



## New geographic and depth records for deep-water mollusks in the Gulf of California, Mexico

### Nuevos registros geográficos y batimétricos para moluscos de mar profundo en el golfo de California, México

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**Abstract.** Six oceanographic cruises (Talud IV-IX) were made in the southern Gulf of California aboard the R/V *El Puma* of the Universidad Nacional Autónoma de México. A total of 56 species of deep-sea mollusks were identified, of which 16 (13 Bivalvia, 2 Gastropoda, 1 Scaphopoda) represent either a new geographic or bathymetric record, or both.

Key words: Talud IV-IX cruises, continental slope, distribution, Bivalvia, Gastropoda, Scaphopoda.

**Resumen.** A partir de 6 campañas oceanográficas (Talud IV-IX) realizadas en el sur del golfo de California a bordo del B/O “El Puma” de la Universidad Nacional Autónoma de México, se identificaron 56 especies de moluscos de aguas profundas. De ellas 16 (13 Bivalvia, 2 Gastropoda, 1 Scaphopoda) corresponden a un nuevo registro geográfico, batimétrico o ambos.

Palabras clave: Cruceros Talud IV-IX, talud continental, distribución, Bivalvia, Gastropoda, Scaphopoda.

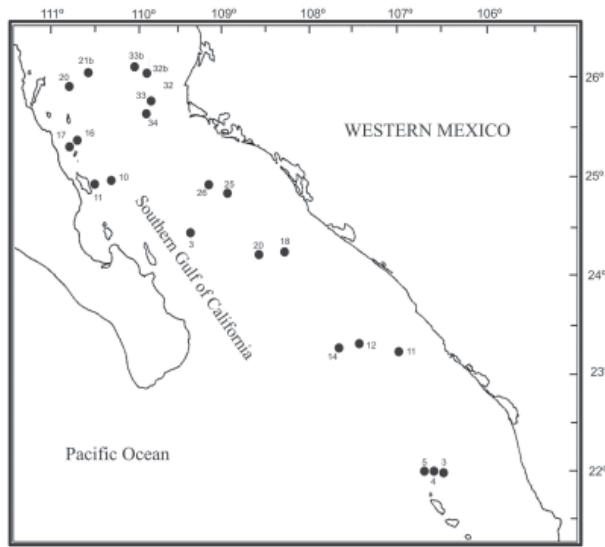
#### Introduction

Records for deep-water mollusks in the Mexican Pacific date back to the exploration of the U.S. Fish Commission Steamer *Albatross* (Dall, 1895). In 1921, the California Academy of Sciences organized a series of expeditions in the Gulf of California. Results were published in several contributions (Baker, 1926; Baker et al., 1928, 1930, 1938a, 1938b). In 1932, the Academy extended its survey to Acapulco (The Templeton Crocker Expedition), on the SW coast of Mexico, and increased the number of records available (see Strong et al., 1933). In the 40s, the New York Zoological Society sponsored sampling activities in western Mexico and Central America (see Hertlein and Strong, 1940), and at the end of the 50s Emerson and Puffer (1957) published the results obtained with samples collected in 1940 by the R/V *E.W. Scripps* in the Gulf of California. In the 60s, Emerson (1960a, 1960b, 1964) and Emerson and Old (1962, 1963a,

1963b) published results related to the expedition of the Puritan-American Museum of Natural History in western Mexico. A checklist of shallow and deep-water mollusks from the Gulf of California was recently presented by Hendrickx and Brusca (2005), including 2250 species from the intertidal to the continental slope. Despite of all this information, over a century after the first exploration was organized aboard the *Albatross*, much remains to be done to increase our knowledge of deep-water mollusks and their geographic distribution.

#### Material and methods

Specimens of deep-water mollusks were obtained in 2000-2005 during the research cruises “Talud IV-IX” aboard the R/V *El Puma*, of the Universidad Nacional Autónoma de México, in the southern Gulf of California (Fig. 1). Sampling gear consisted of a modified 85-liter Karling (K) dredge, and a 2.5 m wide benthic sledge (BS). All specimens were sorted onboard. Mud was filtered



**Figure 1.** Location of sampling stations of TALUD IV-IX cruises in the SW Gulf of California, Mexico, where mollusks were collected.

through a 0.5 mm mesh aperture sieve and mollusks collected in the benthic sledge were picked out by hand. Material was fixed with a ca. 8% formaldehyde sea water solution, preserved in 70% ethanol after washing, identified in the laboratory, and deposited in the Regional Marine Invertebrates Collection, in Mazatlán, Sinaloa, Mexico (EMU-, followed by catalogue number). In some cases, specimens were sent to experts to check identifications. Taxonomic classification and sequence follow Keen (1971) and modifications proposed by Skoglund (1991, 1992, 2001, 2002).

## Results

A total of 56 species of deep-water mollusks were identified: 16 (13 Bivalvia, 2 Gastropoda, 1 Scaphopoda) represented a new geographic (13) or bathymetric (8) record.

Class Bivalvia  
Superfamily Nuculoidea  
Family Nuculidae

***Ennucula cardara*** (Dall, 1916). Figure 2, A  
Material examined. TALUD V, St. 12 (23° 18' N, 107° 27' W), 14/Dec/2000, 1 org., 1160-1170 m, K (EMU-7101); TALUD IX, St. 17 (25° 20' N, 110° 46' W), 13/Nov/2005, 1 org., 836 m, BS (EMU-6939).

Comments. Previously known from Cape Flattery,

Washington, USA, to Cabo San Lucas, Baja California Sur, Mexico (Bernard, 1976, 1983; Scott, 1998). Type locality: San Diego, California, USA, 1962 m (Dall, 1916).

***Ennucula colombiana*** (Dall, 1908). Figure 2, B  
Material examined. TALUD IV, St. 3 (22° 02' N, 106° 26' W), 23/Aug/2000, 1 org., 778-800 m, mud, BS (EMU-7075a); TALUD IV, St. 25 (24° 52' N, 108° 58' W), 26/Aug/2000, 3 orgs., 789 m, mud, BS (EMU-7075-B); TALUD V, St. 3 (22° 02' N, 106° 28' W), 13/Dec/2000, 1 org., 770-780 m, mud, BS (EMU-7074); TALUD V, St. 14 (23° 16' N, 107° 41' W), 14/Dec/2000, 1 org., 2080-2140 m, mud, K (EMU-7128); TALUD VI, St. 3 (22° 00' N, 106° 28' W), 13/Mar/2001, 4 orgs., 770-780 m, mud, BS (EMU-7073); TALUD VII, St. 4 (22° 04' N, 106° 28' W), 06/May/2001, 1 org., 1200-1230 m, mud, BS (EMU-7077); TALUD VIII, St. 16 (25° 24' N, 110° 37' W), 18/Apr/2005, 1 org., 1030 m, BS (EMU-7076-A); TALUD VIII, St. 20 (25° 55' N, 110° 43' W), 19/Apr/2005, 1 org., 1150 m, mud, BS (EMU-7076-B).

Comments. Known from shallow water, in 11-730 m depth (Hertlein and Strong, 1940; Keen, 1971). Maximum known depth for this species is increased to 2140 m, with many intermediate depth records.

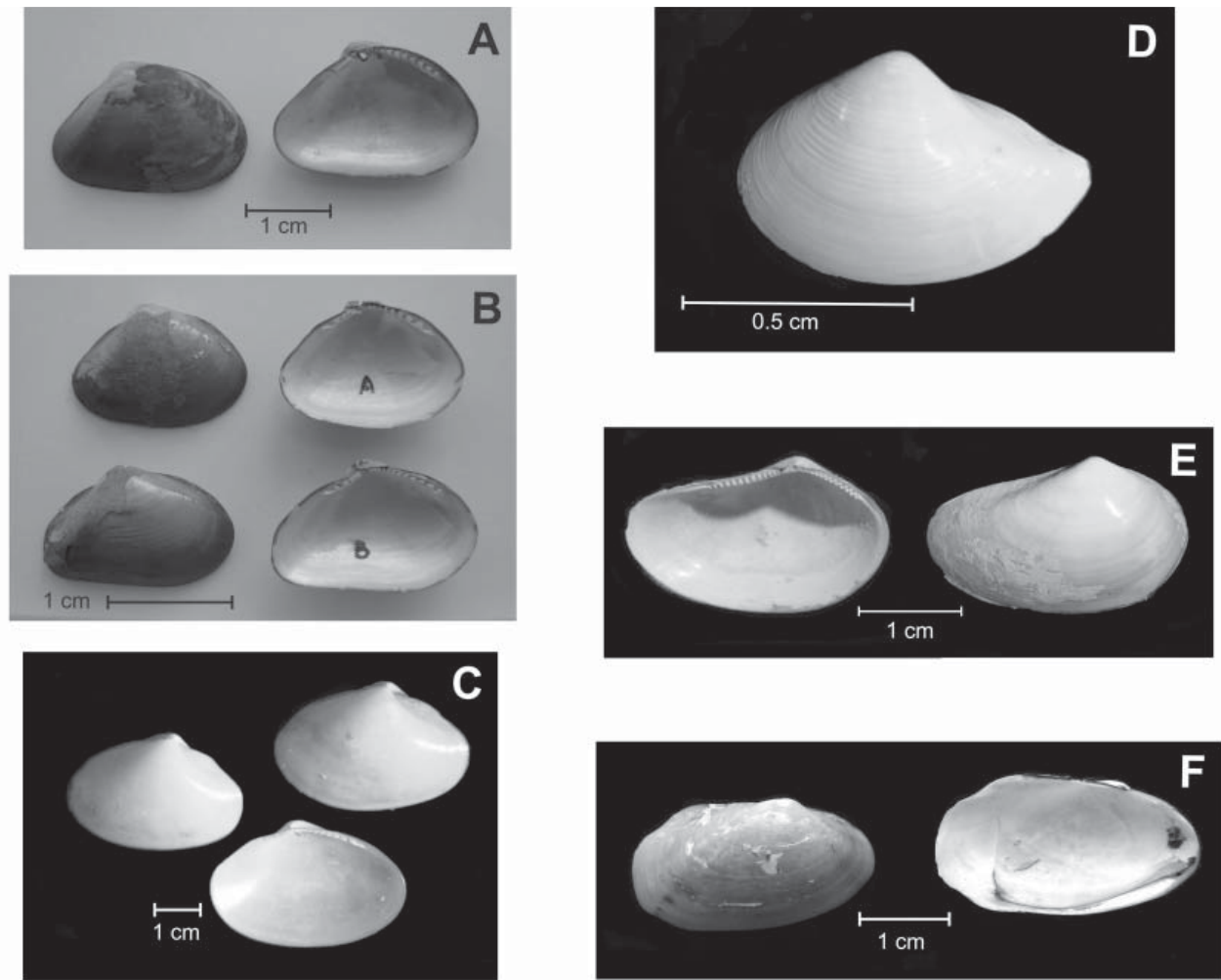
***Ennucula tenuis*** (Montagu, 1808). Figure 2, C  
Material examined. TALUD IV, St. 25 (24° 52' N, 108° 58' W), 26/Aug/2000, 52 orgs., 778-800 m, mud, BS (EMU-7109); TALUD VI, St. 20 (24° 14' N, 108° 35' W), 15/Mar/2001, 1 org., 1250-1440 m, mud, K (EMU-7110).  
Comments. Known as a circumboreal species; in the East Pacific from Nunivak Island, Alaska, to San Diego, California (Bernard, 1976, 1983). Previous southernmost records are from San Diego (Scott, 1998) and Isla Cedros, Baja California, Mexico (Hertlein and Strong, 1940). Type locality: Dumbar, England. According to Dall (1889), this species occurs between 315 and 810 m. It has been reported by Scott (1998) from 10 to 927 m. Present records increased known depth to 1250 and 1440 m.

Superfamily Nuculanoidea  
Family Nuculanidae

***Nuculana pontonia*** (Dall, 1890). Figure 2, D  
Material examined. TALUD VIII, St. 3 (24° 32' N, 109° 29' W), 16/Apr/2005, 2 orgs., 1100 m, mud, BS (EMU-7120).

Comments. Previously known from Santa Barbara, California, USA, to Panama and Peru; no records for the Gulf of California (Keen, 1971; Bernard, 1976, 1983; Scott, 1998). Type locality: Islas Galápagos (between 1141 and 1461 m) (Dall, 1889). Previously known from 1485 to 3050 m depth (Keen, 1971) and from 1150 m (Scott, 1998); present record slightly increases the lower bathymetric limit to 1100 m.

Family Neilonellidae



**Figure 2.** A. *Ennucula cardara* (Dall, 1916), EMU-6939. B. *Ennucula colombiana* Dall, 1908, EMU-7073. C. *Ennucula tenuis* (Montagu, 1808), EMU-7109. D. *Nuculana pontonia* (Dall, 1889), EMU-7120. E. *Neilonella ritteri* (Dall, 1916), EMU-7084. F. *Malletia alata* Bernard, 1989, EMU-7056.

*Neilonella ritteri* (Dall, 1916). Figure 2, E  
 Material examined. TALUD IV, St. 18 (24° 15' N, 108° 17' W), 25/Aug/2000, 1 org., 778 m, K (EMU-7113); TALUD IV, St. 25 (24° 52' N, 108° 58' W), 26/Aug/2000, 452 orgs., 778-800 m, mud, BS (EMU-7084 and EMU-7085); TALUD V, St. 25 (24° 51' N, 108° 57' W), 16/Dec/2000, 3 orgs. 800-860 m, mud, K (EMU-7112).

Comments. Previously known from La Jolla (type locality, at 527 m) (Dall, 1916) and Santa Barbara, California, USA. This is the first record for Mexico.

Family Malletiidae

*Malletia alata* Bernard, 1989. Figure 2, F

Material examined. TALUD IV, St. 25 (24° 52' N, 108°

58' W), 26/Aug/2000, 13 orgs., 778-800 m, mud, BS, (EMU-7059); TALUD V, St. 25 (24° 52' N, 108° 58' W), 16/Dec/2000, 1 org., 800-860 m, mud, K (EMU-7055); TALUD VI, St. 25 (24° 51' N, 108° 57' W), 16/Mar/2001, 4 orgs., 830-850 m, BS (EMU-7058); Talud VII, St. 32b (26° 03' N, 109° 55' W), 09/Jun/2001, 7 orgs., 850-880 m, BS (EMU-7056 and EMU-7057); TALUD VIII, St. 16 (25° 24' N, 110° 37' W), 18/Apr/2005, 12 orgs., 1030 m, BS (EMU-7053 and EMU-7054).

Comments. Previously known only from the type locality, San Diego, California (1200 m depth). This species seems to be remarkably frequent in the southern Gulf of California.

## Superfamily Mytiloidea

## Family: Mytilidae

***Dacrydium pacificum*** Dall, 1916. Figure 3, A

Material examined. TALUD IV, St. 25 (24° 52' N, 108° 58' W), 26/Aug/2000, 50 orgs., 778-800 m, mud, K (EMU-7069 and EMU-7060); TALUD V, St. 25 (24° 52' N, 108° 58' W), 16/Dec/2000, 70 orgs., 800-860 m, mud, K (EMU-7071-A); TALUD V, St. 26 (24° 56' N, 109° 12' W), 16/Dec/2000, 1 org., 1280-1310 m, mud, K (EMU-7071-B). TALUD VII, St. 26 (24° 56' N, 109° 12' W), 08/Jun/2001, 1 org., 1160-1220 m, K, mud (EMU-7072).

Comments. Previously known from the Sea of Alaska, between depths of 502 and 1310 m; also at 55° N, in depth of 2564 m (Bernard, 1983). Type locality: Bering Sea (2522 m depth) (Dall, 1916). This is the first record for Mexico.

## Superfamily Limoidea

## Family Limidae

***Limatula saturna*** Bernard, 1978. Figure 3, B

Material examined. TALUD VIII, St. 11 (24° 54' N, 110° 25' W), 17/Apr/2005, 1 org., 920 m, BS, mud-sand (EMU-7088); TALUD VIII, St. 20 (25° 55' N, 110° 43' W), 19/Apr/2005, 6 orgs., 1150 m, BS, mud (EMU-7087).

Comments. Bernard (1983) reported this species between 45 and 49° N in the East Pacific, but it has recently been recorded from Kodiak Island (56.5° N), Alaska, USA, to Cabo San Lucas (22.9° N), Baja California Sur, Mexico (Scott, 1998). Type locality: no data currently available. Present records extend the distribution to Isla de Carmen, Baja California Sur, within the Gulf of California, Mexico. Previously known from 30 to 675 m depth (Scott, 1998), the bathymetric range of this species is increased to 1150 m.

## Superfamily Lucinoidea

## Family Lucinidae

***Lucinoma heroica*** (Dall, 1901). Figure 3, C

Material examined. TALUD IV, St. 18 (24° 15' N, 108° 17' W), 25/Aug/2000, 1 org., 908-944 m, K, mud (EMU-6931); TALUD IV, St. 25 (24° 52' N, 108° 58' W), 26/Aug/2000, 20 orgs., 778-800 m, mud, BS (EMU-6933); TALUD V, St. 3 (22° 00' N, 106° 28' W), 13/Dec/2000, 2 orgs., 730-732 m, mud, BS (EMU-6930); TALUD V, St. 25 (24° 52' N, 108° 58' W), 16/Dec/2000, 1 org., 800-860 m, mud, K (EMU-7068-A); TALUD V, St. 26 (24° 56' N, 109° 12' W), 16/Dec/2000, 1 org., 1280-1310 m, mud, K (EMU-7068-B); TALUD VI, St. 18 (24° 15' N, 108° 17' W), 15/Mar/2001, 2 orgs., 890-950 m, mud, K (EMU-7083); TALUD VI, St. 25 (24° 51' N, 108° 57' W), 16/Mar/2001, 37 orgs. (36 BS and 1 K), 830-850 m, mud-sand (EMU-7066); TALUD VII, St. 11 (23° 15' N, 106° 59' W), 06/Jun/2001, 6 orgs., 780-790 m, mud, BS (EMU-6934); TALUD VII, St. 25 (24° 52' N, 108° 57' W), 08/Jun/2001,

1 org., 780-850 m, mud, BS (EMU-7067); TALUD VII, St. 32b (26° 03' N, 109° 55' W), 09/Jun/2001, 2 orgs. (1 BS and 1 K), 850-880 m, mud (EMU-6935 and EMU-7078); TALUD IX, St. 17 (25° 20' N, 110° 46' W), 13/Nov/2005, 8 orgs., 836 m, BS (EMU-6939).

Comments. Previously known from the type locality (Santa Rosalia, B.C.S) at 1829 m (Dall, 1901); Gulf of California, 1829 m (Keen, 1971) and 1838 m (Scott, 1998); also in the Gulf of California from 931-1344 m (samples in the mollusk collections at SCRIPPS). Recently reported from Peru (Skoglund, 2001).

## Superfamily Thracioidea

## Family Periplomatidae

***Periploma carpenteri*** Dall, 1896. Figure 3, D

Material examined. TALUD IV, St. 25 (24° 52' N, 108° 58' W), 26/Aug/2000, 1 org., 778-800 m, BS, mud (EMU-7114); TALUD VI, St. 25 (24° 52' N, 108° 58' W), 16/Mar/2001, 1 org., 830-850 m, K, mud (EMU-7115); TALUD VIII, St. 16 (25° 24' N, 110° 37' W), 18/Apr/2005, 73 orgs., 1030 m, BS (EMU-6940 and EMU-7041); TALUD IX, St. 16 (25° 24' N, 110° 37' W), 13/Nov/2005, 6 orgs., 1009 m, BS (EMU-7042).

Comments. Previously known from the Gulf of Fonseca, El Salvador, to the type locality in the Gulf of Panama (378 m depth) (Dall, 1896; Hertlein and Strong, 1946); one record for the Bay of San Carlos, Sonora, Mexico (Poorman and Poorman, 1988). Our records confirm the presence of this species in the Gulf of California (southern part) and extend the known bathymetric range to 1030 m (with intermediate depth records at 778-800 m and 830-850 m).

## Superfamily Poromyoidea

## Family Poromyidae

***Dermatomya mactroides*** (Dall, 1889). Figure 3, E

Material examined. Talud IX, St.10 (24° 55' N, 110° 20' W), 12/Nov/2005, 1 org., 1097 m, BS (EMU-7100).

Comments. Previously known from 637-915 m depth (Keen 1971).

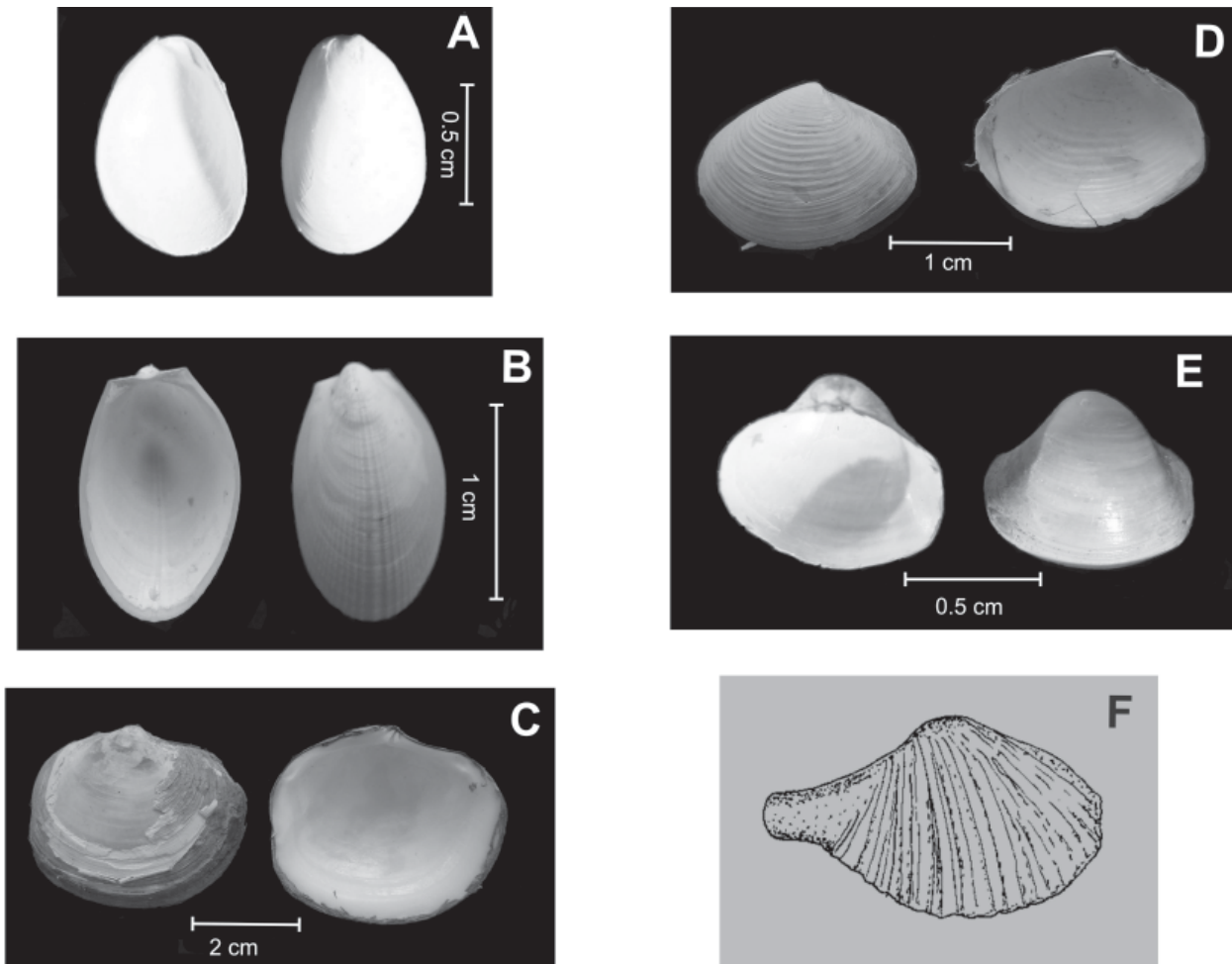
## Family Cuspidariidae

***Cardiomya planetica*** (Dall, 1908). Figure 3, F

Material examined. TALUD VIII, St. 11 (24° 54' N, 110° 25' W), 17/Abr/2005, 9 orgs. (dañados), 920 m, BS, mud-sand (EMU-7124).

Comments. Reported from 28° to 60° N in the East Pacific by Bernard (1974); Isla Cedros, Baja California, Mexico (Keen, 1971). Recently reported from south of the Gulf of Panama to Islas Galápagos, Japan (Coan et al., 2000), and in Peru (Paredes and Cardoso, 2003) where one specimen was collected at 852 m on muddy bottom. This is the first record for the Gulf of California. Type locality: North America.

## Superfamily Verticordioidea



**Figure 3.** A. *Dacrydium pacificum* Dall, 1916, EMU-7069. B. *Limatula saturna* Bernard, 1978, EMU-7087. C. *Lucinoma heroica* (Dall, 1901), EMU, 6930. D. *Periploma carpenteri* Dall, 1895, EMU-6940. E. *Poromya mactroides* Dall, 1889, EMU-7100. F. *Cardiomya planetica* (Dall, 1908), según Keen (1971).

Family Verticordiidae

***Lyonsella quaylei*** Bernard, 1969. Figure 4, A  
Material examined. Talud IV, St. 25 (24° 52' N, 108° 58' W), 26/Aug/2000, 50 orgs., 778-800 m, BS, mud (EMU-7111).

Comments. Previously known from Vancouver Island, British Columbia, Canada, to Santa Catalina Island (type locality), California, USA (Bernard, 1976).

Class Gastropoda  
Superfamily Trochoidea  
Family Trochidae

***Bathybembix bairdii*** (Dall, 1889). Figure 4, B  
Material examined. TALUD IV, St. 25 (24° 53' N, 108° 59' W), 26/Aug/2000, 7 orgs., 778-800 m, mud, BS (EMU-6017); TALUD IV, St. 33 (25° 46' N, 109° 48' W), 27/

Aug/2000, 3 orgs., 1060-1090 m, mud, BS (EMU-6018); TALUD V, St. 11 (23° 14' N, 107° 00' W), 14/Dec/2000, 5 orgs., 850-860 m, BS (EMU-6019); TALUD V, St. 14 (23° 16' N, 107° 41' W), 14/Dec/2000, 1 org., 2080-2140 m, mud, BS (EMU-6020); TALUD V, St. 18 (24° 15' N, 108° 17' W), 15/Dec/2000, 3 orgs., 940-990 m, mud, BS (EMU-6021); TALUD VI, St. 18 (24° 15' N, 108° 16' W), 15/Mar/2001, 2 orgs., 890-950 m, mud, BS (EMU-6022); TALUD VI, St. 25 (24° 51' N, 108° 58' W), 16/Mar/2001, 1 org., 830-850 m, mud-sand, BS (EMU-6023); TALUD VI, St. 34 (24° 44' N, 109° 54' W), 17/Mar/2001, 1 org., 1100-1240 m, mud, BS (EMU-6024); TALUD VII, St. 32b (24° 44' N, 109° 54' W), 09/Jun/2001, 3 orgs., 850-880 m, mud, BS (EMU-6025); TALUD VIII, St. 16 (25° 24' N, 110° 37' W), 18/Apr/2005, 5 orgs., 1030 m, BS (EMU-7043); TALUD VIII, St. 20 (25° 55' N, 110° 43'

W), 19/Apr/2005, 1 org., 1150 m, mud, BS (EMU-7082).  
 Comments. Keen (1971) and McLean (1996) report this species from British Columbia to the Gulf of Tehuantepec, with no records within the Gulf of California. Also known from off El Salvador (Hendrickx and López, unpub. data). Type locality: San Clemente Island, California, USA (745 m depth) (Dall, 1889). Previously known in depths of 457 to 915 m (Keen, 1971) and of 350-1400 m (McLean, 1996). Material from the TALUD cruises is from 778-800 m to 2080-2140 m, thus significantly increasing the known bathymetric range for this species.

***Solariella nuda*** Dall, 1896. Figure 4, C

Material examined. TALUD IV, St. 25 (24° 52' N, 108° 58' W), 26/Aug/2000, > 1000 orgs., 778-800 m, mud, BS (EMU-7051, EMU-7052, EMU-7095 and EMU-7096); TALUD VI, St. 11 (23° 15' N, 106° 59' W), 14/Mar/2001, 1 org., 825-855 m, mud, BS (EMU-7126); TALUD VII, St. 32b (24° 44' N, 109° 54' W), 09/Jun/2001, 3 orgs., 850-880 m, mud, BS (EMU-7091); TALUD VIII, St. 3 (24° 31' N, 109° 29' W), 16/Apr/2005, 1 org., 1100 m, mud-sand, BS (EMU-7127).

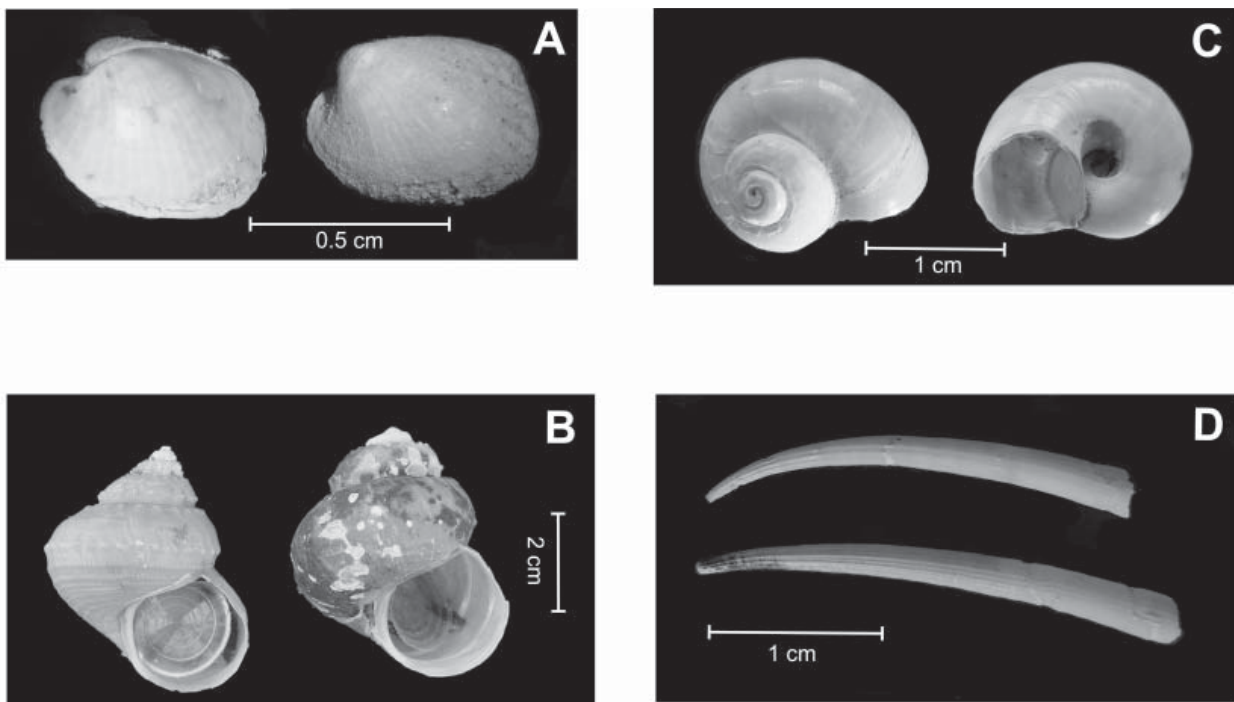
Comments. From British Columbia, Canada, to the type locality: Islas Revillagigedo, Mexico (536-819 m depth) (Dall, 1896; Parker, 1964; Keen, 1971; McLean, 1996), with no previous records from the Gulf of California.

Class Scaphopoda

Family Dentaliidae

***Dentalium agassizi*** Pilsbry and Sharp, 1897. Figure 4, D  
 Material examined. TALUD V, St. 12 (23° 18' N, 107° 27' W), 14/Dec/2000, 2 orgs., 1160-1170 m, sand-mud, K (EMU-7103); TALUD V, St. 14 (23° 16' N, 107° 41' W), 14/Dec/2000, 1 org., 2080-2140 m, mud, K (EMU-7121-A); TALUD V, St. 26 (24° 56' N, 109° 12' W), 16/Dec/2000, 2 orgs., 1280-1310 m, mud, K (EMU-7121-B); TALUD VI, St. 5 (22° 01' N, 106° 40' W), 13/Mar/2001, 3 orgs., 1470-1530 m, mud-sand, K (EMU-7122); TALUD VI, St. 34 (25° 44' N, 109° 54' W), 17/Mar/2001, 20 orgs. (17 BS and 3 K), 1100-1240 m, mud (EMU-7089 and EMU-7090); TALUD VII, St. 4 (22° 05' N, 106° 35' W), 05/Jun/2001, 1 org., 1200-1230 m, mud-sand, K (EMU-7129); TALUD VII, St. 12 (23° 18' N, 107° 26' W), 06/Jun/2001, 3 orgs., 1040-1120 m, mud, K (EMU-7102); TALUD VII, St. 33b (26° 06' N, 110° 07' W), 09/Jun/2001, 5 orgs., 1260-1300 m, mud, K (EMU-7108). TALUD IX, St. 21b (26° 03' N, 110° 36' W), 14/Nov/2005, 3 orgs., 1359 m, BS (EMU-7123).

Comments. Previously known from Santa Barbara Island, California, USA, to Panama and the Galápagos (Parker, 1964; Keen, 1971), with no records for the Gulf of California.



**Figure 4.** A. *Lyonsella quaylei* Bernard, 1969, EMU-7111. B. *Bathybembix bairdii* (Dall, 1889), EMU-7043. C. *Solariella nuda* Dall, 1895, EMU-7051. D. *Dentalium agassizi* Pilsbry and Sharp, 1897, EMU-7090.

## Discussion

A total of 56 species of deep-water mollusks were collected during the TALUD IV-IX cruises in depths > 500 m (Zamorano and Hendrickx, 2007). Review of literature and of the catalogue of mollusks at the Scripps Institution of Oceanography, La Jolla, California, indicates that, including the material collected during this study, 388 species (one Aplacophora, two Monoplacophora, 16 Polyplacophora, 17 Scaphopoda, 29 Cephalopoda, 137 Bivalvia, and 185 Gastropoda) have so far been reported in water deeper than 200 m in the Mexican Pacific. These 388 species correspond to 1085 records, all included in a searchable data base (Zamorano and Hendrickx, 2007). Many species are known from one record only, which makes very difficult to propose a distribution pattern for these organisms.

Although rather reduced in number of species, the collection obtained during this study is - to our knowledge - the first deep-water collection available in a Mexican institution for the Pacific coast of Mexico. In addition, eight species that appear to be new to science were collected during this project and await description. During the second phase of the TALUD project (2007), more species were collected in the central Gulf of California and are currently being studied. The area off the SW coast of Mexico (Banderas Bay to the Gulf of Tehuantepec) is the lesser known when it comes to deep-water fauna and a research cruise to this area is currently being organized. The collection of deep-water mollusks collected in the Mexican Pacific and kept in the collection holdings at the Los Angeles County Museum of Natural History will soon be checked with a view to complete our data base and to review the distribution patterns of this interesting fauna off the western coast of Mexico.

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