Paul Valentich-Scott
Santa Barbara Museum of Natural History

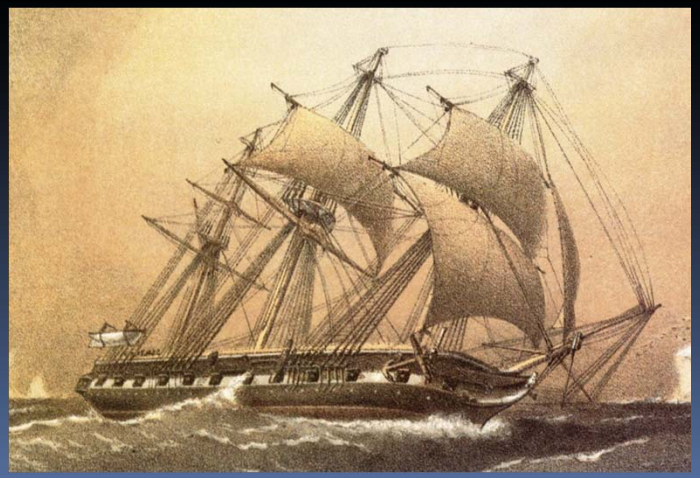
ABYSSAL PACIFIC MOLLUSCA

Introduction

- A few historic deep-sea Pacific cruises and mollusk publications
- Recent Pacific deep-sea mollusk publications
- Best identification tools
- A few collecting suggestions
- What we might find in the CCFZ

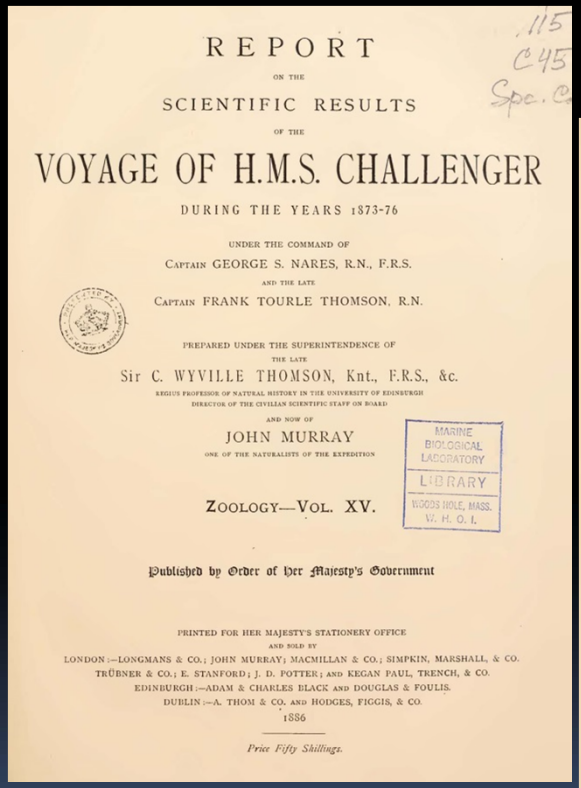
Pacific deep-sea expeditions

- HMS Challenger
  - 1872-1876
  - First expedition to focus on deep-sea (to 8,184 m!)
  - Over 4,700 new species collected



Pacific deep-sea expeditions

- HMS Challenger publications on mollusks



REPORT

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

UNDER THE COMMAND OF

Captain GEORGE S. NARES, R.N., F.R.S.

AND THE LATE

Captain FRANK TOURLE THOMSON, R.N.

PREPARED UNDER THE SUPERINTENDENCE OF

THE LATE

Sir C. WYVILLE THOMSON, Knt., F.R.S., &c.

REGIUS PROFESSOR OF NATURAL HISTORY IN THE UNIVERSITY OF EDINBURGH

DIRECTOR OF THE CIVILIAN SCIENTIFIC STAFF ON BOARD

AND NOW OF

JOHN MURRAY

ONE OF THE NATURALISTS OF THE EXPEDITION

ZOOLOGY—VOL. XV.

Published by Order of Her Majesty's Government

PRINTED FOR HER MAJESTY'S STATIONERY OFFICE

AND SOLD BY

LONDON:—LONGMANS & CO.; JOHN MURRAY; MACMILLAN & CO.; SIMPKIN, MARSHALL, & CO.
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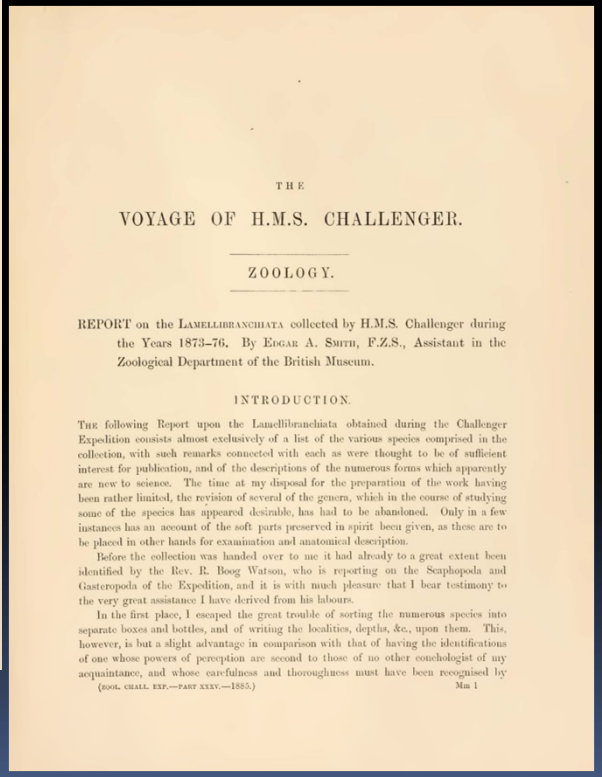


THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

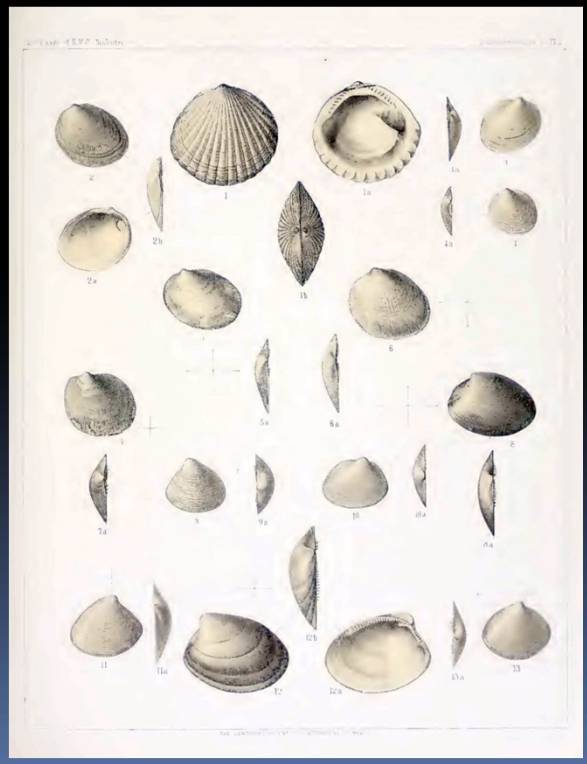
REPORT on the Lamellibranchiata collected by H.M.S. Challenger during the Years 1873–76. By Edgar A. Smith, F.Z.S., Assistant in the Zoological Department of the British Museum.

INTRODUCTION.

The following Report upon the Lamellibranchiata obtained during the Challenger Expedition consists almost exclusively of a list of the various species comprised in the collection, with such remarks connected with each as were thought to be of sufficient interest for publication, and of the descriptions of the numerous forms which apparently are new to science. The time at my disposal for the preparation of the work having been rather limited, the revision of several of the genera, which in the course of studying some of the species has appeared desirable, has had to be abandoned. Only in a few instances has an account of the soft parts preserved in spirit been given, as these are to be placed in other hands for examination and anatomical description.

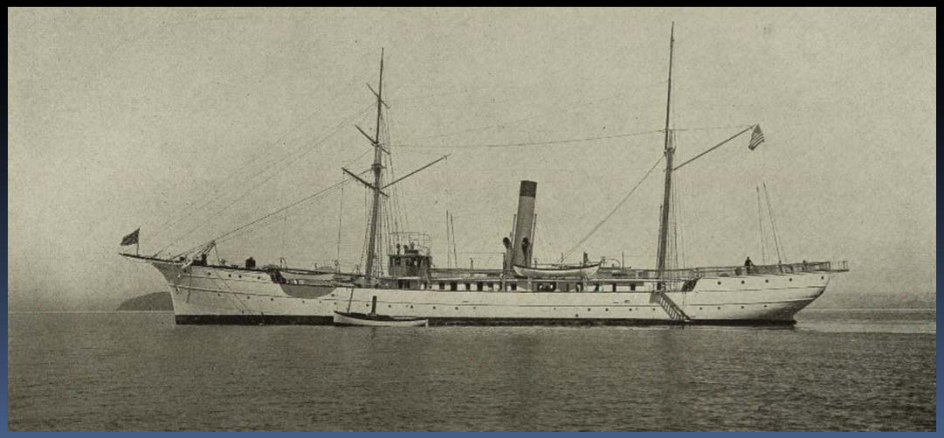
Before the collection was handed over to me it had already to a great extent been identified by the Rev. R. Boog Watson, who is reporting on the Scaphopoda and Gasteropoda of the Expedition, and it is with much pleasure that I bear testimony to the very great assistance I have derived from his labours.

In the first place, I escaped the great trouble of sorting the numerous species into separate boxes and bottles, and of writing the localities, depths, &c., upon them. This, however, is but a slight advantage in comparison with that of having the identifications of one whose powers of perception are second to those of no other conchologist of my acquaintance, and whose carefulness and thoroughness must have been recognised by



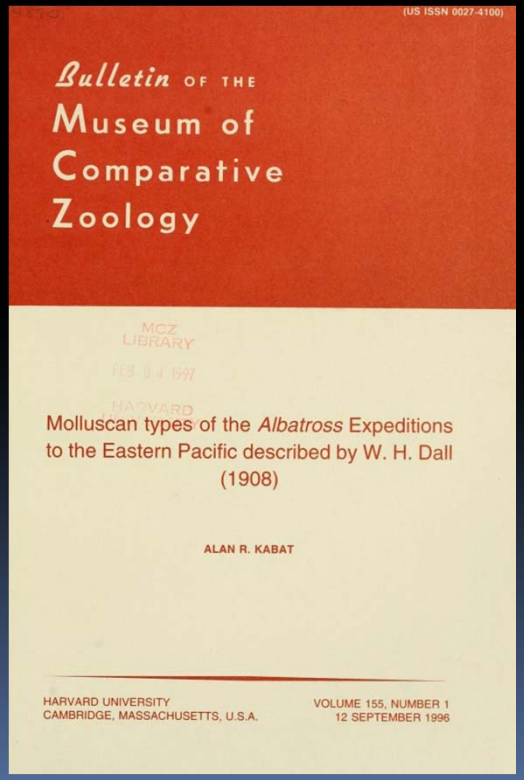
Pacific deep-sea expeditions

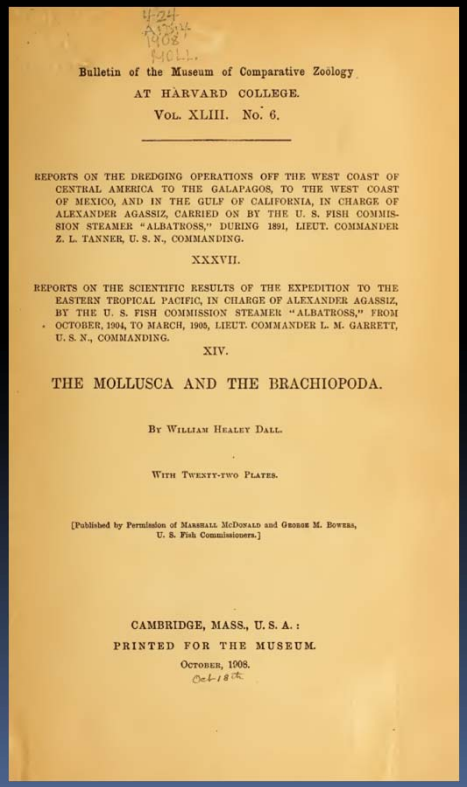
- Pacific Expeditions of *USFC Steamer Albatross*
  - Several cruises from 1891-1905
  - Led by Alexander Agassiz of Harvard
  - Collected down to 7,500 m!

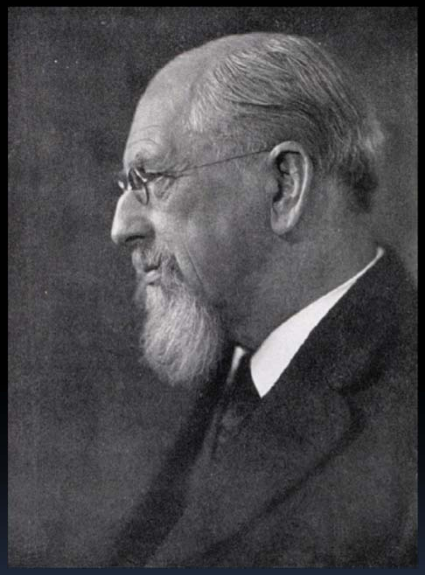


Pacific deep-sea expeditions

- *Albatross* mollusks primarily described by W.H. Dall – 218 new species in 1908

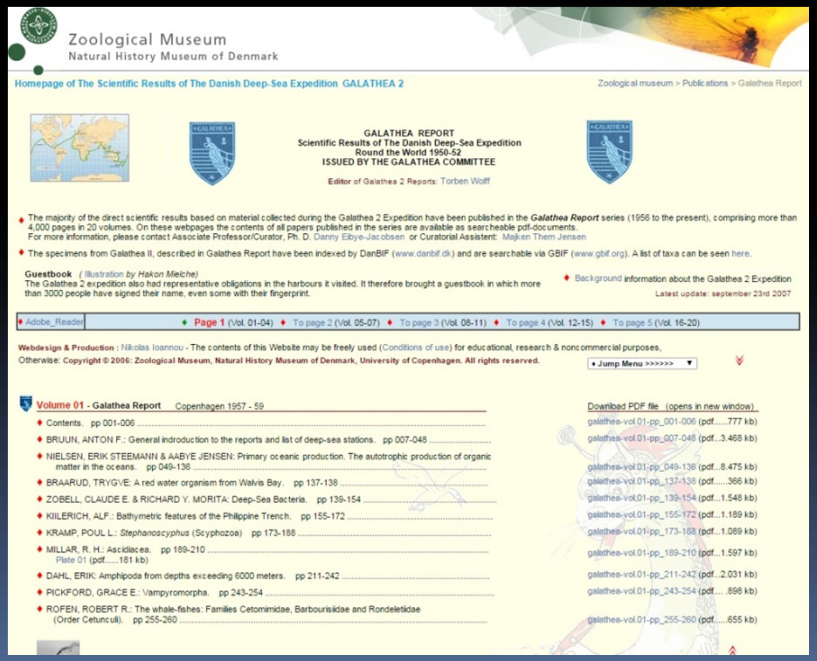






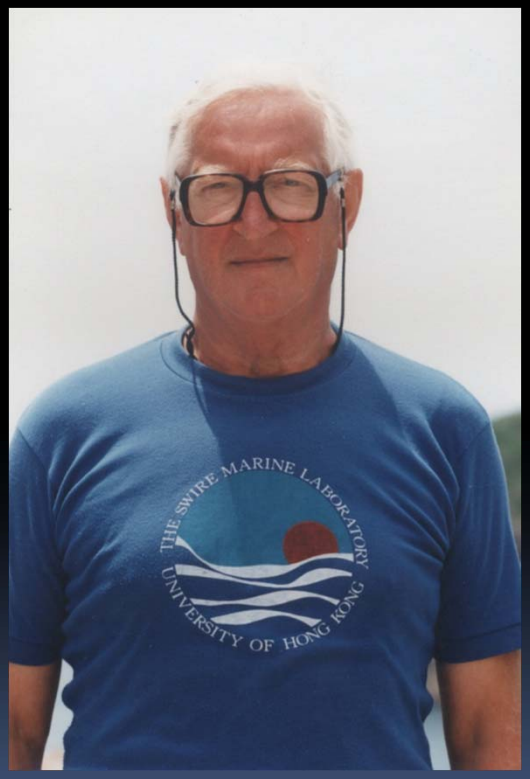
Pacific deep-sea expeditions

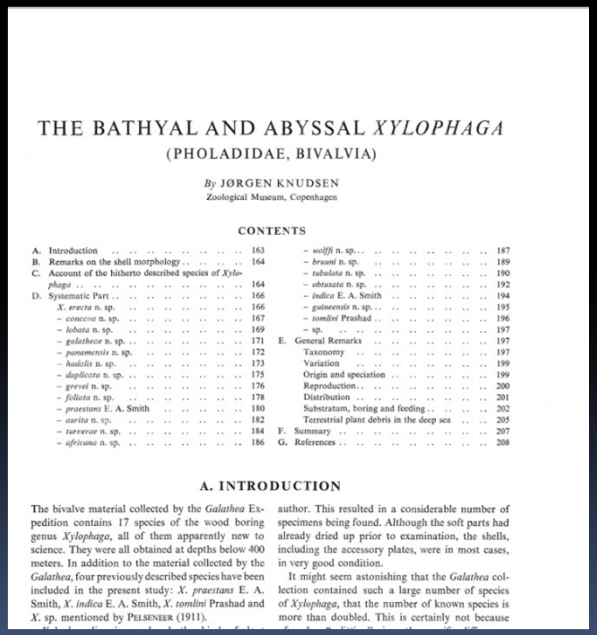
- *Galathea II* Expedition – 1950-1952
  - Express goal to study the ocean > 4,000 m



Pacific deep-sea expeditions

- *Galathea Reports* on mollusks by Knudsen





THE BATHYAL AND ABYSSAL *XYLOPHAGA*
(PHOLADIDAE, BIVALVIA)

By JØRGEN KNUDSEN
Zoological Museum, Copenhagen

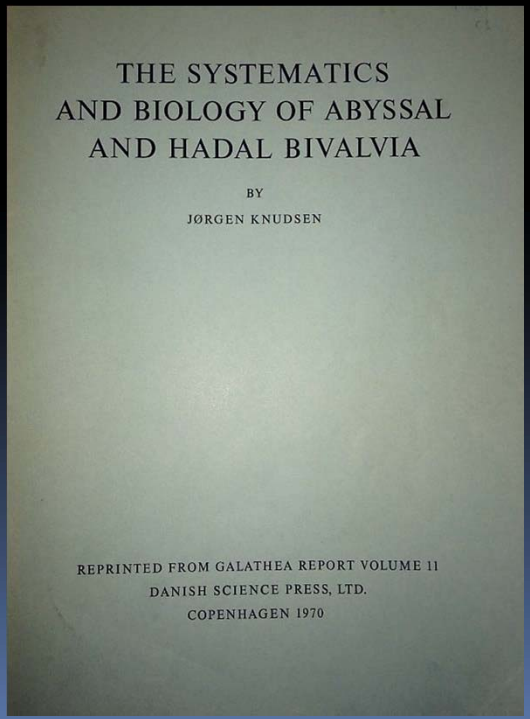
CONTENTS

A. INTRODUCTION

The bivalve material collected by the *Galathea* Expedition contains 17 species of the wood boring genus *Xylophaga*, all of them apparently new to science. They were all obtained at depths below 400 meters. In addition to the material collected by the *Galathea*, four previously described species have been included in the present study: *X. praestans* E. A. Smith, *X. indica* E. A. Smith, *X. tomlini* Prashad and *X.* sp. mentioned by PELSENEER (1911).

author. This resulted in a considerable number of specimens being found. Although the soft parts had already dried up prior to examination, the shells, including the accessory plates, were in most cases, in very good condition.

It might seem astonishing that the *Galathea* collection contained such a large number of species of *Xylophaga*, that the number of known species is more than doubled. This is certainly not because



THE SYSTEMATICS
AND BIOLOGY OF ABYSSAL
AND HADAL BIVALVIA

BY

JØRGEN KNUDSEN

REPRINTED FROM GALATHEA REPORT VOLUME 11
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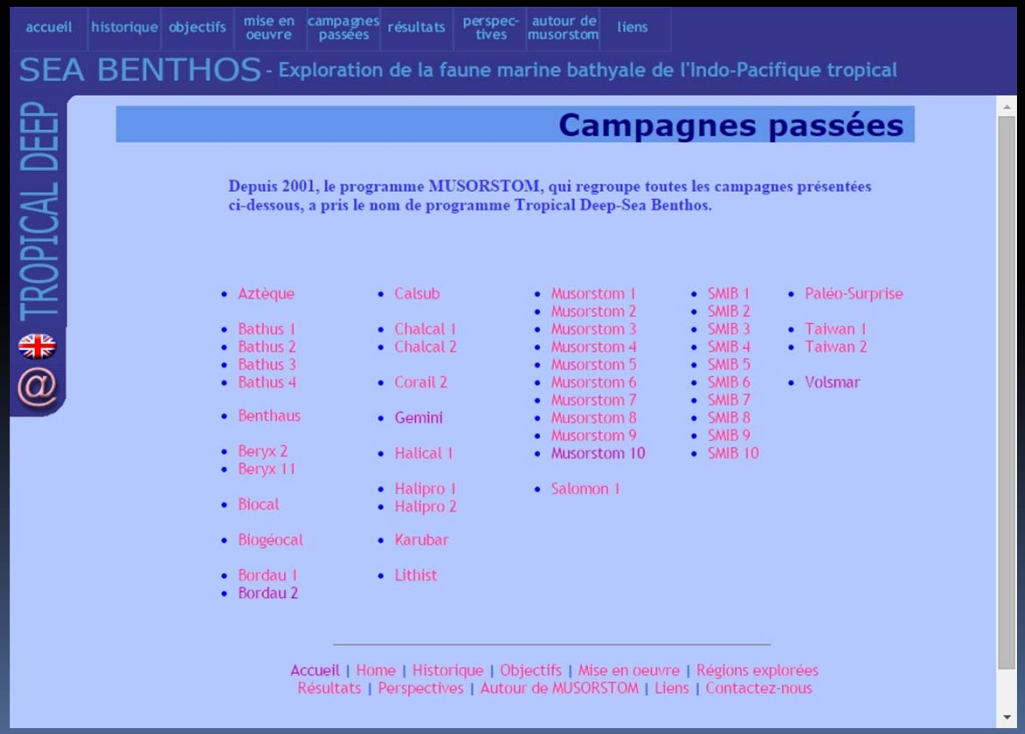
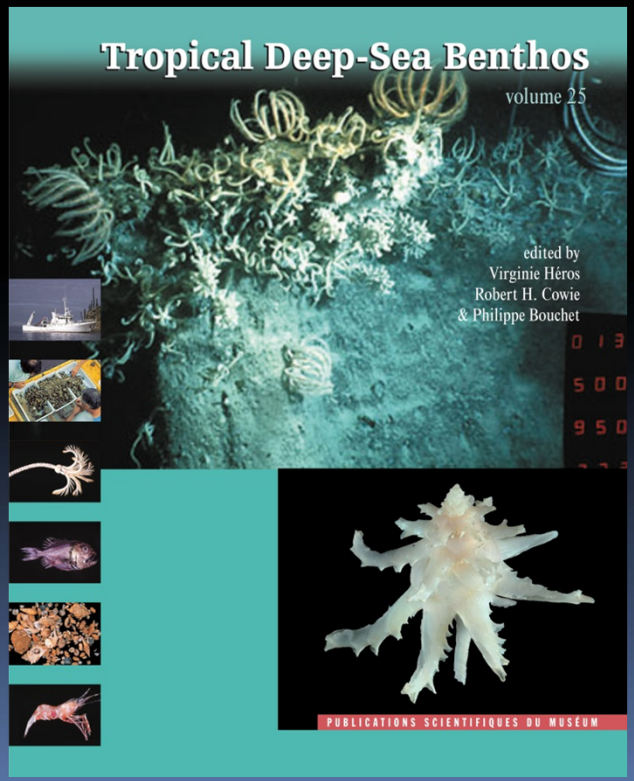
COPENHAGEN 1970

Pacific deep-sea expeditions

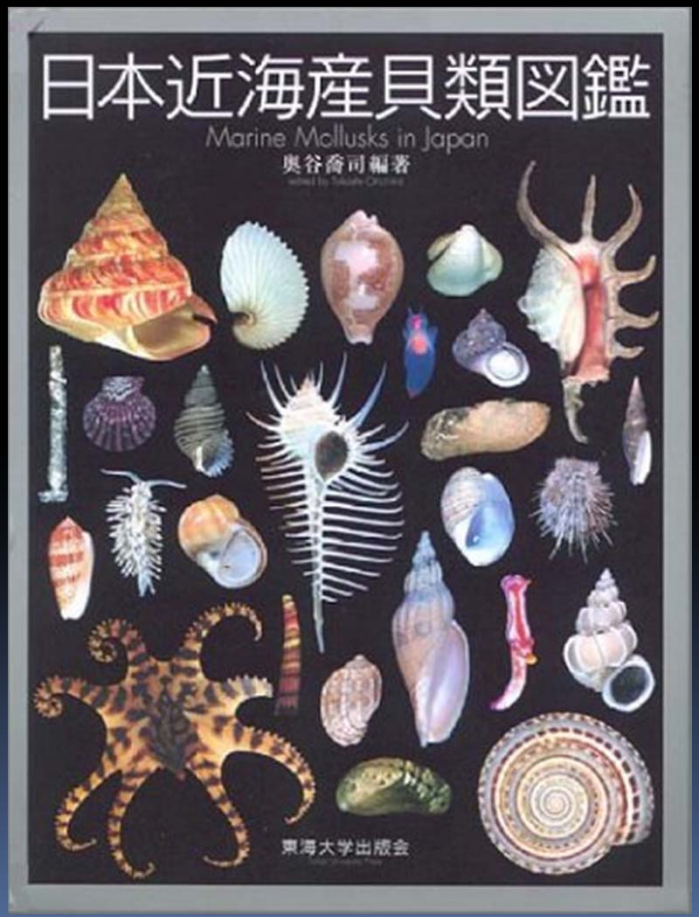
- French Tropical Deep-sea Benthos Expeditions
  - Primarily South Pacific
  - 1970's to present

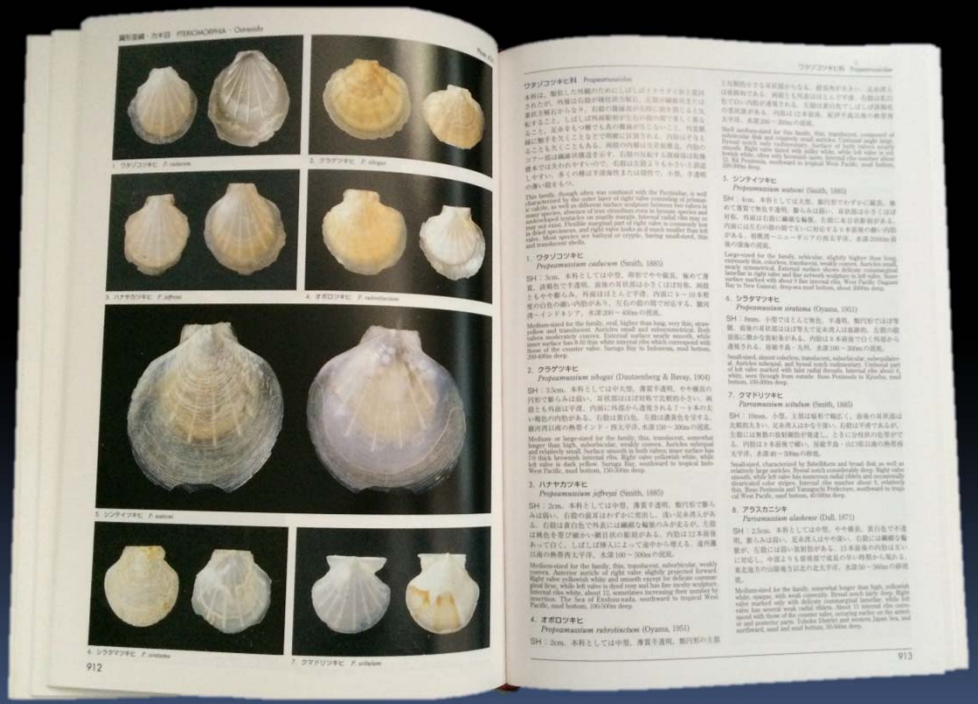




Pacific Mollusca Monographs

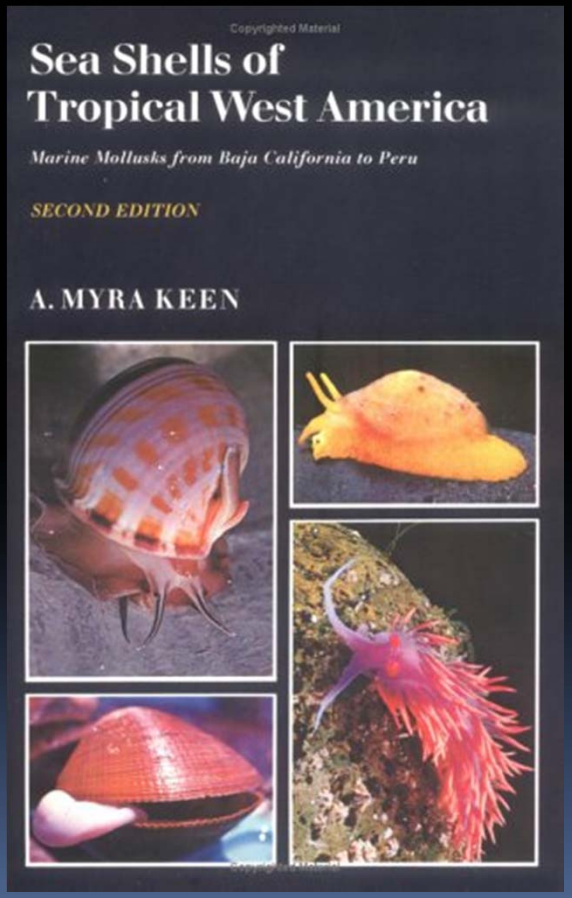
- Western Pacific (Okutani et al., 2000)

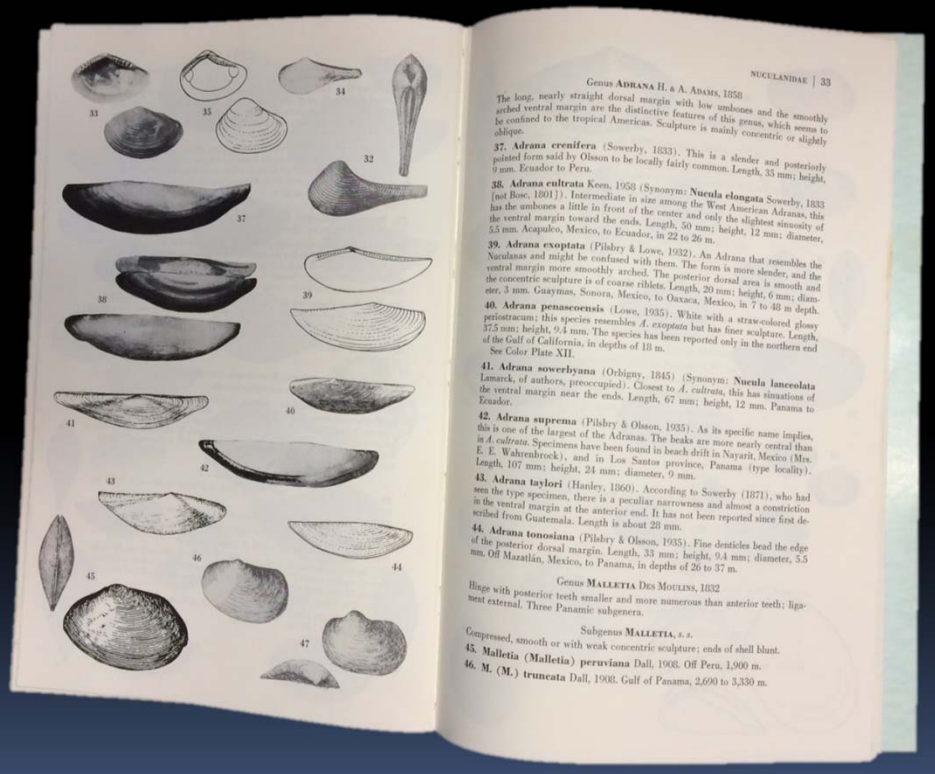




Pacific Mollusca Monographs

- Eastern Pacific Mollusca – Keen, 1971





NUCULANIDAE | 33

Genus **ADRANA** H. & A. ADAMS, 1858

The long, nearly straight dorsal margin with low umbones and the smoothly arched ventral margin are the distinctive features of this genus, which seems to be confined to the tropical Americas. Sculpture is mainly concentric or slightly oblique.

37. Adrana crenifera (Sowerby, 1833). This is a slender and posteriorly pointed form said by Olsson to be locally fairly common. Length, 35 mm; height, 9 mm. Ecuador to Peru.

38. Adrana cultrata Keen, 1958 (Synonym: **Nucula elongata** Sowerby, 1833 [not Bosc, 1801]). Intermediate in size among the West American Adranas, this has the umbones a little in front of the center and only the slightest sinuosity of the ventral margin toward the ends. Length, 50 mm; height, 12 mm; diameter, 5.5 mm. Acapulco, Mexico, to Ecuador, in 22 to 26 m.

39. Adrana exoptata (Pilsbry & Lowe, 1932). An Adrana that resembles the Nuculanas and might be confused with them. The form is more slender, and the ventral margin more smoothly arched. The posterior dorsal area is smooth and the concentric sculpture is of coarse riblets. Length, 20 mm; height, 6 mm; diameter, 3 mm. Guaymas, Sonora, Mexico, to Oaxaca, Mexico, in 7 to 48 m depth.

40. Adrana penascoensis (Lowe, 1935). White with a straw-colored glossy periostracum; this species resembles *A. exoptata* but has finer sculpture. Length, 37.5 mm; height, 9.4 mm. The species has been reported only in the northern end of the Gulf of California, in depths of 15 m.
See Color Plate XII.

41. Adrana sowerbyana (Orbigny, 1845) (Synonym: **Nucula lanceolata** Lamarck, of authors, preoccupied). Closest to *A. cultrata*, this has sinuations of the ventral margin near the ends. Length, 67 mm; height, 12 mm. Panama to Ecuador.

42. Adrana suprema (Pilsbry & Olsson, 1935). As its specific name implies, this is one of the largest of the Adranas. The beaks are more nearly central than in *A. cultrata*. Specimens have been found in beach drift in Nayarit, Mexico (Mrs. E. E. Wahrenbrock), and in Los Santos province, Panama (type locality). Length, 107 mm; height, 24 mm; diameter, 9 mm.

43. Adrana taylori (Hanley, 1860). According to Sowerby (1871), who had seen the type specimen, there is a peculiar narrowness and almost a constriction in the ventral margin at the anterior end. It has not been reported since first described from Guatemala. Length is about 28 mm.

44. Adrana tonosiana (Pilsbry & Olsson, 1935). Fine denticles bead the edge of the posterior dorsal margin. Length, 33 mm; height, 9.4 mm; diameter, 5.5 mm. Off Mazatlán, Mexico, to Panama, in depths of 26 to 37 m.

Genus **MALLETIA** DES MOULINS, 1832

Hinge with posterior teeth smaller and more numerous than anterior teeth; ligament external. Three Panamic subgenera.

Subgenus **MALLETIA**, *s. s.*

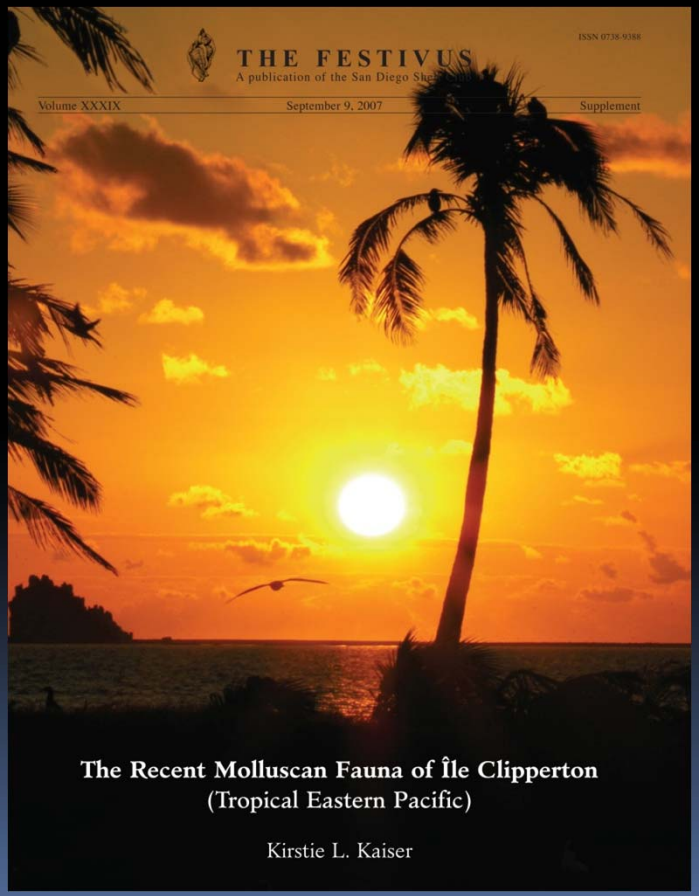
Compressed, smooth or with weak concentric sculpture; ends of shell blunt.

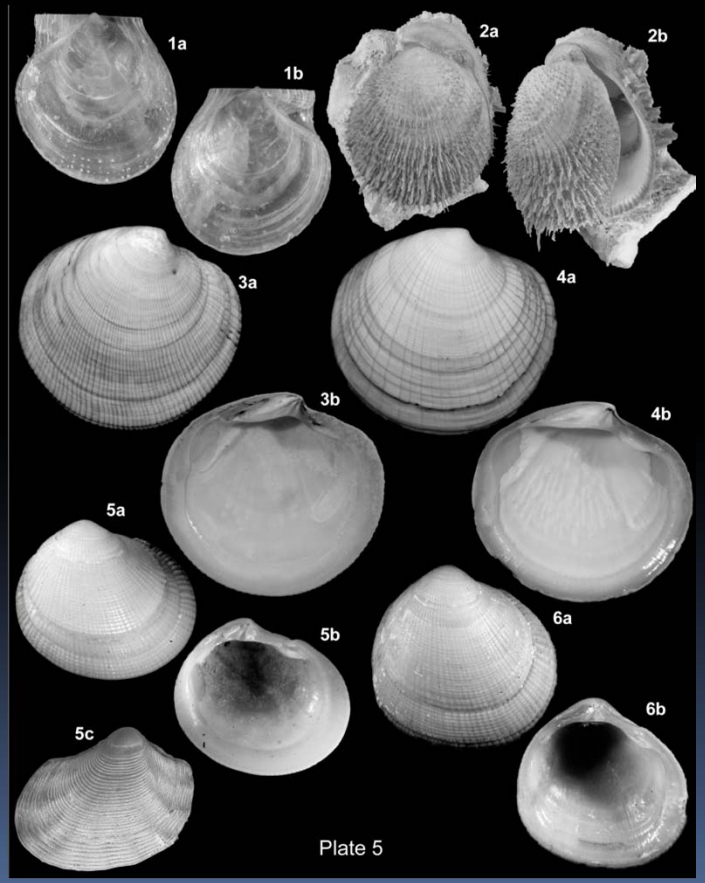
45. Malletia (Malletia) peruviana Dall, 1908. Off Peru, 1,900 m.

46. M. (M.) truncata Dall, 1908. Gulf of Panama, 2,690 to 3,330 m.

Pacific Mollusca Monographs

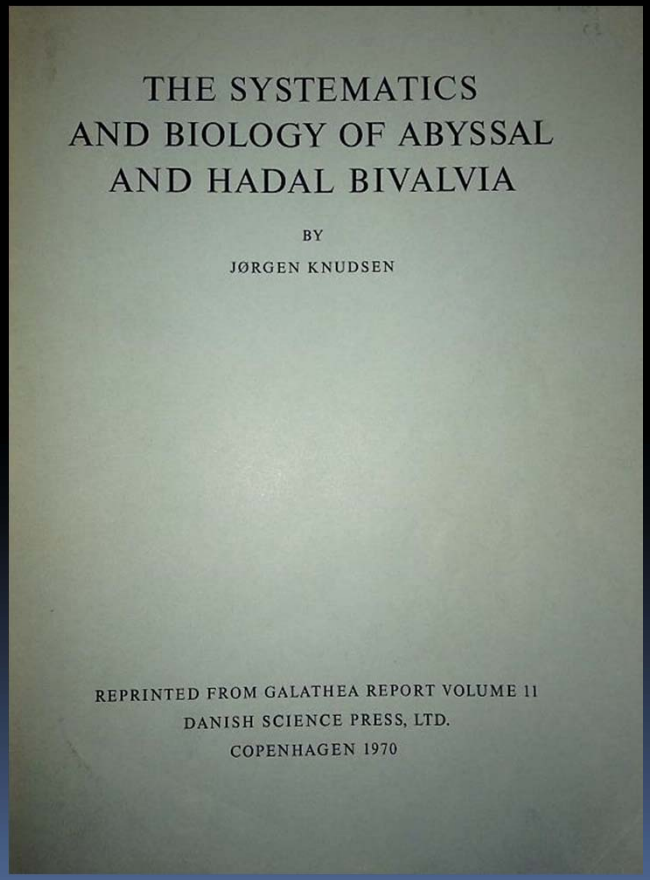
- Eastern Pacific Mollusca – Kaiser, 2007





Pacific Mollusca Monographs

- Eastern Pacific Bivalvia – Knudsen, 1970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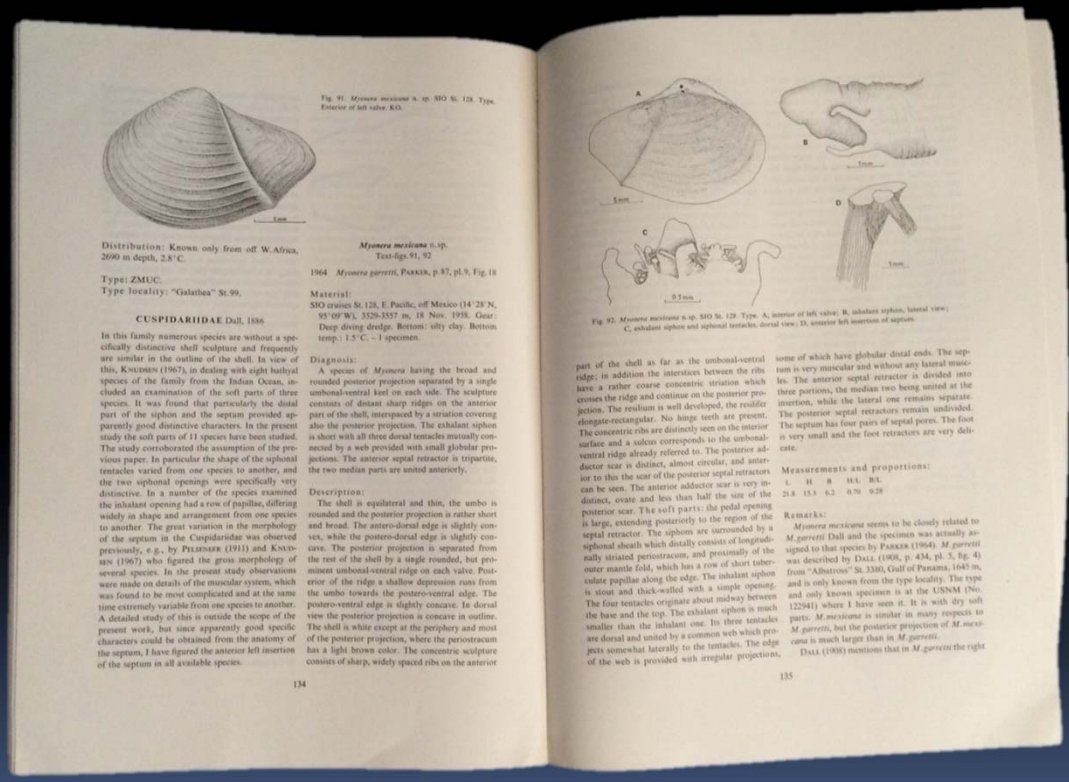


Fig. 91. *Myonera mexicana* n. sp. SIO St. 128. Type. Exterior of left valve. KO.

Distribution: Known only from off W. Africa, 2690 m depth, 2.8° C.

Type: ZMUC.
Type locality: "Galathea" St. 99.

CUSPIDARIIDAE Dall, 1886

In this family numerous species are without a specifically distinctive shell sculpture and frequently are similar in the outline of the shell. In view of this, KNUDSEN (1967), in dealing with eight bathyal species of the family from the Indian Ocean, included an examination of the soft parts of three species. It was found that particularly the distal part of the siphon and the septum provided apparently good distinctive characters. In the present study the soft parts of 11 species have been studied. The study corroborated the assumption of the previous paper. In particular the shape of the siphonal tentacles varied from one species to another, and the two siphonal openings were specifically very distinctive. In a number of the species examined the inhalant opening had a row of papillae, differing widely in shape and arrangement from one species to another. The great variation in the morphology of the septum in the Cuspidariidae was observed previously, e.g., by PELSENEER (1911) and KNUDSEN (1967) who figured the gross morphology of several species. In the present study observations were made on details of the muscular system, which was found to be most complicated and at the same time extremely variable from one species to another. A detailed study of this is outside the scope of the present work, but since apparently good specific characters could be obtained from the anatomy of the septum, I have figured the anterior left insertion of the septum in all available species.

Myonera mexicana n. sp.
Text-figs. 91, 92

1964 *Myonera garretti*, PARKER, p. 87, pl. 9, Fig. 18

Material:
SIO cruises St. 128, E. Pacific, off Mexico (14° 28' N, 95° 09' W), 3529-3557 m, 18 Nov. 1958. Gear: Deep diving dredge. Bottom: silty clay. Bottom temp.: 1.5° C. – 1 specimen.

Diagnosis:
A species of *Myonera* having the broad and rounded posterior projection separated by a single umbonal-ventral keel on each side. The sculpture consists of distant sharp ridges on the anterior part of the shell, interspaced by a striation covering also the posterior projection. The exhalant siphon is short with all three dorsal tentacles mutually connected by a web provided with small globular projections. The anterior septal retractor is tripartite, the two median parts are united anteriorly.

Description:
The shell is equilateral and thin, the umbo is rounded and the posterior projection is rather short and broad. The antero-dorsal edge is slightly convex, while the postero-dorsal edge is slightly concave. The posterior projection is separated from the rest of the shell by a single rounded, but prominent umbonal-ventral ridge on each valve. Posterior of the ridge a shallow depression runs from the umbo towards the postero-ventral edge. The postero-ventral edge is slightly concave. In dorsal view the posterior projection is concave in outline. The shell is white except at the periphery and most of the posterior projection, where the periostracum has a light brown color. The concentric sculpture consists of sharp, widely spaced ribs on the anterior

Fig. 92. *Myonera mexicana* n. sp. SIO St. 128. Type. A, interior of left valve; B, inhalant siphon, lateral view; C, exhalant siphon and siphonal tentacles, dorsal view; D, anterior left insertion of septum.

part of the shell as far as the umbonal-ventral ridge; in addition the interstices between the ribs have a rather coarse concentric striation which crosses the ridge and continue on the posterior projection. The resilium is well developed, the resilifer elongate-rectangular. No hinge teeth are present. The concentric ribs are distinctly seen on the interior surface and a sulcus corresponds to the umbonal-ventral ridge already referred to. The posterior adductor scar is distinct, almost circular, and anterior to this the scar of the posterior septal retractors can be seen. The anterior adductor scar is very indistinct, ovate and less than half the size of the posterior scar. The soft parts: the pedal opening is large, extending posteriorly to the region of the septal retractor. The siphons are surrounded by a siphonal sheath which distally consists of longitudinally striated periostracum, and proximally of the outer mantle fold, which has a row of short tuberculate papillae along the edge. The inhalant siphon is stout and thick-walled with a simple opening. The four tentacles originate about midway between the base and the top. The exhalant siphon is much smaller than the inhalant one. Its three tentacles are dorsal and united by a common web which projects somewhat laterally to the tentacles. The edge of the web is provided with irregular projections, some of which have globular distal ends. The septum is very muscular and without any lateral muscles. The anterior septal retractor is divided into three portions, the median two being united at the insertion, while the lateral one remains separate. The posterior septal retractors remain undivided. The septum has four pairs of septal pores. The foot is very small and the foot retractors are very delicate.

Measurements and proportions:

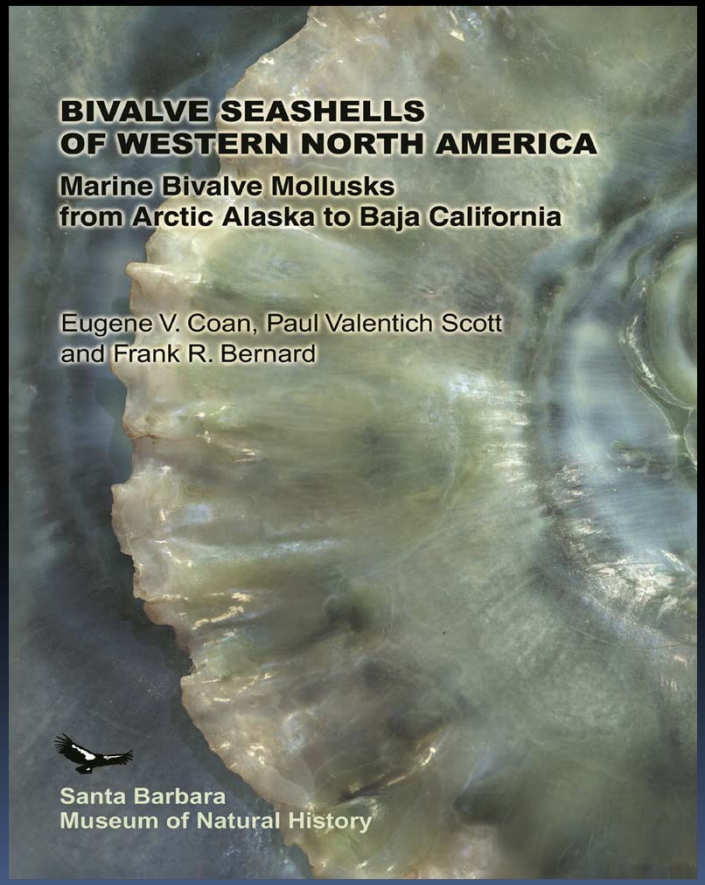
L	H	B	H:L	B:L
21.8	15.3	6.2	0.70	0.28

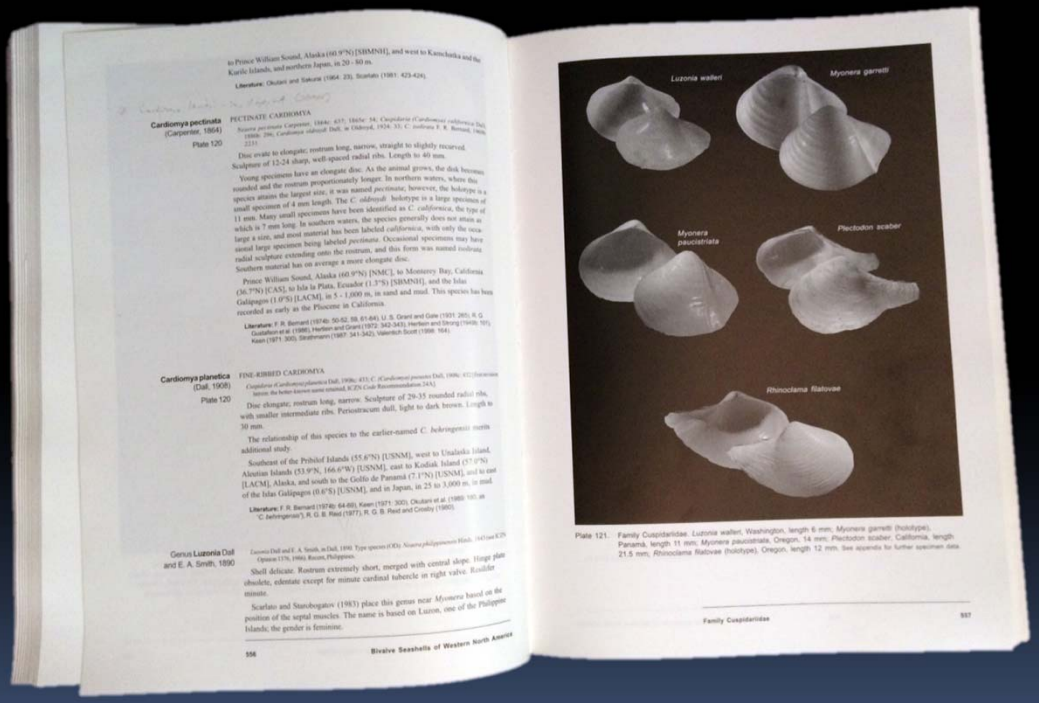
Remarks:
Myonera mexicana seems to be closely related to *M. garretti* Dall and the specimen was actually assigned to that species by PARKER (1964). *M. garretti* was described by DALL (1908, p. 434, pl. 5, fig. 4) from "Albatross" St. 3380, Gulf of Panama, 1645 m, and is only known from the type locality. The type and only known specimen is at the USNM (No. 122941) where I have seen it. It is with dry soft parts. *M. mexicana* is similar in many respects to *M. garretti*, but the posterior projection of *M. mexicana* is much larger than in *M. garretti*.

DALL (1908) mentions that in *M. garretti* the right

Pacific Mollusca Monographs

- Eastern Pacific Bivalvia – Coan et al., 2000





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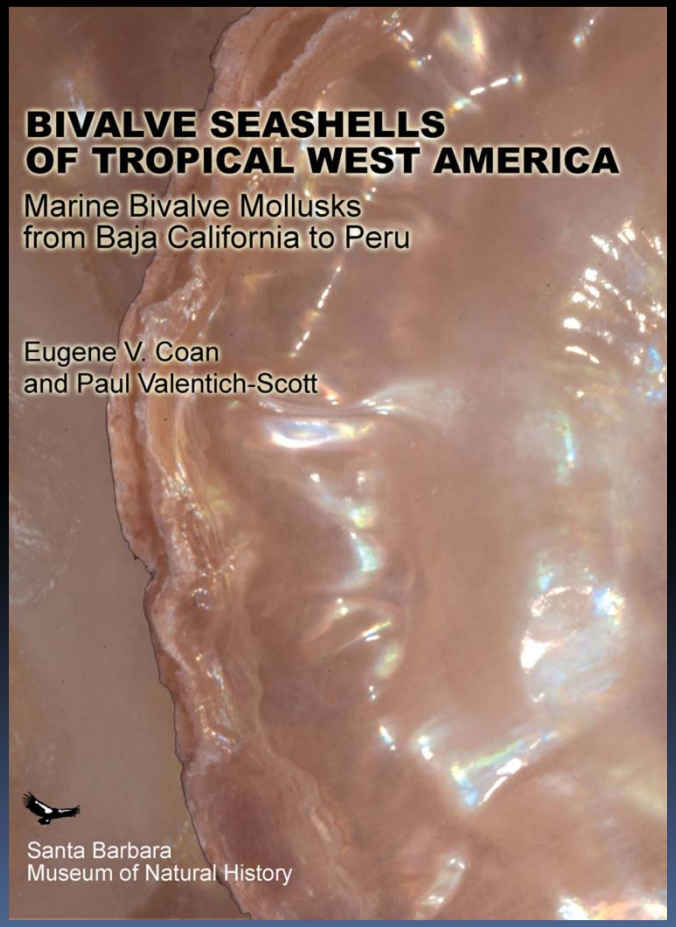
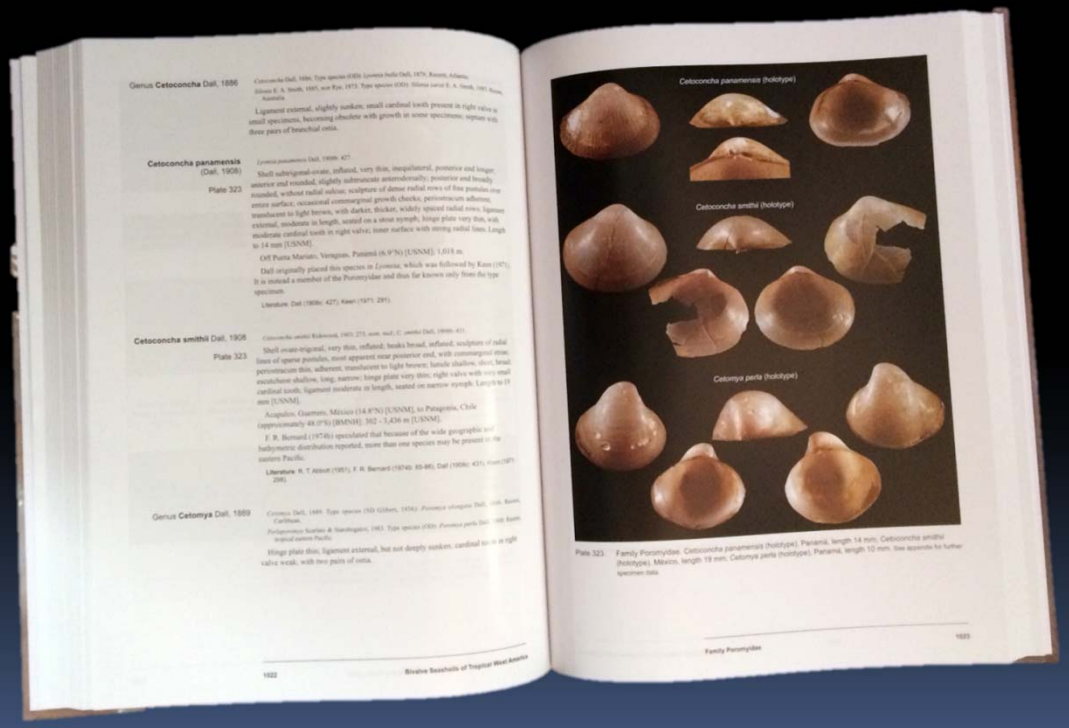
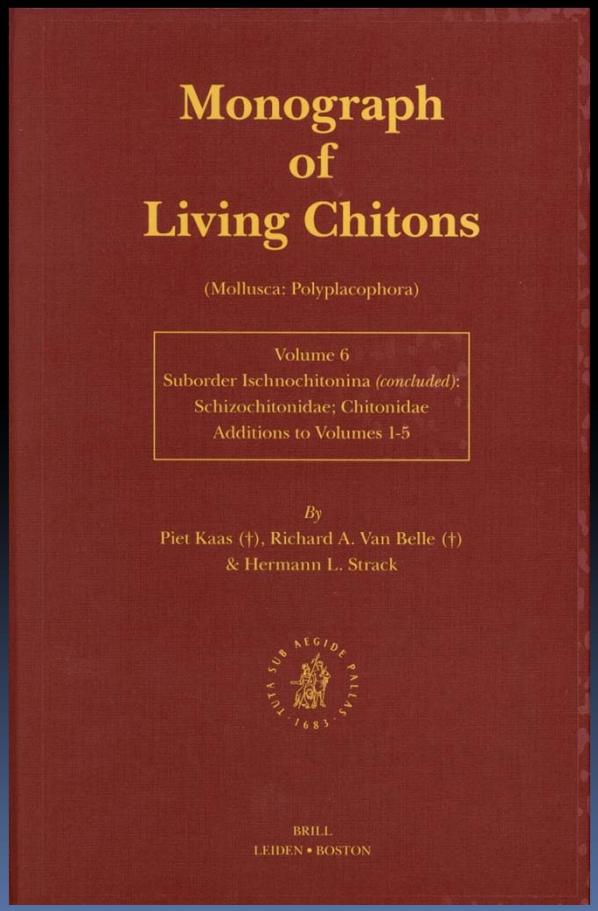
- Eastern Pacific Bivalvia – Coan & Valentich-Scott, 2012

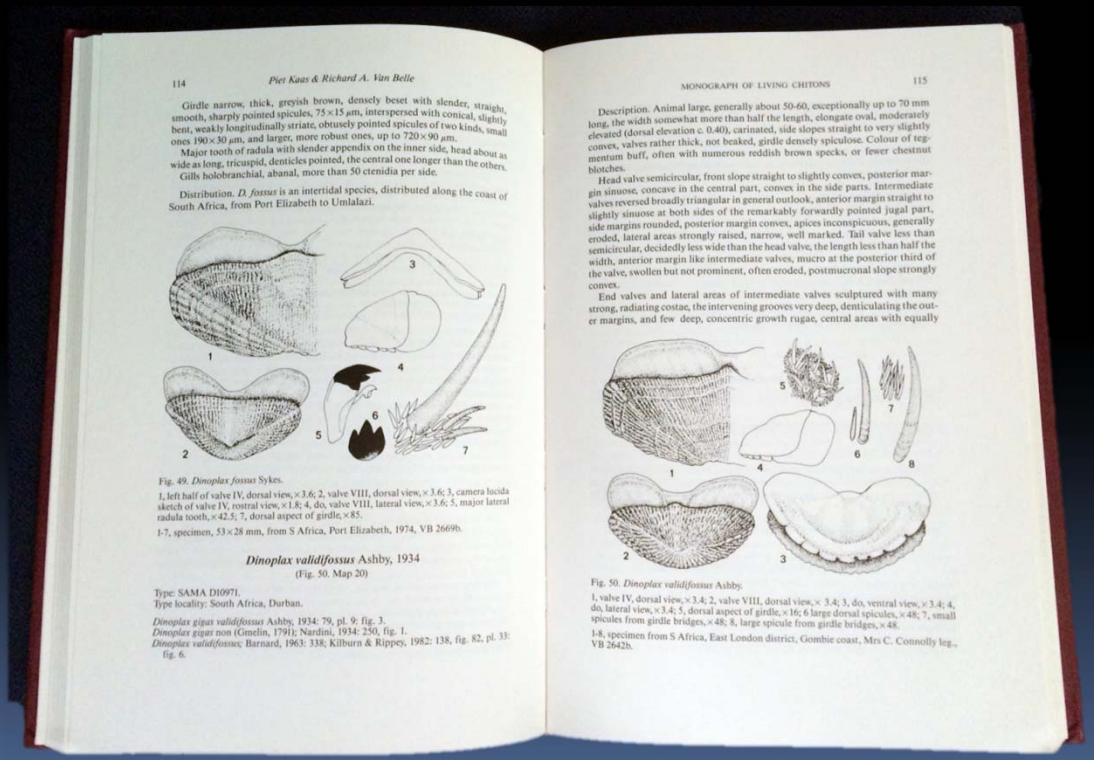




Pacific Mollusca Monographs

- Polyplacophora – Monograph of Living Chitons – Kass & Van Belle 1980's-1990's +2006





114 Piet Kaas & Richard A. Van Belle

Girdle narrow, thick, greyish brown, densely beset with slender, straight, smooth, sharply pointed spicules, 75×15 μm, interspersed with conical, slightly bent, weakly longitudinally striate, obtusely pointed spicules of two kinds, small ones 190×30 μm, and larger, more robust ones, up to 720×90 μm.

Major tooth of radula with slender appendix on the inner side, head about as wide as long, tricuspid, denticles pointed, the central one longer than the others. Gills holobranchial, abanal, more than 50 ctenidia per side.

Distribution. *D. fossus* is an intertidal species, distributed along the coast of South Africa, from Port Elizabeth to Umlalazi.

Fig. 49. *Dinoplax fossus* Sykes.

1, left half of valve IV, dorsal view, × 3.6; 2, valve VIII, dorsal view, × 3.6; 3, camera lucida sketch of valve IV, rostral view, × 1.8; 4, do, valve VIII, lateral view, × 3.6; 5, major lateral radula tooth, × 42.5; 7, dorsal aspect of girdle, × 85.

1-7, specimen, 53×28 mm, from S Africa, Port Elizabeth, 1974, VB 2669b.

Dinoplax validifossus Ashby, 1934

(Fig. 50. Map 20)

Type: SAMA D10971.
Type locality: South Africa, Durban.

Dinoplax gigas validifossus Ashby, 1934: 79, pl. 9: fig. 3.
Dinoplax gigas non (Gmelin, 1791); Nardini, 1934: 250, fig. 1.
Dinoplax validifossus; Barnard, 1963: 338; Kilburn & Rippey, 1982: 138, fig. 82, pl. 33: fig. 6.

MONOGRAPH OF LIVING CHITONS 115

Description. Animal large, generally about 50-60, exceptionally up to 70 mm long, the width somewhat more than half the length, elongate oval, moderately elevated (dorsal elevation c. 0.40), carinated, side slopes straight to very slightly convex, valves rather thick, not beaked, girdle densely spiculose. Colour of tegmentum buff, often with numerous reddish brown specks, or fewer chestnut blotches.

Head valve semicircular, front slope straight to slightly convex, posterior margin sinuose, concave in the central part, convex in the side parts. Intermediate valves reversed broadly triangular in general outlook, anterior margin straight to slightly sinuose at both sides of the remarkably forwardly pointed jugal part, side margins rounded, posterior margin convex, apices inconspicuous, generally eroded, lateral areas strongly raised, narrow, well marked. Tail valve less than semicircular, decidedly less wide than the head valve, the length less than half the width, anterior margin like intermediate valves, mucro at the posterior third of the valve, swollen but not prominent, often eroded, postmucronal slope strongly convex.

End valves and lateral areas of intermediate valves sculptured with many strong, radiating costae, the intervening grooves very deep, denticulating the outer margins, and few deep, concentric growth rugae, central areas with equally

Fig. 50. *Dinoplax validifossus* Ashby.

1, valve IV, dorsal view, × 3.4; 2, valve VIII, dorsal view, × 3.4; 3, do, ventral view, × 3.4; 4, do, lateral view, × 3.4; 5, dorsal aspect of girdle, × 16; 6 large dorsal spicules, × 48; 7, small spicules from girdle bridges, × 48; 8, large spicule from girdle bridges, × 48.

1-8, specimen from S Africa, East London district, Gombie coast, Mrs C. Connolly leg., VB 2642b.

Pacific Mollusca Monographs

- Polyplacophora – Sirenko 2008

Bathyal chitons (Mollusca, Polyplacophora) from off New Caledonia and Vanuatu: families Callochitonidae, Ischnochitonidae and Loricidae

Boris SIRENKO

Zoological Institute, Russian Academy of Sciences, St. Petersburg 199034, Russia
marine@zin.ru

ABSTRACT

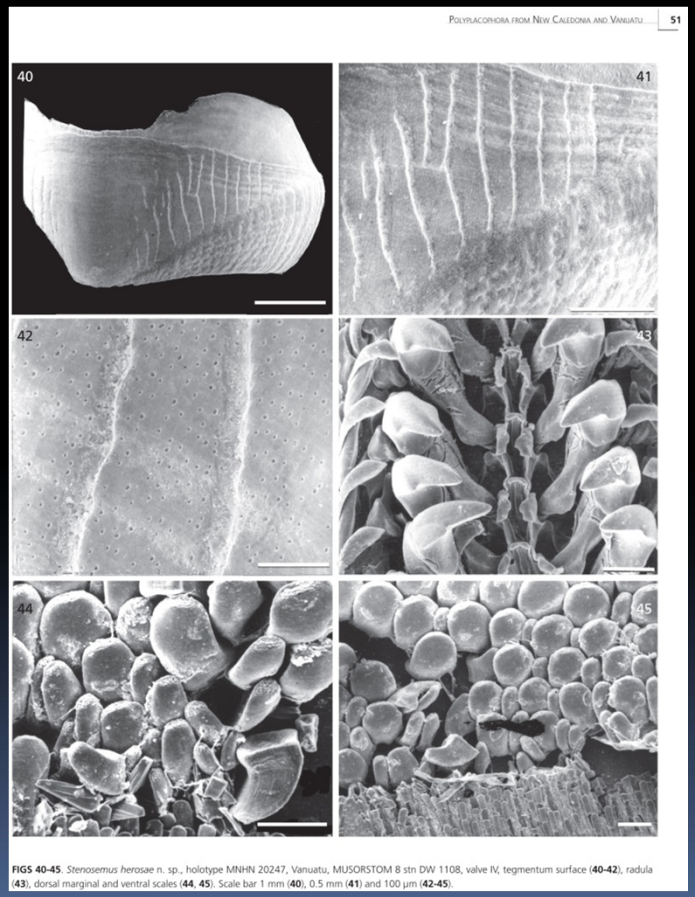
Study of deep-water chitons from around New Caledonia and Vanuatu has revealed 35 species, of which 25 species were identified to species and 10 only to genus. This article includes 7 new records for this area of which 4 are described as new species: *Ischnochiton crassus* Kaas, 1985, *Stenosemus robustus* Kaas, 1991, *S. herosae* n. sp., *Connexochiton discernibilis* Kaas, 1991, *Loricella vanbellei* n. sp., *L. eernissei* n. sp. and *L. dellangeloi* n. sp. In addition, *Vermichiton vermiculus* Kaas, 1991 is reviewed. Based on available biogeographic data it is proposed that *Loricella* originated off South Australia during the Oligocene, in a time of global cooling. Later, *Loricella* extended its range north up to Taiwan and east to Tonga, most likely remaining in the bathyal zone. These new discoveries add to the already high diversity and high proportion of endemics known from this region, and a speculative interpretation of these patterns is offered in conclusion.

RÉSUMÉ

Chitons (Mollusca, Polyplacophora) de l'étage bathyal de Nouvelle-Calédonie et du Vanuatu : les familles Callochitonidae, Ischnochitonidae et Loricidae.

L'étude des chitons de l'étage bathyal de Nouvelle-Calédonie et du Vanuatu montre la présence de 35 espèces, dont 10 ne sont encore identifiées qu'au niveau générique. Dans le présent travail, sept espèces, dont quatre nouvelles, sont signalées pour la première fois dans la région : *Ischnochiton crassus* Kaas, 1985, *Stenosemus robustus* Kaas, 1991, *S. herosae* n. sp., *Connexochiton discernibilis* Kaas, 1991, *Loricella vanbellei* n. sp., *L. eernissei* n. sp. et *L. dellangeloi* n. sp. La description de *Vermichiton vermiculus* Kaas, 1991 est révisée. A partir des données biogéographiques disponibles, il est proposé un scénario faisant remonter l'origine de *Loricella* à l'Oligocène du Sud de l'Australie, à une période de refroidissement général. Plus tard, *Loricella* aurait étendu son aire de distribution jusqu'à Taiwan au nord et Tonga à l'est, en restant vraisemblablement confiné aux profondeurs bathyales. Les nouvelles découvertes signalées ici augmentent encore la richesse et le niveau d'endémisme élevés de la région du Pacifique sud-ouest, et une interprétation spéculative de cette situation est proposée en conclusion.

SIRENKO B. 2008. — Bathyal chitons (Mollusca, Polyplacophora) from off New Caledonia and Vanuatu: families Callochitonidae, Ischnochitonidae and Loricidae, *in* HÉROS V., COWIE R. H. & BOUCHET P. (eds), Tropical Deep-Sea Benthos 25. *Mémoires du Muséum national d'Histoire naturelle* 196: 41-75. Paris ISBN: 978-2-85653-614-8.



FIGS 40-45. *Stenosemus herosae* n. sp., holotype MNHN 20247, Vanuatu, MUSORSTOM 8 stn DW 1108, valve IV, tegmentum surface (**40-42**), radula (**43**), dorsal marginal and ventral scales (**44**, **45**). Scale bar 1 mm (**40**), 0.5 mm (**41**) and 100 µm (**42-45**).

Pacific Mollusca Monographs

- Aplacophora – Scheltema 1998

TAXONOMIC ATLAS
OF THE BENTHIC FAUNA
OF THE SANTA MARIA BASIN AND
THE WESTERN SANTA BARBARA CHANNEL

VOLUME 8

The Mollusca Part 1

The Aplacophora, Polyplacophora, Scaphopoda,
Bivalvia, and Cephalopoda

Edited by

Paul Valentich Scott
and
James A. Blake

SANTA BARBARA MUSEUM OF NATURAL HISTORY
Santa Barbara, California

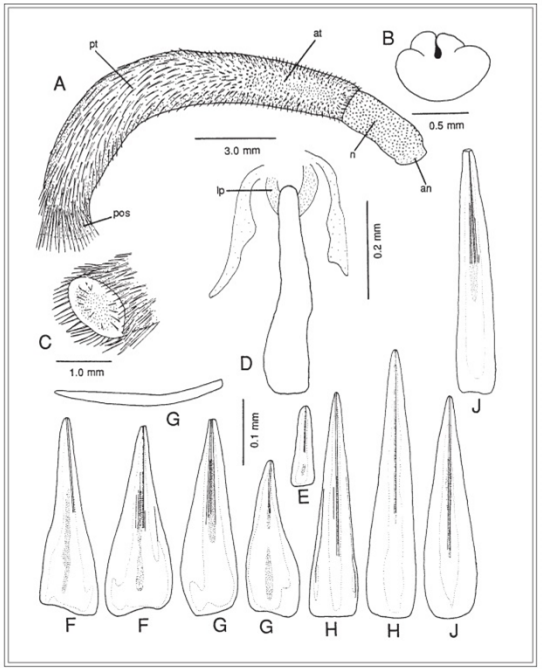


Figure 2.9. *Chaetoderma californicum* Heath: A, specimen from Santa Maria Basin (USNM); B, oral shield of A; C, posterium of A; D, radula reconstructed from holotype sections (CAS); E, G, J, spicules of specimen A, from neck (E), anterior trunk at constriction (G, lateral view above), and mid-posterior trunk (J); F, H, spicules from anterior (F) and posterior (H) trunk of holotype.

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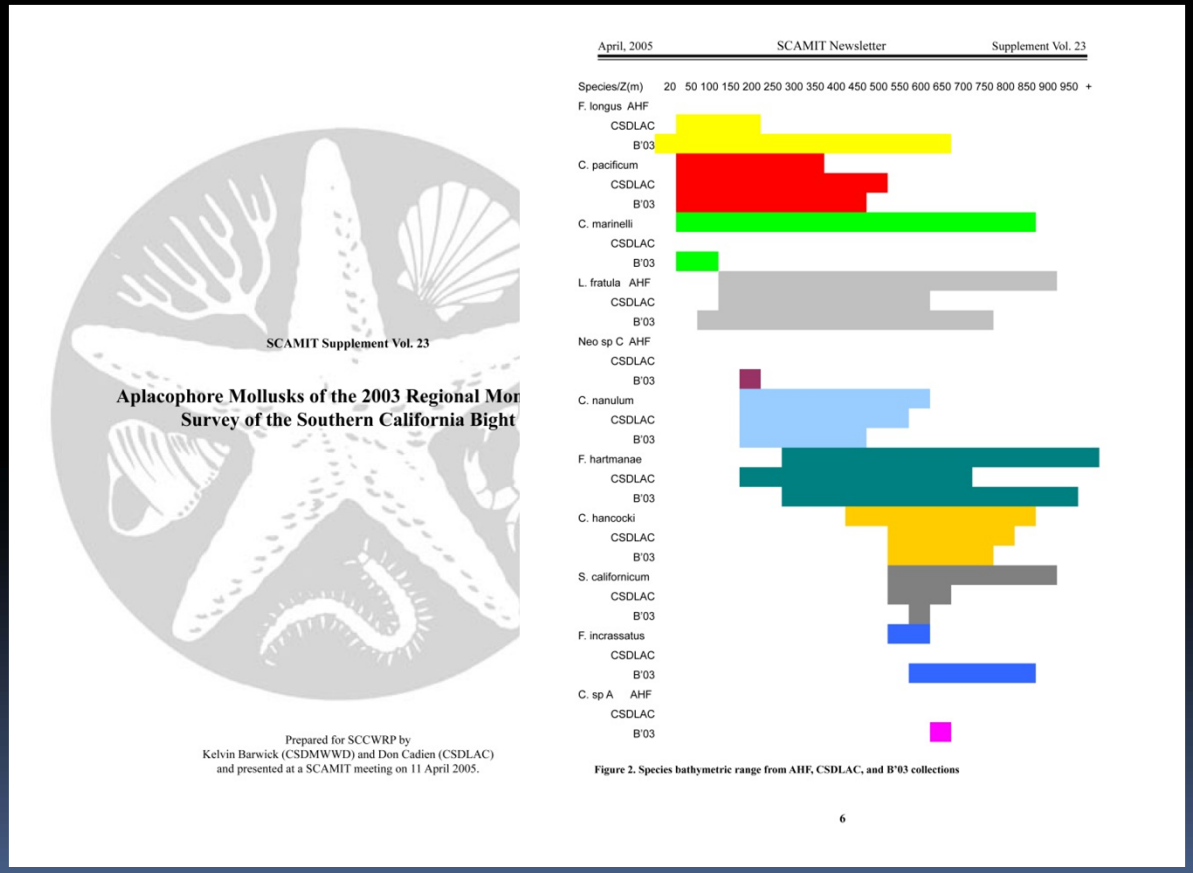
Pacific Mollusca Monographs

- Aplacophora – Barwick & Cadien, 2005



SCAMIT Supplement Vol. 23

Aplacophore Mollusks of the 2003 Regional Mor
Survey of the Southern California Bight

Prepared for SCCWRP by
Kelvin Barwick (CSDMWWD) and Don Cadien (CSDLAC)
and presented at a SCAMIT meeting on 11 April 2005.

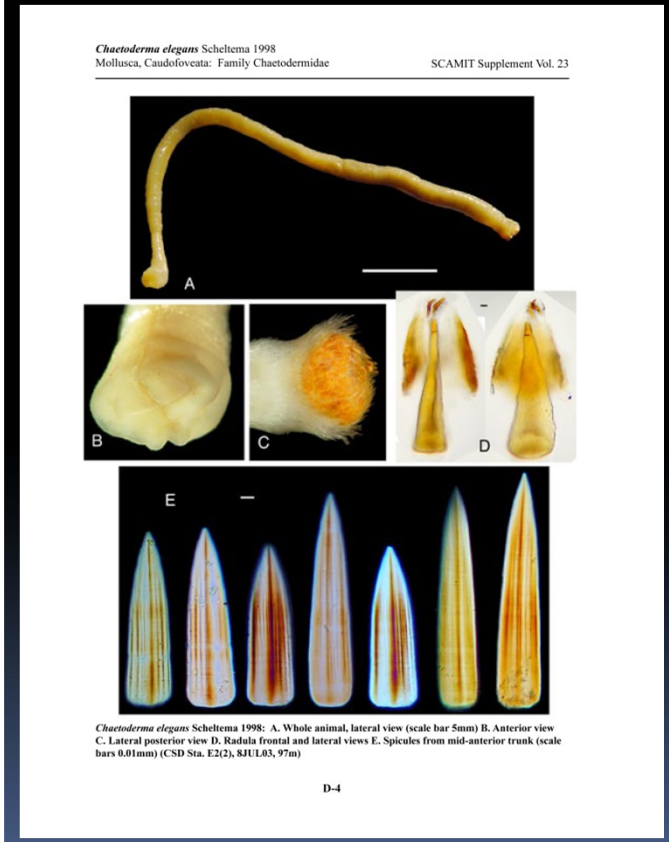
April, 2005 SCAMIT Newsletter Supplement Vol. 23

Species/Z(m) 20 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 +

F. longus AHF
CSDLAC
B'03
C. pacificum
CSDLAC
B'03
C. marinelli
CSDLAC
B'03
L. fratula AHF
CSDLAC
B'03
Neo sp C AHF
CSDLAC
B'03
C. nanulum
CSDLAC
B'03
F. hartmanae
CSDLAC
B'03
C. hancocki
CSDLAC
B'03
S. californicum
CSDLAC
B'03
F. incrassatus
CSDLAC
B'03
C. sp A AHF
CSDLAC
B'03

Figure 2. Species bathymetric range from AHF, CSDLAC, and B'03 collections

6



Chaetoderma elegans Scheltema 1998
Mollusca, Caudofoveata: Family Chaetodermidae SCAMIT Supplement Vol. 23

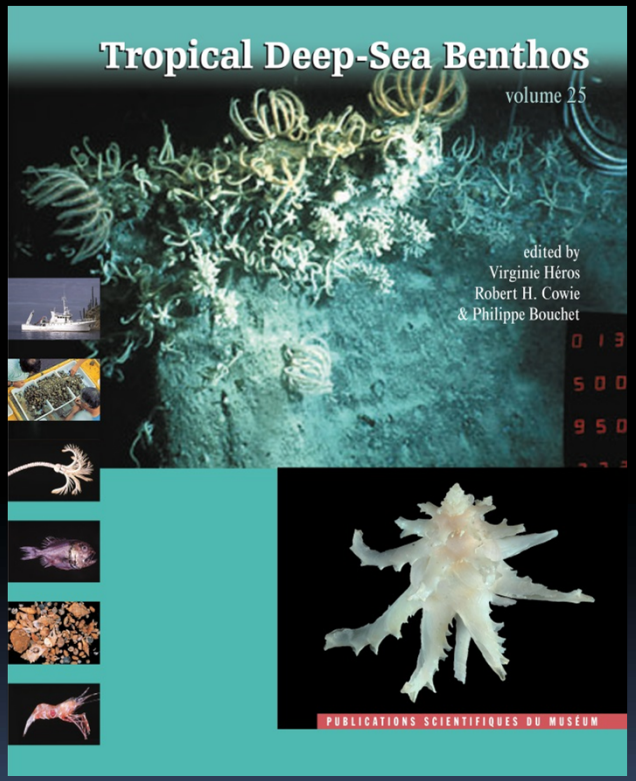
A
B
C
D
E

Chaetoderma elegans Scheltema 1998: A. Whole animal, lateral view (scale bar 5mm) B. Anterior view C. Lateral posterior view D. Radula frontal and lateral views E. Spicules from mid-anterior trunk (scale bars 0.01mm) (CSD Sta. E2(2), 8JUL03, 97m)

D-4

Pacific Mollusca Monographs

- Scaphopoda



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New species and new records of scaphopods from New Caledonia

Victor SCARABINO

Muséum national d'Histoire naturelle, Département Systématique & Evolution, CP 51, 55 Rue de Buffon, 75005 Paris, France
scarabino_victor@yahoo.fr

ABSTRACT

Previous work that recorded 75 species of Scaphopoda in New Caledonian waters is augmented with study of new material from several expeditions. The number of species in the region is increased to 115. Of the 40 additional taxa, 28 are described as new, 7 are new records and 5 remain unidentified. Material from New Caledonia previously identified as *Antalis phanetum* (Dall, 1895) is now determined as *A. albatrossae* n. sp.; material previously identified as *Compressidentalium sedecimcostatum* (Boissevain, 1906) is now determined as *C. clathratum* (Martens, 1881); *Episiphon virgula* (Hedley, 1903), formerly treated as a synonym of *Dentalium subrectum* Jeffreys, 1883, is revalidated; material previously identified as *Entalina mirifica* (Smith, 1895) is now determined as *E. doroscostata* Lamprell & Healy, 1998; *Fissidentalium transversestriatum* (Boissevain, 1906), previously synonymized with *F. shoplandi* (Jousseaume, 1894), is revalidated and the material previously reported from New Caledonia as the latter in fact belongs to the former. New synonyms: *Episiphon jamiesoni* Lamprell & Healy, 1998 is synonymized with *Gadilina insolita* (Smith, 1894); *Dentalium subrectum* Jeffreys, 1883 and *D. bisinuatum* André, 1896 are synonymized with *Laevidentalium eburneum* (Linné, 1767); *Laevidentalium arnoldi* Lamprell & Healy, 1998 is synonymized with *L. boubrichi* Scarabino, 1995; *Bathosiphus steineri* Lamprell & Healy, 1998 and *B. stanisici* Lamprell & Healy, 1998 are synonymized with *Selenosiphus striatulus* Chistikov, 1983. New records from the New Caledonian region: *Striodentalium thetidis* (Hedley, 1903), *Fissidentalium waterhousae* Lamprell & Healy, 1998, *Calliodentalium crocinum* (Dall, 1907), *Gadilina pachypleura* (Boissevain, 1906), *Laevidentalium eburneum* (Linné, 1767), *Laevidentalium* (?) *sominium* Okutani, 1964, *Meganentalina mediocarinata* (Boissevain, 1906).

RÉSUMÉ

Nouvelles espèces et nouvelles occurrences de scaphopodes de la Nouvelle Calédonie.

Au terme d'un précédent travail (Scarabino 1995) sur les scaphopodes du Pacifique tropical, 73 espèces étaient connues de la région néo-calédonienne. L'exploration de la région s'est poursuivie par de nouvelles expéditions, qui portent maintenant à 115 le nombre d'espèces de scaphopodes recensées localement. Sur les 40 espèces additionnelles, 28 sont des espèces nouvelles pour la science, 7 étaient déjà connues ailleurs mais sont signalées de Nouvelle-Calédonie pour la première fois, et 5 autres restent en nomenclature

SCARABINO V. 2008. — New species and new records of scaphopods from New Caledonia, in HÉROS V., COWIE R. H. & BOUCHET P. (eds), Tropical Deep-Sea Benthos 25. *Mémoires du Muséum national d'Histoire naturelle* 196: 215-268. Paris. ISBN: 978-2-85653-614-8.

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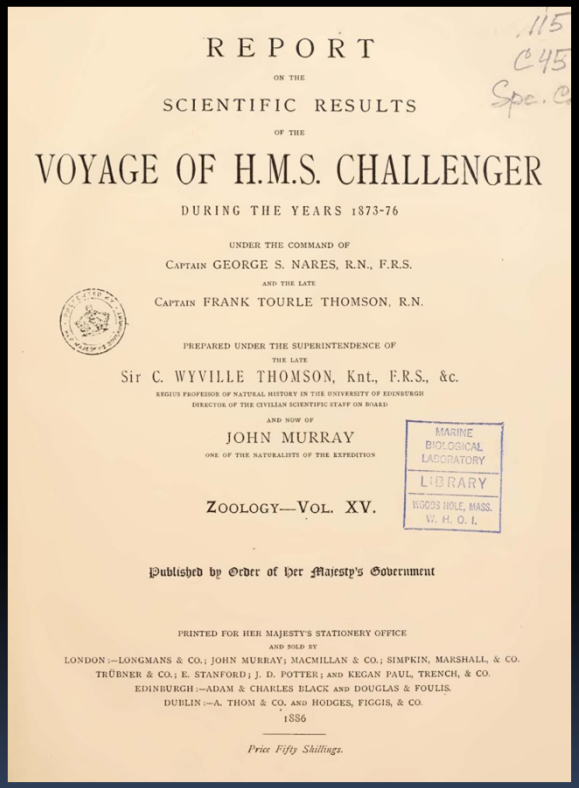
Pacific Mollusca Monographs

- Gastropoda



REPORT

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

UNDER THE COMMAND OF

CAPTAIN GEORGE S. NARES, R.N., F.R.S.

AND THE LATE

CAPTAIN FRANK TOURLE THOMSON, R.N.

PREPARED UNDER THE SUPERINTENDENCE OF

THE LATE

Sir C. WYVILLE THOMSON, Knt., F.R.S., &c.

REGIUS PROFESSOR OF NATURAL HISTORY IN THE UNIVERSITY OF EDINBURGH

DIRECTOR OF THE CIVILIAN SCIENTIFIC STAFF ON BOARD

AND NOW OF

JOHN MURRAY

ONE OF THE NATURALISTS OF THE EXPEDITION

ZOOLOGY—VOL. XV.

Published by Order of Her Majesty's Government

PRINTED FOR HER MAJESTY'S STATIONERY OFFICE

AND SOLD BY

LONDON:—LONGMANS & CO.; JOHN MURRAY; MACMILLAN & CO.; SIMPKIN, MARSHALL, & CO.
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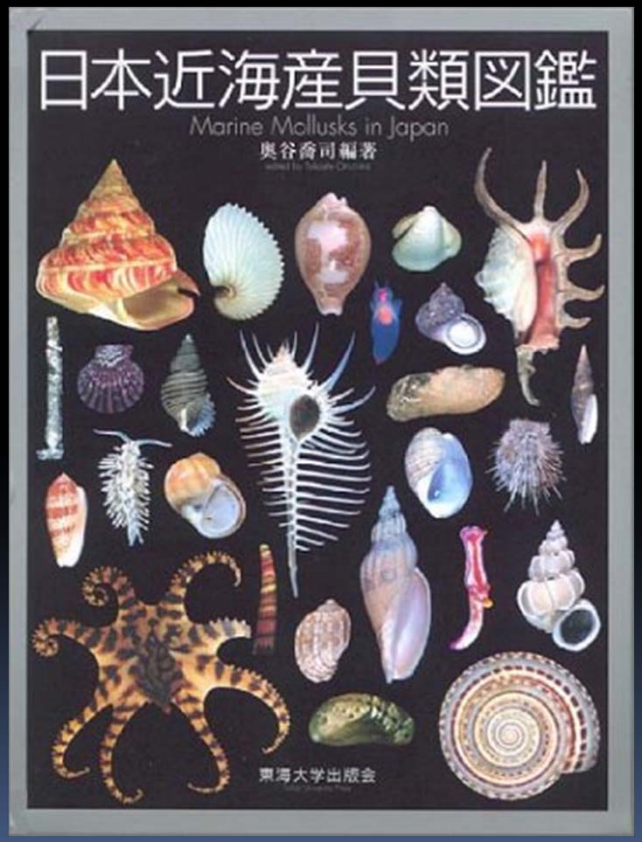
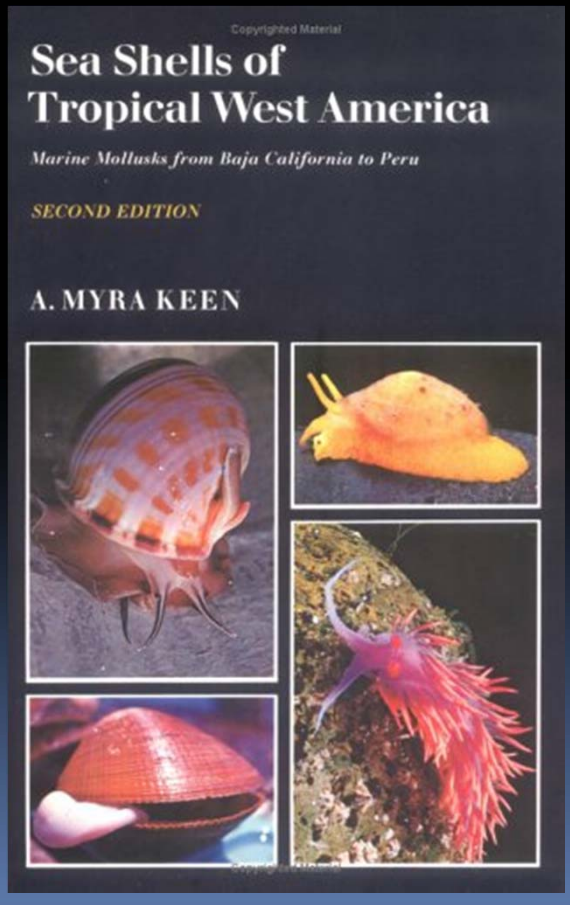




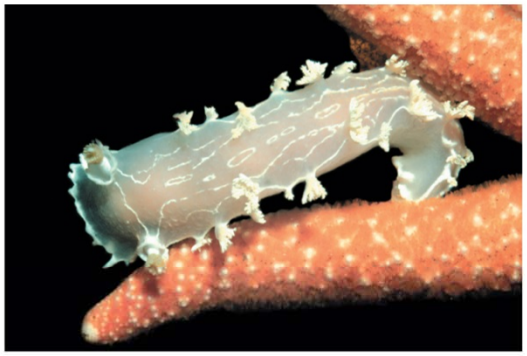
Pacific Mollusca Monographs

- Gastropoda – McLean, 1996

TAXONOMIC ATLAS
OF THE BENTHIC FAUNA
OF THE SANTA MARIA BASIN AND
WESTERN SANTA BARBARA CHANNEL

Volume 9 — The Mollusca Part 2

The Gastropoda



SANTA BARBARA MUSEUM OF NATURAL HISTORY
Santa Barbara, California

1. THE PROSOBRANCHIA

by

James H. McLean[1]

Introduction

The Subclass Prosobranchia, also known as Streptoneura, is used here in its traditional sense, although it is now understood to be a paraphyletic group, rather than one that is monophyletic and includes all of its descendants. As used here it includes the recently recognized suborder Patellogastropoda and the recently recognized suborder Vetigastropoda (Patellogastropoda and Vetigastropoda are part of the old suborder Archaeogastropoda), and the suborders Mesogastropoda and Neogastropoda (which together are also known as Caenogastropoda). These are the gastropods in which the effect of torsion is retained in the adult members—the mantle cavity retains its anterior position. The gill is a typical ctenidium, for the most part bipectinate in Patellogastropoda and Vetigastropoda, and monopectinate in Caenogastropoda. Most members, including all that are treated here, have external shells.

Some families that have previously been treated as prosobranchs, including the families Pyramidellidae, Architectonicidae, and Rissoellidae, are now considered primitive members of the Heterobranchia along with the more derived groups Opisthobranchia and Pulmonata; the latter two groups are united as Euthyneura (see Gosliner, Chapter 2).

Gastropod classification is currently in a state of flux and is likely to remain unsettled for some time. A traditional classification was outlined by Vaught (1989), but changes based on cladistic analysis of anatomical characters have been proposed by recent authors, including Haszprunar (1988, I993) and Ponder and Warén (1988). Further modifications are anticipated. A detailed treatment of phylogeny and classification is omitted here because this work is intended primarily as an identification manual.

Prosobranch gastropods represent the largest group of marine mollusks; in numbers of species they surpass those of all other groups combined. Species can usually be identified on shell characters alone. The morphology of the radula differs among species in some families, providing additional characters for species differentiation; in other families it may be useful only at the family level.

Laboratory Methods

Identification of shelled gastropods is possible without using specialized techniques for relaxation or preservation, although the methods described by Gosliner in Chapter 2 of this volume are equally applicable and should be used for purposes other than identification of species. Small-shelled specimens can be fixed intact in 75% ethyl alcohol or 10% buffered formalin for 24 hours, followed by washing and transfer to 75% ethyl alcohol. The entire bodies of larger specimens cannot be fixed unless the shell is cracked in a vice, in order enable the fixative to penetrate through the early coils of the shell. Shells are best preserved in a dry state; even those kept in buffered alcohol will suffer corrosion after a number of years. Specimens previously fixed in formalin or alcohol can be washed and dried; the initial fixation allows the tissues to dry without decomposition. The radula (and to some extent, other organs) can still be studied at a later date by rehydrating the specimen, followed by preparation using conventional methods.

[1] Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, CA 90007

1

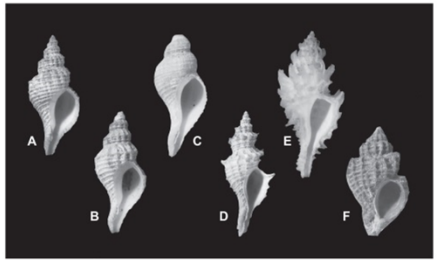


Figure 1.19. Muricidae. **A.** *Scabrotrophon maltzani* (Kobelt and Küster, 1878): 265-274 m, SE of Santa Catalina Island, California (LACM 40-146.6); height 21.5 mm. **B.** *Scabrotrophon cerritensis* (Arnold, 1903): 270 m, off San Clemente Island, California (LACM 150961); height 21.5 mm **C.** *Scabrotrophon lasius* (Dall, 1919): 366-375 m, off SE end of San Nicolas Island, California (LACM 77-132.4); height 22.9 mm. **D.** ***Scabrotrophon grovesi* McLean, new species**: 79-140 m, off NE side of Santa Catalina Island, California (CAS 074962); height 28.1 mm. **E.** ***Scabrotrophon clarki* McLean, new species:** 213 m, off Monterey, Monterey County, California (LACM 2774, holotype); height 43.4 mm. **F.** *Ocenotrophon painei* (Dall, 1903): 91 m, off Avalon, Santa Catalina Island, California (USNM 109306, holotype); height 14.2 mm.

Description. Shell white, medium-sized; spire high but suture not deeply impressed, whorls shouldered, canal moderately long. Axial ribs 13-15; spiral cords two on early whorls, with relatively few on body whorl, interspaces of same width; cords finely imbricate, producing cancellations on crossing axial sculpture. Length 20-33 mm.

Type Locality and Type Specimens. San Pedro, Los Angeles County, California, Pleistocene. Holotype: USNM 162545.

Distribution. Santa Rosa Island (34°N) to San Diego, California (33°N).

Habitat. Rocky bottoms, 110-270 m.

Remarks. *Scabrotrophon cerritensis* was based on Pleistocene material and the name has been ignored in the literature. Here it is introduced for a species living offshore in southern California. As noted in the synonymy above, Myers and D'Attilio (1980) figured a specimen of this species identified as *Nipponotrophon scitulus* [see comparisons under *Scabrotrophon grovesi* below].

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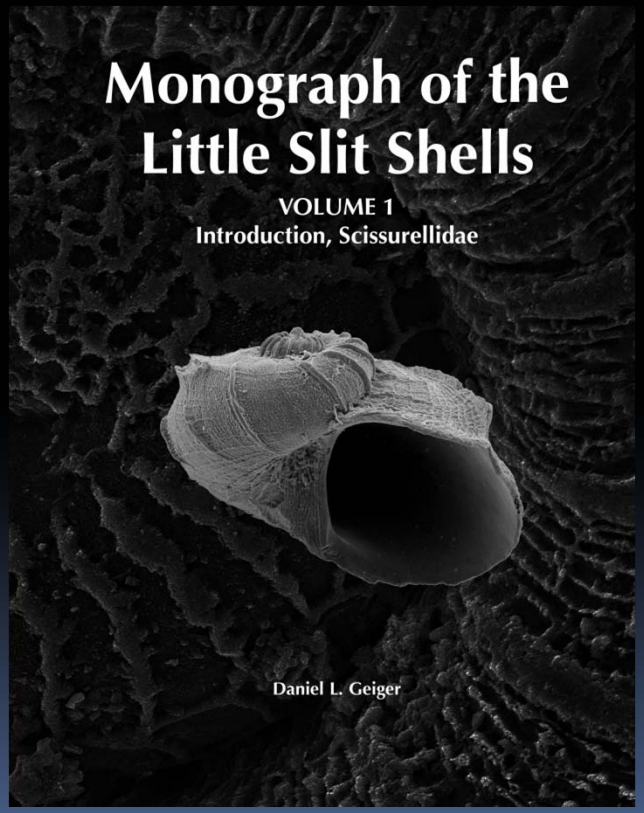
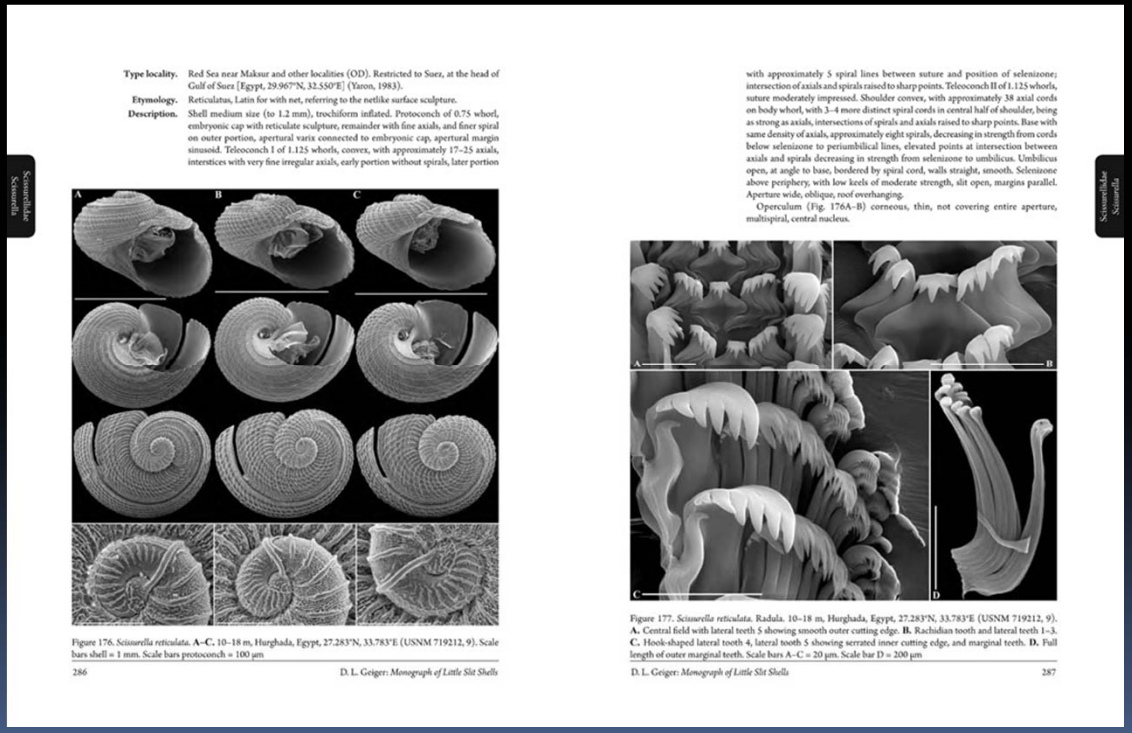
Pacific Mollusca Monographs

- Gastropoda – Geiger, 2012





Type locality. Red Sea near Maksur and other localities (OD). Restricted to Suez, at the head of Gulf of Suez [Egypt, 29.967°N, 32.550°E] (Yaron, 1983).

Etymology. Reticulatus, Latin for with net, referring to the netlike surface sculpture.

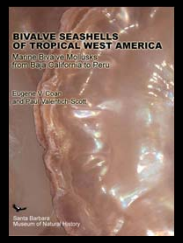
Description. Shell medium size (to 1.2 mm), trochiform inflated. Protoconch of 0.75 whorl, embryonic cap with reticulate sculpture, remainder with fine axials, and finer spiral on outer portion, apertural varix connected to embryonic cap, apertural margin sinusoid. Teleoconch I of 1.125 whorls, convex, with approximately 17–25 axials, interstices with very fine irregular axials, early portion without spirals, later portion with approximately 5 spiral lines between suture and position of selenizone; intersection of axials and spirals raised to sharp points. Teleoconch II of 1.125 whorls, suture moderately impressed. Shoulder convex, with approximately 38 axial cords on body whorl, with 3–4 more distinct spiral cords in central half of shoulder, being as strong as axials, intersections of spirals and axials raised to sharp points. Base with same density of axials, approximately eight spirals, decreasing in strength from cords below selenizone to periumbilical lines, elevated points at intersection between axials and spirals decreasing in strength from selenizone to umbilicus. Umbilicus open, at angle to base, bordered by spiral cord, walls straight, smooth. Selenizone above periphery, with low keels of moderate strength, slit open, margins parallel. Aperture wide, oblique, roof overhanging.

Operculum (Fig. 176A–B) corneous, thin, not covering entire aperture, multispiral, central nucleus.

Figure 176. *Scissurella reticulata*. **A–C.** 10–18 m, Hurghada, Egypt, 27.283°N, 33.783°E (USNM 719212, 9). Scale bars shell = 1 mm. Scale bars protoconch = 100 µm

Figure 177. *Scissurella reticulata*. Radula. 10–18 m, Hurghada, Egypt, 27.283°N, 33.783°E (USNM 719212, 9). **A.** Central field with lateral teeth 5 showing smooth outer cutting edge. **B.** Rachidian tooth and lateral teeth 1–3. **C.** Hook-shaped lateral tooth 4, lateral tooth 5 showing serrated inner cutting edge, and marginal teeth. **D.** Full length of outer marginal teeth. Scale bars A–C = 20 µm. Scale bar D = 200 µm

Pacific Mollusca Identification

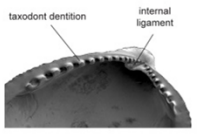


KEY TO SUPERFAMILIES

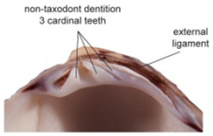
The following is a key to the superfamilies of bivalves covered in this book. It is "artificial" in the sense that phylogenetically meaningful characters are not necessarily selected; instead, features were selected to best aid in identification process. It is specifically for the bivalves that occur in the tropical eastern Pacific and will not necessarily work for bivalves of the same superfamilies occurring in other regions. Several superfamilies have to be keyed out two or more times. In most cases, there is a dichotomous choice; however, in some cases, more than two choices are presented.

Parentheses ( ) indicate the previous step in the key.

1 Hinge with taxodont dentition (reduced to a few teeth in some)..... 2
Hinge with other than taxodont dentition, or without teeth..... 8



Nuculoidea

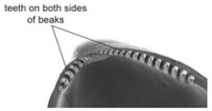


Veneroidea

2 (1) Ligament internal, not visible externally 3
Ligament mostly or entirely external 5

3 (2) Hinge teeth 6 or fewer, entirely or mostly on one side of beaks .....
.....Manzanelloidea
Hinge teeth more than 8, and on both sides of beaks 4

Manzanelloidea



Nuculoidea

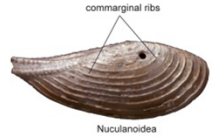
4 (3) Shell very iridescent interiorly .....Nuculoidea
Shell porcelaneous (or slightly iridescent) ..... Nuculanoidea (part)


Nuculoidea


Nuculanoidea

5 (2) Sculpture commarginal, not crenulate within..... Nuculanoidea (part)
Sculpture radial and/or crenulate within..... 6

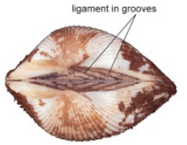
Arcoidea



Nuculanoidea

6 (5) Ligament in chevron-shaped or vertical grooves .....Arcoidea
Ligament in a triangular pit under beaks..... 7

Limopsoidea



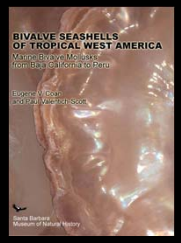
Arcoidea

7 (6) Shape subquadrate .....Arcoidea (part)
Shell subovate or ovate-elongate.....Limopsoidea (part)

Arcoidea (*Arcopsis*)

Limopsoidea

Pacific Mollusca Identification



Species Characteristics of the Family Cardiidae

Taxa	Shell shape	Radial ribs	Posterior / Anterior ends	External color
Trachycardium consors		30-34, covered by horshoe-shaped imbricate scales	posterodorsal radial ribs raised, lamellar	buff, pink, to yellow; rusty brown patches or bands
Trachycardium senticosum		32-40, covered by short spathate scales	scales most prominent on ends	white, with red and purple blotches
Trachycardium procerum		22-23, very heavy, covered by weak crossbars (in some)	radial ribs more flattened on anterior and posterior ends	white, with brown flecks (in some)
Trachycardium belcheri		23-25, with sawtoothed crests	sawtooth crests most prominent on posterior end	white to light yellow, with orange or pink sections
Acrosterigma pristipleura		31-41, flat centrally	posterior rib tops with nodes	white to yellow, with red-brown blotches
Papyridea aspersa		43-50, high, rounded	posterior end with strong spines	white, with red blotches

horseshoe-shaped imbricate scales | short spathate spines | weak crossbars | sawtooth crests

Species Characteristics of the Family Cardiidae - continued

Taxa	Shell shape	Radial ribs	Posterior / Anterior ends	External color
Papyridea crockeri		43-48, low, rounded	posterior end with small spines	cream, motted with rosy red, and yellow zones
Papyridea mantaensis		33-40, heavy, trigonal	posterior end with moderate spines	cream, with orange mottling (especially near beaks)
Americardia biangulata		26-28, broad, flat, with weak crossbars	posterior end set off by sharp keel	yellow to tan, sometimes varigated with brown
Americardia planicostata		30-33, with numerous, fine, closely spaced crossbars	angle between central and posterior slope sharper than Americardia biangulata	cream to brown, with brown blotches
Trigoniocardia granifera		16, nodose, triangular	posterior end with more closely spaced radial ribs	white to light tan
Trigoniocardia obovale		18-22, crossbars on crests	posterior slope with finer, more closely spaced radial ribs	white

low rounded radial ribs | heavy trigonal radial ribs | low flat radial ribs

Pacific Mollusca Identification

Taxa	Shell shape	Radial ribs	Posterior / Anterior ends	External color
Trachycardium consors		30-34, covered by horshoe-shaped imbricate scales	posterodorsal radial ribs raised, lamellar	buff, pink, to yellow; rusty brown patches or bands

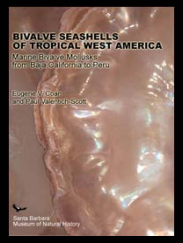
horseshoe-shaped imbricate scales

short spathate spines

weak crossbars

sawtooth crests

Pacific Mollusca Identification



Differing from the western South American *Nucula* (*N.*) *pisum* G. B. Sowerby I, 1833, in having fewer posterior teeth and a more ventrally projecting resilifer (concerning the latter: Villarroel & Stuardo, 1998: 129-131).

Literature: Gemmell et al. (1987: 15-16), Hertlein & Strong (1940: 380), Keen (1971: 26), Olsson (1961: 55).

Nucula (Nucula) profundorum E. A. Smith, 1885

Plate 12

Nucula profundorum E. A. Smith, 1885: 229; *N. chrysocoma* Dall, 1908b: 370; *N. chrysocome, auctt., nom. null.*; *N. darella* Dall, 1916c: 394.

Shell ovate-trigonal, inflated, thick; periostracum adherent, very shiny, light yellow to medium brown; prodissoconch large, white; sculpture of fine radial striae, differentiated more by color rather than prominence, and commarginal growth checks; lunule and escutcheon present, but indistinct; inner ventral margin weakly crenulate; resilifer small, not projecting; anterior teeth about 7-10, posterior about 6. Length to 5 mm [USNM].

Mid-North Pacific (36.2°N, 178.0°E) [BMNH], and Cascadia Abyssal Plain, Oregon, USA (48°N) [LACM], off Acapulco, Guerrero, México (16.9°N) [USNM], to Peru (6.9°S) [USNM]; 734 - 4,134 m [SIO].

Literature: Coan et al. (2000: 73), Hertlein & Strong (1940: 385, as *N. chrysocoma*), Keen (1971: 26, as *N. "chrysocome"*), Rokop (1979, as *N. darella*).

Subgenus **Lamellinucula** Schenck, 1944

Lamellinucula Schenck, 1944. Type species (OD) *Nucula tamatavica* Odhner, 1943, = *N. rugosa* Odhner, 1919, *non* Hecke, 1858. Recent, Madagascar.

Anterodorsal margin with wrinkled transverse ridges; sculpture generally of distinct commarginal ribs and radial striae; umbones prominent; inner ventral shell margin deeply crenulate; resilifer small, narrow, oblique.

This subgenus is close to *Nucula, s.s.*, the most conspicuous difference being the more prominent commarginal sculpture. Cosmopolitan and known from the Paleocene.

Nucula (Lamellinucula) carlottensis Dall, 1897

Plate 13

Nucula carlottensis Dall, 1897a: 6; *N. charlottensis* Dall, in Oldroyd, 1924b: 5, *nom. van.*; *N.* (*L.*) *keenae* F. R. Bernard, 1983a: 253; *N.* (*L.*) *takashii* F. R. Bernard, 1983a: 255.

Shell of moderate size, ovate-trigonal, inflated, moderate in thickness; beaks broad, more than three-fourths of shell length from anterior end; posterior end rounded to subtruncate; periostracum adherent, shiny to silky, yellow to dark brown; prodissoconch large, white, frequently eroded; sculpture cancellate, with heavy, irregular commarginal ribs, overlain by fine radial ribs especially evident in interspaces; lunule and escutcheon very shallow, indistinct, with growth striae only; inner ventral margin finely crenulate; resilifer of moderate size, projecting anteriorly; anterior teeth about 11-13, posterior about 8-9. Length to 8 mm [LACM].

Queen Charlotte Islands, British Columbia, Canada (51.4°N) [USNM], to Acapulco, Guerrero, México (16.9°N) [USNM]; 104 - 2,000 m [SBMNH; Coan et al., 2000].

Literature: Coan et al. (2000: 74), Valentich Scott (1998: 109).

Nucula (Lamellinucula) exigua G. B. Sowerby I, 1833

Plate 13

Nucula exigua G. B. Sowerby I, 1833a: fig. 24 (Feb.); G. B. Sowerby I, 1833c: 198 (13 March); *N. paytensis* A. Adams, 1856: 51; *N. suprastriata* R. Arnold, 1903: 96, *ex* P. P. Carpenter ms.

Shell small, subtrigonal, inflated, moderate in thickness; beaks narrow, terminal at truncate posterior end; periostracum thin, adherent, shiny to silky, iridescent in some; prodissoconch indistinct, moderate size; sculpture cancellate, with heavy, wavy, closely spaced commarginal ribs, overlain by fine radial ribs; lunule and escutcheon slightly impressed, with strong sculpture; inner ventral margin moderately crenulate,

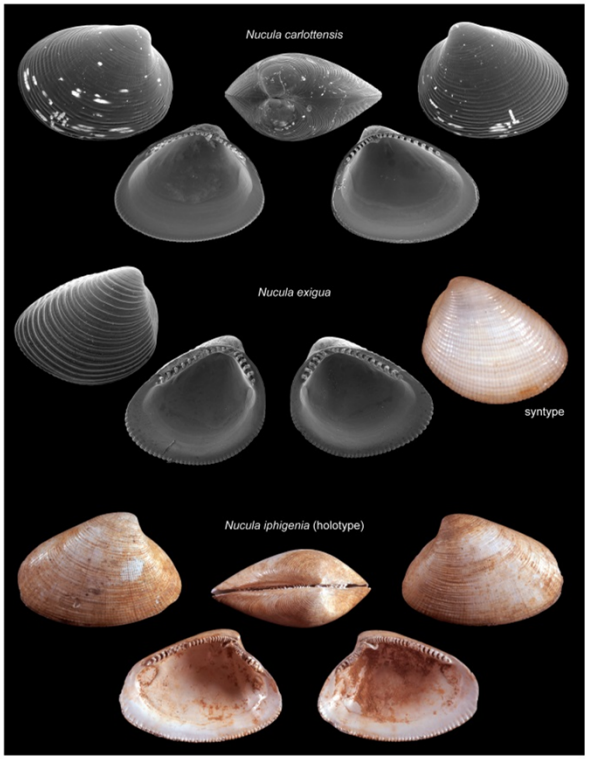


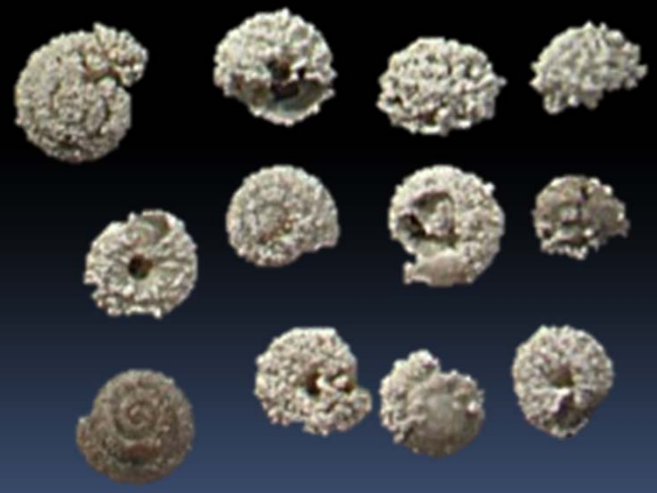
Plate 13. Family Nuculidae. *Nucula carlottensis*, USA, Washington, length 4 mm; *Nucula exigua*, (right photo, syntype), West Columbia, length 4 mm, (left and center SEM photos), México, length 2 mm; *Nucula iphigenia* (holotype), Panamá, length 24 mm. See appendix for further specimen data.

Pacific Mollusca Collecting

- Sieve gently. Don't smash the shells!!

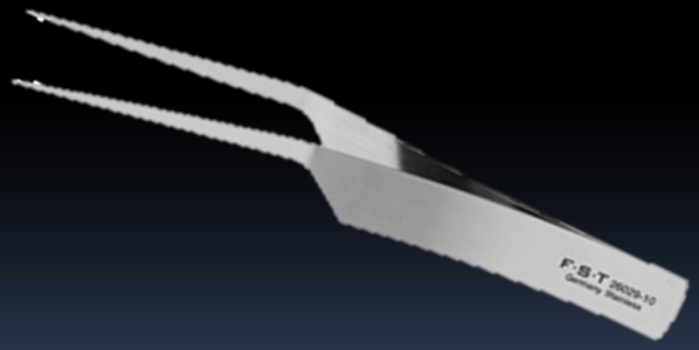
Pacific Mollusca Collecting

- Formalin destroys shells!!
- Remove from formalin as soon as possible
- Transfer to EtOH in 3-4 days if possible



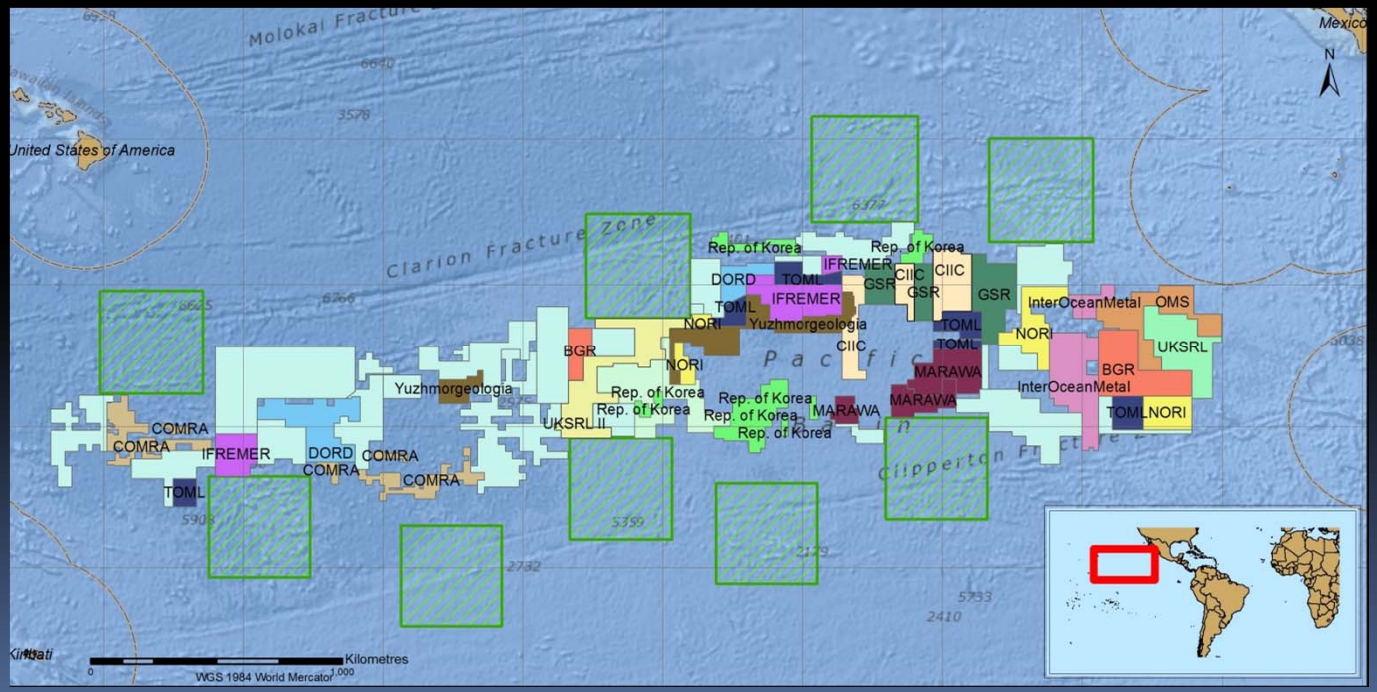
Pacific Mollusca Sorting

- To keep from damaging fragile shells
  - Use soft forceps
  - http://www.finescience.com



Bivalve mollusks in the CCFZ

- Bivalves virtually undocumented in region
- Potentially many new species
- Quick looks at some bivalve families



Bivalve mollusks in the CCFZ

"Taxodonts"

Nuculids

Yoldids

Limopsids

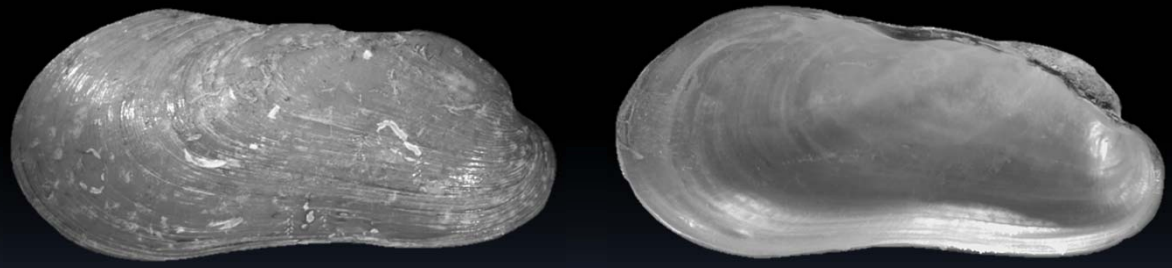
Arks

Bivalve mollusks in the CCFZ

Deep-sea mussels

Dacryids

Benthomodiolids



Bathymodiolids

Bivalve mollusks in the CCFZ

Glass Scallops

Vesicomyids

Bivalve mollusks in the CCFZ

- Anomalodesmataceans

Summary

- The historic literature still important
- Bivalves moderately well documented
- Much still to learn on other molluscan groups
- Don't crush the shells
- Don't dissolve the shells in formalin
- Many, many possible new species
- SBMNH is happy to archive your specimens

Questions?

pvscott@sbnature2.org