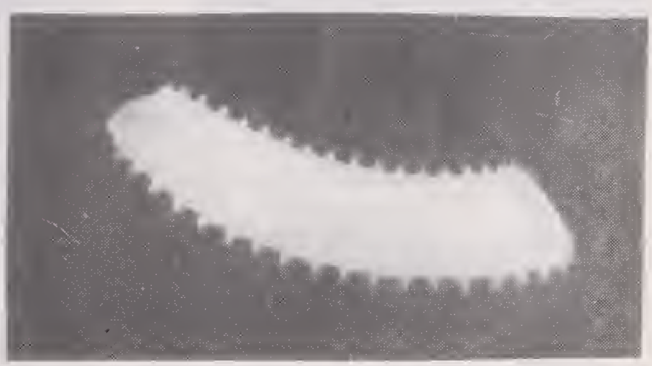

Fig. 8. *C. tornatum* Length: 2.5 mm
Shell sand, Bermuda

Caecum regulare Carpenter, 1858 (Figure 9) with 25-30 flat-topped rings and *C. lineicinctum* Folin, 1879 (Figure 10) smooth except for weak rings approaching the anterior end were collected by the writer in the Virgin Islands and are primarily Caribbean species. Moore (1972) reports finding *C. regulare* specimens in southeast Florida.

Fig. 9. *C. regulare* Length: 2 mm Beach, Pelican Beach, St. Thomas, Virgin Islands

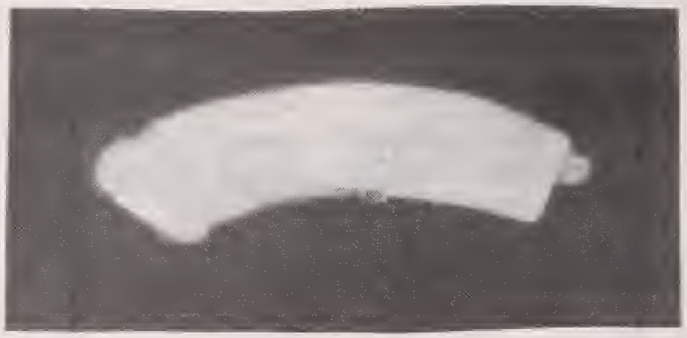

Fig. 10. *C. lineicinctum* Length: 2.5 mm Beach, Pelican Beach, St. Thomas, Virgin Islands.

Caecum floridanum Stimpson, 1858 shown in Figure 11 is distinctive with its greater size (3-4 mm in length) and larger rings near the anterior end. *C. imbricatum* Carpenter, 1858 (Figure 12) often with strong mottled brown and white coloration, has weak annular rings and longitudinal ridges. The specimens of *C. floridanum* and *C. imbricatum* illustrated here were collected by the writer in the Florida Keys.

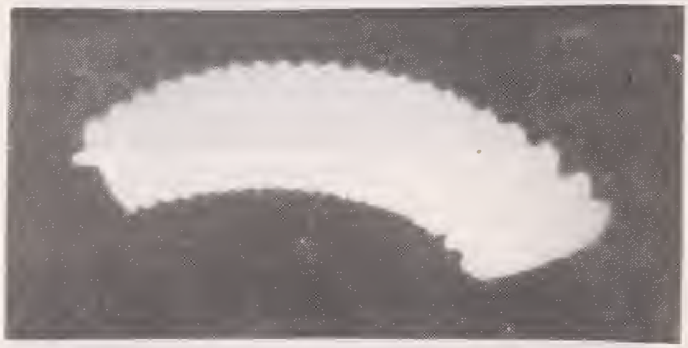

Fig. 11. *C. floridanum* Length: 3.7 mm Base of reef, Marathon, Florida Keys.

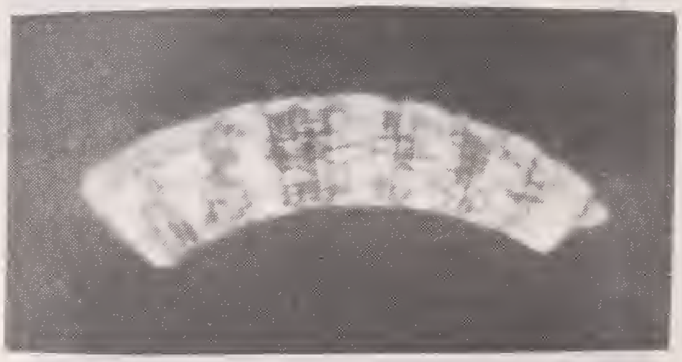

Fig. 12. *C. imbricatum* Length: 3.5 mm Base of reef, Marathon, Florida Keys.

The next three species, *Caecum plicatum* Carpenter, 1858 (Figure 13), *C. delicatulum* Verrill and Bush, 1900 (Figure 14), and *C. debile* Verrill and Bush, 1900, (Figure 15) were from Bermuda shell sand supplied to the writer by Mr. Arthur A. Guest of Bermuda and Mr. Russell Jensen of The Delaware Museum of Natural History. The frequently mottled *C. plicatum* is solid in appearance with strong longitudinal ridges and was the most common caecid in the shell sand samples. There is some question that *C. delicatulum*, *C. debile*, and *C. crispum* Verrill and Bush, 1900 (not shown) described in Verrill and Bush (1900) are separate species. The writer has sent about one hundred specimens to Dr. Moore for examination. The

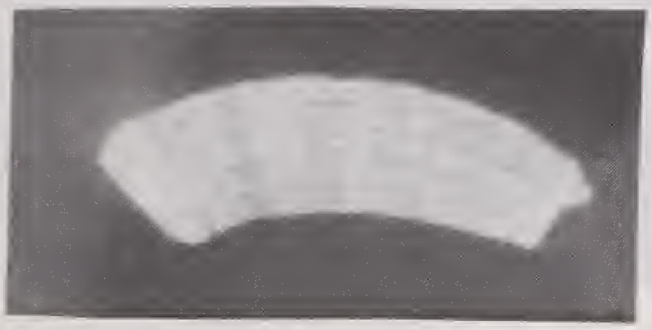

Fig. 13. *C. plicatum* Length: 2.7 mm
Shell sand, Bermuda.

Fig. 14. *C. delicatulum* Length: 3 mm
Shell sand, Bermuda

specimens photographed here show the septum or plug difference noted by Verrill and Bush, "Plug broadly exposed, oblique, most prominent near the outer margin" [for *C. delicatulum*] and "... having a prominent, nearly hemispherical plug" [for *C. debile*].

Caecum cycloferum Folin, 1867 in Figure 16, from dredgings 110 miles west of Tampa, Florida looks a great deal like *C. plicatum* but is a larger shell (3.5 mm versus 2.7 mm) and in proportion is a more slender shell for its length.

Fig. 15. *C. debile* Length: 2.2 mm
Shell sand, Bermuda.

The thin-shelled, "smooth" caecids depend more upon mucro and septum (or plug) differences for identification. *C. vestitum* Folin, 1870 (Figure 17) has a slightly convex septum and a small mucro on the right side. It also has slight annulations at the anterior end in contrast with *C. antillarum* Carpenter, 1858 (Figure 18) with a weaker mucro and no weak annulations or any trace of a varix at the anterior end.

Fig. 16. *C. cycloferum* Length: 3.5 mm
Dredged 200 ft, 110 miles west of
Tampa, Florida.

Fig. 17. *C. vestitum* Length: 2.5 mm
Base of reef, Marathon,
Florida Keys.

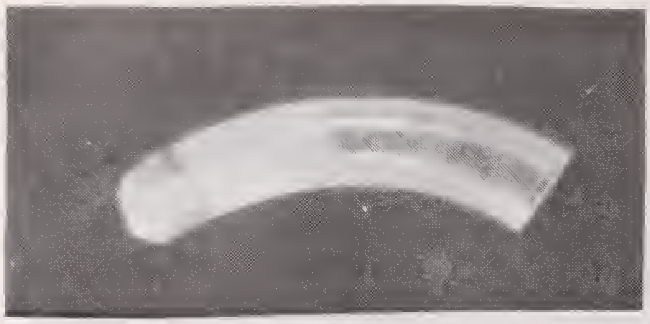

Fig. 18. *C. antillarum* Length: 3 mm
Dredged 280 feet, east of
St. Augustine, Florida

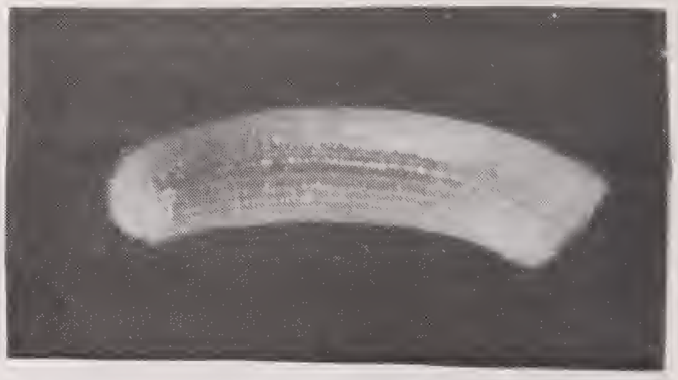

Fig. 19. *C. heladum* Length: 3 mm
Inlet, Bonita Beach, Florida.

The *C. heladum* Olsson and Harbison, 1953 (Figure 19) specimen shown here from beach drift at an inlet near Bonita Beach, Florida shows the weak longitudinal ridges and axial rings. *C. johnsoni* Winkley, 1908 (Figure 20), a North Carolina specimen, shows faint annular rings and a more convex septum.

Caecum subvolutum, Folin, 1874 (Figure 21), found in the Bermuda shell sand mentioned earlier was identified by Dr. Donald Moore who pointed out that *C. subvolutum*, primarily a Caribbean shell, had not been previously reported from Bermuda. The figure shows the large mucro on the smooth slender shell and a varix on the anterior end that closely matches Moore (1972: fig. 4).

Fig. 20. *C. johnsoni* Length: 2.2 mm
Beach, Topsail Beach, North Carolina.

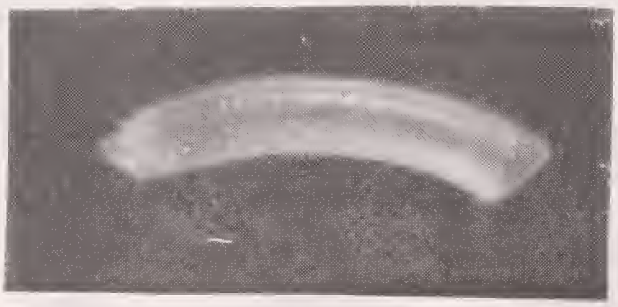

Fig. 21. *C. subvolutum* Length: 2.5 mm
Shell sand, Bermuda.

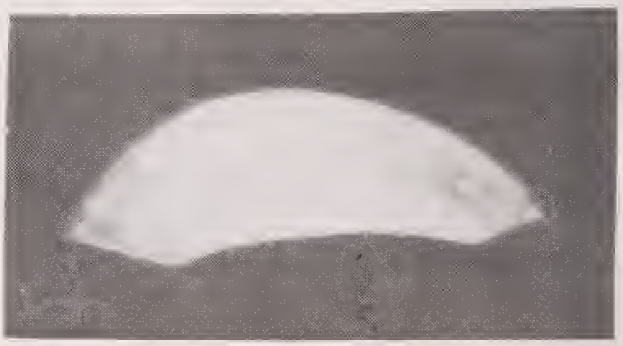

Fig. 22. *C. nitidum* Length: 2.5 mm
Base of reef, Marathon, Florida Keys.

Finally, the smooth caecids with an oblique constricted aperture noted in Abbott (1974) under the subgenus *Meioceras* are shown. *C. nitidum* Stimpson, 1851 (Figure 22) exhibits its characteristic heavily swollen appearance in contrast to *C. cornucopiae* Carpenter, 1858 (Figure 23) with its short, straight, midsection and *C. cubitatum* Folin, 1863 (Figure 24), the more slender, deeper water species with the thin pointed mucro.

Fig. 23. *C. cornucopiae* Length: 2 mm
Base of reef, Marathon,
Florida Keys.

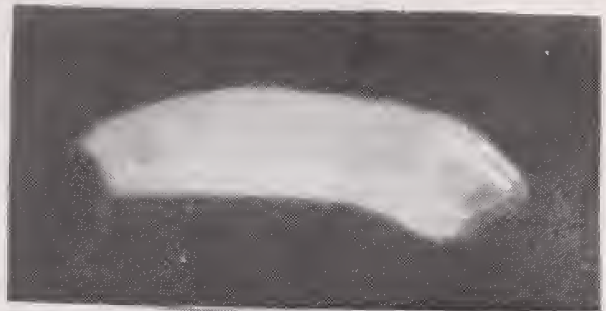

Fig. 24. *C. cubitatum* Length: 1.5 mm
Dredged 125-140 fms., south of
Tarpon Springs, Florida.

The following range information is primarily from Abbott (1974) with extensions according to noted references or from the writer's collecting.

C. pulchellum	New Hampshire to Brazil
C. bipartitum	Florida Keys to Texas and western Gulf of Mexico
C. textile	Clearwater, Florida to West Indies
C. tornatum	Bermuda only
C. regulare	SE Florida to Virgin Islands
C. lineicinctum	NE Caribbean [Moore (1972)] and Bermuda
C. floridanum	North Carolina to Brazil
C. imbricatum	Texas to Florida to Brazil [Rios (1975)]
C. plicatum	Bermuda, Florida to Brazil [Rios (1975)]
C. delicatulum	Bermuda [Verrill and Bush (1900)] and [Waller (1973)]
C. debile	Bermuda [Verrill and Bush (1900)]
C. cycloferum	SE United States to Brazil [Rios (1975)]
C. vestitum	Florida coast to West Indies
C. antillarum	Bahamas and Florida Keys to Brazil [Rios (1975)]
C. heladum	Florida coasts and Puerto Rico
C. johnsoni	Massachusetts to northern Florida
C. subvolutum	Bermuda, Florida to Barbados [Moore (1972)]
C. nitidum	Bermuda, Florida to Brazil
C. cornucopiae	Bermuda, Florida to Brazil [Rios (1975)]
C. cubitatum	Texas, North Carolina to Brazil

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MUREX (OCINEBRA) SYKESI PRESTON, 1904

BY

ANTHONY D'ATTILIO

Department of Marine Invertebrates, Natural History Museum, Balboa Park, P.O. Box 1390, San Diego, California 92112

Introduction

A number of small muricid species, many less than 15 mm in height, that were described by early authors have remained poorly known. This paucity of information results from the following factors: 1) original generic assignments that have been subsequently changed, 2) short generalized descriptions, and 3) unsatisfactory illustrations of species at their exact size. This last factor is the most significant since micro-sculptural details were inadequately illustrated. Study of the holotype, other typological material or enlarged, detailed photographs of such material are then necessary to establish an understanding of the species.

The species discussed in this paper was described in 1904 by Preston in the Journal of Malacology. This serial publication was not previously examined by me. Apparently, it never had a wide distribution. The following citation appears in the Zoological Record for 1904. "Preston H.B. Descrip. of some new sp. of Cingalese and Indian Marine Shells. J. of Mal. XI, 75-78, pls. 6,7."

This species may more properly be assigned to the genus *Favartia* Jousseaume, 1880. A paratype of *Favartia sykesi* (Preston, 1904) is in the collections of the Los Angeles County Museum (N.H.) No. 1963 and this specimen forms the basis of my description which follows. Figures 1a and 1b illustrate the paratype of *F. sykesi*.

Fig. 1a. *F. sykesi* paratype LACM(NH) No. 1963, apertural view.

Fig. 1b. *F. sykesi* dorsal view of same specimen.

Description

Height 18.75 mm, width 12.5 mm, shell broad, diamond shaped, somewhat eroded but disclosing about 5 postnuclear whorls; aperture moderate size, sub-ovate, inner lip erect except above; suture impressed; canal open, not long, broad, distally recurved; 6 varices with leading slope strongly imbricate, broad and strongest cord at periphery of the convex body whorl, shoulder not pronounced, 2 cords above the central peripheral cord and 3 cords below on body whorl; all cords diminishing in strength away from peripheral cord, cords medially divided by moderate depressions; intervarical areas broad and deeply excavated, one additional cord on canal; siphonal fasciole retaining 4 remnants of earlier canals. Where not eroded, short growth stages developed as scaly laminae may be found. Color of shell brownish white. Within aperture narrow brownish spiral bands present marking cords on dorsum.

Discussion

The holotype of *Favartia sykesi* is figured in Fair (1976:80, pl. 20, fig. 293). A comparison with the paratype illustrated here demonstrates that the two unquestionably represent the same species. The species is not figured in Radwin and D'Attilio (1976).

In a recently published work dealing with tropical Pacific marine shells, *F. sykesi* was confused and synonymized with *F. peasei* (Tryon, 1880), a species known to occur in the south tropical Pacific. *F. peasei* is illustrated in Figure 2. Specimens of *F. peasei* collected in the Solomon Islands, in general, closely resemble a few *Favartia* species from the Caribbean Province and the eastern Pacific. For these species Perriliat (1972) proposed the subgenus *Caribiella*: Type species *Murex intermedius* C.B. Adams, 1850, by original designation.

Fig. 2. *F. peasei*. Specimen collected by Father Van der Riet at Ata'a Lagoon, British Solomon Islands.

Acknowledgments

Mr. Gale Sphon kindly processed the loan of the paratype from the Los Angeles County Museum (NH). The photographs are by Mr. David K. Mulliner, Festivus staff photographer. Mrs. Carole M. Hertz made helpful suggestions regarding the text.

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1976. The Murex Book: an illustrated catalogue of Recent Muricidae (Muricinae, Muricopsinae, Ocenebrinae). Pub. Ruth H. Fair, Honolulu. 138 pp., 23 pls.

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1904. Description of some new species of Cingalese and Indian marine shells. Jour. of Malac. 11:75-78. pls. 6,7. (not seen).

Radwin, George E. and Anthony D'Attilio
1976. Murex shells of the world an illustrated guide to the Muricidae. Stanford Univ. Press, Stanford. 282 pp. 30 pls. in color and 192 text figs.

Tryon, George W.
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FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: MAY 21, 1981

BY

MARTIN SCHULER

Carol Burchard called the meeting to order at 7:40 P.M. After new members and guests were introduced, Hugh Bradner presented Amy Kimball, the Club Science Fair winner for 1981, who gave an account of her project, The Ecology of *Colisella digitalis*. Hugh then presented Amy with the prize that she had selected, the book Between Pacific Tides.

Ron McPeak then introduced the speaker for this month, David Leighton, whose talk was entitled The Cultured Abalone. Dr. Leighton has been studying the abalone for some twenty years. His work involves the germination of and growth of the various species of west coast *Haliotis* until they are large enough to seed off the coast. His culturing work also includes the rock scallop, *Hinnites giganteus*.

After the break, Dave Mulliner showed the slides of the April auction. Ron McPeak announced the speaker for July, Janice Sibley, who will speak on limpets. (There is no regular June meeting).

Carol Burchard presented the following motion which will be voted upon at the July meeting. Motion: The editor of the San Diego Shell Club publication, The Festivus, shall be a non-voting member of the executive board with an indefinite term of office.

Margaret Mulliner announced the annual plant sale and Dave Mulliner gave details of the upcoming WSM meeting and the Club's hosting of a wine and cheese party on the first evening. He requested that we all donate either wine or cheese or both for the event.

The shell drawing was won by Mike Dixon, a visitor from England. The meeting was adjourned at 9:30 P.M.

ADDITIONS TO THE ROSTER

Campbell, Byron. 5445 Baltimore #27, La Mesa, Ca. 92041, 463-7910.
Flentz, Mary "Pecten". 5014 Newton Street, Torrance, Ca. 90505.
Hewitt, Susan. 258 Lowell Street, Lexington, Mass. 02173.
Mahar, Mary Lou & Dale Glantz. 1127 Thomas Ave. #7, San Diego, Ca. 92109, 270-0474.
McElroy, Bill and Marlene. 9651 Blackgold Rd., La Jolla, Ca. 92037, 457-4848.

Amy Kimball, a senior at Point Loma High School, was the Club winner in the 1981 Greater San Diego Science and Engineering Fair. She presented an outline of her project and received her Club award, Between Pacific Tides by Ricketts and Calvin. Her brief summary of her winning project follows.

THE ECOLOGY OF COLISELLA DIGITALIS (SUMMARY)

By

AMY KIMBALL

An intertidal limpet, *Colisella digitalis*, has been found to occupy two distinct intertidal niches (Test, 1945). One population is dark and lives on vertical cliff faces in the splash zone, while a second group of animals is smaller with light coloring and lives in the mid-tidal zone on the stalked barnacle, *Pollicipes polymerus*. Despite their different appearances, the limpets have been identified as the same species through electrophoreses (Murphy, 1978).

The purpose of this project was to examine seven factors which might allow both populations to exist.

Procedures:

Genetics: Ten limpets of each type were put into opposite niches and new shell growth was observed for changes. Any changes in aspects of shell pattern which occurred indicated that these factors are determined environmentally, rather than genetically.

Fungus: Both types of limpet were examined under a microscope for infection by *Didymella conchae*. Their shells were treated with copper sulfate, a fungicide, and new growth was monitored for changes.

Diet: Body tissues of a group of each animal were measured with a spectrophometer for difference in calcium content.

Population count: A population count was conducted to find if limpets are evenly distributed on a barnacle colony or if inner or outer barnacles are preferred.

Homing: Low tide positions of seven of each animal were taken for one month to determine if both limpet types have a homing instinct.

Predators: Limpets living on barnacles were painted dark and their disappearance rate over a two week period was compared to that of a control group of light animals to find if color is a factor seclected against by predators.

Shell structure: Basal dimensions of 25 animals of each type were compared to their heights to find if one variety has taller proportions.

Conclusions:

It was concluded that *Colisella digitalis* is able to live on vertical cliffs in the splash zone or in the midtidal zone in a symbiotic relationship with *Pollicipes polymerus*. This relationship is mutually advantageous because the limpets receive a superior substrate in exchange for eating algae which could grow over the barnacles' shells and leave them unable to feed.

It was concluded that diet rather than fungus or genetics is responsible for the different shell colors of the two populations. Population counts indicate that distribution within barnacle colonies is even and *Pollicipes*-type limpets have higher proportions which appear to be related to the fact that there is less basal area available to limpets living on barnacles. Predation tests showed that there was not a significantly higher disappearance rate for dark animals living on barnacles than for light animals living on barnacles. When light specimens of *C. digitalis* from barnacles were relocated to cliff faces, new growth had the same dark coloration as other *C. digitalis* normally living there.

Literature cited

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1945. Ecology of California *Acmaea*. Ecology 26(4):395-405.

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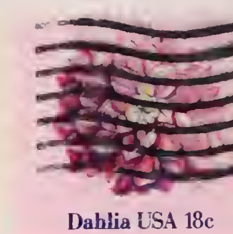

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MEETS THIRD THURSDAY, 7:30 P.M.
ROOM 104, CASA DEL PRADO, BALBOA PARK

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Vice President.............Ron H. McPeak
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VOL. XIII JULY 1981 NO. 7

PROGRAM: "Molluscan Behavior in an Experimental Tidepool" is the topic of speaker, Janice Sibley. Her talk will be accompanied by her motion picture film and slides.

Slides of the 1981 WSM conference will be shown.

Date: July 16, 1981 Time: 7:30 P.M. Room: 104

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NOTE ON THE HOLOTYPE OF MUREX LAQUEATUS SOWERBY, 1841 (GASTROPODA: MURICIDAE) WITH A DESCRIPTION OF A SPECIMEN FROM GUAM

BY

ANTHONY D'ATTILIO

Department of Marine Invertebrates, Natural History Museum, Balboa Park
P.O. Box 1390, San Diego, California 92112

The description of *Murex laqueatus*, written in Latin only as was the custom of the times, appears as follows from page 142 of the Proc. Zool. Soc. London 1841 (for 1840).

> Murex laqueatus, Conch. Illustr. f. 78. *Mur. testâ rhomboideâ, transversè costatâ, crassâ, albâ: spirâ mediocri; anfractibus septem, subangulatis: caudâ breviusculâ, rectâ, crassâ: varicibus tribus obliquiter spiram decurrentibus, à tergo tumulosis, fimbriâ laqueatâ carinatis, ad caudam subspinosis: interstitiis tuberculo magno costatis: aperturâ parvâ, ovali; labio externo crenulato; canali aperto.*
>
> *Hab.* —— ? Mus. Saul.
>
> A much thicker shell than *M. tripterus*, Born., and moreover having the caudal canal spinose.

In that same year an illustration appeared in Sowerby's Conchological Illustrations as Figure 78. It is shown here as Figure 1. The holotype is in the collections of the University Museum of Zoology, Cambridge, England. The following note is based on the holotype specimen received on loan from that institution and illustrated in Figures 2a and 2b.

The holotype is white with a pinkish cast, its structural characters well marked. The species was known only from the type. Subsequent figures in three later 19th century iconographies are all copies of the figure in the Conchological Illustrations. The type locality is not known. Within the last decade living specimens of this species have been collected at Guam, Kwajalein, and the Hawaiian Islands (also Tahiti?). On the basis of its known present distribution, it is apparently an insular species in the western Pacific.

Fig. 1. Holotype of *M. laqueatus* from Sowerby.

Pterynotus laqueatus (Sowerby, 1841)

The following full description is based on a specimen in the San Diego Natural History Museum received from Leo Kemczenski. He collected it off Orote Cliffs, Guam in 90 feet among coral rubble. It is illustrated in Figures 3a and 3b. The radula was extracted and mounted and is illustrated in Figure 4.

Description: The shell is 34 mm in height, broadly fusiform, with a high spire, protoconch not preserved and with about 7 postnuclear whorls. The aperture is small, ovate, with a crenulate outer lip within which there are 10 evenly sized denticles, (the inner lip has a denticle posteriorly which matches the uppermost one in the outer lip and the pair thus frame the anal trough); below the columellar denticle there is a knobby swelling. The canal is moderately long, narrowly open, terminally recurved with two old canal remnants on the siphonal fasciole.

Fig. 2a. *M. laqueatus*, apertural view of holotype. Length:30 mm, Width:19 mm.

Fig. 2b. Dorsal view of same specimen.

Fig. 3a. *Pterynotus laqueatus*, apertural view. Length:34 mm, Width:24 mm.
SDNHM 76510 Collector: Leo Kemczenski

Fig. 3b. Dorsal view of same specimen.

There are 3 varices per whorl which extend outward into flanges which are weakly recurved and terminally form 2 lobes. The flanges extend from the suture above the shoulder to the base of the body whorl. The spiral cords develop strongly on the flange surface; there are 2 such main cords on the upper (posterior) lobe and 3 cords on the lower lobe; 3 lesser cords occur above the shoulder, and 3 minor cords in the area between the lobes. On the canal there are 3 spines but with no connecting web or flange, the more prominent cords or spines are subdivided by 2 grooves. There is a large, knobby ridge between varices and a lesser one at the extreme side of the intervarical area contiguous to the beginning of the flange. The shell is weakly, scabrously lamellate.

Shell color is overcast with light pink shaded into violet at the extremity of the flange; a deeper orange-red occurs on the canal and on the periphery of the cords, and a flush of orange on the spire. Aperture is pale violet within, a bright red is found between the inner lip denticles and on the columella.

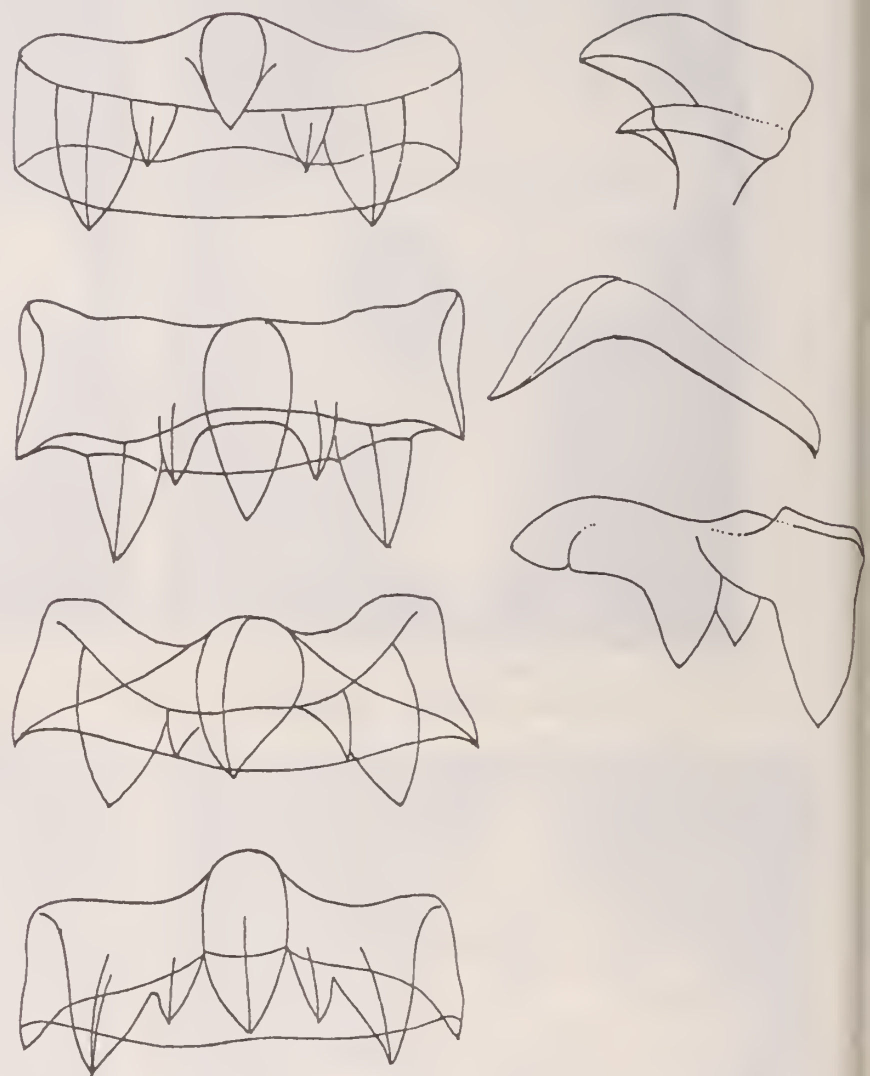

Fig. 4. Radula of *Pterynotus laqueatus* from specimen shown in Figures 3a and 3b.

This species with its rich diversity of color recalls *Pterynotus martinetanum* (Röding, 1798), another multicolored *Pterynotus*.

A juvenile specimen of *P. laqueatus*, SDNHM 76510 , also collected by Mr. Kemczenski in Guam is shown in Figures 5a and 5b.

Geographical range: In addition to its comparatively more frequent occurrence in Guam, the species is said to occur in Kwajalein Island (Hawaiian Shell News 27(9):7, figure 3, collector D.J. MacDonald; for its occurrence in Hawaii, see Hawaiian Shell News 28(10):1, 2 figures; for an additional record in Tahiti, see page 10 of the preceding reference.

Fig. 5a. *P. laqueatus*, apertural view of juvenile, SDNHM 76510
Length: 16 mm, Width: 10 mm.

Fig. 5b. Dorsal view of same specimen.

Acknowledgments

Dr. J. Bishop of the University Museum of Zoology, Cambridge, England very kindly sent me the type on loan. All photographs are the work of Mr. David K. Mulliner, Festivus staff photographer. Mrs. Carole M. Hertz contributed in discussion of the text.

FORT KAM REVISITED, FEBRUARY 1981

BY

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Pearl Harbor, Hawaii 96860

The entrance to Pearl Harbor off Fort Kamehameha has long been a favorite shelling area, oftentimes with some very surprising finds. This is an excellent location in which to look for shallow water Hawaiian cowries, including the much desired *Cypraea semiplota*. Fort Kam is in the lee of the island, and even during mild Kona winds visibility is often as much as ten feet during the incoming tide. Acres of coral slab and turnable rock are marked by red, yellow, green, grey and black sponge and other forms of marine life which include tube worms, brittle stars, and annelid worms that are found in abundance. Other marine life found at Fort Kam is the ever elusive lobster and many different types of crabs. Because of the location of Fort Kam, it has long been a favorite place for people to come and collect edible seaweed. In recent years the popularity of the place has been reduced by pollution from Pearl Harbor (especially during ebb tide), rumors of hammerhead sharks, and limited access past Hickam Air Base guards. The dangerous pollution has now been almost entirely eliminated; the sharks are not really much of a hazard; and we could pass the guards so we decided to skin dive in search of *C. semiplota*. We had shelled here before with snorkle and SCUBA. SCUBA might be preferable because those little black-mantled cowries are said to be most common at about 30 feet depth; visiblility is poor and sharks seem more likely in the murky depths. When ships are passing through the narrow channel, it sounds like a freight train is passing overhead.

We spent several hours looking for small, rounded, black, spongelike objects (*C. semiplota*) associated with black sponge, but alas, no luck this time. The day was not a loss though since the red sponge yielded several *C. teres* and one beautiful *C. chinensis*, far more rare in shallow Hawaiian waters than *C. semiplota*. The papillae of our *C. chinensis* differed a little from the descriptions by Alison Kay (1979) and Pat Burgess (1970). They were the same deep carmine color as the mantle and had the same sparse tiny white bumps. An interesting observation was that some of the papillae had a barely visible white spot at the extreme tip. The tentacles were orange-carmine with a cream colored base and the eyes were a dark brown-black. Alison Kay indicated (pers. comm.) that the *C. chinensis* mantle is variable. She has a specimen similar to ours.

When we later put the cowries in a flat-bottomed dish, the *C. chinensis* moved with a world record speed of 5 to 7 mm/sec.! Robert Schoening has observed, but not clocked, even faster movement of *C. cylindrica* in situ on Guam.

At Fort Kam there is a multitude of *C. caputserpentis*. We also saw more than two dozen *C. helvola*, and one *C. poraria*. In addition we collected a superb specimen of *C. sulcidentata* (55 mm long), and a large *C. schilderorum*. These species are not common at snorkle depth in Hawaii. Although cowries were our goal, we collected the following molluscs that appealed to us: *Cymatium intermedius, Gyrineum busillum, Mitra assimilis, Hydatina amplustre,* and *Terebra dimidiata*. As Pat Burgess said, " Fort Kam is one of the best shelling places in the whole Pacific basin."

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Burgess, C.M. 1970. The living cowries. A.S. Barnes and Co., New York. 389 pp.

Kay, E. Alison. 1979. Hawaiian marine shells. Bishop Mus. Press. Honolulu., 653 pp.

THE CULTURED ABALONE

BY

DAVID L. LEIGHTON

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This most interesting group of herbivorous prosobranchs, the Haliotidae, comprised of about 100 species, exists throughout the world with some curious gaps in distribution. Where large species occur, as along the coasts of Japan, Australia, New Zealand, Africa, and the Pacific coast of North America, intensive fisheries have developed. In most cases, as here in California and our neighboring Baja California, heavy fishing pressures and/or loss of habitat by pollution and increased natural predation, have resulted in marked declines in stocks. Thus the need to culture abalone as "seed" to repopulate natural beds and to support cultivation of seafood crops, has spurred the development of aquaculture for these mollusks in Japan and the United States.

While abalone culture technology first began with the findings of Dr. Takashi Ino and Dr. Takeo Imai in the 1950's, these Japanese efforts were largely unknown to us as we undertook our research and development in the early 1960's. In 1964, Pacific Mariculture succeeded in spawning and rearing juveniles of several California abalones (Buzz Owen did his epochal study of hybridization in abalones there), but that group soon turned its attention to the more instantly remunerative culture of oyster spat. California Marine Associates (a group I cofounded as a partnership) formed in 1967 to tackle rearing the red abalone, *Haliotis rufescens* Swainson, to market size (3-5") in shore-based tanks. Dividing time between construction of the facility and developing the art of abalone culture, at the end of the first year we had successfully reared 60 quarter inch red abalone. Fortunately the next season we had perfected our methods and hundreds grew to thousands. Growth of the red abalone is rather slow; roughly an inch a year. Still, by the early 1970's the large concrete rearing tanks held many thousands of two to three inch abalone.

As our successes became known, others in California entered the field. In 1970-1973, Monterey Abalone Farms, Pacific Ocean Farms, and Ab Lab were born. The California Department of Fish and Game laboratory at Granite Canyon (Carmel) was opened under the direction of Mr. Earl Ebert.

We soon found increasing costs of materials for tank and building construction, and electrical power for our pumps and other equipment, were narrowing any anticipated margins for profit. In an attempt to find less expensive methods for grow-out of abalone from juvenile to adult, I began to explore in-sea habitat rearing. The off-shore petroleum platform seemed ideal for this work. After approaching several oil companies, Atlantic-Richfield agreed to allow use of its Platform Holly off Santa Barbara for abalone culture research. While abalone grew well under these conditions, weekly kelp feeding, maintenance, dive time, and fuel costs have made this approach little better than on-shore practices.

Since 1975 I have been conducting studies in abalone culture and seeding methods in the San Diego area, some under UC Sea Grant support, some as activities of Ocean Studies Division, World Research, Inc., a non-profit research group here. In a paper published in 1974 in which I examined the temperature dependence of early development in southern California abalones, the green abalone, *H. fulgens* Philippi, was shown to be tolerant of amazingly high temperatures and to grow rapidly at 20°-28° C (68°-82°F). There I suggested this species might prove to be a choice candidate for culture using thermal effluent in souther California.

In 1978, the Southern California Edison Company accepted the challenge. My group was provided the funds to conduct research on thermal effluent culture of the green abalone at the SCE Redondo Beach fossil fuel electric power plant. We have found the growth rate of juveniles reared in effluent at 24° - 28°C is almost double that for groups in ambient seawater (14°-18°C). Temperatures greater than 28°C are tolerated by green abalone (upper lethal, 31.5°C, LD_{50}, 48 hr), but effluent seldom exceeds that level. The hatchery producing seed is benefitted by more rapid growth and shortened turn-over for juvenile stock. We have gained an additional advantage: brood stock are maintained in gravid condition and larvae can be obtained throughout the year. Our culture regime has required we induce spawning in brood stock each two weeks. Individuals are spawned one each six months. In 1980, approximately 9,000 one-inch green abalone produced as a consequence of our research were donated by SCE to the California Department of Fish and Game for planting offshore in its Abalone Resource Enhancement Program. This year our program with SCE will produce over 20,000 young green abalone.

A second contract between World Research and SCE is producing red and pink, (*H. corrugata*, Gray) abalones for an aritifical reef recently constructed by SCE and managed by the CF&G south of San Onofre. We hope to have about 30,000 seed abalone of these species ready for planting on that reef by early fall.

Interbreeding of California abalones was first reported by Owen, McLean, and Meyer (1971). Hybrids are frequently found in nature and are easily produced artificially. While it was concluded by Owen et al. that the black abalone, *H. cracherodi* Leach is genetically too distinct to cross, I successfully hybridized black and green abalones in 1977. John McMullen (Ab Lab) shortly thereafter announced production of black-pinks! In current research at the Scripps Institution of Oceanography funded by UC-Sea Grant, Drs. Victor Vacquier, Cindy Lewis and I are examining the chemical and physical nature of sperm-egg interactions in con- and heterospecific combinations. Larvae succeding from viable crosses are being reared through juvenile and young adult stages to compare their characteristics with parental forms and to confirm fertility of specific hybrids. We have produced some hybrids which are noteworthy for their good growth and relatively high survival rates (e.g., the red-greens and red-pinks). Especially beautiful is the combination of red and white (*H. sorenseni* Bartsch).

The cultured abalone often appears quite different in shell coloration compared to specimens from nature. Shell color is governed by pigments, chiefly phycobilins, derived from red and blue-green algae in the diet. In the laboratory or hatchery we generally provide diets of benthic diatoms, green and brown algae, which lack these pigments. Shell color is usually white or green. Alternating diets results in color banding in shells. Our hatchery stock, when released and recaptured in field studies, are easily distinguished from natural recruits.

Abalone culture is becoming a major endeavor in Japan. In this country production costs now seem to snag aquaculture (in spite of the high price paid for abalone steaks). It is hoped that more efficient hatchery production of seed stock, genetic improvement through selection for rapid growth and hybrid development, and perfection of new methods to rear abalone in the sea, will lead to productive abalone aquaculture in this country.

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Owen, B., J.H. McLean, and R.J. Meyer. 1971. Hybridization in the eastern Pacific abalones (*Haliotis*). Bull. LACM(NH)Sci(9), 37pp., 21 figs.

BOOK REVIEW

BY

FORREST POORMAN

15300 Magnolia Street, Sp. 55, Westminister, California 92683

NATURAL HISTORY OF BAJA CALIFORNIA
By Miguel del Barco, S.J.
Translated from the Spanish by Froylán Tiscareño
Baja California Travel Series #45
Published by Dawson Book Shop, Los Angeles, Ca., 1980
298 pages, 16 black and white plates
Cost: $50.00.

In this hard back volume, the translator and publisher have made available for the interested person and for the researcher both the flora and the fauna of peninsular California. This was no easy task for the translator of the Jesuit Miguel del Barco. The narrative is divided into eleven chapters each treating a segment of the natural history of Baja California from "The Wild Animals" in chapter one to "Concerning Minerals, Salt Pans, and Rocks" in chapter eleven. Chapter nine is "About Fishes" and Chapter ten is entitled "About Testaceans (including Mollusks, Crustaceans, and Chelonians)."

Barco's position that the sea is a natural resource of the peninsula led to an unusual wealth of information in his description of the Fishes and Testaceans of the Pacific and of the Gulf of California. He treated these with thoroughness in spite of the meager information available in the 18th century. The description of early pearl fishing is one of the most detailed account known today. In the chapter on mollusks he discusses Conchas azules (abalone), Conchas de perlas (pearl shells), Hacha (fan shell), Burro (jewel box clam), and Purpura (purple dye shell). There is also a discussion of shells and the emersion of California. These chapters are illustrated by five black and white drawings by Father Ignacio Tirsch and by Homer Aschmann. There are two types of illustrations, one contemporary and the other very old originals not from this book. This book was not illustrated in its original form.

The value of the narrative is enriched by the inclusion of many footnotes which accompany the translation and illustration of Father Barco's manuscript.

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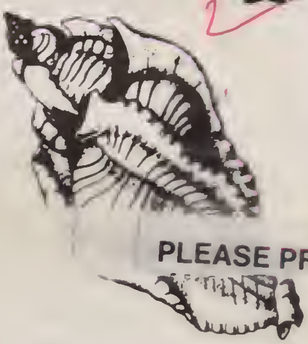

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VOL. XIII AUGUST 1981 NO. 8

PROGRAM: Dr. Wheeler North will discuss "The Ecology of the Kelp Forest." His presentation will be illustrated with his slides.

Slides of the 1981 WSM conference will be shown.

Date: August 20, 1981 Time: 7:30 P.M. Room 104

SAVE THE DATE: The Club's annual September party will be on September 26 at the home of Jeanne and Don Pisor. Details at the meeting.

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A REPORT ON THE FAUNAL STUDY OF THE GEMMELL COLLECTION FROM SAN FELIPE, BAJA CALIFORNIA, MEXICO, FROM 1965 TO 1976*

BY

JOYCE GEMMELL, BARBARA W. MYERS, CAROLE M. HERTZ

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This is a report on the origin of the Gemmell collection and the work now in progress at the San Diego Natural History Museum on this lot of shells primarily from the San Felipe area. The lot also includes some material from fifty miles south of San Felipe at Puertecitos and one hundred miles south at San Luis Gonzaga.

The collection was made by the senior author over a period of more than ten years residence in San Felipe. As a novice collector, Joyce was introduced to Dr. A. Myra Keen's SEA SHELLS OF TROPICAL WEST AMERICA (1958) by Mary Ricaud of Guaymas, Sonora, Mexico. This opened a new direction to her collecting and she realized that the most important part of her collection would probably be the field notes she could keep about this unique area.

Her study collection grew. Uncleaned shells were kept in alcohol, egg cases and various symbiotic organisms were preserved, and cleaned shell specimens were catalogued in a cabinet. Over the years visitors and friends donated gifts of books, supplies, and shell exchanges. One such gift, a complete 20 gallon aquarium setup, became a focal point for observing breeding, egg laying and larval development in several families of mollusks.

The continuous daily activity of normal living in San Felipe became a pattern fixed by the calendar and the tides. The three months from the end of November to the end of February were generally windy and cold and a good time to look for deep water bivalves scoured from the sand and mud bottom. The minus tides were after dark and the wind direction from the north. The next three months, March through May, were gradually warming with an occasional wind storm and the minus tides in the daylight hours. At this time there was an increase in sea life; breeding of mollusks, fish, and arthropods could be observed and egg capsules of squid and octopus seemed to be everywhere. Populations of mollusks at certain beaches congregated year after year on the same rocks and the same sand bars. The next four months, June through September, became progressively hotter with the humidity rising and the prevailing wind now from the south. The intertidal water temperature was now in the 80° range. There were very few mollusks and it was much too hot to be out in the sun for long. The first of October to the end of November was a transition time since air and water temperatures lowered and the low tides were again at night. Collecting was by lantern and *Laevicardium elatum* (Sowerby, 1833) were popping from the sand bars.

In 1976, on her return to California to live, the future placement of this collection became a matter of some concern. Believing that the collection was of considerable value as a well documented collection gathered over a ten year period from a limited geographic area, she hoped that it would be the basis for an annotated list of molluscan species from the San Felipe area.

* as presented at the WSM--1981 conference in San Diego, California.

At the instigation of Carole Hertz, plans were made to again organize the collection (which was still in packing boxes) and invite Barbara Myers to work with us in preparing the list of species. Dr. Hans Bertsch, then Curator of Marine Invertebrates at the San Diego Natural History Museum, graciously offered space in the department to house the collection as an entity during the period of time needed to work on the list and made the facilities of the department available to us.

We started our research with the bivalves because, in our innocence, we believed that they were easier. We had planned to publish a list of species within a short period of time. Fortunately we were sidetracked into preparing a short, minor article for The Festivus on seastar predation on the mollusks in the San Felipe area. This minor, short article ran over thirty pages and took almost a year to complete. Working on it, we lost our innocence.

Under the guidance of Anthony D'Attilio, Acting Curator of the department, the original project grew in scope as did our understanding of proper research. We are still working on the bivalves. We started over, this time taking copious notes on each species we study. We had learned how easy it is to forget. We ran into problem after problem and often thought we were rewriting scientific history. Many of our troubles were the result of our own ignorance and more than a few were caused by matters such as obscure reference material, scanty original descriptions and conflicting conclusions in scientific discussions. This made necessary, in many instances, taxonomic revisions of some species.

We would like to share a bit of our agonies with you. As an example, let us look at a lucinid species...

In checking the original references for the lucinid species *Divalinga eburnea* Reeve, 1850, formerly listed as *Divaricella*, Keen (1971) stated that the genus *Divalinga* Chavan, 1951 has the margin denticulate. Referring to Reeve we found that in the discussion following the original description he stated, "not denticulated at the margin." Our specimens, which are denticulate on the inner ventral margin, appear to follow Keen's description. See Figure 1. It wasn't until we read Reeve's entire section on the divaricate lucinids that we realized that he was referring to denticulations on the posterior dorsal margin. He never mentioned the ventral margin at all. These denticulations are actually extensions of the exterior ribbing. We did have *Divalinga eburnea* after all.

Fig. 1. Interior of valves of *D. eburnea* X8
Lot G389* Location: San Felipe.

In 1880, Von Martens named the genus *Divaricella*. It had been the accepted generic classification for all the divaricate lucinds until 1951 when Chavan, believing that the divaricate lucinids may have evolved from different ancestors, placed the two species *eburnea* and *dentata* in two different genera. Figure 2 shows a valve of *eburnea* on the left and *dentata* on the right. He placed *eburnea* in his newly created genus *Divalinga* and *dentata* was left in Von Martens genus *Divaricella*. Figure 3 shows the details of sculpture in *D. dentata*. When Chavan, in 1969, prepared the section on the Lucinacea for the Treatise on Invertebrate Paleontology, he placed all the divaricate lucinids under one subfamily Divaricellinae Glibert, 1967, which

* G numbers refer to the Gemmell collection housed in the SDNHM at this time.

seems to contradict his theory of disparate ancestry of these lucinids.

In studying specimens of *Divaricella dentata* (Wood, 1815) and *Divalinga eburnea* we found that the differences were only specific in nature. Small specimens of *dentata* when compared with *eburnea* were almost inseparable. See Figure 4. The posterior dorsal denticulation was no more developed in *dentata* than in *eburnea*. See Figures 1 and 3. A reduced posterior lateral tooth appears in *D. dentata*. There is no anterior lateral tooth. In *eburnea* there are very reduced anterior and posterior lateral teeth.

Bretsky in 1976 stated that she believes the differences between *Divalinga* and *Divaricella* are no more than subgeneric differences. We have taken a conservative approach and consider the two species *eburnea* and *dentata* to be within the range of variability of *Divaricella* thus restoring *eburnea* to the genus *Divaricella*.

Oftentimes one of the bivalves we are studying superficially resembles another, even a species in a different family. This happened with juvenile specimens of *Solecardia eburnea* Conrad, 1849 in the Leptonidae and *Cymatioa electilis* Berry, 1963 in the Galeommatidae. These two species are illustrated in Figure 5. In addition to their similar size, valve shape, and the presence of minute punctations exteriorly, the basal margins of both species show

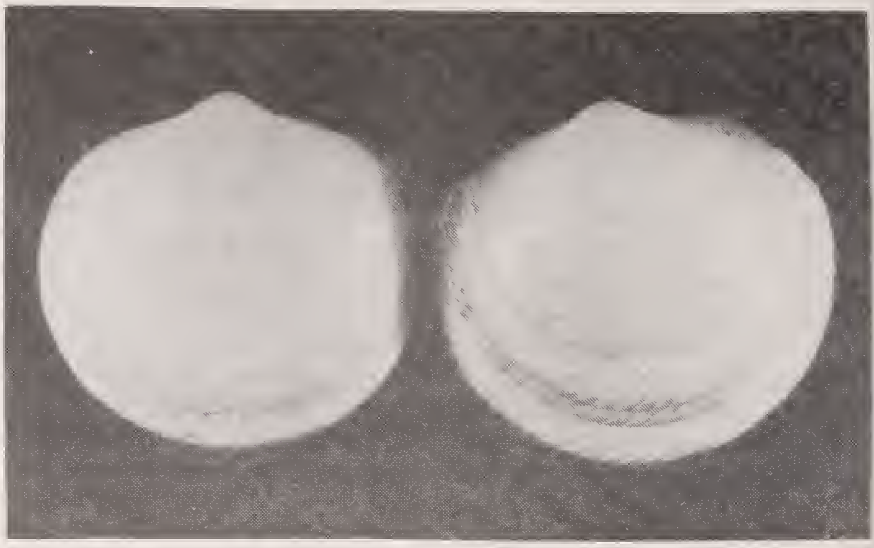


Fig. 2. *D. eburnea* (left) and *D. dentata* (right)
Lot: G-389; 18.5 mm L. SDNHM 31656; 20 mm L.
In drift, San Luis Gonzaga Lake Worth, Florida

Fig. 3. Detail of sculpture and hinge in *D. dentata*.
SDNHM 746; West Indies

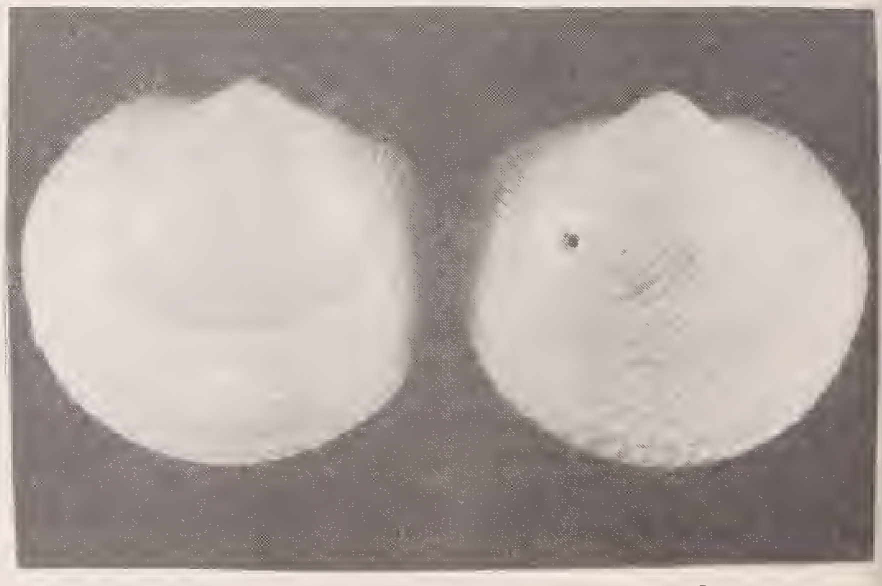
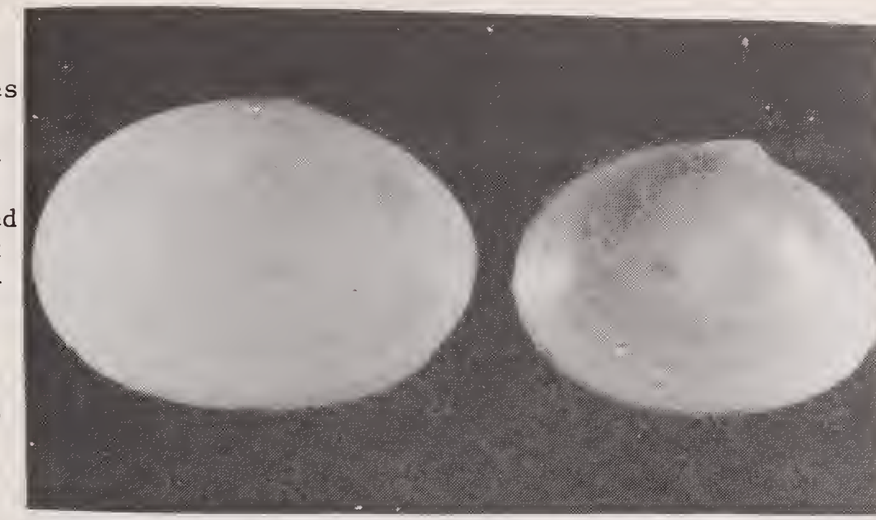


Fig. 4. Exterior of juvenile specimens of
D. dentata (left) and *D. eburnea* (right)
G-389; 13 mm L. SDNHM 12215; 15 mm L.



weak crenulations. Both species have a shiny surface and are white in color. It wasn't until we studied the hinge under a good microscope that we realized the specimens were not *Cymatioa electilis* as previously identified. The hinge in these two genera are obviously different when seen under a microscope. See Figures 6 and 7 for details of the hinge in *Cymatioa electilis* and *Solecardia eburnea.* The hinge plate, in these 11 to 26 mm specimens, is so small that proper identification would be almost impossible without magnification.

Fig. 5. *Solecardia eburnea* (left) and *Cymatioa electilis*
Lot: G-395A; 17.5 mm L. 6 mi. S. of Sulphur Mine, San Felipe, B.C. Mexico
Myers Coll.; 15 mm L. Hood Is., Galapagos Is.

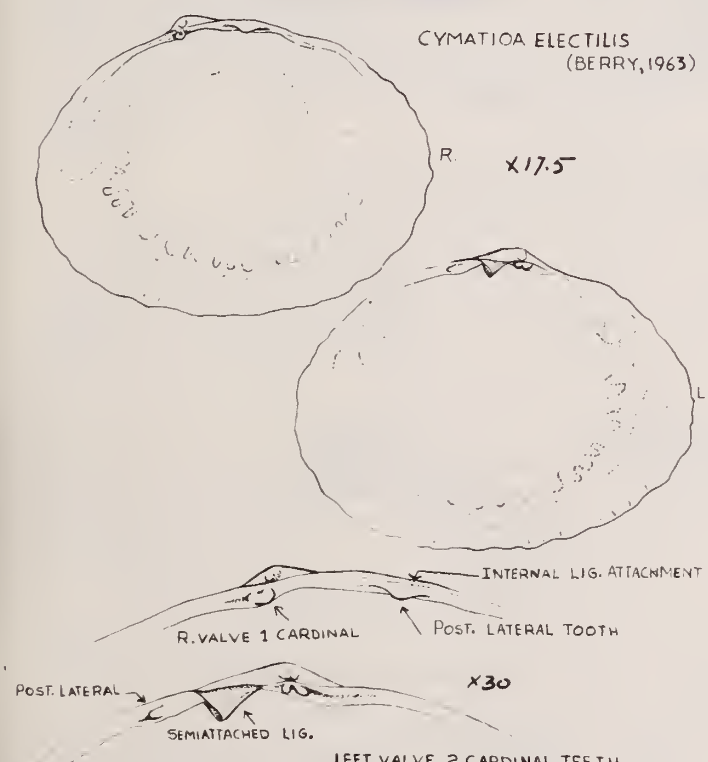


Fig. 6. Details of the interior of *Cymatioa electilis*.

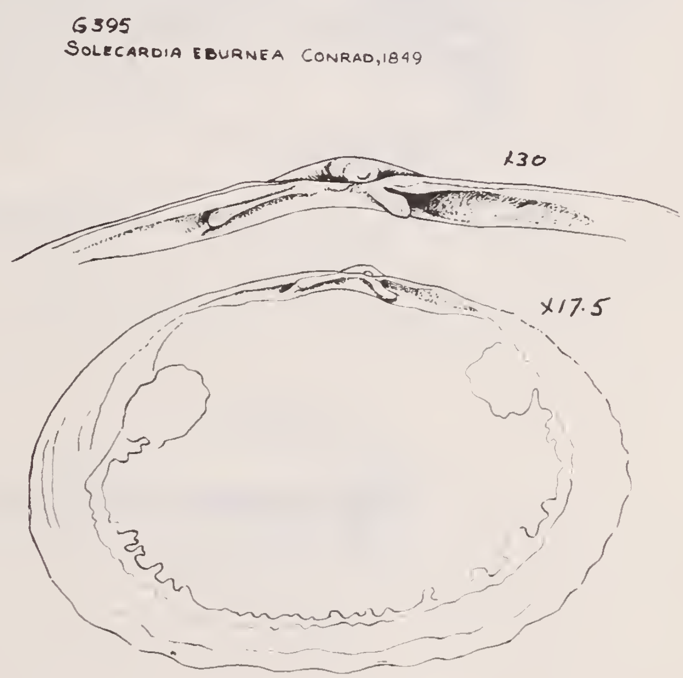


Fig. 7. Details of the interior of *Solecardia eburnea*.

We found two problems relating to the species *Lima orbignyi* Lamy, 1930. The first refers to the placement by Keen (1971) of the two similar appearing *Lima* species *hemphilli* Hertlein and Strong, 1946 and *orbigyni* into two different subgenera. The second problem dealt with our understanding of the existing generic and subgeneric classification in Limidae, particularly the two subgenera of *Lima* s.s., *Submantellum* Olsson and Harbison, 1953 and *Limaria* Link, 1807.

L. orbignyi has been found alive in San Felipe between and under rocks attached by byssus threads in the form of a nest and also found free swimming (pers. obs. Gemmell). *L hemphilli* is also a free swimmer (pers. obs. Hertz & Myers). Macginitie and Macginitie (1968) note in detail its nest building. On the basis of shell characteristics such as similar size, sculpture, and life style the two species appear to belong to the same subgenus.

While the differences in gape between *L. hemphilli* and *L. orbignyi* are sufficient for species identification, they don't appear to merit separate subgeneric classification. Figure 8 illustrates the two views of *L. hemphilli*. Figure 9 shows two views of *L. orbignyi*. In Keen (1971) the species *L hemphilli* was placed in the

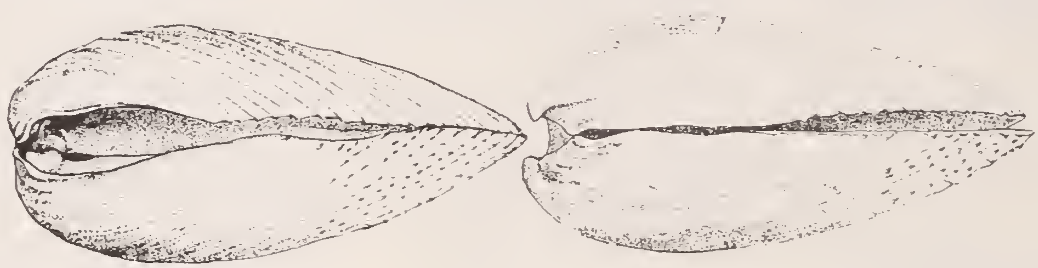


Fig. 8. Two views of *L. hemphilli* (X8) illustrating the gape.

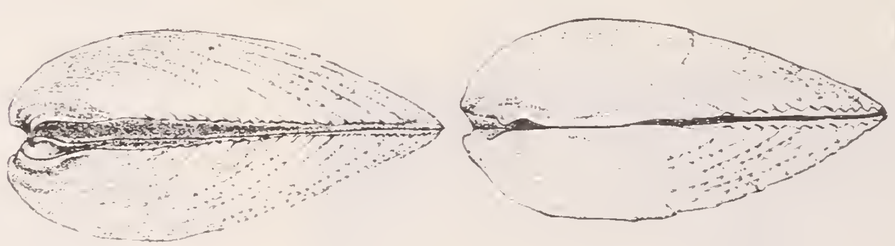


Fig. 9. Two views of *L. orbignyi* (X8) illustrating the gape.

subgenus *Submantellum* Olsson and Harbison, 1953, while *L. orbignyi* was placed in the subgenus *Limaria* Link, 1807. Olsson and Harbison named *Submantellum* as a section (a concept no longer used) under *Limaria* with *L. orbignyi* as type, distinguishing this "section" from *Limaria* as "similar in shell form and sculpture to *Limaria* but with the valves closed or nearly so on all sides."

After many hours of researching the subgeneric classifications under *Lima* s.s. and the confused taxonomic history of *Limaria*, we were relieved to find in H. Vokes (1973) an explanation and solution. He raised *Limaria*, the earliest name, to generic rank and placed *Submantellum* in the synonymy.

Lima s.s. as represented in the Gulf by *L. tetrica* Gould, 1851, is a much heavier shell, highly scabrous with strong ribbing, less inflated, and attains a much larger size than *Limaria*. In our opinion the species *orbignyi* belongs in the genus *Limaria*. Figure 10 contrasts a specimen of *Lima tetrica* (on the left) with *Limaria orbignyi* (on the right).

These are only three of the detailed problems. We have now completed work on seventy species, approximately half of the bivalve species which make up the collection from San Felipe. We still hope to publish the information on the bivalve mollusks from this area and then move on to the study of the gastropods from this same location.

We are taking our vitamins every day. It will be a long haul.

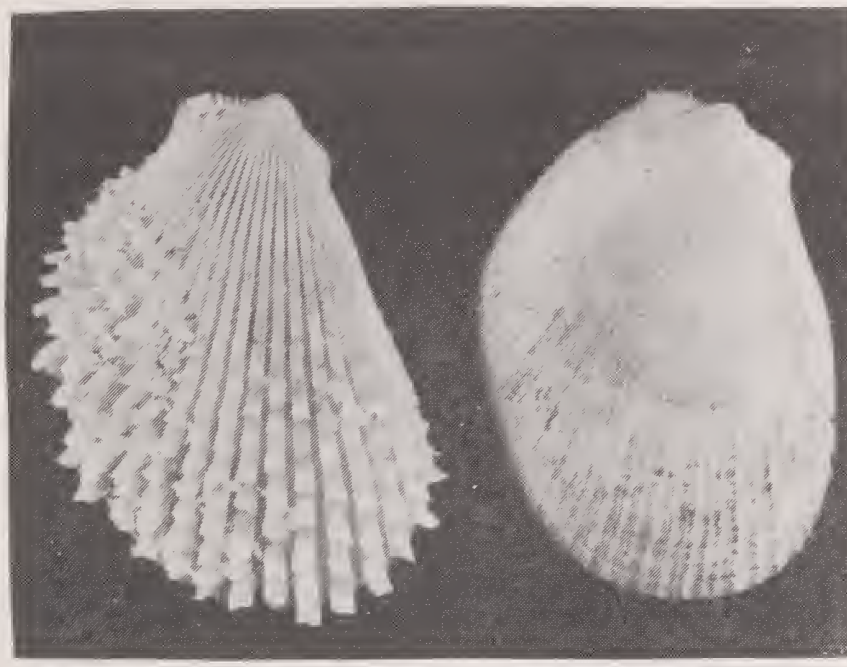


Fig. 10. *Lima tetrica* (left) and *Limaria orbignyi*

Lot: SDNHM 27039; 20 mm L.	G-329; 18.5 mm L.
Espititu Santo Is.,	San Felipe Point,
Gulf of California, Mexico	San Felipe, B.C., Mex.
	alive, between and under rocks

Acknowledgments

We are indebted to David K. Mulliner, Festivus staff photographer, for the fine pictures of these small specimens and to Judith Dyer and Mildred H. Meeder, librarians at the San Diego Natural History Museum, for their efforts in obtaining reference material. Our gratitude is extended to Anthony D'Attilio for his continued assistance and for reading the paper.

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BOOK REVIEW

BY

GORDON A. ROBILLIARD

Woodward-Clyde Consultants, Three Embarcadero Center, Suite 700,
San Francisco, California 94111

GUIDE TO THE NUDIBRANCHS OF CALIFORNIA Including most species found from Alaska to Oregon.
By Gary R. McDonald and James W. Nybakken. 1980.
Published by American Malacologists, Box 2255, Melbourne, Florida.
Price: $13.50.

Despite the publisher's hype on the back cover, this book is not likely to become the "Bible" on California nudibranchs for tidepool and scuba biologists. McDonald and Nybakken are more modest (and more realistic). In the preface, they say they "...hope this guide will stimulate further research on nudibranchs." and "... permit interested individuals not only to identify the animals, but also to learn something about their biology." I believe they have largely succeeded in the latter objective; only time will tell how well they succeed with the former objective.

The dichotomous key to species is the focus of this guide. For identifying specimens that are live and are large juveniles or adults, the key supplemented by the color illustrations are reasonably good. The couplets are generally parallel

3 (2) With extra-rhinophoral appendages (Figure 1): branchial plumes 3...4

3 Without extra-rhinophoral appendages; branchial plumes usually more than 3...6

One can compare the features and make an either-or decision. The major failing of most keys is that the couplets are not parallel. (For example, in the case above, the number of branchial plumes might not be mentioned in 3 (2) and instead "eyes pink" might be characteristic). Only when one reaches the couplet that identifies a particular species is the parallelism lost. However, the extra or non-parallel information provides detail to allow one to confirm that the specimen in hand does fit all (or most of) the key characteristics for the species named in the key.

The glossary and particularly Figures 1-28 are useful even to the professional biologist in understanding the key.

However, the color illustrations are the main support for the key and, one suspects, one of the main reasons the guide was prepared and published. The color, crispness and overall quality of the pictures of *Dirona albolineata* and *Antiopella barbarensis* on the front cover give the reader high expectations for this guide. Unfortunately, these expectations are only partially borne out. About 35% of the color illustrations are marginal to poor quality, while less than 25% are generally good to excellent. Numerous individual illustrations appear to be out of focus, and, in some cases, a whole page of illustrations appears this way (eg. Plates 33-40). Only Plate 87 is on a confusing background-the reader's challenge is to find the nudibranch! - and this was a borrowed slide. In a number of cases, the color reproduction is poor and color of the species appears much more washed out than it is in reality or probably even in the original slide. This is especially disconcerting because McDonald and

Nybakken state correctly that diverse and spectacular colors and color patterns account for much of the enthusiastic interest in nudibranchs; yet one begins to lose enthusiasm when reviewing these illustrations.

There are a few minor editorial problems in the guide. For example, "gill's" are first mentioned on page 7, but are shown in the referenced figures as "branchial plumes." That they are the same is not identified until the following page or in the Glossary. The "dorsum" is described in the text, but not identified in a figure. Under locomotion (page 11) there is no mention of swimming though several species listed in the guide do swim well and often (eg. *Melibe leonina, Dendronotus iris, Tritonia diomedea* and *Cumanotus beaumonti*).

Plate 64 is *Dendronotus diversicolor* (as is plate 65) not *D. albus*. These species were both described or redescribed by me (Robilliard, 1970). However, one should admit the possibility of making a taxonomic error and I may have done that in the 1970 paper. Based on a preliminary review of specimens and data obtained since I published the 1970 paper I believe that the species originally described by MacFarland (1966) as *Dendronotus albus* may be the same as what I described as *D. diversicolor* and therefore *D. diversicolor* would be an invalid name. There are definitly two major color morphs of this species (as I described) and it is widely distributed (at least from Vancouver Island to San Diego). The species I "re-described" as *D. albus* based largely on MacFarland's description and few specimens may, in fact, be the new species and, if so, should be properly named. Its distribution appears to be more limited so far, e.g.. Washington and British Columbia. Verifying and, if necessary, correcting this taxonomic confusion is in progress, albeit slowly.

The *Dendronotus iris* shown in Plate 66 is not the typical gray color morph, but is very similar to that described for *D. nanus* by Marcus and Marcus (1967). I noted that these color and color pattern similarities as well as morphological similarities existed and that there was a good chance that *D. nanus* from the Gulf of California was simply a small *D. iris* (Robilliard, 1972). The illustration in McDonald and Nybakken supports that notion.

Though the latter part of this review was not planned or intended when I began writing the review, it serves as one data point that McDonald and Nybakken were able to "...stimulate [albeit to a limited extent] further research on nudibranchs."

I recommend the guide to those interested in identifying nudibranchs. It is also a useful guide to nudibranch biology as long as the reader recognized that the guide is not (and does not pretend to be) the last or even necessarily the correct word. I recommend it with reservation to those who seek a collection of high quality color illustrations of the sea's most colorful invertebrates.

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ONE DIVE: NOVEMBER 2, 1980

BY

ROGER A. EVANS

1900 Camino de la Costa #1, Redondo Beach, California

The waters off the Palos Verdes Peninsula in southern California offer a number of different dive sites and each dive site is represented by its own characteristic molluscan species.

On November 2, 1980, I completed a scuba dive off the Palos Verdes Peninsula approximately one half mile north of Point Vicente (Figure 1). Despite a growing swell and generally unstable surface conditions, the water visibility was over 20 feet. This area has a large reef, which extends to about 100 meters offshore and runs perpendicular to the coast. The base of the reef is nestled in sand and has a maximum depth of 50 feet, while rising in places to within 20 feet of the surface.

Fig. 1. Palos Verdes Peninsula neat Point Vicente.

My collecting efforts were concentrated on the north side of the reef over a sandy bottom, contoured by wave-like crests and troughs, at a depth of 50 feet. Only two months prior to this dive, the crests and troughs had been covered with a thin layer of algae, a stagnant condition resulting in poor collecting. However, on this dive, I found the sand free of algae from recent wave activity which had redistributed the sand troughs and uncovered a considerable supply of dead shells.

The following species were collected on the sand as dead shells in 50 feet of water and represent a good dive at this particular location. The measurements given represent the greatest dimension of the various species collected, be it height, width, or length. I would like to give credit to my diving partner, Kevin May, for discovering this collecting area.

NUMBER COLLECTED	SPECIES	SIZE
1	*Diodora aspera* (Rathke, 1833)	15 mm
1	*Diodora arnoldi* McLean, 1966	13.5 mm
2	*Megathura crenulata* (Sowerby, 1825)	15 mm
1	*Fissurella volcano* Reeve, 1849	16 mm
1	*Acmaea mitra* Rathke, 1833	24 mm
1	*Notoacmaea insessa* (Hinds, 1842)	13 mm
1	*Calliostoma canaliculatum* (Lightfoot, 1786)	11 mm

4	*Calliostoma gloriosum* Dall, 1871	23 mm
2	*Calliostoma ligatum* (Gould, 1849)	16 mm
10	*Calliostoma supragranosum* Carpenter, 1864	10 mm
5	*Calliostoma tricolor* Gabb, 1865	11 mm
1	*Nitidiscala tincta*(Carpenter, 1865)	9 mm
1	*Hipponix antiquatus* (Linnaeus, 1767)	24 mm
7	*Hipponix tumens* Carpenter, 1864	16 mm
8	*Crepidula onyx* Sowerby, 1824	35 mm
3	*Crepipatella lingulata* (Gould, 1846)	20 mm
1	*Polinices draconis* (Dall, 1903)	62 mm
2	*Erato vitellina* Hinds, 1844	12 mm
27	*Pusula californiana* (Gray, 1827)	11.7 mm
4	*Pusula padreserrai* Cate, 1979	20 mm
2	*Cypraea spadicea* Swainson, 1823 (juveniles)	22 mm
2	*Simnia vidleri* (Sowerby, 1881)	22.5 mm
4	*Amphissa versicolor* Dall, 1871	14.5 mm
2	*Nassarius perpinguis* (Hinds, 1844)	14.5 mm
1	*Olivella baetica* Carpenter, 1864	19 mm
5	*Olivella biplicata* (Sowerby, 1825)	26 mm
4	*Conus californicus* Reeve, 1844	20 mm
1	*Acteocina culcitella* (Gould, 1853)	15.5 mm
2	*Haminoea virescens* (Sowerby, 1833)	12 mm

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: 15 SEPTEMBER 1981

BY

MARTIN SCHULER

President Carol Burchard called the meeting to order at 7:40 P.M. Guests and new members were introduced and Ron McPeak introduced the evening's speaker, Janice Sibley. She spoke on molluscan behavior in an experimental tidepool. She designed and built the tidepool which is at Hubbs-Sea World Research Institute. She is currently using the tidepool to study the homing behavior of several species of limpets. The talk was illustrated with home (lab) movies as well as slides. We all watched in awe and amazement her films showing the larger *Lottia gigantea* attack and displace the smaller limpets in the pool.

After the break, in which we enjoyed homemade ice cream prepared by John Sage, Carol announced that the WSM slides would be shown next month. Carole Hertz asked for articles for The Festivus and requested the donation of another filing cabinet to house back issues of The Festivus. Botanical Garden Rep. Margaret Mulliner reported the success of the plant sale and announced the various plant shows planned for July and August.

The amendment to the Club's Bylaws proposed at the June meeting was approved by a vote of the membership. The amendment reads as follows.

> The Editor of the San Diego Shell Club publication, The Festivus, shall be a non-voting member of the Executive Board and shall have an indefinite term of office.

The meeting was adjourned at 9:10 P.M.

THE FESTIVUS

SAN DIEGO SHELL CLUB

FOUNDED 1961 • INCORPORATED 1968

MEETS THIRD THURSDAY, 7:30 P.M.
ROOM 104, CASA DEL PRADO, BALBOA PARK

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Vice President.............Ron H. McPeak
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VOL. XIII SEPTEMBER 1981 NO. 9

SEE YOU AT THE SEPTEMBER PARTY[[

(There is no regular meeting this month)

DATE: September 26, 1981 TIME: 6:00 P.M. -? PLACE: The Pisor's home

For details and directions, see map on last page of this issue.

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COMMENTS ON ACMAEA FUNICULATA (CARPENTER, 1864)

BY

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San Diego Natural History Museum,
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MARGARET M. MULLINER
5383 Vickei Drive
San Diego, California

Scurria ?var. *funiculata* Carpenter, 1864. Rept. Brit. Assoc. Adv. Sci. for 1863, p. 650.
Scurria (?) *funiculata* Cpr. (?) n.s. State Collection No. 466d. Proc. Cal. Acad. Nat. Sci. vol. 3, 1865, p. 214.
Scurria (? var.) *funiculata* Carpenter, 1866. Amer. Journ. Conch. vol. 2. p. 347.
Acmaea funiculata (Carpenter, 1864). Hanna and Smith (1931). Nautilus 45(1):24, pl. 2, figs. 1-4.

A single specimen of *Acmaea funiculata* (Carpenter, 1864) was found in grunge collected by David K. Mulliner off Bird Rock, La Jolla, California, on February 2, 1975 at a depth of 90 feet. Figure 1 shows a photograph of this specimen and Figure 2 is a drawing of the profile of the same shell. This specimen measured 8mm L x 6mm W x 4mm A and is retained in the Mulliner collection. Three smaller specimens have been found in grunge collected at a depth of 70 to 90 feet by John D. Myers off Pt. Loma, San Diego, California in November 1979 and November 1980 and range in size from 3mm to 6mm in length. They are retained in the Myers collection.

Fig. 1. *Acmaea funiculata* (Carpenter, 1864)

In identifying these specimens, we found it necessary to study the pertinent literature. The taxonomic history of the species is rather interesting and the following is a review of our findings.

The species was first named by Carpenter in 1864 as"*Scurria* ? var. *funiculata*" a variety of *Scurria mitra* Eschscholtz, 1830, now *Acmaea mitra*. Figure 3 shows a profile view of *A. mitra*. Carpenter's description was terse, "with rounded riblets somewhat nodulose." The habitat was listed as "Monterey, 6 dredged dead, Cooper." In 1865 Carpenter seemed convinced that *A. funiculata* was distinct. He published a more complete description under the title "*Scurria* (?) *funiculata*, Cpr. (?) n.s. State collection #466d." The next year, 1866, he published essentially the same description under the name "*Scurria*(? var.) *funiculata*" which seemed again to place *funiculata* as a variety of *mitra*. However, his remarks following the description indicate that he had only one specimen that was different enough to be distinct and this was sent

to the Smithsonian Institution (USNM catalog #14799). Hanna and Smith (1931) studied the soft parts and radulae of specimens of *A. mitra funiculata* from Catalina Island, California and found differences in the radula that separate *A. mitra funiculata* and *A. mitra* s.s. and confirm that this "variety" is a distinct species.

The first figure of *A. funiculata* was a plesiotype from the California Academy of Sciences, collected at Monterey, California, (Hanna and Smith, 1931). Plate 17, figs 24, 25 of Palmer (1958:123 is shown here as Figure 4. It is an oval, acutely conical shell with 36 strong irregular radial ribs. The apex is eroded. The location of Carpenter's other five specimens which had been dredged by Cooper from Monterey is unknown (Hanna and Smith, 1931).

This subtidal species has a geographical range from Shumagin Island, Alaska to Magdalena Bay, Baja California, Mexico (Dall, 1921 and McLean, 1978).

Carpenter (1866) named a second variety of *A. mitra* -- variety *tenuisculpta* and gave a brief Latin description which was translated by Pilsbry (1891) as "sculptured with distant radiating striae or lirulae." Palmer (1958:124, pl. 18, figs. 11, 12, 13) figured a syntype of *A. mitra tenuisculpta* USNM #15490. It is shown here in Figure 5.

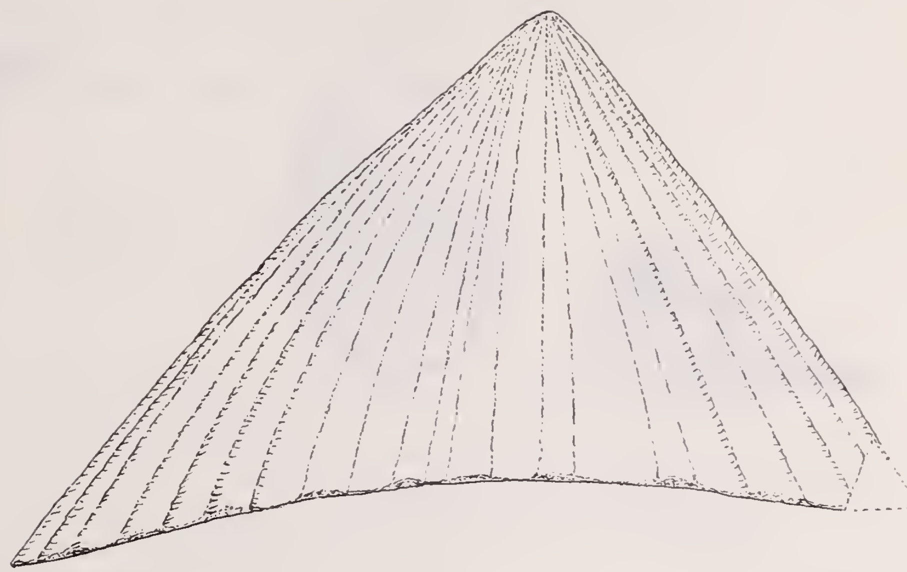

Fig. 2. *Acmaea funiculata* (Carpenter, 1864)
Size: 8mm L x 4mm Alt. Mulliner collection.

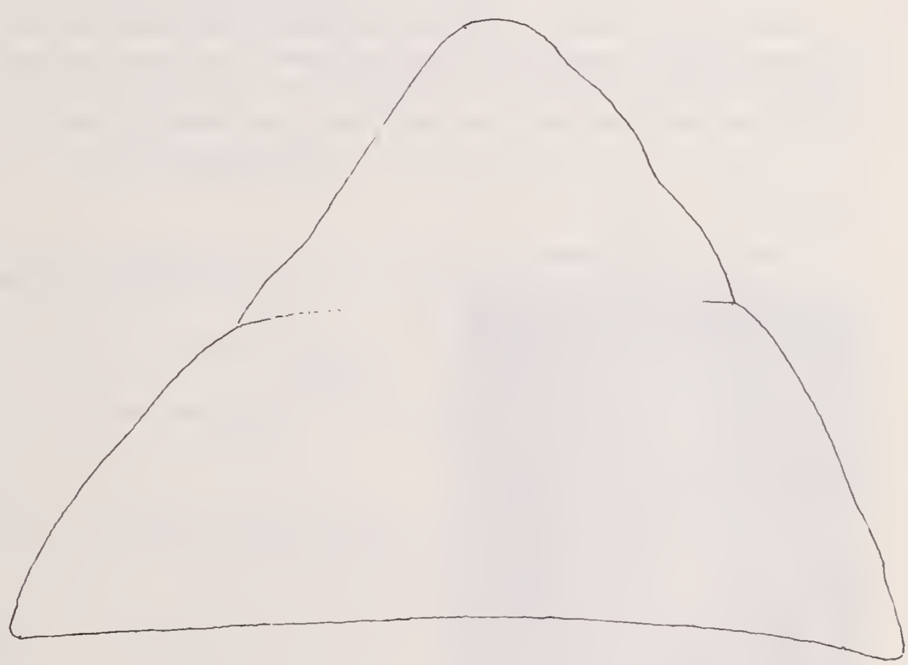

Fig. 3. *Acmaea mitra* (Eschscholtz, 1830)
Size: 17mm L x 15mm W x 13mm Alt
Location: San Diego, California
SDNHM #727.

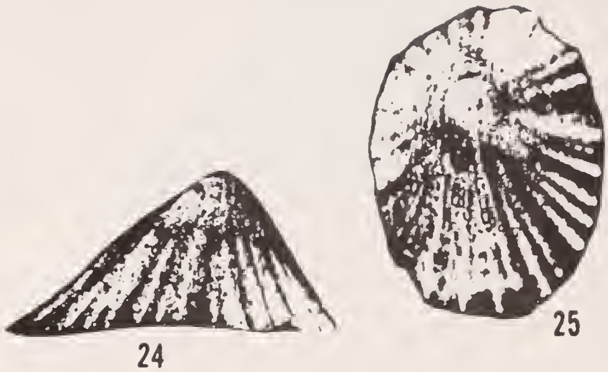

Fig. 4. "*Acmaea funiculata* (Carpenter)
Holotype, U.S.N.M., No. 14799; X 8."

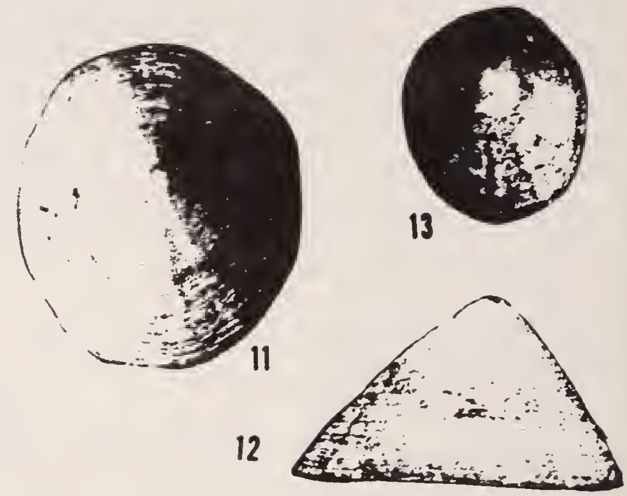

Fig. 5. "*Acmaea mitra tenuisculpta* Dall"
Syntype, USNM No. 15490; X 2.

We have not seen the syntypes of *A. mitra tenuisculpta*. Palmer's figure shows a rounded, less strongly ribbed specimen resembling *A. mitra*. Dall (1914), Hanna and Smith (1931), and Palmer (1958) place *A. mitra tenuisculpta* in the synonymy of *A. funiculata*.

ACKNOWLEDGMENTS

We wish to thank David K. Mulliner and John D. Myers for their efforts in obtaining the grunge in which we found the specimens of *A. funiculata*. We further want to thank Dave Mulliner for the excellent photograph. We also thank Anthony D'Attilio for his two fine drawings and his critical review of this paper.

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COLUBRARIA XAVIERI CAMPBELL, 1961 (GASTROPODA: CYMATIACEA) THE SECOND KNOWN SPECIMEN?

BY

FORREST L. POORMAN AND LEROY H. POORMAN

15300 Magnolia Street, Sp. 55, Westminster, California 92683

Early in September 1960, the Ariel expedition undertook six days of dredging and diving off Guaymas, Sonora and the southeastern coast of Baja California Sur, Mexico. Among the many exciting and new mollusks obtained was a specimen of a previously undescribed *Colubraria*. Campbell (1961) published a description of this rarest of the Panamic colubrarias also figured by Keen (1971). The species is *Colubraria xavieri* and the original description follows.

Colubraria xavieri Campbell, 1961

Description: Shell rather slender, solid, and thick with 6 coarsely sculptured body whorls, the protoconch being absent. Each whorl has approximately two varices. General color medium brown with some indistinct lighter and darker areas; varix light tan with 12 dark brown streaks grouped mainly in pairs that blend into the solid brown of the body whorl. These brown lines end as small dots in the aperture and correspond to the twelve denticles just inside the lip. Inside of the elongate aperture pale brownish-purple bounded by a 2.5 mm. reflected canal anteriorly and a small internal notch posteriorly. The narrow aperture equals 2/3 the length. The outer lip is thickened by a varix and the body has a 3 mm. thin wash of callus with 2 shallow grooves 2 mm. apart on the columella, each bounded posteriorly by a small denticle; the sculptured whorls are of 18 to 20 coarse nodulose axial ribs crossed by fourteen less prominent spiral ridges, between which are 2 to 4 spiral threads; the upper whorls are sculptured by 6 to 8 spiral cords with 2 to 3 spiral threads between and about 14 sharp, straight, axial ribs. The type measures: Length 26.5 mm., maximum width 10.2 mm.

Type locality: Trawled 2 miles west of Cabo Haro, Guaymas, Mexico, in 100 fathoms, on the Ariel expedition, September 2, 1960.

In November 1979, a second specimen of *Colubraria xavieri* was dredged in 100 meters on dead shell and silt bottom three miles southeast of Punta San Antonio, approximately 12 miles from the type locality. The second specimen was dead and the protoconch missing, but the specimen, shown in Figure 1, compares well with the holotype.

The original comparison was made with *Colubraria siphonata* (Reeve, 1844); but material in the authors' collection indicates that it is much closer to *Colubraria lucasensis* Strong and Hertlein, 1937. *Colubraria xavieri* differs from *C. lucasensis* in having coarser sculpture, in the proportionately longer aperture, and in having a heavy lip varix that extends above the suture to terminate as a blunt tubercle. The obsolete varices are 540° apart and align up the spire on every other whorl.

We observe that the protoconchs of *Colubraria*

Fig. 1. *Colubraria xavieri*

procera (Sowerby, 1832) and *C. lucasensis* are similar, but that the protoconch of *C. xavieri* is not known. More comparative work needs to be done to determine subgeneric placement.

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BOOK REVIEW

BY

ANTHONY D'ATTILIO

Department of Marine Invertebrates, Natural History Museum, Balboa Park
P.O. Box 1390, San Diego, California 92112

THE FAMILY BUCCINIDAE PART 1: THE GENERA NASSARIA, TRAJANA AND NEOTERON.
By Walter O. Cernohorsky. August 15, 1981.
Published by American Malacologists, Inc. Box 2255, Melbourne , Florida.
Price: $7.50, postage included

This publication is the second in the proposed monographs of world-wide living and fossil marine molluscan species. Dr. R. Tucker Abbott is editor of this new series entitled Monographs of Marine Mollusca in a format similar to Indo Pacific Mollusca.

Number 2, Part 1 deals with the genera *Nassaria* Link, 1807; *Trajana* Gardner, 1948; and *Neoteron* Pilsbry and Lowe, 1932. A number of subgenera are assignable by the author to *Nassaria* and *Trajana*. *Neoteron* remains a monotypic genus with its only species *ariel* Pilsbry and Lowe, 1932 from the eastern Pacific. The present volume does not contain colored plates as previously used in related monographic works of the second series. However all species are well illustrated in black and white photographs. The clear drawings of protoconchs and radular features are also valuable. Of interest especially is the reduction of the 90 proposed taxa to only 14 valid living and 16 fossil species; less than half the proposed names. Some of the rejected names are referred to other families. In some instances the literature cited is incomplete.

As a number of living species of *Trajana* and *Nassaria* form part of the eastern Pacific fauna, in additon to *Neoteron ariel*, this monograph should be a part of the research material for all students of the tropical and non-tropical members of the family Buccinidae. Presumably a treatment of other genera in this large family will be forthcoming. Mr. Cernohorsky's work is generally of a high order, especially in such monographic studies. Works of this sort, done with our more modern understanding of genetics and population dynamics are very important contributions to our knowledge of the Mollusca.

THE RADULA OF NEOTERON ARIEL (PILSBRY AND LOWE, 1932) (GASTROPODA: BUCCINIDAE)

BY

ANTHONY D'ATTILIO

Department of Marine Invertebrates, Natural History Museum, Balboa Park,
P.O. Box 1390, San Diego, California 92112

Neoteron ariel (Pilsbry and Lowe, 1932). West American and Central American mollusks collected by H.N. Lowe 1929-31. Proc. Acad. Nat. Sci. Phila. 84:33-144, pls. 1-17.

The unusual shape of the species, *Neoteron ariel,* is very intriguing. At the time the late George Radwin and I studied the radula of this species we had concluded that it belonged in Nassariidae. We had made a determined effort to obtain a specimen with the soft parts in a good state of preservation, which would make a radula extraction simple and family assignment more certain.

The San Diego Natural History Museum had two paratypes of this species in its collections, SDNHM type series 578 and 2997 collected at Corinto, Nicaragua in 20 fathoms by H.N. Lowe in 1931. In spite of the shells' value as morphological evidence of the nature of this species, no soft parts were available.

An inquiry to Dr. James H. McLean of the Los Angeles County Museum of Natural History resulted in our obtaining a live collected, preserved specimen of this species for our studies. The radula of *Neoteron ariel* (Figure 1) is illustrated here for the first time. The radula was mounted by George E. Radwin and the illustration done by the author. The holotype illustrated here in Figures 2 and 3 is a copy of the figure in Keen's Sea Shells of Tropical West America... Second Edition, 1971, p. 567, fig. 1135.

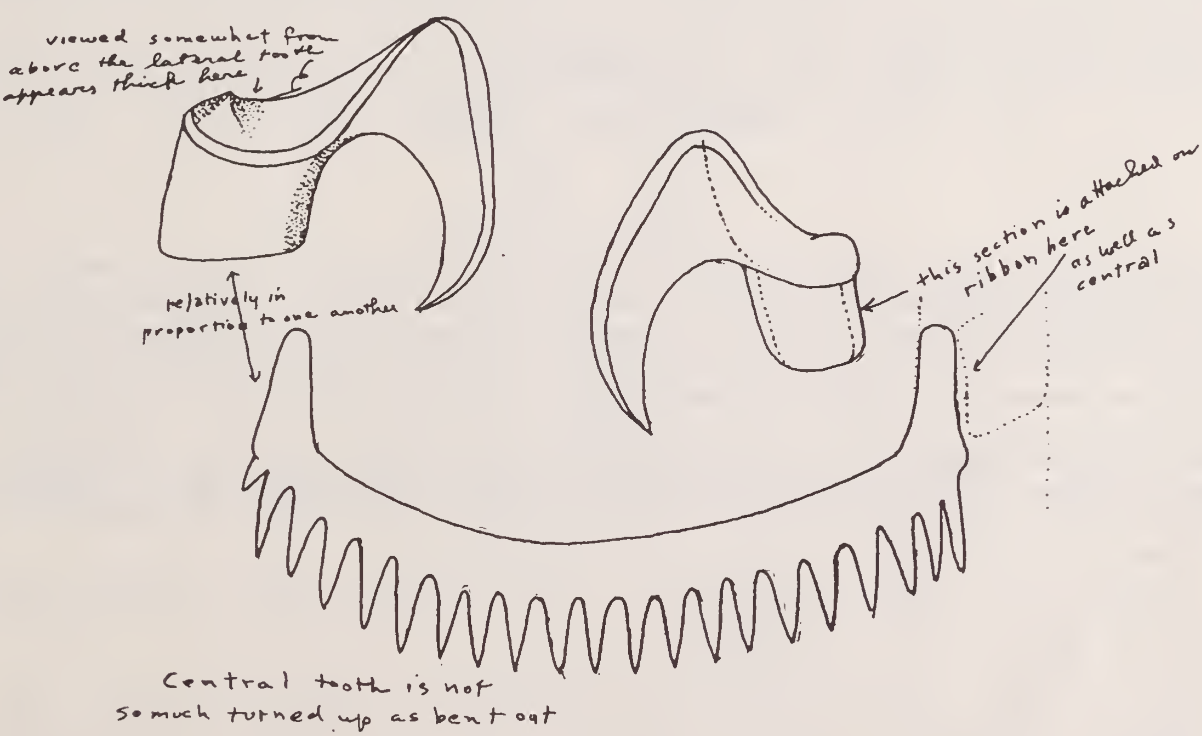


Fig. 1. Radula of *Neoteron ariel,* greatly enlarged.
Locality: south of Quepos, Costa Rica. LACM #72-59
Collected by James H. McLean Date: 3-12-72.

Acknowledgments

I am indebted to Dr. James H. McLean of the LACM(NH) for placing at our disposal the specimen of *Neoteron ariel* used in this study.

Fig. 2. Dorsal view of holotype of *N. ariel* from Keen (1971).

1135

Fig. 3. Apertural view of same specimen.

IN MEMORIAM

CRAWFORD NEILL CATE

1905 - 1981

It is with regret that we report the passing of Crawford Cate on August 9, 1981. Mr. Cate was actively involved in malacology since 1965 when he retired from the Pacific Telephone Company. He was a research associate at the Los Angeles County Museum of Natural History and a member of the executive board of The Veliger as well as holding memberships in the Western Society of Malacologists (from which he received the Award of Honor in 1970); American Malacological Union, Pacific Division; and other scientific societies both in this country and abroad. He also published numerous papers in the field of malacology for more than fifteen years. His last major work was "A review of the Triviidae (Mollusca: Gastropoda)" published in 1979 as a Memoir of the San Diego Society of Natural History.

Crawford Cate together with his wife, Jean (who now resides in Rancho Santa Fe) were former members of the San Diego Shell Club and are remembered with affection by those with whom they came in contact.

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: 20 AUGUST 1981

BY

MARTIN SCHULER

President Carol Burchard called the meeting to order at 7:45 P.M. Ron McPeak then introduced the evening's speaker, Dr. Wheeler North, who spoke on the ecology of the kelp beds. His talk was most interesting and well illustrated with slides and graphs. He traced the decline of the giant kelp in southern California and the efforts made to bring back the kelp beds as they were in the early 1900's.*

After the refreshment break, Carol announced that the September party would be held on the 26th of September at the home of Don and Jeanne Pisor. (See map on last page of this issue). The membership voted for a Chinese theme for the party. The menu will be coordinated by June King and members will be contacted by phone.

Ron McPeak announced that the speaker for October will be Dr. Jack Engle who will talk on the ecology of the Channel Islands. Carole Hertz again asked for the donation of filing cabinets and articles for The Festivus. Martin Schuler announced that he is studying the Harpidae and would like members to bring their *Harpa* to the November meeting.

Slides were shown of the recent WSM conference and Ron McPeak showed slides of a diving trip to Begg Rock. The shell drawings were won by Hugh Bradner and Bill Perrin. The meeting was adjourned at 9:45 P.M.

* Editor's note: For further information on the revitilization of the kelp see: Giant Kelp, Sequoias of the Sea by Wheeler J. North, photography by Bates Littlehales in National Geographic, August 1972, Vol. 142(2):251-268.

Later in his talk Dr. North recounted the many problems his group faced in the project to replace the kelp at Abalone Cove, off the Palos Verdes peninsula. Some of these problems, humorous now in the retelling, were most likely terribly defeating at the time. It is our hope that Dr. North will write an account of this project with its many trials and final success.

CHANGES OF ADDRESS

Glantz, Dale and Mary Lou Mahar, 5605 Friars Rd. #289, San Diego, CA 92108. 296-8634.

Mabry, Villee and Don, 6333 La Jolla Blvd. #171, La Jolla, Ca 92037, 454-5788

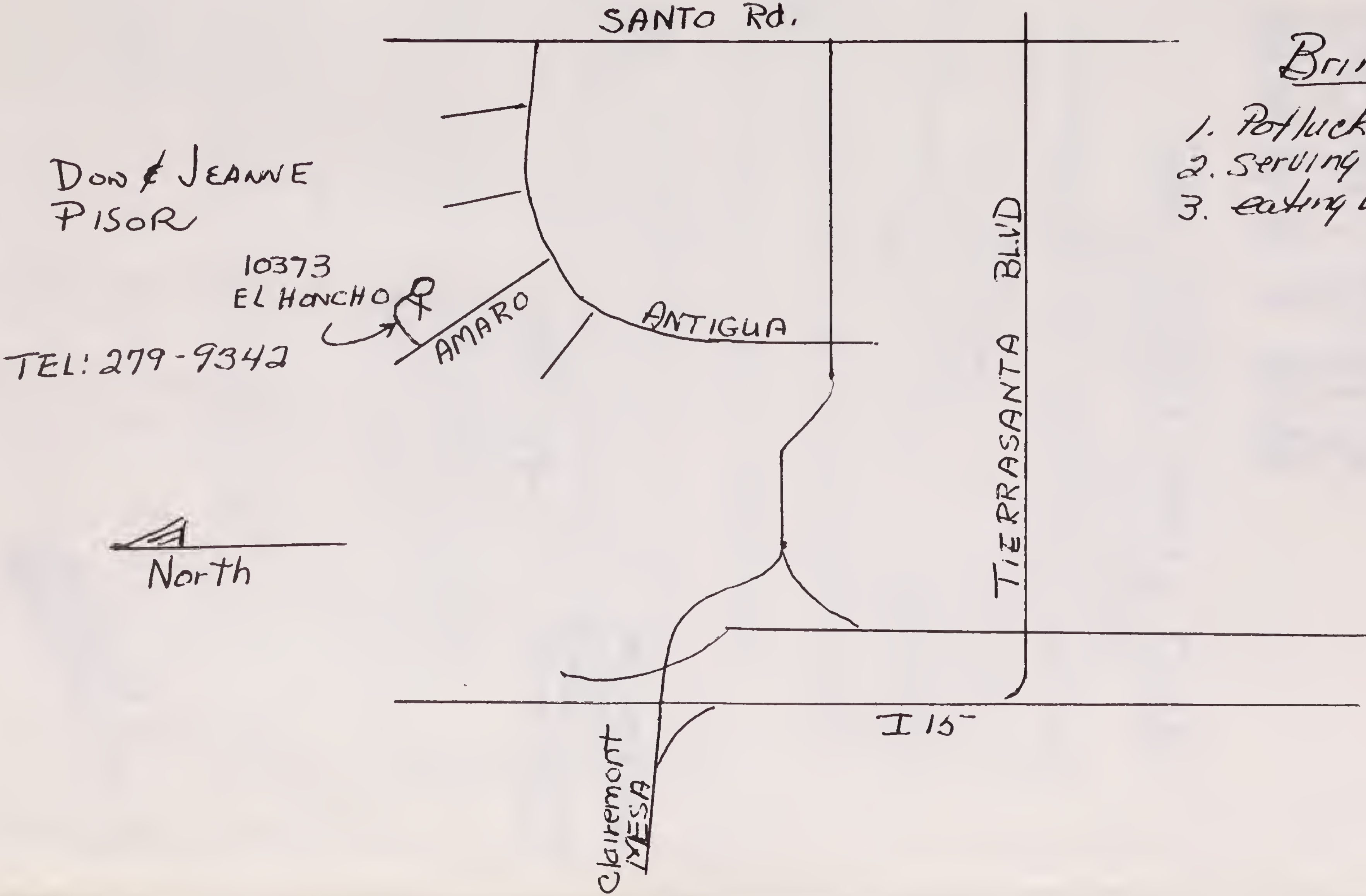
Vaught, Mrs. Kay C., 8646 Paraiso Dr., Scottsdale Ariz 85255

Please notify the Club of changes of address. The cost triples when The Festivus is returned and sent again because a member has not advised us of an address change.

The American Shell Dealers Association, Inc.(ASDA) has been formed to "promote interest in shell collecting as a hobby, establish a code of ethics and minimum business standards for shell dealers, and exchange information about mutual problems including delinquent accounts." For further information contact Dorothy Janowsky, corresponding secretary, 946 Ralph Avenue, Brooklyn NY 11236.

COME TO the September Party"!
Saturday evening September 26, 1981
6 P.M. — ?

Enjoy an evening of Chinese food, music. Come in Costume!



Bring

1. Potluck dish
2. serving utensils
3. eating utensils

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% C. HERTZ
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THE FESTIVUS

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ANNUAL DUES: Payable to San Diego Shell Club Inc. Single membership: $4.00; Family membership: $5.00; Student membership: $3.00; Overseas surface: $6.00.

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VOL. XIII OCTOBER 1981 NO. 10

PROGRAM: Dr. Jack Engle will speak on the Marine Ecology of the Channel Islands. He will illustrate his talk with slides of the area.

Date: October 15, 1981 Time: 7:30 P.M. Room: 104

SAVE THE DATE: The Club's Annual Christmas Dinner Party will be held on December 11, 1981 in the La Sala Room of the Cafe Del Rey Moro in Balboa Park. Further details at the meeting.

CONTENTS

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NOTES ON CROCKERELLA CRYSTALLINA (GABB, 1865) (GASTROPODA: TURRIDAE)

BY

JULES HERTZ

Department of Marine Invertebrates, Natural History Museum, Balboa Park
P.O. Box 1390, San Diego, California

Hertlein and Strong (1951:78) established the turrid genus *Crockerella* with the type species *Clathurella crystallina* Gabb, 1865. Their description for the genus *Crockerella* follows: "Shell small; nucleus smooth; outer lip varicose, smooth within; canal short but distinct, the anal sinus rounded, near the suture, and with little or no anal fasciole." In the same work, Hertlein and Strong described two species which they assigned to this genus, i.e. *Crockerella pederseni* and *Crockerella hilli*. For both species, the nucleus was described essentially as follows: "nuclear whorls 2, the first very small, smooth, the second much larger, angulated in the middle, sculptured with a fine spiral cord on the angle and numerous fine axial riblets." This discrepancy in description of the nucleus was pointed out by Powell (1966:109) in his description of the genus *Crockerella* when he stated "Protoconch of two whorls, the first very small, smooth, the second much larger, angulated medially, and sculptured with a fine spiral cord on the angle and numerous fine axial riblets (not "nucleus smooth", as stated in Hertelein & Strong's introduction of the genus, p.78)." Powell noted that "the genus resembles *Philbertia*, which however differs notably in having a diagonally cancellated protoconch." Hertlein and Strong differentiated *Crockerella* from *Philbertia* Monterosato and *Cytharella* Monterosato in that the anal fasciole is indistinct or lacking in *Crockerella*.

Gabb (1865:184) described *Clathurella crystallina* and gave the following locality data: "Hab. Catalina Island, 40 fms. Dr. Cooper." Dall (1921:79) reassigned the genus and designated the locality for *Philbertia crystallina* as follows: "Off Catalina Island, in 50 fathoms."

The holotype of *Crockerella crystallina* (University of California Museum of Paleontology No. 2389/15959) is pictured here as Figures 1 and 2. The holotype bears the notation "Recent Catalina Island." The species was initially figured by Gabb (1865: pl. 84). The protoconch of the holotype is illustrated here as Figure 3.

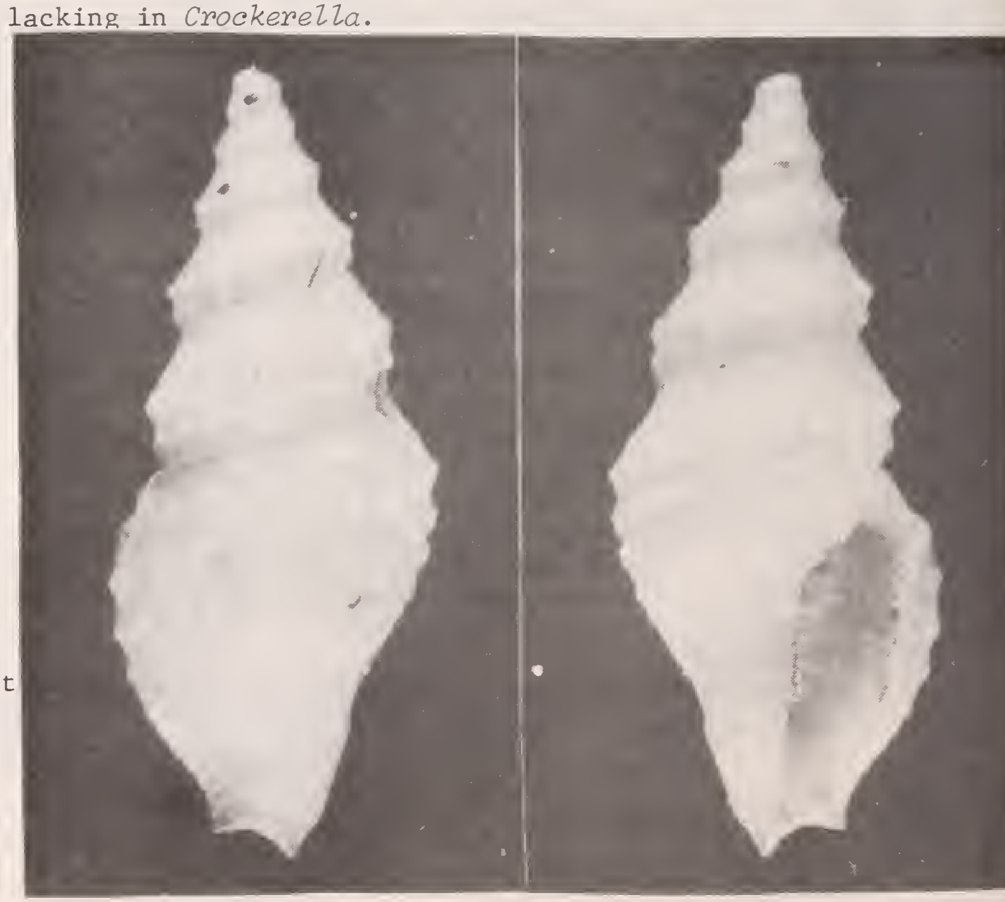

Fig. 1. Holotype of *Crockerella crystallina* (Gabb, 1865). Length: 7.8 mm.

Fig. 2. Apertural view of same specimen

Note the very small first whorl and the smoothness of the whorls. This accounts for Hertlein and Strong's description of the nucleus for the genus *Crockerella* as smooth. The first postnuclear whorl is angulated in the middle with a fine spiral cord on the angle. The discrepancies in descriptions may be a result of interpretation concerning where the protoconch stops and the first postnuclear whorl begins.

Grant and Gale (1931:607) list *Clathurella lowei* Dall, 1903 in the synonymy of *Clathurella crystallina* (fide Dall). The holotype of *Clathurella lowei* (USNM 109,302) is shown here in Figures 4 and 5. Dall (1903: 172) described the nucleus of *C. lowei* as "smooth, polished, rounded, and rather inflated, of one whorl." Figure 6 shows two views of the nucleus of *C. lowei*. The holotype has approximately two smooth, rounded, and rather inflated whorls that are somewhat eroded. The first postnuclear whorl is angulated in the middle (at the periphery) with a fine spiral cord on the angle.

Dall described *C. lowei* as having five (or more) postnuclear whorls; "sculptured

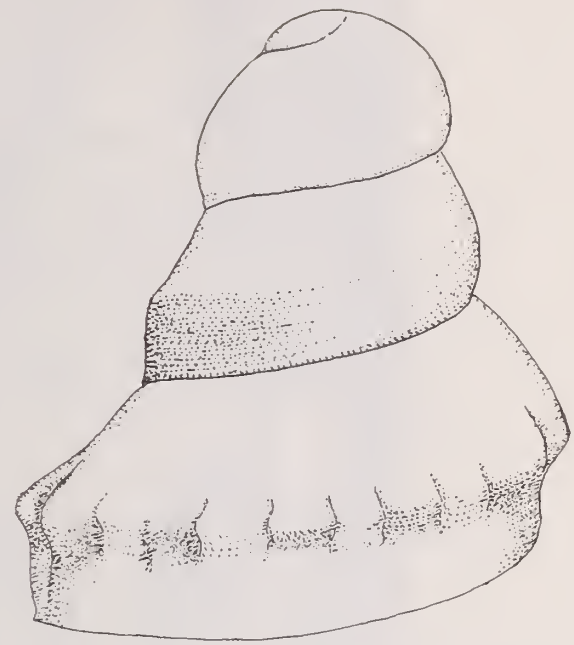

Fig. 3. Protoconch of the holotype of *C. crystallina*. 50X

Fig. 4. Apertural view of holotype of *Crockerella lowei* (Dall, 1903). Length: 7.7 mm.

Fig. 5. Dorsal view of same specimen.

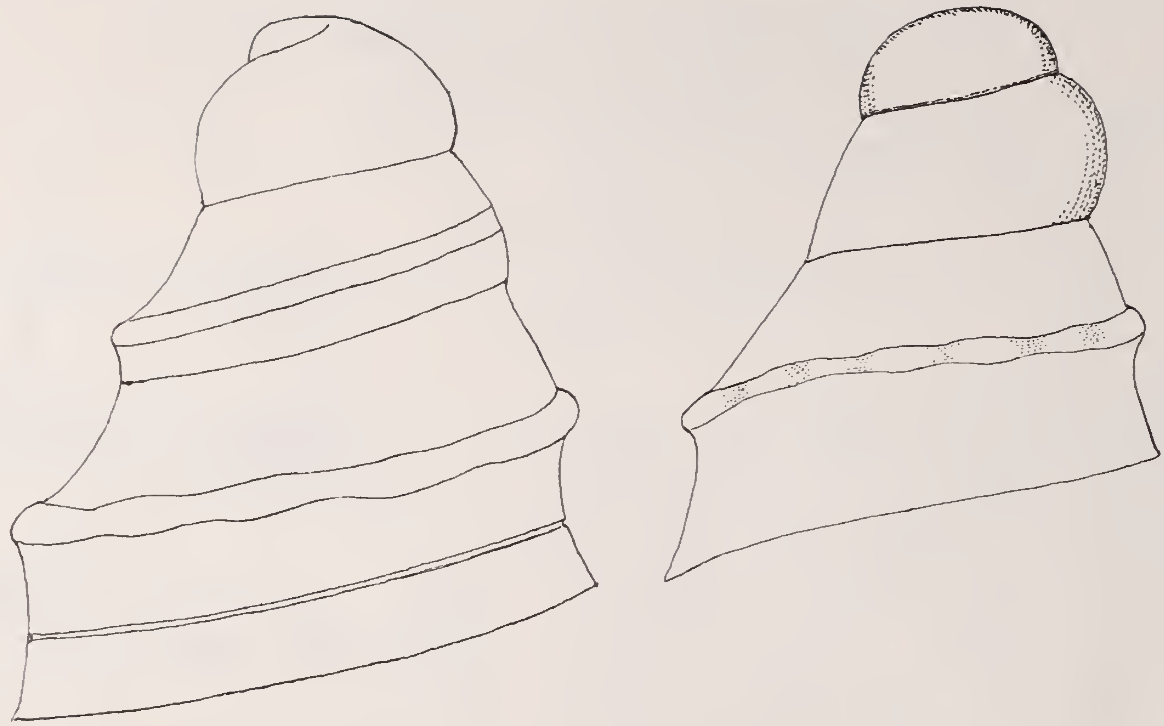

Fig. 6. Two views of the protoconch of *C. lowei*. 50X

with (on the penultimate whorl 13) short axial riblets, slightly oblique with narrower interspaces, the riblets confined to the peripheral part of the whorl and separated from the suture behind by the spirally striated anal fasciole." He thought the species resembled *Glyphostoma*, but the *C. lowei* specimens he had seen had no sculptured callus on the pillar lip. Dall's specimens were obtained by dredging in 40 to 60 fathoms in the Santa Barbara Channel near Avalon, Catalina Island. As a synonym for *Crockerella crystallina*, this species should now bear the designation of *Crockerella lowei* (Dall, 1903).

Figure 7 is an illustration of the nucleus of *Clathurella rava* (Hinds, 1843) which is the type of the genus *Clathurella* Carpenter, 1857. This illustration shows a protoconch having beaded spiral cords in the sutures and on the periphery of the whorls and indicates that Gabb's initial placement of *crystallina* in the genus *Clathurella* was incorrect. However, in defense of Gabb, the nominal species *Clavatula rava* Hinds, 1843 was designated as the type species of *Clathurella* Carpenter, 1857 by a comparatively recent ruling of the International Commission on Zoological Nomenclature (1963:267).

Dall (1919:54) described a new turrid species, *Philbertia hesione*, from a single specimen taken off Santa Rosa Island, California in 53 fathoms. I was unable to find figures of this species. The holotype (USNM211333) is shown here in Figures 8 and 9.

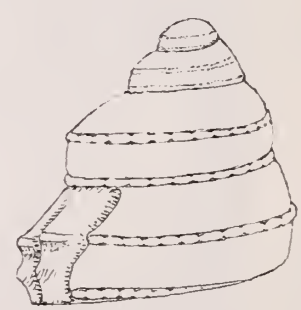

Fig. 7. Protoconch of *Clathurella rava* SDNHM #51099, Coll: D. Shasky. Cabo Pulmo, Baja Calif., Mex.

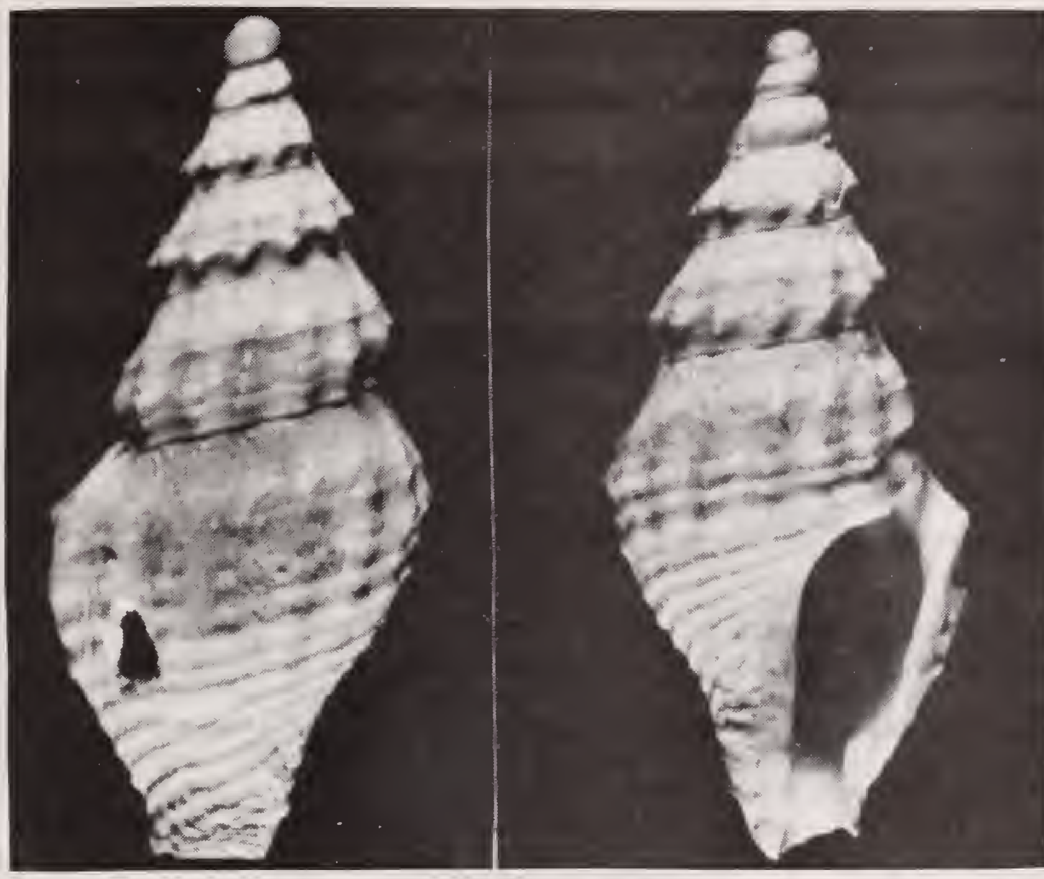

Fig. 8. Dorsal view of holotype of *Crockerella hesione* (Dall, 1919). Length: 9.5 mm.

Fig. 9. Apertural view of same specimen.

The nucleus of the holotype is illustrated in two views in Figure 10. The outer layer of a portion of the protoconch and the first postnuclear whorl has been chipped off leaving those areas smooth. The resulting protoconch looks quite similar to that of the holotype of *Crockerella crystallina*. The shell shown in Figures 8 and 9 also closely resembles *C. crystallina* and I believe it should be reassigned and designated as *Crockerella hesione* (Dall, 1919). It may prove to be a gerontic specimen of *Crockerella crystallina* should addional specimens become available for study. If this were true, then *C. hesione* would fall into the synonymy of *C. crystallina*.

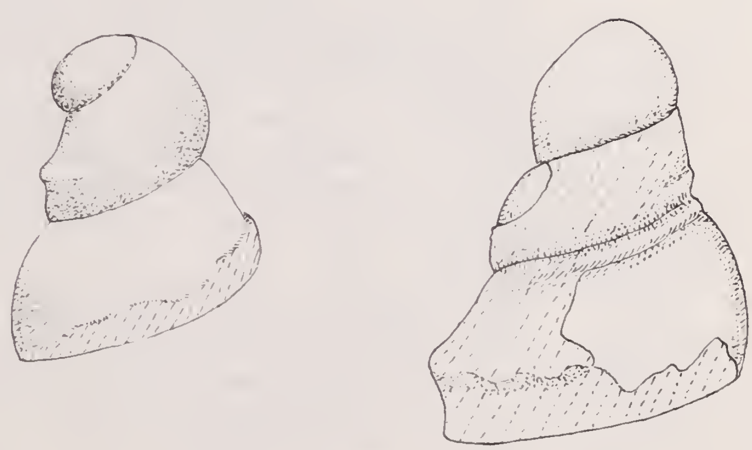

Fig. 10. Two views of protoconch of *Crockerella hesione*. 25X

Abbott (1974:283) had placed

C. hesione in *Glyphostoma* Gabb, 1872. This latter genus has a protoconch of three whorls with the second one having a strong keel. However, the description for *Glyphostoma* specifies the outer lip strongly variced with both outer and inner lips heavily sculptured with denticles and ridges. In contrast, *C. hesione* has essentially smooth inner and outer lips.

A SYNOPTIC SYNONYMY

Crockerella Hertlein and Strong, 1951
    Type by original designation: *Clathurella crystallina* Gabb, 1865
Crockerella crystallina (Gabb, 1865)
    = *Clathurella crystallina* Gabb, 1865
    = *Philbertia crystallina* (Gabb, 1865)
    = *Clathurella lowei* Dall, 1903
Crockerella hesione (Dall, 1919)
    = *Philbertia hesione* Dall, 1919
    = *Glyphostoma hesione* (Dall, 1919)
    = *?Crockerella crystallina* (Gabb, 1865)

ACKNOWLEDGMENTS

I am particularly indebted to David K. Mulliner, Festivus staff photographer, for his excellent high magnification photographs and to Anthony D'Attilio for his fine illustrations of the various turrid protoconchs and for his critical reading of the paper. I am indebted to Dr. Barry Roth (CAS) for helping to locate the holotype of *C. crystallina* and to Dr. Carole S. Hickman of the University of California at Berkeley and Dr. Joseph Rosewater (USNM) for the loans of type specimens.

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OBSERVATIONS ON MURICANTHUS RADIX (GMELIN, 1791) (GASTROPODA: MURICIDAE: MURICINAE)

BY

ANTHONY D'ATTILIO

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P.O. Box 1390, San Diego, California 92112

This species, with its extensive geographical distribution in the eastern Pacific from the northern Gulf of California to Ecuador, is of interest for the variability of its form. This variability is noticeable in the height of spire relative to shell size, degree of shoulder angulation, thickness of shell wall, number of varices per whorl, and obesity of shell.

Recently two specimens of *Muricanthus radix* were brought to my attention. Though they had no reliable locality data, these two specimens exemplify the variability of this species. One, a specimen with 6 varices, 130 mm in height and 110 mm at its greatest width (Figures 1-3) is in the Rose D'Attilio collection. The second specimen has 14 varices, is 170 mm in height and 140 mm at its greatest diameter (Figures 4-6). This specimen, SDNHM #77780, was donated by L.J. Bibbey.

The larger of these two specimens exceeds the range given by Radwin and D'Attilio (1976:77,78, pl.12, figs. 1,2,9) who state that this species is highly polymorphic. They add that the forms of the species; *M. nigritus* (Philippi, 1845); *M. ambiguus* (Reeve, 1845); *M. nitidus* Broderip, 1833 and *M. callidinus* Berry, 1958 show only quantitative, not qualitative, differences and the complex is considered one species.

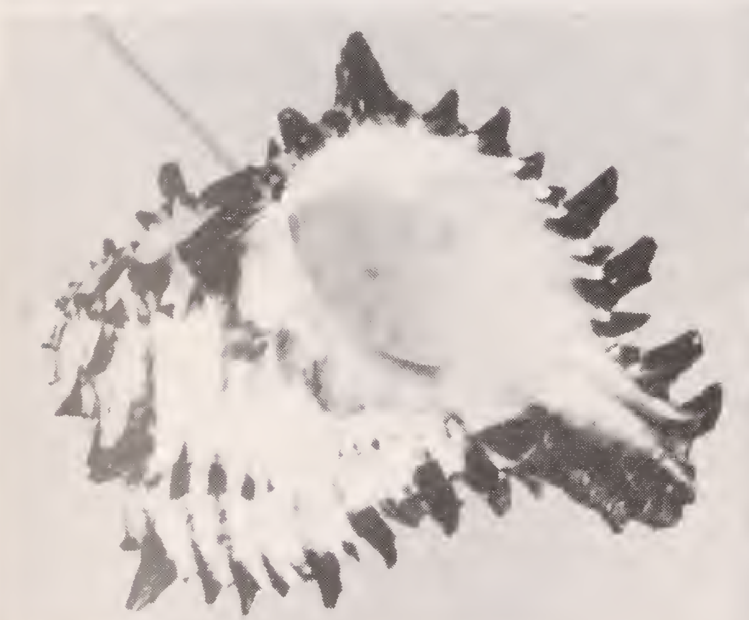
Keen (1971:522,523, figs. 999-1003) considers the "forms" *M. nigritus* and *M. callidinus* given by Radwin and D'Attilio to be valid species questioning only *M. ambiguus* which she says may not be a distinct species "...but a transitional form between the southern *M. radix* and the northern *M. nigritus*."

Local collectors have found specimens of *M. radix* intertidally at San Felipe, B.C., Mexico, which fit the descriptions of *M. nigritus* and *M. radix* as stated by Keen (collections of Gemmell and Hertz). A specimen examined from the Hertz collection from Ensenada Blanca, San Felipe, collected in 1968 intertidally on rocky rubble has 14 varices, is 108 mm in height and 90 mm at its greatest diameter.

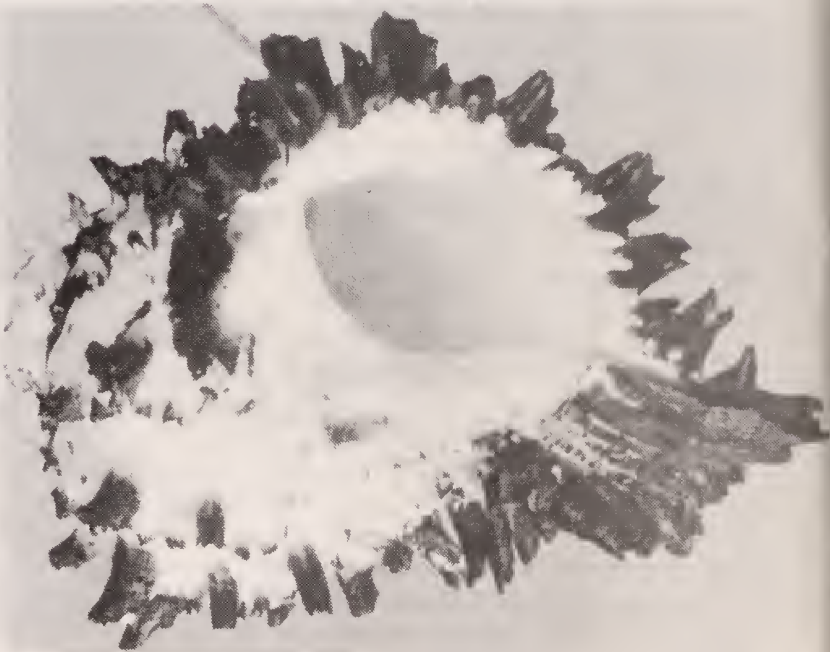
Apparently this species is subject to considerable environmental and ecological influences throughout its longitudinal and vertical range. However a scientific study of this species along its entire distribution has never been made. What is necessary for the determination of the variability of this species is a sampling, taken scientifically, from collecting stations along its vertical and horizontal range. Museum collections and most private collections have a paucity of material from the coast of Central America and lack the detailed data i.e. depth, substrate, water temperature, that such a study would provide. Food preferences and reproductive cycles might also be studied to give a better understanding of this relatively common, though poorly understood species.

Acknowledgments

The following friends and department associates contributed to the paper. Mr. David K. Mulliner took the excellent photographs. The larger specimen photographed was obtained from Mr. L.J. Bibbey. Mr. and Mrs. Jules Hertz contributed to the readability of the text.


Top row: Figures 1-3.
M. radix, specimen with 6 varices, 130 mm height.


Bottom row: Figures 4-6.
M. radix, specimen with 14

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BOOK REVIEW -- AN UPDATE

BY

DAVID K. MULLINER

Department of Marine Invertebrates, Natural History Museum, Balboa Park
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GUIDE TO THE NUDIBRANCHS OF CALIFORNIA Including most species found from Alaska to Oregon. Second Printing (Corrected May 1981).
By Gary R. McDonald and James W. Nybakken. 1980
Published by American Malacologists, Box 2255, Melbourne, Florida.
Price: $13.50 plus $.50 postage.

The Festivus has recently received a copy of GUIDE TO THE NUDIBRANCHS OF CALIFORNIA... Second Printing (Corrected May 1981) for review. The photographs have been improved in most cases by enhancing the colors and increasing their sharpness. Plates 65-72 (p.57) however have lost quality and are slightly out of focus. Gordon Robilliard stated in his review of the first printing [Festivus 13(8):94-95] that about 35% of the color illustrations are marginal to poor. This statement is still true. In the copy I reviewed there are six extra pages: pages 51-56 are included twice.

The excellent figure illustrations have been improved by changing their labeling. Complete terms are used instead of a mixture of abbreviations and complete names. Table 1: A Summary of Food Associations... is a helpful guide. It will be useful for further observations and research of the nudibranchs.

I recommend the Guide as a useful book for those interested in identifying nudibranchs and learning about their unique biology.

Ed. note: In correction: Review by Robilliard [Festivus 13(8):95] should read *Dendronotus irus* shown in Plate 68 instead of Plate 66.
This volume will be available for circulation as well as Cernohorsky's THE FAMILY BUCCINIDAE PART 1: THE GENERA NASSARIA, TRAJANA AND NEOTERON at the October meeting.

ADDITIONS TO THE ROSTER
Seay, Eunice and Jim, 3290 San Carlos Dr., Spring Valley, CA 92077, 466-8994
Wilkerson, J.W., 5130 Fino Dr., San Diego, CA 92124

CHANGES OF ADDRESS
Janowsky, Dorothy, 946 Ralph Ave., Brooklyn NY 11236

SAN DIEGO SHELL CLUB
% C. HERTZ
3883 MT. BLACKBURN AVE.
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THE FESTIVUS

SAN DIEGO SHELL CLUB

FOUNDED 1961 • INCORPORATED 1968

MEETS THIRD THURSDAY, 7:30 P.M.
ROOM 104, CASA DEL PRADO, BALBOA PARK

President..................Carol Burchard
Vice President.............Ron H. McPeak
Rec. Secretary.............Martin Schuler
Corres. Secretary..........Marjorie Bradner
Treasurer..................Walter Robertson
Editor.....................Carole M. Hertz

ANNUAL DUES: Payable to San Diego Shell Club Inc. Single membership: $4.00; Family membership: $5.00; Student membership: $3.00; Overseas surface: $6.00.

CLUB ADDRESS: Address all correspondence to San Diego Shell Club, Inc. c/o 3883 Mt. Blackburn Ave., San Diego, California 92111

VOL. XIII NOVEMBER 1981 NO. 11

PROGRAM: Dr. Eric Hochberg will give an illustrated talk on selected mollusks from the northern Channel Islands. In addition he will provide a discussion of some recent work on Cephalopods.

Date: November 19, 1981 Time: 7:30 P.M. Room: 104

MAKE YOUR RESERVATIONS NOW. The Club's Annual Christmas Party will be held on Saturday evening, December 12, 1981 in the La Sala Room of the Cafe Del Rey Moro. Details, page 117.

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THE FESTIVUS DOES NOT PUBLISH AN ISSUE IN DECEMBER.

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: 5 OCTOBER 1981

BY

MARTIN SCHULER

Carol Burchard called the meeting to order at 7:45 P.M. Guests and new members were introduced as well as those members that we hadn't seen for a while. Ron McPeak then introduced the night's speaker, Dr. Jack Engle, who spoke on the ecology of the Channel Islands and the Channel Islands research program. The talk was very interesting and focused on the forms of marine life found on any one of the islands. Slides were also shown to illustrate the environmental differences found on the different islands and on the other sides of the same islands.

Ron announced that next month's speaker will be Dr. Eric Hochberg who will speak on the Channel Islands. Wally Robertson announced the various books for sale and also noted that the Christmas Party will be held on Saturday December 12, not on December 11 (as announced in error in the October Festivus, Ed.).

Barbara Myers announced that the library is selling duplicate and outdated material.

Carol Burchard presented the slate of officers for 1982. They are as follows.

President: Martin Schuler	Treasurer: Wally Robertson
Vice President: Bill Perrin	Editor: Carole Hertz
Rec./Corr. Secretary: Pat Sage	

Nominations from the floor will be entertained at the November meeing after which the election of officers for 1982 will take place.

Jay Christianson won the shell drawing and the meeting was adjourned at 9:30 P.M.

THE SEPTEMBER PARTY--A CHINESE FEAST

The garden of Jeanne and Don Pisor's home was the lovely setting for the Club's annual September party. Gathered were many members and friends in Chinese finery. There was ethnic music and a sumptuous array of Chinese delicacies which were enjoyed by all. As always, the party was warm with good friendship and the Club thanks our gracious hosts Jeanne and Don Pisor.

THE ANNUAL CLUB CHRISTMAS DINNER PARTY

The San Diego Shell Club's annual Christmas party will be held on Saturday evening, December 12 in the La Sala Room of the Cafe Del Rey Moro in Balboa Park. The no host cocktail hour will begin at 6:00 P.M. Dinner will be at 7:15 P.M.

Menu: Tossed salad, hot rolls and butter
Baron of beef au jus, baked stuffed potato and vegetable
Dessert and choice of coffee or tea
Complimentary dinner wine will be provided by the Club.

Dinner cost is $10.00 ($8.45 plus tax and gratuity). Reservations must be in by Friday, December 4. Make checks payable to San Diego Shell Club, Inc., and either give it to the treasurer, Walter Robertson at the November meeting or send it to the Club address (see front page).

Following dinner there will be entertainment and the Club's traditional shell exchange. Bring your gift wrapped shell to place under the tree. Place data and name inside the package only. On the outside place only general locale i.e. Indo-Pacific, Gulf, etc. Numbers are drawn and those bringing a shell gift choose one from under the tree.

It's always a great party. Come and join your friends. Guests welcome.

A PRELIMINARY REPORT ON SOME FEATURES OF MURICACEAN MORPHOLOGY*

BY

ANTHONY D'ATTILIO

Department of Marine Invertebrates, Natural History Museum, Balboa Park
P.O. Box 1390, San Diego, California 92112

One of the most distinguishing characters of a *Murex* shell is the presence of varices. What is a varix, or how does one distinguish a varix from other sculptural features? A varix, which is an axially aligned structure, is usually spaced with some regularity from whorl to whorl and usually retains a thickened margin on its leading side. See Figure 1. The varical margin then is the preserved outer lip of a previous aperture. When new growth takes place, a varix near the new outer lip is formed. Frequently this previous outer lip is not resorbed in the process of growth. The new growth starts where the old lip and varix are situated and they remain as a remnant of a former growth stage. At times however, the lip may be resorbed in which case varical sculpture is barely present, with little or no evidence of the previous lip. See Figure 2.

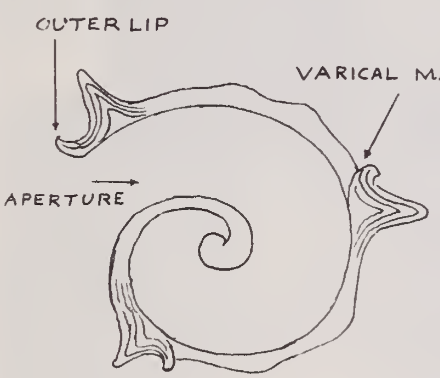

Fig. 1. Schematic transverse section of muricid shell retaining a varical margin.

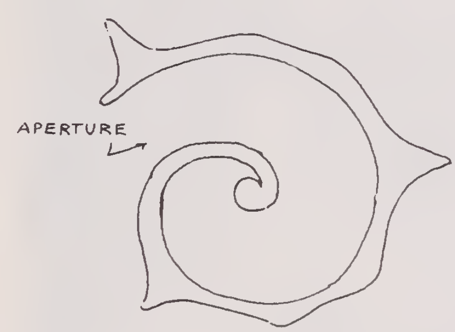

Fig. 2. Schematic transverse section of muricid shell not retaining a varical margin.

Varices are then an indication of rest periods or elements of periodicity in the formation of the shell. Observation seems to support the view that new growth is achieved with rest periods of no growth between one varix and the next. However, this qualitative aspect of muricid ontogeny is not consistent either to family or genus in the Muricacea. Species can be selected from many genera which seem to demonstrate that continuous growth takes place. Varices in these species are not clearly defined. Examination of the shell surface shows consistent growth as small, evenly spaced increments over the entire surface. Figures 3 and 4 illustrate con-continuous growth in the muricid species *Ocenebra lurida* (Middendorf, 1848).

In species with varices (Figure 5), the early postnuclear whorls have close-set axial ridges not clearly differentiated as varices. Usually on the third postnuclear whorl a portion of the axial ridges develop into true varices while a number of the

* Adapted from a paper presented at the WSM-1981 conference in San Diego, California.

Fig. 3. Dorsal view of *O. lurida* illustrating continuous growth SDNHM 6745; Length: 24mm Location: Puget Sound, Washington

Fig. 4. Profile view of the same specimen.

remaining axial ridges retain their early nature and persist as such in whole or in part throughout shell growth. Figure 6 illustrates the first appearance of the differentiation between varix and axial ridge in an enlarged drawing of the early whorls of *Naquetia triquetra* (Born, 1778). The shell develops three varices beginning with the third whorl. All other intervarical ridges are stabilized into a few axial ridges at maturity.

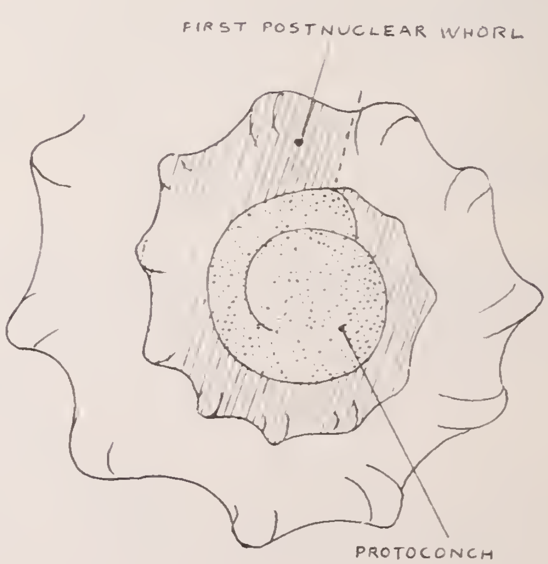

Fig. 5. The 2nd to 3rd postnuclear whorls most frequently have axial sculpture not differentiated into varices and non-functional costae.

The varices may assume a number of forms; a fact which has led to the creation of the many generic categories in the taxonomy of the Muricidae and other muricacean families. The species with rounded spines having three varices have been classified in the genus *Murex* in the strict sense (see Figure 7) or in *Haustellum*. Some similar types of spiny species have been segregated in the genus *Siratus* for reasons of radula, canal structure etc. (see Figure 8). Those species having foliated spines resembling the cut-leaf form of the edible plant, Chicory, are in large part classified in the appropriately named genus *Chicoreus* (see Figure 9). Species having wing-like flanges extending on the varix are placed in genera such as *Pterynotus*, *Pteropurpura* etc. depending principally on the form of the radula. See Figure 10.

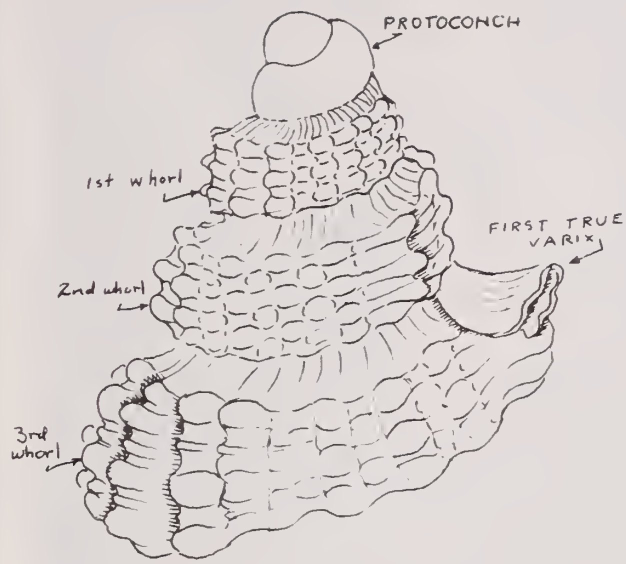

Fig. 6. Greatly enlarged drawing of the early whorls of *Naquetia triquetra* showing the development of the first varix.

Fig. 7. *Murex tricoronis* Berry, 1960
SDNHM 45807; Length: 59 mm
Location: Bahia de Los Angeles, Baja Calif., Mexico

Fig. 8. *Siratus motacilla* (Gmelin, 1791)
SDNHM 79072; Length 60 mm
Location: Dominica, B.W.I.

Fig. 9. *Chicoreus brunneus* Link, 1807
SDNHM 79938; Length: 60 mm
Location: Zamboanga, P.I., Date: 4/52
Coll: M. Sohl

Fig. 10. *Pteropurpura macroptera* (Deshayes, 1839)
Mulliner collection;
Location: off Bird Rock, La Jolla, Ca. in 65 ft. Date: 7/31/71; Coll. D. Mulliner

Fig. 11. *Murexiella radwini* Emerson and D'Attilio, 1970
AMNH 155903; Length 33.5 mm (holotype)
Location: Isabella Is., Galapagos Islands

Intermediate forms of varical sculpture with foliated or non-foliated spines connected by a flange or web can be found in genera like *Murexiella* as shown in Figure 11. In the systematics of the Muricacea many other variations such as spinosity and flange sculpture form the basis of generic divisions. In many of these generic divisions, nonetheless, species may be included which do not conform to the general concept of the genus as taxonomically defined by the characters of the type.

A significant feature of most muricid growth is the relation of the varices as they are positioned from whorl to whorl. The varix on the later whorl, with some exceptions, falls short of coming directly below the varix above. When an entire shell is viewed, the alignment of the varices is seen to be diagonal to the axis of the shell. This diagonal quality

varies from slight to extreme and brings out the interesting fact that a muricid shell whorl having varices does not complete, in most instances, a full circle of 360°. See Figure 12. The diagonally placed varices, when viewed from the spire downward as shown in Figure 13, swirl from right to left. Rarely are the varices parallel to the axis in the muricid shell as illustrated in Figure 14.

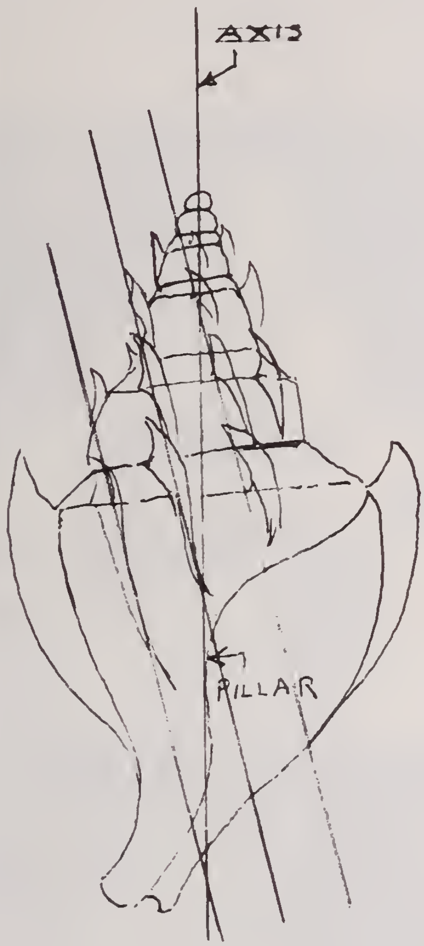

Fig. 12. Schematic illustration showing varices diagonal to axis.

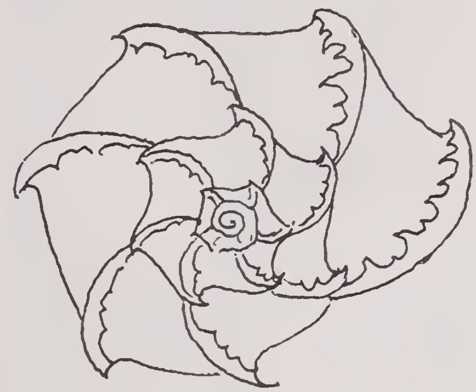

Fig. 13. Schematic illustration showing the swirling effect of varices from right to left when viewed from the spire.

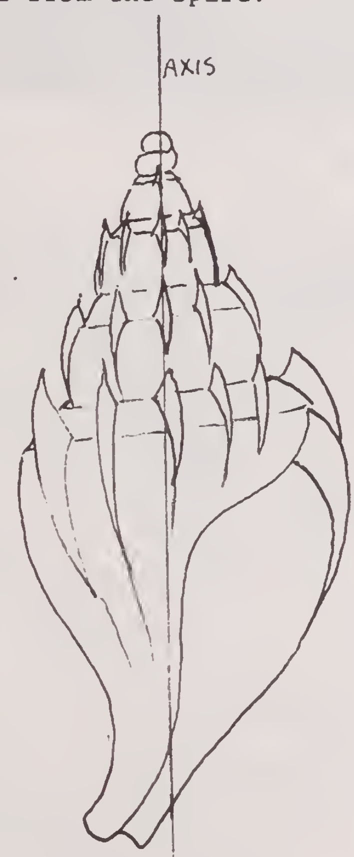

Fig. 14. Schematic drawing showing the varices parallel to the axis.

However some exceptions exist as exemplified by *Aspella* and *Eupleura*. In the genus *Aspella* there are two laterally placed varices aligned parallel to the axis of the shell as shown in Figure 15. However there are eight varices in the earliest whorls (see Figure 16) which have the more common diagonal pattern of growth.

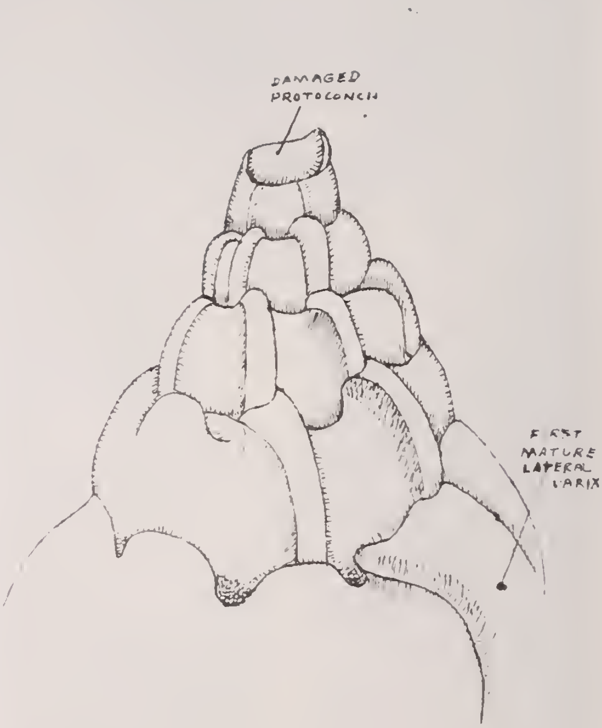

Fig. 15. *Aspella ?pyramidalis* (Broderip, 1833) 3 specimens from Puerto Nunez, Santa Cruz Is, Galapagos Is., under rocks, low tide SDNHM 72235; Length 13mm - 15mm

Fig. 16. Greatly enlarged drawing of early whorls of *A. ?pyramidalis*.

The two views of *Aspella platylaevis* Radwin and D'Attilio, 1976 in Figure 17 show clearly the alignment of the varices parallel to the axis of the shell.

Fig. 17. Two views of *Aspella platylaevis* SDNHM 77206; Length: 12 mm; Location: Mactan Is., P.I.

An interesting variation of muricid growth occurs in *Eupleura*. As can be noted from the illustrations of two species of *Eupleura* in Figures 18 and 19, the apertural varix in *Eupleura* is located beyond the varix above in the mature shell. Figure 20 shows the early growth in *E. muriciformis* which exhibits the more customary muricid growth in its early whorls. *E. nitida* however, (Figure 19) shows consistent vertical alignment of varices from the early postnuclear whorls.

Fig. 18. *E. muriciformis* (Brod., 1833)
SDNHM 23189; Length 44 mm
Location: Kino Bay, Sonora, Mex.

Fig. 19. *E. nitida* (Broderip, 1833)
reprinted from Festivus XII(11):131

Fig. 20. Two views of juvenile *E. muriciformis*
Hertz collection; Length 17 mm;
Location: San Felipe, B.C., Mex. intertidal

The lamellate nature of growth striae in muricids is another characteristic feature although not restricted to this family. In muricacean families it is a pronounced character. The lamellae are often quite strongly developed and extend above the surface of the shell, sometimes appearing undulate, wave-like or even ruffled. An example of this is shown in Figure 21. Where spiral sculpture occurs the lamellae form scaly extensions over the cords. Because of these combined characters, the *Murex* shell is often described as having a scabrously-lamellose surface.

Fig. 21. *Latiaxis sibogae* Schepman, 1911 Length: 16 mm (holotype), Zoölogisch Museum reprinted from Festivus XIII(2):17.

Acknowledgments

I am indebted to David K. Mulliner for the fine photographs in this paper.

Literature dealing with this same subject can be found in the following works.

Linsley, Robert M. and Mahdokht Javidpour 1980. Episodic growth in Gastropoda. Malacologia 20(1):153-160. 7 figs.

Spight, T.M. and A. Lyons 1974. Development and functions of the shell sculpture of the marine snail, *Ceratostoma foliatum*. Marine Biology 24:77-83.

Spight, T.M., C. Birkeland and A. Lyons. 1974. Life histories of large and small Murexes (Prosobranchia: Muricidae). Marine Biology 24:229-242.

THE FESTIVUS DOES NOT PUBLISH AN ISSUE IN DECEMBER.

A SPECTACULAR DIVE AT BEGG ROCK

BY

RON MCPEAK

KELCO, Division of Merck & Co.
2145 East Belt Street, San Diego, California

On August 13, 1981, I had an opportunity to dive Begg Rock. Begg Rock is an underwater pinnacle that rises from ocean depths of nearly 50 fathoms to jut a few feet out of water. It is located approximately 130 miles west of San Diego and ten miles northwest of San Nicolas Island. This offshore area provides beautiful diving along its steep walls. The diving, however, can be hazardous in shallow water, due to high westerly swells which frequently buffet the area. Swells or foggy conditions were likely the cause of the 1824 stranding of the vessel John Begg, the rock's namesake.

Conditions were calm and swells were only moderate during the August dive, a dive to depths of 40 to 80 feet. I leaped into the clear water with camera and collecting bag in hand, and swam toward the rock while submerging. Visibility was excellent and probably exceeded 40 feet. A mosaic of colors came into focus as I approached the steep walls. Vivid reds, purples, pinks, greens, grays, whites, and oranges were splashed on the walls of Begg Rock.

Coelenterates were ubiquitous. The white plumose anemone, *Metridium senile*, covered much of the rock, to depths of at least 100 feet (Figure 1). Juveniles of this species were everywhere and most were formed by pedal laceration--a mode of asexual reproduction. The aggregating anemone, *Anthopleura elegantissima*, formed colorful grey-green patches to depths of at least 80 feet. This anemone is common in tide pools along the coast of California. Another anemone, *Corynactis californica* was recognized by its white-clubbed tentacles and pink, crimson, red, lavender or brown colored body. A few specimens of the small salmon-colored anemone, *Metridium exilis*, and the proliferating anemone, *Epiactis prolifera*. were also observed. Other coelenterates noted were the hydroid *Aglaophenia* sp.; hydrocoral, *Allopora* sp. and the stony coral, *Astrangia lajollensis* (Figure 2).

Fig. 1. Side of Begg Rock at about 40 feet with *Metridium senile* and *Spheciospongia confoederata*.

In addition to coelenterates, many other species of suspension feeding invertebrates were visible during the dive. Several species of sponges were common. A large grey sponge, *Spheciospongia confoederata* formed colonies up to five feet long and two

feet in height and *Acarnus erithacus* was easily identified by its bright orange-red color (Figure 1). A few specimens of the feather-duster worm, *Eudistyla polymorpha* waved their plume-like gills in the surge. Bright orange (unidentified) colonial tunicates were quite common and provided a colorful contrast to the surrounding white plumose anemones. *Hinnites giganteus* (Gray, 1825) was common subtidally, while *Mytilus californianus*, Conrad, 1837, was abundant in the intertidal and shallow subtidal. Numerous dead and detached *Mytilus* shells were observed in depressions, at depths ranging from 50 to 80 feet (Figure 3). The barnacle, *Megabalanus californicus (=Balanus tintinnabulum)* contributed to the debris collecting in these depressions. These barnacles were either attached to *Mytilus* or were in detached clusters. Since both *Mytilus* and *Megabalanus* primarily occur in the intertidal or shallow subtidal, the debris in depressions was likely produced by swells which dislodged the shallow water animals. It is also possible that starfish fed upon *Mytilus* in shallow water and released the *Mytilus* shells after feeding.

Several species of echinoderms were present. During the dive I observed the following starfish and sea urchins: *Pisaster gigantacus, P. ochraceus, Patiria miniata, Pycnopodia helianthoides, Dermasterias imbricata, Orthasterias koehleri;* and sea urchins, *Strongylocentrotus franciscanus*and *S. purpuratus*. The urchins were most abundant in the *Mytilus-Megabalanus* debris.

Nudibranchs, *Anisodoris nobilis* (MacFarland, 1905) and *Hermissenda crassicornis* (Eschscholtz, 1831) were seen crawling over the rocky substrate. The scaled worm shell *Serpulorbis squamigerus* (Carpenter, 1857) was everywhere. One of the most exciting

Fig. 2. Begg Rock at 60 feet with hydroid *Aglaophenia* and hydrocoral *Allopora*.

Fig. 3. Debris filled depressions with numerous *Mytilus* shells, *Megabalanus californicus*, and the purple urchin *Strongylocentrotus purpuratus*.

aspects of the dive was locating pockets of the beautiful muricid, *Ceratostoma foliatum* (Gmelin, 1791), at depths ranging from 30 to 80 feet. They may have occurred in significant numbers at greater depths, but the dive was limited to a depth of 80 feet. Many of the *Ceratostoma* were covered by bryozoans, the anemone *Metridium senile,* and *Megabalanus californicus.* Some shells were bored by the sponge *Cliona.*

The pockets of 15-30 *Ceratostoma* were in crevices (Figure 4). The clustered muricids did not appear to be spawning or feeding on a particular prey item. Scattered specimens of *C. foliatum*, however, were observed feeding on *Megabalanus* in the debris filled depressions, at depths of 50 to 80 feet.

Fig. 4. Clusters of *Ceratostoma foliatum* at 65 feet.

I collected some of the larger specimens of *C. foliatum* (to 90 mm), and invariably found small *Ceratostoma* beneath. Some of these juvenile *Ceratostoma* have been identified by Anthony D'Attilio and Barbara W. Myers as *C. nuttalli* (Conrad, 1837). One 51 mm adult specimen of *C. nuttalli* was collected. I find it interesting that these two species were found occupying the same habitat. *C. foliatum* is a northern species which ranges from San Diego, California to Sitka, Alaska. The species is reported as uncommon south of Point Conception, California. *C. nuttalli* is a southern species and ranges from Point, Conception, California south to Bahia Santa Maria, Baja California, Mexico. The few specimens of *C. nuttalli* collected at Begg Rock were nearly at the northern limit of distribution for the species. The Begg Rock population of *C. foliatum* was thriving in an area considered near the southern distribution for the species. A review of southern California sea surface temperature data and satellite imagery reveals tongues of colder northern water reaching the Begg Rock-San Nicolas Island area. *C. foliatum*, which is thriving in the colder waters at Begg Rock, would likely be found at San Nicolas Island.

The following gastropods were inadvertently collected when *Ceratostoma* were placed in the collecting bag.

Amphissa versicolor (Dall, 1871)
Calliostoma supragranosum (Carpenter, 1864)
Ceratostoma nuttalli (Conrad, 1837)
Cerithiopsis cosmia Bartsch, 1907
Crepipatella lingulata (Gould, 1846)
Cypraea spadicea (Swainson, 1823)
Epitonium sp.
Fusinus luteopictus (Dall, 1871)
Homalopoma luridum (Dall, 1885)
Maxwellia santarosana (Dall, 1905)
Nucella canaliculata (Duclos, 1832)
Ocenebra foveolata (Hinds, 1844)
Ocenebra lurida (Middendorff, 1848)
Seila montereyensis Bartsch, 1907
Volvarina taeniolata Mörch, 1860
Williamia peltoides (Carpenter, 1864)

The dive at Begg Rock was exciting and finished with a flurry. As I was completing the dive, taking pictures of a cluster of *Ceratostoma,* I suddenly noticed by air supply was very low so I took the last picture, grabbed about eight *Ceratostoma*,

and quickly surfaced, juggling *Murex* and camera. The short dive at Begg Rock will be remembered as one of my favorite dives.

Acknowledgments

I wish to thank Barbara Myers for identifying the miscellaneous shells collected with *Ceratostoma foliatum* and for her many helpful suggestions regarding this paper. I further want to thank Dave Mulliner for making black and white prints from the original slides for inclusion in this article.

The following request was received from Mr. Roland Houart, St. Jobsstraat, 8, B-3330 Landen (Ezemaal), Belgium.

In order to make a revision of the genus *Chicoreus* s.s. (Muricidae) from the Indo-Pacific area (including the Red Sea) I would like to borrow, receive, exchange or buy specimens from any locality in the studied area. Borrowed specimens will be returned after a maximum of 9 months. Please be sure to include the locality data even if not complete. It is most important. I thank you for your help.

Mr. Houart can be contacted at the above address.

NEW MEMBER

Womack, Edwin B., 1007 North E Place, Lompoc, CA 93436.

CHANGES OF ADDRESS

Burch, Mrs. B.L., P.O. Box 309, Kailua, Hawaii 96734.
Janowsky, Dorothy, 792 Evergreen Drive, West Hempstead, NY.
Ruhl, Deborah A., 14083 E. Canning Drive, Whittier CA 90605

A SELECTED INDEX TO VOLUME XIII (1981)

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The rediscovery of *Murex cirrosus* Hinds, 1844. 4:46-51, 8 figs.
Two problematic coralliophilid gastropods [*Latiaxis sibogae* & *L. ricinuloides*] 2:16-20, 4 figs.
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One dive: November 2, 1980. [off Palos Verdes, CA] 8:96-97, 1 fig.
GEMMELL, JOYCE, BARBARA W. MYERS, CAROLE M. HERTZ
A report on the faunal study of the Gemmell collection from San Felipe, Baja California, Mexico, from 1965 to 1976. 8:87-93. 10 figs.
HERTZ, CAROLE M.
In memoriam: Joshua L. Baily, 1889-1981 [List of publications authored by Dr. Baily] 5:63-65.
HERTZ, JULES
A review of several eastern Pacific *Bittium* species (Gastropoda: Cerithiidae) 3:25-44, 27 figs., 2 tables.
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A spectacular dive at Begg Rock. 11: 126-129, 4 figs.

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A preliminary report on some features of muricacean morphology. D'Attilio, A., 11:118-125 , 21 figs.
A report on the faunal study of the Gemmell collection from San Felipe, Baja California, Mexico, from 1965 to 1976. Gemmell, J., B.W. Myers, C.M. Hertz. 8:87-93, 10 figs.
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Book review: The family Buccinidae part 1: the genera *Nassaria, Trajana* and *Neoteron*. D'Attilio, A., 9:103
Colubraria xavieri Campbell, 1961 (Gastropoda: Cymatiacea) the second known specimen? Poorman, F.L. & L.H. Poorman, 9:102-103, 1 fig.
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Minute shells: *Kurtziella ?atrostyla* (Tryon, 1884). Keeler, J. & J. Hertz, 4:55-56, 1 fig.
Minute shells: western Atlantic caecids. Keeler, J., 6:67-72, 24 figs.

Muricidae of Midway. Schmeltz, R., 4:52-54, 3 figs.
Murex (Ocinebra) sykesi Preston, 1904. D'Attilio, A., 6:73-75, 2 figs.
Note on the holotype of *Murex laqueatus* Sowerby, 1841 (Gastropoda: Muricidae) with a description of a specimen from Guam. D'Attilio, A., 7:78-81, 5 figs.
Notes on *Crockerella crystallina* (Gabb, 1865) (Gastropoda: Turridae). Hertz, J., 10:108-112, 10 figs.
Observations on *Muricanthus radix* (Gmelin, 1791) (Gastropoda: Muricidae: Muricinae). D'Attilio, A. 10:113-115, 6 figs.
Observations on two problem species from the Indo Pacific. [including] Note on the type figure of *Murex hirasei* and its author Yochiro Hirase. D'Attilio, A., 1:2-6. 7 figs.
One dive: November 2, 1980. Evans, R., 8:96-97, 1 fig. [off Palos Verdes, CA]
One dive: September 24, 1980. Evans, R., 3:24 [off Palos Verdes, CA]
The cultured abalone. Leighton, D.L., 7:83-84.
The ecology of *Colisella digitalis*. Kimball, A., 6:76. [summary of student project]
The radula of *Neoteron ariel* (Pilsbry and Lowe, 1932) (Gastropoda: Buccinidae). D'Attilio, A., 9:104-105, 3 figs.
The rediscovery of *Murex cirrosus* Hinds, 1844. D'Attilio, A., 4:46-51, 8 figs.
Two problematic coralliophilid gastropods. D'Attilio, A., 2:16-20, 4 figs. [*Latiaxis sibogae & L. ricinuloides*]

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THE FESTIVUS

SAN DIEGO SHELL CLUB

FOUNDED 1961 • INCORPORATED 1968

MEETS THIRD THURSDAY, 7:30 P.M.
ROOM 104, CASA DEL PRADO, BALBOA PARK

ANNUAL DUES: Payable to San Diego Shell Club Inc. Single membership: $4.00; Family membership: $5.00; Student membership: $3.00; Overseas surface: $6.00.

CLUB ADDRESS: Address all correspondence to San Diego Shell Club, Inc. c/o 3883 Mt. Blackburn Ave., San Diego, California 92111

VOL. XIII NOVEMBER 1981 NO. 11

PROGRAM: Dr. Eric Hochberg will give an illustrated talk on selected mollusks from the northern Channel Islands. In addition he will provide a discussion of some recent work on Cephalopods.

Date: November 19, 1981 Time: 7:30 P.M. Room: 104

MAKE YOUR RESERVATIONS NOW. The Club's Annual Christmas Party will be held on Saturday evening, December 12, 1981 in the La Sala Room of the Cafe Del Rey Moro. Details, page 117.

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THE FESTIVUS DOES NOT PUBLISH AN ISSUE IN DECEMBER.

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: 5 OCTOBER 1981

BY

MARTIN SCHULER

Carol Burchard called the meeting to order at 7:45 P.M. Guests and new members were introduced as well as those members that we hadn't seen for a while. Ron McPeak then introduced the night's speaker, Dr. Jack Engle, who spoke on the ecology of the Channel Islands and the Channel Islands research program. The talk was very interesting and focused on the forms of marine life found on any one of the islands. Slides were also shown to illustrate the environmental differences found on the different islands and on the other sides of the same islands.

Ron announced that next month's speaker will be Dr. Eric Hochberg who will speak on the Channel Islands. Wally Robertson announced the various books for sale and also noted that the Christmas Party will be held on Saturday December 12, not on December 11 (as announced in error in the October Festivus, Ed.).

Barbara Myers announced that the library is selling duplicate and outdated material.

Carol Burchard presented the slate of officers for 1982. They are as follows.

President: Martin Schuler
Vice President: Bill Perrin
Rec./Corr. Secretary: Pat Sage
Treasurer: Wally Robertson
Editor: Carole Hertz

Nominations from the floor will be entertained at the November meeing after which the election of officers for 1982 will take place.

Jay Christianson won the shell drawing and the meeting was adjourned at 9:30 P.M.

THE SEPTEMBER PARTY--A CHINESE FEAST

The garden of Jeanne and Don Pisor's home was the lovely setting for the Club's annual September party. Gathered were many members and friends in Chinese finery. There was ethnic music and a sumptuous array of Chinese delicacies which were enjoyed by all. As always, the party was warm with good friendship and the Club thanks our gracious hosts Jeanne and Don Pisor.

THE ANNUAL CLUB CHRISTMAS DINNER PARTY

The San Diego Shell Club's annual Christmas party will be held on Saturday evening, December 12 in the La Sala Room of the Cafe Del Rey Moro in Balboa Park. The no host cocktail hour will begin at 6:00 P.M. Dinner will be at 7:15 P.M.

Menu: Tossed salad, hot rolls and butter
Baron of beef au jus, baked stuffed potato and vegetable
Dessert and choice of coffee or tea
Complimentary dinner wine will be provided by the Club.

Dinner cost is $10.00 ($8.45 plus tax and gratuity). Reservations must be in by Friday, December 4. Make checks payable to San Diego Shell Club, Inc., and either give it to the treasurer, Walter Robertson at the November meeting or send it to the Club address (see front page).

Following dinner there will be entertainment and the Club's traditional shell exchange. Bring your gift wrapped shell to place under the tree. Place data and name inside the package only. On the outside place only general locale i.e. Indo-Pacific, Gulf, etc. Numbers are drawn and those bringing a shell gift choose one from under the tree.

It's always a great party. Come and join your friends. Guests welcome.

A PRELIMINARY REPORT ON SOME FEATURES OF MURICACEAN MORPHOLOGY*

BY

ANTHONY D'ATTILIO

Department of Marine Invertebrates, Natural History Museum, Balboa Park
P.O. Box 1390, San Diego, California 92112

One of the most distinguishing characters of a *Murex* shell is the presence of varices. What is a varix, or how does one distinguish a varix from other sculptural features? A varix, which is an axially aligned structure, is usually spaced with some regularity from whorl to whorl and usually retains a thickened margin on its leading side. See Figure 1. The varical margin then is the preserved outer lip of a previous aperture. When new growth takes place, a varix near the new outer lip is formed. Frequently this previous outer lip is not resorbed in the process of growth. The new growth starts where the old lip and varix are situated and they remain as a remnant of a former growth stage. At times however, the lip may be resorbed in which case varical sculpture is barely present, with little or no evidence of the previous lip. See Figure 2.

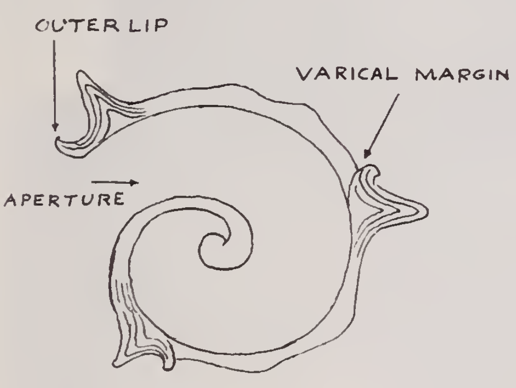

Fig. 1. Schematic transverse section of muricid shell retaining a varical margin.

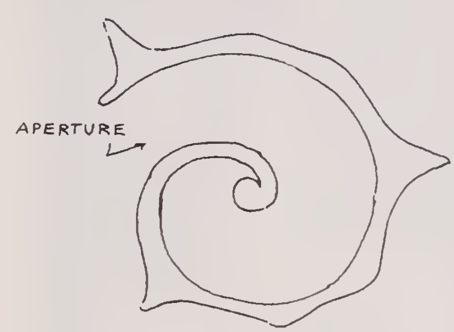

Fig. 2. Schematic transverse section of muricid shell not retaining a varical margin.

Varices are then an indication of rest periods or elements of periodicity in the formation of the shell. Observation seems to support the view that new growth is achieved with rest periods of no growth between one varix and the next. However, this qualitative aspect of muricid ontogeny is not consistent either to family or genus in the Muricacea. Species can be selected from many genera which seem to demonstrate that continuous growth takes place. Varices in these species are not clearly defined. Examination of the shell surface shows consistent growth as small, evenly spaced increments over the entire surface. Figures 3 and 4 illustrate con-continuous growth in the muricid species *Ocenebra lurida* (Middendorf, 1848).

In species with varices (Figure 5), the early postnuclear whorls have close-set axial ridges not clearly differentiated as varices. Usually on the third postnuclear whorl a portion of the axial ridges develop into true varices while a number of the

* Adapted from a paper presented at the WSM-1981 conference in San Diego, California.

Fig. 3. Dorsal view of *O. lurida* illustrating continuous growth SDNHM 6745; Length: 24mm Location: Puget Sound, Washington

Fig. 4. Profile view of the same specimen.

remaining axial ridges retain their early nature and persist as such in whole or in part throughout shell growth. Figure 6 illustrates the first appearance of the differentiation between varix and axial ridge in an enlarged drawing of the early whorls of *Naquetia triquetra* (Born, 1778). The shell develops three varices beginning with the third whorl. All other intervarical ridges are stabilized into a few axial ridges at maturity.

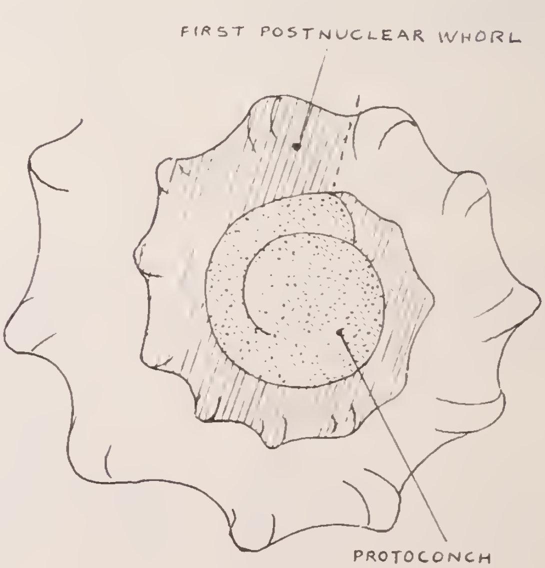

Fig. 5. The 2nd to 3rd postnuclear whorls most frequently have axial sculpture not differentiated into varices and non-functional costae.

The varices may assume a number of forms; a fact which has led to the creation of the many generic categories in the taxonomy of the Muricidae and other muricacean families. The species with rounded spines having three varices have been classified in the genus *Murex* in the strict sense (see Figure 7) or in *Haustellum*. Some similar types of spiny species have been segregated in the genus *Siratus* for reasons of radula, canal structure etc. (see Figure 8). Those species having foliated spines resembling the cut-leaf form of the edible plant, Chicory, are in large part classified in the appropriately named genus *Chicoreus* (see Figure 9). Species having wing-like flanges extending on the varix are placed in genera such as *Pterynotus, Pteropurpura* etc. depending principally on the form of the radula. See Figure 10.

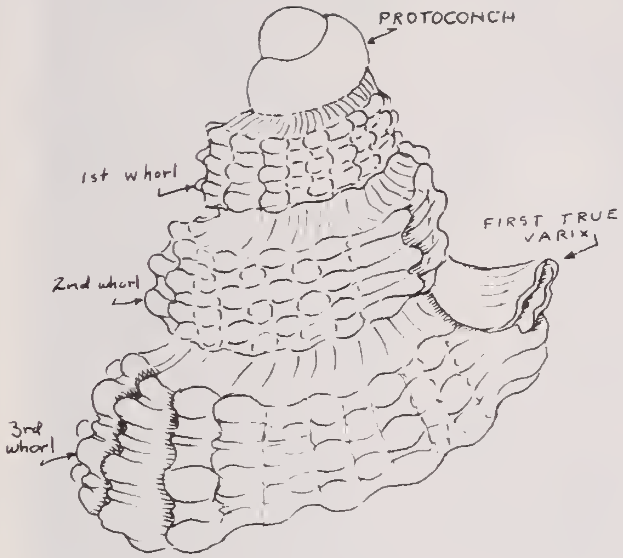

Fig. 6. Greatly enlarged drawing of the early whorls of *Naquetia triquetra* showing the development of the first varix.

Fig. 7. *Murex tricoronis* Berry, 1960
SDNHM 45807; Length: 59 mm
Location: Bahia de Los Angeles, Baja Calif., Mexico

Fig. 8. *Siratus motacilla* (Gmelin, 1791)
SDNHM 79072; Length 60 mm
Location: Dominica, B.W.I.

Fig. 9. *Chicoreus brunneus* Link, 1807
SDNHM 79938; Length: 60 mm
Location: Zamboanga, P.I., Date: 4/52
Coll: M. Sohl

Fig. 10. *Pteropurpura macroptera* (Deshayes, 1839)
Mulliner collection;
Location: off Bird Rock, La Jolla, Ca. in 65 ft. Date: 7/31/71; Coll. D. Mulliner

Fig. 11. *Murexiella radwini* Emerson and D'Attilio, 1970
AMNH 155903; Length 33.5 mm (holotype)
Location: Isabella Is., Galapagos Islands

Intermediate forms of varical sculpture with foliated or non-foliated spines connected by a flange or web can be found in genera like *Murexiella* as shown in Figure 11. In the systematics of the Muricacea many other variations such as spinosity and flange sculpture form the basis of generic divisions. In many of these generic divisions, nonetheless, species may be included which do not conform to the general concept of the genus as taxonomically defined by the characters of the type.

A significant feature of most muricid growth is the relation of the varices as they are positioned from whorl to whorl. The varix on the later whorl, with some exceptions, falls short of coming directly below the varix above. When an entire shell is viewed, the alignment of the varices is seen to be diagonal to the axis of the shell. This diagonal quality

varies from slight to extreme and brings out the interesting fact that a muricid shell whorl having varices does not complete, in most instances, a full circle of 360°. See Figure 12. The diagonally placed varices, when viewed from the spire downward as shown in Figure 13, swirl from right to left. Rarely are the varices parallel to the axis in the muricid shell as illustrated in Figure 14.

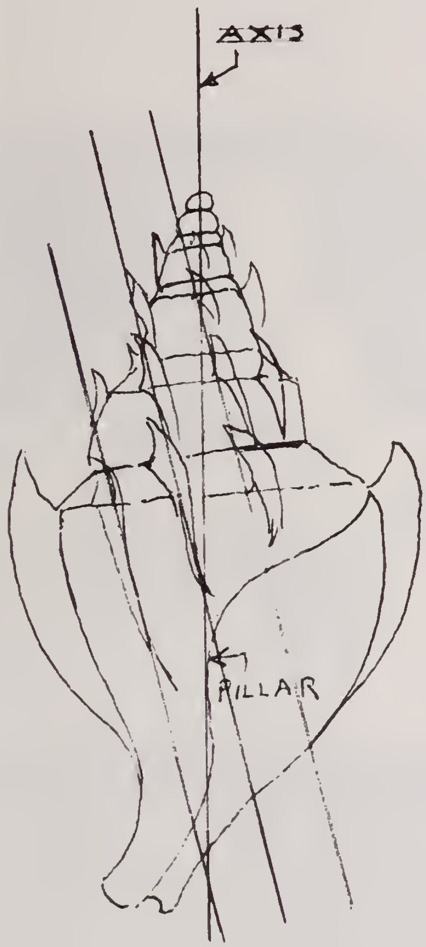

Fig. 12. Schematic illustration showing varices diagonal to axis.

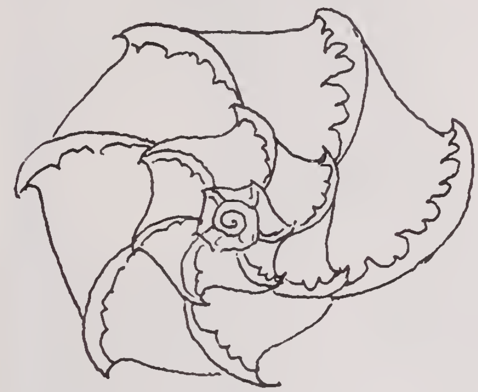

Fig. 13. Schematic illustration showing the swirling effect of varices from right to left when viewed from the spire.

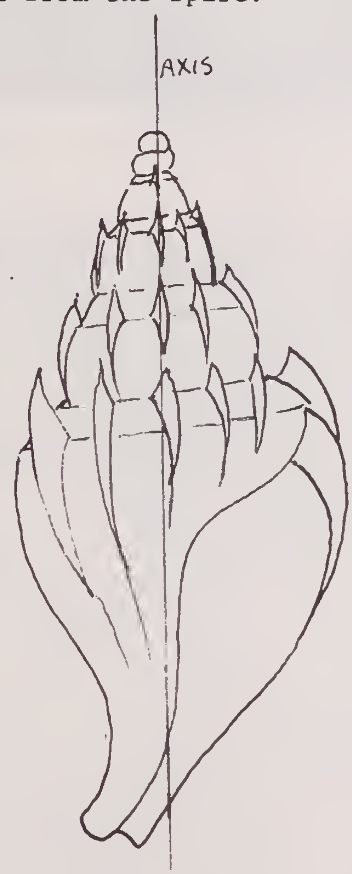

Fig. 14. Schematic drawing showing the varices parallel to the axis.

However some exceptions exist as exemplified by *Aspella* and *Eupleura*. In the genus *Aspella* there are two laterally placed varices aligned parallel to the axis of the shell as shown in Figure 15. However there are eight varices in the earliest whorls (see Figure 16) which have the more common diagonal pattern of growth.

Fig. 15. *Aspella ?pyramidalis* (Broderip, 1833) 3 specimens from Puerto Nunez, Santa Cruz Is, Galapagos Is., under rocks, low tide SDNHM 72235; Length 13mm - 15mm

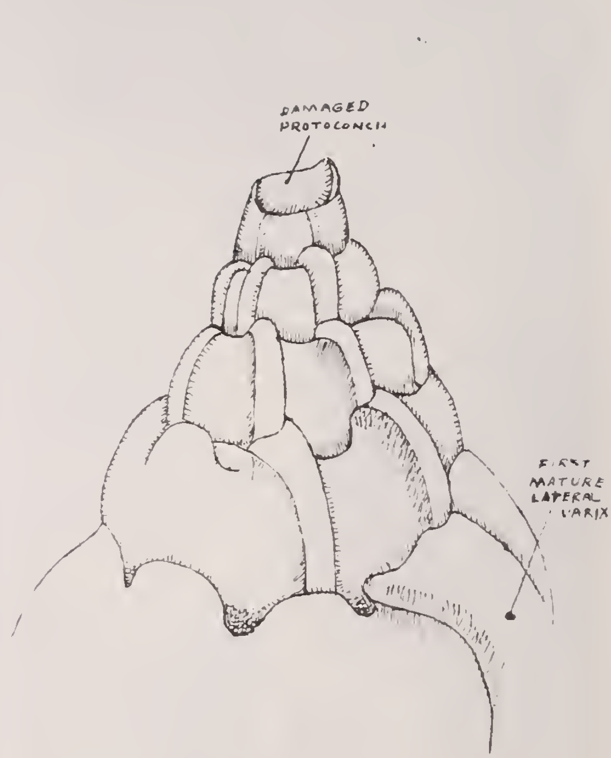

Fig. 16. Greatly enlarged drawing of early whorls of *A. ?pyramidalis*.

The two views of *Aspella platylaevis* Radwin and D'Attilio, 1976 in Figure 17 show clearly the alignment of the varices parallel to the axis of the shell.

Fig. 17. Two views of *Aspella platylaevis* SDNHM 77206; Length: 12 mm; Location: Mactan Is., P.I.

An interesting variation of muricid growth occurs in *Eupleura*. As can be noted from the illustrations of two species of *Eupleura* in Figures 18 and 19, the apertural varix in *Eupleura* is located beyond the varix above in the mature shell. Figure 20 shows the early growth in *E. muriciformis* which exhibits the more customary muricid growth in its early whorls. *E. nitida* however, (Figure 19) shows consistent vertical alignment of varices from the early postnuclear whorls.

Fig. 18. *E. muriciformis* (Brod., 1833)
SDNHM 23189; Length 44 mm
Location: Kino Bay, Sonora, Mex.

Fig. 19. *E. nitida* (Broderip, 1833)
reprinted from Festivus XII(11):131

Fig. 20. Two views of juvenile *E. muriciformis*
Hertz collection; Length 17 mm;
Location: San Felipe, B.C., Mex. intertidal

The lamellate nature of growth striae in muricids is another characteristic feature although not restricted to this family. In muricacean families it is a pronounced character. The lamellae are often quite strongly developed and extend above the surface of the shell, sometimes appearing undulate, wave-like or even ruffled. An example of this is shown in Figure 21. Where spiral sculpture occurs the lamellae form scaly extensions over the cords. Because of these combined characters, the *Murex* shell is often described as having a scabrously-lamellose surface.

Fig. 21. *Latiaxis sibogae* Schepman, 1911 Length: 16 mm (holotype), Zoölogisch Museum reprinted from Festivus XIII(2):17.

Acknowledgments

I am indebted to David K. Mulliner for the fine photographs in this paper.

Literature dealing with this same subject can be found in the following works.

Linsley, Robert M. and Mahdokht Javidpour 1980. Episodic growth in Gastropoda. Malacologia 20(1):153-160. 7 figs.

Spight, T.M. and A. Lyons 1974. Development and functions of the shell sculpture of the marine snail, *Ceratostoma foliatum*. Marine Biology 24:77-83.

Spight, T.M., C. Birkeland and A. Lyons. 1974. Life histories of large and small Murexes (Prosobranchia: Muricidae). Marine Biology 24:229-242.

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A SPECTACULAR DIVE AT BEGG ROCK

BY

RON MCPEAK

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2145 East Belt Street, San Diego, California

On August 13, 1981, I had an opportunity to dive Begg Rock. Begg Rock is an underwater pinnacle that rises from ocean depths of nearly 50 fathoms to jut a few feet out of water. It is located approximately 130 miles west of San Diego and ten miles northwest of San Nicolas Island. This offshore area provides beautiful diving along its steep walls. The diving, however, can be hazardous in shallow water, due to high westerly swells which frequently buffet the area. Swells or foggy conditions were likely the cause of the 1824 stranding of the vessel John Begg, the rock's namesake.

Conditions were calm and swells were only moderate during the August dive, a dive to depths of 40 to 80 feet. I leaped into the clear water with camera and collecting bag in hand, and swam toward the rock while submerging. Visibility was excellent and probably exceeded 40 feet. A mosaic of colors came into focus as I approached the steep walls. Vivid reds, purples, pinks, greens, grays, whites, and oranges were splashed on the walls of Begg Rock.

Coelenterates were ubiquitous. The white plumose anemone, *Metridium senile*, covered much of the rock, to depths of at least 100 feet (Figure 1). Juveniles of this species were everywhere and most were formed by pedal laceration--a mode of asexual reproduction. The aggregating anemone, *Anthopleura elegantissima*, formed colorful grey-green patches to depths of at least 80 feet. This anemone is common in tide pools along the coast of California. Another anemone, *Corynactis californica* was recognized by its white-clubbed tentacles and pink, crimson, red, lavender or brown colored body. A few specimens of the small salmon-colored anemone, *Metridium exilis*, and the proliferating anemone, *Epiactis prolifera.* were also observed. Other coelenterates noted were the hydroid *Aglaophenia* sp.; hydrocoral, *Allopora* sp. and the stony coral, *Astrangia lajollensis* (Figure 2).

Fig. 1. Side of Begg Rock at about 40 feet with *Metridium senile* and *Spheciospongia confoederata*.

In addition to coelenterates, many other species of suspension feeding invertebrates were visible during the dive. Several species of sponges were common. A large grey sponge, *Spheciospongia confoederata* formed colonies up to five feet long and two

feet in height and *Acarnus erithacus* was easily identified by its bright orange-red color (Figure 1). A few specimens of the feather-duster worm, *Eudistyla polymorpha* waved their plume-like gills in the surge. Bright orange (unidentified) colonial tunicates were quite common and provided a colorful contrast to the surrounding white plumose anemones. *Hinnites giganteus* (Gray, 1825) was common subtidally, while *Mytilus californianus,* Conrad, 1837, was abundant in the intertidal and shallow subtidal. Numerous dead and detached *Mytilus* shells were observed in depressions, at depths ranging from 50 to 80 feet (Figure 3). The barnacle, *Megabalanus californicus (=Balanus tintinnabulum)* contributed to the debris collecting in these depressions. These barnacles were either attached to *Mytilus* or were in detached clusters. Since both *Mytilus* and *Megabalanus* primarily occur in the intertidal or shallow subtidal, the debris in depressions was likely produced by swells which dislodged the shallow water animals. It is also possible that starfish fed upon *Mytilus* in shallow water and released the *Mytilus* shells after feeding.

Several species of echinoderms were present. During the dive I observed the following starfish and sea urchins: *Pisaster gigantaeus, P. ochraceus, Patiria miniata, Pycnopodia helianthoides, Dermasterias imbricata, Orthasterias koehleri;* and sea urchins, *Strongylocentrotus franciscanus*and *S. purpuratus*. The urchins were most abundant in the *Mytilus-Megabalanus* debris.

Nudibranchs, *Anisodoris nobilis* (MacFarland, 1905) and *Hermissenda crassicornis* (Eschscholtz, 1831) were seen crawling over the rocky substrate. The scaled worm shell *Serpulorbis squamigerus* (Carpenter, 1857) was everywhere. One of the most exciting

Fig. 2. Begg Rock at 60 feet with hydroid *Aglaophenia* and hydrocoral *Allopora*.

Fig. 3. Debris filled depressions with numerous *Mytilus* shells, *Megabalanus californicus*, and the purple urchin *Strongylocentrotus purpuratus*.

aspects of the dive was locating pockets of the beautiful muricid, *Ceratostoma foliatum* (Gmelin, 1791), at depths ranging from 30 to 80 feet. They may have occurred in significant numbers at greater depths, but the dive was limited to a depth of 80 feet. Many of the *Ceratostoma* were covered by bryozoans, the anemone *Metridium senile,* and *Megabalanus californicus.* Some shells were bored by the sponge *Cliona.*

The pockets of 15-30 *Ceratostoma* were in crevices (Figure 4). The clustered muricids did not appear to be spawning or feeding on a particular prey item. Scattered specimens of *C. foliatum*, however, were observed feeding on *Megabalanus* in the debris filled depressions, at depths of 50 to 80 feet.

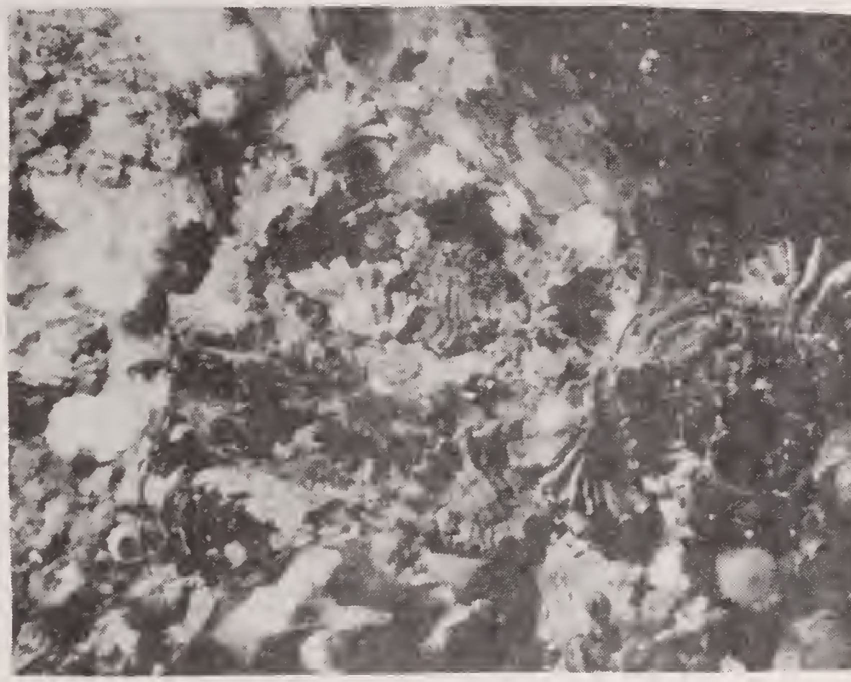

Fig. 4. Clusters of *Ceratostoma foliatum* at 65 feet.

I collected some of the larger specimens of *C. foliatum* (to 90 mm), and invariably found small *Ceratostoma* beneath. Some of these juvenile *Ceratostoma* have been identified by Anthony D'Attilio and Barbara W. Myers as *C. nuttalli* (Conrad, 1837). One 51 mm adult specimen of *C. nuttalli* was collected. I find it interesting that these two species were found occupying the same habitat. *C. foliatum* is a northern species which ranges from San Diego, California to Sitka, Alaska. The species is reported as uncommon south of Point Conception, California. *C. nuttalli* is a southern species and ranges from Point, Conception, California south to Bahia Santa Maria, Baja California, Mexico. The few specimens of *C. nuttalli* collected at Begg Rock were nearly at the northern limit of distribution for the species. The Begg Rock population of *C. foliatum* was thriving in an area considered near the southern distribution for the species. A review of southern California sea surface temperature data and satellite imagery reveals tongues of colder northern water reaching the Begg Rock-San Nicolas Island area. *C. foliatum*, which is thriving in the colder waters at Begg Rock, would likely be found at San Nicolas Island.

The following gastropods were inadvertently collected when *Ceratostoma* were placed in the collecting bag.

Amphissa versicolor (Dall, 1871)
Calliostoma supragranosum (Carpenter, 1864)
Ceratostoma nuttalli (Conrad, 1837)
Cerithiopsis cosmia Bartsch, 1907
Crepipatella lingulata (Gould, 1846)
Cypraea spadicea (Swainson, 1823)
Epitonium sp.
Fusinus luteopictus (Dall, 1871)
Homalopoma luridum (Dall, 1885)
Maxwellia santarosana (Dall, 1905)
Nucella canaliculata (Duclos, 1832)
Ocenebra foveolata (Hinds, 1844)
Ocenebra lurida (Middendorff, 1848)
Seila montereyensis Bartsch, 1907
Volvarina taeniolata Mörch, 1860
Williamia peltoides (Carpenter, 1864)

The dive at Begg Rock was exciting and finished with a flurry. As I was completing the dive, taking pictures of a cluster of *Ceratostoma,* I suddenly noticed by air supply was very low so I took the last picture, grabbed about eight *Ceratostoma*,

and quickly surfaced, juggling *Murex* and camera. The short dive at Begg Rock will be remembered as one of my favorite dives.

Acknowledgments

I wish to thank Barbara Myers for identifying the miscellaneous shells collected with *Ceratostoma foliatum* and for her many helpful suggestions regarding this paper. I further want to thank Dave Mulliner for making black and white prints from the original slides for inclusion in this article.

The following request was received from Mr. Roland Houart, St. Jobsstraat, 8, B-3330 Landen (Ezemaal), Belgium.

In order to make a revision of the genus *Chicoreus* s.s. (Muricidae) from the Indo-Pacific area (including the Red Sea) I would like to borrow, receive, exchange or buy specimens from any locality in the studied area. Borrowed specimens will be returned after a maximum of 9 months. Please be sure to include the locality data even if not complete. It is most important. I thank you for your help.

Mr. Houart can be contacted at the above address.

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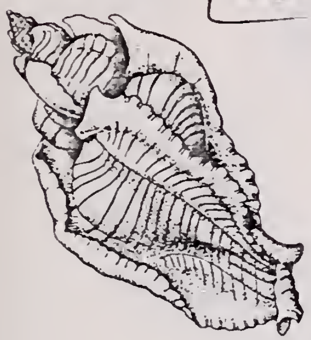

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PROGRAM: "San Felipe to Gonzaga, 1964-1976--a Naturalist's View" is the title of the talk by Joyce Gemmell. Her talk will be accompanied by her slides of the area.

A mini-talk entitled "A Week at Punta Asunción" will follow the break and will be slides by Hertz, McPeak and Mulliner.

Date: January 21, 1982 Time: 7:30 P.M. Room: 104

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DUES ARE DUE

In April 1981 the Club voted to raise the dues for 1982. The notice was printed in the May issue of The Festivus. The rapidly rising costs of paper, printing, postage etc. necessitated this raise. The new rates are printed above. A student membership will now be the same as a single membership.

OBSERVATIONS ON THE "HINGE-LIGAMENT" IN BATHYARCA ORBICULATA (DALL, 1881) (BIVALVIA: ARCIDAE)

BY

BARBARA W. MYERS, CAROLE M. HERTZ, ANTHONY D'ATTILIO

Department of Marine Invertebrates, San Diego Natural History Museum, Balboa Park, P.O. Box 1390, San Diego, California 92112

Bathyarca orbiculata (Dall, 1881)
Arca pectunculoides Scacchi, var. *orbiculata* Dall, 1881:121

A specimen of *Bathyarca orbiculata* was generously donated to the San Diego Natural History Museum (SDNHM 80329) by William Siapno, head of marine sciences, Deepsea Ventures. The specimen was collected June 1, 1978, at 14°40'N x 126°2.9'W while dredging for manganese nodules from their R/V Prospector at a depth of 10 to 20 thousand feet (precise depth not recorded).

The purpose of this paper is to discuss and illustrate the morphological variation in the hinge-ligament of *Bathyarca orbiculata* (Dall, 1881). In this paper, the concept "hinge-ligament" is used to denote the highly specialized nature of the interlocking connecting structures in this group of bivalves. The hinge-ligament of *B. orbiculata* is amphidetic (on both sides of the umbones), taxodont (teeth in two similar series meeting below the umbones), and multivincular (many flattened cords extending from one valve to the other).

In identifying this specimen we compared it with numerous specimens at Scripps Institution of Oceanography and with information in Knudsen (1970). Knudsen referred this species to *Arca*. For generic placement we are following Verrill and Bush (1898), Clarke (1962), and Keen (1971) and referring *orbiculata* to *Bathyarca* Kobelt, 1891.

In most bivalves the mantle adds only minimal calcareous growth in the hinge area and the umbones remain close together throughout the life of the mollusk. In the family Arcidae the growing edge of the mantle secretes additional calcareous material in the hinge area adding increments of growth at the hinge line. This causes the umbones to separate (Purchon, 1968). As a result, changes can be expected to occur in the morphology of the hinge-ligament in *Bathyarca*.

Our specimen, which measures 28 mm long by 22 mm wide appeared quite different in the hinge-ligament area than the one figured in Knudsen (1970:77, fig. 47). Through the courtesy of Spencer Luke, Assistant Curator of the Benthic Invertebrate collection at Scripps Institution of Oceanography, we were able to obtain a number of specimens of *B. orbiculata* from their wet collection. There were no notable differences in the exterior sculpture of the specimens examined. We found that they varied in the morphology of the hinge-ligament from specimen to specimen within lots.

Although Knudsen discussed the variation in the shape of this species, that is height, length, depth, obliqueness etc., he only briefly commented on the variation in the hinge-ligament characters. The following drawings will illustrate these variations and differences.

Figure 1 is a detail of the hinge-ligament of a 7 mm long specimen of *Bathyarca orbiculata* collected December 18, 1969 on the R/V Melville by C. Hubbs and S. Luke. It was collected on the abyssal plain (31°10'N, 119°39.2'W) at a depth of between 3600 and 3676 meters with a 25 foot otter trawl. The specimen is in the Scripps Institution of Oceanography Coll. #70-22. The figure shows that along the point of contact the hinge line is smooth and elevated from the anterior to the posterior end. At the

Figure 1.

anterior end, the hinge area is not delineated by sculpture from the shell surface but by the termination of the periostracum on both valves. Figure 2 shows the interior of the right valve of the specimen in Figure 1. The anterior teeth and the first four teeth posterior to the edentulous umbonal area are of equal strength becoming elongate oblique ridges at the extreme posterior end.

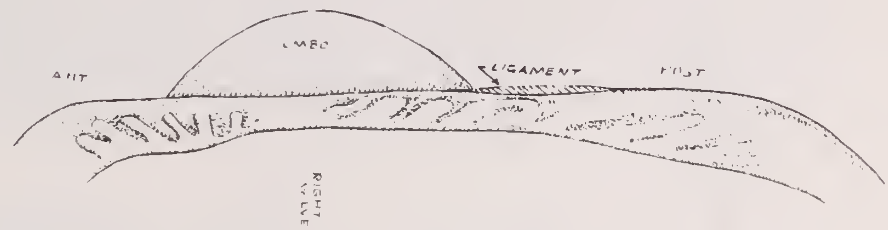

Figure 2.

Figure 3 is a detail of the hinge-ligament of a 16 mm long specimen of *Bathyarca orbiculata* collected December 18, 1969 on the R/V Melville by C. Hubbs and S. Luke. It was collected on the abyssal plain (31°10'N, 119°392'W) at a depth of between 3600 and 3676 meters with a 25 foot otter trawl. The specimen is in the Scripps Institution of Oceanography Coll. 70-22. As in the specimen in Figure 1, this specimen shows that along the point of contact the hinge line is elevated from the anterior to the posterior end. In this stage of growth, fine incised lines radiate from the extreme posterior to the extreme anterior end. The termination of the periostracum on both valves delineates the hinge area anteriorly. Figure 4 shows the hinge teeth of the right and left valves of the

Figure 3.

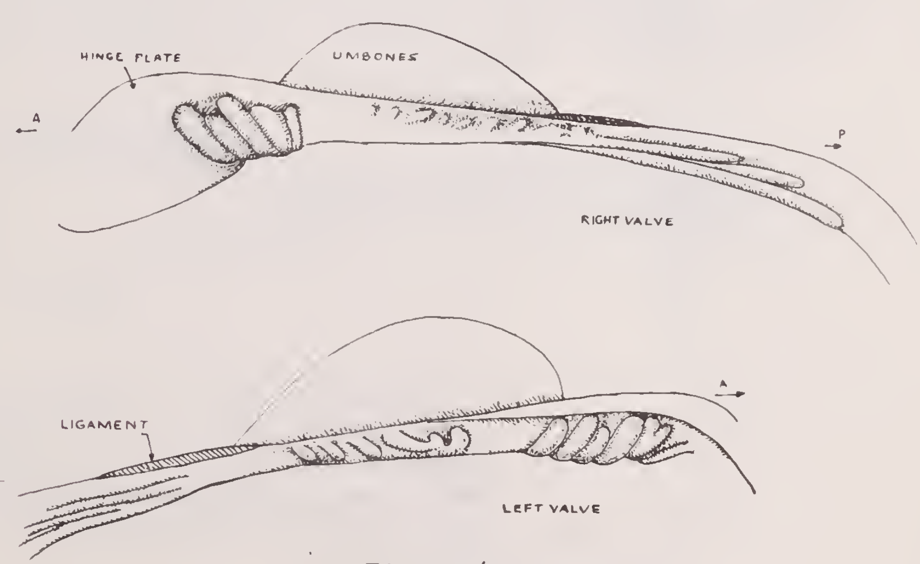

Figure 4.

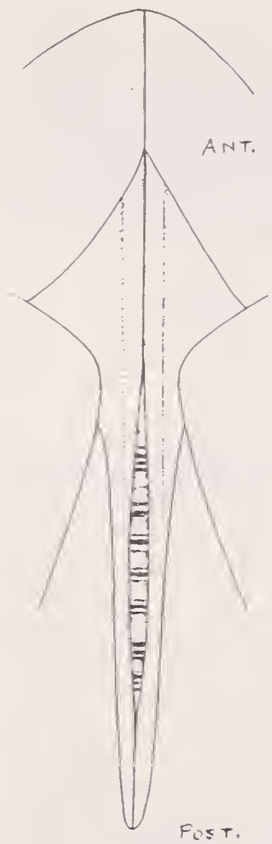

Figure 5.

specimen illustrated in Figure 3. The stronger teeth are at the anterior end, fading to oblique elongated ridges at the posterior end. There is a small edentulous area below the beaks.

Figure 5 is a 28.75 mm specimen collected by F. Rokop and S. Luke on the R/V Melville, March 23, 1970 from Baja California, Mexico on the abyssal plain (31°20'N, 120°09'W) with a 25 foot otter trawl at a depth of from 3706 to 3806 meters (SIO 70-94). This specimen shows the hinge line depressed and the strap-like attachments of the multivincular ligament are visible on the posterior portion of the hinge. Figure 6 illustrates the teeth of the right valve of the specimen illustrated in Figure 5. The hinge plate has narrowed and the teeth at the anterior end are a series of irregular nodes. The posterior teeth have become obsolete except for three nodes at the extreme posterior end.

Figure 6.

Figure 7 is of a 29 mm long specimen collected on December 11, 1966 at Cortes Bank (32°035'N; 120°30'W) by 40 foot otter trawl at a depth of 3777 to 3792 meters. The collector was C. Hubbs and the specimen is SIO#BI66-3. The anterior portion of the hinge-ligament in this specimen is similar to that in Figure 3 but the posterior portion of the hinge margin appears sunken and has four longitudinal grooves or ridges on each side of the hinge line more or less parallel to the edge of the hinge area, meeting those of the opposite side at the hinge line forming elongate V's. Figure 8 is an illustration of the teeth of the right valve of the specimen shown in Figure 7. It shows a lessening of the size and strength of the teeth.

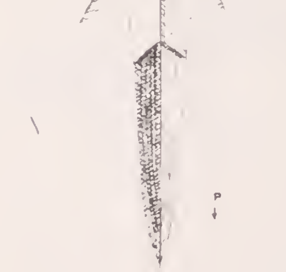

Figure 7.

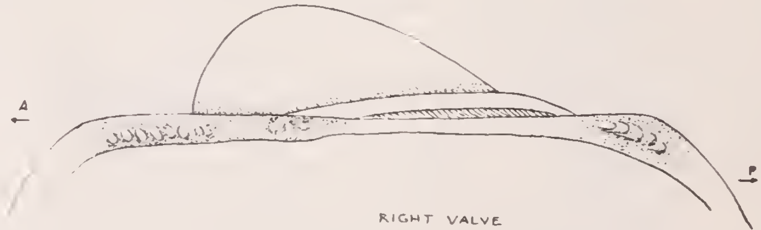

Figure 8.

Figure 9 shows a 31 mm specimen of *B. orbiculata* collected by S. Luke on March 23, 1971 west of Patton Escarpment (31°35'N; 120°18'W) by 25 foot otter trawl at a depth of 3916 to 3950 meters on the R/V Melville (SIO#BI70-36). In this specimen the entire hinge line is recessed. The termination of the

periostracum remains the same (as demarcated by the dotted lines). However, the sunken hinge area is now sculpturally defined. In the area between C and D the hinge line has a narrow portion of the strap-like multivincular ligament. The remaining area between C and D is sculptured with fine gently curved ridges meeting at the hinge line; chitinous material is deposited between these elongate ridges. Figure 10 is the right valve of the specimen in Figure 9, showing only minute teeth which are obsolete at the posterior end. The thickness of the hinge plate (on which the teeth rest) is reduced to a line at the posterior end. Anteriorly the teeth are irregular and haphazardly arranged, (see Detail at B) dwindling in size at the beaks.

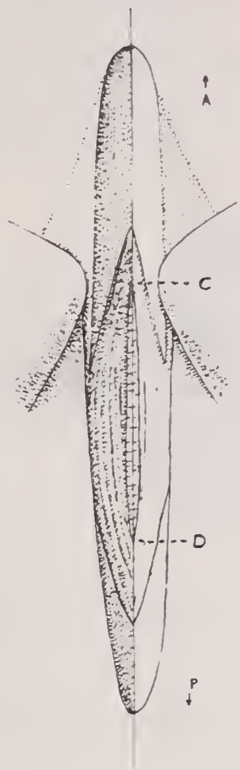

Figure 9.

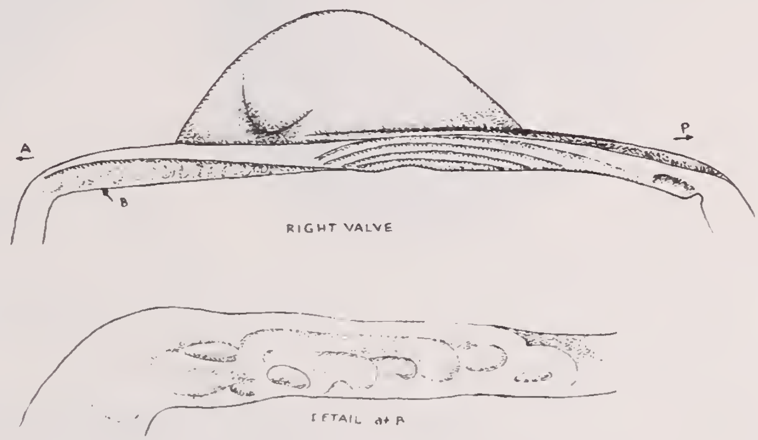

Figure 10.

Figure 11 shows a 32 mm long specimen from the same lot as the specimen in Figure 9. The entire hinge area between the beaks is depressed towards the hinge line. The beaks now become somewhat more distant from each other. The area that in Figure 9 was described between C and D extends the entire length of the hinge-ligament in this specimen. The ridges are curved, terminating and meeting at the hinge line. There are eight on each side. Figure 12 is of the right valve of the specimen.

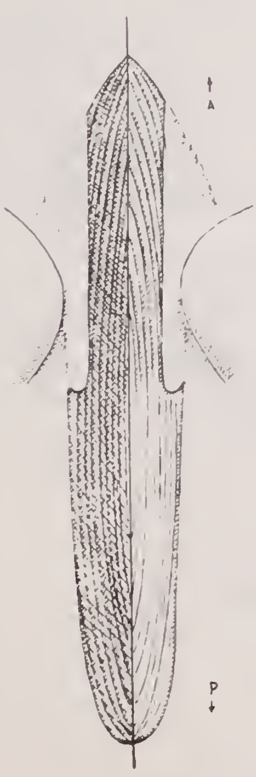

Figure 11.

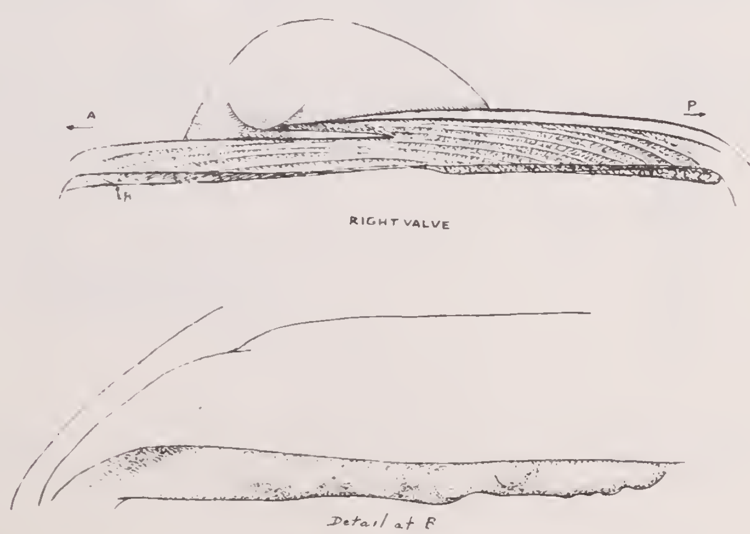

Figure 12.

shown in Figure 11. The teeth are obsolete except at the extreme anterior and extreme posterior ends where they are reduced to nodes. See Detail at B. The thickness of the hinge plate is reduced to a line except at each end.

Figure 13 (after Knudsen 1970:77, fig. 47) shows two views of *Bathyarca orbiculata.*

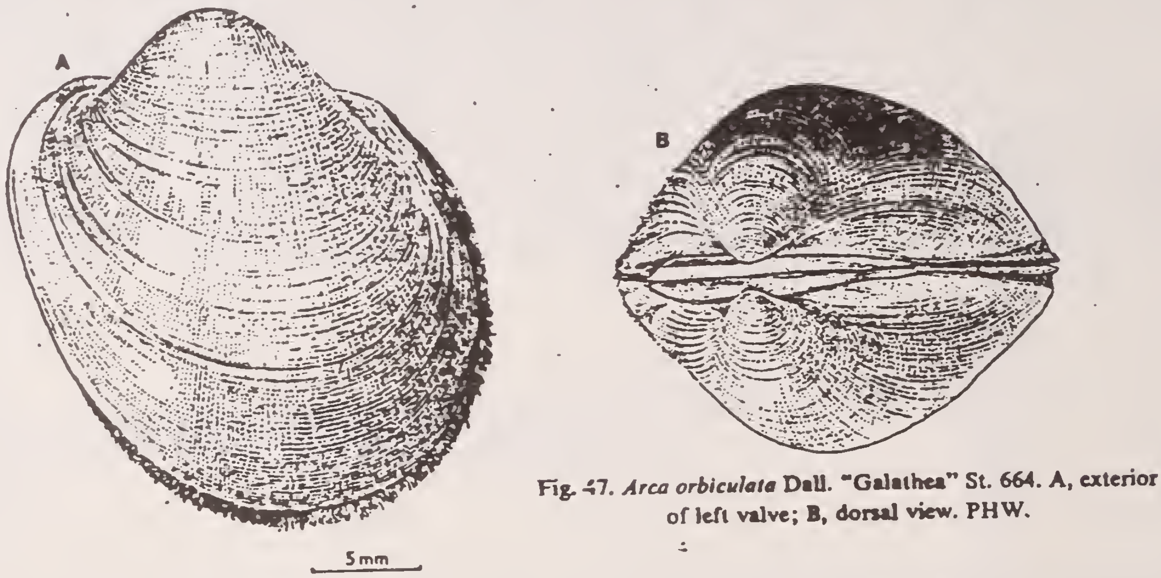

Figure 13. Drawings of two views of *B. orbiculata* after Knudsen (1970).

Figure 14.

Included in the *Bathyarca* material examined was a lot of over 100 small specimens (SIO#BI70-47) less than 10 mm in length. At first examination, these appeared to be juvenile specimens of *B. orbiculata*. In comparing them with small specimens in other lots of *B. orbiculata* it became evident that these were not juveniles. The shells in this lot are heavier, more inflated for their size with a dense periostracum bristling with spines. The concentric ribs are stronger and more numerous than in small specimens of *B. orbiculata*. The hinge teeth are stronger and more regular. Changes in the hinge-ligament and teeth in these small specimens are similar to those described for *Bathyarca orbiculata*. According to Rokop, (1979: 190) these are an undescribed species.

Figure 14 is a 5.25 mm specimen of *Bathyarca* sp. (SIO#BI70-47) collected by F. Rokop and S. Luke in the San Diego Trough (32°34'N; 117°33'W) by 25 foot otter trawl at a depth of 1170 to 1216 meters on the R/V Agassiz on October 29, 1970. This specimen shows one phase in the development of the hinge-ligament. Figure 15 illustrates the teeth of the left valve of the specimen in Figure 14.

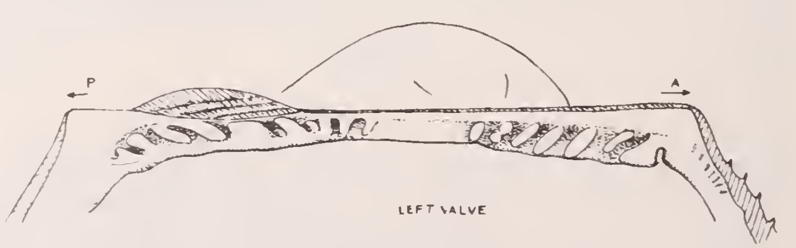

Figure 15.

While the external sculpture of *Bathyarca orbiculata* shows little variation, the hinge-ligament is constantly changing and in some way related to its growth. It appears that as the external hinge-ligament becomes more complicated, the internal hinge plate gradually diminishes in size and is reduced to a narrow line. The teeth change in size and character as the hinge plate diminishes and eventually become nearly obsolete, especially at the posterior end.

ACKNOWLEDGMENTS

We would like to acknowledge the assistance of Mr. Spencer Luke of Scripps Institution of Oceanography for allowing us to study lots of *Bathyarca* in its collections as well as making specimens available for loan. We thank Mr. William Siapno for his donation of a specimen of *Bathyarca orbiculata* to the San Diego Natural History Museum which initiated this study.

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SHELLING IN THE BRITISH ISLES

BY

MARTIN SCHULER

4810 Cobb Drive, San Diego, California 92117

I must confess that the prospect of shelling in England and Ireland didn't appeal to me at first. But I mustered up my enthusiasm and when opportunity presented itself I scoured the beaches and clambered over the rocks looking for the shell life of the eastern North Atlantic.

We stopped first at the seaside town of Weston super Mare (Weston by the Sea), in England. We first came across a large area of basalt rubble ranging in size from small rocks to very large boulders. The rubble was of a loose nature and along with the constant pounding of the waves did not allow tidal pools of any kind to form. Instead, a very shallow layer of water lay beneath the rocks. Unfortunately, the first time we went down to the shore it was high tide and we found ourselves shelling in the high middle tide zone. Since the rocky terrain continued right up to the base of the cliff the shelling prospects were abundant. Clinging inside the crevices in the rocks were many variations of *Acmaea virginea* and *Littorina littoralis*. Throughout this area, neither of these two species were found seeking the protection of the undersides of the rubble or the clumps of kelp. The next plentiful species found was *Littorina littorea*. These were found clinging to the undersides of short-leafed kelp and these in turn were growing on the undersides of the rocks. Other shells found mixed in with the "grunge" were wave worn and most were broken. What I was able to collect were several *Nassarius incrassatus* and a specimen of *Volutopsis norwegicus*.

When several days later we returned to Weston super Mare, we were greeted with the first low tide we'd seen in England, and what a low tide it was. Weston super Mare is one of several towns noted for a maximum tidal range of about 42 vertical feet. I estimated the tide to be out about 2½ miles when we returned. We didn't make it back to the rocky area (possibly a mistake on our part); instead we walked along the sandy shore along the local amusement pier. Here the sand extends seaward for about 100 feet from the seawall and then turns into thick mud. Quite often the British Rescue Squad has had to fly out into the flats and airlift victims stranded chest deep in the mud with the incoming tide on the way. Here a few species were found which were also found in the rocky area of Weston super Mare, in particular *Nassarius incrassatus* and *Littorina littorea* which were larger than those found at the first locality. The only other gastropod found in this area was the common *Buccinum undatum*. This was the most plentiful shell on the beach. The bivalves in the area were the common *Tellina squalida, Cardium edule,* and *Macoma balthica*.

Another oceanfront village we came to was Lyme Regis, renowned for its fabulous fossils including ammonites and the flying Pterosaurs of the Jurassic and Cretaceous Periods. The coast line leaves much to be desired. The entire shore is composed of wave-worn pebbles from the sea wall into the water. There the waves rise six feet straight up and crash with a force seldom seen at this wave height. It was apparent that no mollusk could survive, let alone be found, in such turmoil.

After two weeks in England (one of them in London) we crossed the Irish Sea and set up for our stay in Belfast for the next two weeks. Having settled ourselves in a place to stay, we began our sightseeing tour of Northern Ireland. After driving for about two hours we arrived at a geological wonder known as the Giant's Causeway. Columns of hexagon-shaped basalt with an average thickness of 18 inches range in height from a few inches to over ten feet. These columns also happen to join directly

with the sea. They are so tightly fused together that they allow the sea to collect in pockets in the rock structures creating the most picturesque tidal pool imaginable. Various forms of algae and kelp floated in the water adding color to a deep chocolate background. Again the shells found were common but a little more diverse than those found in England. Three species of littorines were found in this one area, *Littorina littorea, L. saxatilis,* and two color forms of *L. littoralis*; one a lemon-yellow in coloration and the other a tannish-brown with darker checkered markings. The most attractive shells found at the Giant's Causeway were the land snails, *Cepaea nemoralis,* found clinging in the spaces between the basalt and the earthen walls. They are about 3/4 of an inch in diameter and a lemon-yellow color with several chocolate-brown stripes paralleling the whorls.

THE ANNUAL CLUB CHRISTMAS PARTY--1981

It was a beautiful evening. Forty of us joined in celebrating the season and the twentieth year of the San Diego Shell Club. Friends long absent from Club functions were warmly greeted in the festively decorated room (thanks to the efforts of June King and the Schulers).

After a delicious dinner the Club was treated to a sparkling program of Christmas music presented by the Madison High School Honor Ensemble. Charter member, John Souder, as Master of Ceremonies recalled the Club's early years and outgoing President Carol Burchard thanked her Board and installed the officers for 1982.

Following was the Club's traditional shell gift exchange and the gathering around the piano for carol singing. It was a special time for all.

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: 5 NOVEMBER 1981

BY

MARTIN SCHULER

Vice-President, Ron McPeak called the meeting to order at 7:30 P.M. and guests and seldom seen members were introduced and reintroduced. Ron presented the evening's speaker, Dr. Eric Hochberg, who spoke first on the land mollusks of the Channel Islands. His talk was a delightful change of pace for the Club, was very informative and well illustrated with slides.

During a small break, members who had brought in their collections of *Harpa* helped each other in identifying some of the more questionable species. After the break Dr. Hochberg continued with the segment of his talk on the cephalopods of the western United States. Again his talk was illustrated with slides.

During the business portion of the meeting there was discussion on the Christmas party, its cost and date for receipt of the money. A vote was taken to determine the dessert at the party! Following was the election of officers for 1982. After asking for nominations from the floor, the vote was held and the slate of officers submitted by the nominating committee were approved unanimously. The officers for 1982 are as follows. President: Martin Schuler; Vice-President: Bill Perrin; Rec./Corres. Secretary: Pat Sage; Treasurer: Walter Robertson; Editor: Carole M. Hertz.

The shell drawing was won by Billee Dilworth who graciously gave her shell to a young guest.

BOOK REVIEW

BY

CAROLE M. HERTZ

Department of Marine Invertebrates, Natural History Museum, Balboa Park,
P.O. Box 1390, San Diego, California

THE AUDUBON SOCIETY FIELD GUIDE TO NORTH AMERICAN SEASHELLS.
By Harald A. Rehder August 21, 1981.
Published by Alfred A. Knopf, New York.
894 pages, 705 color photographs.
Price: $11.95.

This new book by Harald A. Rehder, Zoologist Emeritus in the Department of Invertebrate Zoology of the Smithsonian Institution, has been designed as a true handbook. It is of compact size (approx. 4"X 8") with a soft simulated leather cover, quality paper and bound well so that the book can be opened out flat without it creaking and tearing. This Guide gives a sampling of the species from both the east and west coasts of the United States, covering 669 species. Each species treated is photographed in color with additional photographs of some of the living mollusks.

The color photography is of a very high quality. The shells are photographed against natural looking marine substrate backgrounds. In many cases they appear to have been taken on glass above the substrate, thus increasing the three dimensional effect. This reviewer particularly appreciated both interior and exterior views of bivalve species and excellent enlargements of gastropod genera such as *Truncatella*, *Bittium*, *Odostomia*, *Turbonilla* etc. which are usually hopelessly illustrated at almost natural size or eliminated completely. Only in some of the chiton illustrations does the caliber of the photography slip and may be a result, in part, of several less than ideal specimens.

The caption under each photograph gives plate number, the coast on which the shell is found, size, page number of the description, and the name of the shell. Unfortunately, the author has decided to use the "common names" for the species instead of the scientific ones even though he states that "the common names of seashells have never been standardized..." I think the intelligence of the novice collector is underrated in thinking it is too difficult for him/her to learn *Mopalia ciliata* instead of Hairy Mopalia.

Dr. Rehder has certainly not underestimated his reader in the fine introductory paragraphs or in the quite technical text. The descriptive section is arranged taxonomically but by common names with the scientific name beneath each entry. Authors and dates are omitted. Comprehensive background information on each class and family is given in addition to rather extensive species descriptions for a popular guide. Additional notes of interest follow the habitat and range headings for each species. The extensive introductory section briefly discusses the history of the mollusk giving general information on the animal, its reproduction, and its growth. Line drawings are used to illustrate parts of the shell and explain sculptural characteristics.

I question several of the entries in the text. It is mentioned, for example, that the Bursidae (pp. 501-502) "feed on marine worms and bivalves..." However, *Bursa californica* feeds on echinoderms (pers. obs.). Included is *Knefastia dalli* (#87, pp. 616-617) which is a Gulf of California species and not within the stated geographical scope of the Guide. Several species are listed as "common species" such as *Fusinus barbarensis* (p. 578) which this writer wishes were so.

The handbook follows a new format designed to make shell identification easier for the novice collector. In the color photograph section the species are grouped according to similarity of shell characters and a series of "Thumb Tab Guides" or silhouettes are provided to guide the reader to the proper color photograph. This reviewer found the system unwieldy and difficult to use. Moreover, with the related information in the text arranged taxonomically, comparing text descriptions becomes a frustrating venture.

The Guide has a good glossary and an index with entries for both common and scientific names. A four page section is included giving basic information on shell collecting for the beginner.

It is this reviewer's opinion that this quality handbook is a valuable introductory guide to seashells. The excellent color photography and the considerable information given on the species included make it a worthwhile purchase for the new collector and a book or more than passing interest for the longtime collector despite the shortcoming of its new approach to shell identification and its use of common names for the species.

EXCERPTS FROM THE <u>1982 TIDE CALENDAR FOR THE NORTHERN GULF OF CALIFORNIA</u>

The entries listed here will show only periods of low tides of -4.0 feet and below. The tidal measurements, in this calendar prepared by the University of Arizona, are for Puerto Penasco, and are given in Mountain Standard Time. To correct for San Felipe, subtract one hour from listed times (San Felipe is on Pacific Standard Time). For Bahia de Los Angeles, add 15-30 minutes to calendar predictions (the amplitude at Bahia de Los Angeles is about one-half that of calendar measurements). Tides at Guaymas and Santa Rosalia cannot be estimated using this calendar. Interpretation is approximate.

January
7. -4.0 at 6:00 P.M.
8. -4.9 at 7:00 P.M.
9. -5.9 at 7:45 P.M.
10. -5.0 at 8:30 P.M.
11. -4.0 at 9:15 P.M.

February
6. -4.8 at 7:00 P.M.
7. -5.2 at 8:00 P.M.
8. -5.8 at 8:30 P.M.
9. -4.2 at 9:00 P.M.
22. -4.0 at 7:30 P.M.
23. -4.3 at 8:00 P.M.
24. -4.0 at 8:30 P.M.

March
7. -4.1 at 7:00 P.M.
8. -4.5 at 8:00 P.M.
9. -4.1 at 8:30 P.M.
24. -4.2 at 7:30 P.M.
25. -4.1 at 8:00 <u>A.M.</u>
-4.1 at 8:00 P.M.
26. -4.0 at 8:30 A.M.
27. -4.0 at 8:50 A.M.

April
23. -4.8 at 7:30 A.M.
24. -5.8 at 8:00 A.M.
25. -4.9 at 8:30 A.M.
26. -4.1 at 9:30 A.M.

May
22. -4.6 at 7:00 A.M.
23. -5.5 at 7:30 A.M.
24. -5.0 at 8:15 A.M.
25. -4.0 at 9:00 A.M.

June
20. -4.1 at 6:30 A.M.
21. -5.0 at 7:30 A.M.
22. -5.0 at 8:00 A.M.
23. -4.0 at 9:00 A.M.

July
19. -4.0 at 7:00 A.M.
20. -4.2 at 7:30 A.M.
21. -4.2 at 8:00 A.M.
22. -4.0 at 9:00 A.M.

August
18. -4.2 at 7:30 A.M.
19. -4.6 at 8:00 A.M.
20. -4.1 at 8:15 A.M.

September
16. -4.0 at 7:00 A.M.

October
none

November
1. -4.1 at 7:45 <u>P.M.</u>
2. -4.2 at 8:00 P.M.
29. -4.3 at 7:00 P.M.
30. -5.5 at 7:30 P.M.

December
1. -5.8 at 7:30 P.M.
2. -4.1 at 8:30 P.M.
28. -4.3 at 6:30 P.M.
29. -5.8 at 7:00 P.M.
30. -5.9 at 8:00 P.M.
31. -5.3 at 8:30 P.M.

MINUTE SHELLS: CAECUM CALIFORNICUM DALL, 1885 (GASTROPODA: RISSOACEA)

BY

JULES HERTZ

Department of Marine Invertebrates, San Diego Natural History Museum, Balboa Park, P.O. Box 1390, San Diego, California 92112

Caecum californicum Dall, 1885 is reported found from Monterey Bay, California to Magdalena Bay, Baja California, Mexico. It is a common species in San Diego and was most recently discussed by Hertz (1979: 11(1):2-4). Four specimens were found on October 25, 1981 at the north end of Tourmaline Surfing Beach (Sun Gold Point), San Diego, California. They were found on the bottom of a large rock, attached to the outside of a sand encrusted polychaete tube. The rock was in the low tide zone at a 0.5' tide and was on a gravel substrate.

The animals when placed in salt water were extremely active. The photographs by David K. Mulliner, Festivus staff photographer, have captured the large exposed areas of the animal in the process of turning. In Figure 1, the foot with operculum attached can clearly be seen. In Figure 2, the head is clearly visible showing the mouth, tentacles, the eyes at the base of the tentacles, and the penis behind the right tentacle. The off-white shell is approximately 3 mm in length. The color of the shell of *C. californicum* is highly variable. I have seen shells of this species that vary from white to light brown as well as some that are combinations of white and brown.

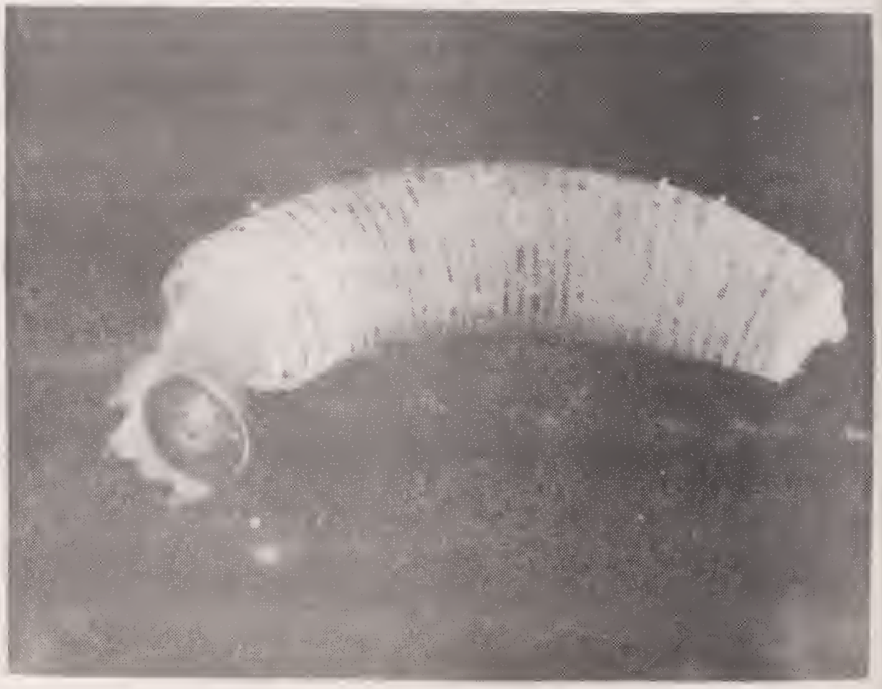

Fig. 1. *C. californicum* showing operculum at base of foot.

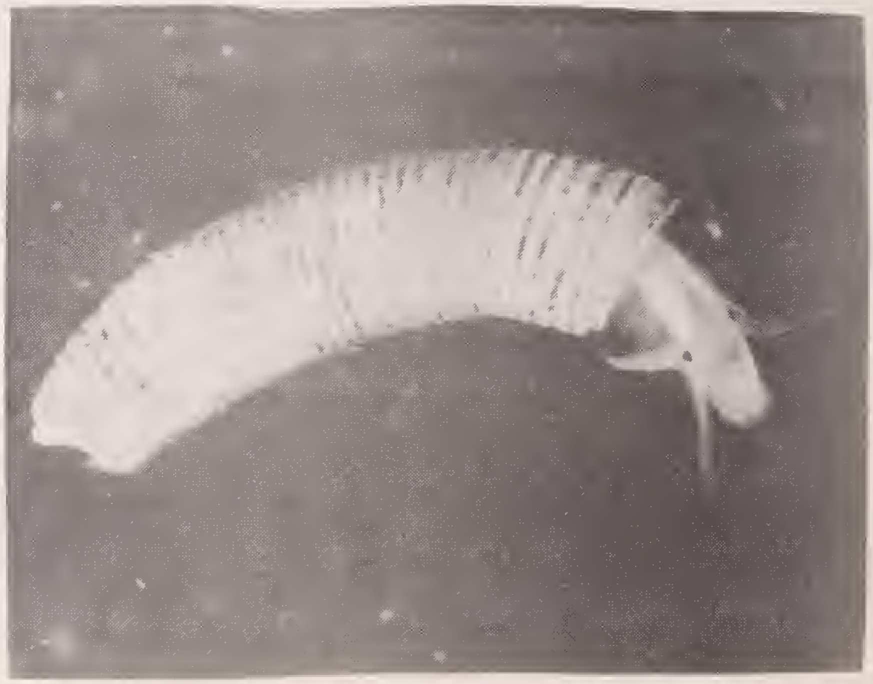

Fig. 2. *C. californicum* with animal extended.

Moore (1962) studied species of *Caecum* from sea-grass communities of Biscayne Bay, Florida and found that they had cephalic tentacles tipped with long, stiff, sensory cilia and no indication of a siphon in any of the *Caecum* species. On the basis of his study and the work of Götze (1938) in which she found that *C. glabrum* had ciliated tentacles and that the male had a large, well-developed penis, Moore changed the superfamily assignment of the Caecidae from the Cerithiacea to the Rissoacea.

It is of interest to note the techniques used by Dave Mulliner in photographing this very small animal. He first soaked a small piece of driftwood in salt water until it was completely saturated. He then placed it in a dish of saltwater which had been cooled in a refrigerator. The *Caecum* was placed on the driftwood with its operculum towards the camera. The animal in this position showed a desire to turn over and it was during this turning over process that the animal was photographed. Dave used a single light with a reflector to fill in the shadows. The light was placed to enhance details of the shell and the exposed animal.

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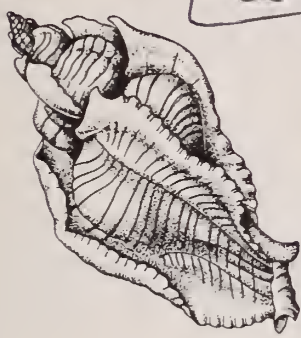

SAN DIEGO SHELL CLUB

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MEETS THIRD THURSDAY, 7:30 P.M.
ROOM 104, CASA DEL PRADO, BALBOA PARK

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VOL. XIV FEBRUARY 1982 NO. 2

PROGRAM: Dr. William Newman of Scripps Institution of Oceanography. will give an illustrated talk entitled "An Introduction to Barnacles."

Slides from the September and Christmas parties will be shown.

Date: February 18, 1982 Time: 7:30 P.M. Room: 104

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DUES ARE DUE

In April 1981 the Club voted to raise the dues for 1982. The notice was printed in the May issue of The Festivus. The rapidly rising costs of paper, printing, postage etc. necessitated this raise. The new rates are printed above. A student membership will now be the same as a single membership.

A REVIEW OF CHAMA BUDDIANA C. B. ADAMS, 1852 (BIVALVIA: CHAMIDAE)

BY

CAROLE M. HERTZ, JOYCE GEMMELL, BARBARA W. MYERS

Department of Marine Invertebrates, San Diego Natural History Museum, Balboa Park, P.O. Box 1390, San Diego, California 92112

ABSTRACT

In comparing the lectotype of *Chama buddiana* C.B. Adams, 1852 with specimens of *C. buddiana* from San Felipe (collected by Hertz and Mulliner), San Luis Gonzaga (collected by Gemmell), Bahía Concepción (collected by Myers) as well as specimens ranging from San Felipe to Panama and the Galapagos Islands in the San Diego Natural History Museum (SDNHM) collections, we believe, at this time, that *Chama buddiana* C.B. Adams, 1852; *Chama frondosa* var. *fornicata* Carpenter, 1857; *Chama mexicana* of authors, not Carpenter, 1857; as cited in the synonymy represent, with some expected variations, one species.

SYNONYMY

Chama buddiana C.B. Adams, 1852
= *Chama ?frondosa* var. *fornicata* Carpenter, 1857
= *Chama mexicana* of authors, not of Carpenter, 1857

Chama echinata Broderip, 1835
= *Chama frondosa* Brod. var. *Mexicana* Carpenter, 1857

DESCRIPTION

The interior of the right valve is white up to the crenulations near the edge. Where the crenulations begin, the color appears as a pink to violet narrow line to the ventral margin.
The hinge is typical of the genus. The exterior of the right valve in well-preserved specimens shows elevated, arched white spines and/or scales on a ground shading from pink to violet. In eroded specimens these spines are reduced to scales. A distinctive feature of *C. buddiana* is the two prominent radiating rows of large broad spines with wider spacing between the rows which appear posteriorly beyond the elevated portion of the upper valve. The interior of the left, or attached, valve is white and also has a narrow pink to violet color line between the crenulations and the margin. In the majority of specimens, the area of the

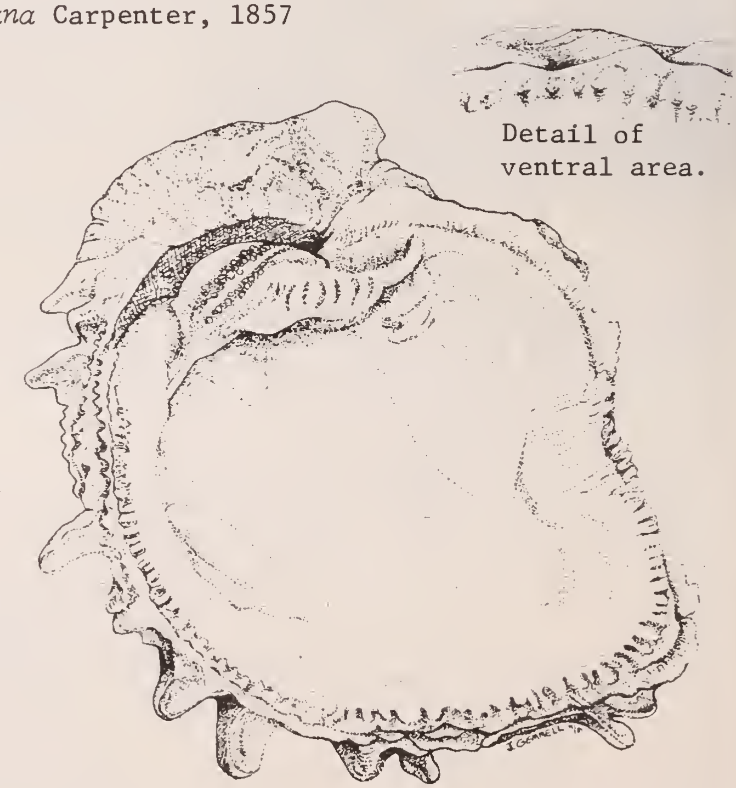

Figure 1. Drawing of interior of *C. buddiana* showing detail of ventral area of left valve.

anterior muscle scar is flushed with pink ranging to violet. Exteriorly, the spines are white and more foliated than on the upper valve. These spiny scales often appear concentric in arrangement. Fresh specimens have a brown or olivaceous periostracum, most noticeable along the margins. Figure 1 shows the left valve.

DISCUSSION

The lectotype of *C. buddiana* C.B. Adams, 1852 (MCZ190150) shown in Figures 2 and 3 is an old badly abraded specimen with only a hint of the original exterior sculpture. There is evidence of the bases of the two radiating rows of broad spines posteriorly on the upper valve. The remnants of the scales are also visible. Interiorly the attached valve exhibits the purple flush in the area of the anterior muscle scar. The interior margins of both valves are crenulate with a faint pink line beyond the crenulate margin. Adam's original description of *C. buddiana* follows.

Figure 2. Interior of lectotype of *C. buddiana*. Left valve 80 mm x 59 mm Right valve (top valve) 67 mm x 56 mm

Figure 3. Exterior of right valve of lectotype (MCZ190150) of *C. buddiana*.

405. **Chama Buddiana.** Nov. sp.

Shell orbicular or subtriangular: exterior surface and inner margins purplish red, with the spines pure white: surface uneven, with interrupted radiating striæ; upper valve ornamented with a few radiating series of short thick triangular vaulted spines: lower valve attached by about two-thirds to three-quarters of its surface, the rest being like the upper valve, but with the dentiform spines smaller: within both valves are deeply and finely crenulated at the junction of the white sur-

face and red margin: beak submarginal. Easily distinguished from *C. Pacifica* and *C. Broderipii* by the small thick dentiform triangular white spines.

Diameter about 3 inches.

Station.—On ledges of rocks, a little above low water mark. The lower valve is so firmly attached as to render it difficult to obtain specimens entire without the use of mineralogical tools.

Habitat.—Guaymas; Lt. Green! Mus. Essex Inst.
Panama; C. B. A.!

6 specimens were obtained.

Named in honor of Dr. B. W. Budd of New York city.

We wonder if Adams' description was a composite of the original lot of six specimens since the lectotype chosen by Turner (1956) is a poorly preserved specimen in which the sculpture is difficult to determine.

In 1857 Carpenter described *Chama frondosa* var. *fornicata*. He cites its similarity to *C. buddiana*, but states in describing the interior, "the color never displays the rich purple and orange of *C. frondosa mexicana*, being white bordered with puce." He further mentions the "ashy epidermis" of *C. frondosa fornicata* which is apparent on specimens of *C. buddiana* we studied. His Latin description which follows describes irregular, radiating, vaulted spines with the interior white to the red purple edge; margin crenulated.

121, *b.* Chama ? frondosa : *var.* fornicata.

C. ?frondosa, t. costis numerosis irregularibus radiantibus, squamis fornicatis crebris indutis; huc et illuc frondosá; intus albá, ad marginem rubro-purpureá; margine crenulato; dentibus ad apicem valde serratis; epidermide cinereá; per totum latus affixá.

Carpenter himself synonymized *C. frondosa* var. *fornicata* with *C. buddiana* in 1864:364 after studying and comparing his specimens with C.B. Adams' type specimens deposited in the museum at Amherst College.

Keen (1968:397, pl. 56, figs. 31a, 31b, 35a, 35b), studied Carpenter's Mazatlan collection in the British Museum (N.H.). Of *C. frondosa fornicata* she writes "only two of the several syntype specimens are complete enough and in good enough condition to provide recognizable figures." She illustrated them for the first time. In Keen (1971) these figures appear as #349 for *C. mexicana*. They are reproduced here as Figures 4 and 5.

Figure 4.

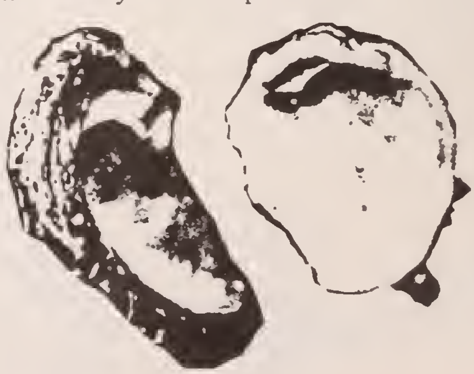

Figure 5.

Reproduced from Keen (1971). Syntypes of *Chama frondosa fornicata*.

In 1857, Carpenter also described *C. frondosa* Brod. var. *Mexicana*. Apparently he examined a mixed lot. From studying his original description we believe that he actually described *C. echinata* Broderip, 1835. Carpenter in describing *C. frondosa mexicana* mentions the interior coloration of a rich purple with orange on the teeth, a strong character found in *C. echinata* and in no other West American *Chama*. Very young specimens of *C. echinata* may resemble those of *C. buddiana*. However, in juvenile specimens of *C. echinata* over 15 mm in length in the SDNHM collections, all exhibited the coral colored teeth of the adult *C. echinata*. Specimens of *C. echinata* do not exhibit the interior, red ventral color margin which is visible on *C. buddiana* from juvenile to adult. Carpenter's Tablet 426 of *C. frondosa mexicana* taken from Brann (1966, pl. 10) illustrated here as Figure 6 shows a juvenile upper valve with dense overlapping spines similar to *C. echinata* with no evidence of the two prominent radiating rows of blunt spines or scales of *C. buddiana*. Figure 7 from Bernard (1976:33, fig. 7a) is of the syntype of *C. echinata* BM(NH) 1950.11.1.21.

Figure 8 is a photograph of the upper valve of a juvenile *C. echinata*, approximately 20 mm in length. Figure 9 illustrates the exterior of the upper valve of a juvenile *C. buddiana* approximately 23 mm in length.

Figure 6. Carpenter's Tablet 426, from Brann (1966)

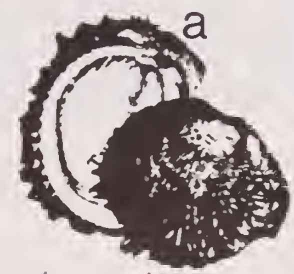

Figure 7. Syntype of *C. echinata* from Bernard (1976)

Figure 8. Exterior of upper valve of juvenile *C. echinata*, approximately 20 mm in length. SDNHM 28884.

Figure 9. Exterior of upper valve of a juvenile *C. buddiana*, approx. 25mm x 25mm. Mulliner collection.

Further, Carpenter stated about Tablet 433:88 of *C. frondosa mexicana* that it "contains a pair young, purple and orange...." We believe he was referring to the interior of the valves since in the next sentence he stated that the "outside, with Vermetidae, Lithophagi &c,." From Carpenter's description, in information regarding Tablet 433, and his illustration of Tablet 426, we are convinced that *C. frondosa mexicana* falls into the synonymy of *C. echinata*.

According to Bernard (1976(278):19), *C. mexicana* and *C. buddiana* are separate species and *C. frondosa fornicata* is synonymous with *C. mexicana*. In discussing *C. mexicana*, he considers that "this species is readily separable from other West American chamids by the irregular internal purple red flush, which generally spreads to include the anterior adductor muscle scar." The lectotype of *C. buddiana* exhibits this purple flush on and around the anterior muscle scar. Bernard further notes the presence of two radial rows of larger spines on *C. mexicana*. The lectotype of *C. buddiana* shows the remains of these two rows of radial spines.

Bernard further placed *C. producta* Broderip, 1835 in the synonymy of *C. mexicana* Carpenter, 1857 using the holotype of *C. producta* as an illustration of *C. mexicana* [Bernard 1976(278):36, fig. 10a]. Our examination of the holotype of *C. producta* shown in Figures 10 - 12 revealed a specimen with a severely eroded right valve, the remnants of which are not spinose. The lower valve is highly frilled and shows no spines or scales. The exterior of both valves has been treated with a varnish-like substance. Interiorly the margins of the valves are smooth (also worn) and "the purple border on the smooth internal edge of the upper valve is of some width" as stated by Broderip in his original description. There is no purple coloration in the area of the anterior adductor muscle scar. In our opinion the holotype of *C. producta* does not agree with the description of *C. frondosa mexicana* Carpenter or *C. buddiana*. It most closely resembles specimens of *C. frondosa* Broderip, 1835 we examined.

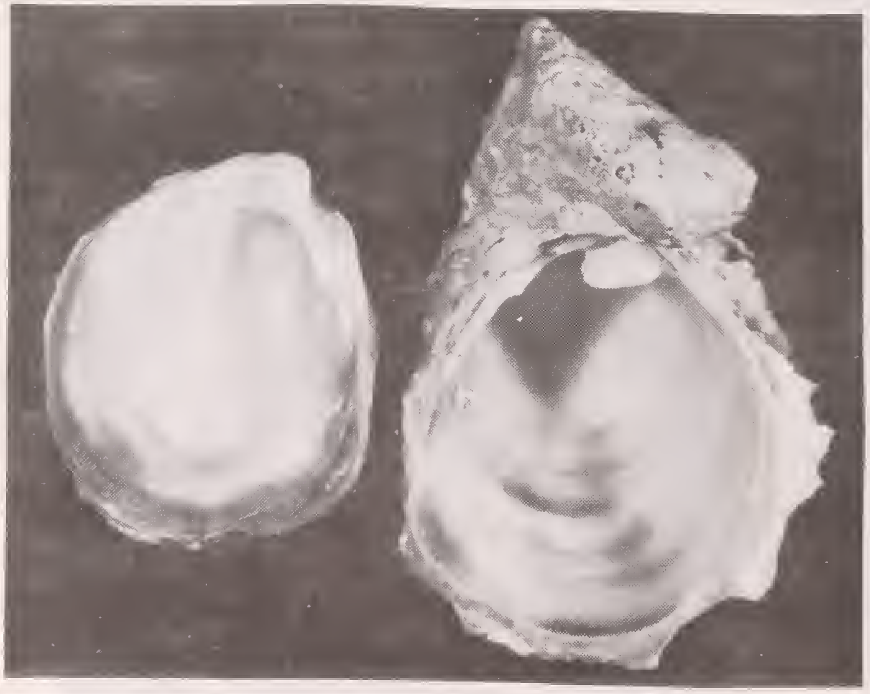

Figure 10. Holotype of *Chama producta* Broderip, 1835 BM(NH) 1950.11.1.60. Interior view.

Figure 11. Top view of holotype of *C. producta*.

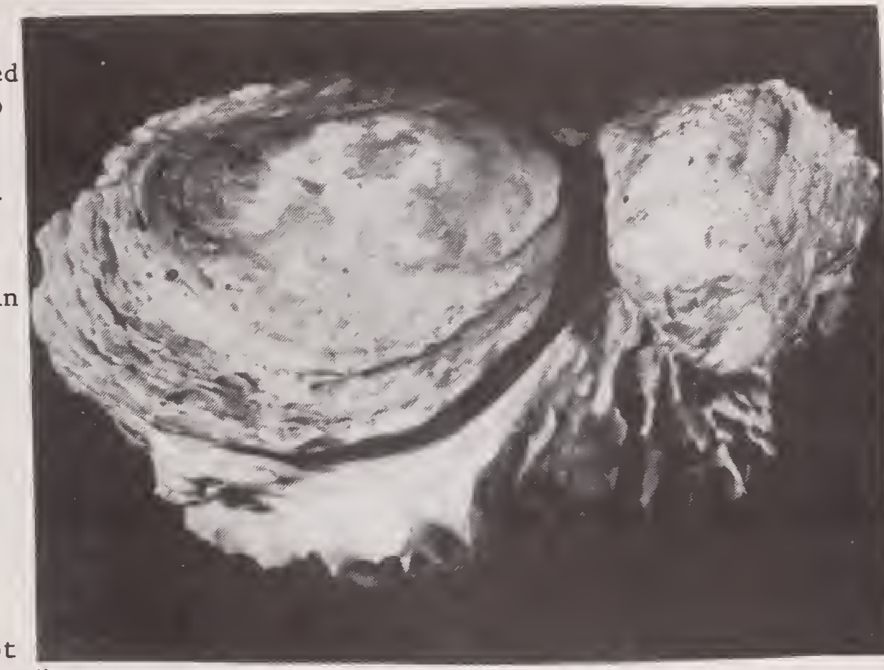

Figure 12. Profile view of holotype of *Chama producta*.

Keen (1971:147) considered *C. buddiana* and *C. mexicana* two separate species placing *C. frondosa fornicata* in the synonymy of *C. mexicana* rather than in the synonymy of *C. buddiana*. She states, "The pink color band near the margin of *C. buddiana* mentioned by C.B. Adams in describing that species seems to be a good character for separating it from the similar-appearing *C. mexicana* for the latter has instead a flush or stain of pink, especially around the anterior muscle scar, but no sharp line or band near the finely crenulate margin, except the red edge of the outer layer."

The lectotype of *C. buddiana* has a flush of pink to purple around the anterior muscle scar of the attached valve but no pink color band, merely the red edge beyond the crenulate margin, a reflection of the outer layer. Keen also indicates the presence of two rows of large white spines. The lectotype of *C. buddiana* shows the remains of these radial rows of large spines.

Keen lists *C. buddiana* as occurring from Clipperton Island to Ecuador and the Galapagos and *C. mexicana* as occurring from the Gulf of California to southern Mexico.

From our study of specimens of *C. buddiana* from juvenile (25 mm)to adult (115mm) we find that the interior coloration is similar throughout the geographical range from San Felipe in the northern Gulf of California to the Galapagos Islands. None of the shells studied had a "red band" only a reflection of the exterior color. Most of the shells exhibited a flush of pink to purple on the anterior muscle scar of the attached valve. Exteriorly, all specimens showed the two radiating rows of larger, broader, vaulted spines posteriorly with wider interspaces on the upper valve and the specimens had the same basic coloration of varying shades of pink with white spines.

Figures 13 - 23 illustrate specimens of *Chama buddiana* from San Felipe in the northern Gulf of California to Panama and the Galapagos Islands. Views of the exterior of the upper valves indicate the two radiating rows of large, broad, vaulted spines posteriorly in each specimen. The interior views in these black and white photographs show as a darkened area the pink to purple flush on the anterior muscle scar of the attached valve as well as the red edge of the outer layer beyond the crenulate margin.

CONCLUSION

We believe that *Chama buddiana* C.B. Adams, 1852 is a species with a wide distribution from San Felipe in the northern Gulf of California to the Galapagos Islands. The species has several consistent shell characters throughout its range; Its exterior sculpture of arched white spines and/or scales on a ground shading from pink to violet with two rows of broad, radiating vaulted spines posteriorly on the upper valve. Interiorly, the attached valve displays a flush of violet on the anterior muscle scar in most specimens and has a narrow pink to violet color line

from the crenulations to the ventral margin.

It is our opinion that *C. frondosa fornicata* falls in the synonymy of *C. buddiana* and that *C. mexicana* of authors, not of Carpenter is synonymous with *C. buddiana*. Further, we contend that *C. frondosa mexicana* Carpenter is a junior synonym of *C. echinata* Broderip, 1835.

Figure 13. *C. buddiana*. Hertz collection
Loc. San Felipe, B.C., Mex., on side of large rock, intertidal, low tide zone, 2/25/71. Leg. J. Hertz

Figure 14. Exterior of specimen in Figure 13. Approx. 98mm x 70mm.

Figure 15. *C. buddiana*. Myers collection
Loc. Bahía Concepción, B.C., Mex. in 15 feet on rock, 3/74. Leg. B.W. Myers. Approx. 75mm x 65mm.

Figure 16. Interior of specimen in Figure 15.

Figure 17. *C. buddiana* SDNHM 53083, Leg. G.E. Radwin. Approx. 80mm x 60mm.

Figure 18. Interior of specimen shown in Figure 17. Bahía Coastocomate, Jal., Mex., 3mi. NNE of Barra de Navidad, 45-65', on and under rocks, 10/17/68.

Figure 19. *C. buddiana* SDNHM 28863., Leg. H.N. Lowe, Puntarenas, Costa Rica, 1931. Approx. 60mm x 55mm.

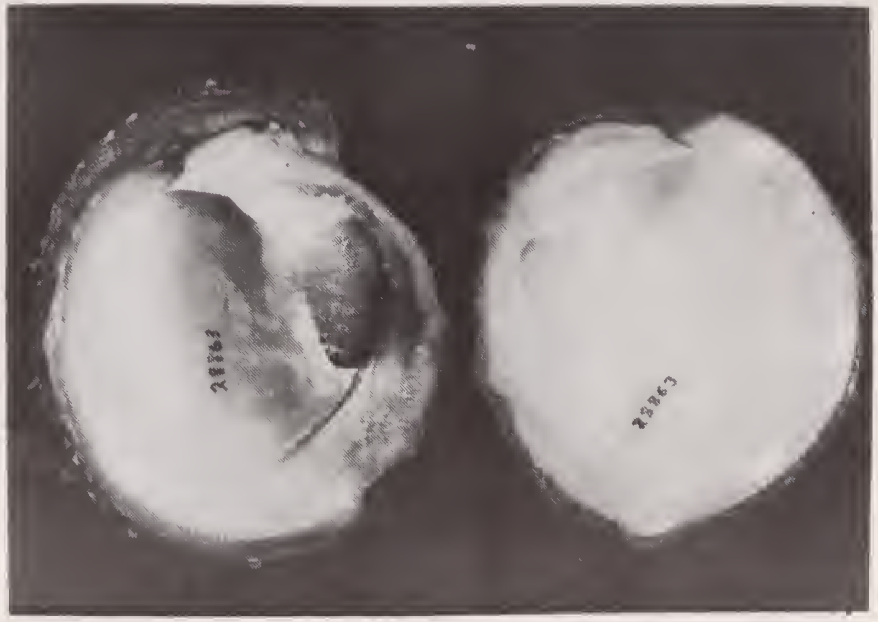

Figure 20. Same specimen shown in Figure 19.

Figure 21. *C. buddiana* (upper valve) SDNHM 10903, Leg. P. Johnson, 1958. Palo Seco leper colony, Canal Zone, Panama (Pacific side). Approx. 90mm x 70mm.

Figure 22. *C. buddiana* SDNHM 28867, ex Cal. Acad. Sci,(Lowe Estate) Charles Island, Galapagos Islands. Approx. 100mm x 80mm.

Figure 23. Interior of specimen shown in Figure 22.

Acknowledgments

We are grateful to Drs. Kenneth M. Boss and Ruth D. Turner of the Museum of Comparative Zoology, Harvard and to Ms. Solene Morris of the British Museum (Natural History), London for the loan of type material, and to Dr. F.R. Bernard for information relating to his monograph on eastern Pacific chamids. We thank Judith Dyer, Librarian at the San Diego Natural History Museum, for her efforts in obtaining reference material from other institutions. We are most appreciative of the time and effort spent by David K. Mulliner in preparing the fine photographs for this paper and to Margaret and David Mulliner for the loan of study material. Our very special thanks to Anthony D'Attilio who not only cricically read the paper but provided continuing encouragement and advice.

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BOOK REVIEW

BY

GORDON A. ROBILLIARD

Woodward-Clyde Consultants, Three Embarcadero Center, San Francisco, California 94111

PACIFIC COAST NUDIBRANCHS: A GUIDE TO THE OPISTHOBRANCHS OF THE NORTHEASTERN PACIFIC.
By David W. Behrens, 1980.
Sea Challengers Press. 112 pages. ISBN 0-930118-04-9
Price: $10.95.

Even the casual bookstore browser will be immediately attracted to the beautiful color photographs of opisthobranchs on the cover of this book. The more knowledgeable marine biologist will be attracted to the apparent confusion in the title--is the book about nudibranchs or opisthobranchs? (It's about opisthobranchs). Either way, Behrens will have accomplished at least one of his objectives--piquing people's interest in Pacific Coast opisthobranchs.

The preface by Hans Bertsch is a succinct informative review of the taxonomic and biological research history of Pacific Coast opisthobranchs and opisthobranch-ologists. The body of the text is an illustrated and annotated guide to Pacific Coast opisthobranchs, including a large number that have not yet been identified —in some cases not even to genus.

The color photographs are a key feature of this book. Most are clear, well-formulated and show the key characteristics. None were off-register at least to the extent that they are unusable as has been the case for some recent, similar publications. In a few cases, the animal is too small (in the photo) and its color is too similar to the background for details to show. Behrens has done a good job of selecting photos that show the "typical" color morph(s) found in California, but the reader should be aware that there is a great deal of intra-specific variation in color pattern, hue and intensity over the entire geographic range of many species.

Ecological notes are added for most species. Again the information is most appropriate to the populations in California. However, many species live in different habitats and eat different things in Baja California, Oregon, Washington, British Columbia, Alaska or even Japan.

The use of common names, many made up specifically for this book, is regrettable, unnecessary and continues an unfortunate tradition placed on authors who wish to publish under the Sea Challengers label. Behrens argues in his introduction for the use of scientific names and then is forced to provide common names, most of which are neither descriptive nor pleasing.

The book is generally well organized, the type is easily read, Behrens' style is easy and interesting and there are relatively few errors. The diagrams and glossary are simple, but will assist the reader in identifying the specimen in hand. Behrens cross-references species that look similar to help those of us who "picture key" the specimen in hand and might be inclined to identify a species on the basis of the first picture it resembles.

I recommend this book to each of the limited but growing audience of tidepoolers as well as amateurs and professional biologists interested in identifying Pacific Coast opisthobranchs. At last there is a coffee table book, albeit a small one, that is also useful.

BOOK REVIEW

BY

GORDON A. ROBILLIARD

Woodward-Clyde Consultants, Three Embarcadero Center, San Francisco, California 94111

HAWAIIAN NUDIBRANCHS
By Hans Bertsch and Scott Johnson 1981.
Honolulu, Hawaii: Oriental Publishing Company, 112 pages (illustrated)
ISBN 0-932596-15-0
Price: $6.95.

Is it fashionable for authors to confuse their audience about the real contents of their book? Bertsch & Johnson, like Behrens (Pacific Coast Nudibranchs, Sea Challengers Press, 1980) lead the reader to believe the book is about nudibranchs. However, a quick glance at the table of contents, the photos and even the first paragraph of the Introduction immediately shows that "Hawaiian Nudibranchs" includes other opisthobranch molluscs. The reader unfamiliar with nudibranchs or opisthobranchs will not be able to determine the relationship of the taxa until page 7 (unless he/she tries to understand the Classification Scheme).

The redeeming feature of this book is the presentation of high-quality, well-printed color photographs. Some of the photographs including the color are spectacular while others are only excellent. Almost all are printed in focus and in-register. Some, such as the photos of *Platydoris formosa* on pages 36-37 show good closeup detail of key characteristics such as gills and rhinophores as well as the whole animal.

However, many of the photographs are uninformative at best. For example, it is difficult to tell where *Petalifera petalifera* and *Padina* begins (p. 25), and the key characteristics of the species are not at all obvious, except that it is well camouflaged. The *Berthellina citrina* on the underside of a rock, its natural habitat, appears as a small orange dot (p. 27). There are numerous other photos in which the animal of interest is too far away or in which the animal in its natural habitat is too well camouflaged to show in the photo. How many times do the authors need to make this point? I never could find the four *Phestilla sibogae* on page 90 and I had a difficult time distinguishing *P. melonobranchia* from the coral on pages 92-93. In others of these "natural habitat" photos, there is too much background clutter for the photo to be either aesthetically pleasing or informative.

The text is disappointing in both the quality and the information content. I learned very little about most species other than where the authors found them in Hawaii. Even the introductory text is sparse in information and is uncharacteristic of the type of work that I associate with Bertsch. One gets the impression that Bertsch and Johnson put a lot of effort in getting together and producing a set of color photographs and then lost interest in the project when it came time to prepare the text.

I recommend this book to those who want to add to the ever-growing group of paperback, miniature, coffe-table books, including several recent ones on opisthobranchs. I do not recommend it to the biologist or student of opisthobranchs who wishes to learn something about the biology of Hawaiian opisthobranchs. For that, I recommend contacting Dr. Bertsch directly.

IN MEMORIAM

EDWIN C. ROWORTH

It is with regret that we report the death of Edwin C. Roworth on January 28, 1982 at the age of 92. For many years Ed's was a familiar face at Club functions as well as being available to chat at Cardiff Sea Shells where he was buyer and consultant for many years.

Ed collected shells for over seventy years and in 1970 donated his extensive collection to Arizona State University where the E.C. Roworth collection is now utilized by the department of Geology for teaching, study and research.

Ed was a longtime friend and member of The San Diego SHell Club and we will miss him.

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: 21 JANUARY 1982

The meeting was brought to order at 7:45 P.M. by President Marty Schuler. New members and guests were introduced including member Bob Schoening visiting from Hawaii. Ron McPeak then introduced the evening's speaker, Joyce Gemmell, who gave an illustrated talk on the area from San Felipe to Gonzaga during the years 1964 to 1976. This was not a typical shell talk but a resident's eye view of this unique area. The audience was treated to a peek at a way of life that is fast disappearing in this rapidly developing part of Mexico. The unloading of cattle boats from La Paz on the beach at downtown San Felipe, the one lane torturous, dirt road trip from Puertecitos to Gonzaga, the desert ?highways to the beach, totuava fishing in San Felipe, all became real in Joyce's knowledgeable and humor-filled presentation.

After the break, Ron McPeak was the narrator in a brief slide presentation on a week's trip to Punta Asuncion, Baja California with Carole and Jules Hertz and Dave Mulliner. Slides of the area including spectacular underwater photography taken off the seamount near Isla Asuncion were shown.

During the business portion of the meeting the resignation of Pat Sage as Secretary (a result of a move to Irvine) was announced. Carol Burchard was appointed to fill the position.

The Club will again participate in The Greater San Diego Science & Engineering Fair in April. The year's judging committee is Ron McPeak, Dave Mulliner, Marty Schuler with Jules Hertz as alternate.

Committees were announced for 1982. Barbara Myers and Margaret Mulliner have agreed to continue as librarian and assistant librarian and Margaret Mulliner will continue as Botanical Foundation representative. The position of Club host, ably filled in the past by John Sage, is still open. A volunteer is greatly needed. Please contact Marty Schuler.

Marty announced that it is not too early to begin donating shells for the annual auction in April. Bring them to a meeting or contact a board member for pickup.

The shell drawing was won by Peg Mulliner who should get her prize at the next meeting.

NEW MEMBERS

Catarios, Debbie & Larry. 4173 Golf Street, San Diego, CA 92117. 270-4376
Thieriot, Julia. 1665 Pentecost Way #5, San Diego, CA 92105, 264-3483
Williams, Yvetta & Richard. c/o 305 No. Harbor Blvd. #TE1-1694, San Pedro, CA 90731

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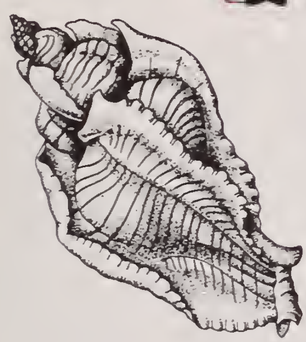

SAN DIEGO SHELL CLUB

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VOL. XIV MARCH 1982 NO. 3

PROGRAM: Mr. Dan Miller of the California Department of Fish and Game will give an illustrated talk entitled, " The Sea Otter and Shellfish."

SAVE THE DATE: The Annual Auction/Potluck will be held on Saturday 17 April 1982 at the home of Martin Schuler.

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OBSERVATIONS OF LIVING CAECUM CREBRICINCTUM

BY

BERTRAM C. DRAPER

Malacology Section, Los Angeles County Museum of Natural History,
900 Exposition Blvd., Los Angeles, California 90007*

There are few accounts in the literature of the living animals of the Caecidae. Those I have examined were by Moore (1962), Marcus & Marcus (1963), Fretter & Graham (1978). In September 1981 diver Roger Evans of Redondo Beach, California collected five living specimens of *Caecum crebricinctum* (Carpenter, 1864) for me and I was able to keep them alive for research for several weeks by keeping them in sea water in my refrigerator. These tiny mollusks ranged in length from four to six millimeters so it was necessary to arrange to do all of my observations under a microscope. I have provided my binocular microscope with relatively strong lighting both from above and from below. This proved very helpful in observing their actions and many details of their anatomy while they were in a dish of sea water. At powers of 30X and 60X it was possible not only to see external details of the animals, but also some internal parts through the nearly transparent bodies of these animals. Of course only the fore parts of their bodies were visible for study since their shells covered the rest of their bodies. One of the caecids is shown in Figure 1 with its body extended about as far as is usual.

A closer view of one of the animals is shown in Figure 2. The tentacles can be seen on either side of the snout with an eye near the base of each tentacle. The snout is shaped like an accordian and is somewhat extendable, with the mouth at its outer end being able to expand to about twice its normal diameter when feeding. On the left tentacle there is a series of bumps along the outer side, but none on the right tentacle. The significance of the protrusions does not seem to be known. All Caecidae appear to have these on their left tentacles (Moore, 1962; Marcus & Marcus, 1963). Below and beyond the snout the fore part of the foot can be seen. It contains a white V-shaped mucous gland by which it lays a mucus layer on which to crawl.

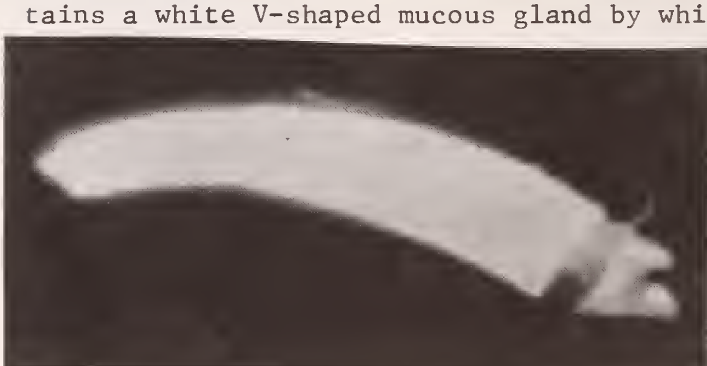

Figure 1. Living *Caecum crebricinctum* magnified about 20 times, crawling on bottom of glass tray in sea water.

Figure 2. Animal in Figure 1 magnified about 80 times. Lighter colored V in outer part of the foot is the forward mucous gland by which it lays a trail on which to crawl.

1.

* Residence: 8511 Bleriot Ave., Los Angeles, CA 90045.

Figure 3. Animal of *Caecum crebricinctum* seen from above at about 80X showing tentacles, eyes, proboscis with foot just visible below it. Lumps on the left tentacle are seen here.

Figure 3 shows the the head of the animal taken from above at about 80X. The lumps on the left tentacle are visible here.

While observing the caecids at 30X magnification in a clear plastic dish with sea water to a depth of about ten millimeters, I placed a small black rock in the dish near one of the caecids. When the animal came out of its shell it appeared to see the dark rock and attempted to move to it. However, the mucus it laid down on the dish did not seem to hold and the animal kept slipping back, apparently unable to pull its relatively large shell. After several such unsuccessful attempts it tried a new tactic. It pulled itself back into the shell, then extended its operculum a short way out of the shell and then snapped the operculum back into the shell. This moved the shell about one millimeter toward the rock. After repeating this process about six times it reached the rock and started to crawl up on it, the mucus holding there. As it moved up on the rock it expanded its mouth to twice its normal size and within the snout the orange colored buccal mass with the radula could be seen moving toward the rock. The radula was moved against the rock in a rasping motion several times. Then the radula was pulled back into the buccal mass which was then withdrawn into the snout to a position back of the eyes, apparently to bring in any food it had found on the rock. The radula in its orange buccal mass is normally seen between the eyes but moves forward into the snout a short way when the animal is crawling.

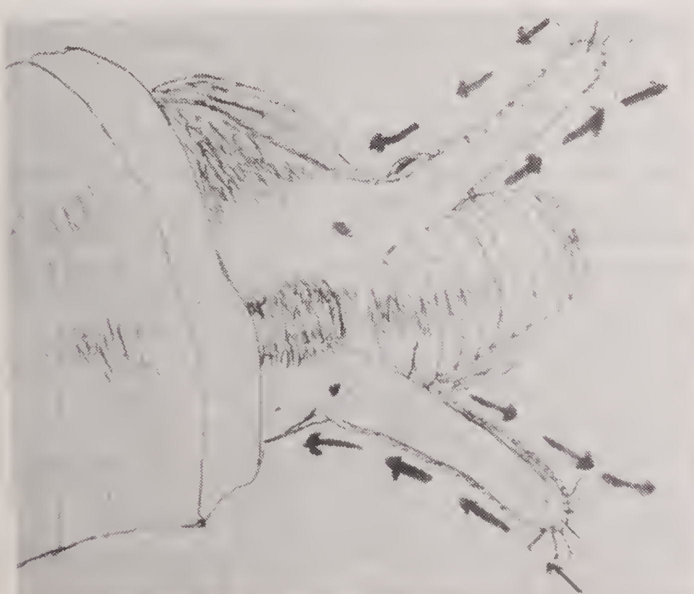

Figure 4. Diagram of cilia on tentacles of *Caecum* animal showing the flow patterns of sea water in and out of the shell to the gills inside.

The tentacles are rather transparent with what is possibly a nerve channel visible extending to the outer end of each tentacle. When viewed under 60X magnification with lighting from below, several rather large rigid setae can be seen extending from the outer end of each tentacle. Moore (1962) called these sensory cilia, and my observations indicated they use these bristle-like setae for feeling anything they are approaching. Along both sides of each tentacle are continuous tracts of very fine short motile cilia which are constantly in motion. Those on the outer sides of each tentacle move toward the shell while those on the inner edges move away from the shell. The movement of these cilia provides a constant flow of water into the mantle cavity along the upper sides of the

body and out on either side just below the tentacles. This flow of water continues even when the animal retracts into the shell and is easily seen by the tiny impurities in the water moving into and out of the shell at all times while the animal is alive. This showed considerable slowing when the water temperature was lowered, but did not stop as long as the animals were alive during my several weeks of observations. In Figure 4 I have shown the patterns of water flow as I observed them. Moore (1962) described his observations of motile cilia and water flow much as I observed them, except he only mentioned them along the outer edges of the tentacles.

Moore (1962) stated that previously published information indicated that researchers had failed to find a gill in the Caecidae they had dissected and the Caecidae were considered to lack this organ. However, Marcus & Marcus (1963) in their Figure 65 showed a curved comb-like structure at the top of the body in the mantle cavity, which they described as a Kiemen (German for gill). This provides a challenge for me, or someone else, to do some further research on the caecid animal.

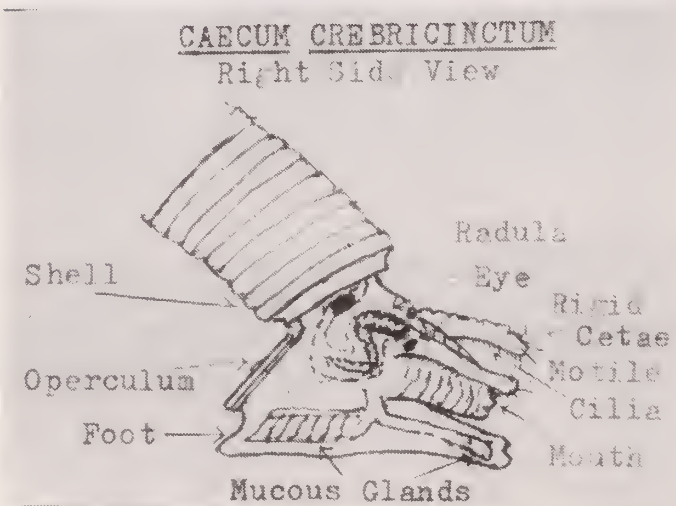

Figure 5. Diagram of the underside of a caecid animal, showing relative locations of the radula and the mucous glands.

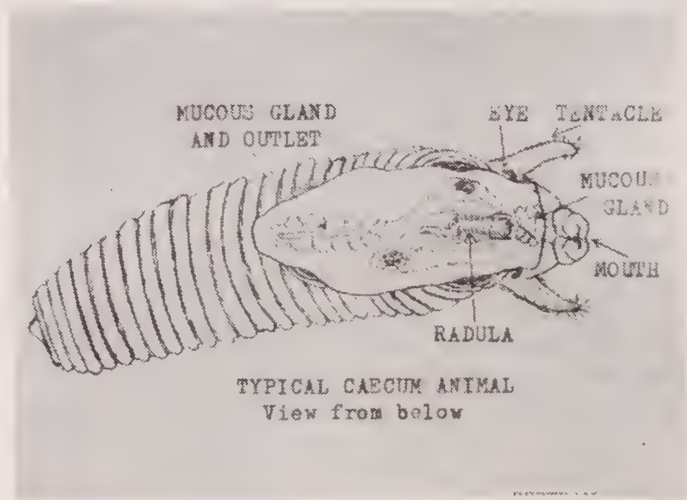

Figure 6. Diagram of *Caecum* animal from the right side showing retracted position of the radula as seen through the body.

An account of the radulae of the Caecidae was previously given by me in Draper (1978). However my observations of the living caecid animals brought out some things I had missed before. My previous studies had used only dried bodies removed from the shells by cracking the shells with a pair of ladies' toenail nippers. The bodies were removed with fine picks and forceps and the bodies were then softened for study. The radulae were visible within the bodies but only in the fully retracted position. In the living animals the radulae could also be seen within the bodies surrounded by an orange colored buccal mass which in turn is inside the buccal cavity which extends from mid-body to well forward of the eyes. The body of one of the living animals was removed from the shell just after it showed no further signs of life. The mantle was still filled with water somewhat like a balloon and by squeezing it the radula in its buccal mass was moved forward into the snout and to its extended position. Figures 5 to 7 show the radula of a *Caecum* in its retracted position. Figure 8 shows the extended position but the buccal mass had to be dissolved to obtain this photo. In the radula as shown, the left third is the part of the radula still being developed. The center third is fully developed and ready to move gradually forward to replace the active part of the radula as it wears down, but is now serving

only to move the active third into the working position. The active third at the right spreads out somewhat and does the actual work of rasping diatoms and algae from the rocks. In performing this feeding function the entire buccal mass containing the radula moves forward down the snout so that the radula is in the expanded mouth on the feeding area.

Figure 7. *Caecum* radula removed from the body while still in the retracted position, with the tissue of the buccal sac only partially dissolved.

Figure 8. *Caecum* radula extended by being flattened out. This is the normal rasping position with the active third at the right doing the work.

It was interesting to note that during this study the *Caecum* kept in sea water in the refrigerator at about 40°F became inactive enough to survive for nearly three months, being warmed up for observation only for brief periods about once a week. They must have become inactive enough to survive without food since I had none to feed them. This species certainly can adapt to cold water since they range as far north as Cook Inlet, Alaska.

Acknowledgments

I wish to thank Dr. James McLean of the Los Angeles County Museum of Natural History for his help in finalizing and clarifying this report on my observations and Roger Evans of the Conchological Club of Southern California for making possible this study by collecting and bringing to me several living specimens of *Caecum crebricinctum*.

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THE SPINE -- AN ELEMENT OF VARICAL SCULPTURE IN THE MURICIDAE

BY

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Introduction

In continuation of some studies on the morphology of muricacean families, the following text and illustrations are offered which, it is hoped, will be of interest and instructive to students of these gastropods.

Discussion

Murex in the narrow sense (sensu stricto) has the simplest spines. In *Murex pecten* Lightfoot, 1786, a form typical of the genus, the long spines are solid, of varying length, and attenuated to sharp points. Examples of these spines are shown in Figure 1. Since all spines in *Murex* s.s. are formed by the mantle working from two edges, there is a suture on the ventral mid-area of the spine running the entire length.

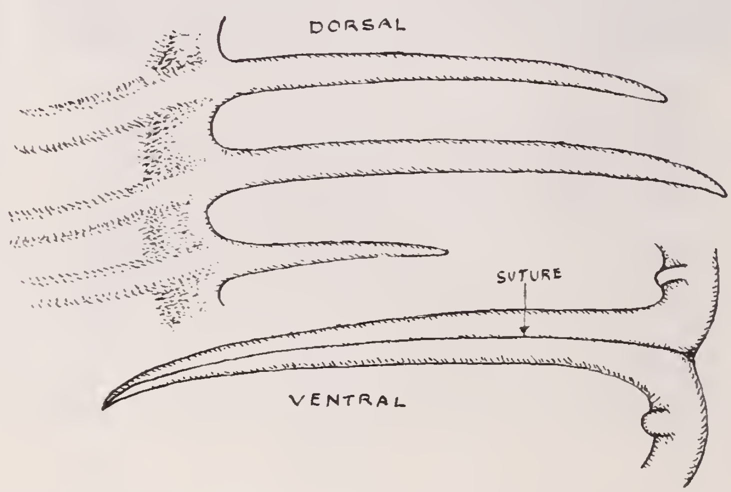

Figure 1. Dorsal and ventral views of the spines of *Murex pecten*.

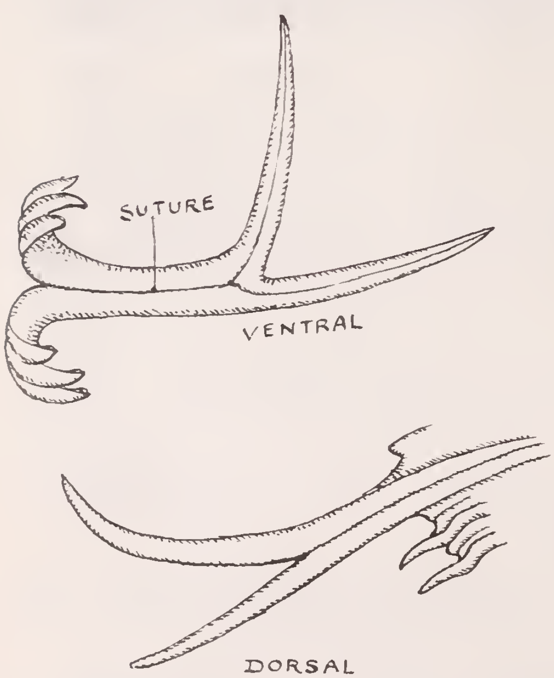

Figure 2. Dorsal and ventral views of the bifurcated spines of *Murex (Murex) cervicornis*

In *Murex (Murex) cervicornis* Lamarck, 1822, an interesting variation occurs. The spines bifurcate (divide in two) at an early stage as shown in Figure 2. A variation of the bifurcated spine is found in *?Chicoreus damicornis* (Hedley, 1903) and is illustrated in Figure 3. This species has thick spines that are broad, flattened basally, remaining partly open, and bifurcate only terminally.

The genus *Siratus* most often has spines much like *Murex (Murex)*. However they differ in having shorter spines between the longer ones. Often there is a webbing or flange connecting the lower portion of these spines. Figure 4 illustrates the spines of *Siratus beaui* (Fischer & Bernardi, 1857).

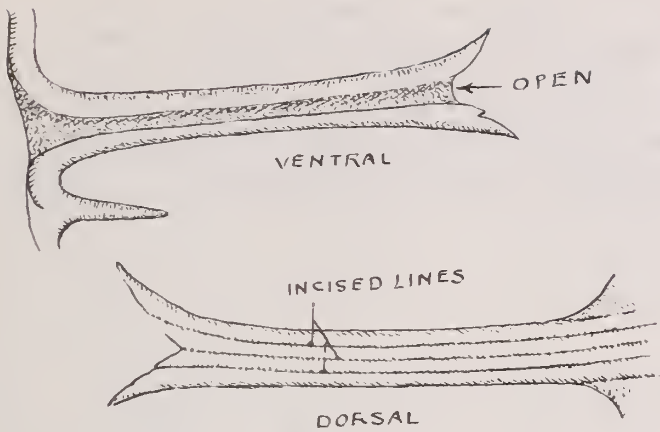

Figure 3. Dorsal and ventral views of the bifurcated spine in *?Chicoreus damicornis*.

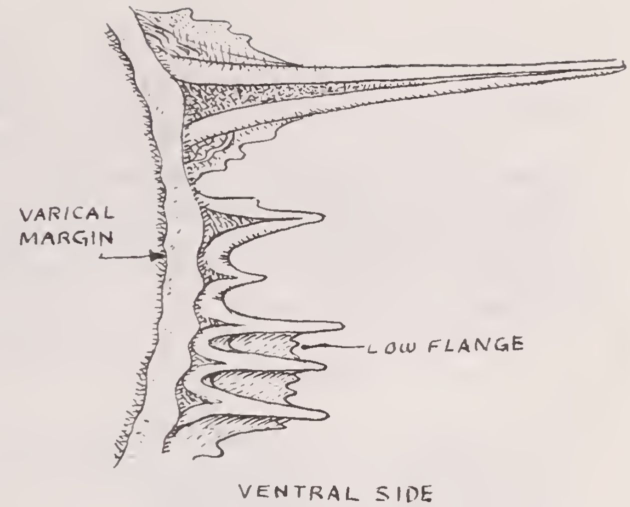

Figure 4. The spines of *Siratus beaui* showing the flange connecting the lower portion of the spines.

Bolinus cornutus (Linne, 1758) from West Africa is at maturity a robust, large species with simple long curved spines differing from *Murex (Murex)* species in having spines that are broadly open on the ventral surface and therefore lacking a suture. Figure 5 illustrates the open spine of *B. cornutus*.

Figure 5. Ventral view of the spine of *Bolinus cornutus*.

Much more complex spines are found in *Chicoreus* and related genera. In general character these are more or less broadly open and in the shape of the cut leaf of a chicory plant. The dorsal shell surface is made up of axial, furrowed cords. These cords continue on to the spine and terminate in points forming a foliated spine. Figure 6 shows two views of the outwardly flaring shoulder spine in *Chicoreus cornucervi* (Röding, 1798). Figure 7 illustrates two views of the second spine from the shoulder in the same species. This second spine turns inward. The remaining spines are outwardly flaring but are not bifurcated.

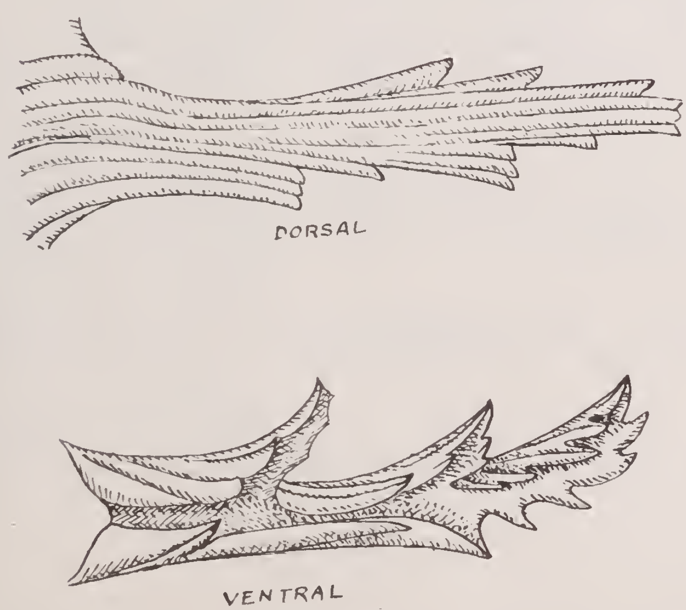

Figure 6. Two views of outwardly flaring shoulder spine in *Chicoreus cornucervi*.

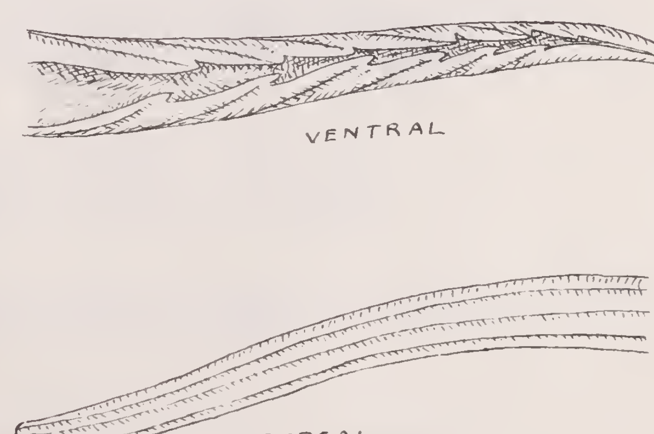

Figure 7. Second spine from the shoulder in *Chicoreus cornucervi*.

In another species of *Chicoreus, C. palmarosae* (Lamarck, 1822), the large shoulder spine flares out terminally and is bifurcated as shown in Figure 8.

While the genus *Homalocantha* has some species with simple, straight spines, a distinctive group of species shows another unusual spine form. In these species the spines are spathulate (shovel-like) terminally and frequently the shovel edge is divided into spinelets. In addition, these spinelets may extend outwardly or curve inwardly. Figure 9 shows the spathulate quality of the spines in *Homalocantha pele* (Pilsbry, 1918).

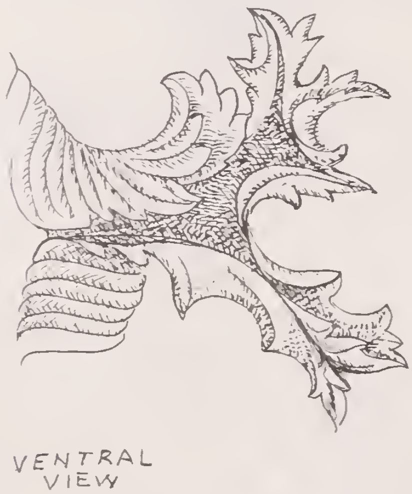

Figure 8. The shoulder spine in *Chicoreus palmarosae*, ventral view.

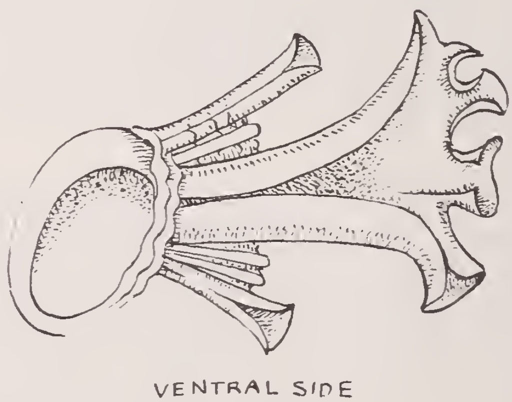

Figure 9. The spathulate spine in *Homalocantha pele,* ventral view.

In a subsequent paper further modifications of varical sculpture in Muricidae will be treated, followed by a paper discussing the spines in Coralliophilidae.

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING--18 FEBRUARY 1982

The meeting was called to order at 7:45 P.M. by President Marty Schuler. After new members and guests were introduced, Bill Perrin presented Dr. William Newman, the speaker for the evening who gave a stimulating talk on barnacles. He began his talk by discussing a three page handout which was distributed to the members and which contained background information on this group of animals. Bill Newman's enthusiasm for his subject was contagious and the members were treated to a slide presentation on the history, structure and variety of barnacles which entertained, amazed, and educated us.

After the break, slides of both the September and Christmas parties were shown. The business portion of the meeting followed. Members were urged to donate shells for the Auction. [See details in this issue. Ed.]. The Club still lacks a telephone committee and a host. Members were urged to volunteer. Treasurer Wally Robertson announced that dues were due in January. He also urged members to donate and buy generously at the Auction.

Bill Perrin won the door prize.

THE ANNUAL AUCTION/POTLUCK--17 APRIL 1932

The Annual Auction/Potluck will be held on Saturday April 17 at the home of Marty Schuler. (Map will be in the April issue). Festivities begin at 6:00 P.M.

The Auction is the Club's ONLY fund raiser Its proceeds form the major part of the Club's annual budget: it supports our donations to scientific organizations, our social events and determines the budget of The Festivus. We invite ALL our members, local and out of town, to donate generously to the Auction. For local members--bring your shell donations to the March meeting or arrange for pickup with any board member. For out of town members, please send to the Club address. Specimen quality shells with collecting data are preferred.

For those who have no shells to donate---Come and BUY!!!

DUES ARE DUE

Dues for 1982 were due in January. Please send your check to Wally Robertson or to the Club address. Members whose dues are not received by March 31 will be dropped from the membership roster. (Roster will be included in the April Festivus).

NEW MEMBERS

Herrman, Richard, 1251 Hornblend, #19, San Diego, CA 92109. 488-1419.
Breese, Jack & Debi, 3011 Equitation Lane, Bonita, CA 92002. 267-5113.

CHANGES OF ADDRESS

Bukry, David. U.S. Geol. Survey (a-015), Scripps Inst. Oceanography, La Jolla, CA 92093.
Kennedy, George L., 100 Webster St., Apt. B., Palo Alto, CA 94301

ADDRESS CORRECTION

Catarios, Debbie & Larry, 4173 Galt Street, San Diego, CA 92117. 270-4376.

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THE FESTIVUS

SAN DIEGO SHELL CLUB

FOUNDED 1961 • INCORPORATED 1968

MEETS THIRD THURSDAY, 7:30 P.M.
ROOM 104, CASA DEL PRADO, BALBOA PARK

President....................Martin Schuler
Vice President...............Bill Perrin
Secretary....................Pat Sage
Treasurer....................Walter Robertson
Editor.......................Carole M. Hertz

ANNUAL DUES: Payable to San Diego Shell Club Inc. Single membership: $5.00; Family membership: $6.00; Overseas surface: $8.00.

CLUB ADDRESS: Address all correspondence to San Diego Shell Club Inc., c/o 3883 Mt. Blackburn Ave., San Diego, California 92111.

VOL. XIV APRIL 1982 NO. 4

COME TO THE AUCTION/POTLUCK!!

(There will be no regular meeting this month).

DATE: Saturday 17 April 1982
TIME: 6:00 P.M. --?
PLACE: Home of Martin Schuler

For directions and details see map on last page of this issue.

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A SECOND LIVING SPECIES OF HIPPOPUS LAMARCK, 1799: H. PORCELLANUS ROSEWATER, 1982. (BIVALVIA: TRIDACNIDAE)

BY

ANTHONY D'ATTILIO and BARBARA W. MYERS

Department of Marine Invertebrates, San Diego Natural History Museum, Balboa Park, P.O. Box 1390, San Diego, California 92112

Several years ago this new species was first brought to our attention by Mr. L.J. Bibbey and we began to investigate specimens of *Hippopus*. Shortly thereafter we brought the subject to the attention of Dr. Joseph Rosewater of the United States National Museum, who described *Hippopus porcellanus* in February of 1982. During the intervening time we did a thorough study of *Hippopus* and this paper is the result of our research.

The giant clams, family Tridacnidae, are of interst not only because they are the largest bivalves in the world, but because they have the ability to farm symbiotic algae (zooanthellae) within the fleshy folds of the mantle creating for themselves a food source in addition to their usual filter feeding method Yonge (1936:309). Further the orientation of the animal to the shell appears to be the reverse of most other bivalves and workers of the 19th Century believed the animal rotated its body within the shell (Blainville 1825:544) and (Reeve 1860:74). Lucaze-Duthier (1902: 203) repudiated this belief stating that this is impossible and illogical and that the mantle has caused the appearance of displacement. Yonge (1953:464) in his study of the anatomy and placement of the body within the shell, believes these changes occur by the mantle/shell rotating, in relation to the body, in a counterclockwise direction through an angle of 180°.

Stasek (1962:33-34) disagreed with Yonge. His examination of post-larval *Tridacna maxima* (Röding, 1798) showed them to be wedge-shaped with an angle of 68° at the umbos. See Figure 1. This angle separated the pedal gape (ventral) and the ligament or hinge (dorsal). The pedal gape is situated against the substrate and the ligament faces away from the substrate or towards the surface. He proposed that growth at the ventral-posterior margin increased the angle between the pedal gape and the ligament to 145°, pushing the shell growth upwards and over so that

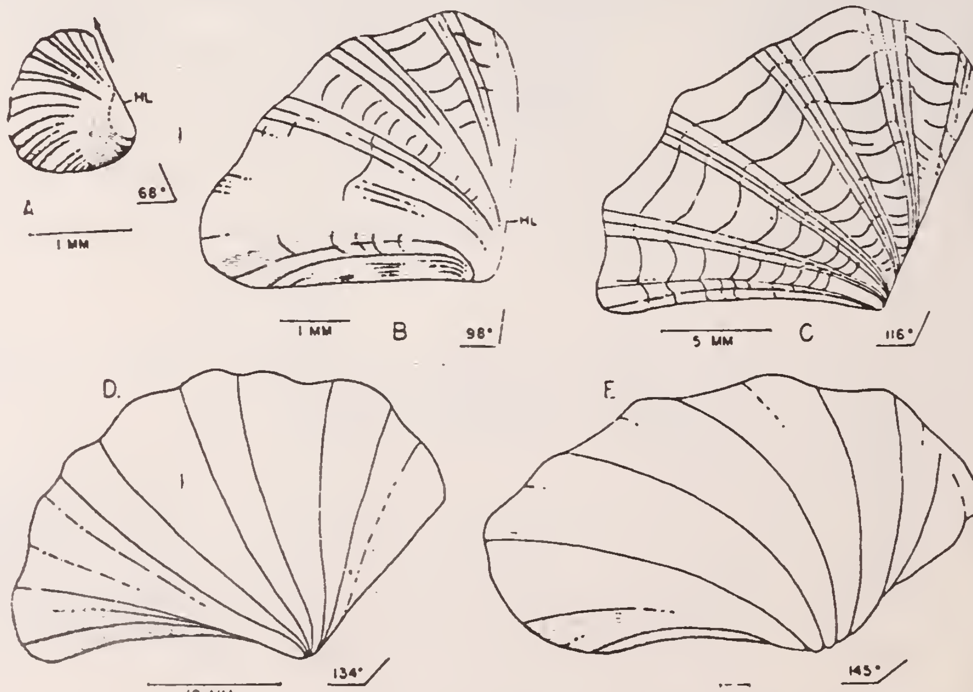

FIG. 3. — Five stages in the growth of *Tridacna elongata* showing changes in shell shape and alterations in the magnitude of the dorso-ventral angle. The inferior slope is shaded in each instance. Sculpture is suggested in the first three stages but omitted from the last two

Figure 1. From Stasek (1962:9). *Tridacna elongata* = *T. maxima*

the once dorsal ligament is now against the substrate (ventral) and the gaping valves are facing the surface of the water (dorsal). This concept of differential growth was not widely accepted until 1975 when LaBarbera (1975:78) confirmed this theory by a sequential study of living post-larval *Tridacna squamosa* Lamarck, 1819.

However, our examination of adult specimens of *Hippopus hippopus* (Linne, 1758) and *Hippopus porcellanus* seems to indicate that most growth is in the anterior-dorsal region, opposite to that shown for *Tridacna maxima* and *T. squamosa*. Post-larval studies of the genus *Hippopus* may prove that a different method of shell growth takes place in *Hippopus* than in *Tridacna*.

Most bivalves may be oriented by holding the two valves together in the closed position with the umbos uppermost and the hinge closest to the holder's body. In this position the right valve is in the right hand and the left valve is in the left hand. The umbos are dorsal and the opening valves below are ventral. The anterior end is away from the holder and and the posterior end is towards the holder

To orient the valves of *Hippopus* we are following Rosewater (1965). Hold the valves together in the closed position with the umbos down and the hinge farthest away from the holder. The right valve is in the right hand and the left valve is in the left hand. The hinge end (away from the holder) is anterior and the keel end (towards the holder) is posterior. The umbos are ventral and the opening valves are dorsal. See Figure 2.

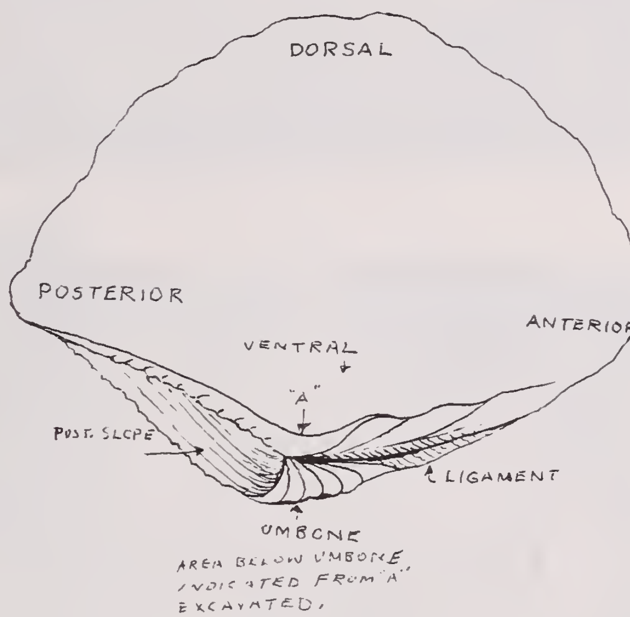

Figure 2. *Hippopus porcellanus* Left valve showing orientation of the shell. Area below the beaks excavated.

TRIDACNIDAE Lamarck, 1819 (See Vokes, 1972)
HIPPOPUS Lamarck, 1799
Hippopus porcellanus Rosewater, 1982

The following description is based upon our personal observations and differs in some details from that of Dr. Rosewater.

Description:

This species (Figures 3,4,5) reaches a width (anterior to posterior) of 381 mm (15 in.) (L.J. Bibbey collection). It is ovate, inflated, and has a strongly undulating dorsal margin. The byssal opening is closed in most specimens we examined, but in a few there is a very slight opening. The valves are moderately light to heavy and thick. Young specimens have orange-brown to brownish red maculations; larger specimens are generally white and older specimens are usually encrusted. Interiorly the valves are porcelaneous white with a stain of yellow on the plicae of the posterior slope. There is a bright orange stain directly below the ligament, but not on the teeth. There are nine strong, wide, convex primary ribs on each valve of varying strength up to the posterior keel. On the posterior slope there are four minor ribs starting from the keel and followed by ten plicate riblets. All the ribs are weakly radially striate. The more convex ribs are toward the center of the valves. The posterior is truncate, sharply defined by a keel which becomes deeply

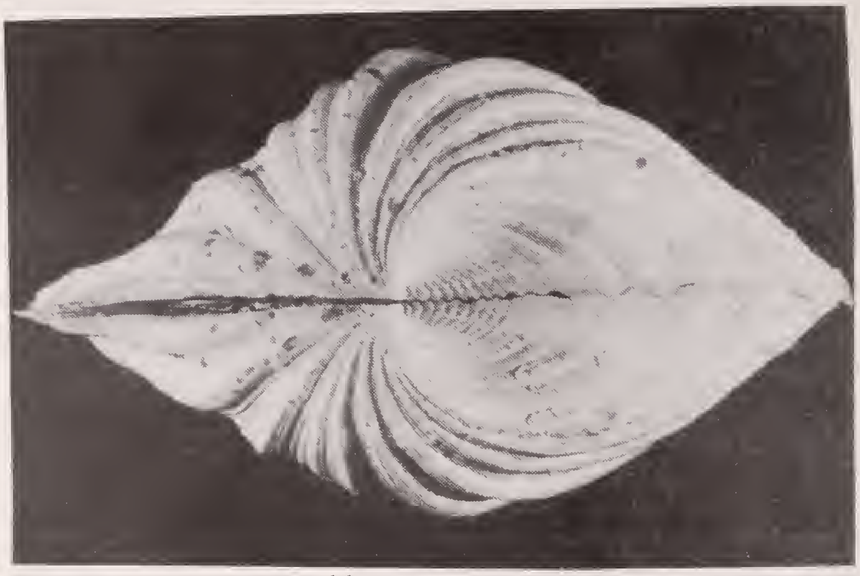

Figure 3. *H. porcellanus*, ventral view.
Photo: Mulliner

Figure 4. *H. porcellanus*, exterior of right valve, same specimen.
Photo: Mulliner

Figure 5. *H. porcellanus*, interior of left valve same specimen.
Photo: Mulliner

concave near the beaks with growth. The shell is somewhat drawn out towards the anterior end. The interspaces are weakly concave and are prolonged beyond the ribs. They are divided into two to three riblets with secondary riblets in-between. The concentric sculpture consists mainly of growth increments. Interiorly the interspaces are divided radially reflecting the external sculpture. The external convex ribs viewed from within are smooth except at their termination; the entire dorsal margin is weakly crenulate. Muscle scars are central and the pallial line entire. In the right valve there is one oblong cardinal tooth more or less flat at the top with two elongate ridge-like lateral teeth anterior to the umbos. The left valve has one smaller triangular cardinal tooth and one elongate lateral on the anterior of the valve. The ligament is mostly external. Interiorly, below the beaks and the posterior slope the valves are deeply excavated.

Comparison with *H. hippopus* Linne, 1758.

H. porcellanus is separable from *H. hippopus* Linne, 1758, (Figures 6,7,8) in the more rounded shape of the dorsal margin which in *H. hippopus* is triangulate. In *H. hippopus* the anterior end is much more attenuated and is concave between the anterior margin and the much raised portion of the mid-area of the valves. There are two forms of *H. hippopus*; a less common smooth form approaching the new species in its lack of sculpture and the usual scabrous form which, in addition, has some of the scales extended into tubular and often leafy projections on the ribs and in the interspaces. The smooth form in *H. hippopus* and the scabrous form have in young specimens generally, the color-

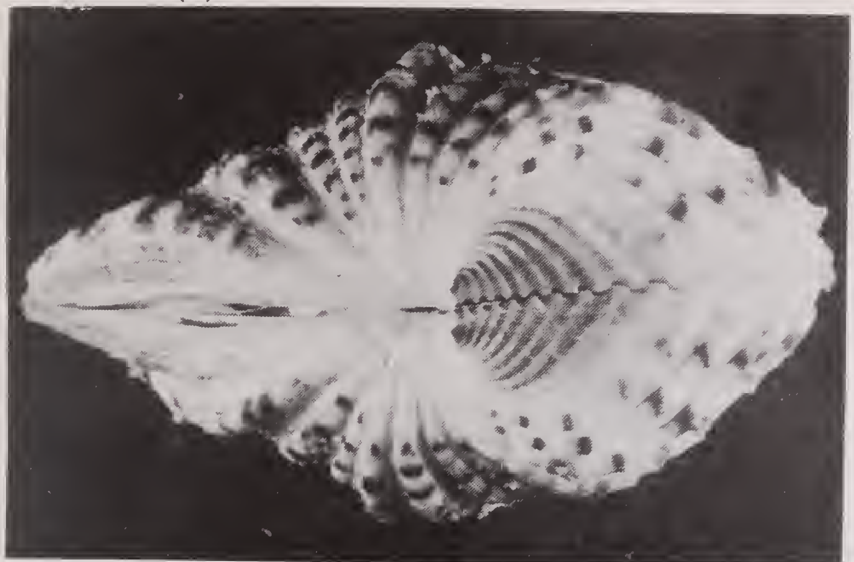

Figure 6. *H. hippopus*, ventral view Photo: Mulliner

ation extending over the entire shell which is visible even interiorly. The ribs of *H. hippopus* are more pointed and the interspaces are much deeper; in young specimens appearing squared off. We have not been able to find in any description of *H. hippopus*, the presence of the large swollen calcareous structure filling the interior umbonal area and protruding beyond the hinge plate, further emphasized by a deep groove. In large specimens, it is visible as in Figure 9.

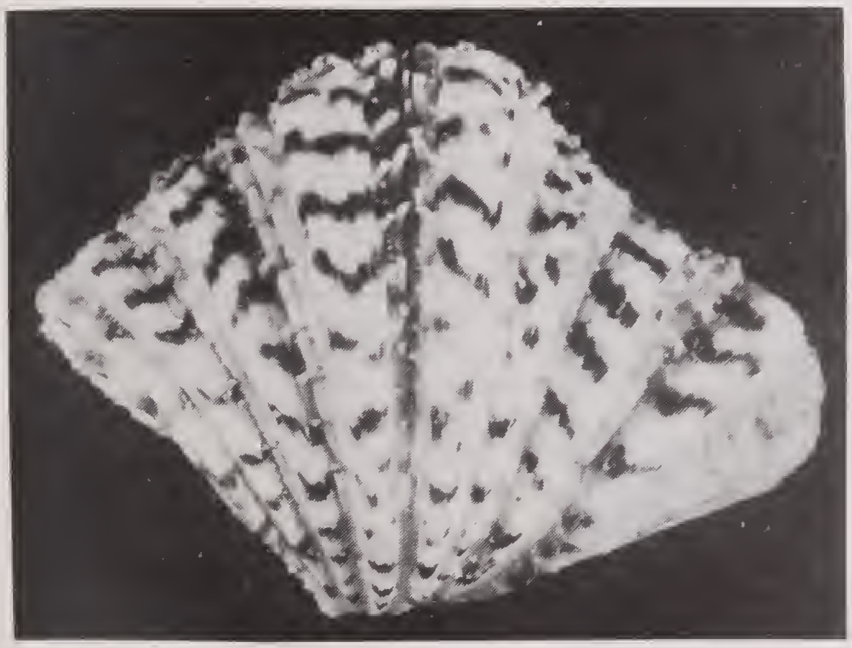

Figure 7. *H. hippopus*, exterior of right valve, same specimen. Photo: Mulliner

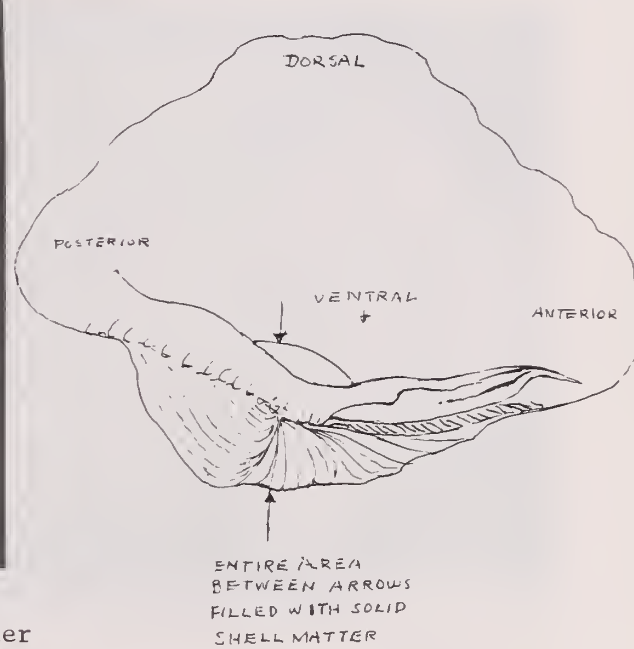

Figure 9. *H. hippopus*. Drawing of interior of left valve showing calcareous mass under the beaks.

Figure 8. *H. hippopus*, interior of left valve, same specimen Photo: Mulliner

This swollen structure is entirely lacking in all specimens of the new species examined. As a result of the presence of this large calcareous mass and the generally thicker valves, specimens of the new species of relatively the same size are much lighter in weight. The coloration in *H. hippopus*, when present, extends as maculations over the entire shell and is dark red to maroon. In *H. porcellanus* the coloration is orange-brown to brownish-red. The posterior slope

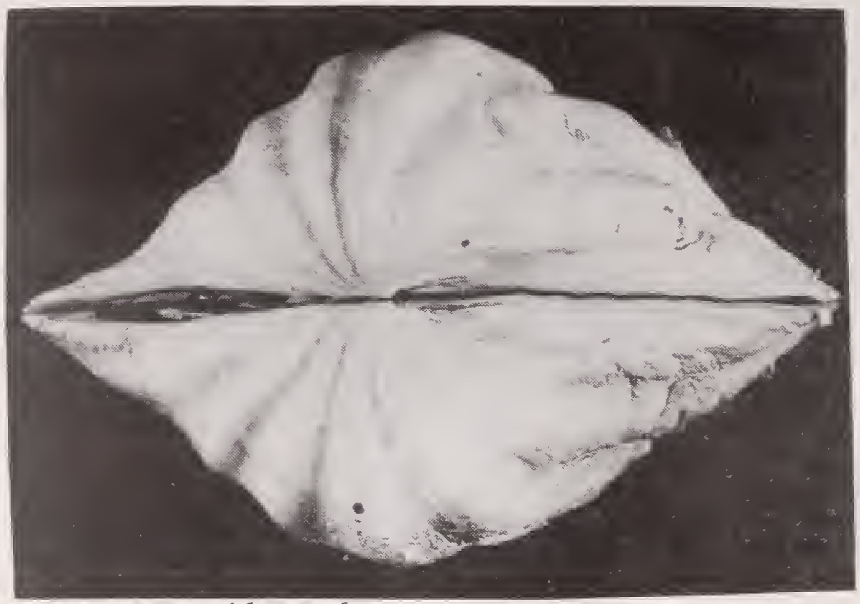

Figure 10. *Tridacna derasa*, ventral view. Photo: Mulliner

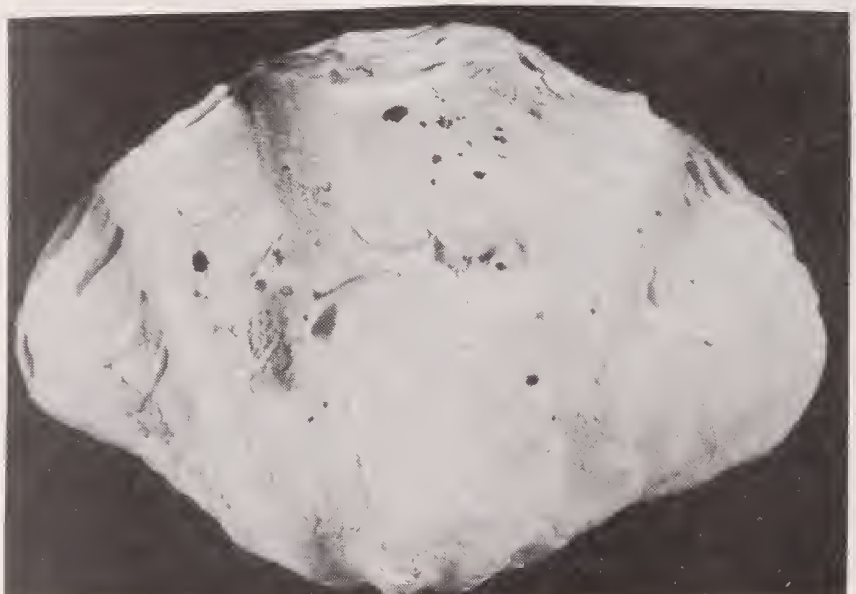

Figure 11. *T. derasa*, exterior of right valve, same specimen. Photo: Mulliner

Figure 12. *T. derasa*, interior of left valve, same specimen Photo: Mulliner

in *H. hippopus* is usually broader and much more strongly concave than in *H. porcellanus*.

Comparison with *Tridacna derasa* Röding, 1798.

Large specimens of *Hippopus porcellanus* have been compared with *Tridacna derasa* (Figures 10,11,12) which has a narrow, shallow posterior slope and nearly closed byssal opening. The shell of *T. derasa* is much thicker and heavier. Its concentric scales are large, erect, and extend across the entire rib, a condition not found in *H. porcellanus*. The posterior slope is comparatively very narrow and not as well defined as in *H. porcellanus*. The radial ribs are less sharply defined and fewer in number and the riblets are not reflected on the interior of the valves. The area below the beaks is not strongly excavated as in *H. porcellanus*. The plicae on the posterior slope are poorly defined and fewer in number. The hinge structure and teeth are much more massive than in *H. porcellanus*.

ACKNOWLEDGMENTS

We wish to thank L.J. Bibbey for generously donating several specimens of the new species to the San Diego Natural History Museum and for first calling to our attention the possible existence of a second living species of *Hippopus*. He also provided us with specimens of *H. hippopus* and *Tridacna derasa* for comparison. We wish to thank Rose D'Attilio for allowing us to use specimens from her collection for this study. We are most grateful to David K. Mulliner, Festivus staff photographer, for the photographs of *Hippopus porcellanus* and the comparison species shown in this paper.

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<u>LIGUUS</u> COLLECTING

BY

TWILA BRATCHER

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To a scuba diver and collector of marine shells, the opportunity to go hunting for *Liguus*, the beautiful Florida tree snails sounded different and interesting. It was. The circumstances were ideal. In February I had been invited to be the banquet speaker and a judge at the Broward Shell Show held at Pompano Beach, Florida. The *Liguus* hunt was planned for the judges, Cecelia Abbott and Ann Jaffe (arts and crafts), Tucker Abbott and me (scientific), and was led by two members who had been hunting *Liguus* in the Everglades for decades. This trip, with people who know the Everglades well, presented a rare opportunity. They have the area mapped with each hammock (an island with trees) numbered. They know which color forms of the beautiful snails will be found on each hammock. They also know the habits, biology, and food preferences of the animals and ages of the individual ones. It was a real education.

I thought I was well prepared with the shirt and pants I wear diving and my jogging shoes for slogging through the mud. (I forgot the socks for my jogging shoes and decided to wear panty hose to have something between by jogging shoes and my feet), Archie Jones, bless his heart, brought everything we neophytes might have forgotten; extra socks, gloves, caps, shirts, collecting bags and lig poles. He talked me into changing into a cotton shirt which he said would be cooler and not catch on the underbrush as mine would. He also brought sulphur powder for us to put in a ring under the top of our socks and under our belts to eliminate the possibility of chiggers.

The lig pole is interesting; a hollow aluminum pole about ten feet long on the end of which is attached a cup about three inches in diameter. The use amazed me. When a snail is discovered, perhaps 30 feet high in a tree, three poles are attached together. Dislodging a firmly attached snail and maneuvering it into the cup and safely to the ground from the end of a swaying 30 foot pole takes some technique. The experts managed some "five-pole *Liguus*"!! I felt a real sense of accomplishment with a couple of "three-pole" ones.

It was almost as difficult for me to spot a snail far up in the tree as it originally was for me to see a marine shell against its natural background. In either case an inexperienced eye can easily overlook the object of the search.

The snails were estivating in February and were in a state of suspended animation. Since all of us wanted to keep them alive, our mentor, Archie, advised us on the care and feeding of *Liguus*.

Since the estivating seal was probably broken in removing the animal from the tree, I was told to put them in a bucket of slightly warm water to dissolve the membrane and carefully remove the remains of it. This activated the animals, but they should remain dormant until late April or early May. Following directions, I lined the bottom of a cigar box with a damp paper towel, put the animals inside, and closed the lid not to open it again until time for the *Liguus* to emerge. Opening it before the intended time would again break the seal of any positioned over the box opening.

When I want to awaken them, I will submerge them in tepid water until they begin crawling around. Then I will put them in a terrarium or a screen-topped box with leaf-mould on the bottom (no earth), and a few moist limbs for them to crawl on. They should be sprayed with an atomizer for moisture. The best food for them is a paste of cornstarch and calcium carbonate. It was suggested that adding some powdered alfalfa might be a good idea. This paste should be smeared on the limbs on which they crawl. They should be expected to live a couple of years on this diet (probably the

remainder of a normal life span) but not to reproduce.

Liguus do not eat the same type of vegetation as the garden snail. In their natural habitat they graze on the fine lichen on the tree trunks in the swamp. In the moist climate of Florida they will live in citrus trees but may need to be fed. They do not damage the trees.

A friend in Florida said she was once given a couple of *Liguus* shells. Not knowing they had animals in them, she put them in a desk drawer where they remained for several years. Suddenly one day they started crawling around. She said she fed them peanut butter and mashed banana which she rubbed onto a screen on which they crawled. They survived a couple of years.

On my *Liguus* hunt the sun shone, the Everglades was beautiful, and we encountered no bothersome insects. The day was perfect and it was a refreshing change from marine collecting.

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: 18 MARCH 1982

The meeting was called to order by President Marty Schuler at 7:45 P.M. after which Bill Perrin introduced the speaker for the evening, Mr. Dan Miller of the Department of Fish and Game, who gave an informative and often humorous talk on the sea otter. Mr. Miller discussed the sea otter "with its cuddle factor of twenty" and its effects on the shellfish population. A lively question and answer period followed his presentation.

It was announced during the business portion of the meeting that Pat Sage would resume her duties as Secretary and John Sage would again be the Club Host. Our appreciation goes to them both.

The plans for the Auction were discussed. It was agreed to raise the price of the punch to $1.50 per person to cover the rising cost.

The shell drawing was won by Phil Faulconer. The meeting was adjourned at 9:30 P.M.

If you have not yet donated shells for the Club auction, please do so right away. The committee has to prepare the shells for bidding and the list of shells to be auctioned must be duplicated so that copies are available for those who attend. If you are attending the Auction/Potluck and have not been contacted about your food donation please call June King at 296-0574.

The Botanical Garden Foundation plant sale will be held on the patio of the Casa del Prado on May 29 and 30 from 10:00 A.M. to 5:00 P.M. All member clubs are asked to donate plants, bulbs and cuttings to help the Foundation in its annual fund drive. Shell Club members have always been generous and are again asked to prepare plants to donate. Contact Margaret Mulliner, Botanical Foundation Representative (488-2701) for details.

The Fifth Annual Tidepool Shell Show is scheduled from Saturday May 8 through Sunday May 16 from 11:00 A.M. to 5:30 P.M. This non-competitive show displays hundreds of the rarest shells in the world on loan from twenty private collections on the west coast and also features a special display on The Shell in Art and Decor. From the Tidepool collection there will be paintings, drawings, original prints and weavings with a seashell theme. Address: 22762 Pacific Coast Highway, Malibu.

The 15th Annual Meeting of the Western Society of Malacologists (WSM) will be held at the University of Redlands from June 20 to June 24, 1982. Deadline for reservations is May 10, 1982. For details and/or a reservation form contact Margaret Mulliner, 5283 Vickie Drive, San Diego, CA 92109.

A PHYSICIST LOOKS AT BIOGEOGRAPHY*

BY

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Until recently many workers felt that the final aim of biogeography is the elucidation of the history of the faunas. History can be presented by tabulating observations, or by generalizing,--developing insights that attempt to explain the observations... ideally developing models that allow you to make predictions which can be confirmed. In biology and biogeography exceptions can almost always be found to these predictions, these generalizations.

David Watts (1971) stated, "Biogeography seeks to establish patterns of order from the apparent chaos of the multiplicity of life forms present upon the surface of the earth, and its soil, atmosphere, and water bodies. In so doing, it is concerned with the mechanisms whereby both plants and animals originate, evolve, and organize themselves into assemblages which show particular distributions and affinities. It evaluates the challenge of environment, and the response to it by organisms of very different genetic structures, and takes into account the effects of environmental change, which can appreciably modify all organic relationships within a short space of time. Biogeographers wish to know why certain species may be found in some areas and not in others, and why associates can at times turn into competitors. They are also anxious to determine the exact means whereby all life forms are supported by the world's energy and chemical resources.... All too frequently, the factual material which the biogeographers consider is imperfect and incomplete. Thus, in many parts of the world, a full count of species and varieties of organisms has not yet been made, and the consequences of their interactions with each other are little understood. Sophisticated techniques of measuring environmental components, such as those appertaining to the heat balance of the earth's atmosphere, have been introduced only recently, so our knowledge of the exchanges inherent in these is still somewhat imprecise; and the details of the pathways of energy and chemical element movement between organisms and their environment are far from being definitively interpreted. Under these circumstances, even the informed observer must to some extent use ideas for which positive proof is lacking, and so depend at times on personal judgments which may arouse controversy...."

A sophisticated mathematical approach to biogeography is given by Robert H. MacArthur in his book, Geographical Ecology.

Hedgpeth (1979) notes that " there is much lively argument concerning the diversity and stability of communities in sea. Some workers (e.g. Dunbar,1960) have discussed community or ecosystem development in evolutionary terms... as if there were a natural selection of ecosystems. While it seems probable that there has been evolution in the broad meaning of development from a simple to complex groupings... the implication of a sort of a superorganism in which the component species might act like a pool of genes is a vitalistic overstatement."

In opposition to this "diversity model" there has long been a tendency to regard the community as a coherent closed system. Both of those views are, of course, wrong if carried to extreme. Consider the effect of a strong tsunami. The organisms which repopulate the devastated area are rarely the ones that were dominant just before the event. During any short period of time in a limited region the concept of a large interacting community seems reasonable, but the expectation that it

* Adapted from a talk presented at the Western Society of Malacologists (WSM), 1981.

will stay in the same equilibrium state is naive.

In physics satisfactory descriptions are obtained of a large assembly of particles by using statistical mechanics. This can be done because the number of species is one or at most a few, and their interactions are very simple. They do not reproduce, grow, or feed on each other. The enormous complexity of living organisms and the complexity of their interactions and the great differences in their responses to disturbances, all make the predictive science unquantitative and usually allow a number of equally defensible scenarios regarding their past history.

Nuclear and atomic physics, though in many ways the simplest of all natural sciences, present severe problems. In the relatively qualitative science of geophysics, concepts and theories change quickly. Within the past 15 years an accumulation of experimental evidence has led almost all geophysicists to believe that large plates are in relative motion of about 10 cm per year on the surface of our imperfect sphere of the earth; but there is not yet full understanding or agreement about the detailed motion of these plates even during the last 10 to 15 million years. Nor is there full understanding of the position of the pole of plate rotation with respect to the earth's axis. Furthermore, the earth's axis has not always pointed in the same direction with respect to its orbit around the sun (Even the magnitude of the Chandler wobble--the small nutation of our spinning globe--changes with time) and of course the earth's magnetic pole drifts around with respect to the earth's axis and actually has flipped several times in the last five million years. Worldwide measurements of magnetic field flip are not in complete agreement. For example, Africa shows normal poles 2 mybp* while other samples show flipped field. It is not known whether these flips in the earth's magnetic field occur abruptly or over times of 100 or even 5,000 years. (There is not even a satisfactory explanation of what actually <u>causes</u> the earth's magnetic field). The ultraviolet radiation from sunlight and the intensity of cosmic radiation may both increase significantly during a field reversal thereby causing mutation or even extinction of some shallow water organisms. And of course, an abrupt reversal might be quite disturbing to those marine organisms whose orientation or locomotion is coupled to the magnetic field direction.

Van Andel (1979) writes "If we start with the present position of all plates we can use the combined effect of their relative motions to determine their positions in the past. As far back as perhaps 10 to 15 million years this gives reasonably reliable results but for longer time spans we must consider the possibility that the entire complex of plates may have shifted with respect to the spin axis and the equator of the earth. Indicators of such shifts are therefore important and they do exist. The one that has recently received most attention is the trail of volcanic islands that is presumed to be produced when a plate passes over a hot spot fixed deep in the Earth's mantle.... Plate motions calculated for the last 10 m.y.** on the basis of such absolute motion indicators have generally agreed well with each other, and with the data on relative motions of plate pairs.... In the Pacific... two separate trends of such linear island chains exist. The younger one of these indicates a west-northwestward motion at a low angle to the equator for the past 45 to 50 m.y. Before that time, the motion occurred at a much higher angle to the equator and resulted in a fast transfer of the Pacific plate towards the north.... Unfortunately, this rather well defined migration path of the Pacific plate does not tell us anything about the paths of other plates, because the Pacific is bordered by subduction zones and the movements of the surrounding plates can be independent.

"As is usually the case, this use of linear island chains is not undisputed. There is still a reasonable possibility for doubt regarding validity of the entire hot-spot concept and some small but growing body of evidence suggests that, if hot spots exist at all, they may not be as fixed as one would like to assume... independent and precise confirmation would be very welcome. Such confirmation is indeed available,

*mybp = million years before present
**m.y. = million years

but its precision often leaves a good deal to be desired. Paleomagnetic measurements on rocks... can yield a paleolatitude from the magnetic inclination and the azimuth to the magnetic pole from the declination. Rock alteration, metamorphism, the difficulty of obtaining accurate ages, and many other pitfalls have combined to keep the number of really excellent measurements smaller than one would wish. Moreover, the azimuth yields a meridian to the pole but does not say which meridian...so that the longitude of the rock at the time of magnetization remains unknown."

Plate motions have other implications of importance in malacology and biogeography. Consider for example ocean currents; van Andel shows the changing surface currents determined largely by the changing configurations of continents in the circum-Pacific regions during the last 60 million years. During fully half of this time there were no eastward moving surface currents at equatorial latitudes. I wonder to what extent this invalidates the commonly accepted argument that progressive eastward transport explains why abundances are greatest in the western Pacific.

Ocean currents near shore also affect the upwelling of deep water, which on the one hand can increase the nutrient concentration but on the other hand can result in the very cold water such as we know along the California coast. How quickly and how much can the various mollusks adapt to changing food or changing temperature? What temporary or long term survival advantage will they have?

Another implication of plate motions is uplift and subsidence. In California the Pacific plate is pushing up mountains. In the western Pacific near the Tonga Trench, the plate is sinking down under the Asian continent and thereby producing many volcanos, as well as earthquakes of different kinds from those in California. Dan Davis and Sean Solomon of MIT extrapolate today's knowledge of plate motions to predict that Southern California will bump into Alaska in 80 million years. They predict that there will be a mountain range like the Andes along the east coast of North and South America, and that Central America will be submerged. Consider the effects of such changes on tides, ocean currents, upwelling, surface water temperature, climate, fresh water run-off, etc.! Even minor subsidence and uplift can be of biogeographical significance. For example, the Isthmus of Panama was once submerged. Many of the mollusks in that region are similar to ones on the west coast of Africa, presumably because the American and the African continents had slowly separated to near their present positions. It is an intriguing, maybe even a satisfying, model until we note that the similarity applies mainly to mollusks on the west coast rather than on the east coast of the Isthmus.

Hawaii presents many biogeographic puzzles. For example, in the Cypraeidae there are about five endemic species and about 25 species that occur with broad distribution throughout the Pacific. Kay (1961, 1967) suggests that many of the endemic Hawaiian *Cypraea* are derived from broadly distributed Pacific counterparts:

C. gaskoini from *C. cribaria*	*C. ostergaardi* from *C. helvola*
C granulata from *C. nucleus*	*C. sulcidentata* from *C. schilderorum*
C. semiplota from *C. staphylaea*	*C. tessellata* from *C. isabella*

All but *Cypraea cribaria* and *C. staphylaea* are collected today in Hawaii. What then has caused these derived species? Presumably not survival under conditions of changing water level, temperature, etc. because the parent species still live there. Why don't *C. cribaria* and *C. staphylaea* occur there? Why is this derived endemism so much more prevalent in Hawaiian waters than elsewhere?

Returning to physical parameters that can affect biogeography, consider the change in sea level that occurs during an ice age due to a great accumulation in the icecaps. Hays and Pitman (1973) calculate that 80 million years b.p. the sea was almost 300 meters higher than present sea level and about 25% of present continental land was inundated. As recently as 30 million years b.p. about 15% of the land was inundated. Hays & Pitman indicate that we are today near the minimum sea level.

Sea level decrease during icecap growth would surely result in the drying of many lagoons and the isolation of some seas. The magnitude of the effects will vary with the severity of the ice age. How rapid is the onset of an ice age? Can it be triggered

by reduced sunlight via volcanism? World-wide temperatures dropped several degrees from the extensive high altitude dust after the explosion of Krakatoa; but good scientists disagree on whether the dust from an asteroid impact would lower or raise world-wide temperature. They cannot even say with confidence all the contributing factors which would cause an ice age.

Alvarez and co-workers (1980) have attributed the Cretaceous-Tertiary extinction 63 million years ago to the dust clouds thrown up by impact of a 6-mile diameter asteroid upon the earth with energy about 100,000 times the largest recorded earthquake. They believe that the dust cloud reduced the level of sunlight to only one-tenth of normal moonlight for a period of roughly three years, resulting in the death of photosynthetic plants and all that fed on them.

The notion of asteroid impact is not new. A probablistic study based on asteroid size distribution, and confirmed by impact craters on the moon, indicates that the Earth should have suffered several cataclysmic impacts during its history. The significant thing about the Alvarez group work is that their inferences are based upon the scientific observation of an iridium layer. The amount of material in this layer is an indicator of the mass of the asteroid. Its impact velocity of about 56,000 miles per hour can be calculated from astrodynamics. The total energy of the impact is thus known, and nuclear weapons research tells with considerable accuracy the amount of dust that would be thrown into the atmosphere by impact on land or impact in the ocean.

I think that ocean impact would probably also produce a tsunami of devastating magnitude for shallow water mollusks throughout much of the world. Isolated seas with narrow mouths such as the Mediterranean might escape the extensive damage. But the Mediterranean has not been exempt from devastating tidal waves. The volcanic explosion of the island of Thera in about 1500 B.C. created a tsunami that inundated villages throughout the eastern Mediterranean and brought to an end the great Minoan civilization, which some scientists say had been the dominant political power in the Mediterranean for several thousand years.

Another physical parameter is the high altitude winds of the jet stream. Jerome Namias has recently been very successful in connecting world-wide weather (and probably world-wide climate) with the position of the jet stream which, among other effects, will change the cloud cover over the north Pacific Ocean. This, in turn, could produce changes in ocean currents, upwelling and near-shore water temperature. (El Niño conditions, and the sardine abundance at Monterey can be directly connected with jet stream position).

The scientific base upon which we work is uncertain. William Schopf and colleagues at UCLA have discovered that there were relatively advanced bacterium-like forms of life on Earth 3.5 billion years ago, where previously the oldest known fossil cells were 2.3 billion years old. That is a sudden change of 50% in the recognized age of life on Earth. Also, very recently D. Huchra of Harvard Smithsonian Center for Astrophysics determined that the "big bang" origin of the universe was a factor of two more recent than previously thought (9 billion rather than 18 billion years). Thus even in physical science it is very difficult to think of things for which we can properly say, "THIS IS A FACT." In biological science the number of variables leads to a diversity which rarely can be predicted accurately, even in a statistical sense.

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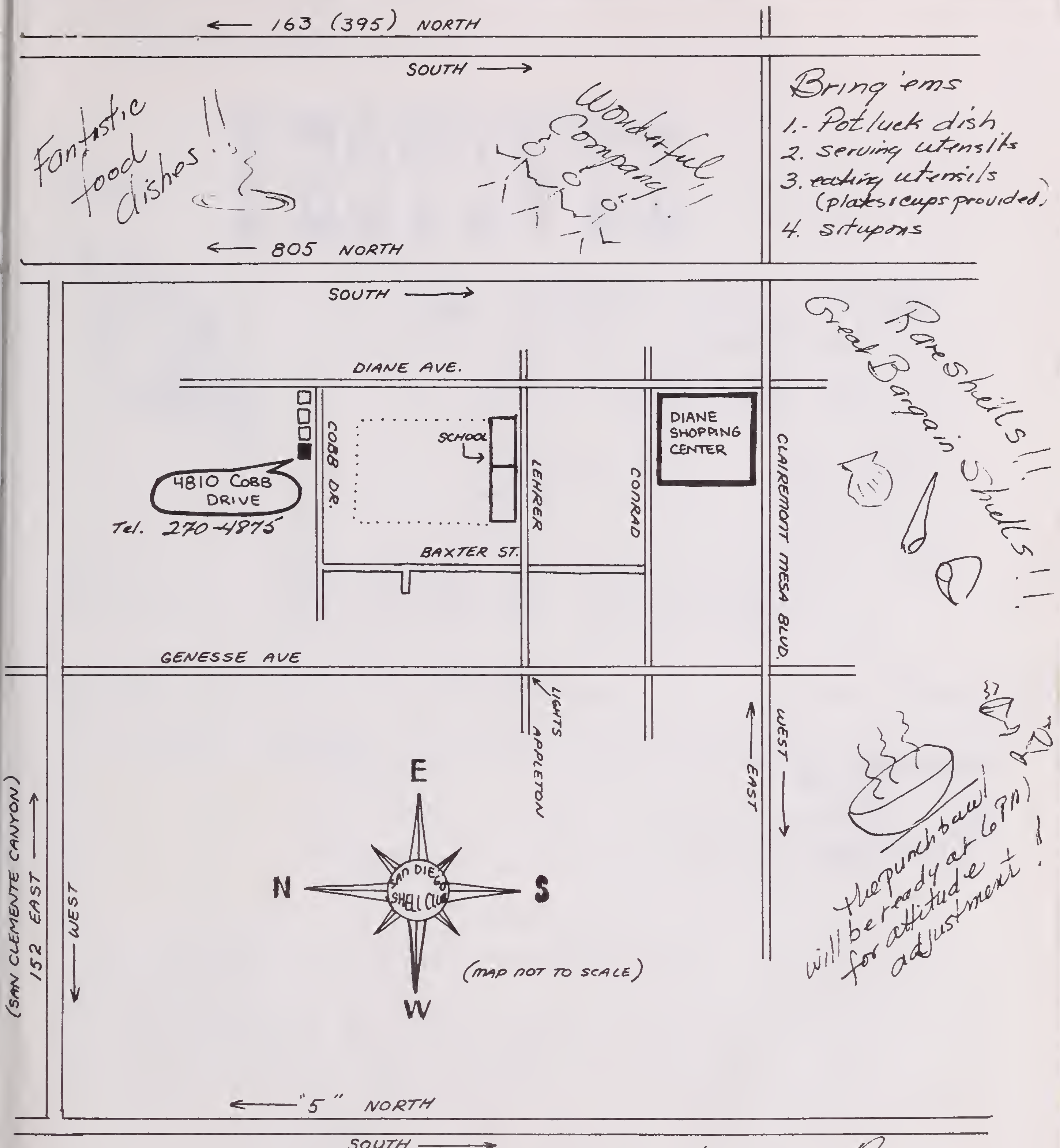

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VOL. XIV MAY 1982 NO. 5

PROGRAM: Dr. James H. McLean of the Los Angeles County Museum of Natural History will give an illustrated presentation on the limpets from the rifts.

DATE: May 20, 1982 TIME: 7:30 P.M. ROOM: 104

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THREE <u>CAPULUS</u> SPECIES IN THE EASTERN PACIFIC: SOME COMMENTS

BY

LEROY H. POORMAN

15300 Magnolia Street, Westminster, California 92683

A number of *Capulus* from the Gulf of California are now in the author's collection. These form an interesting array as to size, shape, and host species and are worthy of illustration and comment. The specimens have been identified as *Capulus sericeus*. A description follows.

Capulus sericeus J. & R. Burch, 1961

<u>Description</u>: Shell cap-shaped, oval, apex spiral, turned towards the posterior side, curling downwards, and twisted to the left as in some species of the genus *Crepidula*; aperture transversely oval, with an irregularly sinuated margin, the posterior expanded; exterior surface with definite and distinct axial and radiating raised lines, a velvety periostracum extending beyond the margins; interior rose color with darker rays extending from the apex to the anterior margin; shell not symmetrical but modified in shape by its sessile habit conforming to the surface on which it is attached; growth marks conspicuous but irregular. Length of holotype 14.8 mm; width 12.3 mm; height 6.3 mm.

The type locality is given as "off Cabo Haro, near Guaymas, Sonora, Mexico at a depth of 100 fathoms." This is eight miles from the source of most of the specimens in the author's collection which are from the waters adjacent to Bahia San Carlos in depths of 30-100 meters.

Figures 1-5 are of *Capulus sericeus* on five different species of the Pectinidae: *Pecten lunaris, Pecten sericeus, Pecten vogdesi, Argopecten circularis,* and *Chlamys lowei*. The smallest *Pecten* on which a *Capulus* was found is a juvenile *P. sericeus* 13.2 mm in maximum measurement. The largest *Capulus* specimen in the series is 20.8 mm x 18.4 mm x 8.5 mm, and the smallest specimen is 2.2 mm. A specimen in the Skoglund collection is 46.5 mm x 37.0 mm. This dead specimen was dredged off Danzante Island, Baja California Sur, and may prove to be a specimen of *Capulus californicus* Dall, 1900.

Fig. 1. *Capulus sericeus* J. & R. Burch, 1961 15.5 mm, on *Pecten lunaris*. Dredged 70-80 meters off Moro Colorado, Sonora, Mexico.

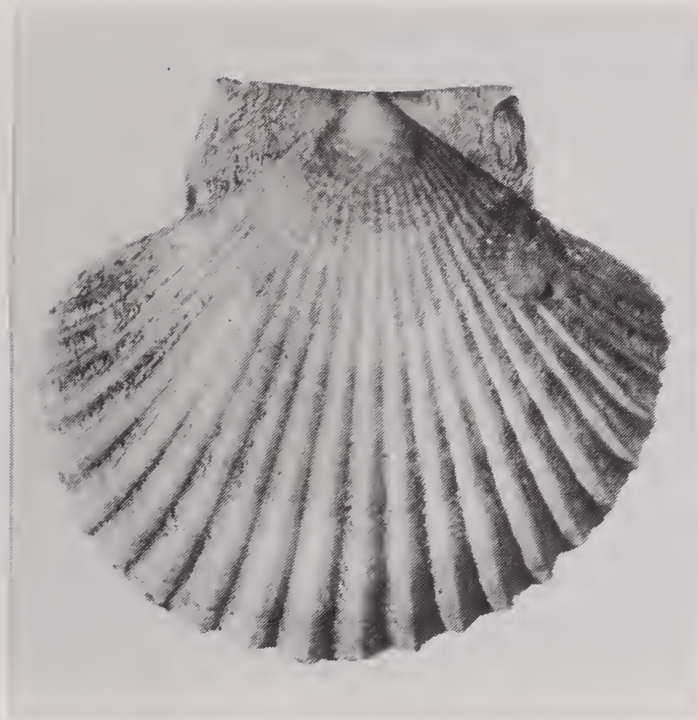

Fig. 2. *Capulus sericeus*
7.4 mm, on *Pecten sericeus*. Dredged 100 meters off Bahía San Carlos, Guaymas, Sonora, Mexico.

Fig. 3. *Capulus sericeus*
12 mm, on *Pecten vogdesi*. Dredged 60 meters off Bahía San Carlos, Guaymas, Sonora, Mexico.

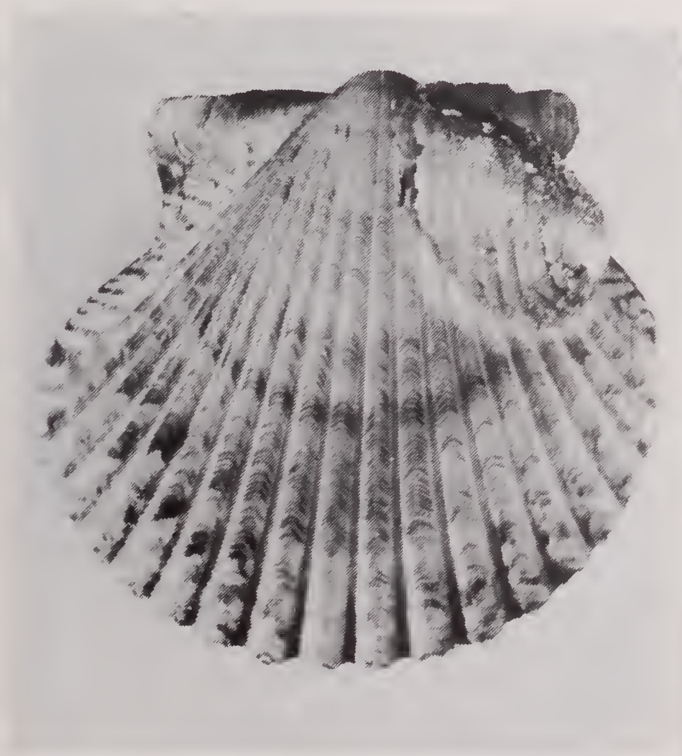

Fig. 4. *Capulus sericeus*
22 mm, on *Argopecten circularis*. Dredged 30-50 meters off Rio Sinaloa, Sinaloa, Mexico.

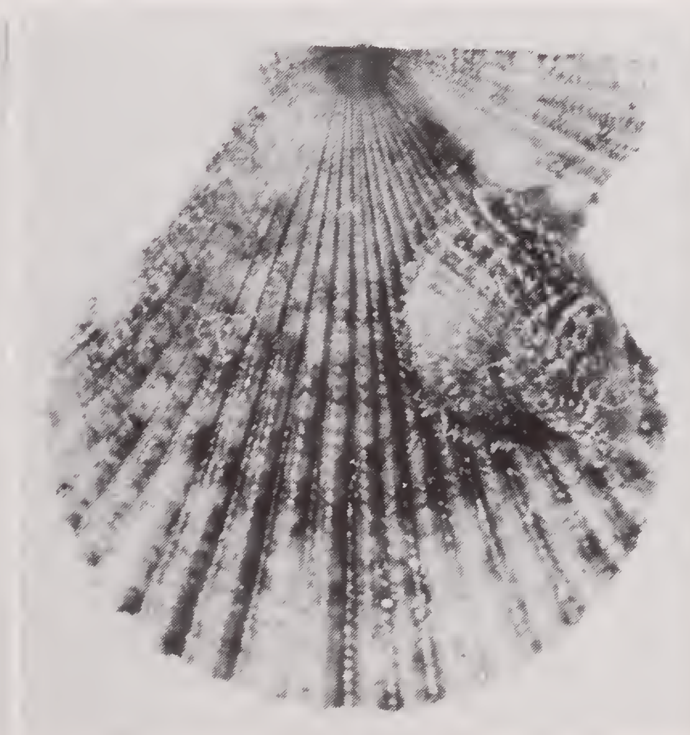

Fig. 5. *Capulus sericeus*
4.3 mm, on *Chlamys lowei*. Dredged 100 meters off Bahía San Carlos, Guaymas, Sonora, Mexico.

Fig. 6. *Capulus* cf. *ungaricoides* (Orbigny) 15.6 mm, on *Argopecten circularis*. Dredged 70 meters off St. Jorge, south of Punta Peñasco, Sonora, Mexico.

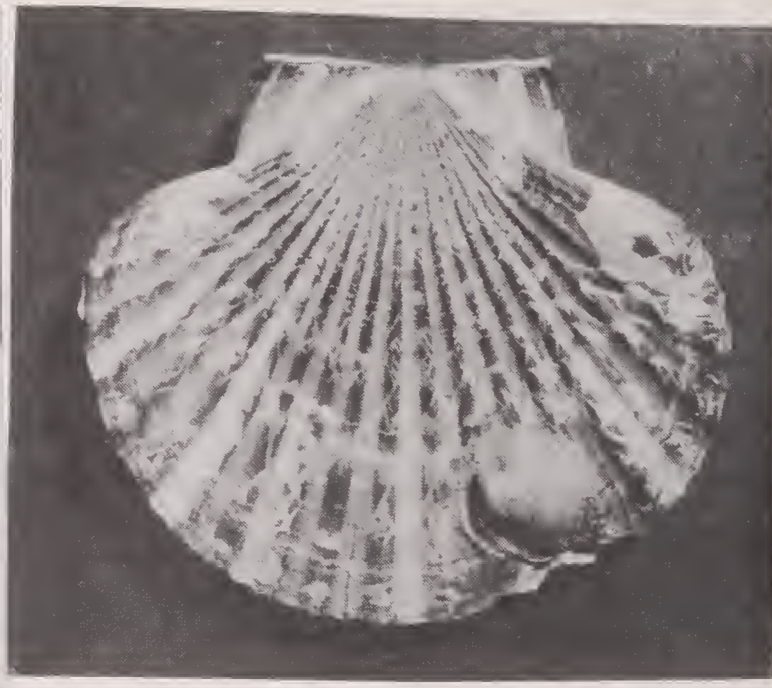

Fig. 7. *Capulus sericeus* on *Pecten lunaris*. Dredged 70-80 meters off Moro Colorado, Sonora, Mexico. Dr. S. Stillman Berry collection.

Figure 6 is one of two specimens from north of Tiburon Island in the Gulf of California. In all respects, they fit the description of a Peruvian species, *Capulus ungaricoides* (Orbigny, 1841).

The normal position of the capulid on the host is on the right valve at the root of the ear. Sometimes the capulid will locate itself differently (Figure 7) and will remain there long enough to damage the mantle and cause distortion of the shell margin. Figure 8 is of a juvenile that has positioned itself at the root of the ear but on the left valve. The capulid may remain here or it may migrate to the corresponding position on the right valve.

Figure 9 is of five specimens of different sizes grouped on a specimen of *Pecten diegensis*. All were living but some were more dominant than others and grew faster or migrated to the pecten at a later time. Obviously, they move about on the host shell to feed. Some specimens remain in the normal position for a long

Fig. 8. *Capulus sericeus* 2.2 mm, on *Pecten sericeus*. Dredged 100 meters off Bahía San Carlos, Guaymas, Sonora, Mexico.

time and develop a tongue of shell material which extends beyond the margin covering the proboscis where it is inserted into the scallop. Many pectens have a slight gap below the ears when the valves are closed so the proboscis of the capulid can remain inserted. Where the opening to the host is narrow, repeated withdrawls and insertions of the proboscis may wear a deep notch in the shell of the host. This does not seem to be a result of damage to the mantle but a result of abrasion. A number of pecten valves bearing such scars have been examined. One large valve of *Pecten sericeus* has a semicircular notch 4 mm across and 3 mm deep. The notch is through shell material 2.5 mm thick and is strongly beveled from either side, indicating the capulid must have moved about in its position on the pecten.

Distortion of the normal cap-shaped shell occurs for two reasons. If the capulid is on a host shell which is strongly convex such as *Pecten vogdesi*, the shell is apt to develop higher than normal and with the protoconch overhanging the posterior slope. If the host pecten is nearly flat, such as *Pecten sericeus*, the capulid will be much lower in height and the posterior slope will extend well beyond the protoconch. Also, the margin will be more flaring and the shell will appear much larger. Thus, by using a larger area, nature equalizes the volume inside the shells of two animals situated differently.

The second factor causing distortion is the corrugation of the host shell. If the capulid remains fixed in the same position on the host all of its life, the margin will conform to the corrugation of the host. As the shell grows, the trace of these corrugations is built into the shell of the capulid (Figure 4).

Original descriptions and discussions of shell morphology center about such characteristics as form and relative position of the embryonic shell, radiating and concentric sculpture, form of the periostracum, internal and external color, and overall shell proportions. Within these

Fig. 9. *Capulus californicus* largest 13 mm, smallest 3 mm, on *Pecten diegensis*. SDNHM collections.

Fig. 10. *Capulus californicus* 50 mm, on *Pecten diegensis*. SDNHM collections.

parameters more than 30 specimens from the Gulf of California have been examined. Similarly, a number of specimens from off the coast of Southern California have been examined (Figures 9 and 10). Peruvian material was not available for study, but specimens from the coast of Sonora conform to the description of *Capulus ungaricoides*.

Differences in the protoconchs have been offered as one characteristic separating the three species: *Capulus californicus, C. sericeus,* and *C. ungaricoides*. Any large collection of specimens from the Gulf of California includes all of the specified variations. A more generalized description is offered here.

Protoconch: A low-spired coil of 2½ turns, dextral; 2 mm in maximum diameter; translucent, pale brown; a white embryonic coil of 1 turn immersed in the blunt tip; increasing through several growth stages to begin the teleoconch; aperture at termination of protoconch, oval, 1.5 mm major axis, 1 mm minor axis.

The plane of the coil of the protoconch may be as much as 15° on either side of the plane of the teleoconch when viewed vertically (Figure 7). Also, the plane of the protoconch may be on either side of the vertical when using the plane of the aperture of the teleoconch as the horizontal (Figure 3).

The protoconch may be high and free standing, not touching the posterior slope of the teleoconch (Figure 6). Or, the protoconch may be low, touching the posterior slope of the teleoconch, especially if it is broad and low.

Sculpture; The interior is marked by a horseshoe shaped muscle scar with the opening facing the lower right side of the aperture on most specimens. This is variable, depending on the curvature of the host shell and the relative position of the capulid on it. The interior also shows a broad low sinus extending from the interior of the protoconch down to the insertion point of the proboscis at the lower right margin.

External sculpture is of a variable number of fine threads which begin early on the protoconch and radiate across what appears to be the dorsum of the teleoconch all the way to the margin. On some specimens these threads become obsolete shortly beyond the protoconch. The internal sinus reflects through the thin shell as a broad low ridge. If a marginal tongue of shell is present, it will be at the end of this ridge.

Periostracum: A visible periostracum begins soon after the embryonic shell and is laid down in narrow concentric plates, translucent and beige in color. The underlying radiating threads are marked by radiating rows of fine extrusions of periostracum. When the specimen dries, the concentric ribbons of periostracum are broken by radiating cracks, giving a velvety effect. The lower the inflation of the capulid shell, the greater is the cracking and the more velvety the surface.

Color: Basic shell color is pale ivory when fresh, fading to white when aged. The interior varies from rose pink in some specimens to completely white in others. The pink interior of some dead specimens may linger long after the exterior is eroded and dull gray.

The exterior may be marked by irregular broad rays of rose brown which may show through to the interior (Figure 6). These rays are sometimes strong enough to show through the dense periostracum; but many specimens give no evidence of such rays.

Fretter & Graham (1981) give a useful discussion of the reproductive and feeding habits of *Capulus ungaricus* (Linnaeus, 1758). This is a species found from Norway to West Africa and the Mediterranean and from Greenland to Florida and Bermuda.

The above observations point up the difficulty of developing criteria pertaining to shell morphology which will differentiate among the three species discussed. Perhaps comparative anatomical work will establish fundamental differences. Until this is done the validity of the three species of *Capulus* in the eastern Pacific will remain questionable.

I thank Anthony D'Attilio (Department of Marine Invertebrates, San Diego Natural History Museum) for making the specimens from California available for study. Appreciation is also due David Mulliner (Research Associate, SDNHM) for technical assistance in the preparation of the illustrations.

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1927. Ibid. 2(3):111, pl. 91, figs. 15-16.

AND THEN THERE WAS AUCTION '82

BY

PAT SAGE

Club history will laud the successful '82 auction/potluck as a fun lover's milieu. Auctioneers Dave Mulliner, Sandie Seckington, Carole Hertz and Marty Schuler zipped through the lovely specimens at a humorous, fast-paced clip, leaving members and guests in a constant state of anticipation for the next, and then the next exciting contribution such as:Tony D'Attilio's drawing of *Ocenebra barbarensis*, Helmut Meier models, *Angaria vicdani* (not one, but two!), *Angaria sphaerula*, numerous specimens of *Spondylus, Conus kintoki, Harpa doris* and on and on. Only a very small number of specimens were relegated to next year's auction.

Food donors outdid themselves again this year and Dave Mulliner's punch was, as usual, outstanding. Needless to say, diets were in jeopardy.

The Club wishes to express sincere gratitude to all donors, workers, buyers, and to June King's usual expert coordination of menu planning. A special thanks to Club President, Marty Schuler, for hosting our grand, fun-filled, annual affair.

FOR YOUR INFORMATION

The San Diego Shell Club's Science Fair winner for this year is Steven Barnett, a tenth grader at La Jolla High School. His project is entitled, "Environment Preference of Abalone." He will present a summary of his project and receive his Club award at an upcoming Club meeting.

The Conchologists of America's annual convention (and tenth anniversary) will be held at the Sundial Beach Hotel on Sanibel Island, Florida from July 14-17. Field trips, auction and dealers' bourse are some of the special events planned. For further information contact Richard L. Goldberg, 49-77 Fresh Meadow Lane, Flushing, NY 11365. Registration packet can be obtained by writing Mrs. John Stevens, Box 217, 425 Lighthouse Way, Sanibel, FL 33957.

New Member

Shasky, Donald R., 229 Cajon Street, Redlands, CA 92373

THE FLANGE AS A MODIFICATION OF VARICAL SCULPTURE IN THE MURICIDAE

BY

ANTHONY D'ATTILIO

Department of Marine Invertebrates, San Diego Natural History Museum, Balboa Park, P.O. Box 1390, San Diego, California 92112

The genera *Pterynotus, Purpurellus* and *Murexiella* possessing a flange or blade-like extension over the varix are treated here. The species selected demonstrate, in part, the degree of these sculptural differences. The flanges, like the spines treated in a previous paper [Festivus 14(3):33-35] are extensions of the spiral sculpture. They project above the varix forming a buttress-like support for the flanges at the area closest to the shell. Older varices frequently have the flange broken in part or completely depending on the species involved. The particular ecological conditions of species having a wide-spread geographical distribution affects the condition of the flange. Most members of the genera enumerated here also have the superfamily characteristic of a fine or coarse scabrous lamellate surface.

Similar sculptural elements are found in the related subfamilies Ocenebrinae and Trophoninae as well as Typhinae and some of these will be discussed and illustrated in later issues of the Festivus.

Pterynotus pinnatus Swainson, 1833
= *Murex pinnatus* Swainson, 1822

The flange in this species has a simple, ruffled surface which is more or less appressed from whorl to whorl and extends from the suture to the canal on the body whorl. See Figure 1.

Pterynotus elongatus (Lightfoot, 1786)

This species resembles *P. pinnatus* in its possession of a continuous flange on the body whorl. On the spire of *P. elongatus* the flange is formed into broad, hooked spines. See Figure 2.

Pterynotus orchidiflorus Shikama, 1973

The flange is weakly or strongly lobed and moderately appressed from whorl to whorl. In this species the flange on the body whorl extends only to the start of the siphonal canal. The canal has three to four distinct spines of varying lengths. See Figure 3.

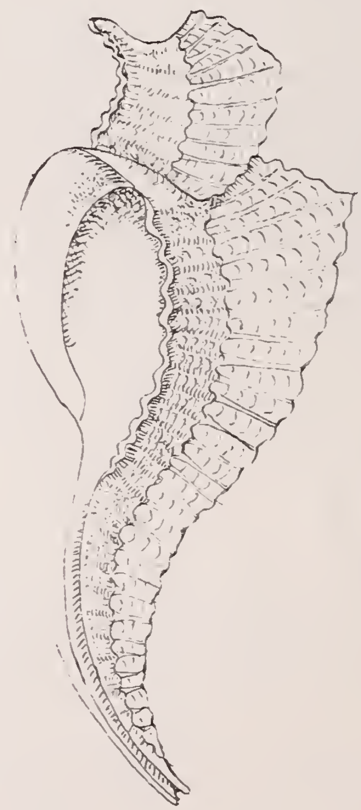

Fig. 1. Detail of *P. pinnatus*

Fig. 2. Detail of *P. elongatus*

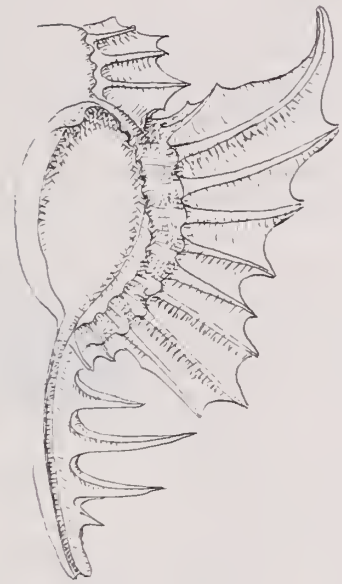

Fig. 3. Detail of *P. orchidiflorus*

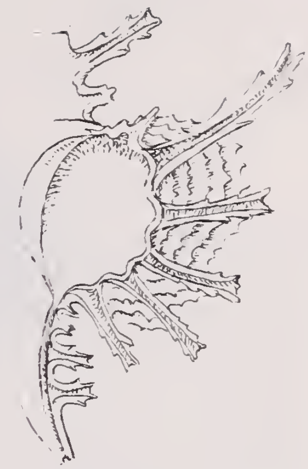

Fig. 4. Detail of *M. hidalgoi*

Murexiella hidalgoi (Crosse, 1869)

This genus is based on the type *hidalgoi* and a few other species of similar form. A diminution of the strength of the sculpture in *Murexiella* leads gradually into the sculptural nature of the genus *Favartia*. The flange in *M. hidalgoi* (Figure 4) actually consists of a few open spines with a connecting web-like structure. The spines normally project beyond the webbed flange. In addition, the leading or ventral side of the web reveals a series of overlapping lamellae, the margins of which are undulate, leading presumably to a strengthening of the varix. There is no flange connecting the spines on the canal.

Purpurellus gambiensis (Reeve, 1845)

In *Purpurellus* the posterior portion of the spine appears to be doubled over towards the anterior end. Though the margin of the overlapping portion of the spine is visible, it is tightly appressed. The flange in *Purpurellus* extends to the distal portion of the canal (Figure 5). Most frequently the flange is strongly indented on the canal forming a separate lobe. This genus is equivocal in having a Muricinae radula and an entirely sealed canal which does not resemble that of the Ocenebrinae.

Variations of these varical flanges or flange and spine combinations are also found in other genera such as *Siratus* and *Naquetia*.

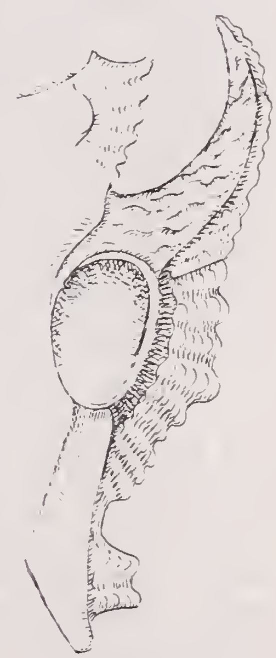

Fig. 5. Detail of *P. gambiensis*.

RUMINA DECOLLATA (LINNAEUS, 1758): A BELATED WELCOME TO SAN DIEGO

BY

CAROLE M. HERTZ

Department of Marine Invertebrates, San Diego Natural History Museum, Balboa Park
P.O. Box 1390, San Diego, California 92112

In 1966, T.W. Fisher of the Department of Biological Control, U.C. Riverside, reported on the appearance of *Rumina decollata* (Figure 1) in California [Veliger 9(1): 16]. Commenting on this "first infestation" in Riverside, California, he stated, "The quarantine status of *Rumina decollata* as a potential pest in California is set forth in the State of California Department of Agriculture Quarantine Memorandum E-83 (1958)." In 1966 it was believed that *R. decollata* was already in California for seven to ten years. Testing of molluscicides for the elimination of *R. decollata* began in 1966 since the then available commercial baits were not effective.

In 1974 Dr. Fisher updated the information on *R. decollata* [Veliger 16(3): 334-335]. By this time *R. decollata*, or the decollate snail, was found to be widely distributed in localized populations in the counties of Imperial, Kern, Los Angeles, Orange, Riverside, San Bernadino, San Diego, and Ventura, "but eradication is not considered feasible nor necessary."

Dr. Fisher had observed that where *R. decollata* was present, the brown garden snail *Cryptomphalus (Helix) aspersa* (Müller, 1776) was either absent or present in much smaller numbers than *Rumina*. Also, no direct evidence was found showing that *R. decollata* fed on growing plant material. In the 1974 report Dr. Fisher raised the possibility that the decollate snail might be used for biological control of the brown garden snail.

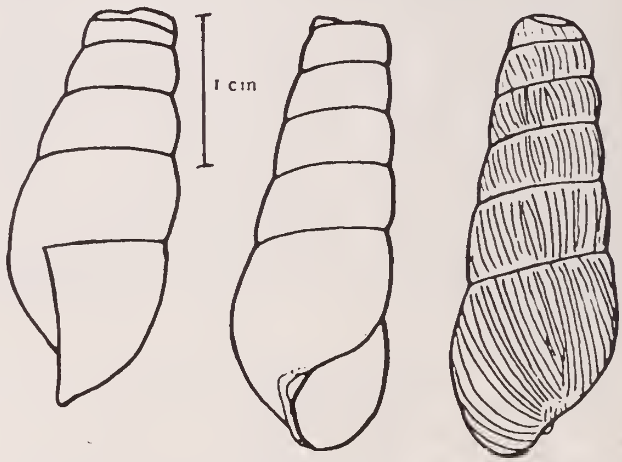

Figure 1
Rumina decollata (LINNAEUS, 1758): Sketch of shell from three aspects. The decollate shell is the "tip-off."

Figure 1. *Rumina decollata* from Veliger 9(1):16.

The decollate snail evolved in North Africa and is quite common in the area near the Mediterranean Sea. It was first detected in the United States in 1813 in South Carolina and is now in thirteen states. Since *Rumina decollata* is a burrowing snail its eggs and juveniles are not easily detected in commercial shipments of plants. Studies of the decollate snail in home gardens show it feeds on "leaves of *Dichondra*, baby tears and violets, on cotyledons of germinating seeds, on very young seedlings and on flower petals. It is not clear if the decollate snail initiates this sort of feeding or if it follows mechanical bruising caused by pruning, mowing, human or animal traffic or initial bites by primary plant feeders... After several leaves have been formed the decollate snail usually has little further interest in the plants (Fisher, Orth, Swanson, 1982).

Recently Mr. George Opel, head of the Integrated Pest Management Unit of the San Diego Department of Agriculture, Biological Control, visited the San Diego Natural

History Museum. He stated that *Rumina decollata* is definitely considered a beneficial mollusk as a successful predator on the brown garden snail, *Cryptomphalus (Helix) aspersa*. In fact it is sold as such at commercial insectories and information on introducing and encouraging *R. decollata* in citrus groves has been published. (Fisher, Orth, Swanson, 1982).

Before rejoicing that the days of the California brown snail are numbered, consider that Mr. Opel reported two other herbivorous land mollusks in Southern California: *Otala lactea* (Müller, 1821) shown in Figure 2 has been found in the Encanto area and in citrus in Escondido and *Helix aperta* Müller, 1821 (Figure 3) is in the San Ysidro area.

955.a 955.b

Figure 2. *Otala lactea* from Conchologia Iconica, plate 47, figures 955a, 955b.

1063.

Figure 3. *Helix aperta* from Conchologia Iconica, plate 161, figure 1063.

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Fisher, Theodore W., Robert E. Orth, Stuart C. Swanson
1982. Snail against snail. Pest Control Circular, No. 529, Pest Control Dept., Sunkist Growers, Inc., Van Nuys, CA. pp. 15, 16.

WARNING: SHELLFISH QUARANTINE

The state Department of Health Services has issued its annual shellfish quarantine effective through October 31. Dr. Donald Ramras, of the San Diego County Health Department, warned of the danger of paralytic shellfish poisoning from eating mussels, rock scallops and clams from the coast of San Diego county until October 31. The mollusks feed on *Gonyaulax catenella*, a dinoflagellate, which produces the poison which becomes concentrated in the shellfish and can affect the nervous systems of humans who eat them.

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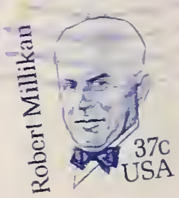

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VOL. XIV JUNE 1982 NO. 6

PROGRAM: Dr. Bert Kobayashi will give an illustrated lecture on the marine nature preserve in La Jolla, California.

Slides of the Club Auction/Potluck will also be shown.

DATE: June 17, 1982 TIME: 7:30 P.M. ROOM: 104

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MASSIVE SETTLEMENT OF LEPTOPECTEN MONOTIMERIS (CONRAD, 1837) ON MACROCYSTIS AT POINT LOMA

BY

R. H. McPEAK & DALE A. GLANTZ

Kelco, Division of Merck, Inc., 2145 East Belt Street
San Diego, California 92113

McLean (1978) recognized two species of *Leptopecten*, *L. latiauratus* (Conrad, 1837) and the kelp scallop *L. monotimeris* (Conrad, 1837). *L. latiauratus* has a small, thin shell with a diameter of 10-22 mm. The shell has 12-16 ribs and the concentric lamellae are strong. *L. monotimeris* is larger, having a shell diameter of 20-33 mm. The ribs of the shell are rounded and the concentric lamellae are absent. *L. latiauratus* is brownish with markings of white and darker brown, while *L. monotimeris* is yellow or orange-brown with diagonal or chevron shaped markings of white and darker brown (Figure 1). *L. latiauratus* ranges from Point Reyes, California to Cabo San Lucas and the Gulf of California while *L. monotimeris* ranges from Santa Barbara County, California to southern Baja California. McLean (1978) reports *L. latiauratus* as occurring on rocks or pilings in bays and on off-shore bottoms attached to debris and worm tubes while *L. monotimeris* attaches to rocks, elk kelp (*Pelagophycus*), and giant kelp (*Macrocystis*) in open water, and *Zostera* in bays.

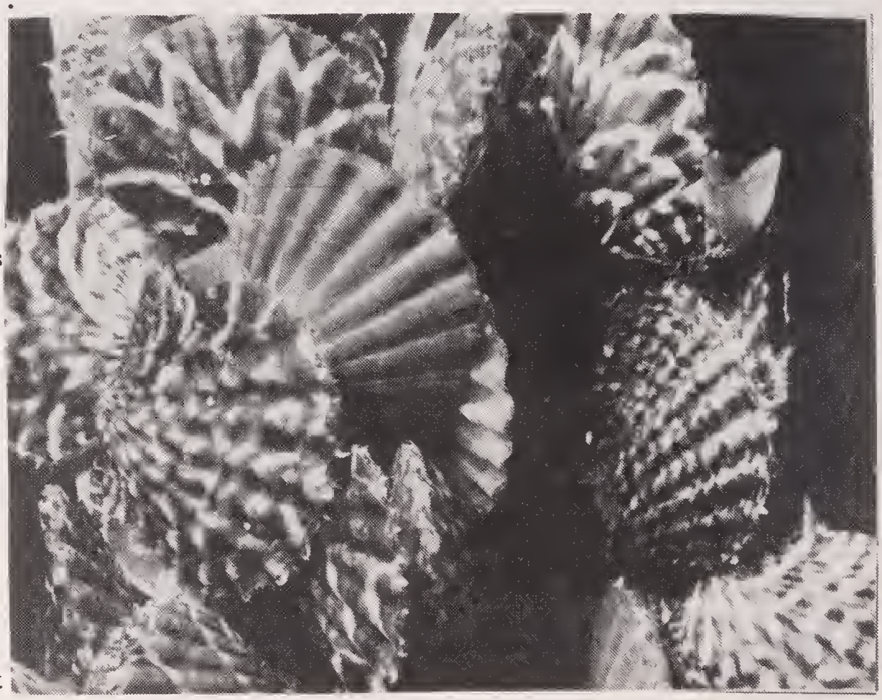

Fig. 1. *Leptopecten monotimeris*, closeup on kelp fronds showing chevron shaped markings.

Many authors, in the past, referred to the open ocean *Leptopecten* as *L. latiauratus*: Limbaugh (1955), Clendenning (1960), Carlisle, et al. (1964), Turner, et al. (1969). We suspect that these authors were actually dealing with *L. monotimeris*. A specimen identified as *L. latiauratus* in a Department of Fish and Game publication (Carlisle, et al, 1964) was kindly sent to us by Ken Wilson of the California Department of Fish and Game. The specimen was collected from "Hilda," a Standard Oil platform off Summerland, California. Carole M. Hertz and Barbara W. Myers, San Diego Natural History Museum Department Assistants, identified the specimen as *L. monotimeris*. Specimens collected on giant kelp reported in this publication, were also identified as *L. monotimeris* by Hertz and Myers. In this publication, we consider literature reports of open ocean *Leptopecten* collected on giant

kelp, elk kelp, or offshore structures to be *L. monotimeris*.

The massive *Leptopecten* settlement was observed on the Standard Oil platform "Hazel" in August 1958, one month after the platform was completed (Carlisle, et al, 1964). "Hazel" is located approximately two miles off Summerland in 100 ft. of water. The *Leptopecten* was dominant until 1959 when bay mussels *Mytilus edulis* (Linnaeus, 1758) began to take over. A year later, in August 1960, the kelp scallops were non-existent except for a few hardy individuals buried deep in the masses of bay mussels. The kelp scallops were in spawning condition throughout the year and tiny scallops, less than 1 mm, were observed almost every month. Mature scallops with ripe gonads were observed within six months of settlement. During January 1959, there were 533 scallops/ft^2 (Carlisle, et al., 1964). Moderate settlement of *Leptopecten* was reported on "Hilda" in August 1960. By July 1961, bay mussels were taking over most available space on "Hilda".

Turner, et al (1969) noted that the massive *Leptopecten* settlement on the offshore oil platforms in 1958 and 1959 coincided with the warm water years (1957-1959) along the southern California coast (Radovich, 1961). They assumed that the subsequent disappearance of the kelp scallops was related to the cooler water temperatures which occurred from 1960 through 1963. Glenn R. VanBlaricom (pers. comm.), however, observed massive settlement of *Leptopecten* in 1975, the coldest year on record since Scripps Institution of Oceanography began taking surface water temperatures in 1917. The observation was made on a man-made reef known as the "San Diego-La Jolla Underwater Park Reef," located in 40 ft. of water. The reef was constructed from large quarry boulders in April 1975. On September 18, 1975 the entire reef was covered with small *Leptopecten* (VanBlaricom, pers. comm.).

We observed and photographed *Leptopecten* on the elk kelp, *Pelagophycus porra* (Figure 2). MacGinitie & MacGinitie (1949) and Limbaugh (1955) reported enormous numbers of *Leptopecten* settling on *Pelagophycus* at mid-depths. *Pelagophycus,* an annual, attaches to the substrate with a small holdfast. A long stipe (stem) extends from the holdfast upwards to a large bladder. Several blade-bearing stalks arise from the top of the bladder. Blades (generally numbering 12-16) can reach lengths of 60 ft. and are frequently held out by currents. Plants are generally subsurface and only rarely grow to reach the surface. Elk kelp populations occur offshore of *Macrocystis* beds in water ranging from 60 to 100 ft. depth.

Fig. 2. *L. monotimeris* on the elk kelp, *Pelagophycus porra.*

Jack Hatton (pers. comm.) harvested kelp commercially by hand off Point Loma during the early 1930's. He recalls wearing large gloves to protect hands and arms from being cut by scallops which covered the kelp. Interestingly, the scallops were sold as feed to San Diego County chicken ranches.

Limbaugh (1955) observed large numbers of *Leptopecten* attached to *Macrocystis.* Clendenning (1960) reported accumulations so dense on *Macrocystis* fronds at Point Loma that some of the plants sank to the bottom. In October 1959, kelp scallops were

also observed in quantities abundant enough to sink *Macrocystis* fronds on the Richfield Oil Island at Rincon, California (Carlisle, et al, 1964).

Macrocystis attaches to the rocky substrate by a holdfast. Fronds originate at the base of the plant near the holdfast and eventually grow to the surface. These fronds consist of a stem-like stipe, numerous blades, and gas-filled bladders which serve to float the fronds away from the bottom. Even though the plant is a perennial, individual fronds only live for approximately six months before breaking away. Mature plants may consist of more than 100 fronds with only a portion of these fronds reaching the surface. The remainder of the fronds are considered juvenile and will eventually reach the surface.

Kelco biologists observed a massive *L. monotimeris* settlement on juvenile *Macrocystis* at south Point Loma during October 1977 (Figure 3). The site of the observation was within a 70 acre "hole" in the kelp bed (Figure 4). The bottom substrate within the "hole" was dominated by purple sea urchins *Strongylocentrotus purpuratus* and red sea urchins, *S. franciscanus* during early 1977. The sea urchins were controlled during the spring of 1977. Subsequently, on May 3, 1977, tiny kelp plants were observed. Excellent recruitment of *Macrocystis* (1 to 4 inches high) was noted throughout the area on June 1, 1977. Water depth was approximately 45 ft. (13.7 m). Videotapes were made on August 4 and 5, 1977, at which time the plants were extremely dense and had grown to 20 ft. in height. "Tiny white flecks" were observed on the *Macrocystis* blades, while reviewing the tapes. The "tiny white flecks" might have been juvenile *L. monotimeris*. R.H. McPeak, J. Duffy (California Department of Fish and Game), and M.J. Tegner (Scripps Institution of Oceanography) conducted a diving survey among the subsurface juvenile *Macrocystis* plants on October 19, 1977, and reported massive settlement of *L. monotimeris* (Figure 5). The *Leptopecten* were dense enough to cause some of the plants to sink (Figure 6). The scallops presumably settled during July only upon juvenile *Macrocystis* which had grown to a height of approximately 15 ft. (4.5m). Surprisingly, the scallops did not settle upon nearby adult canopy-producing plants.

Fig. 3. *L. monotimeris* settlement on juvenile *Macrocystis* at Point Loma, October, 1977.

Numerous *Macrocystis* plants develop on a square meter of bottom when conditions are optimal. After a year of development, only a few plants remain on the square meter of the bottom. There were 10-20 juvenile *Macrocystis* per square meter on October 19, 1977. Many of the young plants were tangled and it was from one such mass that we surveyed the distribution of scallops along the vertical length of the plants. Two entangled plants, consisting of four fronds each were collected. The plants were 12.8 meters in length and were approximately one meter beneath the surface. A total of 198 scallops were distributed along the plants as follows:

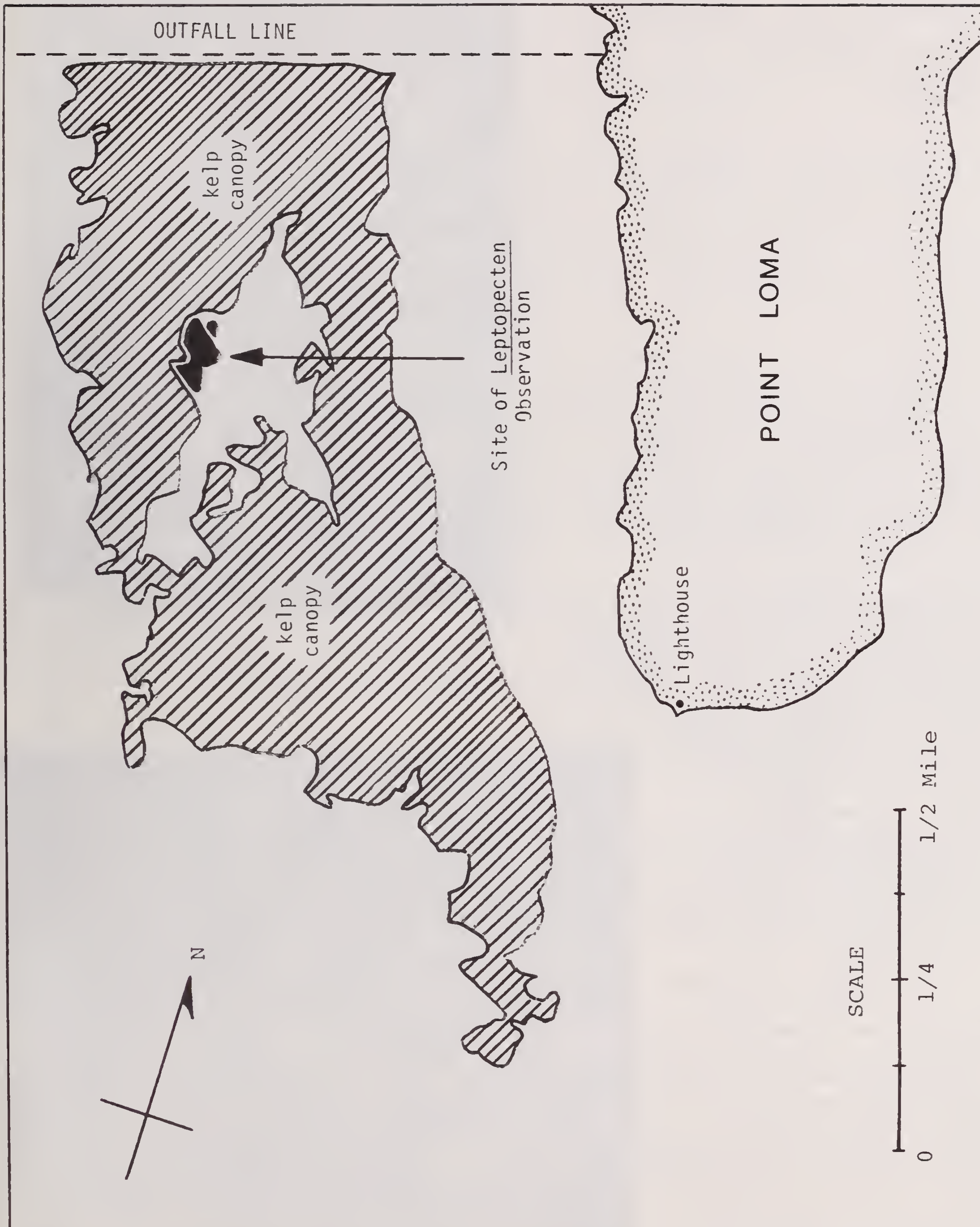

Fig. 4. Site of *Leptopecten* observation on *Macrocystis*.

DISTANCE (METERS)	NUMBER OR LEPTOPECTEN
12-12.8 (distal end)	0
11-12	0
10-11	0
9-10	9
8-9	101
7-8	54
6-7	11
5-6	16
4-5	7
3-4	0
2-3	0
1-2	0
0-1 (base)	0
	198

The 198 scallops weighed a total of 0.29 kg., while the kelp plants weighed 3.4 kg. In this instance, *L. monotimeris* settlement was "moderate: and the kelp plants did not sink. Three additional groups of entangled plants with "heavy" scallop coverage were collected. A total of 1219 scallops weighing 1.79 kg. were collected on one group of plants. The plants weighed 3.18 kg. and were sunk by the scallops. Two plant groups did not sink. These plants weighed 4.74 kg. and 5.52 kg. and contained 1106 and 1766 scallops, respectively. The 1106 scallops weighed 1.62 kg. and the 1766 scallops weighed 2.60 kg.

The dense settlement of *L. monotimeris* during 1977 resulted in the demise of some juvenile *Macrocystis* when the plants sank. Only a portion of the *Macrocystis* population within the "hole" was lost. Plants with moderate numbers of scallops reached the surface by early November 1977 and produced healthy canopy.

Little is known about the reproductive biology of *Leptopecten*. Carlisle, et al (1964) observed that *Leptopecten* had high year-round reproductive capabilities while Turner, et al (1969) noted that *Leptopecten* larvae were always present in

Fig. 5. Massive *Leptopecten* settlement on *Macrocystis* at Point Loma, October 1977. The weight of these *Leptopecten* did not sink the kelp plants.

Fig. 6. Massive *Leptopecten* settlement on *Macrocystis* resulted in sinking the kelp plants.

the water column during their man-made reef studies.

Massive settlement of *Leptopecten* at Point Loma may have resulted from localized response to reduced predation by senorita fish, *Oxyjulis*. Bernstein (1977) noted that senorita fish are quite efficient at regulating *Leptopecten* populations in the Point Loma kelp bed. He observed kelp scallops on caged plates which were protected from *Oxyjulis*, while none appeared on uncaged plates (Bernstein, 1977). The absence of or a reduction in predation could trigger a significant increase in the *Leptopecten* population.

It is difficult to understand why the *Leptopecten* larvae apparently preferred subsurface juvenile *Macrocystis* to nearby adult *Macrocystis*. The adult plants did consist of both juvenile (subsurface) and mature (canopy producing) fronds, while the young plants consisted of only juvenile fronds. Dense, mature, surface canopy can reduce light by as much as 90%. Larvae of bivalves and other invertebrates respond to a variety of stimuli including light and temperature (Crisp, 1974). Many invertebrate larvae have a photopositive response (Crisp, 1974). It is possible that settling *Leptopecten* larvae preferred increased light at mid-depths rather than low light beneath the mature *Macrocystis* canopies.

Pearse, et al (1970) observed that sea urchins at Point Loma recruited in barren areas devoid of *Macrocystis*. They noted that sea urchin recruitment declined following reforestation of the barren areas with *Macrocystis*. The authors postulated that filter feeding organisms, living on adult *Macrocystis*, were effectively limiting larval sea urchin settlement. Tegner (1980) also noted an increase in red sea urchin recruitment after *Macrocystis* canopy was eliminated by grazing at Point Loma. After canopy returned, Tegner (1980) noted a reduction in sea urchin recruitment. Thus, *Leptopecten* larvae may have effectively been removed by filter feeding organisms living on adult *Macrocystis* while larvae were able to successfully settle on juvenile fronds free of filtering organisms.

The mid-depth occurrence of *L. monotimeris* might be partially explained by larval settlement response to temperature. Yoshioka (1973) studied the larval temperature dependence of the bryozoan *Membranipora*. The author found that there was a scarcity of *Membranipora* larvae in warm surface waters above the thermocline during summer months. He observed that *Membranipora* larvae were negatively buoyant and avoided warm water by ceasing swimming temporarily and sinking to deeper, cooler water. On August 4, 1977 the surface temperature at Point Loma was 69.5°F while the bottom temperature was a chilly 55°F. It is possible that *Leptopecten* larvae preferred the cooler mid-depth temperatures.

Additional information on the reproductive biology and larval life history of *Leptopecten monotimeris* is needed to fully understand the reasons for massive settlement of this interesting bivalve. Kelco biologists spend considerable time diving and evaluating the Point Loma kelp beds. They plan to record and study additional occurrences of *Leptopecten* in hopes of better understanding the complexities of this interesting nearshore environment.

Acknowledgments

We wish to thank Barbara Myers and Carole Hertz, San Diego Natural History Museum Department Assistants, for identifying the *Leptopecten* specimens; and Ken Wilson of the California Department of Fish and Game for providing a specimen collected on "Hilda". We are thankful to Dr. Glenn VanBlaricom for information on the occurrence of *Leptopecten* during 1975. Warren Miels, a Kelco Marine Technician, was very helpful in collecting and evaluating the kelp plants with attached *Leptopecten*. We are very grateful to David K. Mulliner, Festivus staff photographer, for preparing black and white photographs from the original slides.

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COLORFUL NEW ADDITIONS TO OUR CLUB LIBRARY

By

BARBARA W. MYERS

Department of Marine Invertebrates, San Diego Natural History Museum, Balboa Park, P.O. Box 1390, San Diego, California 92112

A COLLECTOR'S GUIDE TO SEASHELLS OF THE WORLD
By Jerome M. Eisenberg, 1981.
McGraw Hill, New York. 239 pages, 158 color plates. ISBN 0-07-019140-9
Price: $24.95.

The two cover pictures and the first 11 color plates are stunning professional photographs of the highest quality and an exciting entree to this book. Perhaps because one is shown the best at the beginning, the remaining plates seem disappointing by comparison. The problem with these remaining plates is that too often the backgrounds blend with the color of the shells photographed resulting in a loss of definition. As the average number of specimens per plate is 15, choosing a background suitable to all 15 specimens was obviously a problem. However, as I progressed through the book, I found that the photographs are very well executed and identity can usually be made for each species.

The number of plates (158) and the number of pictured specimens (4000) representing 2600 species is impressive. Species are arranged by family with indication of size and the book is easy to use. Minimal species information is given and there are no descriptions.

The index gives values in dollars for the species illustrated plus values for additional well-known species.

The book, as the author states in his introduction, is intended for collectors. He chose species most often bought, sold, or traded. Within its limitations I find this book a valuable and attractive addition to our Library.

MITRE SHELLS FROM THE PACIFIC AND INDIAN OCEAN
By Peter Pechar, Chris Prior & Brian Parkinson.
Robert Brown and Associates, Australia. 56 color plates. Nat'l Lib. Austral. Reg. No. 0 909 197 11 3.
Price: $19.95.

This book also is a collection of color plates with minimal information and no species descriptions. The plates (56) have contrasting backgrounds that show these mitre shells to best advantage. The arrangement of the specimens on the plates is pleasing. Similar species are placed together to point out differences and color forms are photographed together to show similarities. Plate 36, for instance, shows 16 different color forms of *Vexillum vulpecula* (Linnaeus, 1758).

In 1976 Walter Cernorhorsky recognized 375 Recent species of Mitridae. Out of 680 specimens photographed in this book, 270 species are represented.

This book has a more limited use than the previous one because of its focus on one family.

COLLECTING IN SAN FELIPE: AN AMATEUR'S PERSPECTIVE

BY

PAT SAGE

1635 Lanoitan Avenue, National City, California 92050

In the company of several "seasoned" collectors, I recently made a three-day shelling excursion to San Felipe, Baja California, Mexico, which was filled with many delightful learning experiences.....not the least of which was driving, under the guidance of long-time resident Joyce Gemmell, directly to the collecting areas.

Expectations were running high on the morning of April 24, 1982, as all of us piled into Dave Mulliner's truck for the first outing at Punta San Felipe. Catching the first good low tide (-5.8') entailed rising early enough to depart at 6:10 A.M. Unfortunately few, if any of our group, had managed a good night's sleep in view of neighboring all-night revelers singing the praises of Bacchus.

Knowledge coupled with experience develops "Collector's Eyes" and the congenial "old-hats" were most accommodating in sharing their "eyes" with the novice among them. Separating the experienced collector from the beginner takes only a glance at the "goody-bags" before even one specimen has been taken. In the "smaller" container one will see such items as a knife, a small hammer and chisel, capped bottles .... and gloves!!! Chomping at the bit to get underway, the uninitiated in the fine art of collecting gives no thought to these needs and consequently neglects taking them along. Of course, some "experts" forget the gloves and suffer cuts along with the beginner.

The quest for the day was established as *Typhis clarki* and *Turritella anactor*. Before the first foot bogged down in the mud "Mr. Eagle Eyes" Hertz announced he had found a *Turritella* - and his was also the first voice to lay claim to a *Typhis*. Then, one by one, Joyce Gemmell, Marty Schuler and Peggy and Dave Mulliner had each found a *Typhis* - sometimes two, until there was just Carole Hertz and me left who had not been able to distinguish the mud from the animal. As I was beginning to remind myself of my husband in search of his glasses - knowing they are there but not "seeing" them, Carole found hers. Finally Joyce called me over and put her finger on one allowing me to take it for my own. Introductions having been made, success became apparent when shortly thereafter I was able to shout with glee, "I found one."

The three hours spent on Punta San Felipe were a series of "show and tell" delights. The midshipman fish (*Porichthys notatus*) protecting eggs laid on the bottom of a rock and its grunting, unwelcome sounds directed at the intruders - the camouflage of the *Arca* and *Chama* - the beautiful little frog fish (*Antennarius avalonis*) Dave took alive for photographing - the nudibranchs that Marty and Dave discovered - the nondescript, muddy *Argopecten circularis* that later inspired the sacrifice of two toothbrushes to reveal their true, beautiful colors - all these, and more were new discoveries for this beholder. It was a fine, instructive morning in spite of lack of sleep, the heat, mucky-mud, dehydration and genuine weariness.

The obstacle course encountered on the way to Playa Alicia on April 25th is in itself a topic best left to a man and his government. We outwitted the pitfalls along the way however, and arrived there in short order without mishap.

In view of the newly developing Punta Estrella nearby, it seemed that in no time at all the reef became well-populated with campers, fishermen and nationals in search of succulent seafood dinners. The reef with all its fascinations did not yield a great variety of specimens (even though two more *Typhis clarki* were collected). The fun part

of collecting for me on that day was more rewarding on the beach with the sand-dwelling Turridae, Terebridae, Olividae, Columbellidae and Turritellidae.

April 26th, our last morning was spent at Ensenada Blanca adjacent to Punta San Felipe. After wrestling with small boulders for awhile this weakling gave up the rocky area on the point and concentrated on the sandy areas again. All too soon it was time to go, and being the most reluctant to leave, I was the last to board the truck.

Now, in the final stages of cleaning and sorting my treasures, I have noted a total number of 52 species - as yet, not all identified. In thinking back on the trip - the camaraderie of friendly people - the fish tacos - the daily cocktail hour - the shrimp we enjoyed (but could not obtain to bring home because of some new government regulation that has depressed the retailers' trade) - the Mexican bread and pastries - the clear, clear evening skies revealing stars one rarely sees anymore, there are but two items I would have added and they are: (1) my husband and (2) more time.

IN MEMORIAM

JANE STOTTER

It is with regret that we report the passing of Jane Stotter at age 73. Jane died on Wednesday, June 2, 1982 in a hospital. She was a charter member of The San Diego Shell Club and was active in Club affairs for many years.

FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING: 20 MAY 1982

BY

PAT SAGE

The May meeting was called to order by President Marty Schuler at 7:45 P.M. Vice-President Bill Perrin introduced the distinguished speaker, Dr. James H. McLean of the Los Angeles County Museum of Natural History who gave a report on his studies of limpets collected from the hydro-thermal rifts, illustrated with magnificent slides. Results of his studies thus far indicate a new superfamily will be named at the conclusion of his project.

After the coffee/cookie break, a short business meeting was held. Treasurer Wally Robertson reported on the highly successful '82 Auction and the solvency of the Club and Festivus for another year. Bill Perrin noted that speakers for several upcoming meetings have been scheduled as well as a special July presentation by '82 Science

Margaret Mulliner, Treasurer of the Western Society of Malacologists, informed members of procedures for late registration for the June meeting at Redlands, California.

The Shell drawing winner for the evening was Don Pisor. The meeting was adjourned at 9:45 P.M.

CORRECTION: Vol. XIV(5):60, line 25 erroneously written *Cryptomphalus (Helix) aspersa* should read *Helix (Cryptomphalus) aspersa*.

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MEETS THIRD THURSDAY, 7:30 P.M.
ROOM 104, CASA DEL PRADO, BALBOA PARK

President....................Martin Schuler
Vice President...............Bill Perrin
Secretary....................Pat Sage
Treasurer....................Walter Robertson
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CLUB ADDRESS: Address all correspondence to San Diego Shell Club Inc., c/o 3883 Mt. Blackburn Ave., San Diego, California 92111.

VOL. XIV JULY 1982 NO. 7

PROGRAM: Frank King will give an illustrated talk which he has entitled, "Shelling Off the Edge of the Earth."

Steven Barnett, the Club's 1982 Science Fair winner will present a summary of his winning project, "Environment Preference of Abalone."

DATE: July 15, 1982 TIME: 7:30 P.M. ROOM: 104

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LYRIA (ENAETA) CUMINGII (BRODERIP, 1832): AN UNUSUAL FIND IN SAN FELIPE, BAJA CALIFORNIA, MEXICO

BY

JULES HERTZ

Department of Marine Invertebrates, San Diego Natural History Museum, Balboa Park, P.O. Box 1390, San Diego, California 92112

On 26 April 1982, I found a mature specimen of *Lyria (Enaeta) cumingii* (Broderip, 1832) at Ensenada Blanca, San Felipe, Baja California, Mexico. The live specimen was collected at low tide (-4.1') emerging from sand at the edge of the low tide zone. The lump in the sand resembled that typically formed by the common *Oliva incrassata* (Lightfoot, 1786). The specimen shown in Figure 1 measures 31.7mm by 14.5mm. The photographs are by Festivus staff photographer, David K. Mulliner.

Keen (1971) reports the distribution of *Lyria cumingii* from Magdalena Bay, Baja California through the Gulf of California and south to Peru. DuShane and Sphon (1968) reported it from Bahía San Luis Gonzaga and Bahía Willard, Baja California. Eight live specimens were also collected at Bahia Willard by Joyce Gemmell (pers. comm.) intertidally at a rare extreme low tide on April 20, 1967. DuShane (1962) reported a single specimen collected by Emery Chace at Puertecitos, Baja California. This latter reference was to *Lyria pedersenii* (Verrill, 1870) which Keen (1971) placed in the synonymy of *L. cumingii*.

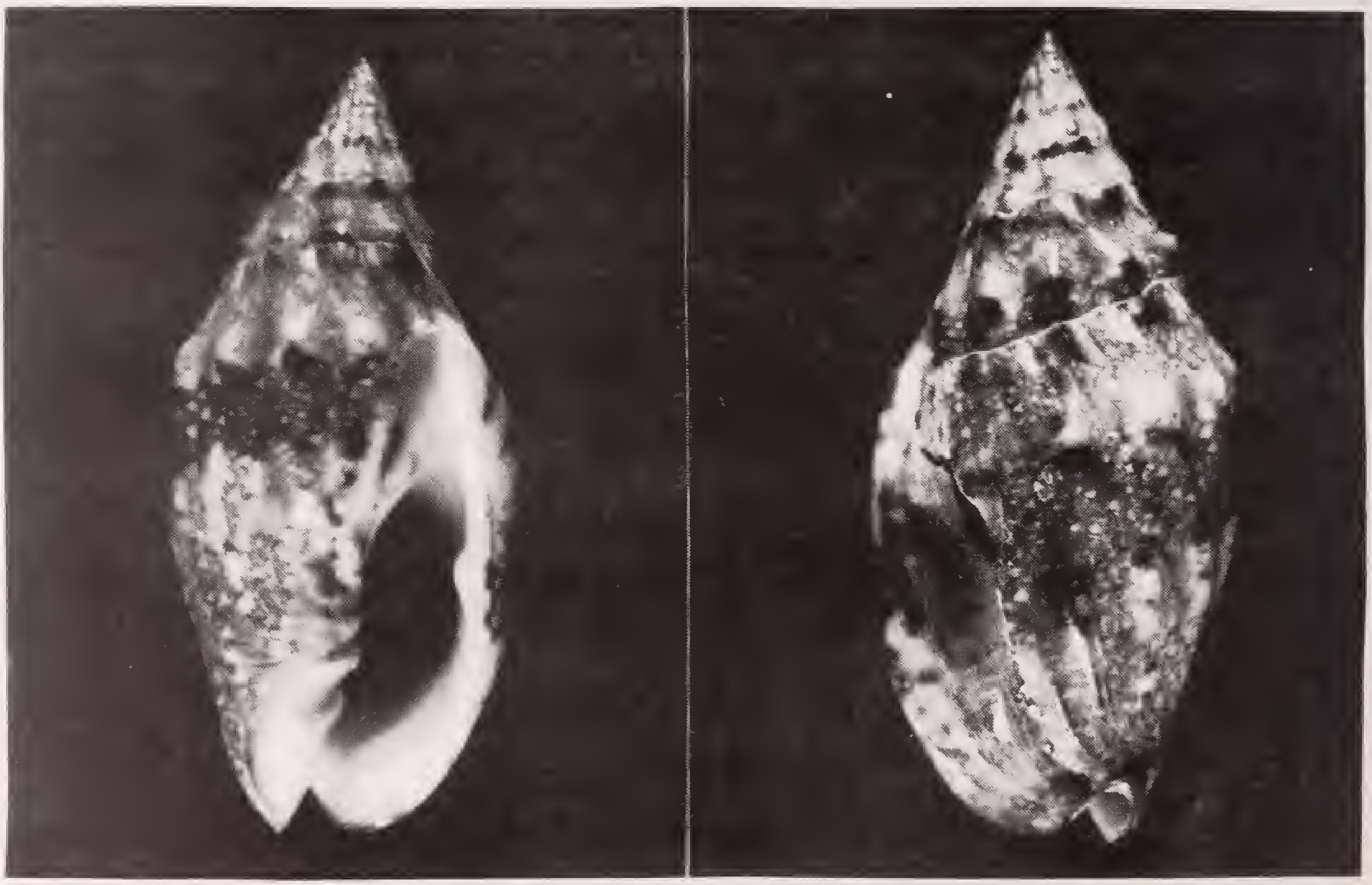

Fig. 1. Apertural and dorsal views of *Lyria cumingii*.

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FROM THE MINUTES

SAN DIEGO SHELL CLUB MEETING -- 17 JUNE 1982

BY

PAT SAGE

President Martin Schuler called the meeting to order at 7:45 P.M. Guests and out-of-town members were introduced and welcomed. Vice-President Bill Perrin then presented the guest speaker, Dr. Bert Kobayashi of UCSD. His program was a lively, illustrated lecture on the marine nature reserve in La Jolla, complete with a four page handout distributed to those present.

After the cookie/coffee break, Dave Mulliner showed slides taken of the '82 Auction/Potluck. A short business meeting followed.

The shell drawing was won by Pat Sage and the meeting was adjourned at 9:45 P.M.

NEW MEMBERS

BELOTE, JENNIFER, 2676 Worden St., No. 65, San Diego, CA 92110. 224-9147
GARDNER, SANDRA, 1755 University Ave., Palo Alto, CA 94301
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THE DISTRIBUTION OF DIPLODONTA ORBELLUS (GOULD, 1851) AND A DIAGNOSIS OF DIPLODONTA SUBQUADRATA (CARPENTER, 1856) (BIVALVIA: UNGULINIDAE)*

BY

CAROLE M. HERTZ, BARBARA W. MYERS, JOYCE GEMMELL

ABSTRACT

In studying species of the genus *Diplodonta* Bronn, 1831, from San Felipe, Baja California, Mexico, we have found conflicting information relating to the geographical distribution of *Diplodonta orbellus* (Gould, 1851). Clarification of the species *Diplodonta subquadrata* (Carpenter, 1856) became necessary in order to determine its morphology and distribution relative to *D. orbellus*. *Diplodonta suprema* Olsson, 1961 was found to be a junior synonym of *D. subquadrata*.

LUCINACEA Fleming, 1828
Ungulinidae H.& A. Adams, 1857
Diplodonta Bronn, 1831

The genus *Diplodonta*, type species *Venus lupinus* Brocchi, 1814 by subsequent designation, describes a group of trigonal-orbiculate bivalves with an external ligament; with two cardinal teeth in each valve, one bifid in each (the right posterior and the left anterior); with no lateral teeth. There are two large muscle scars and a simple pallial line. The genus was described from a Mediterranean Tertiary fossil formation.

COMPARISON OF *DIPLODONTA ORBELLUS* FROM SAN DIEGO AND THE COAST OF CALIFORNIA WITH SPECIMENS FROM SAN FELIPE AND THE GULF OF CALIFORNIA

In working with the Gemmell collection from San Felipe we had difficulty in identifying specimens of *Diplodonta* which appeared to us to be identical to specimens of *D. orbellus* from San Diego. Current literature (Keen, 1971; Olsson, 1961) restricted *D. orbellus* to the Pacific coast of California. McLean (1978) lists it from the Pribilof Islands to the Gulf of California. The holotype of *Diplodonta orbellus* (Gould, 1851) is from San Diego, California. The exterior reveals a drab, white, globose shell marked with growth lines, some deeper than others. The beaks are not prominent in the 18mmH x 18.5mmL x 16mmI (inflation) specimen. There is no lunule. The exterior of the holotype is shown in Figure 1. Study of the holotype proved less than enlightening since the bifid cardinal teeth (a distinguishing character in *Diplodonta*) are broken in both valves. The interior of the holotype is shown in Figure 2. Further study of specimens of *D. orbellus* from the type locality, Mission Bay, San Diego, California showed the hooked cardinal bifid anteriorly in the left valve and the bifid cardinal posteriorly in the right valve. See Figures 3 and 4.

Gould's original description of the species which follows is rather general for *Diplodonta*.

LUCINA ORBELLA (Pl. XV. Fig. 3.)

Lucina orbella, Gould; Proc. B. S. N. H., Nov. 1851. IV. 90.

T. parva, tenuicula, subglobosa, albida, concentricè inequaliter striata; apicibus medianis, haud eminentibus, absque lunulâ anticâ; lateribus ferè symmetricis: intus alba. Cardo valvæ dextræ dentibus duobus instructus quorum antico minore, postico bifido; valvæ sinistræ duobus quorum antico bifido, postico perobliquo; dentibus lateralibus nullis; cicatricibus inconspicuis, palliali serie punctorum composito.

Shell small, rather thin, subglobose, dingy white, marked with delicate lines of growth, which at some parts are more conspicuous than at others, and render the surface somewhat irregular;

* Modified from a paper presented at the Western Society of Malacologists (WSM) June 1982

Fig. 1. Dorsal view of holotype of *Diplodonta orbellus* MCZ169271. (Gould type collection No. A985).

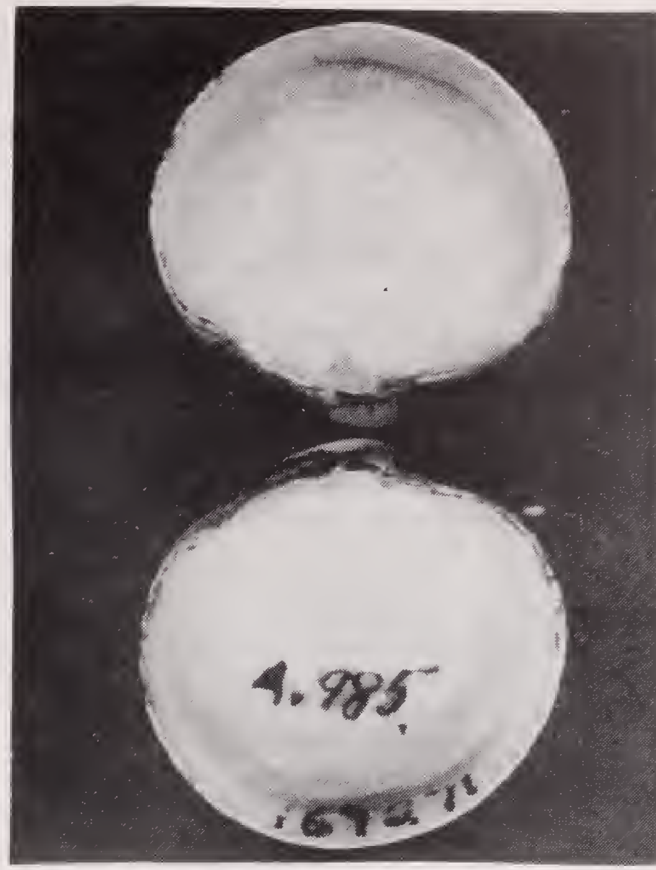

Fig. 2. Interior view of holotype of *D. orbellus*.

Fig. 3. Dorsal view of specimen of *D. orbellus* from type locality. SDNHM3945.

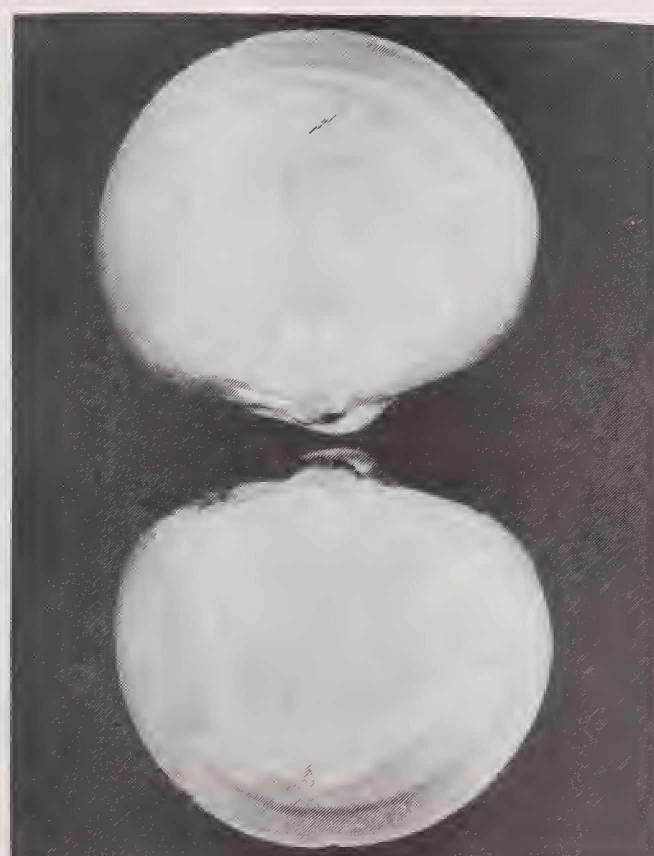

Fig. 4. Interior view of specimen shown in Figure 3.

beaks very nearly median, not prominent; no distinct lunule in front of them: ligament prominent; extremities a little above the middle of altitude, very nearly symmetrical. Interior white. Hinge with two direct teeth in the right valve, of which the anterior is smallest, and the posterior is bifid; and two in the left valve, of which the anterior is bifid and the posterior very oblique; lateral teeth none; muscular impressions faint, very large; pallial impression indistinct, composed of a series of polished dots.

Length four fifths of an inch; height six eighths of an inch; breadth half to five eighths of an inch.

From San Diego. *Licut. Green.* Santa Barbara. *Col. Jewett.*

The size and globose form of this species recalls *L. columbella*, Lk., (*L. Adansonii*, D'Orb.): but the shell is much less solid, the beaks less elevated, no areas before and behind them, and the surface is not lamellar. *L. globularis* may be more like it. Some specimens are nearly perfect spheres, and all of them are very convex lenses.

Gould carefully describes the placement of the bifid cardinal teeth but only briefly mentions the ligament as being prominent. We find the hinge-ligament in *D. orbellus* a stable identifying character. (We use the term hinge-ligament to emphasize the concept of the hinge and ligament as an integral unit).

In *Diplodonta orbellus* the cardinal bifid in the left valve is directly below the beak and projects hook-like. The posterior blade-like cardinal is almost parallel to the ligamental nymph or shield. In the right valve the root of the bifid cardinal is posterior to the beaks and slants posteriorly. The anterior cardinal is peg-like and under the beak as shown in Figure 5. There are no lateral teeth.

The ligament is mostly external. It is largely posterior to the beaks, usually terminating at the umbo but occasionally projecting slightly beyond. Interiorly, the posterior dorsal margin folds over behind the ligament which rests in a groove attached to and behind a calcareous shield as shown in Figure 5. Often this shield is broken when

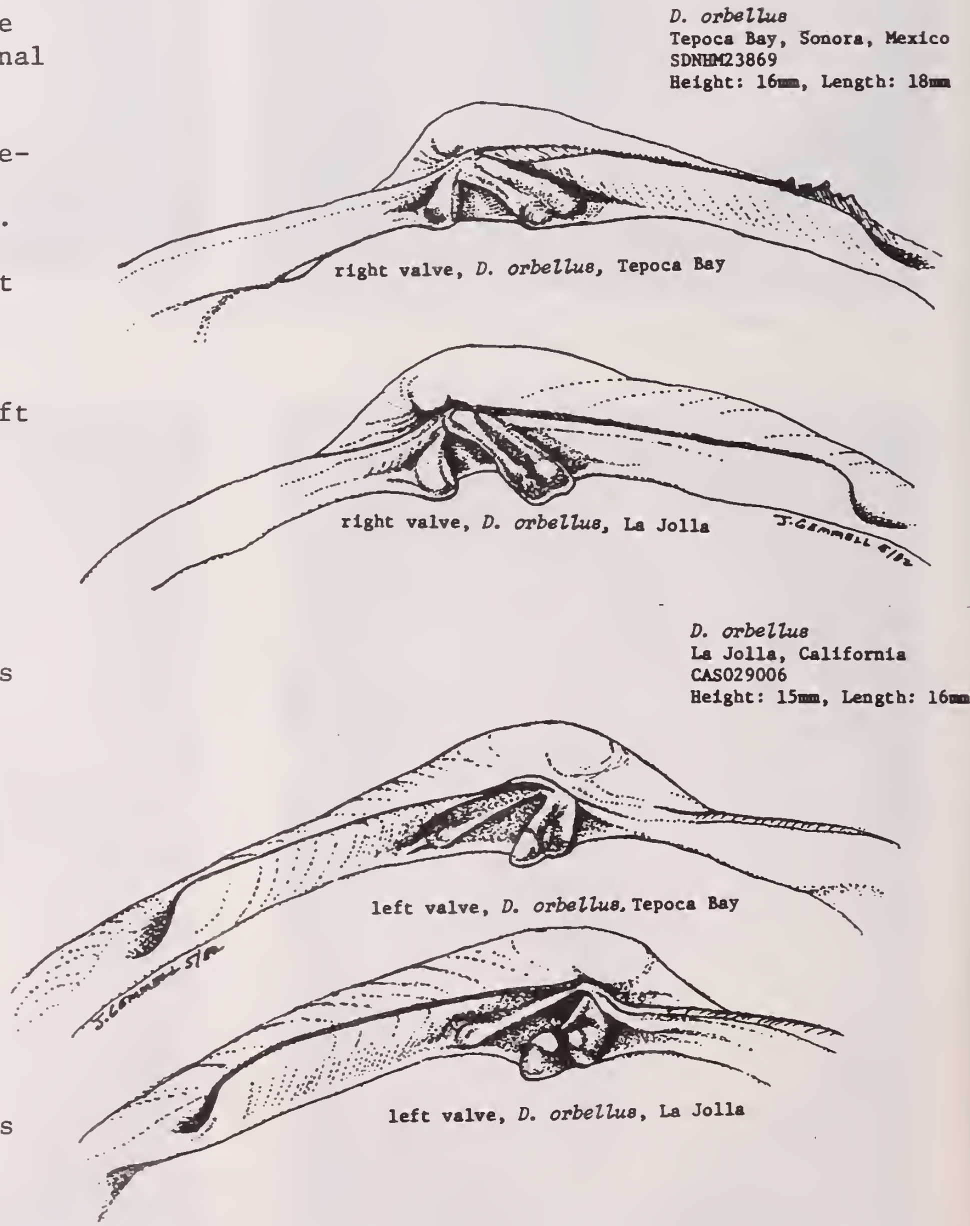

Fig. 5. Camera lucida drawings of interior of right and left valves of specimens of *D. orbellus* from La Jolla and Tepoca Bay.

the valves are separated making identification difficult.

The muscle scars are large, the anterior rather tear-shaped and the posterior longer. The pallial line is entire composed of a series of polished dots and attached to the base of the muscle scars. See Figures 2 and 4.

In comparing San Diego specimens with the Gemmell specimens from San Felipe, we came to the conclusion that the two were the same. Figure 6 compares the exterior dorsal view of a specimen from La Jolla, California (CAS029006) with a specimen from San Felipe (Gemmell collection).

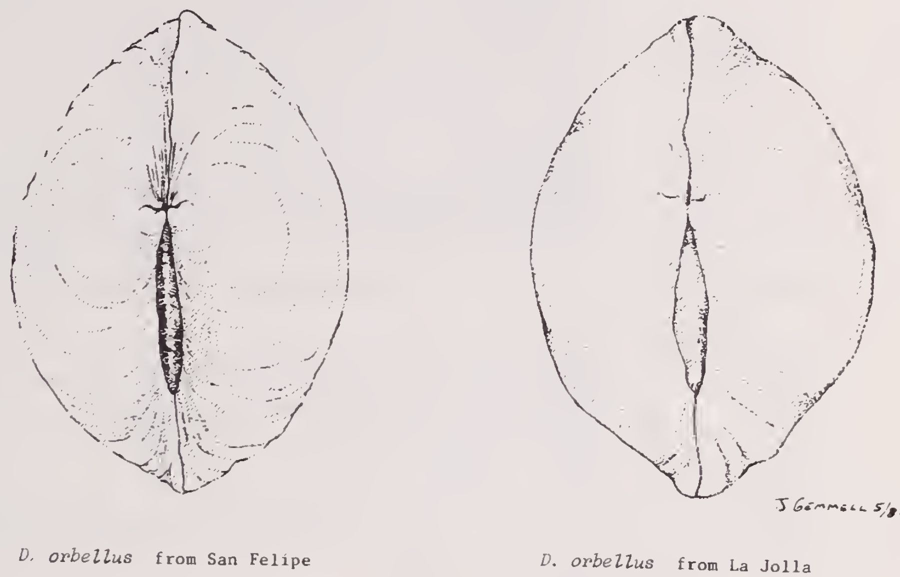

Fig. 6. Camera lucida drawings comparing *D. orbellus* from San Felipe and La Jolla.

Specimens of *D. orbellus* from California are found both in the bays and along the open coast. In the bays they are in sand and mucus nests (Abbott, 1974) while on the open coast they are often found on the platform reefs in San Diego living in empty pholad holes as well as in hard sand or clay (Myers, pers. obs.) and in dead bivalves (Hertz, pers. obs.). Kelsey (1907) put it well when he stated that he found them in San Diego "cosily nested in the deserted shells of bivalves like *Semele rupium* [*S. rupicola*] with a cushion of the same muddy nature, which fits the shell and prevents friction with the hard walls outside."

Specimens of *D. orbellus* from the San Felipe area collected by Gemmell were found living embedded in claylike mud. When specimens were removed, the mud holes retained the shape of the shell.

The nest of *D. orbellus* from the California coast is very strange (Figure 7). MacGinitie & MacGinitie (1968) state that this clam "envelops itself with a covering of fibrous debris or. less frequently, sand held together with mucus. Several projections of this covering extend outward to anchor the clam against the action of the waves. The clam has no siphons, merely orifices at the edge of the mantle."

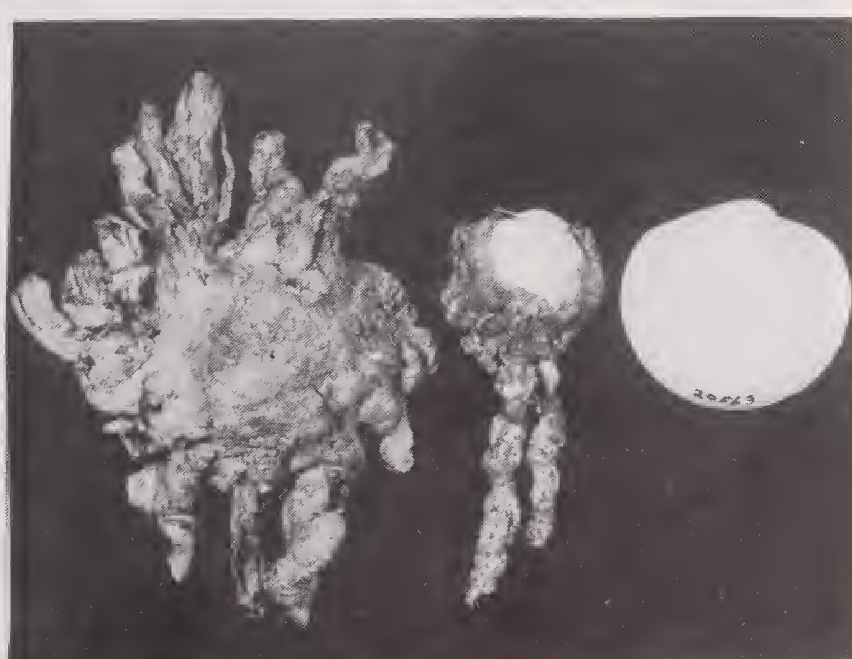

Fig. 7. Three specimens of *D. orbellus* from San Diego. (SDNHM collections) Left specimen completely covered by its nest, center specimen partially covered and exhibiting long projections. Right specimen without nest.

Some early workers (Keep, 1911; Keep & Baily, 1935; Johnson & Snook, 1927) thought that *Diplodonta* had siphons and that the tubular projections of the nest were siphonal coverings. However, Dall (1901) had already determined that *Diplodonta* had no siphons but "two siphonal orifices."

This was confirmed by Fritz Haas (1942) who explained that the projections were "mooring ropes" to anchor the animal against wave action. He noted that the projections are not hollow tubes but, being made of disintegrating plant matter, often become hollow on drying. He added that "the *Diplodonta* covering seems to consist of two halves corresponding to the two valves of the shell, opening at the ventral side and united at the dorsal side of the animal."

Even today very little is known concerning the method of nest making or the biology of the animal (Morris, Abbott, Haderlie, 1980).

Further comparisons of specimens convinced us that *D. orbellus* occurs on the Pacific coast from Monterey, California to Panama and in the Gulf of California from San Felipe to Bahía de los Angeles intertidally to 46 meters (150 ft.). Further study may indicate a still wider distribution for this species.

COMPARISON OF *DIPLODONTA SUPREMA* OLSSON, 1961 WITH *DIPLODONTA SUBQUADRATA* (CARPENTER, 1856)

In attempting to determine the identification of *Diplodonta orbellus* from San Felipe it was necessary to investigate other species of *Diplodonta* in the nothern Gulf, namely *D. suprema* and *D. subquadrata*.

The holotype of *Diplodonta suprema* Olsson, 1961 (ANSP218935) was examined (Figure 8). This large (37mm), plump specimen from Panama is chalky white, marked only by concentric growth lines. The beaks are not prominent; the ligament external; and there is no lunule or escutcheon. Figure 9 is an interior view of the holotype. It shows that the shell is subquadrate. This was noted in detail by Olsson in his original description which follows when he stated, "The anterior side is a little shorter than the posterior, narrower and broadly subtruncate at the end while the posterior and ventral sides form part of a wide circular curve."

Fig. 8. Dorsal view of holotype of *D. suprema* (ANSP218935)

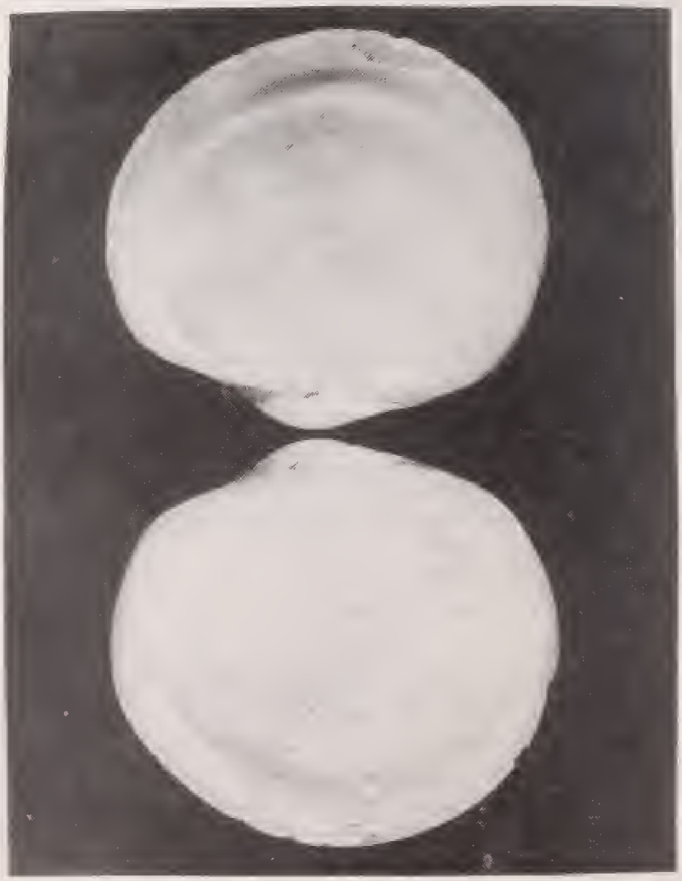

Fig. 9. Interior view of holotype of *D. suprema*.

Diplodonta (Diplodonta) suprema, new species Plate 32, figures 2-2b

Shell large (length 37 mm.), subcircular, convex, relatively thin, white or cream-colored. Surface nearly smooth, marked only with fine, concentric lines of growth and resting marks, and in some specimens very minute radial lines and wrinkles may be observed. The hinge line is straight, long, with the small beaks, subcentral, projecting slightly above it and placed a little in front of the middle. The anterior side is a little shorter than the posterior, narrower and broadly subtruncate at the end while the posterior and ventral sides form part of a wide circular curve. Externally the valves appear rounded and plump with the fullest inflation in a broad zone running from the beak to the posterior-ventral margin. Hinge normal with the left anterior and the right posterior cardinal teeth bifid. Cavity of shell deep, the adductor scars and pallial line plainly marked. Adductor scars are of nearly equal size, the anterior one somewhat more elongate, each placed just below the end of the hinge. Pallial line entire, attached to the lower end of each adductor. No lunule or escutcheon.

Length 37.3 mm., height 31.2 mm., diameter 28.2 mm.

Unusual amongst Recent species of the genus because of its large size recalling several fossil forms usually referred to the subgenus *Sphaerella*. It is most similar to *T. subvexa* (Conrad) from the Miocene of Maryland which attains nearly the same size but has larger umbones and a more circular form.

Range—Panama. Panama Canal Zone: Palo Seco.

Figure 10 shows the detail of the hinge-ligament of the holotype of *D. suprema*. In the left valve the blade-like cardinal bifid is below the beak and projects downward. The anterior half of the bifid is higher. The posterior cardinal is a slender blade appressed at the base to the ligamental plate and slanted posteriorly.

In the right valve the posterior blade-like bifid cardinal starts below the beak and slants posteriorly. The posterior half of the bifid cardinal is chipped. The anterior cardinal, flattened posteriorly and somewhat rounded anteriorly slants slightly anterior to the beak and touches the dorsal margin as it projects out from the beak.

The ligament attaches to a sloping shelf under and posterior to the beaks on the dorsal margin. The dorsal margin folds over only at the extreme posterior end of the ligament and forms a groove with a very short calcareous shield.

Olsson listed the holotype

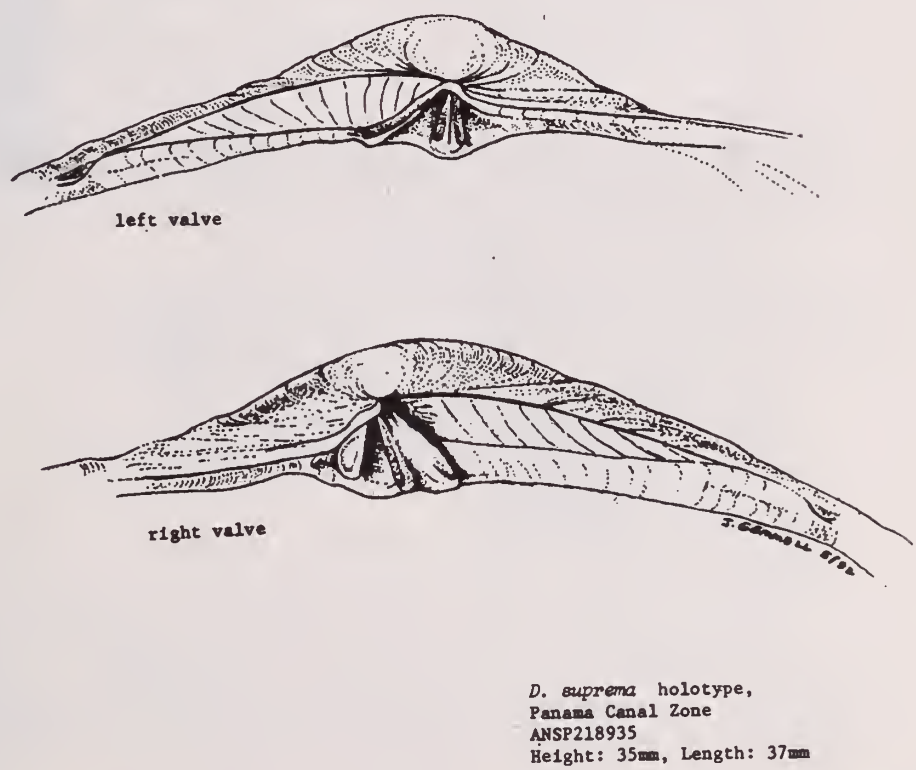

Fig. 10. Camera lucida drawings of left and right valves of the holotype of *D. suprema*.

from Panama. In studying *Diplodonta* in the Gulf of California we found specimens of varying sizes that fit Olsson's description and thought that *D. suprema* had a wider distribution. Figure 11 is of two valves from a lot of six valves dredged at 46 meters (150 ft.) at Bahia Concepcion, Baja California Sur, Mexico by Carol Skoglund in October 1979. The valves are approximately 25mmH x 28mmL.

Many of the smaller specimens in the San Diego Natural History Museum collections that resemble *D. suprema* were labeled *D. subquadrata*. This necessitated closer study of *Diplodonta subquadrata* (Carpenter, 1856).

An effort was made to obtain the type of *D. subquadrata* from the British Museum (N.H.). After several exchanges of correspondence with Solene Morris, of the Bivalve Section of the Department of Molluscs, we were informed that the type could not be found. She suggested that at this time we "cite the species in question as temporarily misplaced."

Keen (1968) illustrated two valves from the syntypic lot. Figure 12 is from the original photograph of the syntype lot which was graciously lent to us by Dr. Keen. Lacking the type, we have had to rely on this photograph and the original description which follows.

Fig. 11. Interior view of two valves dredged by Carol Skoglund at Bahía Concepcion, Baja California, Mexico.

9. Diplodonta subquadrata.

D. t. subquadrata, valde inæquilaterali, antice brevi; tenui, albo-flavescente, epidermide tenuissima; striis incrementi exillimis, ligamento subexterno; dentibus cardinalibus parvis; lateralibus antico in utraque valva acuto, postico subobsoleto; cicatricibus muscularibus, antica a cardine remota, elongata, intus crenulata; postica irregulariter pyriformi; linea pallii margini appropinquante.

Long. ·76, lat. ·89, alt. ·57 poll.

Hab. Mazatlan. Mus. Cuming.

In shape like *Lucinopsis undata*; remarkable for the anterior lateral teeth.

The original Latin description assumes that the reader understands that the genus *Diplodonta* has a bifid cardinal tooth in each valve. Carpenter mentions tha presence of an acute anterior lateral tooth in each valve as well as a subobsolete posterior lateral. His note following the Latin description states "remarkable for the anterior lateral teeth." The photograph of the syntypic lot (Figure 12) clearly shows the bifid cardinal and gives no indication of any laterals. As mentioned previously, the genus has no lateral teeth.

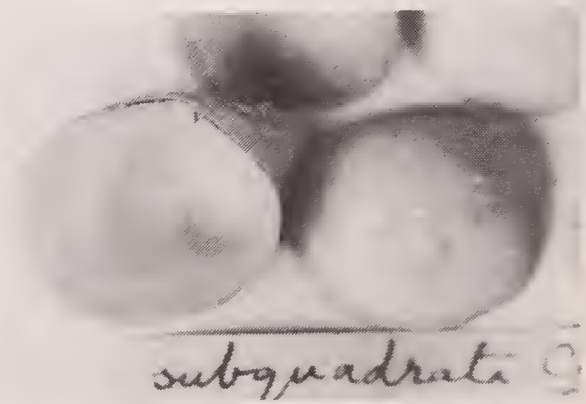

Fig. 12. Two valves of the syntype lot of *D. subquadrata* from original Keen photograph. Size: 26.3mmL.

Dall (1899) stated, "Carpenter has mistaken the edge of the oblique and excavated hinge plate for a lateral tooth..." While this shows that Dall saw no lateral teeth, it does not completely explain what Carpenter thought he saw.

D. subquadrata has a shell white to cream, inflated, relatively thin, marked only by concentric lines of growth. It is subquadrate in shape, the posterior ventral side widely curved, the anterior side shorter and truncate. This is the same general shape noted by Olsson for *D. suprema*. The margin is smooth, the beaks almost central, not prominent and the ligament external. There is no lunule or escutcheon.

Figure 13 is a detail of the hinge-ligament of a specimen of *D. subquadrata* from Isla Espiritu Santo in the Gulf of California. It is 12.5mmH x 13.5mmL.

Interiorly the left anterior and right posterior cardinal teeth are bifid. In the right valve the blade-like bifid cardinal starts below the beak and slants slightly posteriorly. The anterior half of the bifid projects higher. The anterior cardinal is flattened posteriorly and is somewhat convex anteriorly. It slants slightly anterior to the beak and touches the dorsal margin at its inception as it projects from the beak.

In the left valve the blade-like bifid cardinal is below the beak and projects downward. The anterior half of the bifid is higher. The posterior cardinal is also blade-like, slender, appressed to the ligamental plate and slanted posteriorly. There are no lateral teeth.

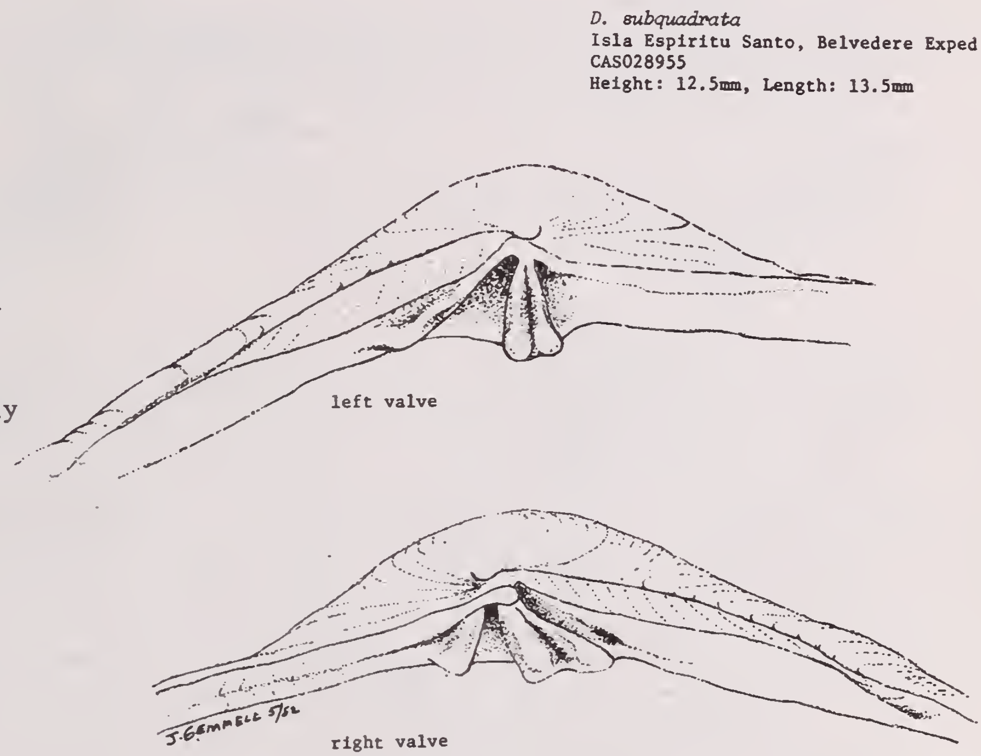

Fig. 13. Camera lucida drawings of the interior of the left and right valves of *D. subquadrata*. showing detail of the hinge-ligament.

The ligament attaches to a sloping shelf under and posterior to the beaks on the dorsal margin. The dorsal margin folds over only at the extreme posterior end of the ligament and forms a groove with a very short calcareous shield.

The posterior muscle scar is oval and the anterior muscle scar is elongate. This is opposite to their position in *Diplodonta orbellus*. They are also relatively smaller than in *D. orbellus*. The pallial line is entire, often irregular, and meets the lower end of each muscle scar.

The species was originally described from Mazatlan. Our investigation showed the distribution from just north of Cedros Island (San Benito Is.) on the Pacific coast through the Gulf of California as far north as San Luis Gonzaga and south to Panama, Ecuador and the Galapagos. More than half the lots studied listed the depths in which the specimens were collected and the range was from 5.5 to 229 meters (3 to 125 fms.). Intertidal information was lacking.

Figure 14 is a distribution map for the two species *D. orbellus* and *D. subquadrata*. Because of space limitations, the southern portion of the map is offset to the right.

Figure 14. Distribution map of *D. orbellus* and *D. subquadrata*. (Map is not to scale).

CONCLUSION

Our study showed the distribution of *D. orbellus* from Monterey, California to Panama and throughout the Gulf of California. *D. subquadrata* examined ranged from San Benito Island on the Pacific coast to Panama, Ecuador and the Galapagos Islands and throughout the Gulf of California.

Specimens of *D. orbellus* we studied reached a maximum size of 31mmH x 37mmL with the average size being closer to 20 mm in length. Inflation in this species is variable. Specimens with approximately the same height and length were often quite different in their degree of inflation.

Keen's measurement of a syntype of *D. subquadrata* revealed a specimen of 26.3mmL. Specimens we studied reached 32.5mmH x 36mmL. The majority of the specimens, however, were between 10 and 20mm in length. The smaller specimens (10-20mm) were less inflated; the large specimens were highly inflated. The largest (Skoglund collection from Bahía Concepción) had an inflation of 30mm. Olsson's measurements of the holotype of *D. suprema* are 31.2mmH x 37mmL x 28.2mmI.

In studying the hinge-ligament, teeth, muscle scars and general shell morphology of *D. subquadrata* and *D. suprema*, it is our conclusion that *D. suprema* falls in the synonymy of *D. subquadrata*.

ACKNOWLEDGMENTS

We wish to thank the following people in their respective institutions for making type and study material available to us; Dr. George M. Davis of the Academy of Natural Sciences of Philadelphia (ANSP); Drs. Ruth Turner and Kenneth J. Boss of the Museum of Comparative Zoology at Harvard (MCZ); Solene Morris of the British Museum (N.H.); Dr. F.G. Hochberg and Mrs. Carey Resch Smith of the Santa Barbara Museum of Natural History (SBMNH); Dr. Barry Roth of the California Academy of Sciences (CAS); Dr. James H. McLean and Mr. Gale Sphon of the Los Angeles County Museum of Natural History (LACM); and Mr. Spencer Luke of Scripps Institution of Oceanography (SIO).

We are grateful to Margaret Mulliner, Ruth Purdy, Don Shasky and Carol Skoglund for the loan of specimens from their collections. We appreciate the assistance of Judith Dyer, Librarian, San Diego Museum of Natural History (SDMNH). Our special thanks to Dr. A. Myra Keen for the photograph of the syntype of *D. subquadrata.*

To David K. Mulliner we owe a debt of gratitude for both the color slides for the oral presentation and the black and white photography for this paper. To Anthony D'Attilio our affection and appreciation for his constant help and encouragement.

MATERIAL STUDIED

Diplodonta orbellus, holotype MCZ 169271 [Gould type collection No. A985]
Diplodonta subquadrata, photo of holotype [Keen from Brit. Mus.]
Diplodonta suprema, holotype ANSP 218935

Specimens studied are from the collections of the San Diego Natural History Museum, (SDNHM), Scripps Institute of Oceanography (SIO), Santa Barbara Museum of Natural History (SBMNH), Los Angeles County Museum of Natural History (LACM), California Academy of Sciences (CAS) as well as from the private collections of Joyce Gemmell, Carole and Jules Hertz, Margaret and David Mulliner, Barbara Myers, Ruth Purdy and Carol Skoglund.

Diplodonta orbellus
SDNHM San Quintin, B.C. 3942; Is. San Martin, 61114; La Paz, B.C., 23870; Carmen Is., 23866; Is. Espiritu Santo, 23868, 53495; Bahía San Carlos, 23859; Bahía Escondido, 56415; Bahía Santa Maria, 23865; Bahía Tepoca, 23869; Is. Salsipuedes, 44401; Is. Danzante, 44622; Is. Partida, 45431; Pta. Willard, 44334;

California coast,23855; Newport Bay, 61146; La Jolla, 1083, 3943, 23854, 73765; Terminal Is., 23852; Long Beach, 23853; San Diego, 3941, 3946, 3940; Pt. Loma, 71689; Imperial Beach, 3944, 3952; Ocean Beach, S.D., 3954; Mission Bay, 3945, 20563; Mission Beach, S.D., 67194; San Luis Obispo, 3951.

LACM NE end of Cedros Is., B.C. 71-156

SBMNH Newport Bay, 28106; Coal Oil Pt., S.B., 08484; Corona Del Mar, 43162; San Pedro, 49678, Reef Pt., Orange Co., 32938.

CAS Reef Pt., Orange Co., 028983; Santa Rosa Is, Channel Is. 028970; Santa Barbara, 028968, 028965; N end Pt. Conception, 028966, Newport Bay, 029002; SW Santa Catalina Is., outer Santa Barbara Channel, 029001, 028999; Pacific Grove, 028997; Monterey Bay, 028985; San Pedro, 028979, 029000, 029011; Pt. Fermin, 028971; Balboa Bay, 028982; Anacapa Is., 028969; Carpenteria Reef, 028998; Is. Carmen, 028981; Is. Patos, 029014; Is. Georges, 028963; Is. Espiritu Santo,028925, 028948; Is. San Marcos, 028957; Guaymas, 028907; Bahía San Carlos, 028947; Is. Raza, 029013; Scammon's Lagoon 028996; Bahía Magdalena, 029009, 029010; La Jolla, Ca., 029006.

GEMMELL San Luis Gonzaga, San Felipe.

HERTZ La Jolla

MULLINER San Felipe, Bahía de los Angeles

MYERS San Diego, La Jolla

PURDY Panama, Guaymas

Diplodonta subquadrata

SDNHM Is. San Benito, 23867; San Luis Gonzaga, 52731; Bahía Navidad & Coastecomate, 54326; Is. Tiburon, 52172; Is. Carmen, 23866;

CAS Is. Espiritu Santo, 028955, 028912, 028958, 028949, 028959; Cabo San Lucas, 028926; La Paz, 028921, Guaymas, 028940, 029041, 028946; Is. Carmen, 028909; Acapulco, 028924; Panama, 028928; Guatemala, 028927; Galapagos 028929.

GEMMELL Bahía Gonzaga

MULLINER Bahía de los Angeles

SHASKY Salango Is., Ecuador

SKOGLUND Bahía Concepción

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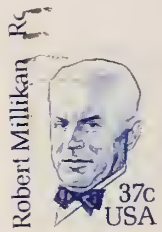

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THE FESTIVUS

SAN DIEGO SHELL CLUB

FOUNDED 1961 • INCORPORATED 1968

MEETS THIRD THURSDAY, 7:30 P.M.
ROOM 104, CASA DEL PRADO, BALBOA PARK

ANNUAL DUES: Payable to San Diego Shell Club Inc. Single membership: $5.00; Family membership: $6.00; Overseas surface: $8.00.

CLUB ADDRESS: Address all correspondence to San Diego Shell Club Inc., c/o 3883 Mt. Blackburn Ave., San Diego, California 92111.

VOL. XIV AUGUST 1982 NO. 8

PROGRAM: Ron McPeak will give a talk on his recent diving trip to Pulmo Reef. He will show his slides of the area, many of which were taken underwater.

Steven Barnett, the Club's 1982 Science Fair winner, will present a summary of his winning project, "Environment Preference of Abalone," and receive his prize.

MARK YOUR CALENDAR: Saturday, 18 September is the date for the annual September party. See page 93.

DATE: August 19, 1982 TIME: 7:30 P.M. ROOM: 104

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THERE ARE SHELLS OFF THE EDGE OF THE EARTH

BY

FRANK KING

859 E. Vista Way, Vista, California 92083

The chronicles of the Don Pisor 1982 tour to West Australia is inexorably entwined with one character named Merv Cooper. Marvelous Merv we thought as we scurried about the sand bars in the middle of the night picking up rare volutes. Merv the Curve we thought as we sat all day waiting in vain for the boat to bring us fuel and water so that we could start for home. Such was the fluctuation of our mood during a series of rapidly changing events that constituted an unforgettable adventure. Let us review the characters and the setting before we examine the details.

Eight mature adults, mostly of sound mind and body, tolerated the sixteen and a half hours flying time from Los Angeles to Sidney on April 14. Overnight and most of the day in Australia's largest city were thoroughly enjoyable and gave the group a chance to get over jet lag and become acquainted. Marjorie Wing from Sun City, Arizona, while a bit hard of hearing, proved to be an intrepid collector and good sport. Constance Boone and Barbara Hudson, frequent traveling companions from Houston, Texas furnished the serious scientific element since the Museum was to be the recipient of a number of their specimens, especially oysters. Don and Jeanne Pisor and Don's brother, Richard provided the driving force to get us to the scene of action. The writer, a gross amateur collector, and his wife, Harriett, rounded out the entourage. Harriett came along only because she is a good and obedient wife and not for any love of shelling and especially no appreciation for camping.

Two time zones west of Sydney we found Perth, a beautiful, clean and bustling city where almost a million West Australians live. The huge space of Western Australia is approached but not exceeded by that of West Texas. The airport formalities were quickly dispensed with and we got our first look at Magnificent Merv who met us in his Corvette. We got a little hint of his nature when we saw his shirt open to the umbilicus and the almost life-sized image of an upside down skin diver hanging as a pendant.

We should have suspected what was to come when we were immediately invited to go on an evening dinner cruise down the beautifully serpentine Swan River. We accepted, of course, though with some misgivings when informed that we were expected to come in "fancy dress." Merv's mandible almost hit his patella when he saw us in our finest and he meant by "fancy" that it was a costume party. We finally went as American tourists but were totally out of place among the elaborately dressed young disco dancers. Even the "flasher" came with fabricated equipment of elephantine proportions. The buffet was excellent and finally when everyone was drunk enough to be a hazard on the road, the boat docked and we were taken back to our hotel. (We asked to walk).

The next day was Sunday and we got some indications of the planning that had gone into the tour when we found that our hotel was above the bus station and in the middle of a good shopping area. Don rented a van and drove us to Woodman's Point, following Merv's map down the wrong side of the street as is the custom in Australia. We found the area where *Cypraea friendi* was first collected. The water was frigid, however, and we noted no cowries under the stones exposed at medium tide. We had a great day, though, touring the bustling port of Fremantle where sheep are loaded live on specially made ships to be taken to Arab countries where they are slaughtered according to religious ritual.

In the meantime, Merv and his cousin, Peter Browning, had started north with two

boats to be used in our further adventures. We shopped and visited shell dealers until time to board our Ansett Pioneer Lines bus for the thousand mile trip to Onslow. The coaches are self contained and make only one stop every three hundred miles or so on the journey to Port Hedland. Fontunately they slow for sheep and kangaroos. Another small shock came when the bus came to a halt at a "Y" in the road where the only structure standing was a sign pointing to Onslow. Our stiff joints were quickly loosened when we climbed into waiting taxis and bounded over the corduroy red clay road at breakneck speed for ninety kilometers to the tiny fishing village that the "new highway" missed. The driver explained that when it rained the town was often isolated for weeks. We studied the clouds and sighed.

Mighty Merv and Peter had just arrived with the boats (five blown tires on the way), and supervised our settling into the historic Beadon Hotel, last reconstructed in 1916. The rooms had air conditioners in various stages of repair, and the facilities at the end of the hall were well worn but functional. We had time for a taste of local shelling after a sixteen mile run out to Thevenard Island where the rock turners got a few common shells while the swimmers stayed on the boat and collected full grown *Syrinx aruanus* for each of us. After the best meal we had in Australia and a fitful night's sleep, we boarded two motor launches and, towing a dinghy we headed East at 23 knots leaving Onslow to fall over the horizon.

Masterful Merv led us through the maze of shallow reefs for an hour and a half. Peter followed in his smaller boat and pulled the dinghy with the drinking water in it. In the rough seas, the fresh water tank broke and we arrived on Weld Island with one five gallon tank. "Not to worry." Arrangements were already made for a shrimp trawler to bring fuel, 15 gallons of water, and five gallons of alcohol for the specimens. With a dubious sigh of relief we set up the tents, brought ashore the generator and freezer, and settled in to what was to be our home for the next week.

Weld Island is several hundred yards offshore where the mainland is composed of mud flats, mangroves, and sandy desert. At full tide the island may be one-half mile long and maybe two hundred yards wide. At low tide its size more than triples. It is a seagull rookery and is not quiet. The area between the island and the mainland is shallow with a channel. At low tide many sandbars are exposed and these are the homes of the volutes we came to find. Juvenile *Syrinx aruanus* could be found in relative abundance.

Unfortunately, time constraints dictated our arrival two days before decent tides occurred and within a short time all the rocks in the upper littoral were worn slick from being turned and our bags were bulging with unlucky hermit crabs and their homes. To keep up spirits we climbed aboard the larger boat and cruised around and snorkeled. Sure enough, some volutes crossed our paths. *Voluta damoni, V. dampieria, V. oblita* went into collecting bags and the general pulse rate increased. An exciting find by this collector was a rare volute which may turn out to be a new species, believed to be a possible hybrid between *V. ellioti* and either *V. jamrachi* or *V. dampieria*. The shrimp trawler lay far offshore all day and we looked forward to their joining us when they brought our water and fuel. We were beginning to need the alcohol. Some of us fondly hoped to be able to spend the night on the trawler, grabbing what we could from the grunge.

When the night went by and there was no trawler in sight at daybreak, a little anxiety set in. Ebullient Merv suggested that with six gallons of wine and a boat-load of beer there was nothing to worry about. He'd get on the wireless and see what had happened. After all, Onslow was only one and a half hours away.

The next day the tide was still not too good. The snorkelers were taken across the channel to the area of the sand bars where an encouraging number of volutes were found crawling around in three to six feet of water. Shore collecting improved a little. The next day the tide would be good enough to take the shore collectors across while the snorkelers could get an early start. We had barbecued steaks and potatoes cooked in the coals. Long sausages were grilled and generally all looked

bright. Enough alcohol had been brought to start soaking some shells and finally radio contact was made with someone who explained that since we did not go out to the trawler to get our fuel and water, the folks aboard thought we must not need it. They went south for better fishing. "The Lady" said she would send someone. The water was gone but we still had some pop.

Time came to catch the afternoon tide and all loaded aboard for the trip across to the mainland. A fresh onshore wind kept us cool and blew away the "midgies" that usually plagued us. Lightning flashed and beautiful rainbows appeared among dark clouds far inland. It was interesting to watch the "willy willies"-- funnel clouds of red dust twisting across the desert. Richard and the writer snorkeled out near the channel while Don and the ladies went ashore to collect among the mangroves and follow the tide out. Merv and Peter sat in the boat trying to find out when fuel and water might arrive.

As the sun neared the horizon they motored to a sandspit half a mile away to collect the ladies with a promise to return and get us soon. I found a beautiful *V. damoni* and watched while a troop of thousands of *Strombus campbelli* galloped along the bottom, all headed in the same direction. Suddenly the wind shifted and sizeable waves bounced us about. We could see the shore people still on the sandbar making no attempt to get on the boat. It was almost dark as we began to swim and then wade in knee-deep water. We were afraid we might not be found. As we neared the group we could see their plight. When the wind shifted, the boat blew out into the channel leaving a wave swept area of deep water between. The tide was coming in fast and the engine would not start.

With all the drama of a mid-ocean rescue, the dinghy was used to ferry the castaways to safety. Peter showed his calm nature as he methodically went about getting the engine started. Late at night we arrived back at our camp. It was pitch dark as we waded through the mud and clambered up the rocks to the tents. Physically and emotionally exhausted, we groped for flashlights. Our hearts sank. All the tents had blown down in the now gale force wind. Far into the night we finally collapsed into our sleeping bags. We hardly noticed that our air mattress had deflated.

Thirsty and sore and a little angry we got through our early morning low tide collecting. The hot part of the day was spent cleaning shells and trying to stay in the shade of the small tents. Nobody spoke of rationing the pop we had left but we all drank as little as possible. It seemed that none of the eight Americans were beer drinkers while the Aussies were never without a "stubby" in hand. The latest word was that the man would be out from town with gas and water in the morning.

The very low tides we came to shell had arrived. Unfortunately they were after dark. For two great evenings we wandered the extensive mud and sand flats where many volutes and a few murex were found along with a scattering of bivalves and *Fusinus*. Two of us got full grown *Melo amphora*. Morning tides allowed collecting on nearby sand bars and the extensive tidepools where *Angaria, Murex. Lambis, Marginella, Natica, Polinices,* and *Terebra* were collected. With dry mouths, the days were spent cleaning shells and jockying for a spot in the meager shade. If you left your space, you might be in the sun until someone else needed to use one of the luxuries we enjoyed; a chemical toilet installed behind a bush that concealed it from the tent area at least. We caught fish and watched for rescue boats during the flood tides which lapped at the floor of the cook tent. A helicopter flew by on the way to oil rigs on Barrow Island up the coast.

We decided to head home a day early to be sure to have time to catch the bus on Wednesday. Tuesday morning all the shells were packed and all but one tent folded. We sat on the shore watching for the fisherman who had promised to bring fuel and water when the tide was high enough. During the early morning low tide as we dug up *Penicillus*, the watering pot clam, on the mud flat near camp; Don was stung on the foot by some unseen creature. Because of the extreme pain, it was assumed to be a sting ray and he got hot soaks. When we began to talk about the Blue Ringed octopus we had seen and the symptoms of its deadly bite, Don visibly paled.

Merv the Nerve and Peter sat on the boat drinking beer as the water grew deeper.

We found that a mixture of white wine and orange drink concentrate kept your mouth from sticking together. As tempers began to flare, Don, in spite of his painful foot, donned flippers and bucked the current and wind waves out to the anchored boats to get a report. He returned with word that nobody in Onslow would bring us supplies and there was not enough petrol for even one boat to get back to town for more. Besides, the tide was receding and soon it would not be possible to get over the reef. We seemed doomed to miss the bus and there would be no other for two days. Rage began to emerge. Don was dispatched back to the boat with a demand, "Get us out of here!"

In swift succession the tanks of the larger boat were siphoned and Don set adrift in the dinghy as Merv and Peter bounded away over the waves at top speed in the smaller boat. A final message had been broadcast. "We're headed for Onslow without enough fuel to get there. Meet us at South Island."

While some played Acey Deucy and others read, most of us tried to remember how to dig evaporation pits to collect water. We had some propane left---we could distill some sea water. Folded tents and pieces of equipment could be made into a large SOS on the beach. The tide was going out rapidly and the sun hung low over the emerging sand bar as a spot appeared on the horizon. From the top of a sand dune we could see that it was indeed a boat on the way.

The sun was down as the first five gallon tank of water was hauled ashore. Hands trembled as cups were filled and we felt no guilt at our extravagance as a few drops were spilled to the ground. We were saved! No one had panicked. No one had gone raving mad. We felt rather smug.

Suddenly a decision had to be made. Merv had passed a great looking sand bar on the way in and if two people could be chosen quickly the small boat could still get there before low tide. Shell collectors are indeed crazy.

Tents were not pitched again for the last night. The sky was clear and the wind gentle. We lay under the stars, anxious for a good sleep since we had to start loading the boats at dawn. Even the insects were conspicuously absent. Then a tiny furry thing skittered across our plastic ground cloth, its little claws unable to get a hold until it reached the sleeping bags. It climbed the nearest hip, ran down to the toes and dived off onto a nearby bush. Within moments another ran between us. Rats! All night long they scampered around and over us. In the morning our carefully hoarded apple was half gone. We remembered the hollow loaves of bread in the cook tent. And we'd thought it was from poor quality control in the bakery.

None the worse for the wear, we quickly loaded the equipment and set out for home as soon as the rising tide would permit. If all went well there would be time for a shower before heading for the bus stop. And all did go well in the larger boat. The smaller boat ran out of fuel and Connie's chair collapsed as the large waves pounded the hull.

Suitcases and smelly shells in hand, we waded ashore in Onslow and into the hotel where showers and a quick meal made us into new persons. Our troubles seemed to be over. The taxis arrived on time and while Merv and Peter loaded the boats for the drive down the coast, we set out for the bus stop with a half hour to spare.

Ten miles out of town the first taxi ground to a stop. It died. Dead. Stark. Panic! The second taxi wheeled about and sped to town where a third vehicle was obtained. The drivers were husband and wife. The lady drove faster and she set the pace. Those of us in the second car watched the cloud of dust far ahead as we sped along. We slowed slightly for an emu crossing the road. As we neared the crossroads, not a vehicle was in sight. Neither our compatriots nor the bus could be seen. With hardly a word, our driver turned south in the direction the bus would have gone had it already passed. The pavement seemed rough. We had a flat tire. In record time the spare was applied and at 140 km/hr we sped down the highway. Ten miles along, there was the bus at the roadside. Jeanne stood at the door, refusing to board before we arrived. It was she who had caught a glimpse of the silver streak as it passed over the horizon and instituted the Keystone Kops chase.

The rest of the tour went relatively well. Merv ruined his car when he hit a kangaroo on the way, but he looked rested the next day when he arrived shaven and coiffured to take us to his shell shop. Over an elegant Chinese dinner that evening, we laughed about our good and bad times and discussed the trip to Broome next year. Magnificent Merv was in charge.

FROM THE MINUTES

SAN DIEGO SHELL CLUB -- 15 JULY 1982

BY

PAT SAGE

President Martin Schuler called the meeting to order at 7:45 P.M. After having welcomed visitors, he introduced the evening's speaker, Dr. Frank King, whose presentation was titled, "Yes, There Are Shells Off The Edge Of The Earth." Although Frank King's account of the misadventures of collecting in the "boonies" of Australia was an experience he would not like to repeat, the telling was humorous and entertaining- and the show and tell specimens he exhibited, lovely and desirable!

After the refreshment break, Dave Mulliner gave a mini-slide presentation of a recent group shelling excursion to San Felipe, Baja California, Mexico. Then there was a short business meeting. Ideas for the upcoming September party with a "Sci-Fi" theme were invited as well as a request for a volunteer to coordinate the menu. Club Treasurer, Walter Robertson announced the availability of several publications.

The shell drawing was won by Rita Scheck and the meeting adjourned at 9:40 P.M.

FOR YOUR INFORMATION

The 1982 West Coast Shell Show, sponsored by the Santa Barbara Malacological Society will be held in Fleischmann Auditorium, Santa Barbara Museum of Natural History on the 2nd and 3rd of October (set up of exhibits on Sept. 30 and Oct. 1). Competition is open to all shell collectors. There will be both Open and Amateur categories as well as several non-competitive exhibits. Entry application blanks must be received by 27 August. (Information and sample entry blank will be available at our August meeting. Address all correspondence concerning the shell show to: Show Committee, P.O. Box 30191, Santa Barbara, CA 93105.

The Club's annual September party, this year with an "Out of This World" theme, will be held at the home of Harriet and Frank King on Saturday, 18 September beginning at 6:00 P.M. Members and guests are invited to attend in appropriate space attire, molluscan or otherwise. Further information will be announced at the August meeting and a map will be included in the September issue of The Festivus.

NEW MEMBERS

Marguerite A. & Richard H. Knobla, 32120 Oakshore Dr., Westlake, Village, CA 91361

CONVERGENCE IN THE TYPHINE FORM

BY

ANTHONY D'ATTILIO

Department of Marine Invertebrates, San Diego Natural History Museum, Balboa Park, P.O. Box 1390, San Diego, California 92112

The following is an update of a paper presented at the June 1982 meeting of the Western Society of Malacologists; the paper is modified in part as a result of discussions at the conference with colleagues, in particular Dr. Emily Vokes.

ABSTRACT

It is proposed here that the genera *Pterotyphis* Jousseaume, 1880; *Tripterotyphis* Pilsbry & Lowe, 1932; and *Prototyphis* Ponder, 1972 be reassigned to the Muricinae. *Cinclidotyphis* DuShane, 1969 with its distinctive morphology is also reassigned to Muricinae.

DISCUSSION

Essentially all true Typhinae are distinguished by the presence of tubes. These tubes are structurally modified spines placed along the shoulder periphery and usually situated, with exceptions, between the four or five varices. Of these tubes, only the one most proximate to the aperture is functional and at its base opens into the posterior portion of the aperture. This tube is believed to be an anal tube for carrying away waste material. The origin of the tube structure is probably related to the food and digestive process of the soft parts about which very little is known. Previous tubes are sealed as a new tube is formed during the animal's episodic varical growth.

The known history of the Typhinae in geologic time encompasses most of the Tertiary with most lines of generic development becoming established quite early in this period. Recent or living examples of species show that the Typhinae have undergone only moderate changes of morphology. Some living genera and species have remained relatively stable at least from the Eocene, when viewed from the aspect of gross morphology. There has not been much speculation, to my knowledge, concerning the most immediate possible ancestor or ancestors of the Typhinae. However I believe that four genera are of different ancestry from the majority of typhines and three form a convergent series of genera.

This convergent series of genera consisting of both fossil and living species are the following: *Pterotyphis* Jousseaume, 1880; *Tripterotyphis* Pilsbry & Lowe, 1932; and *Prototyphis* Ponder, 1972. *Cinclidotyphis* DuShane, 1969, while not convergent with these three should also be reassigned to the Muricinae. It is my opinion that the ancestor of the first three of the listed genera has a Muricinae-like ancestral genus similar to *Pterynotus* Swainson, 1833, and may be diagnosed as follows. Instead of four to five varices, this group has consistently only three varices. The morphology of the three anal tubes per whorl is alike in being formed as in other typhines by the mantle sealing a spine; the seal line may be noted by the presence of a suture. The two genera *Prototyphis* and *Tripterotyphis* have the tube confluent with what would normally be, in most trivaricate Muricidae, the shoulder spine at the aperture. In *Prototyphis* this tube is frequently found not entirely sealed, thus displaying the process of tube formation not substantially different from that of the open spine in

the family Muricidae such as is shown in the illustration of *Pterochelus acanthopterus* (Lamarck, 1816) in Figure 1.

In most typhine genera the siphon is closed by the extensive growth of the left side of the siphonal shell margin which greatly overlaps the right side. The method of closure of the siphonal canal in the three genera *Pterotyphis*, *Tripterotyphis*, and *Prototyphis* is consistently different than Typhinae in general although showing differences from one species to another. In these genera the siphonal canal grows in equal measure from both sides. The aperture has an entire or superficially entire peristome. *Prototyphis* is easily mistaken for the muricine genus *Pterochelus* Jousseaume, 1880. See illustration of *Prototyphis angasi* (Crosse, 1863) in Figure 2. The canal in *Prototyphis* rarely closes at maturity. When it does, the two margins of the siphonal canal come close together or seal to form a tube. This is a character typical of the muricid subfamily Ocenebrinae. However the radula of *Prototyphis* is Muricinae. The siphon closes in *Tripterotyphis* in part only as shown in the illustrations and detail of *Tripterotyphis lowei* (Pilsbry, 1931), the type of the genus. See Figure 3.

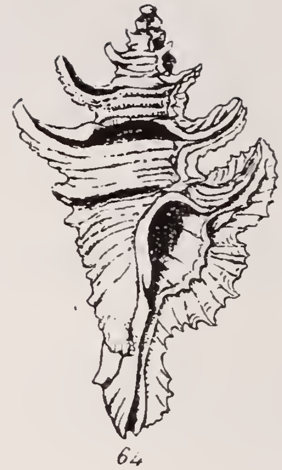

Fig. 1. *Pterochelus acanthopterus* (Lamarck,1816) type of the genus. From Reeve, 1845-1846.

Fig. 2. *Prototyphis angasi* (Crosse, 1863).

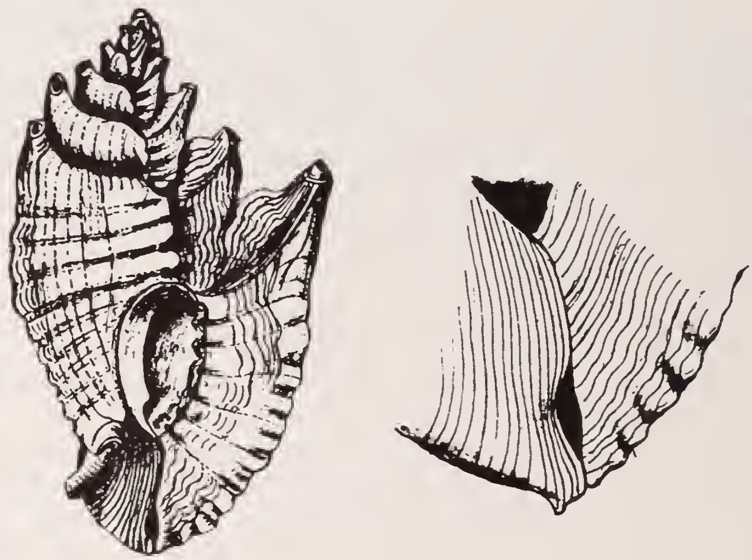

Fig. 3. Apertural view and detail of the partly open canal of *Tripterotyphis lowei* (Pilsbry, 1931). Paratype (SDNHM 3129).

The siphon closes in a similar way in *Pterotyphis* as shown in the illustration of *Pterotyphis fimbriatus* (A. Adams, 1854) in Figure 4. Figure 5 is an illustration of *Cinclidotyphis myrae* DuShane, 1969, the type of this genus. *Cinclidotyphis* diverges from all other typhine-like genera in having an entirely open canal although otherwise retaining many of the characteristics of the convergent group.

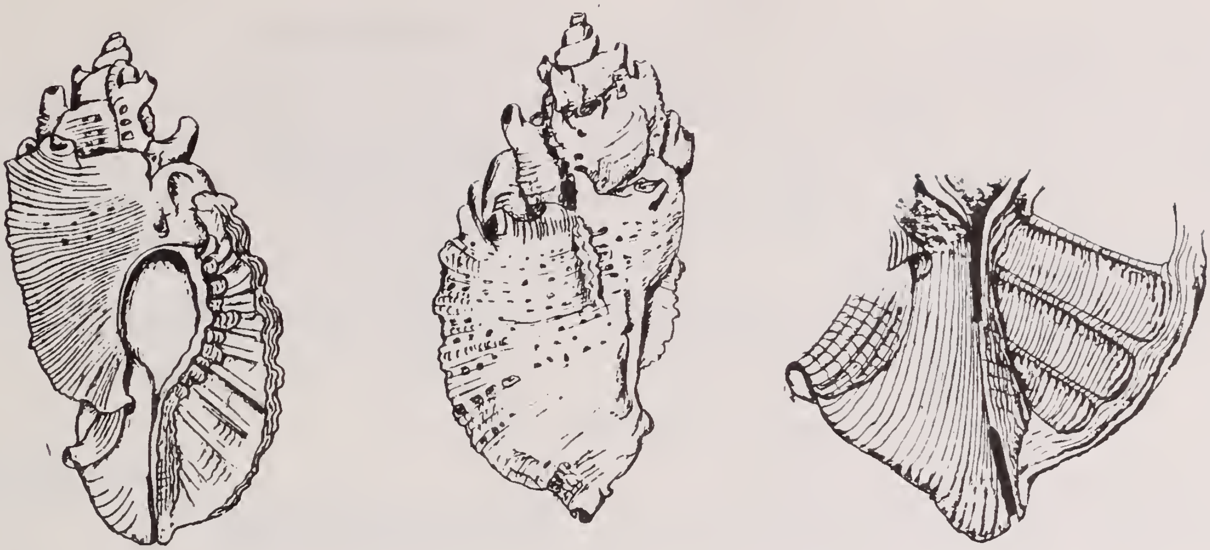

Fig. 4. Apertural and dorsal views of *Pterotyphis fimbriatus* (A. Adams, 1854) from the R. Purdy collection. Length: approx. 23 mm. Also shown is a detail of the partly open canal in this same specimen.

Spiral sculpture of scabrous cords, as in *Pterynotus*, are also a striking feature of most species in this separate group. This is shown in the detail of *Pterotyphis pinnatus* in Figure 6. Such scabrous sculpture of continuous spiral cords is lacking or poorly developed in true typhines. The Muricinae genus *Pterochelus*, considered by some taxonomists to be a subgenus of *Pterynotus*, most clearly resembles *Prototyphis*. *Pterochelus*, with its erect outer apertural margin, differs mainly by sealing or blocking off the open spine. It thus prevents the spine from becoming a tube. This apertural development is apparent mainly when *Pterochelus* species are fully mature. Immature species of *Pterochelus* and *Prototyphis* are not easily separable from each other.

In studying the radulae of typhine species, consistent differences were noted between the four genera under discussion and Typhinae in general. The radulae of the genera discussed here more closely resemble a muricine group such as

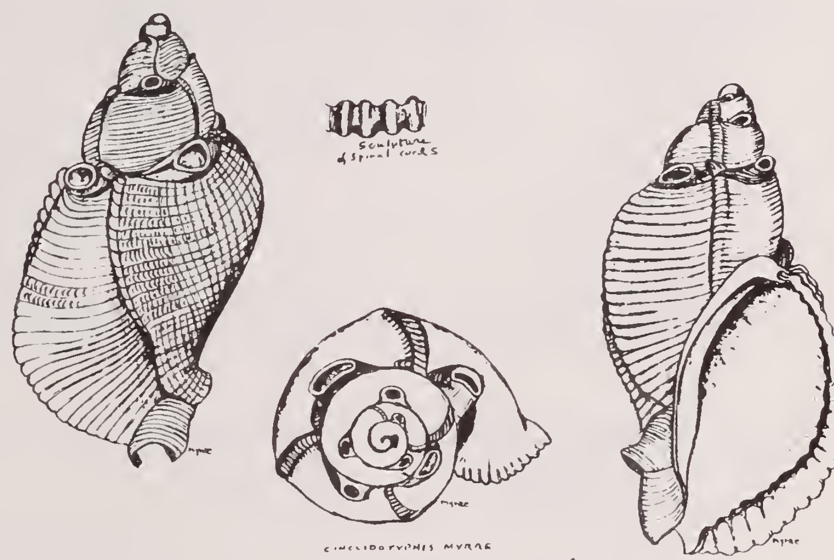

Fig. 5. Three views of *Cinclidotyphis myrae* DuShane, 1969. Also shown is a detail of the sculpture of the spiral cords.

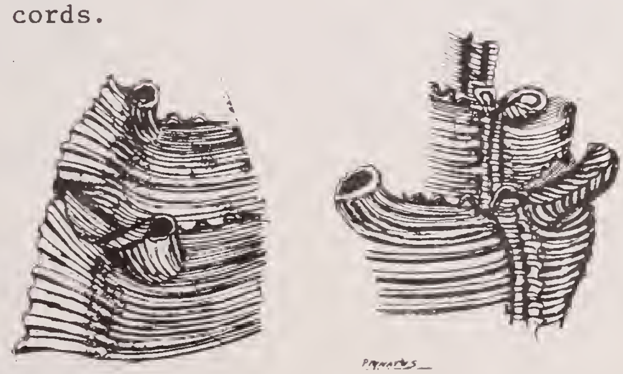

Fig. 6. Detail of sculpture of scabrous cords in *Pterotyphis pinnatus* (Broderip, 1833).

Pterochelus or *Pterynotus*. A radula drawing of *Pterochelus duffusi* Iredale, 1936 is shown in Figure 7.

The radula takes a number of forms in true Typhinae and it would be difficult to illustrate a typical Typhinae radula. However, a number of these Typhinae radulae are illustrated here in Figures 8 to 11 to show their diversity.

The consistency in form of the radulae of the trivaricate group under discussion, however, show their affinity to each other and to the Muricinae. See Figure 7. The radulae of three of the four genera are illustrated in Figures 12 to 14. They are *Prototyphis angasi* (Crosse, 1863), *Tripterotyphis lowei* (Pilsbry, 1931), and *Cinclidotyphis myrae* DuShane, 1969.

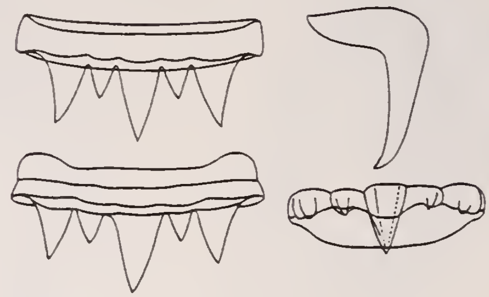

Fig. 7. Radula drawing of *Pterochelus duffusi* Iredale, 1936.

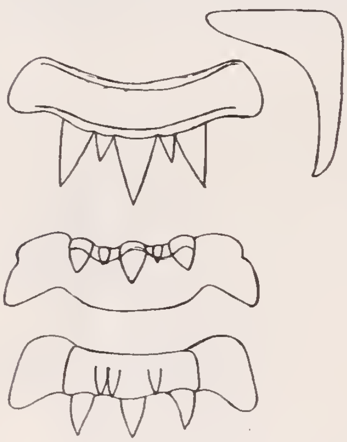

Fig. 8. Radula of *Typhinellus sowerbii* (Broderip, 1833).

Fig. 9. Radula of *Talityphis latipennis* (Dall, 1919).

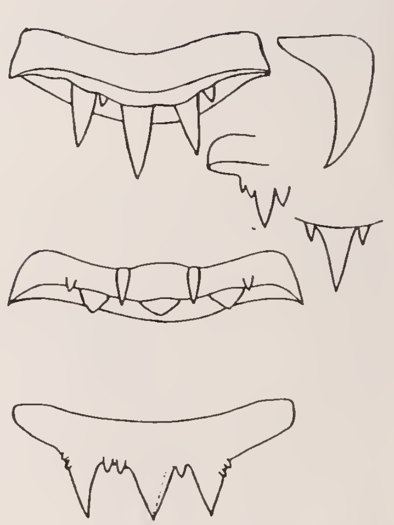

Fig. 10. Radula of *Trubatsa pavlova* (Iredale, 1936).

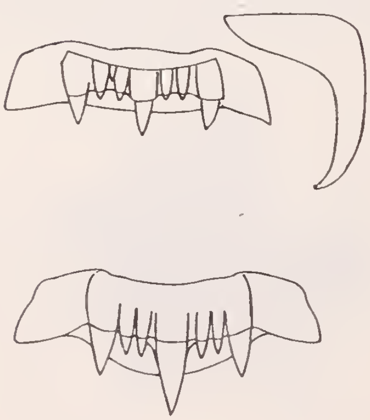

Fig. 11. Radula of *Typhisopsis clarki* (Keen & Campbell, 1964).

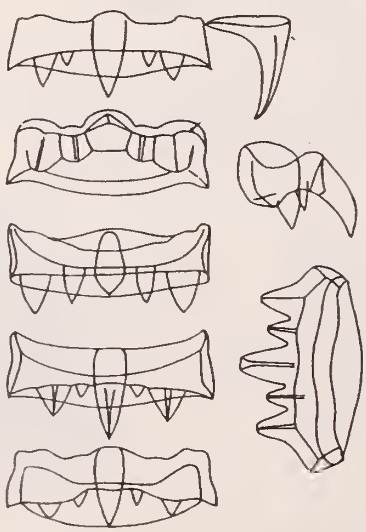

Fig. 12. Radula of *Prototyphis angasi* (Crosse, 1863).

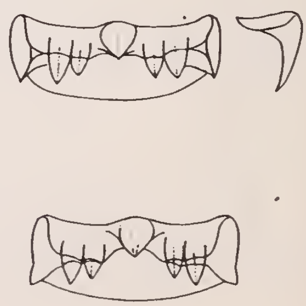

Fig. 13. Radula of *Tripterotyphis lowei* (Pilsbry, 1931)

Acknowledgments

I am indebted to Emily H. Vokes for helpful suggestions concerning the taxonomy of this paper and for the loan of study material. My thanks go to Mr. David K. Mulliner who carefully prepared 35 mm slides of specimens and my drawings for the oral presentation of this paper at the June 1982 meeting of the WSM, and to Mr. John Myers for reducing my drawings for use in this paper.

Fig. 14. Radula of *Cinclidotyphis myrae* DuShane, 1969.

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THE FESTIVUS

SAN DIEGO SHELL CLUB

FOUNDED 1961 • INCORPORATED 1968

MEETS THIRD THURSDAY, 7:30 P.M.
ROOM 104, CASA DEL PRADO, BALBOA PARK

President.....................Martin Schuler
Vice President................Bill Perrin
Secretary.....................Pat Sage
Treasurer.....................Walter Robertson
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CLUB ADDRESS: Address all correspondence to San Diego Shell Club Inc., c/o 3883 Mt. Blackburn Ave., San Diego, California 92111.

VOL. XIV SEPTEMBER 1982 NO. 9

Come to the "OUT OF THIS WORLD" party.
(There is no regular meeting this month).

For details and directions, see map on the last page of this issue.

Date: 18 September 1982 Time: 6:00 P.M. -? Place: The Frank King's home

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DR. RICHARD C. BRUSCA AT THE SAN DIEGO NATURAL HISTORY MUSEUM

We welcome Dr. Richard C. Brusca to San Diego. He is spending his sabbatical year as Curator of the Department of Marine Invertebrates at the San Diego Natural History Museum.

Dr. Brusca, who received his PhD from the University of Arizona in 1975, is Curator of Crustacea at the Allan Hancock Foundation and Professor of biology at the University of Southern California as well as the Director of Academic Programs at the Catalina Marine Science Center of that University.

Rick Brusca's research interest is systematics and biogeography and he is currently preparing a textbook on invertebrate zoology. Besides his sizeable list of publications, his well-known book COMMON INTERTIDAL INVERTEBRATES OF THE GULF OF CALIFORNIA, Second revised edition [1980. 513 pp., 340 ill., 243 black & white photos, 31 color photos, U. of Ariz. Press, Tucson] is on the library shelves of many Club members interested in the fauna of the Gulf. He also published in 1978 with his brother, G.J. Brusca, A NATURALIST'S SEASHORE GUIDE. COMMON MARINE LIFE OF THE NORTHERN CALIFRONIA COAST AND ADJACENT SHORES. [205 pp. Mad River Press].

FROM THE MINUTES

SAN DIEGO SHELL CLUB--19 AUGUST 1982

By

PAT SAGE

Martin Schuler called the meeting to order at 7:40 P.M. After welcoming guests, the speakers for the evening were introduced.

Steven Barnett, the 1982 Club Science Fair winner, gave a presentation of his winning project, "Environment Preference of Abalone" which dealt with the green abalone. He proposed to work on the red abalone in his next year's project. He was presented with the San Diego Shell Club award, "Between Pacific Tides."

Ron McPeak's slide presentation was a synopsis of three dive trips to Baja California's Los Angeles Bay, Escondido Bay and Cabo Pulmo. The slides of fish, corals, gastropods and nudibranchs plus other flora and fauna were quite beautiful.

After the refreshment break visiting artist, B. Buckingham, gave a description of his carvings of marine life that were displayed for the pleasure of the membership.

New business concerned primarily the September "Out of This World" party to be hosted by Frank and Harriet King at their home in Vista. [See map last page of this issue for details, Ed.]. Billee Dilworth graciously consented to act as food coordinator and the sign-up sheet was passed. For further information contact either Marty Schuler or Billee Dilworth.

The subject for the October meeting will be "Fossil Sharks' Teeth and Where to Find Them Locally." The shell drawing for the evening was won by new member, Mig Jumel. The meeting adjourned at 9:00 P.M.

MOLLUSCAN POPULATIONS AT BAHÍA SAN CARLOS, SONORA, MEXICO

BY

LEROY H. POORMAN

15300 Magnolia Street, Westminster, California 92683

Adapted from a paper presented to the Western Society of Malacologists at Redlands, California, 21 June 1982.

Since 1953 Forrest and I have made 37 visits totaling 955 days to San Carlos, Sonora. At first these were for one or two weeks each, but since 1973 our ventures have been for two or three months each year. Our primary interest was observing and collecting mollusks. Each time we went, it was with increased knowledge and more sophisticated techniques. We collected every month of the year except June, July, and August; but we were there mostly during the fall and early spring.

Accurate records of habitats and species collected were kept. My purpose is to report on the species found and their habitats. Our observations raised a number of questions in our minds. These "points to ponder" may be very clear to other people; and yet every hypothesis we formed brought forth new exceptions and contradictions.

This report is organized about a rectangle extending 3 miles east and west and 4 miles north and south. The rectangle is centered at 27^{o} 55' N Lat., 111^{o} 05' W Long. This geographic region includes a point of land projecting into the Gulf of California about one half the way up the east shore (see Figure 1). The water is well circulated by wind and tide; and water temperatures range from 18^{o} to 37^{o} C., with $\pm 3^{o}$ variation from year to year.

Seismic activity in the Gulf There have been reports of increased seismic activity in the deeper waters of the upper Gulf for the past seven years. Scripps Institution of Oceanography is conducting studies in the Guaymas Basin, some 35 miles off the coast, where deep sea boiling vents are reported. Violent storms with high winds sometimes batter the shore. Midwinter rains can send sheets of water off the desert into the Gulf carrying many tons of silt which colors the water for miles. These are a few of the variables that make it so difficult to draw conclusions from our observations concerning the rectangle.

Habitats There is one large estero in the rectangle. The head was formerly an area of mangroves which are now gone to real estate development. Below the mangroves were acres of intertidal sand and silt sloping out to water 10-15 meters in depth. In 1953 the number of species on the flats was fantastic; but the estero is now so polluted that it is an open invitation to hepatitis. The pollution is from raw sewage from homes and a large marina, and also from the remains of fish brought into the estero by native fishermen and cleaned there. The air is strong with the smell of H_2S and most of the remaining shells are badly eroded. We have seen the human population of this region go from near zero to about 8,000 persons during the winter months.

The rest of the shoreline in the rectangle is made up of several coves with sandy beaches, intertidal reefs, rocky headlands and promontories, and sheer walls with water 30-40 meters in depth immediately offshore. The first eight years of our collecting were concerned with these intertidal habitats.

Since 1961 most of our activities have been carried out with small boat dredging, using a dredge with a 16-inch opening. New habitats were opened up for investigation including: sand and silt bottom, gravel, small and large rocks, beds of soft corals, one large bed of a species of antipatharian coral, under-water pinnacles and rocky

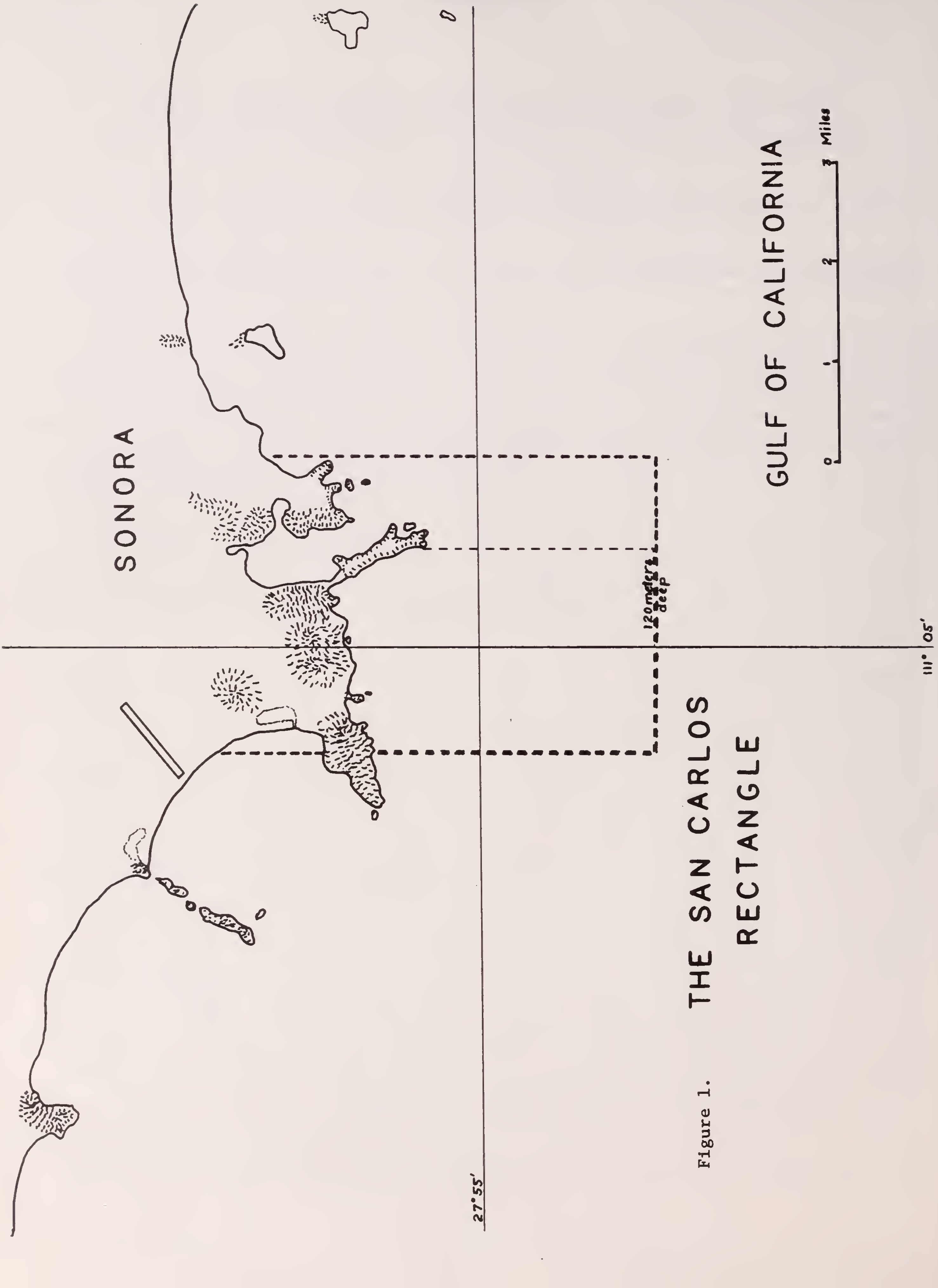
SONORA
GULF OF CALIFORNIA
THE SAN CARLOS
RECTANGLE
27°55'
111° 05'
120 meters deep
0
1
2
3 Miles

Figure 1.

ledges. There are also large areas of dead shells on silt in deeper water.

Algae provide important habitats and food in the rectangle. Floating seaweed is abundant during the summer months but is mostly gone by October. *Padina* is sometimes found in the rectangle in great quantities and is host to many species; but it comes and goes without reference to season or year. Two species of *Caulerpa* are also important. These are home for both prosobranchs and opisthobranchs, especially around the holdfasts. For several years we planted small rocks covered with two species of *Caulerpa* on the reef below the trailer park where only *Padina* had grown before. When we came back one fall, we found that the algae had spread along the reef for a third of a mile. One year later only one of the species remained but was now a solid mat out to 5 meters depth. A few living specimens of *Oxynoe, Lobiger,* and *Berthelinia* were on the original planting; but only the *Oxynoe* survived more than the first year and now are there in great numbers.

We have noted many changes in the sea bottom over the years. Reefs that were rich in molluscan life would become covered with sand and silt and the animals would disappear. Some of these reefs reappeared a few years later and the animals soon returned.

Dredging Our records indicate that we have made more than 4,000 dredging hauls in this rectangle. As a possible explanation for declining populations, it has been suggested that we dredge too much. Some simple calculations involving the size of the dredge, the number of hauls per year, and the size of the rectangle, indicate that it will take us more than 400 years to cover the bottom once. Considering the great changes one storm makes in the bottom, or the variations from other forces we find from year to year, it is not likely that we are oversampling. With the tidal currents offshore running 3-5 knots with equally strong countercurrents deeper down, it is probable that the softer bottom is continually in motion, at least out to the 100 meter mark.

Results Our records indicate nearly 1,000 species in our collection were taken somewhere in the rectangle in the past 28 years. In the phylum Mollusca they cover 4 classes, 22 orders, and 168 families. Seven new species have been described from the rectangle and another ten possible new species are awaiting more work. The records include 259 significant extensions of distribution as given in Keen's second edition of SEA SHELLS OF TROPICAL WEST AMERICA. Not as much attention has been paid to minute species yet. We have nearly 200 lots still awaiting identification. The literature is inadequate and identification is difficult. A good estimate of the total number of species in the rectangle is 1400 to 1500.

Points to ponder The following observations and hypotheses are based on field experience and do not lend themselves to statistical analysis.

1. We believe that there is a cyclic rise and fall in populations of many species.
   Examples: One year we dredged juvenile *Glyphostoma neglecta*. Then for several years there were adults only. This was followed by one year of old, eroded specimens. After several years of dead shells only, the cycle started again.

   When *Padina* was abundant, *Phylaplysia padina* were very common. Last fall the algae was plentiful but there were no *Phylaplysia*.

2. The number of intertidal species is declining. Contributing factors include:
   a. pollution from raw sewage, marinas, and rotting fish;
   b. large runoffs from rain with attendant silt;
   c. environments wiped out by construction;
   d. overcollecting by tourists--especially skin divers;
   e. commercial exploitation, jewelry makers, trash fishermen.

3. There is a decline in the quantity of offshore mollusks at all depths. Possibly related factors follow.
   a. Seismic activity and/or the warming of the water has occurred during the past few years.
   b. There is much shell predation by octopus, fish and starfish.
   c. This year there were almost no trash fish, the finback whales were gone, and sportfishing was very low.
   d. However, pelicans, cormorants, gannets and frigate birds were all back.

4. Benthic range--migration questions (3 examples).

   a. *Cassis centiquadrata* is normally found intertidally on sand bars. Why do we dredge so many small specimens just beginning the teleoconch in water to 60 meters? Why are the few adults which remain in deep water so much heavier and smaller than those which migrate to shore?

   b. *Cypraea annettae* is a common intertidal species. When dredged in 60 meters it is only half the normal size. But *Cyphoma* from 100 meters are larger than intertidal specimens.

   c. We dredge numerous small *Falsifusus dupetitthouarsi* down to 10 mm. in size in 100 meters. Then we come on dozens of adults crawling in sand among rocks intertidally some 5 miles from our dredging area. Do the adults migrate to shore to spawn and the veligers return to deep water to mature?

5. Some populations are isolated geographically, benthically, or by habitat.

   a. *Drillia tumida* occurs in 10-15 meters on gravel and small rocks off the trailer park. The only other population in the rectangle is 3 miles away in 100 meters on silt and dead shell.

   b. *Niso splendidula* occurs only on small rocks and gravel in 30 meters. There are two populations 2 miles apart with none in between.

   c. *Cantharus shaskyi, Mitra walkerorum,* and *Fusinus zacae* are found along the 100 meter line no matter what the bottom.

Over many years we have witnessed much change in the environment and in the variety of species. Yet we feel that we can say with reasonable certainty where in the rectangle any given habitat is to be found and the species most likely to occur there.

Addition to the roster:

Leonard, Mr. Fred L., 800 North 41st Ave., Hollywood, FL 33021.

Changes of address:

Schoening, Bob, 1177 Dublin Pl., Herndon, VA 22070.
Williams, Pete & Pat, c/o Lt. Pete Williams, Chief, Environmental & Preventive Medicine Service, NRMC Corpus Christi, TX 78419.

New Members:

Jumel, Mig., 317 Windyridge Glen, Escondido, CA 92026.
Thorpe, Fran H., 3910 Battersea Rd., Coconut Grove, FL 33133.

FAVARTIA GUAMENSIS EMERSON & D'ATTILIO, 1979: OBSERVATION ON ITS GEOGRAPHICAL DISTRIBUTION

BY

ANTHONY D'ATTILIO

Department of Marine Invertebrates, San Diego Natural History Museum, Balboa Park, P.O. Box 1390, San Diego, California 92112

In 1979 Dr. William K. Emerson and I described a number of new muricid species from various localities. The paper, "Six New Living Species of Muricacean Gastropods" appeared in the Nautilus Vol. 93(1):1-10, (10 January). One of the new species was *Favartia guamensis* taken from depths of approximately 18-21 meters (60 feet) in coral rubble at Guam. See Figures 1 and 2 of the holotype. This small species is distinctive and colorful, varying from pink to orange or flushed with violet. Our knowledge of the geographical distribution at that time was based entirely on the type locality.

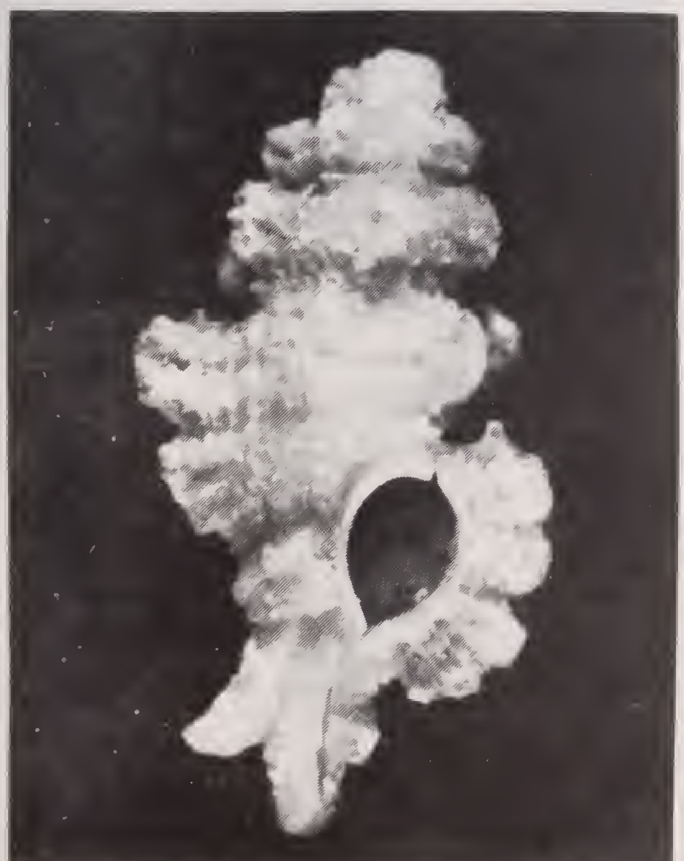

Fig. 1. Apertural view of *Favartia guamensis* Emerson & D'Attilio, 1979, Holotype, SDNHM 72625. Size: 715 mm in length Type locality: off Orote Cliffs, Guam, in 18-21 m., under large boulders. Leo Kempczenski, collector. Photo: David K. Mulliner.

Fig. 2. Dorsal view of holotype.

In a letter recently received from Mr. Andre Lefant of Papeete, Tahiti, were enclosed some photos in color of this same species, *Favartia guamensis* taken at Tahiti in somewhat shallower water than the type. A black and white print made by Mr. David K. Mulliner from one of Mr. Lefant's color photos is shown in Figure 3.

If these specimens from Tahiti are part of a viable breeding population, we may give the presently known distribution as from Guam in the western central Pacific to Tahiti in the far southeastern portion of the tropical Pacific. The shells, as indicated by Mr. Lefant, are approximately 9-13 mm. They are within the same size and color range as the specimens from Guam.

Such a superficially disjunct distribution does not seem natural for such closely related morphological forms of one species. We can surmise that when sought for carefully, the species will be found in numerous intervening island areas. Much of the oceans remain entirely unexplored, especially for such small molluscan species.

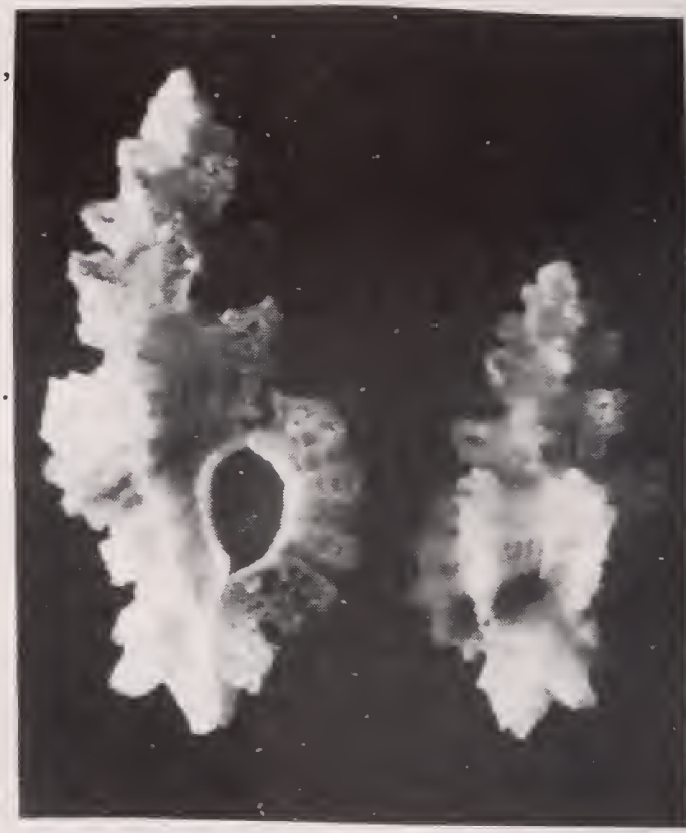

Fig. 3. *Favartia guamensis* from Tahiti.
Sizes: 9 and 13 mm.
Andre Lefant, collector.
From a color photograph by Mr. Lefant
Black & white photo prepared by
Mr. David K. Mulliner.

SUPPLEMENT TO "AN ABRIDGED CHECK LIST...": PAPERS ON WEST AMERICAN MARINE MOLLUSCA, PUBLISHED DURING THE YEARS 1937 TO 1956

A. MYRA KEEN
Stanford University, California

Editor's note

This "Supplement" was originally completed in 1956 and mimeographed that summer by John Q. Burch, editor of the Minutes of the Conchological Club of Southern California. It was never published. Recently a copy of this work was "found" in the San Diego Natural History Museum reprint files. This "Supplement" extends the bibliography of the literature on West American marine mollusks to 1956. Its value to the worker concerned with the mollusks of this area is considerable; and with the permission of Dr. A. Myra Keen, The Festivus is pleased to publish the "Supplement."

Following is the chronology of the bibliographic material on West American marine mollusks which antedates this "Supplement."

1758-1864

Carpenter, Philip Pearsall

1857. Report on the present state of our knowledge with regard to the Mollusca of the west coast of North America. From: Report of the British Association for the Advancement of Science of 1856. (pre- Apr. 22).

1864. A supplementary report of the present state of our knowledge with regard to the Mollusca of the west coast of North America. From: Report of the British Association for the Advancement of Science for 1863, pp. 517-686 (post-Aug. 1).

1872. The mollusks of western North America. Embracing the second report made to the British Association on this subject, with other papers; reprinted by permission, with a general index. Smithsonian Inst. Misc. Coll. 10 (252): xii + 325 + 13-121 (Dec).

1864-1908

Dall, William Healey

1909. Material toward a bibliography of publications on the post-Eocene marine mollusks of the northwest coast of America, 1865-1908. Appendix xiii of Contributions to the Tertiary paleontology of the Pacific coast I The Miocene of Astoria and Coos Bay, Oregon. U.S. Geol. Surv. Prof. Paper 59(1908):192-216. (Apr. 2).

1908-1936

Keen, A. Myra

1937. An abridged checklist and bibliography of west North American marine Mollusca. Stanford Univ. Press, Stanford CA, 87 pp. (Sept.).

<u>Introductory Note:</u>-- The following titles are arranged in the same manner and with the same coverage as in the "Abridged Check List":-- Pelecypoda, Scaphopoda, and Gastropoda (except Nudibranchiata) from the area between San Diego, California and Point Barrow, Alaska. A complete canvass of the "Minutes of the Conchological Club of Southern California" would be desirable, but as many of these contributions were in the form of extracts from letters, the criterion for inclusion that was adopted here was a) a formal title and by-line, and b) publication after the date when the "Minutes" became available by subscription.

A few titles are included from years prior to 1937 that were missed in previous bibliographic lists. It is inevitable that pertinent titles also have been overlooked in this compilation, but even so, those that are cited herein and the summary at the end should form a convenient guide to recent literature. My apologies go to author and to reader for any errors and omissions.

Coverage dates include July 1937 to July 1956.

1. Abbott, Donald P. "Water circulation in the mantle cavity of the owl limpet, *Lottia gigantea* Gray," Nautilus, vol. 69, no. 3 (Jan. 1956), pp. 79-87, figs. A-D.

2. Abbott, R. Tucker. "Eastern Pacific *Poromya* and *Cetoconcha* names," Nautilus, vol. 65, no. 1 (July 1951), p. 33.

3. ------. <u>American Seashells</u> (New York: Van Nostrand, 1954). pp. xiv + 541, 100 figs., 40 pls.

4. Ancey, C.F. "Liste de coquilles recoltées à San Diego (Californie)," Le Naturaliste, 3me Ann., vol. 1, no. 57 (Aug. 1881), pp. 453-454.

5. Baily, Joshua L. "Note on a Pacific *Cetoconcha*," Nautilus, vol. 58, no. 2 (Oct. 1944), p. 67.

6. -----. "*Iolina*, new name for *Iolaea* A. Adams, 1860," Nautilus, vol. 61, no. 3 (Jan. 1948), p. 107.

7. -----. "Locomotion in *Lima*," Nautilus, vol. 63, no. 4 (April 1950), pp. 112-113.

8. -----. "*Maxwellia*, genus novum of Muricidae," Nautilus, vol. 64, no. 1 (July 1950), pp. 9-14.

9. -----. "Some notes on *Haliotis*," Nautilus, vol. 64, no. 3 (Jan. 1951), pp. 91-94.

10. Bartsch, Paul and Rehder, Harald A., "Two new marine shells from the Aleutian Islands," Nautilus, vol. 52, no. 4 (April 1939), pp. 110-112, pl. 8.

11. Bartsch, Paul. "The West American *Haliotis*," Proc. U.S.Nat. Mus., vol. 89, no.3094 (1940), pp. 49-58, pls. 6-8.

12. -------. "*Burchia*, a new genus of turrids," Nautilus, vol. 57, no. 4 (April 1944), pp. 115-116.

13. -------. "Some notes upon West American turrid mollusks," Proc. Biol. Soc. Washington, vol. 57 (June 28, 1944), pp. 25-30.

14. -------. "Some turrid mollusks of Monterey Bay and vicinity," Proc. Biol. Soc. Washington, vol. 57 (Oct. 31, 1944), pp. 57-68.

15. -------. "*Morrisonella*, a new genus of East Pacific deep sea mollusks," Nautilus, vol. 59, no. 1 (July 1945), p. 23.

16. -------. "Some notes on the genus *Exilioidea*," Nautilus, vol. 59, no. 2 (Oct. 1945), pp. 61-63, pl. 7.

17. -------. "A remarkable new genus and species of West American marine mollusks," Jour. Washington Acad. Sci., vol. 36, no. 8 (Aug. 15, 1946), pp. 281-282, figs. 1-3.

18. Bentson, Herdis. "A systematic study of the fossil gastropod *Exilia*," Univ. Calif. Publ. Bull. Dept. Geol. Sci., vol. 25, no. 5, pp. 199-238, pls. 1-3.

19. Bequaert, J. "Random notes on American Potamididae," Nautilus, vol. 56, no. 1, (July 1942), pp. 20-30.

20. Berry, S. Stillman, "A second Californian *Dimya*," Proc. Malac. Soc. London, vol. 26, pt. 1 (May 4, 1944), pp. 25-26, 4 figs.
21. ------. "A new Californian *Neosimnia*, "Jour. Conch., vol. 22, no. 8 (May 1946), pp. 190-193, 4 figs.
22. ------. "Californian forms of *Pedicularia*," Leaflets in Malac., vol. 1, no. 1 (Nov. 4, 1946), pp. 1-4, 3 figs.
23. ------. "On *Opalia montereyensis* (Dall)," Jour. Entom. and Zool., vol. 40, no. 1, (1948), pp. 15-19, 5 figs.
24. ------. "New light on the taxonomy of West American species of *Crepidula*," Amer. Malac. Union News Bull. (Nov. 1949), p. 22 (abstract).
25. ------. "A partial review of some West American species of *Crepidula*," Leaflets in Malac., vol. 1, no. 8 (Nov. 14, 1950), pp. 35-40.
26. ------. "A pteropod new to California," ibid., pp. 41-42.
27. ------. "West American razor-clams of the genus *Ensis*," Trans. San Diego Soc. Nat. Hist., vol. 11, no. 15 (August 14, 1953), pp. 393-404, pl. 29, 4 figs.
28. ------. "Notices of new West American marine Mollusca," Trans. San Diego Soc. Nat Hist., vol. 11, no. 16 (Sept. 1, 1953), pp. 405-428, pls. 28-29, 10 figs.
29. ------. "Importance of the large pyramidellid elements in the West American fauna," Amer. Malac. Union Ann. Rept. (1954), p. 25 (abstract).
30. ------. "The West Coast's confused and confusing white slipper shells, *Crepidula*, subgenus *Ianacus*," Amer. Malac. Union Ann. Rept. (1955), p. 32 (abstract).
31. ------. "Mollusca dredged by the Orca off the Santa Barbara Islands, California, in 1951" Jour. Washington Acad. Sci., vol. 46, no. 5 (May 1956), pp. 150-157, 9 figs.

32. Bonnot, Paul. "California abalones," California Fish and Game, vol. 26, no. 3 (1940), pp. 200-211.
33. ------. "The edible bivalves of California," California Fish and Game, vol. 26, no. 3 (July 1940), pp. 212-239, figs. 81-97.
34. ------. "The abalones of California," California Fish and Game, vol. 34, no. 4, (Oct. 1948), pp. 141-169, figs 52-68.

35. Bormann, Mary. "A survey of some West American Ocenebras, with description of a new species," Nautilus, vol. 60, no. 2 (Oct. 1946), pp. 37-43, pl. 4.
36. ------. "Some West American Ocenebras," Minutes, Conch. Club. S. Calif., no. 71, (July 1947), pp. 7-9.
37. ------, editor. Shells and Shell Collecting (Long Beach, California: Long Beach Shell Club) Mimeographed (1948), 72 pp.
38. Bormann, Ralph, Bormann, Mary, and Bormann, Ralph, Jr. "Some rare California shells," Nautilus, vol. 55, no. 4 (April 1942), pp. 141-142.

39. Burch, John Q., editor. 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, nos. 33-63 [March 1944-September 1946], separately issued (1946) as Part I and Part II, vols. I-II).

40. Burch, John Q. "Notes on *Petricola tellimyalis* (Carpenter)," Min. Conch. Club S. Calif., no. 83 (Sept. 1948), pp. 9-10.
41. -----. "A systematic outline of the Muricacea of the eastern Pacific," Min. Conch. Club S. Calif., no. 149 (Aug. 1955), pp. 3-13.

42. Burch, Tom. "A new *Pseudomelatoma* from California," Nautilus, vol. 52, no. 1 (July 1938), pp. 21-22, 3 figs.
43. -----. "Addition to the molluscan fauna of California," Nautilus, vol. 54, no. 2 (Oct. 1940), pp. 46-47, pl. 2.
44. -----. "A survey of the West American Aligenas, with a description of a new species," Nautilus, vol. 55, no. 2 (Oct. 1941), pp. 48-51, pl. 4.

45. Carlisle, John G., Jr. "The problem of the abalone: artificial spawning and fertilization of *Haliotis rufescens*," Amer. Malac. Union News Bull. (Nov. 1949), p. 20 (abstract).

46. Chace, Emery P. "Field notes on some West Coast mollusks," Nautilus, vol. 56, no. 2 (Oct. 1942), pp. 41-43.

47. -----. "Some notes on *Neverita*," Amer. Malac. Union News Bull. (Dec. 1950) p. 26 (abstract).

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Errata in the Bibliography of the "Abridged Check List..." (1937)

p. 51: The date of no. 10 is Aug. 13, 1917 (not Aug. 13, 1907). This title therefore should follow no. 28.

p. 56: The pagination of no. 85 should be: pp. 557-572, pls. 74-75 (not pp. 74-75).

P. 63: For title 199, the date of vol. I shold be ("1924" Sept. 1925).

DIRECTIONS

Have an Out of this World Time!

Out of this World Friends

From I-5
North on I-5 to Hwy 78. Left on Escondido Ave.

From 163
North on 163 to 15 to Escondido to Hwy 78. Right on Escondido Ave.

Escondido Ave. (1+mi) runs right into E. Vista Way. (Hobo Joe's will be directly in front of you). Continue on E. Vista Way for 2.7 mi to Osborne. Left on Osborne for .9 mi. Right on Hutchison. .3mi on Hutchison. Left thru chainlink fence and you're almost there--quite a long driveway!

Frank & Harriet King
2704 Hutchison
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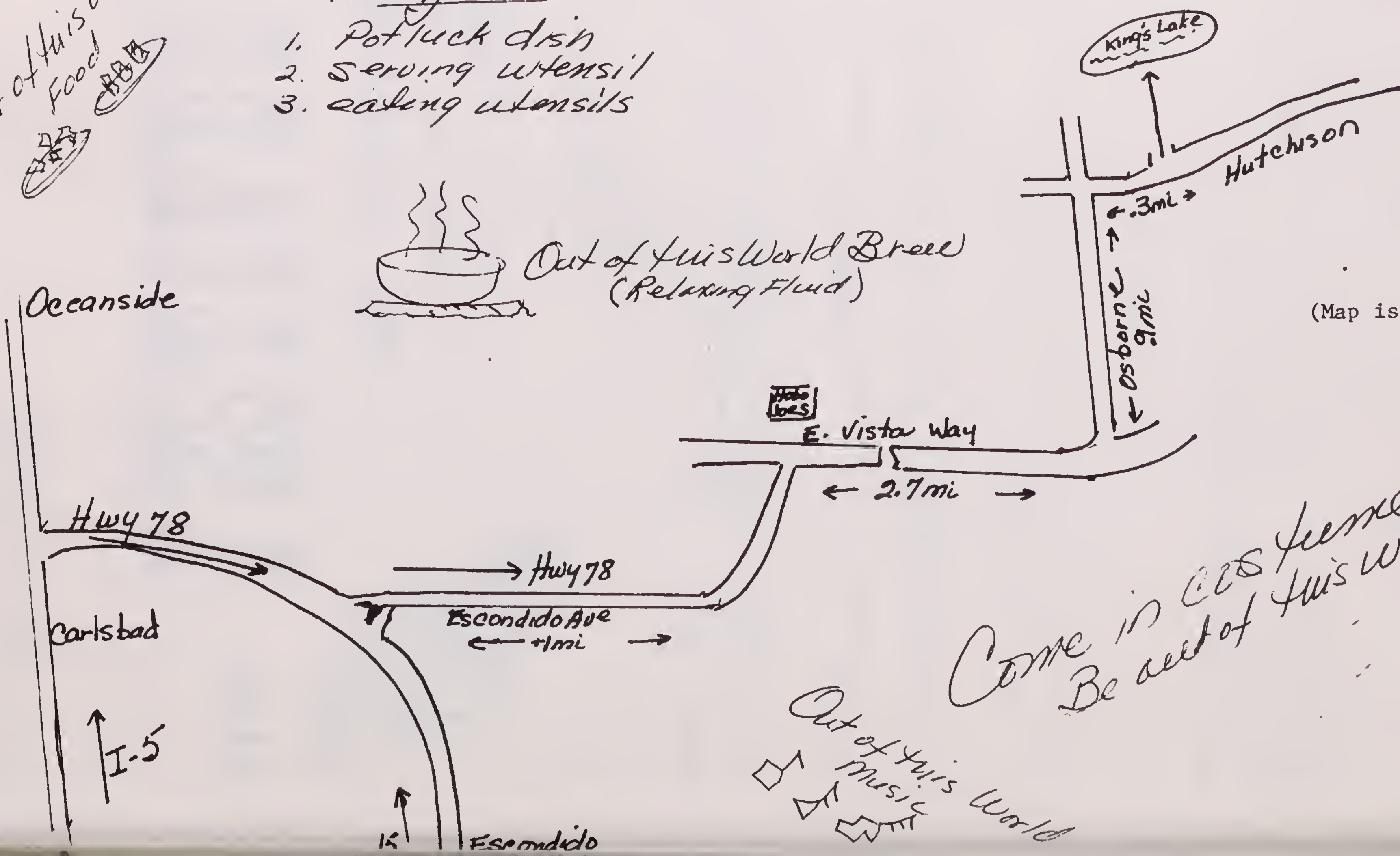
2. Serving utensil
3. eating utensils

Out of this World Brew
(Relaxing Fluid)

(Map is not to scale).



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THE FESTIVUS

SAN DIEGO SHELL CLUB

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VOL. XIV | OCTOBER 1982 | NO. 10

PROGRAM: William A. Walker of the Los Angeles County Museum of Natural History will speak on fossil sharks' teeth and where to find them.

Date: 21 October 1982 | Time: 7:30 P.M. | Place: Room 104

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MINUTE SHELLS

ODOSTOMIA HELGA DALL & BARTSCH, 1909 AND ODOSTOMIA FETELLA DALL & BARTSCH, 1909

BY

JULES HERTZ

Department of Marine Invertebrates, San Diego Natural History Museum, Balboa Park, P.O. Box 1390, San Diego, California 92112

Many species belonging to the genus *Odostomia* Fleming, 1813 (family Pyramidellidae Gray, 1840) occur along the coast of Southern California. These are most often minute white shelled species with various patterns of sculpture. Most are found by dredging, but there are a number occasionally found intertidally. Live collected species are uncommon intertidally, particularly in large numbers.

Pyramidellids have developed a method of sucking liquid food into their gut from the body of their prey. Fretter and Graham (1949) suggested that each species of pyramidellid is normally associated with a particular host and does not usually occur apart from the neighborhood of the host. Cole and Hancock (1955) believed that pyramidellids were not so precise in their feeding habits but were predominantly associated with one particular host. Fretter and Graham (1962) list a series of odostomias whose hosts vary from the polychaete worm *Pomatoceros triquetor* to various species of bivalves (*Astropecten irregularis, Mytilus edulis, Pecten maximus, Chlamys opercularis, Ostrea edulis,* and *Mya arenaria*). Morris, Abbott, and Haderlie (1980) note that *Petaloconchus montereyensis* Dall, 1919 also hosts a snail *(Odostomia sp.)* that feeds on the fleshy edge of the mantle.

During March 1981, 10 to 20 specimens of *Odostomia helga* Dall and Bartsch, 1909 were observed under large rocks at the low tide line. The low tides at that time were from -0.5 to 0.2 feet. The specimens were found at the north end of Tourmaline Surfing Beach (Sun Gold Point), Pacific Beach, San Diego, California. They varied in size from 2.5 to 4.0 mm. Apertural and dorsal views of a typical mature specimen from this lot are shown in Figures 1 and 2. The specimens (shells and animals) were white with the body whorl almost translucent. Specimens were found on the bottoms of rocks smoothed by water action and covered locally with tube forming polychaetes. The rocks were in areas of coarse sand. I was unable to determine the host for *O. helga* even after observing them periodically from March 1981 to May 1982.

Figure 3 shows some views of the protoconch of the specimen shown in Figures 1 and 2. Figures 4 and 5 show the apertural and dorsal views of the type specimen of *O. helga* (USNM 60905).

Dall and Bartsch's original description of *O. helga* was based primarily on specimens from San Diego, California although they examined several large lots from the San Pedro, California area. Their original description is as follows.

Fig. 1. Apertural view of *Odostomia helga* Dall & Bartsch, 1909. approx.26X

Fig. 2. Dorsal view of *O. helga* specimen shown in Figure 1.

Fig. 3. Camera lucida drawings of protoconch of *O. helga* specimen shown in Figure 1.
(a) Detail of shape
(b) Detail of nucleus
(c) Detail of early postnuclear whorls.

Fig. 4. Apertural view of *O. helga*, type (USNM 60905)

Fig. 5. Dorsal view of type of *O. helga*.

Shell conic, milk-white. Nuclear whorls smooth, deeply obliquely immersed in the first of the succeeding whorls, above which only a portion of the last two volutions project. Post-nuclear whorls moderately rounded, slightly contracted at the sutures, feebly shouldered at the summits, marked between the sutures by four broad low spiral bands which are separated by narrow, deeply incised lines. In addition to these bands, the first three and one-half whorls are marked by feeble axial ribs which are best developed near the summit of the whorls and scarcely reach the suture. The junction of the ribs and cords form weak nodules. Sutures strongly impressed but not channeled. Periphery of the last whorl well rounded, marked by a low spiral cord. Base strongly rounded posteriorly, attenuated anteriorly, marked by seven spiral cords, which grow successively weaker from the periphery toward the umbilical region and are separated by slender, deeply-incised spiral lines. Aperture large, broadly oval; posterior angle acute; outer lip thin, showing the external sculpture within; columella moderately strong, curved, reflected, and reinforced by the base; provided with an oblique fold at its insertion.

The type (Cat. no. 60905, U.S.N.M.) and ten specimens come from San Diego, California. The type has six post-nuclear whorls and measures: Length 4.2 mm., diameter 2 mm.

In the same paper, Dall and Bartsch (1909) named a second species, *Odostomia fetella* which superficially looks very similar to *O. helga*. Their original description of *O. fetella* was based primarily on specimens from San Diego, California although they examined specimens from San Ignacio Lagoon, Baja California, Mexico to San Pedro, California. The original description of *O. fetella* follows.

Shell very elongate-ovate, milk-white. Nuclear whorls small, obliquely two-thirds immersed in the first of the succeeding turns. Post-nuclear whorls well rounded, moderately contracted at the sutures and slightly shouldered at the summit, marked by four strong flattened cords which grow successively a little weaker from the summit to the periphery, separated by narrow, deeply incised spiral grooves. Periphery of the last whorl marked by a broad, flat cord somewhat wider than the first supra-peripheral one. Base of the last whorl somewhat attenuated anteriorly, well rounded, marked by eleven equal and equally narrow, rounded, spiral cords. In addition to this sculpture, there are many very fine incised spiral lines and decidedly retractive axial lines of growth on the spire and base. Aperture broadly oval, slightly effuse anteriorly, posterior angle acute; outer lip thin, showing the external sculpture within; columella moderately strong, slightly curved, somewhat reflected, completely reënforced by the base, provided with a strong fold at its insertion; parietal wall covered by a thin callus.

The type (Cat. no. 46478, U.S.N.M.) and 124 specimens come from San Diego, California. The type has seven post-nuclear whorls and measures: Length 4.4 mm., diameter 1.8 mm.

Figures 6 and 7 show apertural and dorsal views of the type of *Odostomia fetella*.

Comparison of the original descriptions of *Odostomia helga* and *Odostomia fetella* as well as study of the two type specimens show their obvious similarity. I found little, if any, difference in the nuclei of the type specimens of *O. helga* and *O. fetella*. Dall and Bartsch in their 1909 monograph of West American pyramidellid

Fig. 6. Apertural view of type of *Odostomia fetella* (USNM 46478)

Fig. 7. Dorsal view of type of *O. fetella*.

mollusks placed *O. helga* in the subgenus *Chrysallida* Carpenter, 1856 and *O. fetella* in the subgenus *Menestho* Mõller, 1842. They also included a key to the subgenera of *Odostomia*. The primary difference between the subgenera *Chrysallida* and *Menestho* is in the axial sculpture. Per Dall and Bartsch (1909), the subgenus *Chrysallida* consists of "odostomias having strong axial ribs crossed by equally strong spiral keels between the sutures, the intersection of these two elements forming nodules. The axial ribs pass only faintly over the base, while the spiral sculpture remains quite prominent." Dall and Bartsch characterized the subgenus *Menestho* as follows: "Shell not umbilicated, marked by moderately well developed and usually equally spaced spiral cords; axial sculpture reduced to mere lines of growth which frequently appear as very slender raised threads in the grooves between the cords.

In researching the differences between *O. helga* and *O. fetella*, I examined many large lots from both the National Museum of Natural History, Smithsonian Institution (USNM) and the San Diego Natural History Museum (SDNHM). For *O. helga* this consisted of USNM lots 162773, 162774, 60905, and SDNHM lots 15284, 18287, 18288, 18289, 41404, 42173, 42194, 42195, 42197, 42198, 42202, and 42203. For *O. fetella* this consisted of USNM lots 46477, 46478, 208068, and SDNHM lots 18321, 18322, 41964, 41965, 41966, and 41967.

In several of these lots, such as USNM 162773 and 162774, there is a large variation in specimen axial sculpture. Some specimens were essentially devoid of axial sculpture while others had significant amounts of sculpture on the upper whorls. Variation to a lesser degree occurred in the axial sculpture of the specimens found at Pacific Beach, San Diego, California during March 1981. Between March 1981 and May 1982, specimens having extreme differences in sculpture were found.

Figures 8 and 9 show the apertural and dorsal views of a specimen of *O. helga* collected on December 24, 1981. This represents the most prominently sculptured specimen found at this site. Conversely, Figures 10 and 11 show the apertural and dorsal views of a specimen *(O. ?fetella)* essentially devoid of axial sculpture collected on October 25, 1981.

Fig. 8. Highly sculptured *O. helga:* apertural view.

Fig. 9. Dorsal view of specimen shown in Figure 8.

Fig. 10. Specimen of *(O.?fetella)* with minimal sculpture.

Fig. 11. Dorsal view of specimen shown in Figure 10.

The obvious question, therefore, follows. Are there truly two species, *O. helga* and *O. fetella*, or are these polymorphic forms of a single species? The answer requires anatomical study of the animals of a large population and is beyond the scope of this paper.

Figures 12 and 13 show the animal of the specimen depicted in Figures 10 and 11. Figure 12 gives a good view of the animal's foot, and Figure 13 shows the animal's eyes on the head near the base of the tentacles.

Fig. 12. *O. ?fetella* with extended foot. Specimen collected at Pacific Beach, California on October 25, 1981.

Fig. 13. Same animal as shown in Figure 12. Note eyes on head at base of tentacles.

Acknowledgments

I am particularly indebted to David K. Mulliner, Festivus staff photographer, for his excellent photographs of these minute shells and to Anthony D'Attilio for the camera lucida protoconch drawings. I am also grateful to Dr. Joseph Rosewater of the National Museum of Natural History, Smithsonian Institution for the loan of type material and other lots of odostomias.

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GEOGRAPHIC UNCERTAINTIES IN THE WEST AMERICAN DONACIDAE*

BY

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Golden Gate Park, San Francisco, California 94108

Last year, I presented to the Western Society of Malacologists the preliminary results of my work on the West American members of the bivalve family Donacidae. That work is now completed and in press. In preparing the sections on the distribution of each species, I was faced with an array of problems-- anomalous records or specimens that didn't fit the pattern of the rest of the material I studied. There were several kinds of problems, each with a different explanation. I thought that these case histories might be of interest to you and might be of help in examining similar problems in other groups.

I prefer to say that where a species lives is its "occurrence" or its "distribution" rather than its "range." The latter, though widely accepted, evokes for me the image of a herd of caribou wandering each year from one Arctic area to another, and benthic mollusks don't "range" about their world. (One worker has suggested the restriction of the term "range" to the broadest of statements -- "Gulf of California to Panama" -- and use of the terms "distribution" or "occurrence" for more detailed information, including habitat data).

Describing the distribution of a species is not always an easy task. In preparing a revision of a group, one must, as a matter of course, doubt anything that anyone else has said before. But even when one is able to examine a large quantity of material, one cannot answer all the questions. There will remain uncertainties, and it is difficult to describe them and to explain them in the little section under each species labeled "distribution." As one approaches the level of abstraction of a large faunal volume, this task becomes virtually impossible.

In the case of the Donacidae, I examined more material from more institutions than was possible for any group I had worked on previously. Review of a large quantity of material is of great benefit to any such study. Each of the large research collections in this country has different strengths. In some, different parts of the west American coast are better represented, some are stronger on the clam fauna of sandy beaches, others stronger on subtidal gastropods. But the more collections one examines, the more likely one is to run into troublesome specimens-- such as those labeled as coming from places far removed from other records.

Let's look at some of the categories of such puzzling records.

First and most common, of course, are incorrect identifications. For example, all records of *Donax punctatostriatus* from South America are incorrect. They are based either on *Donax obesulus* or on a new subspecies of *Donax caelatus* which I will describe in my paper. *Donax punctatostriatus* is not yet known from any further south than Manzanillo, Mexico.

The literature is filled with such incorrect identifications, and they account for most incorrect distributional records. If the misidentified specimens involved are in the major collections, it is easy to clarify which species actually occurs where. If they are not, one can none-the-less be fairly confident that a given record is wrong

* Modified from a paper presented at the Western Society of Malacologists (WSM) meeting, June 1982.

if one has shown a prevalent misidentification has occurred. Thus, it is likely that all so-called *Donax punctatostriatus* from South America are something else.

A similar case is that of early records that are not represented by any specimens one can locate. For example, Dall reported *Donax punctatostriatus* from California, but there aren't any specimens in major collections I have examined from any farther north than Isla Cedros. Since this part of the coast has been reasonably well surveyed over many years, one can assume that the Californian record was in error. The same is the case for records of *Donax culter* (reported as *Donax conradi*) from California. It is not represented in collections even on the outer coast of Baja California. A key factor in these cases is the presence or absence in the area in question of species that could be misidentified as the species involved.

A third kind of problem is a single lot in a collection from a station well removed from all other material. Just how one decides to treat this situation depends on interpreting several factors -- how reliable you think the locality information is (which is not always an easy decision to make), the magnitude of the distance, the appearance of the specimens, how well intermediate stations have been collected, and the nature of the place involved.

For example, there is a single specimen of *Donax kindermanni* in the U.S. National Museum labeled as having come from Panama. It's an old lot, and there is no other material in any collection from any farther south than El Salvador, none from Nicaragua nor Costa Rica, and no other material from Panama. Thus, the distance is great. I strongly suspect that the USNM locality is in error, but I have no way of proving it. It is also true that the Central American coast has not been heavily surveyed. On balance, though, I exclude this record.

A similar situation is represented by a single lot of *Donax carinatus* in the Museum of Comparative Zoology labeled as having come from Pisco, Peru, the next most southerly record being Mancora, Peru, some 750 miles northward. It's a fairly old lot, and I doubt the record. The marine environment at Pisco is not like the tropical one at Mancora.

Even recently acquired materials can be in error. There is a lot in the MCZ of *Donax carinatus* labeled as having come from the coast near Hermosillo, Sonora. It came from the Parker survey of the Gulf of California. But, as it turns out, it doesn't match his paper which reports this species only from one station and that south of Mazatlán. So there is evidence that an error has crept into the collection since his publication. The coasts of Sonora and Sinaloa have been fairly well surveyed, and such a conspicuous species would probably not be missed.

Even original descriptions can have locality errors. Orbigny described *Donax paytensis* from Paita, Peru. It is a synonym of *Donax dentifer*, of which no specimens are in collections I've reviewed from south of Playas, Ecuador. He also described *Donax obesus* from there, but I have seen no specimens of it from south of Canoa, Ecuador. Maybe these two species get as far south as Paita, Peru, but I think that there is a good chance that neither of them does and that the original localities were wrong. Moreover, the fact that two species are involved bolsters the argument.

When dealing with situations in which there are specimens from problematical localities, it is difficult to make absolute statements. Proving that something does <u>not</u> occur in a given place is, in fact, theoretically impossible. Even building a case that something doesn't occur in a certain place is a good deal more difficult than proving that it <u>does</u> occur there. One must weigh the available evidence and try to come up with language that accurately states the degree of doubt. From situation to situation, group to group, and worker to worker, there are no standards for such statements. One tries to make the threshold decision about what to say the distribution of a species is "for sure," and what records to put into subsequent statements about questionable, doubtful, or impossible records. In such additional statements, I decided to use the word "probably" for records that seem fairly certain and are based on material that, for one reason or another, I could not study personally. (For

SOME SAMPLE *DONAX* DISTRIBUTIONS

Species	Northward				Southward		
	Doubtful	Possible	Probable	"For Sure"	Probable	Possible	Doubtful
D. obesus		Guerrero, Mexico		Gulf of Fonseca to Canoa, Ecuador		Tumbez, Peru; Paita, Peru	
D. culter	California			La Paz and Sonora to Acapulco, Mexico			Peru
D. assimilis	Mazatlán. Mexico	Guerrero, Mexico		Gulf of Fonseca to Gulf of Guayaquil			
D. dentifer			Guatemala	Gulf of Fonseca to Playas, Ecuador		Paita, Peru	
D. carinatus		Hermosillo, Mexico		Altata & Bahía Magdalena, Mexico to Tumbez, Peru		Pisco, Peru	
D. kindermanni				Jalisco, Mexico to Gulf of Fonseca		Panama	South America
D. gracilis				San Bartolomé, Mexico to Playas, Ecuador	Negritos, Peru		
D. gouldii		Northern California*				Isla Soccoro, Mexico*	

* = larval drift in special years

Table 1.

example, I could not look at Olsson's collection). I chose the word "possible" for records that were further afield and on which some sort of an error might be the explanation. This graded into other terms for records I was fairly certain were in error, using such terminology as: "This is not confirmed by other records," "not corroborated my museum specimens," "I think that this locality is probably incorrect," or "doubtful."

There is a further complication. In unusually warm years, marine temperatures and currents can play hovoc with so-called "normal" distributions. There are a number of records of *Donax gouldii* in northern California -- Tomales Bay, the San Mateo County coast, and Monterey Bay. But this common, gregarious southern Californian species does not normally occur north of the Pismo Beach area, which I would make its northern limit. This is a well-explored coast and a well-known species, and these northern records certainly represent larval settlement in unusual years. The larvae of several species on the east coast of the U.S. repeatedly settle north of their normal occurrence, only to be killed by the cold winter.

This phenomenon most probably occurs also in the case of species that are less well known and on parts of the shores of the eastern Pacific that are less well studied. Rarely is a geographic or habitat limitation an absolute barrier, or an equally substantial barrier all of the time. For this reason alone our statements about the distribution of species are only approximations. Table 1 shows some sample *Donax* distributions.

You may better appreciate why the published distribution of a species differs from author to author, if you keep these explanations in mind.

Up to this point, I've made no mention of the well-documented introductions by man of many mollusk species outside of their normal distributions. In some cases, such introduced species have spread rapidly. But such introductions are surely only a special case of the natural movement of species. As we come to better know marine species and their distributions, we may be able to watch as a particularly successful species comes to inhabit new territory on its own and on more than a "special year" basis. This will make our statements about distributions in our monographs and books more complete and interesting. For example, we might say that a species "occurs from Panama northward to central Mexico, but may be expected in the Gulf of California by the end of the century."

"OUT OF THIS WORLD" PARTY

BY

PAT SAGE

On the evening of 17 September, an assembly of intergalactic representatives star-shipped in for wining and dining at the Vista home of Frank and Harriett King.

The array of native planetary costumes was sparkling and imaginative. The usual gourmet food served at these annual functions was delicious and lured more than one alien back for seconds. Gathering at "Dave's Punch Bowl" was another favorite thing to do. It is regretted that members lost in space for the occasion could not have been on course for a most lovely evening.

Had awards been issued for the most "Out of this World" feature, it would have been a hands-down decision in favor of the delightful, magnificent, and lovely home of this year's hosts.

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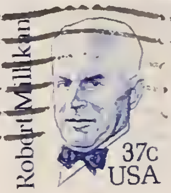

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VOL. XIV NOVEMBER 1982 NO. 11

PROGRAM: Boris Innocente from Phoenix will come and give an illustrated talk on Diving off Palawan.

Election of officers for 1982

MARK YOUR CALENDAR. The Club's annual Christmas party will be held on 11 December. See details in this issue.

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THE FESTIVUS DOES NOT PUBLISH AN ISSUE IN DECEMBER.

NOTES ON TURVERIA ENCOPENDEMA, A PARASITE ON SAND DOLLARS

BY

BERTRAM C. DRAPER

8511 Bleriot Avenue, Los Angeles, California 90045

In 1956, Dr. S. Stillman Berry described and named *Turveria encopendema*, a tiny mollusk which lives as a parasite on certain species of sand dollars. This mollusk has such an unusual shell that Dr. Berry had to establish a new genus for it. He named it *Turveria* honoring Mr. and Mrs. Henry R. Turver who collected the shells and brought him the sand dollars which serve as their hosts. These echinoids are of the genus *Encope*, and two species have been identified as having these tiny mollusks living on them. They are *Encope grandis* A. Agassiz and *E. californica* Verrill. So as a specific name Dr. Berry chose *encopendema*, with reference to the genus of sand dollars on which they live. Dr. A. Myra Keen (1971) shows the genus *Turveria* in the family Eulimidae along with several other parasitic genera to which it is likely related.

In his description, Dr. Berry showed a sand dollar of the species *Encope grandis* which had seven shells of *Turveria encopendema* in tiny pockets among its flat spines. The specimen he selected as his holotype had a length of 4.0 mm and maximum diameter of 1.6 mm. It came from Cholla Cove, Bahia de Adair, Sonora, Mexico, now better known as Cholla Bay, and was collected in May 1954.

Fig. 1. Sand dollar *Encope grandis* A. Agassiz. Ventral view of specimen from Cholla Bay, Sonora, Mexico with three individuals of *Turveria encopendema* Berry, 1956 in situ as indicated by the arrows. Width of *E. grandis* is 103 mm.

During a trip to Cholla Bay in October 1973, my wife and I brought back several sand dollars of the species *Encope grandis*, and upon examination at least one had three *Turveria encopendema* specimens living on it. Figure 1 shows this sand dollar and the three tiny parasitic shells indicated by arrows A, B, and C. Figures 2, 3, and 4 show enlarged views of the three shells as they lived on the echinoid. The largest, shown at A, is 3.9 mm in length and 1.8 mm in diameter.

A year later my wife and I were again at Cholla Bay. Along with Carol Skoglund of Phoenix, Arizona, we collected shells and "grunge" on and under flat rocks at Pelican Point. This area is at the south edge of Cholla Bay and just a few meters in-shore from extensive beds of sand dollars which are barely exposed at extreme low tide. Later at home while looking through this grunge, I found several shells that I identified as *Turveria*. However, they were somewhat longer and white with deep orange spiral bands at the sutures, much more colorful and apparently more mature than any of the

Turveria on the sand dollars. Figure 5 shows three of these shells, the largest being 5.0 mm in length but only 1.8 mm in diameter.

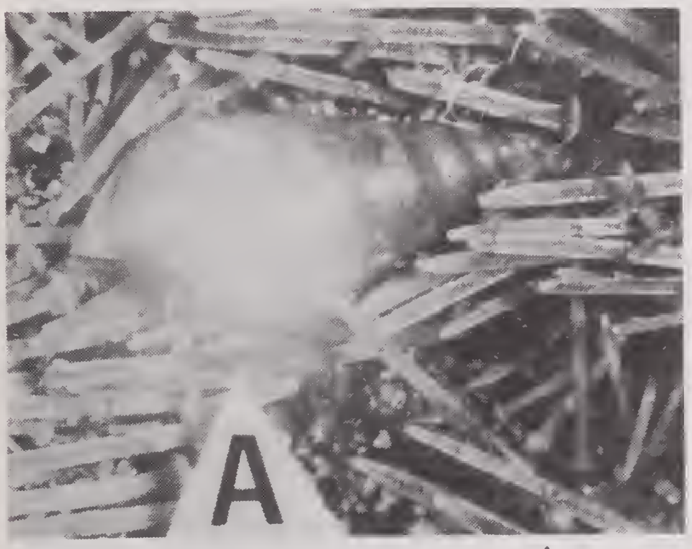

Fig. 2. Close-up view of *Turveria encopendema* shown at arrow A in Figure 1. Length: 3.9 mm, diameter: 1.8 mm, whorls approximately 9.

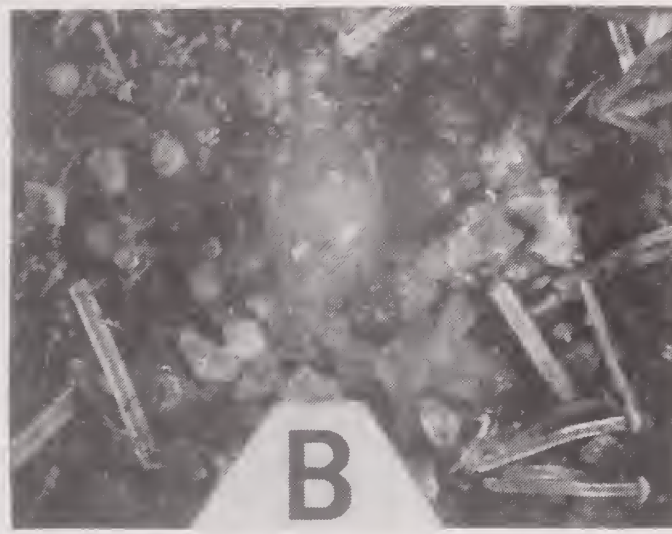

Fig. 3. Close-up view of *T. encopendema* shown at arrow B in Figure 1. Length: under 1.5 mm.

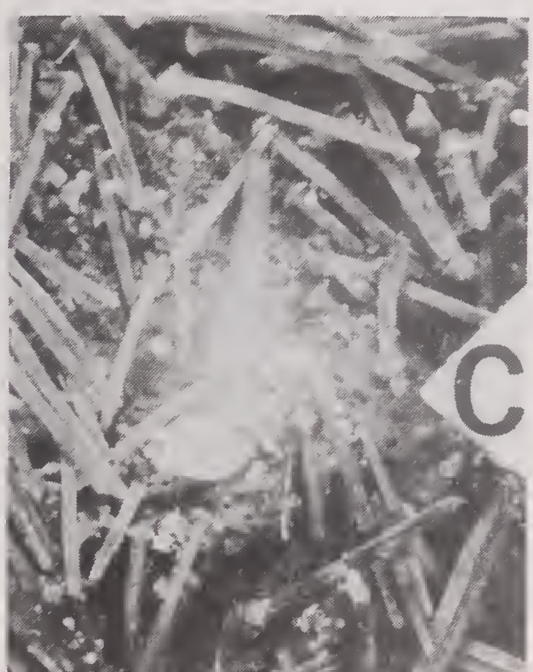

Fig. 4. Close-up view of *T. encopendema* shown at arrow C in Figure 1. Length: under 1.5 mm.

Fig. 5. Three mature *T. encopendema* specimens collected at Pelican Point, Cholla Bay under or between flat rocks about mid-tide level. Largest is 5.0 mm in length, 1.8 mm in diameter. Shells are white with deep orange spiral bands at the suture.

To better compare these, Figure 6 shows the largest shell from Figure 5 on the sand dollar just above the shell at arrow A in Figures 1 and 2. It appears that this larger shell has nearly two more whorls and a more fully developed outer lip. Three other shells of *Turveria encopendema* found in high drift a few miles south of Cholla Bay in Marua Estero are shown in Figure 7 along with the shell removed from the A location in Figure 1. The largest of these appears to be nearly mature while the other two are quite juvenile.

My curiosity was aroused and I wondered why all the shells found among the rocks at Pelican Point appeared to be fully mature while those on the sand dollars were all rather immature. Could the mature shells represent *Turveria* that were ready for mating and left their host sand dollars and rode an incoming wave up to the rocks where they could find mature mates from other sand dollars? Maybe they copulate there and their fertilized eggs hatch there and then ride an outgoing wave to the sand dollar beds where they find an *Encope* sand dollar on which to settle. Or do the mature *Turveria* leave their pockets in the sand dollar's spines, move around until they find a mate, leave their eggs on the sand dollar, then die and become washed in-shore? I favor the theory that they leave the sand dollars, ride a wave to shore rocks, possibly complete their final mature shell growth, mate, and then die. The lack of mature shells on the sand dollars support this theory.

So far, the reported range of *Turveria encopendema* is limited to the north part of the Gulf of California, Mexico. If anyone has found them beyond this area, I would appreciate hearing where they were found. I would also be interested in any additional observations of their habits or ecology.

Fig. 6. Comparison of largest *Turveria encopendema* in Figure 5 and specimen at arrow in Figure 1 which is still in situ on the sand dollar.

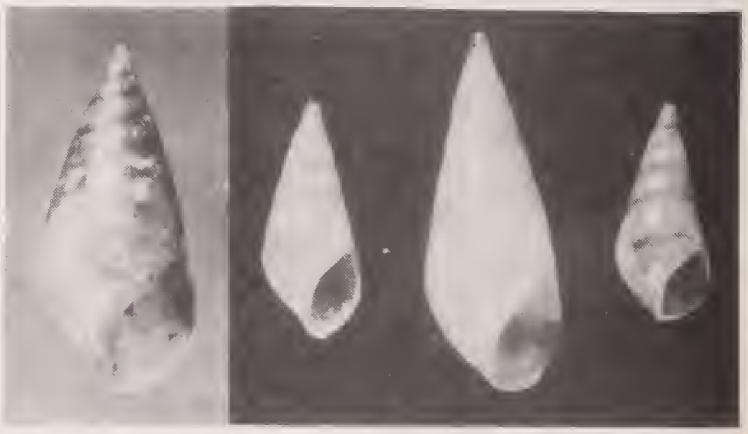

Fig. 7. *T. encopendema* shown at arrow A in Figure 1 is shown at left along with 3 shells of the same species from Marua Estero. several miles south of Cholla Bay. None appear to be fully mature.

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UPDATE ON NUDIBRANCHIA FROM TROPICAL WEST AMERICA*

BY

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Nudibranchs are sea snails in which all vestiges of the shell are lost in the adult stage and in which there is a return to bilateral symmetry. Food habits range from grazing on sessile animals to active swimming and capture of small planktonic prey. All nudibranchs are carnivorous.

There are 68 species of nudibranchs in A. Myra Keen's SEA SHELLS OF TROPICAL WEST AMERICA, Second edition, 1971, Stanford University Press. In "Sea Shells of Tropical West America." Additions and Corrections to 1975, OCCASIONAL PAPER 1 of the Western Society of Malacologists, by A. Myra Keen and Eugene Coan (1975), 14 species were added to the list, one removed as not being found in tropical West America, and one placed in synonymy.Since the publication of that Occasional Paper, nine new species have been described and three additional species reported which had not been listed before. Three generic changes have also been made.

Following are the changes in the listing of nudibranch species in Keen & Coan (1975).

Additional species

Aldisa sanguinea (Cooper, 1863) [a range extension from southern California noted by Ferreira & Bertsch (1975)]
Platydoris carolynae Mulliner & Sphon, 1974.
Chromodoris baumanni Bertsch, 1970.
Chromodoris marislae Bertsch, 1973
Felimida sphoni Marcus, 1971
Hypselodoris agassizii (Bergh, 1894) [reinstated by Sphon (1971)]
Thorunna lapislazuli Bertsch & Ferreira, 1974
Laila janssi Bertsch & Ferreira, 1974
Flabellina stohleri Bertsch & Ferreira, 1974
Coryphellina rubrolineata O'Donoghue, 1929 [noted in the Panamic province by Marcus & Marcus (1970)]
Eubrandus rustyus Marcus, 1961 [noted in the Gulf of California by Robilliard (1971)]
Aeolidiella takanosimensis Baba, 1930 [noted in the Gulf of California by Ferreira & Bertsch (1975)]
Limenandra nodosa Haefelfinger & Stamm, 1958 [noted in the Gulf of California by Bertsch (1972)]
Phidiana lascruscensis Bertsch & Ferreira, 1974

Synonym

Chromodoris banksi sonorana, Marcus & Marcus, 1967

Deletion

Chromodoris macfarlandi Cockerell, 1901

* Adapted from a paper presented at the Western Society of Malacologists (WSM) in June 1982.

Following are 12 additional species that occur in tropical West America. Of these, nine have been described since Keen & Coan (1975). Two generic changes are also listed.

Chromodoris antonii Bertsch, 1976
Chromodoris galexorum Bertsch, 1978
Sclerodoris tanya (Marcus, 1971) [genus changed from *Doris* to *Sclerodoris* by Bertsch (1981)]
Peltadoris nyarita Ortea & Llera, 1981
Doriopsis viridus Pease, 1861 [noted in the Gulf of California by Bertsch (1971)]
Tambja eliora (Marcus & Marcus, 1967)[genus changed from *Nembrotha* to *Tambja* by Farmer (1978)]
Tambja abdere Farmer, 1978
Tambja fusca Farmer, 1978
Tambja mullineri Farmer, 1978
Roboastra tigris Farmer, 1978
Crosslandia daedalis Poorman & Mulliner, 1981
Bornella sarape Bertsch, 1980
Hypselodoris lapislazuli (Bertsch & Ferreira, 1974) [genus changed from *Thorunna* to *Hypselodoris*]

Acknowledgment

I thank James Lance for his assistance in researching this paper.

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ORTEA, JESUS and EVA MARIA LLERA
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DISTRIBUTION OF EULIMOSTRACA ATTILIOI HERTZ & HERTZ, 1982

BY

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Hertz & Hertz (1982) described *Eulimostraca attilioi* from two shells trawled in nets south of the La Jolla Trench, off San Diego, California in 90 to 140 meters (300 to 450 feet). Figure 1 is a photograph of the paratype of *E. attilioi* (Hertz collection). A recent letter from Dr. James H. McLean, Los Angeles County Museum of Natural History (LACM) noted the existence of two additional specimens in the LACM collection. The first (LACM-AHF1344-41) was collected in 65 fathoms on rock, 20 miles south of San Nicolas Island, California (32°53'N, 119°25'W) on June 11, 1941, by the Hancock Foundation vessel Velero II. It is 22.6 mm long which is much larger than the largest (8.90 mm) of the shells described by Hertz & Hertz. This specimen is shown in Figure 2. The second (LACM 80462) was collected in December 1973 in 120 fathoms, off Gaviota Pass, California by a fishing trawler (collector: Ralph Hazard). This latter shell is 19.1 mm long (broken tip) and 6.8 mm maximum diameter at lip. See Figure 3. This new information indicates that *Eulimostraca attilioi* has a wider distribution in deep water (300-720 ft) off southern California.

Fig. 1. *E. attilioi*, paratype, Hertz collection. Length: 8.90 mm.

Fig. 2. *E. attilioi*, LACM-AHF 1344-41 Length: 22.6 mm.

Fig. 3. *E. attilioi*, LACM 80462 Length: 19.1 mm.

Acknowledgments

We are indebted to Dr. James H. McLean for bringing the two specimens of *E. attilioi* to our attention and for the loan of the two specimens. Our appreciation to David K. Mulliner, Festivus staff photographer, for photographing the paratype and the two LACM specimens.

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1982. A new eastern Pacific species of *Eulimostraca* (Gastropoda: Eulimidae). The Veliger 25(1):72-76, 2 plates, 3 text figures. (July 1).

CORRECTION: FESTIVUS XIV(10):118

In the Jules Hertz paper on the minute species *Odostomia helga* and *Odostomia fetella*, paragraph 2, lines 6-9 should read as follows: "Fretter and Graham (1962) list a series of odostomias whose hosts vary from the polychaete worm *Pomatoceros triquetor* and the seastar *Astropecten irregularis* to various species of bivalves (*Mytilus edulis, Pecten maximus, Chlamys opercularis, Ostrea edulis,* and *Mya arenaria*)...."

NEW MEMBERS

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CHANGE OF PHONE

SOUDER, JOHN 462-0404

THE FESTIVUS DOES NOT PUBLISH AN ISSUE IN DECEMBER.

FROM THE MINUTES

SAN DIEGO SHELL CLUB -- 21 OCTOBER 1982

BY

PAT SAGE

President Martin Schuler called the meeting to order at 7:45 P.M. After welcoming new members and guests, he turned the meeting over to Vice President Bill Perrin. Bill substituted for the evening's guest speaker who had to cancel at the last minute. Bill gave a very interesting and enlightening presentation on dolphins and their relationship to tuna and tuna fisheries.

After the refreshment break, the business meeting was held. Marty cited the need for volunteer lecturers on shells for senior citizens organizations. (Those interested contact Marty).

It was voted to raise the annual dues to $7.00 for single members, $8.00 for family memberships, and $10.00 for overseas memberships (surface mail). The raise is necessary to defray rising publishing and mailing costs of The Festivus.

The Executive Board's recommended slate of officers for 1983 was presented to the membership. Nominations from the floor will be entertained at the November meeting after which the election of new officers will take place. The Board's recommended slate is as follows. President: Pat Sage, Vice President: Ron McPeak, Treasurer: Walter Robertson, Corresponding Secretary: Marilyn Perrin, Recording Secretary: John Sage.

Discussion was held on the Club's representative to the S.D. Botanical Garden Foundation for 1982 and Marty Schuler volunteered to accept the position.

The annual Christmas party was discussed and the menu chosen by vote. The party will be held in the Destroyer Room of the Naval Station Officer's Club on 11 December 1982. [For details, see below. Map is on the last page of this issue].

John Sage won the shell drawing. The meeting was adjourned at 9:30 P.M.

THE ANNUAL SAN DIEGO SHELL CLUB CHRISTMAS PARTY

This year the Club Christmas dinner party will be held at the Mariners Club, 32nd St. Naval Station in the Destroyer Room on Saturday, 11 December. The festivities will begin at 6:00 P.M. with no host cocktails. Dinner will be at 7:00 P.M. The menu chosen by the membership follows.

Dinner Salad, Roast Prime Ribs of Beef, Rice Pilaf, Green Beans Almondine, Rolls, Coffee or Tea.

The Club will provide complimentary dinner wine.

Following dinner and the traditional Club shell gift exchange, there will be dancing to the "mellow" music of a band in the main room.

The cost for the evening is $11.50 per person. Deadline for reservations is Saturday, December 4. Checks should be made payable to The San Diego Shell Club, Inc. and given to Treasurer Wally Robertson or sent to the Club address (front page).

Remember to participate in the traditional shell gift exchange. Bring your gift wrapped shell to place under the tree. Place data and name inside the package only. On the outside place only general locale i.e. Pacific, Caribbean etc. Numbers will be drawn and those bringing a shell gift will choose one from under the tree.

It will be a great party, as usual. Come and enjoy the season with your friends. Guests are welcome.

DUES FOR 1983-- $7.00, single; $8.00, family; $10.00, overseas (surface mail).

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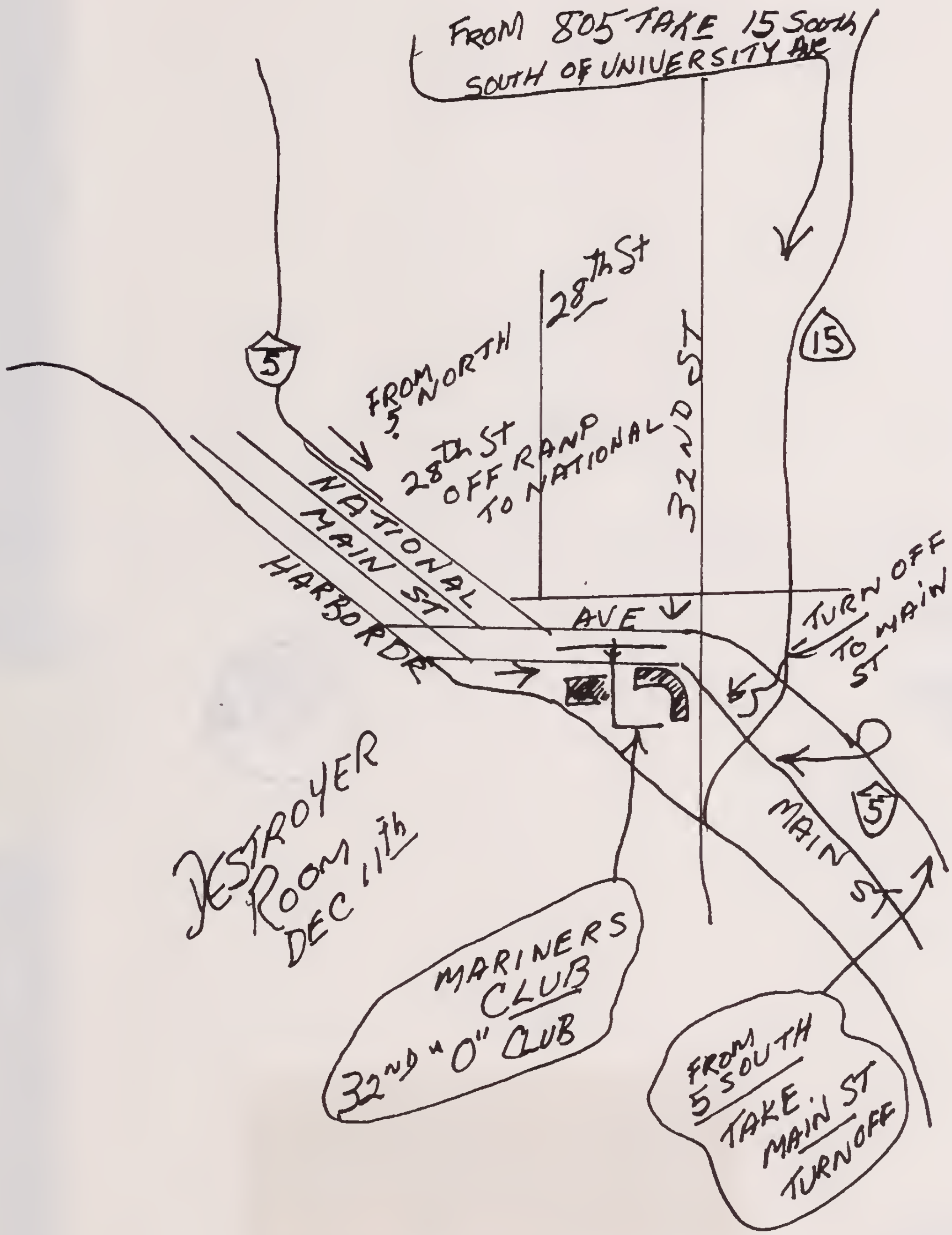
San Diego Shell Club Annual Christmas Party

Saturday, December 11, 1982
32nd Street Naval Station
6:00 PM — ?



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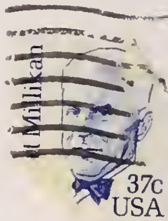

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