

The Northwest American Psammobiidae

BY

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(4 Plates; 8 Text figures)

INTRODUCTION

THIS IS THE THIRD ARTICLE based on research conducted while I was a graduate student at Stanford University, the Tellinidae and Semelidae having been discussed in earlier papers (COAN, 1971, 1973). The main purpose of the present account is to put on record data on the systematics of the northwest American Psammobiidae. The present survey also permitted the review of data on the geographic and geologic distributions and habitats of members of this family. These aspects are summarized at the end of the article.

The major previous accounts on this family in northwestern America were those of DALL (1898), GRANT & GALE (1931), and BURCH (1945a-1945b).

The detailed "Introduction," "Acknowledgments," and "Methods" sections of my earlier paper need not be repeated here, although special thanks are extended to Drs. Myra Keen, Warren Addicott, and Kenneth Boss who reviewed the present manuscript, and to Mr. Barry Roth who prepared the illustrations. The following abridged comments on format and abbreviations will permit the present paper to stand alone.

(1) The applicable synonymous species-level names are listed in chronological order, with the name to be used cited first and "first revisions," if any, indicated. Under each name are listed accounts published using those names and also accounts of type material pertinent to each. These works are listed in chronological order with major changes in generic allocation indicated in brackets above the account in which they were first employed. It is to be assumed that nearly all subsequent accounts used the same name combination. Other nomenclatural comments are included in brackets after the account to which they refer.

The works listed do not represent a complete catalogue of literature but are the major accounts concerning living

and fossil northwest American material, particularly those containing previously unpublished information or taxonomic innovations. Not included are books written largely for amateurs or general works on marine biology.

Numbers following dates (as 1851: 27) are page numbers.

(2) The type material pertinent to the valid name and its synonyms is discussed. Measurements given are of the greatest lengths of type specimens. When type material is no longer extant the dimensions from original accounts or of original illustrations are given. (In most early accounts the illustrations were usually printed at natural size, though this was rarely stated.) Photographs of type specimens or of original illustrations are included.

(3) Type localities of the various nominal species are given. The original collector is also cited, and sometimes major collections are mentioned when this clarifies the history or location of the specimens.

(4) A nomenclatural commentary may be given to explain nomenclatural complications not made clear in the synonymy or in the discussion of type material.

(5) Description. A short diagnosis of each species is given that emphasizes distinguishing characters. Most features of internal shell morphology are not discussed in detail but are illustrated with line drawings.

(6) Geographic Distribution and Ecology. The end-points of the distribution are given, together with reference to the sources of the records. The intermediate distributional data from between these end-points are summarized.

The sources of habitat information on each species other than from museum labels are indicated. I mention also the approximate number of lots examined.

(7) Geologic Distribution and Biogeography. The final section under each species is a summary of paleontologic

records from published accounts. I have not listed all Pleistocene records, but generally have given only the end-points of their distributions and indicated the published accounts that form their bases. This is followed by notes on earlier records, on what seem to be related west American fossil species from earlier than the Pleistocene and other related species in other provinces.

References are included under "Literature Cited" for all genera, species, and papers mentioned.

Conventions, symbols, and abbreviations used are as follows:

- AMNH - American Museum of Natural History, New York, New York
 ANSP - Academy of Natural Sciences, Philadelphia, Pennsylvania
 BM(NH) - British Museum (Natural History), London, England
 CAS - California Academy of Sciences, San Francisco, California
 cm - centimeter(s)
ex (Conrad) MS - from the manuscript name of (Conrad)
 ICZN - International Commission on Zoological Nomenclature, or International Code of Zoological Nomenclature (STOLL *et al.*, 1964)
 "in synonymy"
 - a name proposed in the synonymy of another and therefore not available
 LACM - Los Angeles County Museum of Natural History, Los Angeles, California
 m - meter(s)
 MCZ - Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts
 mm - millimeter(s)
nomen nudum
 - an unavailable name lacking any description, definition, or other indication
 not, not of - as in the case of homonyms or misidentifications
 pair - the two valves of one specimen
 SBMNH - Santa Barbara Museum of Natural History, Santa Barbara, California
 SDNHM - San Diego Natural History Museum, San Diego, California
 SU - Stanford University, Stanford, California
 UCB - University of California at Berkeley, California
 UCD - University of California at Davis, California
 USNM - United States National Museum, Smithsonian Institution, Washington, District of Columbia

SYSTEMATIC ACCOUNT

PSAMMOBIIDAE Fleming, 1828

[Name retained: ICZN (1970), Opinion 910]

KEEN (1969) recognized both the family Psammobiidae and the family Solecurtidae. Here I adopt a more conservative approach, regarding the latter as a subfamily. A comprehensive analysis of the familial and generic classification of these groups should be undertaken.

There are a number of accounts on the anatomy and functional morphology of members of this family. These studies have been conducted for the most part on species not from west America, and it is beyond the scope of the present paper to review them in detail.

Among the Psammobiinae, European species of the genus *Gari* are discussed by BLOOMER (1911), YONGE (1949), PURCHON (1960), and ANSELL (1967); these authors review still earlier papers. The genus *Asaphis* has been described by WHITE (1942) and PURCHON (1960).

In the Sanguinolariinae, a single species of *Sanguinolaria* is discussed by DINAMANI (1967).

The Solecurtinae seems to be the best known of subfamilies of the Psammobiidae. Relevant papers, containing references to still other accounts, are GHOSH (1920), WHITE (1942), YONGE (1949, 1952), PURCHON (1960), and JEGLA & GREENBERG (1968).

Psammobiinae Fleming, 1828

Into the Psammobiinae are placed those members of the Psammobiidae that are elongate to ovate-elongate and are not conspicuously inequivalve. Many are sculptured, and the gape is small to absent. Pallial sinuses tend to be smaller than those in the Sanguinolariinae.

Gari Schumacher, 1817

[Type species: *Gari vulgaris* Schumacher, 1817, by ICZN (1970), Opinion 910, = *Solen amethystus* Wood, 1815]

The genus *Gari* contains most species of living Psammobiinae. Their shells are elongate-ovate to quadrate and are smooth to well sculptured. The posterior end is often wider than the anterior and is more or less truncate.

(*Gobraeus*) Brown, 1844, *ex* Leach MS

[Published in synonymy; name retained under ICZN Article 11(b). Type species: *Solen vespertinus* Gmelin, 1791, by M, = *Tellina depressa* Pennant, 1777]

The subgenus *Gobraeus* is characterized by species whose shells are nearly smooth or have concentric sculpture of growth lines only (the posterior slope may also have some fine superficial radial striae). The pallial sinus is partly confluent with the pallial line. Many species attain a large size.

HERTLEIN & GRANT (1972) regarded *Gobraeus* as a full genus. I remain conservative in this matter until a more thorough review of generic units in the *Gari* complex is undertaken. It is unclear, for instance, how closely the type species of *Gobraeus* is related to west American species.

Gari (Gobraeus) californica (Conrad, 1849)

(Figures 1 and 20)

Psammobia californica Conrad

[CONRAD, 1837: plt. 19, fig. 3 (figure only, not validated)]

CONRAD, 1849: 121 [based on the above figure]

CARPENTER, 1864c: 633 [1872: 119]

[*Psammobia (Gobraeus)*]

DALL, 1898: 58

I. OLDROYD, 1924: 57, 215; plt. 46, fig. 3

I. OLDROYD, 1925: 185; plt. 43, fig. 5

[*Gari (Gobraeus)*]

GRANT & GALE, 1931: 382

BURCH, 1945a: 21-22, 26 (text fig.); 1945b: 17

"*Sanguinolaria rubro-radiata* Conrad," Carpenter, *ex* Nuttall MS [*nomen nudum*]

CARPENTER, 1857a: 212

CARPENTER, 1857b: 195, 301

CARPENTER, 1860: 1

Psammobia rubroradiata Carpenter, *ex* Nuttall MS [*rubrolineata*, misspelling of authors]

CARPENTER, 1864c: 540, 563, 602, 638 [1872: 26, 49, 88, 124]

CARPENTER, 1865: 55

DALL, 1898: 61 [as a synonym of *P. californica*]

PALMER, 1958: 17, 20, 112-113, 341; plt. 16, figs. 3-5, 7

Psammobia lilacina Wilkins, in Palmer, *ex* Carpenter MS [in synonymy]

PALMER, 1958: 113

Type Material:

Psammobia californica & *P. rubroradiata* - BM(NH) Nuttall collection 1861.5.20.88, pair, 41.2 mm. This is the holotype of Conrad's species and a lectotype (PALMER, 1958) of Carpenter's. Evidently, neither Carpenter nor Palmer were aware that this specimen was also Conrad's type specimen. Figure 1.

Type Locality:

Psammobia californica & *P. rubroradiata* - None given by CONRAD (1837, 1849), but presumably from California; T. Nuttall.

Nomenclatural Commentary:

None necessary.

Description:

Large (to 115 mm); quadrate; heavy; anterior end rounded; longer, broadly truncate posteriorly; beaks relatively prominent, dorsal margins sloping from them more abruptly than in other species; sculpture of irregular concentric undulations; periostracum tan, lost relatively early and present only as ventral shreds in adult; externally rayed with reddish lines. Internal details shown in Figure 20.

Geographic Distribution and Ecology:

Shelikof Strait, Alaska (USNM 207429); southwestern end of Prince William Sound, Alaska (CAS 42150, 48868; Talmadge and Baxter, *in litt.*), to Neah Bay, Washington (USNM 15636), with many intermediate records; Mendocino County, California (UCB 3094), to Bahía Magdalena, Baja California Sur (ANSP 151756; CAS 20300; LACM material), with many intermediate records. Recent collections have not reconfirmed its presence west of Prince William Sound (Baxter, *in litt.*). Records from the Pacific coasts of Oregon and Washington are lacking. This species is found from the intertidal area to 168 m, among rubble; also buried to a depth of 20 cm in finer sediments near bay entrances (BURCH, 1945a; Fitch, 1953; Talmadge, *in litt.*) and offshore (SMITH & GORDON, 1948).

Material seen:

164 lots.

Explanation of Figures 1 to 4

Figure 1: *Gari (Gobraeus) californica*. Holotype of *Psammobia californica* and lectotype of *Psammobia rubroradiata*, BM(NH), Nuttall collection 1861.5.20.88; 41.2 mm

Figure 2: *Gari (Gobraeus) edentula*. Holotype of *Siliquaria edentula*, MCZ (Palaeontology) 15035; 66 mm

Figure 3: Holotype of *Tellina fucata*. BM(NH) 79.2.26.192; 41 mm

Figure 4: *Gari (Gobraeus) edentula*, juvenile, USNM 152745, San Pedro, California, 18 m; 28.4 mm



Figure 1

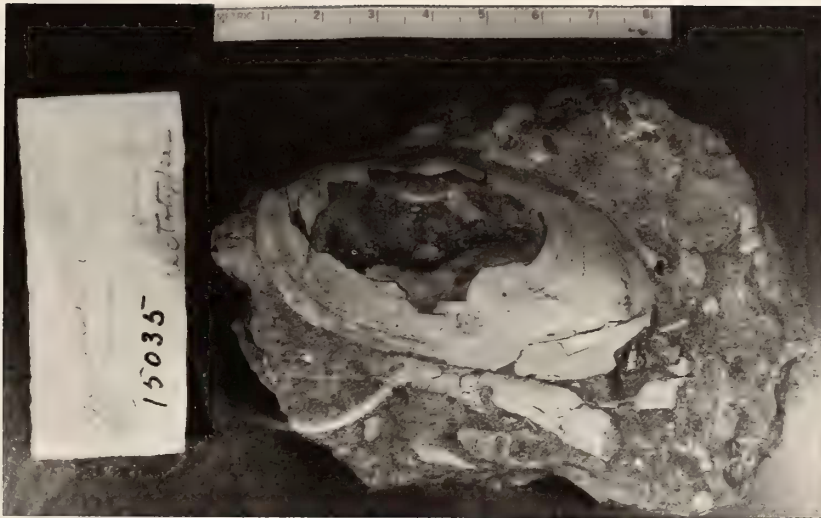


Figure 2

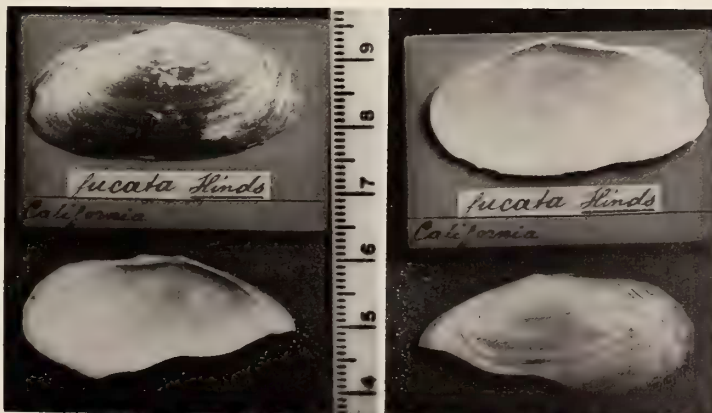


Figure 3

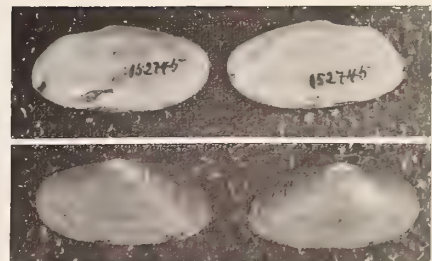


Figure 4

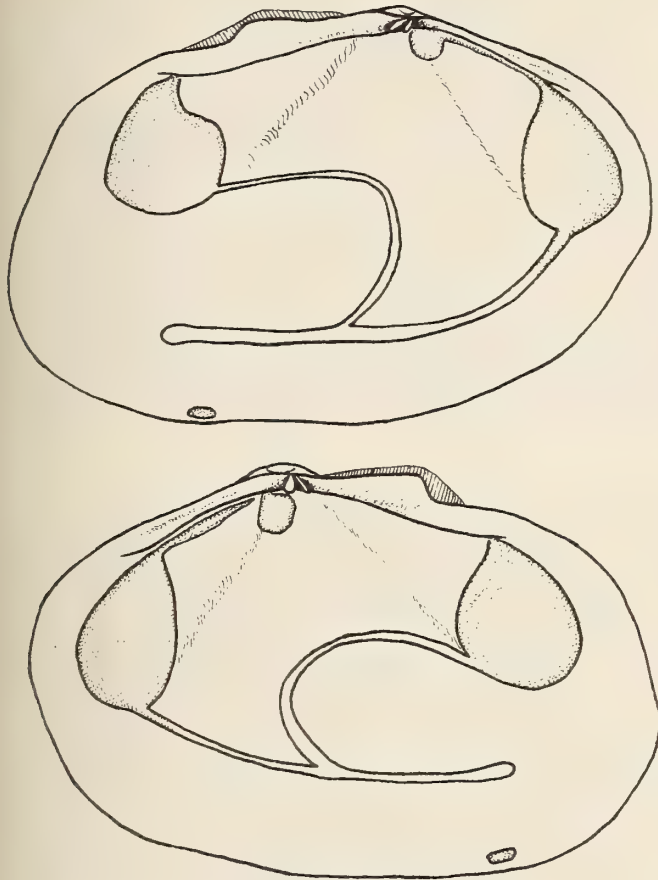


Figure 20

Gari (Gobraeus) californica

Internal view of valves
MCZ 67244, San Diego, California; 107 mm

Geologic Distribution and Biogeography:

Gari californica has been reported in the late Pleistocene from San Nicholas Island (VEDDER & NORRIS, 1963) to San Diego (EMERSON & ADDICOTT, 1953; VALENTINE, 1961; BISHOP & BISHOP, 1972), California. It is also known in the early Pleistocene from the Santa Monica area (HOOTS, 1931; RODDA, 1957) to the San Pedro area (T. OLDROYD, 1925; BURCH, 1947; CLARK, *in* NATLAND, 1957; VALENTINE & MEADE, 1961), California. There are two records in the Pliocene of southern California, but there do not seem to be related fossil species in the eastern Pacific.

There is a homologous species in Japan, *Gari (Gobraeus) kazusensis* (Yokoyama, 1922), which is said to lack radial rays and to be more truncate posteriorly (KIRA, 1962). However, material in the USNM does not convincingly confirm these differences; additional material should be studied to provide a more detailed comparison. There is a wide geographic separation between the two species.

Other related members of this subgenus occur in the Panamic province (KEEN, 1971), but none seems as close as *Gari kazusensis*.

Gari (Gobraeus) edentula (Gabb, 1869)

(Figures 2 to 5 and 21)

Siliquaria edentula Gabb

GABB, 1869: 53, 89; pl. 15, fig. 11 [generic placement questioned by Gabb]

[*Psammobia (Gobraeus)*]

DALL, 1898: 58, 61

[*Psammobia (Psammobia)*]

ARNOLD, 1903: 168

[*Psammobia (Gobraeus)*]

DALL, 1925: 23, 37; pl. 19, fig. 1

I. OLDROYD, 1925: 185; pl. 57, fig. 1

[*Gari*]

STEWART, 1930: 7, 281 - 282; pl. 13, fig. 3

[*Gari (Gobraeus)*]

GRANT & GALE, 1931: 382, 924; pl. 21, fig. 5

BURCH, 1945a: 22; 1945b: 18

[*Gobraeus*]

HERTLEIN & GRANT, 1972: 305; pl. 48, figs. 13, 15

? *Tellina fucata* Hinds

HINDS, 1845: 67; pl. 21, fig. 4

CARPENTER, 1857b: 207

[*Psammobia (Gobraeus)*]

DALL, 1898: 58, 62

[*Gari*]

OLSSON, 1961: 357

PALMER, 1963: 313

KEEN, 1966b: 268; pl. 46, fig. 4

KEEN, 1971: 240 - 241; fig. 602

Type Material:

Siliquaria edentula - MCZ (Paleontology) 15035, holotype, left valve, 66 mm. Figure 2.

Tellina fucata - BM(NH) 79.2.26.192, holotype, pair, 41 mm. Figure 3.

Type Localities:

Siliquaria edentula – San Fernando, Los Angeles County, California; Pliocene.

Tellina fucata – Bahía Magdalena, Baja California Sur; R. B. Hinds.

Nomenclatural Commentary:

Hind's *Tellina fucata* may be an earlier name for the offshore southern Californian species *Gari edentula*. The type specimen of Hind's species is very similar to young specimens from California (Figure 4). However, this species is not known as an adult from Bahía Magdalena. Indeed, the species is not known from south of Catalina Island, southern California, but it is also possible that Hind's specimen was actually from farther north. Thus, it seems that a name change may be in order when more data are available.

Description:

Large (to 140 mm); ovate-elongate; relatively thin and flat for size; rounded, slightly pointed anteriorly; broadly truncate posteriorly; beaks proportionately small; dorsal margin relatively straight; sculpture of weak concentric lines; periostracum olive-tan; surface rayed with dark lines (Figure 5). Internal details shown in Figure 21.

Geographic Distribution and Ecology:

Vicinity of Santa Barbara (FITCH, 1953 & *in litt.*) to San Pedro (USNM 568679 and other lots in various collections) and Catalina Island (USNM 107774), California; ?San Diego, California (FITCH, 1953; I have seen no specimens); possibly to Bahía Magdalena, Baja California Sur (type locality of *Tellina fucata*). This species has been taken from 5 to 137 m, buried in about 15 cm in fine sand (FITCH, 1953).

Material seen:

31 lots

Geologic Distribution and Biogeography:

Gari edentula is known from the late Pleistocene from Point Dume (ADDICOTT, 1964) to Newport Bay (KANA-

KOFF & EMERSON, 1959), California. In the early Pleistocene it has been recorded from the northwestern end of the Los Angeles basin (RODDA, 1957) and San Pedro (DE LONG, 1941; VALENTINE & MEADE, 1961). It has been reported in Californian formations transitional between the Pleistocene and Pliocene and from the Pliocene of southern California and northwestern Baja California. There is one uncertain Miocene record.

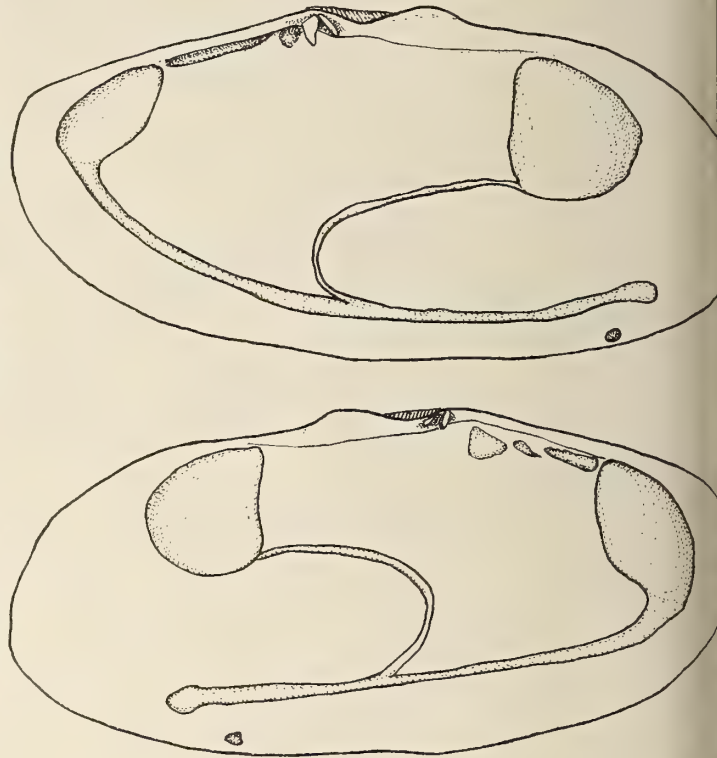


Figure 21

Gari (Gobraeus) edentula

Internal view of valves

MCZ 210459, San Pedro, California; 123 mm

Explanation of Figures 5 to 9

Figure 5: *Gari (Gobraeus) edentula*. CAS 13320, San Pedro, California; 125 mm

Figure 6: *Gari (Gobraeus) regularis*. Holotype of *Psammobia* (?*Amphichaena*) *regularis*, USNM 19407; 26.7 mm

Figure 7: *Gari (Gobraeus) regularis*. USNM 207676, U. S. Fish Commission station 2932, Islas Los Coronados, Baja California Norte, 37 m; 24 mm

Figure 8: *Heterodonax pacificus*. Lectotype (herein) of *Psammobia pacifica*, BM(NH) Nuttall collection 1861.5.20.93; 24.5 mm

Figure 9: *Heterodonax bimaculatus* (Linnaeus, 1758). Potential lectotype (uppermost specimen) and paralectotypes (below) of *Tellina bimaculata*, Linnean Society of London; potential lectotype measures 13.5 mm

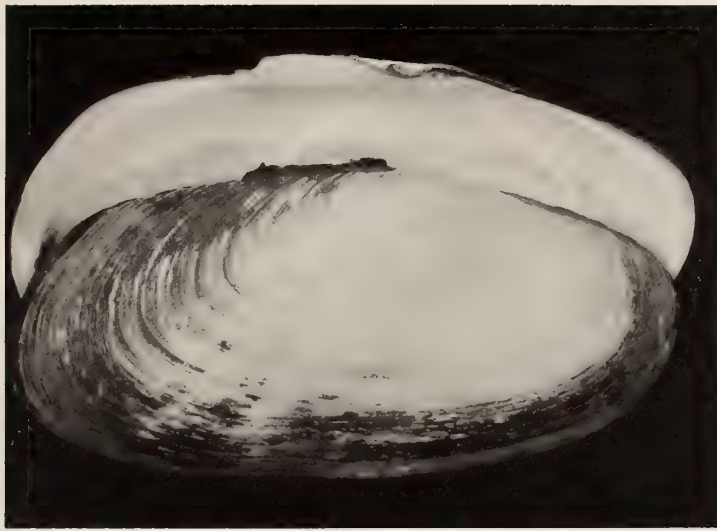


Figure 5

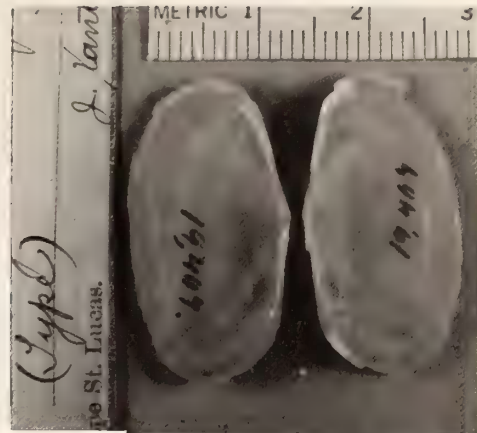


Figure 6

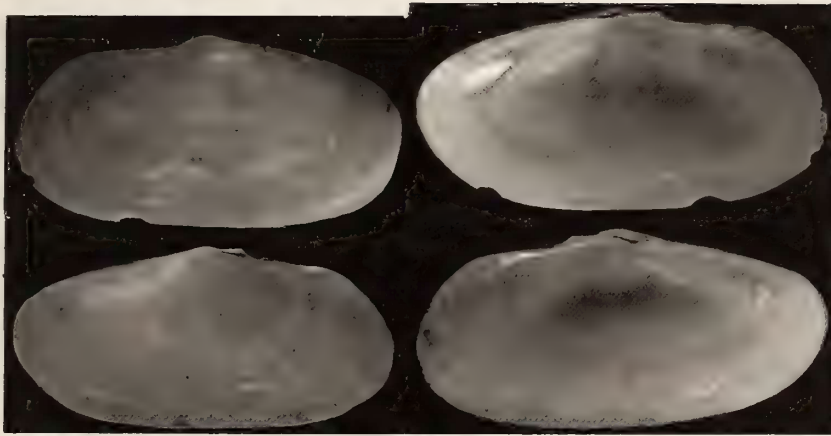


Figure 7

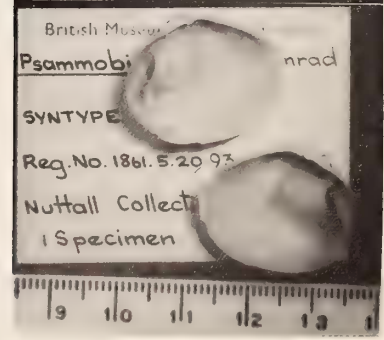
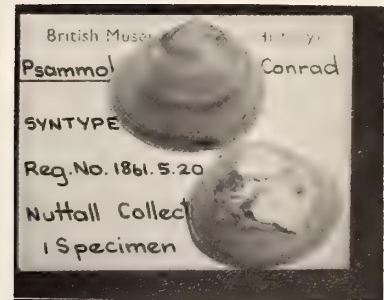


Figure 8

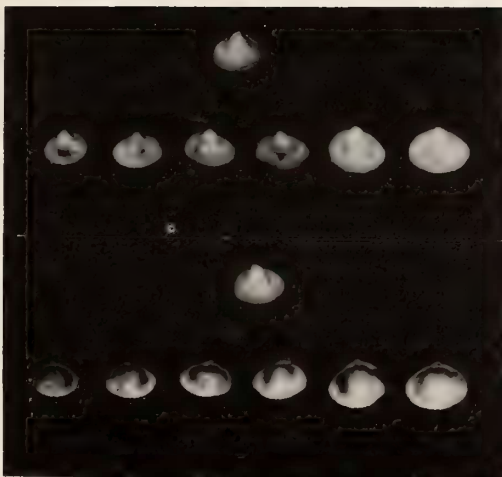


Figure 9

This species might be compared with *Gari martini* (Dickerson, 1917) from the Oligocene of southwestern Washington. I know of no related Asian species.

Gari (Gobraeus) regularis (Carpenter, 1864)

(Figures 6, 7, and 22)

Psammobia (?*Amphichaena*) *regularis* Carpenter, but not the *P. regularis* of some authors

CARPENTER, 1864b: 312 [1872: 210]

CARPENTER, 1864c: 618 [1872: 104]

[*Psammobia* (*Gobraeus*)

DALL, 1898: 57

I. OLDROYD, 1925: 184

[*Gari* (*Gobraeus*)]

BURCH, 1945a: 21; 1945b: 17

PALMER, 1958: 27, 44, 48, 113 - 114, 340; pl. 15, figs. 1 - 6

OLSSON, 1961: 356 - 357

PALMER, 1963: 313

KEEN, 1971: 242 - 243; fig. 608

[not KEEN, 1958: 190 - 191; fig. 466]

Type Material:

USNM 19407, holotype, pair, 26.7 mm. Figure 6.

Type Locality:

Cabo San Lucas, Baja California Sur; J. Xantus.

Nomenclatural Commentary:

This species, perhaps characteristic of the outer coast of Baja California, has been confused with an unrelated species in the Gulf of California, the latter now tentatively referred to *Gari helenae* Olsson, 1961 (KEEN, 1971).

Description:

Small (to 27 mm); elongate-ovate; flattened; thin; equilateral to slightly longer either anteriorly or posteriorly; sharply rounded anteriorly; somewhat truncate posteriorly; dorsal margins weakly sloping; externally with low growth striae and an adherent green periostracum which is somewhat roughened posteriorly; posterior slope with a light band. Internal details shown in Figure 22.

This species differs from young *Gari edentula* in having a lighter, more shiny periostracum which is less roughened posteriorly. The posterior slope is also less set off from the central slope.

Geographic Distribution and Ecology:

Off Islas Los Coronados, Baja California Norte (USNM 207676) (Figure 7), to Cabo San Lucas, Baja California Sur (type lot), with one other specimen from Isla Cedros, Baja California Norte (USNM 157944), tentatively referred to this species. The Islas Coronados speci-

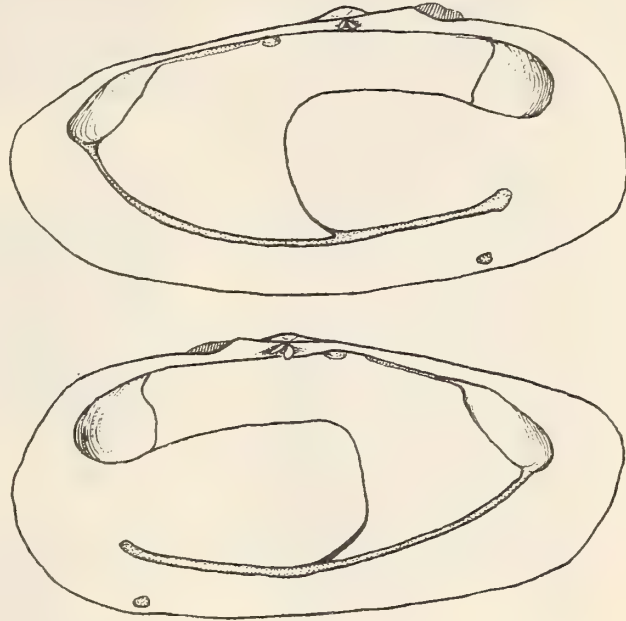


Figure 22

Gari (Gobraeus) regularis

Internal view of valves

USNM 207676, Islas Las Coronados, Baja California Norte; 24 mm

men was taken in 37 m on a sand and shell bottom; the Isla Cedros specimen was taken in about 18 m.

Material seen:

2 lots.

Geologic Distribution and Biogeography:

This rare species is not known as a fossil.

Heterodonax Mörch, 1853

[Type species: *Tellina bimaculata* Linnaeus, 1758, by SD of KOBELT, 1881]

This unique genus, about which little is known, is apparently restricted to the coasts of temperate and tropical America (KEEN, 1969). Its shell is rounded-quadrate, smooth except for concentric growth striae. The hinge teeth are proportionately large for the size of the adult specimen.

As common as is living material in southern California and northern Mexico, no anatomical study of this

genus has been made. This should be a priority project for an interested student.

Heterodonax pacificus (Conrad, 1837)

(Figures 8 to 13 and 23)

Psammobia pacifica Conrad

CONRAD, 1837: 241; plt. 18, fig. 13

[*Sanguinolaria*]

CARPENTER, 1857a: 212

[*Psammobia*]

CARPENTER, 1857b: 195, 301, 351

[*Heterodonax*]

CARPENTER, 1864c: 526, 552, 592, 640 [1872: 12, 38, 78, 126]
[as a synonym of *H. bimaculatus*]

KEEN, 1966a: 171

KEEN, 1971: 242 - 243; fig. 609

Tellina bimaculata Linnaeus, of authors, not of Linnaeus

[not Linnaeus, 1758: 677]

[*Heterodonax*]

CARPENTER, 1864c: 526, 537, 541, 619, 626, 640, 665 [1872: 12, 23, 27, 78, 105, 126, 151]

DALL, 1900: 980

I. OLDROYD, 1925: 186

BURCH, 1945a: 22, 24 (text fig.); 1945b: 18

HERTLEIN & STRONG, 1950: 221 - 222

KEEN, 1958: 190 - 191; fig. 467

OLSSON, 1961: 354 - 355, 558; plt. 85, fig. 10

Tellina vicina C. B. Adams

ADAMS, 1852a: 509 - 510, 546 [ADAMS, 1852b: 285 - 286, 322]

CARPENTER, 1857b: 232, 279, 284, 302, 351, 363

[*Heterodonax*]

CARPENTER, 1864a: 367 [1872: 203]

CARPENTER, 1864c: 526, 552, 592, 640 [1872: 12, 38, 78, 126]
[as a synonym of *H. bimaculatus*]

TURNER, 1956: 98, 128; plt. 18, figs. 11, 12

Donax ovalinus Reeve, ex Deshayes MS [as *D. "ovalina"*]

REEVE, 1854: plt. 3, fig. 17

DESHAYES, 1855: 352

[*Heterodonax*]

HERTLEIN & STRONG, 1950: 221 [as a synonym of *H. bimaculatus*]

Tellina versicolor Carpenter, ex C. B. Adams MS, not of DEKAY [in synonymy]

[not DEKAY, 1843, ex COZZENS MS: 209; plt. 26, fig. 172]

CARPENTER, 1864a: 29 [1872: 203]

CARPENTER, 1864c: 552 [1872: 38]

Heterodonax bimaculatus purpureus Williamson

WILLIAMSON, 1892: 187

Heterodonax bimaculatus salmoneus Williamson

WILLIAMSON, 1892: 187

Type Material:

Psammobia pacifica - BM(NH) Nuttall collection 1861.5.20.93, lectotype herein, pair, 24.5 mm, possibly the specimen figured by CONRAD (1837); BM (NH) Nuttall collection 1861.5.20.92, paralectotype, pair. Figure 8.

Tellina bimaculata (not a synonym) - Linnean Society of London, potential lectotype, the unseparated pair, 13.5 mm; potential paralectotypes, 6 valves. It is to be hoped that what appear to be lateral teeth in the right valves of this lot are in reality especially heavy ligamental buttresses. Otherwise some serious nomenclatural problems would result! Figure 9.

Tellina vicina - MCZ 186365, lectotype (TURNER, 1956), pair, 20.9 mm; MCZ 186369, paralectotypes, 4 pairs. Figure 10.

Donax ovalinus - BM(NH) without registry number, lectotype herein, the larger of two pairs, about 30 mm; paralectotype, the other pair. Figure 11.

Heterodonax bimaculatus purpureus - LACM 1168, lectotype herein, pair, 27.5 mm; LACM 1176, paralectotypes, 8 pairs, 2 valves. Figure 12.

Explanation of Figures 10 to 15

Figure 10: *Heterodonax pacificus*. Lectotype of *Tellina vicina*, MCZ 186365; 20.9 mm

Figure 11: *Heterodonax pacificus*. Lectotype (herein) of *Donax ovalinus*, BM(NH) without registry number; about 30 mm

Figure 12: *Heterodonax pacificus*. Lectotype (herein) of *Heterodonax bimaculatus purpureus*, LACM 1168; 27.5 mm

Figure 13: *Heterodonax pacificus*. Lectotype (herein) of *Heterodonax bimaculatus salmoneus*, LACM 1169; 15.6 mm

Figure 14: *Nuttallia nuttallii*. Lectotype (herein) of *Sanguinolaria nuttallii*, BM(NH) Nuttall collection 1966.302; 56 mm

Figure 15: *Nuttallia nuttallii*. Original illustration of *Psammobia decora*; 71 mm (HINDS, 1842)

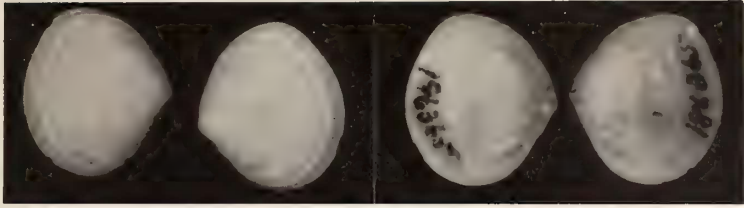


Figure 10

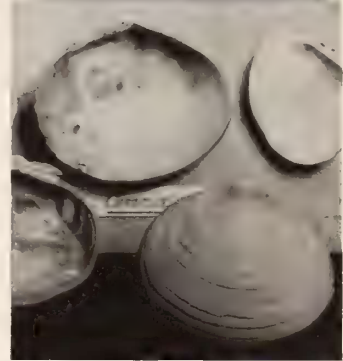


Figure 11

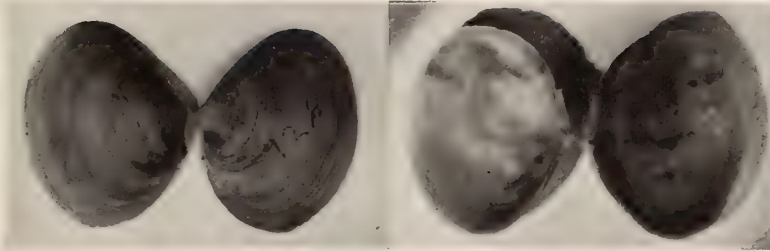


Figure 12

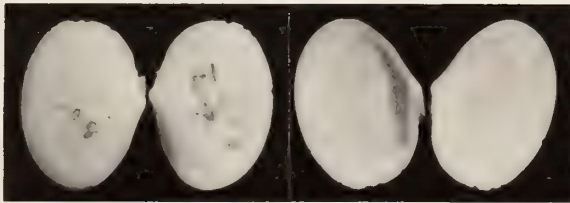


Figure 13

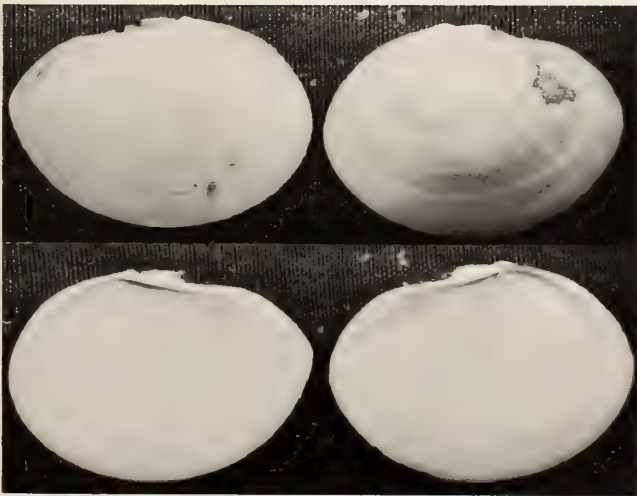


Figure 14

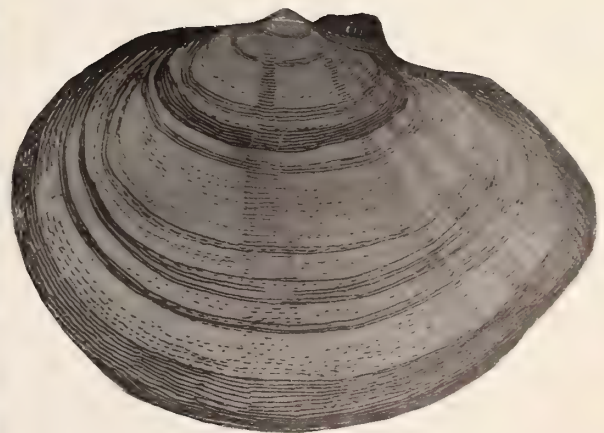


Figure 15

Heterodonax bimaculatus salmoneus – LACM 1169, lectotype herein, 15.6mm; LACM 1177, paratypes, 1 pair, 21 valves. Figure 13.

Type Localities:

Psammobia pacifica – “near” San Diego, California; T. Nuttall, “in deepish water” on a sandy bottom.

Tellina bimaculata – “European Ocean,” in error. It is from the Caribbean.

Tellina vicina – West coast of Panama; C. B. Adams.

Donax ovalinus – Central America; H. Cuming.

Heterodonax bimaculatus purpureus and *H. b. salmoneus* – San Pedro, California; M. B. Williamson.

Nomenclatural Commentary:

Following COAN, in KEEN (1971), the Pacific and Atlantic forms are regarded as separate species, *Heterodonax pacificus* being larger and having a pallial sinus that tends to approach the pallial line at a right angle, but not to meet it (Figure 23). In *H. bimaculatus* the pallial sinus tends to merge with the pallial line at an angle.

Panamic material, particularly from the southern end of its distribution, tends to be thicker than specimens from California (Dr. S. S. Berry, verbal communication). After careful statistical study of specimens from Mexico and Central America workers may choose to regard all or part of this material as representing a subspecies, *Heterodonax pacificus vicinus*.

Description:

Large for genus (to 30mm); oval; equivalve; longer, rounded anteriorly; weakly to well truncate posteriorly; sculpture of rounded, concentric ribs, occasionally with a few radial grooves; externally white, purple, pink, or orange, occasionally with dark flecks, rays, or blotches; similarly colored internally; pallial sinuses striose. Other internal details shown in Figure 23.

Geographic Distribution and Ecology:

Point Conception, California (SU 4696), through southern California and the entire Panamic province to Tumbes, Peru (OLSSON, 1961), with many intermediate records. More northerly records from Monterey, California (UCB 2395; SMITH & GORDON, 1948) may represent larval settlements in especially warm years or errors in labeling. Specimens labeled as having come from the “Columbia River” (ANSP 51617; AMNH 33580 & 33581) are most certainly in error. *Heterodonax pacificus* is found intertidally in protected bays in sand, relatively close to the surface (BURCH, 1945a).

Material seen:

93 lots from area of study.

Geologic Distribution and Biogeography:

This species is known as a west American fossil only

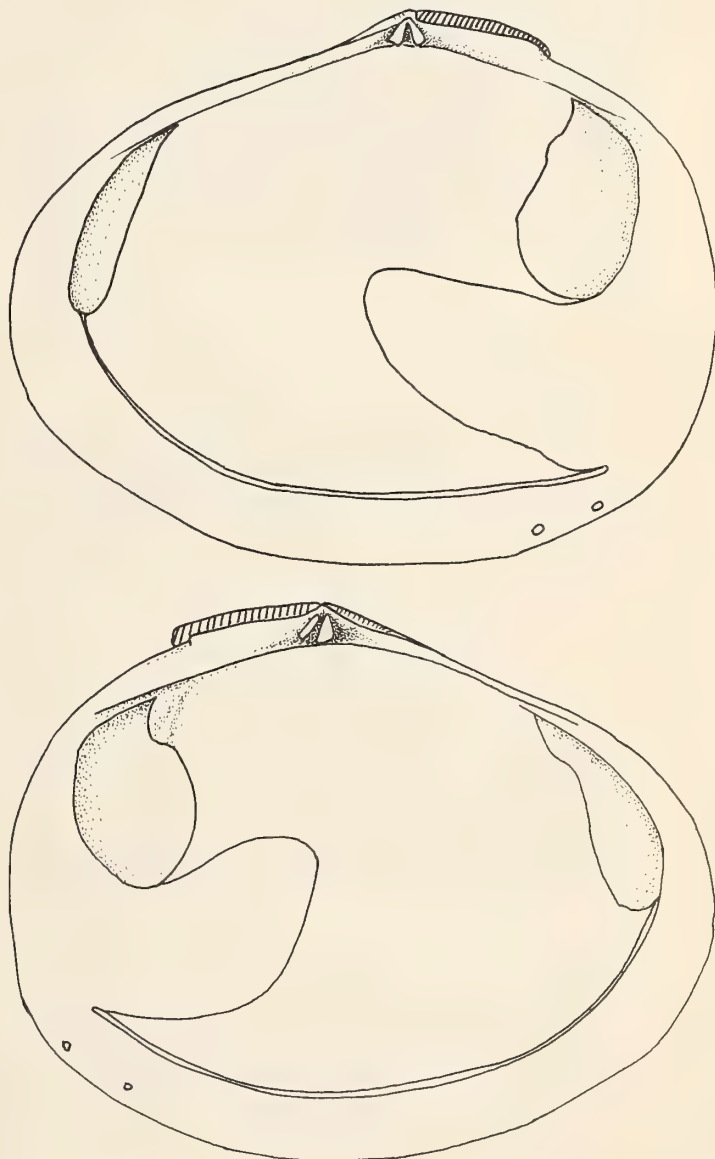


Figure 23

Heterodonax pacificus

Internal view of valves

SU 148/1, San Diego, California; 25.4 mm

from the late Pleistocene of the San Pedro area, California (DALL, 1900), to Bahía Magdalena, Baja California Sur (JORDAN, 1936), with two intermediate records. It appears to have been a late arrival in the Californian province, having been derived from the Caribbean homologue, *Heterodonax bimaculatus*.

Sanguinolariinae Grant & Gale, 1931

Into this subfamily are placed those members of the Psammobiidae that are elongate to ovate and are conspicuously inequivalve. They are mostly smooth, and may have a heavy, adherent periostracum. Pallial sinuses tend to be larger than those of the Psammobiinae. The gape is less conspicuous than in the Solecurtinae.

Nuttallia Dall, 1898

[Type species: *Sanguinolaria nuttallii* Conrad, 1837, by OD]

Following the recent practice of Japanese authors, the genus *Nuttallia* is here regarded as being distinct from *Sanguinolaria*. Species of *Nuttallia* are characteristically large, oval, with a much flattened right valve. A shiny, adherent periostracum is present.

Nuttallia nuttallii (Conrad, 1837)

(Figures 14 to 16 and 24)

Sanguinolaria nuttallii Conrad

CONRAD, 1837: 230 - 231; plt. 17, fig. 6
 CONRAD, 1849: 214
 CARPENTER, 1857a: 212
 CARPENTER, 1857b: 195, 207, 226, 231, 234, 301, 351, 352
 CARPENTER, 1864c: 540, 584, 588, 638, 665, 683 [1872: 26, 70, 74, 124, 151, 169]

[*Sanguinolaria* (*Nuttallia*)]

DALL, 1898: 58
 ARNOLD, 1903: 168 - 169
 I. OLDRYD, 1925: 185 - 186; plt. 55, figs. 1, 4
 GRANT & GALE, 1931: 383; plt. 20, figs. 15a, 15b
 BURCH, 1945a: 22, 24 (text fig.); 1945b: 18
 KEEN, 1966a: 171

Psammobia decora Hinds

HINDS, 1842: 81; plt. 6, fig. 1
 HINDS, 1845: 66 - 67; plt. 19, figs. 6, 7
 CONRAD, 1849: 214 [as a synonym of *S. nuttallii*]
 KEEN, 1966b: 268

Sanguinolaria grandis Carpenter, ex Gould MS [*nomen nudum*]

CARPENTER, 1857b: 228, 349

Sanguinolaria orcutti Dall

DALL, 1921: 17
 DALL, 1925: 26, 36; plt. 12, figs. 1, 2
 JORDAN, 1926: 224, 249 - 250; text fig. 1
 GRANT & GALE, 1931: 383 - 384 [as a synonym of *S. nuttallii*]

Type Material:

Sanguinolaria nuttallii - BM(NH) Nuttall collection 1966.302, lectotype herein, the specimen with the less broken periostracum on left valve, pair, 56mm; paralectotype, pair, approximately same size. Figure 14.

Psammobia decora. - Lost (KEEN, 1966b), 71mm (HINDS, 1842). Figure 15.

Sanguinolaria orcutti - USNM 333118, holotype, pair, 130mm; USNM 645105, pair, figured by DALL (1925) but apparently received later than 1921. Figure 16.

Type Localities:

Sanguinolaria nuttallii - San Diego, California; T. Nuttall, in marshes.

Psammobia decora - San Diego, California; R. B. Hinds.

Sanguinolaria orcutti - Bahía San Quintín, Baja California Norte; late Pleistocene [as "late Pliocene or early Pleistocene"]; C. R. Orcutt.

Nomenclatural Commentary:

GRANT & GALE (1931) found Dall's *Sanguinolaria orcutti* indistinguishable from *S. nuttallii*, and I concur in this opinion. The reported hinge differences seem not to be significant, and many molluscan species in the Pleistocene of Bahía San Quintín appear to have grown to a relatively large size. It must have been a favorable place to live.

Description:

Large for genus (to 150mm); ovate, longer posteriorly; left valve more inflated; thin; rounded anteriorly; broadly truncate dorso-posteriorly; smooth, except for concentric growth lines; covered with an adherent, light to dark brown, shiny periostracum; sometimes with dark, radial lines externally; purplish internally. Other internal details shown in Figure 24.

Geographic Distribution and Ecology:

Bodega Bay, California (UCD collection; STOHLER, 1959), to Bahía Magdalena, Baja California Sur (USNM 217818), with many intermediate localities. Specimens labeled as coming from Oaxaca, Mexico (SDNHM 18549), probably represent an error. This species is found in the intertidal area of protected bays, particularly near

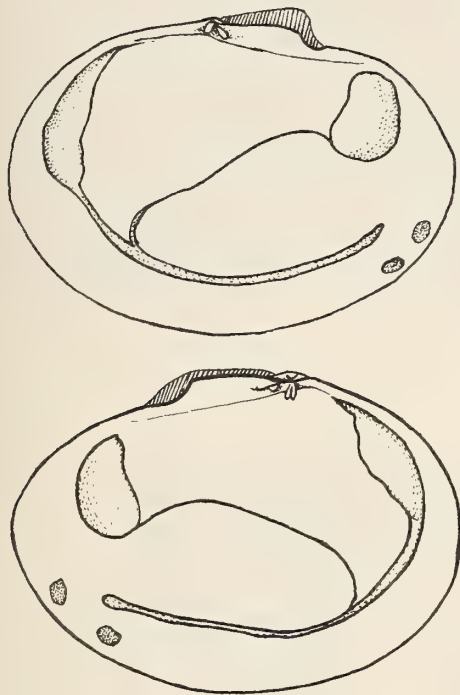


Figure 24

Nuttallia nuttallii

Internal view of valves

MCZ 140680, False Bay, San Diego, California; 74 mm

entrance channels, buried in sand or gravel to a depth of about 30 to 40 cm. They lie horizontally, with the convex left valve uppermost. They are uncommon in sand below the area of wave action on more open coast (WEYMOUTH, 1921; MACGINITIE, 1935; BURCH, 1945a; FITCH, 1953). POHLO (1972) describes the morphology of the soft parts and reports the species to be a non-selective suspension feeder.

Material seen:

121 lots.

Geologic Distribution and Biogeography:

Nuttallia nuttallii has been reported in the late Pleistocene from Summerland, California (VALENTINE, 1961)

to Bahía Magdalena, Baja California Sur (JORDAN, 1936), with a number of intermediate records. There are two records in the early Pleistocene, both from the San Pedro area, California (T. OLDROYD, 1925; BURCH, 1947). It has also been reported in both the Pliocene and the Miocene of California.

Comparisons should be made to *Nuttallia alata* (Gabb, 1869) from the Miocene of California and to *N. toulai* (HERTLEIN & JORDAN, 1927) from the Miocene of Baja California Sur. Other species of the genus are reported from the Oligocene and Eocene of California.

There are apparently three Recent species of *Nuttallia* in Japan. The most similar of these is *N. ezonis* Kuroda & Habe, in HABA, 1955. The Californian species differs in being larger, broader posteriorly, and in having a longer pallial sinus. The periostracum of *N. nuttallii* is also thinner and lighter in color.

Solecurtinae d'Orbigny, 1846

This subfamily is composed of those members of the Psammobiidae that are elongate, equivalve, and widely gaping at both ends. Most are smooth or have a few incised oblique lines. The periostracum may be adherent or easily worn off.

***Tagelus* Gray, 1847**

[Type species: "*Sol. guinensis*", by OD of Gray, 1847, = *Solen guineensis* Holten, 1802, ex Chemnitz MS (not to be confused with *Solen guinensis* Hanley, 1842, ex Gray MS, a member of the Solenidae), = *Solen adansonii* Bosc, 1801 (better known as *Solecurtus angulatus* Sowerby, 1874), an African species regarded by some authors as being the same as *Solen plebeius* [Lightfoot], 1786, a Caribbean species. The two species are probably distinct.]

Members of the genus *Tagelus* are smooth, elongate, and more or less equilateral. The anatomies of a number of species have been described (BLOOMER, 1903a, 1903b; 1905; 1907a, 1907b; HOFFMANN, 1914; GHOSH, 1920). The impact on subgeneric classification of the differences among the non-Californian species discussed in these papers is beyond the scope of the present review.

(*Tagelus*)

Without a radial strengthening rib; periostracum thin, easily worn off; white within.

Tagelus (Tagelus) affinis (C. B. Adams, 1852)

(Figures 17 and 25)

Solecortus affinis C. B. Adams

ADAMS, 1852a: 524, 548 [1852b: 300, 324]

CARPENTER, 1857b: 245, 280, 301

CARPENTER, 1857c: 27

CARPENTER, 1864a: 369 [1872: 205]

CARPENTER, 1864c: 553 [1872: 39]

[*Tagelus*]

DALL, 1898: 59, 61

I. OLDROYD, 1925: 187

BURCH, 1945a: 23, 29 (text fig.); 1945b: 18

HERTLEIN & STRONG, 1950: 222, 251; plt. 1, figs. 9, 11

TURNER, 1956: 29; plt. 29, figs. 17, 18

KEEN, 1958: 192 - 193; fig. 470

OLSSON, 1961: 351, 535; plt. 62, figs. 4, 4a

KEEN, 1971: 245 - 246; fig. 615

Type Material:

MCZ 186363, lectotype (TURNER, 1956), pair, 57 mm; MCZ 186559, paralectotypes, 2 pairs. Figure 17.

Type Locality:

West coast of Panama; C. B. Adams.

Nomenclatural Commentary:

The relationship of this species to *Tagelus (T.) affinis irregularis* Olsson, 1961, described from Ecuador, remains uncertain. It may be a distinct species or a synonym. I agree with KEEN (1971) that *T. (T.) longisimatus* Pilsbry & LOWE, 1932, named as a subspecies of *T. (T.) affinis*, is distinct.

Description:

Medium-sized for genus (to 60 mm); relatively short; inflated; relatively heavy; nearly equilateral; ends broadly rounded; postero-dorsal slope not sharply angled or expanded; smooth, with growth striae only; periostracum straw-colored to dark, often present only on outermost margin; white within. Pallial sinus extends past beaks in Californian specimens. Other internal details shown in Figure 25.

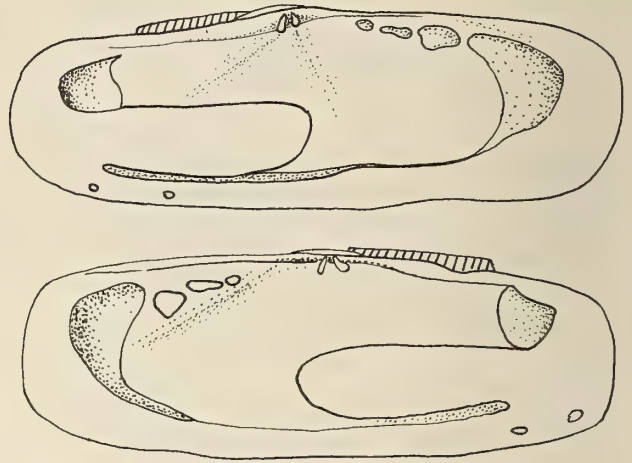


Figure 25

Tagelus (Tagelus) affinis

Internal view of valves

MCZ 257632, Cayucos, California; 67 mm

Geographic Distribution and Ecology:

Cayucos, California (MCZ 175497), to Sua and Mangalaralto, Ecuador (OLSSON, 1961), with many intermediate records. This species is found intertidally in protected bays in mud (BURCH, 1945a). In the Panamic province it has been reported at a depth of 73 m (HERTLEIN & STRONG, 1950).

Material seen:

44 lots from area of study.

Geologic Distribution and Biogeography:

Tagelus (T.) affinis is known as a fossil only from the west coast of Mexico in the Pleistocene of Bahía de Santa Inez, Baja California Sur (HERTLEIN, 1957), Isla Tibu-

Explanation of Figures 16 to 19

Figure 16: *Nuttallia nuttallii*. Holotype of *Sanguinolaria orcutti*, USNM 333118; 130 mm

Figure 17: *Tagelus (Tagelus) affinis*. Lectotype of *Solecortus affinis*, MCZ 186363; 57 mm

Figure 18: *Tagelus (Tagelus) californianus*. Lectotype (herein) of *Solecortus (Cultellus) californianus*, BM(NH) General collection 1861.5.20.136; about 102 mm

Figure 19: *Tagelus (Mesopleura) subteres*. Holotype of *Solecortus (Cultellus) subteres*, BM(NH) Nuttall collection 1861.5.20.125; 45 mm



Figure 16

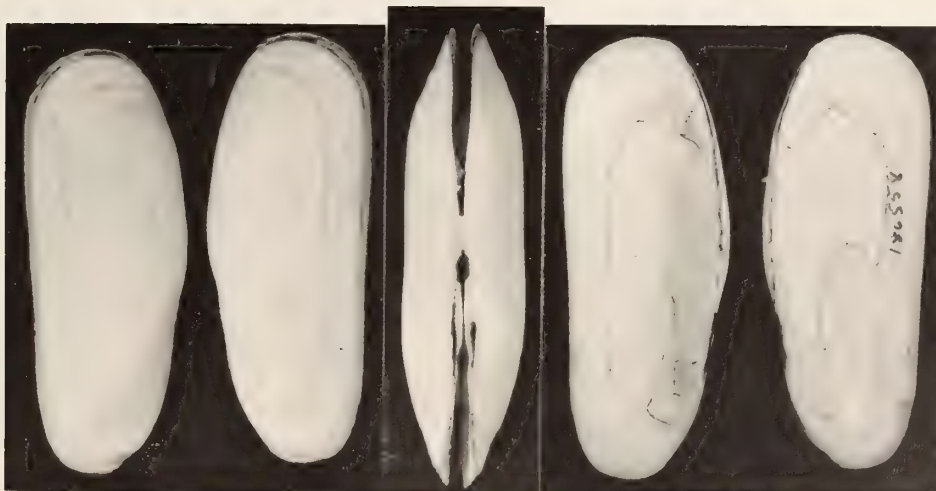


Figure 17



Figure 18

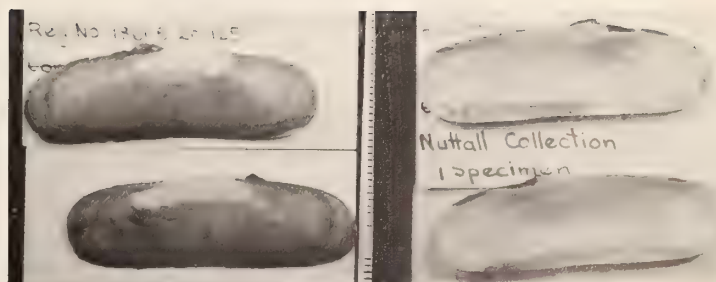


Figure 19