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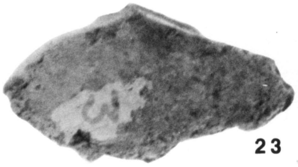
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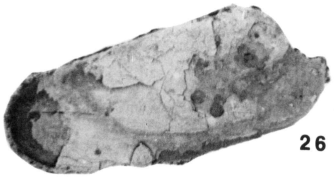
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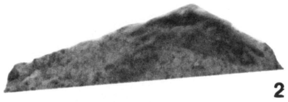
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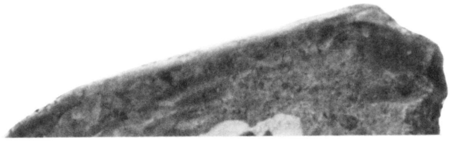
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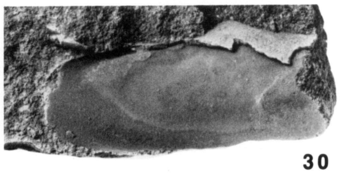
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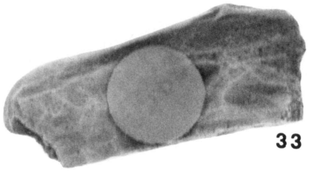
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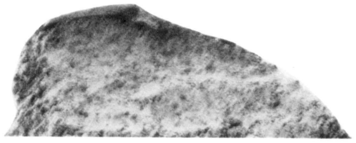
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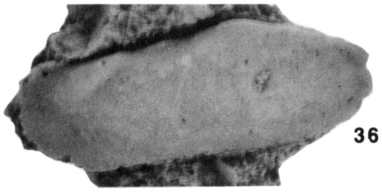
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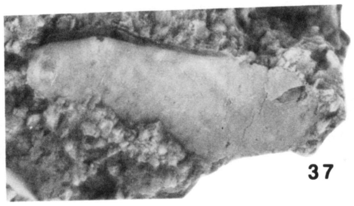
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Explanation of Figures 22 to 41

Figures 22–28. ***Adelodonax tectus*** sp. nov., from UCLA 3622. Figure 22: LACMIP 7825, holotype, left valve, ×1. Figure 23: LACMIP 7827, paratype, hinge left valve, ×3. Figure 24: LACMIP 7826, paratype, hinge left valve, ×3. Figure 25: LACMIP 7829, paratype, right valve, ×1. Figure 26: LACMIP 7828, paratype, right valve, pallial sinus, ×2. Figure 27: LACMIP 7830, paratype, hinge right valve, ×2. Figure 28: LACMIP 7831, paratype, hinge right valve, ×3.

Figures 29–41. ***Adelodonax** altus* (Gabb, 1864). Figure 29: ANSP 4557 from Martinez, Contra Costa Co., Calif., lectotype, ×2. Photo by Takeo Susuki. Figure 30: ANSP 71880 from Martinez, Contra Costa Co., Calif., paralectotype, left valve showing trace of pallial line, ×2. Photo by Takeo Susuki. Figures 31, 38: LACMIP 7843 from UCLA 6489, hypotype, right valve; Figure 31, exterior, ×1; Figure 38, hinge, ×2. Figure 32: LACMIP 7841 from UCLA 3960, hypotype, hinge left valve, ×2. Figure 33: LACMIP 7840 from UCLA loc. 3958, hypotype, hinge right valve, ×2. Figure 34: LACMIP 7842 from UCLA loc. 3960, hypotype, "butterflied" valves, ×1.5. Figure 35: LACMIP 7862 from UCLA loc. 6489, hypotype, hinge left valve, ×2. Figures 36, 40: LACMIP 7837 from LACMIP 28629, hypotype, interior left valve, ×2; Figure 36, rock mold; Figure 40, latex pull. Figures 37, 41: LACMIP 7839 from LACMIP loc. 28629, hypotype, hinge right valve, ×2; Figure 37, rock mold; Figure 41, latex pull. Figure 39: LACMIP 7838 from LACMIP loc. 28629, hypotype, interior of left valve, latex pull, ×2.

horizontal, extending to point just anterior to beaks. Muscle scars nearly equal, round, usually well impressed, posterior scar very near beaks, anterior scar distant.

Holotype: LACMIP 7825.

Paratypes: LACMIP 7826–7835 from UCLA loc. 3622 and LACMIP 7836 from UCLA loc. 3623.

Dimensions: LACMIP 7825, length 25 mm, height 10 mm, inflation of single valve 3.7 mm, beak to posterior 7 mm; LACMIP 7829, right valve length 18 mm, height 7.8 mm, inflation of single valve 2 mm, beak to posterior 6 mm.

Type locality: UCLA loc. 3622, Chico Creek, Paradise Quadrangle, Butte Co., California.

Distribution: 440 m (1320 feet) to 560 m (1740 feet) above the base of the Chico Creek section in the Musty Buck Member of the Chico Formation (UCLA locs. 3622–3624, 3627, 3633), Butte Co., California.

Age: Santonian.

Remarks: ***Adelodonax tectus*** has the beaks more posteriorly placed, and the valves shorter than those of ***A.*** *altus*. ***Adelodonax tectus*** is less elongate than *Ceroniola australis* and has a relatively longer nymph.

At its type locality on Chico Creek, ***Adelodonax tectus*** occurs in abundance with *Notodonax* (***Aliodonax***) ***hsui*** and ***Califadesma elaphium***; all three are of similar shape. Large specimens of *N.* (*A.*) ***hsui*** are readily distinguished from ***A. tectus*** by their abrupt posterior angulation, but small individuals have a less abrupt angulation. They can be distinguished from ***A. tectus*** by their better developed hinge teeth, presence of radial striations on the posterior quarter of the shell, and broader pallial sinus, the lower limb of which is partially confluent with the pallial line. ***Califadesma elaphium*** is most readily distinguished from ***Adelodonax tectus*** by the double angulation of the posterior slope on the former.

The specific name is from the Greek *tecktos,* meaning "soluble," and refers to the leached condition of most specimens from the type locality.

Adelodonax *altus* (Gabb, 1864)

(Figures 29–41)

Pharella alta Gabb, 1864:147, pl. 22, fig. 118; Stewart, 1930: 293, pl. 5, fig. 11.

Diagnosis: Elongate ***Adelodonax*** with the beak at the posterior third and having a slight posterior truncation.

Description: Shell thin, small; valves elongate, compressed and produced anteriorly, moderately inflated and slightly truncated posteriorly; anterodorsal margin rather straight, anterior margin bluntly rounded, ventral margin nearly straight, posterior margin truncated. Beaks opisthogyral, situated at posterior third of the valve. Lunule depressed, long and very narrow; posterior angulation very low. Exterior of valves polished, showing only growth lines.

Hinge with prominent nymph for ligament. Right valve with triangular, low rounded 3b with indistinct socket posterior to it and better defined socket anterior to it; colaminal AIII-3a very long, lamellar, extending from immediately in front of beak for nearly one-third length of anterodorsal margin. Left valve with AII-2 long, lamellar, and extending anterior to long lateral socket; 4b a slightly raised welt on hinge plate posterior to triangular, shallow, round-bottomed socket. Pallial line distant from valve margin anteriorly, becoming moderately close to margin posteriorly; pallial sinus U-shaped, horizontal, extending to point just anterior to beaks. Muscle scars of nearly equal size; posterior scar very near beaks; anterior scar distant, moderately well impressed, acutely subtrigonal.

Lectotype: ANSP 4557, **herein designated**. Stewart (1930:293) could not recognize the specimen figured by Gabb (1864). He suggested that if no better specimen from Gabb's original material was found, the specimen Stewart (1930:pl. 5, fig. 11) figured might be designated lectotype. That specimen has been missing since 1960 (Elana Benamy, *in litt.,* 20 Nov. 1987). Two specimens remain of Gabb's original material: an incomplete left valve similar in size to the specimen figured by Stewart and a "butterflied" pair of valves that are one-third smaller. The "butterflied" pair of valves, although small, provides a better indication of valve shape and is chosen as lectotype (Figure 29).

Paralectotype: ANSP 71880 (Figure 30).

Hypotypes: LACMIP 7837–7839 from LACMIP loc. 28629, LACMIP 7840 from UCLA loc. 3958, LACMIP 7841–7842 from UCLA loc. 3960, LACMIP 7843 from UCLA 6489.

Dimensions: Lectotype ANSP 4557 right valve, length 12 mm, height 6.5 mm, beak to posterior 4.8 mm; hypotype LACMIP 7842, length 14 mm, height 6.4 mm, beak to posterior 5.8 mm.

Type locality: Near Martinez, Contra Costa Co., California (Gabb, 1864).

Distribution: Great Valley Series near Martinez and Deer Valley, Contra Costa Co.; Garzas Member of the Moreno Formation near Garzas (LACMIP loc. 8148) and Orestimba creeks (UCLA locs. 6359, 6360, 6489), Merced and Stanislaus cos., California. Poorly preserved specimens from the Cabrillo Formation on Mt. Soledad (LACMIP loc. 28629), San Diego Co. (identified as "*Pharella alta*" in Kennedy, 1975:15). Rosario Formation on the north side of Punta Banda (UCLA loc. 7137), Baja California, Mexico.

Age: Maastrichtian. Gabb (1864) indicated that *Pharella alta* was from the "Martinez Group," but it has not subsequently been recovered from deposits of Paleocene age near Martinez. Stewart (1930:293) recognized that the rock type and preservation are typical of the Late Cretaceous Great Valley Series from the vicinity of Martinez, Contra Costa Co., California, and at several Contra Costa County localities (UCLA locs. 3958, 3959, 3960, 3314, and 4671), it has been found in association with species indicative of late Maastrichtian age. The Cabrillo Formation on Mt. Soledad, which yields abundant ***Adelodonax** altus*, is not continuous with other outcrops of the Cabrillo Formation (KENNEDY, 1975), and no other age diagnostic fossils have been found there. The specimen from the Rosario Formation on Punta Banda, Baja California, occurs with other mollusks of early Maastrichtian age.

Remarks: STEWART (1930:293) suspected that this species was not a *Pharella,* but did not reassign it. He mistook the anterior for the posterior, indicating that the shell is "produced posteriorly" and that the beaks are prosogyral and anterior to the valve middle. The position of the pallial sinus shows "*Pharella*" *alta* Gabb, 1864, to be anteriorly produced.

Although GABB (1864) did not mention any similarity between *Pharella alta* and *Cultellus australis* Gabb, 1860, described from Chile, the two are similar in shape. *Cultellus australis* has a somewhat more anteriorly elongate shell than *P. alta.* The Chilean species was moved to *Solen*[?] (*Cultellus*) by PHILIPPI (1887), and designated the type species of the new genus *Ceroniola* by WILCKENS (1904: 249, pl. XX, figs. 11a, b, 12, 13). The left hinge of *Ceroniola australis* (Gabb, 1860) (WILCKENS, 1904:pl. XX, fig. 11a; STINNESBECK, 1986: pl. 4, fig. 3) resembles that of ***Adelodonax** altus* except for the presence of posterior laterals in the former. WILCKENS (1904) lacked a complete right valve hinge of *Ceroniola australis,* and STINNESBECK's right valve is also incomplete (1986:pl. 4, fig. 4). STINNESBECK appears to have inadvertently flipped the negatives so that the right and left hinges of *Ceroniola australis* are printed as mirror images (1986:pl. 4, figs. 3, 4). WILCKENS (1904: 249, pl. XX, fig. 13) described a long anterior and a short posterior groove. He considered the posterior groove to be too distant from the valve margin to be a ligament groove. The common preservation of specimens of ***Adelodonax*** in the butterfly position with the nymphs adjacent suggests that the ligament attached the valves here and that the similar groove and nymph structure of *Ceroniola* may have been the site of ligament attachment. The age of *Ceroniola australis* (Gabb), which is from the Quiriquina Formation (WILCKENS, 1904:205; STINNESBECK, 1986) is erroneously given as "U. Tertiary" by Keen (*in* MOORE, 1969:N609). PHILIPPI (1887) referred the Quiriquina beds to the Unter Tertiaren, but the Quiriquina beds were regarded as Cretaceous by WILCKENS (1904) and are presently considered to be of Maastrichtian age (STINNESBECK, 1986; RICCARDI, 1987:table III). Thus the type species, *Ceroniola australis* is from the same stage as ***Adelodonax** altus* (Gabb).

Specimens of ***Adelodonax** altus* are usually poorly preserved, in part because the shells are thin and in part because the sandstone matrix in which they occur is porous and subjects them to leaching. The best specimens are from the Great Valley Series near Martinez and Deer Valley, Contra Costa Co. The specimens from the Cabrillo Formation on Mt. Soledad, San Diego Co., are mainly molds in a coarse, mica-rich sandstone matrix. Despite the coarse-grained matrix, latex pulls provide hinge details (Figures 36, 37, 39–41). Well preserved specimens are also present in hard sandstone of the Rosario Formation on the north side of Punta Banda, Baja California, Mexico (UCLA loc. 7137), associated with a diverse bivalve and gastropod fauna (SAUL, 1970) that is probably of early Maastrichtian age.

Superfamily MACTRACEA Lamarck, 1809

DALL (1898:910) placed the genus *Mactropsis* Conrad, 1854, in the Mesodesmatidae, apparently because of its thick shell, as he stated (1898:907–908) that fossil species of Mesodesmatidae might be distinguished from the mactrids by their excessive solidity and thickness of their valves rather than by any clearly marked differential characters. He did not, however, exclude certain other thick shelled forms from the Mactridae, *e.g., Pseudocardium* Gabb, 1866. Keen (*in* MOORE, 1969:N610) and BEU (1971) retained *Mactropsis* in the Mesodesmatidae, but PALMER & BRANN (1965:190) included it in the Mactridae, a placement with which I concur.

DALL (1895:910–911) considered *Mactropsis* an ancestral mesodesmatid, and he stressed the more primitive features of its hinge with respect to the hinge of Recent *Mesodesma.* In addition to the features described by Dall, *Mactropsis* has left valve laterals AII and PII that are strongly striated on both sides and right valve laterals that are strongly striated on one face, AI and PI on their dorsal face and AIII and PIII on their ventral face. These laterals resemble those of *Spisula.* Anterior lateral AI is not bimodal and shows no inclination toward the formation of an incipient cardinal 1 (Figure 3). The tensilifer and resilifer, which are not separated by a shelly partition, are of equal length, but the resilifer is approximately three times as wide as the tensilifer. The tensilifer is on the inner slope of the valve margin but exteriorly exposed in a narrow wedge just behind the beak. Figures 43 and 44 are of the hinge of the type species of *Mactropsis, Erycina aequorea* Conrad, 1833 (by subsequent designation, DALL, 1895).

In Recent species of *Mesodesma* the tensilifer is in a more external position than is that of *Mactropsis.* The tensilifer of *Mesodesma donacium* is a wide-based triangle with the dorsal side external and the anterior side internal and set off from the resilifer by the steeply depressed posterior side of the resilifer (Figures 50, 51). In *Mesodesma* (*Ceronia*) *arctatum* the tensilifer is smaller relative to the resilifer and set off from the resilifer by the overhanging edge of the deeply depressed posterior side of the resilifer (Figures 45, 46). In addition, *Mesodesma donacium* has


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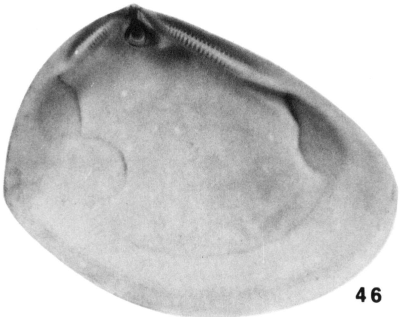
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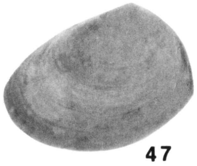
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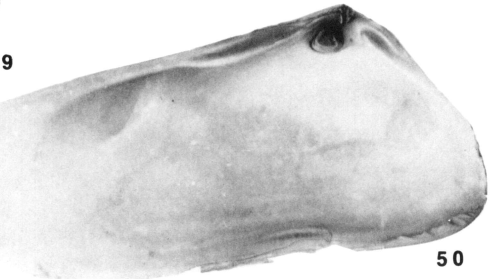
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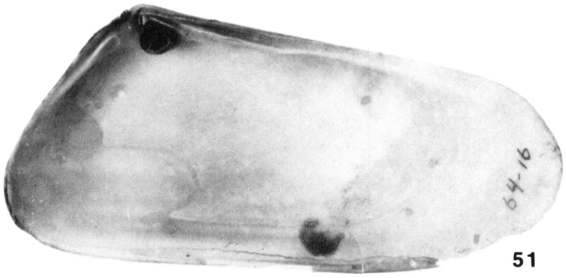
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Explanation of Figures 42 to 52

Figures 42–44. *Mactropsis aequorea* (Conrad, 1833) from LACMIP loc. 5659, hypotypes. Figures 42, 43: LACMIP 7860, left valve, ×2; Figure 42, exterior; Figure 43, interior (see Figure 3 for labeling of teeth). Figure 44: LACMIP 7859, interior right valve, ×3 (see Figure 3 for labeling of teeth).

Figures 45–49. *Mesodesma* (*Ceronia*) *arctatum* (Conrad, 1830) from Hampton Harbor, New Hampshire, hypotypes. Figures 45, 48, 49: LACM 104120, right valve; Figure 45, interior, ×2 (see Figure 3 for labeling of teeth); Figure 48, exterior, ×1; Figure 49, posterior, ×1. Figures 46, 47: LACM 104121, left valve; Figure 46, interior, ×2 (see Figure 3 for labeling of teeth); Figure 47, exterior, ×1.

Figures 50–52. *Mesodesma donacium* (Lamarck, 1818) from Iquique, Chile, hypotypes, ×1. Figure 50: LACM 64-16.1, right valve interior (see Figure 3 for labeling of teeth). Figures 51, 52: LACM 64-16.2, left valve; Figure 51, interior (see Figure 3 for labeling of teeth); Figure 52, exterior.

bimodal anterior lateral teeth AII and AI that exhibit a tendency to form incipient cardinals 2a and 1.

Califadesma gen. nov. provides a more likely progenitor for the hinge of *Mesodesma* than does that of *Mactropsis*. The laterals of ***Califadesma*** are already bimodal, as are those of *Mesodesma* but not those of *Mactropsis*. ***Califadesma*** has a relatively larger resilifer that extends to the hinge plate margin and the tensilium was behind nymphs. The seat of the tensilium of *Mactropsis* is more internal than that of either ***Califadesma*** or *Mesodesma* and, although it might have migrated inward from a similar ancestral position, it would have had to remigrate to a more external position were *Mactropsis* ancestral to *Mesodesma*. Inward migration of tensilium and resilium is characteristic of mactrids (SAUL, 1973), and the tensilifer position of *Mesodesma* can be derived from that of ***Califadesma*** by inward repositioning that includes loss of the nymph. The overall shape of *Mactropsis* is trigonal with the beaks located anterior to the midpoint (Figure 42) rather than donaciform with posteriorly placed beaks as are ***Califadesma*** and *Mesodesma*.

DALL (1898:907) noted that no shell characters unequivocally differentiate the Mesodesmatidae from the Mactridae, but ***Califadesma*** is sufficiently similar to *Meso-*

desma to be a mesodesmatid. *Mactropsis* falls not between ***Califadesma*** and *Mesodesma* in morphologic features, as its age might suggest, but is more similar in shape and hinge features to typical *Spisula* than to *Mesodesma.* The more trigonal mesodesmatids, such as *Paphies* Lesson, 1831, have smooth rather than the striated laterals of *Mactropsis.* As there are a number of relatively thick shelled mactrids including *Spisula solida* (Linnaeus, 1758), the thick shell of *Mactropsis* provides insufficient reason for placing this genus in the Mesodesmatidae.

Myadesma Clark, 1922, comprises four Pacific Slope species of Eocene to Miocene age: *M. eocenica* Clark, 1938; *M. howei* Clark, 1922 (Figures 85, 86); *M. dalli* Clark, 1922, type species by original designation (Figures 79–84); and *M. pacifica* (Hall & Ambrose, 1916), originally described as a *Mesodesma* (Figure 78). *Myadesma* has been included in Mesodesmatidae (Keen *in* MOORE, 1969) or in Myadesmatidae (CLARK, 1922; BEU, 1971). Myadesmatidae has been considered related to Mesodesmatidae of the Veneroida (BEU, 1971), Myidae of the Myoida (CLARK, 1922; HICKMAN, 1969), or Periplomatidae of the Pholadomyoida (CLARK, 1922). *Myadesma* resembles *Mesodesma* in its cuniform shape with the beaks near the posterior end, in having a well-marked, shallow pallial sinus (Figure 78), and in having anteriorly directed resilifers. The resilifers differ greatly from those of *Mesodesma* in that the resilifer of the left valve protrudes beyond the plane of the commissure (Figures 79, 81–84, 86) and that of the right valve is correspondingly sunken and lies against the valve (Figures 82, 83). The shape and position of the resilifers were seen by CLARK (1922) as similar to those of Myidae. Additionally, within the resilifer of the left valve, CLARK (1922) recognized a lithodesma that indicated to him a close relationship to Periplomatidae, and he suggested that Myidae should be included among anomalodesmaceans because of these similarities. Preservation of the type material is such that it is difficult to determine whether or not the lithodesma is in part fused to the dorsal side of the resilifer in the left valve; CLARK (1922) said cemented. BEU (1971) indicated that it is fused to the resilifer of the left valve (Beu says "right valve," but he consistently uses right for left in his discussion of *Myadesma*). Matrix fills a narrow space between the resilifer and the lithodesma, but there is no well-demarked boundary between the posterodorsal half of the lithodesma and the ridge bounding the resilifer on its dorsal side. The hinge has been well described by CLARK (1922); its structures do not resemble those of mactraceans. Not mentioned in any description is the consistent foramen in the beak of the right valve (Figures 82, 83). Similar wear holes are present in the pholadomyoid families Myochamidae, Periplomatidae, and Thraciidae. Such holes are not present in mactraceans or myaceans. I concur with CLARK (1922) and BEU (1971) in placing this genus in the family Myadesmatidae Clark, 1922, and assign the family to the order Pholadomyoida Newell, 1965, and the superfamily Pandoracea Rafinesque, 1815.

Family MESODESMATIDAE Gray, 1840

The shells of the Mesodesmatidae are said to differ from those of the Mactridae in being disproportionately heavy (Keen *in* MOORE, 1969), but several genera with heavy shells are included in the Mactridae (*e.g., Spisula, Pseudocardium*), and some species of *Mesodesma* (*e.g., M. mactroides*) do not have a heavy shell. The siphons differ in the two families: those of Mesodesmatidae are naked and nearly or completely separated whereas in the Mactridae the siphons are united to their tips. As in the Mactridae, mesodesmatid hinges are arcticoid. KALISHEVICH (1967) incorrectly states that the resilifer of Mesodesmatidae is situated between the cardinal teeth, before cardinal 4b of the left valve. The resilifer of Mesodesmatidae is, however, placed as in Mactridae and is behind all cardinal teeth (see Figures 3, 45, 46, 50, 51) in both valves. In both Mactridae and Mesodesmatidae the cardinals are commonly crowded by the progressive enlargement and forward migration of the resilifer (SAUL, 1973). The resilifer has rotated far forward in such mesodesmatid species as *Mesodesma donacium* and *M.* (*Ceronia*) *arctatum,* and the insignificant, fragile cardinal teeth are both readily overlooked and easily broken off, but in both valves all cardinals are on the anterior side of the resilifer. Typical mesodesmatids with striated laterals are compressed, cuneiform, and only moderately heavy. In the group with smooth laterals, which includes *Paphies,* the shell is more or less compressed, more commonly trigonal than cuneiform, and usually heavy.

The *Treatise on Invertebrate Paleontology* does not list Mesodesmatidae as being present in the Cretaceous, although *Ceroniola* Wilckens, 1904, is included by Keen (*in* MOORE, 1969:N609) in this family. *Ceroniola* does not have mactroid hinge teeth. If it has a resilifer and is not related to ***Adelodonax,*** it may belong in the Quenstedtiidae.

Typical *Mesodesma* Deshayes, 1832, ranges from Pliocene to Recent (HERM, 1969); its subgenus *Ceronia* Gray, 1853, is known from Miocene to Recent (BEU & ROOIJ-SCHUILING, 1982). *Donacilla* (*Mesodesma*) *sakhalinensis* Kalishevich, 1967, of late Eocene age differs from *Mesodesma* in lacking striations on its laterals and a posterior lateral in the left valve. If KALISHEVICH (1967:fig 2c) is correct and cardinal 4b is on the posterior side of the resilifer, *D.* (*M.*) *sakhalinensis* is not a mesodesmatid. Its affinities cannot be determined from the published figures.

Genus ***Califadesma*** Saul, gen. nov.

Type species ***Califadesma elafium*** Saul, sp. nov.

Diagnosis: A mesodesmatid with the resilifer posteriorly slanted and the two cardinal teeth on the hinge plate. Posteriorly the shell has a double siphonal fold.

Description: *Donax*-shaped bivalves of small size with sturdy shells, externally smooth except for fine growth lines. Valves elongate and compressed anteriorly, truncated