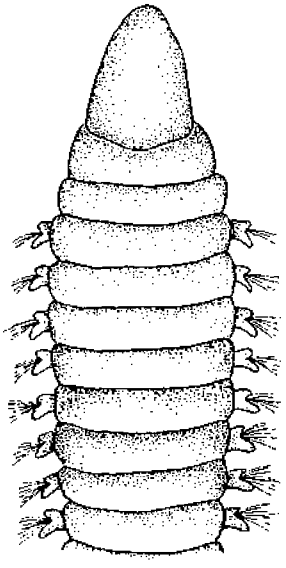
January, 1996 SCAMIT Newsletter Vol. 14, No.9

NEXT MEETING:	Lumbrineridae (except *Ninoe*)
GUEST SPEAKER:	Larry Lovell
DATE:	February 12, 1996
TIME:	9:30am - 3:30pm
LOCATION:	MEC 2433 Impala Drive Carlsbad, California



Lumbrineris cruzensis (ex Hilbig, 1995)

FEBRUARY 12 MEETING

The February meeting will be on polychaetes in the family Lumbrineridae (except *Ninoe*). The meeting will have Larry Lovell as guest speaker, and will be held at MEC in Carlsbad (see attached map). The emphasis in the meeting will be on identification of typical lumbrinerid specimens, rather than on complete specimens in excellent condition. Please bring your voucher specimens with you, along with the whole lumbrinerid fraction of one or more samples. We also plan to discuss sample handling and its impact on the identifiability of the resulting lumbrinerid specimens. A secondary goal is exchange of

FUNDS FOR THIS PUBLICATION PROVIDED, IN PART, BY THE
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experience with and opinion on the recently published Taxonomic Atlas second worm volume. Please be prepared to share any problems you have noted in this volume.

ELECTIONS

Nominations for SCAMIT officers for the 1996-97 year were made at the January meeting. All current SCAMIT officers were nominated again. No other nominations were received. Additional nominations would be welcome, please submit any to the Vice-President at the below address by the end of February, or at the February meeting. Candidate biographies have been included with this newsletter along with ballots that are due by the March meeting. If you will be unable to attend the March meeting please send your ballots to Don Cadien at LA County Sanitation Districts.

Don Cadien
Marine Biology Lab-JWPCP
24501 Figueroa St., Carson, CA, 90745

SPECIES LIST

A meeting was held on 19 January at SCCWRP to finalize additions and corrections to the first edition of the SCAMIT Taxonomic Listing of Benthic Invertebrates. The second edition will combine both trawl and benthic infaunal species records in a single listing. The final updates should be implemented shortly, and the new edition on its way to members within a month. We continue to welcome comment, correction, and addition to the listing. Materials received will be used in preparation of the next edition of the Taxonomic Listing. Send them to:

Dave Montagne
Marine Biology Laboratory
County Sanitation Districts
of Los Angeles County
24501 S. Figueroa Street
Carson, CA 90745
fax # (310) 834-7689
or
Ron Velarde
City of San Diego
Marine Biology Laboratory
4077 North Harbor Drive, MS 45A
San Diego, CA 92101
fax # (619) 692-4902

LITERATURE

Two new books on echinoderms are available, neither, unfortunately, concerning species from the northeastern Pacific. The first (1995. Sea Stars, Sea Urchins, and Allies - Echinoderms of Florida and the Caribbean) is by Dr. Gordon Hendler, Curator of Echinoderms at the Natural History Museum of Los Angeles County (and SCAMIT member), and deals with the identity and ecology of Caribbean echinoderms. Each of the covered species (those occurring shallower than 100 ft.) is diagnosed and illustrated. It can be obtained from Smithsonian Institution Press (see attached order form) for $39.95.

The second (Rowe & Gates 1996) provides the first comprehensive catalogue of information on the echinoderms of Australia since they were summarized by Clark in 1946. This is not a descriptive catalogue, and will not be of use for identification directly, but provides a summary of information available on each species. It is a section of the Zoological Catalogue of Australia, which will address the entire Australian fauna in about 90 volumes. Information on this and other portions of the series are available from CSIRO Information Services at:

PO Box 89, East Melbourne
Victoria 3002, Australia
or by
FAX: (03) 419 0459
or
email: bookshop@cis.csiro.au

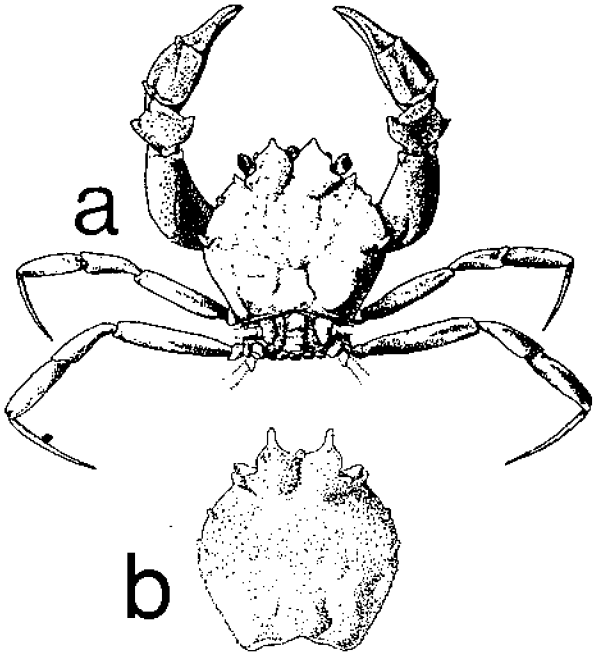
Another volume of the Taxonomic Atlas of the Benthic Fauna of the Santa Maria Basin and Western Santa Barbara Channel has been published. Volume 13 - The Bryozoa was released at the end of December 1995. The authors, Dorothy and John Soule and Henry Chaney have contributed a major revisionary effort on the ectoproct fauna, drawing on several other collections as well as those taken from the MMS project that forms the basis of much of the series. They describe six new genera and 41 new species in the newly released volume. The schedule of expected release dates for the remaining volumes in the series is attached.

SECOND *Deilocerus* TAKEN

The small oxystomatous crab *Deilocerus planus* (known until recently as *Clythrocerus planus*) is familiar to those who sample shallow coarse substrates as part of their programs. Few are, however, aware that a second species in this genus occurs in the Southern California Bight. This species, *Deilocerus decorus,* is not listed in Schmitt's Decapods of California. It was not described until 1933, well after the publication of Schmitt's monograph. Despite this, the species is described and illustrated there - As *Cyclodorippe* sp? (Schmitt 1921, pg. 186-187, figure 115b).

It was not included in the decapod section of Straughan and Klink (1980) as the author of the section confined herself to the common species, and *D. decorus* is not common. She later (Wicksten 1988) reported on two lots from the California Academy of Sciences collections taken from 185m off Pt. Soberantes in Monterey County. No lots of this species are represented in the Natural History Museum of Los Angeles County collections, which include the Allan Hancock Foundation specimens (Gary Petit, pers. com.). It was covered in Rathbun's monograph on the oxystomatous crabs (1937), where records of three collections of single specimens were noted (the most recent in 1907). One of these records was from off Pt. Loma, where the species has recently been retaken. Several specimens (all at first identified as *D. planus*) have been found by the staff of the Pt. Loma lab from off Pt. Loma at depths of 100m+. The bottom at the stations where it occurs is relatively coarse, so the habitat is probably similar to that reported for *D. planus* in shallow water.

The two species are similar in size and shape, but *D. decorus* is more ornamented. Both are granulate or dentate along the side of the carapace, but *D. decorus* is more strongly so. The lateral carapace teeth of *D. decorus* are also granulate, while those of *D. planus* are smooth. The chelae and periopods of *D. decorus* bear strong granulations while those of *D. planus* are nearly smooth, and the periopodal propodi in *D. decorus* bear plumose setae lacking in *D. planus*.



Males of a.) *D. planus* and b.) *D. decorus* from Schmitt 1921

The frontal lobes of *D. decorus* are prolonged into digitiform processes, while those of *D. planus* are nearly triangular. Placement of the lateral carapace teeth relative to the post-orbital tooth also differs. In *D. planus* the anterior tooth is closer to the post-orbital than to the posterior tooth, while in *D. decorus* the reverse is true.

MINUTES FROM JANUARY 16

The sparsely attended meeting was held in the Times-Mirror room of the Natural History Museum of Los Angeles County. A review of the natural history of scaphopods was distributed at the meeting, along with an assessment of the status of the species listed as occurring on Pacific Coast of the United States in Turgeon et al. (1988). Comments provided by Shimek at the NAMIT meeting were also reviewed, and cited in some instances. We were, however, careful not to include data from his unpublished manuscript on the scaphopods to appear shortly in the Taxonomic Atlas series.

All of Shimek's commentary was pertinent to our more southern fauna, but several species we encounter here were not treated by him. Of particular interest were the definitions of genera he provided in his handout. These allowed us to see that the usage *Pulsellum aberrans* was incorrect based on the morphology mentioned in the generic definitions. In preparation for the meeting a handout was prepared which summarized some aspects of the biology and ecology of scaphopods, and provided summary discussion of the species reported from the Southern California Bight. A slightly modified version is attached.

Following an introductory discussion of the materials presented in the handout we examined a series of specimens selected from the collections of the NHMLAC mollusk collection. In some cases these lots were vouchers deposited by Shimek as vouchers of his species concepts. Species examined were *Antalis pretiosum, Dentalium vallicolens, Graptacme inversa, Graptacme semipolita, Rhabdus rectius, Gadila aberrans, Pulsellum salishorum, Polyschides californicus*, and *Polyschides tolmiei*.

It became clear during these identifications that the records of *Antalis pretiosum* and *Graptacme semipolita* from the Pt. Loma and LA County databases were based on incorrect concepts of the species. The specimens provided by Tony Phillips of *Graptacme semipolita* from Hyperion data were all very small, and inconclusive. Voucher lots of the two dentaliid species (*Rhabdus rectius* - LACO 57, SCCWRP 61; *Dentalium vallicolens* - MBC 33) examined at an earlier SCAMIT meeting were reexamined and their identity confirmed by comparison with museum materials, and the information provided by Shimek in his manuscript.

The dentaliids encountered by LA County and the Pt. Loma lab were either *Dentalium vallicolens* or *Rhabdus rectius*. More curved specimens of *R. rectius* had been interpreted as being *Graptacme semipolita* by LA County, and *D. vallicolens* had been identified as *G. semipolita* by Pt. Loma. Our specimen examinations indicated that the sculpture of *R. rectius* could easily be missed because it is very fine, very low, and the shell is usually transparent. We found that it was frequently necessary to use a tool to block the strongest light source, allowing more diffuse refracted light to pick out the faint longitudinal sculpture.

The same method helped to establish that the fine sculpture of *Dentalium vallicolens* usually extended for the full length of the shell (contrary to the illustration in Shimek's manuscript, which shows it extending only halfway down the shell). The sculpture of *Graptacme semipolita* was both coarser and stronger than that of the other two species, and none of the specimens brought by participants matched the lots examined from the Museum collection.

Examination of *Pulsellum salishorum* vouchered from Puget Sound by Shimek showed that none of the participants had encountered it in the Bight. Museum lots of the two gadilids *Polyschides californica* and *P. tolmiei* were examined. It was apparent that what was being recorded as *P. californicus* by LA County was actually *P. tolmiei*. The two species differ in their general shape, *P. californicus* being more slender than *P. tolmiei*, with a less prominent inflation of the shell prior to formation of the adult aperture. Even immature specimens should be separable based on inflation.

During examination of these materials it became evident that none of the available keys was adequate for separation of the species we encounter in all cases. Each (including the new key provided by Shimek in his MMS manuscript) is misleading or inaccurate to one extent or another. Once his key is published we will make attempts to emend it for use in the Southern California Bight, and at that time corrections or alternative approaches to particular couplets will be tried.

In the afternoon we adjourned to the Malacology Office on the third floor of the Museum for a visit with Dr. Jim McLean. He brought us up to date on the status of the MMS Atlas section dealing with gastropod mollusks, and allowed us to examine the manuscript. Although not all the families encountered in California waters are included, those families which are treated are handled completely. Materials for a reevaluation of the pyramidellids were strewn across several tables, and it appears that at long last the revision of at least the California members of that group is at hand. We can expect copious synonymy of earlier names, as well as descriptions of some new species. Dr. McLean has roughly 150 undescribed mollusk species from the Eastern Pacific in one cabinet. Descriptions of these are in various stages, but many will be included in the long awaited comprehensive monograph on west coast gastropod mollusks. The time line on this is now much shorter, with completion expected within just a few years. Fortunately the work done for the MMS Atlas volume will be at hand to facilitate the comprehensive monograph. With the Coan, Scott and Bernard bivalve monograph due out sometime in 1996, we will soon be enjoying a surfeit of new and authoritative source material on the taxonomy of our mollusk fauna.

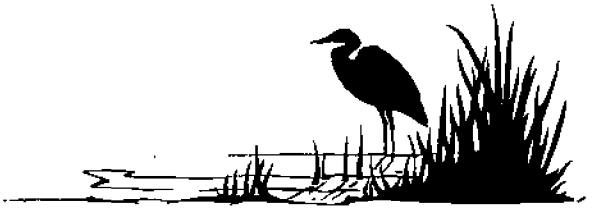
CORRECTION

It was recently noticed that there is a mistake in the *Boccardia* table that appeared in Vol. 13 (5) of the Newsletter in September 1994. The table notes that *Boccardia basilaria* Hartman 1961 is lacking notosetae on the first setiger. This is incorrect. *B. basilaria* does have notosetae present on the first setiger. Also, Blake and Woodwick (1971) have the same error in their table. In a later publication Blake (1986) redescribes *B. basilaria* while comparing it to a new species from the Galapagos Islands and mentions that setiger 1 is biramous. This is in keeping with Hartman's original description (1961) and her Atlas (1969). Although, her illustration of *B. basilaria* (1961) does not show the notosetae present on the first setiger she does mention (1969) that there are only a *few* setae present as compared with the more numerous neurosetal fascicle.

SCAMIT members using the *Boccardia* table may want to correct this mistake to avoid any possible confusion in the future. We believe this mistake was simply a typographical error, since this more recent table was based on Leslie Harris' older version where *B. basilaria* is correctly described, with notosetae present on setiger 1. Although, both the *Polydora* and *Boccardia* tables from Vol. 13 (5) were proofed several times before they were issued with the newsletter a few typos may still be present. Please alert the newsletter staff if any more are found so they may be corrected as soon as possible without creating any more confusion.

REQUEST FOR SPECIMENS

Ron Velarde has requested specimens of any encountered species in the polychaete Family Sphaerodoridae and in the turrid gastropod genus *Ophiodermella*. Ron is planning to report on the sphaerodorids, and perhaps also the turrid at a future meeting. Specimens should be brought to a SCAMIT meeting, or if meeting attendance is not possible contact Ron concerning specimen transfer.



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SCAMIT OFFICERS:

If you need any other information concerning SCAMIT please feel free to contact any of the officers.

President	Ron Velarde	(619)692-4903
Vice-President	Don Cadien	(310)830-2400 ext. 403
Secretary	Cheryl Brantley	(310)830-2400 ext. 403
Treasurer	Ann Dalkey	(310)648-5611

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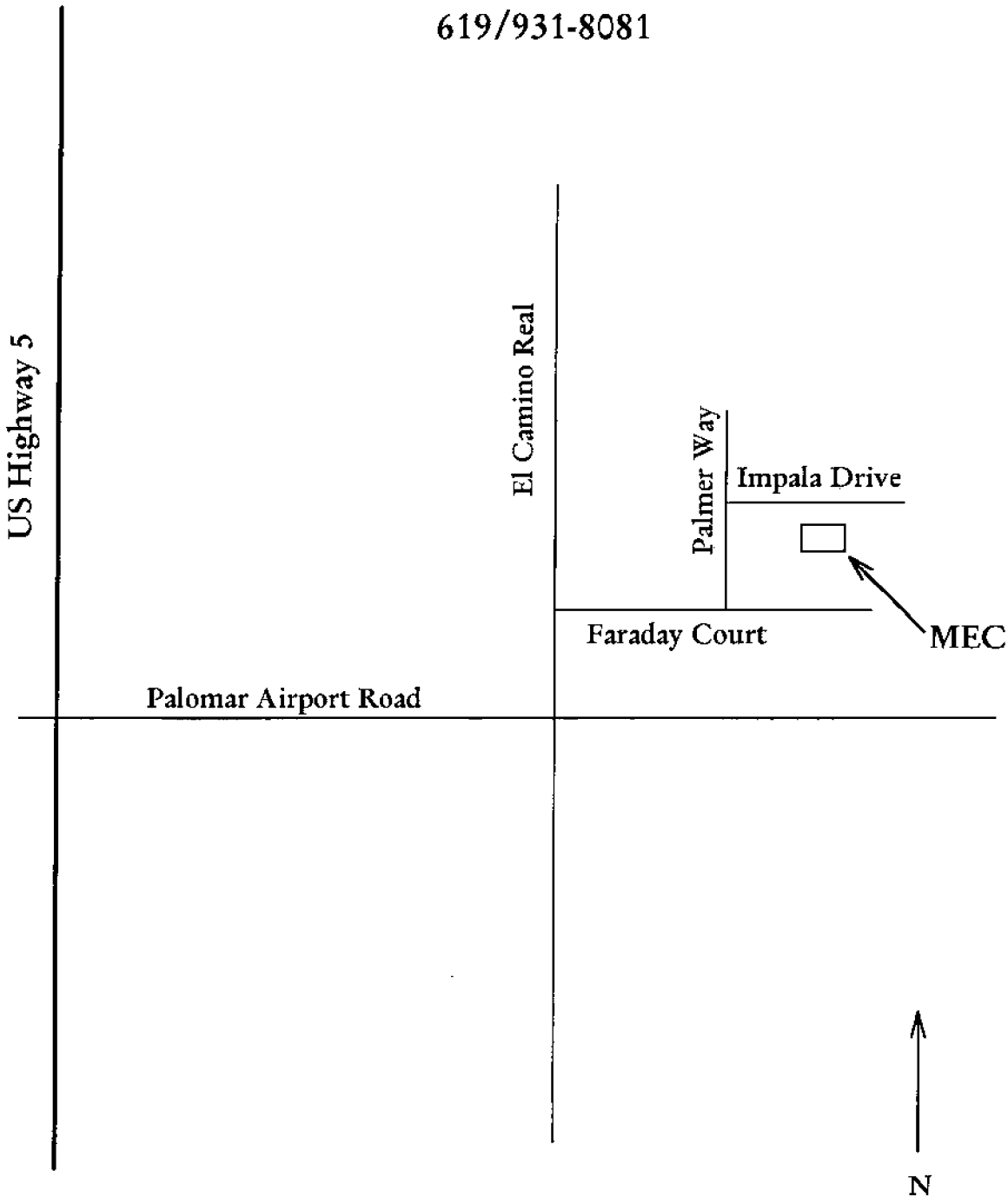

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CANDIDATE BIOGRAPHIES

PRESIDENT

Ron Velarde

Ron is the current President of SCAMIT and a past Vice-President; he has been a Marine Biologist with the City of San Diego since 1983 and currently is the supervisor of Benthic Taxonomy for the Ocean Monitoring Program. His taxonomic interests include most groups, especially polychaetes and nudibranch mollusks. He earned his B.S. degree in Marine Biology from California State University, Long Beach, in 1976, and did post-graduate research on the systematics and ecology of autolytid polychaetes.

VICE-PRESIDENT

Don Cadien

Charter member of SCAMIT. Studied invertebrate taxonomy and biology at California State University, Long Beach, under Dr. D. J. Reish. Worked at Cabrillo Marine Museum, then at the L.A. County Museum of Natural History under Dr. J. H. McLean in Malacology. Spent 15 years at M.B.C. Applied Environmental Sciences as a taxonomist and later also Project Manager, leaving in 1989 as a Senior Marine Biologist to join the L.A. County Sanitation Districts' Marine Biology Lab. Specialties in taxonomy and biology of mollusks (particularly nudibranchs) and peracarid crustaceans. Currently a Research Associate in the Crustacea Section of the L.A. County Museum of Natural History.

SECRETARY

Cheryl Brantley

Cheryl is the current Secretary of SCAMIT and a marine biologist for the County Sanitation Districts of Los Angeles County. She has worked for the Districts since graduation with her B.A. degree in Aquatic Biology from the University of California, Santa Barbara in 1985. As a taxonomist in the Districts' Marine Biology Laboratory, Cheryl has specialized in polychaetes with emphasis on the Spionida, Eunicida and the Aphroditiformia.

TREASURER

Ann Dalkey

Ann is presently the Treasurer for SCAMIT and has held this position since SCAMIT was founded. Ann is a member of the water biology staff at the Hyperion Treatment Plant where she specializes in the identification of polychaetes and amphipod crustaceans. Prior to working at Hyperion, Ann was a member of the laboratory staff at the County Sanitation Districts of Orange County. She worked there for nearly 10 years, reaching a position of senior laboratory and research analyst. She received her B.S. from California State University Long Beach in Marine Biology in 1974 and her M.S. from the same university in 1982. Her thesis research pertained to polychaete bioassay.

BALLOT FOR SCAMIT OFFICERS 1996-97

Vote for one (1) nominee for each office. Please mail or return completed ballot to Don Cadien by March 31, 1996. You may return it to the Secretary or other attending officer at the March 11 meeting. The address to mail it to is:

Don Cadien
Marine Biology Laboratory
County Sanitation Districts
of Los Angeles County
24501 S. Figueroa Street
Carson, CA 90745

President - The president presides at all meetings and represents SCAMIT in external business affairs.

_____ Ron Velarde

_____ Write-in:_____

Vice-President - The Vice-President chairs ad hoc committees, supervises the specimen exchange, tabulates election ballots, edits the newsletter, and fills in for the President as necessary.

_____ Don Cadien

_____ Write-in:_____

Secretary - The Secretary keeps minutes of the meetings, is responsible for the newsletter, and preparation of the ballots.

_____ Cheryl Brantley

_____ Write-in:_____

Treasurer - The Treasurer collects dues, makes disbursements, keeps financial records, and makes an annual statement of the financial status of SCAMIT.

_____ Ann Dalkey

_____ Write-in:_____

1996-97 SCAMIT Meeting Topics - Please suggest any topics you deem worthy of a SCAMIT meeting.

_____

_____

Santa Barbara Museum of Natural History

Taxonomic Atlas

List of volumes and authors to be published in 1995 - 1996

Volume 3 - The Cnidaria (anticipated publication date - May 1996)

Daphne G. Fautin, University of Kansas
F. G. Hochberg, Santa Barbara Museum

Volume 6 - Polychaeta, Part 3 (anticipated publication date - March 1996)

James Blake, Science Applications International Corp.
Brigette Hilbig, Science Applications International Corp.

Volume 7 - Polychaeta, Part 4 (anticipated publication date - May 1996)

James Blake, Science Applications International Corp.
Brigette Hilbig, Science Applications International Corp.
William J. Light, Colorado Springs
R. Eugene Ruff, Ruff Systematics

Volume 8 - The Mollusca, Part 1 (anticipated publication date - March 1996)

Douglas Eernisse, California State University, Fullerton
F. G. Hochberg, Santa Barbara Museum
Amelie Scheltema, Woods Hole Oceanographic Institution
Paul Scott, Santa Barbara Museum of Natural History
Ron Shimek, Montana State University

Volume 9 - The Mollusca, Part 2 (anticipated publication date - 30 December 1995)

James McLean, Natural History Museum of Los Angeles County
Terrance Gosliner, California Academy of Sciences

Volume 10 - The Crustacea, Part 1 (anticipated publication date - February 1996)

Joel Martin, Natural History Museum of Los Angeles County
Donald Cadien, Los Angeles County Sanitation District
Isabella Williams, ENSR Consulting and Engineering

Volume 11 - The Crustacea, Part 2 (anticipated publication date - April 1996)

George Wilson, Australian Museum, Sydney
Richard Brusca, University of South Carolina
Masahiro Dojiri, City of Los Angeles
Les Watling, Darling Marine Center, Maine

Volume 13 - The Bryozoa (anticipated publication date - 20 December 1995)

Dorthy Soule, University of Southern California
John Soule, University of Southern California
Henry Chaney, Santa Barbara Museum of Natual History

Volume 14 - Miscellaneous taxa (anticipated publication date - June 1996)

Keith Woodwick, California State University Fresno (enteropneusts)
F. G. Hochberg, Santa Barbara Museum (brachiopods)
John Pilger, Agnes Scott College (echiurans)
Paula Winchell, Science Applications International Corp.
Mary Bergen, Sacramento, California (holothuroids)
Gordon Hendler, Natural History Museum of Los Angeles County (ophiuriods)
Andew Lissner, Science Applications International, Corp. (asteroids & echinoids)
Gretchen Lambert, California State University Fullerton (ascidians)

SCAPHOPODA

Donald B. Cadien - CSDLAC 16 January 1996

The scaphopod fauna of the northeastern Pacific has been underexamined. Much of the species level taxonomy is based on Pilsbry and Sharp (1897-98), which, while very well done, is nearly a century old. Dr. Ron Shimek (now at Montana State University) has been involved in a reexamination of this fauna, especially that portion of it to the north of California. He made a presentation at the most recent NAMIT workshop which summarized the state of present knowledge and incorporated both recent changes and changes which will be introduced with the publication of his Scaphopod section of the Santa Maria Basin Taxonomic Atlas series (probably within just a few months). His presentation, as reported on by Kelvin Barwick, prompted this reexamination of the current status of taxa reported to occur in the North East Pacific region. The listing provided in Turgeon et. al. (1988) was used as the basis for the scaphopod portion of the SCAMIT Taxonomic Listing (edition 1). Taxa they list as from the Pacific are extracted and presented below in the same hierarchical groupings used by Turgeon et. al. (op. cit.) - [*= recorded by SCAMIT member agency]

Order Dentaliida
- Family Dentaliidae
  - Antalis berryi (A.G. Smith & Gordon, 1948)
  - Antalis pretiosum (Sowerby, 1860)*
  - Dentalium agassizi Pilsbry and Sharp, 1897
  - Dentalium neohexagonum Sharp and Pilsbry, 1897*
  - Dentalium vallicolens Raymond, 1904*
  - Fissidentalium megathyris (Dall, 1890)
  - Graptacme inversa (Deshayes, 1826)
  - Graptacme semipolita (Broderip & Sowerby, 1829)*
- Family Laevidentaliidae
  - Rhabdus dalli (Pilsbry and Sharp, 1897)
  - Rhabdus rectius (Carpenter, 1865)*
  - Rhabdus watsoni (Sharp and Pilsbry, 1897)*

Order Gadilida
- Family Pulsellidae
  - Pulsellum aberrans (Whiteaves, 1887)*
  - Pulsellum salishorum E. Marshall, 1980
- Family Siphonodentaliidae
  - Polyschides californicus (Pilsbry and Sharp, 1898)*
  - Polyschides tolmiei (Dall, 1897)*
  - Siphonodentalium quadrifissatum (Pilsbry and Sharp, 1898)*
- Family Gadilidae
  - Gadila fusiformis Pilsbry and Sharp, 1898
  - Gadila hepburni (Dall, 1897)

The only relatively complete earlier treatment of the group in our area is that of John Q. Burch in the Minutes of the Conchological Club of Southern California from 1945. Scaphopods had been included in Oldroyd's The Marine Shells of the West Coast of North America (1927), but the coverage was relatively uninformative, and the illustrations meager. Slightly later Grant and Gale (1931 - Catalogue of the marine Pliocene and Pleistocene Mollusca of California and adjacent regions) provided some additional information beyond the original descriptions, but added no illustrations of the species. A number of our local species were illustrated and briefly described in Seashells of Tropical West America (Keen, 1958[2nd edition 1971], or American Seashells (Abbott, 1954[2nd edition 1974]). None of these provide the depth of information and breadth of illustration of Burch's 1945 effort.

Problems with Scaphopod Identification

The nature of tusk shells, particularly dentaliids but also juvenile gadilids, leads to problems for taxonomists. The basic difficulty is that there are relatively few non-anatomical characters to use in species differentiation. Steiner (1992), in his phyletic analysis of the scaphopods, had only four of 28 characters derived from the shell. The shell is shaped similarly in all members of the class; an elongate tube open at both ends. Some species can have shells with surface sculpture at some or all periods of their development. Seemingly distinctive apertural modifications (slits or notches) are present in some or all members of some species. These may be useful to differentiate species, but are often found to vary with degree of maturity, and even within an age group. Shimek maintains in the NAMIT notes that a selection of derived metrics can be used to precisely define the shape of the shell on a species specific basis. These metrics, however, are only reliable on unbroken adult shells, a relatively small subset of our monitoring specimens.

Tusk shells grow longer by addition of shell at the edge of the anterior aperture, and they are also either thickened or thinned by actions of the mantle over the length of the shell. In some species the posterior end of the shell, whose aperture becomes increasingly tight as the mollusk grows, is intentionally resorbed and/or decollated to provide a more "fitting" habitation (Reynolds, 1992). Such loss of the thin juvenile end of the shell leads to proportional change in it's length/diameter ratio, loss of the characters of the juvenile shell sculpture (either smooth, finely striate, coarsely striate, ribbed, etc.), and often a severe alteration of it's overall gestalt. In many species there is also a slight but perceptible difference of curvature in the juvenile and adult portions of the shell. If the juvenile tip is accidentally broken off or intentionally decollated the resulting tusk shell is very different in appearance from that preceding the breakage.

This problem has been commented on with regard to identification by Burch, who made observations on the differences between *Dentalium* (now *Rhabdus*) *rectius* and *watsoni* (Burch, 1945). I quote from his discussion..."...the longest specimens from either set will fit the described measurements of *watsoni* (16-19 times the diameter) but if you break off one of the long specimens at the right spot you then have the measurements of *rectius* (12-15.5 times the diameter). Young [or broken] specimens measure *rectius* and the older ones *watsoni*." This condition is a result of growth allometry. At a certain stage of maturity increase in shell diameter ceases or is greatly reduced in rate while growth continues as shell elongation. Any species with this type of growth allometry can

easily present the appearance of two or more species depending on the retention or decollation of the juvenile shell. Other dentaliid species seem to retain the relationship between growth in diameter and growth in length throughout their lives. These are fairly immune to misidentification through loss of the juvenile shell.

A further complication related to growth is found in members of the dentaliid families Laevidentaliidae and Gadilinidae, and specifically in the genera *Rhabdus* and *Episiphon*. Members of these genera appear to resorb or decollate the juvenile shell, then replace it with a newly constructed narrow tube extending the posterior aperture (Reynolds, 1992). This new tube is not sculptured, and the species may not key properly if the new apertural extension tube is interpreted as the juvenile shell.

In gadilids, where the mature aperture is narrower than that of the juvenile, the problems in identification caused by specimen immaturity are also severe. Since the identification can often hinge on the position of the greatest shell diameter relative to the aperture, immature shells in which this greatest diameter is not yet formed are not easily assigned to species. Other shell characters such as shell thickness, color, or surface sculpture may or may not help with such juveniles. In some cases it may be necessary to note that adults of only one species are found in the sampling area, allowing the deduction that co-occurring juveniles belong to the same species. In areas where more than one species is present, the juveniles should probably remain at generic (or family) level.

SCAPHOPOD BIOLOGY

Trophic relations - prey and predators

Most species investigated to date appear to be selective predatory deposit-feeders. Predatory because the particles they selectively ingest are foraminifera. Alternatively they can be considered carnivores (Bilyard 1974) despite the location of the prey within the sediments. Shimek (1989) reports that some species of forams are preferred, and are consumed selectively, while others are generally avoided, and some species consumed as encountered. These three categories correspond to presence in guts at greater, less, or equal proportion to their availability in the surrounding sediments. In a few cases (Steiner 1994) deep water scaphopods appear to intentionally ingest sediments along with foraminifera, while guts of most scaphopods contain at least some sediment. These deep-water species have more elongate guts which are fully packed with sediment, probably in response to the more diffuse food resources of deep-sea sediments. They seem to be neither selective predators nor non-selective deposit-feeders, but to fit into an intermediate "opportunistically selective" category which allows use of a wider resource spectrum.

Direct observation (Shimek 1988) of *Rhabdus rectius*, combined with examination of patterns of cilia on the captacula with electron microscopy help to explain this type of scaphopod feeding behavior. His investigations demonstrated that *R. rectius* was primarily a non-selective deposit feeder, which would also selectively ingest foraminifera where they were available. This ability was based on the presence of a well developed continuous ciliated tract along each captaculum allowing conveyor belt movement of fine particulates up the captacular stalk into the

mantle cavity where they were collected and passed to the mouth by other captacula. The lack of crushing of ingested foraminifera by *R. rectius* may be an indication that deposit feeding is indeed the primary feeding mode of the species, with the consumption of the occasional packet of organic material (foram) only an energetic bonus.

Known predators of scaphopods are few, but damage to shells is relatively common (Kropp, 1992). These reports are borne out by experience with local environmental samples. Many of the scaphopods taken in such samples show evidence of shell breakage and repair, presumably from a survived predation attempt. Shimek reports (1989) predation by rat-fish *Hydrolagus colliei* on several species of scaphopods. One sand-star *Astropecten verrilli*, which feeds on mollusks, was observed with a large dentaliid sticking out of the gut through the dorsum of the star (Cadien, pers. obs.), and it is assumed that smaller forms such as *Gadila aberrans* and *Siphonodentalium quadrifissatum* (which occur in the same habitat) would also be acceptable prey.

Life position and burrowing

Scaphopods are burrowers. They live either partially or entirely below the surface of the sediments with their anterior end below their posterior end (Gainey, 1972) . This is not to imply that they are in a vertical position. This may be true for some species, but the majority of species probably are angled through the sediment. Gainey suggests that their ability to burrow upward (which he observed) allows repositioning the shell for various angled downward feeding excursions into the sediment, the angle being determined by the location of the feeding stratum relative to the length of the animal. Like other selective deposit feeders they construct a feeding excavation or pit within which their specialized food gathering structures can function. In scaphopods these structures are the captacula, extensible tentacle-like filaments arising near the foot which manipulate particles, capture selected prey, and convey them to the mouth. The feeding excavation is roughly the size of the expanded foot, and is created by the foot probing into and compacting the sediments at the front of the shell (Yonge & Thompson 1976). This excavation is enlarged by the captacula, which may pull material from the roof of the cavity for examination on the floor (Gainey, 1974).

Shimek (1989) reports observations on living *Gadila aberrans* in aquaria where they seldom contact the sediment surface, preferring to stay at least 6-8cm and often up to 30cm below the surface. These animals were fast and agile diggers, moving through the sediments at rates up to 1 cm/sec. It is likely that other smooth, lightly shelled forms such as this are also rapid burrowers. Larger shelled species such as *Antalis pretiosum* or *Dentalium vallicolens* are more likely to be less active burrowers, and to have more frequent contact with the sediment surface.

These observations partially contradict earlier assessments such as those of Yonge and Thompson (1976) who state "..these tusk shells do not penetrate to any depth; the narrow end must always project above the surface." This is apparently not true for at least some species of dentaliids, and is probably not true for most gadilids. Yet it does hold for some local dentaliids. Observations on *Antalis pretiosum* from a submersible in Puget Sound (Nuytten, 1993) showed a number of the posterior shell ends protruding from the sediment to be covered with red algae, demonstrating that these ends were seldom (if ever) pulled beneath the sediment surface.

TAXONOMY OF LOCAL SPECIES

Dr. Shimek was kind enough to distribute copies of his upcoming section of the Santa Maria Basin Taxonomic Atlas at the recent NAMIT mollusk workshop. He was also careful in indicating that this was a prepublication draft, and should not be cited prior to it's publication. We will honor this by not discussing new materials or opinions introduced in the draft here. There are, however, several other sources of information which we can utilize to reevaluate the status of west coast scaphopod taxonomy. There appear to be several species which appear on the AFS scaphopod listing which are no longer valid, or require reallocation to other genera or families. The preparation of the AFS list was by leading workers (Emerson, McFadien, and Kraeuter) and choices made there (elevation of *Cadulus* and *Dentalium* subgenera to full generic status for instance) were not arbitrary. The genera and higher level taxa are briefly diagnosed in Moore (1960), and additional information on genera and subgenera is provided by Emerson (1952, and 1962).

Antalis berryi

Described from Monterey Bay, this is viewed as a southern subspecies of *A. pretiosum* by Abbott (1974). All specimens in the museum collection so identified bore a secondary hand written identification of a manuscript name. The status of the species remains unclear.

Antalis pretiosum

This is the northeast Pacific wampum shell harvested from Puget Sound by several indian tribes. This process was well described recently (Nuytten, 1993). The shells are large, thick, opaque white, and lack longitudinal sculpture. They do have intermittent annular swellings, but are essentially unscuptured.

Dentalium agassizi

A form with even numerous ribs running the length of the shell. It occurs in waters deeper than those normally sampled in monitoring programs, between 800-1600m according to Burch (1945), and from the California channel islands south to Panama.

Dentalium neohexagonum

The only dentaliid occurring in shallow inshore sandy bottoms in the Bight. All other dentaliid species in the area favor off-shore habitats with higher proportions of silt and or clay. It is also the only angular scaphopod to be taken in our area (shell nearly hexagonal in cross section with flattened sides).

Dentalium vallicolens

A large robust species strongly associated with the presence of relatively coarse sediments (relict sands and/or shelly debris) on the mid to outer shelf. The shell is thicker than that of *Rhabdus rectius*, and similar in thickness to that of *Graptacme semipolita*. The shell is finely ribbed, a condition which persists in the adult, with the ribs usually extending the full length of the adult shell. Care must be exercised in searching for ribs, they can often be seen only with the use of oblique illumination, which is caught by the ribs, but not the shell surface itself, making the ribs stand out more clearly from the background of the shell.

Fissidentalium erosum

A very deep water species (1000+ meters) not occurring in the Bight. It occurs in mixed populations with the next species, and was recently described (Shimek and Moreno, 1996). It can only be separated from *F. megathyris* by the more eroded shell, and by morphometrics of the body regions.

Fissidentalium megathyris

A very deep water species which does not occur at depths sampled in Bight programs, although it may range into our geographic area. Should a shell of this animal be translocated into our sampling depths (by a hermit crab, for instance), it would be immediately recognizable by the very strong and numerous longitudinal ribs which crowd it's surface.

Graptacme inversa

Burch (1945) notes this as very similar to *semipolita*, but differing in the placement of the apertural slit to the side of the median line of the shell apex. It may prove to be only a variant of the next species.

Graptacme semipolita

The shell is of moderate size, but not particularly thin, translucent to nearly opaque white, and usually prominantly ribbed on the juvenile portion of the shell. The species is more strongly curved than *Rhabdus rectius* and about equal in curvature to *Dentalium vallicolens* of equal length. It increases in diameter more rapidly than *R. rectius*, and is much more strongly ribbed than *D. vallicolens*. *Dentalium hannai* Baker 1925 is a synonym (Burch 1945) which differs only in possession of an apertural slit not seen in *semipolita*. Burch found the two "species living together off Redondo Beach.

[*Rhabdus dalli*]

A third species, which combined with the two following species, forms a continuum of change with growth. As discussed by Burch(1945) - see above under "Problems in Scaphopod Identification"- changes in the length/diameter ratio can be obtained by decollation of the juvenile portion of the shell. This is the largest of the three "species", with a length 11-14 times the diameter. It is very likely to be a synonym of *R. rectius*.

Rhabdus rectius

Both the preceding and following species bracket this one in length/diameter ratio. All three have at most an inconspicuous apical notch dorsally, all are very slightly curved, and lack sculpture. This name has priority. All three species, although maintained (conservatively) on the AFS list, should be combined under Carpenter's species *rectius*. It can be distinguished from *Graptacme semipolita* by the much straighter shell, by the smaller diameter at any given length, and by it's near glassy transparency (especially in smaller specimens). *Dentalium vallicolens* differs from *R. rectius* in being much thickly shelled, larger in diameter at every length, slightly more curved, and more strongly ribbed on the shell.

[*Rhabdus watsoni*]

Burch presented evidence that this species was probably synonymous with the previous one, but then backed away from formally establishing the synonymy. No evidence of their separation has come forward in the intervening 50 years, and they should be combined. Abbott (1974) treated *R. watsoni* as a synonym of *R. rectius*.

Compressidens stearnsii

Reported at between 80-200m depths off Santa Monica Bay and Palos Verdes by Burch (1945), this is a species I have not seen. It should be easily recognizable because of the dorso-ventral flattening characteristic of the genus, producing a flattened oval aperture.

Pulsellum aberrans (=***Gadila aberrans***)

It was clear from the examination of shell material by Shimek (1989) that four nominate *Cadulus* species were the same: *C. aberrans*, *C. fusiformis*, *C. hepburni*, and *C. nitentior*; with *C. aberrans* having priority, and the other three being junior synonyms. With the elevation of the *Cadulus* subgenera the name of the species becomes *Gadila aberrans* based on it's foot anatomy. Why it was placed in *Pulsellum* (in a different family) on the AFS list is not known, but this seems in error. The species should be placed in the Gadilidae on the SCAMIT taxonomic listing.

Pulsellum salishorum

A northern species not occurring in the Bight, originally described from Puget Sound. This differs from most other gadilids in lacking a constriction of the mature shell at the aperture; that is the largest diameter of the shell is at the anterior aperture. It is relatively strongly curved in the juvenile, with the rate of curvature decreasing rapidly to a nearly straight adult shell.

Polyschides californicus

The shell is translucent white and fragile compared to dentaliids or more robust gadilids such as *Gadila aberrans*. The diameter increases more rapidly with length than in either *Gadila* or *Siphonodentalium*, giving the shell a pudgy appearance. Unlike the *Cadulus* species of the eastern U.S., which have both the dorsal and ventral arcs of the shell convex, only the ventral arc is convex in west coast *Polyschides*. The genus is characterized by presence of several slits in the posterior aperture, but these are almost never visible - being routinely broken off. The species is found in muddy sediments on the outer shelf and upper slope. It can be separated from *P. tolmiei* by its more slender shell, and the presence of only a slight inflation prior to the apeture. The greatest shell diameter is much closer to the aperture in this species than in *P. tolmiei*. Adult *P. californicus* are also much longer than adult *P. tolmiei*.

Polyschides tolmiei

Has a lighter, thinner, less opaque shell that *P. californicus*, and tapers a bit less abruptly from the widest part of the shell to the anterior aperture. It is also has a greater maximum diameter relative to the length than *P. californicus*. Found in muddy habitats on the outer shelf and upper slope where it feeds like a dentaliid by ciliary movement of sediment to the mantle cavity along the stalks of the captacula (Poon 1987). The greatest width of the *P. tolmiei* shell occurs in the anterior 1/3 of the shell, while that of *P. californicus* occurrs in the anterior 1/6.

Siphonodentalium quadrifissatum

An inhabitant of inner and mid shelf sandy sediments *S. quadrifissatum* can be easily identified if the posterior aperture is intact. It is characterized by possession of four slits (thus the name) which divide the aperture into four lobes. If the posterior aperture is damaged and the slits and lobes are broken off the species can be recognized by having the diameter increasing evenly and slowly, with the dorsal and ventral arcs nearly parallel. In *Gadila aberrans* the ventral arc is always greater than the dorsal, giving the shell a slight belly. There is a bathymetric separation between *S. quadrifissatum* and the two *Polyschides* species, but were they to co-occur, *S. quadrifissatum* would be noticeable thicker shelled, and noticeably thinner in profile than either.

[*Gadila fusiformis*]

a synonym of ***Gadila aberrans*** (see Shimek 1989)

[*Gadila hepburni*]

a synonym of ***Gadila aberrans*** (see Shimek 1989)

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