

A review of the Recent Pandoridae (Bivalvia) in the Panamic Province, with descriptions of three new species

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ABSTRACT

Six genera and 16 species of Panamic Pandoridae are described and illustrated. Three species are described as new, namely *Pandora (Pandora) rachaelae*, *Pandora (Pandorella) sarahae*, and *Clidiophora dorsorectus*, and one new genus, *Coania*. Diagnoses are provided for the genera, subgenera, and species, as well as illustrations of the type specimens of the nominate species. *Frenamya*, *Clidiophora*, *Heteroclidus*, and *Foveadens* are herein elevated to generic rank. The high diversity of Pandoridae in the tropical Panamic Province is compared with other tropical regions along with more temperate climes.

INTRODUCTION

The Greek myth of Pandora portrays her as the first mortal woman, one of exceptional beauty. Pandora also opened the forbidden box, releasing all the evils of humankind. So it is with the members of the bivalve family Pandoridae, species of amazing beauty, but also those with taxonomic confusion and peril. We herein review the Pandoridae of the Panamic Province, accompanied by full descriptions, diagnostic characters between genera and species, and provide photographs of types and typical specimens.

The functional morphology of the Atlantic *Pandora inaequivalvis* (Linnaeus, 1758) and *P. pinna* (Montagu, 1803) was detailed by Allen (1954). The biology and functional morphology of the Pacific *P. filosa* was examined by Thomas (1994). Through experimental studies, Allen and Allen (1955) postulated that the primary life position of *P. inaequivalvis* is with the eurved side down, but the species is capable of surviving in almost any orientation for considerable periods. However, Allen and Allen also noted that specimens buried more than 2 cm below the sediment surface had a low rate of survival, which likely limits the distribution of most *Pandora* to low energy habitats. Additional pandorid functional morphology was elucidated by Yonge and Morton

(1980) and Morton (1984), with particular emphasis on the ligament and lithodesma. The functional morphology and natural history of all Panamic Pandoridae remains undocumented.

In their monograph of the Western Atlantic Pandoridae, Boss and Merrill (1965) presented the first modern review of the family in the New World. Due to a paucity of literature at the time, they postulated that the family is not diverse in the tropical regions, a hypothesis which will be refuted by the data herein. Importantly, Boss and Merrill provided detailed anatomical descriptions and precise illustrations to accompany their shell morphology descriptions. Unfortunately, subsequent workers did not follow the dentition and ligament nomenclature defined in this important paper.

Boss (1965) included all known generic, subgeneric, specific, and subspecific names in the Pandoridae. This has provided a base for our current research, in particular with documenting generic and subgeneric names.

Panamic pandorids were first described by G.B. Sowerby, I (1835), in his review of new species collected by Cuming in South America. Carpenter (1856, 1865) described additional species from Mexico, and Dall (1915) added more species from Mexico and Panama. Keen (1958) presented the first complete accounting of the Panamic pandorids, including diagnoses of *Pandora* subgenera and illustrations of several type specimens, and slightly revised this treatment thirteen years later (Keen, 1971). Olsson (1961) provided keys to the southern Panamic *Pandora* subgenera and species, and extended the geographic distribution of several species.

Thus, with the seemingly ardent work by the authors above, we were perplexed to have great difficulty identifying common pandorid species in the Panamic Province. When examining museum and private collections we found that the identifications were almost random, with little continuity between identifications, sometimes even within a single collection. Upon examination of the type specimens of the Panamic species, we further noted that most of the species in collections were incorrectly identified. It was with this backdrop that we

developed the diagnoses below, with a goal of providing useful tools to identify this difficult and plastic group of bivalves.

Abbreviations and Text Conventions: Each valid taxon is followed by a synonymy, a description, distribution and habitat data, information on type specimens and type locality, and additional remarks about the taxon. Distribution information is based on Recent specimens we have examined, unless otherwise noted. We have not examined any fossil material. Sadly, no wet preserved specimens were located during this study, thus we did not describe the anatomy of the species covered below. All references to valve convexity and concavity refer to the external view the specimens.

Abbreviations used in the text are as follows: BMNH – The Natural History Museum, London, United Kingdom; CAS – California Academy of Sciences, San Francisco, California, USA; LACM – Natural History Museum of Los Angeles County, Los Angeles, California, USA; MCZ – Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA; PRI – Paleontological Research Institution, Ithaca, New York, USA; SBMNH – Santa Barbara Museum of Natural History, Santa Barbara, California, USA; UMML – University of Miami Marine Laboratory, Rosenstiel School of Marine and Atmospheric Science, Miami, Florida, USA; USNM – National Museum of Natural History, Smithsonian Institution, Washington DC, USA.

SYSTEMATICS

Pandoridae Rafinesque, 1815

Diagnostic characters between genera and subgenera are given in Table 1, and species-level characters are given in Table 2.

Genus *Pandora* Bruguière, 1797

Pandora Bruguière, 1797. Type species (SD Children, 1823): *Pandora rostrata* Lamarck, 1818, = *Solen inaequivalvis* Linnaeus, 1758. Recent, Mediterranean.

Description: Shell strongly inequilateral, posterior end longer; right valve flat to concave; left valve flat to convex; hinge plate vestigial to well developed, with weak to strong cardinal teeth bordering resilifer; lithodesma usually present; sculpture of irregular commarginal striae or ribs, some with radial ribs or grooves; interior nacreous. Siphons short.

Distribution: The genus is cosmopolitan in distribution, found from intertidal to abyssal depths.

Remarks: Considered by Boss and Merrill (1965) to be primarily a cold-water genus, the findings in this paper indicate a high tropical diversity. It is likely other tropical regions have a much higher diversity than currently reported.

Subgenus *Pandora* sensu stricto

Hinge of left valve narrow, greatly reduced, anterior cardinal tooth a small tubercle or broadly flattened, posterior cardinal tooth absent to reduced. Right valve with small to moderate anterior cardinal tooth, posterior tooth short to moderately long. Exterior sculpture of commarginal striae or ribs, some with very faint radial striae.

Pandora (Pandora) brevifrons G.B. Sowerby I, 1835 (Figure 1)

Pandora brevifrons G.B. Sowerby I, 1835: 93.

Description: SHELL SHAPE: Ellipsoid-elongate; very inequivalve, left valve very inflated, right valve very concave; entire shell strongly twisted dorsoventrally; anterior end short; anterodorsal margin straight; posterior end attenuate, without discrete rostrum; ventral margin of left valve broadly rounded, slightly straighter mid-ventrally.

SCULPTURE AND COLOR: Anterior end of left valve not set off by a change in sculpture or color; left valve with 2 low radial ribs extending from beaks to posterior margin, commarginal striae over entire valve; right valve sculpture of fine commarginal striae, with long, deep, furrow along posterodorsal margin.

HINGE: Left valve with anterior tubercle, and an elongate, oblique resilifer; right valve with two short, subequal cardinal teeth; lithodesma unknown.

MUSCLE SCARS: adductor muscle scars subequal, subcircular.

LENGTH: to 22 mm [BMNH].

Distribution: Currently only known from the type locality at Bahía Panamá, Panama (9.0°N) [BMNH].

Type Material: BMNH 1966572, 3 syntypes - paired valves.

Type Locality: Panama, 18 m (originally 10 fathoms), sandy bottom.

Remarks: Records from the region around San Felipe, Baja California, Mexico (Gemmill et al., 1987; Dushane and Brennan, 1969) are *Pandora sarahae* new species.

In spite of intensive collecting in Panamá, this species has not been found since its description in 1835. It is possible that the type is mislocalized. However, study of specimens from adjacent and far reaching provinces has also not yielded any material of this species.

Literature: Keen (1971: 287), Olsson (1961: 454).

Pandora (Pandora) rachaelae new species (Figures 2–4)

Description: SHELL SHAPE: Ovate-elongate; inequivalve, left valve slightly inflated, right valve flat; posterodorsal margin of right valve overlapping left, ventral margin of left valve overlapping right; entire shell not twisted to slightly twisted; anterior end short; anterodorsal margin slightly recurved; posterior end broadly rounded, with wide, short, truncate rostrum; ventral margin broadly rounded, with

Table 1. Generic and subgeneric characteristics of the Pandoridae in the Panamic Province.

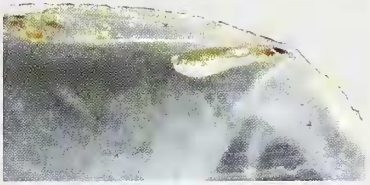

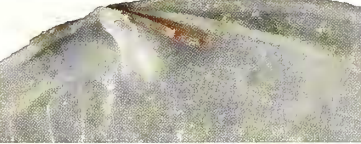
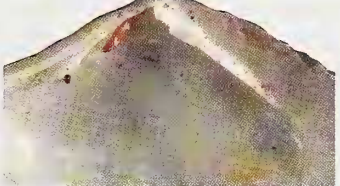
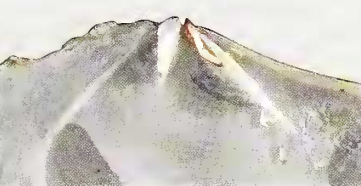

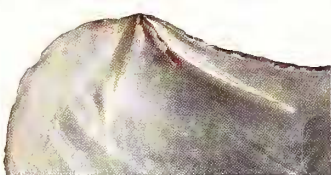


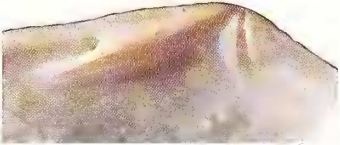


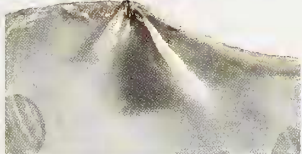
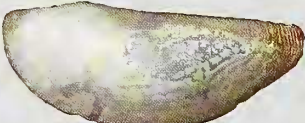
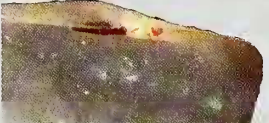
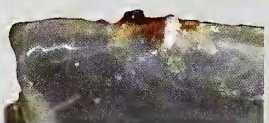

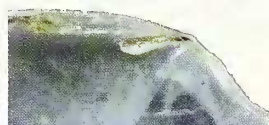

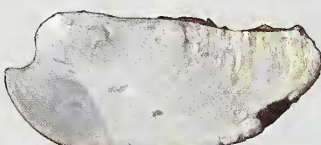
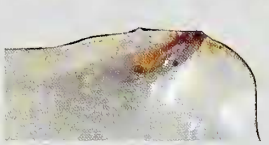
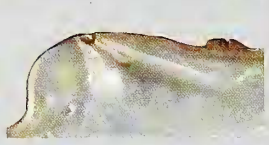
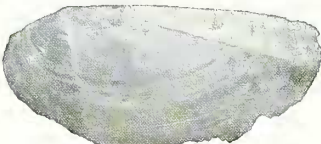

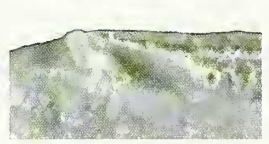
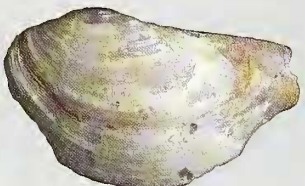
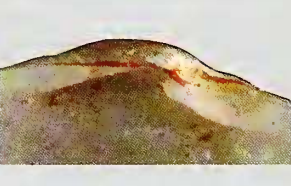


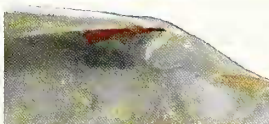
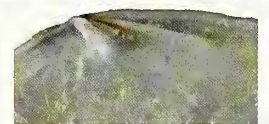

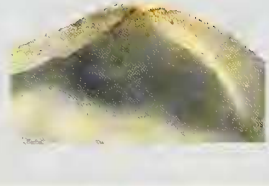

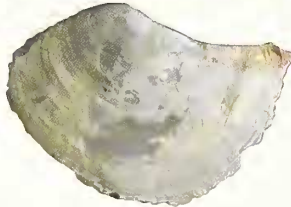
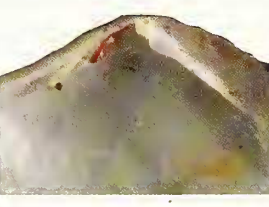
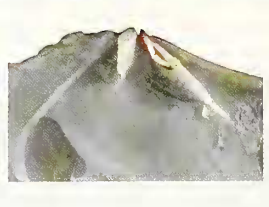
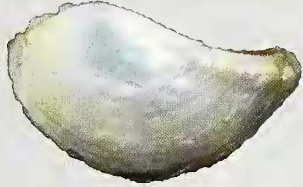


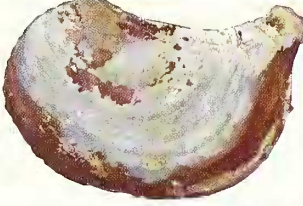

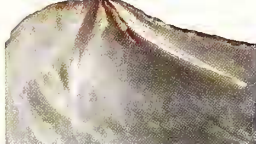
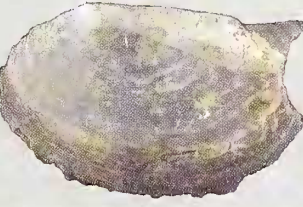

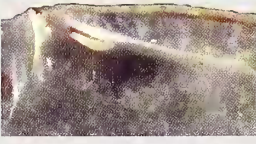
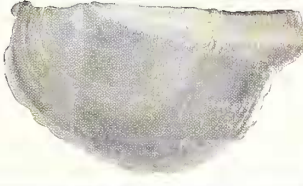





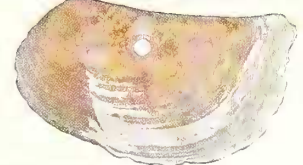
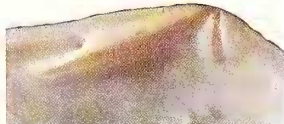
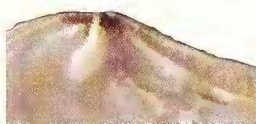
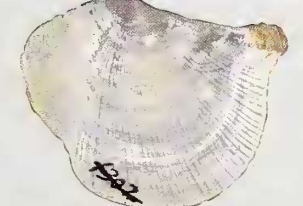

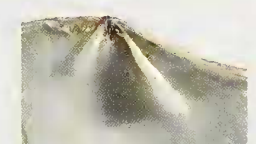
Genus (Subgenus)	Sculpture of valves	Left hinge	Right hinge
<i>Pandora</i> (<i>Pandora</i>)	right valve commarginal only		
<i>Pandora</i> (<i>Pandorella</i>)	right valve with radial grooves		
<i>Frenamya</i>	right valve commarginal only	 anterior tooth, ends anterior of adductor scar	
<i>Clidiophora</i>	right valve commarginal only	 anterior tooth, ends posterior of adductor scar	
<i>Heteroclidus</i>	right valve commarginal only	 anterior tooth, ends anterior of adductor scar	
<i>Foveadens</i>	right valve commarginal only		
<i>Coania</i>	right valve with radial grooves; left valve with radial ribs		

Table 2. Species characteristics of the Pandoridae in the Panamic Province.

Taxa	Shell Shape	Left Valve Dentition	Right Valve Dentition
<i>Pandora (Pandora) brevifrons</i>			
<i>Pandora (Pandora) rachaelae</i>			
<i>Pandora (Pandora) uncifera</i>			
<i>Pandora (Pandorella) granulata</i>			
<i>Pandora (Pandorella) radiata</i>			
<i>Pandora (Pandorella) sarahae</i>			
<i>Frenamya arcuata</i>			
<i>Frenamya cristata</i>			

(Continued)

Table 2. (Continued)

Taxa	Shell Shape	Left Valve Dentition	Right Valve Dentition
<i>Frenamya radians</i>			
<i>Clidiophora claviculata</i>			
<i>Clidiophora cornuta</i>			
<i>Clidiophora dorsirectus</i>			
<i>Heteroclidus punctata</i>			
<i>Foveadens panamensis</i>			
<i>Coania rhyphis</i>			



Figures 1–4. 1. *Pandora brevifrons*, syntype, BMNH 1966572, Panama, sandy bottom, 18 m; length = 22 mm. 2–4. *Pandora rachaclae* new species, 2. Holotype, SBMNH 347835, Mexico, Baja California Sur, off Cabo Pulmo, 23°26′00″ N, 109°25′21″ W, 13–17 m; length = 13.9 mm. 3–4. Paratypes, SBMNH 84939, same locality as holotype; 3. Length = 14.5 mm, 4. Length = 14.2 mm.

shallow indentation approximately one-third of total length from anterior end.

SCULPTURE AND COLOR: Left valve sculpture of commarginal striae and irregular, low commarginal undulations; left valve with one low radial rib extending from beaks to posterior margin, in some top of rib with granules or nodes; in most, anterior end of left valve demarcated by change in color, without sulcus; right valve sculpture of commarginal striae, with wide commarginal undulations in some, long furrow along posterodorsal margin weak to absent.

HINGE: Left valve with anterior tubercle, and a short oblique resilifer; right valve with two cardinal teeth; anterior tooth short, curved in some, not reaching posterior end of

anterior adductor muscle scar; posterior tooth, thin, elongate, paralleling dorsal margin; lithodesma thin, narrow.

MUSCLE SCARS: Both adductor muscle scars subcircular.

LENGTH: To 14 mm [SBMNH].

Distribution: Los Frailes, Baja California Sur (23.4°N) [SBMNH], to San Felipe, Baja California (31.0° N) [SBMNH], to Puerto Huatulco, Oaxaca (15.8° N) [CAS], Mexico; also at Isla Soeroro, Islas Revillagigedo, Colima, Mexico (18.8° N) [CAS]; intertidal zone to 60 m, sand [SBMNH].

Type Material: Holotype SBMNH 347835, length = 13.88 mm, height = 6.18 mm, coll. by Carl and Laura Shy, January 1969. Paratypes: SBMNH 84939, same locality as

holotype, 3 pairs; USNM 1132899, same locality as holotype, 1 pair. Additional paratypes: CAS 181543, 6 pairs, Mexico, Colima, Islas Revillagigedo, Isla Socorro, 20 m.

Type Locality: Mexico, Baja California Sur, off Cabo Pulmo, 23°26'00" N, 109°25'21" W, 14–18 m (originally 7–9 fathoms).

Etymology: Named in honor of the senior author's oldest daughter, Raehael Gwinn, in thanks for her continual support and positive attitude.

Comparisons: This species has a more compressed left valve than *P. brevifrons*, has a more ventrally sloping anterodorsal margin, and has a broader, more tubercular anterior eardinal tooth.

Literature and Additional Records: Not seen in previous literature. This species has frequently been misidentified in museum and private collections as *Pandora brevifrons* or *P. granulata*. SBMNH has 13 additional lots.

Pandora (Pandora) uncifera Pilsbry and Lowe, 1932 (Figure 5)

Pandora uncifera Pilsbry and Lowe, 1932: 104.

Description: SHELL SHAPE: Ellipsoid-elongate; equi-valve, both valves compressed, flat; anterior end short; anterodorsal margin eurved ventrally in a distinctive hook; posterior end attenuate, with wide, moderately long, truncate rostrum; ventral margin broadly rounded to straight, except for broad, shallow indentation approximately one-third of length from anterior end.

SCULPTURE AND COLOR: Anterior end of left valve demarcated by change in color, without sulcus, commarginal striae and undulations over entire surface, more subdued anteriorly; left valve with one very low, broad radial rib extending from beaks to posteroventral margin; right valve sculpture of wide commarginal undulations, broad region on posterodorsal margin with vertical striations.

HINGE: Left valve with two eardinal teeth, anterior tooth moderately short, posterior tooth elongate, paralleling dorsal margin; right valve with two weak cardinal teeth, anterior tooth narrow, moderately short, posterior tooth elongate, narrow, resilifer narrow, oblique; lithodesma moderately thick, narrow.

MUSCLE SCARS: Both adductor muscle scars subcircular to subovate.

LENGTH: To 13 mm [SBMNH].

Distribution: Bahía de las Palmas, Baja California Sur (23.7°N), north to Bahía San Luis Gonzaga, Baja California (29.8°N) [SDNHM, CAS], and Cabo Tepoea, Sonora (30.3°N) [SBMNH], Mexico, to Manta, Manabí, Ecuador (0.9°S) [PRI]; 5–66 m [SBMNH].

Type Material: Holotype ANSP 155632.

Type Locality: Acapulco, Guerrero, Mexico, 37 m (originally 20 fathoms).

Literature: Gemmell et al. (1987: 61–62), Hertlein and Strong (1946: 97), Keen (1971: 287), Olsson (1961: 454), Pilsbry and Lowe (1932: 104–105).

Subgenus *Pandorella* Conrad, 1863

Pandorella Conrad, 1863. Type species (M): *Pandora arenosa* Conrad, 1834. Miocene, Virginia.

Kennerlia Carpenter, 1864. Type species (SD Stoliczka, 1870): *Pandora (Kennerlia) bicarinata* Carpenter, 1864, = *P. bilirata* Conrad, 1855. Recent, California. *Kennerleyia*, *Kennerlyia*, *Kenerlyia*, *Kenerleyia*, of authors, unintentional alterations of an established name.

Description: Hinge of left valve greatly reduced, anterior eardinal tooth a small tubercle or broadly flattened, posterior eardinal tooth absent to reduced. Right valve with two eardinal teeth; anterior small to moderate; posterior short to moderately long. Lithodesma present. External sculpture of right valve with radial grooves or ribs.

Remarks: The dentition of this subgenus is very similar to that of *Pandora s.s.* The prime distinguishing character of *Pandorella* is the presence of radial ribs or grooves in the right valve.

Other eastern Pacific Ocean species in this subgenus include *Pandora (Pandorella) bilirata* Conrad, 1855, *P. (P.) filosa* (Carpenter, 1864), *P. (P.) glacialis* Leach, 1819, and *P. (P.) wardiana* A. Adams, 1860.

Pandora (Pandorella) granulata Dall, 1915 (Figure 6)

Pandora granulata Dall, 1915: 449.

Description: SHELL SHAPE: Subquadrate to subovate; inequivalve, left valve moderately inflated, right valve flat to concave; anterodorsal margin straight; anterior end produced, sharply rounded; posterior end only slightly attenuate, some with very broad, short, subtruncate rostrum; posterodorsal margin straight; right valve overlapping left along posterodorsal margin; ventral margin broadly rounded, with shallow indentation.

SCULPTURE AND COLOR: Anterior end of left valve demarcated by change in sculpture, without sulcus, with a few commarginal undulations on anterior end, central and posterior slopes with commarginal striae only; left valve with two sharp, narrow, radial ribs extending from beaks to posterior margin, with strong commarginal ribs overlying radials forming nodes, granules or scales on some; right valve sculpture of very fine commarginal striae, with few to many (1–10) fine radial grooves that are less prominent or numerous in juveniles.

HINGE: Left valve with one short, obscure anterior cardinal tooth; right valve with two cardinal teeth; anterior



Figures 5–6. 5. *Pandora uncifera*, SBMNH 347838, Mexico, Baja California Sur, off Cabo Pulmo, 23°26'00" N, 109°25'21" W, 13–17 m; length = 13 mm. 6. *Pandora granulata*, syntype, USNM 211348, Mexico, Baja California Sur, off La Paz, 24°18' N, 110°22' W, 48 m; length = 7.2 mm.

short, stout; posterior thin, elongate, paralleling dorsal margin; some right valves with additional internal rib, near end of posterior cardinal, paralleling dorsal margin; ligament narrow, short, oblique; lithodesma broad, stout, short.

MUSCLE SCARS: Anterior adductor muscle sear ovate-elongate, posterior sear subcircular.

LENGTH: To 10 mm [SBMNH].

Distribution: La Paz, Baja California Sur (24.2°N) [USNM], into the Golfo de California as far north as Puerto Libertad, Sonora (29.9°N) [SBMNH], to Teacapán, Sinaloa (22.2°N) [SBMNH], Mexico; 15–80 m [LACM, SBMNH], in sand and mud [SBMNH].

Type Material: USNM 211348, syntypes, about 100 open valves, about 12 closed pairs.

Type Locality: Off La Paz, Baja California Sur, Mexico, 24°18' N, 110°22' W, 48 m (originally 26.5 fathoms), broken shell bottom (ALBATROSS 2823).

Remarks: Synonymized in error by Valentieh-Seott (1998) and Coan et al (2000). *Pandora bilirata* Conrad, 1855, has more prominent radial grooves on the exterior of the right valve and does not have granulations on the radial ribs of the left valve.

Literature: Keen (1971: 289).

Pandora (Pandorella) radiata G.B. Sowerby, 1835 (Figure 7)

Pandora radiata G.B. Sowerby I, 1835: 94; *P. (Kennerlia) bicarinata* Carpenter, 1864: 638; 1865: 603; *P. (Kennerlyja) convexa* Dall, 1915: 449.

Description: SHELL SHAPE: Subovate; left valve moderately to highly inflated, right valve flat to very concave, deeply fitting inside left valve; anterodorsal margin with nearly straight slope, slightly upturned on end; posterior end broadly subtruncate, with short broad rostrum in some specimens; posterodorsal margin straight; right valve moderately overlapping left along posterodorsal

margin; ventral margin broadly rounded, with shallow to significant indentation towards anterior end.

SCULPTURE AND COLOR: Anterior end of left valve demarcated by shallow sulcus, entire surface of irregular commarginal striae, some with low, broad, obscure radial ribs; left valve with one narrow radial rib extending from beaks to posterior margin, frequently eroded in larger specimens, some specimens with faint dorsal rib; right valve sculpture of very fine commarginal striae, and strong, widely spaced radial grooves.

HINGE: Left valve with one long, obscure anterior cardinal tooth, in some hinge plate depressed anterior of tooth; right valve with two cardinal teeth; anterior tooth short, stout; posterior tooth thin, elongate, wider ventrally; ligament narrow, moderately short, oblique; lithodesma broad, thick.

MUSCLE SCARS: Both adductor muscle scars subequal, subcircular.

LENGTH: To 31 mm [USNM].

Distribution: Catalina Island, Los Angeles County, California (33.5°N) [USNM], into the Golfo de California as far north as Isla Smith, Baja California (29.1°N) [SBMNH] and Cabo Lobos, Sonora (29.9°N) [SBMNH], Mexico, to Zorritos, Tumbes, Perú (3.5°S) [SBMNH]; 20–170 m [SBMNH].

Type Material: *Pandora radiata*: BMNH 1964469, holotype, one pair; *Pandora bicarinata*: USNM 592440, 1 pair mounted on glass slide; Catalina Island, California. *Pandora convexa*: USNM 171068, syntypes, 2 pairs; off lower California, Ballenas, Mexico [Puerto Abrejos, Baja California Sur], 10 m (originally 5.5 fathoms), Albatross 2835, 26°42'30"N, 113°34'15"W.

Type Locality: Insularum Muerte, Columbiæ Occidentalis [Isla del Muerto, Guayas, Ecuador].

Remarks: The relationship with *Pandora bilirata* Conrad, 1855, should be examined more thoroughly, preferably with molecular data. It is possible that this northern species is a junior synonym of *P. radians*.

Literature: Hertlein and Strong (1946b: 97–98, as *P. convexa*), Keen (1971: 289–291).

Pandora (Pandorella) sarahae new species
(Figure 8)

Pandora brevifrons G.B. Sowerby I, of authors, not G.B. Sowerby I, 1835

Description: SHELL SHAPE: Ellipsoid-elongate; very inequivalve, left valve very inflated, right valve very concave; entire shell slightly to moderately twisted dorsoventrally; anterior end short; anterodorsal margin slightly recurved in most; posterior end attenuate, with short, subtruncate rostrum; ventral margin of left valve straight to slightly rounded, broadly curved along anteroventral and posteroventral margins.

SCULPTURE AND COLOR: Anterior end of left valve set off by a change in sculpture, with commarginal striae anterior of beaks, and fine commarginal ribs posterior of beaks, extending over posterior end, with fine sulcus demarcating the two regions; left valve with one moderate radial rib extending from beaks to posterior margin, with heavy commarginal ribs extending across it to the dorsal margin; right valve sculpture of fine commarginal striae, with long, deep, wide furrow along posterodorsal margin, larger specimens with irregular radial grooves near ventral margin.

HINGE: Left valve with two teeth; anterior tooth low, thickened tubercle; posterior tooth short, thin, extending anterior of ligament; ligament long, oblique, with thin groove or thickening posterior to it; lithodesma very thin, narrow; right valve with two cardinal teeth; anterior tooth stout, short, curved, not reaching posterior portion of anterior adductor muscle scar; posterior tooth long, thin, paralleling dorsal margin.

MUSCLE SCARS: Anterior adductor muscle scar sub-trigonal to subcircular, posterior subcircular.

LENGTH: To 12 mm [SBMNH].

Distribution: Bahía Magdalena, Baja California Sur (24.6°N) [SBMNH] and San Felipe, Baja California (31.0°N) [SDNHM], Mexico; 2–10 m, sand [SDNHM, SBMNH].

Type Material: Holotype SBMNH 84940, length = 12.04 mm, height = 5.09 mm, collected by Carol and Paul Skoglund, October 1979. Paratypes, locality same as holotype: SBMNH 84941, 3 specimens; SBMNH, 2 specimens; CAS 181988, 1 specimen, length = 10.63 mm; USNM 1132897, 1 specimen, length = 11.13 mm; Paratypes, SDNHM 90076, Mexico, Baja California, San Felipe, 10 specimens.

Type Locality: Mexico, Baja California Sur, Bahía Magdalena, Puerto San Carlos, 24°48'7.60" N, 112°7'17.61" W, 2–10 m, in sand.

Etymology: Named in honor of the senior author's youngest daughter, Sarah Gwinn, who has a keen biological spirit, and a twisted sense of humor.

Comparisons: No other Panamic pandorid has the strong lateral twisting found in *P. sarahae*. In comparison to *P. granulata*, *P. sarahae* has a narrower, more produced, anterior end, and fewer radial grooves on the exterior of the right valve. *Pandora radiata* is much wider dorsoventrally than either of the two aforementioned species, and has more, deeper radial grooves in the right valve. *Pandora rachaclae* is not twisted, and most specimens are compressed.

Literature: Gemmell et al. (1987: 61, as *P. brevifrons*).
Genus *Frenamya* Iredale, 1930

Frenamya Iredale, 1930. Type species (OD): *Coelodon patulus* Tate, 1889. Recent, Australia.



Figures 7–8. 7. *Pandora radiata*, holotype, BMNH 1964469, Ecuador, Guayas, Isla del Muerto; length 13 mm. 8. *Pandora saraha*, holotype SBMNH 84940, Mexico, Baja California Sur, Bahía Magdalena, Puerto San Carlos, 24°48'7.60"N, 112° 7'17.61" W, 2–10 m, sand; length = 12 mm.

Cocclodon Carpenter, 1865, non Audinet-Serville, 1832. Type species (SD Stoliczka, 1871): *Pandora ceylanica* G.B. Sowerby I, 1835. Recent, Ceylon.

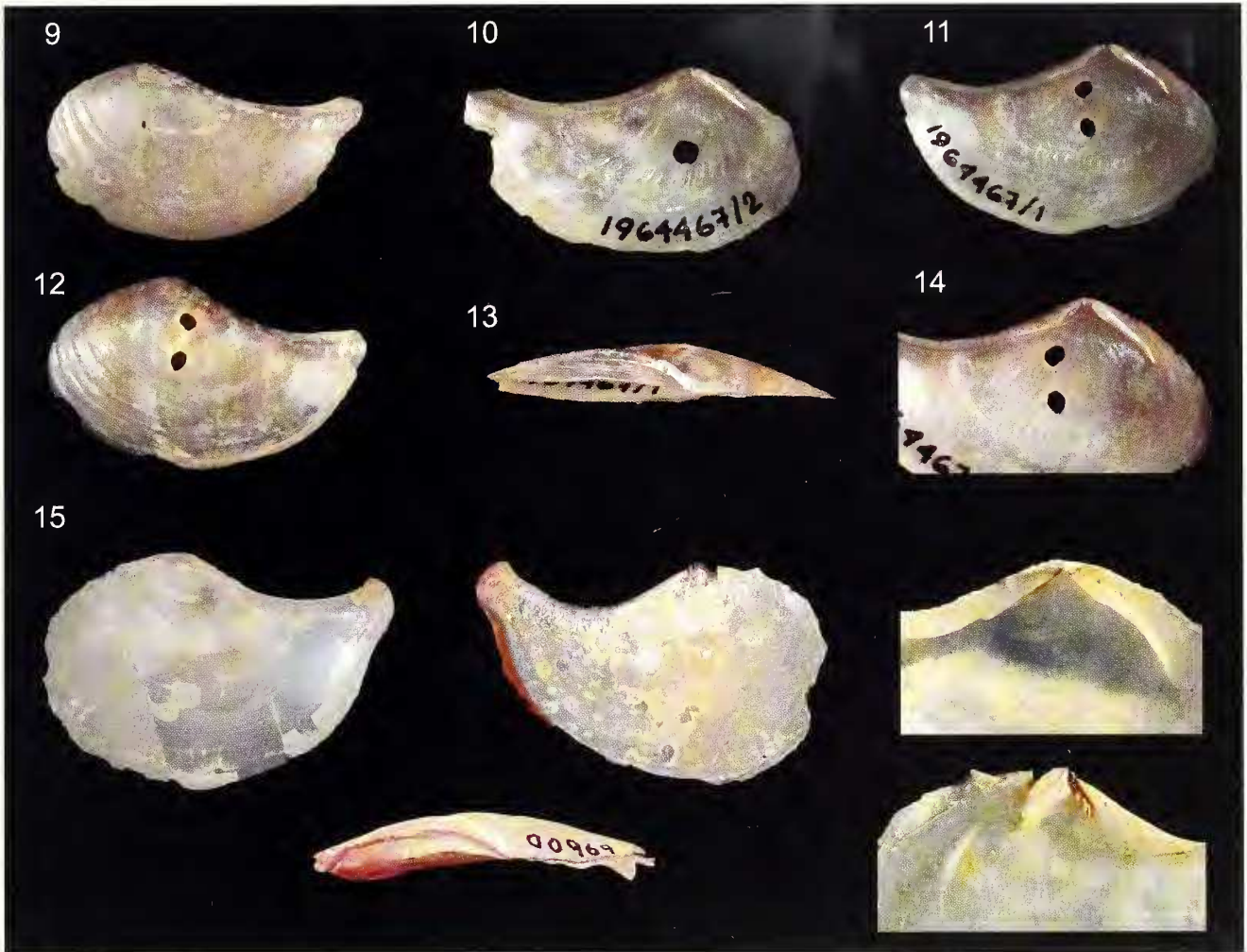
Description: Shell strongly inequilateral, posterior end longer; right valve flat to coneave; left valve flat to convex. Hinge of left valve with strong, moderate to long anterior cardinal tooth. Right valve with 3 cardinal teeth, the central cardinal strong, elongate to diamond shaped. Lithodesma absent. External sculpture of commarginal striae or ribs only.

Frenamya arcuata (G.B. Sowerby I, 1835) (Figures 9–15)

Pandora arcuata G.B. Sowerby I, 1835: 93.

Description: SHELL SHAPE: Ham-shaped; left valve moderately inflated, right valve flat to slightly coneave, not fitting inside left valve; anterior end relatively short; anterodorsal margin with straight, strong trigonal serrations in most large specimens; posterior end strongly rostrate; posterodorsal margin moderately to very strongly recurved, some more recurved posteriorly; right valve overlapping left along posterodorsal margin, more so near posterior end; ventral margin evenly rounded, almost circular, without indentation.

SCULPTURE AND COLOR: Anterior end of left valve demarcated by very slight change in color, with shallow sulus in some, commarginal striae over entire surface, with one or two very low commarginal undulations in some;



Figures 9–15. 9–14. *Frenamiya arcuata*, syntypes, BMNH 1964467, Ecuador, Guayas, Santa Elena; 9, 13 length = 22 mm; 10 length = 27 mm; 11, 12 length = 25 mm. 15. *Frenamiya arcuata*, SBMNH 119375, Mexico, Baja California Sur, Bahía Santa Maria, 24°44'0" N, 112°12' W, 15 fm; length 14 mm.

left valve with one low, broad radial rib extending from beaks to posterior margin, with strong commarginal bars crossing posteriorly; right valve sculpture of very fine commarginal striae, with shallow posterodorsal groove, and rib dorsal to it; right valve without change in color on anterior end.

HINGE: Left valve with three cardinal teeth; anterior tooth long, curved ventrally directed, widest near beaks, ending at the top of the anterior adductor scar; central tooth very small, short, directly below beaks; posterior tooth very thin, moderately long, paralleling dorsal margin; without furrow posterior to ligament; ligament moderately long, broad, oblique; right valve with three cardinal teeth; anterior thin, long, curved, extending to top of anterior end of muscle scar; central tooth moderately short, very stout, diamond shaped, slightly bifid; posterior thick, slightly granulate on top, moderately elongate, paralleling dorsal margin, reaching only half way to posterior adductor muscle scar.

MUSCLE SCARS: Anterior adductor muscle scar subcircular, posterior scar ovate-elongate, posterior scar almost touching dorsal margin.

LENGTH: To 26 mm [SBMNH], reported in literature to 40 mm [Keen, 1971], but no specimens of this length were found.

Distribution: In the Gulf of California as far north as Bahía Santa Maria, Baja California Sur, Mexico (24.7° N) [SBMNH], south to Máncora, Tumbes, Peru (4.1° S) [UMML, CAS]; 15–30 m [SBMNH].

Type Material: BMNH 1964467/1–3, syntypes, 3 left valves.

Type Locality: Ecuador, Guayas, Santa Elena.

Remarks: Unfortunately the type specimens of *E. arcuata* are only left valves, which has led to many misinterpretations of the species. We have found it to be much less common than previously reported.

Olsson (1961: Plate 81, figs. 1a–g) figured a number of species as a single species, and Keen (1971) followed this lead.

The record of *E. arcuata* in Keen (1971) from Laguna Ojo de Liebre, on the Pacific side of Baja California Sur, remains unverified. Specimens of this species were not located from that locality at CAS, which would be the likely repository for specimens that Keen vouchered.

Literature: Carpenter (1865: 596–597), Hertlein and Strong (1946: 98, as *P. cristata*), Hertz et al. (1985), Keen (1971: 287), Olsson (1961: 456).

Frenamiya cristata (Carpenter, 1865)
(Figure 16)

Clidiophora cristata Carpenter, 1865: 597

Description: SHELL SHAPE: Subovate-elongate; both valves compressed, twisted to right posteriorly; left valve moderately convex, right valve slightly concave; anterodorsal margin straight, sloping ventrally, some with very weak serrations; posterior end attenuate, with short, truncate, well-demarcated rostrum especially in right valve; posterodorsal margin strongly arcuate; right valve overlapping left along posterodorsal margin; ventral margin broadly rounded, without indentation.

SCULPTURE AND COLOR: Anterior third of left valve demarcated by change in color, without sulcus, commarginal striae over anterior end; left valve with one heavy broad to narrow radial rib extending from beaks to posterior margin, with shallow groove ventral to it; right valve sculpture of very fine commarginal striae, and irregular low commarginal undulations.

HINGE: Left valve with two cardinal teeth; anterior elongate, narrow, anteroventrally directed towards anterior end of anterior adductor muscle scar; posterior tooth very thin, moderately short, adjacent to the dorsal margin; right valve with three cardinal teeth; anterior elongate, narrow; central tooth short, stout; posterior tooth, elongate, narrow thin, not granulate on top, paralleling dorsal margin; ligament moderately wide, oblique, short; without furrow between ligament and posterior tooth.

MUSCLE SCARS: Adductor muscle scars subequal, anterior subcircular, posterior ovate-elongate.

LENGTH: To 24 mm [BMNH].

Distribution: Only known from the type locality in the Golfo de California, Mexico (general type locality) [BMNH]. Records from Guatemala and El Salvador reported by Hertlein and Strong (1946: 98) remain unverified. Likely these were confused with *P. arcuata*.

Type Material: Holotype BMNH 1963441, 1 pair.

Type Locality: Gulf of California, Mexico.

Frenamiya radians (Dall, 1915)
(Figures 17–19)

Pandora (Coelodon) radians Dall, 1915: 450; *P. arcuata* G.B. Sowerby I, *auctt. non* G.B. Sowerby I, 1835.

Description: SHELL SHAPE: Subovate-elongate; left valve slightly to moderately inflated, right valve flat to slightly concave, fitting inside left valve; anterior end moderate to long; anterodorsal margin with straight to broadly rounded, with strong trigonal serrations in large specimens; posterior end attenuate, with narrow, moderately long, truncate rostrum; posterodorsal margin evenly recurved; right valve overlapping left along posterodorsal margin; ventral margin broadly rounded, without indentation.

SCULPTURE AND COLOR: Anterior end of left valve demarcated by change in color, without strong sulcus, commarginal striae over entire surface, some with a few commarginal undulations; left valve with one very low, very broad radial rib extending from beaks to posterior margin; right valve sculpture of very fine commarginal striae, with deep posterodorsal groove.

HINGE: Left valve with one long, thin to stout, ventrally directed anterior cardinal tooth, widest near beaks, ending at top of anterior adductor scar; long, narrow furrow posterior to ligament; ligament narrow, oblique; right valve with three cardinal teeth; anterior long, thin; central tooth short, stout, diamond shaped; posterior thin to thick, smooth to granulate on top, very elongate, paralleling dorsal margin, not quite reaching posterior adductor muscle scar.

MUSCLE SCARS: Both adductor muscle scars nearly circular, posterior scar moderately close to dorsal margin.

LENGTH: To 24 mm [SBMNH].

Distribution: Puerto Abreojos, Baja California Sur (26.8° N) [USNM], and Bahía Jolotemba, Nayarit, Mexico (21.4° N) [CAS, Kaiser Collection], to Zorritos, Tumbes, Peru (3.5° S) [Olsson, 1961]; 4–300 m [SBMNH, CAS], mud [SBMNH].

Type Specimens: USNM 171053, holotype, 1 open pair; off lower California, Ballenas, Mexico [Puerto Abreojos, Baja California Sur], 10 m (originally 5.5 fathoms), Albatross 2835, 26°42'30" N, 113°34'15" W.

Literature: Dall (1915: 450–451), Keen (1971: 289), Olsson (1961: plate 81, figure 1d as *P. arcuata*).

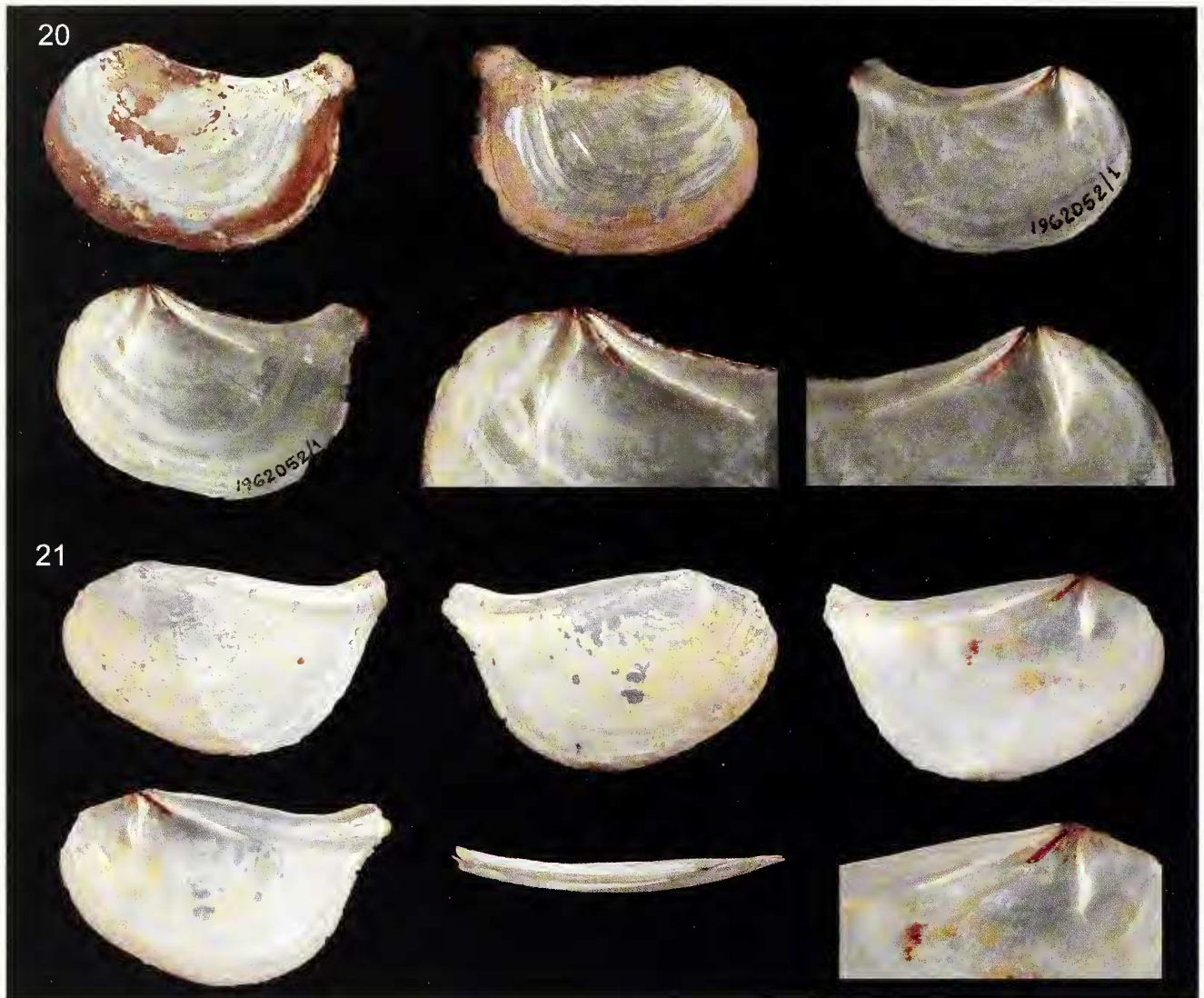
Genus *Clidiophora* Carpenter, 1864

Clidiophora Carpenter, 1864. Type species (OD): *Pandora claviculata* Carpenter, 1856. Recent, tropical eastern Pacific.

Description: Shell strongly inequilateral, posterior end longer; right valve flat to concave; left valve flat to convex. Hinge of left valve with very strong, long



Figures 16–19. 16. *Frenamya cristata*, holotype, BMNH 1963441, Mexico, Gulf of California [general locality]; length = 22.5 mm. 17. *Frenamya radians*, holotype, USNM 171053, Mexico, Baja California Sur, Puerto Abreojos, 26°42'30" N, 113°34'15" W, 10 m; length = 15.5 mm. 18–19. *Frenamya radians*, SBMNH 360635, Mexico, Jalisco, Bahía Tenacatita, Caleta de Los Angeles, 6–20 m; Figure 18, length = 20 mm; Figure 19, length = 24 mm.



Figures 20–21. 20. *Clidiophora claviculata*, syntype, BMNH 1962052, Mexico, Sinaloa Mazatlan; length = 44.5 mm. 21. *Clidiophora claviculata*, SBMNH 347854, Mexico, Sonora, off Bahia Kino, 28°47'06" N, 111°57'16" W, 13 m; length = 45 mm.

anterior cardinal tooth, which ends posterior of the anterior adductor muscle, posterior tooth very long, thin. Right valve with two or three cardinal teeth, the central cardinal very small or absent. Lithodesma present. External sculpture of commarginal striae or ribs only.

Clidiophora claviculata (Carpenter, 1856)
(Figures 20–21)

Pandora claviculata Carpenter, 1856: 228.

DESCRIPTION: SHELL SHAPE: Variable from subovate-elongate to subquadrate; both valves compressed, left valve slightly concave or convex, right valve flat to slightly convex or concave; most specimens twisted to the left; anterodorsal margin straight to curved, rarely with very weak serrations; posterior end broadly rounded to

straight, with short, truncate, upturned, well-demarcated rostrum; posterodorsal margin straight to strongly recurved; right valve slightly overlapping left along posterodorsal margin; ventral margin broadly rounded, without indentation.

SCULPTURE AND COLOR: Anterior half to two thirds of left valve demarcated by change in color in some, without sulcus, commarginal striae over posterior end, becoming more prominent anteriorly, worn specimens with weak radials posteriorly; sculpture of both valves of irregular commarginal undulations and striae; both valves with one heavy broad radial rib extending from beaks to posterior margin, with deep groove ventral to it.

HINGE: Left valve with three teeth; anterior tooth elongate, broad, ventrally directed, ending posterior of

anterior adductor muscle scar; central tooth short to moderate in length, thin; posterior tooth very elongate, narrow, some granulate on top, directed to dorsal portion of posterior adductor muscle scar; ligament narrow, oblique, long; lithodesma broad, long; long, narrow furrow between ligament and posterior cardinal tooth; right valve with two cardinal teeth; anterior tooth moderate to long, narrow dorsally, wide medially, narrow ventrally, sometimes with secondary tooth projecting past middle of anterior adductor muscle scar; posterior tooth thin, very elongate, paralleling dorsal margin, most granulate or serrate on top.

MUSCLE SCARS: Both adductor muscle scars subcircular; posterior scar larger; region dorsal to anterior scar thickened in many.

LENGTH: To 45 mm [BMNH].

Distribution: Laguna Manuela, outer coast of Baja California Sur (28.2°N) [CAS], into the Golfo de California to near its head at San Felipe, Baja California (31.0°N) [SDNHM, SBMNH, CAS] and Puerto Peñasco, Sonora (31.3°N) [SBMNH], south to Mazatlán, Sinaloa (23.2°N) [BMNH], Mexico; 15–60 m [SBMNH].

Type Material: BMNH 1962052/1–3, syntypes, 3 pairs.

Type Locality: Mazatlan, Sinaloa, Mexico.

Remarks: Olsson (1961: 456) and Keen (1971: 287) synonymized *Clidiophora claviculata* with *Frenamiya arcuata*. *Clidiophora claviculata* is much more compressed and has the anterior tooth in the left valve directed to the posterior portion of the anterior adductor muscle scar when compared to *F. arcuata*. When compared to *C. cornuta*, *C. claviculata* has a more arcuate posterodorsal margin and a longer rostrum.

Clidiophora claviculata is perhaps the most variable in shell outline of all of the Panamic pandorid species. The type series is very quadrate in overall shape, but commonly specimens we have examined are more ovate-elongate, with a longer rostrum. With further study, it is possible that more than one species might be present in this group. Based on the curvature of the shell and rostrum, this species appears to lay with its right side on the sediment, unlike most other Panamic pandorid species, which lay on their left side.

Literature: Gemmell et al. (1987: 62–63, as *P. cornuta*), Hertz et al. (1985).

Clidiophora cornuta (C. B. Adams, 1852)
(Figures 22–23)

Pandora cornuta C. B. Adams, 1852: 519 [repr.: 295], ex Gould ms; *Clidiophora acutedcutata* Carpenter, 1865: 598, *nomen vanum* (an unjustified intentional emendation of an established name).

Description: SHELL SHAPE: Subovate; both valves compressed, twisted to left posteriorly; left and right valves slightly convex, right valve slightly concave in

some; anterodorsal margin straight and sloping ventrally to slightly curved; posterior end straight to broadly rounded, rostrum short or absent; posterodorsal margin straight, some slightly arcuate terminally; right valve narrowly overlapping left along posterodorsal margin; ventral margin broadly rounded, without indentation.

SCULPTURE AND COLOR: Anterior half to two-thirds of left valve diagonally demarcated by change in color, without sulcus; left valve sculpture of irregular commarginal striae, with one heavy broad radial rib extending from beaks to posterior margin, without shallow groove ventral to it; right valve sculpture of irregular commarginal striae, with moderately broad groove paralleling dorsal margin; escutcheon absent to long, narrow, shallow.

HINGE: Left valve with three cardinal teeth; anterior tooth elongate, broad, ventrally directed, ending in middle of posterior side of anterior adductor muscle; central tooth very small, short, not well demarcated in small specimens; posterior tooth thin, very elongate, removed from dorsal margin; right valve with two cardinal teeth; anterior tooth short, broad; posterior tooth, elongate, narrow, not granulate on top, removed from dorsal margin; ligament moderately wide, oblique, very long; lithodesma broad, long; with slight furrow between ligament and posterior tooth.

MUSCLE SCARS: Adductor muscle scars subequal, subcircular.

LENGTH: To 36 mm [SBMNH].

Distribution: Laguna Ojo de Liebre, Pacific Coast of Baja California Sur (27.8°N) [SBMNH], into the Golfo de California as far north as San Felipe, Baja California (31.0°N) [SBMNH], and offshore south of Bahía la Choya, Sonora (31.0°N) [CAS], Mexico, to Panamá [MCZ]; intertidal zone to 70 m [SBMNH].

Type Material: MCZ 186309, holotype (broken), 1 pair.

Type Locality: Panama (no specific locality).

Remarks: This species is the most common species found in the museum collections, and perhaps is the most common large species in the Panamic Province. It has been mislabeled in collections as *Pandora claviculata*, *P. panamensis*, and *P. radians*.

Carpenter (1865) renamed this species on the grounds that C. B. Adams' name was misleading, having been based on a broken type specimen that appeared to be "cornuate", e.g. to have posterior horns.

Literature: Hertz et al. (1985), Keen (1971: 289), Olsson (1961: 455).

Clidiophora dorsorctus new species
(Figure 24)

Description: SHELL SHAPE: Subovate-elongate, very fragile, thin, translucent; both valves compressed, left



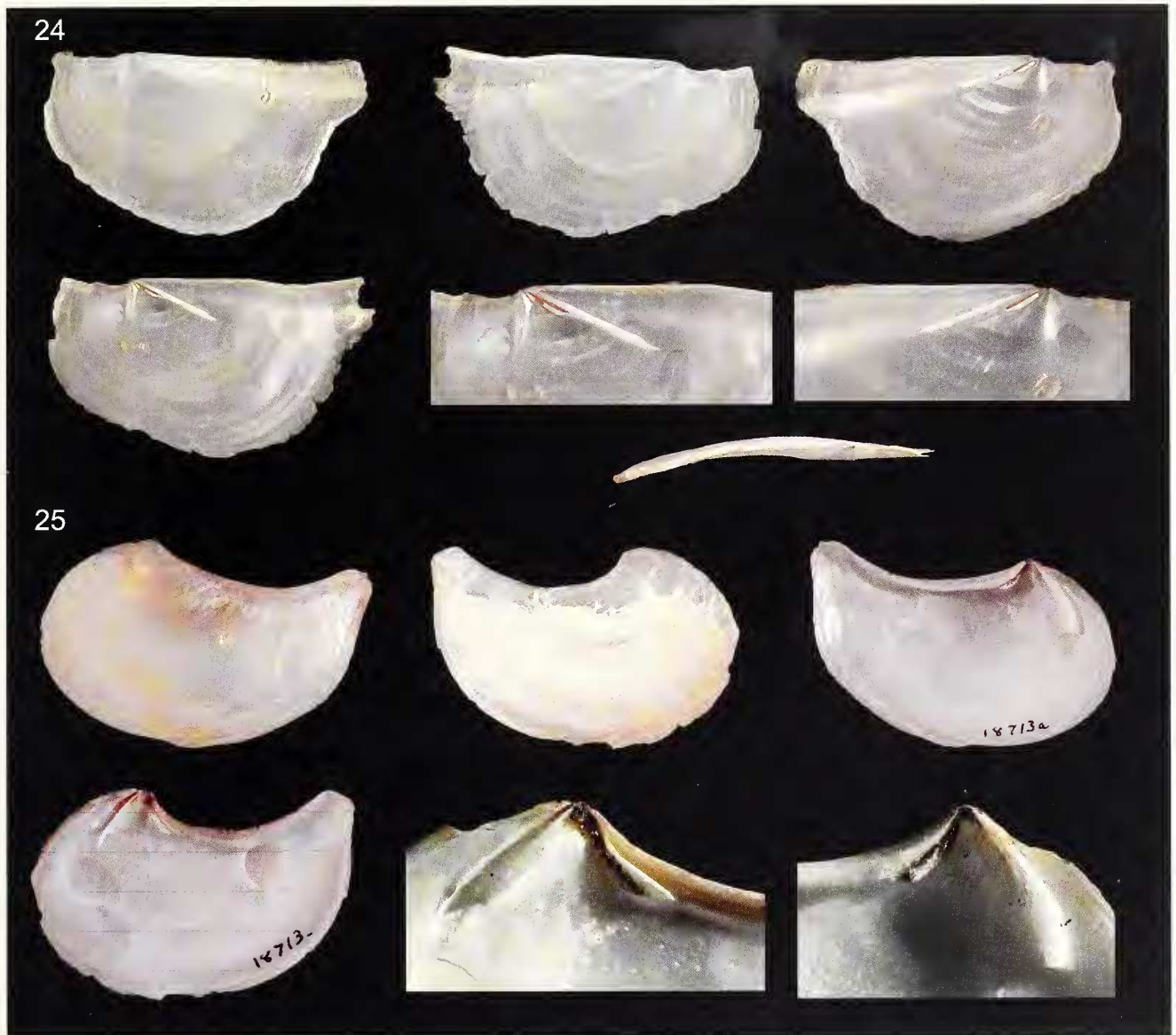
Figures 22–23. 22. *Clidiophora cornuta*, holotype, MCZ186309, Panama [no specific locality]; length, 16 mm. 23. *Clidiophora cornuta*, SBMINH 83351, Mexico, Sonora, off Bahía Kino, 28°47' N, 111°58' W, 55 m; length = 37 mm.

valve flat to slightly convex, right valve flat to slightly concave; most specimens flat, few twisted slightly to the left; anterodorsal margin straight, not curving ventrally, slightly recurved dorsally, without serrations; posterior end broadly to narrowly rounded, rostrum poorly defined, when visible, short, broad; posterodorsal margin straight; right valve slightly overlapping left along posterodorsal margin; ventral margin broadly rounded, expanded posteriorly, without indentation.

SCULPTURE AND COLOR: Left valve not demarcated by change in color, without sulcus; sculpture of left valve of commarginal striae and irregular commarginal undulations, stronger posteriorly; left valve with one sharp,

broad radial rib extending from beaks to posterior margin, fine commarginal ribs from radial rib to dorsal margin.

HINGE: Left valve with three cardinal teeth; anterior tooth moderately long, moderately broad, ending about one-third of length of the posterior side of the anterior adductor muscle scar; medial tooth short, moderately narrow; posterior tooth thin, very elongate, angling well down from dorsal margin, granulate on top, not quite reaching dorsal end of posterior adductor muscle scar; dorsal to posterior tooth a deep furrow extending from beaks to posterior margin; right valve with two cardinal teeth; anterior tooth short, slightly curved, ventrally directed, ending well short of posterior end of anterior



Figures 24–25. 24. *Clidiophora dorsirectus*, holotype, SBMNH 83944, Mexico, Baja California Sur, off Punta la Gringa; 29.0321° N, 113.5196° W; 20–40 fathoms [40–80 m]; length = 34 mm. 25. *Heteroclidus punctata*, SBMNH 118713, California, San Diego County, Coronado Island, intertidal; length = 47 mm.

adductor muscle scar; posterior tooth very elongate, narrow, granulate on top, directed to dorsal portion of posterior adductor muscle scar; ligament long, narrow, oblique; lithodesma broad, thick.

MUSCLE SCARS: Anterior adductor muscle scar subcircular, posterior scar ovate-elongate, region dorsal to anterior scar not thickened.

LENGTH: To 34 mm [SBMMH].

Distribution: In the Golfo de California at Punta la Gringa, Baja California (31.3°N) [SBMNH], and Isla Danzante, (24.7°N) [SBMNH], Baja California Sur, Mexico; 20–90 m [SBMNH].

Type Material: Holotype SBMNH 84944, length = 33.96 mm, height = 19.79 mm, collected by Carol and Paul Skoglund from 1976 through 1993, from type locality. Paratypes, from type locality, SBMNH 84945 (1 specimen); CAS 181987, 1 specimen, length = 21.61 mm; USNM 1132898, 1 specimen, length = 21.12 mm. Paratypes, Mexico, Baja California Sur, west of Isla Danzante, 25.794660°N, 111.281876°W; 30–45 m; collected by Carol and Paul Skoglund, 1984; SBMNH 4 specimens.

Type Locality: Mexico, Baja California, off Punta la Gringa; 29.0321° N, 113.5196° W; 40–80 m (originally 20–40 fathoms).

Etymology: Named after the diagnostic feature – a straight dorsal margin – *dorsorectus*.

Remarks: Like *Pandora claviculata*, this species appears to lay with its right side on the sediment, unlike most other Panamic *Pandora* species, which lay on their left side.

Literature: Not seen in previous literature.

Genus *Heteroclidus* Dall, 1903

Heteroclidus Dall, 1903. Type species (OD): *Pandora punctata* Conrad, 1837. Recent, California.

Description: Hinge of left valve with very strong, long anterior cardinal tooth, which ends anterior of the anterior adductor muscle, posterior tooth very long, thin, paralleling dorsal margin. Right valve with three cardinal teeth, the central cardinal robust, long. Lithodesma present. External sculpture of commarginal striae or ribs only.

Heteroclidus punctata (Conrad, 1837)
(Figure 25)

Pandora punctata Conrad, 1837: 228.

P[andora]. (Heteroclidus) p. gabbi Dall, 1903: 1521.

Description: SHELL SHAPE: Subovate-oblique; both valves compressed, both valves slightly convex, left slightly more convex than right; anterodorsal margin broadly rounded, without serrations; posterior end broadly rounded, with short, truncate, poorly defined rostrum; posterodorsal margin strongly arcuate; right valve overlapping left along posterodorsal margin; ventral margin broadly rounded, with indentation towards anterior slope.

SCULPTURE AND COLOR: Anterior third of left valve demarcated by change in color and sculpture, with very shallow sulcus, anterior end with irregular commarginal striae and fine granules; posterior two-thirds with commarginal striae; left valve with one very low, broad radial rib extending from beaks to posterior margin, with shallow groove ventral to it; right valve sculpture of very fine commarginal striae, and irregular commarginal undulations.

HINGE: Left valve with two cardinal teeth; anterior tooth elongate, thick, anteroventrally directed; posterior tooth short, narrow, obscure; ligament long, moderately wide, oblique; lithodesma broad, thick, long; right valve with three cardinal teeth; anterior tooth long, narrow; central tooth long, broad; posterior tooth, elongate, narrow.

MUSCLE SCARS: Adductor muscle scars subequal, subcircular; both valves with irregular, widely spaced punctations dorsal to pallial line.

LENGTH: To 47 mm [SBMNH].

Distribution: Esperanza Inlet, Vancouver Island, British Columbia (49.9°N) [RBCM], to Punta Pequeña, Pacific coast of Baja California Sur, Mexico (26.2°N) [LACM]; subtidal zone to 50 m [SBMNH], in mud. Known from the middle Pliocene of California.

Type Material: BMNH 1966304, possible holotype, 1 left valve.

Type Locality: Santa Barbara, California, USA.

Literature: Carpenter (1865: 598), Coan et al. (2000: 520), Grant and Gale (1931: 262–263), Hertlein and Grant (1972: 336), Keen (1971: 289).

Genus *Foveadens* Dall, 1915

Foveadens Dall, 1915. Type species (OD): *Pandora (Foveadens) panamensis* Dall, 1915. Recent, tropical eastern Pacific.

Description: Hinge of left valve with two short, curved anterior cardinal teeth; posterior tooth long, partially united with the dorsal margin with a septum. Right valve with three cardinal teeth; anterior cardinal small, tubercular; central short, bulbous; posterior elongate. Lithodesma absent. External sculpture of commarginal striae or ribs only.

Foveadens panamensis (Dall, 1915)
(Figures 26–27)

Pandora (Foveadens) panamensis Dall, 1915: 451.

Description: SHELL SHAPE: Subquadrate to subovate; both valves very compressed, both valves slightly convex, right slightly more convex than left; anterodorsal margin straight, without serrations; posterior end subtruncate, with short, truncate, poorly defined rostrum; posterodorsal margin straight near beaks, slightly upturned posteriorly; right valve overlapping left along posterodorsal margin; ventral margin broadly rounded, with indentation towards anterior slope.

SCULPTURE AND COLOR: Anterior third of left valve demarcated by change in color and sculpture in fresh specimens, anterior end opaque, posterior end translucent, with very shallow sulcus, anterior end with irregular commarginal ribs and striae; posterior two-thirds with weak radial and commarginal striae; left valve with one heavy broad radial rib extending from beaks to posterior margin, with shallow groove ventral to it; right valve sculpture of very fine commarginal striae, and irregular commarginal undulations.

HINGE: Left valve with three cardinal teeth; anterior tooth short, stout, trigonal, ventrally directed; central tooth, very short, narrow; posterior tooth elongate, fused to dorsal margin near beaks, forming tunnel between tooth and dorsal margin; ligament moderately wide, oblique, short; without furrow between ligament and posterior tooth; right valve with two cardinal teeth; anterior tooth short, stout, directed towards middle of anterior adductor muscle; posterior tooth, elongate, very thick, sinuous in some; right valve with an additional minute anterior cardinal visible in some specimens.

MUSCLE SCARS: Both adductor muscle scars subovate, posterior slightly larger.



Figures 26–27. 26. *Foveadens panamensis*, holotype, USNM 252276, Panama, “Old Panama,” intertidal; length = 19 mm. 27. *Foveadens panamensis*, SBMNH S3338, Panama, “Old Panama,” intertidal; length 23 mm.

LENGTH: To 26 mm [SBMNH].

Distribution: This species is uncommon in collections, known from Ciudad Panamá, Panama (9.0°N) [SBMNH, USNM, UMML], and Archipiélago de las Perlas, Panama (approximately 8.5°N) [Olsson, 1961].

Type Material: USNM 252276, holotype, 1 opened pair, badly damaged;

Type Locality: Old Panama, Panama, beach drift.

Literature: Hertlein and Strong (1946: 98), Keen (1971: 289), Olsson (1961: 457).

Coania new genus

Type Species: *Pandora (Kennerlia) rhyppis* Pilsbry and Lowe, 1932: 105.

Description: Hinge of left valve with three cardinal teeth; two moderately short, straight anterior teeth; posterior tooth of moderate length, some slightly united with the dorsal margin with a septum. Right valve with two cardinal teeth; anterior cardinal moderately short, stout; posterior tooth elongate, stout. Lithodesma present. Anterior end of left valve strongly demarcated with notch. External sculpture of left valve with radial sculpture centrally and posteriorly; right valve sculpture of fine commarginal striae and weak, irregular radial grooves.

Etymology: Named in honor of Eugene V. Coan, for his tremendous contributions to our understanding of the eastern Pacific Ocean Bivalvia.

Distribution: Thus far only known from the type locality of the type species, in El Salvador.



Figure 28. *Coania rhyphis*, paratype, SBMNH 39009, El Salvador, La Union, Golfo de Fonseca, La Union; length 24 mm.

Comparisons: The distinct radial sculpture on the left valve and arrangement of the cardinal teeth separate *Coania* from all other genera in the family.

Coania rhyphis (Pilsbry and Lowe, 1932)
(Figure 28)

Pandora (*Kennerlia*) *rhyphis* Pilsbry and Lowe, 1932: 105.

Description: SHELL SHAPE: Subovate-oblique; inequivalve, left valve slightly larger, moderately inflated, right valve flat; anterior end relatively long; anterodorsal margin gently bowed; posterior end very broadly rounded, with short, narrow, truncate rostrum; posterodorsal margin slightly recurved; ventral margin broadly rounded, with deep, broad indentation towards anterior end.

SCULPTURE AND COLOR: Anterior end of left valve strongly demarcated with notch, anterior end with irregular commarginal striae, central slope with narrow, moderately spaced radial ribs, becoming obscure posteriorly in some specimens; left valve with two narrow to broad radial ribs extending from beaks to posterior margin; right valve sculpture of very fine commarginal striae, and a few weak, irregular radial grooves, most evident ventrally.

HINGE: Left valve with three cardinal teeth, two teeth anterior of ligament, one longer posterior tooth; ligament narrow, oblique; lithodesma narrow, thin; right valve with two cardinal teeth, moderately elongate, anterior tooth slightly bifid.

MUSCLE SCARS: Anterior adductor muscle scar subcircular, posterior elliptical.

LENGTH: To 25 mm [SBMNH].

Distribution: Only known from the type locality at La Union, Golfo de Fonseca, El Salvador (13.4°N) [SBMNH, ANSP]; 80 m [ANSP].

Type Material: ANSP 155503, holotype, 1 open pair.

Type Locality: La Union, Gulf of Fonseca, El Salvador.

Literature: Keen (1971: 291), Pilsbry and Lowe (1932: 105).

DISCUSSION

Surprisingly little attention has been paid to understanding the taxonomy of members of the Pandoridae, within the Panamic Province, as well as globally. They are not an uncommon component of the offshore bivalve fauna. Perhaps it is their fragile, laterally flattened shell that has led to the lack of interest. Or possibly, as we have encountered, dealing with the variability of shells shapes leads one to give up in disgust. Whatever the reason, we hope that this work will encourage other bivalve taxonomists to tackle the group in their geographic region.

With 16 pandorid species found in the Panamic Province, one can postulate that there is likely much unexplored diversity in other tropical and temperate regions around the world. Mikkelsen and Bieler (2007)

only reported three species of *Pandora* from southern Florida, even with extensive offshore collecting. Similarly, Lamprell and Healey (1998), found only two pandorids in all of Australia. Oliver (1992) included two species living in the Red Sea, and further stated that the "Pandoridae is a small group of bivalves. . ." The Chinese coastline includes only three species of pandorids (Valentich-Scott, 2003; Xu, 2004), and only four species are reported from Japanese waters (Okutani, 2000).

We have found the best diagnostic identification characters to be in the hinge, rather than the overall shell shape or inflation. We also suspect if live specimens or wet preserved material becomes available, additional anatomical characters will immediately become apparent. Molecular data will undoubtedly yield further advancement in the understanding of this challenging group of bivalves.

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