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Part N
VOLUME 2 (OF 3)
MOLLUSCA 6
BIVALVIA

By †L. R. COX, N. D. NEWELL, D. W. BOYD, C. C. BRANSON, RAYMOND CASEY, ANDRÉ CHAVAN, A. H. COOGAN, COLETTE DECHASEAUX, C. A. FLEMING, FRITZ HAAS, L. G. HERTLEIN, E. G. KAUFFMAN, A. MYRA KEEN, AURÈLE LAROCQUE, A. L. MCALESTER, R. C. MOORE, C. P. NUTTALL, B. F. PERKINS, H. S. PURI, L. A. SMITH, T. SOOT-RYEN, H. B. STENZEL, E. R. TRUEMAN, RUTH D. TURNER, and JOHN WEIR

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PART N
BIVALVIA

By †L. R. Cox, N. D. Newell, D. W. Boyd, C. C. Branson, Raymond Casey, André Chavan, A. H. Coogan, Colette Dechaseaux, C. A. Fleming, Fritz Haas, L. G. Hertlein, E. G. Kauffman, A. Myra Keen, Aurèle LaRocque, A. L. McAlester, R. C. Moore, C. P. Nuttall, B. F. Perkins, H. S. Puri, L. A. Smith, T. Soot-Ryen, H. B. Stenzel, E. R. Trueman, Ruth D. Turner, and John Weir

VOLUME 2

Subclass HETERODONTA Neumayr, 1884

[*nom. transl.* Newell, 1965 (*ex* Heterodonta Neumayr, 1884; unspecified higher category)] [Diagnosis by N. D. Newell]

Mantle lobes more or less joined and usually possessing developed siphons; cardinal area commonly present, prosodetic or divided into lunule and escutcheon; ligament opisthodetic, with or without separate resilium; without lithodesma and rarely with external accessory shelly pieces; nepionic stage usually without taxodont provinculum or adult byssus; generally possessing hinge plate and teeth differentiated into distinct cardinals and laterals; shell structure crossed lamellar, complex, or prismatic, never nacreous; gills eulamellibranchiate. *M.Ord.-Rec.*

Order VENEROIDA H. Adams & A. Adams, 1856

[*nom. correct.* Newell, 1965 (*pro* order Veneracea H. & A. Adams, 1856)] =[Heterodonta auctt. *(partim)*] [Diagnosis by N. D. Newell]

Commonly equivalve, isomyarian; dentition differentiated into standardized cardinals and laterals, or few cardinals only; posterior laterals, where present, lie entirely behind ligament; anterior laterals, if present, formed early in ontogeny by separation from cardinals of anterior part of hinge lamellae; habit active or nestling, rarely sedentary burrowers, or sessile. *M.Ord.-Rec.*

Superfamily BABINKACEA Horný, 1960

[*nom. transl.* McAlester, 1965, *ex* Babinkidae Horný, 1960]

Characters of family. *M.Ord.*

Family BABINKIDAE Horný, 1960

[Materials for this family prepared by A. L. McAlester, Yale University]

Shell anteriorly expanded, compressed; two small cardinal teeth in LV, one large cardinal tooth in RV; elongate, subequal adductor muscle scars, eight rounded pedal muscle scars in line between top of adductors; pallial line nonsinuate. *M.Ord.*

Babinka Barrande, 1881 (p. 31) [**B. prima*; OD]. Characters of family. *M.Ord.*, Eu.(Czech.).—Fig. E1,*1*. **B. prima*; Czech.(Osek); *1a*, LV int. mold, ×2.7 (Newell, n); *1b,c*, LV and RV hinges, latex casts, ×2.7 (McAlester, n).

Superfamily LUCINACEA Fleming, 1828

[*nom. transl.* Anton, 1839 (*ex* Lucinidae Fleming, 1828] [Materials for this superfamily prepared by André Chavan, Seyssel (Ain), France]

Shell generally equivalve, subcircular to oval or subtrigonal; commonly smooth externally or concentrically sculptured on internal layer of straight radial ribs, many genera with two dorsal folds which delimit anterior and posterior areas; beaks normally small, prosogyrous to orthogyrous; lunule generally more extended on RV; escutcheon ill-defined. Hinge with typical tooth formula *3a, 3b/2, 4b,* but *3a* may be obliterated, lateral laminae (if present) duplicate in LV only; integripalliate. Animal with more or less elongate to vermiform foot, rudimentary labial palps, and one or two siphonal apertures. [Marine or estuarine.] *Sil.-Rec.*

The alphabetically arranged generic descriptions in each family-group division of the Lucinacea are

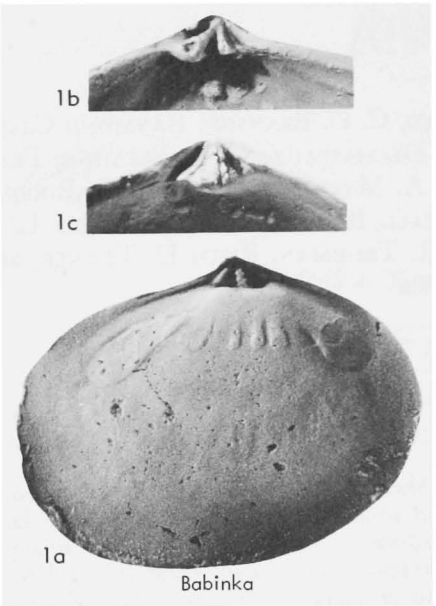


FIG. E1. Babinkidae (p. *N*491).

accompanied by numbers inclosed by square brackets. Such numbers indicate position in the sequence of generic taxa given with the respective families or subfamilies for the purpose of recording CHAVAN's arrangement, designed to reflect "natural relationships" of these taxa as inferred by him.

Family LUCINIDAE Fleming, 1828

[*nom. correct.* D'ORBIGNY, 1837 (*pro* Lucinadae FLEMING, 1828)]

Subcircular to ovate or trapezoidal in outline, shell commonly thickened, concentric sculpture tending to be irregular, strong ribs alternating with weaker ones, radial ribs (if present) stronger laterally; lunule more or less asymmetrical. Hinge with two cardinals, anterior right covered in some, lateral laminae commonly duplicate in LV; ligament marginal to inframarginal, without separated resilium; shell internally more or less punctate or grooved; anterior adductor scar with ventral extension separate from pallial line, forming moderately to strongly divergent or elongate digitation. Margin crenate or smooth. *Sil.-Rec.*

Subfamily LUCININAE Fleming, 1828

[*nom. transl.* CHAVAN, herein (*ex* Lucinidae FLEMING, 1828)]

Shell generally solid, more or less lenticular, convex, with concentric and commonly radial sculpture. Anterior scars short. *L. Jur.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Lucina.*——2. *Lucinisca.*——3. *Recurvella.*——4. *Volupia.*——5. *Here.*——6. *Herella.*——7. *Linga.*——8. *Illesca.*——9. *Pleurolucina.*——10. *Bellilucina.*——11. *Parvilucina.*——12. *Cavilinga.*——13. *Microloripes.*——14. *Callucinella.*——15. *Callucina.*——16. *Pseudolucinisca.*——17. *Striolucina.*——18. *Callucinopsis.*——19. *Barbierella.*——20. *Pillucina.*——21. *Wallucina.*——22. *Loripes.*——23. *Nevenulora.*——24. *Jagonoma.*——25. *Megaxinus.*——26. *Pteromyrtea.*——27. *Ctena.*——28. *Talocodakia.*——29. *Epicodakia.*——30. *Luciniola.*——31. *Codakia.*——32. *Epilucina.*——33. *Cavilucina.*——34. *Mesolinga.*

Lucina BRUGUIÈRE, 1797 [**Venus jamaicensis* SPENGLER, 1784; SD GRAY, 1847] [*non Lucina* LAMARCK, 1799] [=*Egraca* LEACH in GRAY, 1852 (obj.); *Dentilucina* P. FISCHER, 1887 (obj.); *Phacoides* AGASSIZ, 1845]. Medium-sized to large, subtrapezoidal, more or less flattened, with well-marked dorsal areas; sculpture of somewhat evenly spaced concentric lamellae with some areas smoother than remainder of disc. Cardinals two, straight, *3a* obsolete, *3b* and *4b* oblique and compressed, laterals with posterior ones distant; anterior scars elongate; inner shell margin with fine crenulations which tend to vanish. *U.Cret.-Rec.,* Eu.-Afr.-Asia-N.Am.

L. (Lucina) [1] [=*L. (Lepilucina)* OLSSON, 1965 (type, *L. (L.) gratis;* OD)]. Concentric lamellae well spaced, stronger posteriorly; dorsal areas clearly marked; lunule asymmetrical, elongate, narrow. Cardinals oblique, somewhat weakened; anterior scars distant from pallial line; inner margin feebly crenulate. *U.Cret.-Rec.,* Eu.-Afr.-Asia.——FIG. E2,*6*. **L. (L.) jamaicensis* (SPENGLER), Rec., USA(Fla.); *6a-c,* LV and RV hinges, LV ext., ×0.8 (*513,* Perry).

L. (Lucinisca) DALL, 1901 [2] [**L. nassula* CONRAD, 1846; OD]. Sculpture reticulate, posterior area less distinct than anterior; lunule somewhat depressed, slightly asymmetrical. Cardinals well marked; anterior scars elliptical, in part close to pallial line; inner margin strongly dentate. *Mio.-Rec.,* N.Am.-Asia(Japan-Philip.).——FIG. E2,*5*. **L. (L.) nassula* CONRAD, Rec., USA(Fla.); LV ext., ×1.5 (Perry).——FIG. E2,*8*. *L. (L.) cribraria* SAY, Mio., USA(S.Car.); *8a,b,* LV int., RV int., ×3.6 *(98)*.

Barbierella CHAVAN, 1938 [19] [**Lucina barbieri* DESHAYES, 1858;[1] OD]. Small, subtrigonal, sculpture strong, cancellate, with well-marked posterior

[1] New taxa introduced by DESHAYES in 1858 as indicated by first publication of descriptions are not correctly cited, as by some authors, as 1857, when plates alone were published. The names without accompanying descriptions used in 1857 were *nomina nuda.* Likewise, names of taxa used by DESHAYES on plates published in 1858 are correctly cited as 1860, when descriptions first were given.

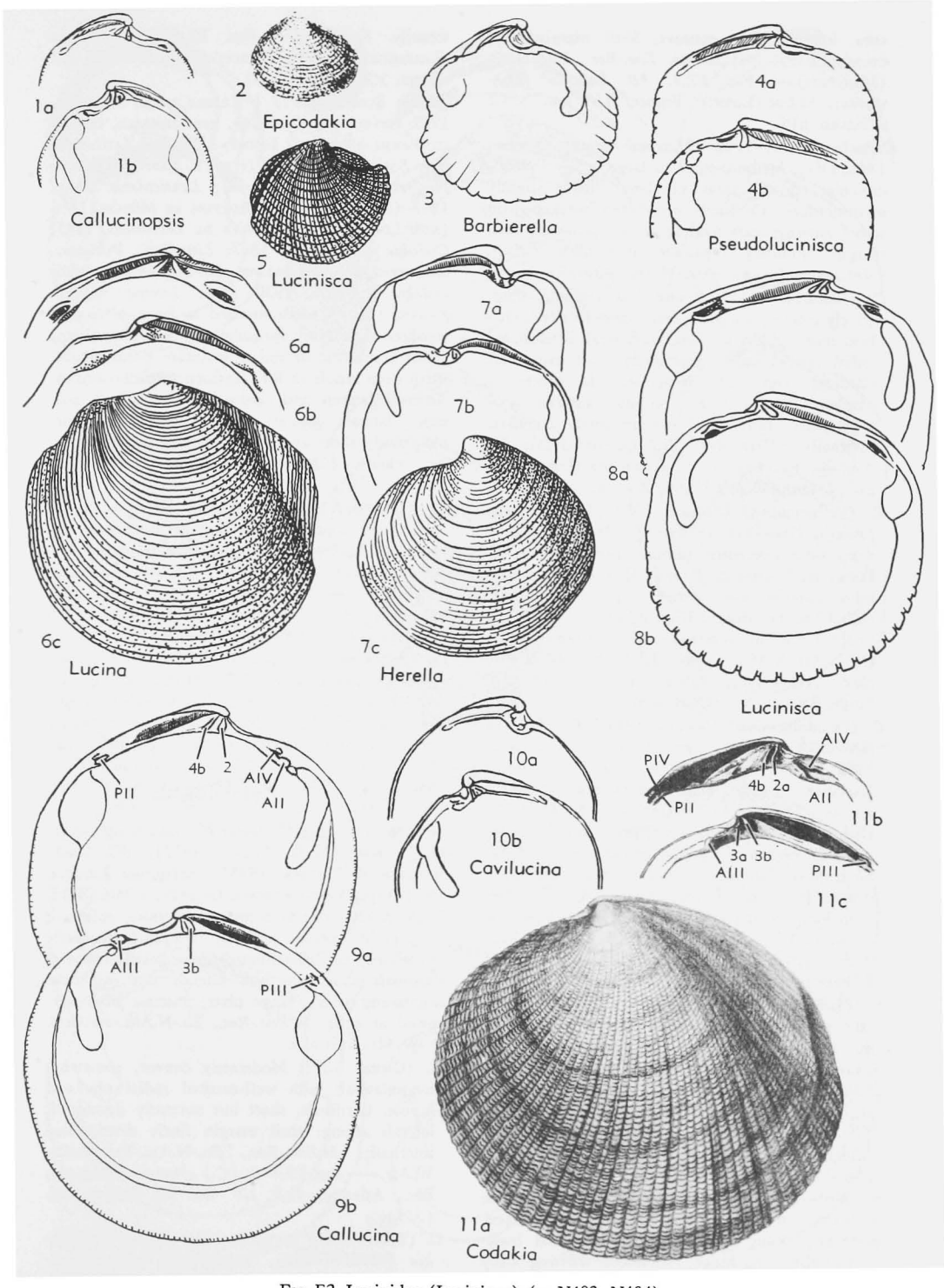


FIG. E2. Lucinidae (Lucininae) (p. *N*492, *N*494).

area; lunule deeply concave. Shell margin with broad internal undulations. *Eoc.-Rec.*, Eu.-Ind.O. (Mauritius).——Fig. E2,*3*. **B. barbieri* (Deshayes), M.Eoc.(Lutet.), France; LV int., ×3.2 (Chavan, n).

Callucina Dall, 1901 [**Lucina radians* Conrad, 1841; OD]. Medium-sized to large, generally suborbicular, dorsal areas obsolete; lunule slightly asymmetrical. Cardinals broad but weakened in some; anterior scars tending to be narrowed; shell margin minutely crenulate internally. *L.Cret.(Apt.)-Rec.*, Eu.-Afr.-Asia-N.Am.-Australia.

C. (Callucina) [15]. Rounded to trigonal, moderately convex; sculpture concentric, locally lamellose, more or less marked, with weak intercalated radial ribs; lunule asymmetrical, not excavated. Cardinals commonly weakened, *3a* practically obsolete; laterals distant, minute; anterior scars moderately short; shell margin finely crenulate internally. *L.Cret.(Apt.)-Rec.*, Eu.-Afr.-N.Am.-W. Asia.——Fig. E2,*9*. *C. (C.) hoernesi* (Deshayes), Eoc, France; *9a,b*, LV int., RV int., ×2.8 *(98)*.

C. (Callucinopsis) Chavan, 1959 [18] [**Lucina foucardi* Deshayes, 1858; OD]. Moderately convex; dense concentric ribbing; lunule excavated. Hinge teeth present, *3a* and *A1* approximate; *3b* bifid; anterior scars rather long, subparallel to pallial line but distant from it; shell margin very finely denticulate internally. *U.Cret.(Senon)-Rec.*, Eu.-N.Afr.-E.Afr.——Fig. E2,*1*. **C. (C.) foucardi* (Deshayes), Paleoc., France; *1a,b*, LV hinge, RV int., ×2 (Chavan, n).

C. (Pseudolucinisca) Chavan, 1959 [16] [**Lucina lacteola* Tate, 1897 (*pro. L. lactea* A. Adams, 1855 (*non Tellina lactea* Poli, 1795=*L. lactea* Lamarck, 1818) (=*L. concentrica* Adams & Angas, 1863, *non* Lamarck, 1806); OD]. Globose, with reticulate sculpture; lunule asymmetrical excavated, partly obliterating tooth 2; *3b* trigonal, laterals lacking; anterior scars short, distant from pallial line; inner margin of shell with long crenulations. *Oligo.-Rec.*, Eu.-Australia. ——Fig. E2,*4*. **C. (P.) lacteola* (Tate), Rec., Australia; *4a,b*, LV and RV hinges, ×0.6 (Chavan, n).

C. (Striolucina) Sacco, 1901 [17] [**Dentilucina (S.) persolida*; OD]. Large, convex, with irregular lamellose concentric ribs; lunule elongate, ligament broad. Hinge with cardinals and feeble laterals; anterior scars long, moderately narrow; shell margin finely crenulated internally. *Eoc.-Plio.*, S.Eu.

Cavilucina P. Fischer, 1887 [33] [**Lucina sulcata* Lamarck, 1806 (1808); OD]. Rather small, rounded-oblong, thick, somewhat inflated; surface with concentric strong ribs; lunule deeply sunken, projecting below along hinge margin and backward, obliterating hinge; escutcheon wanting. Only anterior laterals developed; anterior scars short, very divergent, narrow; shell margin smooth internally. *Eoc.*, Eu.——Fig. E2,*10*. **C. sulcata* (Lamarck), M.Eoc., France; *10a,b*, LV and RV hinges, ×2.4 (Chavan, n).

Codakia Scopoli, 1777 [**Chama codak* Adanson, 1757 (*errore pro C. codok*, pre-Linnaean, invalid =**Venus orbicularis* Linné, 1758; M] [=*Lentillaria* Schumacher, 1817 (type, *L. punctata*=*Venus punctata* Linné, 1758; M); *Lenticularia* Gray, 1847 (missp.); *Chama* Martini in Mörch, 1853 (*non* Linné, 1758); *Antilla* de Gregorio, 1885; *Codokia* P. Fischer, 1887; *Lintellaria* Bucquoy, Dautzenberg, & Dollfus, 1898 (missp.); *Pexocodakia* Iredale, 1930 (type, *Lucina rugifera* Reeve, 1850)]. Medium-sized to large, lenticular, compressed, slightly inequilateral, no differentiated areas; concentric or radial sculpture predominant; small deep lunule in RV; ligament broadly sunken. Anterior laterals and cardinals well marked, posterior laterals obsolete or small; anterior scars moderately short and broad, divergent; shell margin smooth. *U.Jur.-Rec.*, Eu.-Am.-Asia-Australia-Pac.

C. (Codakia) [31]. Generally large, sculpture reticulate; lunule small, very asymmetrical, depressed; ligamentary groove broad. Posterior laterals obsolete. *Paleoc.-Rec.*, Eu.-Am.-Asia-Australia-Pac.——Fig. E2,*11*. **C. (C.) orbicularis* (Linné), Rec., W.Indies; *11a*, LV ext., ×0.8 (Reeve); *11b,c*, LV and RV hinges, ×0.5 *(513)*.

C. (Epilucina) Dall, 1901 [32] [**Lucina californica* Conrad, 1837; OD]. Medium-sized, with concentric sculpture only; lunule rather large, asymmetrical; ligamentary groove of moderate extent. Posterior laterals small. *U.Jur.-Rec.*, Eu.-N.Am.——Fig. E3,*13*. **C. (E.) californica* (Conrad), Rec., USA(Calif.); *13a,b*, LV int., RV int., ×1.7 *(98)*.

Ctena Mörch, 1861 [**Lucina pectinata* Carpenter, 1857 (*non* C. B. Adams, 1852); SD Dall, Bartsch & Rehder, 1938] [=*Jagonia* Recluz, 1869 (type, *Venus eburnea* Gmelin, 1790; OD)]. Transversely ovate to elliptical, anteriorly enlarged, compressed; beaks pointed; sculpture regularly reticulated; no differentiated areas; lunule concave. Cardinals short or thin, laterals not duplicate, originating under hinge plate; anterior scars narrowed at ends. *M.Eoc.-Rec.*, Eu.-N.Am.-Pac.-Ind. O.-W.Afr.-Australia.

C. (Ctena) [27]. Moderately convex, somewhat inequilateral, with well-marked radial ribs and lunule. Cardinals, short but normally developed, laterals strong; shell margin finely denticulated internally. *M.Eoc.-Rec.*, Eu.-N.Am.-Pac.-IndO.-W.Afr.——Fig. E3,*3*. *C. (C.) eburnea* (Gmelin), Rec., Atlantic; *3a,b*, LV and RV hinges, enl. *(513)*.

C. (Talocodakia) Iredale, 1936 [28] [**Epicodakia kennethi*; OD]. Compressed, very inequilateral, radial riblets at ends only; lunule obsolete; ligamentary groove shallow. Cardinals small,

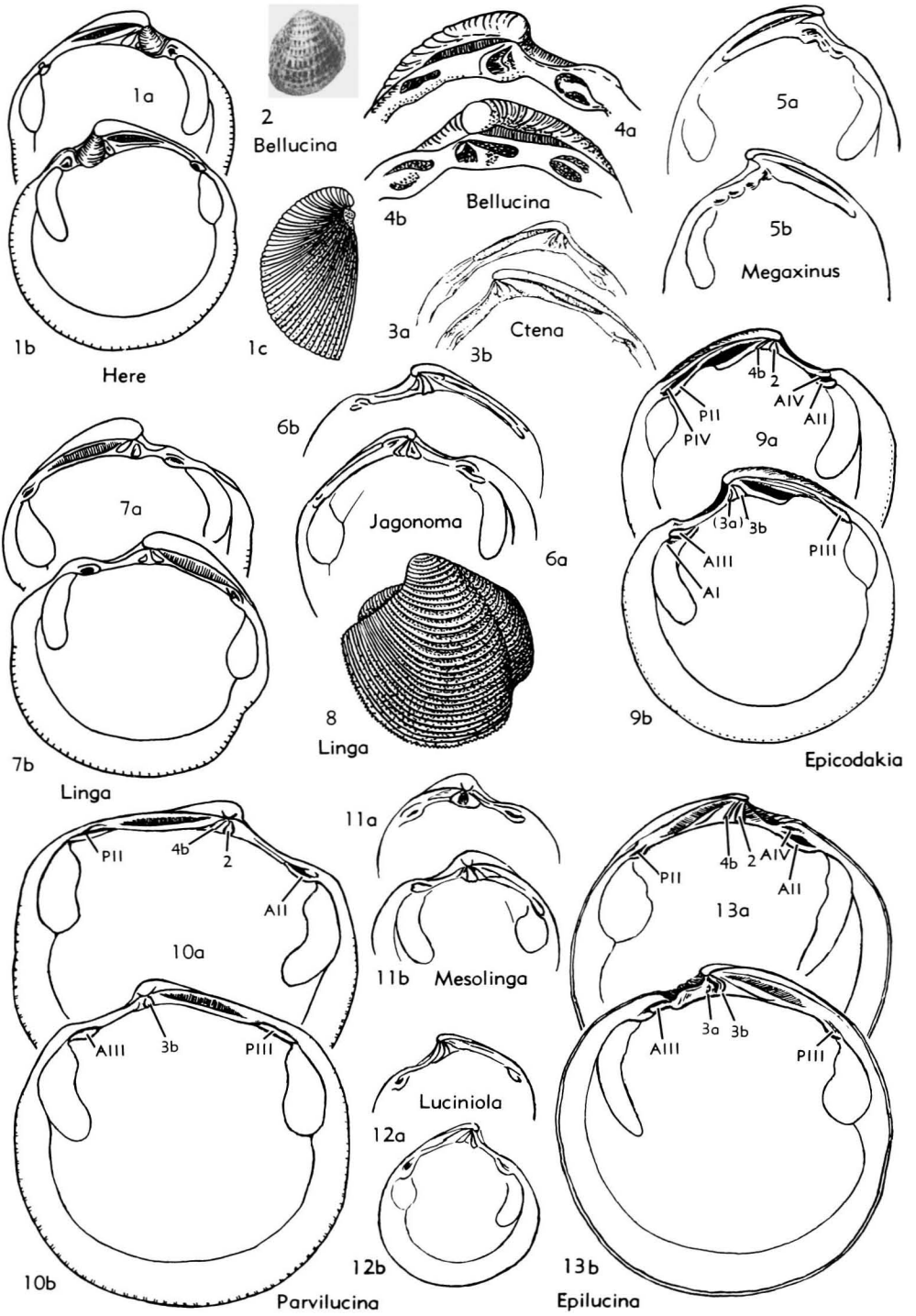


FIG. E3. Lucinidae (Luciininae) (p. *N*494, *N*496, *N*498).

laterals small, distant; anterior scars short, reniform, moderately divergent; shell margin smooth internally. *Oligo-Rec.,* Australia.

Epicodakia IREDALE, 1930 [29] [**E. consettiana* (=*Lucina minima* TENISON-WOODS, 1876, *non* ROEMER, 1836); OD]. Compressed, transversely elliptical to ovate, anteriorly enlarged; with dichotomous radial ribs predominating over concentric ribs; ligament in deep groove. Cardinals and laterals well marked, latter duplicate on LV; anterior scars elliptical, divergent, rounded at ends; marginal internal crenulations of shell almost obsolete. *Pleist.-Rec.,* Australia-N.Am.-Asia.——FIG. E3,*9*. *E. divergens* (PHILIPPI), Rec., Japan; *9a,b,* LV int., RV int., ×2.3 (*119,* mod.).——FIG. E2,*2*. **E. consettiana,* Rec., Australia; LV ext., ×1.35 (Iredale).

Here GABB, 1866 [**Lucina (H.) richtofeni* (=**Lucina excavata* CARPENTER, 1857); SD STOLICZKA, 1871]. Medium-sized to small, rounded, with weak anterior and posterior areas; concentric ribs tending to vanish; lunule deeply excavated, covering part of hinge; anterior scars somewhat short, attenuated; internal shell margin with minute denticles. *Paleoc.-Rec.,* W.Eu.-W.N.Am.-N.Afr.

H. (Here) [5]. Concentric ribs fine, but well-marked; lunule rather broadly rounded, obliterating only anterior cardinal, posterior ones well marked; anterior laterals minute, posterior laterals distant; anterior scars divergent at their ends; internal shell margin finely crenulated. *Eoc.-Rec.,* W.Eu.-W.N.Am.——FIG. E3,*1*. **H. (H.) excavata* (CARPENTER), Mio., USA(Calif.); *1a,b,* LV int., RV int., ×2.25; *1c,* LV ext., ×1.5 (*98*; Gabb, 1869).

H. (Herella) CHAVAN, 1942 [6] [**Lucina levesquei* D'ORBIGNY in DESHAYES, 1858; OD] [=*?Tuberculina* DE GREGORIO, 1882 *(nom. dub.)*]. Sculpture weakly cancellate; lunule narrow, projecting under beaks, covering obsolete RV cardinals, those of LV tuberculiform; laterals feeble; anterior scars short, wholly divergent; internal shell margin almost smooth. *Paleoc.-Oligo.,* W.Eu.-N.Afr.——FIG. E2,*7*. **H. (H.) levesquei* (D'ORBIGNY), L.Eoc.(Cuis.), France (Paris basin); *7a-c,* LV int., RV int., LV ext., ×3.6 (Chavan, n; *257*).

Linga DE GREGORIO, 1884 [**Lucina columbella* LAMARCK, 1819; SD SACCO, 1889] [=*Quasilucina* STEWART, 1930 (type, *Lucina carinifera* CONRAD, 1833; OD)]. Medium-sized, rounded, tumid; concentric ribbing more or less lamellose; lunule sunken, short, cordiform. Hinge teeth strong, short, LV laterals duplicate; anterior scars moderately short; shell margin internally denticulated. *?Paleoc., Eoc.-Rec.,* Eu.-Am.-Afr.-Asia-Australia.

L. (Linga) [7]. Rounded; concentric sculpture nearly uniform consisting of numerous equidistant lamellae; dorsal angulation rounded. Hinge teeth *3a* and *2* present; shell margin crenulated internally. *?Paleoc., Eoc.-Rec.,* W.Eu.-W. Afr.-N.Am.-C.Am. —— FIG. E3,*7,8*. **L. (L.) columbella* (LAMARCK) *basteroti* (AGASSIZ), L. Mio.(Burdigal.), France(Gironde); *7a,b,* LV int., RV int., ×1.8; *8,* LV ext., ×0.8 *(98)*.

L. (Bellucina) DALL, 1901 [10] [**Parvilucina eucosmia* DALL, 1901 (=*Lucina pisum* REEVE, Aug. 1850; *non* SOWERBY, 1836; *nec* D'ORBIGNY, 1841; *nec* PHILIPPI, Apr. 1850) (=**Lucina semperiana* ISSEL, 1869); OD] [=*Cardiolucina* SACCO, 1901 (type, *Cardium agassizi* MICHELOTTI, 1847; =*Cardita agassizi* MICHELOTTI, 1839; OD)]. Small, rounded, very tumid; sculpture of heavy concentric ribs, crossed, but not interrupted, by radiating riblets; lunule small, not immersed. Complete lucinoid hinge with *AIV* and *PIV* feebly marked; anterior scars broad, short; shell margin deeply but finely crenulated internally. *M.Eoc.-Rec.,* Eu.-Afr.-Asia(Japan)-Australia.—— FIG. E3,*2,4*. **L. (B.) semperiana* (ISSEL), Rec., Ind.O.; *2,* LV ext., ×1.4 (Reeve); *4a,b,* LV and RV hinges, enlarged *(513)*.

L. (Illesca) OLSSON, 1932 [8] [**Phacoides (Here) andersoni* OLSSON, 1930; OD]. Smaller than *L. (Linga),* with concentric sculpture of strong well-spaced folds. Hinge teeth *3a* and *2* obliterated by totally immersed lunule; anterior scars ovate, short; internal shell margin finely crenulated. *U.Eoc.,* S.Am.(Peru).——FIG. E4,*3*. *L. (I.) andersoni* (OLSSON); *3a,* LV ext., ×2.4; *3b,c,* LV int., RV int., ×3.6, ×4.8 (Olsson, 1932).

L. (Pleurolucina) DALL, 1901 [9] [**Lucina leucocyma* DALL, 1886 (1889); OD] [=*Dallucina* OLSSON & HARBISON, 1953 (type, *Lucina (Here) amabilis* DALL, 1898; OD); *L. (Paslucina)* OLSSON, 1965 (type, *L. (P.) follis*; OD)]. Smaller than *Linga,* oblong, more or less trigonal to quadrate, with sharp dorsal angulation; radial sculpture laterally strong; lunule not immersed. Cardinal *2* larger than *4b*; broadly crenulated to foliated shell margin internally. *Oligo.-Rec.,* C. Am.-N.Am.——FIG. E4,*7a*. *L. (P.) quadricostata* DALL, Mio., Jamaica; LV ext., ×6 *(1005)*.—— FIG. E4,*7b,c*. *L. (P.) undata* (CARPENTER), Rec., Mex.; *7b,c,* LV int., RV int., ×3.6 *(98)*.

Loripes POLI, 1791 [22] [**Tellina lactea* POLI, 1791 (*non* LINNÉ, 1758) (=*Amphidesma lucinalis* LAMARCK, 1818); SD GRAY, 1847] [*non Loripes* SCHWEIGGER, 1820] [=*Ligula* MENKE, 1830 (*non* MONTAGU, 1803); *Lucinida* D'ORBIGNY, 1846 (type, *L. cryptella,=L. brasiliana,=Lucina brasiliensis* PHILIPPI, 1848; OD)]. Lenticular, compressed, somewhat gibbous; sculpture feeble, concentric; areas almost obsolete; ligament internal. Hinge teeth comprising 1 RV cardinal and 2 weak LV laterals; anterior scars subelliptical; internal shell margin smooth. *Oligo.-Rec.,* Eu.-Afr.-S.Am.-Japan.——FIG. E4,*1*. **L. lucinalis* (LA-

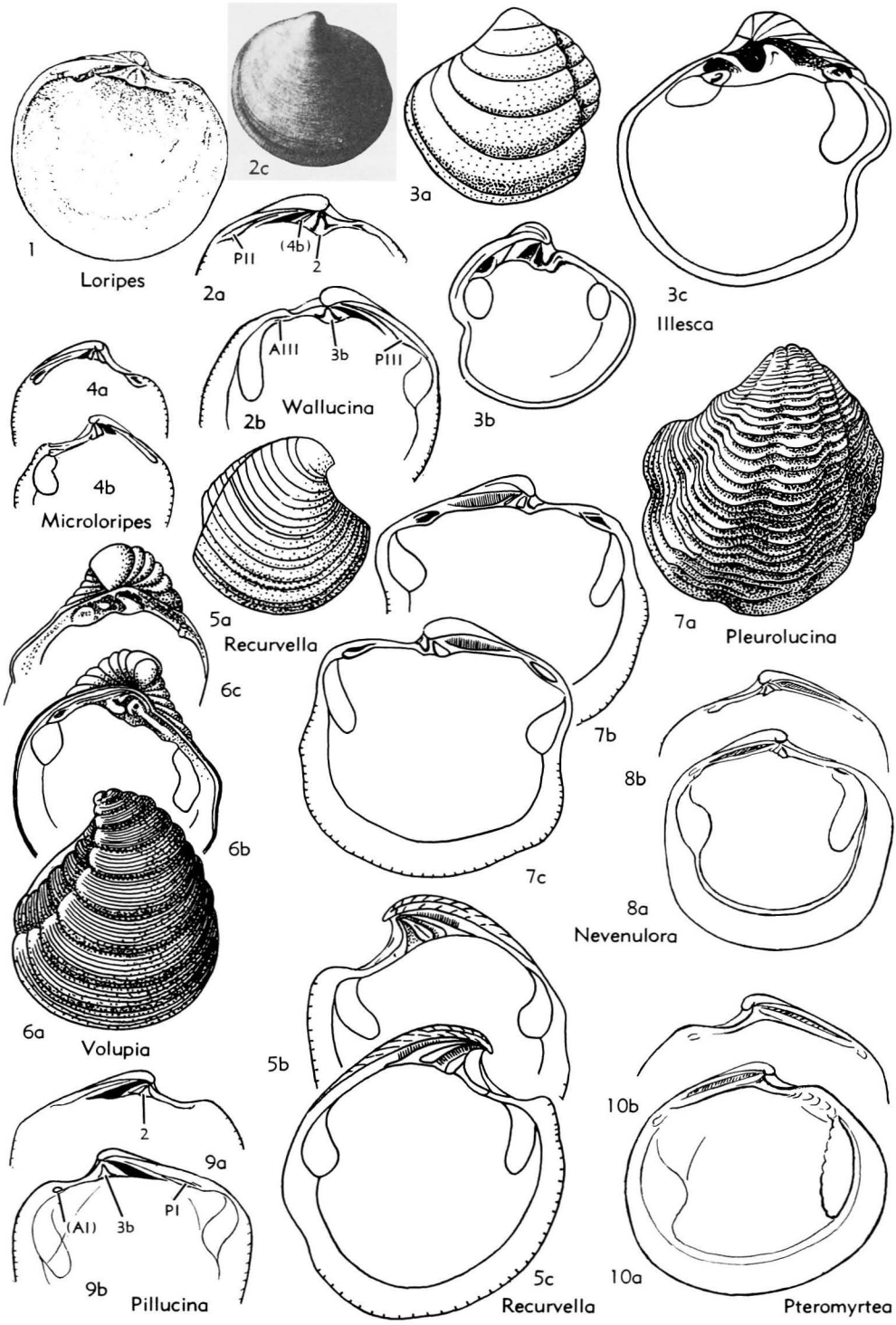


FIG. E4. Lucinidae (Lucininae) (p. *N*496, *N*498-*N*499).

MARCK), Rec., Eng.(Sussex); LV int., ×2.4 *(905a)*.

Luciniola SKEAT & MADSEN, 1898 [30] [**Venus pumila* GOLDFUSS, 1840; OD]. Small, subtrigonal, posteriorly enlarged, moderately convex, thick, with pointed beaks, with coarse concentric sculpture; lunule small. Hinge as in *Epicodakia* but with external ligament; anterior scars subparallel to pallial line. *L.Jur.(U.Lias.)*, Eu.(Ger.-Denm.). ——FIG. E3,*12*. **L. pumila* (GOLDFUSS), Denm.; *12a,b*, RV hinge, LV int., ×3.2 (Skeat & Madsen, 1898).

Megaxinus BRUGNONE, 1880 [**Lucina rostrata* PECCHIOLI, 1864; OD] [=*Stewartia* OLSSON & HARBISON, 1953 (type, *Lucina anodonta* SAY, 1824; OD)]. Irregularly lenticular to oblong compressed; hinge broad, almost edentulous, with remnants of *3b* and *4*; anterior scar broad, juxtaposed to pallial line; shell margin internally smooth. *Paleoc.-Rec.*, Eu.-Am.-N.Z.

M. (Megaxinus) [25]. Very irregular, thickened and gibbous, with ill-defined areas; lunule profoundly penetrating into broad trigonal hinge plate. Anterior scars almost continuous to pallial line. *Oligo.-Rec.*, Eu.-Am.-Red Sea.——FIG. E3, *5*. **M. (M.) rostratus* (PECCHIOLI), Plio., Italy; *5a,b*, LV int., RV int., ×1.6 (Pecchioli, 1864).

M. (Pteromyrtea) FINLAY, 1926 [26] [**Cyclina dispar* HUTTON, 1873 (=*Lucinida laevifoliata* MARSHALL & MURDOCH, 1919); OD]. Thin, rounded, with alate areas; lunule moderately depressed, obliterating anterior cardinals; posterior ones more or less marked; anterior scars wholly contiguous to pallial line. *U.Cret.-Pleist.*, N.Z. ——FIG. E4,*10*. **M. (P.) dispar* (HUTTON), Plio., N.Z.; *10a,b*, LV int., RV int., ×2.2 (Chavan, n).

Mesolinga CHAVAN, 1951 [34] [**Lucina plebeia* CONTEJEAN, 1859 (*non* GIEBEL, 1856) (=**M. typica* CHAVAN, 1952); OD]. Globose, anteriorly produced and rounded, inequilateral; with concentric approximate ribs; ligament marginal, narrow. One right cardinal, 2 left ones, and duplicate right, simple left, tuberculiform laterals; reniform anterior scars narrowed at their end; shell margin internally smooth. *U.Jur.-Cret.*, Eu.-N.Am.-?Asia. ——FIG. E3,*11*. **M. typica* CHAVAN, U.Jur. (Astart.), France(Calvados); *11a,b*, LV int., RV int., ×2.4 (Chavan, n).

Nevenulora IREDALE, 1930 [**Lucinida hilaira* HEDLEY, 1916; OD]. Moderately convex; concentric sculpture of more or less vanishing alternate distant lamellae and finer intercalated striae; lunule well marked. Hinge with cardinals and laterals, both evanescent in some forms; anterior scars moderately short; shell margin smooth internally. *U.Jur.(Raurac.)-Rec.*, Eu.-Australia-N.Z.

N. (Nevenulora) [23]. Irregularly striated, almost smooth, anteriorly angular, posteriorly rounded; lunule moderately concave. Teeth small; anterior scars somewhat divergent. *L.Eoc.-Rec.*, Eu.-Australia.——FIG. E4,*8*. **N. hilaira* (HEDLEY), Rec., Australia; *8a,b*, LV int., RV hinge, ×2 (Chavan, n).

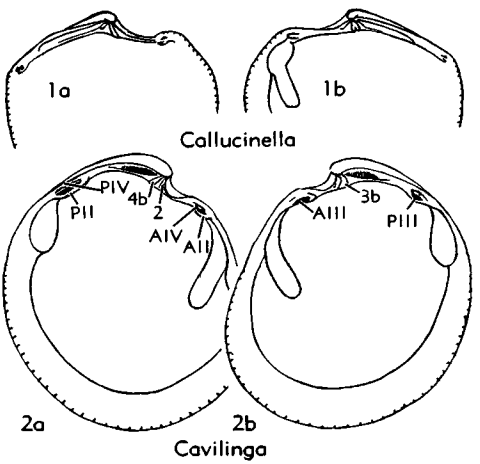


FIG. E5. Lucinidae (Lucininae) (p. *N498-N499*).

N. (Jagonoma) CHAVAN, 1946 [24] [**Lucina circumcisa* ZITTEL & GOUBERT, 1861; OD] [=*Dilora* MARWICK, 1948 (type, *D. lorea*; OD)]. Rounded at both ends; sculpture of alternate stronger and smaller concentric fine ribs. Hinge teeth well developed, *3b* narrow, not bifid; anterior scars not widely diverging. *U.Jur.(Raurac.)-Plio.*, Eu.-N.Z.——FIG. E3,*6*. **N. (J.) circumcisa* (ZITTEL & GOUBERT), Astart., France; *6a,b*, LV int., RV hinge, ×1.6 (Chavan, n).

Parvilucina DALL, 1901 [**Lucina tenuisculpta* CARPENTER, 1864; OD]. Rather small, rounded, inflated, with finely concentric sculpture, radial striae weakening medially, anterior and posterior areas feebly marked. Thin, but almost complete hinge, with *3a* but *AIV* and *PIV* obsolete; anterior scars more or less broad and short. *U.Cret.(Senon.)-Rec.*, Eu.-Afr.-N.Am.-Australia.

P. (Parvilucina) [11]. Sculpture finely reticulate; ligament marginal. Hinge teeth comprising short *3b* and distant laterals; internal shell margin very finely crenulated. *U.Cret.(Senon.)-Rec.*, W.Eu.-N.Am.——FIG. E3,*10*. **P. (P.) tenuisculpta* (CARPENTER), Rec., USA(Calif.); *10a,b*, LV int., RV int., ×4.4 *(98)*.

P. (Callucinella) CHAVAN, 1961 [14] [**Lucina albella* LAMARCK, 1806]. Lenticular, depressed; with fine irregular superficial concentric sculpture; areas obsolete; lunule long; ligament marginal. Hinge teeth comprising broad and bifid *3b* and distant laterals; anterior scars rather narrow, short; internal shell margin feebly crenulated to smooth. *M.Eoc.-Plio.*, W.Eu.-Australia.

——Fig. E5,*1*. **P. (C.) albella* (Lamarck), M. Eoc.(Lutet.), France; *1a,b*, LV and RV hinges, ×2 (Chavan, n).

P. (Cavilinga) Chavan, 1937 [12] [**Lucina trisulcata* Conrad, 1841; OD]. Rounded, trigonal, high, inequilateral, with approximate concentric close ribs and some annular rings; ligament inframarginal; lunule deep. Cardinal *3b* curved, laterals approximate; anterior scars divergent, somewhat elongated. *U.Cret.-Rec.*, W.Eu.-S.Afr.-N.Am.——Fig. E5,*2*. **P. (C.) trisulcata* (Conrad), Mio., USA(Md.); *2a,b*, LV int., RV int., ×6.5 *(98)*.

P. (Microloripes) Cossmann, 1910 (1912) [13] [**Lucina dentata* Defrance, 1823; OD]. Rounded, globose, small; sculpture irregularly concentric; ligament internal, oblique. Anterior scars short; shell margin strongly dentated internally. *?U. Cret.(Senon.), Paleoc-Rec.*, Eu.-W.Afr.——Fig. E4,*4*. **P. (M.) dentata* (Defrance), L.Mio. (Burdigal.), S.France; *4a,b*, LV int., RV int., ×4 (Chavan, n).

Pillucina Pilsbry, 1921 [20] [**P. spaldingi*; OD]. Rounded, moderately convex; sculpture of concentric and radial lines laterally strengthened, medially evanescent. Hinge short, with *2* and *3b* trigonal and one almost obsolete right anterior lateral; anterior scars moderately short; internal margin of shell undulated. *Plio.-Rec.* Australasia-Pac.-Asia-Red Sea.

P. (Pillucina). Lateral tooth *AIII* small; anterior scar rather elongate. *Plio.-Rec.*, Pac.-Asia-Red Sea. ——Fig. E4,*9*. *P. fischeriana* (Issel), Rec., Red Sea; *9a,b*, LV int., RV int., ×5.6 *(98)*.

P. (Sydlorina) Iredale, 1930 [**S. symbolica* (=**Codakia pisidium* Hedley, 1914, *non* Dunker, 1860); OD]. Sculpture stronger than in *P. (Pillucina)*, anterior scar shorter and more rounded, *AIII* rather stout. Rec., Australia-Japan.

Recurvella Chavan, 1937 [3] [**Lucina dolabra* Conrad, 1833; OD]. Small, subtrigonal, compressed, with high, recurved beaks; areas well marked; lunule symmetrical. Hinge high, without laterals; anterior scars short, divergent. *M.Eoc.-Oligo.* or *?Plio.*, W.Eu.-N.Am.-?Asia.——Fig. E4, *5*. **R. dolabra* (Conrad), M.Eoc.(Claiborn.), USA (Ala.); *5a*, RV ext., ×2.4; *5b,c*, RV int., LV int., ×4.8 (*98*; Harris, 1919).

Volupia Defrance, 1829 [4] [**V. rugosa*; OD] [=*Gradilucina* Cossmann, 1902 (type, *Lucina tabulata* Deshayes, 1858; OD)]. Small, oblong, tumid, with prominent curved beaks; sculpture of strong annular rings; areas deep. Cardinals strong, tuberculiform; anterior scars short, ovate-oblong; internal margin of shell crenate. *M.Eoc.-U.Eoc.*, Eu.(France).——Fig. E4,*6*. *V. tabulata* (Deshayes), Eoc.(Barton.), France(Paris basin); *6a*, LV ext., ×6; *6b,c*, LV int., RV int., ×6 *(257)*.

Wallucina Iredale, 1930 [21] [**Lucina jacksoniensis* Smith, 1885; OD]. Rounded, inflated; sculpture of almost uniform concentric and radial lines. Hinge with cardinals broader than in *Pillucina*, 1 right anterior and 2 marked, posterior laterals; anterior scars broad, short; finely denticulated internal shell margin. *Mio.-Rec.*, Australia-Pac.-Asia-W.Afr.——Fig. E4,*2a,b*. *W. erythraea* (Issel), Red Sea; *2a,b*, LV int., RV int., ×3.2 (Chavan, n).——Fig. E4,*2c*. **W. jacksoniensis* (Smith), Australia; RV ext., ×2.4 *(852)*.

Subfamily MYRTEINAE Chavan, new subfamily

Thin, more or less quadrangular or transverse, moderately compressed shell with concentric sculpture; anterior scars medium-sized. *L.Jur.-Rec.*

Arrangement of generic taxa by Chavan.——1. *Mesomiltha*.——2. *Monitilora*.——3. *Prophetilora*.——4. *Gonimyrtea*.——5. *Myrtea*.——6. *Myrteopsis*.——7. *Perampliata*.——8. *Gardnerella*.——9. *Milthona*.——10. *Lucinoma*.——11. *Discomiltha*.

Myrtea Turton, 1822 [**Venus spinifera* Montagu, 1803; M] [=*Cyrachaea* Leach, 1819 (obj.); *Eulopia* Dall, 1901 (type, *Lucina sagrinata* Dall, 1886; OD); *?Notomyrtea* Iredale, 1924 (type, *Myrtea botanica* Hedley, 1918,=*Tellina brazieri* Sowerby, 1883, *non* 1869; OD)]. Transversely elliptical to quadrangular, flattened; areas obsolete; sculpture of concentric, posteriorly elevated ribs with intercalated vermiculate radials in some; beaks pointed; lunule and escutcheon narrow and straight. Cardinals narrow, with *3b, 2*, and *4b;* RV laterals very long (those of LV on margin), originating from under plate; reniform short scars; internal shell margin smooth. *?U.Cret., Oligo.-Rec.*, Eu.-Australia-N.Z.-Asia-N.Am.

M. (Myrtea) [5] [=*Myrtaea* Dall, 1901]. Concentrically ribbed; ligament external. Teeth well developed; laterals of same length anteriorly and posteriorly. *?U.Cret.*, N.Z.; *Oligo.-Rec.*, Eu.-N. Am.-Asia-Australia. —— Fig. E6,*1;* E7,*1*. **M. spinifera* (Montagu), Rec., Medit.; E6,*1*, RV ext., ×0.7 (*513*, Reeve); E7,*1a*, RV int., ×1 *(905a);* E7,*1b,c*, LV and RV hinges, ×1 *(513)*.

M. (Myrteopsis) Sacco, 1901 [6] [**M. taurolaevis* (=*M. magnotaurina*); OD]. Finely striated. Ligament semi-internal. Teeth minute, *AI* shorter than *PI*. *Mio.*, S.Eu.

Discomiltha Chavan, 1952 [11] [**D. oehlerti* Bigot in Chavan, 1952; OD]. Moderately large, suborbicular, flattened, thin; sculpture of well-spaced feeble, concentric ribs and finer striae; posterior area well marked; lunule very asymmetrical, narrow, long, projecting ligament inframarginal. Hinge teeth comprising only 2 weak cardinals

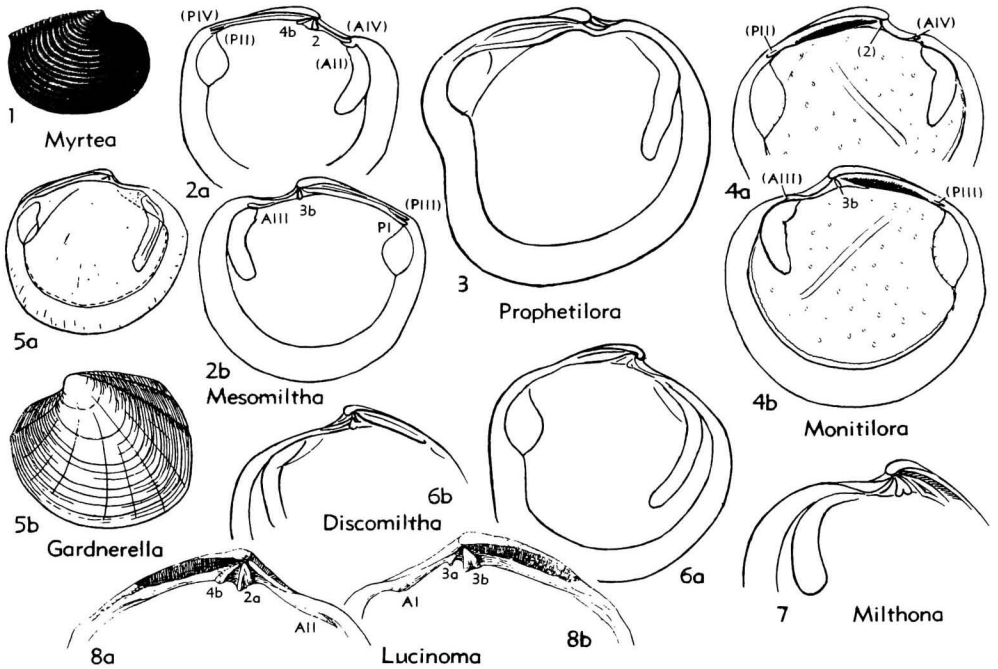


FIG. E6. Lucinidae (Myrteinae) (p. *N*499-*N*501).

partly covered by lunular expansion; shell internally punctate and grooved; anterior scars elongate, narrow, distant from pallial line; shell margin smooth internally. *U.Jur.*, Eu.——FIG. E6,*6*. **D. oehlerti* BIGOT, Astart., France(Calvados); *6a,b*, LV int., RV int., ×1 (Chavan, n).

Gardnerella CHAVAN, 1951 [8] [**Myrtaea waltonensis* GARDNER, 1926; OD]. Large, inequilateral, more or less produced anteriorly, truncated or rounded posteriorly; moderately compressed; sculpture of irregular weak concentric ribs; lunule long. Cardinals thin, 1 right, 2 left, and right laterals; anterior scars rather broad, only slightly divergent; shell internally punctate, with smooth margin. *L.Eoc.-Mio.*, Eu.-N.Afr.-N.Am.——FIG. E6,*5*. *G. cossmanni* (CHAVAN), L.Eoc., France; *5a,b*, LV int., ext., ×0.9 (Chavan, 1941).

Gonimyrtea MARWICK, 1929 [4] [**Loripes concinnus* HUTTON, 1885 (=*L. icterica* LAMY, 1920; *non Lucina concinna* ADAMS, 1870; *nec L. icterica* REEVE, 1850); OD] [=*Alucinoma* HABE, 1958 (type, *A. soyoae;* OD]. Small, subquadrangular, compressed, sculpture fine, concentric; lunule depressed, asymmetrical. Hinge tooth *2* more or less adherent to its edge, *3a* lacking, *3b* present, *AI* small; anterior scars reniform, short; shell margin internally smooth. *Paleoc.-Rec.*, Eu.-N.Afr.-N. Am.-C. Am.-N. Z.-Australia-Japan. —— FIG. E7,*3*. *G. galeottiana* (NYST), Eoc.(Barton.), Belg.; *3a,b*, LV ext., int., ×4 (Glibert, 1936).

Lucinoma DALL, 1901 [10] [**Lucina filosa* STIMPSON, 1851; OD] [=*Triodonta* GRAY, 1851 (*non* BORY, 1827; *nec* MULSANT, 1842; *nec* AGASSIZ, 1846) (obj.); *Thiatira* LEACH, 1819]. Medium-sized to large, lenticular, moderately convex, posterior margin rectilinear; with regularly spaced annular ribs and intercalated finer ones; lunule lanceolate, long, not sunken or bent. Two compressed teeth in each valve, *2* and *3b* bifid, and feeble laminar *AI*; anterior scars narrow, long, diverging; shell margin internally smooth. *Oligo.-Rec.*, Eu.-Red Sea-N.Am.-Pac.-Australia-Japan.—— FIG. E6,*8*. *L. borealis* (LINNÉ), Rec., Eu.; *8a,b*, LV and RV hinges, ×1 *(513)*.

Mesomiltha CHAVAN, 1938 [1] [**Lucina pulchra* ZITTEL & GOUBERT, 1861; OD]. Medium-sized, transversely ovate-rounded, posteriorly depressed; with fine, regular equidistant concentric ribs and very fine intercalated radial lines; lunule lanceolate projecting below in dentiform elongation; long ligament. Hinge teeth comprising 1 RV, 2 LV cardinals, and thin distant laterals; anterior scars curved, detached at their ends; shell margin internally smooth. *L.Jur.(Lias.)-U.Jur., ?Cret.*, Eu. ——FIG. E6,*2*. **M. pulchra* (ZITTEL & GOUBERT), U.Jur.(Astart.), France(Calvados); *2a,b*, LV int., RV int., ×2 (Chavan, n).

Milthona MARWICK, 1931 [9] [**M. glomerosa*; OD]. Moderately large, inequilateral, anteriorly rounded, posteriorly enlarged, with concentric

coarse, wide-spaced ribs; not differentiated posterior area; lunule somewhat depressed, cordiform. Hinge teeth *2* and *3b* bifid, *4b* strong, laterals lacking; anterior scars narrowly linguiform, divergent; shell margin smooth internally. *Mio.,* N.Z.——Fig. E6, *7. *M. glomerosa*; RV int., ×0.9 *(595).*

Monitilora Iredale, 1930 [**Lucina ramsayi* Smith, 1885 (=*Loripes icterica* Angas, 1867, *non Lucina icterica* Reeve, 1850)]. Rounded, with concentric regularly spaced ribs and radial intercalated lines; lunule lanceolate, its edge forming ridge along hinge plate; ligament elongated, inframarginal. Single weak cardinal in each valve, RV lateral obsolete; anterior scars narrow, distant from pallial line; internal rugosities present, margin smooth. *Paleoc.-Rec.,* Eu.-Australia-Asia.

M. (Monitilora) [2]. Medium-sized, circular to elliptical in outline, relatively tumid, dorsal area not distinguished; lunule straight-edged; scars moderately long; shell internally punctate. *Paleoc.-Rec.,* Eu.-Australia-Asia.——Fig. E6,*4. M. elegans* (Defrance), Eoc., France; *4a,b,* LV int., RV int., ×2.7 *(98).*

M. (Prophetilora) Iredale, 1930 [3] [**P. arizela*; OD]. Large, ovate, enlarged backward, compressed, with faint dorsal area; lunule bent inward. Hinge almost obsolete; scars linguiform, relatively long; shell internally pustulose. *Paleoc.-Rec.,* Eu.-Australia.——Fig. E6,*3. *M. (P.) arizela,* Rec., Queensl.; LV int., ×1 (Iredale, 1930).

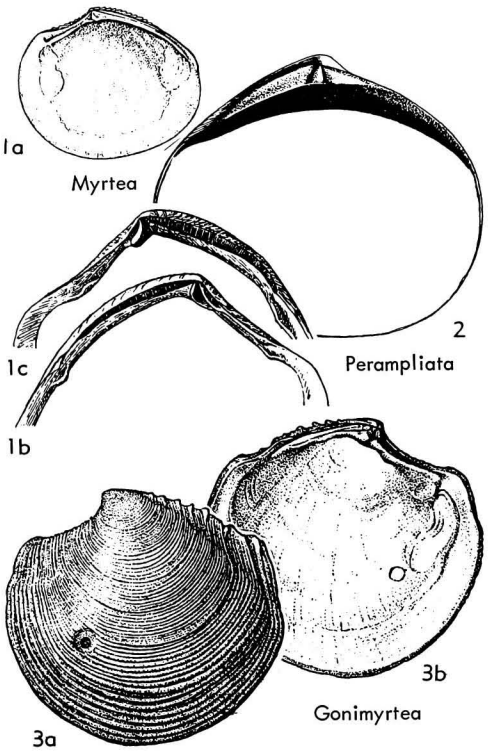


Fig. E7. Lucinidae (Myrteinae) (p. *N*499-*N*501).

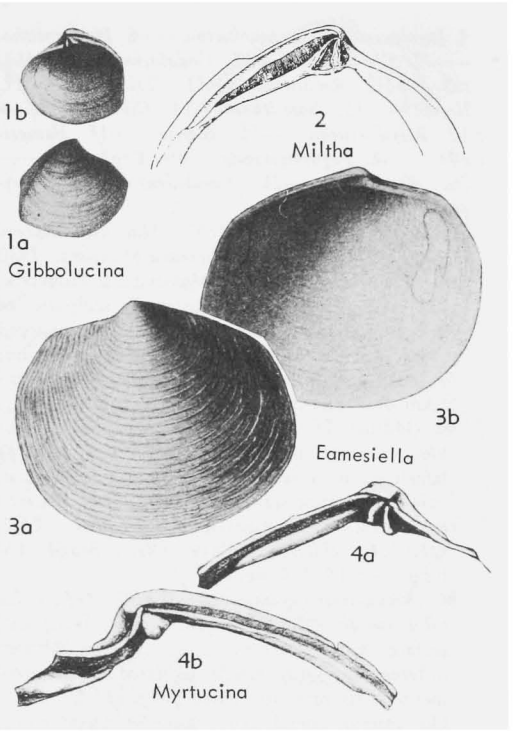


Fig. E8. Lucinidae (Milthinae) (p. *N*502, *N*504).

?**Perampliata** Arkell, 1936 [7] [*pro Ampliata* Arkell, 1934, p. 282 (*non* Wagner, 1907)] [**Tellina ampliata* Phillips, 1829, p. 324; OD]. Large, compressed, with close-spaced concentric ribs; beaks small; lunule lacking, escutcheon broad. Stout short hinge plate with 1 RV and 2 LV cardinals; pallial line and anterior scars unknown. *Jur.,* Eu.(G.Brit.-France).——Fig. E7,*2. **P. ampliata* (Phillips), U.Jur.(Corall.), Eng.; LV int., ×0.7 (Arkell, 1936).

Subfamily MILTHINAE Chavan, new subfamily

Shell relatively solid, generally compressed. Sculpture concentric, faint, irregular to vanishing; anterior scars long. *Sil.-Rec.*

Arrangement of generic taxa by Chavan.——1. *Phenacocyclas.*——2. *Pterolucina.*——3. *Myrtucina.*

4. *Jagolucina.*——5. *Saxolucina.*——6. *Plastomiltha.*——7. *Claibornites.*——8. *Codalucina.*——9. *Miltha.*——10. *Recticardo.*——11. *Trinitasia.*——12. *Ilionia.*——13. *Eomiltha.*——14. *Gibbolucina.*——15. *Pseudomiltha.*——16. *Zorrita.*——17. *Eamesiella.*——18. *Pegophysema.*——19. *Eophysema.*——20. *Anodontia.*——21. *Cavatidens.*——22. *Loripinus.*

Miltha H. & A. ADAMS, 1857 [**Lucina childreni* GRAY, 1825; OD] [=*Miltheoidea* MARWICK, 1930 (type, *Miltha neozelandica* MARSHALL & MURDOCK, 1921; OD)]. Discoidal, flattened; sculpture of unequal concentric striae; ligament on enlarged nymph. Hinge teeth *3b* and *2* somewhat bifid; shell margin smooth internally. *U.Cret.-Rec.,* Eu.-N.Am.-Australia-N.Z.

M. (Miltha) [9]. Large, subcircular to ovate-oblong, slightly inequivalve; surface smooth or lamellose, with faint areas; lunule asymmetrical, striated. Anterior scars long, club-shaped. *U.Cret.-Rec.,* Eu.-N.Am.-Australia-N.Z.——FIG. E8,*2*. **M. (M.) childreni* (GRAY), Rec., Brazil; LV hinge, ×1 *(513,* Sowerby).

M. (Recticardo) COSSMANN, 1908 [10] [**Phacoides (R.) rutoti*; OD]. Medium-sized, subelliptical; surface with concentric dense striation without differentiated areas; lunule depressed, almost symmetrical, its projecting edge prolonged by ridge-like anterior lateral tooth, posterior lateral weak; anterior scars relatively short, penetrating upward between lunular edge and anterior lateral. *U.Cret.-Paleoc.,* Eu.-N.Am.——FIG. E9,*3*. **M. (R.) rutoti* (COSSMANN), Paleoc., Belg.; *3a,b,* LV and RV hinges, ×2 *(98)*.

Anodontia LINK, 1807 [**A. alba* (=**Venus edentula* LINNÉ, 1758); OD]. Rounded, tumid, slightly inequilateral; sculpture of irregular growths and very fine radial striae; anterior area more or less marked, posterior area obsolete; beaks prosogyrous; lunule ill-defined; ligament oblique, sunken. Hinge edentulous except for faint tuberculiform cardinal; anterior scars broad, short, very divergent; shell margin internally smooth. *Eoc.-Rec.,* Eu.-Asia-N.Am.-Pac.-Australia-Afr.

A. (Anodontia) [20]. Medium-sized to large, globose, rounded in front, slightly truncate posteriorly; surface with concentric and radial lines, anterior area ill-defined; lunule depressed; ligament sunken but inserted upon cardinal elongation. *Eoc.-Rec.,* Eu.-Asia-N.Am.-Pac.O.-Australia.——FIG. E9,*6*. **A. edentula* (LINNÉ), Rec., Ind. O.; RV int., ×1.3 *(98)*.

A. (Cavatidens) IREDALE, 1930 [21] [**C. omissa*; OD]. Small, globose, laterally truncate, with concentric sculpture only, dorsal area distinct; beaks high; ligament sunken on cardinal process. *Rec.,* Australia.

A. (Loripinus) DE MONTEROSATO, 1883 [22] [**Lucina fragilis* PHILIPPI, 1836; SD VON MARTENS, 1884]. Small, very globose, thin, anteriorly rounded, not depressed; ligament strongly depressed, without cardinal elongation or process. Hinge tooth *3b* directed backward. *Eoc.-Rec.,* S. Eu.-Afr.-Asia-Japan-?N.Am.

Claibornites STEWART, 1930 [**Lucina rotunda* LEA, 1833; OD]. Medium-sized, lenticular, flattened; sculpture of concentric striae, dorsal areas obsolete; lunule lanceolate. Hinge with narrow cardinals and strong anterior laterals; anterior scars elongate, narrow; shell margin internally smooth. *Paleoc.-Oligo.,* Eu.-N.Am.

C. (Claibornites) [7]. Thick; sculpture coarsely concentric; areas weak; ligament on large depressed nymph, gibbous internally. Hinge as in *Saxolucina,* but with *3a* less obsolete and *3b* only obscurely bifid, *AI* stronger; anterior scars long. *Eoc.,* N.Am.——FIG. E9,*1*. **C. (C.) rotunda* (LEA), M.Eoc., USA(Ala.); *1a,b,* LV int., RV hinge, ×0.9 (Harris, 1919).

C. (Codalucina) STEWART, 1930 [8] [**Lucina uncinata* DEFRANCE, 1823; OD]. Thin, sculpture finely concentric; no areas; ligament deeply sunken, in broad groove. Hinge with well-marked cardinals and anterior laterals, weak posterior laterals; scars relatively long, linguiform. *Paleoc.-Oligo.,* Eu.-N.Am.——FIG. E9,*2*. **C. (C.) uncinata* (DEFRANCE), Paleoc., France; LV int., ×1.3 *(98)*.

Eamesiella CHAVAN, 1951 [17] [*pro Pseudolucina* CHAVAN, 1947 (*non* WILCKENS, 1909)] [**Lucina corrugata* DESHAYES, 1843; OD]. Subquadrangular, rather inflated; surface with distant concentric lamellose waves. Edentulous; stout nymph; shell margin smooth internally. *?Eoc.* or *Oligo., Rec.,* Afr.-Australia-Eu.——FIG. E8,*3*. **E. corrugata* (DESHAYES), Rec., Pac.; *3a,b,* LV ext., int., ×2 (Alcock & Anderson, 1897).

Gibbolucina COSSMANN, 1904 [**Venus callosa* LAMARCK, 1806; OD] [=*?Elathia* ISSEL, 1869 (type, *E. arconatii;* OD) *(gen. dub.)*]. Irregularly compressed; sculpture of coarse lamellae or ribs, with narrow deep areas; lunule concave, short, broad. Trigonal hinge plate with *3a* thin, *3b,* strongly bilobate, *2, 4b* present, laterals lacking; short stout nymph; fine radial internal threads; anterior scars elongate, narrow, subparallel to pallial line; shell margin internally smooth. *Cret.-Rec.,* Eu.-Am.-Australia-Afr.

G. (Gibbolucina) [14]. Small, moderately convex, subtrigonal, gibbose; lunule depressed, partly covering ill-defined cardinals, *3a* obsolete; short scars. *L.Eoc.-Rec.,* Eu.-Afr.-Australia-?Red Sea.——FIG. E8,*1;* E10,*2*. **G. (G.) callosa* (LAMARCK), M. Eoc., France; E8,*1a,b,* RV ext., int., ×1 *(257);* E10,*2a,b,* RV ext., int., ×1 *(257)*.

G. (Eomiltha) COSSMANN, 1910 (1912) [13]. [**Lucina contorta* DEFRANCE, 1823; OD]. Medium-sized, almost flat, transversely subrhomboidal; with more or less elevated concentric lamellae; lunule not sunken. Cardinals well defined;

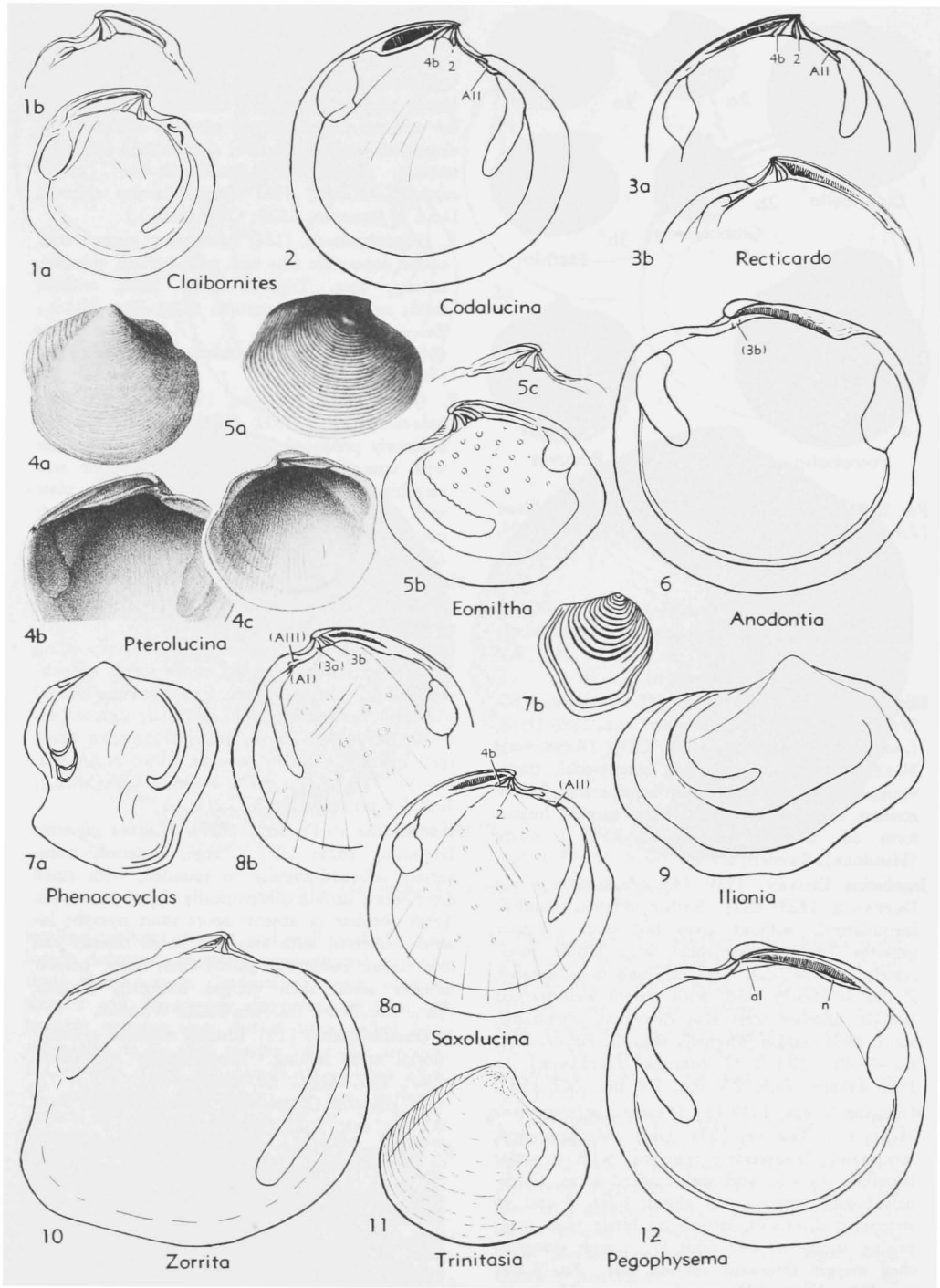


FIG. E9. Lucinidae (Milthinae) (p. *N*502, *N*504-*N*506).

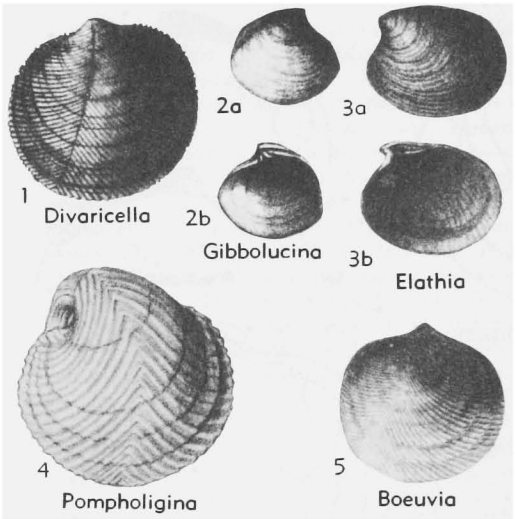


FIG. E10. Lucinidae (Milthinae) *(2);* Divaricellinae *(1,4-5);* (Genus Uncertain) *(3)* (p. *N*502, *N*504, *N*506, *N*508).

scars relatively long. *Cret.-Rec.,* Eu.-Am.-E.Afr. ——FIG. E9,*5*. **G. (E.) contorta* (DEFRANCE), Paleoc., France; *5a,* RV ext., ×0.7; *5b,c,* RV int., LV hinge, ×1 (Chavan, n).

Illionia BILLINGS, 1875 [12] [**I. canadensis;* SD WHITEAVES, 1884] [=*Prolucina* DALL, 1896 (type, *Lucina prisca* HISINGER, 1837; OD); *Platymermis* NOETLING, 1883]. Irregularly rhomboidal, transverse, compressed, with postumbonal sulcus; lunule concave, long. Anterior scars long, narrow, linguiform. *Sil.,* N.Eu.-N.Am.——FIG. E9,*9*. *I. prisca* (HISINGER), Sweden; LV int. mold, ×0.7 *(1026)*.

Jagolucina CHAVAN, 1939 [4] [**Lucina concava* DEFRANCE, 1823; OD]. Rather inflated, rounded, inequilateral, without areas but with irregular growths; beaks prosogyrous; large lunule moderately asymmetrical. Two cardinals in each valve, *2* and *3b* clearly bifid, with distant well-marked laterals; anterior scars very divergent, attenuated, short; shell margin internally smooth. *Paleoc.-Eoc.,* Eu.——FIG. E11,*1*. **J. concava* (DEFRANCE), L. Eoc., France; *1a,b,* RV int., LV int., ×2 *(98)*.

Myrtucina VOKES, 1939 [3] [**Lucina roseburgensis* HENDON in TURNER, 1938; OD]. Medium-sized, compressed, transversely rounded, with irregular lamellose growths and well-marked areas. Cardinals broadly trigonal, *3b* almost bifid, *2* and *4b* somewhat divergent, laterals on hinge plate comprising strong *AI* and faint *PI*; nymph elongate; shell margin internally smooth. *Eoc.,* Eu.-N.Am. ——FIG. E8,*4*. **M. roseburgensis* (HENDON), USA(Ore.); *4a,b,* LV and RV hinges, ×3 (Vokes, 1939).

Pegophysema STEWART, 1930 [**Lucina schrammi* CROSSE, 1876; OD]. Rounded, tumid, slightly inequilateral; sculpture of irregular growths, with well-marked anterior area, posterior area obsolete; lunule narrow, depressed. Cardinal plate triangular without protuberances; anterior scars scarcely divergent, long and narrow; shell margin internally smooth. *Eoc.-Rec.,* N.Am.-N.Afr.-Eu. [=*Lissophaira* OLSSON, 1961 (type, *Lucina spherica* DALL & OCHSNER, 1928; OD) (subj.).]

P. (Pegophysema). [18]. Subcircular; surface with coarse concentric ribs and well-marked, subalate, anterior area. Trigonal hinge plate, without teeth; anterior scars narrow. *Oligo.-Rec.,* N.Am.-Eu.——FIG. E9,*12*. *P. (P.) chrysostoma* (MEUSCHEN), Rec., W.Indies; RV int., ×0.9 *(98)*.

P. (Eophysema) STEWART, 1930 [19] [**Lucina subvexa* CONRAD, 1832 (1846); OD]. Subovate, anteriorly produced, posteriorly enlarged; surface with concentric and radial striae, anterior area vanishing at adult stage. Elongate hinge plate with ill-defined transverse small tooth and left posterior lateral; relatively broad anterior scars. *Eoc., ?Oligo.,* N.Am.-N.Afr.-Eu.

Phenacocyclas LA ROCQUE, 1950 [1] [**P. pohli;* OD]. Irregularly rhomboidal, oblong, compressed; surface only concentrically striated, anteriorly plicate and with deep posterior area corresponding to notch in ventral margin; lunule small; escutcheon narrow. Probably one small anterior lateral and two presumably small cardinals; sigmoid internal groove; falciform, enlarged anterior scars; shell margin internally smooth. *Dev.,* N.Am.-Eu. ——FIG. E9,*7*. **P. pohli,* M.Dev., USA(Mich.); *7a,b,* RV int., ext., ×0.7 *(530)*.

Pseudomiltha P. FISCHER, 1887 [**Lucina gigantea* DESHAYES, 1825; OD]. Large, flattened, transversely subquadrangular to rounded, with small erect beaks; surface concentrically ribbed or smooth. Teeth obsolete or absent; short stout nymph; interior punctate, with also fine radial threads and low flange bordering pallial line; long, narrow anterior scars; shell margin internally smooth. *?Jur., Eoc.-Mio.,* Eu.-Asia-S.Am.-W.Indies.

P. (Pseudomiltha) [15]. Broadly elliptical to ovate; dorsal areas lacking. Hinge totally edentulous. *?Jur., Eoc.-Oligo.,* Eu.-Asia.——FIG. E11,*3*. **P. (P.) gigantea* (DESHAYES), M.Eoc., France; *3a,b,* RV int., ext., ×0.7 (Deshayes, 1825).

P. (Zorrita) OLSSON, 1932 [16] [**P. (Z.) petersoni*; OD]. Transversely subquadrangular, with deep posterior area. Unequal faint internal ribs. Remnants of *3b* and *4b* present. *Eoc.-Mio.,* Peru-Jamaica-Eu.——FIG. E9,*10*. **P. (Z.) petersoni;* LV int., ×0.9 (Chavan, n).

Pterolucina CHAVAN, 1942 [2] [**Lucina coeloprocta* COSSMANN, 1887; OD]. Medium-sized to large, rounded trigonal, relatively compressed, with

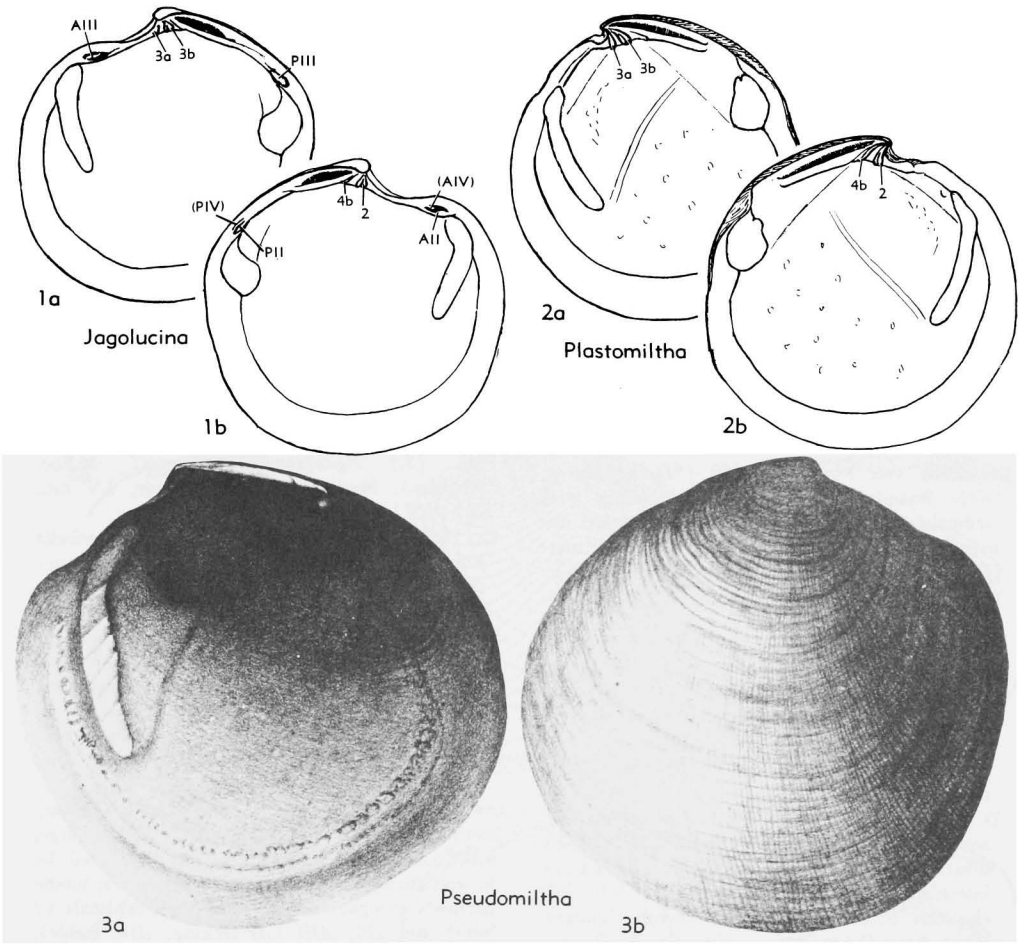


FIG. E11. Lucinidae (Milthinae) (p. *N*504-*N*505).

locally lamellose growths and well-marked areas; lunule depressed; ligament semi-internal on relatively short nymph. Cardinal *3b* weak, oblique, thin, *2* and *4b* scarcely divergent, *AI* faint, *PI* lacking; anterior scars distant from pallial line, subparallel to it; shell margin internally smooth. *U.Cret.-Mio., ?Plio.*, Eu.-Asia-N.Afr.——FIG. E9,*4*. **P. coeloprocta* (COSSMANN), U. Eoc. (Barton.), France; *4a-c*, RV ext., LV int., RV int., ×1 *(160)*.

Saxolucina STEWART, 1930 [**Lucina saxorum* LAMARCK, 1806 (1808); OD]. Medium-sized to large, discoidal to subtrigonal, flattened, anteriorly somewhat acuminate, posteriorly truncate; sculpture consisting of lamellose concentric ribs or outgrowths; areas narrow, anterior marked by lines of punctuations, posterior obsolete; lunule projecting backward. Anterior scars very narrow, long; shell margin internally smooth. *?U.Cret., Paleoc.-Plio., ?Rec.*, Eu.-Afr.-Am.-Eu.

S. (Saxolucina) [5]. Medium-sized; lunule covering part of teeth, but not really excavated. Cardinals *3b* and *2* partly bifid, *4b* present, *3a* and laterals more or less obsolete; nymph curved; shell commonly pustulose internally. *Eoc.*, Eu.; *?Rec.*, Afr.——FIG. E9,*8*. **S. (S.) saxorum* (LAMARCK), Eoc., France; *8a,b*, LV int., RV int., ×1.7 *(98)*.

S. (Plastomiltha) STEWART, 1930 [6] [**Cyclas claibornensis* CONRAD, 1865; OD] [=*Armiltha* OLSSON & HARBISON, 1953 (type, *Lucina disciformis* HEILPRIN, 1886; OD)]. Large, lamellose, with depressed lunule. Straight nymph. Cardinals *3b* and *2* strongly bifid, *3a* well marked, shell internally punctate. *?U.Cret., Paleoc.-Plio.*, C.Am.-N.Am.-Eu.——FIG. E11,*2*. **S. (P.) claibornensis* (CONRAD), Eoc., USA(Ala.); *2a,b*, RV int., LV int., ×1 *(98)*.

?Trinitasia MAURY, 1928 [11] [**Thyasira sancti-*

andreae MAURY, 1925; OD]. Trigonal, subequilateral, convex, ventral margin rounded; surface smooth, posterior area marked by angulation. Cardinals 3 (incompletely known), strong, 1 on RV, 2 on LV; scars apparently not detached, linguiform, and curved. *Mio.,* Trinidad.——FIG. E9,*11*. **T. sanctiandreae* (MAURY); LV int., ×0.75 (Chavan, n).

Subfamily DIVARICELLINAE Glibert, 1967

Shell convex, rounded, with divaricate or undulating external sculpture. *L.Eoc.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Divalinga.*——2. *Viaderella.*——3. *Stchepinskya*——4. *Paralucinella.*——5. *Lucinella.*——6. *Divalucina.*——7. *Boeuvia.*——8. *Divaricella.*——9. *Egracina.*——10. *Pompholigina.*——11. *Eodivaricella.*

Divaricella VON MARTENS, 1880 [**D. angulifera*; OD]. Rounded, with small lunule. Hinge with cardinals and incomplete or obsolete laterals; anterior scars flexuous, narrowly elongate; shell margin internally smooth but incised or exceeded by terminations of ribs. *Plio.-Rec.,* Afr.-Ind.O.-Asia-Australia-C.Am.

D. (Divaricella) [8]. Solid, divaricated by angular ribs. Lateral teeth, *AII, PII,* and *PIII* obsolete; terminations of ribs exceeding margin. *Plio.-Rec.,* Asia-Australia-E.Afr.——FIG. E12,*1*; E10,*1*. **D. (D.) angulifera,* Rec., Ind.O.(Mauritius); E12, *1a,b,* RV hinge, LV int., ×2 *(107);* E10,*1,* RV ext., ×1 (von Martens).

D. (Egracina) CHAVAN, 1951 [9] [**Tellina dentata* WOODS, 1815; OD]. Relatively flattened, divaricated by large flattened ribs, with narrow interspaces. Hinge with *3a, AI, AII, PII, PIII* obsolete; terminations of ribs incising margin. *Pleist.-Rec.,* C.Am.-Afr.——FIG. E12,*5*. *D (E.) dentata collignoni* CHAVAN, Afr.; *5a-c,* LV ext., RV hinge, LV int., ×2.5 *(107)*.

Boeuvia CHAVAN, 1948 [7] [**Lucina pulchella* AGASSIZ, 1845; OD] [=*?Bourdotia* DALL, 1901 (type, *Lucina bourdoti* COSSMANN, 1882; OD) *(nom. dub.)*]. Not much inflated; divaricated by numerous flattened ribs with narrow interspaces. Incomplete hinge without *AI* and *PI*; *3a, 4b, AIV, PII* and *PIV* all obsolete or lacking; ligament partly internal; anterior scars strongly divergent from pallial line; shell margin internally smooth. *L.Eoc.-Oligo.,* N.Afr.-Eu.——FIG. E12,*3*; E10,*5*. **B. pulchella* (AGASSIZ), M.Eoc.(Lutet.), France; E12, *3a,b,* RV hinge, LV int., ×2 *(107)*; E10,*5,* RV ext., ×1 (Deshayes).

Divalinga CHAVAN, 1951 [**Lucina quadrisulcata* D'ORBIGNY, 1846; OD]. Orbicular, inflated; divaricated by broad flattened ribs with narrow interspaces; lunule slightly depressed, dissymmetric; ligament external. Hinge with well-developed cardinals and laterals but no *AI* and *PI*; anterior scars short; shell margin internally denticulate. *L.Eoc.-Rec.,* Eu.-N.Am.-C.Am.-Afr. [=*Cyclas* MÖRCH, 1853 (*non* LAMARCK, 1799) (type, *Lucina quadrisulcata* D'ORBIGNY, 1846; SD CHAVAN, herein).]

D. (Divalinga) [1]. Hinge teeth *3a* and *AIV* feeble; anterior scars slightly divergent from pallial line. *Oligo.-Rec.,* W.Eu.-N.Am.-C.Am.——FIG. E12,*9*. **D. (D.) quadrisulcata* (D'ORBIGNY), Rec., USA(Fla.); *9a,b,* RV hinge, LV int., ×2 *(107)*.

D. (Stchepinskya) CHAVAN, 1951 [3] [**Lucina rigaultiana* DESHAYES, 1858; OD]. Inflated; lunule elongate. Hinge teeth *3a* and *PIV* feeble, anterior and posterior laterals both distant; anterior scars short, acutely diverging from pallial line; shell margin weakly crenulate internally. *L.Eoc.-U.Eoc.,* W. Eu.-?N. Afr.——FIG. E12,*11*. **D. (S.) rigaultiana* (DESHAYES), M.Eoc. (Auvers.), France; *11a,b,* RV hinge, LV int., ×3 *(107)*.

D. (Viaderella) CHAVAN, 1951 [2] [**Divaricella perparvula* DALL, 1901 (=*Lucina pisum* PHILIPPI, 1857; *non* SOWERBY, 1836; *nec* D'ORBIGNY, 1841; *nec* REEVE, 1850)]. Inflated; sculpture obsolete on angle of divergence, posterior lamellae distant. Hinge teeth *PIV* feeble, *PI* lacking (also *AI*); anterior scars short, acutely pointed and diverging. *Mio.,* W.Eu.; *Rec.,* N.Am.-S.Afr.-W. Eu.——FIG. E12,*10*. **D. (V.) perparvula* (DALL), USA(Calif.); *10a,b,* RV hinge, LV int., ×2 *(107)*.

Divalucina IREDALE, 1936 [6] [**Lucina (Cyclas) cumingi* ADAMS & ANGAS, 1863; OD]. Large, solid, moderately inflated; surface divaricated by broad flattened ribs with narrow interspaces; lunule narrowly elongate. Hinge with large cardinals (2 bifid) and *AII, AIII* (*AI* lacking, *AIV* feeble), posterior laterals obsolete; anterior scars narrowly elongate, not divergent from pallial line; shell margin smooth internally. *Oligo.-Rec.,* Asia (Ceylon-Japan)-Australia-N.Z.——FIG. E12,*4*. **D. cumingi* (ADAMS & ANGAS), Rec., N.Z.; *4a,b,* RV hinge, LV int., ×1.5 *(107)*.

Lucinella DI MONTEROSATO, 1883 [5] [**Tellina divaricata* LINNÉ, 1758 (=*Lucina commutata* PHILIPPI, 1836); OD]. Relatively small, solid, with posterior area, sculpture undulated. Hinge with cardinals and laterals, *3a* and *PII* feeble, *AI* and *PI* lacking; ligament deeply internal; anterior scars not much divergent from pallial line; shell margin crenulate internally. *Mio.-Rec.,* W.Eu.-S. Eu.-Ind.O.(Mauritius).——FIG. E12,*7*. **L. divaricata* (LINNÉ), Rec., France; *7a,b,* RV hinge, LV int., ×4 *(107)*.

Paralucinella CHAVAN, 1951 [4] [**Lucina undulata* LAMARCK, 1806; OD]. Relatively small; sculpture undulated. Hinge narrow, dentition as in *Stchepinskya,* but *3a* lacking; ligament elongated; anterior

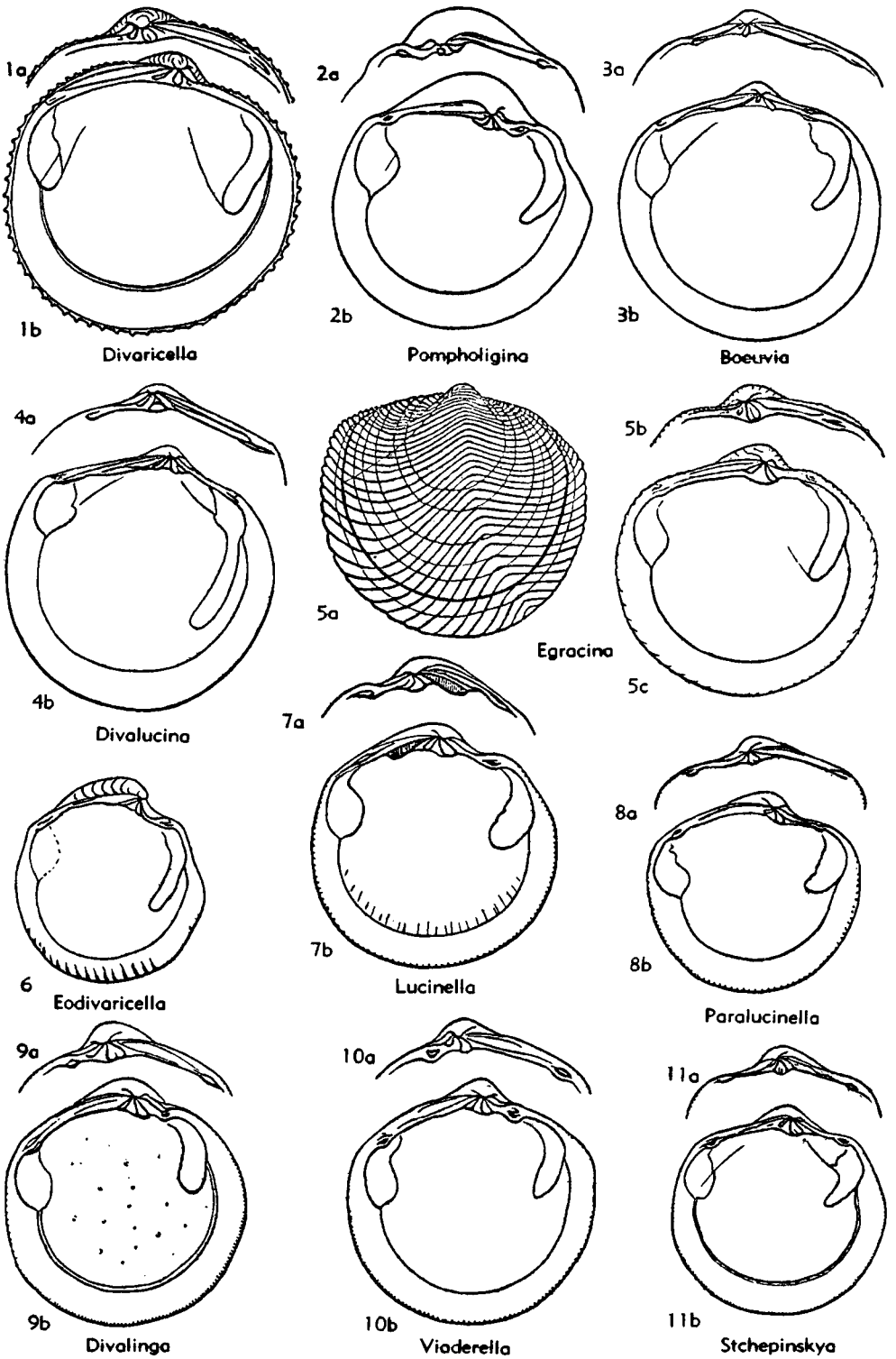


FIG. E12. Lucinidae (Divaricellinae) (p. *N*506, *N*508).

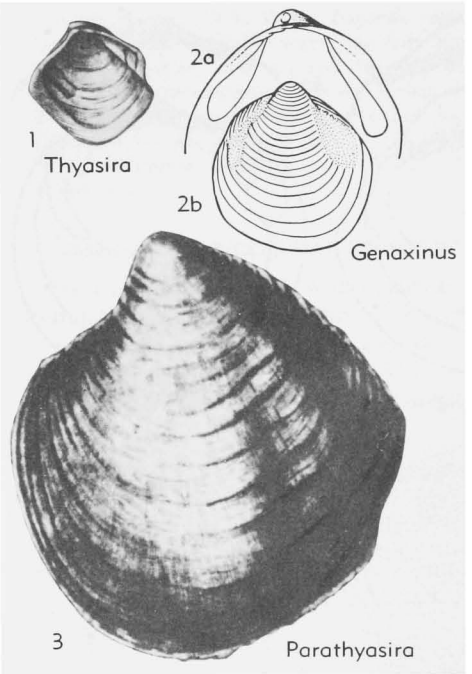


FIG. E13. Thyasiridae (p. N508).

scars short, rounded; shell margin crenulated internally. *Oligo.*, W.Eu.——FIG. E12,*8*. *P. undulata* (LAMARCK), Stamp., France; 8*a,b*, RV hinge, LV int., ×4.5 *(107)*.

Pompholigina DALL, 1901 [**Lucina gibba* GRAY, 1825; OD]. Tumid, with subspiral beaks; surface divaricated by elevated rounded ribs with wide interspaces. Hinge apparently cyclodont, with cardinals and several laterals. *M.Eoc.-Rec.*, W.Afr.

P. (Pompholigina) [10]. Hinge with *3a* and *4b* well developed; anterior scars short, pointed, divergent from pallial line; shell margin smooth internally. *Rec.*, W.Afr.——FIG. E12,*2*; E10,*4*. **P. (P.) gibba* (GRAY); E12,*2a,b*, RV hinge, LV int., ×2 *(107)*; E10,*4*, LV ext., ×1 (Reeve, 1850).

P. (Eodivaricella) CHAVAN, 1951 [11] [**Divaricella oppenheimi* NEWTON, 1923; OD]. Lunule excavated; nepionic sculpture concentric, then divaricate. Anterior scars narrow; middle part of internal shell margin undulated. *M.Eoc.*, W.Afr. (Nigeria).——FIG. E12,*6*. **P. (E.) oppenheimi* (NEWTON); LV int., ×3.3 *(107)*.

LUCINIDAE GENERA DUBIA

Austriella TENISON-WOODS, 1881 [**A. sordida*; OD]. Like *Eamesiella* but with an inconspicuous arcuate tooth and a falciform scar. [May be an eroded form, possibly an edentulous ungulinid.] *Rec.*, Australia.

Elathia ISSEL, 1869 [**E. arconatii*; OD]. *Rec.*, Red Sea [See *Gibbolucina.*]——FIG. E10,*3*. **E. arconatii*; *3a,b*, LV ext., RV int., ×1 (Issel).

?Freila DE GREGORIO, 1930.

Jagonella SELLI, 1944 [**J. gortanii*; OD]. *(Nom. nud.)*

Levimyrtaea OLSSON, 1965 [**Myrtaea (L.) inconspicua*; OD]. Possibly equivalent of *Gonimyrtea* or *Myrteopsis. Mio.*, Ecuador.

Lucinigenus RENIER, 1894 [Rejected, ICZN].

Family THYASIRIDAE Dall, 1901

[=Cryptodontidae DALL, 1895]

Trigonal to subquadrangular or obliquely rounded, thin, with dorsal anterior depression and more or less well-marked posterior area; beaks small, acute, prosogyrate; ligament and resilium juxtaposed, united, former inframarginal, latter deeply sunken in ill-defined depression or socket; no nymph. Surface concentrically ribbed or smooth. Hinge with protruding right lunular edge forming one or two small ill-defined tuberosities, with intermediate left and corresponding sockets; muscle scars elongate, superficial. *M.Trias.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Thyasira.*——2. *Conchocele.*——3. *Philis.*——4. *Maorithyas.*——5. *Tauraxinus.*——6. *Mendicula.*——7. *Axinulus.*——8. *Parathyasira.*——9. *Axinopsida.*——10. *Adontorhina.*——11. *Leptaxinus.*——12. *Genaxinus.*——13. *Storthodon.*

Thyasira LEACH in LAMARCK, 1818 [**Amphidesma flexuosa* LAMARCK, 1818 (=**Tellina flexuosa* MONTAGU, 1803); OD] [=*Axinus* SOWERBY, 1821 (type, *A. angulatus;* OD); *Cryptodon* TURTON, 1822; *Bequania* LEACH in BROWN, 1827; *Ptychina* PHILIPPI, 1836 (obj.); *Prothyasira* IREDALE, 1930 (type, *P. peroniana*; OD) (obj.)]. Obliquely trigonal, with sharp dorsal folds and well-marked posterior area. Concentrically sculptured. *Cret.-Rec.*, Eu.-N.Am.-Pac.-Australia.

T. (Thyasira) [1]. Small, oblique, with lunular margin only slightly curved, protruding in right valve, followed by resilium in moderately short, broadly trigonal depression. A minute pseudocardinal on left valve. *Cret.-Rec.*, Eu.-Pac.-Australia.——FIG. E13,*1*; E14,*8*. **T. (T.) flexuosa* (MONTAGU), Rec., Medit.; E13,*1*, RV int., ×1 *(305)*; E14,*8*, RV hinge, ×1 *(513)*.

T. (Conchocele) GABB, 1866 [2] [**C. disjuncta*; OD]. Very oblique, enlarged backward; lunular margin nearly straight, followed by resilium in long narrow depression; anterior muscle scar broad. *Oligo.-Rec.*, N.Am.-N.Pac.——FIG. E14,*4*.

***T. (C.) disjuncta* (GABB), Rec., USA(Calif.); *4a,b,* RV ext., int., ×0.7 (Keen, 1939).

T. (Philis) P. FISCHER, 1861 [3] [**P. Cumingi;* OD]. Small, somewhat oblique; deeply excavated lunule in spoon-shaped socket under beak, its edge U-shaped in front of ill-defined depression. *Rec.,* Australasia-Japan.——FIG. E14,*6*. **T. (P.) cumingi,* Moluccas; LV int., enl. (Chavan, n).

Adontorhina BERRY, 1947 [10] [**A. cyclia*; OD]. Small, resembling *Axinopsida* but hinge teeth replaced by indefinite ridges and denticles on somewhat reflected lunular and escutcheonal margins. Anterior pseudocardinals tuberculiform. *Pleist.-Rec.,* W.N.Am.——FIG. E14,*11*. **A. cyclia,* Pleist., USA(Calif.); *11a,b,* LV int., ext., ×10 (Berry, 1917).

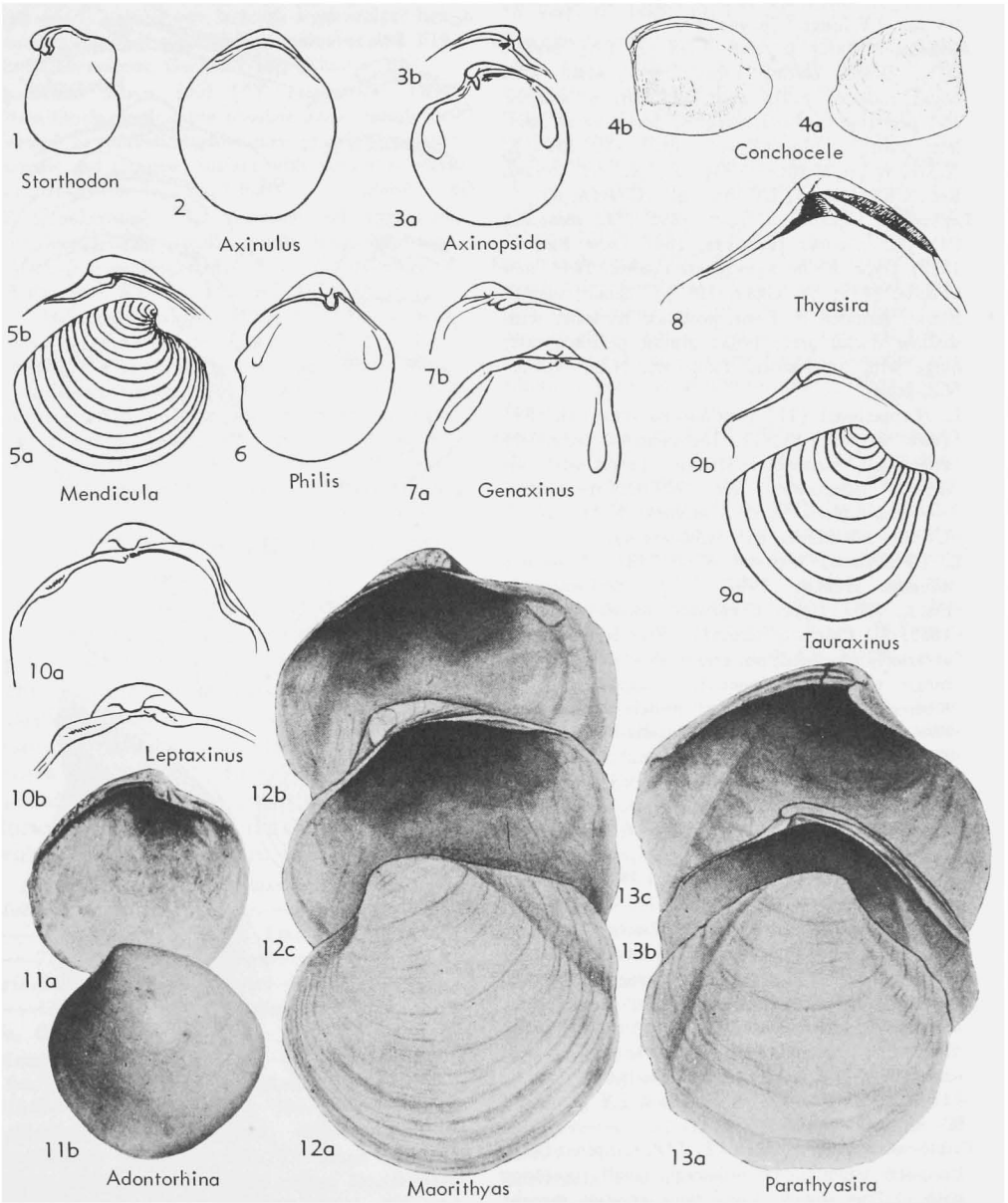


FIG. E14. Thyasiridae (p. *N*508-*N*511).

Axinopsida KEEN & CHAVAN in CHAVAN, 1951 [9] [*pro Axinopsis* SARS, 1878 (*non* TATE, 1868)] [**Axinopsis orbiculata* G. O. SARS, 1878; OD]. Suborbicular, slightly inequilateral; lunular margin concave, ventral and posterior margins rounded; hinge with pointed projecting pseudocardinal; muscle scars ovately elongate. *U.Plio.-Rec.,* N.Eu.-N. Atl.-W.N. Am.-W. Pac.(Japan)-Medit.——FIG. E14,*3*. **A. orbiculata* (SARS), Rec., Norway; *3a,b,* RV int., LV hinge (Chavan, n).

Axinulus VERRILL & BUSH, 1898 [7] [**A. brevis*; OD]. Ovately oblong, subequilateral, small, with broad rounded beaks and long narrow anterior and posterior cardinal margins, dorsal areas obsolete; posterior adductor scar small. *Plio.-Rec.,* E. N.Am.-W.Eu.-Medit.——FIG. E14,*2*. **A. brevis,* Rec., USA(Maine); LV int., enl. (Chavan, n).

Leptaxinus VERRILL & BUSH, 1898 [**L. minutus*; OD][=*Clausina* JEFFREYS, 1847 (*non* BROWN, 1827) (type, *Kellia ferruginosa* FORBES, 1843, *non* MORRIS, 1843; SD GRAY, 1847)]. Small, inequilateral, rounded in front, posterior truncate, with shallow dorsal area; beaks almost opisthogyrate; hinge with tuberosities. *Plio.-Rec.,* N.Eu.-N.Am.-N.Z.-Japan.

L. (Leptaxinus) [11] [=*Clausina* JEFFREYS, 1847 (*non* BROWN, 1827)]. Inequilateral, anteriorly attenuated, posteriorly sinuate; hinge with ill-defined tuberosities. *Rec.,* N.Eu.-N.Am.-Japan. ——FIG. E14,*10*. **L. (L.) minutus,* N.Atl.; *10a,b,* LV and RV hinges, enl. (Chavan, n).

L. (Genaxinus) IREDALE, 1930 [12] [**Thyasira albigena* HEDLEY, 1907; OD] [=*?Vaticinaria* DALL, 1901 (type, *Cryptodon moseleyi* SMITH, 1885; SD CHAVAN, herein)]. Very inequilateral, anteriorly produced, posteriorly short and straight; hinge with subhorizontally elongate toothlike tuberosities in each valve; muscle scars large. *Plio.-Rec.,* Japan-SW.Pac.-Australia-N.Z.——FIG. E13,*2*. **L. (G.) albigenus* (HEDLEY), Plio., N.Z.; *2a,b,* RV int., LV ext., ×15, ×10 (Hedley, 1907).——FIG. E14,*7*. *L. (G.) cookianus* FLEMING, Plio., N.Z.; *7a,b,* LV int., RV hinge, ×30 (Chavan, n).

Maorithyas FLEMING, 1950 [4] [**M. marama* (=*Thyasira flexuosa* SUTER, 1913, *non Tellina flexuosa* MONTAGU, 1803); OD]. Rounded, oblong, globose, with obtuse dorsal folds; escutcheon narrowly crescentic; surface with irregular growth lines; hinge thin, its posterior part excavated in ligamentary groove, bounded below by ridge; inner shell surface with radiating lirae, anterior muscle scar 8-shaped. *Rec.,* N.Z.-Australia-Japan.——FIG. E14,*12*. **M. marama,* N.Z.; *12a-c,* LV ext., int., RV int., ×1 (Fleming, 1950).

Parathyasira IREDALE, 1930 [8] [**P. resupina*; OD]. Rounded trigonal, inequilateral, small, posterior with shallow double angulation; anterior margin concave; surface with fine radial lines; hinge with lunular pseudocardinals and very faint posterior

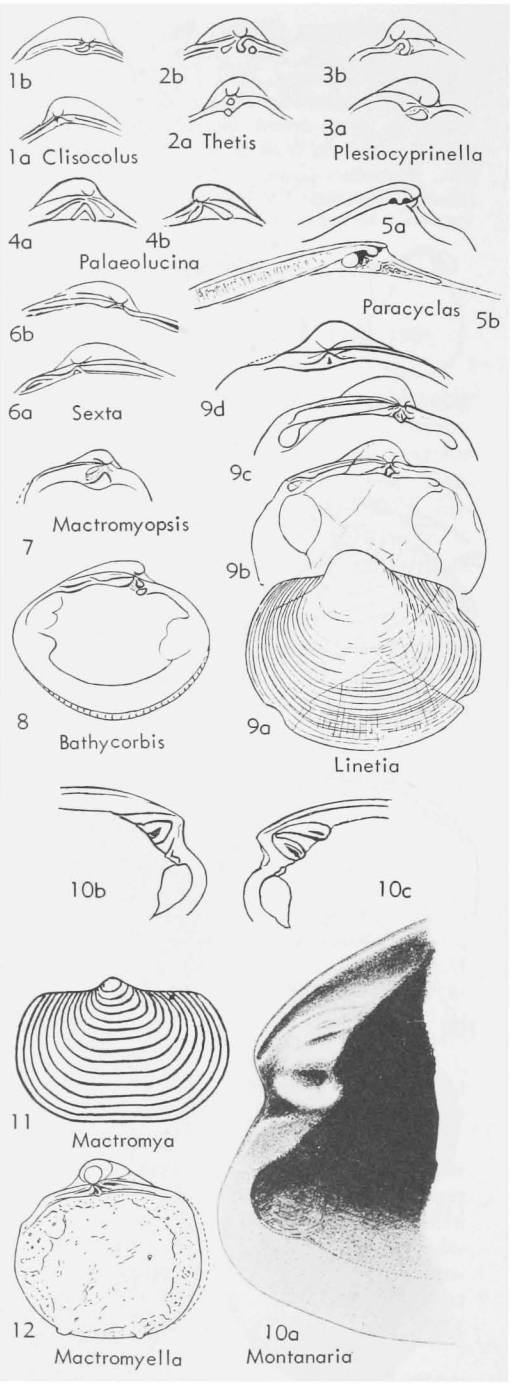


FIG. E15. Mactromyidae (p. *N511-N513*).

laterals. *Pleist.-Rec.,* Australia-N.Z.-Japan.——Fig. E13,*3*; E14,*13. P. resupina neozelandica* Iredale, N.Z.; E13,*3,* LV ext., ×5 (Iredale, 1930); E14, *13a-c,* RV ext., int., LV int., ×1 (Fleming, 1950).

Storthodon Giebel, 1856 [13] [**S. liscaviensis;* OD]. Oblong, gibbous, with well-marked posterior area, beaks pointed, prosogyrous; hinge with pyramidal quadrangular tooth under beaks and nearly similar one beneath it; marginal ligament in flattened area. *M.Trias.,* Eu.——Fig. E14, *1. *S. liscaviensis,* Ger.; RV int. (Chavan, n).

Tauraxinus Sacco, 1901 [**T. miorugosus*; OD]. Flabelliform, with quite obsolete areas, lunule depressed or sunken, ligamentary groove somewhat narrow and elongate; surface with concentric wavy sculpture. *Mio.-Rec.,* Eu.-S.Pac.

T. (Tauraxinus) [5]. Anterior end attenuated, produced; beaks small; lunule long, depressed. *Mio.,* Eu.——Fig. E14,*9. *T. (T.) miorugosus,* Italy; *9a,b,* RV ext., int., enl. (Chavan, n).

T. (Mendicula) Iredale, 1924 [6] [**M. memorata* (=*Lucina induta* Hedley, 1907, *non* Stoliczka, 1887); OD]. Anterior end rounded, beaks prominent, prosogyrate; lunule not defined but corresponding anterior margin projecting backward behind beaks. *Rec.,* S.Pac.-Australia.——Fig. E14,*5. *T. (M.) memorata* (Iredale), Australia; *5a,b,* RV ext., hinge, enl. (Chavan, n).

Family MACTROMYIDAE Cox, 1929

[=Mactromyacidae Cox, 1935]

Globose, outline trigonal to elliptical, commonly elongate transversely; beaks more or less prominent, prosogyrous; lunule ill-defined, ligament in broadened, distinctly marginal groove with somewhat sunken resilium; surface with predominant concentric sculpture. Hinge with primitive laminae in cyclodont pattern; anterior adductor scars ovate, not digitate; some shells with shallow pallial sinus. *Dev.-Rec.*

Arrangement of generic taxa by Chavan.——1. *Mactromya.*——2. *Clisocolus.*——3. *Macromyopsis.*——4. *Mactromyella.*——5. *Linetia.*——6. *Thetis.*——7. *Sexta.*——8. *Bathycorbis.*——9. *Plesiocyprinella.*——10. *Palaeolucina.*——11. *Montanaria.*——12. *Paracyclas.* [Insert above, 1a. *Unicardium;* 6a. *Cordiula.*]

Mactromya Agassiz, 1843 [1] [**M. rugosa* (=**Lutraria concentrica* Münster in Goldfuss, 1840; SD Herrmannsen, 1847]. Transversely elliptical, nearly equilateral, with strong subequidistant concentric ribs; RV hinge with anterior thickening and shallow socket. *Jur.(Bathon.-Portland.),* Eu.-E.Afr.——Fig. E15,*11. *M. concentrica* (Münster), U.Jur., Ger., LV ext., ×1.25 (Chavan, n, after Goldfuss).

Bathycorbis Iredale, 1930 [8] [**Chione despecta* Hedley, 1904; OD]. Transversely trigonal, small, nearly equilateral; surface with strong concentric ribs, laciniate, intercalated striae; LV hinge with 2 superposed tuberculiform teeth and posterior thickening in front of ligament, RV hinge with single rounded tooth and laminar processes in inverted V above it. *Rec.,* Australia.——Fig. E15,*8. **B. despecta* (Hedley); LV int., ×12 *(119).*

Clisocolus Gabb, 1869 [2] [**Loripes dubia* Gabb, 1864; OD]. Trigonal to rounded, somewhat inequilateral, beaks high, with lamellar striae; resilium sunken; hinge with ill-defined virguliform cardinal and anterior lateral in each valve. *Cret.,* W.N.Am.-Eu.——Fig. E15,*1;* E16,*1. *C. dubius* (Gabb), Chico Gr., USA(Calif.); E15,*1a,b,* RV and LV hinges *(119);* E16,*1a,b,* RV and LV hinges, ×1.5; E16,*1c,* LV ext., ×1.5 *(333).*

Cordiula Meyer, 1887 [6a] [**Unicardium? eocenense;* OD]. Similar to *Thetis* in outline and sculpture, but without oblique internal rib; three faint medioposterior pallial sinuosities. One left tubercular cardinal and obsolete laterals. Anterior scar elliptical, posterior elliptical-cordate. *Oligo.,* USA (Miss.).

Linetia Chavan, 1959 [5] [**Mactromya Caumonti* Chavan, 1959 (*ex* Agassiz, MS, 1845) (=*Mactromya calliope* Rollier, 1913, *non* Thévenin, 1909, *ex* d'Orbigny, 1850); OD]. Large, rounded ovate, very inequilateral, with irregular concentric ribbing and radial striation laterally; hinge with *AIII-3* in inverted V with triangular *2* and distinct *4b* below. *Jur.(Aalen.-Callov.),* Eu.——Fig. E15,*9. **L. caumonti* (Agassiz), Bajoc., W.France; *9a-d,* LV ext., int., LV and RV hinges, ×0.8 *(119).*

Macromyopsis Chavan, 1959 [**Unicardium hemirhytideum* Cossmann, 1905; OD]. Subquadrate to subcirculate, rather thick, with strong concentric ribbing; hinge with single cardinal in each valve attached to its anterior lamina, elevated posterior muscle scar. *Jur.(Charmouth.-Callov.),* Eu.

M. (Macromyopsis) [3]. Subquadrate; RV hinge with well-developed cardinal *3. Jur.(Bajoc.-Callov.),* Eu.——Fig. E15,*7. *M. (M.) hemirhytidea* (Cossmann), Bajoc., W.France; LV hinge, ×1.25 *(119).*

M. (Mactromyella) Chavan, 1959 [4] [**Unicardium inflatum* Thévenin, 1909 (*ex* d'Orbigny, 1850); OD]. Subcircular, with rather regular ribbing; RV hinge with evanescent cardinal *3,* overhanging well-developed *AI. Jur.(Charmouth.-Bajoc.),* Eu.——Fig. E15,*12. *M. (M.) inflata* (Thévenin), Bajoc., W.France; RV int., ×1.25 *(119).*

Montanaria Spriestersbach, 1909 [11] [**M. ovata* (=**Pleurophorus devonicus* Beushausen, 1884); SD Haffer, 1959]. Rounded oval to elongate, very inequilateral, beaks small, anterior, surface

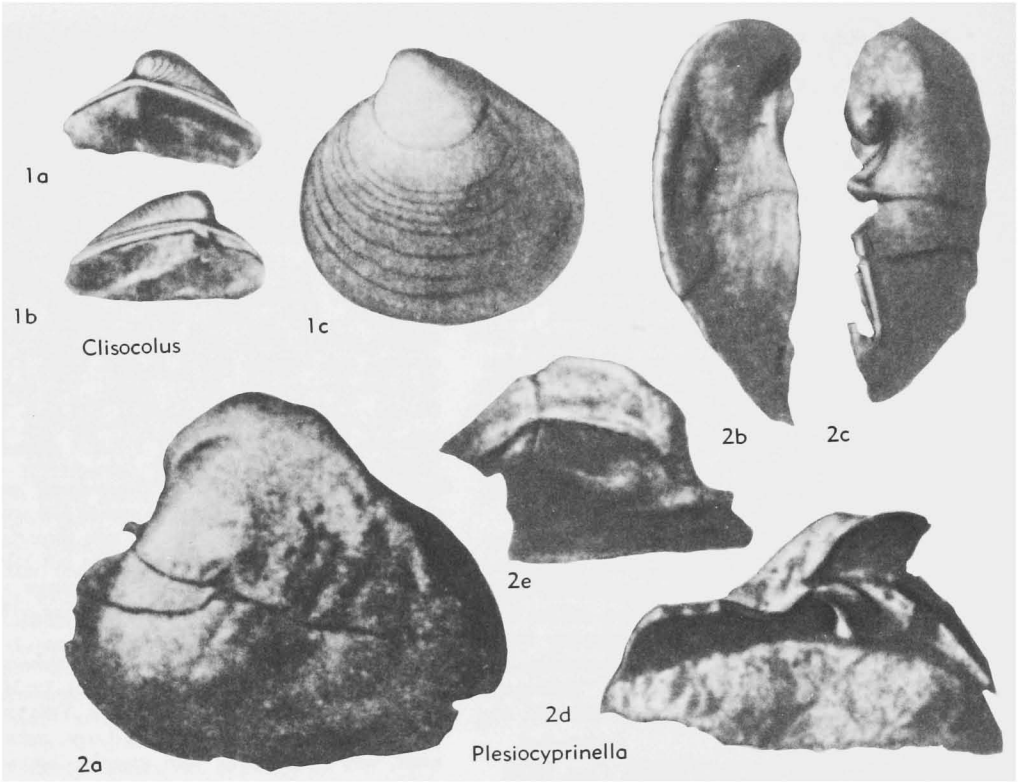


FIG. E16. Mactromyidae (p. *N*511-*N*512).

with fine concentric growth lines only; hinge with *AIII, 3a-3b/4a, 2, (4b); 2* and *3* grooved to bifid, some shells with *AIII* and *4a* weak or lacking; anterior scars ovate. *Dev.*, Eu.——FIG. E15,*10*. **M. devonica* (BEUSHAUSEN), Remscheider beds, Ger.; *10a,* RV hinge (Beushausen); *10b,c,* RV and LV hinges (Chavan, n).

?**Palaeolucina** CHAO, 1927 [10] [**P. carbonaria;* OD]. Mostly elliptical, with somewhat low beaks, distinct ovate lunule, and long narrow escutcheon; surface with lamellose concentric ribs; hinge with 3 teeth in LV, median one bifid; 2 oblique teeth and marginal anterior lamella in RV; muscle scars unknown. *Carb.*, China.——FIG. E15,*4*. **P. carbonaria; 4a,b,* LV and RV hinges, enl. (Chavan, n, after Chao).

Paracyclas HALL, 1843 [12] [**P. elliptica* (=*Lucina proavia* GOLDFUSS, 1840); OD]. Ovate, beaks low, surface with concentric ribs; RV hinge apparently with *2* oblique superposed rounded tubercles separated by sockets, superior one smaller than inferior, flat area in front of them and possibly linear anterior lateral; broad and long ligament depression; anterior muscle scars elliptical. *Dev.*, N. Am. - Eu. —— FIG. E15,*5*. *P. marginata* (MAURER), Ger.; *5a,b,* LV hinges, enl. (Chavan after Maurer).

Plesiocyprinella HOLDHAUS, 1918 [9] [**P. carinata;* OD]. Cordate, rounded, beaks prominent; RV hinge with *AIII, 3a, 3b* hooked, LV hinge with large, low, subtrigonal 2 and thinner, oblique *4b*. *Perm.*, S.Am.——FIG. E15,*3*; E16,*2*. **P. carinata,* Brazil; E15,*3a,b,* LV and RV hinges, ×0.8 *(119)*; E16,*2a-e,* LV ext., ant., RV ant., hinge, LV hinge, all ×1.5 (Holdhaus).

Sexta STEPHENSON, 1954 [7] [**S. navicula*; OD]. Rounded, convex, relatively low beaks, no lunule, ligament external; surface nearly smooth; hinge with anterior laterals, median depression, faint posterior laterals, RV with minute cardinal; adductor scars small, subequal. *U.Cret.(Cenoman.)*, N.Am.——FIG. E15,*6*. **S. navicula,* USA(Tex.); *6a,b,* RV and LV hinges, ×2 *(119)*.

Thetis J. DE C. SOWERBY, 1826 [6] [**T. major;* M (=*Corbula laevigata* SOWERBY, 1818, *non Thetis* OKEN, 1815, inval., *nec* C. B. ADAMS, 1845, *nec* H. ADAMS & A. ADAMS, 1856)] [=*Thetironia* STOLICZKA, 1870 (obj.); *Fimbriella* STOLICZKA, 1871 (obj.)]. Subcircular, tumid, with prominent nearly orthogyrous beaks; surface with concentric

and laterally radial sculpture; ligament thin; hinge with *AIV* continued above and behind tubercular *2* as hooked tooth, RV with 2 superposed tuberculiform cardinals. Oblique internal rib resembling pallial sinus. *Cret.(Alb.-Cenoman.),* Eu.-N.Am. ——Fig. E15,*2*. **T. laevigata* (Sowerby), L.Cret., Eng.; *2a,b,* RV and LV hinges, ×1.25 *(119)*.
[The American species, known as *Thetiopsis* Meek, shows a venerid hinge.]

Unicardium d'Orbigny, 1850 (1849) [1a] [**Corbula cardioides* Phillips, 1829; SD Stoliczka, 1871]. Like *Mactromya* but more tumid, rounded; broadly inflated prosogyrous beaks; irregular lamellose concentric ribbing. Hinge with right faint cardinal tubercle; long straight nymph. *Jur.,* W.Eu.

Family FIMBRIIDAE Nicol, 1950

[=Corbidae Dall, 1895]

Transversely elliptical or ovate, beaks rounded; lunule and escutcheon generally well marked; surface bearing primary radial ribs superposed by smooth or concentrically sculptured external layer; marginal ligament on nymph. Hinge with massive, trigonal or tubercular, generally entire medial teeth in more or less cyclodont pattern, anterior laterals commonly and posterior laterals generally developed; muscle scars ovate to reniform, short, without digitation. *Carb.-Rec.*

Arrangement of generic taxa by Chavan.——1. *Fimbria.*——2. *Scaldia.*——3. *Schafhaeutlia.*——4. *Sphaeriola.*——5. *Haastina.*——6. *Cyclopellatia.*——7. *Sphaera.*——8. *Mutiella.*——9. *Parvicorbis.*

Fimbria Megerle von Mühlfeld, 1811 [1] [**F. magna* (=*Venus fimbriata* Linné, 1758); OD] [*non Fimbria* Bohadsch, 1761 (invalid)] [=*Corbis* Cuvier, 1817 (obj.); *Idothea* Schumacher, 1817 (*non* Fabricius, 1796) (obj.)]. Transversely elliptical, subequilateral, thick, beaks prosogyrous; lunule small, lanceolate, ligament external but partly sunken; surface with strong reticulate sculpture, concentric ribs medially dominant; hinge with 2 cardinals in each valve, *3b* grooved, anterior laterals near, posterior laterals remote; interior with very small pallial sinus and crenulate margin. *M.Jur.(Bathon.)-Rec.,* Eu.-N.Am.-Pac.-India-Australia.——Fig. E17,*1*. **F. fimbriata* (Linné), Rec., Eu.; *1a-c,* RV ext., int., LV int., ×1 *(674)*.

Cyclopellatia Cossmann, 1907 [6] [**C. acrodonta*; OD]. Rounded, nearly equilateral, low prosogyrous beaks; surface with close-spaced radial ribs crossed by concentric striations which predominate posteriorly; hinge broad, thick, LV with marginal anterior approximate to upper lateral *(AIV),* strong trigonal *2,* oblique *4b,* strong *PII* not very remote; ligament marginal. *L.Jur. (Barrem.),* Eu.——Fig. E18,*4*. **C. acrodonta,* S. France; *4a,b,* LV ext., ×1.25, hinge, ×2.5 (Chavan, n, after Cossmann).

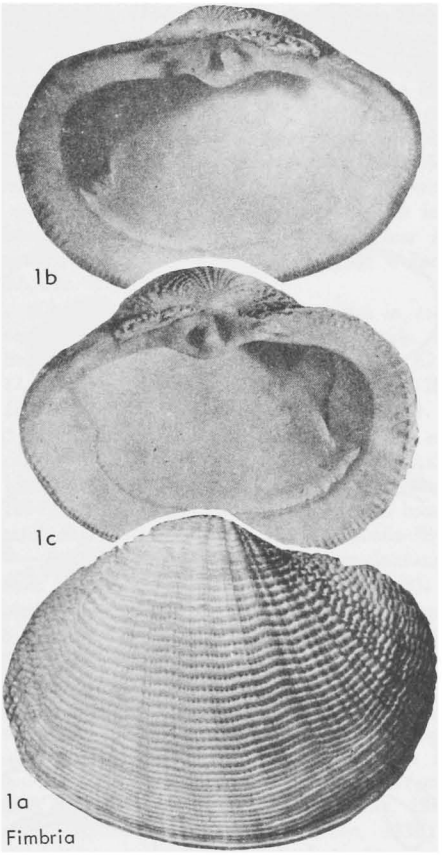


Fig. E17. Fimbriidae (p. *N*513).

Haastina Marwick, 1953 [5] [**Heminajas? haastiana* Wilckens, 1918; OD]. Transversely elliptical, slightly inequilateral, beaks high, prosogyrous; surface with concentric striation; hinge with 3 diverging cardinals, median bifid, posterior weak on RV, posterior laterals strong; muscle scars ovate. *U.Jur.(Oxford.),* N.Z.——Fig. E18,*3*. **H. haastina* (Wilckens); RV int., ×1.5 (Chavan, n, after Marwick).

Mutiella Stoliczka, 1871 [8] [**Corbis rotundata* d'Orbigny, 1843; OD]. Globose, high, ovate, beaks broad, nearly orthogyrous, with long marginal ligament; surface finely reticulate; LV hinge with *AIV* marginal, elongate and small remote tubercular *AII, 2* deeply bifid, *4b* long and stout. *U.Cret.,* Eu.-S.Asia(India).——Fig. E18,*5*. **M. rotundata* (d'Orbigny), Senon., France; LV hinge, ×1.5 (Chavan, n, after d'Orbigny).

Parvicorbis Cossmann, 1892 [9] [*pro Bernayia* Cossmann, 1887 (*non Bernaya* Jousseaume, 1884)] [**Bernayia subarata* Cossmann, 1887; SD Chavan,

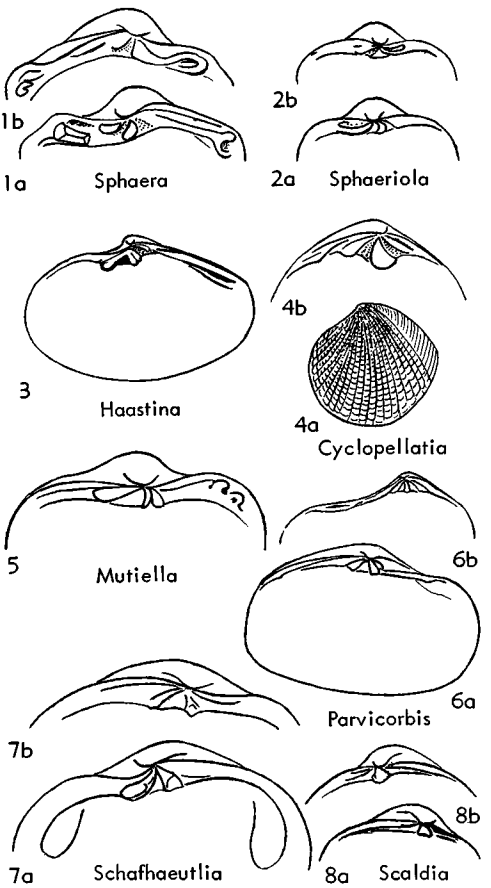


FIG. E18. Fimbriidae (p. *N*513-*N*514).

herein]. Small, transversely elliptical, slightly gaping at both ends; lunule narrow, escutcheon well impressed, nymph short; surface with concentric to reticulate sculpture; hinge with small pointed cardinals, bilobate *2*, remote anterior and posterior laterals; inner shell margin smooth. *Eoc.*, Eu.——FIG. E18,*6a*. **P. subarata* (COSSMANN), France (Paris Basin); *6a*, LV int., ×4.5 (Chavan, n, after Cossmann).——FIG. E18,*6b*. *P. goodallina* (COSSMANN), France (Paris Basin); *6b*, RV hinge, ×8 (Chavan, n, after Cossmann).

Scaldia DE RYCKHOLT, 1847 [2] [**S. lambotteana*; SD STOLICZKA, 1871]. Rounded, short, slightly inequilateral, somewhat prosogyrous prominent beaks; escutcheon narrow, nymph elongate; surface concentrically striate; hinge with 2 cardinals in each valve, *2* and *3b* strong, *3a* laminar, *4b* weak; inner shell margin smooth. *Carb.*, Eu.——FIG. E18,*8*. **S. lambotteana*, Belg.; *8a,b*, LV and RV hinges, ×1.25 (Chavan, n).

Schafhaeutlia COSSMANN, 1897 [3] [*pro Gonodon* SCHAFHAEUTL, 1863 (*non* HELD, 1837)] [**Gonodon ovatum* SCHAFHAEUTL, 1863; OD]. Broadly elliptical, short, very thick, slightly inequilateral; surface with concentric sculpture; hinge with cyclodont conical cardinals and irregular anterior lateral; anterior muscle scar small. *U.Trias.*, Eu.-S.Am.——FIG. E18,*7*; E19,*1*. *S. mellingi* (HAUER); E18,*7a,b*, RV and LV hinges, ×1 (Chavan, n, after Hauer); E19,*1a-c*, LV int., RV int., both valves ant., ×1 (Schafhaeutl, 1863). [=*Gonodus* MUSKETOV, 1913 (missp.).]

Sphaera SOWERBY, 1822 [7] [**S. corrugata*; SD STOLICZKA, 1871] [=*Palaeocorbis* CONRAD, 1869 (obj.)]. Rounded, inflated, solid, subequilateral, with inflated nearly orthogyrous beaks; surface with corrugated concentric ribs; hinge strong, cyclodont, RV with strong anterior lateral, subhorizontal anterior cardinal, and arcuate posterior lateral, LV with anterior lateral fused with anterior cardinal and ill-defined posterior lateral, each valve with 2 remote posterior laterals. *L. Cret.*, Eu.——FIG. E18,*1*. **S. corrugata*, Neocom., France; *1a,b*, RV and LV hinges, ×2 (Chavan, n, after d'Orbigny & Woods).

Sphaeriola STOLICZKA, 1871 [4] [**S. madridi* (=*Cardium madridi* D'ARCHIAC, 1843); OD]. Globose, rounded, subequilateral, with prominent nearly orthogyrous rounded beaks, ligament short, broad; hinge with 2 teeth in each valve, anterior one (*AIV, AIII -3a*) subhorizontal and elongate, posterior one *(2, 3b)* trigonal, arcuate, stout, inner shell margin with denticles not corresponding to apparent ribs; sculpture of concentric sulci on radial internal ribs. *Jur.(Domer.-Bathon.)*, Eu.-N.Z.-Japan.——FIG. E18,*2*. **S. madridi* (D'ARCHIAC), Bathon., Eng.; *2a,b*, RV and LV hinges, ×1.25 (Chavan, n, after Morris & Lycett).

Family UNGULINIDAE
Adams & Adams, 1857

[=Diplodontidae DALL, 1895]

Outline subtrigonal to oblong, rounded or obliquely ovate, beaks generally low, dorsal angulations weak or absent, ligament and resilium marginal; surface smooth, punctate, or with fine concentric sculpture; hinge with two cardinals, medial one bifid, and incomplete or evanescent laterals; muscle scars irregular, anterior scar elongate and not detached from pallial line, posterior scar large. *U.Cret.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Ungulina*.——2. *Numella*.——3. *Felania*.——4. *Brachymeris*.——5. *Microstagon*.——6. *Diplodonta*.——7. *Zemysina*.——8. *Felaniella*.——9. *Zemysia*.

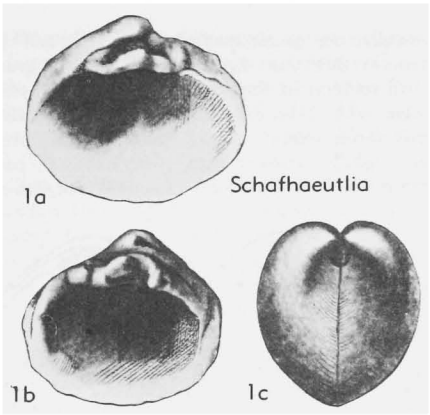


FIG. E19. Fimbriidae (p. *N*514).

——10. *Bruetia.*——11. *Phlyctiderma.*——12. *Timothynus.*——13. *Cycladicama.*——14. *Toralimysia.*

Ungulina ROISSY, 1805 [1] [**U. rubra* (=*Tellina cuneata* SPENGLER, 1782); SD GRAY, 1847] [=*Unguline* DAUDIN in BOSC, 1801 (vernac.); *Clotho* BASTEROT, 1825 (*non* WALCKENAER, 1805, *nec* FAUJAS, 1808) (type, *C. unguiformis;* OD)]. Oblong, thick, irregular; lunule lacking, external ligament extended backward, with groove adjacent to shorter socket occupied by broad resilium which partly covers nymph and obliterates *4b*; large oblong subequal muscle scars. *Oligo.(Aquitan.)-Rec.,* Eu.-W.Afr.——FIG. E20,*8*. **U. cuneata* (SPENGLER), Rec., Senegal; *8a,b,* LV int., RV hinge, enl. *(121)*.

Brachymeris CONRAD, 1875 [4] [**B. alta*; OD] [=*Arene* CONRAD, 1875 (*non* ADAMS & ADAMS, 1854)]. Obliquely oblong, nearly orthygyrous beaks; lunule lacking, narrow marginal ligament and resilium in short groove; hinge with generally bifid *2* and *3b,* and oblique *3a* and *4b,* anterior laterals moderately developed, posterior ones weak; anterior muscle scar very broad. *U.Cret.,* N.Am. ——FIG. E20,*7*. **B. alta,* USA(N.Car.); *7a,b,* RV int., LV hinge, ×3 (Chavan, 1960).

Bruetia CHAVAN, 1962 [10] [**Lucina radians* MELLEVILLE, 1843 (*non* CONRAD, 1841) (=*L. subradians* D'ORBIGNY, 1850); OD]. Subtrigonal to subquadrate, somewhat thick; narrow resilium and flat nymph in front and resting on short ligament; hinge with 2 bifid cardinals in each valve, anterior laterals and *AIV-4a* developed marginally; internal radial lines generally well marked; anterior muscle scar falciform, posterior scar shorter and ovate. *Paleoc.-Mio.,* Eu.-C.Am.——FIG. E20, *5. B. subradians* (D'ORBIGNY), L.Eoc., France (Paris Basin); *5a,b,* LV int., RV hinge, ×3 (Chavan, 1960).

Cycladicama VALENCIENNES in ROUSSEAU, 1854 [**C. luciniformis* (=*Cyrenoida oblonga* HANLEY, 1844 *(nom. nud.)*, 1856); OD] [=*Joannisiella* DALL, 1895 (*pro Joannisia* DALL, 1895, *non* MONTEROSATO, 1884, *nec* KIEFER, 1894) (obj.)]. Transversely subovate, attenuate forward, somewhat angular and truncate rearward, with external flattened area defined by medioposterior weak angulation; ligament in groove adjacent to shorter resilium in broader socket; surface concentrically striate; hinge with 2 cardinals in each valve and single more or less distinct anterior lateral; anterior muscle scar irregularly extended and doubles, elongate. *U.Eoc.-Rec.,* Pac.-W.Afr.-Japan-?Eu.

C. (Cycladicama) [13]. Broad, normal in convexity; hinge with laminar anterior laterals. *U. Eoc.-Rec.,* Pac.-W.Afr.-Japan-?Eu.——FIG. E20, *11. *C. (C.) oblonga* (HANLEY), Rec., Philip. Is.; *11a,b,* RV int., LV hinge, ×2 (Chavan, 1960).

C. (Toralimysia) IREDALE, 1936 [14] [**T. excentrica* (=*Joannisiella sphaericula* HEDLEY, 1906, *non Cyrenella sphaericula* DESHAYES, 1854); OD]. Strongly convex; hinge with broad cardinals and obsolete laterals. *Rec.,* Australia-?Eu. ——FIG. E20,*3*. **C. (T.) excentrica* IREDALE; *3a,b,* RV and LV hinges, enl. (Chavan, 1960).

Diplodonta BRONN, 1831 [**Venus lupinus* BROCCHI, 1814 (*non* LINNÉ, 1858) (=**Tellina rotundata* MONTAGU, 1803) (=*D. rotundata* var. *aequilateralis* CERULLI, 1909); SD HERRMANNSEN, 1846] [=*?Taras* RISSO, 1826 (type, *T. antiquatus*; OD) *(nom. dub.)*; *Mysia* LEACH in BRONN, 1827 (*non* LAMARCK, 1818) (obj.); *Glocomene* LEACH in GRAY, 1852 (type, *Tellina rotundata* MONTAGU, 1803; SD CHAVAN, 1962); *?Mittrea* GRAY, 1864 (type, *Diplodonta brasiliensis* MITTRE, 1850)]. Suborbicular, convex, inequilateral, beaks prosogyrous; ligament on medium-sized flattened nymph with narrow resilium on its anterior extremity; hinge with 2 well-developed oblique cardinals in each valve and weak *5b*; anterior muscle scars sinuate, narrower than posterior scars. *Paleoc.-Rec.,* Eu.-N.Am.-Pac.-W.Afr.

D. (Diplodonta) [6]. Moderately convex; hinge with somewhat narrow short teeth; anterior muscle scars not elongate. *Paleoc.-Rec.,* Eu.-N. Am.-Pac.——FIG. E20,*10*. **D. (D.) rotundata* (MONTAGU), Rec., Medit.; *10a,b,* LV int., RV hinge, ×3 (Chavan, 1960).

D. (Zemysina) FINLAY, 1926 [1927] [7] [**Zemysia (Z.) globus* FINLAY, 1927; OD]. Very convex; hinge with longer and more bifid teeth and more elongate muscle scar than in *D. (Diplodonta). Eoc.-Rec.,* Eu.-N.Am.-Pac.——FIG. E21, *3. D. (Z.) walli* (WOODRING), Mio., Jamaica; *3a,b,* RV ext., int., ×4 *(1005)*.

Felania RECLUZ, 1851 [3] [**Venus diaphana* GMELIN, 1790; OD]. Sublenticular, thin, medium-sized; lunule small, external ligament adjacent to long resilium lying in groove; hinge with 2 cardi-

nals and single anterior lateral in each valve; anterior muscle scars less elongate than posterior scars. *Rec.,* W.Afr.——Fig. E20,*2*. **F. *diaphana* (Gmelin), Senegal; *2a,b,* LV int., RV hinge, enl. (Chavan, 1960).

Felaniella Dall, 1899 [**Mysia (Felania) usta* Gould, 1861; OD]. Subquadrangular to rounded, inequilateral, posteromedially enlarged and flattened, rather thin; ligament in marginal groove, small resilium in elliptical socket at top of nymph; hinge with 2 subvertical or oblique cardinals in each valve; anterior muscle scars somewhat irregular, slightly narrower than posterior scars, pallial line doubled. *U.Cret.-Rec.,* N.Am.-W.Pac.-Eu.-Afr.

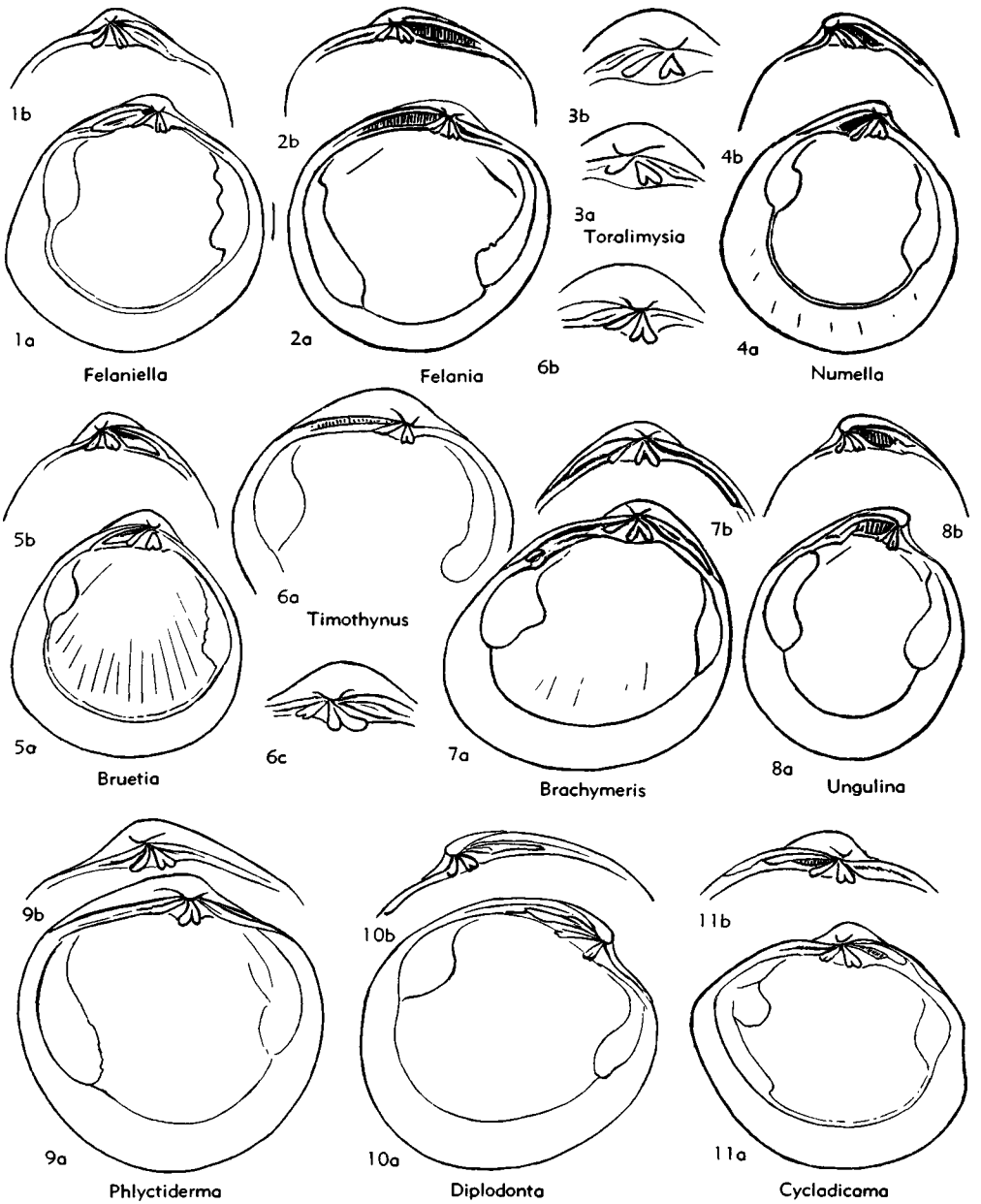


Fig. E20. Ungulinidae (p. *N515-N517*).

F. (Felaniella) [8]. Ligament almost external, resilium restricted; hinge with somewhat oblique teeth; muscle scars rather narrow. *Paleoc.-Rec.*, N.Am.-Pac.-Eu.——Fig. E20,*1*. **F. (F.) usta* (Gould), Rec., Japan; *1a,b*, LV int., RV hinge, ×2 (Chavan, 1960).

F. (Zemysia) Finlay, 1926 [1927] [**Lucina zelandica* Gray, 1835; OD]. Broader and more rounded than *F. (Felaniella)*; ligament somewhat sunken, resilium extended, partly covering long nymph; hinge with nearly vertical teeth; muscle scars relatively broad. *U.Cret.-Rec.*, S.Pac.-S.Afr.-N.Am.-Eu.——Fig. E21,*1*. *F. (Z.) acclinis* (Conrad), Mio., USA(Md.); *1a,b*, RV int., LV hinge, enl. *(121)*.

Microstagon Cossmann, 1896 (1899) [5] [*pro Goodallia* Deshayes, 1860 (*non* Turton, 1822)] [**Goodallia herouvalensis* Deshayes, 1860; SD Dall, 1903]. Small, very obliquely oblong, anteromedially elongated; ligament narrow and long, on nymph adjacent to shorter resilium lying in groove; hinge with thick *2* and oblique *3b*, oblique *3a, AIII, 4b*, and obsolete *PII;* anterior muscle scars well marked, irregularly elongate, enlarged. *L. Eoc. - Rec.*, Eu.-C. Am.-N. Am.-Japan. —— Fig. E21,*2*. *M. miliare* (Lamarck), Eoc., France(Paris Basin); *2a,b*, LV, RV int., ×2 *(121)*. [=*Minipisum* Yabe, 1961 (type, *M. japonicum;* M) (subj.).]

Numella Iredale, 1924 [2] [**Mysia (Felania) adamsi* Angas, 1867; OD]. Ovately oblong, concentrically striate; ligament next to deep resilium, extended narrowly forward and broadly rearward; hinge with elongate *4b*; anterior muscle scars longer and narrower than others. *Mio.-Rec.*, Australia.——Fig. E20,*4*. **N. adamsi* (Angas), Rec.; *4a,b*, LV int., RV hinge, ×3 (Chavan, 1960).

Phlyctiderma Dall, 1899 [11] [**Diplodonta semiaspera* Philippi, 1836; OD]. Globose, rounded, inequilateral, posteriorly enlarged, externally punctate, pustulose, or reticulate; ligament long, in groove, resilium narrow; hinge with somewhat projecting bifid *2* and *3b*, and oblique *3a, 4b, AIII*; posterior muscle scars very broad. *Mio.-Rec.*, N. Am.-W.Pac.-Japan.——Fig. E20,*9*. **P. semiaspera* (Philippi), Rec., USA(Fla.); *9a,b*, LV int., RV hinge, ×4 (Chavan, 1960).

Timothynus Harris & Palmer, 1946 [12] [**Sphaerella bulla* Conrad, 1865; OD] [=*Sphaerella* Conrad, 1838 (*non* Sommerfelt, 1834) (type, *S. subvexa;* OD)]. Very globose, rounded, inequilateral, posteriorly enlarged; ligament and resilium adjacent, with long rounded nymph; surface smooth; hinge with *2* and *3b* deeply bifid and projecting strongly *(2* subvertically, posterior half of *3b* almost horizontally), *3a* and *4b* oblique; anterior muscle scars narrow, much elongated. *L. Eoc.-Rec.*, N.Am.-?Eu.——Fig. E20,*6a*. *T. subvexus* (Conrad), Mio., USA(Md.); LV int., enl. (Chavan, 1960).——Fig. 20,*6b,c*. **T. bulla* (Conrad), Mio., USA(Md.); *6b,c*, LV and RV hinges, enl. (Chavan, 1960).

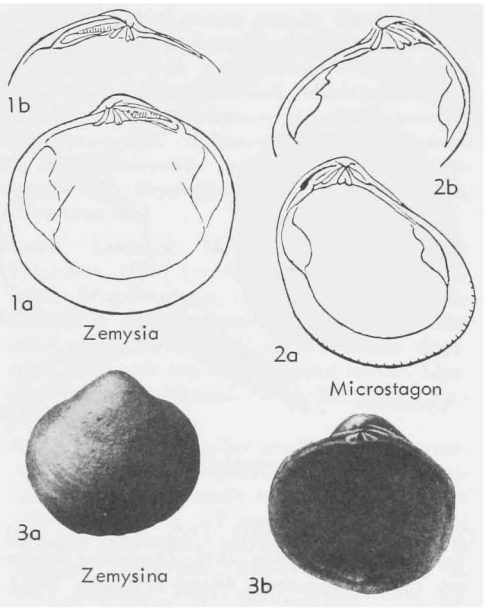


Fig. E21. Ungulinidae (p. *N515*, *N517*).

GENUS DUBIUM

Pegmapex Berry, 1960 [**P. phoebe;* M]. Thin, smooth, orbicular; true hinge plate continued posteriorly with flat expansive shelf formed by narrow, sharply angular, deeply sunken escutcheon. Two cardinals in each valve, posterior right and anterior left larger and bifid. *Rec.*, N.Am.(Mex.).

Family CYRENOIDIDAE
Adams & Adams, 1857

[=Cyrenellidae Fischer, 1882]

Suborbicular, posteriorly enlarged, inequilateral, thin, inflated, with rounded prosogyrous beaks; lunule lacking, escutcheon present or absent, ligament and resilium developed marginally; surface concentrically striate; hinge with anterior LV and RV cardinals forming posterior bent part of their original anterior lateral, elongate, forming pattern *AI-1, AIII-3, AII-2*, with *4b* simple and minute, posterior laterals lacking; muscle scars large, elongate, without digitation. *Rec.*

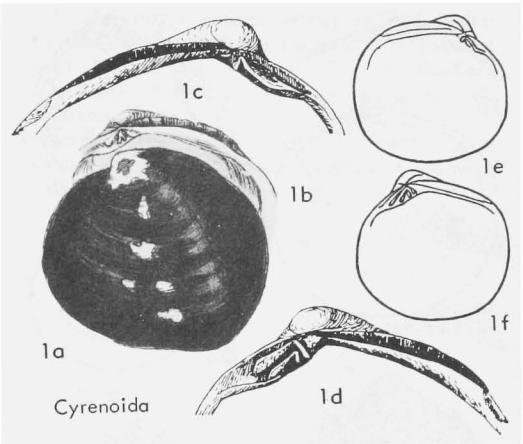


FIG. E22. Cyrenoididae (p. *N*518).

Cyrenoida JOANNIS, 1835 [**C. dupontia*; OD] [=*Cyrenella* DESHAYES, 1835; *Cyrenoides* SOWERBY, 1839; *Cyrenodonta* ADAMS & ADAMS, 1857]. Characters of family. *Rec.*, Afr.-N.Am.-C.Am.——FIG. E22,*1a-d*. **C. dupontae* [=*C. dupontia (lapsus)*], W.Afr.; *1a,b*, LV ext., RV hinge, ×1.25 (Sowerby, 1852); *1c,d*, LV and RV hinges, enl. (Lamy).——FIG. E22,*1e,f*. *C. rhodopyga* VON MARTENS, Congo; *1e,f*, LV and RV int., ×0.8 *(114)*.

Superfamily CHAMACEA Lamarck, 1809

[*nom. correct.* ICZN, 1957, Opinion 484 (*pro* Camacea DE BLAINVILLE, 1825) (=camacées LAMARCK, 1809)] [Chamacea MENKE, 1830, not recognized by ICZN] [Materials for this superfamily prepared by MYRA KEEN]

Sculpture normally well developed, concentric or radial or both; shell cemented to substrate by one valve, at least temporarily; beaks prosogyrate, ligament parivincular; hinge degenerate in appearance, with at least one large cardinal tooth in either valve, two cardinals and weak laterals in some; muscle scars two, large, subequal; pallial line entire. *?U.Cret., Paleoc.-Rec.*

Family CHAMIDAE Lamarck, 1809

[*nom. transl.*, BRODERIP, 1839 (*ex* Camacea DE BLAINVILLE, 1825) (=camacées LAMARCK, 1809)] [Chaminae GRAY, 1823, not recognized by ICZN]

Characters of superfamily. *?U.Cret., Paleoc.-Rec.*

Chama LINNÉ, 1758 [**C. lazarus*; SD CHILDREN, 1823 (ICZN, Opinion 484, 1957)] [=*Jataronus* BRUGUIÈRE, 1792, AUCTT. *(nom. nud.)*; *Maceris* MODEER, 1793 (obj.); *Cameola* RAFINESQUE, 1815 *(nom. null.)*; *Lacinea* SOWERBY, 1842 (obj.); *?Hellia* SCHAFHÄUTL, 1863 (type, *H. gryphus*; Cret., Ger.; M)]. Attached by LV throughout life; ornamentation foliaceous. *?U.Cret., Paleoc.-Rec.*, tropics-Eu.-N.Am.

C. (Chama). Concentric ornamentation of distinctive flattened spines in irregular radial rows. *L.Eoc.-Rec.*, Eu.-Am.-SW.Pac.——FIG. E23,*1*. **C. (C.) lazarus*, Rec., E.Indies; *1a-c*, RV ext., LV int., RV hinge, ×0.5 *(124b, 684)*.

C. (Cipliacella) VINCENT, 1928 [**Chama pulchra* RAVN, 1902; M] [=*Ciplyella* VINCENT, 1930 (obj.); *Cipleyella (nom. null.)*]. Attachment scar obscure; otherwise as in *C. (Chama)*. *Paleoc. (Dan.)*, Eu.

C. (Psilopus) POLI, 1795 [**Chama gryphoides* LINNÉ, 1758; M] [=*Psilopoderma* POLI, 1795 (obj.); *Psilotus, Psilopododerma (nom. null.)*]. Concentric sculpture of small, even, flat scales. *Rec.*, IndoPac.

Arcinella SCHUMACHER, 1817 [**Chama arcinella* LINNÉ, 1767; T] [not preoccupied by *Arcinella* OKEN, 1815, rejected ICZN, Opinion 417] [=*Echinochama* FISCHER, 1887 (obj.)]. Shell attached in early growth stages only; ornamentation spinose. *Mio.-Rec.*, SE.USA-C.Am.-S.Am.——FIG. E23,*2*. **A. arcinella* (LINNÉ), Rec., Carib., *2a-c*, RV ext., LV, RV int., ×0.7 *(675, 684)*.

Pseudochama ODHNER, 1917 [**Chama cristella* LAMARCK, 1819; SD GARDNER, 1923]. Shell attached by RV. *Oligo.-Rec.*, tropics.

P. (Pseudochama). No *PII* in adult; nepionic shell with concentric sculpture only. *Oligo.-Rec.*, Medit.-C.Am.-SW.Pac.——FIG. E23,*3*. **P. (P.) cristella* (LAMARCK), Rec., E.Indies; LV ext., ×0.5 (Reeve, 1847).

P. (Eopseuma) ODHNER, 1919 [**P. (E.) pusilla*; M]. Small; nepionic shell with concentric and radial sculpture; *PII* persisting in adult. *Rec.*, E. Indies.

Superfamily LEPTONACEA Gray, 1847

[*nom. transl.* DALL, 1900 (*ex* Leptonidae GRAY, 1847)] [=Erycinacea FISCHER, 1887] [Materials for this superfamily prepared by ANDRÉ CHAVAN]

Marine, byssiferous, with three apertures in mantle—anterior (buccal), median (pedal), and posterior (anal); shell equivalve, commonly thin and more or less covered by mantle, with small resilium, indenting hinge plate or not, rarely with marginal ligament. Cardinal teeth commonly tubercular, contrasting with elongated laterals and partly atrophied by incomplete individualization of tooth *1;* hinge, therefore, para-

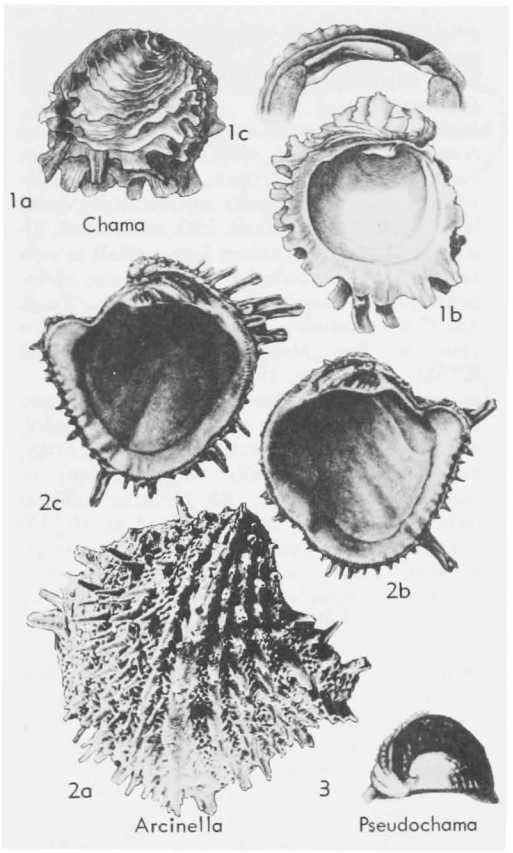


FIG. E23. Chamidae (p. *N*518).

cyrenoid *(114)*. [Burrowing.] *?Cret., Paleoc.-Rec.*

The alphabetically arranged generic descriptions in each family-group division of the Leptonacea are accompanied by numbers inclosed by square brackets. Such numbers indicate position in the sequence of generic taxa given with the respective families or subfamilies for the purpose of recording CHAVAN's arrangement, designed to reflect "natural relationships" of these taxa as inferred by him.

Family ERYCINIDAE Deshayes, 1850

[=Laseadae GRAY, 1847]

Shell somewhat flattened; hinge plate indented under beaks, small, lucinoid; cardinals and laterals present on both valves, duplicate on RV in some; internal ligament in triangular, rather ill-bounded socket, its adjacent marginal part on small nymph in some forms. *Paleoc.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Erycina.*——2. *Hemilepton.*——3. *Scacchia.*——4. *Austroscintilla.*——5. *Lucinaxinus.*——6. *Goodalliopsis.*——7. *Amerycina.*——8. *Parvikellia.*——9. *Litigiella.*——10. *Lasaea.*——11. *Pythina*——12. *Melliteryx.*——13. *Myllita.*——14. *Zemyllita.*——15. *Myllitella.*——16. *Arthritica.*——17. *Semierycina.*——18. *Erycinopsis.* [Insert above, 12a. *?Clathroconcha.*]

Erycina LAMARCK, 1805 [**E. pellucida;* SD STOLICZKA, 1871] [=*Migonitis* RAFINESQUE, 1815 (obj.); *Eryx* SWAINSON, 1840 (obj.)]. Transversely elliptical or ovate, externally smooth or with faint radial striae. Anterior RV cardinal faintly developed, other ones trigonal; elongated laterals. Ligament extended backward. *Paleoc.-Plio., ?Rec.,* Eu.-?S.Afr.-N.Am.-C.Am.

E. (Erycina) [1]. Rather small and thin, transversely ovate to elliptical, commonly subequilateral, smooth or faintly striated radially. Hinge narrow; posterior LV cardinal small, but not minute, lamelliform narrow laterals parallel to margin. *Paleoc.-Mio.,* Eu.——FIG. E24,*1*. **E. (E.) pellucida,* Eoc.(Lutet.), France; *1a,b,* LV and RV hinges, ×4.8 (Chavan, n).

E. (Hemilepton) COSSMANN, 1911 (1912) [2] [**H. longifossula;* OD]. Subelliptical, smooth. Hinge

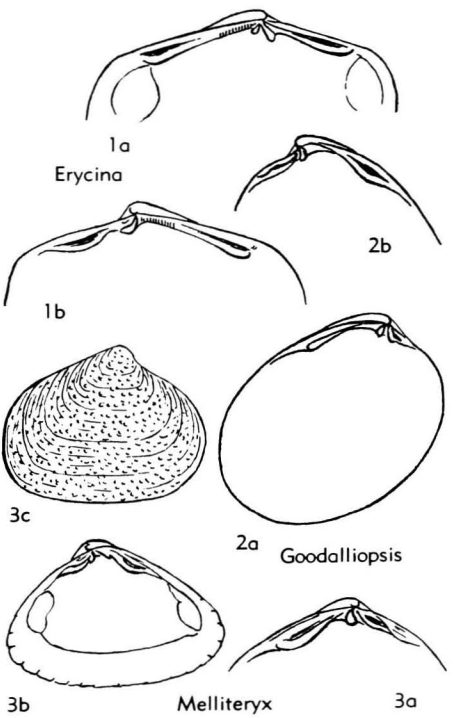


FIG. E24. Erycinidae (p. *N*519-*N*520).

stout, anterior RV cardinal in direct prolongation of elongated *AIII;* posterior RV and anterior LV obliquely trigonal; posterior LV very minute; posterior lateral stout and distant from ligament, much extended backward. *Eoc.-Plio., ?Rec.,* Eu.-N.Am.-C.Am.-?S.Afr.——Fig. E25,*8*. *E. (H.) longifossula,* Mio. (Aquitan.), France; *8a,b,* LV and RV hinges, much enl. (Cossmann, 1913).

Amerycina Chavan, 1959 [7] [**Erycina colpoica* Dall, 1913; OD]. Transversely elliptical, very inequilateral, wtih opisthogyrous beaks and anterior side by far longest, concentrically furrowed. Long anterior laterals; short posterior; in each valve, one trigonal somewhat bilobate cardinal; anterior right quite indistinct and posterior left narrow against well-defined resilium. *?Eoc., Mio.-Rec.,* N. Am.(Gulf Calif.)-W.C.Am.-S.Am.——Fig. E25,*7*. **A. colpoica* (Dall), Gulf Mexico; *7a,b,* RV and LV hinges, ×6 (Chavan, n).

Arthritica Finlay, 1927 [16] [**Kellia bifurca* Webster, 1908; OD]. Ovate, moderately flattened, smooth. Anterior RV and posterior LV cardinals indistinct; *2, 3b,* angular, small, in front of moderately short ligamentary hollow; laterals simple, remote, 2 diverging internal furrows. *Mio.-Rec.,* N.Z.——Fig. E25,*13*. **A. bifurca* (Webster); Rec., *13a,b,* LV int., RV hinge, ×7.2 (Chavan, n).

?Clathroconcha Coen, 1934 (12a) [**C. istriensis;* OD]. Small, slightly convex, inequilateral, anteriorly elongated; minute prosogyrous beaks. Sculpture of strong radial ribs, without any dichotomy, but crossed by concentric lamellae. RV hinge with elongate straight laterals and 2 median sockets, anterior one virguliform and deeper, posterior one trigonal, in front of both is one acute thin tooth (or socket's margin). Pallial line broadened; inner margin crenate. *Rec.,* Adriatic.

Goodalliopsis de Raincourt & Munier-Chalmas, 1863 [6] [**G. orbignyi* =*Erycina terminalis* Deshayes, 1860; M]. Obliquely oblong, small; finely striated, very inequilateral, posterior side broadest. Anterior cardinals in prolongation of *AII* and *AIII*; *AI* rather long, posterior cardinals narrow, in front of oblique socket; posterior laterals strong, more elongate than anterior ones. *M.Eoc.,* Eu.——Fig. E24,*2*. **G. terminalis* (Deshayes), Lutet., France; *2a,b,* LV int., RV hinge, ×16 (Cossmann, 1913; *259*).

Lasaea Brown, 1827 [10] [**Cardium rubrum* Montagu, 1803; M] [=*Cycladina* Cantraine, 1835 (type, *C. adansoni*; SD Gray, 1847) (*non* Berthold in Latreille, 1827); *Lasea* Gray, 1842 *(nom. van.)* (obj.); *Anapa* Gray (type, *Poronia petitiana* Récluz, 1847); *Poronia* Récluz, 1843 (type, *P. adansoniana*; OD)]. Transversely rounded, minute, inflated, inequilateral, smooth, anterior side longest, beaks straight. Cardinals small, all (except *4b*) partly fused to anterior laterals, which duplicate on both valves; ligament interno-marginal, with minute narrow socket. *Eoc.-Rec.,* cosmop.——Fig. E25,*12*. **L. rubra* (Montagu), Rec., Eng.; *12a,b,* LV int., RV hinge, ×10 (Chavan, n).

Litigiella di Monterosato, 1909 [9] [**Erycina cuenoti* Lamy, 1908 (=*Lepton glabrum* P. Fischer, 1873); OD]. Ovate, inequilateral, somewhat produced and angular anteroventrally, beaks low, hinge plate flat, broad, with rather small, ill-separated laterals and narrow long cardinal in each valve in front of wide hollow for receipt of internal part of broad ligament. *Mio.-Rec.,* Eu.-S. Am.-C.Am.-Australia.——Fig. E25,*11*. **L. glabra* (Fischer), Rec., Medit.; *11a,b,* LV hinge and RV int., enl. (Lamy, 1908). [*?Eoc.,* S.Afr.]

Lucinaxinus Cerulli-Irelli, 1909 [5] [**Thyasira (L.) reticulata*; OD]. Subequilateral rounded, with high but not prominent beaks; externally, finely reticulated, laterally with dichotomy of radials. Hinge narrow, RV posterior cardinal oblique, LV anterior angularly fused to *AII,* LV posterior obscure; long marginal laterals; ligament in small oblique socket. *Mio.-Plio.,* Eu.——Fig. E25,*4*. **L. reticulatus* (Cerulli-Irelli), Italy (Calabr.); *4a,b,* LV hinge and RV int.; *4c,* LV ext., enl. (Cerulli-Irelli, 1909).

Melliteryx Iredale, 1924 [12] [**Erycina acupuncta* Hedley, 1909; OD]. Transversely trigonal; externally punctate. Small cardinals and strong laterals, posterior ones larger and duplicate; narrow ligamentary socket and marginal flattening. *Plio.-Rec.,* Japan-Australia.——Fig. E24,*3*. **M. acupuncta* (Hedley), Rec., Australia; *3a,b,* LV hinge and RV int.; *3c,* RV ext., ×3.2 *(365*; Hedley, 1909).

Myllita d'Orbigny & Récluz, 1850 [13] [**Erycina deshayesii* Récluz; OD]. Transversely subelliptical, rather broad, thick; divaricate strong curved ribs, small beaks. Cardinals well defined, RV anterior in prolongation of *AIII*; well-marked subparallel laterals, duplicate on RV, anterior ones longest; ligament internomarginal, with both socket and nymph. *Plio.-Rec.,* SW.Pac.-Australia.

M. (Myllita). Moderately transverse, thick, beaks not inflated. Both valves with well-developed cardinals and strong elongate laterals. *Plio.-Rec.,* SW.Pac. - Australia. —— Fig. E25,*9*. **M. (M.) deshayesii* d'Orbigny & Récluz, Rec., Australia; *9a,b,* LV int., RV hinge; *9c,* all ×4 (Chavan, n).

M. (Zemyllita) Finlay, 1927 [14] [**Pythina stowei* Hutton, 1877; OD]. Very transverse, with rounded beaks. Curved cardinals, only 1 well developed on each valve and short bent laterals. *Plio.-Rec.,* N.Z.-Australia.——Fig. E25,*6*. **M. (Z.) stowei* Hutton, N.Z.; *6a,b,* LV and RV hinges, ×5.2; *6c,* LV juv. ext., ×2.4 (Chavan, n).

Myllitella Finlay, 1927 [15] [**M. vivens*; OD]. Circular, with undulated divaricate ribs and con-

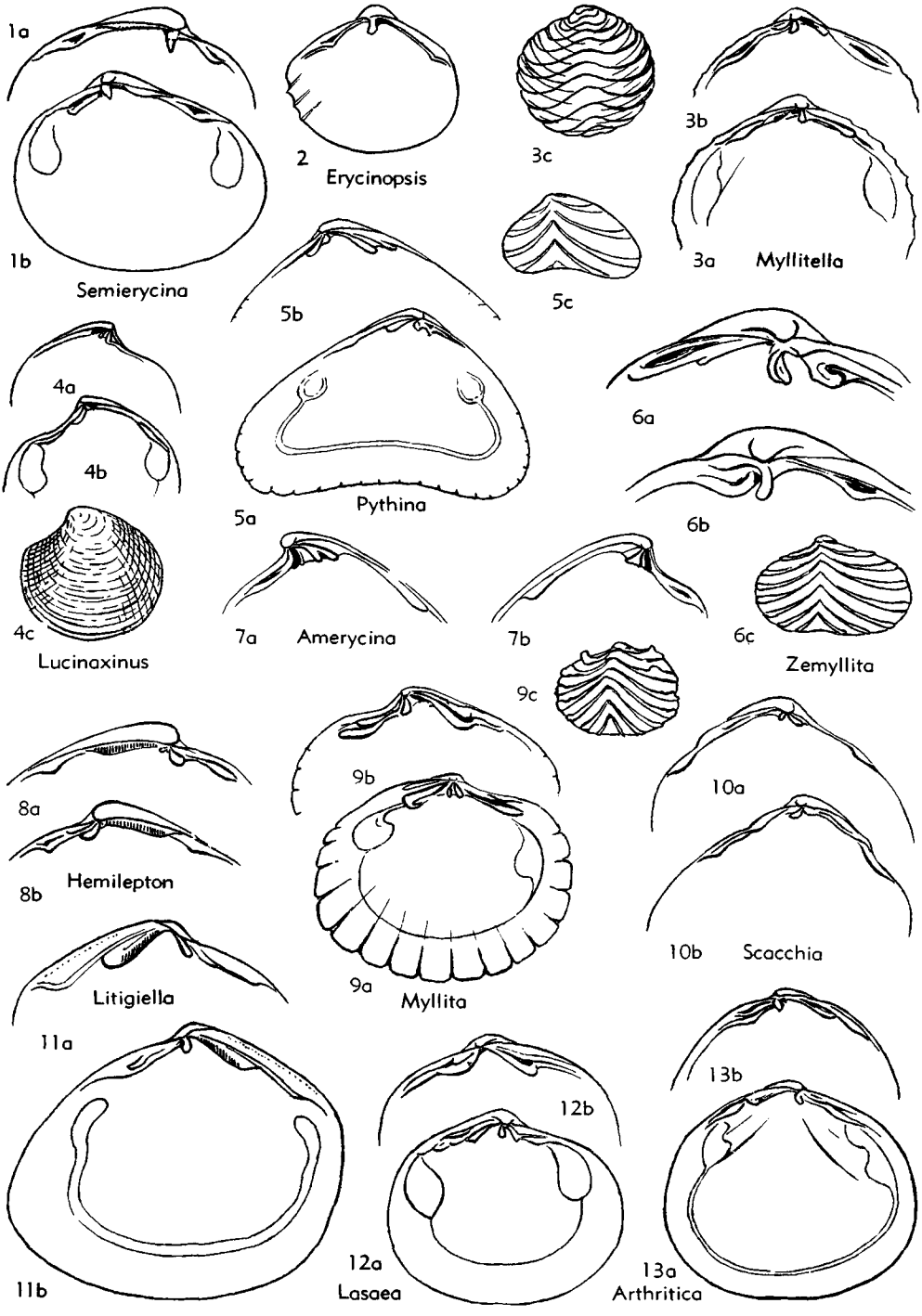


FIG. E25. Erycinidae (p. *N*519-*N*520, *N*522).

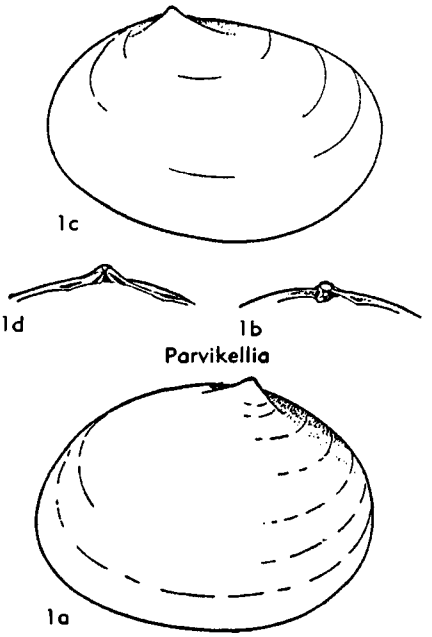


FIG. E26. Erycinidae (p. *N522*).

centric growths. Small cardinals and somewhat remote well-marked elongate laterals; hinge plate scarcely indented by internal part of ligament. *Oligo.-Rec.*, N.Z.——FIG. E25,*3*. **M. vivens*, Rec., N.Z.; *3a,b*, LV int., RV hinge, ×11; *3c*, LV ext., ×6.4 (Chavan, n).

Parvikellia LASERON, 1956 [8] [**P. isolata*; OD]. Oval, thin, polished, inflated; with faint growths. RV hinge with subumbonal resilifer, simple cardinal in front with slight hook, faint marginal anterior laterals, prominent posterior; LV hinge *(P. depressa)* with 2 narrow cardinals and 2 laterals, anterior one ascending toward beak as 3rd anterior cardino-lateral. *Rec.*, Australia.——FIG. E26,*1a,b*. **P. isolata; 1a,b*, RV ext., hinge, enl. (Laseron, 1956).——FIG. E26,*1c,d*. *P. depressa* LASERON; *1c,d*, LV ext., hinge, enl. (Laseron, 1956).

Pythina HINDS, 1844 [11] [**P. deshayesiana;* OD]. Transversely but irregularly trigonal, with divaricate ribs. Very small cardinals and somewhat strong short laterals, posterior ones duplicate on RV; narrow ligamentary hollow and marginal flattening. *U.Eoc.-Rec.*, Eu.-Asia.——FIG. E25,*5*. **P. deshayesiana*, Rec., Philip. Is.; *5a,b*, LV int., RV hinge; *5c*, LV ext., ×3.2 (Chavan, n).

Scacchia PHILIPPI, 1844 [**Tellina elliptica* SCACCHI, 1833 (*non* BROCCHI, 1814) (=**Loripes ellipticus* SCACCHI, 1836); SD GRAY, 1847]. Somewhat trigonal, smooth, inequilateral; anterior side longest. Cardinals rather small *(3b, 2, 4b)*, laterals simple, one on each side, rising apparently from under side of plate; ligament in oblong socket adjacent to well-marked nymph. *Eoc.-Rec.*, Eu.

S. (Scacchia) [3] Lateral teeth rather narrow and remote, cardinals small. *Eoc.-Rec.*, Eu.——FIG. E25,*10*. **S. (S.) elliptica* (SCACCHI), Rec., Medit.; *10a,b*, LV and RV int., ×6 (Cerulli-Irelli, 1909; Cossmann, 1913).

S. (Austroscintilla) KAUTSKY, 1939 [4] [**A. meieri*; OD]. Broad flat laterals, strong right posterior cardinal. *Mio.*, Eu.

Semierycina DE MONTEROSATO in COSSMANN, 1911 (1912) [**Lepton prismaticum* DI MONTEROSATO, 1878; OD]. Small, translucent, transversely subelliptical. Hinge with 1 cardinal developed on each valve, its lower part pointed; anterior approximate and posterior remote laterals. *Paleoc.-Rec.*, W.Eu.

S. (Semierycina) [17]. Shell more ovate and beaks farther forward than in *Erycinopsis*. *Mio.-Rec.*, Eu.——FIG. E25,*1*. **S. (S.) prismatica* (DI MONTEROSATO), Rec., Medit.; *1a,b*, LV and RV int., ×14.5 (Chavan, n).

S. (Erycinopsis) CHAVAN, 1959 [18] [**Erycina semipecten* COSSMANN, 1887; OD]. Trigonal-rounded, concentrically ribbed except on anterior radiated area. RV with strong laterals and 1 vertically projecting cardinal, in front of deep oblique cut. *Paleoc.-Eoc.*, Eu.(France).——FIG. E25,*2*. **S. (E.) semipecten* (COSSMANN), Eoc., France; RV int., ×5.5 *(160)*.

Family KELLIIDAE Forbes & Hanley, 1848

[*nom. correct.* SOWERBY, 1862 (pro Kelliadae FORBES & HANLEY, 1848)]

Shell variable in convexity. Hinge plate indented under more or less prominent beaks, hinge paracyrenoid with obliquely trigonal cardinals, RV with *1* strongest, which is almost entirely differentiated from its origin, obliterating *3b*, LV with generally two unequal pointed cardinals, the anterior one *(2)* upward, posterior one downward; no distinctly elongate anterior laterals, but strong remote posteriors present. *Paleoc.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Kellia*.——2. *Pseudolepton*.——3. *Pseudokellya*.——4. *Aligena*.——5. *Radobornia*.——6. *Paraborniola*.——7. *Diplodontina*.——8. *Lasaeokellya*.——9. *Kaneoha*.——10. *Micropolia*.——11. *Cicatellia*.——12. *Pseudopythina*.——13. *Bornia*.——14. *Lionelita*.——15. *Borniola*.——16. *Byssobornia*.——17. *Scintillula*.——18. *Nesobornia*.——19. *Marikellia*.——20. *Mioerycina*. [Insert above, 4a. *Odontogena*.]

Kellia TURTON, 1822 [1] [**Mya suborbicularis* MONTAGU, 1803; SD RÉCLUZ, 1844] [=*Chironia* DESHAYES, 1839 (type, *C. laperousii*; M); *Orontheа* GRAY (*ex* LEACH, MS) 1852 (obj.)]. Ovate, slightly angular and strongly convex, with concentric striation. Cardinal *3a* in prolongation of *AIII, 1* stout and oblique, *2a* angular, curved, *2b* conical, pointed; strong posterior laterals; *PI, PII* and faint *PIII;* wide cut for ligament. *Eoc.-Rec.,* cosmop.——FIG. E27,*5*. **K. suborbicularis* (MONTAGU), Rec., Spain; *5a,b,* LV int., RV hinge, ×4 (Chavan, n).

Aligena LEA, 1846 (1843, *nom. nud.*) [**Amphidesma aequata* CONRAD, 1843 (=*A. striata* LEA, 1846); SD DALL, 1900]. Irregularly trigonal to quadrangular rounded, high, smooth. Hinge with small *3a,* stout *1,* curved *2a* in prolongation of anterior lateral, with small *2b* behind it; wide oblique ligament and single strong remote posterior lateral on each valve. *Mio.-Rec.,* Eu.-Afr.-N.Am.

A. (Aligena) [4]. Subvertically pointed, more or less virguliform right cardinal; posterior laterals of moderate strength. *Mio.-Rec.,* Eu.-?Afr.-N.Am. ——FIG. E27,*7*. **A. (A.) aequata* (CONRAD), Mio., USA(Va.); *7a,b,* LV and RV int., ×4 (Chavan, n).

A. (Odontogena) COWAN, 1964 [4a] [**A. (O.) borealis;* OD]. Oblique right cardinal, stronger posterior laterals. *Rec.,* N.Am.(W.Can.).

Bornia PHILIPPI, 1836 [**B. corbuloides* (=*Erycina corbuloides* BIVONA MS. in PHILIPPI); SD STOLICZKA, 1871 (=*Cyclas sebetia* COSTA, 1836)] [=?*Ceratobornia* DALL, 1899 (type, *B. (C.) longipes*=*Lepton longipes* STIMPSON, 1855; OD)]. Transversely trigonal to trapezoidal, slightly inequilateral, flattened, shining, smooth or with faint infra-externally placed radials, crenulating inner margin. *Paleoc.-Rec.,* cosmop.

B. (Bornia) [13]. Hinge with narrow oblique well-marked *1, 2a, 2b,* and traces of *AIII, AII* in front of them; short well-defined resilium and moderately strong *PI,* strong *PII,* traces of *PIII,* all closely behind ligament. *Paleoc.-Rec.,* Eu., N.Am.-S.Ind.O.——FIG. E27,*6*. **B. (B.) sebetia* (COSTA), Rec., Italy; *6a,b,* LV int., RV hinge, ×6.8 (Chavan, n).

B. (Borniola) IREDALE, 1924 [15] [**B. lepida* HEDLEY, 1906; OD]. Transversely elliptical, striated, inequilateral, with pointed beaks. *Rec.,* Australia.

B. (Byssobornia) IREDALE, 1936 [16] [**B. filosa* HEDLEY, 1902; OD]. Radial striae conspicuous on entire surface. Oblique cardinals and very short posterior laterals. *Rec.,* Australia.

B. (Lionelita) JOUSSEAUME, 1888 [14] [**L. lionelita* (=*Erycina denticulata* DESHAYES, 1855, var. *lionelita* JOUSSEAUME, 1888, in CHAVAN, 1953); OD]. Tooth *1* almost straight, terminating at right angle to its origin in *AI*; *3a* minute, but discernible; *2b* trigonal pointed; resilium oblique, with strong laterals behind it. *Rec.,* Ind.O.—— FIG. E27,*10*. **B. (L.) denticulata lionelita* (DESHAYES, 1855), Obock; *10a,b,* LV and RV int.; *10c,* RV ext., ×2.4 *(114)*.

Cicatellia LASERON, 1956 [11] [**C. indenta*; OD]. Transversely oval, small, somewhat inequilateral; ventral margin flexuous; broad, prosogyrous, inflated beaks; surface microscopically wrinkled. LV with conical median cardinal and 2 rather faint laterals, rounded protuberant prodissoconch. *Rec.,* Australia, *?Mio.-Rec.,* USA(Fla.).——FIG. E28,*3*. **C. indenta; 3a,b,* LV ext., hinge, enl. *(531)*.

Diplodontina STEMPELL, 1899 [7] [**D. tumbesiana;* M]. Transversely ovate, moderately broad, with concentric striae. LV showing trigonal bilobate cardinal, its posterior part smaller than on *Kellia;* short anterior lamina and broad oblique resilium with parallel thickening above it; posterior margin enlarged. *Rec.,* W.S.Am.——FIG. E27,*3*. **D. tumbesiana,* Peru; LV int., ×4 (Stempell, 1899).

Kaneoha DALL, BARTSCH & REHDER, 1938 [9] [**K. rosea*; OD]. Very small, rounded, smooth, somewhat inflated. *AI-1* and *3b* coalescent under marginal *AIII*; *2* hooked with long *AII,* not detached from it; stout resilium and rather long posterior laterals (duplicate on RV). *Rec.,* Hawaii.—— FIG. E27,*1*. **K. rosea*; *1a,b,* LV and RV hinge, ×32 (Dall, Bartsch & Rehder, 1938).

Lasaeokellya COSSMANN & PEYROT, 1911 (1912) [8] [**Kellia (L.) cestasensis*; OD]. Orbicular, subequilateral, slightly convex, with lamellar growths. RV with oblique *1,* fused to anterior side of *3b* into bifid inequilateral unit; resilium oblique, scarcely indenting inferior margin of plate; posterior laterals toothlike. *Mio.,* Eu.(France).—— FIG. E29,*2*. *L. cestasensis,* Burdigal, France; RV int., ×6.4 *(165)*.

Marikellia IREDALE, 1936 [19] [**Kellia solida* ANGAS, 1877; OD]. Transversely subquadrangular, solid, rather inflated, with irregular concentric lines, small beaks. Hinge broad, with stout trigonal *1* and *2b,* oblique ill-defined *2a* and *3a;* also somewhat oblique long resilium indenting hinge plate, posterior laterals strong. *Rec.,* E.Afr.-Australia. ——FIG. E27,*4*. **M. solida* (ANGAS), Australia; *4a,b,* LV and RV int., ×4 (Chavan, n).

Micropolia LASERON, 1953 [10] [**M. typica*; OD]. Minute, translucent, subtrigonal and subequilateral, smooth. LV hinge with tooth pointed backward and 2 bow-shaped laterals; RV with 2 elongated laterals. *Rec.,* Australia.——FIG. E28,*2*. **M. typica*; *2a-c,* LV ext., LV and RV hinges, enl. *(531)*.

Mioerycina KAUTSKY, 1939 [20] [**Erycina letochai* HOERNES, 1859; OD]. Transversely elliptical, sinuous in middle, almost equilateral. Hinge with short *1* and *2b; AIII-3a* and *2a-AII* being undifferentiated from margin while very small *3b* occurs behind top of *1;* oblique spoon-shaped resilium and long posterior laterals. *Mio.,* Eu.(Austria).

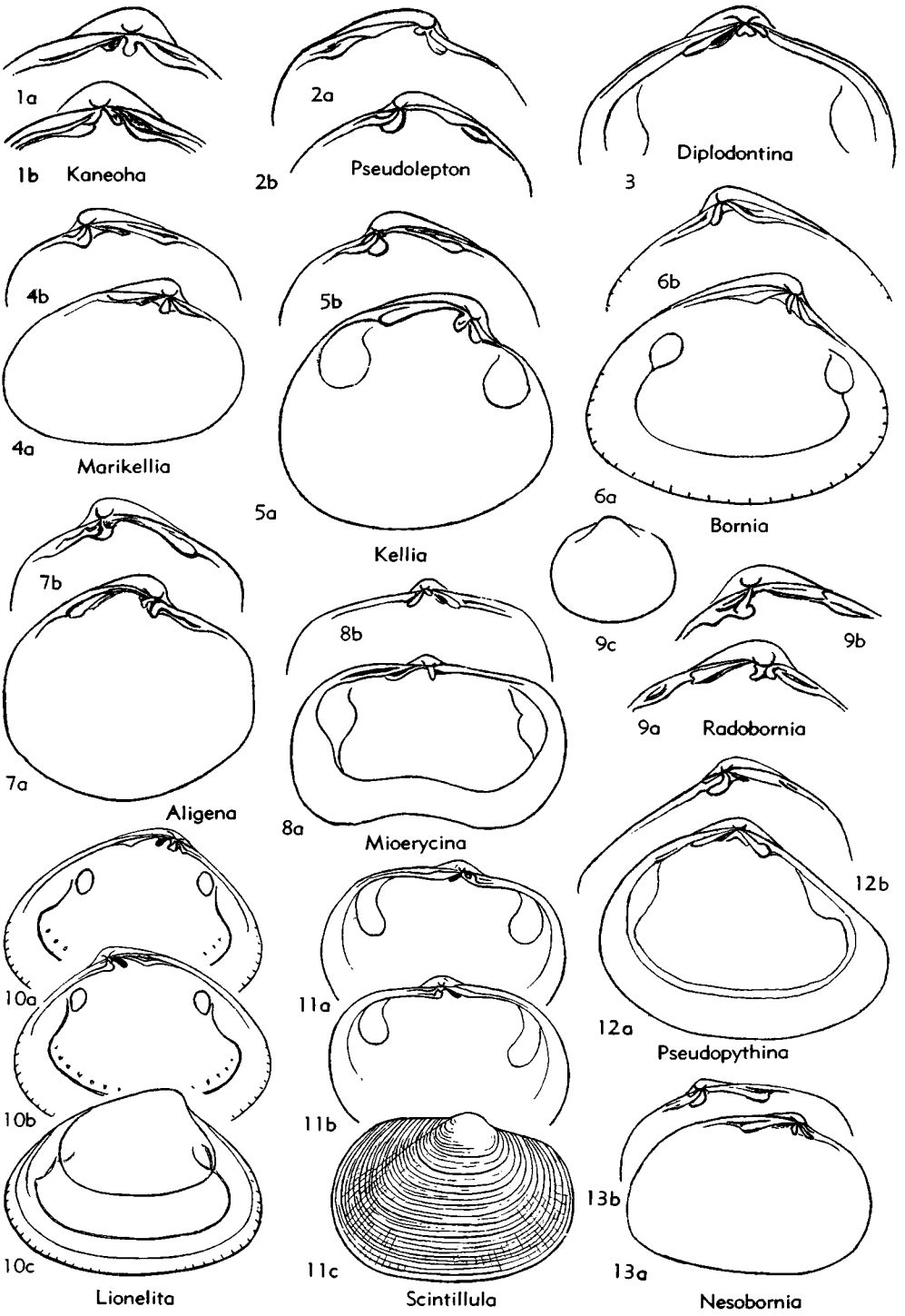


FIG. E27. Kelliidae (p. *N*523, *N*525-*N*526).

——Fig. E27,*8*. **M. letochai* (Hoernes), M.Mio., Austria; *8a,b*, LV int. and RV hinge, enl. *(456)*.

Nesobornia Dall, Bartsch & Rehder, 1938 [18] [**N. bartschi* Chavan, herein (*pro Erycina (Poronia) ovata* Gould, 1850, *non* Gray, 1825, *nec* Philippi, 1836)]. Subtrapezoidal rounded, somewhat inequilateral, obliquely elongated backward, shining and smooth; beaks pointed with 2 small cardinals on each valve: *3a, 1, 2a, 2b*, with faint short anterior prolongations of the former and somewhat backward produced resilium, posterior laterals well-marked. *?M.Eoc.-Rec.*, Hawaii-E.Afr. ——Fig. E27,*13*. **N. bartschi* Chavan, Rec., Hawaii; *13a,b*, LV int. and RV hinge, ×3.2 (Chavan, n).

Pseudokellya Pelseneer, 1903 [3] [**Kellia cardiformis* E. Smith, 1885; OD]. Globular, high, thin, with radial riblets; beaks inflated. Hinge very narrow, LV with 2 small cardinals in prolongation of short anterior lateral thickening and RV with single cardinal, then ligamentary cut and posterior thickening. *Rec.*, Antarctic.——Fig. E29,*1*. **P. cardiformis* (Smith); LV int., ×4.8 *(852)*.

Pseudolepton Cossmann, 1895 [2] [**Lepton insigne* Mayer in Hörnes, 1864; OD]. Subquadrangular to ovate, with diverging striae or granular laminae. Hinge with *3a, 3b*, oblique *2a, 2b* poorly developed; remote posterior laterals *PI, PII. Mio., ?Rec.*, Eu.-?S.Afr.——Fig. E27,*2*. **P. insigne* (Mayer), Mio., Aus.; *2a,b*, LV and RV hinges, enl. (Cossmann, 1913; *456*).

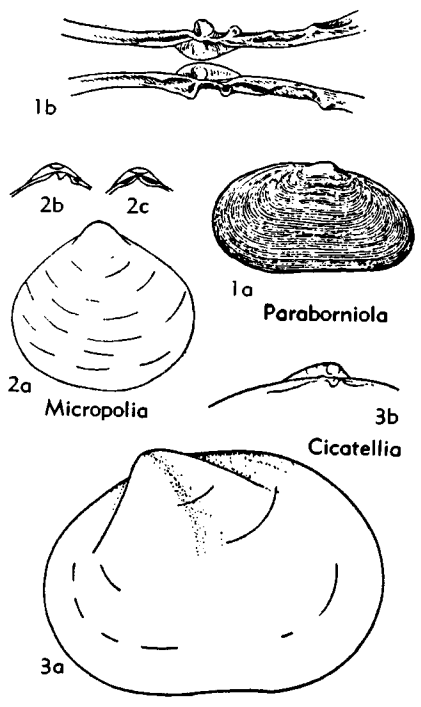


Fig. E28. Kelliidae (p. *N*523, *N*525).

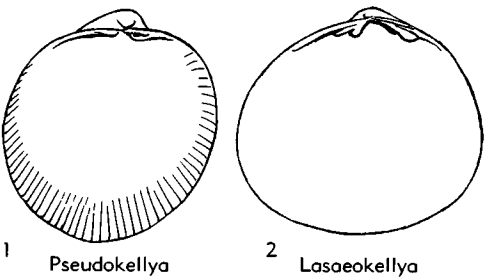


Fig. E29. Kelliidae (p. *N*523, *N*525).

Pseudopythina P. Fischer in di Monterosato, 1884 [12] [**Kellia macandrewi* Fischer, 1867 =*Coralliophaga setosa* Dunker, 1864; M] [=*?Borniopsis* Habe, 1959 (type, *B. tsurumaru;* OD)]. Transversely trigonal, very inequilateral, anteriorly attenuated and elongate; enlarged and rounded backward, smooth. No anterior prolongation of *1, 2* oblique and well marked; *3a* small, *2b* minute; with oblique short resilium and nymph; posterior laterals just behind them, short, placed marginally. *Plio.-Rec.*, W.Eu.-NW.Pac.——Fig. E27,*12*. **P. setosa* (Dunker), Rec., Portugal; *12a,b*, LV int. and RV hinge, ×6.8 (Chavan, n).

Radobornia Dall, Bartsch & Rehder, 1938 [**R. araia*; OD]. Transversely rounded, inequilateral, beaks rather prominent; RV with small laminar *3a* and strong hooked *1*, LV with curved *2a-AII* and curved approximate *2b*, each valve with one remote lamellar posterior lateral; long internal resilium and marginal nymph. *Rec.*, Hawaii.

R. (Radobornia) [5]. Transversely ovate, thin, externally punctate; ventral margin rounded. *Rec.*, Hawaii.——Fig. E27,*9*. **R. (R.) araia* Dall, Bartsch & Rehder; *9a,b*, LV and RV hinges, ×2.8; *9c*, LV ext., ×1.6 (Dall, Bartsch, and Rehder, 1938).

R. (Paraborniola) Habe, 1958 [6] [**P. matsumotoi*; OD]. Transversely elongate, ventral margin straight. Hinge as in *R. (Radobornia)* with *2a* thinner and *2b* strongly trigonal. *Rec.*, Japan. ——Fig. E28,*1*. **R. (P.) matsumotoi* (Habe); *1a,b*, RV ext., hinges, ×1 *(388)*.

Scintillula Jousseaume, 1888 [17] [**S. scintillula*; OD]. Transversely subelliptical almost equilateral, inflated, slightly enlarged backward, finely striated. Hinge with marginal *3a*, slightly continued by *3b* above and behind hooked trigonal *1*, itself in prolongation of *AI*; similarly hooked *2a-AII* followed by tubercular small *2b* on opposite valve; and, perhaps, also minute *4b*; oblique short re-

silium and much elongated faint posterior laterals. *Rec.*, Ind.O.——FIG. E27,*11*. **S. scintillula*, Obock; *11a,b*, LV and RV int.; *11c*, RV ext., ×4 *(114)*.

Family LEPTONIDAE Gray, 1847

Shell commonly compressed; hinge plate not or scarcely indented by resilium, under very small beaks. Paracyrenoid hinge of nepionic appearance, oblique strongest cardinals (right *1* and left *2a*) being not separated from their anterior original lamellae *(AI, AII)*, elongating in front of them. Posterior laterals only slightly longer than anteriors. Pallial line irregular and distant from ventral margin. *?Cret., Paleoc.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Lepton*.——2. *Planikellia*.——3. *Divarikellia*.——

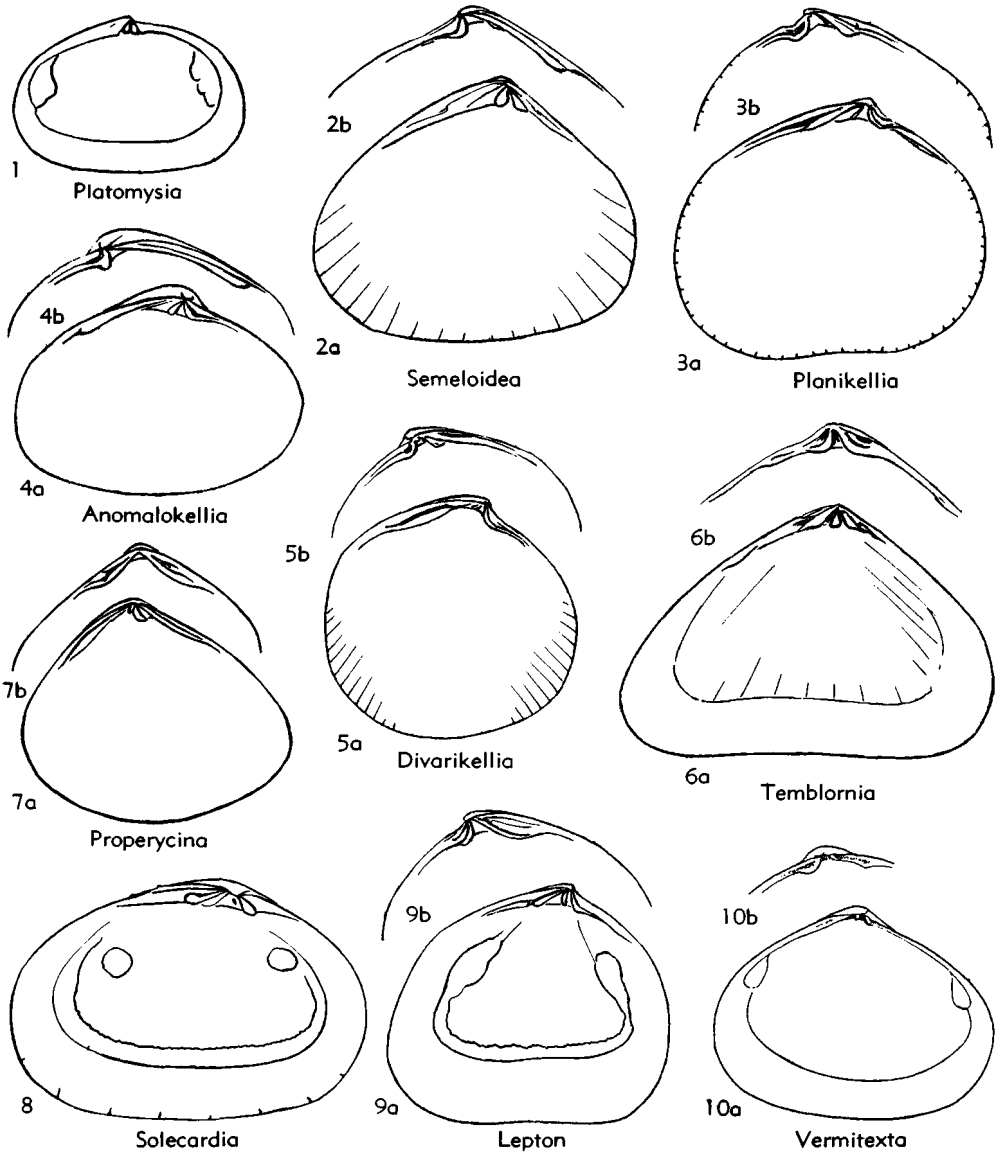


FIG. E30. Leptonidae (p. *N527*).

4. *Vermitexta.*——5. *Anomalokellia.*——6. *Platomysia.*——7. *Semeloidea.*——8. *Temblornia.*——9. *Solecardia.*——10. *Properycina.*——11. *Potidoma.*

Lepton TURTON, 1822 [**Solen squamosus* MONTAGU, 1803; SD HERRMANNSEN, 1846] [=*Eupoleme* GRAY (*ex* LEACH, MS), 1852 (obj.)]. Ovate-subquadrangular, flattened. Hinge with 2 narrow cardinals on each valve, of which anterior ones *(1, 2a)* are gradually strengthened straight from anterior small crest; *3a* very oblique; *4b* narrow, both small and thin; resilium broad and trigonal; posterior laterals (duplicate on right) just behind and above it, lamellar. *?Cret., Eoc.-Rec.,* W.Eu.-W.N.Am.

L. (Lepton). [1]. Ovate, with slight oblique truncation; punctate. Hinge with elongate laterals and *4b* almost vertical. *?Cret., Eoc.-Rec.,* Eu.——FIG. E30,9. **L. (L.) squamosum* (MONTAGU), Rec., Ireland; *4a,b,* LV int. and RV hinge, ×4 (Chavan, n).

L. (Divarikellia) COSSMANN, 1887 [3] [**Erycina nitida* CAILLAT, 1834; OD]. Ovate-rounded, with divaricate riblets. Anterior laterals inflexed, but moderately long, *4b* obscure, elongate posterior laterals. *Eoc.,* W.Eu.——FIG. E30,*5*. **L. (D.) nitidum* (CAILLAT), Lutet., France; *5a,b,* LV int. and RV hinge, ×6.4 (Chavan, n).

L. (Planikellia) COSSMANN, 1887 [2] [**Erycina radiolata* LAMARCK, 1805; OD]. Ovate-rounded, with radial striae. Short anterior laterals, inflexed at their strengthening into cardinals, *4b* oblique backward; stouter posterior laterals. *Eoc.,* W.Eu.——FIG. E30,*3*. **L. (P.) radiolatum* (LAMARCK), Lutet., France; *3a,b,* LV int. and RV hinge, ×4.8 (Chavan, n).

Anomalokellia COSSMANN, 1887 [5] [**Erycina catalaunensis* COSSMANN, 1883; M]. Transversely ellipticotrigonal, small, with concentric striae. Hinge with marginal faint *AIII-3a,* stout angular *AI-1,* thinner angular *AII-2a* and subsymmetric oblique *4b*. Stout angular resilium; remote laterals. *Paleoc.,* Eu.(France).——FIG. E30,*4*. **A. catalaunensis* (COSSMANN), Thanet., France; *4a,b,* LV int. and RV hinge, ×6.4 (Cossmann, 1913).

Platomysia HABE, 1951 [6] [**P. rugata*; OD]. Transversely subelliptical, with concentric regular undulations; 2 small cardinals, anterior one prolonged by marginal small crest. *Rec.,* Japan-N.Atl.-?N.Sea.——FIG. E30,*1*. **P. rugata*; LV int., ×0.8 *(365)*.

Properycina CERULLI-IRELLI, 1908 [**P. mariana;* OD]. Subtrigonal to ovate, with small beaks. Long subsymmetrical anterior laterals and only 1 oblique cardinal *(4b)* distinct from anterior and posterior laterals (both duplicate on right valve). Tooth *1* almost undifferentiated from *AI. M.Eoc.-Rec.,* W. Eu.-Atl.-Medit.

P. (Properycina) [10]. Anterior and posterior margins oblique; *4b* quite distinct, laterals almost straight. *U.Eoc.-U.Plio.,* W.Eu.——FIG. E30,*7*. **P. (P.) mariana,* Calabr., Italy; *1a,b,* LV int. and RV hinge, enl. (Cerulli-Irelli, 1909).

P. (Potidoma) DEROUX, 1961 [11] [**Lepton subtrigonum* FOLIN & PERRIER (*ex* JEFFREYS MS), 1873; OD]. Anterior and posterior margins nearly horizontal, *4b* appressed against anterior cardinolateral *2-AII;* laterals sinuate. *M.Eoc.-Rec.,* W. Eu.-Atl.-Medit.

Semeloidea BARTRUM & POWELL, 1928 [**S. donaciformis*; M]. Trigonal to subquadrangular, thin, with laterally, several radial riblets; LV with 2 well-marked cardinals, posterior one passing above top of anterior one, obliquely attenuated onward; 1 on RV prolonged angularly into small crest under elevated margin; curved, posterior laterals. *Eoc.-Rec.,* Medit.-N.Z.-C.Eu.

S. (Semeloidea) [7]. Hinge plate arched under resilium, *4b* posteriorly curved, *2* rather strong. Posterior laterals long. *Oligo.-Rec.,* Eu.-N.Z.——FIG. E30,*2a*. **S. (S.) donaciformis* BARTRUM & POWELL, Rec., N.Z.; LV int., enl. (Bartrum & Powell, 1928).——FIG. E30,*2b*. **S. (S.) geoffroyi* (PAYRAUDEAU), Rec., Medit.; RV hinge, ×4 (Chavan, n).

S. (Temblornia) KEEN, 1943 [8] [**Donax triangulatus* ANDERSON & MARTIN, 1914; OD]. Short cardinals and shallow small resilium, so that posterior laterals, just behind it, look like cardinals; hinge plate straight under resilium. *Eoc.-Plio.,* N.Am.-S.Am.——FIG. E30,*6*. **S. (T.) triangulata* (ANDERSON & MARTIN), Mio., USA (Calif.); *6a,b,* LV int. and RV hinge, ×7.8 (Chavan, n).

Solecardia CONRAD, 1849 [9] [**S. eburnea*; M]. Medium-sized, transversely elliptical, moderately convex, punctate, with crenulated margin, hinge with oblique cardinals, anteriorly differentiated from short anterior crest; trigonal resilium and oblique short posterior laterals just above and behind it. *Plio.-Rec.,* N.Am.-E.Afr.——FIG. E30,*8*. **S. eburnea,* Rec., Mex.; LV int., ×2.4 (Chavan, n).

Vermitexta LASERON, 1956 [4] [**V. garrardi*; OD]. Nearly equilateral, small, slightly elongated anteriorly; translucent, thin, moderately inflated; sculpture of faint growths and of microscopic short radially arranged broken corrugations. Ligament small; small median cardinal and anterior one, prolonged into long marginal lateral; moderately long laminar posterior laterals. *?Eoc.,* Eu.; *Rec.,* Australia.——FIG. E30,*10*. **V. garrardi,* Rec., Australia; *10a,b,* LV int., RV hinge, enl. *(531)*.

Family MONTACUTIDAE Clark, 1855

Shell more or less convex, rounded, inequilateral; resilium in large defined hollow

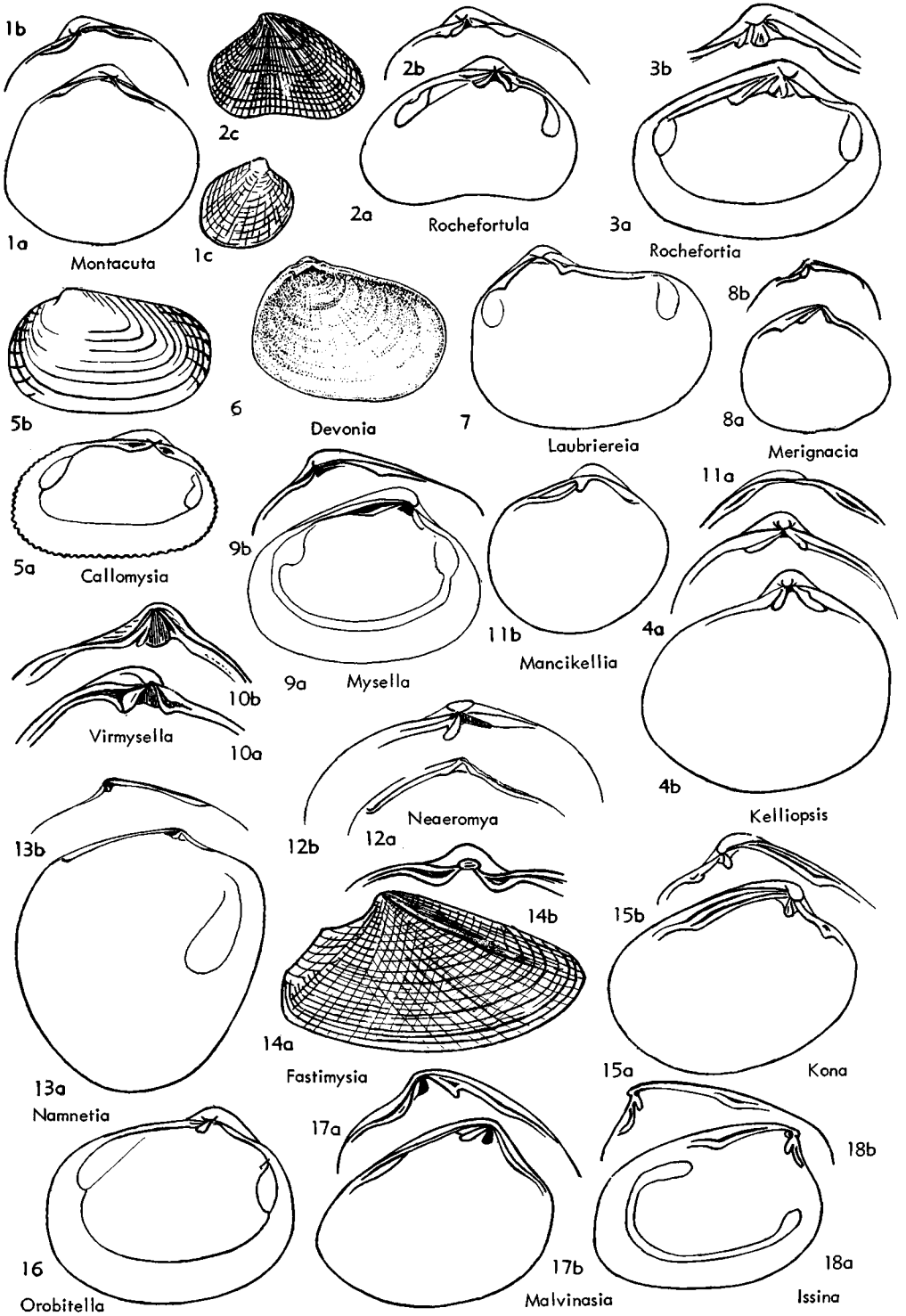


FIG. E31. Montacutidae (p. *N*529-*N*533).

or socket under beaks. Hinge with no true separated cardinals, but only thickened, generally subsymmetrical laterals, commonly bent up at their umbonal end so as to form distant toothlike hook, therefore no more than one pseudocardinal on each valve; posterior laterals commonly duplicate on one valve. *Eoc.-Rec.*

Generic arrangement by CHAVAN.——1. *Montacuta.*——2. *Devonia.*——3. *Entovalva.*——4. *Scioberetia.*——5. *Pythinella.*——6. *Tellimya.*——7. *Nipponomysella.*——8. *Laubriereia.*——9. *Namnetia.*——10. *Decipula.*——11. *Kelliopsis.*——12. *Fronsella.*——13. *Neaeromya.*——14. *Isorobitella.*——15. *Orobitella.*——16. *Axinodon.*——17. *Merignacia.*——18. *Montacutona.*——19. *Issina.*——20. *Kona.*——21. *Lasaeoneaera.*——22. *Virmysella.*——23. *Rochefortula.*——24. *Mysella.*——25. *Rochefortia.*——26. *Malvinasia.*——27. *Curvemysella.*——28. *Sphaerumbonella.*——29. *Mancikellia.*——30. *Pileatona.*——31. *Nipponomontacuta.*——32. *Fastimysia.*——33. *Thecodonta.*——34. *Pristes.* 35. *Barrimysia.*——36. *Callomysia.* [Insert above, 3a. *Conchentopyx;* 31a. *Tahunanuia.*]

Montacuta TURTON, 1822 [1] [**Ligula substriata* MONTAGU, 1808; SD HERRMANNSEN, 1846] [=*Sphenalia* S. WOOD, 1874 (obj.); *Coriareus* HEDLEY, 1907 (type, *C. vitreus;* OD); *Montaguia* BRONN, 1848 (obj.)]. Small, subquadrangular, rounded in front, truncated backward, inflated; with radial striae or distant riblets and concentric lamellar growths. Rounded prosogyrous beaks. Elongate laterals, more or less duplicate on right valve (upper margin scarcely differentiating into *AIII* and *PIII*); anterior ones stronger. Small resilium. *Eoc.-Rec.,* Eu.——FIG. E31,*1. **M. substriata* (MONTAGU), Rec., Britain; *1a,b,* LV int. and RV hinge, ×8; *1c,* RV ext., ×4 (Chavan, n).

Axinodon VERRILL and BUSH, 1898 [16] [**A. ellipticus* (=*Kellia symmetros* JEFFREYS, 1876); OD] [=*Kelliola* DALL, 1899 (obj.)[1]]. Ovately transverse, rounded, orthgyrous; LV hinge with rounded *2,* RV with tuberculiform ill-defined *1;* chondrophore oblique. *Rec.,* N.Am.-N.Atl.——FIG. E32,*7. *A. symmetres* JEFFREYS, USA(Mass.); *7a,b,* LV and RV hinges (Chavan, n).

[1] Identity of *K. symmetros* with *A. ellipticus* established by Dr. K. OCKELMANN.

Barrimysia IREDALE, 1929 [**Rochefortia excellens* HEDLEY, 1912; OD]. Very transverse, with striae crenulating inner margin. Two well-marked laterals, subsymmetrical on both sides of deep somewhat oblique resilium. *Rec.,* Australia-Japan.

B. (Barrimysia) [35]. Outline trigono-elliptical, nearly equilateral. *Rec.,* Australia.

B. (Callomysia) HABE, 1951 [36] [**C. matsuii*; OD]. Subquadrangular transverse, inequilateral, with concentric lines; also oblique riblets at lateral ends. *Rec.,* Japan.——FIG. E31,*5. *B. (C.) matsuii* (HABE); *5a,b,* LV int., ext., ×1.6 *(365).*

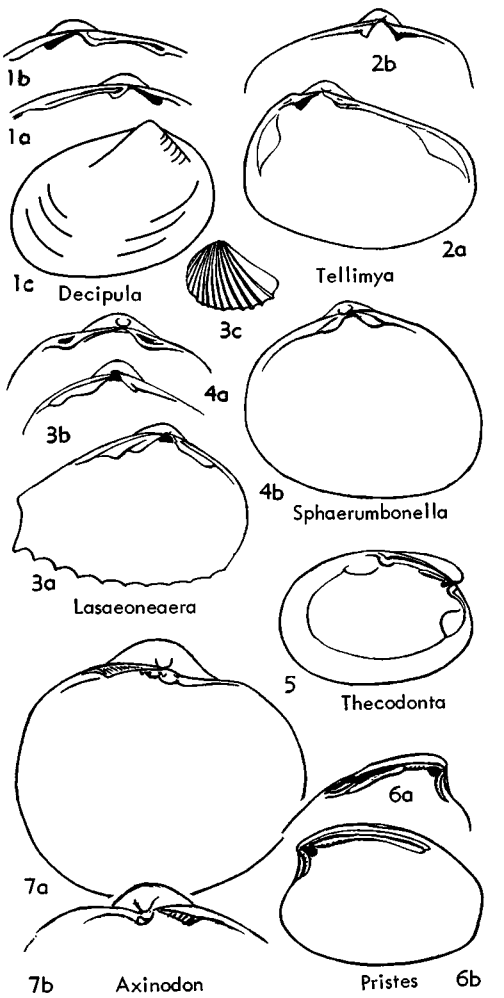


FIG. E32. Montacutidae (p. *N*529-*N*530, *N*532-*N*533).

Conchentopyx BARNARD, 1964 (3a) [**C. granulosa;* M]. Shell internal, semiovate, thin; umbo at anterior quarter; prodissoconch prominent, circular. Coarse growth lines and faint radial striae; inner margin smooth; hinge edentulous; no anal siphon. *Rec.,* S.Afr.

Curvemysella HABE, 1959 [27] [**Mysella paula* (=*Pythina paula* A. ADAMS, 1856); OD]. Transversely elongated, obliquely sloping at each end, with interior and posterior dorsal angulation; medially depressed. Hinge narrow, with lateral lamina on each side of resilial depression. *Rec.,* N. Australia-New Guinea-Japan.——FIG. E33,*1. *C. paula* (A. ADAMS), Japan; *1a,b,* RV ext., int., ×1 (Habe, 1959).

Decipula FRIELE, 1875 [10] [**D. ovata* (=**Montacuta tenella* LOVÉN, 1846); OD]. Transversely oval, thin, inequilateral; beaks low, orthogyrous; anterior side elongated. Long narrow anterior laterals, obliquely modified into right toothlike and left enlarged termination; triangular oblique resilium. *Plio.-Rec.,* Atl.-Medit.——FIG. E32,*1. *D. tenella* (LOVÉN), Rec., N.Sea; *1a,b,* RV and LV hinges; *1c,* LV ext., all enl. *(829).*

Devonia WINCKWORTH, 1930 [2] [*pro Synapticola* MALARD, 1904 (*non* VOIGHT, 1892)] [**Synapticola perrieri* MALARD, 1904; OD]. Transversely subquadrangular, very inequilateral, elongated onward and truncated at both sides. Hinge with a marginal ill-defined *AII* and, behind a broad resilial hollow, a strong *PII. Eoc.-Rec.,* W.Eu.——FIG. E31,*6. *D. perrieri* (MALARD), Rec., Britain (Devon); LV int., ×8.8 *(905a).*

?Entovalva VÖLTZKOW, 1890 [3] [**E. mirabilis;* M] [*?=Cycladoconcha* SPAERCK, 1932 (type, *C. amboinensis*; M)]. Like *Devonia* but shell completely internal, with more distinct teeth. *Rec.,* Zanzibar.

Fastimysia IREDALE, 1929 [32] [**Rochefortia viastellata* HEDLEY, 1909; OD]. Trigono-elliptical, very transverse, inequilateral, shortly sloping under beaks, then obliquely truncated; strongly acuminate at opposite side. Deep resilium in semielliptical socket just under beaks. Almost subsimilar elongated flexuous laterals on both sides. *Rec.,* Australia.——FIG. E31,*14. *F. viastellata* (HEDLEY); *14a,b,* LV ext., hinge, ×11.5 *(433).*

Fronsella LASERON, 1956 [12] [**F. adipata*; OD]. Transversely subquadrangular, to ovately transversal, moderately inflated, anterior side longer. Hinge narrow, bearing in each valve small anterior conical teeth, anterior margin somewhat laminar, and, after broad ligamentary indentation of plate, lamellar rather strong posterior lateral. *Rec.,* Australia-Japan.——FIG. E33,*4b,c. *F. adipata,* Australia; *4b,c,* LV ext. and hinge, enl. (Laseron, 1956).——FIG. E33,*4a. F. oshimai* HABE, Japan; LV hinge, enl. (Habe, 1958).

Issina JOUSSEAUME, 1898 [19] [**I. issina;* OD]. Subquadrangular, small, very inequilateral, posterior side much elongated. On each valve, 2 anterior laterals, marginal one curved, internal one shorter and pointed; and one long curved posterior lateral. Very narrow, but well-marked resilium. *Rec.,* Red Sea.——FIG. E31,*18. *I. issina; 18a,b,* LV int. and RV hinge, ×8 (Melvill & Standen, 1914).

Kelliopsis VERRILL & BUSH, 1898 [11] [**Montacuta elevata* STIMPSON, 1851; OD] Ovately rounded, inequilateral, anterior side longest. On each valve, anterior and posterior toothlike short stout lateral, prolonged by thickening of margin with small subtrigonal resilium between them. *Rec.,* Am.——FIG. E31,*4. *K. elevata* (STIMPSON), USA; *4a,b,* LV and RV int., enl. *(937).*

Kona DALL, BARTSCH & REHDER, 1938 [20] [**K. bucki*; OD]. Subelliptical, small inequilateral. Resilium stout and short, on well-developed shelf. On each valve single short subperpendicular cardinal-like process and 2 (anterior and posterior) unequal true laterals, both well marked. *Rec.,* Hawaii. ——FIG. E31,*15. *K. bucki; 15a,b,* LV and RV int., ×8 (Dall, Bartsch, & Rehder, 1938).

Lasaeoneaera COSSMANN, 1913 [21] [**Corbula radiata* DESHAYES, 1824; M]. Moderately small, anteriorly rounded, posteriorly acuminated. Regular radial ribs, of which, on each valve, is an irregularly thick anterior lateral and, backward, an obliquely divided posterior one. *Eoc.,* Eu.(France). ——FIG. E32,*3. *L. radiata* (DESHAYES), Lutet., France; *3a,b,* LV and RV int., ×3.3; *3c,* LV ext., ×2.7 (Deshayes, 1837).

Laubriereia COSSMANN, 1887 [8] [**Erycina emarginata* DESHAYES, 1860; OD]. Small, trigonal-rounded to subquadrangular, very inequilateral, concentrically striated, anterior side much elongated. Narrow hinge with, on each valve, marginal long anterior lateral enlarged and bent into short, toothlike, additive one under the beak; also marginal posterior lateral. Between them, semicircular socket for resilium. *Eoc., ?Plio.,* W.Eu.——FIG. E31,*7. *L. emarginata* (DESHAYES), Lutet., France; LV int., enl. *(259).*

Malvinasia COOPER & PRESTON, 1910 [26] [**M. arthuri*; M]. Subtrigonal, small inequilateral, posterior side produced. On each valve, anterior long marginal lateral, accompanied by shorter oblique one, toothlike on right valve, hooklike and joined to marginal on left. Subperpendicular trigonal resilium and one sinuate posterior lateral. *Rec.,* Falkland Is.——FIG. E31,*17. *M. arthuri; 17a,b,* RV hinge and LV int., enl. (Chavan, n).

Mancikellia DALL, 1899 [29] [*pro Zoe* MONTEROSATO, 1878 (*non* PHILIPPI, 1840)] [**Zoe pumila* DI MONTEROSATO, 1878 (=*Montacuta pumila* S. WOOD, 1840); OD]. Small convex inequilateral rounded shell, anteroventrally enlarged. Hinge with well-marked laterals, anterior ones separated by broad socket from thickened margin and completed, under beak (in right valve only) by a stout toothlike termination; posterior laterals slightly shorter than anterior and separated from them by large oblique hollow resilifer. *Plio.-Rec.,* W.Eu.-Medit.——FIG. E31,*11. *M. pumila* (WOOD), Rec., S.Sea; *11a,b,* LV hinge and RV int., ×8 (Friele, 1886).

Merignacia COSSMANN, 1914 [17] [**Pseudolepton (M.) pleurodesmatoides* COSSMANN & PEYROT, 1914; OD]. Small, ovate-rounded, flattened, inequilateral, little longer anteriorly. Marginal sinuous anterior lateral on each valve and a toothlike hook appressed to it (stouter on the right). Superficial resilial socket. Moderately flat posterior lateral. Very dissymetric scars. *Mio.,* Eu.(France). ——FIG. E31,*8. *M. pleurodesmatoides* (Coss-

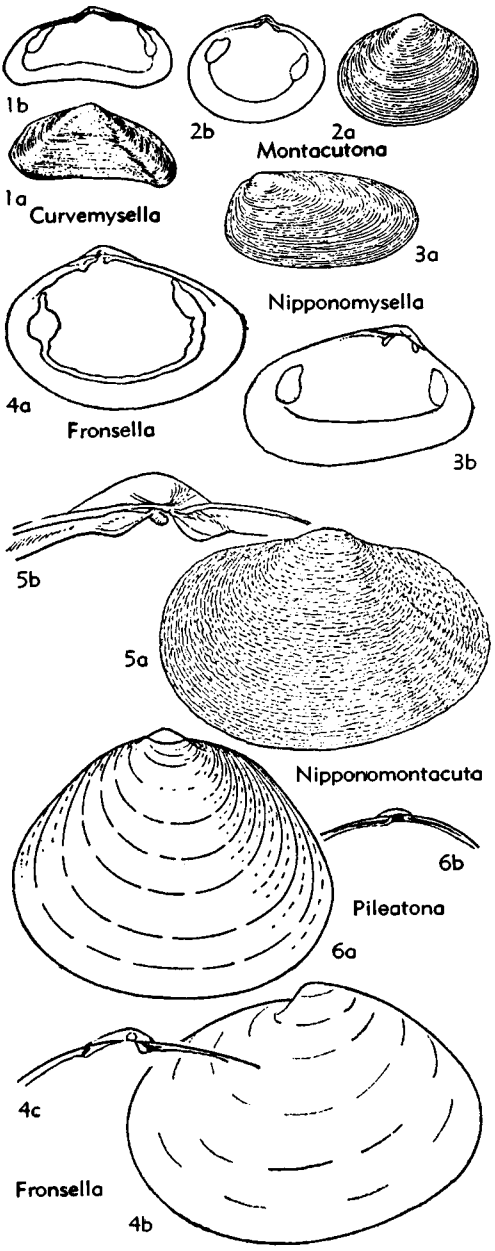


FIG. E33. Montacutidae (p. *N*529-*N*532).

MANN & PEYROT), Burdigal., France; *8a,b,* LV int. and RV hinge, enl. (Cossmann & Peyrot, 1914).

Montacutona YAMAMOTO & HABE, 1959 [18] [**M. mutsuwanensis*; OD]. Suborbicular, compressed, with polished surface, marked only by weak growths. Two solid diverging teeth and a resilial gap between them. Lateral hinge margins more or less thickened and lamellar. *Rec.,* Japan.——FIG. E33,*2*. **M. mutsuwanensis*; RV ext., int., ×4 (Habe & Yamamoto, 1959).

Mysella ANGAS, 1877 (Aug.) [**M. anomala*; OD] [=*Petricola* GRAY, 1825 (*non* LAMARCK, 1801) (type, *Mya bidentata* MONTAGU, 1803; SD GRAY, 1847, subj.)]. Transversely trigono-elliptical, inequilateral, shortened in front, obliquely elongate backward. Approximate concentric ribs. Well-marked laterals, posterior right strongest, anterior right marginal, *1* minute bordering it, *2* oblique and long. Prominent long chondrophore[1] and trigonal resilium. *Mio.-Rec.,* cosmop.

M. (Mysella) [24]. Resilium without crests; chondrophore obliquely elongate, *2* long under *fAI, 1* long, very thin and oblique more or less truncate at both ends. *Mio.-Rec.,* cosmop.——FIG. E31,*9*. **M. anomala,* Rec., Vict.; *9a,b,* LV int. and RV hinge, ×8 (Chavan, n).

M. (Rochefortia) [25] VÉLAIN, 1877 (post-Nov.) [?1878] [**R. australis*; M]. Resilium with crests as bifid tooth; chondrophore stouter and shorter, with minute crest at its top on RV; *I* subvertical and *AI* attenuated, thin; *2* almost marginal. More or less rounded at both ends. *Plio.-Rec.,* Ind.O.(St.Paul Is.)-Australia-N.Am.——FIG. E31, *3*. **R. australis* (VÉLAIN), Rec., St. Paul Is.; *3a,b,* LV int., RV hinge, much enl. (Vélain, mod.).

Namnetia COSSMANN, 1905 [9] [**N. discoides;* M]. Oblong-ovate, smooth, with flattened beaks and very small hinge plate. Marginal left curved and 2 right marginal and minute, infraumbonal anterior laterals. Restricted short resilium and, on each valve, long marginal posterior lateral. No nymph. Anterior adductor clublike. *Eoc.,* Eu. (France).——FIG. E31,*13*. **N. discoides,* Lutet., France; *13a,b,* LV int. and RV hinge, ×2.7 (Cossmann, 1905).

Neaeromya GABE, 1873 [**N. quadrata*; M]. Transversely subquadrangular to trigonal, finely striated. Right strong anterior laminar tooth and oblique posterior enlarged margin; oblique resilium between them; left thinner oblique anterior. *Mio.-Rec.,* C.Am.-N.Am.-Eu.

N. (Neaeromya) [13]. Subquadrangular, anterior side elongate, inequilateral. Right anterior tooth long, left anterior prolonged into margin. *Mio.-Rec.,* USA (Calif.)-C. Am.-Eu.——FIG. E31,*12*. **N. (N.) quadrata* GABB; *12a,b,* LV and RV hinges, ×2 (Pilsbry, 1921).

N. (Isorobitella) KEEN, 1962 [14] [**N. (I.) singularis*; OD]. Ovate-trigonal, subequilateral. Resilium less oblique than in *Orobitella,* being

[1] In such shells, the chondrophore (usually cited as *PI, PII*) functions also as posterior laterals, with its edge laminar and posterior part depressed (*PI, fPII*) in RV, the contrary in LV (*fPI, PII*) so that the other, remote, marginal true laterals may be given as *PIII* and *PIV*.

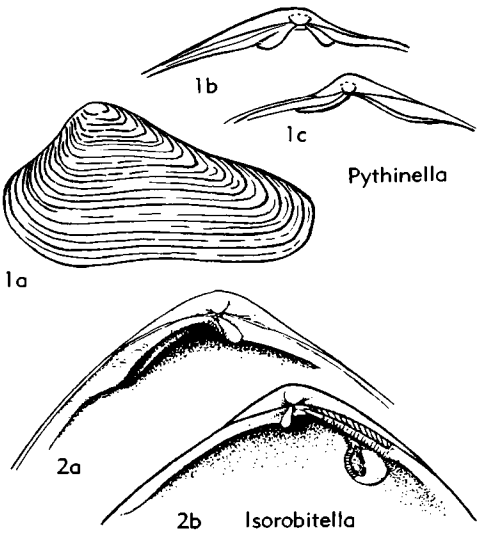


FIG. E34. Montacutidae (p. *N*531-*N*532).

almost parallel to the hinge margin, and showing a median ridge. No gap between the cardinal and the resilifer. *Rec.*, W.Mex.——FIG. E34, *2*. **N. (I.) singularis*; *2a,b*, LV, RV hinges, ×10 (Keen, 1962).

N. (Orobitella) DALL, 1900 [15] [**Montacuta floridana* DALL, 1899; OD]. Anterior margin broadly rounded, elongate, thus very inequilateral. Right laminar tooth rather small. *Mio.-Rec.*, N. Am.——FIG. E31,*16*. **N. (O.) floridana* (DALL), Rec., USA(Fla.); RV int., enl. (Dall, 1900).

Nipponomontacuta YAMAMOTO & HABE, 1961 [31] [**N. actinariophila*; M]. Transversely ovate, subequilateral, anterior end shorter and narrower; moderately convex. Sculpture of growth lines and of several anteroventral radial cords. LV hinge with 2 diverging teeth, posterior one stouter, resilifer between them; lateral margins enlarged, posterior groove for *PIII*. Rec., Japan.——FIG. E33,*5*. **N. actinariophila; 5a,b*, RV ext., LV hinge, enl. (Habe & Yamamoto, 1961).

?**Nipponomysella** HABE, 1959 [7] [**Montacuta oblongata* YOKOYAMA, 1922; OD]. Quite transversely inequilateral, donaciform, with growth lines. Looks like *Tellimya*, but hinge said to be edentulous in right valve and with two unequal cardinals in left. *Rec.*, Japan.——FIG. E33,*3a*. **N. oblongata* (YOKOYAMA); RV ext., ×3 (Habe, 1959). ——FIG. E33,*3b*. *N. obesa* HABE; LV int., ×7.5 (Habe, 1960).

Pileatona LASERON, 1956 [30] [**P. compressa*; OD]. Small, thin, translucent, subtrigonal, with nearly erect beaks and fine growths. Hinge with narrow subumbonal resilifer and 2 obscure subsymmetric laterals. *Rec.*, Australia.——FIG. E33,*6*. **P. compressa; 6a,b*, LV ext., hinge, enl. (Laseron, 1956).

Pythinella DALL, 1899 [5] [**Montacuta cuneata* VERRILL & BUSH, 1898; OD]. Transversely subtrigonal, very inequilateral, elongated posteriorly and attenuated at both sides. Orthogyrous beaks. Hinge with rather long and narrow right, shorter and stouter left, laterals. Resilium restricted to the upper part of a wide arch under the beaks. *Rec.*, N.Am.——FIG E34,*1*. **P. cuneata* (VERRILL & BUSH), Cape Hatteras; *1a-c*, LV ext., hinges, ×11.3 *(937)*.

Rochefortula FINLAY, 1927 [23] [**Rochefortia reniformis;* SUTER, 1909; OD]. Transversely subtrigonal, rounded and sinuate ventrally, ornamented by concentric ribs, regularly crossed by concentric striae. Prosogyrous moderately high beaks. Trigonal well-defined resilium; left anterior and posterior laterals subsymmetric; right anterior oblique, the posterior somewhat remote. *Mio.-Rec.*, Australia-N.Z.-S.Atl.——FIG. E31,*2*. **R. reniformis* (SUTER), N.Z.; *2a,b*, LV int. and RV hinge, ×11.5; *2c*, LV ext., enl. (Chavan, n).

?**Scioberetia** BERNARD, 1895 [4] [**S. australis*; M]. Subcircular, inequilateral, very minute; several crenulations on margin before and behind resilial socket. *Rec.*, S.Am.-Antarctica.

Sphaerumbonella COEN, 1933 [28] [**S. brunellii*; OD]. Ovate, globose, thick, slightly truncated laterally. Rounded beaks. Two short strong subsymmetric right laterals, anterior and posterior, on enlarged margin and on both sides of oblique deep socket. On left valve more internally placed laterals under sockets of right ones. *Rec.*, Red Sea. ——FIG. E32,*4*. **S. brunellii*; *4a,b*, LV and RV int., both enl. (Coen, 1933).

Tahunanuia POWELL, 1952 [31a] [**T. alata;* OD]. Thin, trapezoidal, very inequilateral, anteriorly short and rounded, posteriorly broadened and truncated. Irregular distant concentric waves. Hinge with single tooth in each valve, right one subvertically projecting, left one subhorizontally curved. Oblique broad resiliifer. Slight radial ridge bordering inner margin of both scars. *Rec.*, N.Z.

Tellimya BROWN, 1827 [6] [**Mya ferruginosa* MONTAGU, 1808; SD GRAY, 1847] [=*Tellinomya* AGASSIZ, 1846 *(emend.)*]. Shell subelliptical, very inequilateral, elongated and attenuated onward, shortly truncated backward. Externally striated. Slightly opisthogyrous beaks, under which lies small deep resilial socket. Oblique anterior laterals, right one long, attenuated, subhorizontal, left one shorter and more oblique. Short, strong, almost vertical resilium. *Mio.-Rec.*, W.Eu.-Am.—— FIG. E32,*2*. **T. ferruginosa* (MONTAGU), Rec., USA(Mass.); *2a,b*, LV int. and RV hinge, ×4 (*937* mod., and Chavan, n).

Thecodonta A. ADAMS, 1864 [**T. sieboldi*; M]. Transversely rounded, convex, very inequilateral, posterior part much elongated. Beaks prosogyrous. Sculpture concentric. Anterior left lateral curved,

gradually increasing subparallel to margin, then straightened along oblique resilium. Posterior laterals remote, thickened. *Rec.*, W.Pac.-E.Pac.

T. (Thecodonta) [33]. Obliquely elongate, with projecting beaks. Anterior LV lateral strengthened at right angle along small resilium, posterior laterals unequally remote. *Rec.*, W.Pac.——Fig. E32,*5*. **T. (T.) sieboldi* Adams, Japan; LV int., ×4.5 (Chavan, n).

T. (Pristes) Carpenter, 1864 (*non Pristis* Latham, 1794) [34] [**Pristes oblonga* Carpenter, 1864; OD] [=*Pristiphora* Carpenter, 1866 (*non* Blanchard, 1835); *Serridens* Dall, 1899]. More transverse than oblique, with scarcely projecting beaks and arcuate anterior, transversely serrated, laterals; duplicate subparallel left posteriors. *Rec.*, E.Pac.——Fig. E32,*6*. **T. (P.) oblonga* (Carpenter), USA(Calif.); *6a,b*, LV hinge and RV int., ×9 (Chavan, n).

Virmysella Iredale, 1930 [22] [**V. spernax*; M]. Trigono-elliptical, rather flattened, solid, inequilateral, small. Externally sculptured by alternating concentric lines and growths. A deep trigonal socket bordered anteriorly by laminar bent left and hooklike right lateral; posteriorly, by single right and 2 left ones. *Rec.*, Australia-Alaska-N.Eu.——Fig. E31,*10*. **V. spernax*; *10a,b*, LV and RV hinges, ×6 (Iredale, 1930).

Family GALEOMMATIDAE Gray, 1840

[*nom. correct.* Dall, 1899 (*pro* Galeommidae Gray, 1847)] [=Galeommidii Gray, 1840]

Shell slightly convex or flattened, commonly transverse, irregular or gaping. Resilium ill-defined, accompanied by marginal ligament. Hinge irregular, with small to quite minute, tuberculiform cardinals, hooking or projecting at termination of flexuous somewhat obscure laterals, and crossing themselves from one valve to another around resilium, in more or less cyclodont disposition. *U.Eoc.-Rec.*

Arrangement of generic taxa by Chavan.——1. *Galeomma*.——2. *Paralepida*.——3. *Amphilepida*.——4. *Galeommella*.——5. *Libratula*.——6. *Ephippodonta*.——7. *Ephippodontoana*.——8. *Ephippodontina*.——9. *Thyreopsis*.——10. *Levanderia*.——11. *Lactemiles*.——12. *Scintilla*.——13. *Cymatioa*.——14. *Ambuscintilla*.——15. *?Scintillorbis*.——16. *Spaniorinus*.——17. *Scintillona*.——18. *Barclaya*.——19. *Leiochasmea*.——20. *Achasmea*.——21. *Passya*.——22. *Phlyctaenachlamys*.——23. *Turquetia*.——24. *Cyamionema*.——25. *Vasconiella*.——26. *Divariscintilla*. [Insert above, 3a. *?Uncidens;* 9a. *Aclistothyra;* 9b. *Coleoconcha;* 27. *Tryphomyax*.]

Galeomma Sowerby in Turton, 1825 [1] [**G. turtoni* Sowerby, 1825; SD Gray, 1847] [=*Parthenope* Scacchi, 1833 (type, *P. formosa*; OD); *Hirudinaria* Scacchi, 1833 (type, *H. alba*; M)]. Irregularly quadrangular-transverse, thin, moderately inequilateral, gaping, externally finely radiated or smooth. Hinge margin straight or nearly so; beaks low with lateral thickenings on both sides, raised up at their infraumbonal junction, there crossed with tubercular very minute cardinal. Resilium inframarginal, oblique, small. *Rec.*, W.Eu.-Medit.

G. (Galeomma). Distorted, ventrally gaping; fine external ribs crenulating inner margin. Long narrow hinge plate with cardinals not distinctly separated from lateral thickenings. *Rec.*, W.Eu.-Medit.-W.Afr.——Fig. E35,*4*. **G. (G.) turtoni* Sowerby, Spain; *4a,b*, LV and RV int., ×4.8 (Chavan, n).

G. (Amphilepida) Dall, 1899 [3] [**G. politum* Deshayes, 1855; OD]. Transversely subelliptical, smooth, gaping. Dental process forming oblique T on right valve *(3a, 1, 3b)* and oblique M on left *(2b, 2a, All)*, set apart from enlarged laterals. Oblique resilium under sinuous nymph. *Rec.*, Ind.O.——Fig. E35,*11*. *G. (A.) obockense* Jousseaume, Obock; *11a,b*, LV and RV int.; *11c*, RV ext.; all ×4 *(114)*.

G. (Paralepida) Dall, 1899 [2] [**G. formosum* Deshayes, 1855; OD] [=*Lepirodes* P. Fischer, 1887 (obj.) (*non Lepyrodes* Guénée, 1854)]. Largely gaping, with faint radial riblets. Dental process on both sides of ligament, distinctly separated from lateral thickenings. *Rec.*, Australia-Japan.

Aclistothyra McGinty, 1955 [9a] [**A. atlantica;* OD]. Thin, nearly flat, broadly gaping; transversely semiovate, rounded at both ends. Minute granulations, no radial ornament. Hinge plate straight, slightly thicker medially, without developed teeth. External ligament. *Rec.*, USA(Fla.).

Ambuscintilla Iredale, 1936 [14] [**A. praemium*; M]. Short, broadly and ovately rounded, somewhat transverse, smooth. Small cardinal developed on each valve and short oblique resilium and nymph. Lateral processes thickened but not separated from margin. *Rec.*, Australia-?Ind.O.——Fig. E35,*5*. **A. praemium;* LV int., enl. *(436)*.

Barclayia A. Adams, 1875 [18] [**Scintilla incerta* Deshayes, 1863; M] [=*Barclaya* ?auctt., 1874, Zool. Rec., p. 184; *Barclaya* P. Fischer, 1887 *(err.)*]. Subtrapezoidal, almost subrectangular, somewhat inequilateral, ventrally moderately rounded. Sculptured by concentric lines and numerous radial riblets. On the left valve, 2 long laterals with sockets above them, subparallel to margin, separated by resilium and 2 minute tuberculiform cardinal teeth. *Rec.*, E.Afr.——Fig. E35, *8*. **B. incerta* (Deshayes), Réunion; *8a*, LV int., ×3.6; *8b*, RV ext., ×2.1 (Deshayes, 1863).

Coleoconcha Barnard, 1964 (9a) [**C. opalina;* M].

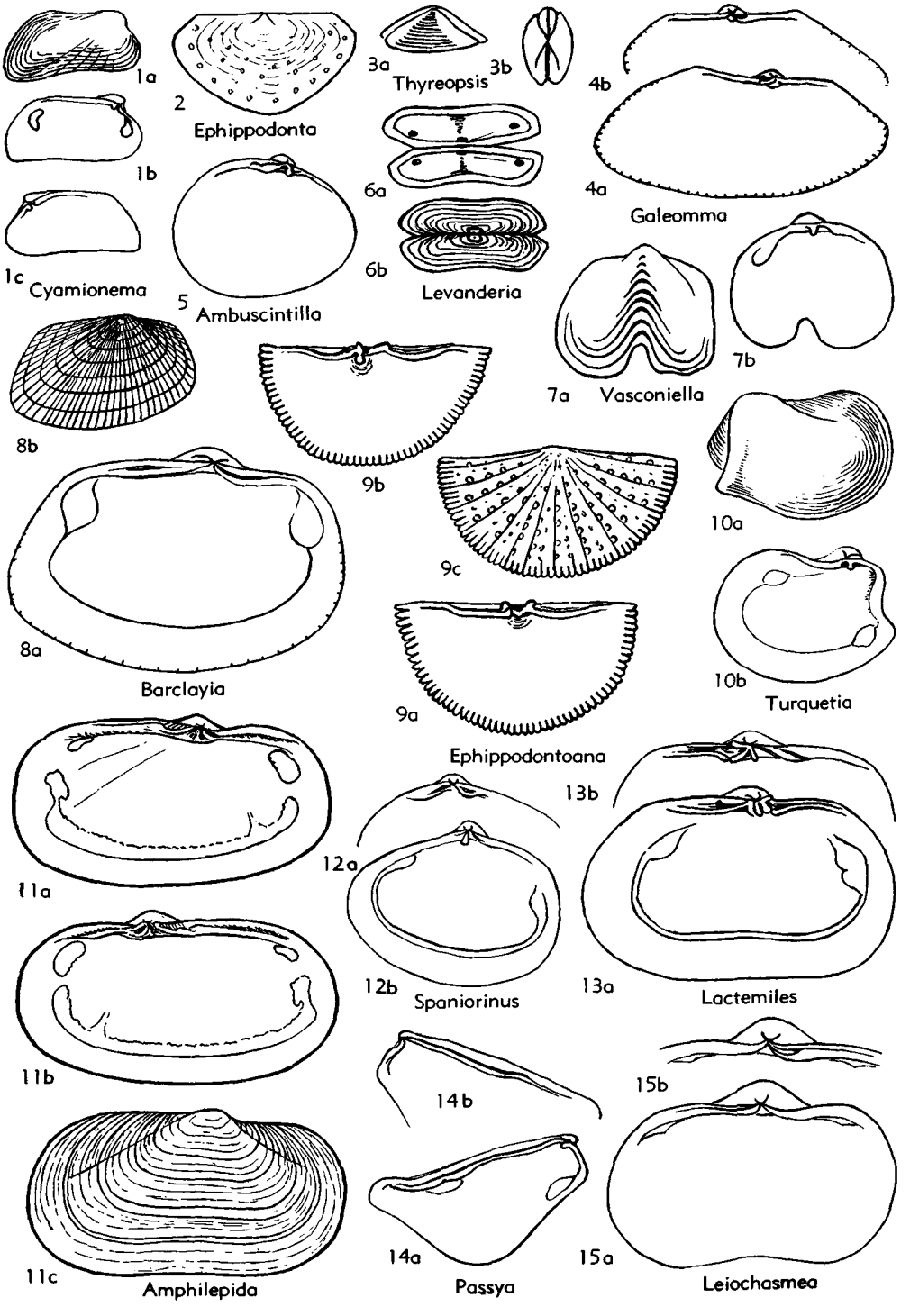


FIG. E35. Galeommatidae (p. *N533*, *N535-N537*).

Shell internal, transversely, rather narrowly semiovate, thin, translucent; umbo slightly in front of middle; prodissoconch prominent, subcircular. Concentric grooves only; tiny granules at both ends corrugating lateral surfaces and crenulating margins. Hinge line straight, very slightly thickened, edentulous; no adductors. *Rec.*, S.Afr.

Cymatioa BERRY, 1964 [13] [*pro Crenimargo* BERRY, 1963 (*non* COSSMANN, 1902)] [**Crenimargo electilis* BERRY, 1963; OD]. Shell resembling *Solecardia* in outline but surface microscopically punctate, with several low, ripple-like radial ribs making ventral margin gently crenate; adductor scars high, pallial line interrupted or dotlike, showing through shell; hinge in RV with small pointed cardinal tooth and long posterior lateral, ligament socket large; hinge of LV with thin anterior laterals, 2 small cardinals and pustular *PII*. *Rec.*, W. C. Am.-Red Sea.——FIG. E36,*6*. **C. electilis* (BERRY); *6a,b*, RV and LV hinges, ×8 (Berry, 1964); *6c*, *C.* sp., Red Sea; LV int., ×3.3 (Chavan, n).

?Cyamionema MELVILL & STANDEN, 1914 [24] [**Cyamiun (C.) decoratum*; M]. Papyraceous, quadrangular, upper and ventral margins subparallel; anterior side short and rounded, posterior end obliquely truncated. Lirate on ventral region. Two minute conical right teeth, one more prominent left, and no separated laterals. Ligament external, elongate. *Rec.*, S.Atl. (Falkland Is.).—— FIG. E35,*1*. **C. decoratum*; *1a*, RV ext.; *1b,c*, LV and RV int., all ×2.8 (Melvill & Standen, 1914). [?Sportellid.]

Ephippodonta TATE, 1889 [**Scintilla? lunata* TATE, 1887; SD MITCHELL, 1890]. Semielliptical, laterally angular, most extended not far from straight hinge margin, ventrally rounded. Externally striated, papillose or reticulated. Ligament bounded on each side by obtuse tooth with bifid crown and long laterals. *Rec.*, Australia.

E. (Ephippodonta) [6]. Almost semielliptical in outline, with symmetric sides. Hinge margin only slightly shorter than oblique diameter. Radial papillae only developed toward external margin. Inner margin plain. *Rec.*, Australia.——FIG. E35, *2*. **E. (E.) lunata* (TATE); RV ext., ×2.4 (Tate, 1889).

E. (Ephippodontina) KURODA, 1945 [8] [**E. (E.) murakamii*; OD]. Irregularly semielliptical hinge margin straight, noticeably shorter than angular diameter. Surface finely reticulated, hinge almost edentulous, with well-marked thickened laterals only. *Rec.*, Japan.——FIG. E36,*4*. **E. (E.) murakamii;* LV int., ×3.1 (Kuroda, 1945).

E. (Ephippodontoana) HABE, 1951 [7] [**E. macdougalli* TATE, 1889; OD]. Almost semicircular, hinge margin diametral. Radial papillae on whole surface, radial riblets indenting ventral margin deeply. *Rec.*, Australia.——FIG. E35,*9*. **E. (E.) macdougalli* TATE; *9a,b*, LV and RV int.; *9c*, RV ext., all ×4 (Chavan, n).

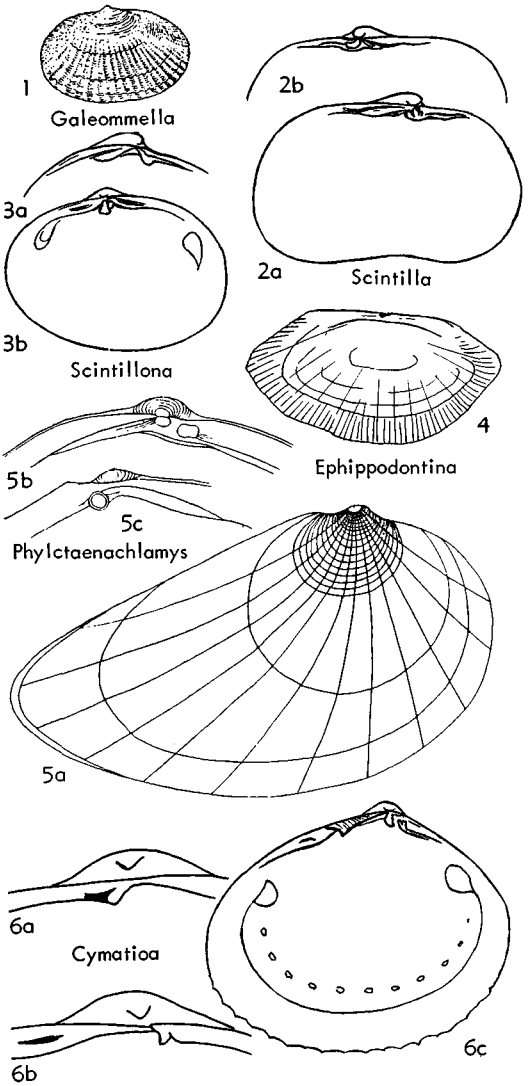


FIG. E36. Galeommatidae (p. *N535-N536*).

Galeommella HABE, 1958 [4] [**G. utinomii*; OD]. Ellipsoidal, moderately convex, not gaping; beaks small, elevated; radial ribs distinct, laterally weakened and less widely spaced than medially. Inner margin crenulated. *Rec.*, Japan.——FIG. E36,*1*. **G. utinomii;* RV ext., ×5 (Habe, 1958).

Lactemiles IREDALE, 1931 [11] [**Scintilla strangei* DESHAYES, 1856; OD]. Medium-sized, elliptical, thin, with shining surface ornamented only by faint striae. Tubercular short crossed cardinals: *3a, I, 3b*, forming T; *2a, 2b*, making inverted V,

prolonged by somewhat short lateral, parallel to margin. Oblique nymph and resilial socket. *Rec.*, Australia-Pac.——Fig. E35,*13*. **L. strangei* (Deshayes), Pac.; *13a,b*, LV and RV int., ×2.8 (Chavan, n). [Beaks prosogyrous.]

Leiochasmea Dall, Bartsch & Rehder, 1938 [**Solecardia (Scintilla) chascax* Pilsbry, 1921; OD]. Small, elliptical, thin, smooth or with coarse growths. Beaks pointed. Hinge line straight. Two marginal thickenings separated by resilium in trigonal depression and by external support of ligament. *Rec.*, Hawaii.

L. (Leiochasmea) [19]. Ventrally gaping. *Rec.*, Hawaii.——Fig. E35,*15*. **L. (L.) chascax* (Pilsbry); *15a,b*, RV int. and LV hinge, ×5.1 (Dall, Bartsch, & Rehder, 1938).

L. (Achasmea) [19] Dall, Bartsch & Rehder, 1938 [**Solecardia (Scintilla) thaanumi* Pilsbry, 1921; OD]. Without ventral gape. *Rec.*, Hawaii-?Japan.

Levanderia Sturany, 1905 [10] [**L. erythraensis*; M]. Narrowly transverse, hinge margin straight, almost diametral; angular at lateral ends, almost straight and somewhat concave ventrally. Externally sculptured with zigzag striae. No teeth developed. *Rec.*, Red Sea.——Fig. E35,*6*. **L. erythraensis*; *6a,b*, both valves int., ext., ×1.6 (Sturany, 1925).

Libratula Pease, 1865 [5] [**L. plana*; M]. Smooth, semilunar, flat, with straight serrate cardinal margin and median ligament. Not gaping. *Rec.*, Pac.

?Passya Deshayes, 1858 [21] [**P. eugenii*; OD]. Subquadrangular, flat, very irregular in outline and inequilateral. Beaks small, pointed, anterior side angular, very short; posterior side sloping down, its end strongly acuminate and somewhat rostrate. Ventral margin very convex in middle. Hinge margin thickened in long sinuate curved lamellae. Ligament external. *U.Eoc.*, Eu.(France).——Fig. E35,*14*. **P. eugenii*; *14a,b*, LV int. and RV hinge, ×4.8 *(258)*.

Phlyctaenachlamys Popham, 1939 [22] [**P. lysiosquillina*; OD]. Very inequilateral, rounded in front, medioposteriorly much acuminated, angular. Regularly sculptured. Hinge with tuberculiform cardinals and elongate lateral. *Rec.*, Australia.——Fig. E36,*5*. **P. lysiosquillina*; *5a*, RV ext., ×9; *5b,c*, LV and RV hinges, ×16.5 (Popham, 1928-29).

Scintilla Deshayes, 1856 [12] [**S. philippinensis*; SD Stoliczka, 1871]. Largely subelliptical, somewhat straightened on hinge margin. Surface granular, nacreous. Sinuous faint anterior and posterior laterals. Two ill-defined unequal cardinals on right valve and one, more or less obscure, on left. *?Eoc.*, W.Eu.; *Rec.*, Pac.-Ind.O.——Fig. E36, *2*. **S. philippinensis*, Penang; *2a,b*, LV int. and RV hinge, enl. (Chavan, n).

Scintillona Finlay, 1927 [17] [**Spaniorinus zelandicus* Odhner, 1924] [=*?Varotoga* Iredale, 1931 (subj.) (type, *Solecardia cryptozoica* Hedley, 1917)]. Transversely ovate, rounded at both ends. Right tubercular prominent small cardinal, left, slightly prominent, oblique one, prolonged into obscure lamella (fitting in socket of opposite valve). Resilium followed by marked nymph. *L.Mio.-Rec.*, Australia-N.Z.——Fig. E36,*3*. **S. zelandica* (Odhner), N.Z.; *3a,b*, LV hinge and RV int., ×4.6 (Chavan, n).

?Scintillorbis Dall, 1899 [15] [**Scintilla crispata* P. Fischer, 1873; OD]. Orbicular, inequilateral, compressed, very thin. Radial and concentric sculpture. External obsolete ligament and stouter resilium. Small tooth on each valve. *Rec.*, Atl.

Spaniorinus Dall, 1899 (1900) [16] [**Solecardia (S.) cossmanni* Dall, 1900; OD]. Transversely subovate, compressed; beaks median; anterior side gradually narrowing, posterior side remaining broad and somewhat truncated. Subvertical tooth in RV, in front of oblique resilium, with traces of shorter teeth on each side; oblique tooth on LV, no distinct laterals on enlarged margins. *Eoc.-Plio.*, W.Eu.-N.Am.——Fig. E35,*12*. **S. cossmanni* (Dall), USA(Va.); *12a,b*, LV hinge and RV int., ×3.6 (Dall, 1900).

Thyreopsis A. Adams, 1868 [9] [**T. coralliophila*; M]. Trigonal, angular dorsally and at extremities, slightly inequilateral. Valves widely gaping. Hinge apparently edentulous. *Rec.*, Ind.O.(Mauritius).——Fig. E35,*3*. **T. coralliophila*; *3a,b*, LV ext., dorsal, ×1.2 (H. Adams, 1868).

Tryphomyax Olsson, 1961 (27) [**T. lepidoformis*; OD]. Small, thin, flat, subovate, somewhat enlarged posteriorly and with more or less pronounced ventral notch. Sculpture of low radial riblets, cancellated by minute concentrics. RV cardinal knoblike; LV with 2 cardinals, anterior one larger. Internal ligament, in small resilifer. *Rec.*, Panama.

?Turquetia Vélain, 1877 [23] [**T. fragilis* Vélain, 1876 (1877); M] [=*Turquetia* Vélain, 1876 *(nom. nud.)*]. Convex, very inequilateral, transversely ovate, rounded and enlarged anteriorly, shortened, obliquely truncated and folded posteriorly. Beaks orthogyrous. Hinge margin thickened on anterior elongation, then showing small tubercular tooth separated by 2 sockets. Ligament external. *Rec.*, S.Atl. (St.Paul Is.).——Fig. E35,*10*. **T. fragilis; 10a,b*, RV ext., int., enl. (Chavan, n). [?Sportellid.]

?Uncidens Coen, 1934 (3a) [**U. arupinensis*; OD]. Small, thin, slightly convex, equivalve, subequilateral, subelliptical, with slight posterior truncation; no lunule or escutcheon. Sculpture of coarse concentric ribs and faint radial lines. RV hinge with anterior lateral, strong median cardinal with rounded median deep concavity and oblique posterior cardinal; semiinternal ligament. LV with 2 rounded, anterior and median cardinal processes,

located in concavities in front of and in RV tooth; and posterior oblique cardinal. Inner margin smooth. *Rec.*, Adriatic.

Vasconiella DALL, 1899 [**Vasconia jeffreysiana* P. FISCHER, 1873; OD] [*pro Vasconia* FISCHER, 1875, *partim*]. Irregularly rounded, ventrally lobated by deep concave sinuosity. Sculpture of unequal lamellar growths. Small conical tooth under submedian beak, followed by resilium and ligamentary attachment. *Rec.*, Atl.-Medit.-N.Z.

V. (Vasconiella) [25]. Slightly oblique, with rather strong rounded tooth. *Rec.*, Atl.-Medit.—— FIG. E35,7. **V. (V.) jeffreysiana* (FISCHER), Cape Breton Is.; *7a,b*, RV ext., int., ×3.2 (Fischer, 1875).

V. (Divariscintilla) POWELL, 1932 [26] [**D. maoria*; OD]. Strongly oblique; with smaller, angular tooth. *Rec.*, N.Z.

GENERA DUBIA

Autonoe LEACH, 1852 (*non* RAFINESQUE, 1815) (*nom. nud.*).

Bilobaria PELSENEER, 1911. Shell undescribed. Type lost.

Hyalokellia HABE, 1960 [**H. polita*; OD]. Described as bean-shaped, posteriorly produced; hinge narrow, with RV small cardinal and long posterior lateral, LV very weak anterior cardinal and posterior lateral. Unfigured. ?Erycinid. *Rec.*, Japan.

Soyokellia HABE, 1958 [**S. compressa;* OD]. Unfigured. Said to be oblong and inequilateral, rounded at both ends, hinge with single anterior and 2 posterior teeth on right valve, resilium narrow. ?Erycinid. *Rec.*, Japan.

Superfamily CHLAMYDOCONCHACEA Dall, 1884

[*nom. transl.* KEEN, herein (*ex* Chlamydoconchidae DALL, 1884)] [Materials for this superfamily prepared by MYRA KEEN]

Shells internal, without pallial or adductor scars or hinge teeth; enclosed in two sacs within the mantle, umbones loosely joined by an abortive ligament; prodissoconchs prominent, persistent, at dorsal ends of valves; animal sluglike, ovoid, covered by tough, papillose mantle, foot protruding anteriorly through orifice, a second orifice posteriorly for anal opening. *Rec.*

Family CHLAMYDOCONCHIDAE Dall, 1899

Characters of superfamily. *Rec.*

Chlamydoconcha DALL, 1884 [**C. orcutti*; OD]. Characters of superfamily. *Rec.*, N.Am.——FIG. E37,*1*. **C. orcutti*, USA(Calif.); *1a*, animal, valve visible dorsally through transparent mantle, ×1.5; *1b-e*, shell, showing RV ext., LV int., LV ext., RV int., all ×10 (*1a*, Williams, 1949; *1b-e*, Los Angeles County Museum specimens, Keen, n).

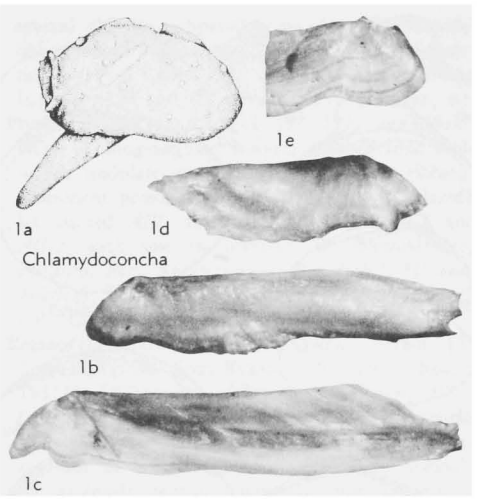


FIG. E37. Chlamydoconchidae (p. *N*537).

Superfamily CYAMIACEA Philippi, 1845

[*nom. transl.* THIELE, 1934 (*ex* Cyamiidae PHILIPPI, 1845)] [Materials for this superfamily prepared by ANDRÉ CHAVAN]

Shell equivalve, commonly somewhat thickened, mostly with resilium adjacent to nymph, slightly hollowing hinge plate; upper hinge elements distinct, elongate and hooked at their termination above inferior ones; laterals distinct, *AI* (or *1*) and *AII* (or *2*) present. Marine; foot with a byssal gland; two posterior apertures in mantle. *Jur.-Rec.*

The alphabetically arranged generic descriptions in each family-group division of the Cyamiacea are accompanied by numbers inclosed by square brackets. Such numbers indicate position in the sequence of generic taxa given with the respective families or subfamilies for the purpose of recording CHAVAN's arrangement, designed to reflect "natural relationships" of these taxa as inferred by him.

Family CYAMIIDAE Philippi, 1845

[=Perrierinidae MARWICK, 1927]

Shell small, more or less angular, with broad hinge plate scarcely or not at all hollowed by oblique well-defined resilium;

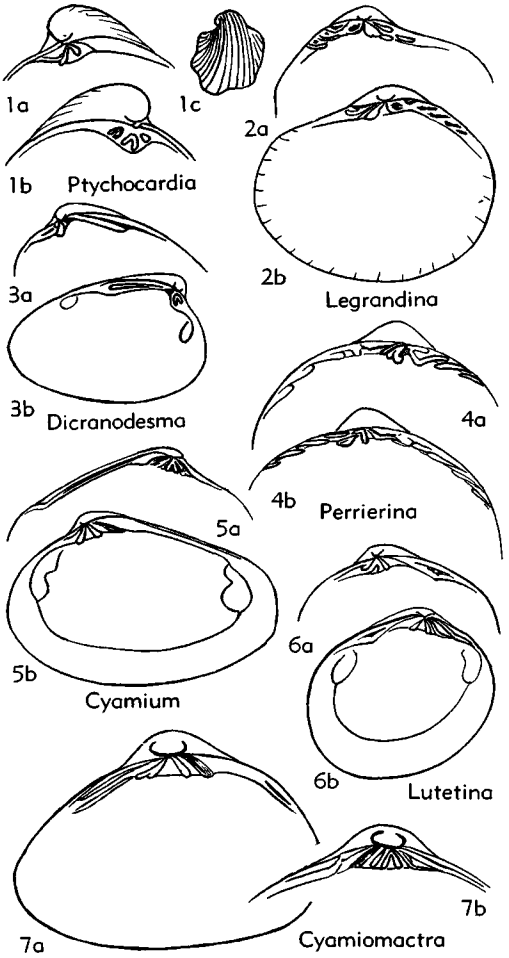


FIG. E38. Cyamiidae (p. *N538-N539*).

cardinals narrowly elongate, diverging, some (commonly *2b*) bilobate; laterals remote, some with taxodont tendency. *Mio.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Cyamium*.——2. *Cyamiomactra*.——3. *Reloncavia*.——4. *Cyamiocardium*.——5. *Perrierina*.——6. *Legrandina*.——7. *Ptychocardia*.——8. *Dicranodesma*.——9. *Lutetina*.

Cyamium PHILIPPI, 1845 [1] [**C. antarcticum*; M]. Transversely elongate, inequilateral, rounded in front, somewhat obliquely extended and faintly truncated backward. Left hinge with remnants of *AII, 2a,* bifid *2b,* and obsolete *4b*; right with remnants of *3a, 1, 3b;* posterior laterals remote, more or less indistinct. *Rec.,* S.Am.-Antarctica.—— FIG. E38,*5*. **C. antarcticum,* S.Am.(Patag.); *5a,b,* LV hinge, RV int., ×5 (Chavan, n).

Cyamiocardium SOOT-RYEN, 1951 [4] [**Cyamium denticulatum* SMITH, 1907; M]. Rounded, with inflated beaks, radiating sculpture. Hinge as in *Cyamiomactra* but without elongate well-developed laterals and with broader *3a,* shorter *2a,* and *3b* obscurely bifid. Denticulated inner margin. *Rec.,* Antarctica-Chile-?N. Z.-?Australia.—— FIG. E39,*1*. **C. denticulatum* (SMITH); *1a,* LV int., ×20; *1b,c,* RV and LV hinges, ×10 *(858)*.

Cyamiomactra BERNARD, 1897 [2] [**C. problematica*; M] [=*Heteromactra* LAMY, 1906 (type, *Mactra (H.) laminifera*)]. Subtrigonal, short, slightly inequilateral; angular in front, enlarged and somewhat obliquely sloping backward; surface smooth. Hinge with 2 well-developed long parallel anterior laterals in each valve, coalescent *3a, 1, 3b,* curved *AII,* largely bifid *2, 4b,* and faint remote posterior lateral; very oblique narrow resilium. *?Pleist., Rec.,* ?Australia-?N.Z.-Antarctica.——FIG. E38,*7*. **C. problematica,* Stewart Is.; *7a,b,* RV int., LV hinge, ×10 (Chavan, n).

Dicranodesma DALL, 1899 (1900) [8] [**Mysella calvertensis* GLENN in DALL, 1900]. Transversely and very obliquely trigonal, inequilateral, shortly rounded in front, acuminate backward; beaks prosogyrous. Hinge moderately stout, RV with anterior lateral and trigonal *1* having remnants of *3* around its top, LV with oblique inverted V *(2-AII),* all in front of oblique resilium, moderately broad, long posterior lateral. *Mio.,* N.Am. (Md.).——FIG. E38,*3*. **D. calvertensis* (GLENN); *3a,b,* RV hinge, LV int., ×4 (Chavan, n).

Legrandina TATE & MAY, 1901 [6] [**L. bernardi;* OD]. Largely ovate, somewhat inequilateral, anteriorly attenuated, posteriorly enlarged; radially ribbed. Hinge with *I, 3a-b, AII* in prolongation of *2,* scarcely bifid, *4b* and several oblique, subparallel, taxodont-like laterals, RV with only 2 right anterior but 4 posterior ones, LV with 1 to 3 laterals; crenulated margin; resilium in spoonlike pit. *Rec.,* S.Pac.(Tasmania).——FIG. E38,*2*. **L. bernardi; 2a,b,* LV hinge, RV int., ×20 (Chavan, n).

Lutetina VÉLAIN, 1876 (1877) [9] [**L. antarctica;* OD]. Largely subovate, relatively thick, anterior side shorter and narrower than broadened posterior; ventral margin convex, shining surface with faint concentric ribs; beaks small. Hinge with narrow oblique cardinals and lamellar anterior lateral; *AIII-3a* obsolete, *1* on inferior margin of plate, *3b, AIV, AII, 2a, 2b* well separated, oblique resilium and each valve with strong posterior lateral. *Rec.,* Atl.(St.Paul Is.).——FIG. E38,*6;* E39,*2*. **L. antarctica*; E38,*6a,b,* RV hinge, LV int., enl. (Chavan, after Vélain, 1876); E39,*2a,b,* LV and RV hinges, ×32 (Bernard).

Perrierina BERNARD, 1897 [5] [**P. taxodonta;* M]. Transversely ovate, very inequilateral, anterior side much shorter than posterior. Hinge with *1, 3a-b,* curved *AII, 2a* coalescent with *2b, 4b* present, and

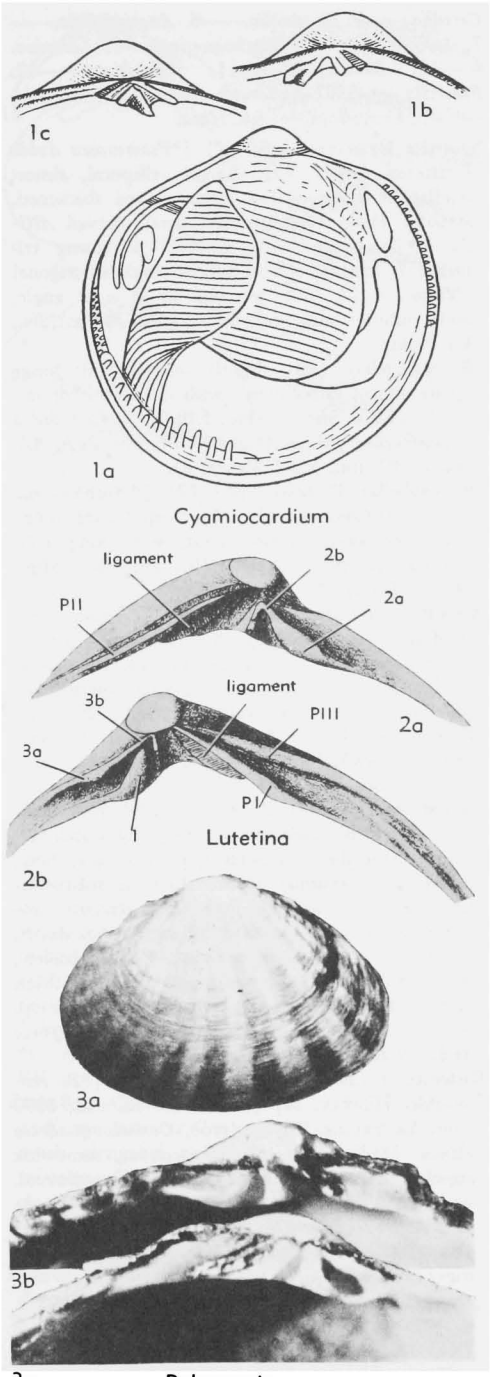


FIG. E39. Cyamiidae (p. *N538-N539*).

several oblique, subparallel, taxodont-like laterals; oblique narrow resilium. *Plio.-Rec.*, N.Z.-Antarctica.——FIG. E38,*4*. **P. taxodonta*, Rec., Stewart Is.; *4a,b*, LV and RV hinges, ×10 (Chavan, n).

Ptychocardia THIELE, 1912 [7] [**P. vanhöffeni*; OD]. Oblong-angular, convex, with 3 radial folds which undulate margin, also concentric ribbing; prominent prosogyrous beaks. Hinge with lamellar curved *AIII*, and tubercular *AIV*, *AI-1* and *AII-2*, each one in inverted V; rounded deep resilium. *Rec.*, Antarctica.——FIG. E38,*1*. **P. vanhoeffeni*; *1a-c*, RV and LV hinges, LV ext., much enl. (Chavan, n).

Reloncavia SOOT-RYEN, *nom. subst.* herein [3] [*pro Kingiella* SOOT-RYEN, 1957 (*non* SEGUY, 1937)] [**Kingiella chilenica* SOOT-RYEN, 1957; OD]. Ovate, radial sculpture distinct, ventral margin crenate. Outer ligament conspicuous and resilium in oblique groove. Two RV cardinals, *3b* grooved; central triangular, not bilobate, *2* and *4a, 4b*. Elongate laterals. *Rec.*, S.Am.(Chile). ——FIG. E39,*3*. **K. chilenica; 3a*, LV ext., ×0.7; *3b,c*, RV and LV hinges, ×24 (Soot-Ryen, 1959).

Family TURTONIIDAE Clark, 1855

Small, prosogyrous, very inequilateral; with rather narrow hinge plate bearing tubercular cardinals and both anterior and posterior laterals; ligament external. Four mantle folds and no outer demibranchs. *Mio.-Rec.*

Turtonia ALDER, 1848 [**Venus minutus* FABRICIUS, 1780; OD]. Anteriorly short, convex, posteriorly acuminate; LV hinge with subhorizontal *AII* adjacent to feebly bifid tubercular *2*, laminar *AIV* and minute *4b* above and behind it; RV with *AI* and *AIII* prolonged by *1* and *AIII-3a* by tubercular *3b*, hinge plate hollowed backward, posterior laterals very distant and minute. *Mio.-Rec.*, N.Eu.-Greenl.-Alaska-Japan.——FIG. E40,*3*. **T. minuta* (FABRICIUS), Rec., North Sea; *3a,b*, RV hinge, LV int., ×10 (Chavan, n).

[This genus has been placed in the Veneracea by K. OCKELMANN (Ophelia I, no. 1, p. 121-145, 1964) but, apart of several anatomical differences, its hinge is not cyrenoid (with hollowed plate, *4b* minute, *AIV* developed, and tubercular cardinals).]

Family SPORTELLIDAE Dall, 1899

[=Basterotidae WOODRING, 1925]

Small to medium-sized, shell commonly thickened, more or less rounded in outline; hinge plate broad, scarcely or not at all hollowed by internal part of ligament, which is principally marginal, lying on nymph; cardinals differently developed, *1* trigonal and strong, obliterating *3*, tooth *2* oblique, *4b*

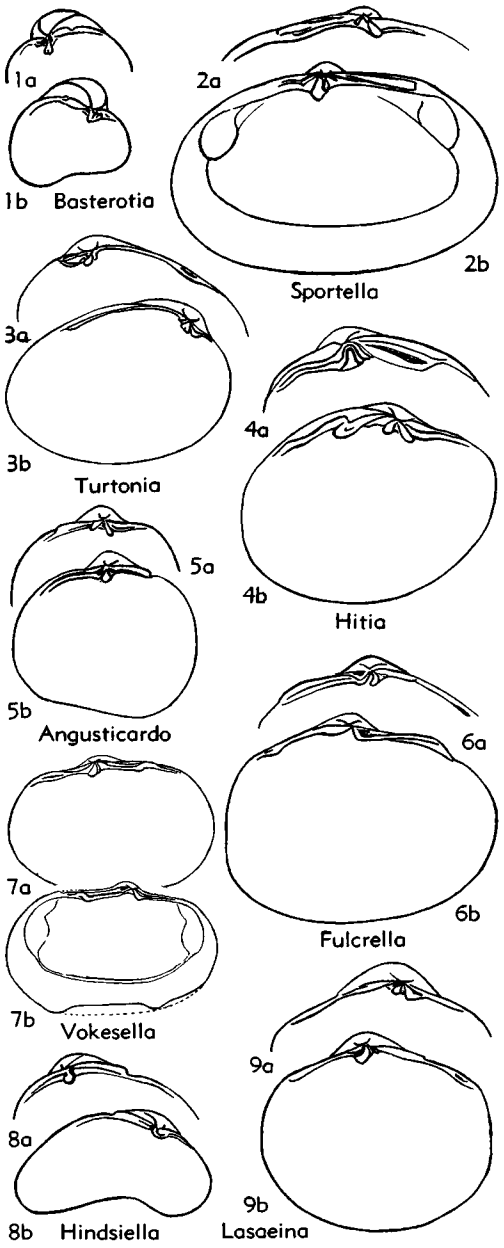


FIG. E40. Turtonidae *(3);* Sportellidae *(1-2,4-9)* (p. *N*539-*N*541).

obsolete in some, laterals incomplete. *Jur.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Sportella.*——2. *Fabella.*——3. *Vokesella.*——4. *Cerullia.*——5. *Hindsiella.*——6. *Angusticardo.*——7. *Isoconcha.*——8. *Benthoquetia.*——9. *Lasaeina.*——10. *Grundensia.*——11. *Anisodonta.*——12. *Fulcrella.*——13. *Basterotia.*——14. *Basterotella.*——15. *Ensitellops.*——16. *Hitia.*

Sportella DESHAYES, 1858 [1] [**Psammotea dubia* DESHAYES, 1824; OD]. Largely elliptical, almost equilateral, more or less flattened and thickened, smooth. Hinge with laminar narrow curved *AIII-3a-3b,* latter posteriorly adjacent to strong trihedral *1;* laminar *AII* at inferior angle of trigonal oblique *2a, 2b* at its top and *4b* at right angle, both minute; long callous nymph. *Paleoc.-Plio.,* Eu.-N.Am.

S. (Sportella). Only slightly inequilateral; hinge plate almost unhollowed, with short anterior laterals. *Paleoc.-Mio.*——FIG. E40,*2.* **S. (S.) dubia* (DESHAYES), M.Eoc.(Lutet.), France; *2a,b,* LV hinge, RV int., ×2 (Chavan, n).

S. (Fabella) CONRAD, 1863 [2] [**Amphidesma constricta* CONRAD, 1841; M]. Inequilateral; hinge plate hollowed, broad, stout, with long subparallel anterior laterals *(AIII, AI, AII). Mio.-Plio., ?Rec.,* N.Am.-SW.Eu.-Medit.

Angusticardo COSSMANN, 1887 [6] [**Poromya rotundata* DESHAYES, 1857; SD COSSMANN, 1913]. Short ovate, with distinct *3a* and *2b,* trigonal *1,* moderately strong posterior *4b,* long anterior laterals, short nymph; no ventral sinuosity. *Eoc.,* W. Eu.——FIG. E40,*5.* **A. rotundata* (DESHAYES), M.Eoc.(Lutet.), France; *5a,b,* LV hinge, RV int., ×6 (Chavan, n).

Anisodonta DESHAYES, 1858 [11] [**A. complanatum*; M]. Subquadrangular, narrowly transverse, anterior side short, attenuated, posterior area long, broad, and vertically truncated; with mediposterior external carina. Hinge with irregular anterior laterals, partly fused to anterior cardinals, trigonal broad *1,* oblique *2,* other ones obsolete, posterior laterals long; with very narrow resilium and short flat broad nymph. *Paleoc.-Rec.,* cosmop.——FIG. E41,*3.* **A. complanatum,* Paleoc., France; *3a,b,* LV int., RV hinge, ×3.7 (Chavan, n).

Basterotia C. MAYER in HÖRNES, 1859 [**B. corbuloides* HÖRNES; M] [=*Eucharis* RÉCLUZ, 1850 (*non* LATREILLE, 1804) (type, *Corbula quadrata* HINDS, 1843; OD)]. Strongly convex, somewhat angular, short, subtrapezoidal, very inequilateral, with very prominent beaks; ventral margin convex, slightly concave in middle. Hinge with one projecting cardinal on each valve, *2* hooklike, *1* trigonal; *3a* oblique, faint; with short nymph and enlarged posterior margin. *Mio.-Rec.,* cosmop.

B. (Basterotia) [*13*]. Dorsally angular. *Mio.-Rec.,* cosmop.——FIG. E40,*1.* **B. (B.) corbuloides* HÖRNES, Helvet., Aus.; *1a,b,* RV hinge, LV int., enl. (Chavan, n).

B. (Basterotella) OLSSON & HARBISON, 1953 [14] [**Pleurodesma floridana* DALL, 1903; OD]. Scarcely angular, irregularly striated; RV coarsely

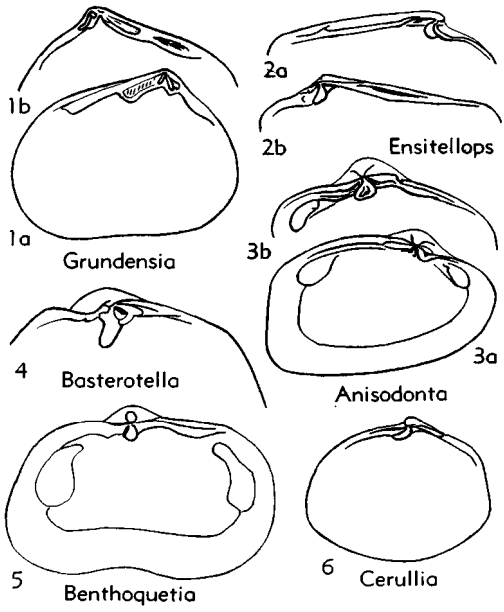


FIG. E41. Sportellidae (p. *N*540-*N*541).

granular. Hinge with distinct resilium beneath nymph. *Mio.-Rec.*, Eu.-Am.——FIG. E41,*4*. **B. (B.) floridana* (DALL), Plio., USA(Fla.); RV hinge, ×3.3 (Chavan, n).

Cerullia CHAVAN, 1953 [4] [*pro Scintillula* CERULLI-IRELLI, 1909 (*non* JOUSSEAUME, 1888)] [**Solecardia (Scintillula) intermedia* CERULLI-IRELLI, 1909; SD CHAVAN, 1953]. Subovate to subelliptical, acuminate forward, slightly truncated backward, somewhat inequilateral. Hinge with long marginal *AIII*, strong oblique curved *1* and *2*, others more or less obsolete, moderately short resilium and nymph; faint left posterior lateral. *Paleoc.-Plio., ?Rec.*, Eu.-?N.Am.——FIG. E41,*6*. **C. intermedia* (CERULLI-IRELLI), U.Plio., Italy; RV int., enl. from ×7 orig. (Chavan, n).

Ensitellops OLSSON & HARBISON, 1953 [15] [**Amphidesma protexta* CONRAD, 1841; OD]. Solenoid, much elongated posteriorly, externally somewhat pustular. Strong curved *AII*, *2* and *1* trigonal, elongated posterior lateral. *Mio.-Rec.*, Am.——FIG. E41,*2*. **E. protexta* (CONRAD), Mio., USA (Va.); *2a,b*, LV and RV hinges, ×4 (Chavan, n).

Fulcrella COSSMANN, 1886 [12] [**Poromya paradoxa* DESHAYES, 1857; OD]. Broadly ovate-transverse, slightly inequilateral. Very long regular anterior laterals, fused to anterior cardinals; well-marked narrow posterior right cardinal and resilial hollow under maginal ligament; remote faint posteriors. *Eoc.-Rec.*, Eu.-N.Am.-Pac.——FIG. E40, *6*. **F. paradoxa* (DESHAYES), L.Eoc., France; *6a,b*, RV hinge, LV int., ×5.3 (Chavan, n).

Grundensia KAUTSKY, 1939 [10] [**G. adametzi*; OD]. Subquadrangular, inequilateral, with broad flat hinge, narrowed in its middle, no detached anteriors, *AII-2a* bifid, *2b* short, *3a*, *1*, small, obsolete *3b*, all small and narrow; long posterior laterals; broad resilium and marginal ligament. *Mio.(Helvet.)*, Austria.——FIG. E41,*1*. **G. adametzi*; *1a,b*, LV int., RV hinge, enl. (Chavan, n).

Hindsiella STOLICZKA, 1871 [5] [*pro Hindsia* DESHAYES, 1858 (*non* H. & A. ADAMS, 1853)] [**Modiola arcuata* LAMARCK, 1807; OD]. Moderately small, inequilateral, transversely elongated, arcuate in middle and rounded at lateral ends. Hinge with long *AIII* and *AII* grooves, rounded tuberculiform *1*, curved *2*; nymph relatively elongate. *Paleoc.-U.Eoc.*——FIG. E40,*8*. **H. arcuata* (LAMARCK), M.Eoc. (Lutet.), France; *8a,b*, RV hinge, LV int., ×4 (Chavan, n).

Hitia DALL, BARTSCH & REHDER, 1938 [16] [**H. ovalis*; OD]. Transversely elliptical, inflated, smooth. Knoblike cardinals; with *1*, *2a* and *2b* and *3a* and *3b* in an inverted V, latter in prolongation of *AIII*, above top of *1*; marginal *AII* and broad ligament, resilium and nymph; remote faint marginal left lateral. *Rec.*, Hawaii.——FIG. E40,*4*. **H. ovalis*; *4a,b*, RV hinge, LV int., ×6 (Chavan, n).

?Isoconcha DAUTZENBERG & FISCHER in PELSENEER, 1911 [**I. sibogai*; SD PRASHAD, 1932]. Transversely elliptical, almost subequilateral, concentrically striated, inflated, small. Hinge with one developed cardinal on each valve and corresponding socket, under beak; ligament external, no distinct resilium. *Rec.*, Australasia.

I. (Isoconcha) [7]. Regularly elliptical, sinuated in middle, subequilateral *(755)*. *Rec.*, Australasia.

I. (Benthoquetia) IREDALE, 1930 [8] [**Turquetia integra* HEDLEY, 1907; OD] [=*Austroturquetia* COTTON, 1930]. Irregularly elliptical, somewhat inequilateral. *Rec.*, N.Z.-Australia.——FIG. E41, *5*. **I. (B.) integra* (HEDLEY); RV int., enl. (Chavan, n). [May be an erycinid with faintly marked laterals.]

Lasaeina COSSMANN, 1910 [1912] [9] [* *Lasaea saucatsensis* COSSMANN, 1896; OD]. Ovately rounded, rather broad, smooth. Hinge with 2 cardinals on each valve; *3a* faint, *3b* strong, *AII-2*, *4b*. Faint anterior and posterior lateral; narrow resilium, moderately long nymph. *Mio.*, Eu.——FIG. E40,*9*. **L. saucatensis* (COSSMANN), Burdigal., France; *9a,b*, LV hinge, RV int., ×7.4 (Chavan, n).

Vokesella CHAVAN, 1952 [3] [**V. inopinata*; OD]. Subelliptical, thin, slightly inequilateral, with distinct right anterior *AI-1-3b* trigonal, oblique, right-angled *AII-2*, a faint *4b*; small oblique resilium and prominent long nymph. *Jur.*, Eu.(W.France). ——FIG. E40,*7*. **V. inopinata*; *7a,b*, RV int., LV int., ×4.7 (Chavan, n).

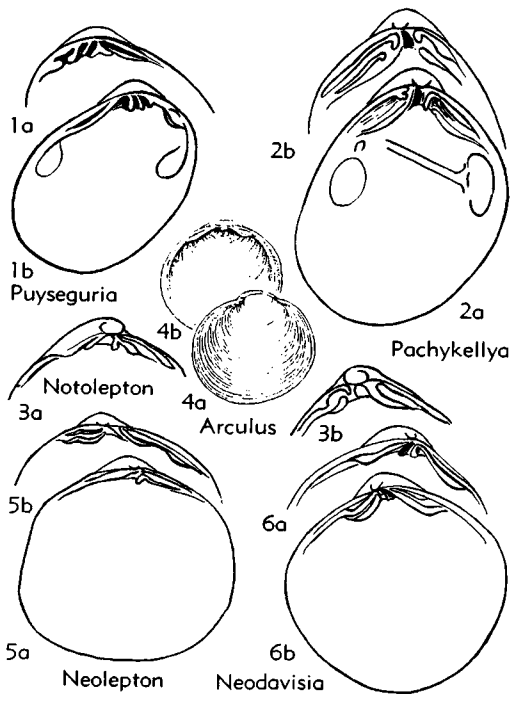


FIG. E42. Neoleptonidae (p. *N*542-*N*543).

Family NEOLEPTONIDAE Thiele, 1934

Shell minute, rounded, with more or less broad hinge plate, arched under internal ligament. Hinge without completely developed cardinals or with one, but with long laminar anterior and posterior arched, commonly hooked laterals on both sides. *Plio.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Neolepton.*——2. *Neodavisia.*——3. *Notolepton.*——4. *Pachykellya.*——5. *Puyseguria.*——6. *Calvitium.*——7. *Jousseaumiella.*——8. *Epilepton.*——9. *Arculus.*

Neolepton DI MONTEROSATO, 1875 [1] [**Lepton sulcatulum* JEFFREYS, 1859; SD CROSSE, 1884]. Suborbicular, somewhat truncated backward, almost equilateral. RV hinge with well-developed duplicate right anterior and successive posterior laterals, LV hinge with *2-AII* angular, *AIV* marginal, also *PII*. *Plio.-Rec.*, Eu.——FIG. E42,*5*. **N. sulcatulum* (JEFFREYS), Rec., Medit.; *2a,b,* RV hinge, LV int., enl. (Chavan, n).

Arculus DI MONTEROSATO, 1909 [9] [**Lepton sykesi* CHASTER, 1895; M]. Oval, subrhomboidal, rather convex, inequilateral, concentrically striated. Each valve with extremely minute erect cardinal and anterior and posterior laterals. *Rec.*, G.Brit.(Guernsey).——FIG. E42,*4*. **A. sykesi* (CHASTER); *4a,b,* RV int., LV ext., ×18 *(905a)*.

Calvitium LASERON, 1953 [6] [**C. glabra*; OD]. Minute, thin, inequilateral, smooth, with large dome-shaped prodissoconch. Internal ligament; LV with small rounded anteriorly placed cardinal with large fold of hinge, bearing hardly a tooth behind it and prominent lateral, RV with 2 prominent laterals. *Rec.*, Australia.——FIG. E43,*3*. **C. glabrum,* New S.Wales; *3a,* RV ext., enl.; *3b,c,* LV and RV hinges, ×12 *(531)*.

Epilepton DALL, 1899 [8] [**Lepton clarkiae* CLARK, 1852; M]. Broadly ovate, pellucid, inequilateral; anterior side twice length of posterior. Hinge with well-marked laterals, duplicate on RV and single distinct oblique tooth in front of resilium. *Rec.*, Eu.(N.Sea-Medit.).——FIG. E43,*2*. **E. clarkiae* (CLARK), Eng.; RV int., much enl. (Chavan, n).

Jousseaumiella BOURNE, 1907 [7] [*pro Jousseaumia* BOURNE, 1906 (*non* SACCO, 1894)] [**Jousseaumia heterocyathi* BOURNE, 1906; SD CHAVAN, herein]. Trigonal, inequilateral, concentrically ribbed. Hinge with duplicate laterals and single vertical slightly inequilateral cardinal on RV, 2 narrow cardinals and marginal successive laterals on LV. *Rec.*, India (Andaman I.).——FIG. E43,*1*. **J. heterocyathi* (BOURNE); *1a,b,* LV and RV hinges, much enl. *(76)*.

Neodavisia CHAVAN, *nom. subst.*, herein [2] [*pro Davisia* COOPER & PRESTON, 1910 (*non* DEL GUERCIO, 1909; *nec* BARNES & MACDUNNOUGH, 1913)] [**Davisia cobbi* COOPER & PRESTON; M]. Rounded, somewhat angular in front, slightly inequilateral. Hinge with strong laterals, duplicate on RV, subparallel, *AI* and *AII* continued by short *3a* and *2*; resilium small, scarcely oblique, submedian. *Rec.*, SW.Atl.(Falkland Is.).——FIG. E42,*6*. **N. cobbi* (COOPER & PRESTON); *6a,b,* LV hinge, RV int., much enl. (Chavan, n).

Notolepton FINLAY, 1927 [3] [**Kellia antipoda* FILHOL, 1880; OD]. Trigonal-rounded, scarcely inequilateral, concentrically striated, with duplicate successive anterior and posterior laterals, *AI* short. *?Mio., Rec.*, Australasia-S.Atl.——FIG. E42,*3*. **N. antipodum* (FILHOL); *3a,b,* LV and RV hinges, much enl. (Chavan, n).

Pachykellya BERNARD, 1897 [4] [**P. edwardsi*; M]. Somewhat obliquely oblong, thick, with prominent beaks and broad hinge, central resilium on both sides of which 2 laterals on each valve are hooked, curved or bifid at their termination. *Pleist.-Rec.*, N.Z.(Stewart Is.).——FIG. E42,*2*. **P. edwardsi* BERNARD; *4a,b,* RV hinge, LV int., ×33 (Chavan, n).

Puyseguria POWELL, 1927 [5] [**P. cuneata*; OD]. Very oblique and inequilateral, ovately rounded, anteriorly produced, posteriorly shortened; beaks

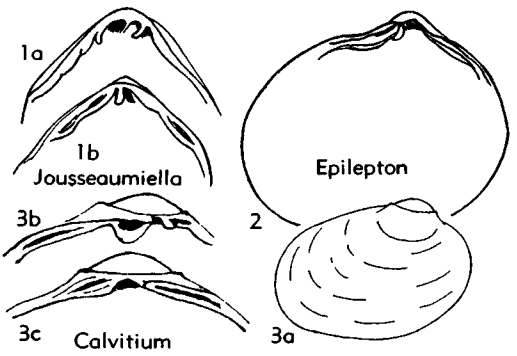


FIG. E43. Neoleptonidae (p. *N*542).

opisthogyrous. Hinge with long anterior laterals and 2 cardinals (2 bifid) of which anterior one is in prolongation of lateral, short posterior laterals. *Plio.-Rec.*, N.Z.——FIG. E42,*1*. *P. wanganuica* (POWELL), U.Plio.; *1a,b*, LV hinge, RV int., ×27 (Chavan, n).

Superfamily CARDITACEA Fleming, 1820

[*nom. transl.* MENKE, 1830 (*ex* Carditidae FLEMING, 1820)]
[Materials for this superfamily prepared by ANDRÉ CHAVAN]

Shell trigonal to cordiform, trapezoidal, or mytiliform, with radial external sculpture predominating at least locally over concentric and with internal layer of straight radial riblets, which invariably crenulate margin if relatively strong; with more or less marked medioposterior rib or angulation; lunule small, commonly depressed; escutcheon somewhat ill-defined; beaks prosogyrate, tending to be rounded. Hinge of curved lucinoid type with two unequal teeth *(2, 4b)* in LV, *3b* oblique; *5b* very thin, if present; *PI* and *AIV* lacking, other laterals tuberculiform or remote, producing in some shells hinge of cyrenoid aspect; ligament internal or external, latter type inserted on well-marked nymph; shell integripalliate; pedal scars distinct. Animal byssiferous, with open mantle lacking communication between branchial aperture and pedal slitlike outlet; gills large, unequal, united posteriorly. [Marine.] *?Ord., Dev.-Rec.*

The alphabetically arranged generic descriptions in each family-group division of the Carditacea are accompanied by numbers inclosed by square brackets. Such numbers indicate position in the sequence of generic taxa given with the respective families or subfamilies for the purpose of recording CHAVAN's arrangement, designed to reflect "natural relationships" of these taxa as inferred by him.

Family PERMOPHORIDAE van de Poel, 1959 (1895)

[*pro* Pleurophoridae DALL, 1895 (Code, 1961, Art. 40)]
[=Kalenteridae MARWICK, 1953; Redoniidae BABIN, 1966]

Medium-sized to large, trapezoidal to modioliform, very inequilateral; radial ribs tending to be obsolete on anterior part of surface, internal margin smooth; with marginal ligament and long nymph. Cardinals partly obsolete, tuberculiform, or much elongated; *5b* and anterior laterals lacking in most, posterior laterals remote, that of LV strongest; anterior and pedal scars on thickened buttress. *?Ord., ?Dev., L.Carb.-U.Cret.*

Subfamily PERMOPHORINAE van de Poel, 1959 (1895)

[*nom. transl.* CHAVAN, herein (*ex* Permophoridae VAN DE POEL, 1959) (=Pleurophoridae DALL, 1895)]

Anterior margin more or less rounded, posterior truncate, with medioposterior angulation and generally several posterior ribs. Hinge with moderately elongate *3b*, trigonal *2*, narrow *4b* appressed in some shells to inferior edge of nymph. *?Ord., ?Dev., L.Carb.-L.Jur.*

Arrangement of generic taxa by CHAVAN.——1. *Permophorus*.——2. *Curionia*.——3. *Pseudopermophorus*.——4. *Celtoides*.——5. *Triaphorus*.——6. *Kalentera*.——7. *Redonia*.——8. *Netschajewia*.——9. *Rimmyjimina*.——10. *Pleurophorella*.

Permophorus CHAVAN, 1954 [1] [*pro Pleurophorus* KING, 1844 (*non* MULSANT, 1842)] [**Arca costata* BROWN, 1841; M]. Subrectangular, solid, with low beaks near anterior end; sculpture rugose concentric, with several posterior radial riblets; lunule and escutcheon well developed. LV hinge with broadly tuberculiform *2*, weak, but distinct, *4b* and 2 broad, distant, oblique, posterior laterals; RV hinge with *3a* as rounded obsolescent tubercle, *3b* oblique, strong, sharply defined and posterior lateral submarginal; deep reniform anterior scar in front of myophoric buttress and shallow pedal scar just below *2*. *L.Carb.-Perm.*, cosmop.——FIG. E44,*1*. *P. albequus* (BEEDE), L.Perm., USA(Tex.); *1a,b*, RV int., LV int., ×2, ×3 *(665)*.——FIG. E45,*3*. **P. costatus* (BROWN), Perm. (Upper Magnesian Ls.), Souter Point, Durham, Eng.; *3a*, latex cast int. RV, ×3.3 (Logan, 1964, fig. 8); showing two cardinal teeth; *3b*, latex cast LV,

×3.3 (Logan, 1964, fig. 9), showing two cardinal teeth (Newell, n).[1]

[1] The type specimens of *P. costatus* are lost and there has been uncertainty about the characteristics and limits of the genus *Permophorus* (Logan, 1964, *548*). Unpublished studies by NEWELL suggest that more than one species of *Permophorus* may occur in the British faunas and that the genus is highly variable in American faunas. Fig. E45,*3a*, above (613.62, Hancock Mus., Newcastle upon Tyne) is here designated as neotype. [NEWELL]

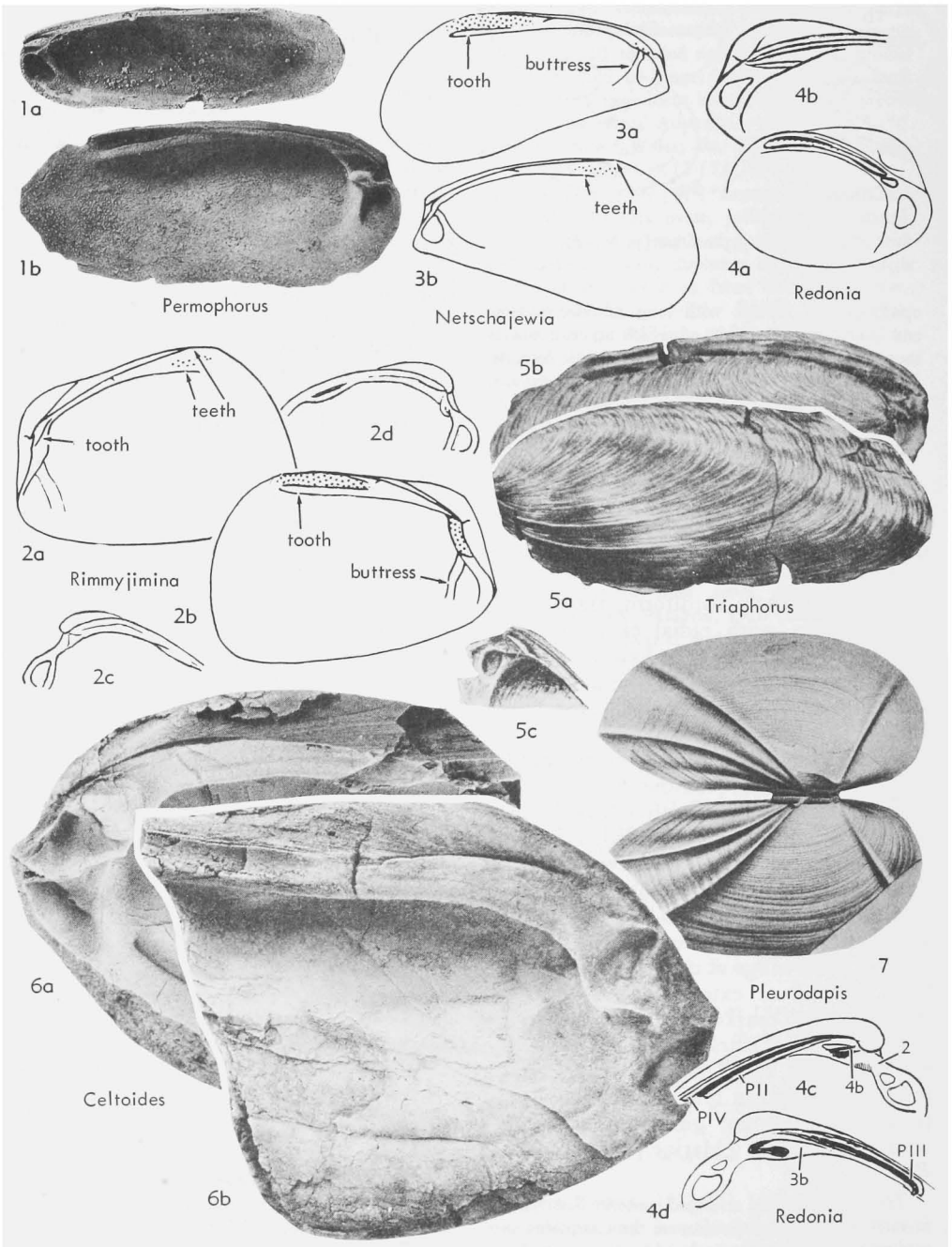


FIG. E44. Permophoridae (Permophorinae) (p. *N543-N547*).

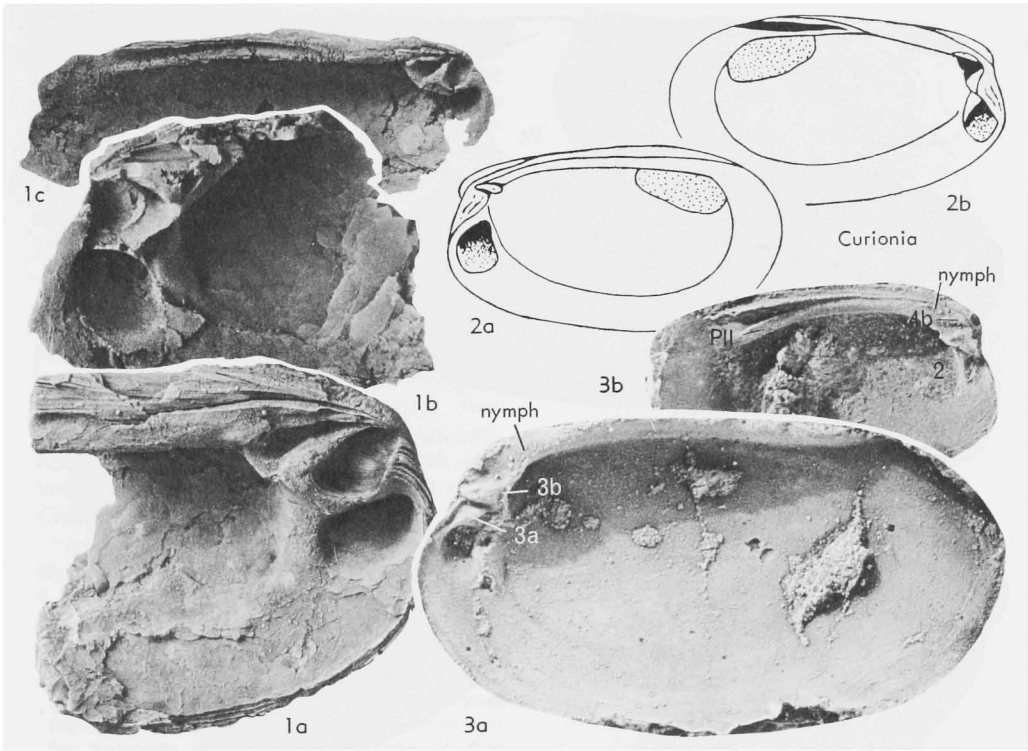


FIG. E45. Permophoridae (Permophorinae) (p. *N*543-*N*545).

Celtoides NEWELL, 1957 [4] [**C. unioniformis*; OD]. Transversely elongate, large, thick-shelled, inequilateral, surface unornamented; lunule small, escutcheon broad. Hinge with broad *3b*, stronger than *2* and bearing radial furrow, both trigonal, *4b* obsolete, *PII* long; with myophoric buttress of moderate size. *Perm.*, N.Am.——FIG. E44,*6*. **C. unioniformis*, USA(Wyo.); *6a,b*, RV int., LV int., ×1 *(669)*.

Curionia ROSSI RONCHETTI, 1965 [2] [**Myoconcha curionii* HAUER, 1857; OD]. Subovate, very inequilateral, with rounded beaks; lunule broadly developed, covering anterior side of cardinal *2*; ornament of concentric striae. Hinge with trigonal oblique *2* and *3b*, very oblique narrow *4b*, distant posterior laterals, that of RV quite marginal. Ovate anterior scar on buttress, broad posterior scar superficial. *Trias.(Carn.-Rhaet.)*, Eu.(Italy-Switz.-Ger.).——FIG. E45,*2*. **C. curionii* (HAUER), Carn., Italy; *2a,b*, RV int., LV int., ×2 (Rossi Ronchetti & Allesinaz, 1965).

Kalentera MARWICK, 1953 [6] [**K. mackayi*; OD]. Transversely suboval, large, beaks near front end; sculpture concentric, posterior radial lines vanishing. Hinge with short conical *2*, deeply oblique *3b*, curved *4b*, and remote, very strong, broad posterior laterals; anterior adductor on buttress extending backward to hinge, beneath which is very deep pedal scar bounded above by toothlike ridge resembling branch of *3b* on RV. *L.Jur.*, N.Z.——FIG. E46,*4*. **K. mackayi*; *4a,b*, RV int., LV int., ×1 *(599)*.

Netschajewia YAKOVLEV, 1925 [8] [**Mytilus pallasi* DE VERNEUIL, 1845 (=*Pleurophorus modioliformis* KING, 1844); OD]. Medium-sized, trapezoidal, relatively narrow, convex, front end angular, produced, rear end acuminate; sculpture of irregular growth lines; lunule and escutcheon lacking. Hinge with obscure *3b* and quite remote posterior laterals, stronger on LV. *Perm.*, Eu.-Greenl.——FIG. E44,*3*. **N. modioliformis* (KING), USSR; *3a,b*, LV int., RV int., ×2 *(669)*.

?**Pleurodapis** CLARKE, 1913 [**P. multicincta*; OD]. Elongate ovate, beaks subanterior, umbones low; hinge line straight, ligament external; dentition unknown; surface with strong rounded ridge from beaks to anterior margin, ending in marginal notch; 4 or 5 divergent radial ridges of varying strength from beaks to posterior margin, delimiting shallow indentations of shell margin. *Dev.*, S.Am.

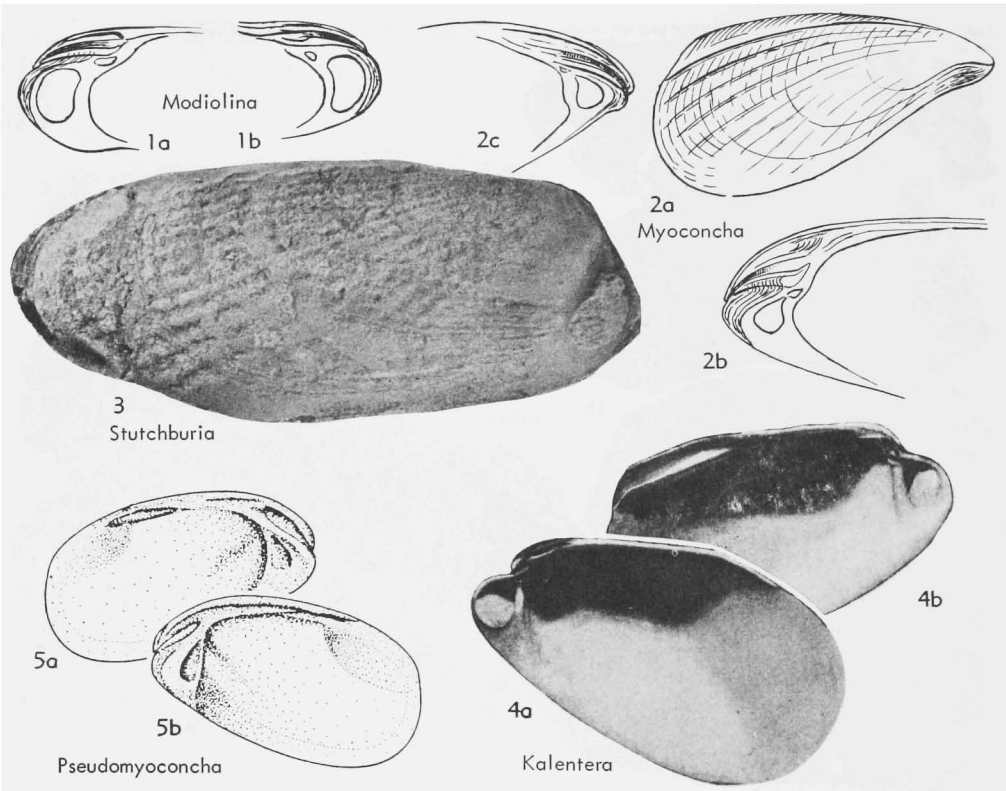


FIG. E46. Permophoridae (Permophorinae) *(4);* (Myoconchinae) *(1-3,5)* (p. *N*545, *N*547-*N*548).

(Ponta Grossa & Santa Cruz, Brazil).——FIG. E44, *7*. **P. multicincta,* Ponta Grossa, Brazil; ×1 *(138)*. [LAROCQUE]

?Pleurophorella GIRTY, 1904 [10] [**P. papillosa*; OD]. Externally like *Permophorus* but somewhat less inequilateral, thin, ornamented only by minute papillae and weak concentric lines; lunule and escutcheon sharply defined. Interior unknown. *U. Penn.*, N.Am.(Tex.).

Pseudopermophorus CIRIACKS, 1963 [3] [**P. annettae*; OD] [?=*Protrete* GIRTY, 1908 (type, *P. texana*; OD)]. Shell heavy, slightly inequivalve, RV more convex than LV, subquadrate, tapering slightly posteriorly; ventral margin gently indented medially at the termination of a broad medial sulcus; posterior and anterior margins broadly rounded; escutcheon deep, elongate, more prominent on the RV; lunule deeply invaginated as an ovoid cavity (brood pouch?) immediately above the anterior adductor; shell surface ornamented with coarse, rounded concentric fila, devoid of radial ornamentation; dentition *3b, (5b), (PIII)/2, 4b, PII* with *5b* barely distinguishable from the ligament nymph. *Perm.(Park City)*, USA(Mont.)-Japan.——FIG. E45,*1*. **P. annettae*; *1a,b,* LV int., RV int., ×2; *1c,* LV int., ×1 *(132)*. [NEWELL]

?Redonia ROUAULT, 1851 [7] [**R. deshayesiana;* SD P. FISCHER, 1886]. Subelliptical, with prominent beaks relatively far forward. Hinge with arcuate subhorizontal *2*, subelliptical *3b*, very long curved and transversely striated, *4b* and *5b* parallel to margin; posterior laterals fused together, anterior adductor on broad buttress. [Doubtfully belongs in Modiomorphidae.] *Ord.*, Eu.(France).——FIG. E44,*4*. **R. deshayesiana,* Brittany; *4a,b,* LV int., RV int., ×1; *4c,d,* LV and RV hinges, enl. (Chavan, n).

Rimmyjimina CHRONIC, 1952 [7] [**R. arcula*; OD]. Small, trapezoidal, relatively broad, convex, front more or less rounded, rear truncate; sculpture of irregular growth lines; lunule small, oval, well defined; narrow escutcheon bearing fine ligament groove. Hinge with narrow *3b,* posterior LV lateral long and broad. *Perm.*, N.Am.-Eu. (Aus.).——FIG. E44,*2*. **R. arcula,* USA(Ariz.); *2a,b,* RV int., LV int., ×5; *2c,d,* RV and LV hinges, ×3.5 *(669)*.

Triaphorus MARWICK, 1953 [3] [**Pleurophorus zelandicus* TRECHMANN, 1918; OD]. Transversely oval, prosogyrous beaks almost terminal; irregular concentric sculpture, radial ridges only on posterior surface; lunule deep, escutcheon well de-

fined. Hinge with very weak oblique *3a*, strong oblique *2* and *3b*, long, weak *4b* welded to long nymph; strong posterior laterals remote; anterior adductor on buttress below anterior cardinals, shallow pedal scar on their lower side. *U.Trias.*, N.Z.——Fig. E44,*5*. **T. zelandicus* (Trechmann), Otamitan; *5a-c*, RV ext., LV ext., RV hinge, ×1 *(599)*.

Subfamily MYOCONCHINAE Newell, 1957

[*nom. transl.* Chavan, herein (*ex* Myoconchidae Newell, 1957)]

Acuminate anteriorly, regularly enlarged posteriorly, mytili- to modioliform, angulated posterodorsally, surface with many fine radial threads, at least toward rear. Hinge with elongate *3b*, extremely narrow, linear *2* and *4b*, rather faint, *4b* fused with lower edge of nymph. *?M.Dev., Perm.-U. Cret.*

Arrangement of generic taxa by Chavan.——1. *Myoconcha*.——2. *Modiolina*.——3. *Daharina*.——4. *Pseudomyoconcha*.——5. *Stutchburia*.——6. *Pleurophorina*. [Insert above, 4a. *?Pseudosanguinolites*.]

Myoconcha J. de C. Sowerby, 1824 [**M. crassa*; M]. Modioliform, with long, narrow submarginal angulation bordered by furrow, surface with very fine numerous riblets. Cardinals *2* and *4b* thin, *3b* stronger, *PII* well developed, behind long nymph; myophoric buttress broad. *?Perm., L.Jur. (Lias.)-U.Cret.(Senon.)*, cosmop.

M. (Myoconcha) [1] [=*?Labayophorus* Likharev, 1939 (type, *L. magnus*; M]. Large, with terminal beaks, ribs vanishing toward anterior side. Cardinals nearly straight, those of LV very thin, low, *3b* generally trigonal; myophoric buttress low, moderate in extent. *?Perm., L.Jur.(Lias.)-U.Cret.(Senon.)*, cosmop.——Fig. E46,*2*. **M. (M.) crassa*, M.Jur.(Bajoc.), France; *2a-c*, RV ext., hinge, LV hinge, ×1 (Chavan, n).

M. (Modiolina) J. Müller, 1851 [2] [**M. bosqueti* (=*Lithodomus discrepans* Müller, 1847); OD]. Small, beaks not quite terminal, whole surface with fine radial and concentric riblets. Cardinals thin, *2* sinuate, *3b* somewhat curved; nymph relatively narrow; myophoric buttress broad. *U.Cret.(Senon.)*, Eu.——Fig. E46,*1*. **M. (M.) discrepans* (Müller), Campan., Neth.; *1a,b*, RV and LV hinges, ×1 (Chavan, n).

Daharina Dubar, 1948, p. 170 [3] [**Myoconcha (Daharina) gentili*; M]. Large, gibbose, thick-shelled, oval, obliquely elongated, smooth, with anterior, terminal beaks; posterodorsal region rather flattened, winglike; anteroventral margins with byssal gape; umbonal angle occupied in each valve by broad, thick hinge plate, posterior part of which bears in RV broad, elongate cardinal tooth, received in socket adjacent to nymph in LV; no lateral teeth; anterior adductor scar deep, on shell wall below hinge plate. *L.Jur.(U.Pliensb.)*, Afr.(Morocco).——Fig. E47,*1*. **D. gentili*; *1a,b*, LV ext., LV int. (broken post. region restored), ×0.4 (Dubar, 1948). [Cox]

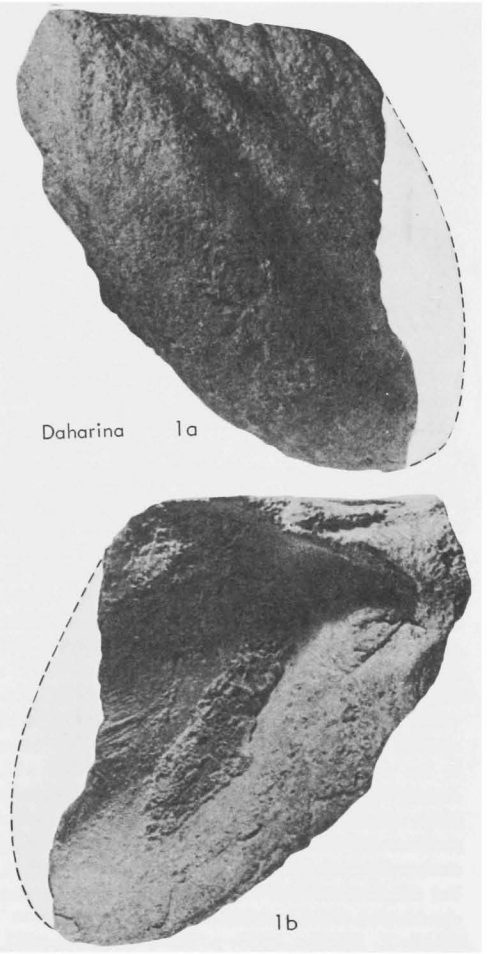


Fig. E47. Permophoridae (Myoconchinae) (p. *N547*).

?Modiella Hall, 1883, p. 4 [**Pterinea pygmaea* Conrad, 1842; M]. Similar externally to *Myoconcha* Sowerby (1824), *Modiolina* Müller (1851), and *Netschajewia* Yakovlev (1925); hinge details unknown. *M.Dev.*, USA(N.Y.). [Newell]

?Pleurophorina Likharev, 1925 [6] [**Pleurophorus simplex* Likharev, 1925 (=*Modiola simplex* Keyserling, 1846); M]. Externally like *Permophorus* but reported to lack cardinal *2*. *Perm.*, USSR.

Pseudomyoconcha Rossi Ronchetti, 1966 (1967) [4] [**Myoconcha lombardica* Hauer, 1857; OD].

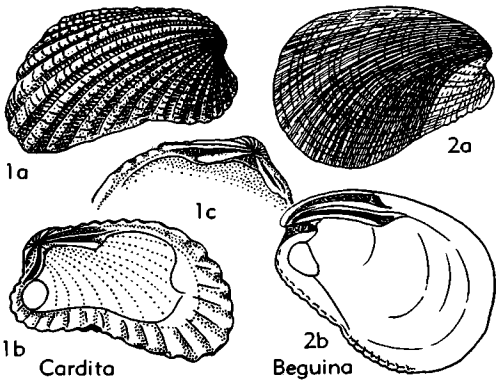


FIG. E48. Carditidae (Carditinae) (p. *N*548).

Very inequilateral, modioliform, more or less sinuate ventrally, strongly convex dorsally. Terminal curved beaks. External concentric irregular growths and radial lines. Broad anterior buttress. LV with *2*, *PII*, no developed *4b*; RV with *3b*, well marked *PIII*. *M.Trias.-U.Trias.*, Eu.(Italy-Ger.-Hung.)-Japan.——FIG. E46,*5*. **P. lombardica* (HAUER), U.Trias., Italy; *5a,b*, LV, RV int., ×1 (Rossi Ronchetti & Allasinaz, 1966).

?**Pseudosanguinolites** PATTE, 1929 (4a) [**P. douvillei*; M]. Transversely much elongated and curved, anterior side angular, posterior side more or less rounded; shell thick, with almost terminal, anterior beaks. Trapezoidal striated area above hinge plate, which in RV bears long posterior cardinal parallel to upper margin; external long narrow ligament; anterior part of hinge unknown, but elliptical anterior scar and ogival posterior one can be seen. *Dev.*, IndoChina.

?**Stahlia** E. FISCHER, 1915, p. 219 [**S. persica*; M]. Rectangular, elongate, not oblique; umbones terminal; evenly and rather strongly inflated; ornament of radial ribs, most prominent on dorsal part of shell, and concentric folds; anterior adductor scar moderately large, below beak; dentition unknown; said to gape posteriorly, but appearance of gape possibly due to imperfect preservation of type. [Possibly synonym of *Myoconcha*.] *L.Jur.(Toarc.)*, SW.Asia(Iran). [Cox]

Stutchburia ETHERIDGE, JR., 1900 [5] [**Orthonota? costata* MORRIS, 1845; OD]. Large, transversely subquadrate, ornamented posteriorly by coarse ribs; lunule and escutcheon developed. Cardinals *2* and *3b* obsolescent, likewise laterals *PI* and *PIII* but *PII* well marked. *Perm.*, cosmop.——FIG. E46, *3*. **S. costata* (MORRIS), Artinsk., Australia; RV ext., ×1 *(669)*.

Family CARDITIDAE Fleming, 1828

[*nom. correct.* COSSMANN, 1914 (*pro* Carditadae FLEMING, 1828]

Small to large, trapezoidal or rounded, with strong radial ribs and shell margin invariably crenulated internally; ligament external. Hinge with faint *3a* and thin *5b*, anterior laterals tuberculiform; anterior scars set on platform. *Dev.-Rec.*

Subfamily CARDITINAE Fleming, 1828

[*nom. transl.* CHAVAN, herein (*ex* Carditidae FLEMING, 1828)]

Mytiliform, with long *3b* and obsolete laterals. *Paleoc.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Cardita*.——2. *Jesonia*.——3. *Beguina*.

Cardita BRUGUIÈRE, 1792 [**Chama calyculata* LINNÉ, 1758; SD GRAY, 1847].[1] Transversely inequilateral, trapezoidal or modioliform, with nodulose radial ribs. Hinge with obliquely trigonal divergent cardinals in LV and faint anterior laterals. *Paleoc.-Rec.*, cosmop.

C. (Cardita) [1] [=*Arcinella* OKEN, 1815 (rejected by ICZN, 1956, Opinion 417, as nonbinominal) (*non* SCHUMACHER, 1817) (obj.); *Mytilicardita* ANTON, 1839 (obj.)]. Relatively small, short; lunule not depressed. Cardinal *3b* elongated backward-inward. *Paleoc.-Rec.*, Eu.-Afr.-Asia-Australia.——FIG. E48,*1*. **C. (C.) calyculata* (LINNÉ), Rec., Medit.; *1a-c*, RV ext., RV int., LV hinge, ×1 (*7*; Chavan, n).

C. (Jesonia) GRAY, 1847 [2] [**Perna jeson* ADANSON, 1757, p. 217 (invalid, pre-Linnaean) (=*Cardita senegalensis* REEVE, 1843); OD] [=*Mytilicardes* DE BLAINVILLE, 1824 (vernacular); *Jesonia* GRAY, 1840 *(nom. nud.)*; *Mytilocardia* AGASSIZ, 1847 (obj.); *Mytilicardia* TRYON, 1872 (obj.)]. Medium-sized, notably elongated, with commonly squamose ribs. Cardinal *3b* scaleniform, prolonged only backward, *AI* lacking but posterior laterals moderately distinct; lunule sunken. *Oligo.-Rec.*, cosmop.

Beguina RÖDING, 1798 [3] [**B. nephritica* (=*Chama phrenetica* BORN, 1780, =**C. semiorbiculata* LINNÉ, 1758); M] [=*Azarella* GRAY, 1854]. Broad modioliform, compressed, with fine intersecting growth lines and disparate radial riblets; beaks stretched out to cover anterior part of hinge. Posterior cardinals much elongated, laterals wanting. *Rec.*, Afr.-Asia-Polynesia.——FIG. E48,*2*. **B. semiorbiculata* (LINNÉ), Ind.O.; *2a,b*, RV ext., int., ×0.8 *(124b)*.

Subfamily CARDITAMERINAE Chavan, new subfamily

More or less trigonal or transversely trapezoidal, with strong radial ribs. Cardinal *3a*

[1] According to International Code (Art. 69,a,iii), type species is *Cardita variegata* BRUGUIÈRE, 1792; SD FLEMING, 1818. In opinion of CHAVAN, FLEMING's designation was not explicit and therefore not to be recognized.—Ed.

present,*3b* V-shaped, laterals fairly well developed. *U.Trias.(Carn.)-Rec.*

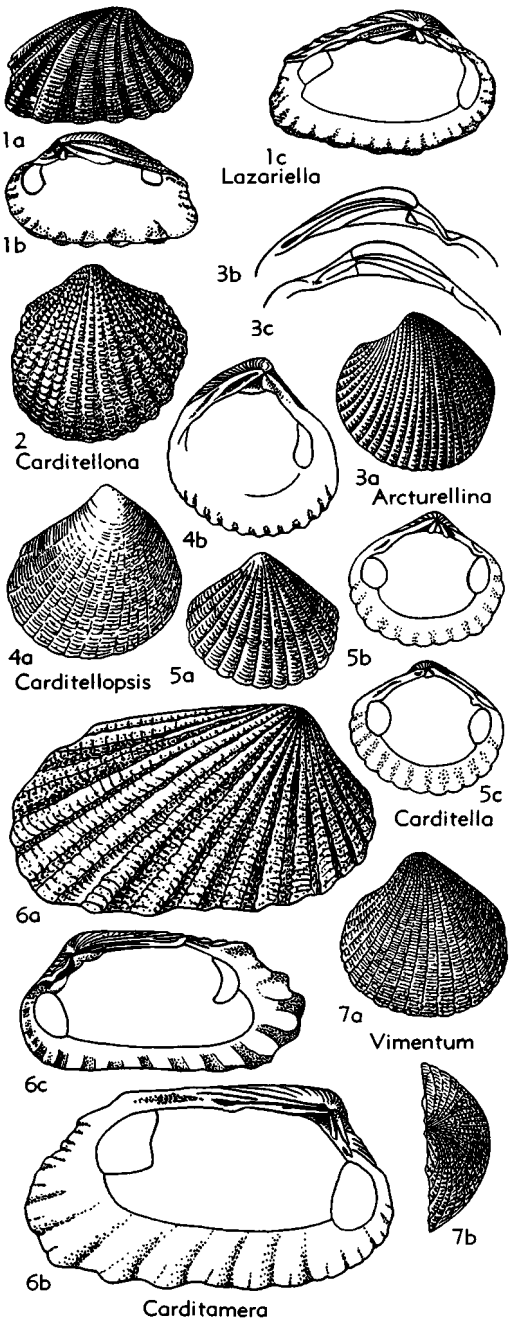


FIG. E49. Carditidae (Carditamerinae) (p. *N*549-*N*551).

Arrangement of generic taxa by CHAVAN.——1. *Carditamera.*——2. *Lazariella.*——3. *Glans.*——4. *Centrocardita.*——5. *Goossensia.*——6. *Carditella.*——7. *Carditellona.*——8. *Cyclocardia.*——9. *Scalaricardia.*——10. *Plionema.*——11. *Vimentum.*——12. *Vetericardiella.*——13. *Miodontiscus.*——14. *Tutcheria.*——15. *Choniocardia.*——16. *Carditellopsis.*——17. *Arcturellina.*——18. *Izumicardia.*——19. *Pleuromeris.*——20. *Cossmannella.*——21. *Cardiocardita.*——22. *Bathycardita.* [Insert above, 11a. *Fenestricardita;* 20a. *Cretocardia.*]

Carditamera CONRAD, 1838 [**Cypricardia arata* CONRAD, 1832; OD]. Transversely subrectangular to trapezoidal, solid, somewhat compressed, with subparallel dorsal and ventral margins; sculpture of flabellate ribs, posterior ones unequal; lunule oblique. Cardinal teeth strong, laterals (except *AIII, AIV,* and in some shells *PIV*) well defined. *U.Eoc.-Rec.,* W.Eu.-Afr.-N.Am.

C. (Carditamera) [1] [=*Lazaria* GRAY, 1854 (type, *Cardita radiata* SOWERBY, 1833; SD DALL, 1903)]. Elongate, posterior margin rounded or with slight straight truncation; ribs rugose. Hinge with faint *PIV. U.Eoc.-Rec.,* N.Am.-W.Eu.-?E. Afr.——FIG. E49,*6a,b.* **C. (C.) arata arata* (CONRAD), Mio., USA(N.Car.); *6a,b,* RV ext., LV int., ×1 (Conrad, 1839).——FIG. E49,*6c. C. (C.) arata verdevilla* GARDNER, Mio., USA(N. Car.); RV int., ×0.8 (Gardner, 1943). [=*Byssomera* OLSSON, 1961 (type, *Cardita affinis* SOWERBY, 1832; OD).]

C. (Lazariella) SACCO, 1899 [2] [**Cardita subalpina* MICHELOTTI, 1839; OD]. Shorter than *C. (Carditamera),* with concave anal truncation, more widely spaced ribs which are subquadrate and strong. Cardinals *3a* and *3b* scaleniform, laterals *AI* and *PIII* obsolete. *L.Mio.(Aquitan.)-Rec.,* SW.Eu.-W.Afr.——FIG. E49,*1. C. (L.) hippopaea* (BASTEROT), Aquitan., S.France; *1a-c,* RV ext., int., LV int., ×1 *(165).*

Arcturellina CHAVAN, 1951 [17] [*nom. subst. pro Arcturella* CHAVAN, 1941 (*non* SARS, 1897)] [**Venericardia asperula* DESHAYES, 1825; OD]. Small to medium-sized, inequilateral, trapezoidal to rounded, moderately convex; with regularly striate or squamose radial ribs; beaks small, rounded; lunule relatively convex and long, bounded forward by oblique furrow. Hinge with very thin *3a,* almost obsolete, and trigonal to subrectangular *3b* with subvertical anterior face and backward extension; *AII* linear, *PII* and *PIII* faint; shell margin deeply indented internally by ends of ribs. *Paleoc.-Rec.,* Eu.-Afr.-S.Am.-Australia.——FIG. E49,*3. *A. asperula* (DESHAYES), M.Eoc. (Lutet.), France(Paris basin); *3a,* LV ext., ×1 (Deshayes, 1837); *3b,c,* LV and RV hinges, ca. ×1.8 *(101).*

Carditella E. A. SMITH, 1881 [**C. pallida*; SD DALL, 1903]. Small, with flabellate ribs crossed

by concentric growth lines; lunule elongate; ligament small, external, adjacent to restricted resilium just behind beak and slightly narrowing tops of *3b* and *4b*. Each valve with 2 unequal cardinals and 2 remote, well-defined laterals. *Plio.-Rec.*, S. Am. - Australia - E. Asia (Japan - Formosa)-S. Atl. (Tristan da Cunha).

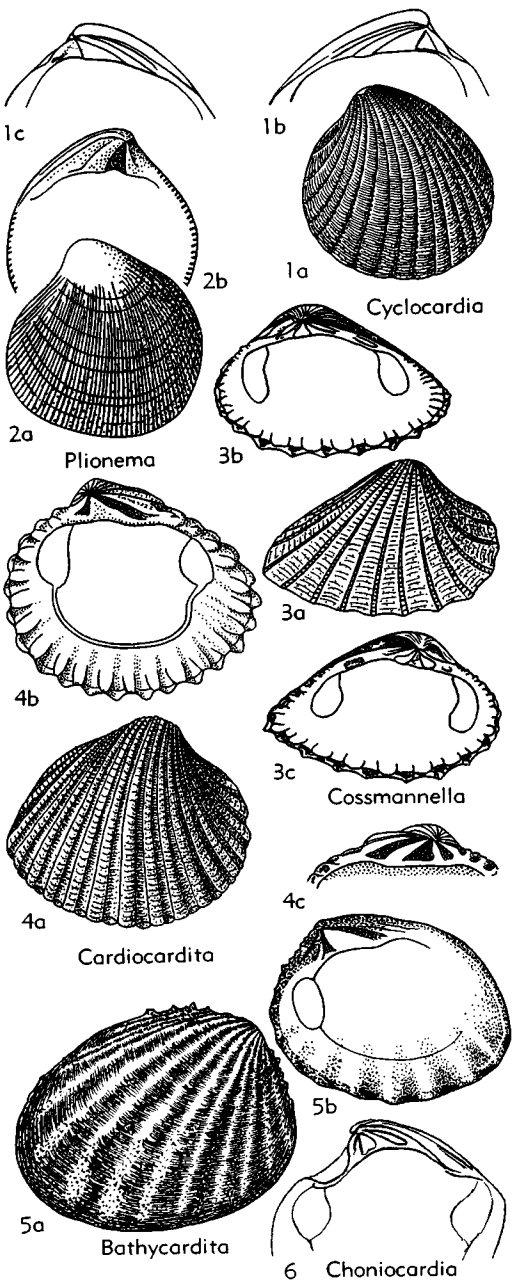


FIG. E50. Carditidae (Carditamerinae) (p. *N550-N551*).

C. (Carditella) [6]. Slightly inequilateral, mostly trigonal, with broad, close-spaced ribs. Cardinal *3a* fused to lunular margin. *Rec.*, S.Am.-Japan. ——FIG. E49,*5*. **C. (C.) pallida*, S.Am. (Port Rosario); *5a-c*, LV ext., int., RV int., ca. ×4 (Smith, 1881).

C. (Carditellona) IREDALE, 1936 [7] [**C. angasi* E. A. SMITH, 1885; OD]. Very inequilateral, obliquely rounded, with well-spaced squamose ribs. Hinge with *3a* more distinct and *AI* shorter than in *C. (Carditella)*. *Plio.-Rec.*, Australia-W. Pac.O.——FIG. E49,*2*. **C. (C.) angasi* SMITH, Australia (Port Jackson); RV ext., much enl. *(852)*.

Cardiocardita ANTON, 1839 [**Chama ajar* ADANSON, 1757 (invalid, pre-Linnaean) (=*Cardita ajar* BRUGUIÈRE, 1792); SD HERRMANNSEN, 1846]. Inequilateral, subtrapezoidal, rounded in front, obliquely truncate at rear; with strong nodular or echinate ribs; beaks low. Hinge with trihedral cardinals, *3a* very small, *3b* straight, sharp-sided, at mid-hinge; anterior laterals minute, almost obsolete. *M.Eoc.-Rec.*, SW.Eu.-Afr.-Pac.O.-Australasia.

C. (Cardiocardita) [21] [=*Cardiocardites* DE BLAINVILLE, 1825 (vernacular); *Agaria* GRAY, 1840 (obj.); *Azaria* TRYON, 1872 (*nom. null.*); *Divergidens* EAMES, 1957 (type, *Cardita triparticostata* NEWTON, 1922; OD)]. Anteriorly angular, ribs commonly well spaced and sharply defined; lunule slightly depressed. *M.Eoc.-Rec.*, SW. Eu.-Afr.-Pac.O.-N.Z.——FIG. E50,*4*. **C. (C.) ajar* (BRUGUIÈRE), Rec., W.Afr.(Senegal); *4a,b*, RV ext., int., ×1 *(7)*.

C. (Bathycardita) IREDALE, 1925 [22] [**Cardita raouli* ANGAS, 1872; OD]. More rounded than *C. (Cardiocardita)* and with less sharply delimited, spinose ribs; lunule deep. *Rec.*, Australia. ——FIG. E50,*5*. **C. (B.) raouli* (ANGAS), Tasmania; *5a,b*, RV ext., int., ×1 *(431)*.

Choniocardia COSSMANN, 1904 [**Venericardia (C.) oppenheimi*; OD]. Relatively small, depressed, with reticulate or striate ribs; lunule broad, well defined, flat and somewhat depressed. Hinge with nearly symmetrical LV cardinals, *3b* straight trigonal, *3a* oblique; anterior and posterior laterals present. *L.Eoc.-Rec.*, Eu.-Australia-E.Asia(Japan).

C. (Choniocardia) [15]. Rounded trigonal to subtrapezoidal, truncate posteriorly; with finely reticulate ribs; lunule oblique, sunken. *L.Eoc.-U.Eoc.*, W.Eu.——FIG. E50,*6*. **C. (C.) oppenheimi* (COSSMANN), M.Eoc.(Lutet.), W.France; RV int., ×3 (Chavan, n).

C. (Carditellopsis) IREDALE, 1936 [16] [**Carditella elegantula* TATE & MAY, 1901; OD]. Rounded trigonal, solid, slightly inequilateral, tending

to be slightly oblong with front side produced and no definite anterior lamellae; with broad, flattened ribs crossed by concentric striae; lunule not depressed. *M.Eoc.-Rec.,* W.Eu.-W.Pac.O.-Australia.——Fig. E49,*4*. **C. (C.) elegantula* (Tate & May), Rec., Australia; *4a,b,* RV ext., LV int., much enl. (Tate & May, 1901).

Cossmannella Mayer-Eymar, 1896 [20] [*"*Cardita (C.) aegyptiaca* Fraas" of Mayer-Eymar, 1896 (=*Cardium aegyptiacum* Mayer, 1896, *non* Fraas, 1867; =*Cardita fajumensis* Oppenheim, 1903); OD] [=*Amekiglans* Eames, 1957 (type, *Cardita costaenodulosis* Newton, 1922; OD)]. Transversely trigonal, subrounded in front, acuminate in rear; with flat ribs separated by narrow interspaces. Hinge with *3b* nearly isosceles triangular, *2* and *4b* subsymmetrical, anterior RV laterals obsolete. *AII* and remote posterior lamellae well marked. *Paleoc.-L.Mio.,* Afr.-Asia(India).——Fig. E50,*3*. *C. costaenodulosis* Newton, M.Eoc., W.Afr. (Nigeria); *3a-c,* RV ext., int., LV int., ×2 *(99)*.

Cretocardia Conrad, 1877 (20a) [**Cardita jaquinoti* Stoliczka, 1871 (=*?Cardium jaquinoti* d'Orbigny, 1847) (=*Cardita orbicularis* Forbes, 1846, *non* Sowerby, 1825); OD]. Subquadrangular, inflated, very inequilateral, with tripartite somewhat tubercular ribs separated by deep trough. Diverging thick *3a* and *3b, 2* small, tubercular and median, *4b* very long, rather thin, curved; minute tuberculiform laterals. *U.Cret.,* India.

Cyclocardia Conrad, 1867 [**Cardita borealis* Conrad, 1831; SD Stoliczka, 1871]. Subtrigonal or short trapezoidal to cordiform, thickened or somewhat compressed, ventral margin well rounded; regular radial ribs may be closely spaced, crossed by numerous equidistant growth lines; beaks very small, tending to be erect. Hinge with very faint *AII* and *PIII,* other laterals virtually obsolete; cardinals strong, *3b* straight in front, *2* straight, equilateral. *U.Cret.(Cenoman.)-Rec.,* cosmop.

C. (Cyclocardia) [8] [=*Arcturus* Humphrey in Gray, 1839 (*non* Berthold in Latreille, 1827; *nec* Curtis, 1830) (obj.); *Bendeglans* Eames, 1957 (type, *Cardita costaeirregularis* Newton, 1922; OD)]. Juvenile-stage ribs narrow, rounded, equally perlate, later becoming flattened and broadened, crossed by close-spaced growth lines; lunule large, smooth, slightly convex. *M.Eoc.-Rec.,* cosmop.——Fig. E50,*1a*. **C. (C.) borealis* (Conrad), Rec., USA(Mass.); LV ext., ×0.8 (Gould, 1841).——Fig. E50,*1b,c*. *C. (C.) granulata* (Say), Mio., USA(Md.); *1b,c,* LV and RV hinges, enl. *(101)*. [=*Strophocardia* Olsson, 1961 (type, *Venericardia megastropha* Gray, 1825; OD).]

C. (Plionema) Conrad, 1872 [10] [**Astarte guerangeri* d'Orbigny, 1843; M]. Small, fine radial ribs very numerous; lacking distinct lunule. Hinge with *2* and *4b* almost equally strong and oblique, *2b* short; laterals wanting. *U.Cret.(Cenoman.),* Eu.——Fig. E50,*2*. **C. (P.) guerangeri* (d'Orbigny), W.France; *2a,b,* LV ext., int., enl. *(695)*.

C. (Scalaricardita) Sacco, 1899 [9] [**Miodon (S.) scalaris* (=*Venericardia scalaris* J. de C. Sowerby, 1825); OD]. Ribs everywhere closely spaced, in young stage flat and regularly incised by furrows which may be slightly oblique; lunule elongate, flat, ill-defined. Hinge with remote, faint anterior laterals and longer, linear posterior laterals; *3b* trigonal-rectangular, *2* vertical, *4b* oblique. *Oligo.-Neog.,* Eu.(Aus.).

C. (Vimentum) Iredale, 1925 [11] [**Cardita dilecta* E. A. Smith, 1885; OD]. Transversely ovate, numerous rounded regular ribs crossed by very close-spaced concentric riblets; lunule cordiform, relatively elongate. Cardinal *3b* conical. *Plio.-Rec.,* Eu. (W. France) - Australia.——Fig. E49,*7*. **C. (V.) dilecta* (Smith), Rec., Australia (Bass Str.); *7a,b,* LV lat., dorsal, enl. *(852)*.

Fenestricardita Casey, 1961 [11a] [**Venus ?fenestrata* Forbes, 1845; OD]. Transversely trapezoidal, posteriorly elongated. Regularly reticulated by narrow concentric and squamose radial ribs. Hinge with marginal *3a,* high trigonal *3b,* oblique *5b,* narrow subvertical *2* and strong sharp, oblique *4b;* marginal *AII,* long well-marked *PIII;* depressed ligament. *L.Cret.-M.Cret.,* W.Eu.

Glans Megerle, 1811 [**Chama trapezia* Linné, 1767; SD Herrmannsen, 1846]. Quadrangular trapeziform, convex, inequilateral, with nodulose or squamose ribs; lunule with convex margin. Hinge as in *Carditamera* but *AIII* and *PII* faint and *PIII* less developed. Shell with well-marked medioposterior dorsal angulation. *Paleoc.-Rec.,* Eu.-Asia-N.Afr.-E.Afr.-Australia-C.Am.

G. (Glans) [3]. Truncate posteriorly, with nodulose or granular rounded ribs, posterior ones unequal in some species. Lateral teeth well developed. *Paleoc.-Rec.,* Eu.-Asia-N.Afr.-E.Afr.-C.Am.——Fig. E51,*5*. **G. (G.) trapezia* (Linné), Rec., Medit.; *5a-c,* RV ext., RV and LV hinges, ×3 *(89a, 101)*.

G. (Centrocardita) Sacco, 1899 [4] [**G.? aculeata* (=**Chama aculeata* Poli, 1795); OD]. Posterior margin rounded, with equal squamose or echinate ribs. Hinge with almost obsolete small laterals. *U.Eoc.-Rec.,* Eu.-E.Afr.-Australia.——Fig. E51,*1*. *G. (C.) aequicostata* (Cossmann), U.Eoc., France (Paris basin); *1a,b,* RV ext., int., ×1 *(160)*.

Goossensia Cossmann, 1885 [5] [**G. plicatuloides* (=*Cardita irregularis* Deshayes, 1860); M]. Relatively small, subtrapeziform, sinuate, very inequilateral, with concentric growth lines intersecting radial ribs which commonly are squamose; lunule depressed. Cardinals and laterals present, *3b* trigonal; shell margin internally irregularly denticulate. *Paleoc.-Eoc.,* W.Eu.——Fig. E51,*7*. **G. irregularis* (Deshayes), M.Eoc.(Lutet.), France

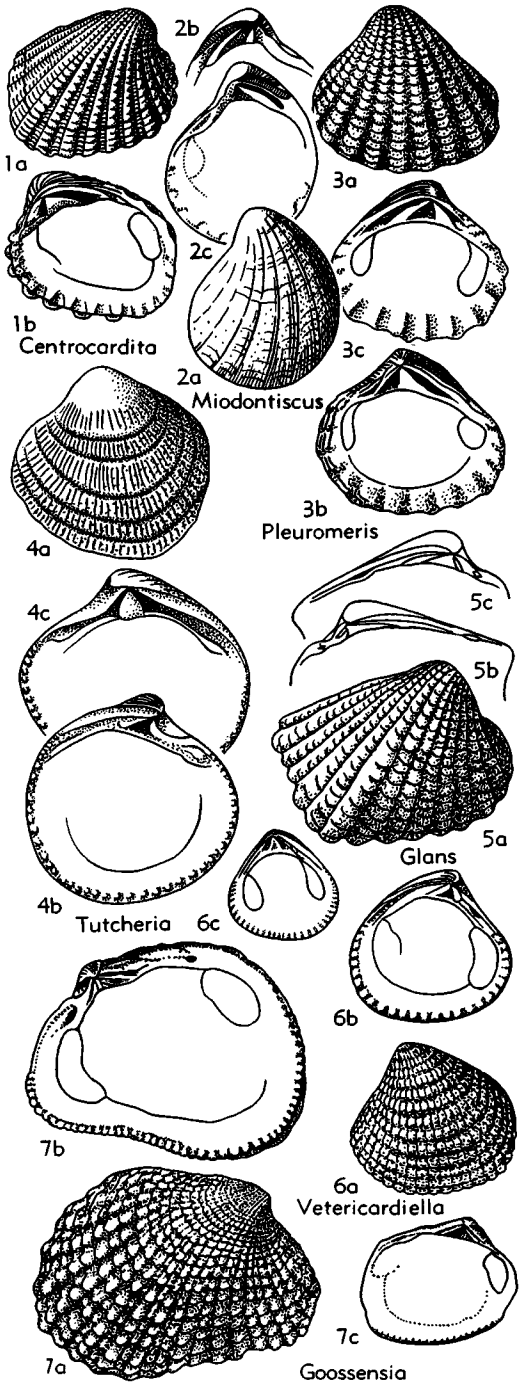


FIG. E51. Carditidae (Carditamerinae) (p. *N551-N553*).

(Paris basin); *7a,b,* RV ext., int., ×3 *(259)*; *7c,* LV int., ×2.5 *(160)*.

I...icardia ICHIKAWA in ICHIKAWA & MAEDA, 1963, p. 119 [18] [**I. parva* ICHIKAWA & MAEDA, 1963; OD]. Moderately small, roundly subquadrate, with prominent prosogyrous beaks; surface with strong, regular, approximate radial ribs. Ventral hinge margin straight, hinge with short, trigonal *3b,* lamellar *3a* and *5b, AII* horizontal, long and straight, reaching lower anterior angle of trigonal *2b, AI* horizontal, then ascending obliquely beneath lunular margin, *4b* present; posterior laterals tuberculiform. *U.Cret.(U.Senon.),* Japan.——FIG. E52,*1*. **I. parva* ICHIKAWA & MAEDA, Campan.; *1a,b,* LV int., RV int., ×1.5 *(426)*.

Miodontiscus DALL, 1903 [13] [*nom. subst. pro Miodon* CARPENTER, 1863 (*non* DUMÉRIL, 1859; *nec* SANDBERGER, 1870)] [**Miodon prolongatus* CARPENTER, 1863; OD]. Small, obliquely oblong, with strongly prosogyrate beaks and long, ill-defined lunule; sculpture of broad radial ribs crossed by concentric furrows. Cardinals oblique, scalariform, *2* short and subparallel to *4b,* which is much elongated, like *3b*; anterior laterals obsolete, posteriors very faint. *Plio.-Rec.,* W.N.Am.-Japan.——FIG. E51,*2*. **M. prolongatus* (CARPENTER), Rec., USA(Calif.); *2a-c,* LV ext., int., RV hinge, ×4 (Keen, 1939).

Pleuromeris CONRAD, 1867 [19] [**P. decemcostata* (=**Venericardia tridentata* SAY, 1826, *decemcostata* CONRAD, 1867; *non Cardita tridentata* REEVE, 1843); OD] [=*?Cycloglans* GORODISKI & FRENEIX, 1959 (1960) (type, *Glans (C.) schencki* FRENEIX *ex* GORODISKI & FRENEIX, MS; OD)]. Rounded trigonal, small, solid, relatively inflated, with erect beaks; radial ribs granular to squamose, large, tending to square transverse profile; lunule elongate, depressed or slightly convex. Hinge with long, partly undetached *3a,* trigonal *3b,* and short, stout *2* and *4b*; anterior laterals narrow but well defined *AIV* lacking, *PII, PIII, PIV* present. *?Eoc., Mio.-Rec.,* N.Am.-Australia-?C.Afr.——FIG. E51,*3*. **P. tridentata decemcostata* CONRAD, Mio., USA (N.Car.); *3a-c,* LV ext., RV int., LV int., ×2.2 (Gardner, 1943).

Tutcheria Cox, 1946 [14] [**Cardium submulticostatum* D'ORBIGNY, 1850 (*pro C. multicostatum* PHILLIPS, 1829, *non* BROCCHI, 1814; OD]. Quadrate to rounded, small, with large, depressed lunule and false escutcheon. Hinge strong, with trigonal, short, entire *3b, 2,* and *4b*; strong tuberculose laterals. *U.Trias.(Carn.)-L.Jur.(Aalen.),* Eu.-S.Am.-N.Z.——FIG. E51,*4*. *T. cingulata* (GOLDFUSS), L. Jur.(Lias.), Eng.; *4a-c,* LV ext., LV int., RV int., ×8 *(187)*.

Vetericardiella CHAVAN, **new genus,** herein [12] [*nom. subst. pro Vetericardia* AUCTT. (*non* CONRAD, 1872)] [**Astarte crenalirata* CONRAD, 1860; OD]. Trigonal, slightly inequilateral, with radial ribs

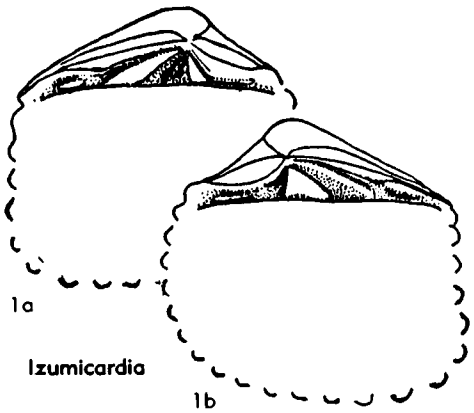


FIG. E52. Carditidae (Carditamerinae) (p. *N552*).

regularly cut off by strong, deeply separated concentric furrows; lunule large, impressed. Elongate laterals on each side of hinge, *3b* short, isosceles triangular, *2* and *4b* equally oblique. *U.Cret. (Senon.)*, N.Am.——FIG. E51,*6a,b*. **V. crenalirata* (CONRAD), USA(Tenn.); *6a,b*, LV ext., int., ×4 *(951)*.——FIG. E51,*6c*. *V. webervillensis* (STEPHENSON), USA(Tex.); RV int., ×3 *(889)*.

[*Vetericardia* is a generic name invalidly proposed by CONRAD (1872, p. 52) as replacement of *Vetocardia* CONRAD, 1868 (Feb., 1869, p. 246), which is an objective junior synonym of *Pseudocardia* CONRAD, 1866 (p. 103) because published as a substitute name for the latter. A type species of *Pseudocardia* was not designated by CONRAD and STOLICZKA's (1871, p. 283) somewhat casual mention of *Venericardia dupiniana* (=*Cardita dupiniana* D'ORBIGNY, 1843) as a form that "can fairly be taken" as the type of *Vetocardia* (and hence of *Pseudocardia*) fails to qualify with provisions of the Code (1961, art. 67,c) as an explicit subsequent designation of a type species. A valid fixation of the type species of *Pseudocardia* was first made by CHAVAN (1952, p. 117) in naming "*C. Smidti* HORN." (presumed to be an erroneous citation of *Cardium schmidti* HÖRNES), eligible as one of the species originally assigned to the genus by CONRAD. STEPHENSON (1941, p. 175) invalidly designated *Astarte crenalirata* CONRAD (1860) as type species of *Vetericardia* CONRAD. A new name consequently is required for the genus based on *A. crenalirata*; *Veteri-cardiella* is chosen.]

Subfamily MIODOMERIDINAE Chavan, new subfamily

Small, oblong, astartiform shells with immature ligament inframarginal. Large hinge plate with oblique *3b* and lacking *3a*. *Paleoc.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Miodomeris*.——2. *Chavanella*.——3. *Pteromeris*.——4. *Coripia*.

Miodomeris CHAVAN, 1936 [**Eomiodon (M.) cossmanni* CHAVAN, 1936; SD CHAVAN, 1938]. Compressed, with close-spaced concentric ribs and radial threads developed mainly at both ends; lunule with convex margin. Hinge with cardinals and laterals. *Paleoc.-U.Eoc.*, Eu.(France-Belg.).

M. (Miodomeris) [1]. Moderately thickened, oblique, with radial lines distinct; ligament marginal. Laterals relatively faint, posterior ones not very remote. *M.Eoc.-U.Eoc.*, Eu.(France).——FIG. E53,*1*. **M. (M.) cossmanni* (CHAVAN), Lutet., W.France; *1a*, LV ext., ×10 *(96)*; *1b,c*, RV and LV hinges, enl. *(96)*.

M. (Chavanella) JAWORSKI, 1938 [2] [*pro Eomiodon* CHAVAN, 1936 (*non* Cox, 1935)] [**Miodon semen* COSSMANN, 1908; OD]. Thickened, only slightly oblique, radial ribs faint; ligament inframarginal. Hinge with subsymmetrical *2* and *4b*, laterals well marked, posterior ones remote. *Paleoc.-U.Eoc.*, Eu.(Belg.-France).——FIG. E53, *3*. **M. (C.) semen* (COSSMANN), Paleoc.(Mont.), Belg.; *3a,b*, LV and RV hinges, enl. *(97)*.

Pteromeris CONRAD, 1862 [**Cardita perplana* CONRAD, 1841 (=*Astarte radians* CONRAD, 1845); OD] [*non Pteromeris* CONRAD, 1865]. Somewhat compressed, oblong, obliquely rounded; with concentric and radial ribbing; lunule ill-defined. Hinge with obsolete posterior laterals. *L.Mio.(Aquitan.)-Rec.*, W.Eu.-N.Am.-N.Z.

P. (Pteromeris) [3]. Radial ribs predominating over concentric ones laterally and around beaks; ligament marginal. *L.Mio.(Aquitan.)-Rec.*, W.Eu.-

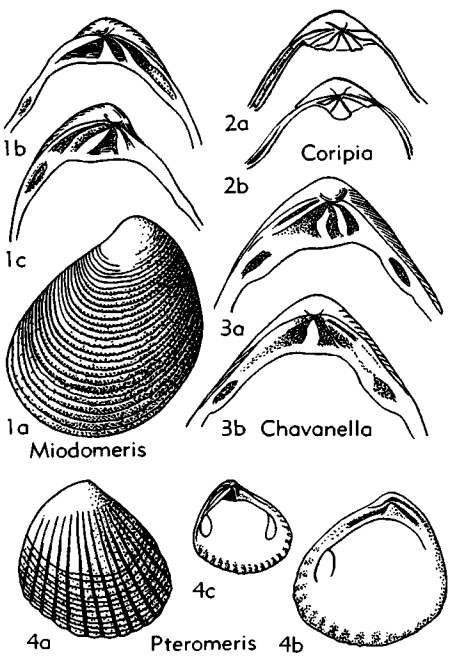


FIG. E53. Carditidae (Miodomeridinae) (p. *N553-N554*).

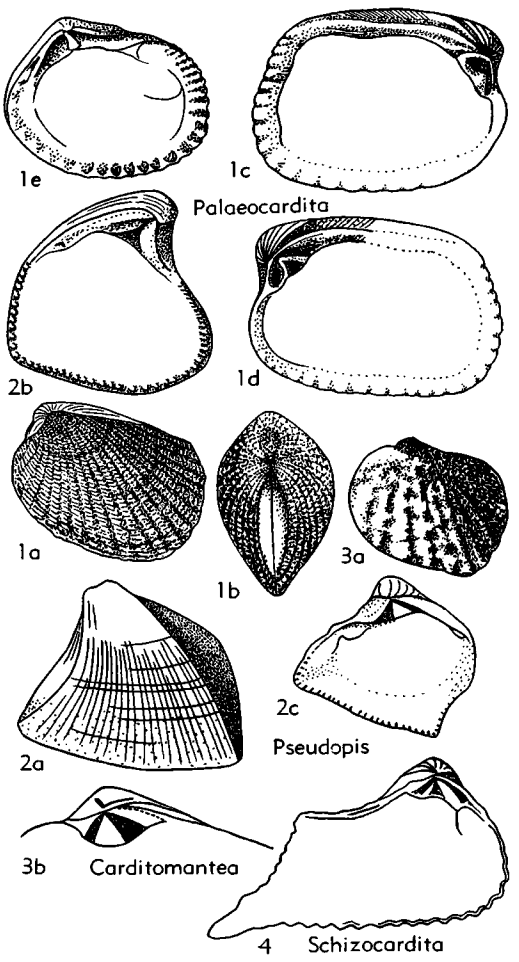


FIG. E54. Carditidae (Palaeocarditinae) (p. *N*554).

N.Am.-N.Z.——FIG. E53,*4*. *P. (P.) perplana abbreviata* (CONRAD), Mio., USA(N.Car.); *4a,b*, RV ext., int., ×3.8; *4c*, LV int., ×4 (Gardner, 1943).

P. (Coripia) DE GREGORIO, 1885 [4] [**Cardita (C.) corbis* (=*Cardita corbis* PHILIPPI, 1836, =*C. minuta* SCACCHI, 1836); M]. Sculpture uniformly reticulate; ligament partly internal. *Mio. (Helvet.)-Rec.*, W.Eu.——FIG. E53,*2*. **P. (C.) corbis* (PHILIPPI), Rec., Medit.; *2a,b*, LV and RV hinges, enl. (Chavan, n).

Subfamily PALAEOCARDITINAE Chavan new subfamily

Posteriorly enlarged to trigoniform, beaks orthogyrous or opisthogyrous, tending to be recurved. Hinge with high, pointed *3b*. *L. Dev.(Downton.)-L.Jur.*

Arrangement of generic taxa by CHAVAN.——1. *Palaeocardita*.——2. *Carditomantea*.——3. *Schizocardita*.——4. *Pseudopis*.

Palaeocardita CONRAD, 1867 [1] [**Cardita austriaca* (=**Cardium austriacum* HAUER, 1853); OD]. Inequilateral, enlarged posteriorly, with granulose or tripartite ribs; beaks almost orthogyrous. Hinge with well-developed cardinals and distant LV posterior lateral. *Trias.*, N.Z.-Eu.——FIG. E54,*1a-d*. *P. crenata* (MÜNSTER), M.Trias.(Ladin.), Aus.(Tyrol); *1a,b*, LV and dorsal views of both valves, ×1 (Münster, 1841); *1c,d*, LV int., RV int., enl. (Laube, 1865).——FIG. E54,*1e*. **P. austriaca* (HAUER), U.Trias.(Rhaet.), Aus.(Tyrol); RV int., ×1 (Stoppani, 1860-65).

Carditomantea QUENSTEDT, 1929 [2] [**C. spinata*; OD]. Trapezoidal, inequilateral, enlarged and rounded posteriorly, with mediposterior angulation; ribs spinose. Hinge with stout trigonal *3b* and well-marked *2* and *4b*; hinge plate enlarged downward. *L.Dev.(Downton.)*, Arctic O.(Spitz.).——FIG. E54,*3*. **C. spinata*; *3a*, LV ext., ×1; *3b*, RV hinge, ×4 (Quenstedt, 1929).

Pseudopis Cox, 1946 [4] [**P. astonensis*; OD]. Relatively small, subquadrate, posterior margin vertically truncate, exterior sharply bicarinate, covered by fine radial threads, growth stages defined; beaks strongly prosogyrous; lunule small, deep; escutcheon lacking. Each valve with single anterior lateral, in LV prolonged by *2*, cardinal *4b* oblique, *3b* short; *PI* weak, *PII* present. *L.Jur. (Lias.)*, Eu.(Eng.-France).——FIG. E54,*2*. *P. deslongchampsi* (TATE), M.Lias., Eng.; *2a-c*, LV ext., int., RV int., enl. *(187)*.

Schizocardita KÖRNER, 1937 [3] [**S. cristata*; OD]. Trigoniform, rounded in front, acuminate and biangulated posteriorly; beaks angular, prominent, slightly opisthogyrous. LV with 2 subequal diverging cardinals and single long, remote posterior lateral; RV with small anterior cardinal oblique, and trigonal, high, bifid median one, with base acuminate onward; long, curved, marginal lateral. *Trias.*, S.Am.(Peru).——FIG. E54,*4*. **S. cristata*; LV int., ×2 *(482)*.

Subfamily VENERICARDIINAE Chavan, new subfamily

Outline subtrapezoidal to rounded trigonal, beaks strongly prosogyrous, with penetrating lunule. Hinge with laminar *3a*, other cardinals curved, laterals approximate, almost obsolete. *?U.Cret.(Senon.), Paleoc.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Venericardia*.——2. *Venericor*.——3. *Leuroactis*.

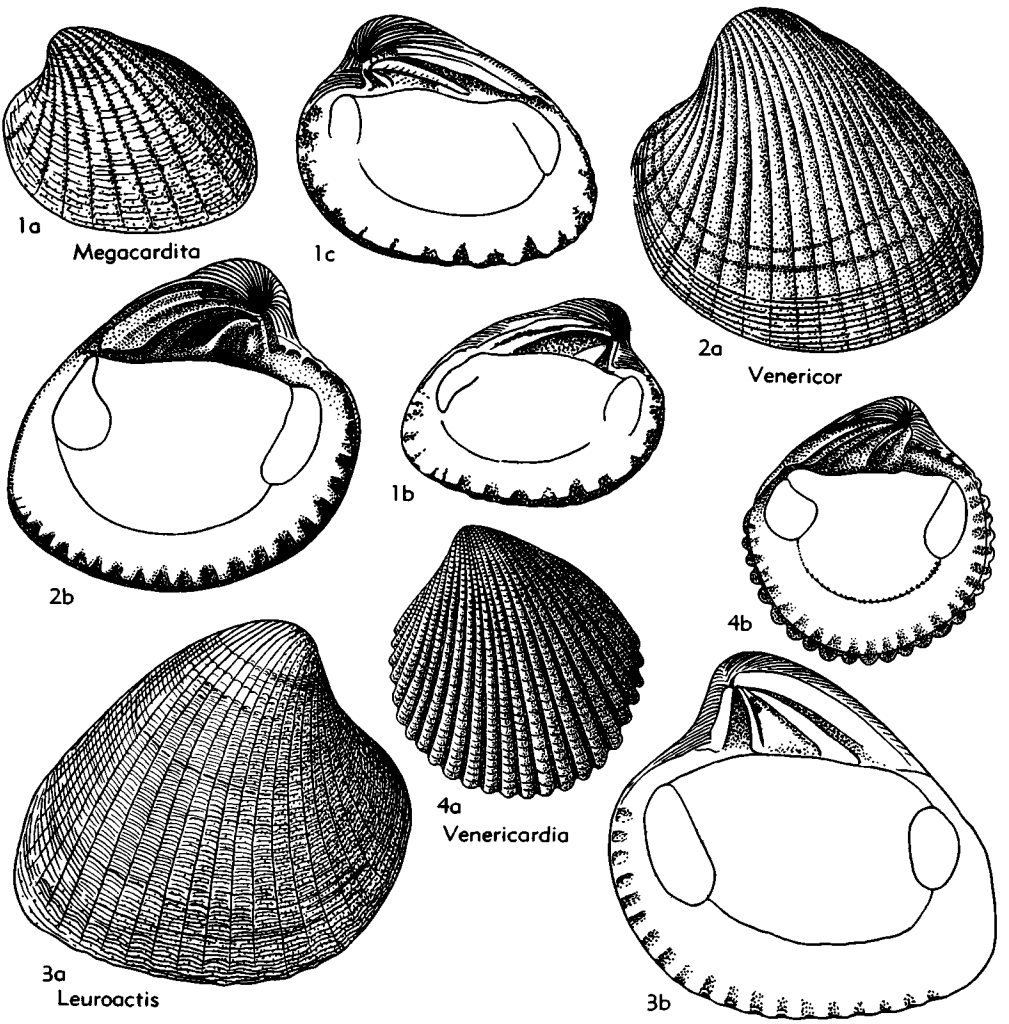


FIG. E55. Carditidae (Venericardiinae) (p. *N555-N556*).

——4. *Pacificor.*——5. *Megacardita.*——6. *Trapezicardita.*

Venericardia LAMARCK, 1801 [**V. imbricata* (=*Venus imbricata* GMELIN, 1791); SD SCHMIDT, 1818]. Rounded trigonal, inequilateral, thick-shelled, with numerous radial ribs evenly elevated at young stage but becoming flattened and enlarged in adults. Hinge with compressed *3a* and *3b* higher than long. *?U.Cret.(Senon.), Paleoc.-Eoc.,* Eu.-Afr.-N.Am.

V. (Venericardia) [1]. Subquadrangular, truncated almost vertically; ribs at juvenile stage rounded, in adults squarish and squamose; lunule very small. Cardinals narrow, high, with *2* and *4b* subparallel, elongate, *All* indistinct. *?U.Cret. (Senon.), Paleoc.-Eoc.,* Eu.-Afr.-N.Am.-N.Z.——FIG. E55,*4*. **V. (V.) imbricata* (GMELIN); M.Eoc. (Lutet.), France(Paris basin); *4a,b,* LV ext., int., ×0.8 (Deshayes, 1837).

V. (Leuroactis) STEWART, 1930 [3] [**Venericardia pilsbryi*; OD]. Obliquely subtrigonal; immature ribs trifid, later becoming rounded and vanishing rapidly, replaced by numerous growth lines; beaks erect; lunule subvertical. Hinge with high, sharp cardinals, anterior lateral wanting. *L.Eoc.,* N.Am.——FIG. E55,*3*. **V. (L.) pilsbryi,* USA(Ala.); *3a,b,* RV ext., int., ×0.5 *(892)*.

V. (Pacificor) VERASTEGUI, 1953 [4] [**V. (P.) mulleri*; OD]. Subtrigonal to rounded; immature ribs trifid, later becoming simple and rounded,

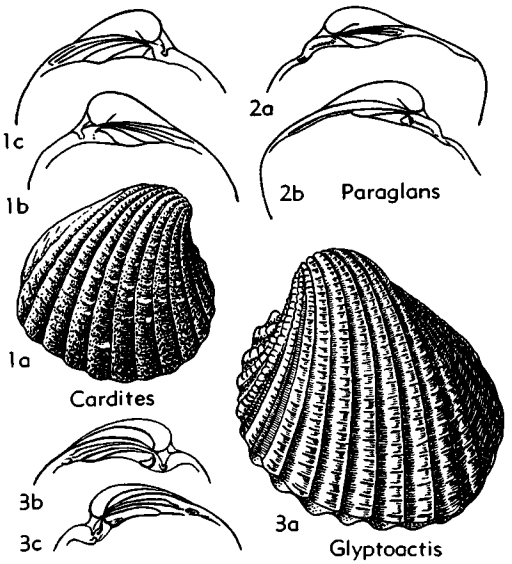


FIG. E56. Carditidae (Glyptoactininae) (p. *N556-N557*).

nodulose to irregularly striated. *Paleoc.-Eoc.*, N. Am.-?Eu.

V. (Venericor) STEWART, 1930 [2] [**Venericardia planicosta* LAMARCK, 1799 (1806); OD]. Obliquely subtrigonal; immature ribs angular and spaced evenly, in adults flat and low, approximate, and finally vanishing; lunule depressed. Cardinals stout, *2* subtrigonal, *4b* curved and thinner, *3b* oblique; *AII* tuberculiform, quite distinct, *PII* superficial. *Paleoc.-Eoc.*, Eu.-N.Am. ——FIG. E55,*2*. **V. (V.) planicosta* LAMARCK, M.Eoc.(Lutet.), France(Paris basin); *2a,b*, LV ext., int., ×0.5 (Deshayes, 1837).

Megacardita SACCO, 1899 [5] [**Venericardia jouanneti* BASTEROT, 1825; OD]. Transversely elliptical, very inequilateral, with rounded ribs becoming approximated in adult stage; beaks rounded, prominent. Hinge with weak *3a*, very oblique *3b* larger than high, *2* and *4b* present; *AII* weak, other laterals obsolete. *?Eoc., Oligo.-Rec.*, Eu.-Afr.-Australia-N.Z.——FIG. E55,*1*. **M. jouanneti* (BASTEROT), Mio.(Helvet.), S.France; *1a-c*, LV ext., int., RV int., ×0.5 *(165)*.

Trapezicardita CASEY, 1961 (6) [**Cypricardia squamosa* KEEPING, 1883; OD]. Quadrate, gibbous, very inequilateral, with obtuse mediposterior angulation; sculpture of squamous distant concentric laminae and radiating striae; prominent incurved anterior beaks; deeply impressed cordiform lunule. Hinge with 2 obtuse LV cardinals and 1 in RV; no developed laterals. Inner margin crenate. *L.Cret.*, W.Eu.

Subfamily CARDITESINAE[1] Chavan, new subfamily

Short trapezoidal to rounded, tumid, with strong, more or less scaly ribs separated by V-shaped furrows; lunule enveloping, very convex, with *3a* and *3b* arched. *L.Cret.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Glyptoactis.*——2. *Claibornicardia.*——3. *Baluchicardia.*——4. *Ludbrookia.*——5. *Xenocardita.*——6. *Paraglans.*——7. *Cardites.*

Cardites LINK, 1807 [*non* LAMARCK, 1801 (spelling error)] [7] [**Chama antiquata* LINNÉ, 1758; M] [=*Cardita* MEGERLE, 1811 (*non* BRUGUIÈRE, 1792); *Actinobolus* MÖRCH, 1853 (*non* WESTWOOD, 1842) (obj.)]. Trapezoidal to rounded, with broad, striate or squamose ribs and short anal truncature; beaks tumid; lunule very convex, depressed, cordiform. Hinge with very faint *3a*, other cardinals well marked; *AII* small, *PII* minute. *L. Eoc.-Rec.*, Eu.-Asia-Australia-Pac. O. —— FIG. E56,*1*. **C. antiquatus* (LINNÉ), Rec., Medit.; *1a*, RV ext., ×1; *1b,c*, RV and LV hinges, ×1.5 *(89a, 101)*.

Glyptoactis STEWART, 1930 [**Venericardia hadra*

[1] For avoidance of homonymy with Carditinae, based on *Cardita*, the spelling Carditesinae is introduced, approval being sought from ICZN as directed by the zoological Code (Art. 55a).

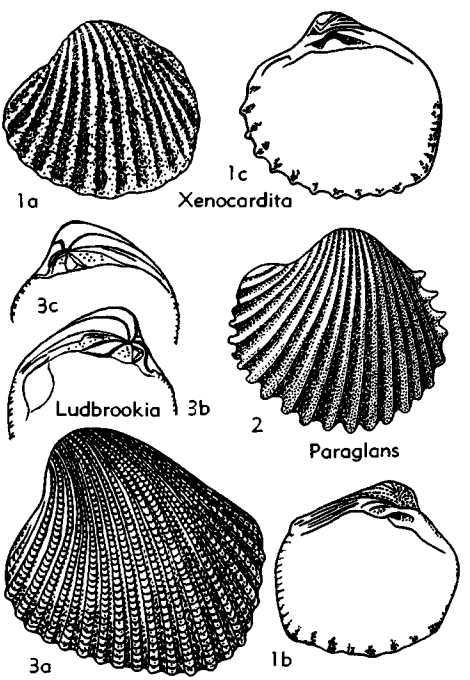


FIG. E57. Carditidae (Glyptoactininae) (p. *N557*).

DALL, 1903; OD]. Short trapezoidal, with high nodulose or echinate ribs; small, irregularly convex lunule extending under and slightly behind beaks. Hinge with very low *2*, thin, long *4b*, rather indistinct *3a*, and strong, oblique *3b*; *AII* minute tuberculiform, close to *2*, *PII* faint. *U.Cret.(Senon.)-Mio.*, N.Am.-Eu.-Afr.

G. (Glyptoactis) [1]. Short, very convex, with prominent beaks, nodulose ribs, and marked posterior depression. Cardinal *2* very low. *Oligo.-Mio.*, N.Am.——FIG. E56,*3*. **G. (G.) hadra* (DALL), Mio., USA(Fla.); *3a*, LV ext., ×1; *3b,c*, LV and RV hinges, ×1 (*229*, Chavan, n).

G. (Baluchicardia) CHAVAN, herein (*ex* RUTSCH, 1944) [3] [**Cardita beaumonti* D'ARCHIAC & HAIME, 1854; OD]. Very short in front, elongate behind, with broadly tripartite ribs, median part nodulose. *U.Cret.(Senon.)-Paleoc.*, Afr.-N. Am.

G. (Claibornicardia) STENZEL & KRAUSE, 1957 [2] [**Venericardia alticosta* CONRAD, 1833; OD]. More developed on both sides and with lower beaks than *G. (Glyptoactis)*; ribs tripartite, posteriorly echinate; lunule less depressed and *2* more developed. *Eoc.*, N.Am.-Eu.

Ludbrookia CHAVAN, 1951 [4] [**Venericardia dupiniana* (=**Cardita dupiniana* D'ORBIGNY, 1843); OD] [=*Pseudocardia* STOLICZKA, 1871 (*non* CONRAD, 1866)] [See note under *Vetericardiella*]. Short trapezoidal, with fine echinate ribs, posterior depression, and straight anal truncature; large sinuous lunule enveloping *2*. Cardinals strong, *2* and *3b* trigonal, *4* oblique, prominent; *PII* broad, relatively weak, other laterals obscure. Projecting RV posterior margin. *L.Cret.(Alb.-Cenoman.)*, Eu. (France)-N.Am.——FIG. E57,*3*. **L. dupiniana* (D'ORBIGNY), Alb.-Cenoman.; *3a*, LV ext., ×1 *(695)*; *3b,c*, LV and RV hinges, ×1.5 (Chavan, n).

Paraglans CHAVAN, 1941 [6] [**Cardium calcitrapoides* LAMARCK, 1806; OD]. Subtrapezoidal to subquadrate, small, with broad posterior truncature; ribs rounded or partly spinose, simple; long convex lunule with broadened inner anterior margin. Hinge with oblique *3b*, very thin *5b*, short, rounded trigonal *2*, and long, oblique *4b*; laterals marked but weak, *AIII* nearly obsolete. *Paleoc.-Oligo.*, W.Eu.——FIG. E56,*2*; E57,*2*. **P. calcitrapoides* (LAMARCK), M.Eoc.(Lutet.), France (Paris basin); E56,*2a,b*, RV and LV hinges, enl.; E57,*2*, RV ext., ×2 (Deshayes, 1837).

Xenocardita VOKES, 1946 [5] [**X. lacunaris* (=*Cardita lacunar* HAMLIN, 1884); OD]. Subtrapezoidal, with broad anal truncature; ribs spinose, posterior ones lamellose; lunule small, with sinuous anterior margin. Hinge with long, subhorizontal *3a*, low, trigonal *3b*, oblique *5b*, curved oblique *4b* above small trigonal *2*; anterior ridge in both valves independent of cardinals but bearing obsolete laterals, LV with 2 posterior ones remote, RV with elevated margin. *L.Cret.(Apt.)*, Lebanon.——FIG. E57,*1*. **X. lacunar* (HAMLIN); *1a-c*, LV ext., int., RV int., ×3 *(945)*.

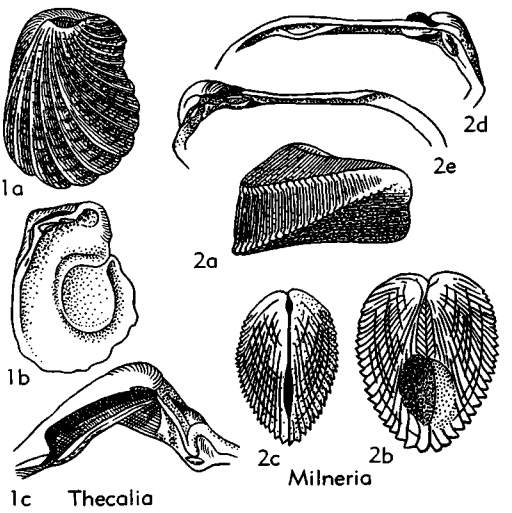


FIG. E58. Carditidae (Thecaliinae) (p. *N557-N558*).

Subfamily THECALIINAE Dall, 1903

Transversely trapezoidal, ventral margin invaginated by incubatory chamber in female. *Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Thecalia.*——2. *Milneria.*

Thecalia ADAMS & ADAMS, 1858 [1] [**Cardita concamerata* BRUGUIÈRE, 1792 (=*C. concamerata* CHEMNITZ, 1784, not binominal); M]. Trapeziform, with rounded nodulose ribs, posterior ones flabelliform; incubatory chamber internal, ovate. Each valve with 2 cardinals, including long trigonal, sinuate *3b*, and faint but distinct anterior laterals, posterior laterals obsolete. *Rec.*, S.Afr.-Austria.——FIG. E58,*1*. **T. concamerata* (BRUGUIÈRE), S.Afr.; *1a,b*, RV ext., LV int., ×1.5; *1c*, LV hinge, enl. *(85)*.

Milneria DALL, 1881 [2] [*pro Ceropsis* DALL, 1871 (*non* SOLIER, 1839)] [**Ceropsis minima* DALL, 1871; OD]. Narrowly trapeziform, very inequilateral, with 2 median posterior angulations, finely echinate ribs, concentric lines; beaks orthogyrous. Hinge with *3b* isosceles triangular, *2* and *4b* subsymmetrical, *3a* and *5b* obsolete; posterior laterals remote, anterior ones lacking. Incubatory chamber external. *Rec.*, W.N.Am.(Calif.).——FIG. E58,*2*. **M. minima* (DALL); *2a*, RV ext., ×4; *2b,c*, both valves, ventral, dorsal, enl. *(305)*; *2d,e*, hinges, enl. *(305)*.

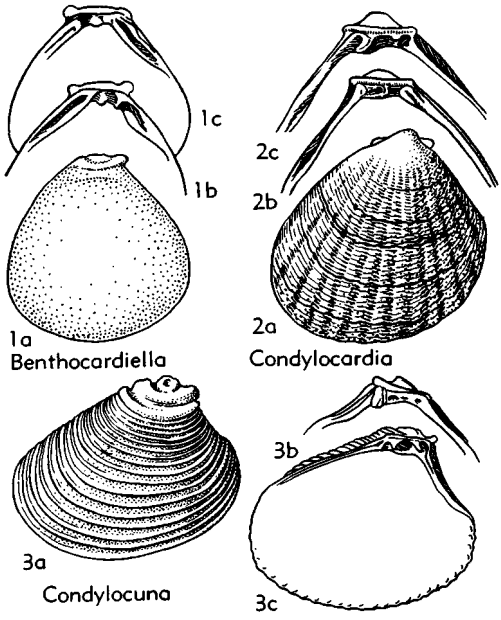


FIG. E59. Condylocardiidae (Condylocardiinae) (p. *N*558-*N*559).

Subfamily UNCERTAIN

Pseudocardia CONRAD, 1866 [**Cardium schmidti* HÖRNES, 1861; SD CHAVAN, 1952] [=*Vetocardia* CONRAD, 1868 (1869) *(nom. van.)* (obj.); *Vetericardia* CONRAD, 1872 *(nom. van.)* (obj.)] [see note under *Vetericardiella*]. *Genus dubium. Mio.,* Eu.

Family CONDYLOCARDIIDAE F. Bernard, 1897

Minute, trigonal, trapeziform or ovate, commonly higher than long; radial ribs more or less marked but may be hidden by concentric sculpture. Spondyliform hinge margin, internal ligament resilial edge partly obliterating cardinal *4b,* behind which posterior tooth *(5b-6b)* is fused to long posterior laterals. *Eoc.-Rec.*

Subfamily CONDYLOCARDIINAE F. Bernard, 1897

[*nom. transl.* CHAVAN, herein (*ex* Condylocardiidae F. BERNARD, 1897)]

Hinge margin more or less spondyliform, resilium wholly internal, both laterals long and hooked. Prodissoconch saucer-shaped. *Eoc.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Condylocardia.*——2. *Benthocardiella.*——3. *Condylocuna.*——4. *Radiocondyla.*——5. *Glibertia.*——6. *Micromeris.*——7. *Mesocuna.*——8. *Erycinella.*——9. *Carditopsis.*——10. *Cunanax.*——11. *Particondyla.* [Insert above, 6a. *Americuna.*]

Condylocardia F. BERNARD, 1896 [1] [**C. sanctipauli* MUNIER-CHALMAS in BERNARD, 1896 (=*C. pauliana* BERNARD, 1897); SD COSSMANN, 1902] [=*Hippella* MÖRCH, 1861 (type, *H. hippopus*; M) *(nom. oblit.,* ICZN pend.)]. Somewhat obliquely trigonal; radial ribs rounded, low, flabellate, crossed by concentric striae. Hinges with 3 cardinals in RV, 2 in LV: *AIII-3a, 3b, 5b, AII, 2a, 4b, 6b, PII, AI* much elongated. *M.Eoc.-Rec.,* S.Pac.-C.Am.-St.Atl.-Eu.——FIG. E59,*2*. **C. sanctipauli* MUNIER-CHALMAS, Rec., St.Paul Is.; *2a-c,* LV ext., LV and RV hinges, much enl. *(41)*.

Americuna KLAPPENBACH, 1962 (6a) [**A. besnardi;* OD]. Obliquely inequilateral, pyriform, with smooth well-marked prodissoconch. Dense concentric ribbing. RV (described as LV) with single cuneiform median tooth and 2 long laterals, separated from margin by narrow furrow; LV (described as RV) with 2 cardinals, 2 prominent, *4b* thinner and 2 marginal laterals. Ligament in broad socket. Margin denticulate. *Rec.,* Brazil.

Benthocardiella POWELL, 1930 [2] [**B. pusilla*; OD]. Rounded trigonal, smooth to concentrically ribbed, large prodissoconch. Hinge plate thick, 3 RV cardinals, 2 in LV; hooked anterior and posterior duplicate laterals; resilium spoon-shaped. *?M.Eoc., Plio.-Rec.,* Australasia-?Eu.(France). ——FIG. E59,*1*. **B. pusilla,* N.Z.; *1a-c,* LV ext., LV int., RV int., much enl. (Powell, 1930).

Carditopsis E. A. SMITH, 1881 [9] [**Cardita flabellum* REEVE, 1843; OD]. Transversely trigonal, subequilateral, anteriorly only slightly produced, flabellate, granulose radial ribs well marked; beaks rounded. Hinge plate relatively narrow, with small teeth, *2, 3b,* rounded median resilium, *5b, 6b* (or *PI, PII*) behind socket nearly symmetrical with anterior cardinals; laterals very elongate, *AI* strongest. *Rec.,* S.Am.(Chile).——FIG. E60,*1*. **C.*

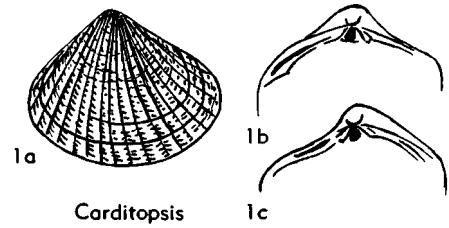


FIG. E60. Condylocardiidae (Condylocardiinae) (p. *N*558-*N*559).

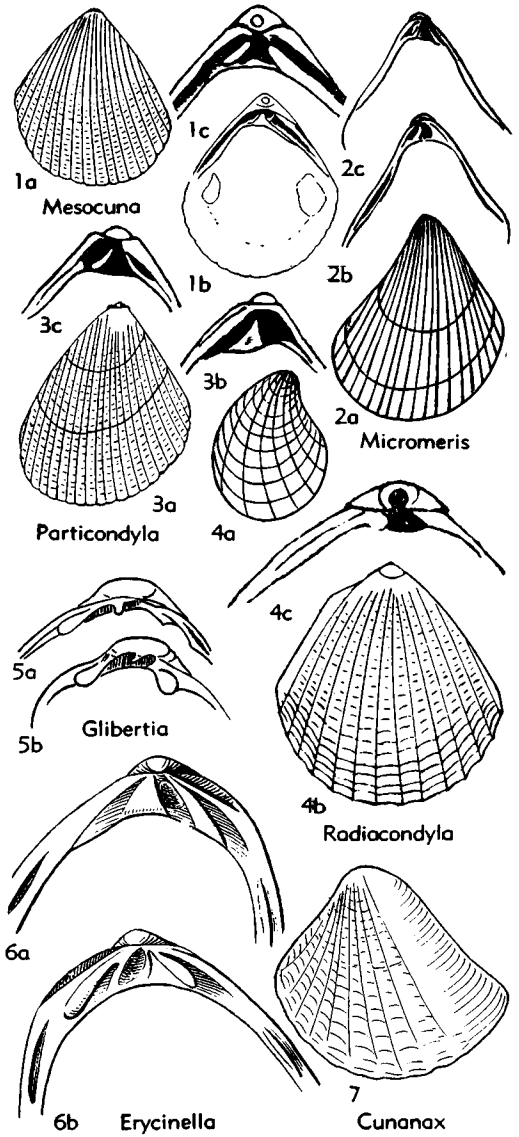


FIG. E61. Condylocardiidae (Condylocardiinae) (p. *N559-N560*).

flabellum (REEVE), Valparaiso; *1a-c,* RV ext., LV and RV hinges, ×4 (Chavan, n).

Condylocuna IREDALE, 1930 [3] [**Condylocardia projecta* HEDLEY, 1902; OD]. Transversely trigonal, very inequilateral, anteriorly elongated; sculpture of concentric waves. Cardinals *3a* weak, *3b* strong, *5b* V-shaped, *2* oblique, *4b* V-shaped, *6b* stout; well-marked RV anterior and LV posterior duplicate laterals; resilium well impressed. *Mio.-Rec.,* Australia-N.Z.——FIG. E59,*3*. **C. projecta* (HEDLEY), Rec., Australia; *3a-c,* LV ext., int., RV int., enl. *(397)*.

Cunanax IREDALE, 1936 [10] [**Cuna pisum* HEDLEY, 1908; OD]. Comparatively large, thick, prosogyrous, strongly inequilateral, outline trigonal; approximated broad, low radial ribs transversely striated. LV teeth diverging subequally, also RV *3a* and *PI* (or *5b*), *3b* bifurcate; anterior lateral remote. Lunule and escutcheon distinct; prodissoconch indistinct. *Plio.-Rec.,* Australasia.——FIG. E61,*7*. **C. pisum* (HEDLEY), Rec., Australia; LV ext., much enl. (Hedley, 1908).

Erycinella CONRAD, 1845 [8] [**E. ovalis*; M] [=*Triodonta* VON KOENEN, 1893 (*non* BORY, 1827; *nec* MULSANT, 1842; *nec* AGASSIZ, 1846; *nec* WILLESMERE, 1885) (type, *T. clara;* SD GLIBERT, 1945)]. Ovate, somewhat enlarged anteromedially; radial ribs low, tending to become obsolete; both marginal ligament and rounded trigonal resilium. Hinge with oblique, elongate *2,* scalariform stout *3b* and *4b* fused to edge of resilium socket, with elongate *PI* and *PII* just behind it, *AII, PIII* remote. *Oligo.-Rec.,* N.Am.-Eu.-S.Afr.——FIG. E61, *6*. **E. ovalis,* Mio., USA(Va.); *6a,b,* RV and LV hinges, enl. (Gardner, 1943).

Glibertia VAN DEN MEULEN, 1951 [5] [**G. prosperi*; OD]. Very small, tumid, ovate, elongated

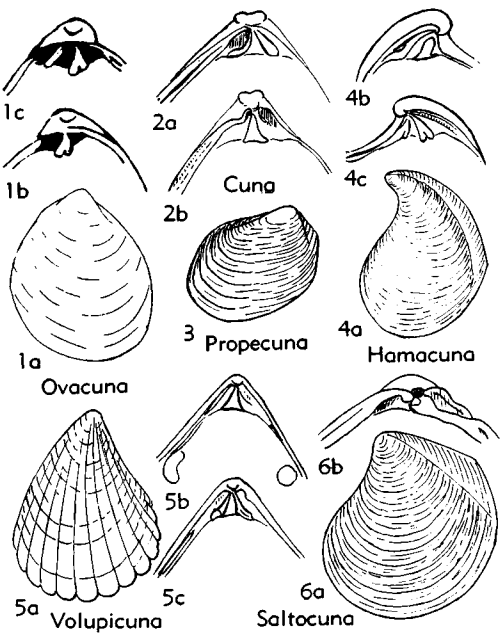


FIG. E62. Condylocardiidae (Cuninae) (p *N560-N561*).

anteriorly; concentric sculpture almost obsolete; flat prodissoconch. Hinge consisting of several projecting callosities, long *AIII-3a,* stout short *3b,* rounded *2, 5b* behind broad resilium, *6b, PIII, PI* in successive crests. *Plio.,* Neth.——FIG. E61,*5*. **G. prosperi*; *5a,b,* RV and LV hinges, much enl. (Chavan, n).

Micromeris CONRAD, 1866 [**M. minutissima* (=*Astarte minutissima* LEA, 1833); OD] [=*Pteromeris* CONRAD, 1865 (*non* CONRAD, 1862) (obj.)]. Oblong, with pointed beaks and cordate broad lunule; sculpture vertical rather than truly radial; resilium somewhat restricted. Relatively narrow cardinals and very long laterals. *Eoc.-Rec.,* N.Am.-Australia.

M. (Micromeris) [6]. Trigonal, inequilateral, elongated anteromedially; with vertical ribs and concentric striae. Hinge with obliquely trigonal *2* and *3b,* very thin *3a, 4b, 5b*; shell margin strongly crenulate internally. *Eoc.,* N.Am.; *Rec.,* Australia. ——FIG. E61,*2*. **M. (M.) minutissima* (LEA), M.Eoc., USA(Ala.); *2a,* LV ext.; *2b,c,* RV and LV hinges; much enl. (Chavan, n).

M. (Mesocuna) LASERON, 1953 [7] [**M. saza*; OD]. Ovately trigonal, subequilateral; with rugose axial ribs and concentric lines. Hinge with massive cardinals and long, strong laterals; shell margin denticulate internally. *Rec.,* Australia.—— FIG. E61,*1*. **M. (M.) saza; 1a,* RV ext.; *1b,c,* RV int., LV hinge; much enl. *(531)*.

Particondyla LASERON, 1953 [11] [**P. cuneata*; OD]. Obliquely trigonal, oblong; sculpture of radial ribs; prodissoconch saucer-shaped. Deep hinge plate with 1 cardinal on RV, 2 on LV, laterals not prominent. *Rec.,* Australia.——FIG. E61, *3*. **P. cuneata; 3a,* LV ext.; *3b,c,* RV and LV hinges; much enl. *(531)*.

Radiocondyla IREDALE, 1936 [4] [**R. arizela* (=*Condylocardia porrecta* HEDLEY & MAY, 1908) (*non* HEDLEY, 1906); OD]. Ovately oblong, relatively narrow; with broad radial ribs intersected by distant concentric furrows; prodissoconch small. Hinge with tuberculiform approximated short teeth of spondyloid appearance. *Mio.-Rec.,* Australia.——FIG. E61,*4a*. **R. arizela,* Rec.; RV ext., enl. (Chavan, n).——FIG. E61,*4b,c*. *R. jacksonensis* LASERON, Rec.; *4b,c,* LV ext., hinge, much enl. *(531)*.

Subfamily CUNINAE Chavan, new subfamily

Hinge margin more or less rounded; prodissoconch also rounded, commonly ill-defined; resilium inframarginal; laterals incomplete. *M.Eoc.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Cuna.*——2. *Saltocuna.*——3. *Ovacuna.*——4. *Propecuna.*——5. *Volupicuna.*——6. *Hamacuna.* [Insert above, 4a. *Goniocuna.*]

Cuna HEDLEY, 1902 [1] [**C. concentrica;* OD]. Narrowly trigonal, commonly obliquely angular; with concentric sculpture overlapping radial ribs which strongly crenulate internal margin. Hinge with median *3b* subtrihedral, posteriorly acuminate at base; *2* and *4b* nearly symmetrical but *4b* posteriorly restricted by resilium which does not reach inferior margin of plate; *AI, PII* thin, long, other laterals fused to margin; pallial line impressed. *M.Eoc.-Rec.,* N.Am.-Australasia.——FIG. E62,*2*. **C. concentrica,* Rec., Australia; *2a,b,* LV and RV hinges, much enl. (Chavan, n).

Goniocuna KLAPPENBACH, 1962 (4a) [**Cuna dalli* VANATTA, 1903; OD]. Subtriangular, inequilateral, very small, with concentric ribbing; hinge strong and broad, with low, long anterior and trigonal median cardinal in each valve, ligament in pit; bordered by posterior cardinal and by short rather faint posterior lateral. Adductor scars rather large; inner margin apparently smooth. *Rec.,* USA(Miss.-Fla.).

Hamacuna COTTON, 1931 [6] [**Cuna hamata* HEDLEY & MAY, 1908; OD]. Very oblique, anteromedially much elongated, with concave front margin and curved prosogyrous beaks, compressed, thick-shelled; surface with concentric sculpture and radial lines toward ventral margin; faint lunule and escutcheon. Hinge with curved bilobate *3b,* arched *2* and *4b* converging upward under beak, long curved *AIII-3a,* relieving remote *AI*; resilium narrow, elongate, and long nymph present. *?Pleist., Rec.,* Australasia.——FIG. E62,*4*. **H. hamata* (HEDLEY & MAY), Australia; *4a-c,* LV ext., int., RV int., much enl. (Chavan, n).

Saltocuna IREDALE, 1936 [**Cuna particula* HEDLEY, 1902; OD]. Broadly rounded obliquely, truncate posteriorly; sculpture coarse concentric; prodissoconch relatively large. Narrow hinge with short posterior laterals and relatively low cardinals. *Plio.-Rec.,* Australasia.

S. (Saltocuna) [2]. Very inequilateral, prodissoconch distinct. Hinge with strong *3b,* broader than high, and well-developed laterals. *Plio.-Rec.,* Australasia.——FIG. E62,*6*. **S. (S.) particula* (HEDLEY), Rec., Australia; *6a,b,* LV ext., RV hinge, much enl. (Chavan, n).

S. (Ovacuna) LASERON, 1953 [3] [**Kellia atkinsoni* TENISON-WOODS, 1876; OD]. Less inequilateral than *S. (Saltocuna),* concentric sculpture faint, prodissoconch not prominent. Hinge with distinctly bifurcate *3b* and weak laterals; pallial line impressed. *Rec.,* Australia.——FIG. E62,*1*. **S. (O.) solida* (COTTON); *1a-c,* RV ext., RV and LV hinges, much enl. *(531)*.

S. (Propecuna) COTTON, 1931 [4] [**Cardita obliquissima* TATE, 1887; OD]. Very inequilateral, oblique grooves cutting across growth lines, also with radial posterior grooves and dorsoventral angulation. *Rec.,* Australia.——FIG. E62,*3*. **S.*

(P.) obliquissima (TATE); LV ext., much enl. (Chavan, n).

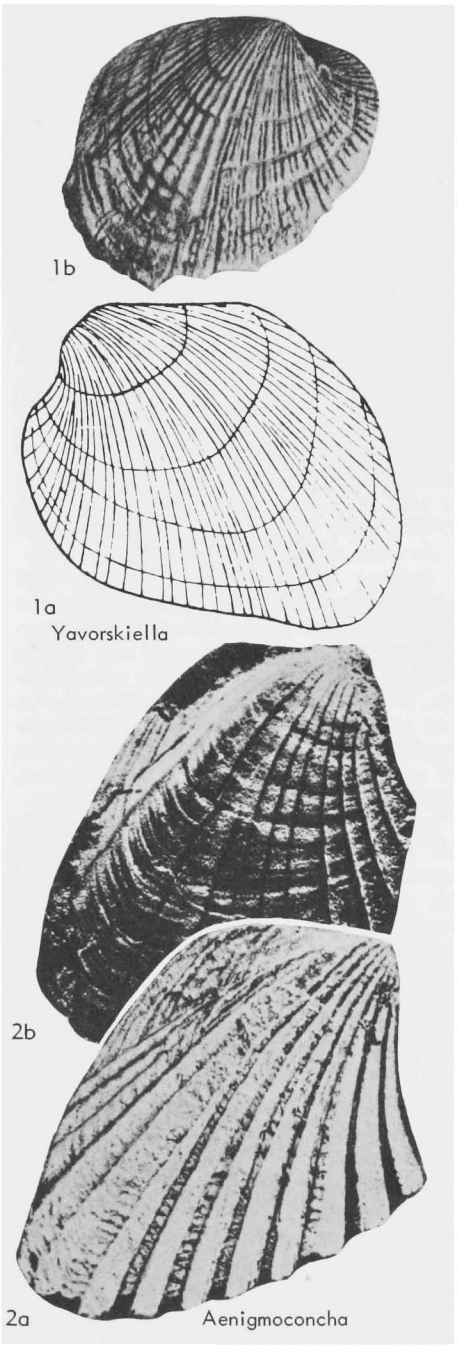


FIG. E63. Family Uncertain (p. *N*561).

Volupicuna IREDALE, 1936 [5] [**Carditella delta* TATE & MAY, 1900; OD]. Highly triangular, slightly inequilateral, rather deep, with strong, well-spaced, pectinate radial ribs. Hinge with bifurcate cardinals *3b, 2, 4b* (subsymmetrical), elongate, thin *3a-AIII* and remote *AI*; pallial line obsolete; resilium quite inframarginal, slightly depressed. *Mio.-Rec.,* Australasia.——FIG. E62,*5*. **V. delta* (TATE & MAY), Rec., Australia; *5a-c,* LV ext., LV and RV hinges, much enl. (Chavan, n).

Family UNCERTAIN

?Aenigmoconcha BENEDICTOVA, 1950 [**A. obliqua*; OD]. Shell subrhomboidal, of considerable size, umbones anteriorly directed, situated at varying distance from end. Hinge margin straight, or only slightly curved. Valves equally but not strongly inflated by diagonal elevation running from umbo to posteroventral angle; clearly delimited from steep posterior slope; valve surface almost flat near upper posterior angle, simulating obtuse auricle. Anterior slope of oblique elevation merging gradually with rest of valve; surface sculptured by narrow, rather closely set radial costae, strongest anteriorly, becoming weaker over diagonal ridge, tending to disappear on upper posterior field; costae of internal mold thin, linear, widely separated toward margins, strongest anteriorly and absent from posterior region; diagonal ridge bearing single narrow rib, simple or bifurcating downward. Flat surfaces of wide costal interspaces in mold marked by conspicuous concrescent lines. Internal characters unknown. [Nonmarine.] *L. Perm.,* USSR(W.Sib.).——FIG. E63,*2*. **A. obliqua; 2a,b,* RV ext. molds, ×1 (Ragozin, 1955). [WEIR]

?Blairella MILLER & GURLEY, 1893 [**B. sedaliensis*; OD]. At present unrecognizable. *L.Carb.,* USA (Mo.). [NEWELL]

?Yavorskiella KHALFIN, 1950 [**Yavorskia skoki* FEDOTOV, 1938; OD]. Shell short, subrhomboidal, subelliptical or quadrilateral, narrowing toward lower posterior angle. Umbones submedian to anterior, broadly based, swollen, directed more or less anteriorly. Valves moderately convex, ill-defined diagonal elevation running from umbones to posterior extremity; shell sculpture of numerous strong radial costae, varying in number and width, widest interspaces occurring on oblique elevation; costae thinner and more closely spaced in front, rather indefinite on posterodorsal surface. Radial costation intersected by well-spaced growth folds. Internal characters unknown. [Nonmarine.] *L. Perm.,* USSR(W.Sib.).——FIG. E63,*1a*. **Y. skoki* (FEDOTOV); LV ext., ×2 (Ragozin, 1955).——FIG. E63,*1b*. *Y. analoga* (BENEDICTOVA), RV mold, ×2 (Ragozin, 1955). [WEIR]

Superfamily CRASSATELLACEA Férussac, 1822

[*nom. transl.* Newell, 1965 (*ex* Crassatellidae Férussac, 1822)]

[Materials for this superfamily prepared by André Chavan except as stated otherwise]

Animal with fully open mantle, or communication between branchial and pedal openings; unequal branchiae; papillate mantle edge. Shell trigonal, trapezoidal, or rounded, with concentric external sculpture, costate to striate, vanishing in some, except in Cardiniidae with internal layer of straight or arcuate radial riblets, which may be reflected as crenulations of inner shell margin. Lunule and escutcheon generally distinct; beaks prosogyrate and pointed. Hinge lucinoid, with *3b* median and *5b* commonly present on right valve, thus more or less cyrenoid in appearance. Lateral teeth laminar in many forms; no *PI* developed except in Cardiniidae and Myophoricardiidae. Ligament external or internal. Integripalliate or with very faint sinuosity. Pedal scars well marked *(110, 111)*. [Marine.] *Ord.-Rec.*

The alphabetically arranged generic descriptions in each family-group division of the Crassatellacea are accompanied by numbers inclosed by square brackets. Such numbers indicate position in the sequence of generic taxa given with the respective families or subfamilies for the purpose of recording Chavan's arrangement, designed to reflect "natural relationships" of these taxa as inferred by him.

Family ASTARTIDAE d'Orbigny, 1844

[=Crassinidae Gray, 1840]

Trigonal rounded to subquadrangular in outline. Concentrically ribbed to smooth, always ribbed around beaks. Successive internal layers of radial riblets periodically set up, under concentric outer layer. Ligament external or inframarginal, with nymph and without defined internal resilial pit. *?M. Ord., Dev.-Rec.*

Subfamily ASTARTINAE d'Orbigny, 1844

[*nom. transl.* Chavan, herein (*ex* Astartidae d'Orbigny, 1844)]

Shell trigonal or transversely trapezoidal, with more or less curved beaks; hinge without distinct *AIV*, other laterals (when present) in prolongation of cardinals. *?M.Ord., Dev.-Rec.*

Arrangement of generic taxa by Chavan.——1. *Astarte.*——2. *Leckhamptonia.*——3. *Isocrassina.*——4. *Grotriania.*——5. *Ashtarotha.*——6. *Bythiamena.*——7. *Digitariopsis.*——8. *Tridonta.*——9. *Nicania.*——10. *Rictocyma.*——11. *Nicaniella.*——12. *Trautscholdia.*——13. *Astartella.*——14. *Eodon.*——15. *Kaibabella.*——16. *Eoastarte.*——17. *Astartopis.*——18. *Astartopsis.*——19. *Matheria.*——20. *Praeconia.*——21. *Megapraeconia.*——22. *Yabea.*——23. *Neocrassina.*——24. *Coelastarte.*——25. *Prorokia.*——26. *Parisiella.*——27. *Sita.*—28. *Goodallia.*——29. *Ancliffia.*——30. *Gonilia.*——31. *Digitaria.* [Insert above, 1a. *Carinastarte;* 10a. *Filatovaella;* 16a. *Astartellopsis;* 25a. *Seendia;* 30a. *Ensio.*]

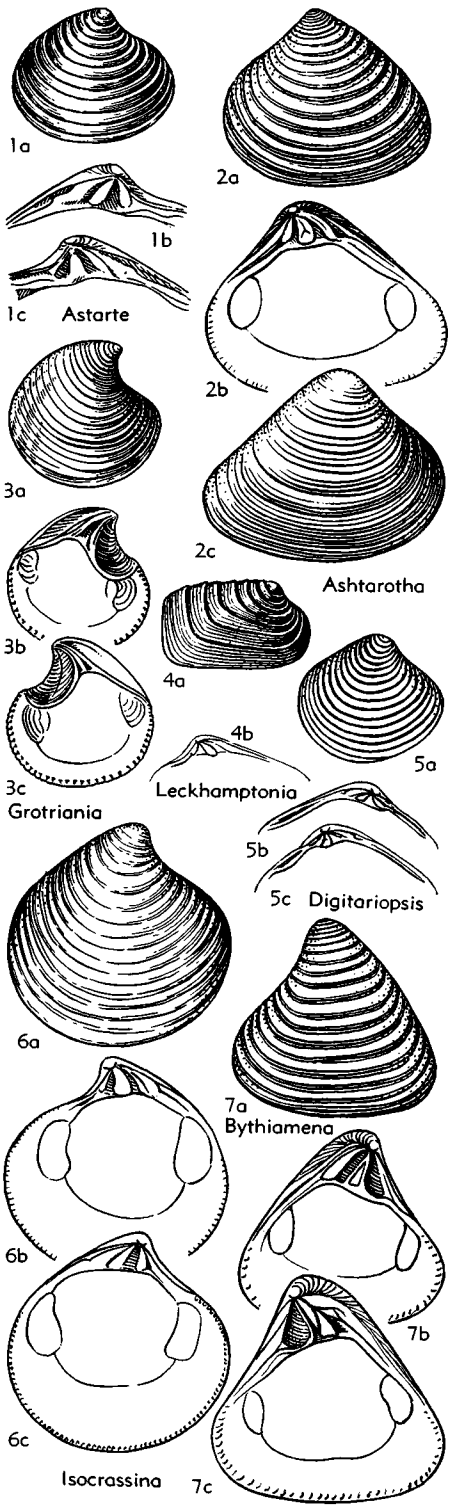
Astarte J. Sowerby, 1816 [**Venus scotica* Maton & Rackett, 1807 (=**Pectunculus sulcatus* da Costa, 1778, var. *scotica* Maton & Rackett, 1807); OD]. Trigono-elliptical to subtrapezoidal, with regularly spaced concentric ribs or undulations, at least around prominent, but small, beaks. Inner margin denticulated or not. Hinge with well-developed cardinals, except for *3a*, faint, and *6b*, lacking; and with well-marked *AI*. Other laminae *(AII, PII, PIII)* partly obsolete. Narrow nymph behind *5b*. *Jur.-Rec.*, cosmop.

A. (Astarte) [1] [=*Crassina* Lamarck, 1818 (obj.)]. Subquadrangular, inequilateral, posterior side enlarged and truncated; rounded strong persistent ribs. Remote lateral teeth and laminar oblique cardinals. Impressed lunule and escutcheon. *M. Jur.-Rec.*, cosmop.——Fig. E64, *1. *A. (A.) sulcata* (da Costa), *scotica* (Maton & Rackett, Rec., Scot.; *1a*, RV ext., ×1.2 *(511); 1b,c*, LV and RV hinges, ca. ×2.5 (Maton & Rackett, 1807).

A. (Ashtarotha) Dall, 1903 [5] [**A. undulata* Say, 1824; OD]. Ovatotrigonal, flattened, thick; depressed around the pointed beaks; posterior side commonly cuneiform. Sculpture of strong concentric waved ribs, in many forms vanishing on disc. Large, depressed, well-defined lunule and flat escutcheon. Teeth strong; elongated marginal laterals. *Neog.*, N.Am.-W.Eu.——Fig. E64,*2a*. **A. (A.) undulata* Say, Mio., USA(Va.); LV ext. ×1.2 (Gardner, 1943).——Fig. E64,*2b,c*. *A. (A.) undulata vaginulata* Dall, Mio. USA(Va.); *2b,c*, RV int., ext., ×1.2 (Gardner, 1943).

A. (Bythiamena) Gardner, 1926 [6] [**A. (B.) isosceles*; OD]. Narrowly trigonal, high. Thick equidistant concentric ribs. Much excavated, but restricted lunule, obliterating *3a*; other cardinals strong; posterior laterals long. *Mio.*, USA(Fla.).——Fig. E64,7. **A. (B.) isosceles*; *7a-c*, LV ext., int., RV int., ×3.6 (Gardner, 1926).

A. (Carinastarte) Hinsch, 1952 [1a] [**A. reimersi* Semper in Ravn, 1907; OD]. Like *A. (Astarte)* in outline, but with irregular ribbing and a



medioposterior angulation. Less remote, straighter and stouter posterior laterals, more vertical *4b*. *Oligo.-Plio.*, Eu.

A. (Digitariopsis) CHAVAN, 1952 [7] [**A. grateloupi* DESHAYES, 1843; OD]. Trapezoidal, rounded, rather small, with irregular concentric fine ribs, commonly medially flattened and laterally oblique. Lunule and escutcheon narrow, long, defined only by their smooth surface. Hinge with well-marked long laterals, 2 very oblique forward. *Neog.*, W.Eu.-Japan.——FIG. E64,*5*. **A. (D.) grateloupi* DESHAYES, L.Mio.(Burdigal.), France; *5a*, RV ext., ×2.8; *5b,c*, LV and RV hinges, ×3.6 (Chavan, n).

A. (Grotriania) SPEYER, 1860 [4] [**Grotriania semicostata;* M]. Like *Isocrassina*, but with faint, medioposterior radial lines, more curved beaks, very large, excavated, concave lunule and flattened escutcheon. Hinge with *3a* fused to margin; other cardinals very narrow; long obsolete laterals. *Oligo.*, Eu.(Ger.).——FIG. E64,*3*. **A. (G.) semicostata* (SPEYER); *3a-c*, RV ext., LV int., RV int., ×2.4 (Speyer, 1860).

A. (Isocrassina) CHAVAN, 1950 [3] [**A. castanea* SAY, 1830 (=**Venus castanea* SAY, 1822; OD]. Subtrigonal-rounded, almost equilateral, thick; strong close-set umbonal ribs passing to low, rounded, spaced concentric undulations. Large shallow lunule. Hinge thick, with high cardinals and short laterals. *U.Eoc.-Rec.*, N.Am.-W.Eu. ——FIG. E64,*6*. **A. (I.) castanea* (SAY), Rec., USA(N.J.); *6a-c*, RV ext., int., LV int., ×1.2 (Say, 1830). [=*Laevastarte* HINSCH, 1952 (type, *Tellina fusca* POLI, 1791; OD).]

A. (Leckhamptonia) COX & ARKELL, 1948 [2] [**Hiatella interlineata* LYCETT, 1850; OD]. Transversely trapezoidal, very inequilateral, rather small. Narrow sharp spaced ridges. Shallow lunule and escutcheon. Hinge with obscure laterals; *4b*, small. *Jur.*, W.Eu.——FIG. E64,*4*. **A. (L.) interlineata* (LYCETT), M.Jur.(Bathon.), Eng.; *4a,b*, RV ext., hinge, ×2.7 *(645*; Chavan, n).

Astartella HALL, 1858 [13] [**A. vera* HALL, 1858; SD MILLER, 1889]. Transversely rhomboidal to ovate, thick, rather small; laterally truncated. Surface with concentric furrows and distant lamellae. Cordiform impressed lunule. Valves margin crenulate. RV hinge with narrow, trigonal *3b*, oblique *5b*, and marginal laterals; LV hinge with 2 partly fused as hook with raised *(AII)* lunular margin, *4b*, strong, broad and oblique, and *PII* elongate. Scars small. *U.Carb.(Penn.)-Perm.*, Eu.-N.Am.-?Australia.——FIG. E65,*2a,b*. **A. vera*, Penn., USA; *2a,b*, RV ext., both valves dorsal, ×1 (Hall, 1858).——FIG. E65,*2c,d*. *A. concentrica* (CONRAD), Penn., USA(Mo.); *2c,d*, LV and RV hinges, ×1.3 (Girty, 1927). [*See* also Fig. E75,*2*.]

FIG. E64. Astartidae (Astartinae) (p. *N562-N563*).

Astartellopsis BEURLEN, 1954 (16a) [**A. prosoclina* (=*Astarte* cf. *triasina* "ROEMER" in COWPER REED, 1929); OD]. Trigonal, with high, acutely pointed, prominent prosogyrous beaks, anterior side depressed, angular where it joins broadly convex ventral margin, posterior margin convex; long lunule. No dorsal carina, but broadly spaced, rather strong concentric waves. Hinge with curved

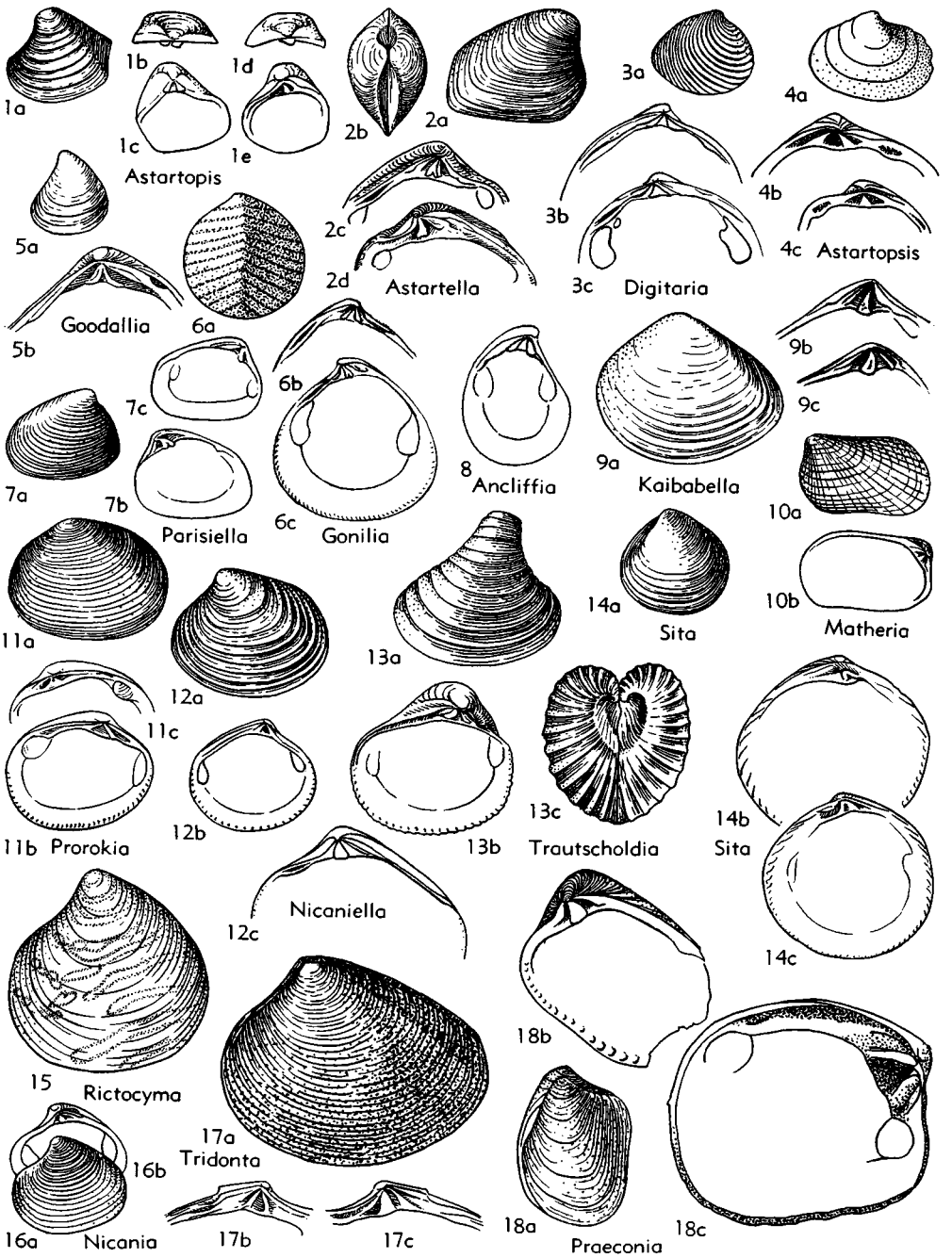


FIG. E65. Astartidae (Astartinae) (p. *N563*, *N565-N568*).

RV cardinals, *3a* marginal, prolonged into straight anterior lateral fused to margin; *2* trihedric, strong, *4b* long and curved, short nymph. *Permotrias.*, Brazil-Ger.-Japan.

Astartopis VON WÖHRMANN, 1889 [17] [**Myophoria richthofeni* STUR, 1868; M]. Small, irregularly subquadrate, deep, with distant concentric ribs and strong posterior fold. Prominent beaks. Lunule and escutcheon broad and flat. Well-marked cardinals, obscure laterals. [Considered by Cox as junior subjective synonym of *Myophoriopis* VON WÖHRMANN (see Myophoriopidae in this superfamily).] *U.Trias.*, Eu.(Aus.).——FIG. E65,*1*. **A. richthofeni* (STUR), Aus.; *1a*, LV ext., ×4; *1b,c*, LV int., hinge, ×2; *1d,e*, RV hinge, int., ×2 *(1001)*.

Astartopsis DE LORIOL, 1891 [18] [**A. elongata*; SD CHAVAN, 1952]. Rounded, convex, thin; with concentric growths. Hinge with remote well-marked anterior laterals and widely divergent cardinals. Ovate superficial scars. Margin finely denticulated. *Jur.(L.Lusitan.)*, Eu.(Switz.).——FIG. E65,*4*. **A. elongata; 4a*, LV ext., ×0.7; *4b,c*, LV and RV hinges, ×1 *(550)*.

Digitaria S. WOOD, 1853 [31] [**Astarte digitaria* WOOD, 1853 (=*Digitaria vulgaris* WOOD, 1853) (=**Tellina digitaria* LINNÉ, 1758; T); SD LAMY, 1920] [=*Woodia* DESHAYES, 1860 (obj.); *Parvati* SEMPER, 1862 (invalid name)]. Ovate, inequilateral, rather small; more or less excentric sculpture. No lunule or escutcheon. Rounded beaks. Two strongly divergent cardinals on each valve and flexuous thin, elongate laterals. *Oligo.-Rec.*, W. Eu.-S. Afr.——FIG. E65,*3*. **D. digitaria* (LINNÉ), Rec., Port.; *3a*, RV ext., ×2.5; *3b,c*, LV and RV hinges, ×5 (Chavan, n).

Eoastarte CIRIACKS, 1963 [16] [**E. subcircularis*; OD]. Shell ovate or subcircular, inequilateral, prosocline; beaks prominent, anteriorly placed, prosogyre; shell surface smooth, dentition: *3b, 5b/2, 4b* without laterals; *3b* and *4b* heavy, subtrigonal, steeply inclined to hinge; without laterals; *2* short, slender, and *5b* elongate, slender, both inclined and nearly parallel to adjacent shell margins; ligament opisthodetic; ligament nymphs and grooves short and shallow; adductor scars deep, subovate, dorsally extended, located high under hinge; anterior adductor pit bounded above by strong buttress which is fused to cardinal plate; pallial line simple. *L.Perm.*, USA(Wyo.).——FIG. E66,*1*. **E. subcircularis*, Grandeur Member, Park City F.; *1a,b*, RV ext., LV int., ×4 *(132)*. [NEWELL]

Eodon HALL in MILLER, 1877 [14] [*pro Microdon* CONRAD, 1842, *non* AGASSIZ, 1833] [**Microdon bellastriatus* CONRAD, 1842; M] [=*Microdonella* OEHLERT, 1881 (obj.)]. Trapezoidal, flattened, inequilateral, with medioposterior angulation and marginal sinuosity; concentrically striated. Hinge less developed than on *Astartella*, with *AII-2, 4b*, and *PII* in LV. *Dev.-Carb.*, USA-W.Eu.——FIG. E66A,*1a*. **E. bellastriatus* (CONRAD), M.Dev., USA; LV ext., ×1 *(146)*.——FIG. E66A,*1b*. *E. tremulus* (DE RYCKHOLT), Carb., Belg.; LV int., ×2

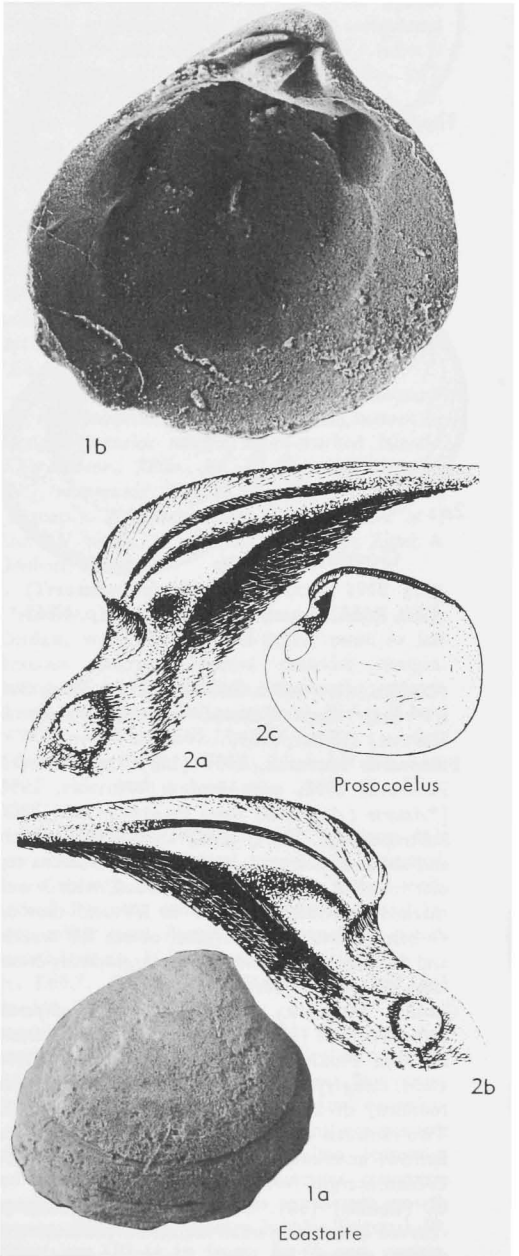


FIG. E66. Astartidae (Astartinae) *(1)*, (Opinae) *(2)* (p. *N565*, *N572*).

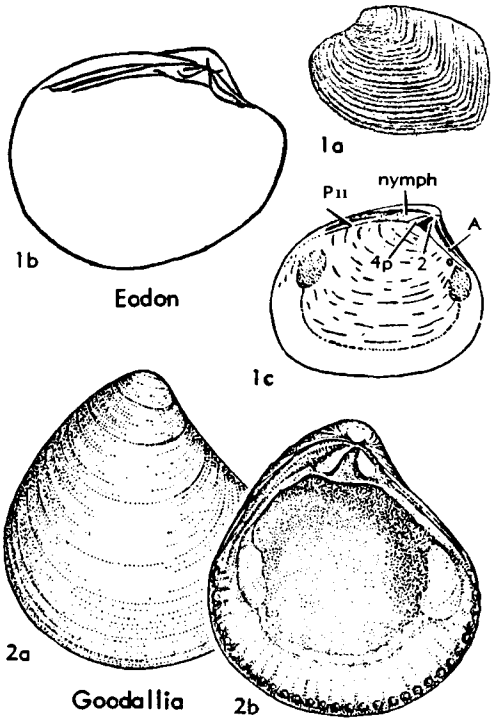


FIG. E66A. Astartidae (Astartinae) (p. *N565-N566*).

(Chavan, n).——FIG. E66A,*2*. *E.* sp., Dev., Ger.; LV int., diagr. [classed as *Cypricardella* by HAFFER] (Haffer, 1959).

Filatovaella MERKLIN, 1959 (10a) [*pro Astartella* FILATOVA, 1958, *non* HALL & WHITNEY, 1958] [**Astarte (Astartella) ioani* FILATOVA, 1958; OD]. Subtrapezoidal, short, thick, slightly inequilateral and angular backward; sculpture of numerous regular rounded ribs. Hinge plate broad, with 3 well-marked cardinals in RV, 2 in LV and thin *6b; 4b* being subvertical; marginal obtuse RV anterior and LV posterior lateral; inner margin finely crenulated. *Rec.*, Kamchatka.

Gonilia STOLICZKA, 1871 [**Lucina? bipartita* PHILIPPI, 1836 (*non* DEFRANCE, 1823) (=**Astarte bipartita* PHILIPPI, 1844, *non* SOWERBY, 1829); (=*A. calliglypta* DALL, 1903); OD]. Rather small, rounded; divaricate sculpture. Ill-defined lunule. Two cardinals on each valve; lateral teeth long and narrow, anteriorly in RV but posteriorly in LV. Crenate margin. *Jur.-Rec.*, Medit.

G. (Gonilia) [30]. Suborbicular, with rather incurved low beaks; small lunule, no posterior area. Long narrow *PII*. Rec., Medit.——FIG. E65,*6*. *G. calliglypta* (DALL), Sicily; *6a*, LV ext., ×5; *6b,c*, LV hinge, RV int., ×8 (Chavan, n; Philippi, 1847).

G. (Ensio) Cox, 1962 [30a] [**Ptychomya agassizi* LYCETT, 1850; OD]. With a trigonal tendency, erected beaks; narrow, obtusely bordered lunule and escutcheon; *4b* somewhat grooved. *Jur.*, Eng.-Afr.(Borneo).

Goodallia TURTON, 1822 [**Mactra triangularis* MONTAGU, 1803; SD HERMANNSEN, 1847]. More or less trigonal, high, small. Anterior right lateral extending upward to beak, *3b, 5b; 2* and *4b, PII*. Broad scars. Margin crenate or not. *M.Jur. (Bathon.)-Rec.*, Eu.-Atl.

G. (Goodallia) [28] [=*Mactrina* BROWN, 1827 (obj.); *Mactroidea* BROWN, 1827]. Trigonal, smooth; almost orthogyrous; *3b* strongly bifid; *AII* indistinct, *PII* elongated. Margin crenate in adult stages. *Mio.(Burdigal.)-Rec.*, W.Eu.——FIG. E65,*5*; E66A,*3*. **G. (G.) triangularis* (MONTAGU); Rec., Atl., E65,*5a*, LV ext., ×6; E65,*5b*, RV hinge, enl. *(511*; Turton, 1822); Rec., Eng.(Sussex), E66A,*3a,b*, RV ext., LV int., ×22 *(905a)*.

G. (Ancliffia) Cox & ARKELL, 1948 [29] [**Astarte pumila* J. DE C. SOWERBY, 1824; OD]. Subtrigonal-rounded, with prominent curved beaks; finely striated. Cordiform shallow lunule and posterior area. Trigonal cardinals, obscure *AII*, short *PII*. Broad scars. Margin usually crenulate. *M.Jur.*, Eu.——FIG. E65,*8*. **G. (A.) pumila* (J. DE C. SOWERBY), Bathon., Eng.; LV int., ×4 (Chavan, n).

Kaibabella H. CHRONIC, 1952 [15] [**K. curvilineata*; OD]. Ovatotrigonal, compressed, with rounded concentric ribs. Lunule and escutcheon poorly defined. Anterior cardinals in prolongation of obsolete laterals: *3a, 4b*, strong; *5b, 6b* present. No posterior laminae. Inner margin apparently smooth. *Perm.*, USA(Ariz.).——FIG. E65, *9*. **K. curvilineata*; *9a*, LV ext., ×2; *9b,c*, LV and RV hinges, ×2 *(128)*.

?Matheria BILLINGS, 1858 [19] [**M. tener*; SD MILLER, 1889]. Subrectangular, very inequilateral; numerous concentric ribs and several growth-furrows; prosogyrous rounded beaks; concave lunule. Hinge with 2 LV and 1 RV distinct cardinals; short right lunular margin. [May belong in Cyrtodontidae; see Cyrtodontacea.] *M.Ord.*, N.Am. (Can.).——FIG. E65,*10*. **M. tenera*; *10a,b*, LV ext., int., ×1 *(618)*.

Megapraeconia CHAVAN, 1952 [21] [**Hippopodium bajocense* THÉVENIN, 1909 (*ex* D'ORBIGNY, 1850); OD]. Trapezoidal to ovate, large, very inequilateral and thick, posteriorly attenuated. Concentric irregular ribbing. Cordiform deep lunule under the curved beaks. Strong anterior scar. Much extended hinge plate with 2 high, massive, cardinals on each valve and obsolete short posterior laterals. Smooth margin. *Jur.(Bajoc.-Lusitan.), ?L.Cret. (Neocom.)*, W.Eu.——FIG. E67,*2*. **M. bajocensis* (THÉVENIN), Bajoc., W.France; *2a,b*, RV int., LV int., ×0.5 (Thévenin, 1909).

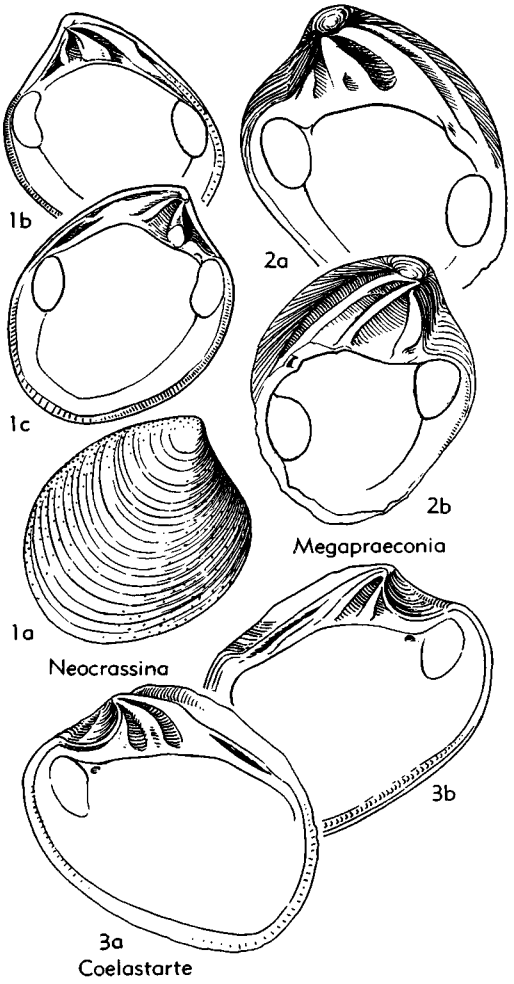


FIG. E67. Astartidae (Astartinae) (p. *N565-N567*).

Neocrassina FISCHER, 1886 [1887] [*nom. subst. pro Crassinella* BAYLE, 1878 (*non* GUPPY, 1874)] [**Astarte obliqua* DESHAYES, 1830 (=*Cypricardia obliqua* LAMARCK, 1819); SD DALL, 1903] [=*Puschia* ROUILLIER & VOSSYNSKI, 1847 (subj.) (type, *Astarte planata* SOWERBY, 1816; M]; *Oreada* ROUILLIER & VOSSYNSKI, 1847 *(nom. nud.)*; *Pruvostiella* AGRAWAL, 1955 (subj.) (type, *Astarte (P.) freneixae*)]. Ovate or trapezoidal, inequilateral, rather thick; concentric ribs commonly vanishing on adults. Two trigonal cardinals and strong posterior lateral on each valve. Broad flattened nymph; no *5b*. Margin denticulated or not. *L.Jur.(U.Lias.)-U.Cret.(Turon.)*, Eu.-Madag.-S.Afr.

N. (Neocrassina) [23]. Slightly depressed lunule; external escutcheon; *PII* considerably behind nymph. *L.Jur.(U.Lias.)-L.Cret.*, Eu.-Madag.——FIG. E67,*1*. **N. (N.) obliqua* (LAMARCK), Bajoc., W.France; *1a-c*, RV ext., int., LV int., ×0.5 (Bayle, 1879).

N. (Coelastarte) BÖHM, 1893 [24] [**Astarte excavata* SOWERBY, 1819; OD]. Excavated lunule; obliquely penetrating, flat escutcheon; compressed cardinals; *PII* just behind nymph. *L.Jur.(Aalen.)-U.Cret.(Turon.)*, Eu.-Madag.-S.Afr.——FIG. E67, *3*. **N. (C.) excavata* (SOWERBY), Bajoc., W. France; *3a,b*, RV int., LV int., ×0.6 (Böhm, 1893).

Nicaniella CHAVAN, 1945 [**Astarte communis* ZITTEL & GOUBERT, 1861; OD]. Trigonal or trapezoidal, small. Concentric ribs regular anteriorly and medially, faint or irregular posteriorly and ventrally. Inner margin usually crenate. Broad well-defined lunule and escutcheon. Hinge with small and strong cardinals, no *3a;* laminar laterals; short narrow nymph. *M.Jur.-Paleoc., ?Plio.*, N.Eu.-W.Eu.-Japan.

N. (Nicaniella) [11]. Trigonal to subquadrangular, with moderately prominent beaks; convex or straight posterior margin. Well-marked laterals. *U.Jur.-Paleoc., ?Plio.*, Eu.——FIG. E65,*12*. **N. (N.) communis* (ZITTEL & GOUBERT), U.Jur. (Sequan.), W.France; *12a,b*, LV ext., int., ×4; *12c*, RV hinge, ×5.1 (Chavan, 1945; Zittel & Goubert, 1861).

N. (Trautscholdia) Cox & ARKELL, 1948 [12] [**Astarte cordata* TRAUTSCHOLD, 1861; OD]. Cordate, wtih high inflated beaks; more or less flexuous anterior, concave posterior margin. Strong *AI*; narrow cardinals. Impressed cordiform lunule and lanceolated escutcheon. *M.Jur.-U.Jur.*, NW.Eu.——FIG. E65,*13*. **N. (T.) cordata* (TRAUTSCHOLD), Jur., USSR; *13a,b*, LV ext., int., ×0.7; *13c*, both valves, ant., ×0.7 (Rouillier, 1847).

Parisiella COSSMANN, 1887 [26] [**P. ambigua*; M]. Very oblique, inequilateral, small and flattened. Fine concentric ribbing. Each valve with 2 well-marked divergent cardinals, *3b* lobate; lateral remote, rather faint. Posterior scar somewhat raised. Smooth margin. *M.Eoc.(Lutet.)*, Eu.(France).——FIG. E65,*7*. **P. ambigua*, Paris basin; *7a-c*, RV ext., int., LV int., ×10 *(160)*.

Praeconia STOLICZKA, 1871 [20] [**Astarte terminalis* ROEMER, 1842 (=*A. terminalis* DESHAYES, 1839-42, =*Hippopodium gibbosum* THÉVENIN, 1909) (*ex* D'ORBIGNY, 1850); OD] [=*Theveninia* ROMAN, 1921 (obj.)]. Subtrapezoidal, compressed, thick, very inequilateral, with median depression and posterior enlargement. Numerous concentric rounded ribs and more or less equidistant growth furrows. Small deep concave lunule. Trigonal *3b*, with faint *AIII-3a* in front; *2, 4b* and remote, elongated *PII*. Margin irregularly crenate. *Jur.(L. Lias.-Lusitan.)*, Eu.(France)-Japan.——FIG. E65, *18a,b*. **P. terminalis* (DESHAYES), M.Jur.(Bajoc.),

W.France; *18a,* RV view, ext., ×0.7; *18b,* RV int., ×1 (*257*; Thévenin, 1909).——Fig. E65, *18c. P. sarthacensis* Cossmann, M.Jur.(Bathon.), W.France; LV int., ×1 (Cossmann, 1914).

Prorokia Böhm, 1893 [25] [**Cardita ovalis* Quenstedt, 1852; OD] [=*Pachytypus* Munier-Chalmas (*ex* Fischer, MS), 1887 (type, *Cardita problematica* Buvignier, 1852; OD)]. Subelliptical, thick, rather small, concentrically ribbed. No lunule or escutcheon. Widely divergent cardinals. *3b* largely trigonal, *3a, 2* and *4b* long and thin; remote posterior laterals, no anterior ones. Raised posterior scar. Crenate margin. *M.Jur.(Bathon.)-U.Jur.(Kimmeridg.),* Eu.——Fig. E65,*11. P. problematica* (Buvignier), U.Jur.(Raurac.), E. France; *11a-c,* LV ext., int., RV int., ×2 (Buvignier, 1852).

?**Seendia** Casey, 1961 (25a) [**Crassatella saxoneti* Pictet & Roux, 1847; OD]. Transversely inequilateral, subrectangular, thick, compressed. Narrow well-defined lunule. Concentric ridges and faint radial lines; margin crenate. Narrow hinge, with 2 cardinals in each valve, *3b* much larger; ligament said to be sunken; posterior adductor surelevated. [Possibly belongs to Eryphylinae.] *L.Cret.,* W.Eu.

Sita Semper, 1862 [27] [**Woodia crenulata* Deshayes, 1860; SD Chavan, herein] [=*Crenimargo* Cossmann, 1902 (obj.)]. Ovate, smooth, rather small. Each valve with 2 cardinals, LV anterior and RV posterior ones strongly lobate; no laterals. Ovately elongated scars. Margin obliquely crenulate. *Eoc.,* W.Eu.——Fig. E65,*14. *S. crenulata* (Deshayes), M.Eoc.(Lutet.), France(Paris basin); *14a,* LV ext., ×4; *14b,c,* U.Eoc.(Barton.), Belg., LV int., RV int., enl. (Glibert, 1936).

[Although originally indicated to be Sanskrit name, *Sita* is here accepted as a properly latinized designation with priority over *Crenimargo,* which was based on misinterpretation of the same species.]

Tridonta Schumacher, 1817 [**T. borealis* (=**Venus borealis* Chemnitz, 1784, invalid non-binom. ICZN); M] [=*Triodonta* Agassiz, 1846 *(nom. null.)*]. Transversely quadrangular to rounded; closely spaced concentric ribs at least in early growth stages; inner margin usually smooth. Hinge lacking *AIV* and *PI*; strong short *AI* and *PII*. Broad nymph behind small *6b*. [Localized in cold and temperate waters.] *L.Cret.-Rec.,* Arctic-N.N.Am.-Japan-Eu.

T. (Tridonta) [8]. Medium-sized, transversely inequilateral; concentric ribs more or less vanishing on the disc. Flattened long lunule. *L.Cret. (Neocom.)-Rec.,* Atl.——Fig. E65,*17. *T. (T.) borealis,* Rec., North Sea; *17a,* LV ext., ×1; *17b,c,* LV and RV hinges, ×0.5 (*511*; Sowerby, 1854).

T. (Nicania) Leach, 1819 [9] [**N. banksii* (=*Venus montagui* Dillwyn, 1817 *var. banksii*); SD Gray, 1847]. Smaller, less inequilateral, with persistent concentric rounded ribs. Very long more depressed lunule, obliterating *3a;* large, somewhat bifid *3b*; posterior cardinals laminar; *AI* strong and *PII* remote, springing from under hinge plate. *Pleist.-Rec.,* circumpolar-N.Eu.-N.N.Am.-Japan.——Fig. E65,*16. *T. (N.) montagui* (Dillwyn), Rec., USA(Mass.); *16a,b,* LV ext., RV int., ×1 (Gould, 1841).

T. (Rictocyma) Dall, 1872 [10] [**R. mirabilis*; M] [=*Rhectocyma* von Martens, 1873, emend.]. With concentric striae and larger ribs, becoming broadly irregular, oblique, and interrupted on disc. *Plio.-Rec.,* Arctic.——Fig. E65,*15. *T. (R.) mirabilis* (Dall), Rec., Unga Is.; LV ext., ×3 (Dall, 1872).

Yabea Hayami, 1965 [22] [**Astarte shinanoensis* Yabe & Nagao in Yabe, Nagao, & Shimizu, 1926; OD]. Very inequilateral, strongly convex, trapezoidal, with prominent prosogyrous beaks; deeply depressed lunule; margin crenulated; *3a* short, curved, *3b, 5b* narrow, not clearly separated from the nymph; *2, 4b*; well developed both anterior and long posterior laterals. *L.Cret.,* Japan.

Subfamily ERIPHYLINAE Chavan, 1952

Shell lenticular or crassatelliform, commonly with pointed beaks. Hinge with *AIV* reaching almost to beak, its socket forming narrow groove in front of *3a*; other laterals (when present) also elongate and laminar. *Dev.-Eoc.*

Arrangement of generic taxa by Chavan.——1. *Eriphyla.*——2. *Dozyia.*——3. *Herzogina.*——4. *Amphiaraus.*——5. *Bruniastarte.*——6. *Eriphylopsis.*——7. *Disparilia.*——8. *Crassatellopsis.*——9. *Astartemya.*——10. *Freiastarte.*——11. *Crassatellina.*——12. *Cardiniopsis.*——13. *Lirodiscus.*——14. *Crustuloides.*

Eriphyla Gabb, 1867 [**E. umbonata* Gabb, 1864; OD]. Almost equilateral, rounded; smooth or finely lamellar. Obliquely depressed lunule; narrow escutcheon. Hinge with 2 cardinals on each valve, *4b* not reaching inferior margin of plate but posteriorly fused to nymphal thickening; *AIII, AIV, PII, PIII* present. Shallow pallial inflexion. Margin smooth or crenulate. *Cret.,* W.N.Am.-W.Eu.-Japan. [=*Mikayoella* Hayami, 1965 (type, *Astarte mikayoensis* Nagao in Yabe, 1927; OD).]

E. (Eriphyla) [1]. Thickened, high; *3a* fused to *AIII, 3b* not very oblique, *4b* reduced to its upper part; posterior laterals not far behind cardinals. *Cret.,* W.N.Am.-W.Eu.——Fig. E68,*1. E. (E.) lapidis* (Packard), U.Cret., USA(Calif.); *1a,b,* LV and RV hinges, ×0.75 *(748)*.

E. (Dozyia) Bosquet in Dewalque, 1868 [2] [**D. lenticularis* (=**Lucina lenticularis* Goldfuss, 1840); M]. Broader and thinner than *E. (Eriphyla)*; *3a* separated from *AIII, 3b* very oblique, *4b* widened posteriorly; posterior laterals

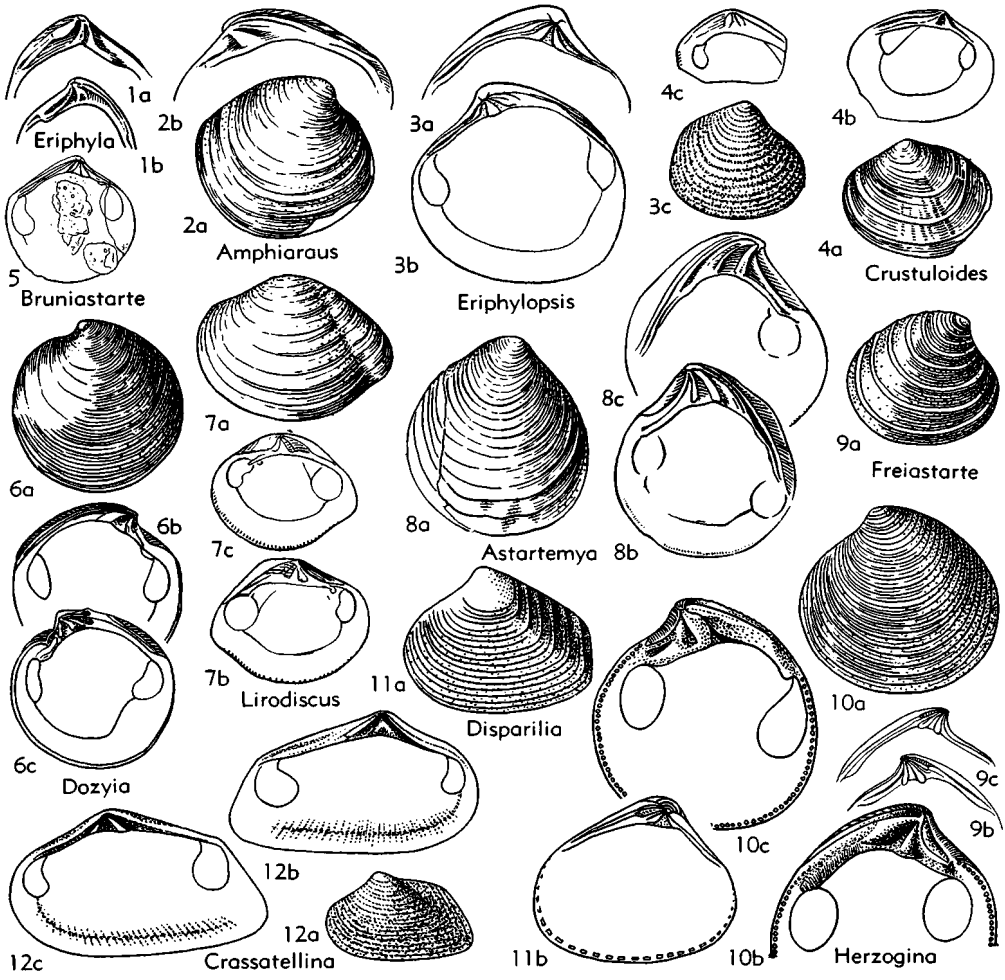


FIG. E68. Astartidae (Eriphylinae) (p. *N*568-*N*571).

remote. *U.Cret.(Senon.)*, W.N.Am.-W.Eu.——FIG. E68,*6*. **E. (D.) lenticularis* (GOLDFUSS), Campan., Neth.; *6a-c*, LV ext., int., RV int., ×0.7 *(415)*.

Amphiaraus VOKES, 1946 [**A. seleniscus*; OD]. Flattened and rounded, inequilateral, smooth. Almost flat lunule and sharply limited escutcheon. Hinge with *AIII-3a* under *AIV*; *3b* trigonal, *5b*, and broad nymphal plate; remote posterior laterals. *M. Jur.(Bajoc.)-L. Cret.(Apt.)*, M. East(Lebanon)-W.Eu.

[Supposition by Cox that *Amphiaraus* is a junior synonym of *Eomiodon* Cox, 1935, classed in the family Eomiodontidae of the Glossacea, is firmly rejected by CHAVAN, who points out that the shell of *Amphiaraus* is lenticular, contrasting strongly with the peculiar trigonal-transverse outline of the angular shell of *Eomiodon*, with lamellose ornament. Further, *Eomiodon* has long sinuate lateral teeth, no *AIV* groove above *3a*, and bears *PI*, a tooth which is lacking in *Amphiaraus* and basically in other astartids.—Ed.] [CHAVAN states (11 January, 1967): "*Amphiaraus* has been treated by several authors as a small neomiodontid (arcticacean), but its small, remote *fAIV* above a stout, noncorbiculoid *AIII*, as well as its *PIII*, instead of *PI*, astartoid cardinals, and lenticular form, are characteristic of the Eriphylinae."]

A. (Amphiaraus) [4]. Transversely ovate. Broad *AIII-3a*; *3b* very oblique; strong right posterior ridge or lateral. *L.Cret.(Apt.)*, Lebanon.——FIG. E68,*2*. **A. (A.) seleniscus* VOKES; *2a,b*, RV ext., hinge, ×0.75, ×1 *(945)*.

A. (Bruniastarte) CHAVAN, 1952 [5] [**Astarte thoas* THÉVENIN, 1909; OD]. Subquadrangular. *AIV* straight and raised; *AIII-3a* thinner; *3b* not very oblique, *PIII* faint. *M.Jur.(Bajoc.)*, Eu.(W. France).——FIG. E68,*5*. **A. (B.) thoas* (THÉVENIN); LV int., ×1 *(110, 111)*.

Astartemya STEPHENSON, 1941 [**A. fentressensis*; OD]. Subtrigonal to ovate, flattened; prominent

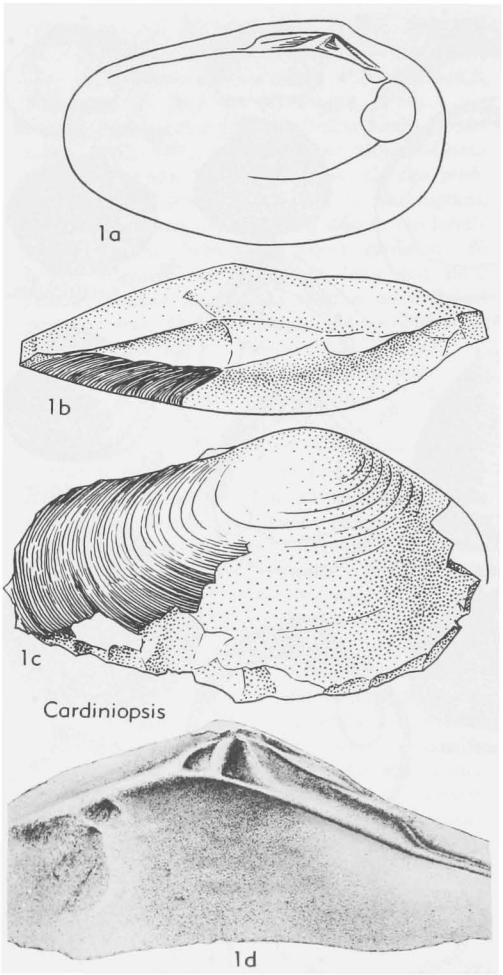


FIG. E69. Astartidae (Eriphylinae) (p. *N570*).

curved beaks. Concentric waves or ribs and fine growth lines. Depressed lunule, flat escutcheon. Hinge with long laterals prolonged upward, commonly to beaks; 2 oblique cardinals on each valve, *5b* obsolete. Flat nymphal plate in front of narrow crest and furrow. Slight pallial impression. *U.Cret., ?Paleoc.,* cosmop.

A. (Astartemya) [9]. Higher than long, subovate; shallow undulations; grooved cardinals; laterals bounded by flangelike plate, anterior ones reaching beaks. Broad nymph. Fine marginal crenulations. *U.Cret.(Senon.),* cosmop.——FIG. E68,*8*. **A. (A.) fentressensis* STEPHENSON, USA(Tex.); *8a-c,* RV ext., int., LV int., ×0.7 *(889)*.

A. (Freiastarte) CHAVAN, 1952 [10] [*nom. subst. pro Freia* BÖHM, 1884 (*non* CLAPARÉDE & LACHMANN, 1858)] [**Astarte coelata* MÜLLER, 1847 (=**Astarte similis* MÜNSTER in GOLDFUSS, 1837 [1840]); OD]. Small, subtrigonal; concentric distant ribs. Anterior laterals not completely reaching beaks, posterior ones thickened behind, *5b* conspicuous. Ligamentary plate on a superficial reed-shaped area. Margin strongly crenate, sometimes smooth. *Cret.,* and possibly *Paleoc.,* W.Eu.-S.Afr.-India. —— FIG. E68,*9*. **A. (F.) similis* (MÜNSTER in GOLDFUSS), Campan., Neth.; *9a-c,* RV ext., RV and LV hinges, ×0.7 *(110, 111, 415)*.

Cardiniopsis STANTON, 1895 [12] [**C. unioides*; OD]. Largely transverse, anteriorly rounded and posteriorly narrowed. Hinge with one prominent median RV cardinal; *3a, 5b,* faint, and 2 subsymmetric LV teeth. Broad long nymph, no laterals except for weak *AIV* in front of 2. Well-impressed pedal scars. *L.Cret.,* USA(Calif.).——FIG. E69,*1*. **C. unioides; 1a,* LV int., ×0.3; *1b,* both valves, dorsal, ×0.3; *1c,* RV ext., ×0.3; *1d,* RV hinge, ×0.5 *(877)*.

Crassatellina MEEK, 1871 [11] [**C. oblonga*; OD]. Transversely subtrapezoidal, rather small. Well-marked anterior lateral prolonged up to beak, in front of cardinals; *2* and *3b* bifid. Elongated nymph. No posterior laterals. *U.Cret.,* USA(N. Dak.-Kans.).——FIG. E68,*12*. **C. oblonga,* USA (Kan.); *12a,* LV ext., ×1; *12b,c,* LV int., RV int., ×2 (Meek & Hayden, 1856).

Crassatellopsis BEUSHAUSEN, 1895 [8] [**C. hauchecornei*; M]. Sublenticular, almost smooth. Pointed beaks. Hinge with stout trigonal anterior LV cardinal and obliquely directed RV one; posterior left and anterior right, both thinner. Very narrow, almost linear resilium apparently present. Anterior scar somewhat elliptical. *Dev.,* Eu.(Ger.).——FIG. E70,*1*. **C. hauchecornei,* Rheinland; *1a-c,* LV int., RV int., LV int., ×1 *(47)*.

Disparilia CHAVAN, 1953 [7] [**Astarte disparilis* D'ORBIGNY, 1843; OD]. Trigonal-transverse, posteriorly narrowed; concentric somewhat lamellar ribs. Hinge with almost obsolete laterals, narrow *3a* and *5b, 2,* stout *3b* and *4b*. External ligament sunken into recess of escutcheon, simulating resilial socket. Crenate margin. *Cret.,* W.Eu.-N.Afr.-Lebanon.——FIG. E68,*11*. **D. disparilis* (D'ORBIGNY), L.Cret.(Neocom.), E.France; *11a,b,* LV ext., int., ×1.5 *(115, 695)*.

Eriphylopsis MEEK, 1876 [6] [**Eriphyla gregaria* MEEK & HAYDEN, 1856; OD]. Subtrapezoidal to rounded, rather small; concentrically undulate, lunule relatively broad. Hinge with elongate laterals, RV anterior and LV posterior ones duplicate, and anterior cardinals more or less in prolongation of their laterals; stout posterior cardinals. *U.Cret.,* W.Eu.-S.Eu.-W.N.Am.——FIG. E68,*3*. **E. gregaria* (MEEK & HAYDEN), USA(Mont.); *3a,b,* LV hinge, RV hinge, ×2 (Chavan, n); *3c,* RV ext., ×1.5 (Meek & Hayden, 1856).

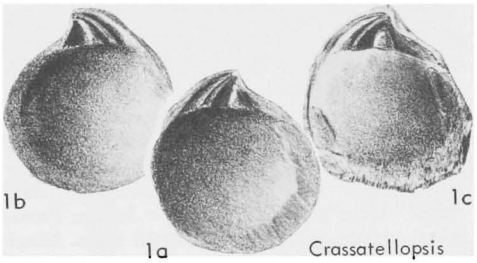


FIG. E70. Astartidae (Eriphylinae) (p. *N570*).

Herzogina CHAVAN, 1952 [3] [**Astarte herzogi* KRAUSS, 1850 (=**Cytherea herzogii* HAUSSMANN, 1837); OD]. Rounded, moderately convex, with strong concentric ribs. Depressed lunule. Hinge with marginal *AIV, AIII* almost perpendicular to *3a, 3b* curved onwards on its lower part; a broad depression for *4b* and the nymph; remote posterior laterals. Crenate margin. *L.Cret.(Neocom.),* S.Afr.——FIG. E68,*10*. **H. herzogii* (HAUSSMANN); *10a-c,* LV ext., int., RV int., ×0.7 (Krauss, 1850).

Lirodiscus CONRAD, 1869 [**Astarte tellinoides* CONRAD, 1833; SD DALL, 1903]. More or less transversely rounded and compressed. Concentrically sculptured. Flattened beaks and escutcheon. Two cardinals on each valve; anterior laterals obliquely directed; posterior ones prolonged under ligamentar extension. Well-impressed scars. Margin commonly denticulate. *Eoc.,* USA.

L. (Lirodiscus) [13]. Thickened, with strong concentric ribs and growth striae; with posterior fold. Broad lunule and escutcheon. Flat nymph with undulating growth striae, extending up from posterior margin to and above *3b* and *4b*. Anterior left laterals bifurcate under lunule. *Eoc.,* USA.——FIG. E68,*7*. **L. (L.) tellinoides* (CONRAD), M.Eoc., Ala.; *7a-c,* LV ext., int., RV int., ×1 (Harris, 1919).

L. (Crustuloides) G. D. HARRIS, 1919 [14] [**Crassatellites (Scambula) psychopterus* DALL, 1903; M]. Thin, much compressed; irregularly striated, undulating peripherally; lunule and escutcheon linear. Hinge plate enlarged in front, with one straight anterior lateral; posterior ones somewhat broadened. *L.Eoc.,* USA(Miss.).——FIG. E68,*4*. **L. (C.) psychopterus* (DALL); *4a-c,* LV ext., int., RV int., ×1 (Harris, 1919).

Subfamily OPINAE Chavan, 1952

[*nom. correct.* herein (*pro* Opisinae CHAVAN, 1952)]

Very high beaks; anterior laterals obsolete; high, trigonal cardinals. Oblong or transverse carinated shell, with a defined posterior area *(50). Dev.-U.Cret.*

Arrangement of generic taxa by CHAVAN.——1. *Opis.*——2. *Trigonopis.*——3. *Pachyopis.*——4. *Coelopis.*——5. *Cryptocoelopis.*——6. *Prosocoelus.*——7. *Tripleura.*——8. *Prosocoelogeton.*——9. *Heteropis.*——10. *Trigonastarte.*——11. *Seebachia.*——12. *Opisoma.*

Opis DEFRANCE, 1825 (1824, *nom. nud.*) [**Trigonia cardissoides* LAMARCK, 1819; M]. Obliquely oblong, with prominent beaks. Ventral margin curved in front of medioposterior undulation; posterior margin then truncated. Concentric ribbing. More or less shallow lunule. Large hinge, without laterals; one strong RV trigonal and 2 LV cardinals, commonly with their lateral faces striated; *4b* stronger than *2*. Ligament narrow. Margin more or less crenate. *L.Jur.(Lias.)-U.Cret.,* Eu.-Madag.-N.Am.-Japan.

O. (Opis) [1]. Subtrigonal, rounded in front and ventrally, inflated, obliquely elongated. Erect beaks. Lunule large, somewhat depressed. Ribs closely spaced. Hinge with *3b* triangular and high. *L.Jur.(Lias.)-U.Cret.,* Eu.-N.Am.-Madag.——FIG. E71,*2*. **O. (O.) cardissoides* (LAMARCK), U.Cret.(Cenoman.), Belg.; *2a,b,* RV ext., ant.; *2c,d,* LV hinge view, ant.; *2e,* LV int. mold, ×1 (*50*; d'Archiac, 1847).

O. (Pachyopis) BIGOT, 1895 [3] [**O. ponderosa* DESLONGCHAMPS, 1883; OD]. Much inflated, thick; ventrally (instead of posteroventrally) elongated. Ribs crossed by median and postmedian angulation. Beaks rounded and conspicuously prosogyrous. Very shallow lunule. Rudimentary anterior LV cardinal. Margin crenate. *Jur. (Bajoc.-Lusitan.),* W.Eu.——FIG. E72,*3*. **O. (P.) ponderosa* DESLONGCHAMPS, Bajoc., W. France; *3a,b,* RV ext., int., ×0.7 *(50)*.

O. (Trigonopis) FISCHER (*ex* MUNIER-CHALMAS, MS), 1887 [2] [**Opis similis* D'ORBIGNY, 1844 (=*Cardita similis* SOWERBY, 1819); M]. Subtrapezoidal, angular in front; inflated, but slightly curved forward; narrow regularly spaced ribs; strong medioposterior angulation. Rounded beaks. Shallow lunule; *3b* largely and more or less obtusely triangular. *L.Jur.-L.Cret.,* W.Eu.——FIG. E71,*3*. *O. (T.) praesimilis* COSSMANN, M.Jur. (Bajoc.), France; *3a-c,* RV ext., int., LV int., ×3 *(161)*.

Coelopis FISCHER (*ex* MUNIER-CHALMAS, MS), 1887 [**"Opis lunulata* MILLER" (*errore pro* **Cardita lunulata* J. SOWERBY, 1819); M]. Subquadrangular to subtrapezoidal, with almost enrolled prosogyrous beaks and large depressed well-defined lunule. Concentric ribbing; anteromedian and medioposterior carinas. Relatively restricted hinge with one strong RV and 2 LV narrow cardinals, without lateral striations; 2 very rudimentary. Denticulated margin. *M.Trias.-L.Cret.,* Eu.

C. (Coelopis) [4]. Without chamber individualized in front of teeth. *M.Trias.-L.Cret.,* Eu.——FIG. E71,*1a*. **C. (C.) lunulata* (SOWERBY), M.Jur.

(Bathon.), France; RV ext., ×3 (Cossmann, 1918).——Fig. E71,*1b-d. C. (C.) affinis* Laube, M.Trias.(Ladin.), Aus.(Tyrol); *1b,c,* LV ant., hinge; *1d,* RV hinge; all ×3 *(58).*

C. (Cryptocoelopis) Bittner, 1895 [5] [**Opis locularis* Bittner, 1895 (=*?O. affinis* Laube, 1865, "female form"); SD Chavan, herein]. With a wide chamber individualized between the lunular margin and the anterior margin of the hinge plate, thus duplicated. *M.Trias. (Ladin.),* Eu.(Aus.).——Fig. E72,*2. *C. (C.) locularis* (Bittner), Tyrol; LV hinge, ×3 *(58).*

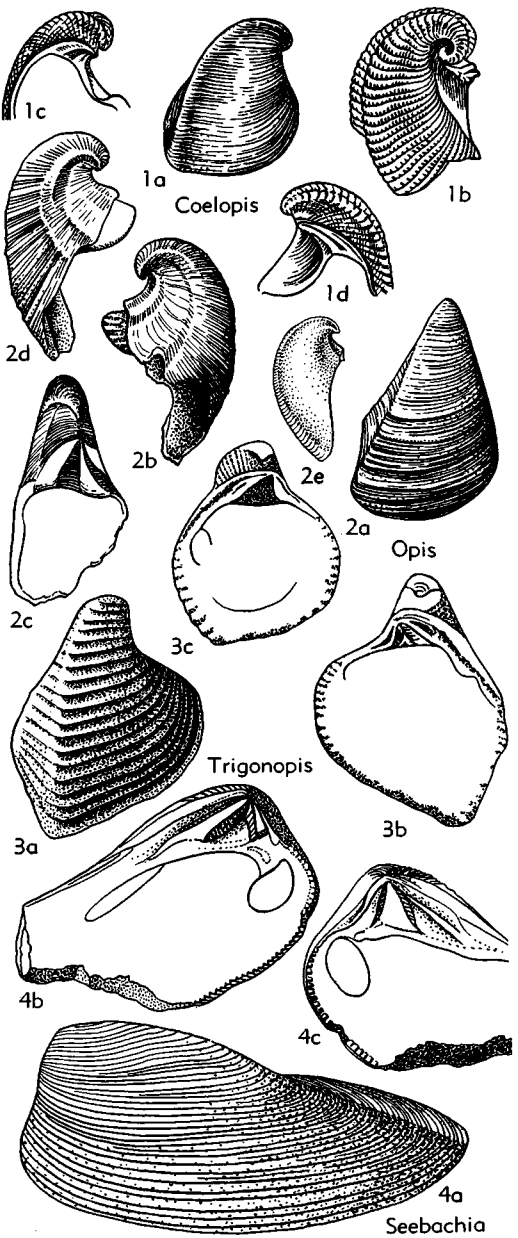


Fig. E71. Astartidae (Opinae) (p. *N*571-*N*573).

Heteropis Böhm, 1893 [9] [**Opis carinata* Quenstedt, 1858; OD]. Higher than long, inequilateral, with medioposterior angulation; finely ribbed. Large flattened or shallow lunule. Prosogyrous oblique prominent, but small beaks. Hinge with anterior laterals partly developed and fused to anterior cardinals, *3b* narrow; posterior ones rudimentary. Smooth inner margin. *Jur.(Bathon.-Lusitan.),* Eu.——Fig. E72,*1a,b. *H. carinata* (Quenstedt), Lusitan., Ger.; *1a,b,* LV ext., int., ×2 (Buvignier, 1852).——Fig. E72,*1c. H. raulinea* (Buvignier), U.Jur.(U.Oxford.), E.France; RV int., ×1 (Böhm, 1893).

Opisoma Stoliczka, 1871 [12] [**Opis paradoxa* Buvignier, 1852 (=**Cardium paradoxum* Buvignier, 1843); OD]. Trigonal, extremely oblong, with an anteromedian strong carina. Opisthogyrous erect beaks. Concentric striation. Three RV and 2 LV much elongated narrow cardinals; *6b* fused to narrow nymph. Anterior scar on a long platform. *Jur.(Infralias-Raurac.),* Eu.(France).——Fig. E72,*4. *O. paradoxum* (Buvignier), U.Jur. (Lusitan.), E.France; *4a-c,* LV ext., int., RV int., ×0.7 (Buvignier, 1852).

Prosocoelus Keferstein, 1857, p. 155 [**Venus prisca* Roemer, 1843; SD Haffer, 1959]. Medium-sized, ovate, gibbous, umbones high, prosogyrous, more or less anterior; lunule very deep, just below beaks; without lateral teeth; RV with strong cardinal tooth received between 2 teeth of LV, anterior of which is ill-defined conical and posterior rather thin; with several diagonal folds and furrows on mid-posterior area or lacking ornament. *Dev.,* Eu.-Spitz.

P. (Prosocoelus) [6]. Short subquadrate, nearly smooth. *L.Dev.,* Ger.——Fig. E66,*2. *P. (P.) priscus* (Roemer); *2a,b,* RV and LV hinges, ×1; *2c,* RV int., ×0.3 (Haffer, 1959).

P. (Tripleura) Sandberger, 1889 [7] [**T. pesanseris* (=**Grammysia pesanseris* Zeil & Wirtgen, 1851); OD]. Posteriorly elongate, with several radial folds. *L.Dev.,* Ger.

P. (Prosocoelogeton) Quenstedt, 1926 [8] [**P. (P.) lenticularis;* OD]. With distinct *3a* along lunular margin, *4b* shorter and stouter than *3a. U.Dev.,* Spitz.

Seebachia Holub & Neumayr, 1881 [11] [**Astarte bronni* Krauss, 1850; OD]. Transversely trigonal, large and very inequilateral; anterior end rounded, posterior much elongated with dorsal angulation. Concentric ribbing. Lunule and escutcheon developed. Cardinals unequal, striated on their lateral faces, *3b* strongest; anterior laterals small, posterior ones absent. Scars impressed, posterior one

on platform. Margin crenate. *L.Cret.(Neocom.)*, S.Afr.-India.——Fig. E71,*4*. **S. bronni* (Krauss), S.Afr.; *4a-c*, LV ext., int., RV int., ×0.5 (Krauss, 1850).

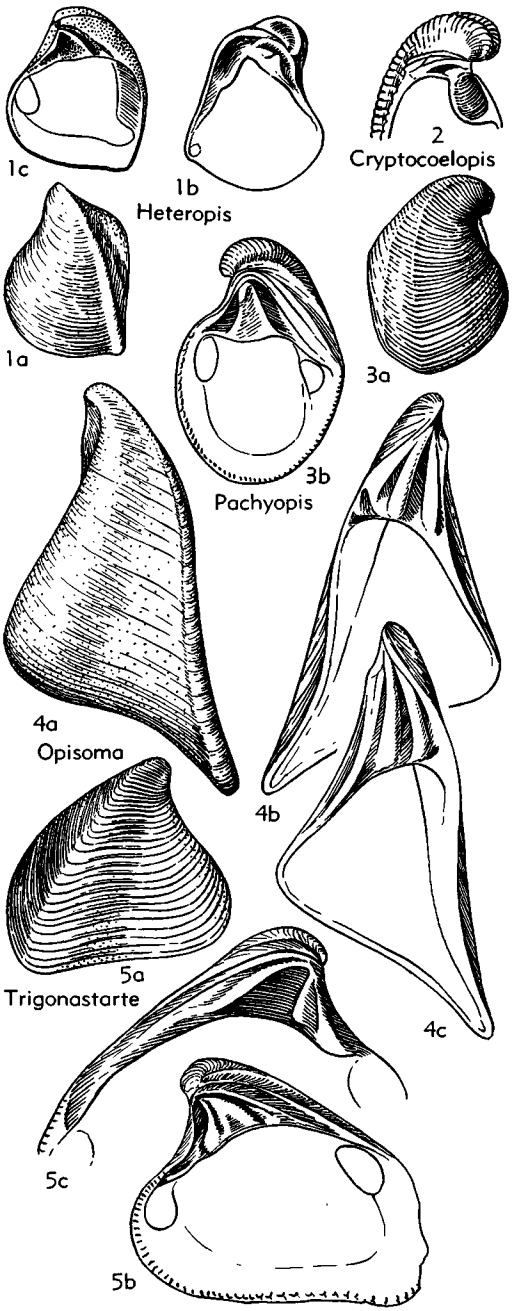


Fig. E72. Astartidae (Opinae) (p. *N571-N573*).

Trigonastarte Bigot, 1895 [10] [**Astarte trigonalis* J. de C. Sowerby, 1824; OD] [=*Opisastarte* Frech & Meyer, 1922 (type, *Astarte trigonalis* Sowerby, 1824; SD Chavan, herein)]. Transversely and inequilaterally trigonal, shortened forward. Prosogyrous beaks; somewhat depressed lunule. Concentric ribbing with medioposterior angulation. One strong RV trigonal and 2 LV cardinals, striated on their lateral faces; poorly marked anterior right and posterior left laterals. Crenulated margin. *M.Jur.*, W.Eu.-Indon.——Fig. E72,*5*. **T. trigonalis* (Sowerby), Bajoc., W.France; *5a-c*, RV ext., int., LV int., ×0.7 *(50, 870)*.

Family CRASSATELLIDAE Férussac, 1822

[=Crassatellitidae Dall, 1895]

Subquadrangular to trigonal in outline, rounded in front, more or less truncated posteriorly. Concentrically ribbed to smooth. Internal layer of radial riblets straight and continuous (so far as observable). Ligament internal, in pit, which commonly obliterates upper part of tooth *4b*; narrowly marginal nymphal ridge behind pit. *Dev.-Rec.*

Subfamily CRASSATELLINAE Férussac, 1822

[*nom. transl.* Chavan, 1952 (*ex* Crassatellidae Férussac, 1822)]

Prosogyrous or orthogyrous beaks; anterior laterals not passing up in front of anterior cardinals. Cardinals divergent. Resilium well developed. *Dev.-Rec.*

Arrangement of generic taxa by Chavan.——1. *Crassatella*.——2. *Pachythaerus*.——3. *Landinia*.——4. *Indocrassatella*.——5. *Salaputium*.——6. *Oriocrassatella*.——7. *Cypricardella*.——8. *Uddenia*.——9. *Crassatina*.——10. *Chattonia*.——11. *Talabrica*.——12. *Eucrassatella*.——13. *Hybolophus*.——14. *Spissatella*.——15. *Bathytormus*.——16. *Anthonya*.

Crassatella Lamarck, 1799 [**Mactra cygnaea* Lamarck, 1799 (*non* Chemnitz, 1782) (=*C. gibba* Lamarck, 1801 =*Venus ponderosa* Gmelin, 1791); SD Schmidt, 1818] [=?*Crassatellites* Krueger, 1823 (type, *C. sinuatus* (*non Crassatella sinuata* Lamarck, 1818); M) *(nom. dub.)*; *Roissya* "Lesson" Schaufuss, 1869]. Subtrapezoidal, thick; prosogyrous beaks. Concentric ribbing and posterior angulation. Lunule and escutcheon deeply sunken. Resilial pit large, but not reaching lower margin of plate. Scars broad, anterior one reniform, posterior one ovate and truncate. Valve margins finely crenulate. *M.Cret.(Turon.)-Mio.*, Eu.-N.Am.

C. (Crassatella) [1]. High, irregular, with more or less vanishing ribs. Short anterior laterals. Post-

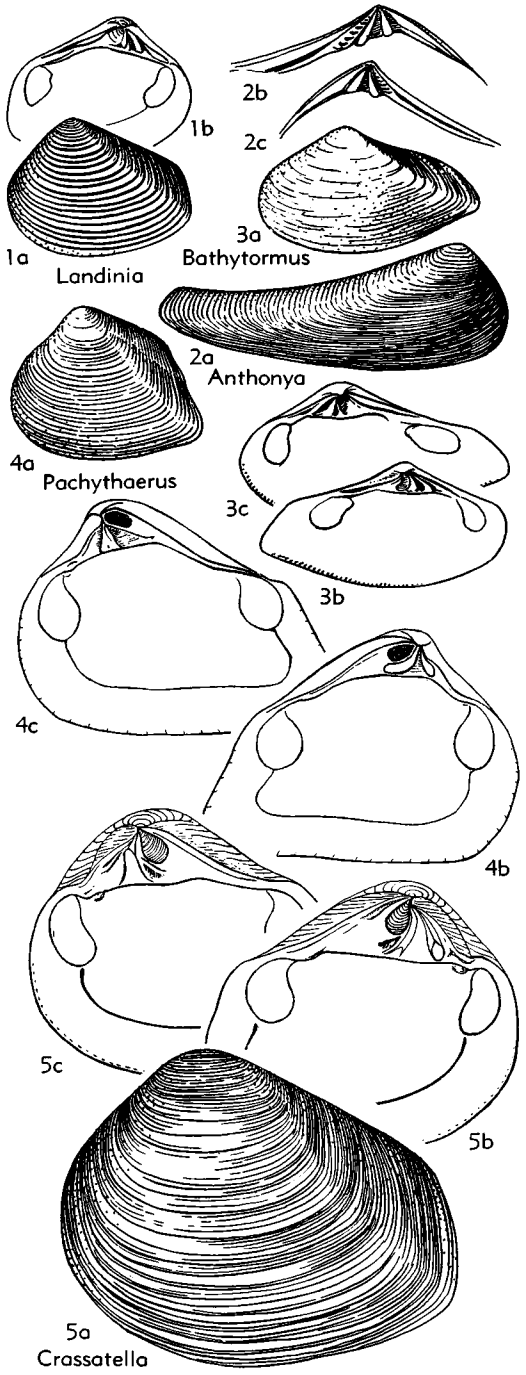


FIG. E73. Crassatellidae (Crassatellinae) (p. *N573-N574*).

resilial ridge prolonged by posterior laterals. *U. Cret.(Turon.)-Mio.(Helvet.)*, Eu.-N.Am.——FIG. E73,*5*. *C. (C.) ponderosa* (GMELIN), M.Eoc., France(Paris basin); *5a-c*, LV ext., int., RV int., ×0.5 (Chavan, n; Deshayes, 1837).

C. (Landinia) CHAVAN, 1952 [3] [**C. landinensis* NYST, 1843; OD]. Transversely elongate, obliquely truncate posteriorly; compressed. Rounded ribs. Anterior teeth long, *2* slightly oblique forward. Strong postresilial ridge, prolonged by remote posterior laterals. *U.Cret.(Senon.)-U.Eoc.*, Eu.-N. Am.-?Palestine.——FIG. E73,*1*. **C. (L.) landinensis* NYST, L.Eoc., France(Paris basin); *1a,b*, LV ext., int., ×0.7 (Deshayes, 1837).

C. (Pachythaerus) CONRAD, 1869 [2] [**C. vindinnensis* D'ORBIGNY, 1843; OD]. With prominent dorsal slope and well-marked posterior angulation. Ribs commonly lamellar. *3b* trigonal, pointed; *4b* curved, continuing far below pit. Postresilial ridge almost fused with margin of escutcheon above laterals. *M.Cret.-M.Eoc.*, Eu.-N.Am.-Japan.——FIG. E73,*4*. **C. (P.) vindinnensis* D'ORBIGNY, L.Turon., W.France; *4a*, LV ext., ×0.75; *4b,c*, LV int., RV int., ×1.4 *(695*; Chavan, n).

Anthonya GABB, 1864 [16] [**A. cultriformis*; M]. Narrowly and transversely inequilateral, flattened; anteriorly rounded, posteriorly much elongated and tapering. Suborthogyrous beaks. Oblique and narrow lunule, flattened escutcheon. Broad obsolete upper anterior lateral, 2 well-developed cardinals, largely oblique resilium and long posterior lateral. *Cret., ?Eoc.*, N.Am.-W.Eu.-Afr.-Asia-Australia-Japan.——FIG. E73,*2*. **A. cultriformis*, U.Cret., USA(Calif.); *2a-c*, RV ext., hinge, LV hinge, ×1 *(333)*.

Bathytormus STEWART, 1930 [15] [**Crassatella protexta* CONRAD, 1832; OD] [=*Crenocrassatella* HABE, 1951 (type, *Crassatella foveolata* SOWERBY, 1870; OD) (subj.)]. Transversely subtrigonal, anterior side rounded, posterior attenuated, in many shells ventrally narrowed. Very small, feebly prosogyrous beaks. Anterior RV lateral laminar, cardinals oblique, very large pit pushing them forward and extending downward to margin of plate and with thin ridge behind it; remote strong laminar laterals. Large scars. Valve margins usually crenulate. *U.Cret.-Rec.*, W.Eu.-N.Am.-NE.Mex.-Asia(India-Japan)-Ghana.——FIG. E73,*3*. **B. protextus* (CONRAD), M.Eoc., USA(Ala.); *3a-c*, LV ext., int., RV int., ×0.7 (Harris, 1919).

Crassatina KOBELT, 1881 [**Crassatella triquetra* "SOWERBY" REEVE (1842) 1843; OD] [=*Crassatina* WEINKAUFF, 1881 *(nom. nud.)*]. Subtrigonal to subquadrate, rather small; prosogyrous beaks. Concentric ribs divided or vanishing backward. Narrow lunule and escutcheon. Anterior RV cardinal more or less prolonging laterals; posterior narrow cardinals and elongate laterals. Trigonal resilium. *Paleoc.-Rec.*, Eu.-Asia(Japan)-Afr.

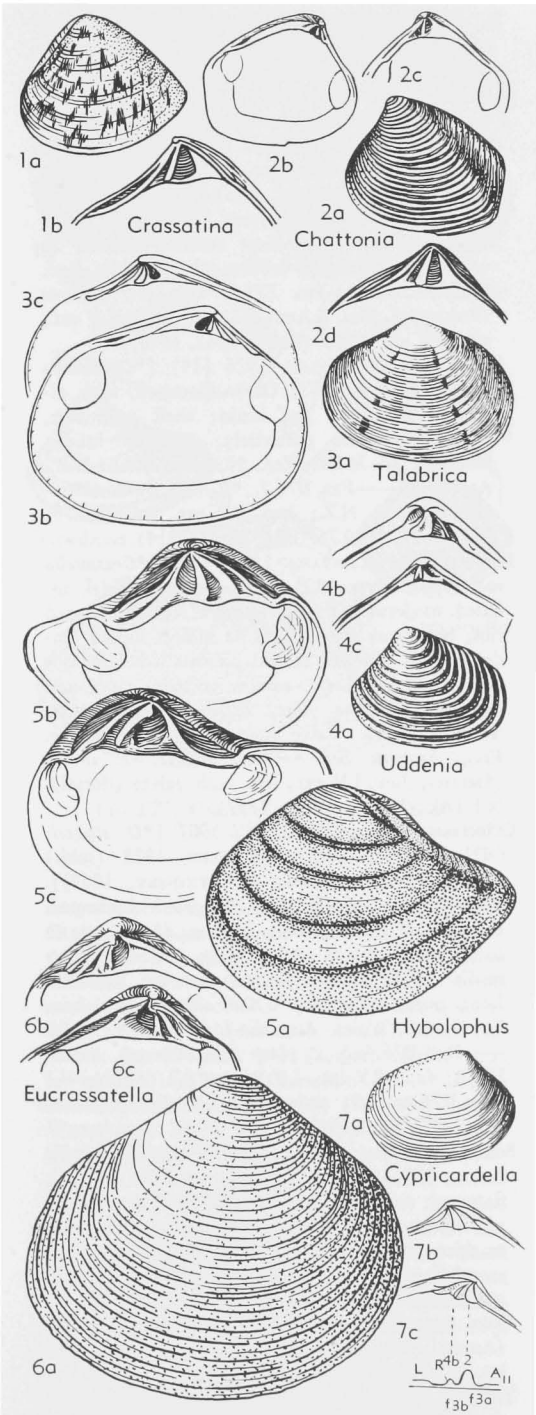


FIG. E74. Crassatellidae (Crassatellinae) (p. *N574-N577*).

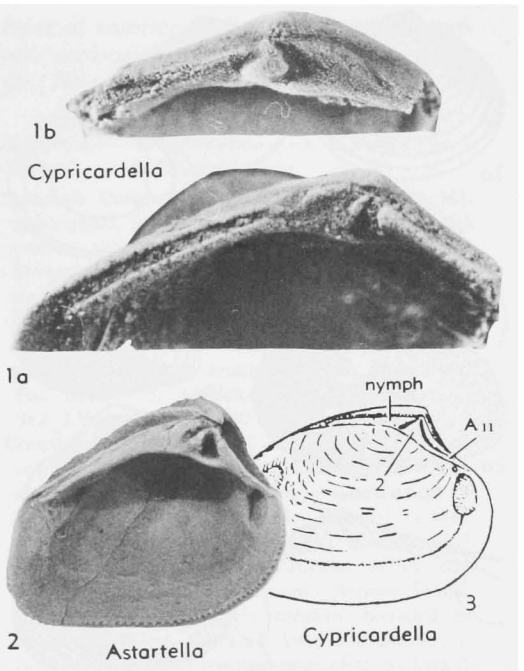


FIG. E75. Crassatellidae (Crassatellinae) (p. *N575-N576*).

C. (Crassatina) [9]. Valve margins crenulate; shell rather thick. Anterior RV cardinal in prolongation of lateral; *3b* slightly curved forward; well-marked ligamentary ridge in prolongation of laterals. *U.Eoc.-Rec.,* Eu.-Afr.-Asia.——FIG. E74,*1a.* **C. (C.) triquetra* (REEVE), Rec., W.Afr.; RV ext., ×1 (Reeve, 1843).——FIG. E74,*1b. C. (C.)* sp. cf. *C. bronni* (WOOD), U.Eoc., Eng.; RV hinge, ×0.7 *(100).*

C. (Chattonia) MARWICK, 1928 [10] [**C. animula;* OD]. Valve margins smooth. Anterior RV cardinal more distinct than lateral; *3b* curved forward; ligamentary ridge and posterior laterals separated. *Paleoc.-Rec.,* W.Eu.-Australia-N.Z.——FIG. E74,*2a-c.* **C. (C.) animula* MARWICK, Oligo., N.Z.; *2a-c,* LV ext., int., RV int., ×4 *(593).*——FIG. E74,*2d. C. (C.) bartonensis* (WOOD), U.Eoc. (Barton.), Eng.; RV hinge, enl. *(100).*

Cypricardella HALL, 1858 [7] [**C. subelliptica*; SD MILLER, 1889]. Subtrapezoidal, flattened, rather small, with somewhat lamellar concentric ribs. Hinge plate narrow; laterals present, long and straight; anterior RV and posterior LV cardinals thin; *3b* stout, virguliform, *2* more or less fused to termination of *AII.* Resilium in front of flat nymph. Elliptical small scars. *Dev.-Carb.,* W. Eu.-N.Am.-India.——FIG. E75,*1.* **C. subelliptica,* Miss., Iowa; *1a,b,* topotypes, LV, RV hinges, ×20, ×12 (Newell, n).——FIG. E75,*3. C.* sp., L.Dev.,

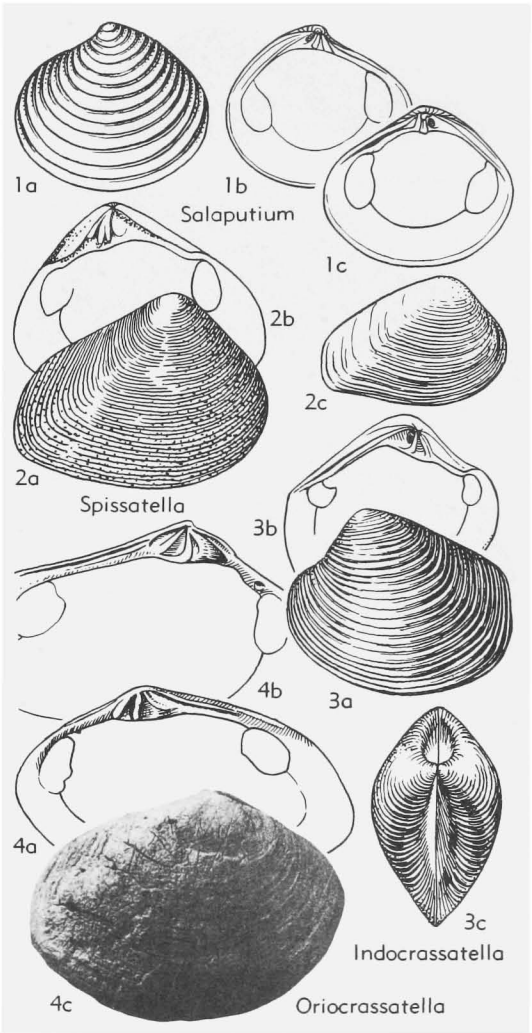


FIG. E76. Crassatellidae (Crassatellinae) (p. *N*576).

Ger.; LV int., diagr. (Haffer, 1959).——FIG. E75, *2. Astartella vera* HALL, U.Penn., Tex.; LV int., ×2 [for comparison with *Cypricardella*] (Newell, n).——FIG. E74,*7. C. baudeti* CHAVAN, Carb., Belg.; *7a,* RV ext., ×1.3 (Hall, 1858); *7b,c,* RV and LV hinges, ×1.3 *(109)*.

Eucrassatella IREDALE, 1924 [**Crassatella kingicola* LAMARCK, 1805; OD]. Transversely subtrigonal and inequilateral, large, thickened; with rounded ventral margin. Concentric ribs vanishing ventrally, stronger and closer toward more or less orthogyrous beaks. Cardinals strong, posterior ones straight in front of large pit which extends downward to lower margin of plate; laterals large. Inner margin smooth. *Paleoc.-Rec.,* Antarctic-N.Z.-W.Eu.-Australia-N.Am.-S.Am.

E. (Eucrassatella) [12]. Rounded, with almost prosogyrous beaks; posterior side truncate. Anterior laterals elongated, cardinals oblique. *Paleoc.,* W.Eu.; *Oligo.-Rec.,* N.Z.-Australia.——FIG. E74, *6. *E. (E.) kingicola* (LAMARCK), Australia; *6a-c,* RV ext., RV and LV hinges, ×0.7 *(509)*.

E. (Hybolophus) STEWART, 1930 [13] [**Crassatella gibbosa* SOWERBY, 1832; OD]. Flattened, with somewhat opisthogyrous beaks; shell tapering backward. Very short anterior laterals; *3a* well separated from lunular margin. *Mio.-Rec.,* N.Am.-S.Am.——FIG. E74,*5. *E. (H.) gibbosa* (SOWERBY), Rec., S.Am.(W.Coast); *5a-c,* LV ext., int., RV int., ×0.7 (Reeve, 1841, 1843).

E. (Spissatella) FINLAY, 1926 [14] [**Crassatella trailli* HUTTON, 1873; OD]. Flattened, with almost orthogyrous flat beaks; shell acuminate, scarcely truncate posteriorly. Narrow lunule. Marginal *3a. M.Eoc.-Rec.,* N.Am.-Australia-N.Z.-Antarctica.——FIG. E76,*2. *E. (S.) trailli* (HUTTON), L.Mio., N.Z.; *2a,b,* RV ext., int., ×0.75; *2c,* RV ext., ×0.75 (*303*; Suter, 1914).

Indocrassatella CHAVAN, 1952 [4] [**Crassatella indica* E. SMITH, 1895; OD]. Subtrapezoidal, inflated, moderately thin. Concentric regular rounded ribs; no dorsal angulations. *3a* almost hidden under lunular margin; resilial pit small, behind upper part of *4b*. Long, narrow posterior ridge and LV lateral lamina. Very small, rounded, partly truncated scars. Valve margins finely crenulate. *Rec.,* Arabian Sea.——FIG. E76,*3. *I. indica* (SMITH); *3a-c,* LV ext., int., both valves (dorsal), ×1 (Alcock & Anderson, 1897).

Oriocrassatella ETHERIDGE, JR., 1907 [**O. stokesi*; OD] [=*Procrassatella* YAKOVLEV, 1928 (subj.) (type, *Schizodus planus* GOLOVKINSKY, 1869)]. Transversely inequilateral, elongated backward. Hinge with *2* strong bifid, *3a* long, *3b* narrow, *4b* curved in front of rather large pit, with postresilial ridge isolating upper part of ligament. Long posterior laterals. *U.Carb.-Perm.,* Aus.-Asia-Eu.-New S. Wales - Australia-Indon.-USSR-Greenl.——FIG. E76,*4a,b. P. plana* (GOLOVINSKI), Perm., USSR; *4a,b,* RV int., LV int., ×0.7 *(1010)*.——FIG. E76,*4c. *O. stokesi,* W.Australia; RV ext., ×0.7 (Dickins, 1956).

Salaputium IREDALE, 1924 [5] [**Crassatella fulvida* ANGAS, 1871; OD]. Subtrigonal, ventrally rounded, flattened; rather small. Concentric ribbing. Resilial pit adjacent to apophysis of posterior cardinal, not reaching lower margin of plate. Laterals very long, especially anterior ones. Anterior scar large, subreniform. Valve margins finely crenulate. *Neog.-Rec.,* Australia-Indon.——FIG. E76,*1. *S. fulvidum* (ANGAS), Rec., Australia; *1a-c,* LV ext., int., RV int., ×2 (Angas, 1863; Chavan, n).

Talabrica IREDALE, 1924 [11] [**Crassatella aurora* ADAMS & ANGAS, 1863; OD]. Transversely subelliptical, compressed, with small orthogyrous beaks. Concentric ribs not divided backward but

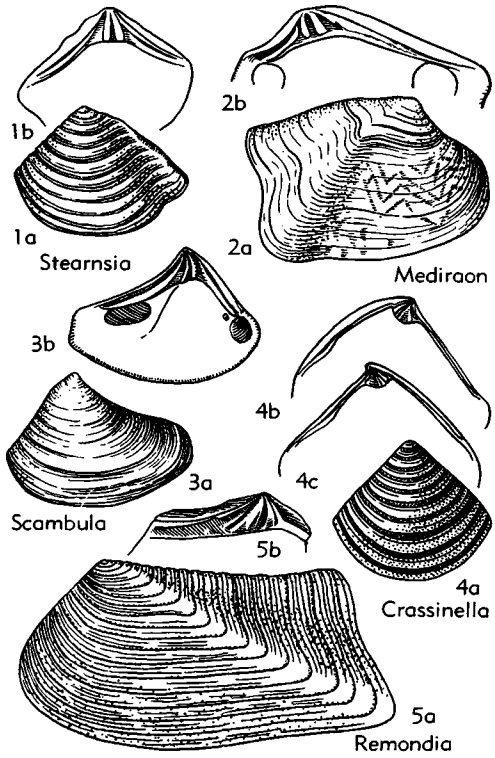


FIG. E77. Crassatellidae (Scambulinae) (p. *N577-N578*).

irregular ventrally. Escutcheon narrow, ill-defined. Cardinals oblique, *4b* not narrowed by pit; anterior laterals elongate, clearly distinguishable from cardinals, posterior laterals remote. Margin feebly crenulate. *U.Plio.-Rec.*, N.Z.-Australia.——FIG. E74,*3*. **T. aurora* (ADAMS & ANGAS), Rec., Tasmania; *3a*, LV ext., ×1 (Angas, 1863); *3b,c*, LV int., RV int., ×1.5 (Chavan, n).

Uddenia STEPHENSON, 1941 [8] [**Gouldia conradi* WHITFIELD, 1885; OD]. Subquadrate to subtrigonal, small; anteriorly rounded, posteriorly attenuated and truncated. Concentric, spaced, narrow and irregular ribs. Orthogyrous beaks. Marginal narrow anterior, large and grooved posterior cardinals; long and remote posterior laterals. Small scars. Valve margins grooved and smooth. *U.Cret.*, N.Am.——FIG. E74,*4*. **U. conradi* (WHITFIELD), Emscher., USA(N.Car.); *4a*, LV ext., ×2.5; *4b,c*, LV and RV hinges, ×8, ×5 *(887)*.

Subfamily SCAMBULINAE Chavan, 1952

Strongly opisthogyrous, or orthogyrous beaks; anterior laterals reaching beaks in front of anterior cardinals. Subparallel, narrow cardinals; reduced resilium in narrow pit *(109)*. *L.Cret.-Rec.*

Arrangement of generic taxa by CHAVAN.——1. *Scambula*.——2. *Remondia*.——3. *Mediraon*.——4. *Stearnsia*.——5. *Crassinella*.

Scambula CONRAD, 1869 [1] [**S. perplana*; M]. Subtrigonal, inequilateral, much compressed, with convex ventral and concave posterior margins. Pointed beaks. Cardinals approximate and striated; short resilium and ligamentary support above and behind top of LV posterior cardinal; broad and very long laterals on both valves. Small anterior scar. Valve margins crenulate. *U.Cret.*, N.Am.—— FIG. E77,*3*. **S. perplana*, Senon., USA(Tenn.); *3a,b*, LV ext., int., ×2 *(951)*.

Crassinella GUPPY, 1874 [5] [**Crassatella martinicensis* D'ORBIGNY in SAGRA, 1853; M] [=*Pseuderiphyla* FISCHER, 1887 (obj.); *Gouldia* AUCTT. (*non* C. B. ADAMS, 1847)]. Trigonal-rounded, short, compressed, small; anterior side rounded, posterior somewhat longer, angular at its end. Concentric lamellar undulations. Narrow lunule; posterior margin strongly concave, bounded by broad escutcheon. Cardinals long and slender, in front of deep, large resilium protruding backward; very long anterior RV and posterior LV laterals. Smooth inner margin. *M.Eoc.-Rec.*, Am.-W.Indies. ——FIG. E77,*4a*. **C. martinicensis* (D'ORBIGNY), Rec., Cuba; RV ext., ×10 (d'Orbigny in Sagra, 1853).——FIG. E77,*4b,c*. *C. branneri* (ARNOLD), Pleist., USA(Calif.); *4b,c*, RV and LV hinges, enl. *(100)*.

Remondia GABB, 1869 [**R. furcata*; M]. Transversely subtrapezoidal, anteriorly rounded, posteriorly elongated, with sinuous truncation. Concentric external undulations and medioposterior angle. Cardinals and laterals curved. Posterior part of *4b* on minor elevation. Inner shell margin crenulate. *L.Cret.*, W.Eu.-N.Am.

R. (Remondia) [2]. Much elongated posteriorly. Teeth arcuate; with nymphal ridge and another one in front of it, which divides resilium. Lunule and escutcheon excavated. *L.Cret.*, W.Eu.-N.Am. ——FIG. E77,*5*. **R. (R.) furcata* GABB, L.Cret., Mexico; *5a,b*, LV ext., hinge, ×0.75, ×0.7 *(333, 877)*.

R. (Mediraon) VOKES, 1946 [3] [**M. divaricatum*; OD]. Shorter backward, much flattened. Resilium not divided, barely separated from nymphal ridge. *L.Cret.*, W.Eu.-Lebanon-N.Am. ——FIG. E77,*2*. **R. (M.) divaricata* (VOKES), Apt., Lebanon; *2a,b*, RV ext., hinge, ×1.5 *(945)*.

Stearnsia WHITE, 1887 [4] [**S. robbinsi*; OD]. Subtrigonal, compressed, almost equilateral; laterally angulated; ventrally rounded, posteroventrally narrowed. Concentric undulations on disc, with sharp posterior carina. Long narrow lunule and

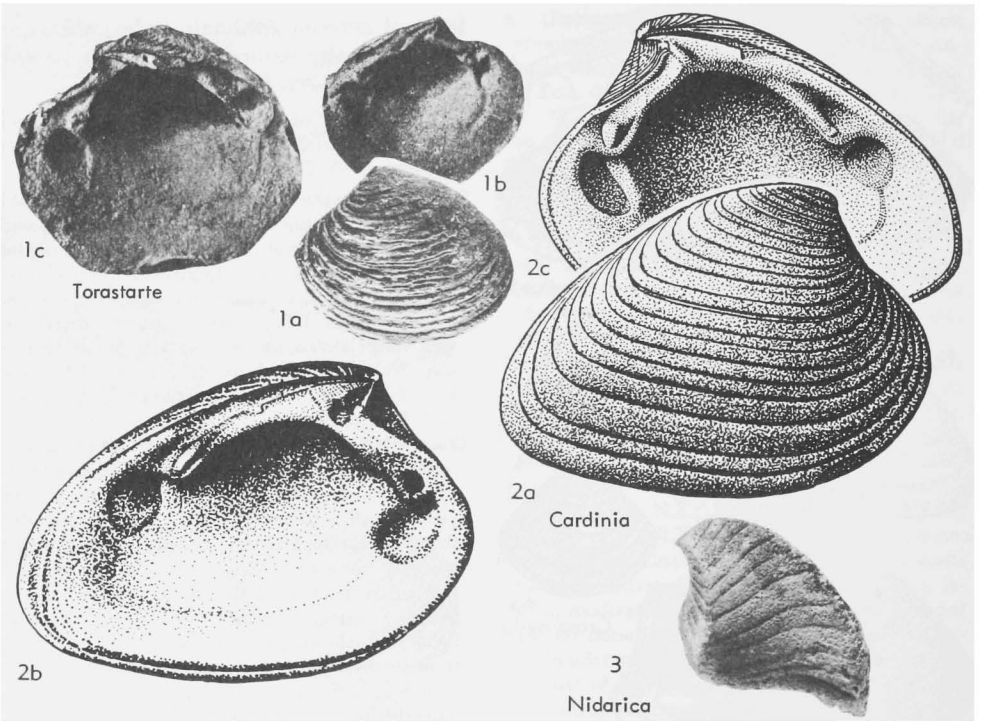


FIG. E78. Cardiniidae (p. *N*578-*N*580).

longer escutcheon. Beaks angular, appressed, almost orthogyrous. Approximate strong cardinals and long laterals; resilium narrowly separated from ligament by septum. Valve margins smooth. *L.Cret.*, W.Eu.-N.Am.——FIG. E77,*1*. **S. robbinsi*, USA(Tex.); *1a,b*, LV ext., int., ×0.7 (White, 1887).

Family CARDINIIDAE Zittel, 1881

[*emend.* COX, 1961] [=Cypricardiniidae ULRICH, 1897] [Materials for this family prepared by L. R. Cox and ANDRÉ CHAVAN except as recorded otherwise]

Ovate or subtrigonal, more or less inequilateral, thick-shelled, equivalve, convexity weak to moderate. Lunule and escutcheon well defined in more typical genera. Ligament opisthodetic, external although deeply sunk in some forms owing to steep slope of escutcheon. Cardinal teeth low, not more than two in each valve, *3b* oblique, *2* more or less fused to margin, more or less obsolete in many forms. Laterals strong, obliquely increasing in prominence, posterior ones of RV never duplicated on LV (no *PIV*) and entirely posterior to ligamental nymphs. Anterior laterals present or absent. Adductor scars deep, subequal; accessory scars rarely present. Pallial line simple. Ornament coarsely concentric or lacking. [Marine.] *Ord.-Rec.*

Besides *Cardinia,* a heterodont genus, ZITTEL originally included in the Cardiniidae several nonheterodont genera which now are referred to the Anthracosiidae and Pachycardiidae *(201)*.

Cardinia AGASSIZ, 1841 [**Unio listeri* J. SOWERBY, 1817; SD ICZN, Op. 292] [=*Thalassides* BERGER, 1833 (suppressed by ICZN); *Ginorga* GRAY, 1840 *(nom. nud.); Sinemuria* DE CHRISTOL, 1841 (suppressed by ICZN); *Cardinea* STUTCHBURY, 1842 *(nom. null.)*; *Pachyodon* STUTCHBURY, 1842 (*non* VON MEYER, 1838); *Dihora* "Gray" Anon., 1842 (obj.); *Thalassites* QUENSTEDT, 1843 *(nom. van.)* (*non* SWAINSON, 1837); *Storthodon* "Brown" ZITTEL, 1881 (*non* GIEBEL, 1856) (obj.)]. Medium-sized to large, ovate to cuneiform. Lunule and escutcheon bordered by more or less distinct ridges, steeply inclined, in some forms lying almost in plane of commissure of valves, ligamental nymph thus deeply sunk, although not internal; lunule commonly extending to posterior side of beak. Single weak, radially elongated cardinal

tooth *(3b)* present in RV in some species (but indistinguishable in others), and received in shallow recess in LV. Lateral teeth heavy, LV posterior and RV anterior ones each with tubercle-like termination received in recess between corresponding

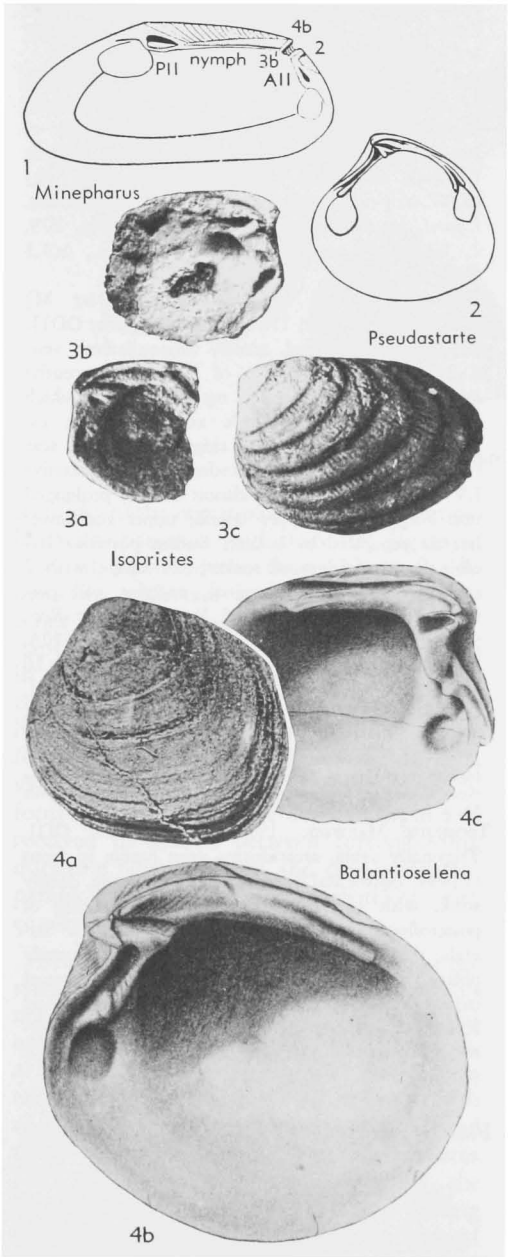


FIG. E79. Cardiniidae (p. *N*579-*N*580).

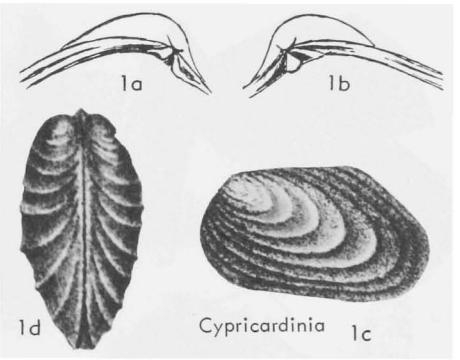


FIG. E80. Cardiniidae (p. *N*579).

tooth and dorsal margin of opposite valve. Ornament of concentric ribs or imbrications, or lacking. *U. Trias. (Carn.) - U. Lias. (Toarc.),* cosmop. [Records from Bajocian based on poor material and doubtfully acceptable.].——FIG. E78,*2. C. hybrida* (SOWERBY), L.Lias., Eng.; *2a-c,* RV ext., LV int., RV int., ×1 (Cox, n).

Balantioselena SPEDEN, 1962, p. 96 [**B. gairi*; OD]. Small, subrectangular, ovate or subtrigonal; umbo placed well forward, prosogyrous; lunule deep, no distinct escutcheon; nymph prominent; cardinal teeth well developed, *3b* in RV received between *2* and *4b* in LV; one anterior lateral in each valve, that of RV tuberculiform; 2 slightly oblique posterior laterals in RV, 1 in LV. *M.Trias.(Ladin.),* N.Z.——FIG. E79,*4. *B. gairi*; *4a-c,* LV ext. (holotype), RV int., LV int., all ×5.5 (Speden, 1962).

Cypricardinia HALL, 1859 [*pro C. lamellosa* HALL, 1859; *non C. lamellosa (Sanguinolaria lamellosa)* GOLDFUSS, 1840] [**C. halli* BEUSHAUSEN, 1897; OD] [=*?Synopleura* MEEK, 1871 (type, *Cypricardinia? carbonaria* MEEK, 1871, *L. Carb.*)]. RV more convex than LV, very inequilateral; modioliform in shape, beaks anterior; outline variable, wider posteriorly; umbonal slope prominent, often obtusely angular; surface with strong imbricating concentric equidistant lamellose undulations and commonly with radiating costellae; valves crossed obliquely by shallow byssal sulcus; dentition *(AIII-3a), 3b, 5b, PI, PIII / (AIV), AII-2, 4b, PII. Ord.(Llandeilo),* Eu.; *Sil.(Medinan)-L. Perm.,* cosmop.——FIG. E80,*1a,b. C. lamellosa* (GOLDFUSS), M.Dev., Ger.; *1a,b,* LV and RV hinges, enl. (Chavan, n, from Beushausen).——FIG. E80,*1c,d. *C. halli* BEUSHAUSEN, L.Dev.(L. Helderberg.), USA(N.Y.); *1c,d,* LV ext., both valves dorsal, ×3 *(373).*

Isopristes NICOL & ALLEN, 1953 [**I. crassus;* OD]. Thick, subquadrate, beaks prosogyrate, located nearly at anterior end of dorsal border; no lunule. Sculpture of strong equidistant spaced concentric

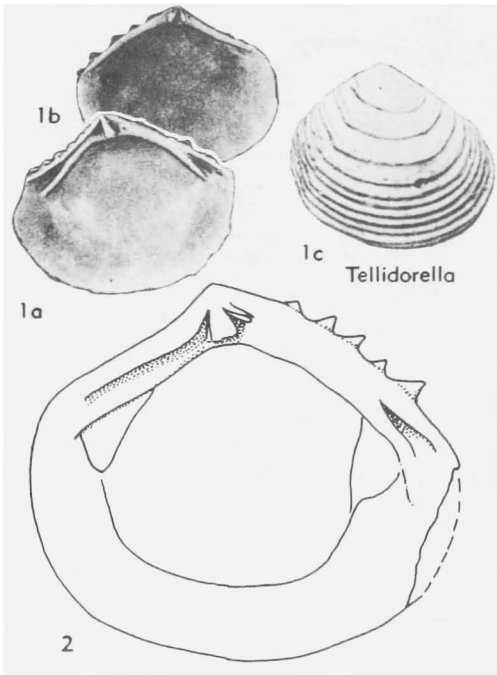


FIG. E80A. Cardiniidae (p. N580).

folds and small, closely spaced radial riblets. Anterior scar rather small and deep; posterior larger. LV with 2 oblique teeth, RV with 1 small round anterior lateral; posterior hinge not preserved; apparently a nymph. Inner margin crenate. *U.Trias. (Nor.),* S.Am.(Peru).——FIG. E79,*3. *I. crassus; 3a-c,* RV and LV int., LV ext., ×0.7 (Nicol & Allen, 1953).

?Minepharus TOKUYAMA, 1958 [**Palaeopharus (Minepharus) triadicus;* OD]. Shell elliptical, tapering slightly anteriorly; umbo prosogyre; ligament area wide, transversely striate; lunule small but distinct; anterior adductor scar strong; posterior scar larger and less distinct; dentition consists of 1 RV and 2 LV cardinals and anterior and posterior lateral; *2b* not clearly separated from margin of lunule; *4b* elongated, slender and welded to depressed triangular nymph; socket *3b* deep, fairly short; socket *PI* profound; *PIII* less distinct than *PI*; narrow furrow divides anterior lateral *AIII*; ornament consisting of radial costae and lines of growth. *U.Trias.,* Japan.——FIG. E79,*1. *M. triadicus*(TOKUYAMA); Yamaguchi Prefecture; LV int., ×1 (A. Tokuyama, 1958). [NEWELL].

Nidarica Cox, 1961 [**Cardinia slatteri* WILSON & CRICK, 1889]. Small-medium in size, *Opis*-like, with strongly prosogyrous, terminal umbones from which prominent, angular carinae pass to extremities of concave ventral margin. Lunule deep, with angular posterior end; nymphs not quite so deeply sunk as in *Cardinia.* No distinct cardinal teeth, but lunular marginal region of LV projects and is much thickened, this projection being received in corresponding recess in RV. Lateral teeth as in *Cardinia.* Ornament of wide-spaced growth imbrications. *L.Jur.(M.Lias.,Domer.-U.Lias., basal Toarc.),* Eng.——FIG. E78,*3. N. slatteri* (WILSON & CRICK), basal Toarc.; LV ext., ×1 (Cox, n).

Pseudastarte COSSMANN, 1921, p. 17 [**Astarte (Pseudastarte) emarginata;* M]. Very small, trigonally ovate, beaks at anterior quarter of length; convexity feeble; lunule shallower than in *Cardinia,* escutcheon narrow; cardinal tooth *(3b)* of RV well developed, bifid; laterals as in *Cardinia. L.Jur.(Lias.,Hettang.),* Eu.(France).——FIG. E79, *2. *P. emarginata* (COSSMANN); RV int., ×5.3 (Chavan, n).

Tellidorella BERRY, 1963 [**T. cristulata;* M] [=*Lirotarte* OLSSON, 1964 (type, *L. paphia;* OD)]. Small, solid, flattened, acutely subequilateral, ventrally rounded. Sculpture of laminate concentric ridges, each one cristate on carinations which bound long narrow lunule and ecutcheon; intervals radially striate or ridged. Anterior scar reniform, posterior one rounded. Median massive LV cardinal, anterior one almost directly prolonged into long anterior upper lateral; upper and lower laterals separated by socket; distant posterior laterals forming edges of socket; LV hinge with 2 cardinals and long, marginal, anterior and posterior lateral; short external ligament. *Mio.-Rec.,* S. Am.(Ecuador)-N. Am.(Mexico).——FIG. E80A, *2. *T. cristulata,* Rec., Mexico; RV int., ×10 (Keen, n).——FIG. E80A,*1. T. paphia* (OLSSON), Mio., Ecuador; *1a-c,* RV int., LV int., RV ext., ×6 (Olsson, 1964).

[This small shell is a "living fossil," having all morphological characters of the Cardiniidae, among which are the *right* duplicate, V-shaped posterior laterals, lack of distinct *5b,* a long *AI,* no marginal *AIV* and *PIV.*]

Torastarte MARWICK, 1953 [**T. bensoni;* OD]. Trigonally ovate, astartiform; deep lunule in front of beak, ligamental nymphs relatively heavy, deeply sunk, with corresponding downward arching of posterodorsal margin. Strong RV tubercular laterals, those of LV marginal, *2, 3b, 4b* narrowly oblique and partly covered. Ornament of unequal closely spaced concentric ribs. *U.Trias.(Otapir.= Rhaet.)-L.Jur.(Lias.),*N.Z.——FIG. E78,*1. *T. bensoni,* Rhaet.; *1a-c,* LV ext., LV int., RV int., ×1 *(593).*

Family MYOPHORICARDIIDAE Chavan in Vokes, 1967

[Materials for this family prepared by L. R. Cox and ANDRÉ CHAVAN]

Small to small-medium, equivalve, subtrigonal to trapezoidal, subequilateral to strongly inequilateral with umbones anterior

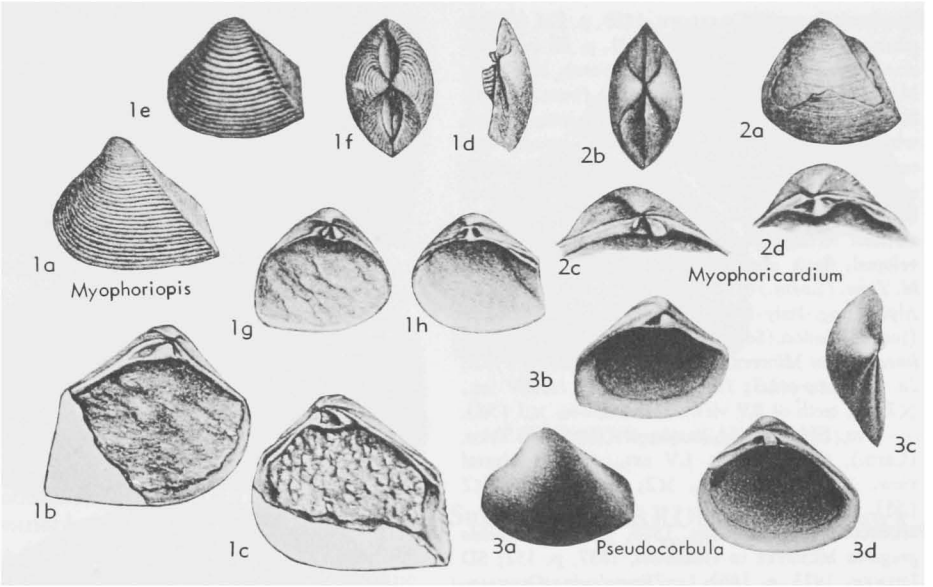


FIG. E81. Myophoricardiidae (p. *N*581-*N*582).

to mid-length; commonly carinate posteriorly, with posterior end truncate; ligament external, opisthodetic, short; hinge fundamentally with one anterior and one posterior lateral in each valve, and two (perhaps three) cardinals in LV, two cardinals in RV, anterior one small, some cardinals commonly suppressed, so that only one may be present in single valve (either LV or RV) and two in other, or only one in each valve; lateral teeth lamelliform, those of LV formed by projections of dorsal margin and received in sockets between corresponding duplicate laterals of RV and dorsal margin; pallial line entire; surface smooth or with concentric riblets. *Trias.*

Much disagreement has existed as to the systematic position of genera placed in this new family, and consequently, in notations applicable to their cardinal teeth. Provisional association of the family with the Crassatellacea implies that the two cardinal teeth of the LV are interpreted as *2* and *4b* and those of the RV as *3a* and *3b*. ODHNER *(683,* p. 582), however, considered the hinge to be of "cyrenoid" type, interpreting the teeth of the LV as *2a* and *2b,* those of the RV as *1* and *3b;* he cited a statement by FRECH that a third (very weak) cardinal *(4b)* can be detected in some specimens of the LV of *Myophoriopis.* ODHNER therefore considered that the genus should be regarded as an early member of the Corbiculacea. The fact that some specimens of *Myophoriopis* have only one cardinal in the LV, received between two in the RV (Fig. E81,*1b,c*), with this arrangement reversed in other specimens (Fig. E81,*1g,h*), is not attributable to hinge inversion (since arrangement of the lateral teeth remains the same) but to great variability in the development of individual teeth and to incomplete preservation. It is owing to this variability that the interpretation of the elements of the hinge presents difficulty.

Myophoricardium VON WÖHRMANN, 1889, p. 226 [**M. lineatum*; M] [=*Myophorocardium* NEUMAYR, 1891 *(nom. null.)*]. Trapeziform to subtrigonal, slightly inequilateral, length only slightly exceeding height; posterior ridge obtuse, no lunule or escutcheon; LV with strong anterior and weak posterior tooth, almost equally divergent and bordering recess for single strong tooth of RV; anterior laterals weak; surface almost smooth. *U. Trias. (Carn.),* Eu.(N. Alps-S. Alps-Sicily-Hung.)-SW.Asia(Jordan)-China(Yunnan).——FIG. E81,*2.* **M. lineatum;* Carinthia *(2a,b),* N.Alps *(2c,d);* *2a,* LV ext., *2b,* dorsal view, both ×1.3; *2c,d,* LV and RV hinges, both ×3 *(58).*

Myophoriopis VON WÖHRMANN, 1889, p. 221 [**Myophoria lineata* VON MÜNSTER, 1841, p. 88 (=*Lyrodon lineatus* VON MÜNSTER in GOLDFUSS, 1837-40); M] [=*Myophoriopsis* NEAVE, 1940 *(nom. null.)*]. Subtrigonal, moderately to strongly inequilateral, with prominent posterior carina; lunule and escutcheon well developed; either valve with single strong cardinal tooth in median position, received between 2 divergent cardinals in other valve; cardinal teeth transversely ridged; laterals well developed; flank ornamented with concentric riblets. *M. Trias. (Ladin.)-U. Trias. (Nor.)*, Eu.(N. Alps-S. Alps-Hung.-Italy-Balkans)-Afr. (Libya)-SW. Asia (Jordan)-Indon.(Sumatra).——FIG. E81,*1a-d*. **M. lineata* (VON MÜNSTER), M.Trias.(Ladin.), S.Tyrol; *1a*, LV ext., ×1.3; *1b*, LV int., ×2; *1c*, RV int., ×2; *1d*, teeth of RV viewed from above, ×2 *(58)*. ——FIG. E81,*1e-h*. *M. rosthorni* (BOUÉ), U.Trias. (Carn.), Carinthia; *1e*, LV ext., ×2; *1f*, dorsal view, ×2; *1g*, LV int., ×2; *1h*, RV int., ×2 *(58)*.

Pseudocorbula E. PHILIPPI, 1898, p. 168 [**Nucula gregaria* MÜNSTER in GOLDFUSS, 1837, p. 152; SD DIENER, 1923, p. 186] [=*?Raetolucina* OSSWALD, 1930 (type, *Corbula alpina* WINKLER, 1859; OD); *Myophoriaemorphis* MAZAROVICH, 1939 (no diagnosis) (type, *Cucullaea nuculiformis* ZENKER)]. Transversely subtrigonal, slightly to strongly inequilateral; with or without weak posterior carina; lunule and escutcheon present; LV with strong anterior cardinal and in some specimens weak posterior cardinal; RV with single strong posteriorly directed cardinal received in recess between LV cardinals, accompanied by well-developed long laterals duplicated in RV, teeth without transverse ridges; surface smooth. *L.Trias.-U.Trias.*, Eu.(Ger.-Spain-S. Alps-Sardinia)-S. Am. (Brazil-Uruguay). ——FIG. E81,*3*. **P. gregaria* (VON MÜNSTER), M. Trias., M.Muschelkalk, W.Ger.; *3a-c*, LV ext., int. and dorsal view; *3d*, RV int., all ×3 (Hohenstein, 1913).

Family HIPPOPODIIDAE Cox, new family

[Materials for this family prepared by L. R. Cox with addition by AURÈLE LAROCQUE]

Medium-sized to large, thick-shelled, irregularly reniform or pyriform, gibbose, with anteriorly placed, terminal or subterminal, prosogyrous beaks, well separated in full-grown specimens; valve margins closed; anisomyarian, posterior adductor scar moderately large, anterior scar smaller, deep, situated in anteroventral lobe; pallial line virtually entire; internal marginal region much broadened anteroventrally by growth laminae, edges of which form rugose

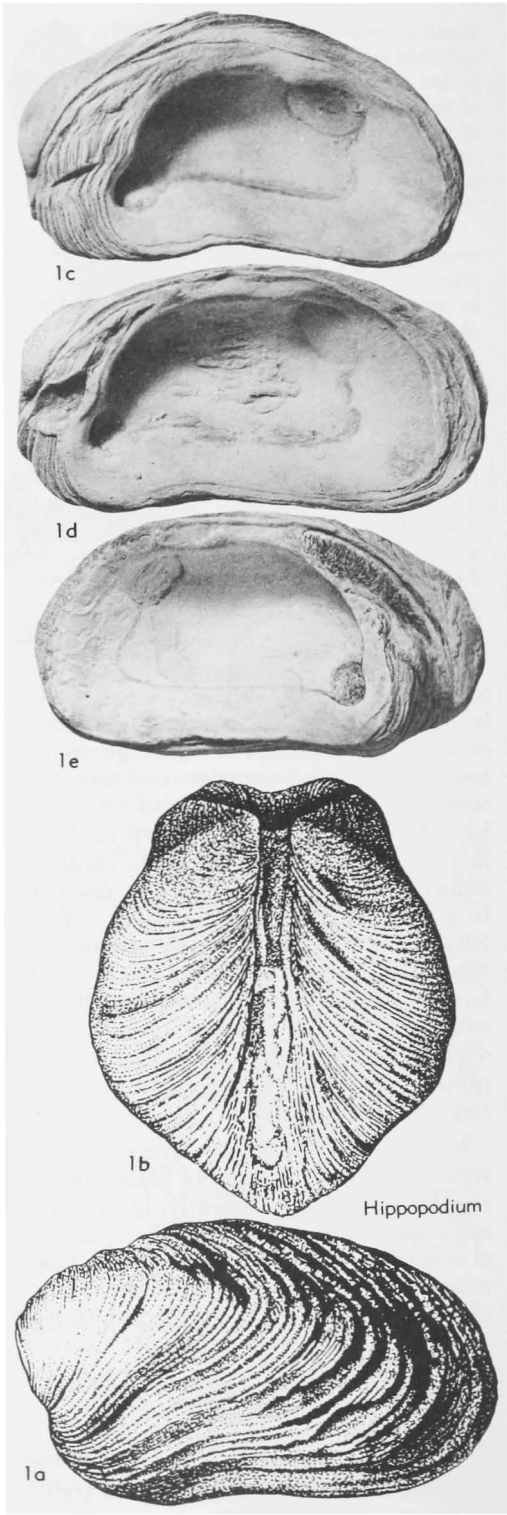


FIG. E82. Hippopodiidae (p. *N*583).

area continued by broad hinge plate bearing cardinal teeth and recesses as follows: adjacent to nymph in RV, broad tooth which is triangular and ridgelike in some specimens but rectangular and flat-topped in others, and anterior to which is broad, shallow recess for similar tooth of LV; RV with weak posterior lateral tooth, LV with or without posterior lateral; ligament external, opisthodetic; nymph strong, arched; exterior of shell with very irregular and pronounced growth rugae. *?Dev., L.Jur.-U.Jur.*

The single cardinal tooth of the RV is presumably to be interpreted as *3b* and the main cardinal of the LV as *2*. An angular edge projecting from the face of the nymph in some LV's is possibly to be regarded as a second cardinal *(4b)*, but the dentition is very variable and the interpretation of minor ridges doubtful.

This family is known only by its type genus,[1] which is remarkable for its discontinuous distribution. Abundant in northwestern Europe (particularly in England) from the Hettangian to the Pliensbachian stages of the Lower Jurassic, it has otherwise been met with only in the uppermost Jurassic of one area in East Africa. Although the East African species was originally made the type of a genus named *Epihippopodium*, differences between it and Lower Jurassic specimens are of no more than specific importance.

Hippopodium J. Sowerby, 1819, p. 91 [**H. ponderosum*; M] [=*Epihippopodium* Dietrich, 1933, p. 71 (type, *E. quenstedti*)]. Characters of family. *L.Jur.(Hettang.-Pliensbach.)*, Eu.; *U.Jur.(Tithon.)*, E.Afr.——Fig. E82,*1*. **H. ponderosum*, L.Jur. (Pliensbach.), SW.Eng.; *1a,b*, LV ext. and dorsal view, ×0.8 *(202)*; *1c-e*, int. of 2 RV's showing variation in cardinal dentition and 1 LV, all ×0.82 (Cox, n).

?Tusayana Stoyanow, 1948 [**T. cibola*; OD]. Nearly circular, beaks almost in middle of hinge line; surface smooth, umbones moderate, beaks prosogyre, lunule small; ligament external; hinge plate thick; LV with 2 cardinal teeth, one of which is bifid, other long and simple, lying behind anterior adductor muscle; RV with 1 amorphous cardinal tooth; 1 posterolamellar tooth in each valve. *Dev.(Island Mesa beds, Jerome F.)*, USA (Ariz.).——Fig. E83,*1*. **T. cibola*; *1a,b*, LV int., RV int., ×1 (Stoyanow, 1948). [LaRocque]

[1] Inclusion of the Paleozoic *Tusayana* in this family is very dubious.—Ed.

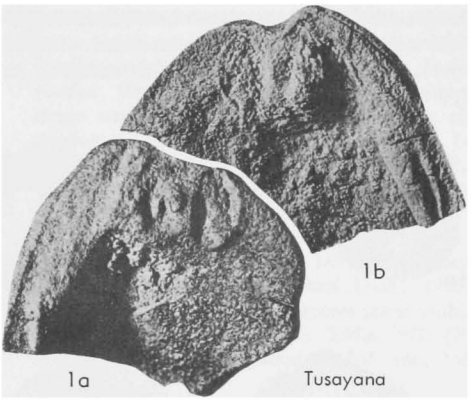


Fig. E83. Hippopodiidae (p. *N*583).

Superfamily CARDIACEA Lamarck, 1809

[*nom. transl.* Gill, 1871 (*ex* family Cardiacea Goldfuss, 1820) (=cardiacées Lamarck, 1809)] [Materials for this superfamily prepared by Myra Keen]

Sculpture normally radial, with change of ribbing pattern in most forms on posterior slope; hinge with two conical cardinal teeth, those in LV of unequal size, anterior larger, in RV fused to some extent; lateral teeth distant from cardinals, anterior laterals wanting in some groups. Pallial line entire in marine forms; some brackish-water forms with pallial sinus and long siphons. *U.Trias.-Rec.*

Family CARDIIDAE Lamarck, 1809

[*nom. correct.*, Broderip, 1839 (*ex* Cardiacea Goldfuss, 1820) (=cardiacées Lamarck, 1809)]

Ligament parivincular, external, typically short. Adductor scars subequal. Hinge with two nonbifid cardinal teeth in either valve, cruciform in arrangement; lateral teeth present, one anterior, one posterior in LV, two anterior, one posterior in RV. *U.Trias.-Rec.*

Subfamily CARDIINAE Lamarck, 1809

[*nom. transl.* Stoliczka, 1870 (*ex* family Cardiacea Goldfuss, 1820) (=cardiacées Lamarck, 1809)]

Semicircular to quadrangular or, rarely, elliptical; rib ornamentation along rib crests, as beading or furrowing, or in intercostal spaces, never arising from sides of ribs; posterior margin digitate or crenulate;

hinge, with few exceptions, nearly straight (deviating less than 25 degrees from straight line), relatively long, posterior cardinal in LV elevated. *U.Trias.-Rec.*

Cardium LINNÉ, 1758 [**C. costatum*; SD CHILDREN, 1823] [=*Bucardites* VON SCHLOTHEIM, 1820 *(nom. van.); Cordium* GISTL, 1848 *(nom. null.); Tropidocardium* RÖMER, 1865 (obj.)]. Ribs either

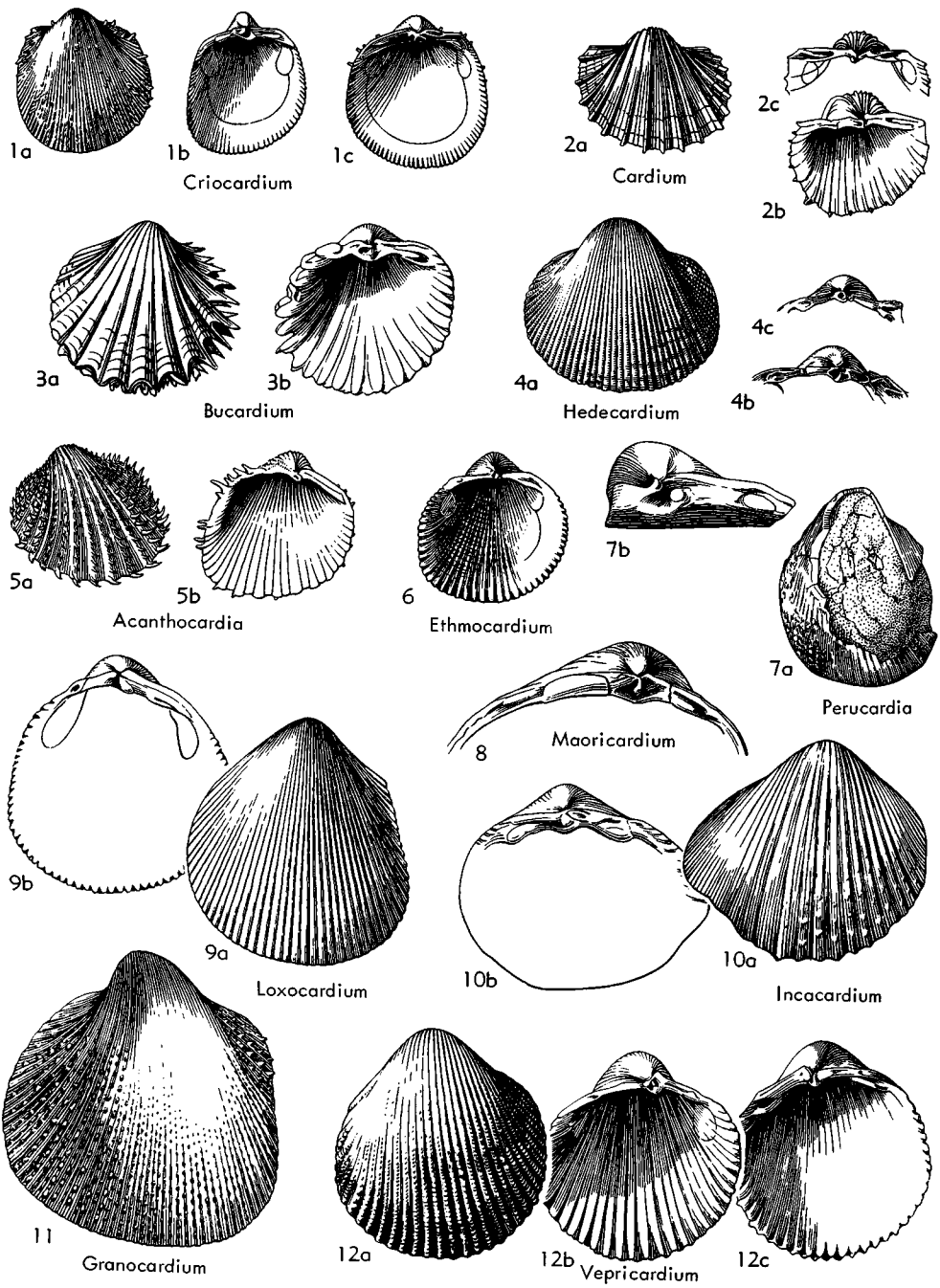


FIG. E84. Cardiidae (Cardiinae) (p. *N585-N586*).

keeled or spinose; cardinal *4b* elevated *(458). Mio.-Rec.,* S.Eu.-W.Afr.

C. (Cardium). Shell gaping at posterior margin; cardinal *4b* vertically above *2* or nearly so. *Mio.-Rec.,* France-W.Afr.——Fig. E84,*2*. **C. (C.) costatum* Linné, Rec., W.Afr.; *2a-c,* LV ext., int., RV int., ×0.25 (Tryon).

C. (Bucardium) Gray, 1853 [**Cardium ringens* Bruguière, 1789; SD von Vest, 1875] [=*Ringicardium* Fischer, 1887 (obj.)]. Posterior ribs strongly digitate; no posterior gape. *L.Mio.-Rec.,* S.France-W.Afr.——Fig. E84,*3*. **C. (B.) ringens* Bruguière, Rec., W.Afr.; *3a,b,* LV ext., int., ×1 (Tryon).

Acanthocardia Gray, 1851 [**Cardium aculeatum* Linné, 1758; SD Stoliczka, 1870] [=*Orbis* de Blainville, 1825 (*non* Müller, 1767, obj.; M); *Archicardium* Sandberger, 1863 (obj.); *Eucardium* Fischer, 1887 (obj.); *Sphaerocardium* Coen, 1933 (type, *Cardium paucicostatum* Sowerby, 1841, *non* Deshayes, 1838; SD Keen, 1937); *Sphoerocardium* Coen, 1933 *(nom. null.)*]. Oblique-quadrate; cardinal teeth in LV partially fused at base; ribs nodose to spinose. *U.Cret.-Rec.,* Eu.-Asia-N.Am.-S.Am.

A. (Acanthocardia). Ribs spinose *(458). U.Oligo.-Rec.,* S.Eu.-Medit.——Fig. E84,*5*. **A. (A.) aculeata* (Linné), Rec., Medit.; *5a,b,* LV ext., int., ×0.5 (Tryon).

A. (Agnocardia) Stewart, 1930 [**Cardium clairbornense* Aldrich, 1911; OD]. Ribs numerous, flat-topped, with hollow, A-shaped spines *(892). Eoc.-Mio.,* N.Am-S.Am.

A. (Incacardium) Olsson, 1944 [**Cardium mellisum*; OD]. Posterior area set off by sinuation; ribs with A-shaped spines on central and anterior slopes; hinge relatively short. *U.Cret.,* Peru.——Fig. 84,*10*. **A. (I.) mellisa* (Olsson); *10a,b,* RV ext., int., ×1 (Olsson).

A. (Rudicardium) Coen, 1915 [**Cardium tuberculatum* Linné, 1758; SD Keen, 1937]. Ribs noded. *Mio.-Rec.,* Medit.

A. (Schedocardia) Stewart, 1930 [**Cardium hatchetigbeense* Aldrich, 1886; OD] [=*Africofragum* Eames, 1957 (type, *Fragum (A.) newtoni;* OD)]. Less oblique than *A. (Acanthocardia);* spines on ribs weak to obsolete, especially anteriorly *(892). Paleoc.-Eoc.,* SE.Asia-Afr.-Eu.-N.Am.-S.Am.

Granocardium Gabb, 1869 [**Cardium carolinum* d'Orbigny, 1844; SD Stewart, 1930]. Smooth-ribbed to spinose, with 1 to 3 intercalary ribs between primaries or with internal pits in intercostal spaces *(892). L.Cret.-U.Cret.,* N.Am.-S.Am.-Afr.-Eu.-Asia-N.Z.

G. (Granocardium). Elliptical, hinge nearly straight, wide; intercalary ribs 2 to 3. *L.Cret.-U.Cret.,* cosmop.——Fig. E84,*11*. **G. (G.) carolinum* (d'Orbigny), U.Cret., France; LV ext., ×1 (Orbigny).

G. (Criocardium) Conrad, 1870 [**Cardium dumosum* Conrad, 1870; SD Stoliczka, 1871] [=*Criocarpium* Böhm, 1884 *(nom. null.); Cardea* Whitfield, 1885 (obj.)]. Quadrate, hinge straight, relatively long; intercalary ribs tending to be single rows of small spines between ribs. *U.Cret.,* N.Am.-Eu.——Fig. E84,*1*. **G. (C.) dumosum* (Conrad), USA(N.J.); *1a-c,* RV ext., LV int., RV int., ×1 (Wade).

G. (Ethmocardium) White, 1880 [**Cardium speciosum* Meek & Hayden, 1857 (*non* Adams & Reeve, 1850) (=**C. whitei* Dall, 1900); OD]. Small, thin, intercostal spaces pitted within. *U.Cret.,* N.Am.-S.Pac.——Fig. E84,*6*. **G. (E.) whitei* (Dall), USA(Mont.); LV int., ×2 (Keen).

Loxocardium Cossmann, 1886 [**Cardium formosum* Deshayes, 1858; SD Crosse, 1886]. Nearly equilateral, posterior margin slightly truncate; posterior ribs notched; rib sculpture of fine looped cross-threads or A-shaped nodes; hinge relatively short *(458). Eoc.-Mio.,* Eu.——Fig. E84,*9*. **L. formosum* (Deshayes), Eoc., France; *9a,b,* LV ext., int., ×2 (Deshayes).

Parvicardium Monterosato, 1884 [**Cardium parvum* Philippi, 1844 (*non* da Costa, 1778) (=**C. exiguum commutatum* Bucquoy, Dautzenberg & Dollfus, 1892); SD Crosse, 1885]. Small, hinge weak, cardinal teeth minute, fused at base in LV; ribs sculptured with heavy cross-threads or spines; resembling *Plagiocardium (Papillicardium)* but with weaker hinge and sharper sculpture *(458). Eoc.-Rec.,* Eu.-N.Am.

Plagiocardium Cossmann, 1886 [**Cardium granulosum* Lamarck, 1805; SD Crosse, 1887]. Elliptical-oblique, hinge arched; rib sculpture of bead-like nodes. *Paleoc.-Rec.,* Eu.-Afr.-E.Indies-N.Z.

P. (Plagiocardium). Shell medium in size; cardinal teeth nearly equidistant between lateral teeth *(458). Paleoc.-Mio.,* Eu.-E.Indies.

P. (Maoricardium) Marwick, 1944 [**Cardium spatiosum* Hutton, 1873; OD]. Shell large, heavy; anterior section of hinge shorter than posterior *(598). Oligo.-Rec.,* Afr.-E.Indies-N.Z.——Fig. E84,*8*. **P. (M.) spatiosum* (Hutton), Plio., N.Z.; LV hinge, ×0.5 *(598).*

P. (Papillicardium) Sacco, 1899 [**Cardium papillosum* Poli, 1795; OD]. Small, resembling *Parvicardium* but with heavier hinge and with beaded rather than spinose sculpture on ribs *(458). Eoc.-Rec.,* Eu.-W.Asia.

Septocardia Hall & Whitfield, 1877 [**S. typica*; OD] [=*Pascoella* Cox, 1949 (type, *P. peruviana*; OD)]. Thick-shelled, ribs beaded, incremental lines conspicuous in interspaces as cross-striae; ligament inserted in broad and slightly oblique furrow bordered by nymph with pointed summit; hinge plate wide, anteriorly forming deep cavity for reception of anterior adductor muscle; anterior lateral teeth small, placed at junction of muscle-

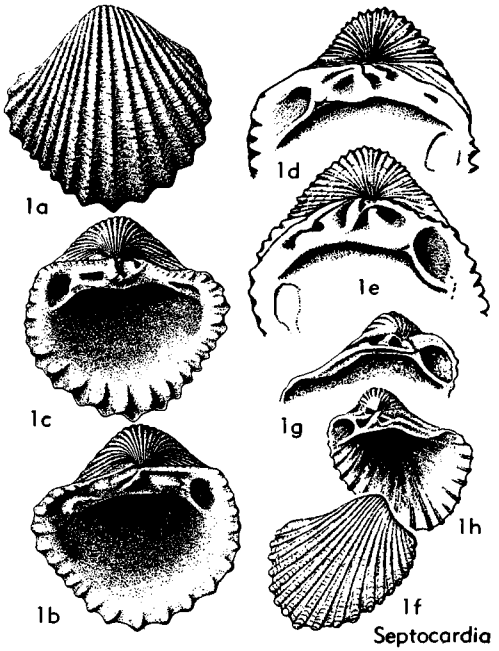


FIG. E85. Cardiidae (Cardiinae) (p. *N585-N586*).

cavity flange and hinge plate proper, cardinal teeth with 2 salient, *4b* lamellar, sloping obliquely backward from beak, *3a-3b* joined above; posterior lateral teeth well developed; pallial line entire, posterior muscle scar ovate, not impinging on hinge plate; inner margins strongly crenulate. [Hitherto allocated to Carditidae, this group seems rather to be the ancestral stock in Cardiacea, but with close affinities to *Palaeocardita,* which is contemporaneous at some localities in N.Am.] *U. Trias.(Nor.),* N.Am.-S.Am.——FIG. E85,*1. *S. typica; 1a-c,* RV ext., LV int., RV int., ×1 (Cox); *1d,e* (Alaska), RV and LV hinges, ×1.3 (Keen, n), from USGS specimens); *1f-h* (USA, Nev.), RV ext., LV and RV hinges, all enl. (Hall & Whitfield).

Vepricardium IREDALE, 1929 [**V. pulchricostatum;* OD]. Like *Bucardium* in outline but larger, posterior ribs not digitate; dorsal margins with smooth areas *(458). U.Cret.-Rec.,* Australia-Afr.-Eu.-S.Am.

V. (Vepricardium). Rib sculpture of close-set spines. *Paleoc.-Rec.,* Eu.-Afr.-E.Indies-Australia. ——FIG. E84,*12. *V. (V.) pulchricostatum* IREDALE, Rec., Australia; *12a-c,* RV ext., LV int., RV int., ×0.6 *(433).*

V. (Hedecardium) MARWICK, 1944 [**Cardium waitakiense* SUTER, 1907; OD]. Ribs smooth, finer on posterior area, interspaces linear *(598). Eoc.-L.Mio.,* N.Z.-Australia-Burma.——FIG. E84, *4. *V. (H.) waitakiense* (SUTER), Oligo., N.Z.; *4a-c,* LV ext., LV and RV hinges, ×0.5 *(598).*

V. (Orthocardium) TREMLETT, 1950 [**Cardium porulosum* SOLANDER, 1766; OD]. Rib-sculpture tending to form vertical frill at rib crest; outline more quadrate than in *V. (Vepricardium),* hinge line narrower and straighter. *M.Eoc.-U.Eoc.,* Eu.

V. (Perucardia) OLSSON, 1944 [**Cardium brueggeni*; OD]. Ribs with granular nodes. *U.Cret.,* Peru.——FIG. E84,*7. *V. (P.) brueggeni* (OLSSON); *7a,b,* LV ext., hinge, ×0.5 (Olsson).

Subfamily TRACHYCARDIINAE Stewart, 1930

Ovate but not oblique; rib ornamentation normally of spines or imbricating scales along posterior sides of ribs; hinge relatively short, either nearly straight or sharply bent; cardinal teeth unequal in size, *All* with socket above; posterior margin notched to digitate. *?Eoc., Oligo.-Rec.*

Trachycardium MÖRCH, 1853 [**Cardium isocardia* LINNÉ, 1758; SD VON MARTENS, 1870] [=*Kathocardia* TUCKER & WILSON, 1932 (type, *Cardium (K.) aclinense*; OD)]. Outline nearly equilateral, height greater than length; hinge heavy, short, nearly straight. *?Eoc., Oligo.-Rec.,* tropic Am.

T. (Trachycardium). Sculpture of imbricating scales over entire shell, reduced to beads anteriorly *(458). Oligo.-Rec.,* W.Indies-E.C.Am.-W. C.Am.-S.Am.——FIG. E86,*5. *T. (T.) isocardia* (LINNÉ), Rec., W.Indies; *5a-c,* LV ext., int., RV int., ×0.5 (*5a,c,* Perry; *5b,* Keen).

T. (Dallocardia) STEWART, 1930 [**Cardium quadragenarium* CONRAD, 1837; OD]. Large shells with ornamentation of nonimbricating spines along posterior sides of ribs *(892). U.Oligo.-Rec.,* N.Am.-S.Am.

T. (Mexicardia) STEWART, 1930 [**Cardium procerum* SOWERBY, 1833; OD]. Ribs scaly in young, nearly smooth in adults; hinge heavy, short; posterior margin somewhat digitate *(892). ?Eoc., Mio.-Rec.,* N.Am.-S.Am.

T. (Phlogocardia) STEWART, 1930 [**Cardium belcheri* BRODERIP & SOWERBY, 1829; OD]. Central ribs with frills along posterior sides, anterior ribs with knobby spines *(892). Mio.-Rec.,* W.C. Am.

Acrosterigma DALL, 1900 [**Cardium dalli* HEILPRIN, 1887; OD]. Elliptical, hinge strongly bent; cardinal teeth unequal in size *(458). U.Oligo.-Rec.,* N.Am.-S.Am.-Eu.-E.Indies-S.Pac.

A. (Acrosterigma). Hinge bent to angle of 60 degrees or more; ribs smooth except for slight pitting along edges of incised intercostal spaces. *Mio.-Plio.,* USA(Fla.)-W.Indies.——FIG. E86,*6. *A. (A.) dalli* (HEILPRIN), Plio., USA(Fla.); *6a,b,* LV ext., int., ×0.25 (Cooke).

A. (Ovicardium) MARWICK, 1944 [**Trachy-*

cardium (O.) rossi; OD]. Ovate, intercostal spaces cross-striate, with vertical sides; hinge with oblique groove behind *4b (598). Plio.,* N.Z.-Australia.

A. (Regozara) IREDALE, 1936 [**R. olivifer;* OD]. Hinge less angulate than in *A. (Acrosterigma);* sculpture of small scales or cross-threads on posterior sides of ribs. *Neog.-Rec.,* E.Indies-Australia.

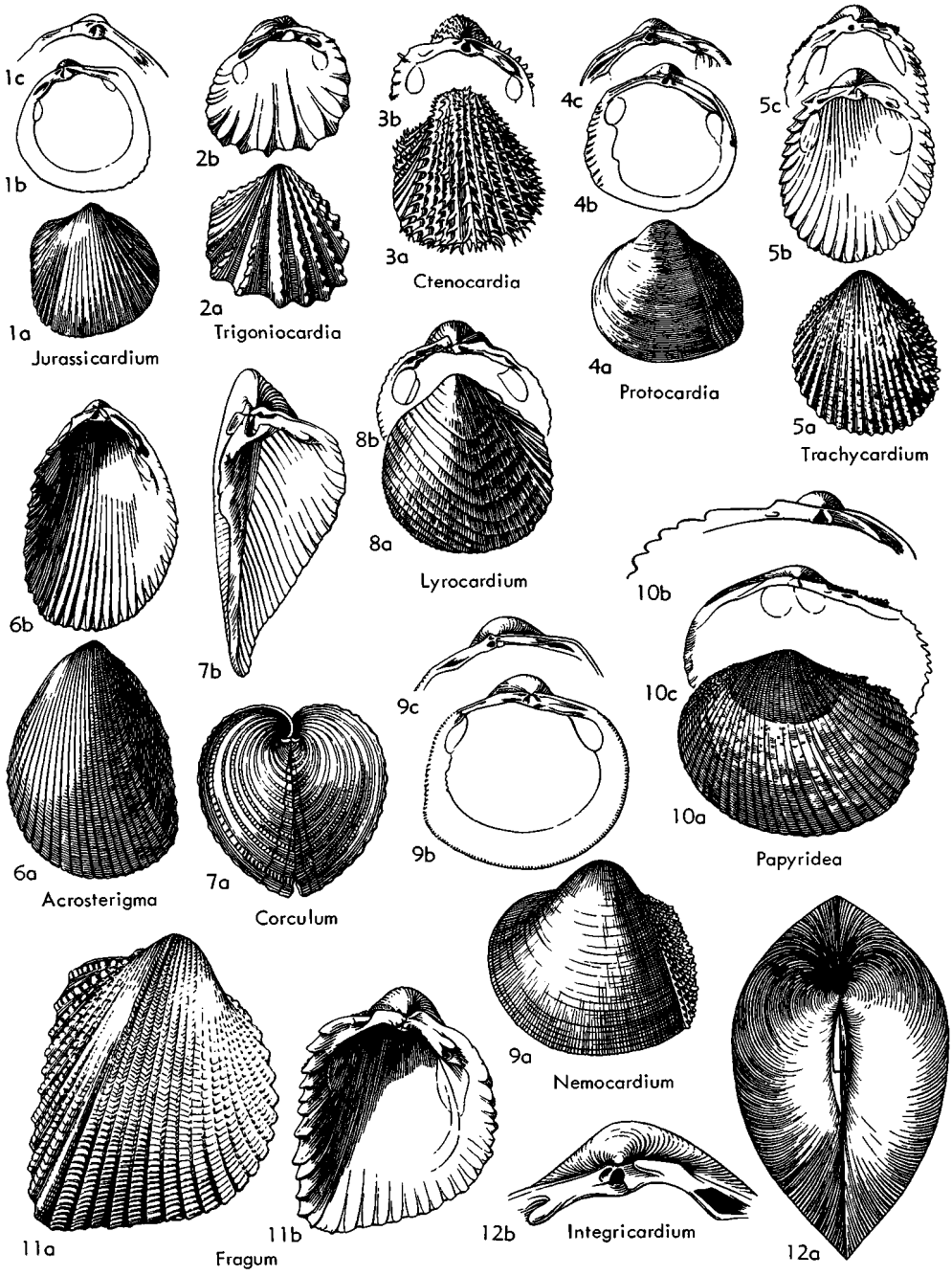


FIG. E86. Cardiidae (Trachycardiinae) *(5-6, 10);* (Fraginae) *(2-3,7,11),* (Protocardiinae) *(1,4,8-9,12)* (p. *N*586, *N*588-*N*589).

A. (Vasticardium) IREDALE, 1927 [**V. nebulosum* (*ex* MARTYN, *nonbinom.*); OD]. Resembling *A. (Acrosterigma)* but eaves of ribs more strongly sculptured; posterior margin notched *(458)*. *U. Oligo.-Rec.*, IndoPac.-N.Am.-C.Am.-Eu.

Papyridea SWAINSON, 1840 [**Cardium soleniforme* BRUGUIÈRE, 1789; SD GRAY, 1847]. Shell longer than high, gaping at both ends, ribs spinose; hinge short; posterior margin notched *(458)*. *Mio.-Rec.*, tropic Am.——FIG. E86,*10*. **P. soleniformis* (BRUGUIÈRE), Rec., W.Indies; *10a-c*, LV ext., hinge, RV int., ×1 (*10a,c*, Perry; *10b*, Keen).

Subfamily FRAGINAE Stewart, 1930

Posterior slope set off by low ridge to sharp keel, postero-ventral margin angulate; rib ornamentation of threads or imbricating spines, intercostal spaces narrow, cross-striate; hinge short, bent more than 25 degrees from horizontal; cardinal teeth mostly unequal in size. *Oligo.-Rec.*

Fragum RÖDING, 1798 [**Cardium fragum* LINNÉ, 1758; T] [=*Hemicardia* SPENGLER, 1799, AUCTT. (invalidly proposed)]. Triangular; hinge with cardinals subequal, peg-shaped; rib ornamentation threadlike *(458)*. *Mio.-Rec.*, E.Indies.

F. (Fragum). Lunular area not depressed. *Mio.-Rec.*, E.Indies.——FIG. E86,*11*. **F. (F.) fragum* (LINNÉ), Rec., E.Indies; *11a,b*, RV ext., LV int., ×1 (Keen).

F. (Lunulicardia) GRAY, 1853 [**Cardium retusum* LINNÉ, 1758; M] [=*Opisocardium* BAYLE, 1879 (obj.)]. Lunule very deeply impressed. *Pleist.-Rec.*, Japan-IndoPac.

Corculum RÖDING, 1798 [**Cardium cardissa* LINNÉ, 1758; SD VON MARTENS, 1870] [=*Cardissa* MEGERLE VON MÜHLFELD, 1811 (obj.); *Hemicardia* FLEMING, 1818 (obj.); *Hemicardium* SCHWEIGGER, 1820 (obj.)]. Foreshortened, posterior slope nearly plane, bounded by carina, of glassy texture; sculpture on ribs faint *(458)*. *Rec.*, E.Indies.——FIG. E86,*7*. **C. cardissa* (LINNÉ); *7a,b*, both valves ant., LV int., ×0.5 (*7a*, Tryon, *7b*, Keen).

Ctenocardia H. ADAMS & A. ADAMS, 1857 [**Cardium hystrix* REEVE, 1844 (*non* LIGHTFOOT, 1786) (=*Fragum symbolicum* IREDALE, 1929); SD DALL, 1900]. With imbricating or tubular spines on ribs; hinge with cardinals subequal, midway between laterals *(458)*. *Mio.-Rec.*, E.Indies-S.Afr.

C. (Ctenocardia). Outline quadrate, not oblique. *Mio.-Rec.*, E.Afr.-E.Indies.——FIG. E86,*3*. *C. (C.) symbolica* (IREDALE), Rec., E.Indies; *3a,b*, RV ext., LV int., ×1 (*3a*, Tryon; *3b*, Keen).

C. (Afrocardium) TOMLIN, 1931 [**Fragum (A.) shepstonense*; OD]. Oblique, umbonal ridge indistinct *(458)*. *Pleist.-Rec.*, S.Afr.-E.Indies.

C. (Microfragum) HABE, 1951 [**Cardium festivum* DESHAYES, 1854; OD]. Quadrate, with little or no sculpture on ribs. *Rec.*, E.Indies-Japan.

Trigoniocardia DALL, 1900 [**Cardium graniferum* BRODERIP & SOWERBY, 1829; OD]. Ovate to quadrate; hinge asymmetric, anterior section shorter than posterior. *Oligo.-Rec.*, tropic Am.

T. (Trigoniocardia). Ovate, mostly small, sculpture beaded, with intercostal striations. *Oligo.-Rec.*, C. Am.——FIG. E86,*2*. **T. (T.) granifera* (BRODERIP & SOWERBY), Rec., W.Mex.; *2a,b*, RV ext., LV int., ×2 (Keen & Frizzell).

T. (Americardia) STEWART, 1930 [**Cardium medium* LINNÉ, 1758; OD]. Quadrate, medium in size, ribs and intercostal spaces smooth *(892)*. *L. Mio.-Rec.*, C.Am.

T. (Apiocardia) OLSSON, 1961 [**Cardium obovale* SOWERBY, 1833; OD]. Rounded-ovate, ribs nearly smooth. *Plio.-Rec.*, W.C.Am.-S.Am.

Subfamily PROTOCARDIINAE Keen, 1951

Rounded quadrate, beaks nearly central; posterior slope well defined by umbonal ridge, its radial ribs tending to be spinose; hinge long, slightly arched, cardinals *2* and *3b* larger, peglike, curved upward, sinuating lower border of hinge plate; pallial line mostly entire, some with small sinus near posterior adductor scar. *U.Trias.(Rhaet.)-Rec.*

Protocardia VON BEYRICH, 1845 [**Cardium hillanum* SOWERBY, 1813; SD HERRMANNSEN, 1847] [=*Hassbergia* KRUMBECK, 1939 (invalidly proposed, without type designation)]. Posterior slope with radial ribs in most, remainder of shell with more or less well developed concentric ribs *(893, 1006)*. *U.Trias.-U.Cret.*, Eu.-N.Am.-S.Am.-Afr.

P. (Protocardia). Anterior concentric and posterior radial ribs well developed. *U.Trias.-U.Cret.*, Eu.-Asia-Afr.-N.Am.-S.Am.——FIG. 86,*4*. **P. (P.) hillana* (SOWERBY), L.Cret., Eng.; *4a-c*, LV ext., int., RV hinge, ×0.5 *(1006)*.

P. (Brevicardium) STEPHENSON, 1941 [**B. fragile*; OD]. With faint radial ribs crossing concentric sculpture of central and anterior slopes *(889)*. *U.Cret.*, N.Am.-Eu.-Asia.

P. (Globocardium) HAYAMI, 1965 [**Cardium sphaeroideum* FORBES, 1845; OD]. Globose, with weak radial ribs. *L.Cret.*, Eu.-Japan.

P. (Leptocardia) MEEK, 1876 [**Cardium subquadratum* EVANS & SHUMARD, 1857; SD DALL, 1901]. Small, polished, posterior radial ribs faint; marginal crenulations strong near junction of posterior and central slopes *(458)*. *L.Cret.-U.Cret.*, N.Am.

P. (Pachycardium) CONRAD, 1869 [**Cardium spillmani* CONRAD, 1858; SD DALL, 1900]. Relatively short, with high narrow beaks; concentric sculpture fine, radial sculpture covering up to half central slope; hinge thickened *(458)*. *L.Cret.-U.Cret.*, Afr.-Eu.-Asia-N.Am.-S.Am.

P. (Tendagurium) DIETRICH, 1933 [**Cardium (T.) propebanneianum*; SD KEEN, 1937]. Radial sculpture wanting on posterior slope *(458). Jur.-Cret.*, Afr.-Eu.-E.Asia.

Integricardium ROLLIER, 1912 [**Cardium dupinianum* D'ORBIGNY, 1844; OD]. Elliptical to elongate-quadrate; sculpture obsolete; hinge as in *Protocardia (795). M.Jur.-U.Cret.*, Eu.-N.Afr.-W.Asia-N.Am.

I. (Integricardium). Elliptical, without umbonal ridge. *M.Jur.-U.Cret.*, Eu.-N.Afr.-W.Asia.——FIG. 86,*12*. **I. (I.) dupiniana* (D'ORBIGNY), U.Cret., France; *12a,b*, both valves dorsal, RV hinge, ×0.6 (d'Orbigny).

I. (Onestia) MCLEARN, 1933 [**Laevicardium onestae* MCLEARN, 1931; OD]. Elongate-quadrate; lateral teeth small; external ligament in deep groove *(458). L.Cret.*, Can.

Jurassicardium COSSMANN, 1906 [**Cardium (J.) axonense*; SD KEEN, 1937]. Posterior-dorsal margin rectangular; posterior ribs not spinose, other radial riblets indistinct *(458). Jur.*, Eu.(France).——FIG. 86,*1*. **J. axonense* (COSSMANN); *1a-c*, RV ext., int., LV hinge, ×2 *(458)*.

Nemocardium MEEK, 1876 [**Cardium semiasperum* DESHAYES, 1858; SD SACCO, 1899] [=*Awadia* ABBASS, 1962 (type, *N. (A.) magharense*; OD)]. Sculpture radial throughout, strong on posterior slope *(459). L.Cret.-Rec.*, Eu.-Asia-S.Pac.-N.Am.-S.Am.

N. (Nemocardium). Central and anterior slopes nearly smooth, marginal crenulations changing abruptly in size at posterior-ventral junction. *L. Cret.-Rec.*, cosmop.——FIG. 86,*9*. **N. (N.) semiasperum* (DESHAYES), Eoc., France; *9a-c*, LV ext., int., RV hinge, ×1 (Deshayes).

N. (Arctopratulum) KEEN, 1954 [**N. (A.) griphus*; OD]. Ovate-trigonal, hinge short. *Oligo.-Mio.*, Japan-W.N.Am.

N. (Discors) DESHAYES, 1858 [**Cardium discors* LAMARCK, 1805 (*non* MONTAGU, 1803) (=**C. parisiense* D'ORBIGNY, 1850); T] [=*Hemidiscors* ROVERETO, 1898 (type, *Cardium (H.) rugiferum*; OD)]. Ovate, smaller than *N. (Nemocardium)*; oblique secondary striae crossing ribs of central and anterior slopes, posterior ribs faint. *Eoc.-Mio.*, Eu.-Asia.

N. (Divaricardium) DOLLFUS & DAUTZENBERG, 1886 [**Cardium discrepans* BASTEROT, 1825; SD COSSMANN, 1886]. More quadrate than *N. (Discors)*, oblique secondary sculpture on posterior slope; central slope nearly smooth. *Oligo.-Plio.*, Eu.-Asia.

N. (Frigidocardium) HABE, 1951, p. 147 [**Cardium eos* KURODA, 1929; OD] [=*Erigidocardium* HABE, 1951, p. 152 *(nom.null.)*]. Radial sculpture beaded throughout, alternate ribs higher. *Rec.*, Japan-IndoPac.

N. (Keenaea) HABE, 1951 [**N. samarangae* MAKIYAMA, 1934; OD]. Resembling *N. (Pratulum)* but with secondary concentric sculpture on posterior slope. *Oligo.-Rec.*, Japan-W.N.Am.

N. (Lophocardium) FISCHER, 1887 [**Cardium cumingii* BRODERIP, 1833; OD]. Fragile, sculpture of faint sinuous radial and concentric threads; periostracum forming laminar keel at junction of posterior and central slopes; cardinal teeth well developed, lateral teeth obsolescent *(226). ?Eoc., Mio.-Rec.*, C.Am.-S.Am.

N. (Lyrocardium) MEEK, 1876 [**Cardium lyratum* SOWERBY, 1841; SD DALL, 1900] [=*Amphicardium* VON MARTENS, 1880 (obj.)]. Like *N. (Discors)* but more quadrate, oblique secondary sculpture more widely and evenly spaced *(458). Pleist.-Rec.*, E.Indies.——FIG. 86,*8*. **N. (L.) lyratum* (SOWERBY), Rec., E.Indies; *8a,b*, LV ext., RV int., ×0.5 (Tryon).

N. (Microcardium) THIELE, 1934 [**Cardium peramabile* DALL, 1881; SD KEEN, 1937]. Small, with secondary concentric sculpture on central and anterior slopes both in intercostal spaces and as beads along ribs. *Mio.-Rec.*, C.Am.

N. (Pratulum) IREDALE, 1924 [**Cardium thetidis* HEDLEY, 1902; OD]. More equilateral than *N. (Nemocardium)*; radial ribs evident throughout but coarser on posterior slope *(459). L.Cret.-Rec.*, Eu.-N.Z.-Australia.

N. (Trifaricardium) HABE, 1951 [**Cardium nomurai* KURODA & HABE, 1951; OD]. Near *N. (Microcardium)* but secondary concentric sculpture on anterior slope only. *Rec.*, Japan.

N. (Varicardium) MARWICK, 1944 [**Cardium patulum* HUTTON, 1873; OD]. Heavy, with strong but irregular secondary concentric ridges anteriorly and ventrally overriding radial ribs; ribs of posterior slope without tubercles or spines *(598). Mio.*, N.Z.

Subfamily LAEVICARDIINAE Keen, 1936

Elliptic-oblique; rib ornamentation of looped threads or small nodes, not spines; ribs of posterior slope weaker than those of central and anterior slopes or obsolescent; posterior margin wavy rather than notched; hinge long and arched (line joining laterals and cardinals bends more than 25 degrees); cardinal teeth somewhat unequal in size, anterior left lateral bladelike. *Eoc.-Rec.*

Laevicardium SWAINSON, 1840 [**Cardium oblongum* GMELIN, 1791; SD STOLICZKA, 1871] [=*Liocardium* AGASSIZ, 1846 *(nom.van.)*; *Exocardium* OLSSON, 1964 (type, *Cardium ecuadoriale* OLSSON, 1932; OD)]. Ribs faintly to moderately developed, weaker on posterior slope; smooth to threaded or noded. *Eoc.-Rec.*, Eu.-Atl.-Pac.

L. (Laevicardium). Smooth, nongaping; cardinals unequal. *Eoc.-Rec.*, Eu.-W.Atl.-E.Pac.-W.Pac.——FIG. E87,*2*. **L. (L.) oblongum* (GMELIN), Rec.,

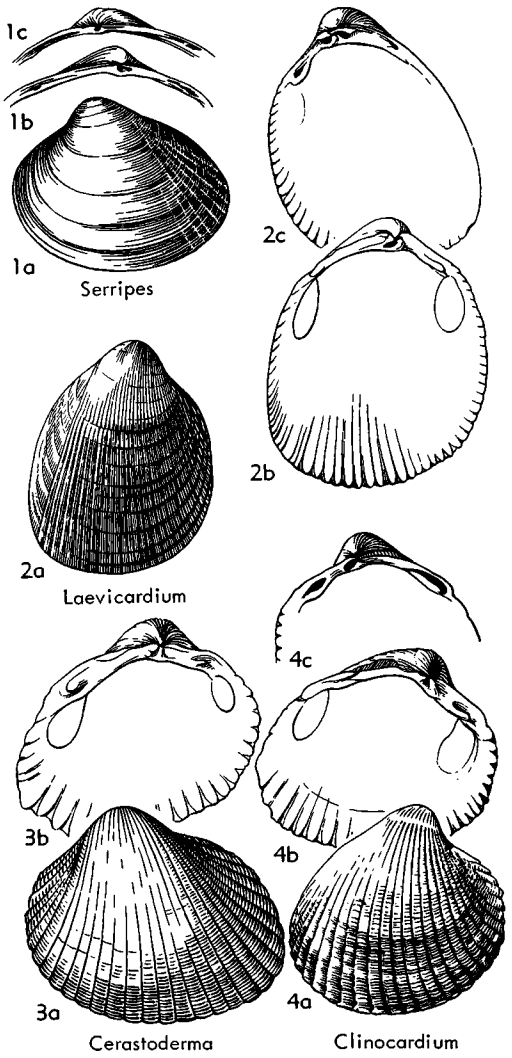


FIG. E87. Cardiidae (Laevicardiinae) (p. *N589-N590*).

Eu.; *2a-c,* RV ext., LV int., RV int., ×0.5 *(2a-c, 89a; 2b,* Keen).

L. (Dinocardium) DALL, 1900 [**Cardium robustum* LIGHTFOOT, 1786; OD]. Ribbing on anterior slope and beaks stronger than in *L. (Laevicardium)*; ornamentation of threadlike nodes crossing ribs *(892). Eoc.-Rec.,* N.Am.-S.Am.

L. (Fulvia) GRAY, 1853 [**Cardium apertum* BRUGUIÈRE, 1789; M]. Thin-shelled, ventricose, slightly gaping posteriorly; cardinal teeth subequal. *Mio.-Rec.,* Japan-E.Indies-Alaska.

Cerastoderma POLI, 1795 [**Cardium edule* LINNÉ, 1758; SD VON MARTENS, 1870] [=*Cerastes* POLI, 1795 (*non* LAURENTI, 1768); *Edulicardium* MONTEROSATO, 1923 (obj.)]. Oblique-quadrangular, hinge only moderately arched; beaks orthogyrate; ribs moderately strong on posterior slope, sculptured with cross-threads *(242). U.Oligo.-Rec.,* Eu. ——FIG. E87,*3*. **C. edule* (LINNÉ), Rec., Eu.; *3a,b,* LV ext., int., ×1 (*3a,* Tryon; *3b,* Keen).

Clinocardium KEEN, 1936 [**Cardium nuttallii* CONRAD, 1837; OD]. Oblique-elliptical, hinge well arched; beaks prosogyrate, ribs weak on posterior slope, ornamented with cross-threads; cardinal *4b* weak, left posterior lateral double *(458). U.Mio.-Rec.,* N.Pac.-NW.Atl.——FIG. E87,*4*. **C. nuttallii* (CONRAD), Rec., USA(Calif.); *4a-c,* RV ext., LV int., RV hinge, ×0.5 (Keen).

Serripes GOULD, 1841 (*ex* BECK, MS) [**Cardium groenlandicum* BRUGUIÈRE, 1789; M] [=*Aphrodite* LEA, 1834 (*non* HÜBNER, 1816)]. Sculpture almost obsolete; shell medium-sized to large, inequilateral; cardinal teeth weak in adults or absent, laterals also evanescent *(458). Mio.-Rec.,* N.Atl.-N.Pac.-Japan.——FIG. E87,*1*. **S. groenlandicus* (BRUGUIÈRE), Rec., Arctic O.; *1a-c,* LV ext., LV and RV hinges, ×0.5 (Tryon).

Family LAHILLIIDAE Finlay & Marwick, 1937

Orbicular to oblong in outline; surface smooth, without radial sculpture; internal margins smooth, not crenulate; ligament external, on large nymph. Cardinal teeth two in each valve, arranged as in Cardiidae; anterior lateral teeth absent, posterior laterals one in each valve. *U.Cret.-Mio.*

Lahillia COSSMANN, July, 1899 [*pro Iheringia* COSSMANN, April 1899, *nom. correct. pro Theringia* COSSMANN, Jan. 1899 (*non* KEYSERLING, 1891) *et pro Amathusia* PHILIPPI, 1887 (*non* FABRICIUS, 1807)] [**Amathusia angulata* PHILIPPI, 1887; SD FINLAY & MARWICK, 1937]. Medium-sized to large, ovate, thin; hinge plate broad, thick. *U.Cret.-Mio.,* S.Am.-N.Z.-Australia-Antarctic.

L. (Lahillia). Pallial line entire *(598). U.Cret.-Mio.,* S.Am.-N.Z.-Australia-Antarctic.——FIG. E88,*5*. **L. (L.) angulata* (PHILIPPI), Oligo.,?Mio., Chile; *5a,b,* RV ext., int., ×0.5 (*5a,* Philippi; *5b,* Wilckens).

L. (Lahilleona) FINLAY & MARWICK, 1937 [**L. neozelanica* MARSHALL & MURDOCH, 1923; OD]. With well-defined rounded pallial sinus *(598). U.Cret.,* N.Z.——FIG. E88,*6*. **L. (L.) neozelanica* MARSHALL & MURDOCH; *6a-c,* LV ext., int., RV hinge, ×0.5 *(304).*

Family LYMNOCARDIIDAE Stoliczka, 1870

[*nom. transl.* (as Adacnidae), VON VEST, 1875 (*ex* Lymnocardiinae STOLICZKA, 1870)]

Shells ribbed to smooth, small to medium-sized, many with alations on dorsal margin, some with shell gaping. Normal hinge with two cardinals in either valve, obsolescent in some; lateral teeth distant, varying from large to obsolete; pallial line entire or sinuate to a varying extent. [Brackish-water forms, perhaps of polyphyletic origin, characterized by great variability.] *Mio.-Rec.*

The classification here is adapted from an outline by EBERSIN (1965), the most complete modern summary of named taxa; however, differential diagnoses of many nominal taxa are yet unavailable.

Subfamily LYMNOCARDIINAE Stoliczka, 1870

Shells oblique, umbones in front of midline; hinge with well-developed anterior lateral teeth. Pallial line normally entire, valves mostly not gaping. *Mio.-M.Plio.*

Lymnocardium STOLICZKA, 1870 [**Cardium haueri* HÖRNES, 1861; OD] [=*Limnocardium (nom. null.)*]. Long-quadrate; ribs few, smooth or with spines; cardinals 2 and *3b* present. *M.Mio.-M.Plio.*, Eu.

L. (Lymnocardium). Hinge teeth and sculpture well developed. *M.Mio.(Sarmat.)-L.Plio.(Ruman.)*, E.Eu.——FIG. E88,*4*. **L. (L.) haueri* (HÖRNES), L.Plio., Aus.; *4a-c*, LV ext., LV hinge, RV int., ×0.5 (Andrussov, 1903).

L. (Arpadicardium) EBERSIN, 1947 [**L. (A.) peregrinum*; OD]. Hinge nearly edentulous; pallial line slightly sinuate. *L.Plio.(Pont.)*, S.USSR.

L. (Bosphoricardium) EBERSIN, 1947 [**Cardium emarginatum* DESHAYES, 1838 (*non* DESHAYES, 1820) (=*C. aperturatum* DESHAYES, 1857); OD]. Ovate, ribs numerous, low; cardinal teeth weak. *L.Plio.(Pont.)*, S.USSR.

L. (Ecericardium) EBERSIN, 1947 [**L. (E.) ecericum*; OD]. Nearly smooth, ribs low; lateral teeth somewhat reduced. *M.Plio.(Kimmer.-Kualnik.)*, S.USSR.

L. (Euxinicardium) EBERSIN, 1947 [**L. subsyrmiense* ANDRUSSOV, 1903; OD]. Ovate, ribs triangular in section, cardinals weak. *L.Plio.(Pont.)*, S.USSR.

L. (Moquicardium) EBERSIN, 1947 [**L. moquicum* SENINSKY, 1905; OD]. Subrounded to ovate-triangular; ribbed within; pallial line raised anteriorly. *M.Plio.(Kimmer.)*, S.USSR.

L. (Nargicardium) EBERSIN, 1947 [**L. (N.) nargiavagicum*; OD]. Ribs widely spaced, triangular in section; hinge with weak cardinals, strong anterior laterals, obsolete posterior laterals. *L.Plio. (Pont.)*, S.USSR.

L. (Pannonicardium) STEVANOVIĆ, 1951 [**L. dumićići* GORIANOVIC-KRAMBERGER, 1899 (*fide* EBERSIN, 1965)]. *L.Plio.(Pont.)*, S.Eu.

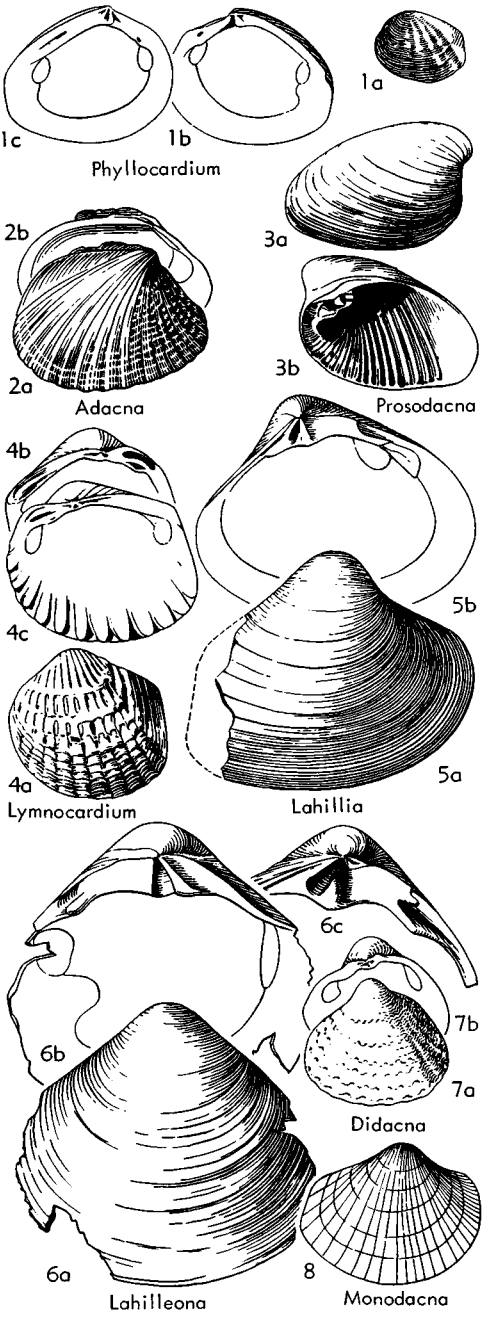


FIG. E88. Lahillidae *(5-6)*; Lymnocardiidae (Lymnocardiinae) *(3-4)*, (Didacninae) *(1,7)*, (Adacninae) *(2,8)* (p. *N*590-*N*593).

L. (Tauricardium) EBERSIN, 1947 [**L. subsquamulosum* ANDRUSSOV, 1903; OD]. Ribs few, well developed anteriorly. *Plio.(Pont.-Kimmer,)*, S. USSR.

Budmania BRUSINA, 1897 [**Adacna meisi* BRUSINA, 1884; SD EBERSIN, 1965]. Ribs few, narrow, crested; hinge weak. *L.Plio.(Pont.)*, S.Eu.

Eoprosodacna DAVIDASCHVILI, 1934 [**Cardium (E.) kartlicum*; M] [=*Limnopappia* SCHLICKUM, 1962 (type, *L. schuetti;* OD)]. *L.Mio.-M.Mio.*, USSR (S.Caucasus).

E. (Eoprosodacna). *L.Mio.-M.Mio.*, USSR(S.Caucasus).

E. (Succuridacna) KOROBKOV, 1954 [**Cardium goriense* DAVIDASCHVILI, 1934; OD] [=*Limnopagetia* SCHLICKUM, 1963 (type, *Cardium friabile* KRAUSS, 1852; OD)]. Ribs widely spaced. *L.Mio.-M.Mio.*, USSR(S.Caucasus).

Horiodacna SABBA STEFANESCU, 1896 [**H. rumana;* M]. Smooth, beaks prosogyrate; shell ribbed internally; hinge with rudimentary cardinal in 1 valve, fossette in other. *L.Plio.(Pont.)*, Eu.(Rumania).

Limnodacna EBERSIN, 1936 [**L. cristulata*; OD]. Posterior slope set off by several carinate ribs; hinge of LV reduced to 1 weak cardinal. *M. Plio.(Kimmer.)*, S.USSR.

Pachydacna EBERSIN, 1955 [*pro Natella* EBERSIN, 1949 (*non* WATSON, 1934)] [**Natella natella* EBERSIN, 1949; M]. Ribs few, hinge heavy. *M. Plio.(Kimmer.-Kuialnik.)*, Euxine Basin, S.USSR.

Prionopleura EBERSIN, 1949 [**Prosodacna prionopleura* WASSOIEVICH & EBERSIN, 1931 (*ex* ANDRUSSOV MS); T]. Ribs keeled, crossed by raised regular growth lamellae. *M.Plio.(Kimmer.)*, S.USSR.

Prosodacna TOURNOUËR, 1882 [**Cardium macrodon* DESHAYES, 1838; OD] [=*Psilodon* COBALESCU, 1883 (*non* PERTY, 1830); *Pseudoprosodacna* GILLET, 1943 (*fide* EBERSIN, 1959)]. Ovate, oblique, beaks prosogyrate; exterior ribbing weak, interior ribs strong; hinge with cardinals wanting, laterals *AI, AII* thick, *AIII* thin; pallial line entire. *L.Plio.-M.Plio.*, S.USSR.

P. (Prosodacna). *L.Plio.-M.Plio.(Pont.-Kuialnik.)*, S.USSR.——FIG. E88,*3*. **P. (P.) macrodon* (DESHAYES), Plio., Euxine Basin, S.Eu.-S.USSR, *3a,b*, RV ext., int., ×0.4 (Davidaschvili).

P. (Metadacna) [**P. metoica* DAVIDASCHVILI, 1930; OD]. *M.Plio.*, Azov area, S.USSR.

P. (Prosochiasta) EBERSIN, 1959 [**P. prosochiasta* ANDRUSSOV, 1917; OD]. *L.Plio.(Pont.)*, S.USSR.

P. (Prosodacnomya) EBERSIN, 1959 [**Cardium rostratum* SINZOV, 1900 (*non* DE KONINCK, 1841) (=*Prosodacna sinzovi* ANDRUSSOV, 1917); OD]. *L.Plio.(Pont.)*, S.USSR.

Stylodacna SABBA STEFANESCU, 1896 [**Psilodon heberti* COBALESCU, 1883; OD] [=*Styladacna* DOLLFUS, 1905 *(nom. null.)*]. Internal ribs heavy, lamellar; hinge without cardinals, laterals small, lamellar. *M.Plio.*, Eu.(Rumania).

Subfamily DIDACNINAE Ebersin, 1962

Umbones subcentral; lateral teeth wanting. *L.Plio.(Pont.)-Rec.*

Didacna EICHWALD, 1838 [**Cardium trigonioides* PALLAS, 1771; SD STOLICZKA, 1870]. Rounded-trigonal, slightly truncate; pallial line entire. *L. Plio.(Pont.)-Rec.*, S.USSR.

D. (Didacna). *Rec.*, Caspian Sea.——FIG. E88,*7*. **D. (D.) trigonioides* (PALLAS); *7a,b*, LV ext., RV int., ×0.5 (Reeve, 1843).

D. (Crassadacna) EBERSIN, 1962 [**Cardium crassatellatum* DESHAYES, 1838; OD]. *Plio.(Pont.-Kimmer.)*, S.USSR.

D. (Pontalmyra) SABBA STEFANESCU, 1896 [**P. placida;* SD SACCO, 1899] [=*Tschaudia* DAVIDASCHVILI, 1956 (type, *Didacna tschaudae* ANDRUSSOV, 1910; OD)]. *Plio.(Pont.-Kuialnik.)*, S. USSR-S.Eu.

Brachiodacna EBERSIN, 1964 [**Cardium negativum* ANDRUSSOV, 1909; OD]. *L.Plio.(Pont.)*, S.USSR (*fide* EBERSIN, 1965).

Caladacna ANDRUSSOV, 1917 [**Cardium steindachneri* BRUSINA, 1884; M] [=*Kaladacna* ANDRUSSOV, 1923 (type, *Cardium fittoni* D'ORBIGNY, 1845; OD)]. Ribs triangular in section, conspicuous, irregular. *Plio.(Pont.-Kimmer.)*, S.USSR.

Didacnomya ANDRUSSOV, 1923 [**Cardium vulgaris* SINZOV, 1876 (*non* DA COSTA, 1778) (?=*Monodacna vulgaris planior* KRESTOVNIKOV, 1928); OD]. *Plio.(Pont.-Kuialnik.)*, S.USSR.

Oraphocardium EBERSIN, 1949 [**Phyllocardium oraphense* DAVIDASCHVILI, 1930; OD]. Like *Phyllocardium* but posterior margin rectangular instead of oblique. *Plio.(Pont.-Kimmer.)*, S.USSR.

Oxydacna DAVIDASCHVILI, 1930 [**O. tenericardo, ex* ANDRUSSOV MS; M]. Ribs narrow at crests. *M.Plio.(Kimmer.)*, S.USSR.

Phyllocardium FISCHER, 1887 [**Cardium planum* DESHAYES, 1838; M] [=*Phyllicardium* AUCTT. *(nom. null.)*]. Ovate, tending toward alation of dorsal margin. *Plio.(Pont.-Kimmer.)*, S.USSR.—— FIG. E88,*1*. **P. planum* (DESHAYES), L.Plio., S. USSR; *1a-c*, LV ext., RV int., LV int., ×1 (Andrussov).

Plagiodacna ANDRUSSOV, 1903 [**Cardium carinatum* DESHAYES, 1838 (*non* BRONN, 1831) (=*C. angulosum* DESHAYES, 1857); SD CROSSE, 1905]. Rhomboidal, with umbonal ridge. *Plio.(Pont.-Kuialnik.)*, S.USSR.

Pseudocatillus ANDRUSSOV, 1903 [**Cardium pseudocatillus* BARBOT-DE-MARNY, 1869; T]. Shell somewhat compressed, ribs weak. *Plio.(Pont.-Kuialnik.)*, S.USSR.

Pteradacna ANDRUSSOV, 1907 [**Cardium edentulum* DESHAYES, 1838 (*non* MONTAGU, 1808) (=*C. subedentulum* D'ORBIGNY, 1852; M]. Ribs numerous, with threadlike nodes; dorsal margin alate; hinge edentulous. *M.Plio.(Kimmer.)*, S.USSR.

Stenodacna ANDRUSSOV, 1923 [**Cardium angusti-*

costatum ROUSSEAU, 1842; M]. *M.Plio.(Kimmer.)*, S.USSR.

Subfamily PARADACNINAE Ebersin, 1964

Shells very thin and fragile, mostly edentulous; pallial line entire or nearly so. *Plio. (Pont.-Kimmer.)*.

Paradacna ANDRUSSOV, 1909 [*pro Abichia* ANDRUSSOV, 1907 (*non* GEMMELLARO, 1888)] [**Cardium abichi* HÖRNES, 1874; M]. Elongate, trapezoidal, posterior slope smooth, posterior ribs carinate, wide-spaced. *Plio.(Pont.-Kimmer.)*, S.USSR.

Arcicardium FISCHER, 1887 [**Cardium acardo* DESHAYES, 1838; M]. Shell flattened, trigonal, very inequilateral, edentulous. *L.Plio.*, USSR (Crimea).

Chartoconcha ANDRUSSOV, 1907 [**Cardium bayerni* HÖRNES, 1874; M]. Smooth, hinge edentulous. *Plio.(Pont.-Kuialnik.)*, S.USSR.

Panticapaea ANDRUSSOV, 1923 [**Cardium duboisi* MAYER, 1856; M]. *U.Plio.(Kimmer.)*, S.USSR.

Papyrocardium GABUNIA, 1953 [**P. fragilicostatum* (*fide* EBERSIN, 1965)]. *U.Plio.(Kimmer.)*, S.USSR.

Parvidacna STEVANOVIĆ, 1951 [**P. planicostata* (*fide* EBERSIN, 1965)]. *L.Plio.(Pont.)*, S.USSR.

Subfamily ADACNINAE von Vest, 1875

[*nom. transl.* EBERSIN, 1965 (*ex* Adacnidae VON VEST, 1875)]

Hinge weak to edentulous; pallial sinus present in most; some forms gaping at one or both ends. *U. Plio. (Aktschagyl.-Apscheron.)-Rec.*

Adacna EICHWALD, 1838 [**Glycimeris laeviuscula* EICHWALD, 1829 (?=*A. laeviuscula* EICHWALD, 1838); SD VON VEST, 1875]. Edentulous; valves thin, gaping at both ends; pallial sinus large. *U. Plio.(Apscheron.)-Rec.*, Caspian Sea-S.USSR.——FIG. E88,*2*. **A. laeviuscula* (EICHWALD), Rec., Caspian Sea; *2a,b*, RV ext., LV int., ×1 (Chenu, 1857).

Apscheronia ANDRUSSOV, 1903 [**Cardium propinquum* EICHWALD, 1841 (*non* MÜNSTER, 1837) (=*C. proximum* DESHAYES, 1857); M]. Shell surface smooth, without ribs. *U.Plio.(Apscheron.)*, S.USSR.

Avicardium KOLESNIKOV, 1950 [**Cardium nikitini* ANDRUSSOV, 1902; OD]. *U.Plio.*, Caspian Basin.

Caspicardium ASTAFIEVA, 1955 [**Cardium trapezinum* ANDRUSSOV, 1923 (*fide* EBERSIN, 1965)]. *U.Plio.(Apscheron.)*, S.USSR.

Catilloides ANDRUSSOV, 1923 [**Monodacna catilloides;* OD]. *U.Plio.(Apscheron.)*, S.USSR.

Hypanis EICHWALD, 1838 (*ex* PANDER MS) [**Cardium plicatum*; M]. Resembling *Adacna* but with wide-spaced sharp ribs. *U.Plio.(Apscheron.)*, S. USSR.

Hyrcania KOLESNIKOV, 1950 [**Didacna hyrcana*

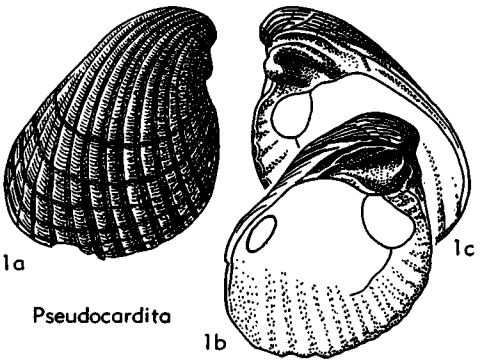


FIG. E89. Lahillidae (Pseudocarditinae) (p. *N*593).

ANDRUSSOV, 1923; OD] [=*Turkmena* POPOV, 1956 (type, *Didacna turkmena* ANDRUSSOV, 1923; OD); *Irinia* POPOV, 1956 (type, *Didacna turkmena major* ANDRUSSOV, 1923; OD)]. *U.Plio. (Apscheron.)*, S.USSR.

H. (Hyrcania). *U.Plio.(Apscheron.)*, S.USSR.

H. (Didacnoides) ASTAFIEVA, 1955 [**Monodacna didacnoides* ANDRUSSOV, 1923; T (*fide* EBERSIN, 1965)]. *U.Plio.(Apscheron.)*, S.USSR.

H. (Hyrcanomya) ASTAFIEVA, 1955 [**Monodacna bakuana* ANDRUSSOV, 1923 (*fide* EBERSIN, 1965)]. *U.Plio.(Apscheron.)*, S.USSR.

Monodacna EICHWALD, 1938 [**Corbula caspia* EICHWALD, 1829; SD VON VEST, 1875]. Rounded-quadrate, ribs broad; hinge with cardinals *2* and *3b*, no laterals; pallial sinus small. *U.Plio. (Apscheron.)-Rec.*, Caspian-S.USSR.——FIG. E88, *8*. **M. caspia* (EICHWALD), Rec., Caspian Sea; RV ext., ×1 *(124b)*.

Parapscheronia EBERSIN, 1955 [**Apscheronia volarovici* ANDRUSSOV, 1923; M]. *U.Plio.(Apscheron.)*, S.USSR.

Plagiodacnopsis ANDRUSSOV, 1923 [**Monodacna (P.) isseli;* OD]. *U.Plio.(Apscheron.)*, S.USSR.

Subfamily PSEUDOCARDITINAE Ebersin, 1964

Outline oblique; hinge lacking laterals and right anterior cardinal; pallial line entire. *Plio.*

Pseudocardita OPPENHEIM, 1918 [**Cardium (P.) bukowskii;* SD KEEN, 1937]. Oblique, inequilateral, ribs broad, rounded; hinge plate wide, teeth stout, nymphs elongate. *Neog.(?Pont.)*, Asia Minor. ——FIG. E89,*1*. **P. bukowskii* (OPPENHEIM), Plio., S.Turkey; *1a-c*, RV ext., LV int., RV int., ×1 (Oppenheim, 1918).

Subfamily UNCERTAIN

Diversicostata EBERSIN & WASSOIEVIĆ, 1930 [**Monodacna maxima, ex* ANDRUSSOV MS; SD SALISBURY,

1932 (proposed as an undefined "section" and later rejected as invalid by EBERSIN)].

Myocardia VON VEST, 1861 [**M. truncata*; SD VON VEST, 1875]. Hinge resembling that of *Cardium* but shells with the pallial sinus of *Adacna*. *Mio.*, Eu.(Hung.).

Prophyllicardium JEKELIUS, 1944 [**P. soceni* (*fide* Zool. Record, 1946)]. *Mio.*, Eu.(Rumania).

Replidacna JEKELIUS, 1944 [**R. carasi* (*fide* Zool. Record, 1946)]. *Mio.*, Eu.(Rumania).

Uniocardium CAPELLINI, 1880 [**U. meneghini*; M]. *Plio.*, Eu.(Italy).

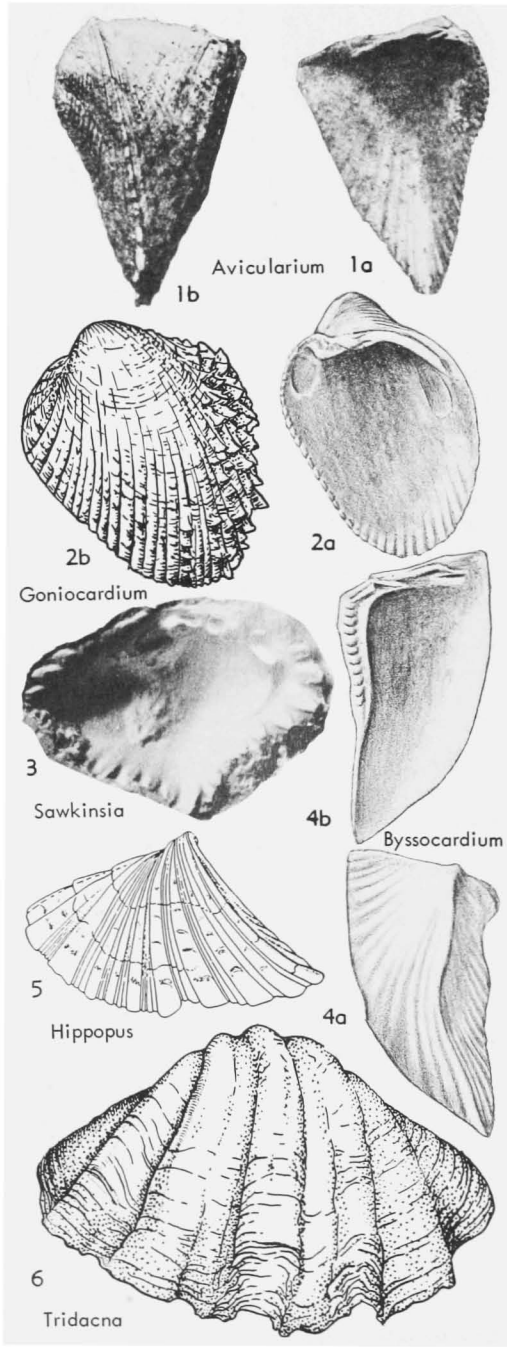


FIG. E90. Tridacnidae (p. *N*594-*N*595).

Superfamily TRIDACNACEA Lamarck, 1819

[*nom. transl.* DALL, 1895 (*ex* Tridacnidae GOLDFUSS, 1820) (=tridacnées LAMARCK, 1819)] [Materials for this superfamily prepared by MYRA KEEN]

Medium-sized to very large shells, with radial ribbing; byssal gape in most; hinge with two oblique lamellar cardinal teeth and one or more lateral teeth; soft parts "rotated" within shell as special adaptation to mode of life among corals; posterior adductor and large posterior pedal retractor muscle scar centrally located, anterior adductor scar wanting; pallial line entire. *?U. Cret., Tert.-Rec.*

Family TRIDACNIDAE Lamarck, 1819

[*nom. correct.* MENKE, 1830 (*pro* Tridacnadae *nom. transl. et correct.* FLEMING, 1828, *ex* ?tribe Tridacnae GOLDFUSS, 1820) (=tridacnées LAMARCK, 1819)]

Radial ribs smooth or with spinose ornamentation. *?U.Cret., Tert.-Rec.*

Tridacna BRUGUIÈRE, 1797 [**Chama gigas* LINNÉ, 1758; SM LAMARCK, 1799] [=*Tridachnes* RÖDING, 1798 (obj.); *Tridacnodites* KRÜGER, 1823 (obj.); *Dinodacna* IREDALE, 1937 (obj.)]. Large to massive, ribs few, strong; anterior lateral teeth wanting. *?U.Cret., Tert.-Rec.*, Eu.-E.Indies-Afr.-S.Pac.

T. (Tridacna). Ribs deeply folded; umbones subcentral. Shells unattached but among reef corals. *L.Mio.-Rec.*, Eu.-E.Indies.——FIG. E90,6. **T. (T.) gigas* (LINNÉ), Rec., E.Indies; LV ext., ×0.05 *(562; 797)*.

T. (Chametrachea) MÖRCH, 1853 [**Tridacna crocea* LAMARCK, 1819; SD IREDALE, 1937] [=*Flodacna* IREDALE, 1937 (type, *T. squamosa* LAMARCK, 1819; OD); *Sepidacna* IREDALE, 1937 (type, *T. troughtoni* =*Tridachnes maxima* RÖDING, 1798; OD); *Vulgodacna* IREDALE, 1937 (type, *T. maxima* var. *fossor* HEDLEY, 1921 =*Tridachnes maxima* RÖDING, 1798; OD)]. Valves equilateral to strongly inequilateral, umbones anterior to mid-line; sculpture tending to be scaly. Boring into coral. *?U.Cret., Tert.-Rec.*, Afr.-Eu.-E.Indies.

T. (Persikima) IREDALE, 1937 [**P. whitleyi* (=*Tridachnes derasa* RÖDING, 1798); OD]. Um-

bones posterior to mid-line, shell strongly inequilateral. *Rec.*, S.Pac.

Avicularium GRAY, 1853 [**"Cardium aviculare* LAM." (=*Cardita avicularia* LAMARCK, 1805); SD DALL, 1900] [=*Lithocardium* WOODWARD, 1854 (obj.)]. Triangular, higher than long, ribs evident but nearly smooth. *M.Eoc.-L.Oligo.*, Eu.-W.Indies.——FIG. E90,*1*. **A. avicularium* (LAMARCK), Eoc., France; *1a,b*, LV int., ext., ×0.5 (Cossmann & Pissarro, 1904).

Byssocardium MUNIER-CHALMAS, 1882 [**Cardium emarginatum* DESHAYES, 1829; OD]. With an anterior gape bordered by plaits, as in *Tridacna*, but shell more triangular. *M.Eoc.-L.Mio.*, Eu.——FIG. E90,*4*. **B. emarginatum* (DESHAYES), Eoc., France; *4a,b*, RV ext., int., ×0.7 (Deshayes).

Goniocardium VASSEUR, 1880 [**Cardium rachitis* DESHAYES, 1829; SD KEEN, 1937]. Oblique-ovate, spinose, anterior lateral teeth wanting. *M.Eoc.-U.Eoc.*, Eu.——FIG. E90,*2*. **G. rachitis* (DESHAYES), Eoc., France; *2a*, RV int., ×0.7; *2b*, LV ext., ×1 (Cossmann & Pissarro, 1904).

Hippopus LAMARCK, 1799 [**Chama hippopus* LINNÉ, 1758; M] [=*Pelvis* MEGERLE, 1811 (obj.); *Cerceis* GISTL, 1848 (obj.) *(nom. van.)*]. Like *Tridacna* in general form but byssal gape closed in adult. *Mio.-Rec.*, E.Indies-W.Indies.——FIG. E90,*5*. **H. hippopus* (LINNÉ), Rec., E.Indies; RV ext., ×0.3 (Stasek, 1962).

Sawkinsia Cox, 1941 [**S. matleyi*; OD]. Resembling *Tridacna* but not gaping; anterior lateral teeth present. *U.Eoc.-U.Oligo.*, Carib.——FIG. E90,*3*. **S. matleyi*, Eoc., Jamaica; RV int., ×1 (Cox, 1941).

Superfamily MACTRACEA Lamarck, 1809

[*nom. transl.* DALL, 1895 (*ex* family Mactracea GRAY, 1823) (=mactracées LAMARCK, 1809)] [Materials for this superfamily prepared by MYRA KEEN]

Thin-shelled, porcelaneous; hinge with inverted V-shaped cardinal tooth in LV, two cardinals in RV; lateral teeth and accessory cardinal laminae present in most groups; external ligament small or wanting, internal ligament or resilium seated in socket-like resilifer; pallial sinus normally well developed *(507, 510)*. *U.Cret.-Rec.*

Family MACTRIDAE Lamarck, 1809

[*nom. correct.* SWAINSON, 1835 (*pro* family Mactracea GRAY, 1823) (=mactracées LAMARCK, 1809)]

Periostracum present, glossy; shell smooth or concentrically sculptured; valves slightly gaping; pallial line with sinus; siphons of animal united to their tips *(510)*. *U.Cret.-Rec.*

Subfamily MACTRINAE Lamarck, 1809

[*nom. transl.* ADAMS & ADAMS, 1856 (*ex* family Mactracea GRAY, 1823) (=mactracées LAMARCK, 1809)]

Subequilateral, nearly closed; hinge well developed, two cardinals of RV somewhat joined; siphons wholly retractile within shell. *U.Cret.-Rec.*

Mactra LINNÉ, 1767 [**Cardium stultorum* LINNÉ, 1758; SD FLEMING, 1818 (+ICZN, Dir. 72, as of GRAY, 1847)] [=*Trigonella* DA COSTA, 1778 (obj.; SD WINCKWORTH, 1926); *Deikea* MAYER, 1872 (type, *M. gallensis* MAYER, 1867; SD KEEN, herein); *Colorimactra* IREDALE, 1929 (type, *M. queenslandica* E. A. SMITH, 1914; OD); *Telemactra* IREDALE, 1929 (type, *M. obesa* REEVE, 1854, *ex* DESHAYES MS; OD)]. Trigonal to oval, somewhat inflated, subequilateral; lunule and escutcheon delimited; ligament separated from resilium by shelly lamina; lateral teeth smooth; pallial sinus oval. *Eoc.-Rec.*, cosmop.

M. (Mactra). Lunule and escutcheon not set off by groove; hinge of LV with *AII* and *4b;* RV with *3a-3b* not fused above, laterals doubled; pallial sinus rounded, not deep. *Rec.*, circumtrop.——FIG. E91,*2*. **M. (M.) stultorum* (LINNÉ), Medit.; *2a*, LV ext., ×0.5 (Reeve, 1854); *2b,c*, LV and RV hinges, ×1 *(510)*.

M. (Allomactra) TOMLIN, 1931 [*pro Heteromactra* COSSMANN & PEYROT, 1909 (*non* LAMY, 1906)] [**M. (H.) grateloupi* COSSMANN & PEYROT, 1909, *ex* DESHAYES MS; OD]. Trigonal, flattened, smooth, resembling *M. (Eomactra)* but with wider cardinal plate, resilifer pyriform, *4b* wanting, also nymph; pallial sinus long and broad. *Mio. (Burdigal.)*, Eu.——FIG. E91,*3*. **M. (A.) grateloupi* COSSMANN & PEYROT, France; *3a,b*, RV ext., int., ×1; *3c*, LV hinge, ×2 *(164)*.

M. (Andrussella) KOROBKOV, 1954 [**M. acutecarinata* ANDRUSSOV, 1902; OD]. Posterior slope meeting central slope in sharp keel that may be prolonged into spout. *Plio.*, E.Eu.——FIG. E91,*1*. **M. (A.) acutecarinata* ANDRUSSOV, S.Caucasus; *1a,b*, RV, LV ext., ×1.5; *1c*, RV hinge, ×5 (Andrussov, 1902).

M. (Austromactra) IREDALE, 1930 [**A. caloundra;* OD]. Trigonal, equivalve, sculpture of laminar concentric ridges wavy at ends; hinge broad; pallial sinus small, rounded. *Rec.*, S.Pac.——FIG. E91,*6*. **M. (A.) caloundra* (IREDALE), Australia; *6a,b*, LV ext., int., ×1 (Iredale, 1930).

M. (Avimactra) ANDRUSSOV, 1905 [**M. (A.) aviculoides*; M]. Trigonal, dorsal margin long and straight, ventral attenuated by radial fold; hinge with large resilifer. *Plio.*, E.Eu.——FIG. E91,*5*. **M. (A.) aviculoides*, S.Caucasus; *5a*, RV ext., ×1; *5b*, RV hinge, ×2 (Andrussov, 1905).

M. (Barymactra) COSSMANN & PEYROT, 1909 [**Mactra burdigalensis* MAYER, 1864; OD]. Large, thick, short, hinge teeth close-set; pallial sinus

short, slightly descending, line doubled, bordered above by row of punctate scars. *Eoc.-Mio.*, Eu.-SW.Afr.——Fig. E91,*4*. **M. (B.) burdigalensis* Mayer, Mio., France; *4a,b*, RV int., LV int., ×0.5 *(164)*.

M. (Coelomactra) Dall, 1895 [**M. violacea* Gmelin, 1791; OD]. Valves thin, inflated, dorsal areas grooved, resilifer not roofed at apex; hinge plate oblique, teeth not concentrated, laterals long, thin, cardinals buttressed; pallial sinus short, high. *Rec.*, Pac.——Fig. E92,*6*. **M. (C.) violacea* Gmelin, E.Indies; *6a*, LV ext., ×0.5 (Reeve, 1854), *6b,c*, LV and RV hinges, ×2 *(510)*.

M. (Cryptomactra) Andrussov, 1902 [**Lucina*

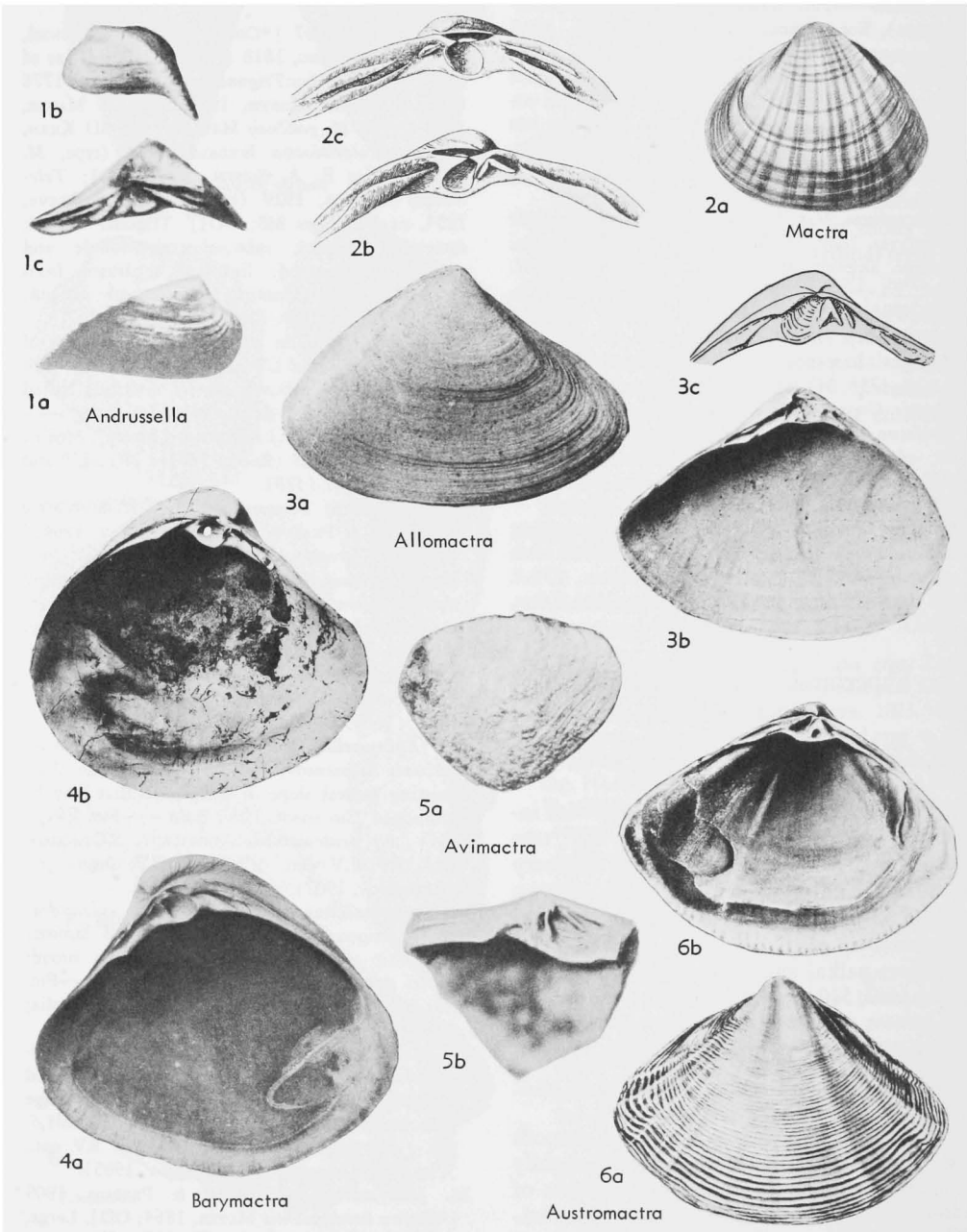


Fig. E91. Mactridae (Mactrinae) (p. *N595-N596*).

pesanseris MAYER-EYMAR, 1857; M]. Small, trapezoidal, with 1 or 2 strong radial folds, making ventral margin sinuous. *Mio.(Sarmat.)*, E.Eu.—— FIG. E92,*1*. **M. (C.) pesanseris* (MAYER-EYMAR), U.Mio., S.Caucasus; *1a,b*, LV ext., RV ext., ×1; *1c,d*, RV and LV hinges, ×1.5 (Andrussov, 1902).

M. (Cyclomactra) DALL, 1895 [**M. tristis* "GRAY" *(err. pro *M. tristis* REEVE, 1854)*; OD]. Like *M. (Mactroderma)* but subcircular, compressed, liga-

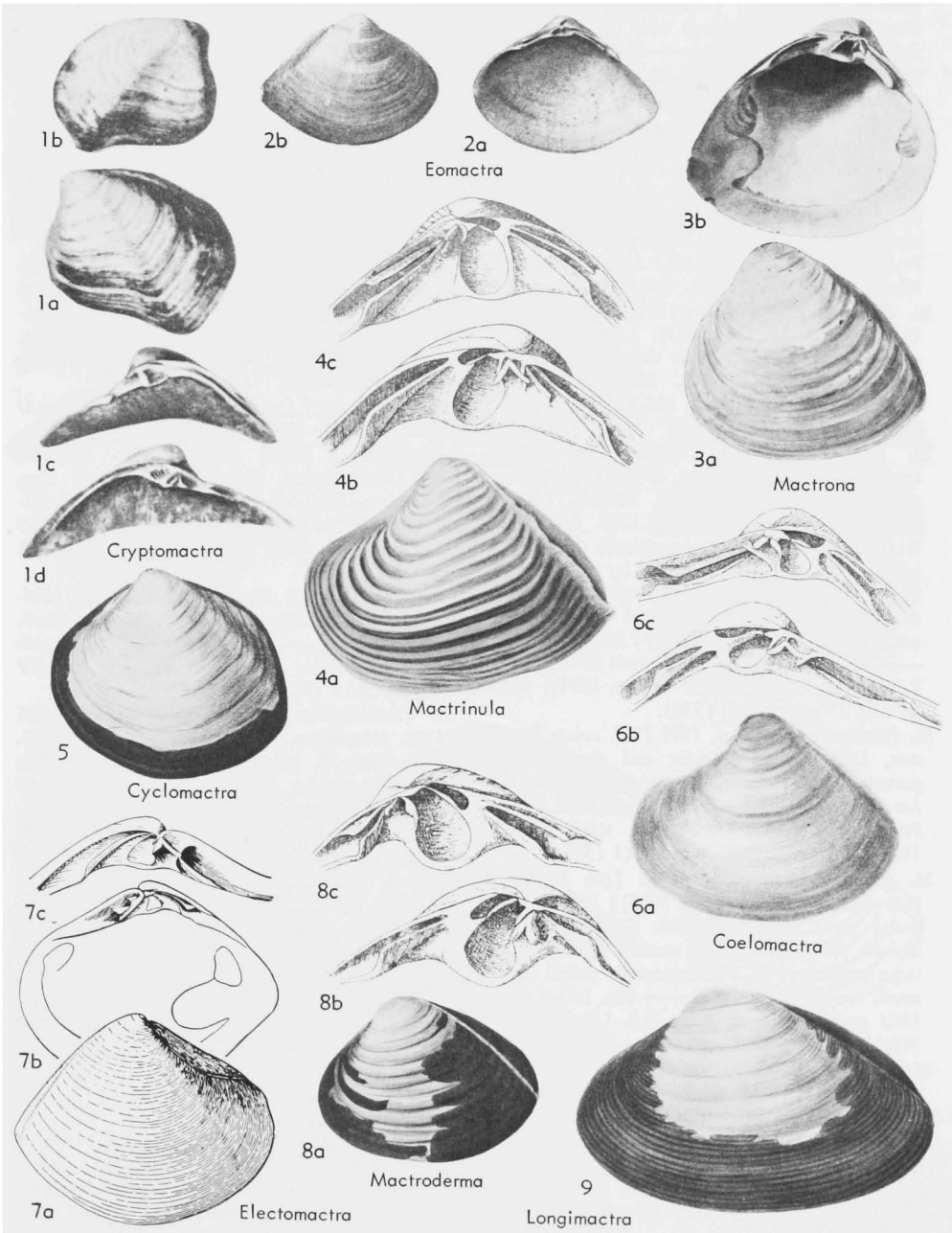


FIG. E92. Mactridae (Mactrinae) (p. *N*596-*N*598).

ment almost submerged though separate from resilium. *Plio.-Rec.*, S.Pac.——Fig. E92,*5*. **M. (C.) tristis* Reeve, Rec., N.Z.; LV ext., ×0.7 (Reeve, 1854).

M. (Electomactra) Iredale, 1930 [**M. parkesiana* Hedley, 1902; OD] [=*Electromactra*, spelling error]. Small, short, hinge wide and heavy for size of shell. *Rec.*, S.Pac.——Fig. E92,*7*. **M. (E.) parkesiana* Hedley, Australia; *7a,b*, RV ext., int., ×1.5; *7c*, LV hinge, ×5 (Hedley, 1902).

M. (Eomactra) Cossmann in Cossmann & Peyrot, 1909 [**M. basteroti* Mayer, 1853; OD]. Small, triangular, smooth except for concentric ribs on lunule and escutcheon; resilifer small, not projecting beyond margin of hinge plate. *Eoc.-Plio.*, Eu.——Fig. E92,*2*. **M. (E.) basteroti* Mayer, Mio., France; *2a,b*, RV int., ext., ×1 *(164)*.

M. (Longimactra) Finlay, 1928 [**M. elongata* Quoy & Gaimard, 1835; OD]. Long, concentric ribs stronger at ends; sinus deep, muscle scars large. *Rec.*, S.Pac.——Fig. E92,*9*. **M. (L.) elongata* Quoy & Gaimard, N.Z.; LV ext., ×0.5 (Reeve, 1854).

M. (Mactrinula) Gray, 1853 [**M. plicaria* (=**Mactra plicataria* Linné, 1767); M] [=*Mactrella* Gray, 1853 (type, *M. striatula* Linné, 1767; M); *Papyrina* Mörch, 1853 (obj.; SD Keen, herein)]. Valves concentrically plicate, inequilateral, posterior slope set off by ridge; resilifer large and narrow, hinge teeth not concentrated, cardinal in LV reinforced by apophysis, with accessory lamella in front. *L.Mio.-Rec.*, Pac. ——Fig. E92,*4*. **M. (M.) plicataria* Linné, Rec., E.Indies; *4a*, LV ext., ×0.5 (Reeve, 1854); *4b,c*, LV and RV hinges, ×2 *(510)*.

M. (Mactroderma) Dall, 1894 [**M. velata* Philippi, 1848; OD]. Anterior end shorter than posterior; pallial sinus large and round. *Rec.*, N. Am.-S.Am.——Fig. E92,*8*. **M. (M.) velata* Philippi, W.C.Am.; *8a*, LV ext., ×0.3 (Reeve, 1854); *8b,c*, LV and RV hinges, ×1 *(510)*.

M. (Mactrona) Marwick, 1952 [*pro Mactrula* Marwick, 1948 (*non* Risso, 1826)] [**M. (Mactrula) mula* Marwick, 1948; OD]. Exteriorly like *M. (Mactra)* but with sunken ligament and large cardinal of *M. (Cyclomactra)*; pallial sinus small, rounded. *Plio.*, S.Pac.——Fig. E92,*3*. **M. (M.) mula* Marwick, N.Z.; *3a,b*, LV ext., int., ×0.4 (Marwick, 1948).

M. (Mactrotoma) Dall, 1894 [**M. fragilis* Gmelin, 1791; OD]. With thin, silky periostracum, posterior area set off by angular ridge over which periostracum is wrinkled; ligament long, resilifer large, shallow. *Rec.*, circumtrop.——Fig. E93,*11*. **M. (M.) fragilis* Gmelin, Carib.; *11a*, LV ext., ×0.5 (Reeve, 1854); *11b,c*, LV and RV hinges, ×2 *(510)*.

M. (Maorimactra) Finlay, 1928 [**M. ordinaria* E. A. Smith, 1898; OD]. Small, outline *Corbula*-like, posterior end longer. *Rec.*, S.Pac.——Fig. E93,*4*. **M. (M.) ordinaria* Smith, N.Z.; LV ext., ×2 (Smith, 1898).

M. (Micromactra) Dall, 1894 [**M. californica* Conrad, 1837; M]. Shell small, solid, beaks and umbones with undulating concentric ribs; hinge as in *M. (Mactrotoma)*. *Rec.*, W.N.Am.-C.Am. ——Fig. E93,*3*. **M. (M.) californica* Conrad, Panama; LV ext., ×1 (Reeve, 1854).

M. (Nannomactra) Iredale, 1930 [**M. jacksonensis* E. A. Smith, 1885; OD]. Thin, glassy, concentrically striate, trigonal; hinge narrow, delicate; pallial sinus shallow. *Rec.*, S.Pac.——Fig. E93,*6*. **M. (N.) jacksonensis* Smith, Australia, *6a,b*, RV int., dorsal, ×1.5 *(852)*.

M. (Sarmatimactra) Korobkov, 1954 [**M. vitaliana* d'Orbigny, 1845; OD]. Subtrigonal, umbones wide; hinge fairly massive; lamina between ligament and resilifer toothlike; pallial sinus short, rounded, pallial line deeply incised, vertically striate. *Mio.*, E.Eu.

M. (Simomactra) Dall, 1894 [**M. dolabriformis* Conrad, 1837; M]. Outline flattened cuneiform, inequilateral; pallial sinus smaller than in *M. (Mactrotoma)*, siphonal gape small. *Rec.*, W.N.Am.-C.Am.——Fig. E93,*7*. **M. (S.) dolabriformis* Conrad, USA(Calif.); *7a*, LV ext., ×0.3 (Dall, 1894); *7b,c*, RV and LV hinges, ×1 *(510)*.

M. (Stiphromactra) Böhm, 1929 [**M. (S.) welwitschi*; OD]. Hinge wide but teeth very small. *Eoc.*, W.Afr.——Fig. E93,*10*. **M. (S.) welwitschi*, Angola; *10a-c*, RV ext., LV and RV hinges, ×0.5 (Böhm, 1929).

M. (Tumbeziconcha) Pilsbry & Olsson, 1935 [**M. thracioides* Adams & Reeve, 1848; OD]. Resembling *M. (Mactrinula)* as to sculpture but lacking posterior ridge; concentric ribs intersected by oblique striae on posterior slope. *Rec.*, W.C.Am.——Fig. E93,*2*. **M. (T.) thracioides* Adams & Reeve, Peru; LV ext., ×1 (Pilsbry & Olsson, 1935).

Aliomactra Stephenson, 1952 [1953] [**A. compressa*; OD]. More compressed than *Mactra*; ligament short, external, with internal part on surface sloping down and forward from nymph; pallial sinus rounded, moderate, not confluent. *U.Cret.*, N.Am.——Fig. E93,*9*. **A. compressa*, USA(Tex.); *9a*, RV ext., ×1; *9b,c*, RV and LV hinges, ×1.5 (Stephenson, 1953).

Cymbophora Gabb, 1869 [**Mactra ashburnerii* Gabb, 1864; OD] [=*Veleda* Conrad, 1870 (*non* Blackwall, 1859) (type, *V. lintea*=*Cardium lintea* Conrad, 1860, *non* Conrad, 1855=*Cymbophora intoxicata* Hanna, 1924)]. Trigonal, resilifer narrow and shallow, bordered by accessory lamella; lateral teeth strong, close to beaks. *U.Cret.*, E.N.Am.-W.N.Am.-Eu.——Fig. E93,*8*. **C. ash-*

burnerii (GABB), USA(Calif.); LV hinge, ×1 *(748)*.

Diaphoromactra IREDALE, 1930 [**Hemimactra versicolor* TATE, 1887; OD]. Small, solid, oblique, anterior end short, posterior with umbonal ridge; lateral teeth partially or entirely wanting in LV; pallial sinus broad and shallow. *Rec.*, S.Pac.—— FIG. E93,*1*. **D. versicolor* (TATE), Rec., Australia;

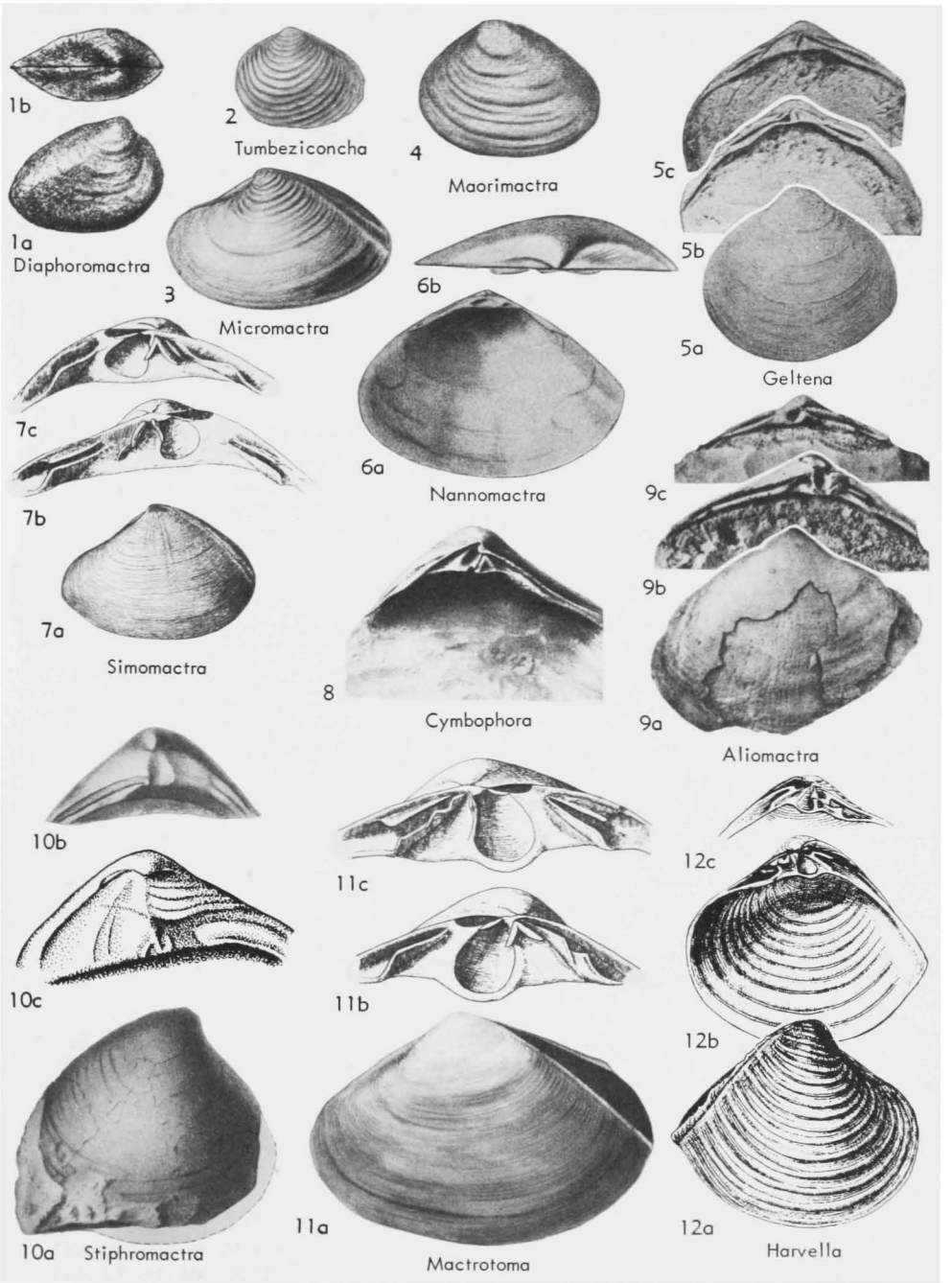


FIG. E93. Mactridae (Mactrinae) (p. *N598-N601*).

1a,b, RV ext., both valves dorsal, ×1.5 (Tate, 1887).

Geltena Stephenson in Vokes, 1946 [**G. subequilatera*; OD]. Subcircular to broadly subovate; resilifer very small; nymph plate heavy; hinge plate with deep groves above laterals. *U.Cret.*, Eu.-N.Am.-W.Asia.——Fig. E93,*5*. **G. subequilatera*, USA(Tex.); *5a,* LV ext., ×1; *5b,c,* ×1, LV and RV hinges, ×1.3 (Stephenson in Vokes, 1946).

Harvella Gray, 1853 [**Mactra elegans* Sowerby,

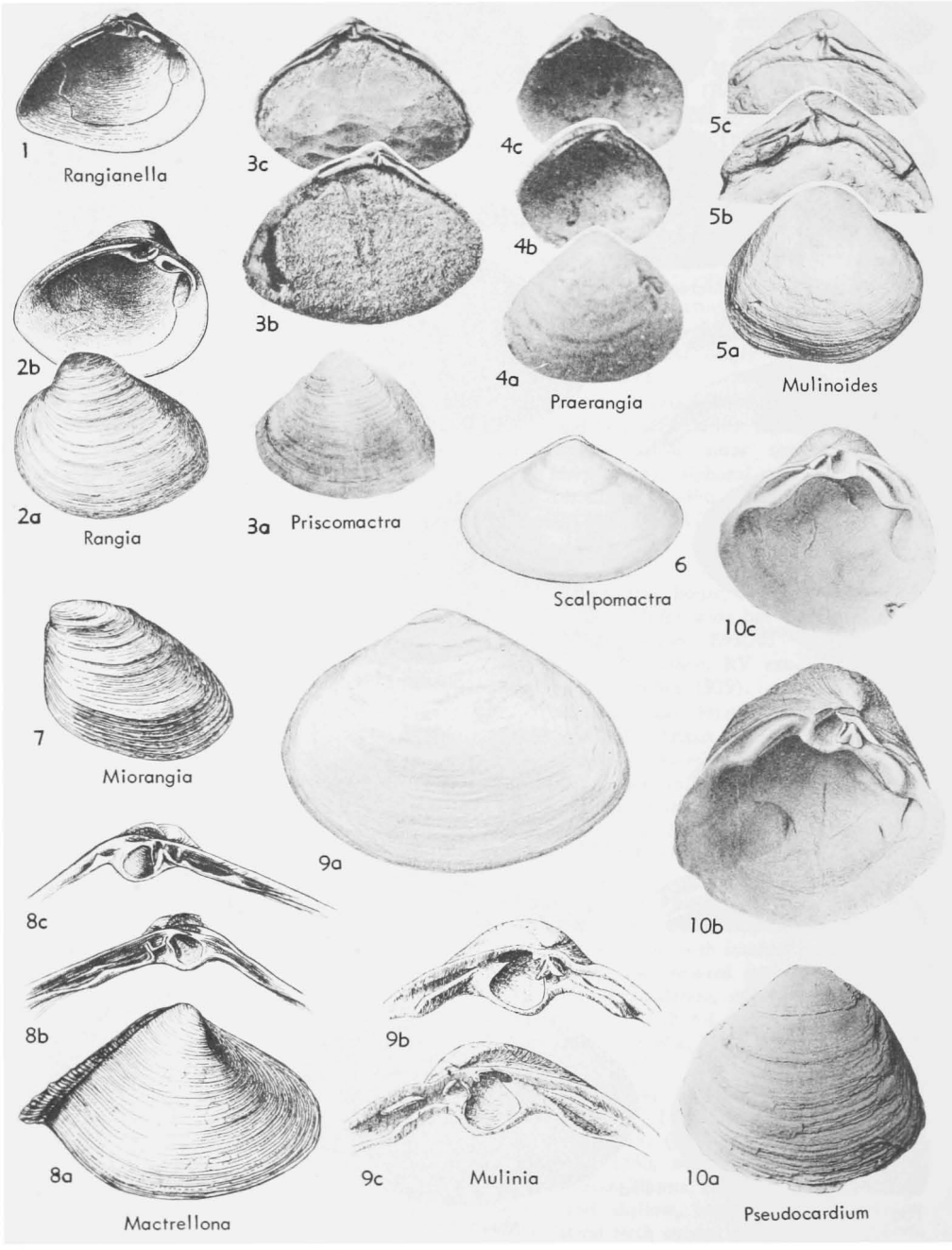


Fig. E94. Mactridae (Mactrinae) (p. *N601*).

1825; M]. Resembling *Mactrellona* but with spaced concentric undulations in front of keel; anterior lateral teeth short. *Rec.*, W.C.Am.——Fig. E93,*12*. **H. elegans* (Sowerby); *12a-c*, RV ext., int., LV hinge, ×1 (H. Adams & A. Adams, 1856).

Mactrellona Marks, 1951 [**Mactra alata* Spengler, 1802; OD] [=*Mactrella* auctt. (*non* Gray, 1853)]. Trigonal, inequilateral, thin, inflated, posterior slope set off by keel, umbones prominent; hinge concentrated, anterior laterals short. *Mio.-Rec.*, E.C.Am.-W.C.Am.——Fig. E94,*8*. **M. alata* (Spengler), Rec., Carib.; *8a*, RV ext., ×0.5; *8b,c*, RV and LV hinges, ×1 (H. Adams & A. Adams, 1856).

Mulinia Gray, 1837 [**M. typica* (=*Mactra edulis* King & Broderip, 1832); T]. Outline as in *Mactra* but ligament entirely internal, not separated from resilium by shelly ridge; shell not gaping; pallial sinus short, small. Estuarine. *Rec.*, W.C.Am.-E.C.Am.-S.Am.-E.Afr.——Fig. E94,*9*. **M. edulis* (King & Broderip), S.Am.; *9a*, LV ext., ×1 (Carcelles, 1950); *9b,c*, RV and LV hinges, ×2 *(510)*.

Mulinoides Olsson, 1944 [**M. chilca*; OD]. Resembling *Cymbophora* but shell more solid, rounded, lateral teeth stronger, less lamellar, resilifer more mactroid in form; posterior dorsal area well marked, set off by ridge; lunule present. *U.Cret.*, W.S.Am.——Fig. E94,*5*. **M. chilca; 5a*, RV ext., Peru; ×0.5; *5b,c*, LV and RV hinges, ×1 (Olsson, 1944).

Priscomactra Stephenson, 1952 [1953] [**P. cymba*; OD]. Ligament and hinge as in *Geltena* but outline subtrigonal and mactroid. *U. Cret.*, N.Am.——Fig. E94,*3*. **P. cymba*, USA(Tex.); *3a*, LV ext., ×1; *3b,c*, LV and RV hinges, ×1.3 (Stephenson, 1953).

Pseudocardium Gabb, 1866 [**Cardium gabbii* Rémond, 1863 (=*Mulinia densata* Conrad, 1857); M]. Shell solid, rounded-trigonal; hinge with long substriate or pitted laterals; pallial sinus short, rounded. *Oligo.-Rec.*, W.N.Am.-E.Asia.——Fig. E94,*10*. **P. densatum* (Conrad), Plio., USA (Calif.); *10a-c*, LV ext., int., RV int., ×0.5 (Packard, 1916).

Rangia Des Moulins, 1832 [**R. cyrenoides* (=*Gnathodon cuneatus* Sowerby, 1831); M] [=*Gnathodon* Sowerby, 1831 (*non* Goldfuss, 1820); *Colombia* Rang, 1834 *(nom.nud.)*; *Perissodon* Conrad, 1863 (type, *Mactra clathrodonta* Conrad, 1833; SD Dall, 1894)]. Shell somewhat resembling *Mulinia* but with lateral teeth elongate, curved, cross-striate, posterior pair longer; pallial sinus small. [Estuarine.] *?Paleoc.,-Mio.-Rec.*, N.-Am.-S.Am.-Eu.

R. (Rangia). Anterior lateral teeth hooked. *Mio.-Rec.*, E.N.Am.-W.N.Am.-S.Am.——Fig. E94,*2*. **R. (R.) cuneata* (Sowerby), Rec., USA(La.); *2a,b*, LV ext., int., ×0.5 (Dall, 1894).

R. (Miorangia) Dall, 1894 [**Gnathodon johnsoni* Dall, 1892; OD]. Small, extremely inequilateral, with cardinals reversed, superior pair in LV; pallial sinus obsolete. *Mio.*, E.N.Am.——Fig. E94,*7*. **R. (M.) johnsoni* (Dall), USA(Miss.); LV ext., ×1.5 (Dall, 1894).

R. (Rangianella) Conrad, 1868 [**Gnathodon trigonum* Petit, 1853 (=*Mactra mendica* Gould, 1851); M]. Small, nearly equilateral, lateral teeth short, straight, subequal, faintly rugose; pallial sinus inconspicuous or obsolete. Estuarine to marine. *Rec.*, W.C.Am.-N.Am.——Fig. E94,*1*. **R. (R.) mendica* (Gould), W.C.Am.; LV int., ×1 (Dall, 1894).

R. (?Praerangia) Cossmann, 1908 [**P. minuscula*; OD]. Resembling *Rangia* in form but much smaller, with shallower sinus. *Paleoc.(Mont.)*, Eu.——Fig. E94,*4*. **R. (?P.) minuscula* (Cossmann), Belg.; *4a-c*, RV ext., LV int., RV int., ×7 (Cossmann, 1908).

Scalpomactra Finlay in Marwick, 1928 [**Mactra scalpellum* Reeve, 1854; OD]. Resembling *Spisula* but lateral teeth not striate; resilium stout, oblique, triangular below, produced above as long spike curved to front, with minute ligament attached at top and united nearly its full length. *Plio.-Rec.*, S.Pac.——Fig. E94,*6*. **S. scalpellum* (Reeve), Rec., N.Z.; LV ext., ×1 (Powell, 1957).

Scissodesma Gray, 1837 [**Mactra spengleri* Linné, 1767; SD Gray, 1847] [=*Schizodesma* Gray, 1838 *(nom.van.)*]. Ligament only partially external, in deep slit, no lamina separating it from resilium. *Rec.*, Pac.——Fig. E95,*8*. **S. spengleri* (Linné), E.Indies; *8a-c*, RV ext., int., LV hinge, ×1 (H. Adams & A. Adams, 1856); *8d-e*, LV, RV hinges *(510)*.

Spisula Gray, 1837 [*"*Mactra solida* Montagu" (=**Cardium solidum* Linné, 1758); SD Gray, 1847] [=*Spisulina* Fischer, 1887 (type, *Mactra truncata* Montagu, 1808; M)]. Trigonal to ovate, not gaping, concentrically striate; lunule and escutcheon delimited; ligament and resilium not separated by shelly lamella; pallial sinus oval. *Tert.-Rec.*, cosmop.

S. (Spisula). Lanule and escutcheon concentrically grooved; lateral teeth striate. *Rec.*, Atl.——Fig. E95,*4*. **S. (S.) solida* (Linné), Eng.; *4a-c*, RV int., ext., LV hinge, ×1 (H. Adams & A. Adams, 1856).

S. (Crassula) Marwick, 1948 [**Mactra aequilateralis* Deshayes, July 1854 (=**M. aequilatera* Reeve, May 1854); OD]. Posterior area bounded by sharp ridge, sculpture only on anterior end, not wavy. *Rec.*, S.Pac.——Fig. E95,*5*. * *S. (C.) aequilatera* (Reeve), N.Z.; LV ext., ×0.5 (Reeve, 1854).

S. (Crepispisula) Eames, 1957 [**S. (C.) amekiensis*; OD]. Near *Scissodesma* in outline but with concentric sculpture, posterior carina less marked, ligament slit smaller, lateral teeth not crenulate; lunule and escutcheon sulcate. *Eoc.*, W.Afr.——

FIG. E95,7. **S. (C.) amekiensis*, Nigeria; *7a,b*, RV int., LV int., ×2 (Eames, 1957).

S. (Hemimactra) SWAINSON, 1840 [**Mactra gigantea* LAMARCK, 1818 (=*M. solidissima* DILLWYN, 1817); M]. Large, ovate-trigonal, with dorsal areas not sulcate; anterior arm of cardinal in RV confluent with ventral lamina, cardinals markedly compressed; laterals striate. *Tert.-Rec.*, E.N.Am.-Atl.——FIG. E95,2. **S. (H.) solidissima* (DILLWYN), Rec., USA(Mass.); *2a*, LV ext.,

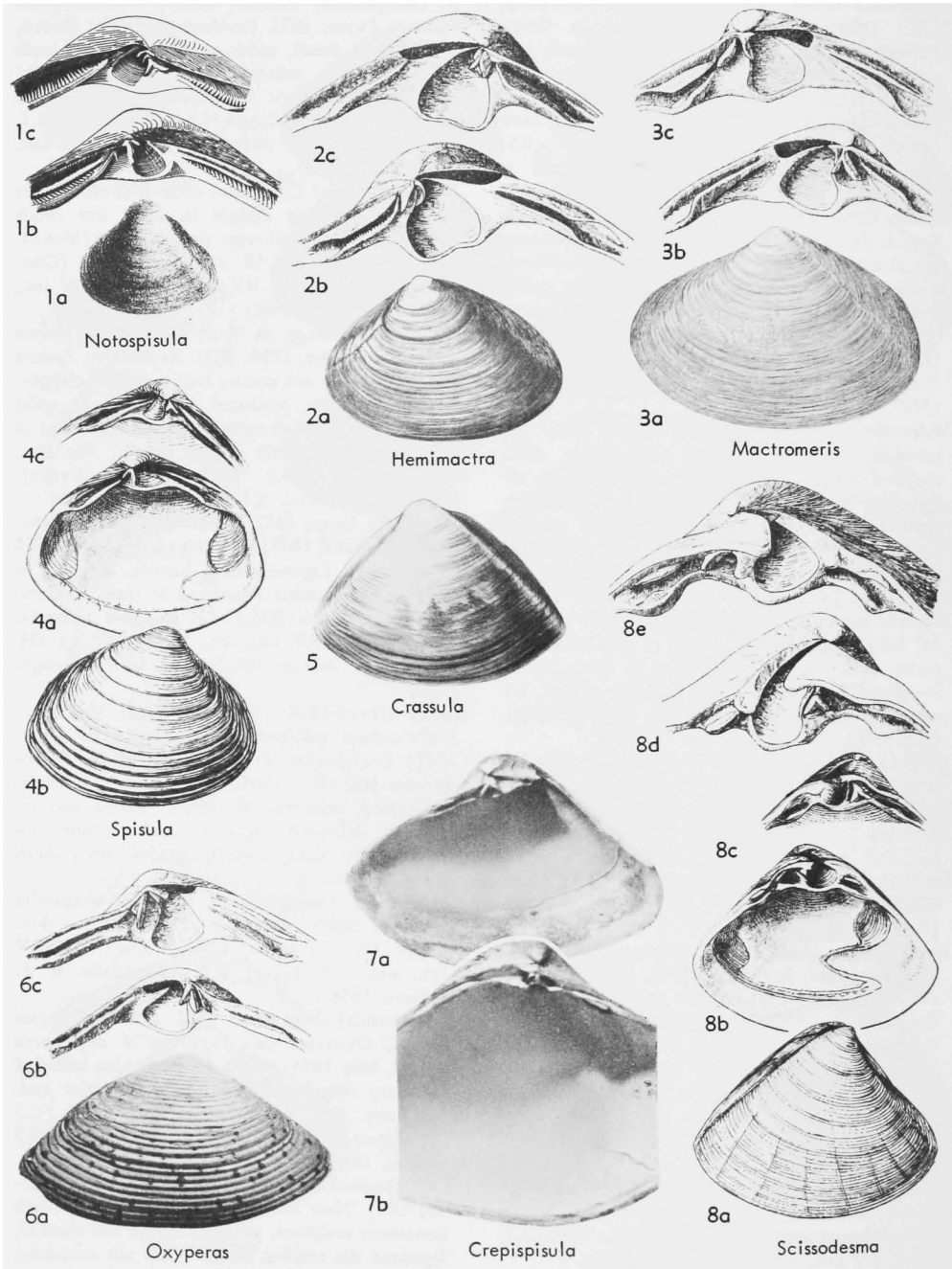


FIG. E95. Mactridae (Mactrinae) (p. *N601-N603*).

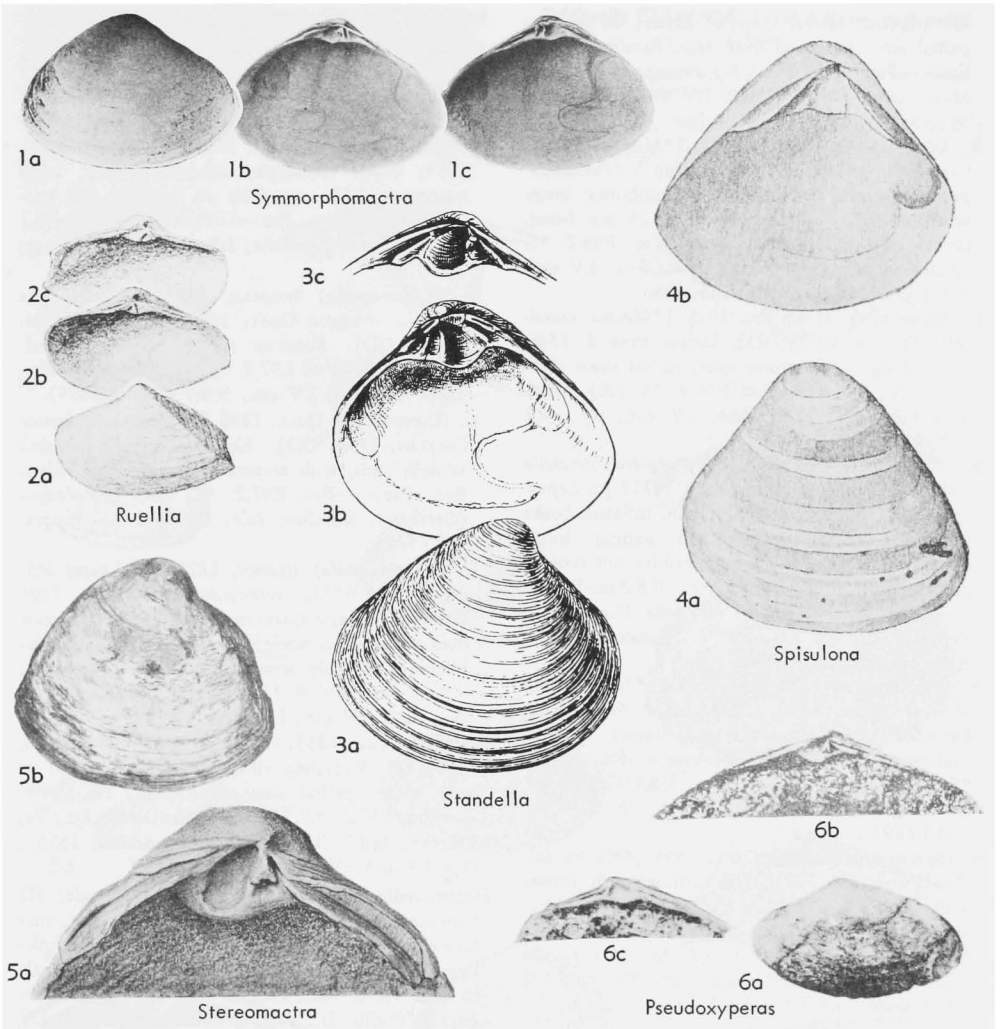


FIG. E96. Mactridae (Mactrinae) (p. *N*603-*N*604).

×0.3 (Gould-Binney, 1870); *2b,c,* RV and LV hinges *(510)*.

S. (Mactromeris) CONRAD, 1868 [**Mactra ovalis* GOULD, 1840 (*non* SOWERBY, 1817) (=**M. polynyma* STIMPSON, 1860); SD STOLICZKA, 1871] [=*Mactrodesma* CONRAD, 1869 (type, *M. ponderosa* CONRAD, 1830 [*non* EICHWALD, 1830] =*M. subponderosa* D'ORBIGNY, 1852; M)]. With fibrous periostracum; lateral teeth smooth, cardinals not compressed, anterior arm of *3a* not confluent with ventral lamina. *Mio.-Rec.,* W.N.Am.-Japan-N.Atl.——FIG. E95,*3*. **S. (M.) polynyma* (STIMPSON), Rec., N.Atl.; *3a,* LV ext., ×0.5 *(217)*; *3b,c,* LV and RV hinges, ×1 *(510)*.

S. (Notospisula) IREDALE, 1930 [**Gnathodon parvum* PETIT, 1853; OD]. Small, thick, trigonal, tumid, rounded anteriorly, pointed posteriorly; lateral teeth ridged; pallial sinus small to obsolete. *Rec.,* S.Pac.——FIG. E95,*1*. **S. (N.) parva* (PETIT), Australia; *1a,* LV ext., ×1 (Petit, 1853); *1b,c,* RV and LV hinges, ×3 *(397)*.

S. (Oxyperas) MÖRCH, 1853 [*"*Mactra triangularis* LAMARCK, 1818" (*non* MONTAGU, 1803) (=**M. lentiginosa* GOULD, 1852); M]. Triangular, with well-marked concentric folds; pallial sinus deep. *Rec.,* Pac.——FIG. E95,*6*. *S. (O.) lentiginosa* (GOULD), ?E.Indies; *6a,* RV ext., ×0.7 *(510)*; *6b,c,* LV and RV hinges, ×2 *(510)*.

S. (Pseudoxyperas) SACCO, 1901 [**P. proaspersa;* OD]. Differing from *S. (Oxyperas)* by being

less trigonal; lateral lamellae striate; *4a* present; pallial sinus long and oval. *Mio.(Burdigal.)-Rec.*, Eu.——Fig. E96,*6*. **S. (P.) proaspersa* (Sacco), Mio., Italy; *6a-c*, LV ext., LV and RV hinges, ×1 (Sacco, 1901).

S. (Ruellia) Cossmann, 1914 [**Mactra bernayi* Cossmann, 1886; OD]. Resembling *S. (Pseudoxyperas)* but with lower beaks and umbones; hinge with *4a*, as in *S. (Oxyperas)*, *2a-2b* not fused, laterals not striate. *Eoc.*, Eu.——Fig. E96,*2*. **S. (R.) bernayi* (Cossmann), France; *2a-c*, LV ext., RV, LV int., ×1.3 (Cossmann, 1886).

S. (Spisulona) Marwick, 1948 [**Mactra crassitesta* Finlay, 1927; OD]. Larger than *S. (Spisula)*; hinge with strong spur; pallial sinus shallow. *Plio.*, S.Pac.——Fig. E96,*4*. **S. (S.) crassitesta* (Finlay), N.Z.; *4a,b*, LV ext., int., ×1 (Hutton, 1893).

S. (Standella) Gray, 1853 [**Mactra striatella* Lamarck, 1818; SD Stoliczka, 1871] [=*Leptospisula* Dall, 1895 (obj.)]. Thin, inflated, beaks undulated, dorsal areas smooth; gaping; hinge concentrated, laterals smooth, resilifer not roofed; pallial sinus large, deep. *Rec.*, E.S.Am.-W.Afr. ——Fig. E96,*3*. **S. (S.) striatella* (Lamarck), W.Afr.; *3a-c*, RV ext., int., LV hinge, ×1 (H. Adams & A. Adams, 1856).

S. (Stereomactra) Stewart, 1930 [**Schizodesma abscissa* Gabb, 1866; OD]. Like *Scissodesma* but shell larger, heavier, laterals longer; resilium shallow. *U.Mio.-Plio.*, W.N.Am.——Fig. E96,*5*. **S. (S.) abscissa* (Gabb), Mio., USA(Calif.); *5a*, LV hinge, ×0.5 (Packard, 1916); *5b*, RV ext., ×0.3 *(892)*.

S. (Symmorphomactra) Dall, 1894 [**Mactra falcata* Gould, 1851; M]. With cardinal teeth prominent, thin, posterior arm overhanging resilifer, accessory teeth present, hinge plate flat. *Mio.-Rec.*, W.N.Am.——Fig. E96,*1*. **S. (S.) falcata* (Gould), Rec., USA(Calif.); *1a-c*, RV ext., LV int., RV int., ×0.7 (Packard, 1916).

Subfamily LUTRARIINAE Adams & Adams, 1856

Inequilateral, shell widely gaping; hinge somewhat irregular, concentrated, laterals tending to be obsolete; resilifer broadly open. Siphons of animal not retractile within shell, covered to tips with rough epidermis. *Mio.-Rec.*

Lutraria Lamarck, 1799 [**Mya lutraria* Linné, 1758; T] [=*Cacophonia* Gistel, 1848 *(nom. van., pro Lutraria)*; *Eustylon* Gistel, 1848 *(nom. van., pro Cacophonia)*; *Lutaria* Mayer, 1875 *(nom. null.)*]. Elongate, thin, gaping at each end; ligament short; no lunule or escutcheon. *Mio.-Rec.*, cosmop.

L. (Lutraria). Outline elliptical; hinge with *2a-2b* heavy, prominent. *Mio.-Rec.*, Eu.-IndoPac.—— Fig. E97,*5*. **L. (L.) lutraria* (Linné), Rec., Medit., *5a-c*, RV ext., int., LV hinge, ×1 (H. Adams & A. Adams, 1856); *5d-e*, LV and RV hinges, ×2 *(510)*.

L. (Goniomactra) Mayer, 1867 [**L. impar* Reeve, 1854; OD]. Elongate, subquadrangular, with concentric folds, especially on anterior and posterior slopes. *Rec.*, Pac.——Fig. E97,*6*. **L. (G.) impar* Reeve, Australia; LV ext., ×0.5 (Reeve, 1854).

L. (Lutromactra) Iredale, 1929 [**L. impedita (pro L. elongata* Gray, 1837) *(non* Münster, 1835); OD]. Posterior end somewhat pointed. *Rec.*, Pac.——Fig. E97,*8*. **L. (L.) impedita* Iredale, Australia; LV ext., ×0.5 (Reeve, 1854).

L. (Lutrophora) Dall, 1895 [**Mactra complanata* Gmelin, 1791; OD]. Elongate, evenly rounded at both ends, with texture and surface of *Raeta*. *Rec.*, Pac.——Fig. E97,*2*. **L. (L.) complanata* (Gmelin), E.Indies; *2a,b*, LV and RV hinges, ×2 *(510)*.

L. (Psammophila) Brown, 1827 (*ex* Leach MS, *in synon.*) [**L. solenoides* Lamarck, 1801 (=*Mya oblonga* Gmelin, 1791); M]. Posterior dorsal margin concave; hinge with *2a-2b* weak; ligament partially separated from resilium. *Rec.*, Atl.——Fig. E97,*9*. **L. (P.) oblonga* (Gmelin), Eu.; *9a,b*, RV ext., LV int., ×1 *(124)*.

Eastonia Gray, 1853 [**Mactra rugosa* Helbling, 1779; M]. Radiately ribbed or striate except at ends, ovate; pallial sinus deep. *Rec.*, Eu.-Medit. ——Fig. E97,*7*. **E. rugosa* (Helbling), Eu.; *7a*, RV ext., ×0.7 (H. Adams & A. Adams, 1856); *7b,c*, LV and RV hinges, ×1 *(510)*.

Heterocardia Deshayes, 1855 [**H. gibbosula*; SD Stoliczka, 1871]. Short, dorsal slope arched, surface concentrically striate, with vermiculate wrinkling; ligament as in *Mactra*; posterior laterals in each valve. *Rec.*, Pac.——Fig. E97,*1*. **H. gibbosula*, Philip. Is.; *1a-c*, LV int., RV hinge, LV ext., ×1 (H. Adams & A. Adams, 1856).

Meropesta Iredale, 1929 [**M. meridiana*; OD] [=*Merope* H. & A. Adams, 1856 (*non* Newman, 1838) (type, *Mactra nicobarica* Gmelin, 1791; SD Stoliczka, 1871); *Standella* auctt. (*non* Gray, 1853)]. Resembling *Eastonia* but thinner, ovate, with radiating sculpture; hinge deep; pallial sinus broadly rounded, long, reaching mid-line of shell. *Rec.*, IndoPac.——Fig. E97,*4*. **M. nicobarica meridiana*, Australia; LV ext., ×0.5 (Allan, 1950).

Tresus Gray, 1853 (Jan.) [**Lutraria maxima* Middendorff, 1849 (*non* Jonas, 1844) (=*L. nuttalli* Conrad, 1837); M] [not preoccupied by *"Trésus"* Walckenaer, 1833, vernacular and *nom. nud.*; =*Cryptodon* Conrad, 1837 (*non* Turton, 1822; obj.); *Schizothaerus* Conrad, 1853 (Feb.; obj.; M)]. Large, ovate, ventricose, gaping posteriorly;

hinge teeth small, resilifer large; ligament separated from resilium by shelly plate. *U.Mio.-Rec.*, W.N.Am.-E.Asia.——Fig. E97,*3*. **T. nuttalli* (Conrad), Rec., USA(Calif.); *3a*, RV ext., ×0.2 (Stanford Univ. specimen); *3b,c*, LV and RV hinges, ×1 *(510)*.

Subfamily PTEROPSELLINAE Keen, new name (1894)

[*nom. subst.* Keen, herein (*pro* Pteropsinae Dall, 1894, based on junior homonym)]

Shell thin, valves subequilateral, nearly closed; hinge feeble, concentrated, laterals

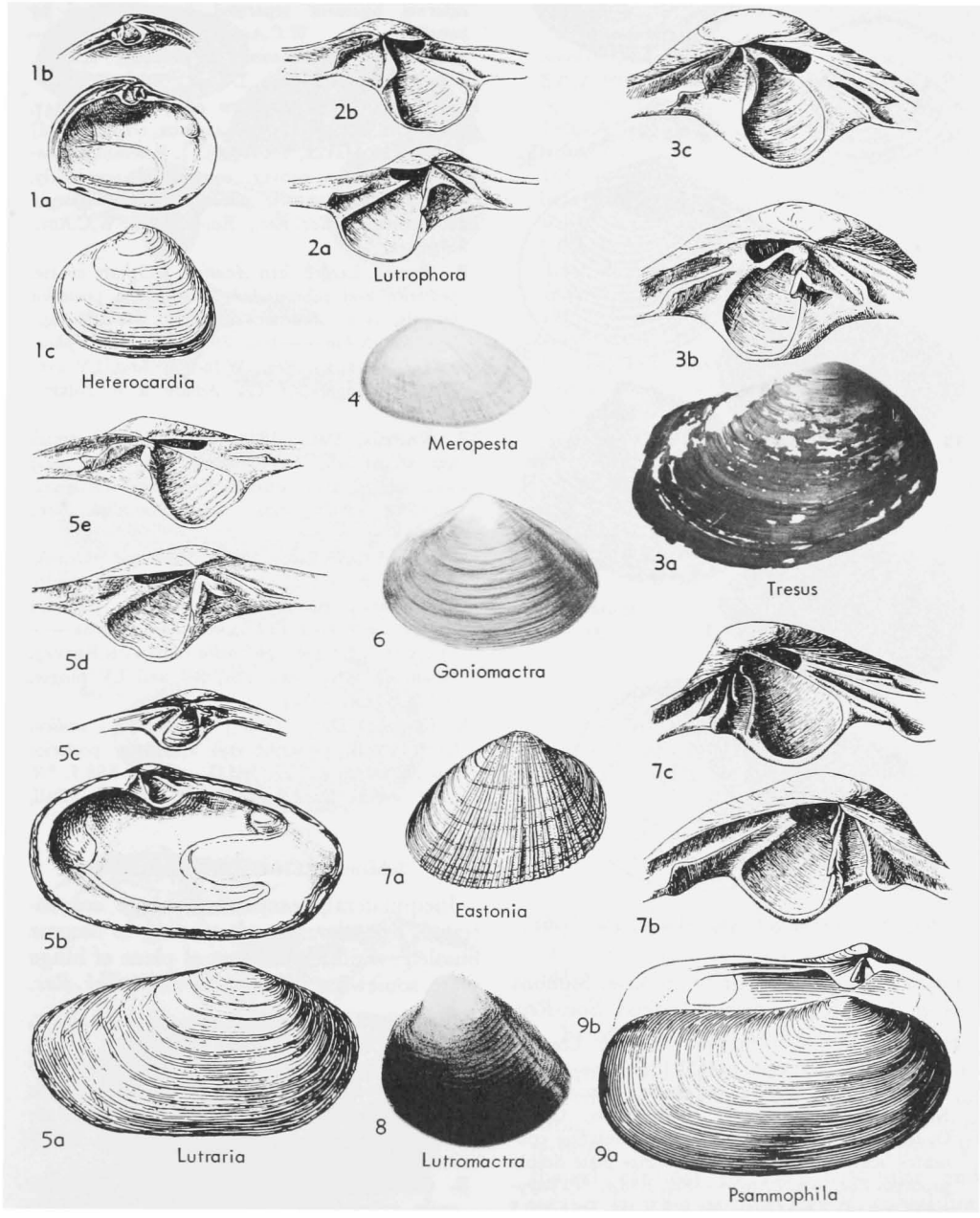


Fig. E97. Mactridae (Lutrariinae) (p. *N*604-*N*605).

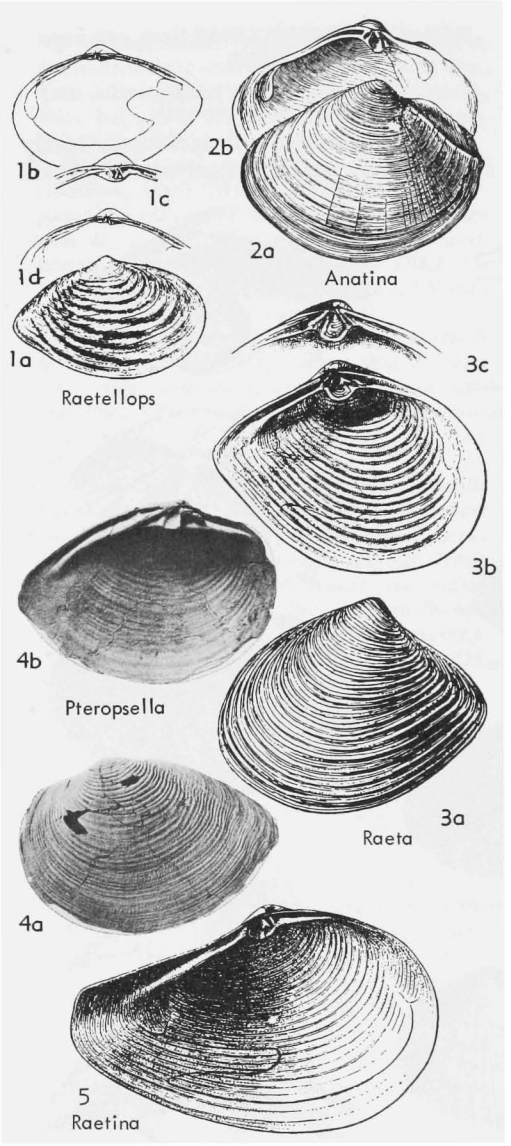


FIG. E98. Mactridae (Pteropsellinae) (p. *N606*).

much reduced or partially obsolete. Siphons of animal wholly retractile, naked. *Eoc.-Rec.*

Pteropsella VOKES, 1956 [*pro Pteropsis* CONRAD, 1860 (*non* RAFINESQUE, 1814)] [**Lutraria papyria* CONRAD, 1833; OD] [=*Kymatox* STENZEL & KRAUSE, 1957 (type, *K. praelapidosus*; OD)]. Ovate, posteriorly attenuate; with undulating concentric sculpture; resilifer ovate; hinge plate deeply grooved. *Eoc.*, SE.N.Am.——FIG. E98,*4*. **P. papyria* (CONRAD), USA(Ala.); *4a,b*, LV ext., int., ×0.5 (Stenzel & Krause, 1957).

Anatina SCHUMACHER, 1817 [**A. pellucida* (=**Mactra anatina* SPENGLER, 1802); M] [=*Labiosa* MÖLLER, 1832 (*ex* SCHMIDT MS) (*nom. van. pro Anatina*); *Cypricia* GRAY, 1847 (obj.); *Leucoparia* MAYER, 1867 (*nom. van. pro Cypricia*)]. Thin, ovate, anterior end rounded, posterior end gaping, set off by ridge; lunule and escutcheon evident; external ligament separated from resilium by lamella. *Rec.*, W.C.Am.-E.N.Am.-E.S.Am.——FIG. E98,*2*. **A. anatina* (SPENGLER), E.S.Am. (?Brazil); *2a,b*, RV ext., LV int., ×0.7 *(836)*.

Raeta GRAY, 1853 [**Mactra campechensis* GRAY, 1825 (=**L. plicatella* LAMARCK, 1818); M] [=*Lovellia* MAYER, 1867 (obj.)]. Resembling *Anatina*, but more convex, compressed posteriorly, sculpture of concentric plications; dorsal margin not reflected. *Eoc.-Rec.*, Eu.-E.N.Am.-W.C.Am.-S.Am.

R. (Raeta). Larger than *Anatina*, sculpture coarse, posterior end subrounded; hinge with posterior laterals, as in *Anatina*. *Eoc.-Rec.*, Eu.-E.N.Am.-W.C.Am.-S.Am.——FIG. E98,*3*. **R. (R.) plicatella* (LAMARCK), Rec., W.Indies; *3a-c*, LV ext., int., RV hinge, ×1 (H. Adams & A. Adams, 1856).

R. (Raetella) DALL, 1898 [**Labiosa (R.) tenuis* (*ex* ADAMS MS); OD]. Small, thin, dorsal areas well defined, shell inflated; hinge with no lateral lamellae; pallial sinus short, rounded. *Rec.*, E.Asia.

R. (Raetellops) HABE, 1952 [**Poromya pulchella* ADAMS & REEVE, 1850; OD]. Shell small, sculpture coarse; posterior end rostrate; posterior lateral teeth well developed. *Rec.*, E.Asia.——FIG. E98,*1*. **R. (R.) pulchella* (ADAMS & REEVE), Japan; *1a-d*, RV ext., int., RV and LV hinges, ×1.5 (Habe, 1952).

R. (Raetina) DALL, 1898 [**Labiosa (R.) indica*; OD]. Small, posterior end attenuate; posterior laterals wanting. *Rec.*, Ind.O.——FIG. E98,*5*. **R. (R.) indica* (DALL), India; LV int., ×1 (Dall, 1925).

Subfamily ZENATIINAE Dall, 1895

Inequilateral, compressed; hinge concentrated, irregular, laterals tending to become obsolete; resiliifer bent out of plane of hinge plate, somewhat adherent to valve. *Eoc.-Rec.*

Zenatia GRAY, 1853 [**Lutraria zelandica* GRAY, 1837 (=**L. acinaces* QUOY & GAIMARD, 1835); M] [=*Metabola* MAYER, 1867 *(nom. van., pro Zenatia)*]. Quadrate, periostracum conspicuous; ends gaping, beaks nearer anterior end; valves reinforced by radial buttress below hinge; pallial sinus very deep. *Mio.-Rec.*, S.Pac.

Z. (Zenatia). Moderately elongate, not conspicuously narrow. *Rec.*, S.Pac.——FIG. E99,*5*. **Z. (Z.) acinaces* (QUOY & GAIMARD), N.Z.; *5a*, RV

ext., ×1 *(124b); 5b,c,* LV and RV hinges, ×2 *(510).*

Z. (Zenatiopsis) TATE, 1879 [**Zenatiopsis angustata;* M]. Outline narrower than *Z. (Zenatia). Mio.-Rec.,* S.Pac.——FIG. E99,*3.* **Z. (Z.) angustata* (TATE), Mio., Australia; *3a,b,* RV ext., LV int., ×1 (Tate, 1879).

Z. (Zenatraria) BEU, 1966 [**Z. (Z.) vellai;* OD]. *Pleist.,* N.Z.

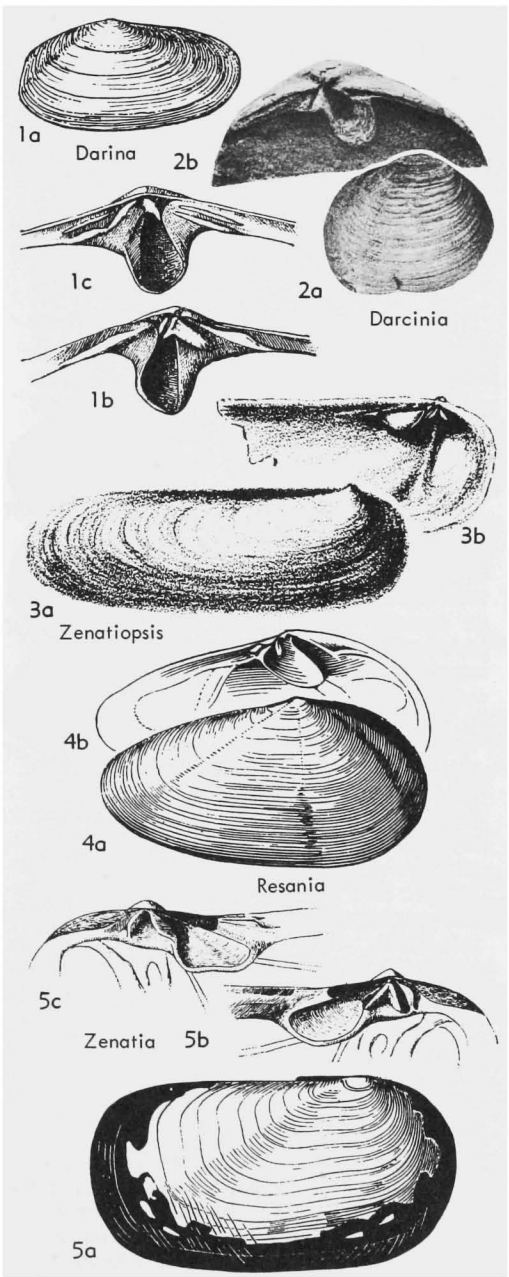


FIG. E99. Mactridae (Zenatiinae) (p. *N606-N607*).

Darcinia CLARK & DURHAM, 1946 [**D. colombiana*; OD]. With posterior umbonal ridge as in *Darina*; sculpture and posterior gape as in *Eastonia*; hinge plate with deeply excavated resilifer, heavy cardinals, well-developed anterior laterals and nearly obsolete posterior laterals. *Eoc.,* W.S.Am.——FIG. E99,*2.* **D. colombiana,* Colombia; *2a,* RV ext., ×1; *2b,* RV hinge, ×1.5 (Clark & Durham, 1946).

Darina GRAY, 1853 [**Erycina solenoides* KING, 1832; M]. Elongate, thin, with periostracum; beaks back of mid-line; both ends gaping; ligament short, deep, resilifer large, resting on ray-like buttress; hinge teeth weak; pallial sinus deep. *Rec.,* W.S.Am.——FIG. E99,*1.* **D. solenoides* (KING), *1a,* LV ext., ×1 (H. Adams & A. Adams, 1856); *1b,c,* LV and RV hinges, ×2 *(510).*

Resania GRAY, 1853 (Jan.) [**R. lanceolata*; M] [=*Vanganella* GRAY, 1853 (Apr.) (type, *V. taylorii,* =*R. lanceolata*; M); *Laminaria, Myomactra* MAYER, 1867 *(nom. van. pro Vanganella, Resania)*]. Elongate, anterior end longer, smooth, gaping; ligament not set off by shelly ridge, resilifer large, oblique, resting on thickened radial rib; second rib behind anterior adductor scar; pallial sinus short, broad. *Rec.,* S. Pac.——FIG. E99,*4.* **R. lanceolata,* N.Z.; *4a,b,* RV ext., LV int., ×1 *(124b).*

Family ANATINELLIDAE Gray, 1853

[*nom. correct.* THIELE, 1934 (*pro* Anatinelladae GRAY, 1853)]

Shell inflated, gaping; hinge with prominent narrow resiliifer, narrow cardinal and accessory lamella in each valve; laterals wanting; pallial line without sinus *(510). Rec.*

Anatinella SOWERBY, 1833 [**A. sibbaldii* (=*Mya nicobarica* GMELIN, 1791); M]. Thin, sculpture of concentric striae and fine radial lines; ligament short, separated from resilium by shelly plate. *Rec.,* IndoPac.——FIG. E100,*2.* **A. nicobarica* (GMELIN), Japan; *2a,b,* RV ext., int., ×1 (Kuroda, 1951).

Family CARDILIIDAE Fischer, 1887

Equivalve, higher than long, beaks inturned, subspiral; external ligament on strong nymph, resilium in large, oblique resilifer; hinge with strong inverted V-shaped cardinal in LV, triangular and weaker lamellar cardinal in RV; pallial line entire *(510). ?Eoc., Oligo.-Rec.*

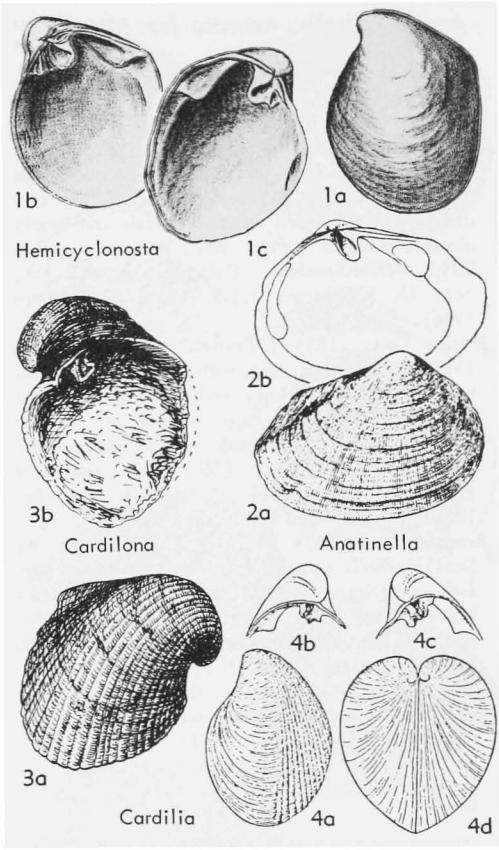


FIG. E100. Anatinellidae *(2)*; Cardiliidae *(1-,3-4)* (p. *N607-N608*).

Cardilia DESHAYES, 1835 [**Isocardia semisulcata* LAMARCK, 1819; SD HERRMANNSEN, 1846] [=*Leptina* PICTET, 1855 (*non* MEIGEN, 1830; obj.)]. Sculpture of radial ribs over at least part of shell; cardinal teeth on buttress below resilifer; one lateral present in RV; posterior muscle scar on myophore or flange projecting from dorsal margin of shell. *L.Mio.-Rec.*, IndoPac.——FIG. E100,*4*. **C. semisulcata* (LAMARCK), Rec., Japan; *4a-d*, LV ext., LV and RV hinges, both valves ant., ×1.3 (Kuroda, 1951).

Cardilona MARWICK, 1943 [**C. bensoni*; OD]. Like *Cardilia* in form and sculpture, with strong resilifer, but lacking hinge plate, cardinal teeth, and posterior myophore. *Oligo.*, S.Pac.——FIG. E100,*3*. **C. bensoni*, N.Z.; *3a,b*, RV ext., int., ×0.8 (Marwick, 1943).

?Hemicyclonosta MICHELIN, 1828 [**H. michelini* "DESHAYES" (=*Hemicyclodonta* DESHAYES, 1850, *ex* MS); M] [=*Hemicyclostera* BRONN, 1838, *Hemicycloster* PAETEL, 1875 *(nom. null.)*, spelling errors] [The evidence for valid publication by MICHELIN is inconclusive, although accepted by his contemporaries; should the work be rejected, the generic name may revert to synonymy with *Cardilia*]. Resembling *Cardilia* but without radial sculpture. *Eoc.-Plio.*, Eu.——FIG. E100,*1*. **H. michelini*, Eoc., France, *1a-c*, LV ext., RV int., LV int., ×1.3 *(259)*.

Family MESODESMATIDAE Gray, 1839

[*nom. correct.* DALL, 1895 (*pro* Mesodesmidae GRAY, 1839)] [=Paphiinae H. ADAMS & A. ADAMS, 1856)]

Shells cuneiform, more or less compressed, disproportionately heavy. Siphons retractile, naked, nearly or completely separated *(507, 510)*. *Eoc.-Rec.*

Subfamily MESODESMATINAE Gray, 1840

[*nom. transl. et correct.* DALL, 1895 (*ex* Mesodesmidae GRAY, 1840)]

Texture porcelaneous, periostracum conspicuous; ligament small or obsolete, resilium narrow, oblique; hinge in Eocene forms with cardinal lamella in RV, weak or obsolescent in Recent forms but long narrow cardinal in LV becoming stronger, crossing apex of resilifer. *Eoc.-Rec.*

Mesodesma DESHAYES, 1832 [**Mactra donacia* LAMARCK, 1818; SD ANTON, 1839] [="*Amphidesma* LAM." AUCTT. (*non* LAMARCK); *Ceronia* GRAY, 1853 (type, *Erycina denticulata* GRAY, 1825,=*Mactra deaurata* TURTON, 1822; M)]. Donaciform, posterior end short; hinge strong, ligament short, internal, resilifer with raised margins; pallial sinus well marked. *Rec.*, N.Am.-S.Am.-Pac.

M. (Mesodesma). Posterior end obliquely truncate; resilifer broad; lateral teeth striate. *Rec.*, Eu.-E.N.Am.-W.S.Am.-Pac.——FIG. E101,*13*. **M. (M.) donacium* (LAMARCK), Chile; *13a,b*, LV ext., RV int., ×1 *(124b)*.

M. (Amesodesma) IREDALE, 1930 [**A. perfuga*; OD]. Posterior end somewhat quadrate; resilifer narrow. *Rec.*, S.Pac.——FIG. E101,*2*. **M. (A.) perfuga* (IREDALE), Australia; RV int., ×1 (Iredale, 1930).

Atactodea DALL, 1895 [*pro Paphia* LAMARCK, 1799 (*non* RÖDING, 1798)] [**Mactra glabrata* GMELIN, 1791; OD]. Subtrigonal, strong, smooth or concentrically sculptured; hinge strong, ligament submarginal; resilium narrow; pallial sinus short. *Rec.*, IndoPac.——FIG. E101,*4*. **A. glabrata* (GMELIN), E.Indies; *4a-c*, RV int., LV hinge, RV ext., ×1 (H. Adams & A. Adams, 1856).

?Ceroniola WILCKENS, 1904 [**Cultellus australis* GABB, 1860; M]. Resembling *Mesodesma* in form; shell gaping at each end; ligamental pit not well developed; hinge with 2 laterals but cardinal area not clear. *U.Tert.*, S.Am.——FIG. E101,*8*. **C. australis* (GABB), Chile; *8a-c*, LV ext., int., RV int., ×1 (Wilckens, 1904).

Donacilla PHILIPPI, 1836 (*ex* LAMARCK, vernacular) [**D. lamarckii* (=*Amphidesma donacilla* LAMARCK, 1818) (=*Mactra cornea* POLI, 1795); M] [="*Donacilla* DE BLAINVILLE, 1819," AUCTT., proposed in synonymy]. Ligament marginal, obsolete; laterals not sulcate, anterior lateral long,

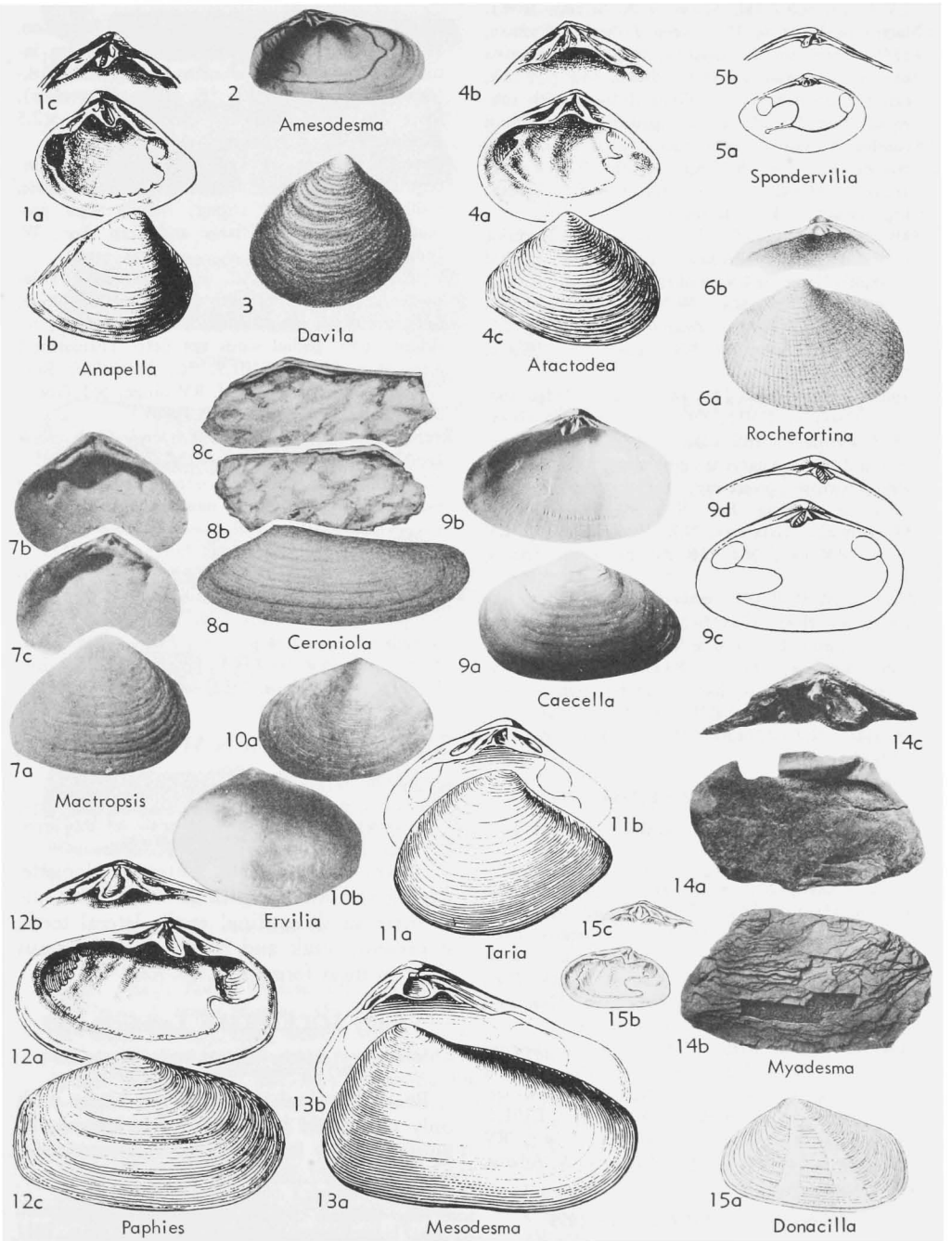


FIG. E101. Mesodesmatidae (Mesodesmatinae) *(2,4,7-8,11-14)*, (Davilinae) *(1,3)*, (Erviliinae) *(5-6,9-10)* (p. *N*608-*N*610).

posterior short; margin of resilial pit toothlike. *Rec.*, Eu.-S.Pac.——FIG. E101,*15*. **D. cornea* (POLI), Eu.; *15a*, RV ext., ×1.3; *15b,c*, RV int., LV hinge, ×0.7 (H. Adams & A. Adams, 1856).

Mactropsis CONRAD, 1854 [*pro Triquetra* CONRAD, 1846 (*non* DE BLAINVILLE, 1828)] [**Erycina aequorea* CONRAD, 1833; SD DALL, 1895]. Thick, cardinal plate heavy, cardinals distinct, with subequal arms, laterals striate; ligament and resilium combined, near dorsal border; pallial sinus small but distinct. *Eoc.*, E.N.Am.——FIG. E101,*7*. **M. aequorea* (CONRAD), USA(Ala.); *7a-c*, RV ext., int., LV int., ×1.5 (Harris, 1919).

?**Myadesma** CLARK, 1922 [**M. dalli;* OD]. Posterior end short, beaks opisthogyrate; resilifers directed anteriorly, large in LV, sunken in RV; pallial sinus small, broad. *Eoc.-Mio.*, W.N.Am.——FIG. E101, *14*. **M. dalli*, Oligo., Vancouver Is.; *14a,b*, LV int., ext., ×0.5; *14c*, RV hinge, ×1 (Clark, 1922).

Paphies LESSON, 1830 [**P. roissyana* (=**Mya australis* GMELIN, 1791); OD] [=*Machaena* GRAY, 1843, *ex* LEACH MS (obj.); M]. Ovate-elongate, subequilateral; ligament internal, small, resilifer long, narrow, projecting; pallial sinus angular, small, or wanting. *Rec.*, S.Pac.——FIG. E101,*12*. **P. australis* (GMELIN), N.Z.; *12a-c*, RV int., LV hinge, RV ext., ×1 (H. Adams & A. Adams, 1856).

Taria GRAY, 1853 [**T. stokesii* (=*Mesodesma lata* DESHAYES, 1843) (?=*M. quoyi* DESHAYES, 1832); M] [=*Taria* H. ADAMS & A. ADAMS, 1856, AUCTT. (obj., KOBELT, 1881)]. Resembling *M. (Mesodesma)* but more equilateral, lateral teeth smooth. *Rec.*, S.Pac.——FIG. E101,*11*. **T. quoyi* (DESHAYES), N.Z.; *11a,b*, LV ext., RV int., ×1 *(124b)*.

Subfamily DAVILINAE Dall, 1895

Outline somewhat rounded; pallial line without sinus. *Rec.*

Davila GRAY, 1853 [**D. polita* (=*Mesodesma planum* HANLEY, 1843); M]. Smooth, compressed, periostracum thin; ligament small, nearly marginal, resilium narrow, elongate; cardinal tooth large and prominent in LV, obsolete in RV. *Rec.*, IndoPac.——FIG. E101,*3*. **D. plana* (HANLEY), Philip. Is.; RV ext., ×1 (Reeve, 1854).

Anapella DALL, 1895 [**Mesodesma triquetrum* HANLEY, 1843; OD]. Resembling *Atactodea* in form; hinge with cardinal tooth bifid in RV, laterals smooth. *Rec.*, W.Pac.-S.Pac.——FIG. E101,*1*. **A. triquetra* (HANLEY), S.Australia; *1a-c*, RV int., ext., LV hinge, ×1 (H. Adams & A. Adams, 1856).

Subfamily ERVILIINAE Dall, 1895

Small, thin, equilateral; ligament marginal, subobsolete, resilium small; hinge concentrated, laterals small, one cardinal in either valve, RV larger, LV bifid; pallial sinus distinct. *Pleist.-Rec.*

Ervilia TURTON, 1822 [**Mya nitens* MONTAGU, 1806; M]. Concentrically striate, periostracum inconspicuous; ligament obsolete. *Pleist.-Rec.*, Atl.-Medit.——FIG. E101,*10*. **E. nitens* (MONTAGU), Rec., USA(Fla.); *10a,b*, RV ext., int., ×2.5 (Smith, 1937).

Argyrodonax DALL, 1911 [**A. haycocki*; M]. Concentrically sculptured; external ligament feeble, resilium narrow but strong; muscle scars pronounced; pallial sinus large and deep. *Rec.*, W. Indies.

Caecella GRAY, 1853 [**C. horsfieldii;* OD]. Relatively large, elongate, with fine concentric striae; periostracum thick, brown; ligament obsolete; resilium small; pallial sinus not deep. [Estuarine.] *Rec.*, Pac.——FIG. E101,*9*. **C. horsfieldii; 9a-c*, LV ext., int., int., ×3; *9d*, RV hinge, ×1 (specimens, British Museum, N.H.).

Rochefortina DALL, 1924 [**Rochefortia (R.) semele* (=**Ervilia sandwichensis* E. A. SMITH, 1885); OD]. Sculpture radial and concentric; with minute escutcheon; pallial sinus moderately deep. *Rec.*, Pac.——FIG. E101,*6*. **R. sandwichensis* (SMITH), Hawaiian Is.; *6a,b*, LV ext., hinge, ×8 *(852)*.

Spondervilia IREDALE, 1930 [**Ervilia australis* ANGAS, 1877 (=**E. bisculpta* GOULD, 1861); OD]. Sculpture radial at ends, with fine wavy concentric threads on central slope. *Rec.*, Pac.——FIG. E101, *5*. **S. bisculpta* (GOULD), Japan; *5a,b*, LV int., RV hinge, ×3 (Habe, 1952).

Superfamily SOLENACEA Lamarck, 1809

[*nom. transl.* TRYON, 1884 (*ex* family Solenacea GRAY, 1823) (=solenacées LAMARCK, 1809)] [Materials for this superfamily prepared by MYRA KEEN]

Valves cylindrical to flattened, elongate, gaping at both ends, hinge weak, with one to three small cardinal teeth; lateral teeth, if present, weak and laminar; pallial sinus short in most forms. *L.Cret.-Rec.*

Family SOLENIDAE Lamarck, 1809

[*nom. correct.* LEACH, 1823 (*pro* family Solenacea GRAY, 1823) (=solenacées LAMARCK, 1809)]

Beaks terminal or nearly so; hinge with only one tooth in either valve; siphons of animal fused, foot modified for rapid digging in sand. *L.Eoc.-Rec.*

Solen LINNÉ, 1758 [**S. vagina;* SD SCHUMACHER, 1817] [=*Vagina* MEGERLE VON MÜHLFELD, 1811 (obj., T); *Solenia* OKEN, 1823 *(nom. null.)*; *Listera* GRAY, 1852, *ex* LEACH MS (*non* TURTON,

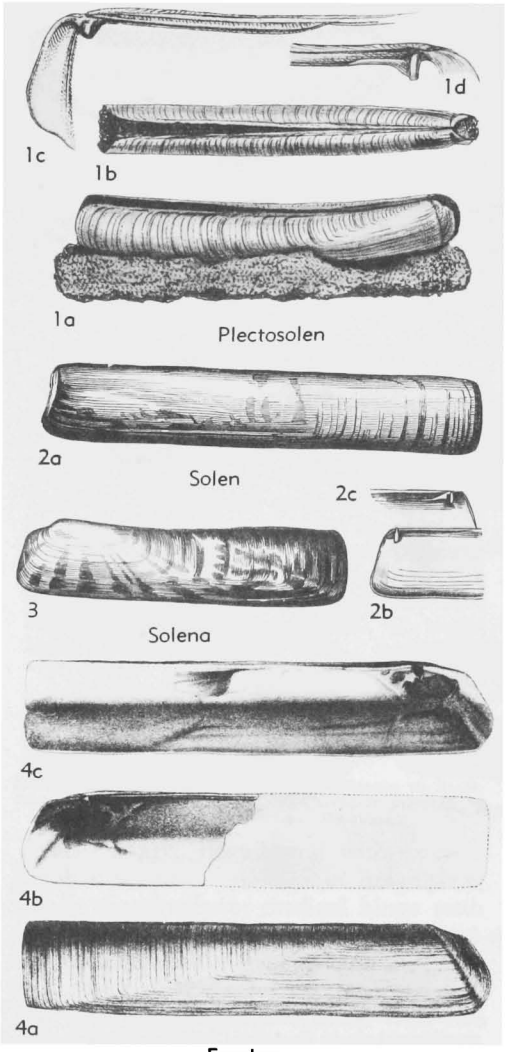


FIG. E102. Solenidae (p. *N*611).

1822) (obj.); *Fistula* MÖRCH, 1853, *ex* MARTINI MS (type, *S. brevis* HANLEY, 1842, *ex* GRAY MS; SD KEEN, herein)]. Long, nearly straight; anterior margin truncate, smooth within; anterior adductor muscle scar elongate. *Eoc.-Rec.,* N.Am.-Eu.-Pac. ——FIG. E102,*2*. **S. vagina,* Rec., Eu.; *2a-c,* LV ext., RV hinge, LV hinge, ×0.4 *(124b)*.

Solena MÖRCH, 1853 [**Solen obliquus* SPENGLER, 1794; SD STOLICZKA, 1871] [=*Hypogella* GRAY, 1854 (type, *S. ambiguus* LAMARCK, 1818, =*S. obliquus;* SD DALL, 1900)]. Anterior end somewhat produced beyond beaks, obliquely truncate; anterior adductor scar short. *Eoc.-Rec.,* Asia-Eu.-Am.

S. (Solena). Anterior margin thickened within, smooth outside. *Oligo.-Rec.,* E.Asia-Eu.-C.Am. ——FIG. 102,*3*. **S. (S.) obliquus* (SPENGLER), Rec., Carib.; LV ext., ×0.5 *(124b)*.

S. (Eosolen) STEWART, 1930 [**Solen plagiaulax* COSSMANN, 1906 (*nom. subst. pro S. obliquus* SOWERBY, 1844, *non* SPENGLER, 1794); OD]. With external oblique groove near anterior end. *Eoc.,* Eu.-N.Am.——FIG. E102,*4*. **S. (E.) plagiaulax* (COSSMANN), M.Eoc., France; *4a-c,* RV ext., RV hinge, LV hinge, ×0.5 (Deshayes, 1860).

S. (Plectosolen) CONRAD, 1866 [**Solen gracilis* SOWERBY, 1844; SD STOLICZKA, 1871]. Dorsal margin slightly curved, anterior end rounded, set off by furrow. *L.Eoc.-M.Eoc.,* Eu.-W.N.Am.—— FIG. E102,*1*. **S. (P.) gracilis* (SOWERBY), Eng.; *1a,b,* LV ext., both valves, dorsal, ×1; *1c,d,* RV, LV hinge, ×2.5 (Sowerby, 1844).

Family CULTELLIDAE Davies, 1935

Valves wider and more compressed than in Solenidae, beaks mostly not terminal; hinge with one to three cardinal teeth. *L. Cret.-Rec.*

Cultellus SCHUMACHER, 1817 [**C. magnus* (=*Solen lacteus* SPENGLER, 1794); M]. Oblong, ends rounded, gaping; hinge with 1 cardinal in RV, 2 in LV, posterior bifid; pallial sinus small. *L.Eoc.-Rec.,* Eu.-Asia-IndoPac.

C. (Cultellus). Large, with rib above rounded anterior adductor scar. *L.Eoc.-Rec.,* Eu.-C.Asia-IndoPac.——FIG. E103,*2*. **C. (C.) lacteus* (SPENGLER), Rec., E.Indies; RV int., ×0.7 (Woodward).

C. (Cultrensis) COEN, 1933 [**C. (C.) adriaticus;* M]. Small and thin, dorsal margin straight, with 2 furrows from beak to ventral margin. *Rec.,* Medit.

Ensis SCHUMACHER, 1817 [**E. magnus* (=*Solen ensis* LINNÉ, 1758); T] [=*Ensatella* SWAINSON, 1840 (obj.)]. Beaks terminal or nearly so, dorsal margin slightly curved; 2 cardinal teeth or cardinal chevrons present; anterior adductor scar elongate. *L.Eoc.-Rec.,* N.Am.-Eu.——FIG. E103,*6*. **E. ensis* (LINNÉ), Rec., Medit.; *6a,b,* LV ext., RV int., ×0.3 *(89a)*.

Leptosolen CONRAD, 1865 [**Siliquaria biplicata* CONRAD, 1858; M] [=*Solenaria* STOLICZKA, 1870 (*?non* RAFINESQUE, 1815) (type, *Leguminaria affinis* EICHWALD, 1867; M)]. Like small *Siliqua* with radial sulcus and strong internal rib; ligament long and narrow. *L.Cret.-U.Cret.,* N.Am.-E.Eu.——FIG. E103,*9*. **L. biplicata* (CONRAD), U.Cret., USA(Ala.); *9a,b,* LV ext., int., ×1 (Wade).

Neosolen GHOSH, 1920 [**N. aquae-dulcioris*; M]. Small, thin, translucent, truncate in front, pos-

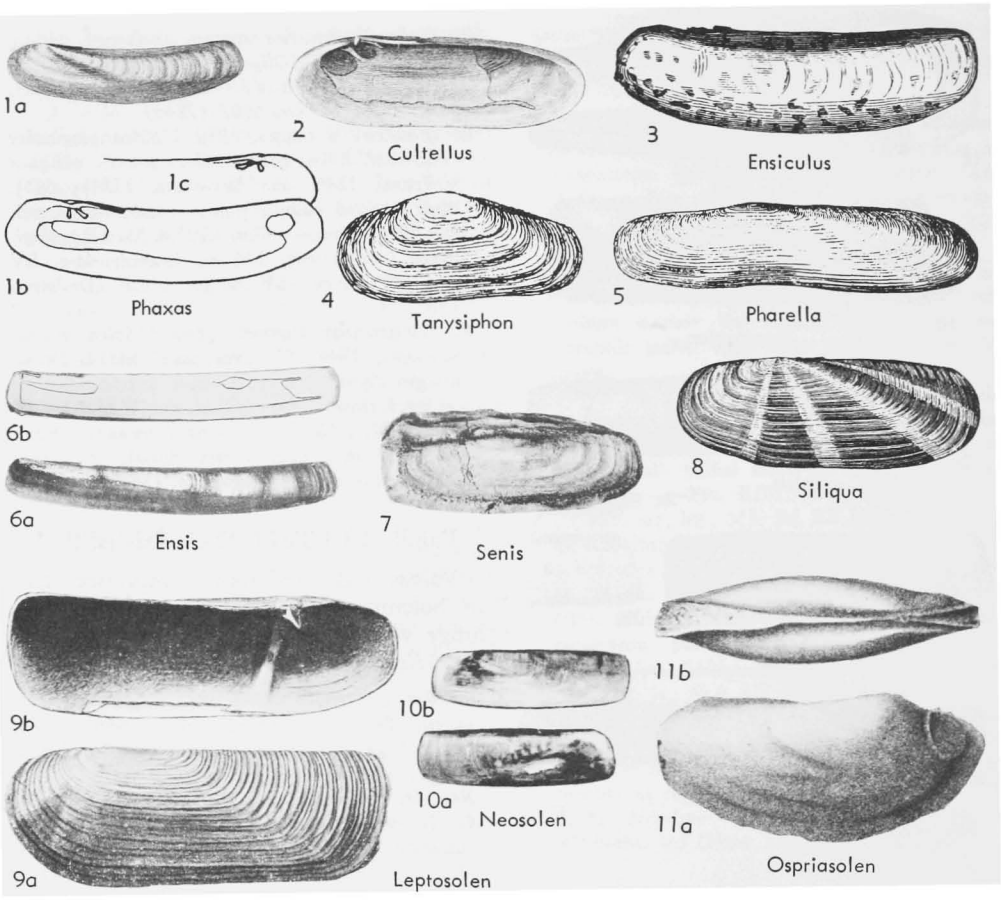


FIG. E103. Cultellidae (p. *N*611-*N*613).

teriorly rounded; RV with 1 small, long tooth; anterior adductor scar long, triangular, posterior small, rounded. *Rec.,* S.Asia. [Estuarine.]——FIG. E103,*10*. **N. aquaedulcioris,* India; *10a,b,* RV ext., int., ×1 (Ghosh).

Ospriasolen CONRAD, 1868 [**Cultellus cretaceus* GABB, 1860; M] [=*Ospirasolen,* spelling error]. Elongate, gaping, pallial line with deep sinus. *U. Cret.,* N.Am.——FIG. E103,*11*. **O. cretaceus* (GABB), USA(N.J.); *11a,b,* RV int. mold, both valves dorsal, ×1 (Weller, 1907).

Pharella GRAY, 1854 [**Solen javanicus* LAMARCK, 1818; SD KOBELT, 1881]. Subcylindrical, rounded at ends, ventral margin contracted, umbones in front of mid-line; anterior adductor scar elongate, subtrigonal; hinge with 2 cardinals in RV, 3 in LV. *Plio.-Rec.,* E.Indies.——FIG. E103,*5*. **P. javanica* (LAMARCK), Rec., Java; LV ext., ×1 (Fischer).

Phaxas GRAY, 1852 (*ex* LEACH MS) [**S. pellucidus* PENNANT, 1777; M] [=*Subcultellus* GHOSH, 1920 (obj.)]. Dorsal margin curved, ends of shell rounded; beaks near anterior end; anterior adductor scar long and triangular, posterior scar small, sinus short. *Eoc.-Rec.,* Asia-Eu.-E.Indies.

P. (Phaxas). Shell small and thin. *Eoc.-Rec.,* E. Asia-Eu.——FIG. E103,*1*. **P. (P.) pellucidus* (PENNANT), Rec., Eng.; *1a,* LV ext., ×1 (Locard); *1b,c,* RV int., LV hinge, ×1.3 (Stanford Univ. specimen).

P. (Ensiculus) H. ADAMS, 1860 [**Solen cultellus* LINNÉ, 1758; OD] [=*Cultellus* AUCTT. (*non* SCHUMACHER)]. Larger and more solid than in *P.(Phaxas). Rec.,* E.Indies.——FIG. E103,*3*. **P. (E.) cultellus* (LINNÉ); LV ext., ×0.5 *(124b)*.

?**Senis** STEPHENSON, 1952 [1953] [**S. elongatus;* OD]. Long-quadrangular, beaks slightly in front of mid-line; ligament external, long, narrow, nymph thin and prominent; hinge smooth, without teeth. *U.Cret.,* N.Am.——FIG. E103,*7*. **S. elongatus,* USA(Tex.); LV ext., ×1.5 *(890)*.

Siliqua MEGERLE VON MÜHLFELD, 1811 [**Solen radiatus* LINNÉ, 1758; M] [=*Aulus* OKEN, 1815,

AUCTT. (in work rejected by ICZN, 1956, Op. 417) (obj.; SD HERRMANNSEN, 1846); *Leguminaria* SCHUMACHER, 1817 (obj.; M); *Solecurtoides* DESMOULINS, 1832 (obj.; SD DALL, 1900); *Machaera* GOULD, 1841 (*non* CUVIER, 1832) (type, *Solen costatus* SAY, 1822; SD DALL, 1900)]. Thin-shelled, moderately large, with internal rib; pallial sinus widely rounded, fairly deep. *Eoc.-Rec.*, N. Am.-Eu.-Pac.-Asia.

S. (Siliqua). Internal rib nearly vertical, from beaks to ventral margin. *Eoc.-Rec.*, N.Am.-Eu.-E.Indies. ——FIG. E103,*8*. **S. (S.) radiata* (LINNÉ), Rec., E.Indies; LV ext., ×0.3 *(124b)*.

S. (Neosiliqua) HABE, 1965 [**Aulus winterianus* DUNKER, 1853; OD]. Internal rib narrow, running diagonally from beaks to anteroventral margin. *Rec.*, W.Pac.

?Tanysiphon BENSON, 1858 [**T. rivalis;* M]. Resembling *Glauconome* in Veneracea, small, thin, long-ovate, with greenish periostracum; beaks in front of mid-line, ligament short; hinge with 3 teeth in either valve, anterior 2 smaller, posterior tooth flattened, resembling a resilifer; pallial sinus large, rounded, extending beyond mid-line. *Rec.*, S.Asia. [Estuarine.]——FIG. E103,*4*. **T. rivalis*, India; LV ext., ×1 (Benson, 1858).

Superfamily TELLINACEA de Blainville, 1814

[*nom. transl.* DALL, 1895 (*ex* family Tellinacées DE BLAINVILLE, 1814)] [Materials for this superfamily prepared by MYRA KEEN except as otherwise indicated]

Shells mostly inequilateral with external ligament or, if sunken, in pit on hinge plate, not in chondrophore; cardinal hinge teeth two in either valve, tending to be bifid, lateral teeth well developed in most families; adductor muscle scars connected by pallial line with distinct sinus. Animal with two elongate siphons that are not fused. *U.Trias.-Rec.*

Family TELLINIDAE de Blainville, 1814

[*nom. correct.* SWAINSON, 1840 (*pro* family Tellinacées DE BLAINVILLE, 1814)]

Somewhat elongate; ligament external; valves more or less unequal, most forms with posterior flexure, especially in RV *(822)*. *L.Cret.-Rec.*

Subfamily TELLININAE de Blainville, 1814

[*nom. transl.* H. ADAMS & A. ADAMS, 1856 (*ex* family Tellinacées DE BLAINVILLE, 1814)]

Lateral teeth present in at least one valve; sculpture various. *L.Cret.-Rec.*

Tellina LINNÉ, 1758 [**T. radiata;* SD CHILDREN, 1823] [=*Musculus* MÖRCH, 1853 (*ex* MARTINI, nonbinom.) (*non* RÖDING, 1798); *Liotellina* FISCHER, 1887 (obj.); *Tellinarius, emend.*]. Characteristics of subfamily. [Most modern attempts to divide *Tellina, s.l.*, into a number of genera, each with several subgenera, abound in inconsistencies. Evolutionary history of the family in different ocean basins seems to have resulted in many parallel forms or homeomorphs, so that subdivision on one set of characters (e.g., shell outline) runs counter to that on another (e.g., hinge details or musculature). A proper review being beyond the scope of the present summary, the expedient of a conservative classification is adopted herein, treating most generic taxa as subgenera of *Tellina.*] *?Cret., Tert.-Rec.*, cosmop.

T. (Tellina). Smooth, polished, hinge with 2 cardinals and 2 laterals in either valve. *Rec.*, E.N.Am. W.Indies.——FIG. E104,*11*. **T. (T.) radiata* LINNÉ, W.Indies; *11a,b*, LV ext., RV hinge, ×0.7 (Chenu).

T. (Abranda) IREDALE, 1924 [**A. rex* (*pro T. elliptica* SOWERBY, 1868) (*non* BROCCHI, 1814); OD]. Small, compressed, elliptical; concentrically ridged behind the angle setting off posterior slope. *Rec.*, Australia.——FIG. E104,*1*. **T. (A.) rex* (IREDALE); LV ext., ×1 (Sowerby in Reeve).

T. (Acorylus) OLSSON & HARBISON, 1953 [**T. suberis* DALL, 1900; OD]. Small, solid, subovate, flexed; hinge stout, RV with 2 cardinals, 2 laterals, LV with 1 cardinal, no laterals; pallial sinus deep, widely confluent with pallial line. *Plio.*, E.N.Am.——FIG. E104,*7*. **T. (A.) suberis* DALL, USA(Fla.); *7a*, RV ext., ×3 (Olsson & Harbison); *7b*, RV int., ×4 (Dall, 1900).

T. (Angulus) MEGERLE VON MÜHLFELD, 1811 [**T. lanceolata* GMELIN, 1791; SD GRAY, 1847]. Of moderate size, elongate, posterior end pointed but not twisted; hinge with *AI* strong, near cardinals, other laterals wanting, cardinals small. *Rec.*, Pac.——FIG. E104,*8*. **T. (A.) lanceolata* GMELIN, E.Indies; *8a*, RV ext., ×1 (Chenu), *8b*, RV hinge, ×2 (Olsson & Harbison).

T. (Arcopagia) BROWN, 1827 (*ex* LEACH MS) [**T. crassa* PENNANT, 1777; SD HERRMANNSEN, 1846] [=*Cydippe* GRAY, 1852 (*ex* LEACH MS) (*non* ESCHSCHOLTZ, 1829) (obj.)]. Rounded, somewhat inflated, concentrically ridged, with 2 laterals in RV; pallial sinus deep, rounded, not confluent. [See also *T. (Sinuosipagia).*] *?Cret., Eoc.-Rec.*, Eu.-N.Afr.——FIG. E104,*6*. **T. (A.) crassa* PENNANT, Rec., Medit.; *6a,b*, LV lat., ×0.5 (Reeve); *6c*, RV int., ×0.5 (Davies).

T. (Arcopaginula) LAMY, 1918 [**T. inflata* GMELIN, 1791; M]. Medium-sized, white, smooth, posterior area set off by rib; inequivalve, LV larger; *AI* and *AII* short, *PI* long, *PII* weak; pallial sinus confluent. *Rec.*, W.Pac.——FIG.

E104,*12*. **T. (A.) inflata* GMELIN, Japan; *12a,b*, RV ext., int., ×1 (Habe).

T. (Arcopella) THIELE, 1934 [**T. balaustina* LINNÉ, 1758; M]. Near *T. (Arcopagia)* but smaller, posterior end shorter; lateral teeth weak in LV. *Rec.*, Eu.——FIG. E104,*5*. **T. (A.) balaustina* LINNÉ, France; *5a-c*, RV ext., int., LV int., ×1 *(89a)*.

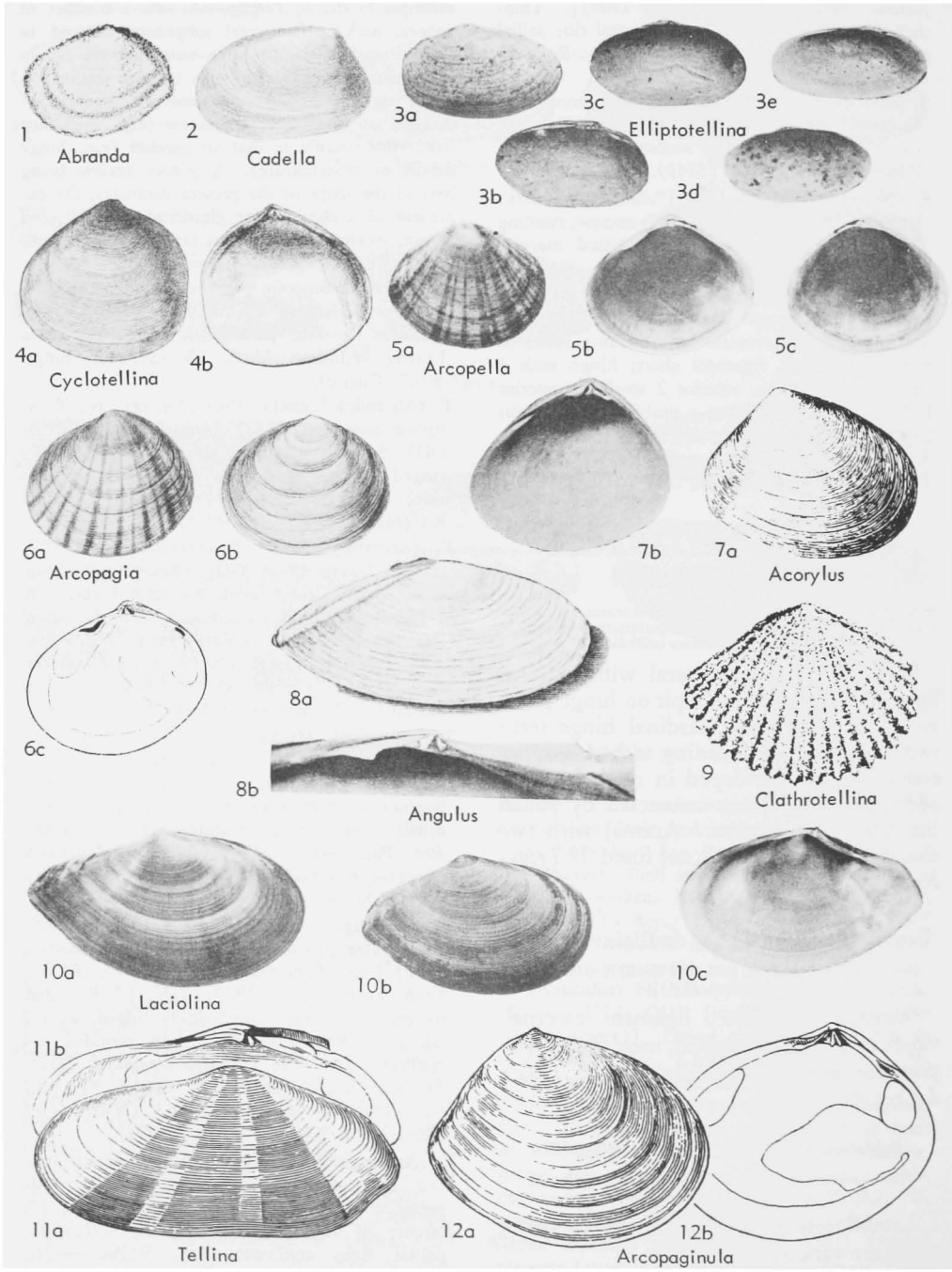


FIG. E104. Tellinidae (Tellininae) (p. *N613-N615*).

T. (Cadella) DALL, BARTSCH, & REHDER, 1939 [**T. lechriogramma* MELVILLE, 1893; OD]. Small, resembling *T. (Semelangulus)* in outline and sculpture but with normal ligament; also resembling *T. (Moerella)* but with smaller pallial sinus. *Rec.,* Indo-Pac.——FIG. E104,*2*, **T. (C.) lechriogramma* MELVILLE, India; LV ext., ×1.5 (Melville).

T. (Clathrotellina) THIELE, 1934 [**T. pretiosa* DESHAYES, 1855 (*non* EICHWALD, 1830)=*T. pretium* SALISBURY, 1934; M]. Small, with cancellate sculpture, otherwise resembling *T. (Merisca). Rec.,* IndoPac.——FIG. E104,*9*. *T. (C.) pretium* SALISBURY, E.Indies; RV ext., ×2 (Reeve).

T. (Cyclotellina) COSSMANN, 1887 [**Donax lunulata* LAMARCK, 1805; OD]. Shape as in *T. (Arcopagia)* but with posterior lateral in LV; pallial sinus smaller, partly confluent, angular, joined to adductor by linear scar. *Eoc.-Rec.,* Eu.-Carib.-IndoPac.——FIG. E104,*4*. **T. (C.) lunulata* (LAMARCK), Eoc., France; *4a,b,* RV ext., int., ×1 (Deshayes).

T. (Elliptotellina) COSSMANN, 1887 [**Donax tellinella* LAMARCK, 1805; OD]. Near *T. (Tellinella)* but smaller, with lateral teeth weak or wanting in LV. *L.Eoc.-M.Eoc.,* Eu.——FIG. E104,*3*. **T. (E.) tellinella* (LAMARCK), France; *3a-e,* RV ext., int., LV ext., int., RV int., ×2 (Cossmann).

T. (Elpidollina) OLSSON, 1961 [**T. decumbens* CARPENTER, 1865; OD]. Thin, subtrigonal, somewhat inflated, cardinal teeth small, laterals large in RV, pallial sinus large and deep. *Rec.,* W.C. Am.——FIG. E105,*11*. **T. (E.) decumbens* CARPENTER, Panama; *11a,b,* LV ext., RV int., ×0.7 (Reeve; Olsson).

T. (Eurytellina) FISCHER, 1887 [**T. punicea* BORN, 1790; M]. Medium-sized, elongate, posterior end not rostrate; sculpture concentric; hinge with *4b* small, laterals in LV not as strong as in RV, anterior laterals close to cardinals, posterior distant; pallial sinus confluent with pallial line, approaching or touching anterior adductor. *Mio.-Rec.,* E.N.Am.-W.N.Am.-S.Am.——FIG. E105,*1*. **T. (E.) punicea* BORN, Rec., W.Indies; *1a-c,* LV ext., RV and LV hinges, ×1 (Chenu).

T. (Fabulina) GRAY, 1851 [**T. fabula* GMELIN, 1791; SD WINCKWORTH, 1932] [=*Tellinula* MÖRCH, 1853 (*ex* CHEMNITZ) (obj.)]. Ovate, with oblique sculpture on RV except at ends; hinge with only 1 lateral, *AI,* near cardinals. [See also *T. (Scissula).*] *Mio.-Rec.,* Eu.——FIG. 105,*7*. **T. (F.) fabula* GMELIN, Rec., Medit.; *7a,b,* LV ext., RV ext., ×1 (Reeve).

T. (Finlayella) LAWS, 1933 [**F. sinuaris*; OD]. Small, pallial sinus asymmetrically developed, deeper in LV than in RV. *Mio.-Plio.,* S.Pac.——FIG. E105,*8*. **T. (F.) sinuaris* (LAWS), Mio., N.Z.; *8a-c,* RV ext., LV int., RV int., ×2 (Laws).

T. (Gastranopsis) COSSMANN, 1906 [**G. bureaui;* OD]. Resembling *Gastrana* but with lateral teeth in RV. *Eoc.,* Eu.——FIG. E105,*2*. **T. (G.) bureaui* (COSSMANN), France; *2a-d,* RV ext., LV int., LV ext., RV int., ×3 (Cossmann).

T. (Hemimetis) THIELE, 1934 [**T. plicata* VALENCIENNES, 1827; M]. Thin, somewhat lenticular, resembling *Apolymetis* but with lateral teeth and a lunule in RV; sculpture of concentric lamellae; ligament narrow; pallial sinus not confluent. *Rec.,* IndoPac.——FIG. E105,*5*. **T. (H.) plicata* VALENCIENNES, Japan; *5a,b,* LV ext., RV int., ×0.5 (Habe).

T. (Hertellina) OLSSON, 1961 [**T. nicoyana* HERTLEIN & STRONG, 1949; OD]. Outline as in *Sanguinolaria* but hinge and oblique sculpture as in *T. (Scissula). Rec.,* W.C.Am.——FIG. E105, *3*. **T. (H.) nicoyana* HERTLEIN & STRONG, W. Costa Rica; *3a-c,* RV ext., LV and RV hinges, ×1 (Hertlein & Strong).

T. (Homalina) STOLICZKA, 1870 [**T. triangularis* "Chemnitz" DILLWYN, 1817 (*non* GMELIN, 1791) (=*T. trilatera* GMELIN, 1791); OD]. Thin, trigonal, posterior end slightly longer; hinge weak, anterior lateral teeth short, close to cardinals, posterior laterals at end of ligament; pallial sinus deep, confluent. [See also *T. (Macomona).*] *Rec.,* E.Indies.——FIG. E105,*9*. **T. (H.) trilatera* GMELIN, E.Indies; *9a,b,* LV ext., RV ext., ×1 (Reeve, 1867).

T. (Iraqitellina) DANCE & EAMES, 1966 [**I. iraqensis;* OD]. *Rec.,* Persian Gulf.

?T. (Jactellina). [*See Exotica (Jactellina),* subfamily Macominae.]

T. (Laciolina) IREDALE, 1937 [**T. quoyi* SOWERBY in REEVE, 1868; OD] [=*Bosempra* BROWN, 1844, *ex* LEACH MS (invalidly proposed in synonymy of *Tellina depressa* GMELIN, 1791)]. Large, oblique, smooth, posterior end shorter; ligament long, somewhat sunken. *Rec.,* Pac.O.-W.Atl.-Eu.-N.Am.——FIG. E104,*10*. *T. (L.) incarnata* LINNÉ, France; *10a,b,* RV ext., ×1; *10c,* RV int., ×1 *(89a).*——FIG. E105,*4*. **T. (L.) quoyi* SOWERBY, N.Australia; RV ext., ×0.7 (Reeve, 1868).——FIG. E106,*15*. *T. (L.) ochracea* (CARPENTER), W.Mexico; *15a,* RV ext., ×0.5; *15b,* LV hinge, enl. (Hertlein & Strong, 1940-51).

?T. (Loxoglypta) DALL, BARTSCH, & REHDER, 1939 [*See Exotica (Loxoglypta),* subfamily Macominae.]

T. (Lyratellina) OLSSON, 1961 [**T. lyra* HANLEY, 1844; OD]. Elliptical, posterior end unflexed; escutcheon deep and narrow, below valve margin. *Mio.-Rec.,* NW.S.Am.-W.C.Am.——FIG. E105, *10*. **T. (L.) lyra* HANLEY, Rec., Panama; *10a,* LV ext., ×0.7; *10b,c,* LV hinge, RV hinge, ×2 (Olsson, 1961).

T. (Macaliopsis) COSSMANN, 1887 [**T. barrandei* DESHAYES, 1857; SD DALL, 1900]. Rounded-trapezoidal, posterior end truncate, sculpture of spaced concentric ridges; cardinals and laterals

strong, remote; pallial sinus narrow, only slightly confluent. *Paleoc.-Mio.*, Eu.-E.C.Am.—— Fig. E107,*6*. **T. (M.) barrandei* Deshayes, Eoc., France; *6a,b*, LV ext., RV int., ×1 (Deshayes).

T. (Macomona) Finlay, 1927 [**T. liliana* Iredale, 1915; OD]. Resembling *T. (Homalina)* but larger, compressed, posterior end twisted and somewhat pointed; RV with 2 cardinals and 2 laterals, posterior weak; pallial sinus deep, confluent, reaching to anterior muscle scar. *Tert.*-

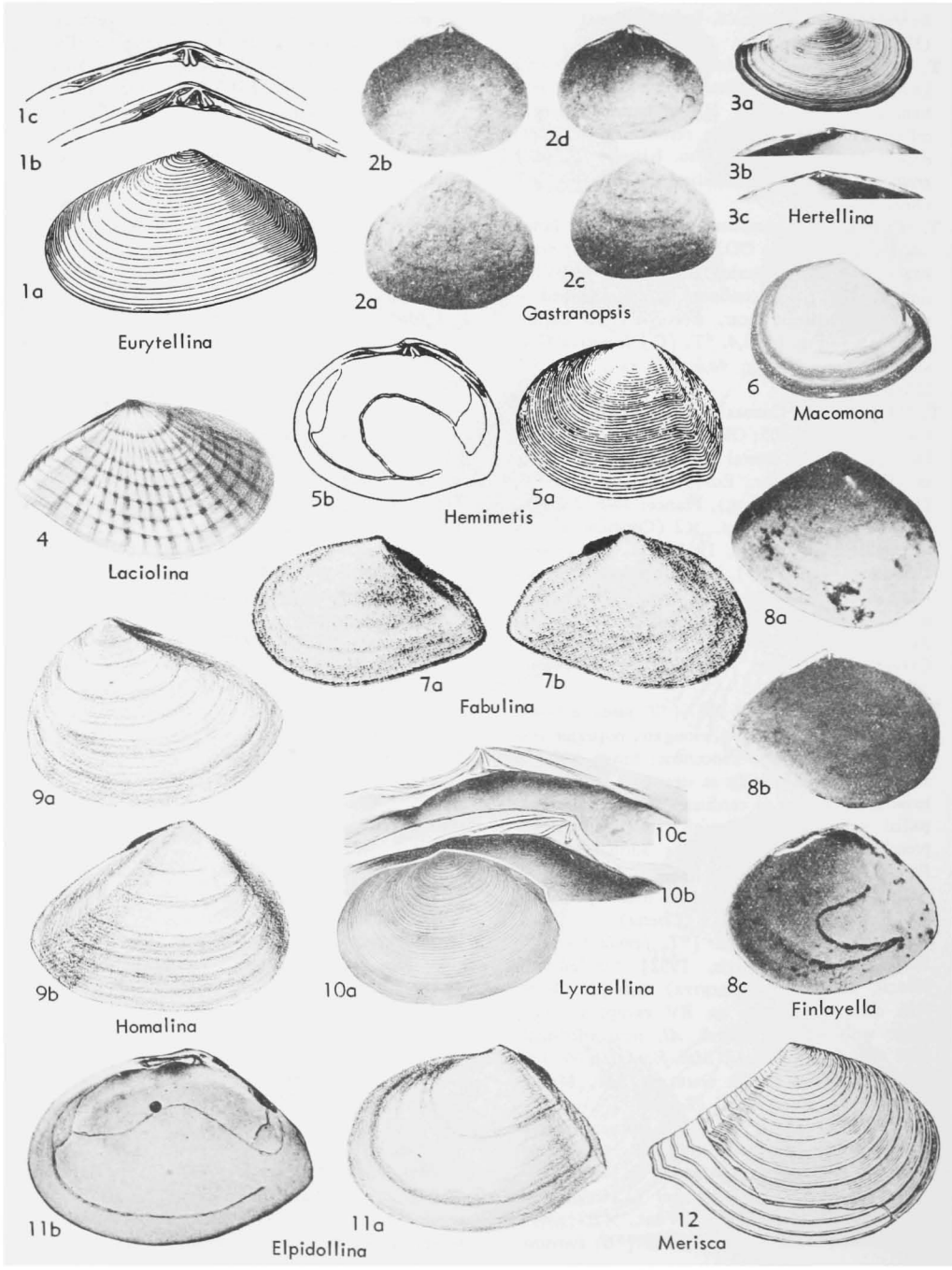


Fig. E105. Tellinidae (Tellininae) (p. *N615-N618*).

Rec., Australia.——Fig. E105,6. **T. (M.) liliana* Iredale, Rec., N.Z.; LV ext., ×0.3 (Powell).

T. (Merisca) Dall, 1900 [**T. crystallina* Wood, 1815=*T. cristallina* Spengler, 1798; OD].

Small to moderate-sized, posterior end rostrate, with basal margin emarginate in front of rostrum; sculpture of distant thin concentric lamellae; hinge without laterals in LV; pallial sinus

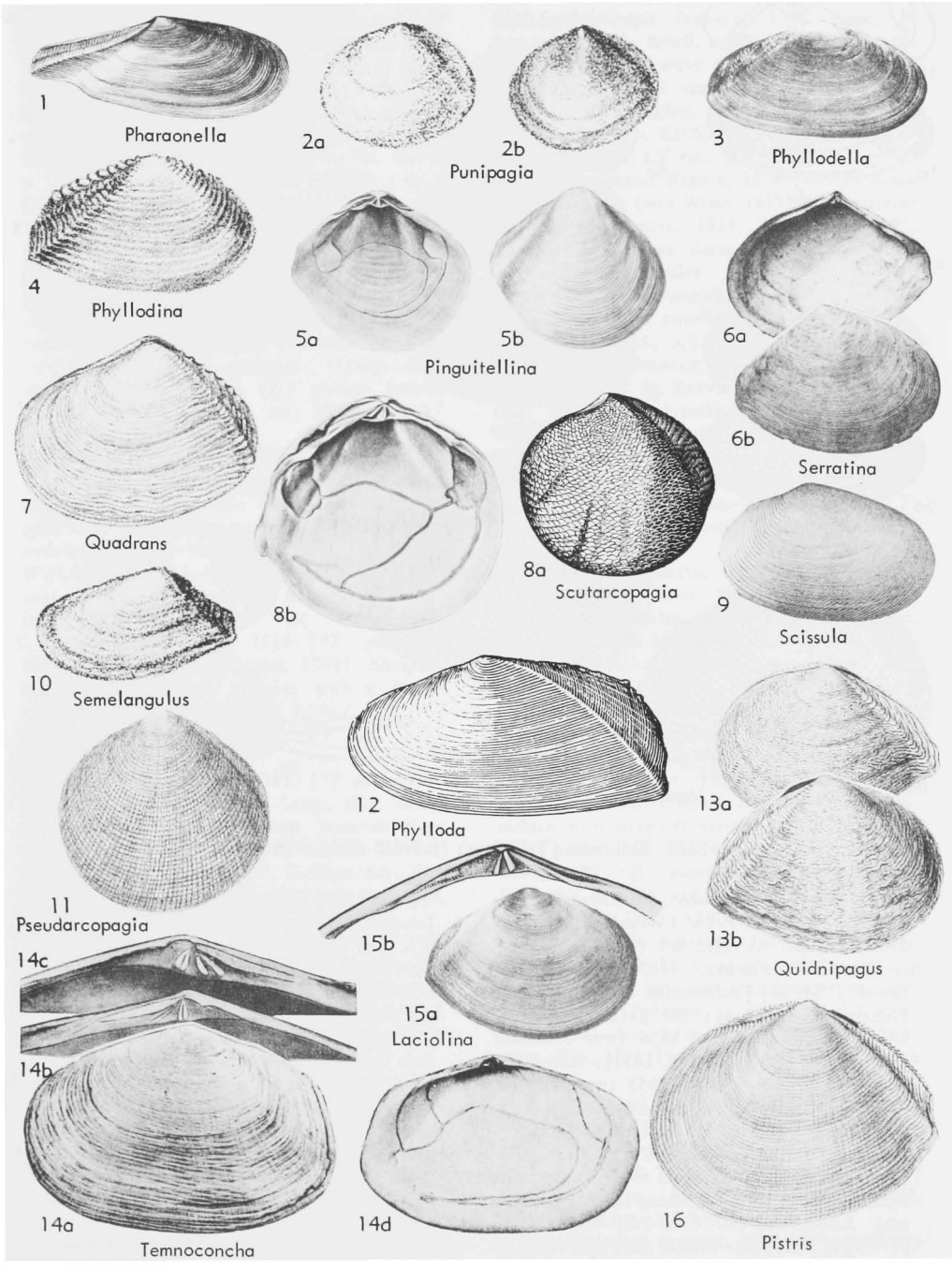


Fig. 106. Tellinidae (Tellininae) (p. *N*615-*N*620, *N*625).

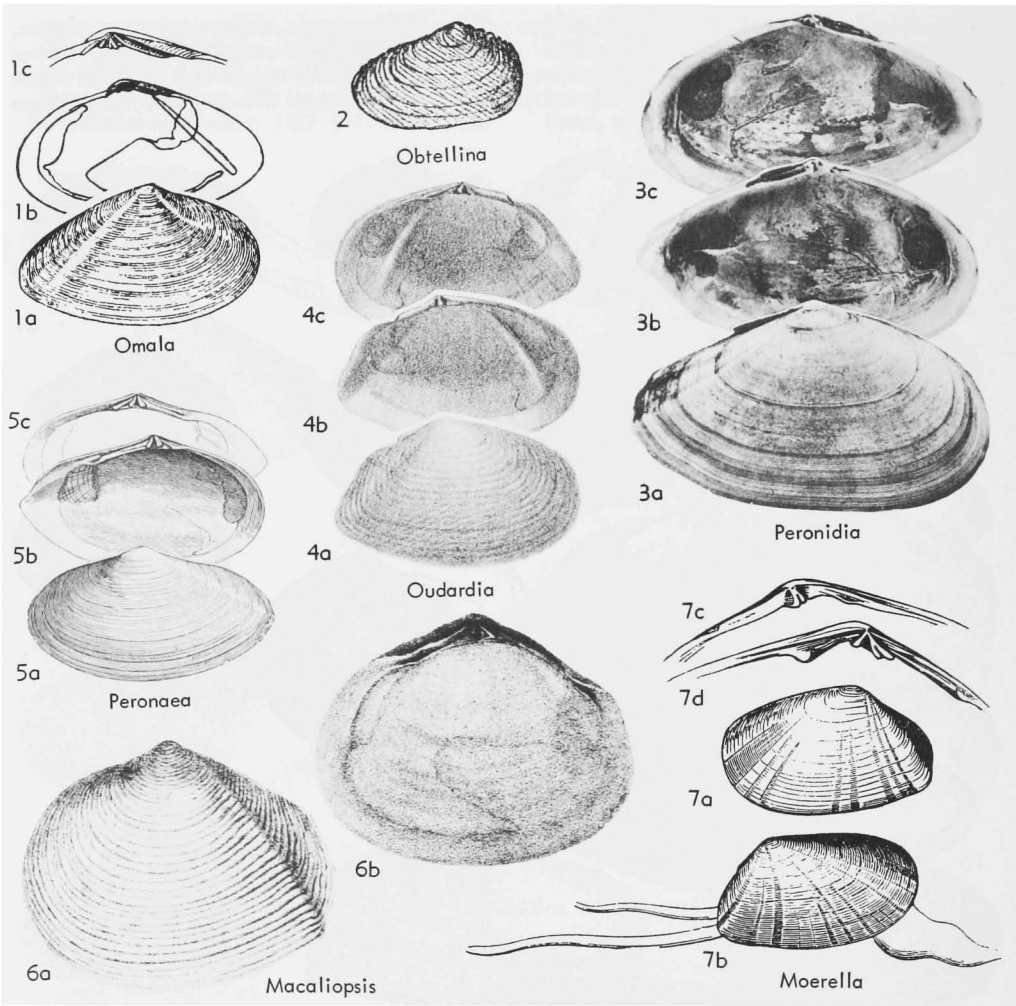


FIG. E107. Tellinidae (Tellininae) (p. *N*615-*N*616, *N*618-*N*619).

deep, confluent. *Mio.-Rec.,* E.C.Am.-W.C.Am. ——FIG. E105,*12*. **T. (M.) cristallina* SPENGLER, Rec., W.Indies; RV ext., ×1 (Dall).

T. (Moerella) FISCHER, 1887 [**T. donacina* LINNÉ, 1758; M] [=*Donacilla* GRAY, 1851 (*non* PHILIPPI, 1836) (obj.; SD SALISBURY, 1934); *Moera* H. & A. ADAMS, 1856 (*non* HUEBNER, 1819) (obj.; SD STOLICZKA, 1871); *Bathytellina* KURODA & HABE in HABE, 1958 (type, *B. citrocarnea*)]. Rather small, elongate-ovate, posterior end obscurely rostrate; sculpture of concentric threads; hinge with *3a* bifid, *2* very small, laterals strong, anterior pair closer to cardinals; pallial sinus confluent, almost touching anterior adductor scar. *L.Eoc.-Rec.,* Eu.-N.Am-Pac.——FIG. E107, *7*. **T. (M.) donacina* LINNÉ, Rec., Eu.; *7a-d,* LV ext., RV ext., LV and RV hinges, ×1 (Chenu). [=*Asbjoernsenia* FRIELE, 1886 (type, *A. striata;* M). Dr. OCKELMANN of Helsingør, Denmark, has studied the type specimens and has reported that they represent young *Tellina (Moerella) pygmaea* LOVÉN.]

T. (Nitidotellina) SCARLATO, 1965 [**Tellina nitidula* DUNKER, 1860; OD]. *Rec.,* E.Asia.

T. (Obtellina) IREDALE, 1929 [**T. bougei* SOWERBY, 1909; OD]. Beaks near posterior end; surface with fine oblique lines and irregular spines on posterior margin; pallial sinus largely confluent. *Rec.,* Pac.——FIG. E107,*2*. **T. (O.) bougei* SOWERBY, New Caledonia; LV ext., ×1.5 (Sowerby).

T. (Omala) SCHUMACHER, 1817 [**O. inaequivalvis*

=*Tellina hyalina* GMELIN, 1791; M]. Ovate, thin, pellucid, ligament long, sunken; hinge with *AI* close to cardinals. *Rec.*, Pac.——FIG. E107,*1*. **T. (O.) hyalina* GMELIN, Japan; *1a-c*, RV ext., int., hinge, ×0.5 (Habe).

T. (Oudardia) MONTEROSATO, 1884 [**T. oudardii* PAYRAUDEAU, 1826 =*T. compressa* BROCCHI, 1814; OD]. Resembling *T. (Moerella)* in form but with a thick internal rib, radiating from beak to ventral margin in front of mid-line; surface with or without fine oblique lines of sculpture. *?Eoc., Oligo.-Rec.*, Eu.-W.N.Am.——FIG. E107, *4*. **T. (O.) compressa* BROCCHI, Plio., Eu.; *4a-c*, RV ext., LV int., RV int., ×1 (Hörnes).

T. (Peronaea) POLI, 1791 [**T. planata* LINNÉ, 1758; SD STOLICZKA, 1870] [=*Peronaeoderma* POLI, 1795 (obj.; SD KEEN, herein)]. Ovate, posteriorly rounded, inequivalvae, LV flatter; sculpture of incremental lines and a few fine radials; lateral teeth weak; ligament long, depressed; pallial sinus confluent. *U.Oligo.-Rec.*, Eu.——FIG. E107,*5*. **T. (P.) planata* LINNÉ, Mio., Aus., *5a-c*, LV ext., int., RV int., ×0.7 (Zittel).

T. (Peronidia) DALL, 1900 [**T. albicans* GMELIN, 1791; OD]. Elongate, solid, compressed, subequivalve, without lunule, escutcheon long, narrow; shell with fine concentric grooves, stronger anteriorly; lateral teeth weak. *Eoc.-Rec.*, Eu.-W.N.Am.-E.Asia.——FIG. E107,*3*. **T. (P.) albicans* GMELIN, Rec., Algeria; *3a-c*, RV ext., LV int., RV int., ×0.7 *(89a)*.

T. (Pharaonella) LAMY, 1918 [**T. pharaonis* HANLEY, 1844; SD SALISBURY, 1934]. Elongate, posterior end strongly rostrate, with a double radial rib. *Rec.*, Pac.——FIG. E106,*1*. **T. (P.) pharaonis* HANLEY, Red Sea; RV ext., ×0.5 (Reeve).

T. (Phylloda) SCHUMACHER, 1817 [**P. aurea* =*T. foliacea* LINNÉ, 1758; M]. Large, thin, ovate, posterior dorsal margin serrate, posterior slope with spinose radials; with 2 laterals in RV, laterals weak or absent in LV. *U.Oligo.-Rec.*, Eu.-Pac.——FIG. E106,*12*. **T. (P.) foliacea* LINNÉ, Rec., E.Indies; LV ext., ×0.5 (Chenu).

T. (Phyllodella) HERTLEIN & STRONG, 1949 [**T. insculpta* HANLEY, 1844; OD]. Like *T. (Eurytellina)* but with the foliations of *T. (Phyllodina)* on posterior slope. *Rec.*, W.C.Am.——FIG. E106,*3*. **T. (P.) insculpta* HANLEY; RV ext., ×1 (Hertlein & Strong).

T. (Phyllodina) DALL, 1900 [**T. squamifera* DESHAYES, 1855; OD]. With concentric sculpture forming spines along posterior dorsal margin; pallial line not confluent. *Oligo.-Rec.*, E.C.Am.-W.C.Am.——FIG. E106,*4*. **T. (P.) squamifera* DESHAYES, Rec., W.Indies; RV ext., ×1 (Reeve).

T. (Pinguitellina) IREDALE, 1927 [**T. robusta* HANLEY, 1844; OD]. Small, inflated, smooth, posterior slope set off by an angle; pallial sinus long. *Rec.*, Pac.——FIG. E106,*5*. **T. (P.) robusta* HANLEY, NE.Australia; *5a,b*, LV int., RV ext., ×2 (Iredale).

T. (Pistris) THIELE, 1934 [*pro Pristis* LAMY, 1918 (*non* LINCK, 1790)] [**T. pristis* LAMARCK, 1818; M] [=*Pristipagia* IREDALE, 1936 (type, *P. gemonia*; OD)]. Small, relatively high, ligament deep; sculpture of wavy ribs and fine impressed radial lines; pallial sinus free; resembling *T. (Serratina)* but higher, with stronger sculpture. *Rec.*, Pac.——FIG. E106,*16*. **T. (P.) pristis* LAMARCK, E.Indies; LV ext., ×1 (Reeve).

T. (Pseudarcopagia) BERTIN, 1878 [**T. decussata* LAMARCK, 1818 (*non* WOOD, 1815) =*T. victoriae* GATLIFF & GABRIEL, 1914; SD DALL, 1900]. Lenticular, sculpture decussate; hinge with 2 laterals in either valve. [See also *T. (Arcopagia)*, *T. (Sinuosipagia)*.] *Rec.*, Pac.——FIG. E106,*11*. **T. (P.) victoriae* GATLIFF & GABRIEL, Australia; LV ext., ×0.5 (Reeve).

T. (Punipagia) IREDALE, 1930 [**T. subelliptica* SOWERBY, 1868, in REEVE (*non* MEEK & HAYDEN, 1857) =*T. hypelliptica* SALISBURY, 1934; OD] [=*Punigapia* THIELE, 1934, spelling error]. Small, rounded, ligament short, somewhat sunken; pallial sinus deep, triangular, about half confluent. *Rec.*, Pac.——FIG. E106,*2*. *T. (P.) hypelliptica* SALISBURY, Australia; *2a,b*, LV ext., ×1 (Reeve).

T. (Quadrans) BERTIN, 1878 [**T. gargadia* LINNÉ, 1758; SD DALL, 1900]. Shell thin, posterior slope wrinkled, the margin with spines; ligament sunken; laterals feeble, 2 in RV, wanting in LV, pallial sinus confluent below. *Rec.*, Pac.——FIG. E106,*7*. **T. (Q.) gargadia* LINNÉ, E.Indies; LV ext., ×1 (Reeve).

T. (Quidnipagus) IREDALE, 1929 [*"*Cochlea palatam* Martyn" IREDALE, 1929 (=*T. rugosa* BORN, 1778, *non* PENNANT, 1777); OD]. Somewhat attenuate posteriorly, lunule and escutcheon small; surface with irregular wrinkles and radial furrows; pallial sinus half free. *Rec.*, Pac.——FIG. E106,*13*. **T. (Q.) palatam* (IREDALE), E.Indies; *13a,b*, LV ext., RV ext., ×0.5 (Reeve).

T. (Scissula) DALL, 1900 [**T. decora* SAY, 1826 =*T. similis* SOWERBY, 1806; OD]. Ovate-quadrate, surface of both valves with fine oblique grooving not in harmony with incremental lines [see also *T. (Fabulina)*]. *Plio.-Rec.*, E.C.Am.-W.C.Am.——FIG. E106,*9*. **T. (S.) similis* SOWERBY, Plio., USA(Fla.); RV ext., ×2 (Olsson & Harbison).

T. (Scutarcopagia) PILSBRY, 1918 [**T. scobinata* LINNÉ, 1758; OD]. Lenticular, inflated, with scaly or granose sculpture. *Pleist.-Rec.*, IndoPac. ——FIG. E106, *8*. **T. (S.) scobinata* LINNÉ, Rec.; *8a*, NE.Australia, LV ext., ×0.5 (Iredale); *8b*, E.Indies, LV int., ×0.5 (Chenu).

T. (Semelangulus) IREDALE, 1924 [**T. tenuilirata* SOWERBY, 1867, in REEVE; OD]. Small, ovate,

somewhat cuneiform, anterior end longer; sculpture of concentric striae; ligament sunken, almost internal; hinge of RV with 2 laterals, wanting in LV. *Rec.,* Pac.——Fig. E106,*10*. **T. (S.) tenuilirata* Sowerby, SE.Australia; LV ext., ×1 (Reeve).

T. (Serratina) Pallary, 1922 [**T. serrata* Brocchi, 1814; OD] [=*Striotellina* Thiele, 1934 (obj.)]. Relatively high for length, ovate, sculpture concentric, radial ribs obsolete. *Mio.-Rec.,* Eu.-E.Atl.——Fig. E106,*6*. **T. (S.) serrata* Brocchi, Mio., France,; *6a,b,* RV int., ext., ×1 (Cossmann & Peyrot).

T. (Sinuosipagia) Cossmann, 1921 [**T. colpodes* Bayan, 1873; OD]. Resembling *T. (Arcopagia)* but muscle impressions more unequal and lateral teeth more sharply truncate. *Eoc.,* Eu.——Fig. E108,*6*. **T. (S.) colpodes* Bayan, France; *6a,b,* RV ext., int., ×0.8 (Cossmann).

T. (Tellinangulus) Thiele, 1934 [**T. aethiopica* Thiele & Jaeckel, 1931; M]. Small, asymmetrically rounded, somewhat rostrate; sculpture

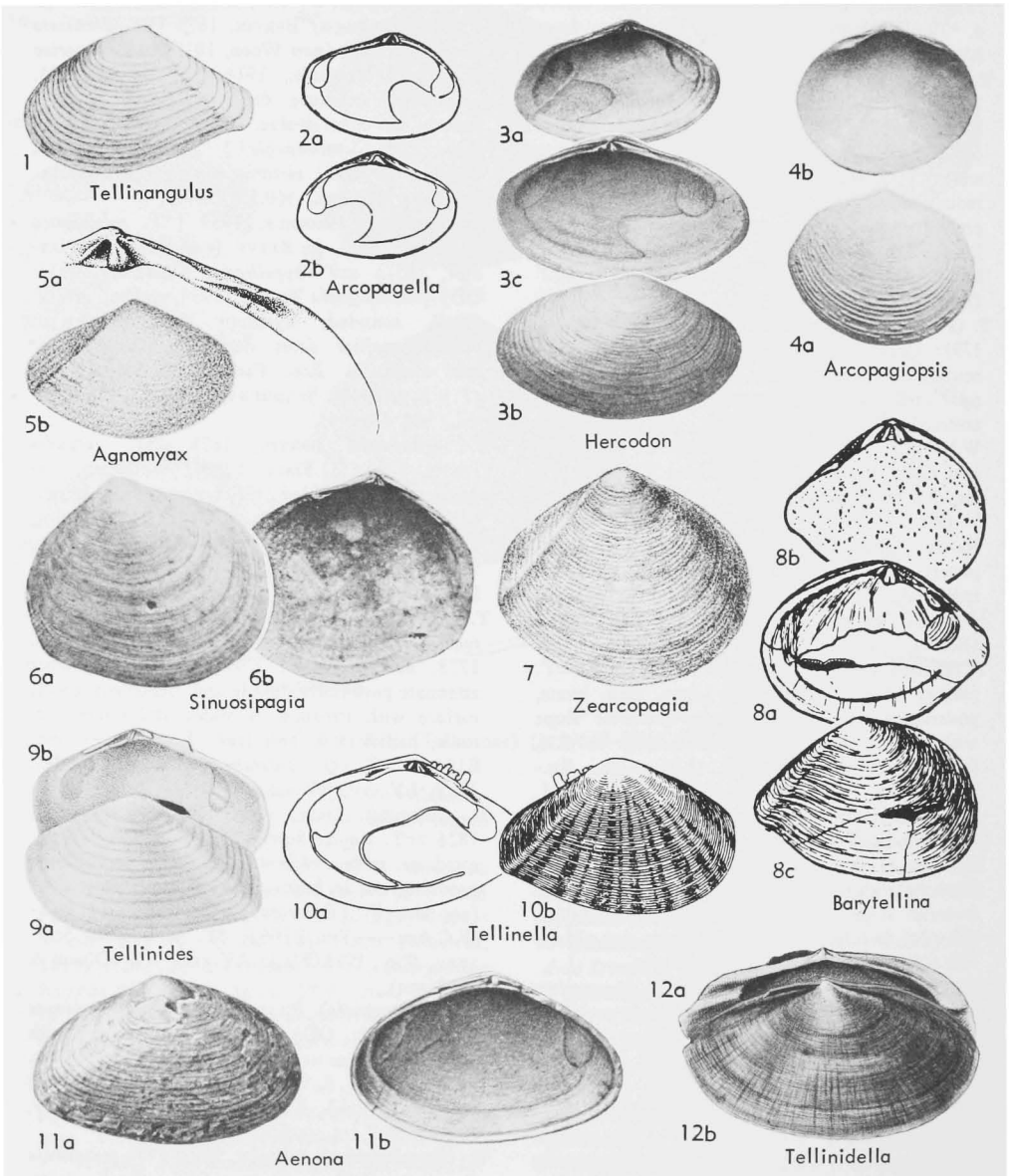


Fig. E108. Tellinidae (Tellininae) (p. *N620-N621*).

of few concentric lamellae, interspaces faintly striate radially; hinge with *AII* and *PI* wanting, *3a* short. *Rec.*, E.Afr.——FIG. E108,*1*. **T. (T.) aethiopica* THIELE & JAECKEL, E.Afr.; LV ext., ×4 (Thiele & Jaeckel).

T. (Tellinella) MÖRCH, 1853 [**T. virgata* LINNÉ, 1758; SD STOLICZKA, 1870] [=*Capsa* LAMARCK, 1799 (*non* BRUGUIÈRE, 1797) (type, *T. angulata* LINNÉ, 1767; M); *Eutellina* FISCHER, 1887 (obj.); *Maoritellina* FINLAY, 1927 (type, *T. charlottae* SMITH, 1885; OD); *Tellinota* IREDALE, 1936 (type, *T. roseola;* OD)]. Elongate, pointed behind, posterior slope with 1 or 2 radial ribs; sculpture of fine concentric lamellae. *Oligo.-Rec.*, Eu.-W.Indies-Pac.——FIG. E108,*10*. **T. (T.) virgata* LINNÉ, Rec., E.Indies; *10a,b*, RV int., ext., ×0.5 (Habe).

T. (Tellinidella) HERTLEIN & STRONG, 1949 [**Tellinides purpureus* BRODERIP & SOWERBY, 1829; OD]. Resembling *T. (Eurytellina)* in form but with a thin shell; hinge with *PI* weak. *Rec.*, W.C.Am.——FIG. E108,*12*. **T. (T.) purpurea* (BRODERIP & SOWERBY), W.C.Am.; *12a,b*, RV int., ext., ×0.6 (Gray).

T. (Tellinides) LAMARCK, 1818 [**Tellinides timorensis*; M]. Rectangular, smooth, posterior slope obliquely truncate, with a slight flexure. *Rec.*, E. Indies.——FIG. E108,*9*. **T. (T.) timorensis* (LAMARCK); *9a,b*, LV ext., RV int., ×1 (Blainville).

T. (Zearcopagia) FINLAY, 1927 [**T. disculus* DESHAYES, 1855; OD]. Lenticular, concentrically grooved; hinge with *AII* remote from cardinals; resembling *T. (Pseudarcopagia)* but without radial sculpture. *Rec.*, Pac.——FIG. E108,*7*. **T. (Z.) disculus* DESHAYES, Philip. Is.; RV ext., ×1 (Reeve).

Aenona CONRAD, 1870 [**Tellina eufaulensis* CONRAD, 1860; SD STOLICZKA, 1871]. Thin, fragile, compressed, nearly equilateral and smooth; dorsal margins of shell serving as lateral teeth; pallial sinus broad, not confluent. *U.Cret.*, N.Am.——FIG. E108,*11*. **A. eufaulensis* (CONRAD), USA (Tenn.); *11a,b*, RV ext., RV int., ×2 (Wade).

Agnomyax STEWART, 1930 [**Tellina monilifera* GABB, 1864; OD]. Resembling *Linearia* but with radial ribs on posterior slope only; posterior end diagonally truncate; hinge with cardinals directed ventrally, *3b* large and bifid. *U.Cret.*, W.N.Am.-?S.Asia-?Eu.——FIG. E108,*5*. **A. monilifer* (GABB), USA(Calif.); *5a*, RV hinge, ×5 (Stewart); *5b*, RV ext., ×2 (Gabb).

Arcopagella MEEK, 1871 [**A. mactroides*; M]. Resembling *Tellina (Arcopagia)* but with anterior and posterior teeth in both valves; surface smooth. *U.Cret.*, N.Am.——FIG. E108,*2*. **A. mactroides*, USA(Kans.); *2a,b*, RV int., LV int., ×1 (Meek).

Arcopagiopsis COSSMANN, 1886 [**Tellina pustula* DESHAYES, 1825; SD SALISBURY, 1934]. Resembling *Tellina (Arcopagia)* but pallial sinus horizontal. *Eoc.*, Eu.——FIG. E108,*4*. **A. pustula* (DESHAYES), M.Eoc., France; *4a,b*, RV ext., int., ×2 (Cossmann).

Barytellina MARWICK, 1924 [**B. crassidens*; OD]. Shell thick; hinge with posterior laterals and *3b* strong. *Plio.*, N.Z.——FIG. E108,*8*. **B. crassidens*, N.Z.; *8a-c*, RV int., LV int., RV ext., ×1 (Marwick).

Hercodon CONRAD in KERR, 1875 (issued separately, 1873) [**H. ellipticus*; M]. Elliptical, surface with irregular growth lines and numerous fine radials; hinge with *3a* angular, long, oblique, *2a* bifid, *4b* linear; pit for resilium deeply impressed; pallial sinus broad, rounded. *U.Cret.*, N.Am.——FIG. E108,*3*. **H. ellipticus*, USA(N.Car.); *3a-c*, LV int., RV ext., RV int., ×0.7 (Stephenson, 1926).

Linearia CONRAD, 1860 [**L. metastriata;* M] [=*Oene* CONRAD, 1873 (type, *O. plana;* M); *Aene*, spelling error]. Ovate, beaks nearly central; sculpture of beaded radials, strongest at ends; hinge with 2 cardinals directed forward, dorsal margins of RV beveled to serve as laterals, with double grooves in LV. *L.Cret.-U.Cret.*, Eu.-N.Am.-Afr.

L. (Linearia). Umbones rather high, inner ventral margin finely crenulate. *L.Cret.-U.Cret.*, N.Am.-Eu.-N.Afr.——FIG. E109,*11*. **L. (L.) metastriata* CONRAD, U.Cret., USA(Tenn.); *11a,b*, RV ext., int., ×2.5 (Wade).

L. (Liothyris) CONRAD in KERR, 1875 [?1873] [**L. (L.) carolinensis*; M]. Umbones lower and shell longer and smoother than in *L. (Linearia);* ventral margin smooth; pallial sinus deep. *U.Cret.*, N.Am.——FIG. E109,*7*. **L. (L.) carolinensis*, USA(Tenn.); *7a-c*, RV int., LV ext., LV int., ×0.8 (Wade).

Nelltia STEPHENSON, 1953 ("1952") [**N. stenzeli;* OD]. Resembling *Tellina* but not flexed, posterior end shorter; cardinal teeth weaker, anterior laterals distant, short, weak; pallial sinus relatively short. *U.Cret.*, N.Am.——FIG. E109,*8*. **N. stenzeli*, USA(Tex.); *8a-e*, RV ext., int., LV hinges, int., ×1 (Stephenson).

Palaeomoera STOLICZKA, 1870 [**Tellina strigata* GOLDFUSS, 1840; M]. Like *T. (Phylloda)* in form; sculpture of fine, reticulate radial ribs; hinge with one lamellar anterior cardinal in each valve, bifid in RV, posterior cardinals not traceable in either valve; laterals less distinct. *U.Cret.*, Eu.-N.Afr.——FIG. E109,*4*. **P. strigata* (GOLDFUSS), Ger.; *4a-c*, RV ext., LV int., RV int., ×1 (Holzapfel, 1889).

Solyma CONRAD, 1870 [**S. lineolatum*; M]. Ovate-quadrate, smooth; hinge in LV with one bifid cardinal, margins of shell serving as laterals.. *U. Cret.*, N.Am.——FIG. E109,*1*. **S. lineolatum;* *1a,b*, USA(N.J.), RV ext., int., ×1; *1c*, USA (Tex.), hinge, ×3 (Whitfield).

Strigilla TURTON, 1822 [**Tellina carnaria* LINNÉ, 1758; SD GRAY, 1847] [=*Limicola* GRAY, 1852, *ex* LEACH MS (*non* KOCH, 1816) (obj.); *Strigillina*, spelling error, STOLICZKA, 1870]. Lenticular, sculp-

tured with oblique riblets; shells mostly tinged with pink. *Oligo.-Rec.,* Eu.-W.Indies-Afr.-C.Am.-S.Am.

S. (Strigilla). Oblique ribbing over most of shell, with one or more lines of flexure; pallial sinus somewhat discrepant. *Mio.-Rec.,* Eu.-W.Indies. ——Fig. E109,*5*. **S. (S.) carnaria* (Linné), Rec., Carib.; LV ext., ×1 (Woodward).

S. (Aeretica) Dall, 1900 [**Tellina senegalensis* Hanley, 1844 (*non* Gmelin, 1791) =*S. polyaulax* Tomlin & Shackleford, 1915; OD]. Oblique sculpture on anterior part of shell only, posterior slope smooth; pallial line connecting adductors in one valve, falling short in the other. *Oligo. (Aquitan.)-Rec.,* Eu.-W.Afr.——Fig. E109,*10*. **S. (A.) polyaulax* Tomlin & Shackleford, Rec., W.Afr.; RV ext., ×1.5 (Nicklès).

S. (Pisostrigilla) Olsson, 1961 [**Tellina pisiformis* Linné, 1758; OD]. Small, oblique sculpture with a line of sharp flexure or zigzag bends along center of posterodorsal area. *Mio.-Rec.,* E.C.Am.-W.C.Am.——Fig. E109,*6*. **S. (P.) pisiformis* (Linné), Rec., USA(Fla.); LV ext., ×2 (Stanford Univ. specimen).

S. (Rombergia) Dall, 1900 [**S. rombergii* Mörch, 1853; OD]. Sculpture as in *S. (Strigilla)*

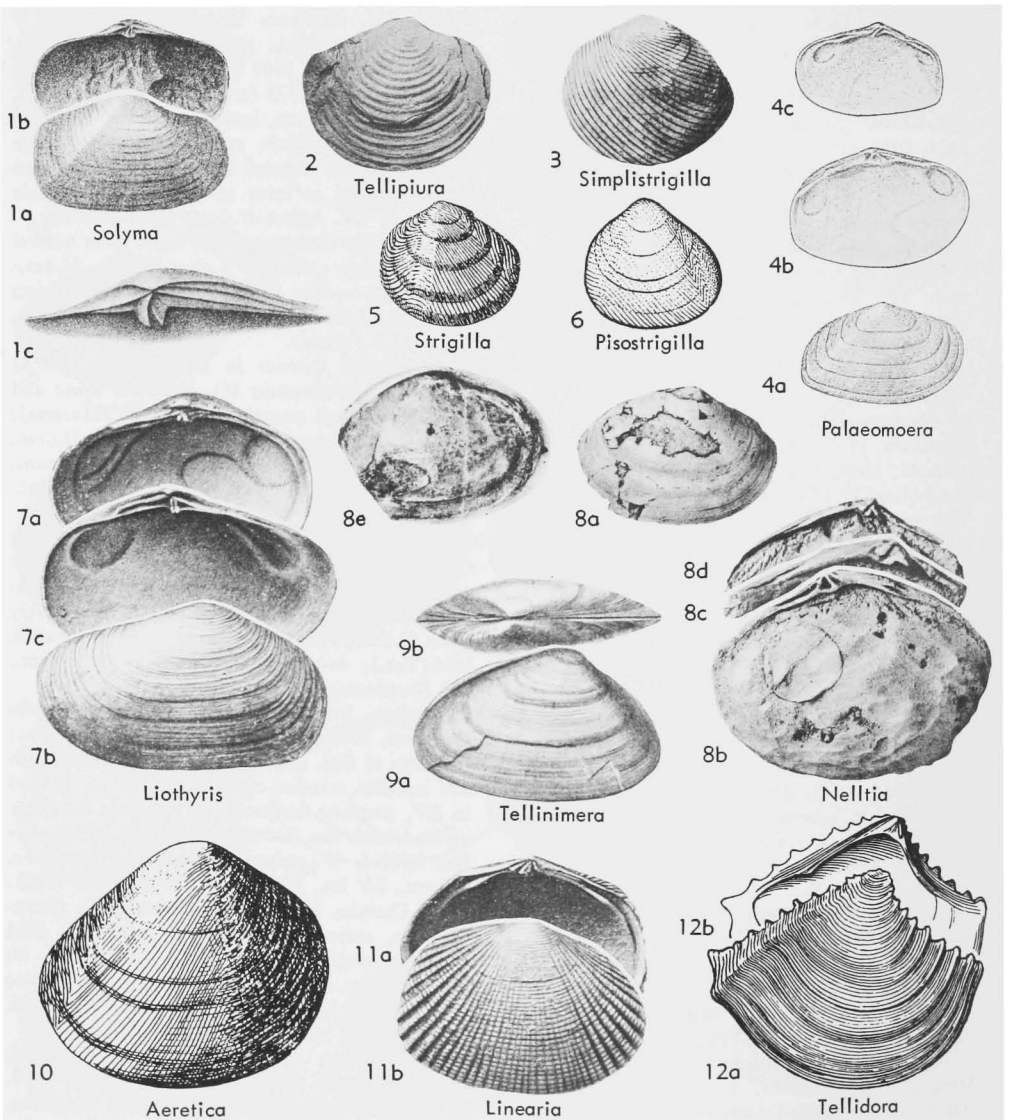


Fig. E109. Tellinidae (Tellininae) (p. *N621-N623*).

but pallial sinus alike in both valves, falling short of uniting adductors. *Rec.*, W.Indies.

S. (Simplistrigilla) Olsson, 1961 [**S. (S.) strata* (=**Strigilla serrata* Mörch, 1860); OD]. Oblique striations without any lines of flexure. *Rec.*, W.C. Am.-S.Am.——Fig. E109,*3*. **S. (S.) serrata*, Ecuador; LV ext., ×3 (Olsson).

Tellidora H. Adams & A. Adams, 1856 [**Tellina burneti* Broderip & Sowerby, 1829; SD Stoliczka, 1870] [=*Tellinodora* Paetel, 1875 (spelling error)]. Compressed, inequilateral, ovate-trigonal, surface with spaced concentric lamellae ending in marginal serrations. *Plio.-Rec.*, E.N.Am.-W.C.Am. ——Fig. E109,*12*. **T. burneti* (Broderip & Sowerby), Rec., W.C.Am.; *12a,b*, RV ext., LV int., ×1 (Chenu).

Tellinimera Conrad, 1860 [**T. eborea;* SD Gardner, 1916][=*Tellimera* Conrad, 1870, *emend. (nom. van.)*]. More compressed and inequilateral than *Aenona*, surface with sharp concentric striations; cardinal plate channeled posteriorly, with a small pit anteriorly; hinge with *2a* V-shaped, *4b* bifid. *U.Cret.*, E.N.Am.——Fig. E109,*9*. **T. eborea*, USA(Md.); *9a,b*, RV ext., both valves dorsal, ×2 (Gardner).

Tellipiura Olsson, 1944 [**Tellidora (T.) peruana;* OD]. Resembling *Tellidora* in serrate dorsal margin and hinge but outline more equilateral, with close-spaced concentric riblets or undulations. *U. Cret.*, W.S.Am.——Fig. E109,*2*. **T. peruana* (Olsson), Peru; RV ext., ×1 (Olsson).

Subfamily MACOMINAE Olsson, 1961

Sculpture generally more subdued than in Tellininae; hinge without lateral teeth. *Eoc.-Rec.*

Macoma Leach, 1819 [**M. tenera* (=*Tellina calcarea* Gmelin, 1791); M] [=*Macroma, Macrotoma*, spelling errors; *Limecola* Brown, 1844 (*ex* Leach MS) (in synonymy of *Tellina solidula* Pulteney, 1799 =*T. balthica rubra* da Costa, 1778); *Macomopsis* Sacco, 1901 (type, *Tellina elliptica* Brocchi, 1814; OD); *?Pulvinus* Scarlato, 1965 (type, *Tellina micans* Hanley, 1844; OD)]. Inequilateral, mostly thin, with deciduous periostracum; posterior end slightly twisted; pallial sinus tending to be discrepant, larger in one valve. *Eoc.-Rec.*, cosmop.

M. (Macoma). Ovate-trigonal, shell texture somewhat chalky. *Mio.-Rec.*, N.Eu.-N.Am.-NE.Asia. ——Fig. E110,*4*. **M. (M.) calcarea* (Gmelin), Rec., Arctic; *4a*, RV ext., ×0.8 (Sars); *4b*, RV int., ×0.5; *4c*, both valves, ×0.8 (Davies).

M. (Austromacoma) Olsson, 1961 [**Solen constrictus* Bruguière, 1792; OD]. Texture not chalky; pallial sinus large, high, pointed under beak, connected to anterior adductor scar at its lower end. *Plio.-Rec.*, E.N.Am.——Fig. E110,*7*. **M. (A.) constricta* (Bruguière), Rec., Carib.; *7a,b*, LV ext., int., ×1 (Philippi).

M. (Bendemacoma) Eames, 1957 [**Peronaea nigeriensis* Newton, 1922; OD]. Large, high, solid, oblique; hinge with *3a* grooved; pallial sinus tongue-shaped, narrow, confluent for half its length. *Eoc.*, Afr.——Fig. E110,*11*. **M. (B.) nigeriensis* (Newton), Nigeria; *11a-c*, LV ext., int., RV int., ×0.5 (Newton).

M. (Cymatoica) Dall, 1890 [**M. (C.) occidentalis* =*Tellina undulata* Hanley, 1844; SD Dall, 1900]. Small, elongate, with undulating oblique sculpture. *Mio.-Rec.*, E.C.Am.-W.C.Am.——Fig. E110,*5*. **M. (C.) undulata* (Hanley), Rec., W. Mex.; LV ext., ×2 (Dall).

M. (Macoploma) Pilsbry & Olsson, 1941 [**M. (M.) ecuadoriana*; OD]. Area of posterior slope near dorsal margin granulated. *Plio.-Rec.*, W.C. Am.-S.Am.——Fig. E110,*6*. **M. (M.) ecuadoriana*, Plio., Ecuador; LV ext., ×0.6 (Pilsbry & Olsson).

M. (Panacoma) Olsson, 1942 [**M. (P.) chiriquiensis;* OD]. Sculpture of a few small granules and strong raised concentric threads separated by flat interspaces; pallial sinus wide, confluent below. *Mio.-Plio.*, W.C.Am.——Fig. E110,*8*. **M. (P.) chiriquiensis*, W.Panama; *8a,b*, LV ext., RV ext., ×1 (Olsson).

M. (Pinguimacoma) Iredale, 1936 [**Pinguimacoma hemicilla;* OD]. Small, thin, resembling *Tellina (Pinguitellina)* in form but without laterals. *Rec.*, Australia.——Fig. E110,*9*. **M. (P.) hemicilla* (Iredale), E.Australia; *9a,b*, RV ext., hinge, ×3 (Iredale).

M. (Psammacoma) Dall, 1900 [**Psammotaea candida* Lamarck, 1818; OD]. Elongate, smooth, posterior flexure obsolete, periostracum delicate; ligament and resilium wholly external; pallial sinus only half confluent. *Mio.-Rec.*, E.N.Am.-Pac. ——Fig. E110,*12*. **M. (P.) candida* (Lamarck), Rec., E.Indies; *12a,b*, LV ext., int., ×0.5 (Philippi).

M. (Rexithaerus) Tryon, 1869 *ex* Conrad MS [**Tellina secta* Conrad, 1837; SD Dall, 1900]. Large, compressed, nonchalky; ligament strong, deep-set, dorsal margin produced upward behind it. *Mio.-Rec.*, W.N.Am.——Fig. E110,*10*. **M. (R.) secta* (Conrad), Rec., USA(Calif.); RV ext., ×0.5 (Reeve).

M. (Rostrimacoma) Salisbury, 1934 [**Panopea cancellata* Sowerby in Reeve, 1873; OD]. Large, anterior end produced; surface cancellate. *Rec.*, E.Atl.——Fig. E110,*3*. **M. (R.) cancellata* (Sowerby), W.Afr.; RV ext., ×0.3 (Salisbury).

M. (Salmacoma) Iredale, 1929 [**Salmacoma vappa;* OD]. Ovate, inequivalve, posterior flexure pronounced. *Rec.*, S.Pac.——Fig. E110,*2*. **M. (S.) vappa* (Iredale), Rec., NE.Australia; RV ext., ×1 (Iredale).

M. (Scissulina) DALL, 1924 [**Tellina dispar* CONRAD, 1837; OD]. With fine oblique sculpture on one valve. *Rec.*, Pac.——FIG. E110,*1*. **M. (S.) dispar* (CONRAD), USA(Hawaii); *1a*, RV ext., ×1 (Sowerby); *1b,c*, detail of posterior end (*1c*, LV; *1b*, RV), ×6 (Dall, Bartsch, Rehder).

M. (Temnoconcha) DALL, 1921 [**Psammacoma (T.) brasiliana;* OD] [=*Psammothalia* OLSSON, 1961 (type, *Tellina cognata* C. B. ADAMS, 1852; OD)]. Resembling *M. (Scissulina)* but more quadrate, with oblique sculpture on both valves. *Rec.*, W.C.Am.-E.S.Am.——FIG. E111,*8*. **M.*

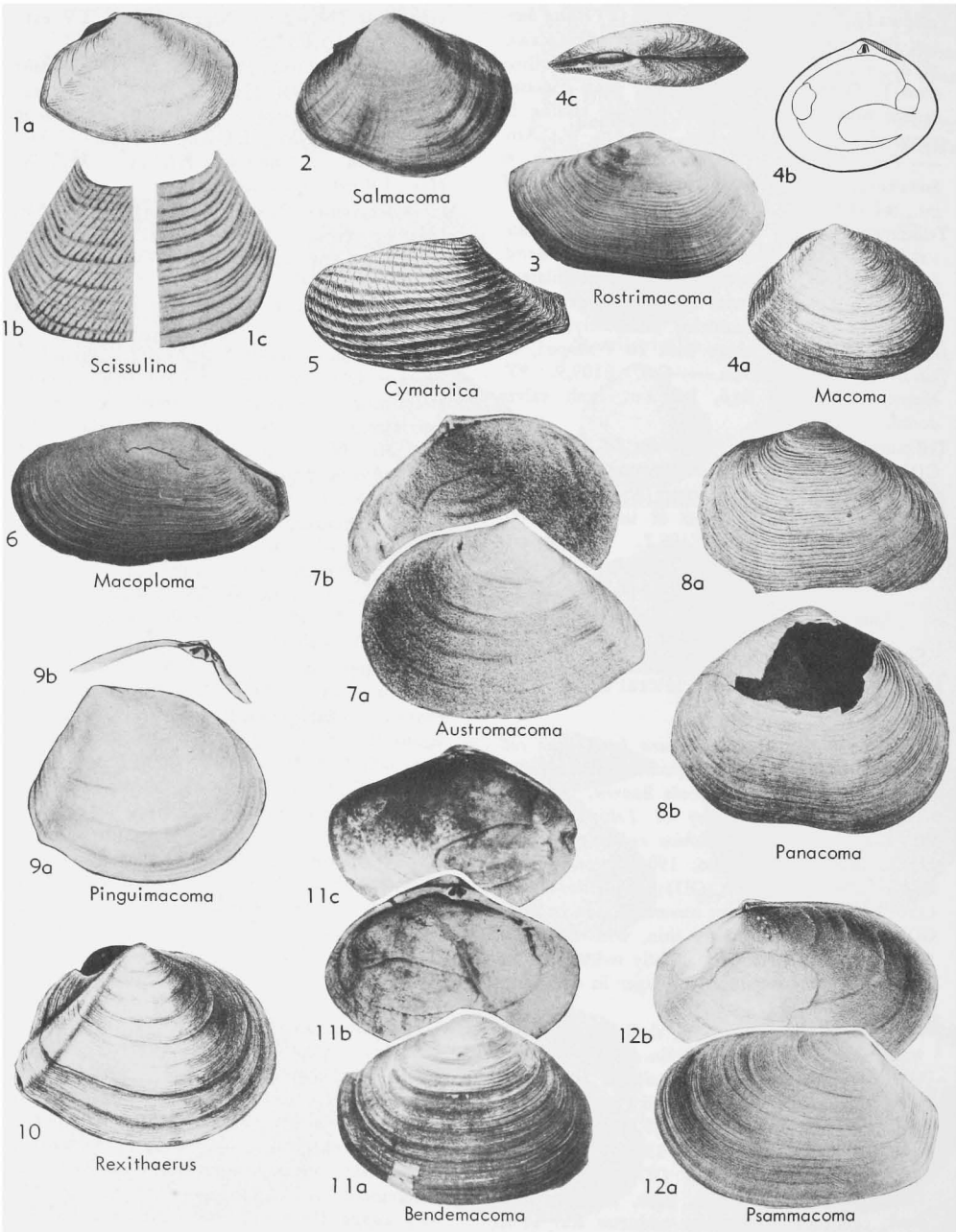


FIG. E110. Tellinidae (Macominae) (p. *N623-N624*).

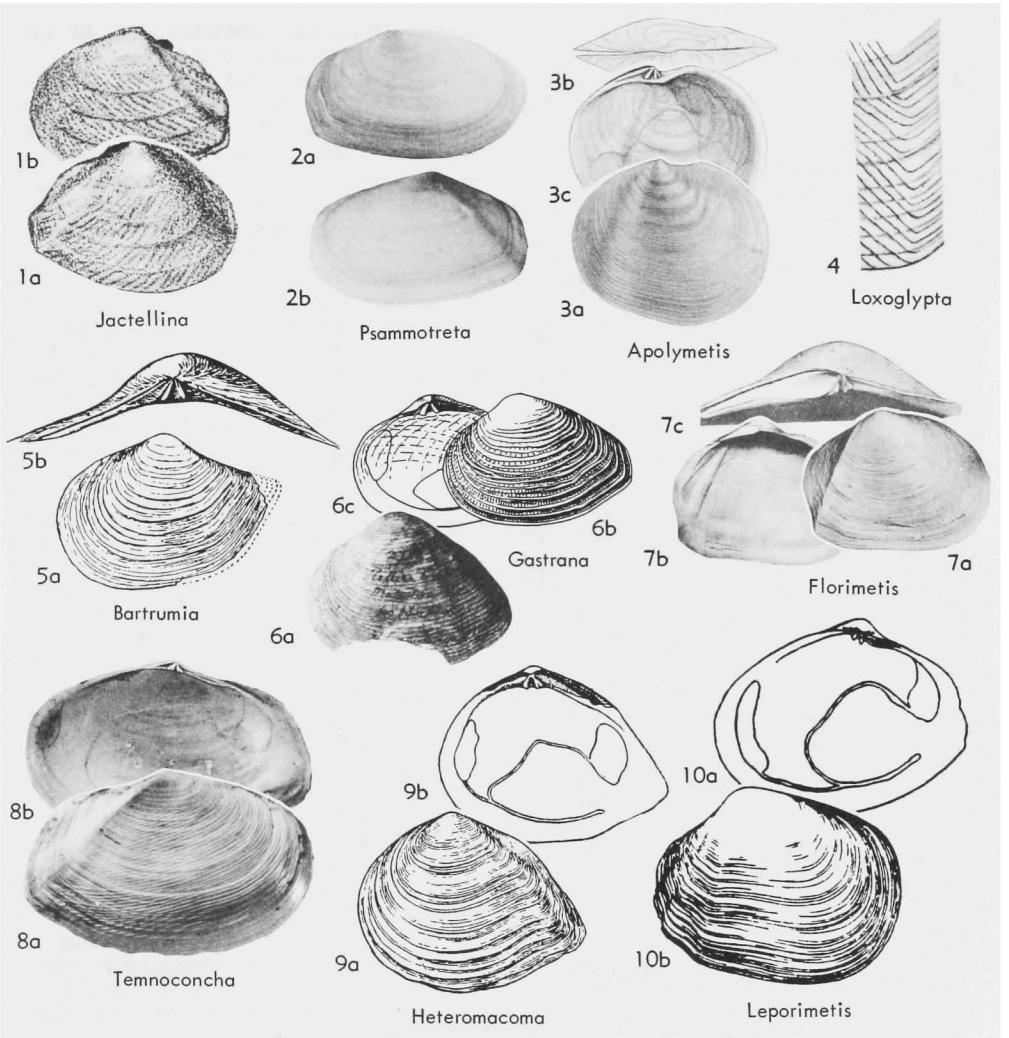


FIG. E111. Tellinidae (Macominae) (p. *N*624-*N*626).

(T.) brasiliana (DALL), Brazil; *8a,b,* RV ext., int., ×1 (Stanford spec.).——FIG. E106,*14. M. (T.) cognata* (C. B. ADAMS), Peru; *14a,d,* LV ext., int., ×1; *14b,c,* LV and RV hinges, enl. *(688).*

Apolymetis SALISBURY, 1929 [*pro Polymetis* SALISBURY, 1929 (*non* WALSINGHAM, 1908), *pro Metis* H. ADAMS & A. ADAMS, 1856 (*non* PHILIPPI, 1843)] [**Tellina meyeri* PHILIPPI, 1846, *ex* DUNKER MS; M]. Subcircular, compressed, flexure and median furrow pronounced, ligament long, embedded; sculpture of spaced concentric ribs. *Mio.-Rec.,* E.Indies.——FIG. E111,*3. *A. meyeri* (PHILIPPI), Rec., E.Indies; *3a-c,* RV ext., both valves dorsal, LV int., ×0.5 (Philippi, 1846).

Bartrumia MARWICK, 1934 [**Raeta tenuiplicata* BARTRUM, 1919; OD]. Shorter than *Macoma (Rostrimacoma),* more inflated; ligament sunken as in *Psammotreta. Mio.,* S.Pac.——FIG. E111,*5. **B. tenuiplicata* (BARTRUM), L.Mio., N.Z.; *5a,* LV ext., ×1; *5b,* hinge, enl. (Marwick, 1934).

Exotica LAMY, 1918 (*ex* JOUSSEAUME MS) [**E. exotica* (?=*Tellina triradiata* A. ADAMS, 1870); T]. Like *T. (Moerella)* in form but lacking lateral teeth; sculpture tending to be oblique, fine. *Rec.,* Pac.-Ind.O.-E.Indies.

E. (Exotica). Surface smooth or with concentric striae only. *Rec.,* Ind.O.——FIG. E112,*1. **E. (E.) triradiata* (A. ADAMS), Red Sea; RV ext., ×2 (Adams, 1870).

?E. (Jactellina) IREDALE, 1929 [**Tellina obliquaria* DESHAYES, 1855; OD]. Sculpture of fine oblique

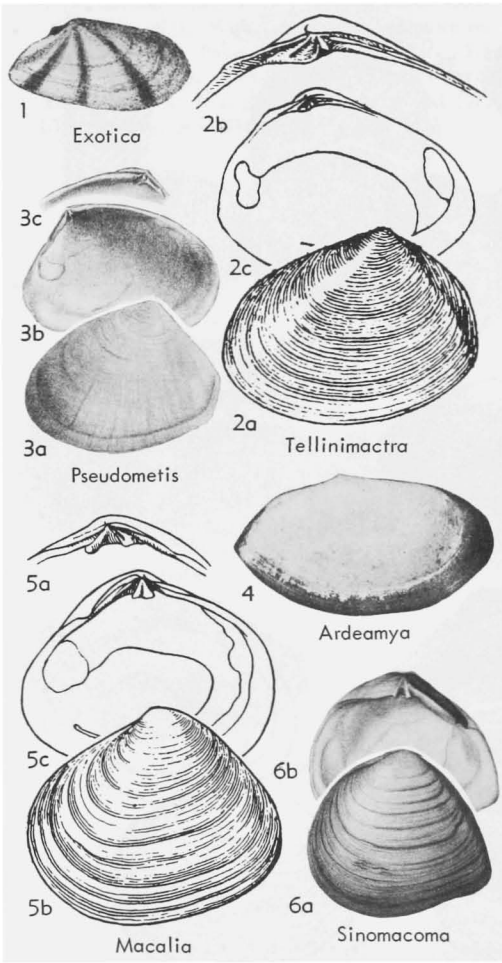


FIG. E112. Tellinidae (Macominae) (p. *N625-N628*).

ribs in both valves. *Rec.*, E.Indies.——FIG. E111, *1*. **E. (J.) obliquaria* (DESHAYES), E.Indies; *1a,b*, RV ext., LV ext., ×1.5 (Reeve, 1868).

?**E. (Loxoglypta)** DALL, BARTSCH, & REHDER, 1939 [**Tellina obliquilineata* CONRAD, 1837; OD]. Oblique sculpture replaced at anterior end of shell by concentric grooves. *Rec.*, Pac.——FIG. E111,*4*. **E. (L.) obliquilineata* (CONRAD), USA(Hawaii); detail of sculpture, ×12 (Dall, Bartsch, & Rehder, 1939).

Florimetis OLSSON & HARBISON, 1953 [**Tellina intastriata* SAY, 1826; OD] [=*Apolymetis* AUCTT. *(partim, see Psammotreta)*]. Quadrate, posteriorly with strong flexure, central slope with broad median furrow; sculpture of incremental lines; ligament deep; pallial sinus large. *U.Mio.-Rec.*, W.Atl.-E.Pac.-E.Indies.——FIG. E111,*7*. **F. intastriata* (SAY), Rec., USA(Fla.); *7a,b*, RV ext., LV int., ×0.5; *7c*, hinge, ×1.7 *(689)*.

Gastrana SCHUMACHER, 1817 [**G. donacina* =*Tellina abildgaardiana* SPENGLER, 1798 (=*T. matadoa* GMELIN, 1791); SD BUCQUOY, DAUTZENBERG, & DOLLFUS, 1898] [=*Diodonta* DESHAYES, 1846 (*non* HARTMAN, 1843); *Fragilia* DESHAYES, 1848 (type, *Tellina fragilis* LINNÉ, 1758; M)]. Oblique, thin, surface with irregular concentric lamellae; hinge with *3b* bifid; pallial sinus rounded, deep, not confluent. *Eoc.-Rec.*, Eu.-W.Afr.——FIG. E111, *6*. **G. matadoa* (GMELIN), Rec., W.Afr.; *6a*, LV ext., ×1 (Fischer, 1942); *6b,c*, LV ext., RV int., ×1 (Nicklès, 1950).

Heteromacoma HABE, 1952 [**Tellina irus* HANLEY, 1845; OD] [=*Gastrana* AUCTT. *(partim)*]. Ovate-trigonal, RV with lunular area, LV with corresponding emargination; ligament long, in sunken groove; adductor scars unequal; pallial sinus large, angular, slightly discrepant, about three-fourths confluent. [Type species has been confused by authors with *Macoma inquinata* (DESHAYES, 1854) from W.N.Am. and *"Gastrana" yantaiensis* (CROSSE & DEBEAUX, 1863) from China; see also *Sinomacoma*.] *Rec.*, W.Pac.——FIG. E111,*9*. **H. irus* (HANLEY), Japan; *9a,b*, LV ext., RV int., ×0.5 (Habe, 1952).

Leporimetis IREDALE, 1930 [**Tellina spectabilis* HANLEY, 1844; OD]. Oblique-trigonal, posterior strongly flexed, incremental sculpture roughened; pallial sinus nearly meeting anterior adductor scar. *Mio.-Rec.*, W.Pac.——FIG. E111,*10*. **L. spectabilis* (HANLEY), Rec., Japan; *10a,b*, RV ext., RV int., ×0.5 (Habe, 1952).

Macalia H. ADAMS, 1860 [**Tellina bruguieri* HANLEY, 1844; M] [=*Tellinungula* RÖMER, 1873 (obj.; M); *Macalina* HABE, 1952 *(nom. null.)*]. Trigonal, smooth, hinge with markedly large cardinal teeth; adductor scars unequal. *Rec.*, W.Pac. ——FIG. E112,*5*. **M. bruguieri* (HANLEY), Japan; *5a-c*, RV hinge, RV ext., LV int., ×1 (Habe, 1952).

Psammotreta DALL, 1900 [**Tellina aurora* HANLEY, 1844; OD] [=*Cydippina* DALL, 1900 (type, *T. brevifrons* SAY, 1834; OD); *Scrobiculina* DALL, 1900 (type, *Scrobicularia viridotincta* CARPENTER, 1856; OD); *Schumacheria* COSSMANN, 1902 *(nom. van. pro Scrobiculina); Apolymetis* AUCTT. *(partim, see Florimetis)*]. More elongate than *Macoma*, ligament and resilium sunken, almost internal, adductor scars unequal; pallial sinus partly confluent. *Mio.-Rec.*, C.Am.-S.Am.-W.Pac.

P. (Psammotreta). Shorter than *Macoma (Psammacoma)*; anterior end not inflated. *Rec.*, E.C.Am.-W.C.Am.-S.Am.——FIG. E111,*2*. **P. (P.) aurora* (HANLEY), W.C.Am.; *2a,b*, RV ext., LV ext., ×1 *(822)*.

P. (Ardeamya) OLSSON, 1961 [**Tellina columbiensis* HANLEY, 1844; OD]. Elongate-elliptical, beaks small, narrow, rising above dorsal margin. *Rec.*,

W.C.Am.-S.Am.——FIG. E112,*4*. **P. (A.) columbiensis* (HANLEY), Peru; RV ext., ×0.5 *(688)*.

P. (Pseudometis) LAMY, 1918 [**Tellina truncata* PHILIPPI, 1843 (*non* LINNÉ, 1767 =*T. praerupta* SALISBURY, 1934); SD SALISBURY, 1934]. Resembling *P. (Psammotreta)* but higher, anterior end more inflated; surface smooth; posterior flexure weak; ligament less immersed than in *Florimetis;* pallial sinus about one-third confluent. *Mio.-Rec.,* E. C. Am.-W. C. Am.-W. Pac.——FIG. E112,*3*. **P. (P.) praerupta* (SALISBURY), Rec., E.Indies; *3a-c,* LV ext., int., RV hinge, ×0.5 (Philippi, 1843).

P. (Tellinimactra) LAMY, 1918 [**Tellina edentula* SPENGLER, 1798; OD]. Thin, more ovate and less strongly flexed than *Florimetis,* lacking central depressed area; ligament and resilium large; pallial sinus larger than in *P. (Psammotreta). Rec.,* W.Pac.——FIG. E112,*2*. **P. (T.) edentula*

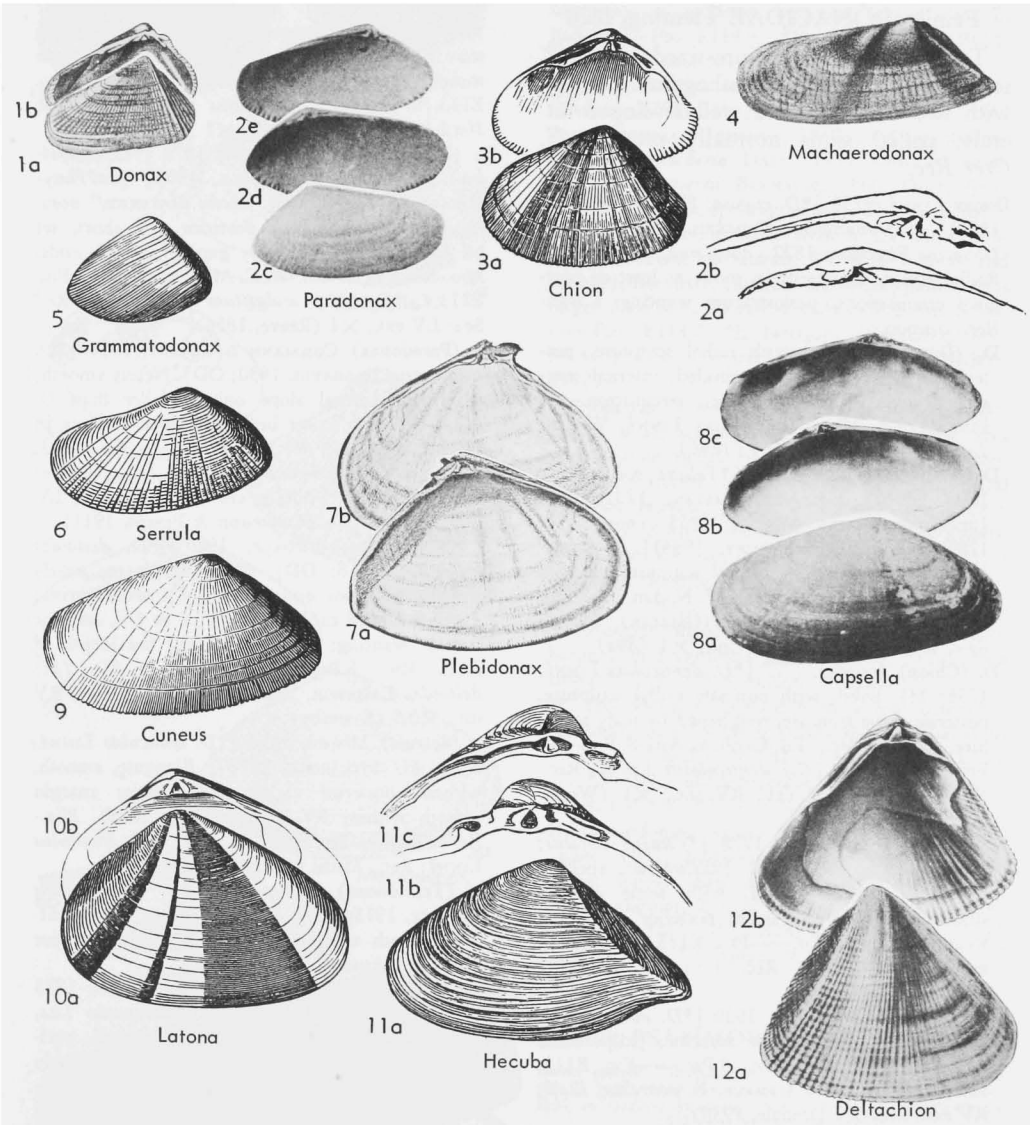


FIG. E113. Donacidae (p. *N628*).

(SPENGLER), Japan; *2a-c,* LV ext., int., hinge, ×0.7 (Habe, 1952).

Sinomacoma YAMAMOTO & HABE, 1950 [**Fragilia yantaiensis* CROSSE & DEBEAUX, 1863; OD]. Trigonal, heavy shelled, ligament in long groove; area in front of beaks beveled, wide; posterior end not twisted. *Rec.,* E.Asia.——FIG. E112,*6.* **S. yantaiensis* (CROSSE & DEBEAUX), NE.China; *6a,b,* LV ext., RV int., ×0.5 (Crosse & Debeaux, 1863).

Family DONACIDAE Fleming, 1828

Trigonal shells, medium-sized to small, solid, inequilateral, opisthogyrate; hinge with two cardinals and well-developed laterals; pallial sinus normally present. *U. Cret.-Rec.*

Donax LINNÉ, 1758 [**D. rugosa;* SD SCHUMACHER, 1871] [=*Donaciarius* DUMÉRIL, 1806 (obj.); *Donacina* FÉRUSSAC, 1822 *(nom. nud., in synon.)*]. Radial sculpture present in most, at least as marginal crenulations; periostracum wanting. *L.Eoc.-Rec.,* cosmop.

D. (Donax). Sturdy, with radial sculpture, posterior area concentrically wrinkled; internal margin strongly denticulate. *Rec.,* circumtrop.——FIG. E113,*1.* **D. (D.) rugosus* LINNÉ, W.Afr.; *1a,b,* LV ext., RV int., ×1 *(124b).*

D. (Capsella) GRAY, 1851 [**Tellina polita* POLI, 1795 (=**T. variegata* GMELIN, 1791); M] [=*Peronaeoderma* MÖRCH, 1853 (*non* POLI, 1795) (obj.; SD SALISBURY, 1934)]. Elongate-ovate, polished, without radial sculpture, internal margin smooth. *Rec.,* Eu.-W. N. Am. —— FIG. E113,*8.* **D. (C.) variegatus* (GMELIN), Medit.; *8a-c,* LV ext., LV int., RV int., ×1 *(89a).*

D. (Chion) SCOPOLI, 1777 [**D. denticulata* LINNÉ, 1758; M]. Solid, with punctate radial sculpture, posterior slope truncate, roughened by scaly sculpture. *L. Eoc.-Rec.,* Eu.-Carib.-E. Asia-S. Pac.——FIG. E113,*3.* **D. (C.) denticulatus* LINNÉ, Rec., W.Indies; *3a,b,* LV ext., RV int., ×1 (Woodward; Chenu).

D. (Cuneus) DA COSTA, 1778 [**Cuneus vittatus;* SD WINCKWORTH, 1926] [=*Cunerus,* spelling error]. Radiately ribbed, with some oblique striae crossing central slope; posterior truncation weak. *Mio.-Rec.,* Eu.——FIG. E113,*9.* **D. (C.) vittatus* (DA COSTA), Rec., Eu.; LV ext., ×1 *(124b).*

D. (Deltachion) IREDALE, 1930 [**D. virilis*; OD]. Small, high, posterior side truncate; pallial sinus 0.75 length of shell. *Rec.,* S.Pac.——FIG. E113, *12.* **D. (D.) virilis* IREDALE, E.Australia; *12a,b,* RV ext., int., ×2 (Iredale, 1930).

D. (Grammatodonax) DALL, 1900 [**D. madagascariensis* WOOD, 1828 ("Lamarck" by error); OD]. Short, compressed, surface furrowed with oblique ribs; RV with 1 cardinal, LV with 2. *Rec.,* Afr.——FIG. E113,*5.* **D. (G.) madagascariensis* WOOD, S.Afr.; LV ext., ×1 *(124b).*

D. (Hecuba) SCHUMACHER, 1817 [**Venus scortum* LINNÉ, 1758; SD HERRMANNSEN, 1847]. Large, with conspicuous posterior carina; sharp groove in dorsal margin of RV in front of *AI. Rec.,* E. Indies.——FIG. E113,*11.* **D. (H.) scortum* (LINNÉ), E.Indies; *11a-c,* LV ext., ×0.5; LV and RV hinges, enl. *(124b).*

D. (Latona) SCHUMACHER, 1817 [**D. cuneatus* LINNÉ, 1758; M]. Radials reduced to fine threadlike striae except on posterior slope, which may be rugose; interior margin smooth or with minute radial wrinkles. *Rec.,* E.Indies.——FIG. E113,*10.* **D. (L.) cuneatus* LINNÉ, E.Indies; *10a,b,* RV ext., LV int., ×1 *(124b).*

D. (Machaerodonax) ROEMER, 1870 [**D. scalpellum* GRAY, 1823; SD DALL, 1900] [=*?Platydonax* DALL, 1900 ("*D. finchii* SOWERBY," *nom. inquirend.*)]. Elongate, posterior end short, set off by ridge; shell slightly gaping at both ends. *Mio.-Rec.,* E. C. Am.-W. C. Am.-IndoPac.——FIG. E113,*4.* **D. (M.) scalpellum* GRAY, Rec., Red Sea; LV ext., ×1 (Reeve, 1854).

D. (Paradonax) COSSMANN & PEYROT, 1910 [**D. transversus* DESHAYES, 1830; OD]. Nearly smooth, radials on central slope only; smaller than *D. (Donax),* with lower beaks; posterior laterals in RV strong. *Oligo.-Rec.,* Eu.-Carib.——FIG. E113, *2.* **D. (P.) transversus* DESHAYES, Mio., France; *2a,b,* LV and RV hinges, enl.; *2c-e,* RV ext., LV int., RV int., ×1 (Cossmann & Peyrot, 1911).

D. (Plebidonax) IREDALE, 1930 [**D. deltoides* LAMARCK, 1818; OD]. Relatively large, nearly smooth, posterior end set off by a weak carina; 1 massive bifid cardinal in RV, 2 in LV, anterior laterals wanting; pallial sinus half the length of shell. *Rec.,* S.Pac.——FIG. E113,*7.* **D. (P.) deltoides* LAMARCK, Australia; *7a,b,* LV int., RV int., ×0.5 (Sowerby).

D. (Serrula) MÖRCH, 1853 [**D. trunculus* LINNÉ, 1758; SD STOLICZKA, 1870]. Elongate, smooth, without posterior carination; posterior margin smooth within; RV without lateral teeth. *Plio.-Rec.,* Eu.——FIG. E113,*6.* **D. (S.) trunculus* LINNÉ, Rec., Medit.; LV ext., ×1 *(124b).*

D. (Tentidonax) IREDALE, 1930 [**D. veruinus* HEDLEY, 1913; OD]. Small, elongate, sides slanting, smooth except for wrinkle-ridged posterior area. *Rec.,* Australia.

Egerella STOLICZKA, 1870 [*pro Egeria* LEA, 1833 (*non* ROISSY, 1805)] [**Egeria subtrigonia* LEA, 1833; SD STOLICZKA, 1871]. Thin, small, variable, radial sculpture faint, interior margins finely serrate; lateral teeth wanting. *Paleoc.-Eoc.,* Eu.-E.N.Am.——FIG. E114,*1.* **E. subtrigonia* (LEA), Eoc., USA(Ala.); *1a-c,* LV ext., int., RV int., ×3 (Harris, 1919).

Galatea BRUGUIÈRE, 1797 (Genus without species) [**Galathea radiata* LAMARCK, 1805 (=**Venus*

paradoxa Born, 1778); SM Lamarck, 1805] [=*Egeria* Roissy, 1805 (*pro Galatea*) *(nom. van.); Potamophila* Sowerby, 1821 (obj.); *Megadesma* Bowdich, 1822 (obj.); *Galateola* Fleming, 1828 *(nom. nud.); Galataea, Galathea, Galateia,* spelling errors]. Large, thick, trigonal, with a smooth, heavy periostracum; hinge plate massive; inner ventral margin smooth; pallial sinus small. *Rec.,* W.Afr.——Fig. E114,*3*. **G. paradoxa* (Born); RV int., ×1 (Nicklès, 1950).

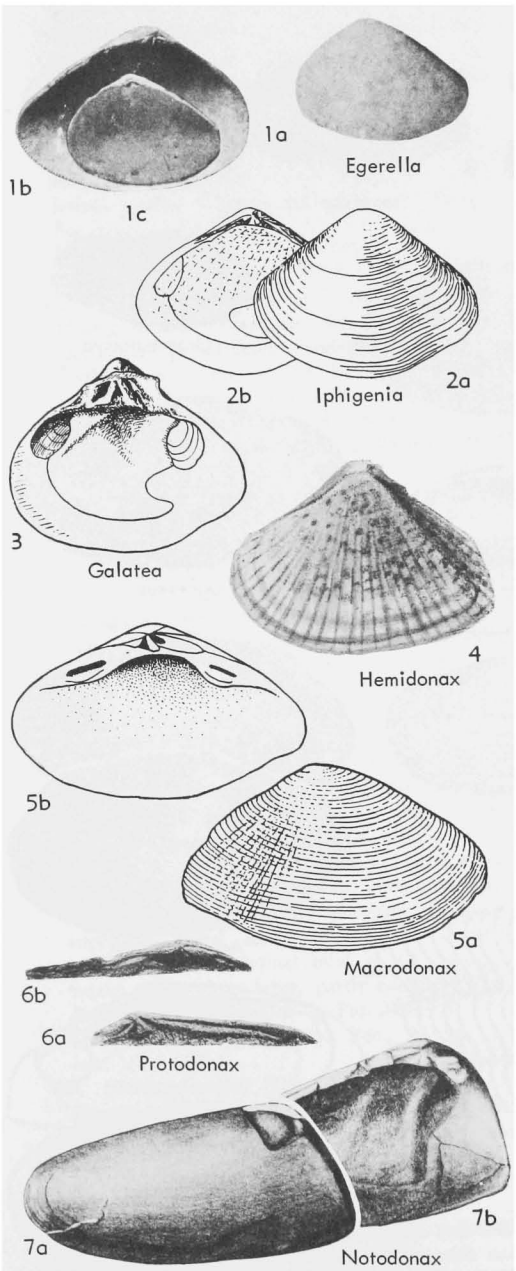


Fig. E114. Donacidae (p. *N628-N629*).

Hemidonax Mörch, 1870 [**Donax pictus* Tryon, 1870 (=**Cardium donaciforme* Bruguière, 1792); M] [=*Donacicardium* von Vest, 1875 (obj.); OD]. Sculpture of smooth but elevated radial ribs, inner margin coarsely crenate; hinge somewhat as in *Donax* but teeth larger. *Rec.,* E. Indies.——Fig. E114,*4*. **H. donaciformis* (Bruguière); LV ext., ×1 (Reeve, 1844).

Iphigenia Schumacher, 1817 [**Donax laevigata* Gmelin, 1791; M] [=*Fischeria* Bernardi, 1860 (*non* Robineau-Desvoidy, 1830; *Finlaria,* spelling error); *Profischeria* Dall, 1903 (*pro Fischeria;* type, *F. delessertii* Bernardi, 1860; OD); *Iphegenia, Ephigenia,* spelling errors]. Thin, trigonal to ovate, with a periostracum, smooth; LV with 2 subequal cardinals, no laterals, RV with *1* weak and *3b* bifid, laterals 2, elongate and weak; pallial sinus large. *Mio.-Rec.,* W.Afr.-E.C.Am.-W.C.Am.-S.Am. ——Fig. E114,*2*. **I. laevigata* (Gmelin), Rec., W.Afr.; *2a,b,* LV ext., RV int., ×1 (Nicklès, 1950).

?Macrodonax Olsson, 1944 [**M. peruviana*; OD]. Large, solid, sculpture discrepant, posterior area with nodose radial ribs, remainder of shell concentrically ribbed; hinge heavy, with anterior and posterior laterals; pallial area unknown. *U.Cret. (Senon.),* S.Am.——Fig. E114,*5*. **M. peruviana,* Peru; *5a,b,* RV ext., int., ×0.25 (Olsson, 1944).

Notodonax Feruglio, 1936 [**Donax (N.) annaeeugeniae;* OD]. Donaciform, solid, with a posterior-dorsal angulation; margin smooth within; hinge with 2 cardinals and 2 laterals; pallial sinus small. *U.Cret.,* S.Am.-N.Am.-SW.Asia.

N. (Notodonax). Surface with a few concentric furrows, lateral teeth relatively short; pallial sinus wavy to angular. *U.Cret.,* S.Am.——Fig. E114, *7*. **N. (N.) annaeeugeniae* (Feruglio), Patag.; *7a,b,* LV ext., RV int., ×1 (Feruglio, 1935).

N. (Protodonax) Vokes, 1945 [**Protodonax elongatus;* OD]. Surface smooth, lateral teeth somewhat longer than in *N. (Notodonax),* pallial sinus angular. *U.Cret.,* N.Am.-SW.Asia.——Fig. E114,*6*. **N. (P.) elongatus* (Vokes), USA (Wyo.); *6a,* LV hinge, ×1; *6b,* RV hinge, ×2 *(944)*.

Family PSAMMOBIIDAE Fleming, 1828

[*nom. correct.* Fischer, 1887 (*pro* Psammobiadae Fleming, 1828)] [=Garidae Stoliczka, 1871 (*nom. transl.* Stewart, 1930, *ex* Garinae Stoliczka, 1871); Asaphidae Winckworth, 1932 (*non* Burmeister, 1843)]

Shells inequilateral, slightly gaping in most forms, especially at posterior end; hinge with one to three cardinal teeth, lat-

erals weak to wanting; ligament on nymph; pallial sinus present. *U.Cret.-Rec.*

Subfamily PSAMMOBIINAE Fleming, 1828

[*nom. transl.* E. A. Smith, 1885 (*ex* Psammobiidae Fleming, 1828)]

Ovate-trapezoidal, gape small or absent. *U.Cret.-Rec.*

Gari Schumacher, 1817 [**G. vulgaris* (=*Solen amethystus* Wood, 1815) (ICZN pend.)] [=*Psammotaea* Lamarck, 1818 (type, *P. donacina;* SD

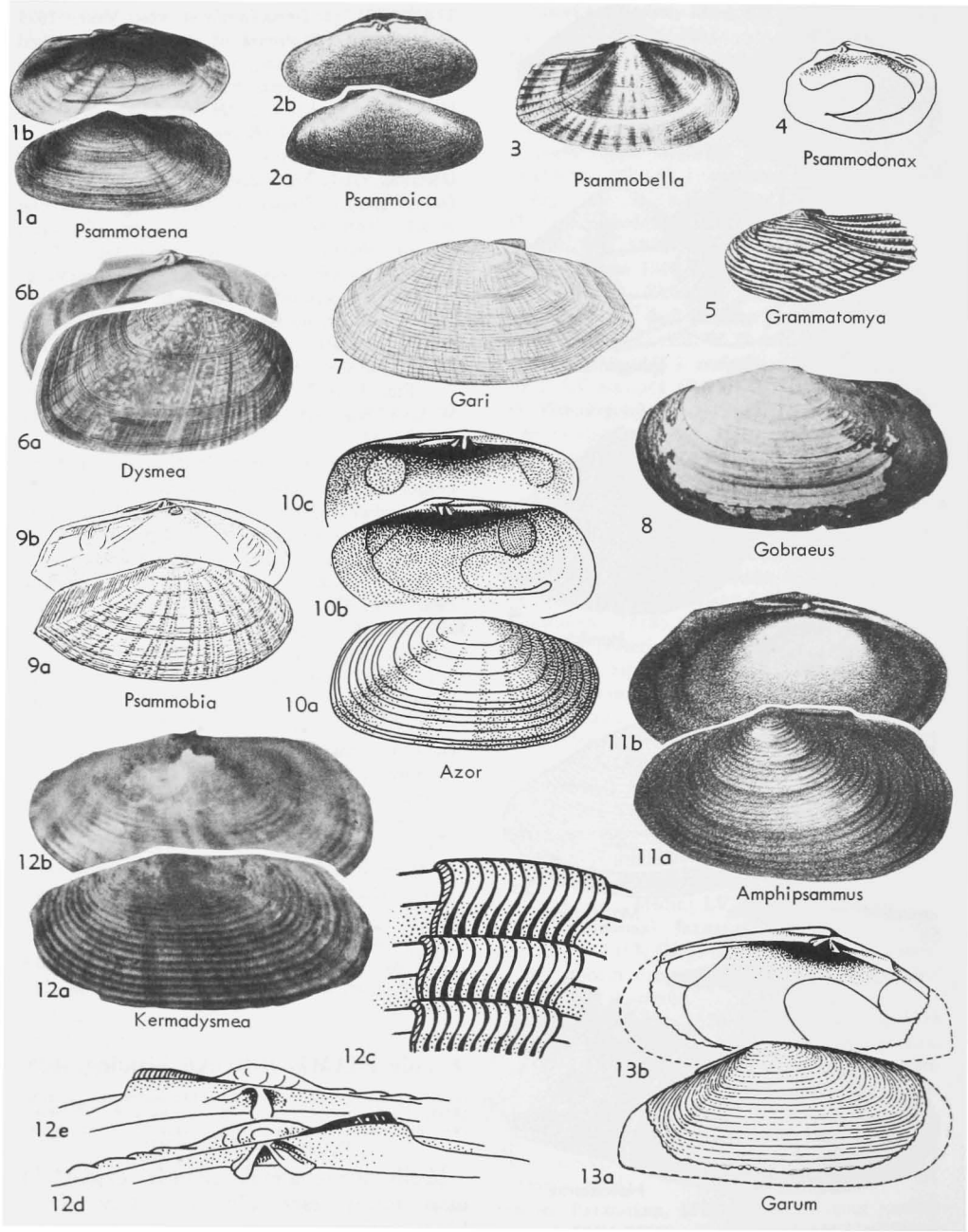


Fig. E115. Psammobiidae (Psammobiinae) (p. *N630-N631*).

CHILDREN, 1823); *Capsella* DESHAYES, 1855 (*non* GRAY, 1851); *Milligaretta* IREDALE, 1936 (type, *M. venta;* OD)]. Elongate-ovate to quadrate, smooth to strongly sculptured, posterior end wider than anterior. *Eoc.-Rec.*, cosmop.

G. (Gari). Posterior slope weakly set off; pedal muscle scars 1, oval, in front of cardinal teeth; sculpture of concentric growth lamellae, overlain by oblique striae in some. *Mio.-Rec.*, Eu.-Asia. ——FIG. E115,*7*. **G. (G.) amethystus* (WOOD), Rec., E.Indies; LV ext., ×1 (Wood, 1815).

G. (Amphipsammus) COSSMANN, 1914 [**Psammobia lamarckii* DESHAYES, 1857; M]. Posterior slope with radial riblets, shell otherwise smooth; lateral lamellae wanting; sinus free, not confluent. *Eoc.-Oligo.*, Eu.——FIG. E115,*11*. **G. (A.) lamarckii* (DESHAYES), Eoc., France; *11a,b*, LV ext., int., ×0.5 (Deshayes, 1825).

G. (Azor) J. SOWERBY, *ex* LEACH MS, 1824 [**Sanguinolaria compressa;* M]. Small, smooth, rectangular, pallial sinus rounded, pallial line not confluent. *Eoc.*, Eu.——FIG. E115,*10*. **G. (A.) compressa* (SOWERBY), Eng.; *10a-c*, RV ext., int., LV int., ×1 (Brit. Mus. Guide, 1959).

G. (Dysmea) DALL, BARTSCH, & REHDER, 1939 [**Solen occidens* GMELIN, 1791; OD]. Smooth except for concentric riblets on flaring posterior end; pallial sinus confluent for half its length. *Rec.*, IndoPac.——FIG. E115,*6*. **G. (D.) occidens* (GMELIN), E.Indies; *6a,b*, RV ext., LV int., ×0.3 (Chemnitz, 1782).

G. (Garum) DALL, 1898 [**Psammobia filosa* CONRAD, 1853; M]. Sculpture of fine concentric grooves; pallial sinus short. *Eoc.*, N.Am.-Eu.——FIG. E115,*13*. **G. (G.) filosa* (CONRAD), M.Eoc., USA(Ala.); *13a,b*, RV ext., int., ×1 (Stanford Univ. specimen).

G. (Gobraeus) BROWN, 1844 (in synon.), *ex* LEACH, MS [**Solen vespertinus* GMELIN, 1791 (=**Tellina depressa* PENNANT, 1777); M] [=*Psammocola* DE BLAINVILLE, 1825, AUCTT. (*non* DE BLAINVILLE, 1824) (obj.)]. More gaping than *G. (Gari)*, nearly smooth, concentric sculpture of growth lines only, posterior slope with superficial radial striae; 2 subequal cardinals in RV, anterior cardinal bifid in LV, posterior weak; pallial sinus large, partly confluent. *Eoc.-Rec.*, Eu.-N.Am.-S.Am.——FIG. E115,*8*. **G. (G.) depressa* (PENNANT), Rec., Medit.; LV ext., ×0.6 *(89a)*.

G. (Grammatomya) DALL, 1898 [**Psammobia squamosa* LAMARCK, 1818; M]. Entire surface obliquely grooved, coarser on dorsal posterior area. *Rec.*, IndoPac.——FIG. E115,*5*. **G. (G.) squamosa* (LAMARCK), Borneo; LV ext., ×1 (Woodward, 1854).

G. (Kermadysmea) POWELL, 1958 [**K. galatheae*; OD]. Resembling *G. (Dysmea)* but with concentric ribs, granular. *Rec.*, S.Pac.——FIG. E115, *12*. **G. (K.) galatheae* (POWELL), Kermadec Is.; *12a,b*, LV ext., RV int., ×0.7; *12c*, sculpture, enl.; *12d,e*, RV and LV hinges, enl. (Powell, 1958).

G. (Psammobella) GRAY, 1851 [**Psammobia costulata* TURTON, 1822; SD KOBELT, 1881]. Small, smooth except for radial ribs on posterior slope; hinge feeble, pallial sinus deep, partly confluent. *Rec.*, Eu.——FIG. E115,*3*. **G. (P.) costulata* (TURTON), Eng.; RV ext., ×1 (Forbes & Hanley, 1848).

G. (Psammobia) LAMARCK, 1818 [**Tellina fervensis* GMELIN, 1791; SD CHILDREN, 1822, as *T. feroensis*] [=*Haplomochlia* GISTEL, 1848 *(nom. van.)* (obj.)]. Posterior slope with strong ridge; pedal muscle scars 2 to 3, below cardinal teeth. *Rec.*, Eu.——FIG. E115,*9*. **G. (P.) fervensis* (GMELIN), Eng.; *9a,b*, RV ext., LV int., ×1 (Wood, 1815).

G. (Psammodonax) COSSMANN, 1887 [**Psammobia caillati* DESHAYES, 1857; OD]. Inequilateral, posterior end short, posterior slope radially striate; hinge without laterals; pallial sinus large, passing beaks, oval, only partly confluent. *L.Eoc.-U.Eoc.*, Eu.——FIG. E115,*4*. **G. (P.) caillati* (DESHAYES), M.Eoc., France; LV int., ×1 (Deshayes, 1864).

G. (Psammoica) DALL, 1900 [**"Psammobia appendiculata* DESHAYES," *err. pro Solen appendiculata* LAMARCK, 1806; OD] [=*Macropsammus* COSSMANN, 1902 *(nom. van.)*]. Small, smooth, compressed, truncate behind; ligamental nymph prominent; pallial sinus long, not confluent. *Eoc.*, Eu.——FIG. E115,*2*. **G. (P.) appendiculata* (LAMARCK), M.Eoc., France; *2a,b*, RV ext., int., ×1 (Deshayes, 1825).

G. (Psammotaena) DALL, 1900 [**"Psammobia effusa* LAMARCK" (=*Solen effusa* LAMARCK, 1806); OD]. Resembling *G. (Amphipsammus)* but with posterior slope smooth. *Eoc.*, Eu.——FIG. E115,*1*. **G. (P.) effusa* (LAMARCK), M.Eoc., France; *1a,b*, LV ext., int., ×0.7 (Deshayes, 1864).

Amphichaena PHILIPPI, 1847 [**A. kindermanni*; M] [=*Amphidona* MÖRCH, 1858 *(nom.null.)*]. Subcylindrical, inner margin arcuate at anterior end, smooth or nearly so posteriorly; pallial sinus short, not reaching mid-line. *Pleist.-Rec.*, W.C.Am. ——FIG. E116,*11*. **A. kindermanni*, Rec., W. Mexico; *11a-c*, LV int., RV int., LV ext., ×1 (R. Palmer & L. Hertlein, 1926).

Asaphinella COSSMANN, 1886 [**Capsa minima* DESHAYES, 1857; OD]. Outline as in *Gari* but less inequilateral, adult shells small. *Eoc.*, Eu.

A. (Asaphinella). Oblong, smooth. *Eoc.*, Eu.——FIG. E116,*1*. **A. (A.) minima* (DESHAYES), France; *1a-c*, LV ext., LV int., RV hinge, ×5 (Deshayes, 1857).

A. (Herouvalia) COSSMANN, 1891 [**A. semitexta* COSSMANN, 1886; OD]. Minute, sculptured strongly reticulate, especially on posterior slope. *Eoc.*, Eu.——FIG. E116,*2*. **A. (H.) semitexta*

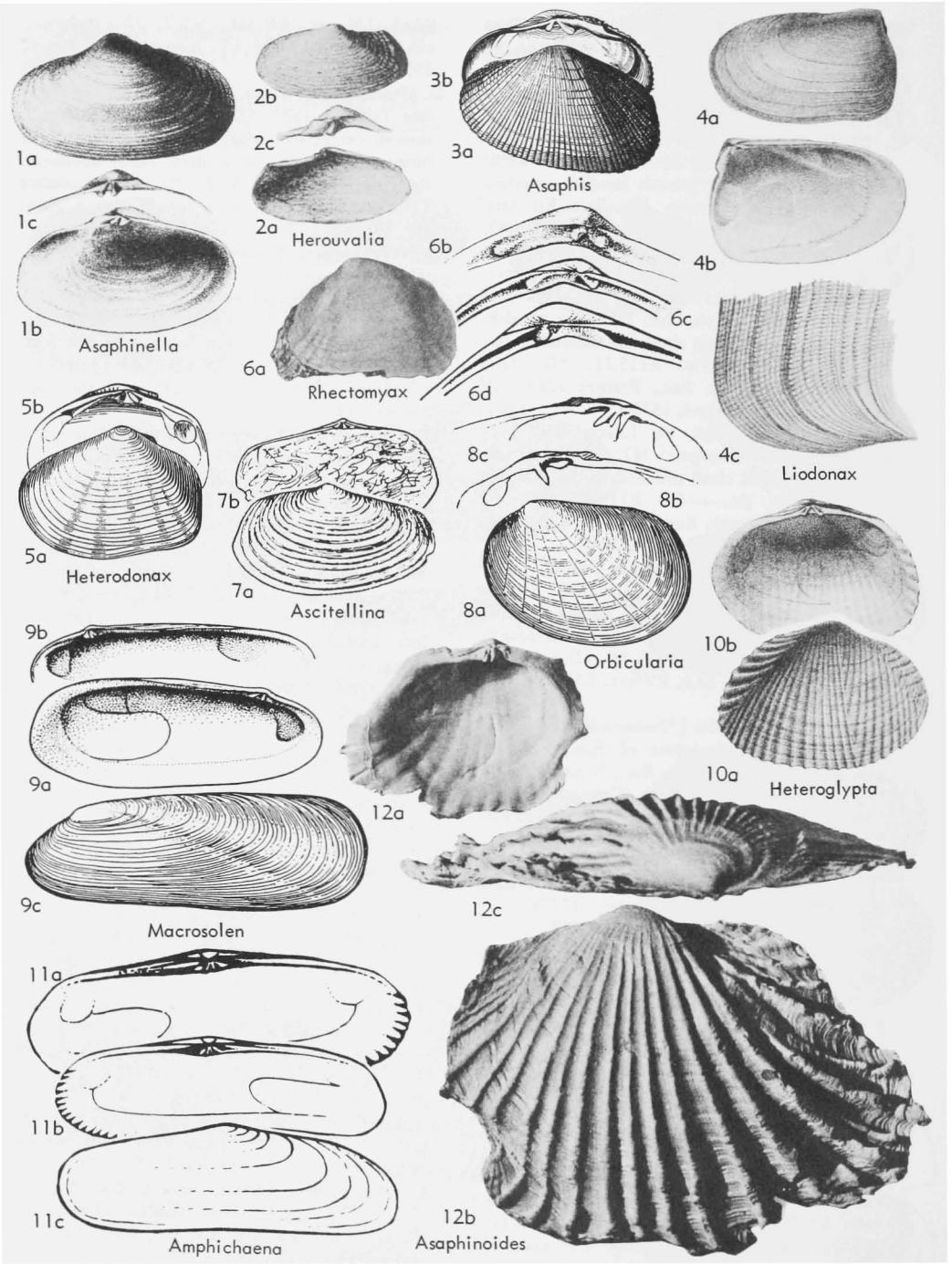


FIG. E116. Psammobiidae (Psammobiinae) (p. *N*630-*N*631, *N*633).

COSSMANN, France; *2a,b,* LV int., ext., ×4; *2c,* LV hinge, enl. *(160).*

Asaphis MODEER, 1793 [**Venus deflorata* LINNÉ, 1758; M] [=*Capsa* BRUGUIÈRE, 1797 (obj.; SD SCHMIDT, 1818); *Corbula* RÖDING, 1798 (*non* BRUGUIÈRE, 1797) (obj.; SD WINCKWORTH, 1930); *Capsula* SCHUMACHER, 1817 (obj.; M); *Psammocola* DE BLAINVILLE, 1824 (obj.; SD BUCQUOY, DAUTZENBERG, & DOLLFUS, 1895); *Procos* GISTEL, 1848 *(nom. van. pro Capsa); Acaphis* PAETEL, 1875 *(nom. null.)*]. Shells of medium size, with well-developed radial ribs, elliptical, inequilateral, not gaping; hinge plate well developed. *Mio.-Rec.,* S.Am.-IndoPac.-Indies.

A. (Asaphis). Hinge plate narrow to moderate in width; ribs numerous, rounded in section. *Rec.,* E.Indies-W.Indies.——FIG. E116,*3.* **A. (A.) deflorata* (LINNÉ), W.Indies; *3a,b,* LV ext., RV int., ×0.5 *(124b).*

A. (Asaphinoides) HODSON, 1931 [**A. (A.) cantaurana* F. HODSON in HODSON & HODSON; OD]. Hinge plate wide, ribs few, sharply triangular in section. *L.Mio.,* S.Am.——FIG. E116,*12.* **A. (A.) cantaurana,* Venez.; *12a-c,* LV int., ext., dorsal, ×1 (Hodson & Hodson, 1931).

A. (Heteroglypta) VON MARTENS, 1880 [**Psammobia contraria* DESHAYES, 1863; M]. Anterior and posterior slopes with oblique ribs that intersect central ribs at angle, posterior ribs coarser. *Rec.,* IndoPac.——FIG. E116,*10.* **A. (H.) contraria* (DESHAYES), Ind.O.; *10a,b,* RV ext., int., ×1 (Deshayes, 1863).

Ascitellina MARWICK, 1928 [**A. donaciformis*; OD]. Small, posterior end short, sculpture of concentric ridges; hinge with posterior cardinals bifid, laterals weak or absent; ligament external, nymphs narrow, somewhat sunken posteriorly; pallial sinus large, nearly reaching anterior adductor, partly confluent. *Oligo.-Rec.,* S.Pac.——FIG. E116,*7.* **A. donaciformis,* Oligo., N.Z.; *7a,b,* LV ext., int., ×3 *(593).*

Heterodonax MÖRCH, 1853 [**Tellina bimaculata* LINNÉ, 1758; SD KOBELT, 1881]. Rounded-quadrate to ovate, with concentric growth striae only, variously colored; hinge teeth large, laterals wanting. *Plio.-Rec.,* C.Am.-N.Am.——FIG. E116,*5.* **H. bimaculatus* (LINNÉ), Rec., W.Indies; *5a,b,* LV ext., RV int., ×1 *(124b).*

Liodonax FISCHER, 1887 [**Donax auversiensis* DESHAYES, 1858; SD COSSMANN & PEYROT, 1911]. Trigonal, posterior end short; sculpture of fine radial ribs except on posterior slope. *Eoc.,* Eu.——FIG. E116,*4.* **L. auversiensis* (DESHAYES), France; *4a,b,* LV ext., int., ×1; *4c,* surface sculpture, enl. (Deshayes, 1860).

Macrosolen ZITTEL, 1883, *ex* MAYER-EYMAR MS. [**Sanguinolaria hollowaysii* SOWERBY, 1817; M] [=*Latosiliqua* DE GREGORIO, 1894 (type, *Solen plicatus* VON SCHAUROTH, 1865; OD)]. Elongate, oval, flaring behind, beaks subanterior; not gaping; posterior slope with a radial furrow; hinge with 2 diverging cardinals in either valve; ligament on a nymph; pallial sinus large. *L.Eoc.-Mio.,* Eu.-Asia-N.Afr.——FIG. E116,*9.* **M. hollowaysii* (SOWERBY), Eoc., Eng.; *9a-c,* LV int., RV int., LV ext., ×0.4 (Brit.Mus.Guide, 1959).

Orbicularia DESHAYES, 1850 [**Solen orbiculatus* WOOD, 1828; OD] [=*Elizia* GRAY, 1854 (obj.)]. Orbicular, nearly flat; pallial sinus not confluent. *Rec.,* E.Indies——FIG. E116,*8.* **O. orbiculata* (WOOD), *8a,* LV ext., ×1; *8b,c,* RV and LV hinges, enl. *(124b).*

Rhectomyax STEWART, 1930 [**Asaphis undulata* GABB, 1864; OD]. Small, ovate-quadrate, beaks nearly central; not gaping; sculpture of concentric striae except for undulating radial ribs at ends of shell; hinge with 1 cardinal in each valve and a toothlike nymph. *U.Cret.,* W.N.Am.——FIG. E116,*6.* **R. undulatus* (GABB), USA(Calif.); *6a,b,* RV ext., RV hinge, ×4 *(892); 6c,d,* RV and LV hinges, ×5 (specimen, Univ. Calif., Los Angeles).

Subfamily SANGUINOLARIINAE Grant & Gale, 1931

[*nom. transl.* KEEN, herein (*ex* Sanguinolariidae GRANT & GALE, 1931)]

Smooth or nearly so, inequilateral and more or less inequivalved; pallial sinus well developed. *Mio.-Rec.*

Sanguinolaria LAMARCK, 1799 [**Solen sanguinolentus* GMELIN, 1791; M] [=*Lobaria* SCHUMACHER, 1817 (*non* MÜLLER, 1776; obj.); *Isarcha* GISTEL, 1848 *(nom.van.)* (obj.)]. Ovate; periostracum of varying development. *Mio.-Rec.,* N.Am.-S.Am.-IndoPac.

S. (Sanguinolaria). Somewhat inflated, slightly gaping, posterior end pointed; valves nearly equal in size; shell tending to be tinged with red. *Mio.-Rec.,* N.Am.-S.Am.——FIG. E117,*3.* **S. (S.) sanguinolenta* (GMELIN), *Rec.,* Carib.; LV ext., ×1 *(124b).*

S. (Hainania) SCARLATO, 1965 [**S. (H.) tchangsii*; OD]. *Rec.,* E.Asia.

S. (Nuttallia) DALL, 1900 [**S. nuttallii* CONRAD, 1837; OD]. Large, rounded, RV flattened; shell gaping posteriorly; hinge with posterior cardinal obsolete in LV; pallial sinus somewhat detached. *Mio.-Rec.,* E.Asia-W.N.Am.——FIG. E117,*5.* **S. (N.) nuttallii* (CONRAD), Rec., USA(Calif.); RV ext., ×0.3 *(307).*

S. (Psammosphaerica) JOUSSEAUME, 1894 [**P. psammosphaerita;* M] [=*Psammosphaerita,* spelling error]. Like *S. (Sanguinolaria)* but without any gape. *Rec.,* Ind.O.

S. (Psammotella) HERRMANNSEN, 1852 (*ex* DE BLAINVILLE, 1826, vernac.) [**Tellina rufescens* "CHEMNITZ" (*nonbinom.*) (=**T. cruenta* LIGHTFOOT, 1786; M)]. Elongate-ovate, LV flattened, somewhat rostrate posteriorly; without periostra-

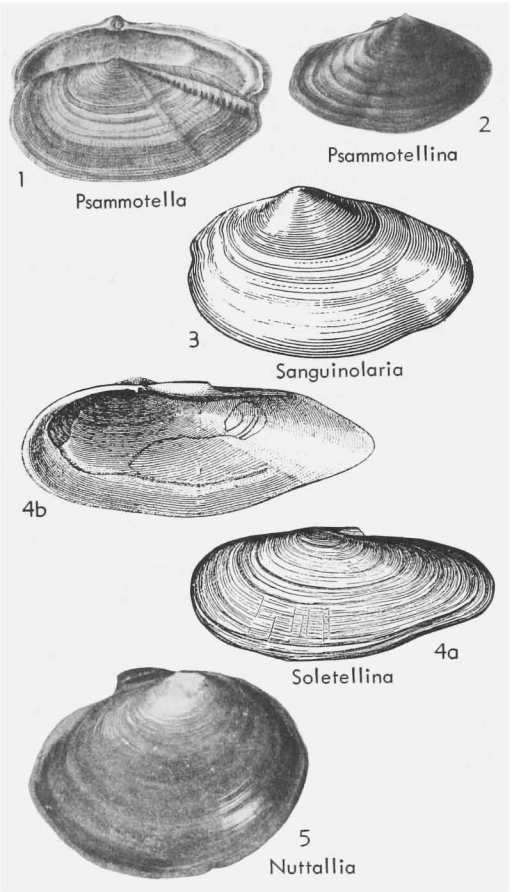


FIG. E117. Psammobiidae (Sanguinolariinae) (p. *N*633-*N*634).

cum; valves pinkish-buff in color. *Rec.*, W.C.Am. ——FIG. E117,*1*. **S. (P.) cruenta* (LIGHTFOOT), Brazil; LV ext., RV int., ×0.5 (Chemnitz, 1782).

S. (Psammotellina) FISCHER, 1887 [**Psammotella ambigua* REEVE, 1857 (*ex* DESHAYES MS); M] [=*Psammotella* H. ADAMS & A. ADAMS, 1856 (*nom. nud.*), REEVE, 1857 (*non* HERRMANNSEN, 1852); *Flavomala* IREDALE, 1936 (type, *Solen biradiatus* WOOD, 1815; OD)]. Thin, with a deciduous periostracum, asymmetrical but not rostrate posteriorly, tending to be tinged bluish-purple. *Rec.*, IndoPac.——FIG. E117,*2*. **S. (P.) ambigua* (REEVE), E.Indies; RV ext., ×0.5 (*783*).

S. (Soletellina) DE BLAINVILLE, 1824 [**S. radiata* (=**Solen diphos* LINNÉ, 1771); M] [="*Psammotaea* LAMARCK" AUCTT. (*non* LAMARCK); *Florisarka* IREDALE, 1936 (type, *F. onuphria*, =*Soletellina donacioides* REEVE, 1857; OD)]. Elongate-ovate, posterior end somewhat rostrate, ventral margin sinuate; periostracum dark-colored, shell yellowish to violet, variously rayed with darker stripes. *Mio.-Rec.*, IndoPac.——FIG. E117, *4*. **S. (S.) diphos* (LINNÉ), Rec., E.Indies; *4a*, LV ext., ×0.7; *4b*, RV int., ×0.5 (*4a, 124b; 4b, 1007*).

Family UNICARDIOPSIDAE Vokes, 1967

[=Unicardiidae FISCHER, 1887 (*partim*)] [Materials for this family prepared by ANDRÉ CHAVAN]

Shell medium-sized, transversely ovate, inflated, anteriorly produced and rounded, posteriorly truncated, very inequilateral; with prominent opisthogyrous beaks; escutcheon well marked; surface with coarse concentric ribs. Hinge showing general tellinacean tendency to develop anteriorly, with tooth *2* small oblique, *3b* tubercular and superficial, *4b* thin; semicircular resilium adjacent to prominent flat nymph; integripalliate but with superior diverticulation of posterior scar. *M.Jur.-U.Jur.*

Unicardiopsis CHAVAN, 1962 [**Unicardium aceste* D'ORBIGNY, 1850; OD]. Characters of family. *M. Jur.-U.Jur.*, Eu.——FIG. E118,*1*. **U. aceste* (D'ORBIGNY), U.Jur.(Sequan.), France; *1a*, LV int. (*112*); *1b*, LV ext., ×2 (Chavan, 1950); *1c*, RV int., *ca.* ×2 (Chavan, n).

Family QUENSTEDTIIDAE Cox, 1929

Equivalve, subequilateral, rectangular, compressed, ligament external, in long pit; hinge plate flat, narrow. *L.Jur.-M.Jur.*

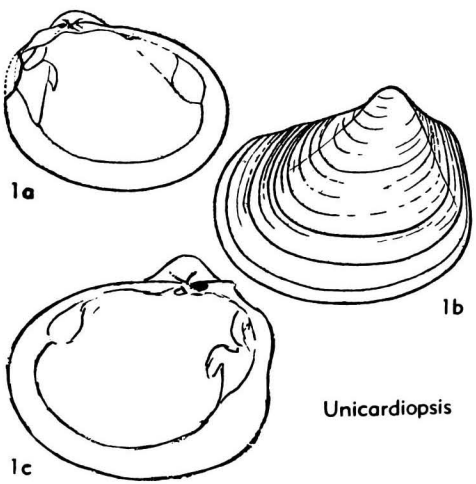


FIG. E118. Unicardiopsidae (p. *N*634).

Quenstedtia MORRIS & LYCETT, 1855 [**Pullastra oblita* PHILLIPS, 1829; SD STOLICZKA, 1871] [=*Corbicella* MORRIS & LYCETT, 1855 (type, *Corbis (C.) bathonica;* SD STOLICZKA, 1871)]. Sculpture of irregular concentric ribs; hinge with 1 cardinal in LV, socket and faint *AII* in front of it; RV with 1 socket and incipient cardinal; lateral teeth otherwise wanting; posterior adductor scars rounded, anterior elongate and sinuate; pallial sinus small, rounded. *L.Jur.-M.Jur.*, Eu.——FIG. E119,*3a*. **Q. oblita* (PHILLIPS), M.Jur., Eng.; LV ext., ×1 (Phillips, 1829).——FIG. E119,*3b,c*. *Q. rodborensis* (LYCETT, 1851), M.Jur., Eng.; *3b,c*, RV int., LV int., ×0.5 (Arkell, 1934).

Family ICANOTIIDAE Casey, 1961

Equivalve, closed, compressed, somewhat oblong, anterior and narrower; smooth to radially ribbed, especially on posterior slope; ligament on nymphs; hinge with two cardinals in either valve, no laterals; pallial sinus large, deep, rounded. *Cret.(Hauteriv.-Maastricht.)*.

Icanotia STOLICZKA, 1870 [**Psammobia impar* ZITTEL, 1865; OD]. Ovate-elongate, anterior end short; radial sculpture well-developed except on lunular and escutcheonal areas. *Cret.(Apt.-Maastricht.)*, Eu.-N.Am.-Asia.——FIG. E119,*1*. **I. impar* (ZITTEL), U.Cret., Ger.; LV ext., ×0.7 (Zittel-Eastman).

Scittila CASEY, 1961 [**S. nasuta;* OD]. Ovate-quadrate, without lunule and with incipient escutcheon; beaks subcentral, posterior margin obliquely truncate, posterior slope set off by low ridge; central slope with low radial furrow sinuating ventral margin; sculpture weak to wanting. *L.Cret. (Hauteriv.-Apt.)*, Eu.——FIG. E119,*2*. **S. nasuta*, Eng., ×1; *2a-c*, LV ext., LV and RV hinges, ×2 (Casey).

Family SCROBICULARIIDAE Adams & Adams, 1856

Resembling Semelidae, with sunken resilium, but without lateral teeth on hinge; posterior end without evident flexure *(508)*. *Eoc.-Rec.*

Scrobicularia SCHUMACHER, 1815 [**S. calcarea* (=**Trigonella plana* DA COSTA, 1778); SD BUCQUOY, DAUTZENBERG, DOLLFUS, 1898] [=*Ligula* MONTAGU, 1808 (*non* BLOCK, 1782) (obj.); *Arenaria* MEGERLE VON MÜHLFELDT, 1811 (*non* BRISSON, 1760) (obj.); *Lavignonus* FÉRUSSAC, 1821 (ex CUVIER, 1817, *vernac.*) (obj.), *Lavigno, Lavignon, Lavignona,* spelling errors; *Listera* TURTON, 1822 (obj.); *Lutricola* DE BLAINVILLE, 1824 (type, *L. compressa,* =*Trigonella plana* DA COSTA, 1778; SD KEEN, herein) (obj.); *Calcinella* DESHAYES, 1830 *(pro Ligula, partim)*; *Carinella* SOWERBY, 1839 (*non* JOHNSTON, 1833) (obj.); *Martinea* BUCQUOY, DAUTZENBERG, & DOLLFUS, 1898 (*ex* DA COSTA MS.) (obj.)]. Smooth, compressed, lenticular, with well-devloped chondrophores. *Eoc.-Rec.*, Eu.-E.Indies.——FIG. E119,*4*. **S. plana* (DA COSTA), Rec., Eu.; LV ext. showing siphons, ×1 (H. Adams & A. Adams).

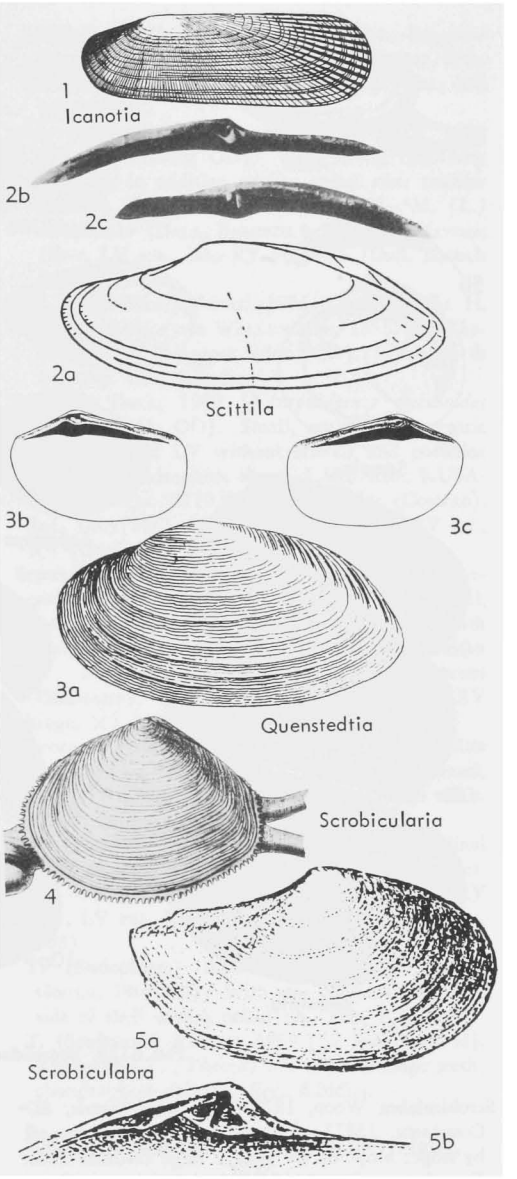


FIG. E119. Quenstedtiidae *(3)*; Icanotiidae *(1-2)*; Scrobiculariidae *(4-5)* (p. *N635-N636*).

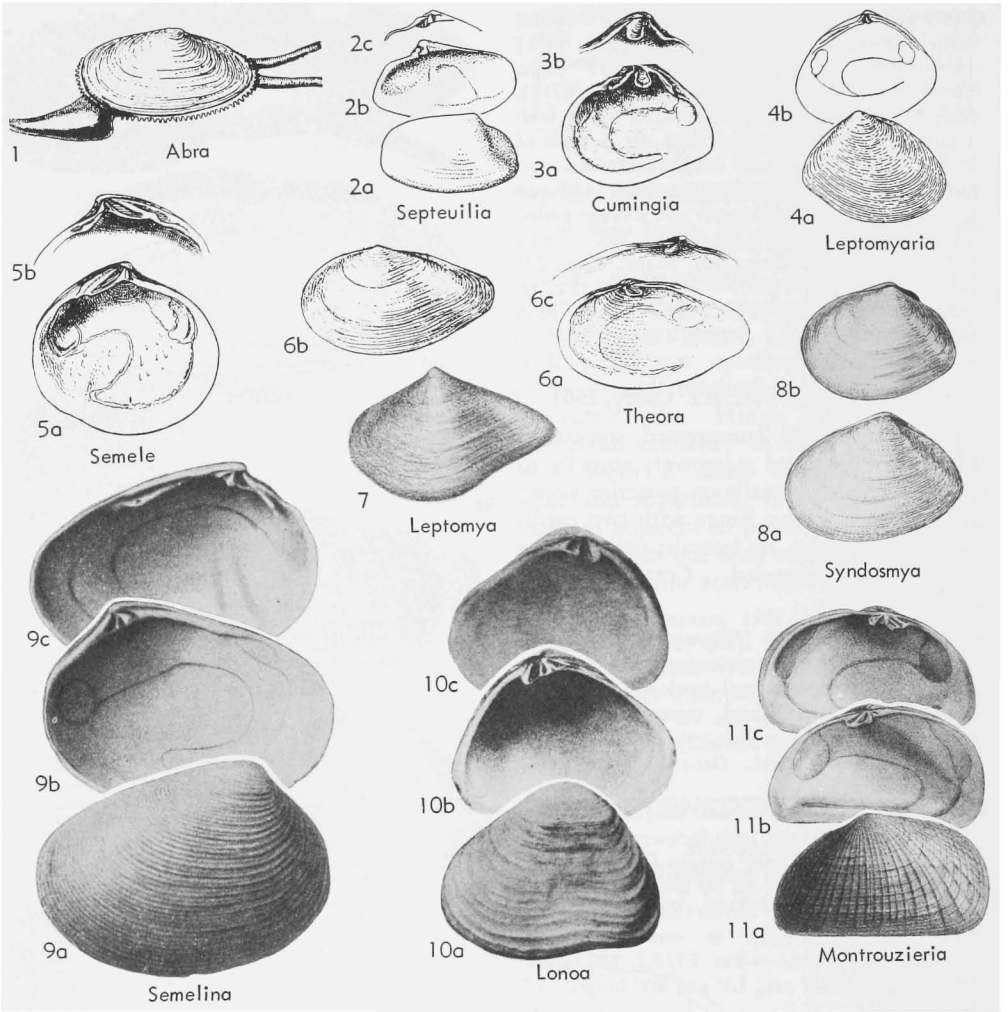


FIG. E120. Semelidae (p. *N636-N637*).

Scrobiculabra WOOD, 1877 [**S. dulwichiensis;* SD COSSMANN, 1887]. Posterior end rostrate, set off by ridge; hinge of RV with 2 large cardinal teeth. *Eoc.*, Eu.——FIG. E119,*5*. **S. dulwichiensis,* Eng.; *5a,* RV ext., ×2; *5b,* RV hinge, enl. (Wood).

Family SEMELIDAE Stoliczka, 1870

Shells mostly well sculptured, with slight posterior flexure; ligament both external and internal, resilium sunken or lodged in small chondrophore; hinge with two cardinal teeth, laterals present in most forms; pallial sinus large, rounded *(508)*. *Eoc.-Rec.*

Semele SCHUMACHER, 1817 [**S. reticulata* (=**Tellina proficua* PULTENEY, 1799); M] [=*Amphidesma* LAMARCK, 1818 (type, *A. variegata*; SD CHILDREN, 1822); *Syndesmyella* SACCO, 1901 (type, *S. plicovoides*; OD); *Elegantula* DE GREGORIO, 1884 (type, *S. fazisa,* =*Amphidesma striata* REEVE, 1853; M)]. Mostly large shells, with anterior end longer than posterior; sculpture radial, concentric, or oblique; resilium in ovoid depression of hinge plate; lateral teeth stronger in RV than in LV, cardinals subequal; pallial sinus ascending obliquely, pallial line not confluent. *Eoc.-Rec.,* N.Am.-S.Am.-Eu.-Pac.——FIG. E120,*5*. **S. proficua* (PULTENEY), Rec., Carib.; *5a,b,* LV int., RV hinge, ×1 *(7c)*.

Abra LAMARCK, 1818 (*ex* LEACH MS) (proposed in synonymy) [**Mactra tenuis* MONTAGU, 1818; SD

HERRMANNSEN, 1846] [=*Habra, nom. null.; Orixa, Dorvillea* GRAY, 1852 (*ex* LEACH, MS) (obj.; M); *Lutricularia* MONTEROSATO, 1884 (type, *Erycina ovata* PHILIPPI, 1836, *non* GRAY, 1825, =*Syndosmya segmentum* RÉCLUZ, 1843; SD CROSSE, 1885); *Abrina* HABE, 1952 (type, *Abra kanamarui* KURODA, 1951; OD)]. Thin, small resilium in a chondrophore that projects slightly into the shell cavity; pallial line partially confluent. *Eoc.-Rec.*, cosmop.

A. (Abra). Trigonal, beaks high, pointed; lateral teeth weak. *Mio.-Rec.*, Eu.-N.Am.-S.Am.-Pac.——FIG. E120,*1*. **A. (A.) tenuis* (MONTAGU), Rec., Eng.; LV ext. showing siphons and foot, ×1 *(7c)*.

A. (Iacra) H.ADAMS & A.ADAMS, 1856 [**Scrobicularia (I.) seychellarum* A.ADAMS, 1856; M] [=*Strigillina* DUNKER, 1861 (type, *S. lactea*)]. Surface divaricately sculptured; posterior flexure strong. *Rec.*, IndoPac.

A. (Syndosmya) RÉCLUZ, 1843 [**Mactra alba* WOOD, 1802; SD WOODWARD, 1854] [=*Sinodesmia, Sinodesmya, Syndesmya, Syndomya,* spelling errors]. Hinge as in *A. (Abra)* but shell more ovate; lateral teeth stronger. *Eoc.-Rec.*, E.N.Am.-Eu.——FIG. E120,*8*. **A. (S.) alba* (WOOD), Rec., Eng.; *8a,b*, LV ext., LV ext., ×1 (Forbes & Hanley, 1854).

Cumingia SOWERBY, 1833 [**C. lamellosa;* GRAY, 1847] [=*Harpax* GISTEL, 1848 *(non* PARKINSON, 1811) (obj.); *Mikrola* MEYER, 1887 (type, *M. mississippiensis*; M); *Cummingia* (spelling error)]. Outline irregular, due to nestling habit, generally rounded in front, angular posteriorly; resilifer large, cardinal teeth small, laterals large in RV, obsolescent in LV, pallial sinus partially confluent. *Eoc.-Rec.*, N.Am.-S.Am.-IndoPac.——FIG. E120,*3*. *C. mutica*, Rec., Ecuador; *3a,b*, RV int., LV hinge, ×1 (H.Adams & A.Adams, *508*).

Leptomya A. ADAMS, 1864 [**Neaera cochlearis* HINDS, 1844; SD STOLICZKA, 1871]. Smooth, posterior end more or less pointed; pallial sinus large, partially confluent. *Rec.*, S.Pac.-Japan-C.Am.

L. (Leptomya). Posterior end rostrate; lateral teeth of moderate length. *Rec.*, W.Pac-S.Pac.-W.C.Am.——FIG. E120,*7*. **L. (L.) cochlearis* (HINDS), E.Indies; LV ext., ×1 (Hanley, 1882).

L. (Leptomyaria) HABE, 1960 [**Leptomyaria trigona*; OD]. Posterior end rounded, anterior widely produced; lateral teeth long. *Rec.*, Japan.——FIG. E120,*4*. **L. (L.) trigona* (HABE); *4a,b*, RV ext., int., ×4 (Habe, 1960).

Montrouzieria SOUVERBIE, 1863 [*pro Montrouziera* SOUVERBIE, 1863 (*non* BIGOT, 1860)] [**Montrouziera clathrata;* OD] [=*Eumontrouziera* HEDLEY, 1915 (obj.)]. Small, trapezoidal, with radial striae; chondrophores triangular, external ligament short. *Rec.*, Pac.-E.Indies.

M. (Montrouzieria). Hinge with 2 cardinals in RV, 1 in LV, 1 lateral in each. *Rec.*, Pac.——FIG. 120,*11*. **M. (M.) clathrata* SOUVERBIE, Rec., N.Caledon., *11a-c*, RV ext., LV int., RV int., ×2 (Souverbie).

M. (Lonoa) DALL, BARTSCH & REHDER, 1939 [**L. hawaiiensis*; OD]. With strong concentric sculpture in addition to fine radial ribs; resilifer shelflike. *Rec.*, Pac.——FIG. E120,*10*. **M. (L.) hawaiiensis* (DALL, BARTSCH & REHDER), Hawaii; *10a-c*, LV ext., int., RV int., ×4 (Dall, Bartsch & Rehder).

M. (Thyellisca) VOKES, 1956 [*pro Thyella* H. ADAMS, 1866 (*non* WALLENGREN, 1858)] [**Thyella pulchra* H.ADAMS, 1866; OD]. Lateral teeth wanting. *Rec.*, E.Indies.

Semelina DALL, 1900 [**Amphidesma nuculoides* CONRAD, 1841; OD]. Small, sculpture concentric only; hinge of LV without laterals and posterior cardinal, chondrophore short. *L.Mio.-Rec.*, E.USA-Carib.——FIG. E120,*9*. **S. nuculoides* (CONRAD), Rec., USA(Fla.); *9a-c*, LV ext., LV int., RV int., ×4 (Gardner).

Septeuilia COSSMANN, 1914 [**Scrobicularia bezanconi* COSSMANN, 1887; SD KEEN, herein]. Small, elongate, posterior end shorter, truncate; hinge with 1 large nonbifid cardinal and a lamellar lateral in LV. *Eoc.*, Eu.——FIG. E120,*2*. **S. bezanconi* (COSSMANN), France; *2a-c*, LV ext., int., RV hinge, ×3 *(160)*.

Theora H.ADAMS & A.ADAMS, 1856 [**Neaera lata* HINDS, 1843; SD STOLICZKA, 1871]. Compressed, smooth, hyaline, with a posterior gape; hinge weak. *Rec.*, E.Indies.

T. (Theora). Adductor scars elongate; cardinal teeth present, LV with no laterals. *Rec.*, E.Indies.——FIG. E120,*6*. **T. (T.) lata* HINDS; *6a-c*, RV int., LV ext., hinge, ×1 (H.Adams & A.Adams, *508*).

T. (Endopleura) A.ADAMS, 1864 [**T. lubrica* GOULD, 1861; M]. With one cardinal bifid; inside of shell with a radial rib. *Rec.*, E.Indies.

T. (Souleyetia) RÉCLUZ, 1869 [**S. moulinsii*; M]. Resembling *T. (Theora)* but without hinge teeth; chondrophore oblique. *Rec.*, E.Indies.

Family SOLECURTIDAE d'Orbigny, 1846

[=Pharinae ADAMS & ADAMS, 1856]

Elongate-quadrate, widely gaping at both ends; hinge plate weak, narrow; pallial sinus shallow to deep *(223)*. *L.Eoc.-Rec.*

Subfamily SOLECURTINAE d'Orbigny, 1846

[*nom. transl.* GHOSH, 1920 (*ex* Solecurtidae D'ORBIGNY, 1846)]

Beaks subcentral. *L.Eoc.-Rec.*

Solecurtus DE BLAINVILLE, 1824 [**Solen strigilatus* LINNÉ, 1758; SD DESHAYES, 1829] [=*Psammosolen* RISSO, 1826 (obj.); *Macha* OKEN, 1835

(obj.); *Silex* QUOY & GAIMARD, 1835 (type, *S. albus* =*Solen rhombus* SPENGLER, 1794; M); *Cyrtosolen* HERRMANNSEN, 1848 *(nom.van. pro Solecurtus); Adasius* GRAY, 1852 (*ex* LEACH MS) (obj.); *Solecurtellus* GHOSH, 1920 (type, *Solen dombeii* LAMARCK, 1818; M]. Sculptured with

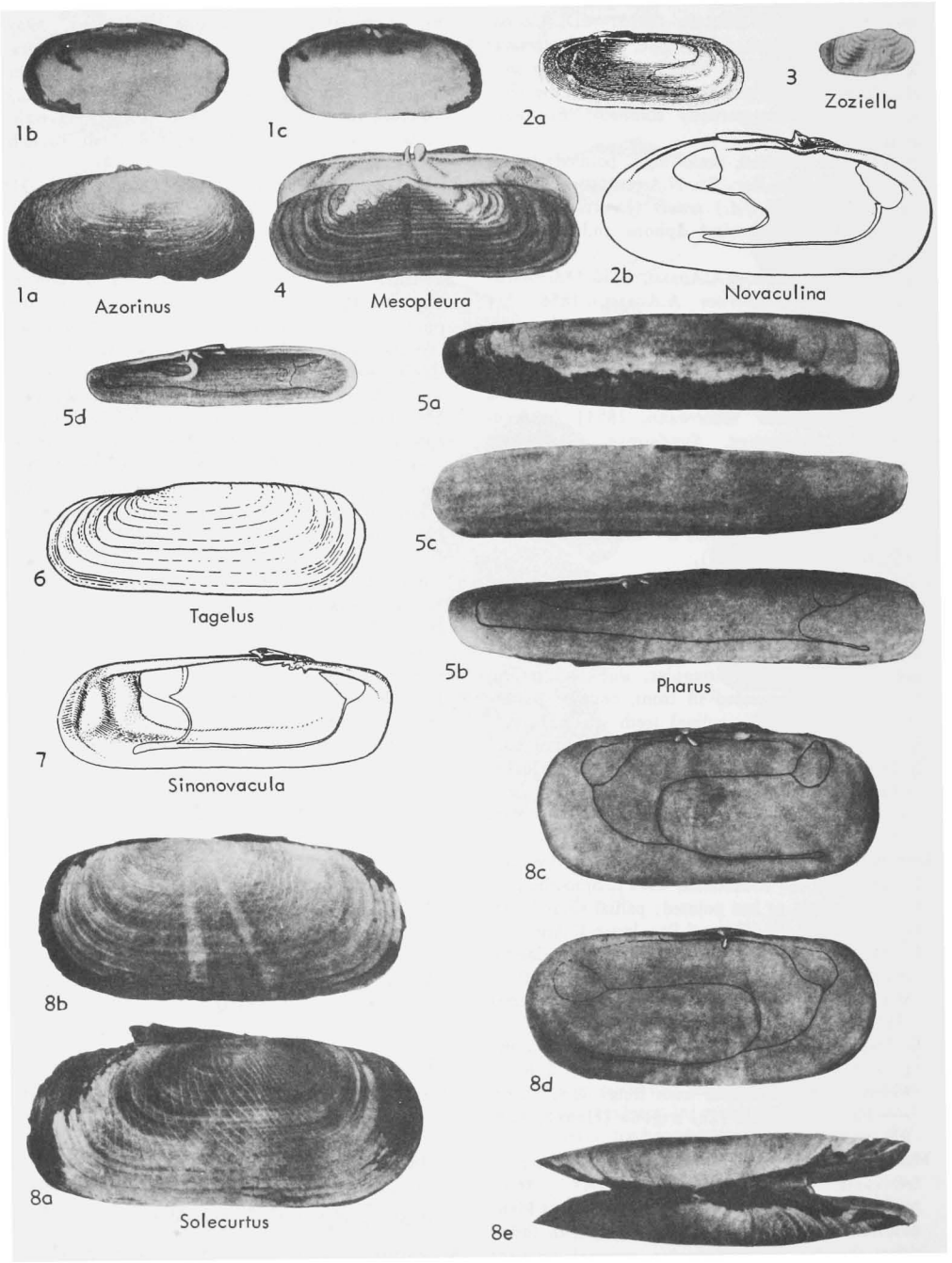


FIG. E121. Solecurtidae (Solecurtinae) *(1,3-6,8);* (Novacutininae) *(2,7)* (p. *N637-N639*).

spaced oblique striae; hinge without lateral teeth, cardinals 2 in RV, 1 in LV, pallial sinus large; ligamental nymph long. *Eoc.-Rec.*, Atl.-Pac.——Fig. E121,*8*. **S. strigilatus* (Linné), Rec., Medit.; *8a-e*, RV ext., LV ext., RV int., LV int., both valves dorsal, ×0.7 *(89a)*.

Azorinus Récluz, 1869 [**Solen coarctatus* Gmelin, 1791 (=**S. chamasolen* da Costa, 1778); M] [=*Azor* Brown, 1844 (*ex* Leach MS) (*non* Sowerby, 1824) (obj.); *Zozia* Winkworth, 1930 (obj.; OD)]. Hinge with 2 cardinal teeth in either valve. *L.Eoc.-Rec.*, Eu.-Asia.

A. (Azorinus). Surface smooth. *Plio.-Rec.*, Eu.——Fig. E121,*1*. **A. (A.) chamasolen* (da Costa), Rec., Medit.; *1a-c*, RV ext., LV int., RV int., ×0.5 *(89a)*.

A. (Zoziella) Eames, 1951 [**A. (Z.) punjabensis*; OD]. Small, with undulating concentric folds and 2 central radial furrows. *L.Eoc.*, Asia.——Fig. E121,*3*. **A. (Z.) punjabensis*, Pak., RV ext., ×1.5 *(288)*.

Pharus Brown, 1844 (in synonymy) [**Solen legumen* Linné, 1758; M] [=*Polia* d'Orbigny, 1845 (*non* Ochsenheimer, 1816) (obj.); *Ceratisolen* Forbes & Hanley, 1848 (obj.); *Erratisolen*, *Seratisolen* auctt. *(nom.null)*; *Artusius* Gray, 1852 (*ex* Leach MS) (obj.)]. Cylindrical, ligament subcentral, no ligamental nymph; hinge with 2 cardinals in LV, 1 in RV, long low anterior lateral and short projecting posterior lateral; pallial sinus short. *L.Mio.-Rec.*, Eu.——Fig. E121,*5*. **P. legumen* (Linné), Rec., Medit.; *5a-d*, LV ext., RV int., LV int., RV int., ×0.7 *(89a)*.

Tagelus Gray, 1847 [**"Sol. guinensis" (non Solen guinensis* Hanley, 1842) (*pro "Solen tagel* Adanson, 1757" of Gray) =**Solen adansonii* Bosc, 1801 (better known as *Solecurtus angulatus* Sowerby, 1874); OD] [=*Siliquaria* Schumacher, 1817 (non Bruguière, 1789) (type, *S. notata*, =*Solen plebeius* Lightfoot, 1786; M); *Cultellus* Conrad, 1837 (*non* Schumacher, 1817)]. Narrower than *Solecurtus*, surface smooth; periostracum present; teeth 2 in either valve, simple; pallial sinus deep, mostly reaching to or beyond vertical mid-line, partly confluent with pallial line. [Estuarine to marine.] *Oligo.-Rec.*, N.Am.-S.Am.-Eu.-W.Afr.

T. (Tagelus). Medium-sized to large, without any median rib. *Oligo.-Rec.*, N.Am.-S.Am.-Eu.-W.Afr.——Fig. E121,*6*. **T. (T.) adansonii* (Bosc), Rec., W.Afr.; RV ext., ×0.5 (Fischer-Piette, 1942).

T. (?Clunaculum) Dall, 1899 [**Solecurtus mollis* Sowerby, 1874 (*ex* Gould MS); OD]. Valves obliquely constricted; pallial sinus confluent with pallial line, not reaching beaks; posterior adductor scar triangular. *Rec.*, ?S.Am.

T. (Mesopleura) Conrad, 1868 [**Solen bidentatus* Spengler, 1794 (=**S. divisus* Spengler, 1794); SD Stoliczka, 1871] [=*Subtagelus* Ghosh, 1920 (obj.)]. Smaller and thinner than *T. (Tagelus)*, with a central rib, especially in young (obsolete in some adults), showing exteriorly as dark line; pallial sinus relatively short, nymphs long. *Plio.-Rec.*, E.N.Am.-W.N.Am.-C.Am.——Fig. E121,*4*. **T. (M.) divisus* (Spengler), Rec., W.Indies; LV ext. and RV int., ×1 (Chemnitz, 1795).

Subfamily NOVACULININAE Ghosh, 1920

[*nom. correct.* Yonge, 1949 (*ex* Novaculinae Ghosh, 1920)]

Long-cylindrical, resembling Solenidae but with soft parts as in Solecurtinae; beaks nearly at anterior end, hinge with two or three cardinal teeth; pallial sinus small to large. *Rec.*

Novaculina Benson, 1830 [**N. gangetica*; M] [=*Loncosilla* Rafinesque, 1831 (type, *L. solenoides;* M); *Navaculina (nom. null.)*]. Shell width uniform throughout; periostracum present; hinge with 3 cardinals in LV, 2 in RV in most; pallial sinus of moderate depth. [Freshwater.] *Rec.*, S. Asia.——Fig. E121,*2*. **N. gangetica*, India; *2a,b*, RV int., LV int., ×1 *(1007*; Prashad, 1924).

Sinonovacula Prashad, 1924 [**Solen constrictus* Lamarck, 1818; OD]. Larger than *Novaculina*, more equivalve, beaks lower, pallial sinus shorter and broader; valves obliquely compressed near middle. [Estuarine.] *Rec.*, E.Asia.——Fig. E121,*7*. **S. constrictus* (Lamarck), IndoChina; LV int., ×0.5 (Prashad, 1924).

Family SOWERBYIDAE Cox, 1929

[=Isodontidae Arkell, 1934]

Inequilateral to oblique in outline; hinge with large lateral teeth and normally with two cardinals. *?Trias., U.Jur.*

Sowerbya d'Orbigny, 1850 [**S. crassa*; M] [=*Isodonta* Buvignier, 1851 (type, *I. deshayesia*; M); *Isodon* (*emend.* Douvillé, 1912) (*non* Say, 1822)]. Lateral teeth long and large; shell resembling *Mactra* as to form but without chondrophore; cardinal teeth 2 in either valve; pallial sinus evident, rounded. *U.Jur.(Oxford.)*, Eu.——Fig. E122,*2*. **S. crassa*, France; *2a-c*, RV ext., int., LV int., ×1 (Cottreau).

?Rhaetidia Bittner, 1895 [**R. zittelii*; OD]. Resembling *Sowerbya* in outline but hinge with large lateral teeth only, no cardinals; pallial line entire. *Trias.*, Eu.——Fig. E122,*1*. **R. zittelii*, U.Trias., Alps; *1a*, RV ext., ×2; *1b*, both valves dorsal, ×2; *1c*, RV ext., ×1 (Bittner).

Family TANCREDIIDAE Meek, 1864

[Materials for this family prepared by L. R. Cox]

Shell small to medium-sized, smooth or with weak radial ornament, equivalve,

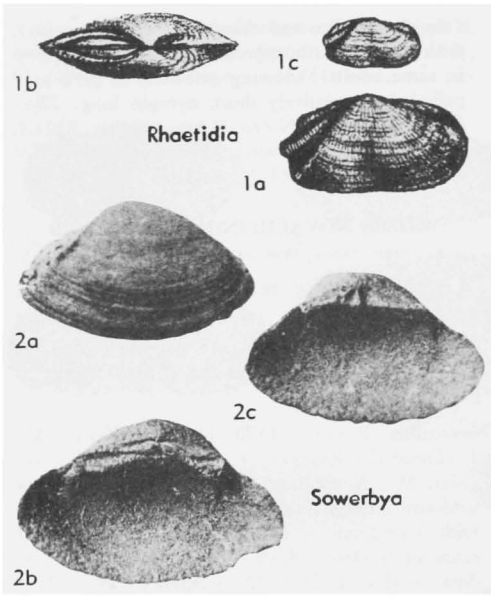


FIG. E122. Sowerbyidae (p. *N639*).

feebly to moderately inflated, ovate or subtrigonal, more or less elongate, subequilateral to strongly inequilateral, in latter case with anterior end longer; ligament external, opisthodetic, usually short; cardinal teeth fundamentally two in each valve *(2, 4b* in LV, *3a, 3b* in RV), but decreased to single tooth in one or both valves in some forms by extreme reduction of LV posterior *(4b)*, of RV anterior *(3a)*, or of both, and increased to three in some LV's of *Eodonax* by development of thin ridge *(4a?)* adjoining lunular margin; single posterior lateral *(PII)* present in LV and received, below dorsal margin of RV, in socket which may lie between two distinct lateral teeth *(PIII, PI)*; anterior laterals, if distinguishable, consisting of laminar projections from margins; adductor scars small; pallial line simple or with shallow sinus. *U.Trias.-U.Cret.*

Tancredia LYCETT, 1850, p. 407 [**T. donaciformis*; SD MORRIS & LYCETT, 1855, p. 91]. Subtrigonal, with anterior end of shell tapering to more or less acute extremity; subequilateral to strongly inequilateral; posterior margins commonly gaping; adductor scars circular or oval, subequal, placed in rather dorsal position; pallial line remote from ventral margin, bending abruptly upward posteriorly. *U.Trias.-L.Cret.*, cosmop.

T. (Tancredia) [=*Hettangia* TERQUEM in BUVIGNIER, 1852, p. 14) (type, *H. deshayesea*; SD TERQUEM, 1855, p. 290)]. Mostly rather large, subequilateral, high and obliquely truncated posteriorly, subangular anteriorly; posterior slope ridged; lunule narrow and elongate, bordered by ridge; cardinal teeth moderately strong, 2 usually distinguishable in both valves; posterior laterals relatively strong; LV anterior lateral a laminar projection of dorsal margin, RV anterior laterals rarely distinguishable. *L.Jur.(L.Lias.)-U.Jur.(Oxford.)*, cosmop.——FIG. E123,*4a-e*. **T. (T.) donaciformis* LYCETT, M.Jur.(Aalen.), France; *4a-e*, LV ext., both valves dorsal, RV int., LV int. and int. mold showing pallial line, all ×1 (Benecke, 1905).——FIG. E123,*4f,g*. *T. (T.) coxi* CHAVAN, U.Jur.(U.Oxford.), France; *4f,g*, RV int., LV int., ×10 (Chavan, 1950).

T. (Corburella) LYCETT, 1850, p. 422 [**Corbula curtansata* PHILLIPS, 1829, p. 128; OD]. Medium-sized subequilateral, high and rounded posteriorly, rostrate anteriorly, ventral margin sinuate; posterior slope not ridged; no lunule; only 1 cardinal tooth in each valve; LV posterior lateral small but elongate; anterior laterals not distinguishable. *M.Jur.-U.Jur.*, cosmop.——FIG. E123,*6*. **T. (C.) curtansata* (PHILLIPS), U.Jur.(Oxford.), Eng.; LV ext., ×1 *(19f)*.

T. (Isotancredia) CHAVAN, 1950, p. 12 [**Tancredia extensa* LYCETT, 1850, pl. 11, fig. 9; OD]. Small, elongate, subtrigonal, subequilateral, with dorsal margins straight and sloping, anterior more steeply than posterior; posterior end of shell rather low, obliquely truncated, anterior end cuneiform; posterior slope ridged; cardinal teeth 1 in each valve; posterior laterals moderately prominent; RV anterior lateral present but weak. *M.Jur.-U.Jur.*, cosmop.; *L.Cret.*, S.Afr.—FIG. E123,*2*. **T. (I.) extensa* LYCETT, M.Jur.(Bathon.), Eng.; LV ext., ×1 (Morris & Lycett, 1855).

T. (Paratancredia) CHAVAN, 1950, p. 12 [**T. (P.) brasili*; OD]. Small to medium-sized, compressed, inequilateral, less elongated than in other subgenera, high and obliquely truncated posteriorly, tapering to some extent anteriorly, although less than in other subgenera; cardinal teeth 2 in each valve, anterior ones elongated; posterior laterals small, RV anterior lateral distinct, elongate. *M.Jur.-U.Jur.*, cosmop.——FIG. E123,*1*. **T. (P.) brasili*, U.Jur.(Oxford.), France; *1a,b*, LV int., RV int., ×3, ×7 (Chavan, 1950).

T. (Palaeomya) ZITTEL & GOUBERT, 1861, p. 194 [**Palaeomya deshayesi* ZITTEL & GOUBERT, 1861 (*non* BUVIGNIER) (=**Tancredia corallina* ZITTEL, 1881, p. 97); M] [=*Rosenbuschia* RÖDER, 1882, p. 97 (type, *R. typica*; M)]. Elongate, very inequilateral, anterior end much longer than posterior end, tapering; LV anterior cardinal an elongate lamina; posterior laterals prominent; RV anterior lateral distinct, elongate. *L.Jur.-U.Jur.*, cosmop. ——FIG. E123,*3*. **T. (P.) corallina* (ZITTEL & GOUBERT), U.Jur.(Oxford.), France; *3a-c*, RV

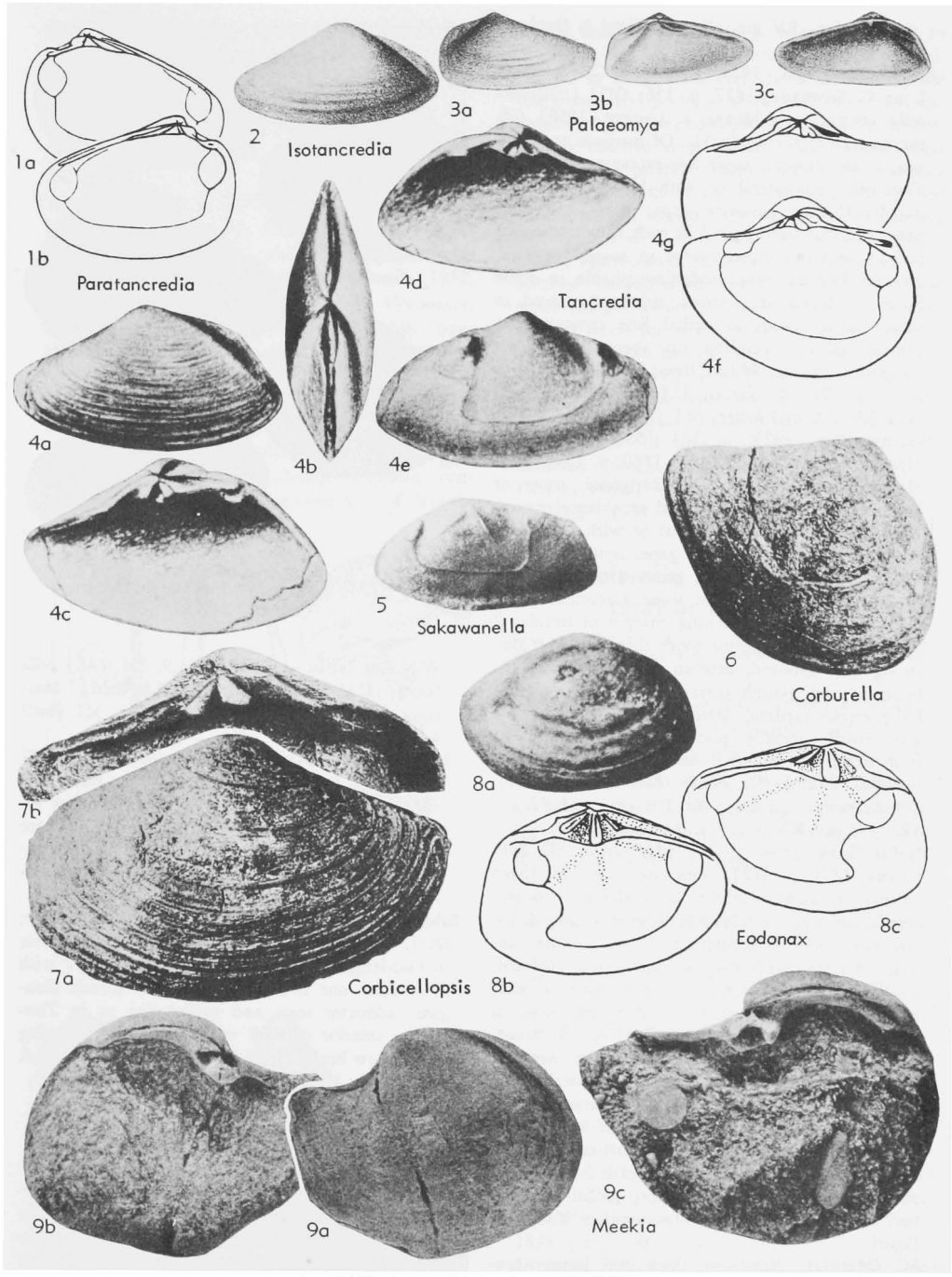


FIG. E123. Tancrediidae (p. *N640-N642*).

ext., LV int., RV int., all ×2 (Zittel & Goubert, 1861).

Corbicellopsis Cox, 1929, p. 577 [**Corbis laevis* J. DE C. SOWERBY, 1827, p. 156; OD] [=*Corbicella* AUCTT. (*non* MORRIS & LYCETT, 1855) (cf. synonymy of *Quenstedtia*)]. Of medium to large-size, ovate, anterior taper less pronounced than in *Tancredia;* equilateral or with beaks anterior to mid-length; no posterior gape; nymphs prominent; cardinal teeth 1 or 2 in each valve; posterior laterals well developed except in smaller species; anterior laterals weak, indistinguishable in some forms; adductor scars small, subequal, placed in rather dorsal position; pallial line remote from ventral margin, bending up abruptly to meet posterior adductor. *M.Jur.(Bajoc.)-L.Cret.*, Eu.——FIG. E123,*7*. **C. laevis,* U.Jur.(Oxford), Eng.; *7a,b,* RV ext. and hinge, ×1 *(19f)*.

Eodonax Cox, 1929, p. 584 [**Sowerbya dukei* MORRIS & LYCETT in DAMON, 1860, p. 172; OD]. Medium-sized, subovate or subtrigonal, more or less pointed anteriorly, rounded or obliquely truncated posteriorly; subequilateral or with beaks just posterior to mid-length; no gape; nymphs prominent; 2 moderately strong, grooved cardinal teeth in LV, also thin ridge in some specimens (possibly 3rd cardinal) adjoining margin of lunule; 2 cardinals in RV, anterior tooth thin, posterior one strong and grooved, median ridge in recess between it and nymph corresponding to groove in LV posterior cardinal; lateral teeth weak; adductor scars small, dorsally placed; pallial line remote from margin, with small sinus. *U.Jur.-L.Cret.*, Eu.——FIG. E123,*8*. **E. dukei* (MORRIS & LYCETT), U.Jur.(Portland.), Eng.; *8a,* LV ext., ×1 *(171)*; *8b,c,* LV int., RV int., ×1 (Cox, n).

Meekia GABB, 1864, p. 191 [**M. sella*; SD STOLICZKA, 1871, p. 312]. Subovate except for sharp anterior rostrum, slightly to moderately inequilateral, anterior end shorter; valve margins closed posteriorly in earlier, gaping in later species; anterior margins with narrow gape below rostrum; lunule lanceolate; surface unornamented or with weak radial lines; cardinal teeth 2 in each valve, on short hinge plate, anterior cardinal of LV broad, prominent, received in deep socket between smaller, subequal cardinals of RV; posterior cardinal of LV parallel to nymph; posterior laterals weak, 1 in LV received between 2 in RV; no anterior laterals; shelly internal buttress runs in anteroventral direction from beneath hinge plate, passing below anterior adductor, pallial line entire. *L.Cret.(Alb.)-U.Cret.(Maastricht.)*, W.N.Am.-Japan.

M. (Meekia). Relatively thick and heavy; pronouncedly rostrate, with strongly concave anterodorsal margin; inflation moderately strong; surface with more or less distinct radial ornament and with microscopic punctations; anterior cardinal of LV peglike. *Cret.(Alb.-Maastricht.)*, W.N.Am.-Japan.——FIG. E123,*9*. **M. (M.) sella* GABB, U.Cret.(Maastricht.), USA(Calif., Martinez), *9a-c,* LV ext., LV int., RV int., ×1 (Saul & Popenoe, 1962).

M. (Mygallia) SAUL & POPENOE, p. 962, p. 302 [**Meekia mygale*; OD]. Differs from *M. (Meekia)* in thinner, more elongated and less inflated shell, less marked anterior rostrum, absence of surface punctations, and more elongate anterior cardinal tooth of LV. *Cret.(Alb.-Maastricht.)*, W.N.Am.-Japan.

Sakawanella ICHIKAWA, 1950, p. 245 [**S. triadica*; OD]. Small elongate-oblong, beaks just anterior to mid-length; LV with 1 cardinal tooth, RV with 2, anterior one ill-defined; posterior laterals elongate; adductor scars and pallial line as in *Tancredia*; interior of shell with 2 grooves diverging from below beak. *U.Trias.*, Japan.——FIG. E123,*5*. **S. triadica*; LV int. mold, ×2 (Ichikawa, 1950).

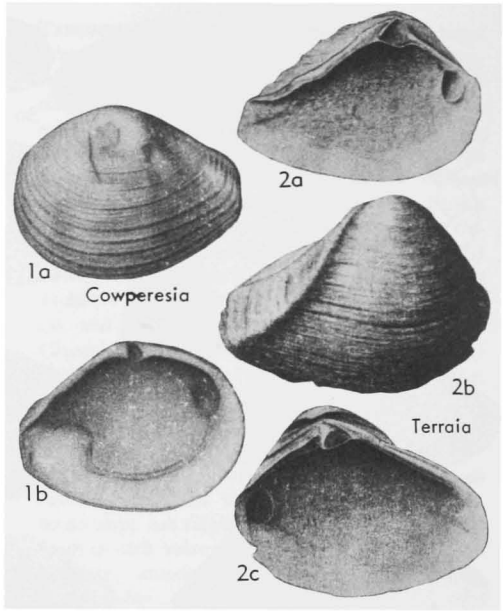


FIG. E124. Superfamily and family Uncertain (p. *N642-N643*).

Doubtful TELLINACEA

Cowperesia MENDES, 1952, p. 86 [**Pseudocorbula anceps* REED, 1935, p. 34; OD]. Suboval or subtriangular, tapering posteriorly; equivalve or slightly inequivalve; umbones low, orthogyre, submedian; surface ornamented with concentric ridges or relatively smooth; posterior umbonal ridge rounded; lunule and escutcheon obscure; dentition consisting of 1 cardinal tooth below beak of RV and corresponding socket; shallow pallial sinus present. [In view of CHAVAN, this genus is refer-

able to the Tellinidae. KEEN agrees that it may be an ancestral tellinacean but considers it inappropriately classifiable in the Tellinidae.] *Permo-Trias.*, S.Am.(S.Brazil).——FIG. E124,*1*. **C. anceps* (REED), Corumbatai, Passa Dois F., S.Brazil; *1a,b*, LV ext. and int., ×2 (Mendes, 1952). [NEWELL]

Terraia Cox, 1934, p. 269 [**Solenomorpha altissima* HOLDHAUS, 1919, p. 12; OD] [=*Jacquesia* MENDES, 1944, p. 62 (type, *Myophoriopis brasiliensis* REED, 1929; OD); *Holdhausiella* MENDES, 1952, p. 94 (type, *Sanguinolites elongatus* HOLDHAUS, 1919; OD); *Maackia* MENDES, 1954, p. 100 (type, *M. contorta;* OD); *Oliveiraia* MENDES, 1954, p. 103 (type, *Thracia pristina* REED, 1929; SD NEWELL, herein)]. Trigonally ovate, thick-shelled, equivalve, inequilateral, not greatly inflated; posterior end tapering to low, vertically truncated extremity, without gape; umbones obtusely angular, contiguous, placed at about anterior 0.3 of length; lunule and escutcheon long, narrow, limited by carinae which in most specimens are sharp, although in some shells escutcheon carina may die out posteriorly; posterior slope with prominent elevated carina, separated from escutcheon by narrow, slightly concave area; surface with growth rugae which may produce denticulations on posterior carina; RV with single blunt tooth placed just behind umbo, narrow shallow groove separating this tooth from short nymph, which supported external, opisthodetic ligament; between tooth and anterior margin is shallow triangular recess; posterior margin somewhat thickened; LV with deep median recess for reception of RV tooth, bordered by narrow weak tooth separated by shallow groove from nymph; well-defined lateral teeth lacking; anterior adductor with low reinforcing buttress (clavicle); pallial line simple. *Permo-Trias.*, S.Am.(Brazil-N.Uruguay).——FIG. E124,*2*. **T. altissima* (HOLDHAUS), Estrada Nova F., Urug. (Rivera Prov.); *2a-c*, LV int., RV ext., RV int., ×2 (Cox, 1934). [NEWELL]

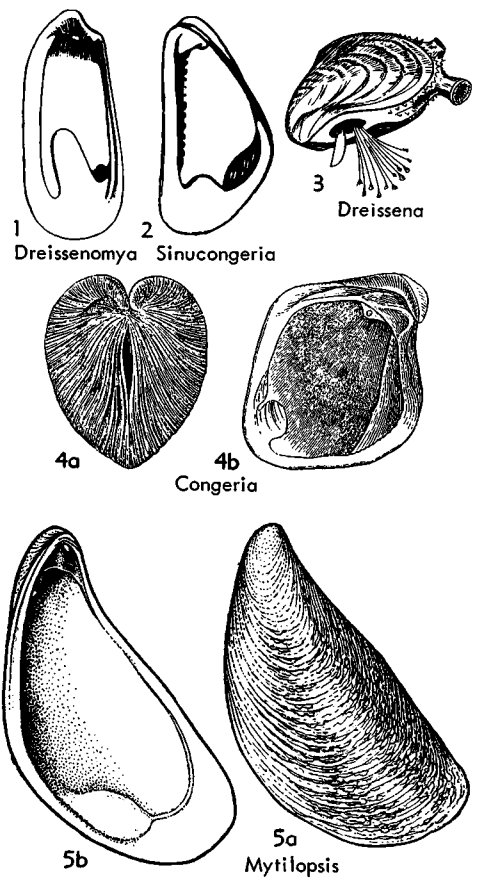


FIG. E125. Dreissenidae (p. *N*644).

Superfamily DREISSENACEA Gray in Turton, 1840

[*nom. transl.* GILL, 1871 (*ex* Dreissenidae GRAY in Turton, 1840)] [Materials for this superfamily prepared by MYRA KEEN]

Mytiliform to quadrate, beaks anterior or terminal; interior of shell not nacreous; ligament sunken, hinge edentulous; beak cavity bridged by septum or myophore; posterior adductor muscle scar long; periostracum well developed. Animal byssiferous; siphons two; gills reticulate. *Eoc.-Rec.*

Family DREISSENIDAE Gray in Turton, 1840

[*nom. correct.* GRAY, 1847 (*ex* Dreissenadae GRAY in Turton, 1840)]

Characters of superfamily. *Eoc.-Rec.*

Dreissena BENEDEN, 1835 [*nom. correct.* ICZN Op. 872 (*pro Driessena* BENEDEN, 1835)] [**Mytulus polymorphus* PALLAS, 1771 *(errore pro Mytilus)*; M] [=*Tichogonia* ROSSMAESSLER, 1835 (obj.); *Dithalmia* JAY, 1835 *(nom. nud.); Mytilina* CANTRAINE, 1837 (*non* BORY DE ST. VINCENT, 1824) (obj.); *Coelogonia* BRONN, 1837 (type, *Mytilus brardii* BRONGNIART, 1823; M); *Mytilomya* BRONN, 1838 (obj.); *Mytolimax* SCHAUFUSS, 1869 (obj.); *Dreisena, Dreisseina, Dreissencia, Dreissenia, Dreissensa, Dreissensia, Dreissina, Dreistena, Dreysseina, Dreyssena, Dreyssensia, Dreyssentia, Driessensia* AUCTT. *(nom.null.)*]. Mytiliform, anteriorly compressed, with periostracum; septum with single adductor muscle scar. *Eoc.-Rec.*, Eu.-Afr.

D. (Dreissena). Smooth, pallial line entire. *Eoc.-Rec.*, Eu.-Afr.——Fig. E125,*3*. **D. (D.) polymorpha* (Pallas), Rec., Eu.; oblique anteroventral view of entire animal, ×1 (Fischer).

D. (Dreissenomya) Fuchs, 1870 [**Dreissenomya schroeckingeri*; OD] [=*Congeriomya* Andrussov, 1897 *(nom.van.)*; *Dreissensiomya* Fischer, 1886 *(nom. null.)*; *Dreyssenomya* Neumayr, 1891 *(nom.null.)*;]. Septum obsolescent; pallial line deeply sinuate: *Plio.*, E.Eu.——Fig. E125,*1*. **D. (D.) schroeckingeri* (Fuchs), Hungary, RV int., ×0.5 (Papp).

D. (Prodreissensia) Rovereto, 1898 [**D. (P.) perrandoi*; OD]. Shell sculptured with longitudinal ribs. *Oligo.(Tongr.)*, Eu.

D. (Sinucongeria) Lörenthey, 1894 [**Congeria arcuata* Fuchs, 1870; OD]. Like *D. (Dreissenomya)* but more trigonal, septum larger, pallial sinus smaller. *Plio.*, E.Eu.——Fig. E125,*2*. **D. (S.) arcuata* (Fuchs), Hungary; RV int., ×1 (Papp).

Congeria Partsch, 1835 [**C. subglobosa*; SD Pilsbry, 1911] [=*Enocephalus* Münster, 1831 *(nom. nud.)*]. Quadrate, smooth, thick-shelled; septum with 2 scars, for anterior adductor and pedal retractor muscles; pallial line entire. *L.Oligo.-Plio.*, Eu.-W.Asia.——Fig. E125,*4*. **C. subglobosa*, Mio., Aus.; *4a,b*, ant. view of both valves, LV int., ×0.3 (Fischer).

Mytilopsis Conrad, 1858 [**Mytilus leucophaeatus* Conrad, 1831; SD Dall, 1898] [=*Praxis* H. Adams & A. Adams, 1857 (*non* Guenèe, 1852); *Mytiloides*, spelling error)]. Mytiliform, as in *Dreissena*, but septum backed by a myophore with 2 scars, as in *Congeria*. *U.Oligo.-Rec.*, W.S.Am.-Eu.-Afr.-E.Indies.——Fig. E125,*5*. **M. leucophaeatus* (Conrad), Rec. USA(Va.); *5a,b*, RV ext., LV int., ×1.5 (Keen, n).

Superfamily GAIMARDIACEA Hedley, 1916

[*nom. transl.* Fleming, herein (*ex* Gaimardiidae Hedley, 1916)] [Materials for this superfamily prepared by C. A. Fleming]

Small, thin, equivalve, ventricose, with anterior beaks, surface smooth or radially ribbed; integripalliate; anterior retractor separate from adductor. Ligament external or sunken, opisthodetic; hinge weak, basically with single LV cardinal and bifid RV cardinal (tooth *1* invariably beneath bifid *3*), LV and RV anterior laterals and LV posterior lateral varyingly reduced. Foot byssiferous, with creeping disc; mantle triforic, fry developed in gills. [Commonly attached to floating seaweed.] *(685, 908.) Mio.-Rec.*

Family GAIMARDIIDAE Hedley, 1916

[*nom. correct.* Odhner, 1924, p. 63 (*pro* Gaimardiadae Hedley, 1916, p. *26*, *nom. imperf., nom. subst. pro* Modiolarcidae, *nom. correct. pro* Modiolarcadae J. E. Gray in M. E. Gray, 1857, p. 25)] [Materials for this family prepared by C. A. Fleming, New Zealand Geological Survey]

Characters of superfamily. *Mio.-Rec.*

Gaimardia Gould, 1852, p. 459 [**Modiola trapesina* Lamarck, 1819, p. 114; M] [=*Modiolarca* Gray, 1847, p. 199 (*non* Gray, 1843, p. 259) (obj.); *Phaseolicama* Rousseau, 1854, p. 116 (type, *P. magellanica*; M); *Gaimarda* Gray, 1855, p. 108; *Phascolicama* Gray, 1855, p. 108]. Trapezoid, smooth, anteriorly rostrate, up to 32 mm. long, generally gaping anteroventrally. Teeth commonly reduced; anterior and posterior accessory marginal teeth in some species. *L.Pleist.-Rec.*, N.Z.-Patagonia-Subantarct. Is.——Fig. E126,*4*. **G. trapesina* (Lamarck), Rec., Magellan Strait; *4a-c*, RV ext., LV int., RV int., ×3 (C. A. Fleming, n).

Costokidderia Finlay, 1927, p. 457 [**Kidderia costata* Odhner, 1924, p. 68; OD]. Resembling *Kidderia* but with strong radial ribs on median and posterior parts of shell, imbricated by growth striae and crenulating margins. *U.Pleist.-Rec.*, N.Z.——Fig. E126,*2*. **C. costata* (Odhner), Rec., Auckland Is.; *2a,b*, LV ext., RV int., ×9 *(685)*.

?Eugaimardia Cotton, 1931, p. 63 [*pro Neogaimardia* Cotton, 1931, p. 341 (*non* Odhner, 1924, p. 64)] [**Neogaimardia perplexa* Cotton, 1931, p. 341; M]. Similar to *Neogaimardia* but lacking ventral sinuosity and anterior rostrum; hinge more robust, veneriform; ligament external. [Systematic position doubtful.] *Rec.*, S.Australia.——Fig. E126,*3*. **E. perplexa* (Cotton); *3a,b*, RV ext., hinge, ×9 (B. C. Cotton).

Kidderia Dall, 1876, p. 46 [**K. minuta;* M]. Small, solid, elongate-oval, lacking ventral sinuosity and gape of *Gaimardia*, with sunken subinternal ligament; some species not rostrate. *Mio.-Rec.*, N.Z.-Fuegia-Subantarctic Is.——Fig. E126,*1*. **K. minuta*, Rec., Kerguelen; *1a-c*, RV ext., RV int., LV int., ×9 (C. A. Fleming, n).

Neogaimardia Odhner, 1924, p. 64 [**Kellia rostellata* Tate, 1889, p. 63; OD]. Small, rostrate, with anteroventral sinus and gape; ligament internal; right cardinal embraced by hooklike left cardinal; accessory marginal teeth present. *L.Pleist.-Rec.*, N.Z.-S.Australia.——Fig. E126,*5*. **N. rostellata* (Tate), Rec., Victoria; *5a,b*, LV and RV hinges showing accessory marginal teeth *(a-c, a_1, b_1)* and teeth (Bernard's notation), ×9 *(685)*.

Superfamily ARCTICACEA Newton, 1891

[*nom. transl.* Habe, 1951 (*ex* Arcticidae Newton, 1891)] [=Trapezacea Habe, 1951] [Materials for this superfamily prepared by Myra Keen with additions as recorded]

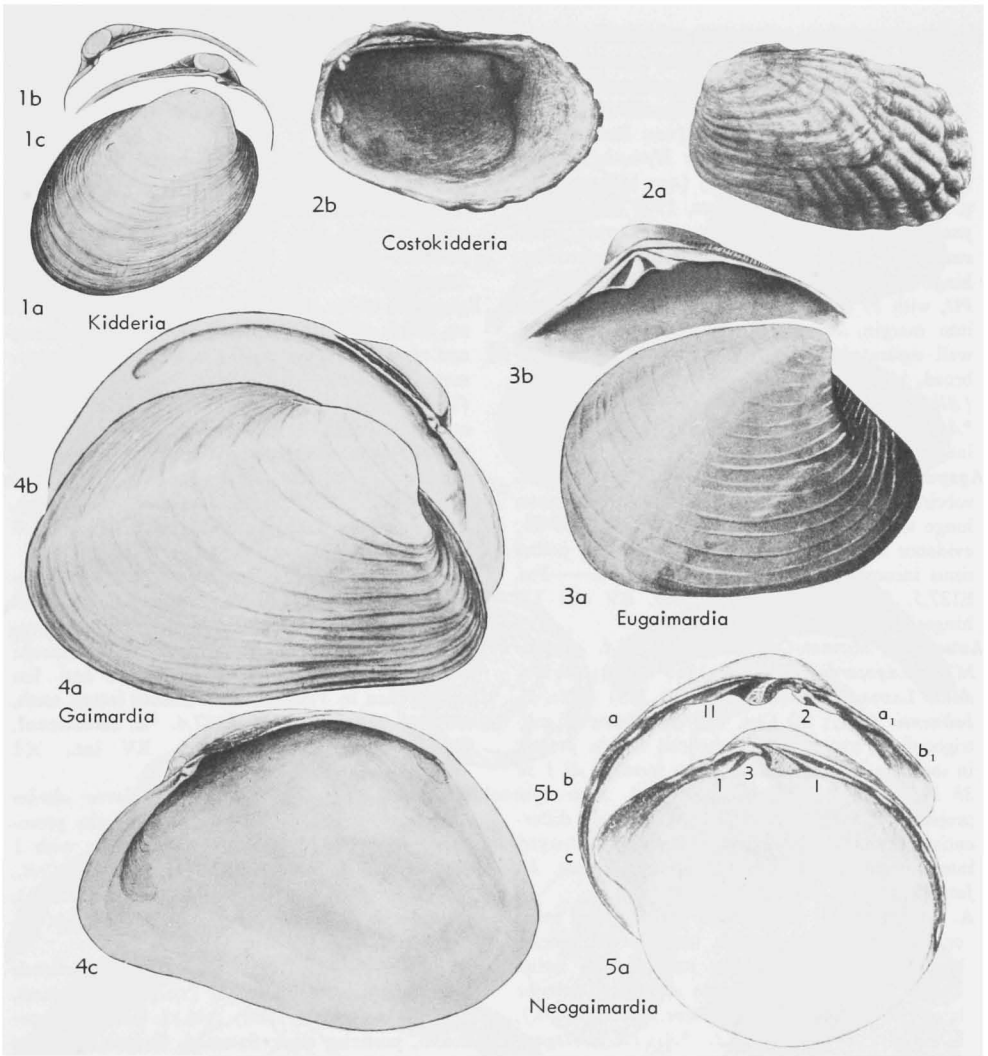


FIG. E126. Gaimardiidae (p. *N*644).

Shells inequilateral, mostly equivalve, beaks well forward, spirally twisted only in a few; surface smooth or with some concentric (rarely any radial) ribbing; ligament external; hinge of the form termed cyprinoid by authors, having two or three cardinal teeth in each valve and well-developed laterals in most; teeth tending to radiate from beaks; pallial line normally entire (sinuate in few). *M.Dev.-Rec.*

Family ARCTICIDAE Newton, 1891

[=Cyprinidae D'ORBIGNY, 1844 (*non* BONAPARTE, 1841); Venilidae DALL, 1889; Veniellinae DALL, 1895] [Family-group names based on *Cyprina* LAMARCK, 1818 and *Venilia* MORTON, 1833 are invalid (Code, Art. 11e)] [Materials for this family prepared by MYRA KEEN and RAYMOND CASEY]

Equivalve, inequilateral, closed; shell evenly inflated or with lateral carinae; sculpture, if present, mostly of fine concentric riblets (radial threads in a few); ligament on nymphs, insertion grooves incised; hinge formula=*AI AIII 3a 1 3b 5b PI PIII/AII 2a 2b 4b PII PIV,* not all teeth fully developed, especially *AII 1 5b, PI PIII 2a, PII* and *PIV;* valve margins smooth within or feebly crenulate; adductor muscle scars subequal; pallial line entire or slightly sinuate. *U.Trias.-Rec.*

Arctica SCHUMACHER, 1817 [**A. vulgaris* (=**Venus islandica* LINNÉ, 1767); M] [Not preoccupied by *Arctica* MÖHRING, 1758 (ICZN, rejected work)] [=*Cyprina* LAMARCK, 1818 (obj.; SD CHILDREN, 1823); *Armida* GISTEL, 1848 (*non* RISSO, 1826) (obj.); *Asmidia (nom. null.); Nympha* MÖRCH, 1853 (p. 36, in synon.) (obj.) (*non* MÖRCH, 1853, p. 25); *Cypriniadea* ROVERETO, 1900 *(nom. van., pro Cyprina)* (obj.)]. Solid, smooth, ovate, periostracum well developed; no lunule or escutcheon; hinge formula, *AI AIII 3a 1 3b PI/AII 2a 2b 4b PII,* with *PI* elongate, its edge striate, *PII* merged into margin, *2a* scarcely differentiated from *AII,* well separated from *2b, 1* small, tubercular, *3b* broad, bifid, *AI* and *AII* short, crenulate. *L.Cret. (Alb.)-Rec.,* Eu.-N.Atl.-N.Am.——FIG. E127,*1*. **A. islandica* (LINNÉ), Plio., Eng.; *1a,b,* RV ext., int., ×0.3 (Wood, 1853).

Agapella VOKES, 1946 [**A. rotunda*; OD]. Smooth, subcircular to subovate, with prominent umbones; hinge with narrow *3b* and large hook-shaped *2b;* evidence as to posterior lateral teeth and pallial sinus incomplete. *L.Cret.(Apt.),* SW.Asia.——FIG. E127,*5*. **A. rotunda,* Syria; *5a,b,* RV and LV hinges, ×1.5 (after *945*).

Anisocardia MUNIER-CHALMAS, 1863 [**A. elegans;* M] [=*Apocardia* DOLLFUS, 1863 (obj.); *Cardiodonta* LAUBE, 1867 (*ex* STOLICZKA MS) (type, *C. balinensis* (?M); SD COX, 1947)]. Ovate to subtrigonal or trapezoidal; superficial lunule present in some but no escutcheon; hinge formula *AI 1 3a 3b PI/AII 2a 2b PII,* with *3b* bifid, *1* strongly projecting, *2b* chevron-shaped, *2a* not well differentiated from *AI, PI* strong, elongate, *PII* merged into margin; pallial line posteriorly truncate. *M. Jur.(Bajoc.)-L.Cret.(Apt.),* Eu.-Afr.

A. (Anisocardia). Subtrigonal, posterior end more or less truncate or rostrate, umbones prominent, beaks strongly prosogyrate; surface with radial threads; inner ventral margin crenulate; anterior lateral teeth short. *M.Jur.(Bajoc.)-L.Cret.(Apt.),* Eu.-E.Afr.——FIG. E127,*3*. **A. (A.) elegans* MUNIER-CHALMAS, U.Jur.(Kimmeridg.), France; *3a,* LV ext., ×0.7 *(1026); 3b,c,* LV and RV hinges, ×1 (Cox, 1947).

A. (Antiquicyprina) CASEY, 1952 [**Cyprina loweana* MORRIS & LYCETT, 1854; OD]. Ovate, with trapezoidal tendency and obtuse posterior carina; hinge with anterior lateral teeth longer than in *A. (Anisocardia),* tooth *1* less prominent. *M.Jur.(Bathon.),* Eu.——FIG. E127,*9*. **C. sarthaloweana* (MORRIS & LYCETT), Eng.; *2a,* LV ext., ×0.7; *2b,c,* RV and LV hinges, ×0.7 *(92)*.

A. (Collignonicardia) MAHMOUD, 1955 [**A. (C.) simplex;* OD]. Sculpture of fine, serrate concentric riblets; shell trigonal, with blunt posterior carina; hinge unknown. *Cret.,* Egypt.

Coelocyprina DOUVILLÉ, 1921 [**C. sarthacensis;* OD]. Trigonal-ovate, globose, with faint radial striae, inner ventral margin crenulate; lunule deeply sunken, inhibiting development of anterior hinge teeth; posterior lateral teeth not observed. *M.Jur.(Bathon.),* Eu.——FIG. E127,*9*. **C. sarthacensis,* France; LV int., ×0.7 (after Douvillé, 1921).

Dietrichia RECK, 1921 [**D. parvula;* OD]. Ovate, smooth, evenly inflated; lunule deep; dentition imperfectly known, posterior lateral teeth apparently wanting. *Jur.,* E.Afr.——FIG. E127,*6*. **D. parvula; 6a,b,* RV int., both valves ant., ×2 (Reck).

Epicyprina CASEY, 1952 [**Venus angulata* J. SOWERBY, 1814; OD]. Ovate, with trapezoidal tendency and obtuse posterior ridge; escutcheon deep, narrow, limited by sharp carinae; hinge formula, *AI (III) 1 3a 3b PI/AII 2a 2b 4b PII,* with *1* strong, conical, anterior to *3a,* anterior laterals rugose, nymphs with interlocking rugosities; pallial line simple. *L. Cret.(Apt.-Alb.),* Eu.-Afr.-W. Indies-S. Am.——FIG. E127,*8*. **E. angulata* (SOWERBY), Alb., Eng.; *8a,* LV ext., ×0.3; *8b,c,* RV and LV hinges, ×1 *(92)*.

Etea CONRAD, 1875 [**E. carolinensis;* M]. Elongate-subovate, tapering and truncate posteriorly, umbones well forward, posterior ridge strong, posterior area flat or concave; no lunule or escutcheon; hinge longer, narrower, less massive and less arched than in *Veniella,* with smooth lateral teeth. *U.Cret.,* N.Am.——FIG. E127,*4*. **E. carolinensis,* USA(N.Car.); *4a,b,* LV ext., RV int., ×1 (Stephenson).

?Fissilunula ETHERIDGE, 1902 [**Cytherea clarkei* MOORE, 1870; M]. Large, massive, beaks prosogyrate; lunule with median sulcus; hinge with 1 cardinal in RV; pallial sinus present, small. *U.Cret.,* Australia.——FIG. E127,*11*. **F. clarkei* (MOORE), New S. Wales; *11a,b,* RV hinge, RV ext., ×0.3, ×0.2 (Etheridge, 1902).

Hartwellia KITCHIN, 1926 [**Astarte hartwellensis* J. DE C. SOWERBY, 1845; M] [=*Atalanta* SEELEY, 1864 (*non* MEIGEN, 1800) (obj.)]. Ovate or trapezoidal, posterior slope flattened, limited by ridge; beaks small and pointed; lunular area excavated, bounded by overhanging ridges; escutcheon deep, with carinate edges; sculpture *Astarte*-like in young; hinge formula, *AI AIII 1 3a 3b PIII/AII 2a 2b 4b PII,* with laterals well developed, cross-striate, *3a* and *3b* united by tuberosity, nymphs with rugose callosities; pallial line feebly sinuate. *U.Jur.-L.Cret.,* Eu.-N.Asia-N.Atl.

H. (Hartwellia). Ovate-trapezoidal, posterior ridge distinct; hinge with teeth *1* and *2b* pyramidal. *U.Jur.(Kimmeridg.)-L.Cret.(Neocom.),* NW.Eu.-N.Asia-N.Atl.——FIG. E127,*10*. **H. (H.) hartwellensis* (SOWERBY), Kimmeridg., Eng.; *10a-c,* LV ext., LV and RV hinges, ×0.5 (Casey, 1952).

H. (Tealbya) CASEY, 1952 [**Cyprina tealbiensis* WOODS, 1907; OD]. Externally like *H. (Hartwellia)* in young but becoming trigonal-ovate with ill-defined posterior ridge. *L.Cret.(Neocom.),*

Eu.——Fig. E127,7. **H. (T.) tealbiensis* (Woods), Eng.; *7a,b,* LV int., RV hinge, ×0.7 (Casey).

Isocyprina Röder, 1882 [**Cardium cyreniforme* Buvignier, 1852; SD Cossmann, 1921]. Suborbicular or ovate, evenly inflated or with feeble posterior carina; lunule superficial, mostly bounded by impressed line; escutcheon wanting; surface

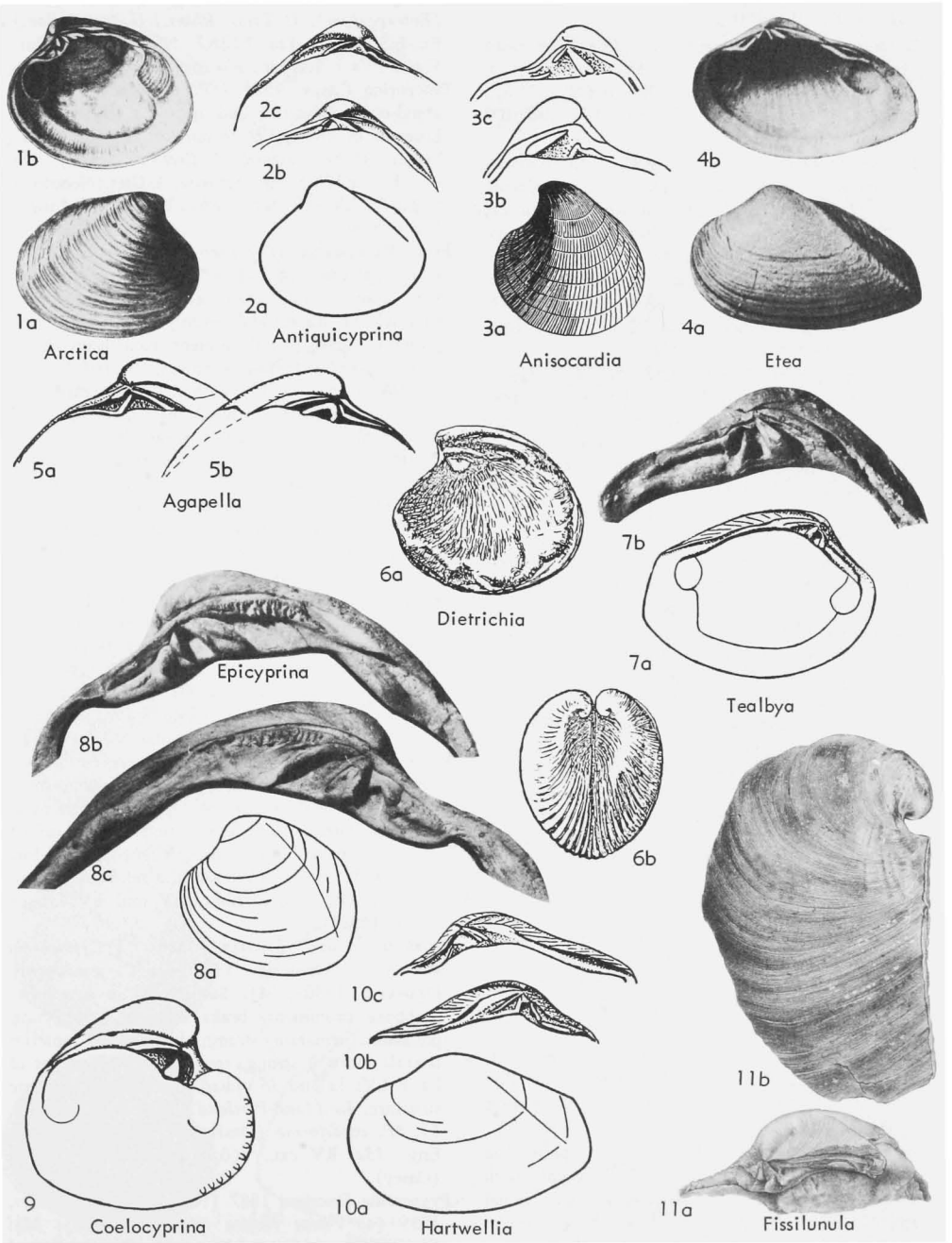


Fig. E127. Arcticidae (p. *N*646-*N*647).

smooth or with fine concentric lines; hinge formula, *AI(III) (1) (3a) 3b PI/AII (2a) 2b 4b (PII)* (teeth indicated in parentheses reduced or obsolete), lamina *AII (+2a)* joined to *2b* by vinculum, *PII* merged into margin, *PI* strong, elongate. *U. Trias.-U.Jur.*, Eu.-S.Am.

I. (Isocyprina). Hinge with tooth *2a* differentiated from *AII. Jur.(Lias.-Oxford)*, Eu.——Fig. E128, *2. *I. (I.) cyreniformis* (Buvignier), U.Jur. (Oxford), Eng.; *2a-c*, LV ext., LV and RV hinges, ×0.7 (Casey).

I. (Eotrapezium) Douvillé, 1913 [**Mesodesma germari* Dunker, 1844; OD] [=*Raetolucina* Osswald, 1929 (type, *Corbula alpina* Winkler, 1859; M)]. Suborbicular or elongate-ovate; hinge with cardinal tooth *1* scarcely differentiated from *AI*, no *2a*, lamina *AIII-3a* suppressed in most. *U.Trias.-L.Jur.(Lias.)*, Eu.-S.Am.——Fig. E128, *1. *I. (E.) germari* (Dunker), L.Jur., Ger.; *1a,b*, LV and RV hinges, ×0.7 (Cox).

I. (Venericyprina) Casey, 1952 [**I. (V.) argillacea*; OD]. Externally like *I. (Isocyprina)*, posterior end elongate or rostrate in some; hinge with lateral teeth cross-striate, lamina *AIII-3a* well developed, *2a* distinct at end of *AII. U.Jur. (Kimmeridg.)-L.Cret.(Apt.)*, Eu.——Fig. E128, *3. *I. (V.) argillacea*, U.Jur., Eng.; *3a,b*, RV int., LV hinge, ×2 (Casey).

?Izumia Ichikawa & Maeda, 1963 [**I. trapezoidalis*; OD]. Outline subtrapezoidal, surface nearly smooth but with fine radial lirae beneath outermost layer, causing crenulation of inner margins; hinge plate well developed, cardinal teeth veneroid in appearance, lateral teeth distinct; pallial line not exposed in type material. *U.Cret.*, E.Asia.——Fig. E128, *14. *I. trapezoidalis*, Japan; *4a,b*, LV int., RV int., ×2 (Ichikawa & Maeda).

?Loparia Oppenheim, 1901 [**L. katzeri*; M]. Small, obliquely trapezoidal, with angulation setting off posterior slope; surface smooth except for some thick, elevated, distant concentric ridges; hinge unknown. *Eoc.*, Eu.——Fig. E128,*6. *L. katzeri*, Bosnia; RV ext., ×3 (Oppenheim).

Microcyprina Cossmann, 1921 [**Cyprina (M.) neuvillei*; OD]. Outline cordiform, surface smooth; hinge as in *Arctica* but *AI* not crenulate, *1* bifid, *2a, 2b* thin. *Eoc.*, Eu.——Fig. E128,*4. *M. neuvillei* (Cossmann), France; *4a,b*, RV ext., int., ×1 (Cossmann, 1921).

?Mokattamia Mayer, 1890 [**M. agassizi*; M]. Rounded-ovate, resembling Mesozoic genus *Ptychomya* but shorter, with larger posterior muscle scars. *Eoc.*, Egypt. [Unfigured.]

Petalocardia Vincent, 1925 [**Venus pectinifera* Sowerby, 1823; SD Glibert, 1936]. Small, with distant spaced concentric lamellae and fine radial riblets, inner margin crenulate; hinge as in *Arctica* but with only 2 cardinal teeth in either valve. *Eoc.-Oligo.*, Eu.——Fig. E128,*5. *P. pectinifera* (Sowerby), Eoc., France; *5a,b*, RV int., LV ext., ×4 (Glibert, 1936).

Plesiocyprina Fischer, 1887 (*ex* Munier-Chalmas MS) [**P. gaudryi*; OD]. Trapezoidal, sharply carinate; surface smooth; hinge as in *Isocyprina (Eotrapezium). U.Trias.(Rhaet.)-U.Jur.(Callov.)*, Eu.-E.S.Am.——Fig. E128,*7. *P. gaudryi*, U.Jur., France; *7a,b*, LV int., RV int., ×1.7 (Fischer).

Procyprina Casey, 1952 [**P. venusta*; OD]. Trigonal-ovate, posterior end more or less truncate; hinge as in *Arctica* but *3b* narrow, anterior laterals longer. *U.Jur.(Oxford.)-L.Cret.(Valangin.)*, Eu. ——Fig. E128,*8. *P. venusta*, L.Cret.(Neocom.), Eng.; *8a*, LV ext., ×0.7; *8b,c*, LV and RV hinges, ×2 (Casey).

Pronoella Fischer, 1887 [*pro Pronoe* Agassiz, 1843 (*non* Guérin, 1838)] [**Venulites trigonellaris* von Schlotheim, 1820, auctt.; ?M]. Ovate, trigonal, or trapezoidal, evenly inflated or with posterior carina; lunule present, escutcheon absent or poorly defined; hinge formula, *AI AIII 1 3a 3b PI/AII 2a 2b 4b (PII)*, with *PII* represented only by a thickened or projected shell margin; pallial line simple or with shallow sinus. *Jur.*, Eu.

P. (Pronoella). Anterior lateral teeth strong; *1* and *2a* stoutly triangular; *2a* laminar or wedge-shaped. *Jur.(Lias.-Portland.)*, Eu.——Fig. E128, *9. *P. (P.) trigonellaris* (von Schlotheim), Ger.; *9a*, RV ext., ×0.5 (Casey); *9b,c*, LV and RV hinges, ×0.7 (Cox, 1947).

P. (Gythemon) Casey, 1952 [**P. elongata* Cox, 1944; OD]. Elongate, beaks subterminal; lunule deeply impressed; anterior lateral teeth short; hinge plate deep, with narrow, wedge-shaped cardinals. *M.Jur.(Bajoc.)*, Eu.——Fig. E128,*10. *P. (G.) elongata* Cox, Eng.; *10a*, RV ext., ×0.5; *10b,c*, RV and LV hinges, ×0.7 (Casey).

Proveniella Casey, 1952 [**Cyprina meyeri* Woods, 1913; OD]. Ovate-trapezoidal, umbones moderately to strongly prominent; hinge formula as in *Veniella*, lateral teeth cross-striate, *1* co-laminar with *AI*; pallial line entire. *Cret.*, Eu.——Fig. E128,*12. *P. meyeri* (Woods), L.Cret.(Apt.), Eng.; *12a*, LV ext., ×0.5; *12b,c*, RV and LV hinges, ×1.3 (Casey).

Pseudotrapezium Fischer, 1887 [**Cypricardia bathonica* d'Orbigny, 1850 (=**C. cordiformis* Deshayes, 1830); M]. Subtrigonal to cuneiform, umbones prominent, beaks strongly prosogyrate, posterior carination strong; hinge with anterior laterals short, *1* strong, restricting development of *2a* in LV; 3a and *3b* united into a single angulate structure. *Jur.(Lias.-Portland.)*, Eu.——Fig. E128, *13. *P. cordiforme* (Deshayes), M.Jur.(Bathon.), Eng., *13a*, RV ext., ×0.7; *13b,c*, hinges, ×0.5 (Casey).

Pygocardia Fischer, 1887 [**Cyprina tumida* Nyst, 1835 (=**Venus rustica* Sowerby, 1818); M]. Globose to quadrate; hinge with anterior lateral teeth stronger than in *Arctica*, anterior cardinal

weak, posterior laterals long, curved. *Oligo.-Plio.*, Eu.——Fig. E128,*11*. **P. rustica* (Sowerby), Plio., Eng.; *11a-c*, RV ext., LV int., RV int., ×0.5 (Wood).

Rollierella Cossmann, 1924 [*pro Rollieria* Cossmann, 1923 and Cossmann, 1924 (*non* Cossmann, 1920)] [**Isocardia laubei* Rollier, 1913 (*pro I. cordata* Laube, 1867, *non* Buckman, 1845); OD].

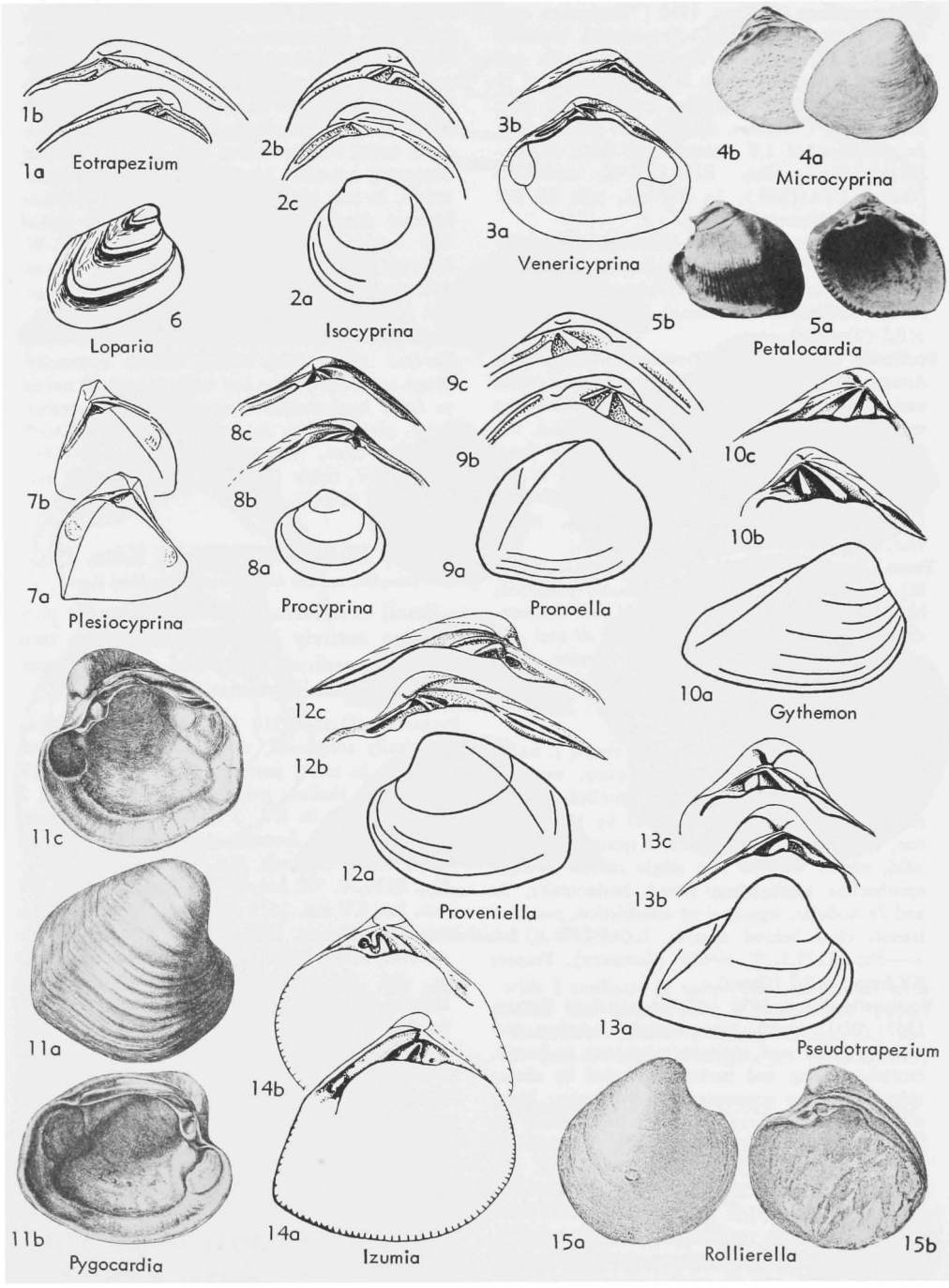


Fig. E128. Arcticidae (p. *N*648-*N*650).

Orbicular, gibbous, evenly inflated; hinge as in *Pseudotrapezium. M. Jur. (Bathon.)*, Eu.——Fig. E128,*15*. **R. laubei* (Rollier), Ger.; *15a,b*, RV ext., int., ×1 (Laube).

Schedotrapezium Stewart, 1930 [**Trapezium carinatum* Gabb, 1864; OD]. Trapezoidal, umbones well forward, posterior ridge strong; lunule and escutcheon wanting; hinge in RV with slender *3b* and laminar *3a* diverging at obtuse angle from below beak, *1* laminar, more or less parallel with *3a*, dentition of LV unknown. *U.Cret.*, N.Am.-?W.Afr.-?Eu.——Fig. E129,*1*. **S. carinatum* (Gabb), USA(Calif.); *1a*, RV ext., ×3; *1b*, RV hinge, ×8 (Stewart).

Somarctica Tamura, 1960 [**Arctica (S.) abukumensis*; OD]. Exterior as in *Arctica;* hinge with *2a* present, *3a* small. *U.Jur.*, E.Asia.——Fig. E129, *3*. **S. abukumensis* (Tamura), Japan; LV hinge, ×0.7 (Tamura).

Staffinella Casey, 1952 [**Protomiodon staffinensis* Anderson & Cox, 1948; OD]. Trigonal-ovate, umbones not prominent, lunule and escutcheon wanting; hinge like that of *Hartwellia (s.s.)*, but with teeth *1* and *2a* poorly differentiated from laterals; pallial line truncate posteriorly. *M.Jur. (Bathon.)*, Eu.——Fig. E129,*4*. **S. staffinensis* (Anderson & Cox), Scot.; *4a*, LV ext., ×0.7; *4b,c*, RV int., LV hinge, ×1.7 (Casey).

Tenea Conrad, 1870 [**Mysia parilis* Conrad, 1860; M]. Subcircular to subovate; umbones produced; hinge with *3b* broad, deeply bifid, *2b* chevron-shaped, *1* and *2a* attached to vestigial *AI* and *AII*, no posterior laterals; pallial sinus narrow, deep. *U.Cret.*, N.Am.——Fig. E129,*7*. **T. parilis* (Conrad), USA(Tex.); *7a*, LV ext., ×1; *7b,c*, RV and LV hinges, ×2 (Stephenson).

Tortarctica Casey, 1961 [**Isocardia similis* J. de C. Sowerby, 1826; OD]. Trigonal-ovate, well inflated, beaks prominent, spirally enrolled, lunular area depressed, escutcheon limited by blunt carinae; hinge with *AIII* pustular, *1* spoon-shaped, *3b* bifid, united with *3a* into single curved strongly opisthocline tooth lying almost horizontally, *2a* and *2b* nodular, separated by constriction, posterior laterals close behind nymph. *L.Cret.(Alb.)*, Eu. ——Fig. E129,*5*. *T. similis* (Sowerby), France; RV hinge, ×0.7 (Casey).

Vectianella Casey, 1952 [**Tellina vectiana* Forbes, 1845; OD]. Small, trigonal-ovate, tapering posteriorly, compressed, umbones subcentral, no lunule, escutcheon long and narrow, bounded by obtuse ridges; sculpture concrescent, finely lineate; hinge with *1* and *3a* large, laminar, *3b* minute, *2b* stoutly triangular, bifid, anterior laterals obsolescent. *L.Cret.(Apt.)*, NW.Eu.——Fig. E129,*2*. **V. vectiana* (Forbes), Eng.; *2a*, LV ext., ×0.7; *2b,c*, LV and RV hinges, ×1 (Casey).

Veniella Stoliczka, 1870 [*pro Venilia* Morton, 1833 (*non* Duponchel, 1829)] [**Venilia conradi* Morton, 1833; M] [=*Goniosoma* Conrad, 1869 (*non* Perty, 1833) (type, *G. inflata*; M); *Cicatrea* Stoliczka, 1870 (type, *Cyprina cordialis;* OD); *Roudairia* Munier-Chalmas, 1881 (type, *R. drui;* M) *(Roudaireia, nom. null.); Trigonocardia* Zittel, 1881 (in synonymy of *Roudairia*); *Platopis* Whitfield, 1891 (type, *Opis undata* Conrad, 1852; SD Woodward, 1892) *(Platopsis, nom. null.); Venetia, Venniella, nom. null.*]. Subtrapezoidal and moderately ventricose in young, obliquely subtrigonal and strongly ventricose in adult, umbones prominent, beaks prosogyrate, posterior carina strong; surface with distant thickened concentric lamellae; hinge massive, laterals cross-striate, *3a* and *3b* united in hook-shaped structure inserted posterior to tubercular tooth *1;* pallial line truncate posteriorly. *U.Cret.*, Asia-Afr.-W. Indies-N.Am.-S.Am.——Fig. E129,*6*. **V. conradi* (Morton), USA(Miss.); *6a,b*, LV int., RV hinge, ×1 (Casey, n).

Venilicardia Stoliczka, 1870 [**Cyprina bifida* Zittel, 1865; OD]. Like *Arctica* externally; hinge as in *Epicyprina* but with *3a* and *3b* united to form hook-shaped structure, *1* strong, tubercular, placed below *3a*, nymphs and lateral teeth smooth. *Cret.*, Eu.-Afr.-S. Asia-S. Am. —— Fig. E129,*8*. **V. bifida* (Zittel), Ger.; *8a,b*, RV ext., int., ×0.5 (Zittel).

Family BERNARDINIDAE Keen, 1963

[Materials for this family prepared by Myra Keen]

Small to minute shells with ligament partially to entirely internal; hinge with two or three cardinal teeth and two or more laterals; pallial line entire. *Rec.*

Bernardina Dall, 1910 [**B. bakeri;* OD]. Concentrically sculptured, thin, prodissoconch set off by ridge in some; posterior dorsal margin of RV fitting into shallow groove in LV; hinge with 2 cardinal teeth in RV, 3 in LV, anterior lateral strong in LV, 2 flexuous laterals in RV; resilium in pit behind cardinals. *Rec.*, W.N.Am.-C.Am.—— Fig. E130,*10*. **B. bakeri*, USA(Calif.); *10a-c*, RV ext., int., LV int., ×12 (specimen, Stanford coll.).

Halodakra Olsson, 1961 [**Circe subtrigona* Carpenter, 1857; OD]. Ovate, inequilateral, smooth or with concentric striae; posterior area with chevron-shaped color markings in some; ligament in shallow resilifer, somewhat sunken; hinge with 3 or more teeth in cardinal area, posterior lateral behind resilifer more or less well developed; posterior margins of shell grooved to receive opposite valve; pallial line indistinct, apparently entire. *Rec.*, W.N.Am.-S.Am.——Fig. E130,*7*. **H. subtrigona* (Carpenter), Ecuador; *7a,b*, LV and RV hinges, ×13; *7c*, LV ext., ×7 *(688)*.

Family EULOXIDAE Gardner, 1943

[Materials for this family prepared by Myra Keen]

Ovate, inequilateral, not elongate; hinge

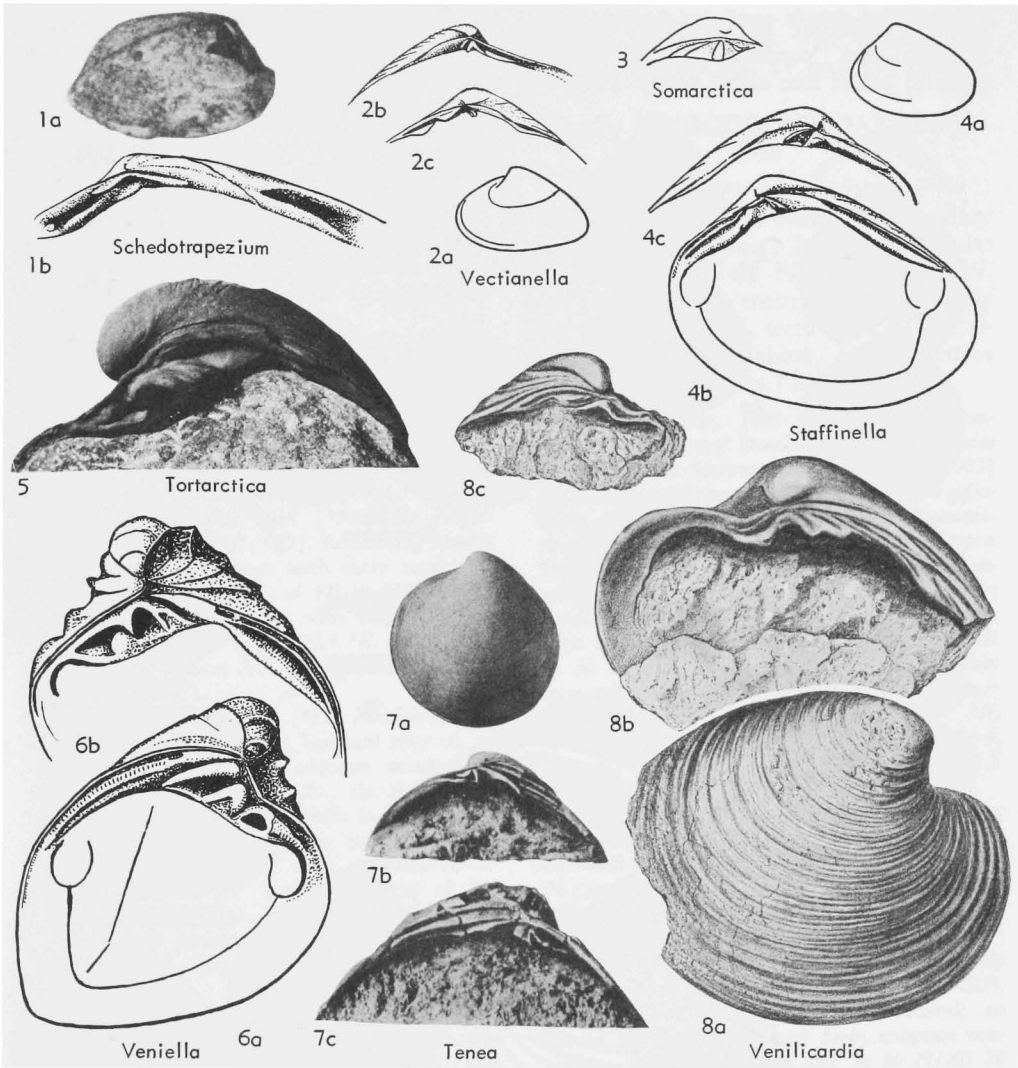


FIG. E129. Arcticidae (p. *N*650).

with two or three cardinal teeth, no posterior laterals; pallial line entire. *Mio.*

Euloxa CONRAD, 1863 [**Venus latisulcata* CONRAD, !840; M]. Sculpture of concentric undulations; posterior slope set off by radial ridge; hinge with 3 cardinals in LV, 2 in RV. *Mio.,* E.N.Am.——FIG. E130,*6*. **E. latisulcata* (CONRAD), USA(Va.); *6a-c,* LV ext., RV int., LV int., ×1 (Nicol, 1953).

Cabralista KEEN, *nom. subst.* herein [*pro Cabralia* BÖHM, 1899 (*non* MOORE, 1886)] [**Cabralia schmitzi* BÖHM, 1899; M]. Ovate to trapezoidal, with both radial and concentric sculpture; hinge with 3 cardinals in either valve, no lateral teeth; pallial line entire. *Mio.,* E.Atl.——FIG. E130,*9*. **Cabralista schmitzi* (BÖHM), Salvages Is.; *9a-c,* LV ext., LV and RV hinges, ×1 (Böhm, 1899).

Family KELLIELLIDAE Fischer, 1887

[*nom. correct.* DALL, 1900 (*pro* Kellyellidae FISCHER, 1887)]
[Materials for this family prepared by MYRA KEEN]

Small to minute, equivalve, mostly suborbicular; not gaping; ligament mostly external, some with resilium or fossette under beak; hinge incompletely developed, anterior

lamellae adjacent to cardinals, posterior lamellae not constant; inner margins smooth; pallial line entire *(854). Tert.-Rec.*

Kelliella M. SARS, 1870 [**K. abyssicola* (=**Venus miliaris* PHILIPPI, 1844); M] [=*Kelliella* M. SARS, 1865, 1868, AUCTT. *(nom. nud.); Kellyella*

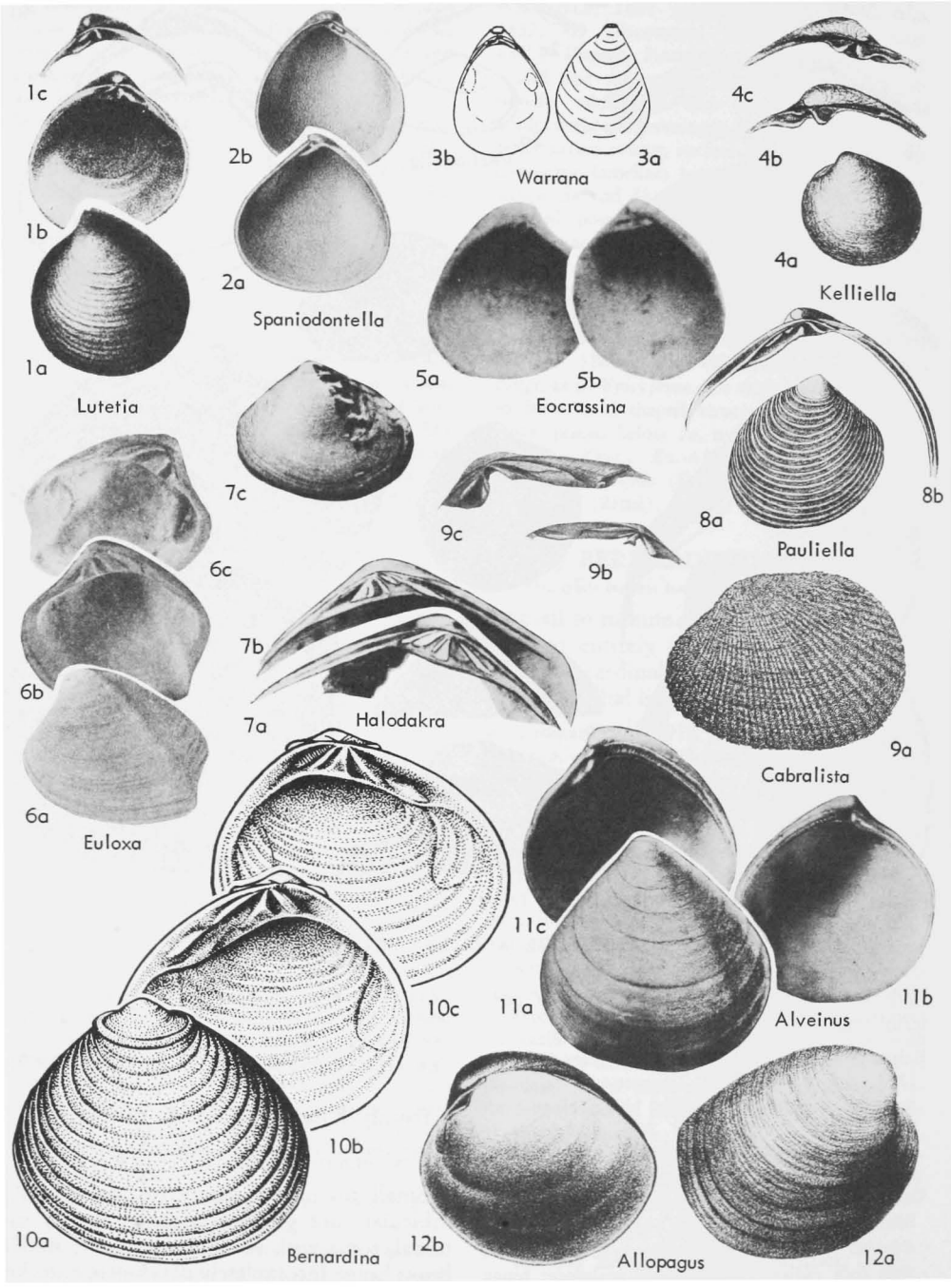


FIG. E130. Bernardinidae *(7,10);* Euloxidae *(6,9);* Kelliellidae *(1-5,8,11-12)* (p. *N650-N653*).

FISCHER, 1887 *(nom. null.)*]. Minute, rounded-ovate; lunule circumscribed; hinge with 2 teeth in LV, 1 cardinal and anterior lateral in RV. *Tert.-Rec.*, Atl.-Medit. [Deep-water.]. —— FIG. E130,*4*. **K. miliaris* (PHILIPPI), Rec., Norway; *4a*, LV ext., ×6; *4b,c*, RV and LV hinges, enl. *(829)*.

Allopagus STOLICZKA, 1871 [**Hippagus leanus* DESHAYES, 1860; OD]. Minute, thin, ovate, very inequilateral, tumid, beaks small; hinge of RV with 1 cardinal in front of beak, LV with cardinal below. *M.Eoc.*, Eu.——FIG. E130,*12*. **A. leanus* (DESHAYES), France; *12a,b*, RV ext., int., ×10 *(259)*.

Alveinus CONRAD, 1865 [**A. minutus;* M]. Smooth; ligamental nymph feeble; resilium in cavity under beaks; hinge of RV with 2 parallel teeth; LV with single tooth bent or A-shaped; posterior margin of RV grooved. *U.Eoc.-Mio.*, Eu.-N.Am.——FIG. E130,*11*. **A. minutus*, Eoc., USA(La.-Miss.); *11a-c*, LV ext., int., RV int., ×14 *(388)*.

?Eocrassina COSSMANN, 1914 [**Parisiella veneriformis* COSSMANN, 1907; OD]. Resembling *Lutetia* but nymph larger, hinge teeth more regular, *1* and *3b* in RV, *2a, 2b*, and *PII* in LV; margin even, not grooved; muscle scars large, high in shell. *U.Eoc.*, Eu.——FIG. E130,*5*. **E. veneriformis* (COSSMANN), France; *5a,b*, LV int., RV int., ×10 (Cossmann, 1907).

Lutetia DESHAYES, 1860 [**L. parisiensis;* SD STOLICZKA, 1871]. Globose, ligament external, on nymph, resilium wanting; adductor muscle scars small, equal, oval. *L.Eoc.-Mio.*, Eu.-N.Am.-Asia.

L. (Lutetia). Hinge with 3 teeth in either valve, RV with posterior tooth nearly marginal, central tooth L-shaped, anterior tooth deflected downward, teeth in LV laminar; margin of RV grooved. *L.Eoc.-Oligo.*, Eu.-N.Am.——FIG. E130, *1*. **L. (L.) parisiensis* DESHAYES, Eoc., France; *1a-c*, LV ext., int., RV hinge, ×10 (Deshayes, 1858).

L. (Spaniodontella) ANDRUSSOV in GOLUBIATNIKOV, 1902 [*pro Spaniodon* REUSS, 1867 (*non* PICTET, 1851)] [**Spaniodon nitidus* REUSS, 1867; M] [=*Davidaschvilia* MERKLIN, 1950 (type, *Spaniodontella intermedia* "ANDRUSSOV" GOLUBIATNIKOV, 1902; OD)]. Slightly larger than *L. (Lutetia)*, hinge teeth relatively larger, especially central teeth; hinge plate wider. *Mio.*, Eu.-SW.Asia. ——FIG. E130,*2*. **L. (S.) nitida* (REUSS), Ger.; *2a,b*, RV int., LV int., ×7 (Reuss, 1867).

Pauliella MUNIER-CHALMAS, 1895 [**P. bernardi;* M]. Ovate, sculpture concentric; hinge with 3 cardinal teeth in either valve, 2 posterior laterals, 3 anterior lateral laminae. *Rec.*, Ind.O.——FIG. E130,*8*. **P. bernardi*, St. Paul I.; *8a*, RV ext., ×5; *8b*, RV hinge, ×10 *(44)*.

Warrana LASERON, 1953 [**W. dielasma;* OD]. High-ovate, with concentric sculpture; prodissoconch distinct; ligament internal; hinge of LV with thin arched cardinal and linear obscure laterals. *Rec.*, Australia.——FIG. E130,*3*. **W. dielasma*, SE. Australia; *3a,b*, RV ext., LV int., ×18 *(531)*.

Family NEOMIODONTIDAE Casey, 1955

[Materials for this family prepared by RAYMOND CASEY]

Shells subtrigonal to ovate, smooth, inner margins smooth; hinge lucinoid, formula: *AI AIII 3a 3b 5b PI PIII/AII 2b 4b PII*, with cardinal teeth entire, laterals typically long and corbiculoid, teeth *5b, PIII* not always developed. [Habitat, fresh-water or seas of reduced salinity.] *L.Jur.-U.Cret.*

Neomiodon FISCHER, 1887 [*pro Miodon* SANDBERGER, 1871 (*non* DUMÉRIL, 1859)] [**Cyclas medius* J. DE C. SOWERBY, 1826; SD DALL, 1903] [=*Bidentina* OPPENHEIM, 1895 (obj.; *pro Miodon*); *Miodontopsis* DALL, 1903; *Protomiodon* ANDERSON & COX, 1948 (type, *Cyrena brycei* TATE, 1873; OD)]. Subtrigonal, ovate to suborbicular, with no definite lunule or escutcheon; smooth or with weak concentric sculpture, posterior slope more or less ridged; hinge formula, *AI AIII 3a 3b PI PIII/AII 2b 4b PII*, laterals minutely cross-striate; pallial line entire. *M.Jur.(Bathon.)-L.Cret.(Weald.)*, Eurasia.——FIG. E131,*8*. **N. medius* (SOWERBY), U.Jur.(Purbeck.), Eng.; *8a-d*, LV ext., RV int., LV hinge, LV dorsal, ×1.5 (Casey).

Crenotrapezium HAYAMI, 1958 [**C. kurumense;* OD]. Externally resembling a cuneiform *Neomiodon* but with hinge of *Eomiodon*. *L.Jur.(Lias.), ?L.Cret.(Weald.)*, E.Asia.——FIG. E131,*1*. **C. kurumense*, Lias, Japan; *1a-c*, LV ext., dorsal, hinge, ×1; *1d*, RV hinge, ×2 (Hayami).

Cyrenopsis ETHERIDGE, 1902 [**Mactra meeki* =*Unicardium meeki* ETHERIDGE, 1892; OD]. Subtrigonal to suborbicular, evenly inflated; no lunule, escutcheon long and deep; sculpture concentric; hinge-formula, *AI AIII 3a 3b PI/AII 2b 4b PII*, with smooth laterals; pallial line entire. *L.Cret.(Apt.)*, Australia.——FIG. E131,*3*. **C. meeki* (ETHERIDGE); *3a,b*, RV ext., LV int., ×0.7 (Jack and Etheridge).

Eomiodon COX, 1935 [**E. indicus;* OD] [=*Protocyprina* VOKES, 1946 (type, *Astarte libanotica* FRAAS, 1878; OD)]. Gibbous-trigonal, cuneiform, or suborbicular, lunule and escutcheon impressed, smooth, lunule limited by furrow, escutcheon by ridge; sculpture concrescent *Astarte*-like in young; hinge as in *Neomiodon* except for presence of small *5b* and absence of *PIII*; pallial line truncate posteriorly. *L.Jur.(Lias.)-U.Cret.(?Cenoman.)*, Eu.-N.Afr.-Asia-N.Am.——FIG. E131,*6*. **E. indicus*, M.Jur., India; *6a,b*, LV and RV hinges, ×1 (Cox).

Musculiopsis MACNEIL, 1939 [**M. russelli;* OD].

Subrectangular, posteriorly truncate; lunular area excavated, escutcheon wanting; young with posterior carina; surface nearly smooth; hinge of LV with strong *2b*, slender *4b*, short *AII* and long *PII* adpressed to margin, dentition of RV imperfectly known; pallial line apparently entire. *L.Cret.*, N. Am.——Fig. E131,*7*. **M. russelli*, USA(Nev.); *7a*, RV ext., ×2; *7b*, LV int., ×3 (MacNeil).

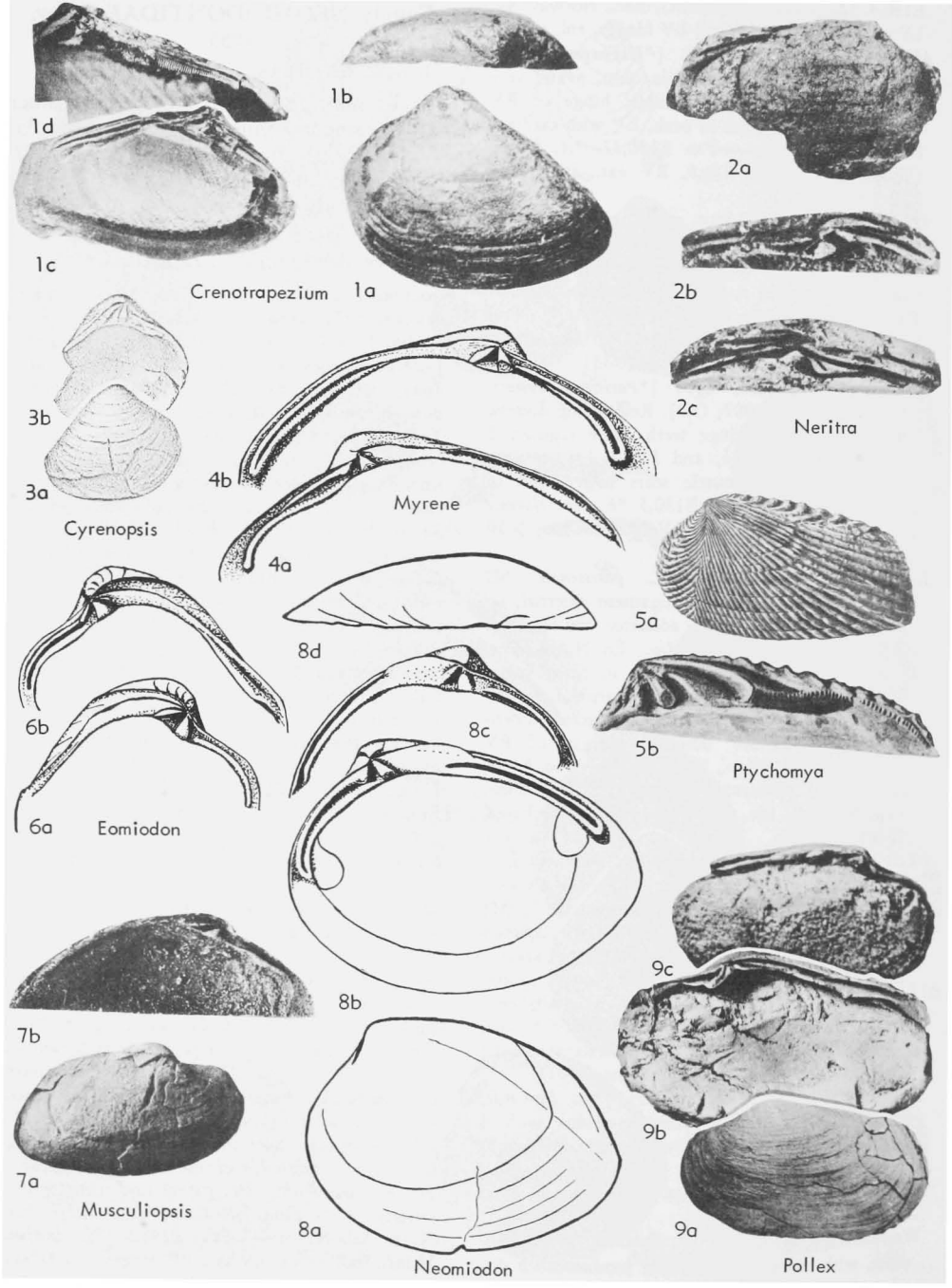


Fig. E131. Neomiodontidae *(1,3-4,6-8)*; Pollicidae *(2,9)*; Ptychomyidae *(5)* (p. *N653-N655*).

Myrene CASEY, 1955 [**M. fittoni*; OD]. Cuneiform, trigonal-ovate, or trapezoidal; lunule and escutcheon not clearly defined; posterior slope ridged or carinate, posterior area flattened, with or without second ridge or carina; surface smooth or with concentric riblets; hinge formula, *AI AIII 3a 3b 5b PI/AO AII 2b 4b PO PII*, laterals cross-striate in most; pallial line entire. *U.Jur.(Oxford.)-L.Cret. (Ryaz.)*, Eu.-NE.Asia.——FIG. E131,*4*. **M. fittoni*, L.Cret., Eng.; *4a,b*, RV and LV hinges, ×2 (Casey).

Family POLLICIDAE Stephenson, 1953

[Materials for this family prepared by MYRA KEEN]

Elongate, plump, subelliptical, ligament external, opisthodetic; inner margins of shell smooth, shape of muscle scars and pallial line unknown. *U.Cret.*

Pollex STEPHENSON, 1953 [**P. obesus;* OD]. Sculpture of faint radial lines, hinge with 3 cardinal teeth in either valve; anterior cardinal with 2 cusps; posterior lateral tooth long, lamellar. *U. Cret.*, N.Am.——FIG. E131,*9*. **P. obesus*, Cenoman., USA(Tex.); *9a*, LV ext., ×1; *9b*, RV int., ×1.3; *9c*, LV int., ×3 (Stephenson).

Neritra STEPHENSON, 1954 [**N. polliciformis;* OD]. Resembling *Permophorus* (Permophoridae) in form but with hinge somewhat more like that of *Pollex*, except that anterior cardinal in RV is narrower and central cardinal broader. *U.Cret.*, N.Am.——FIG. E131,*2*. **N. polliciformis*, USA(N.J.); *2a*, RV ext., ×1; *2b,c*, int., LV and RV hinges, ×3 (Stephenson).

Family PTYCHOMYIDAE Keen, new family

Elongate-ovate shells of solid texture, with well-developed radial sculpture; hinge of somewhat veneroid aspect but also with astartoid resemblances, the formula, *AIII 3a 1 3b PIII/AII 2a 2b 4b PII*. *?U.Jur., L.Cret.-U.Cret.*

Ptychomya AGASSIZ, 1842 [**P. plana;* M] [=*Radioconcha* CONRAD, 1869 (type, *Crassatella robinaldina* D'ORBIGNY, 1844 [=*P. plana*]; SD KEEN, herein)]. Ovate-trapezoidal; ligamentary depression broad and long; hinge with *2a-2b* joined above; pallial line truncate. *?U.Jur., L.Cret.-U.Cret.*, Eu.-N.Am.-S.Am.-Afr.

P. (Ptychomya). Radial sculpture becoming divaricate on anterior and posterior slopes, rib ends showing as crenulations of inner margins. *?U. Jur., L.Cret.-U.Cret.*, Eu.-N.Am.-S.Am.-Afr.——FIG. E131,*5*. **P. (P.) plana* AGASSIZ, L.Cret., Eng.; *5a*, LV ext., ×0.5; *5b*, RV hinge, ×1 (Woods, 1907).

P. (Pleuroconcha) CONRAD, 1872 [**Crassatella "gallieni"* (i.e., **Crassatella galliennei* D'ORBIGNY, 1844); M]. Radial sculpture not divaricate, *U. Cret.*, Eu.

Family TRAPEZIIDAE Lamy, 1920

[=Lithophagellidae COSSMANN, 1910; Libitinidae THIELE, 1924] [Materials for this family prepared by MYRA KEEN]

Elongate, beaks near anterior end; hinge plate narrowed, normally with two cardinals in either valve, one posterior and one small anterior lateral; pallial line mostly entire. *?L.Cret., U.Cret.-Rec.*

Trapezium MEGERLE VON MÜHLFELD, 1811 [**T. perfectum* (=*Chama oblonga* LINNÉ, 1758); SD STEWART, 1930] [=*Libitina* SCHUMACHER, 1817 (type, *L. bicarinata;* M); *Cypricardia* LAMARCK, 1819 (type, *C. guinaica*, =*Chama oblonga* LINNÉ; SD CHILDREN, 1823)]. Oblong, solid, ligament external. Nestling in crevices. *Eoc.-Rec.*, N.Am.-Eu.-IndoPac.-Ind.O.

T. (Trapezium). Surface with radiating striae; inner margin smooth. *Eoc.-Rec.*, E.N.Am.-Eu.-E. Indies.—FIG. E132,*9*. **T. (T.) oblongum* (LINNÉ), Rec., E.Indies; *9a,b*, LV ext., RV int., ×1 (de Blainville, 1825).

T. (Glossocardia) STOLICZKA, 1870 [**Cypricardia obesa* REEVE, 1843; OD]. More quadrate than *T. (Trapezium)*, radial striae not present; hinge teeth more strongly developed. *Rec.*, IndoPac.——FIG. E132,*1*. **T. (G.) obesum* (REEVE); *1a,b*, RV int., LV int., ×0.5 *(305)*.

T. (Neotrapezium) HABE, 1951 [**Cardita sublaevigata* LAMARCK, 1819; OD]. Radial sculpture wanting; shell quadrangular, compressed, distorted by nestling habit; posterior lateral teeth weak and small. *Rec.*, IndoPac.——FIG. E132,*2*. **T. (N.) sublaevigatum* (LAMARCK), Ind.O.; *2a,b*, LV ext., RV int., ×1.5 *(512)*.

Coralliophaga DE BLAINVILLE, 1824 [**C. carditoidea* (=**Chama coralliophaga* GMELIN, 1791); M] [=*Lithophagella* GRAY, 1854 (type, *Cardita dactyla* BRUGUIÈRE, 1792; OD)]. Thin, translucent, sculpture of radiating striae or granules; hinge reduced. *Eoc.-Rec.*, Eu.-W.Indies-E.Indies-N.Am.

C. (Coralliophaga). Posterior end with elevated concentric ridges; pallial line sinuate. *Eoc.-Rec.*, Eu.-W.Indies-E.Indies.——FIG. E132,*6*. **C. (C.) coralliophaga* (GMELIN), Rec., W.Indies; *6a-c*, RV int., ext., LV hinge, ×1 *(7)*.

C. (Oryctomya) DALL, 1898 [**C. (O.) claibornensis;* OD]. Surface granular; hinge with 1 cardinal in either valve; pallial sinus distinct, angular. *Eoc.-Mio.*, E.N.Am.——FIG. E132,*4*. **C. (O.) claibornensis*, Eoc., USA(Ala.); *4a*, LV ext., ×1; *4b*, enl. *(223)*.

?Corbiculopsis WHITFIELD, 1891 [**C. birdi;* M]. Trapezoidal, wider posteriorly, somewhat carinate;

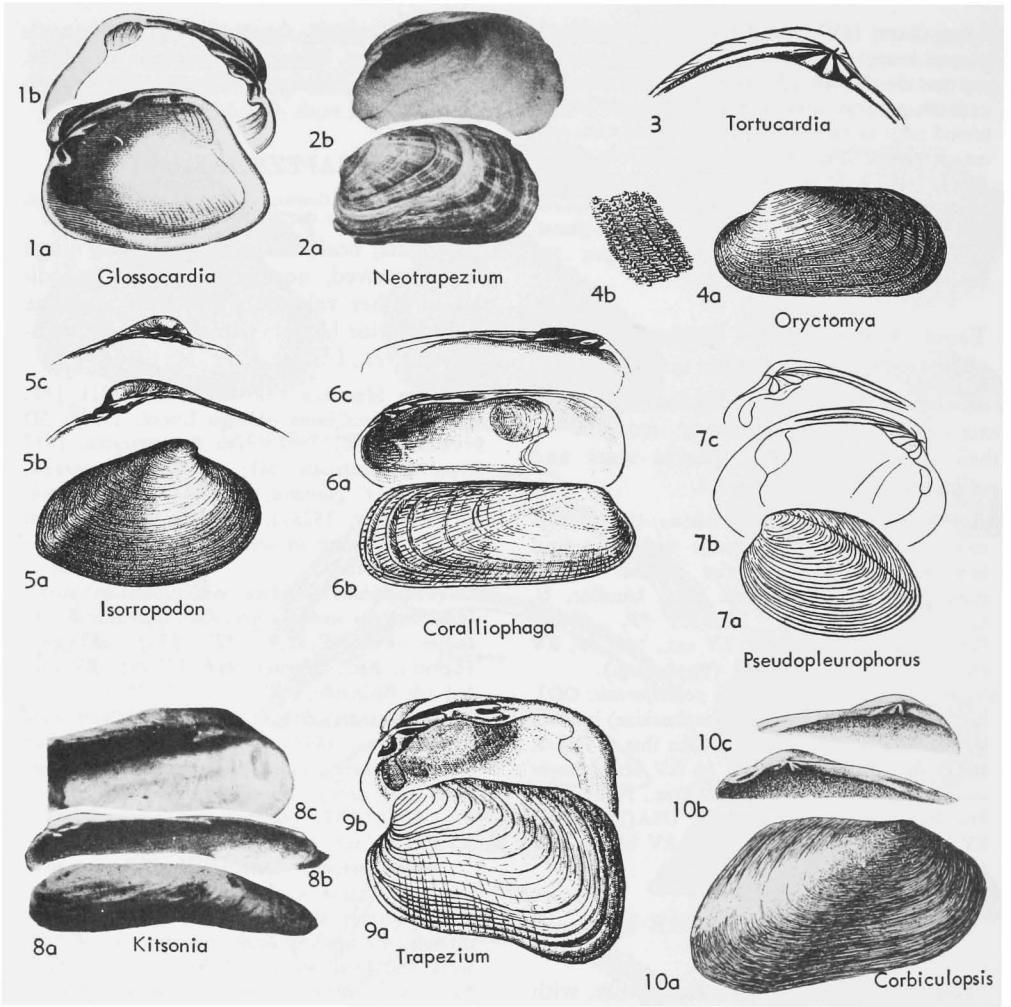


FIG. E132. Trapeziidae (p. *N655-N657*).

hinge imperfectly known, *2a* and *3b* bifid. *L.Cret. (Apt.)*, SW.Asia.——FIG. E132,*10*. **C. birdi*, Syria; *10a-c*, RV ext., RV and LV hinges, ×0.7 (Whitfield).

?Isorropodon STURANY, 1896 [**I. perplexum*; M]. Ovate, inequivalve, LV smaller than RV; posterior area set off by radial ridge. [Deep-water.] *Rec.*, Medit.——FIG. E132,*5*. **I. perplexum*, off Egypt; *5a-c*, RV ext., RV and LV hinges, ×2.5 (Sturany, 1896).

Kitsonia EAMES, 1957 [**Coralliophaga eocenica* NEWTON, 1922; OD]. Thin, elongate, smooth, ligament external, long; hinge with larger teeth than in *Coralliophaga*, 2 cardinals in RV, posterior bifid, 1 lamellar cardinal in LV; adductor impressions large; pallial sinus 0.4 of shell length. *Eoc.*, W.Afr.——FIG. E132,*8*. **K. eocenica* (NEWTON), Nigeria; *8a,b*, LV ext., RV int., ×2.5; *8c*, LV hinge, ×5 (Eames, 1957).

Pseudopleurophorus CHAVAN, 1954 [**P. rochi*; OD]. Ovate-trapezoidal, surface with growth rugae only, posterior area set off by ridge; hinge with strong posterior lateral in RV received between duplicate laterals in LV, *3a* wanting. *U.Cret.*, C.Afr.——FIG. E132,*7*. **P. rochi*, Tchad; *7a-c*, LV ext., int., RV hinge, ×1.5 (Chavan).

Tortucardia OLSSON, 1944 [**Glossocardia (T.) stephensoni*; OD]. Oblong, with strong posterior carina, beaks small; escutcheon narrow; hinge with *2a*, *2b*, and *4b* stout, subequal, *All* close to

margin, dentition of RV imperfectly known. *U. Cret.(Maastricht.),* S.Am.——Fig. E132,*3*. **T. stephensoni* (Olsson), Peru; LV hinge, ×1 (Olsson).

Family MECYNODONTIDAE Haffer, 1959

[Materials for this family prepared by Aurèle LaRocque]

Characters of *Mecynodon. M.Dev.*

Mecynodon Keferstein, 1857 [**Megalodus carinatus* Goldfuss, 1837; SD Haffer, 1859] [=*Mecinodon* French, 1889; *Mecynodus* Beushausen, 1895 (obj.)]. Rhomboidal, with strong postumbonal ridge; surface concentrically striate or smooth; dental formula: *1 3 1 III/2a 2p II. M.Dev.,* Eu.(Ger.-Eng.); *M.Dev.(Onondag.),* N.Am.——Fig. E133,*1*. **M. carinatus* (Goldfuss), Dev. (*Stringocephalus* Ls.), Ger.; *1a,b,* RV ext., int., approx. ×1 *(47); 1c,d,* LV and RV hinges (diagram.) (Haffer, 1959); *1e,* RV int., ×1 (Haffer, 1959).

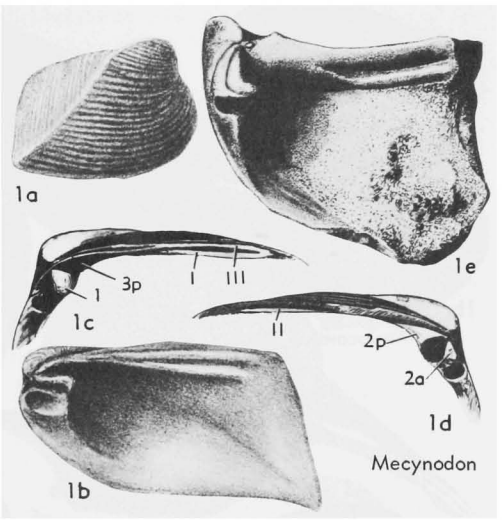


Fig. E133. Mecynodontidae (p. *N657*).

Superfamily GLOSSACEA Gray, 1847

[*nom. transl.* Habe, 1951 (*ex* Glossidae Gray, 1847)] [=Isocardiacea Gray, 1842 (*nom. transl. et correct.* Dall, 1895, *ex* Isocardiadae Gray, 1842); Arcticacea auctt. *(partim)*] [Family-group names based on *Isocardia* Lamarck, 1799, are invalid (Code, Art. 11e)] [Materials for this superfamily prepared by Myra Keen and Raymond Casey with additions as recorded]

Shells inequilateral, mostly equivalve, beaks well forward, spirally twisted in most; surface smooth or with some concentric (rarely any radial) ribbing; ligament external; hinge of the form termed cyprinoid by authors, having 2 or 3 cardinal teeth in each valve and well-developed laterals in most; teeth tend to be parallel to hinge margins; pallial line normally entire (sinuate in a few). *U.Trias.-Rec.*

Family GLOSSIDAE Gray, 1847

[=Isocardiadae Gray, 1842] [Materials for this family prepared by Myra Keen and Raymond Casey]

Rotund to cordiform, not gaping, with prosogyrate to gyrate beaks; no lunular groove; ligament and resilium in deep groove; hinge with two lamellar cardinals in either valve, variable in form, laterals inconstant; adductor scars equal; internal margin smooth; pallial line entire. *Paleoc.-Rec.*

Glossus Poli, 1795 [**G. rubicundus* (=*Cardium humanum* Linnè, 1758); M] [=*Cuculla* Seba, 1781 *(nonbinom.); Glossoderma* Poli, 1795 (obj.); *Isocardia* Lamarck, 1799 (obj.; SD Children, 1823); *Buccardium* Megerle von Möhlfeld, 1811 (obj.); *Bucardia* Schumacher, 1817 (obj.); *Tychocardia* Roemer, 1868 (obj.)]. Beaks gyrate, lunular area depressed. *Paleoc.-Rec.,* Eu.-N.Atl.-W.Asia-IndoPac.

G. (Glossus). Cordiform, smooth, ligament long. *L.Oligo.-Rec.,* Eu.-N.Atl.——Fig. E134,*4*. **G. (G.) humanus* (Linné), Rec., N.Atl.; *4a,* LV ext., ×0.5; *4b,c,* RV and LV hinges, ×1 *(124b)*.

G. (Aralocardia) Vyalov, 1937 [**Isocardia eichwaldiana* Romanovsky, 1890; OD]. Beaks strongly coiled; concentric sculpture strong especially on umbones. *U.Eoc.-L.Oligo.,* Eu.-W.Asia.——Fig. E134,*1*. *G. (A.) multicostatus* (Nyst, 1845), Oligo., Ger.; *1a,b,* LV ext., hinge, ×0.5 (Von Koenen, 1893).

G. (Cytherocardia) Sacco, 1900 [**Isocardia cytheroides* Mayer, 1868; OD]. Smaller than *G. (Glossus)*, more ovate, beaks less twisted, hinge thinner. *Eoc.-Mio.,* Eu.——Fig. E134,*9*. **G. (C.) cytheroides* (Mayer), Mio., France; LV ext., ×1 (Mayer, 1868).

G. (Meiocardia) H.Adams & A.Adams, 1857 [**M. moltkiana* "Spengler" (=**Chama moltkiana* Gmelin, 1791); SD Stoliczka, 1870] [=*Miocardia (nom.null.)*]. Surface concentrically grooved. *Paleoc.-Rec.,* Eu.-IndoPac.——Fig. E134, *7*. **G. (M.) moltkianus* (Gmelin), Rec., E.Indies; LV ext., ×1 *(124b)*.

G. (Miocardiella) Sacco, 1904 [**M. taurinensis*; OD]. Small, subtrigonal, beaks prosogyrate, not coiled. *Tert.,* Eu.——Fig. E134,*3*. **G. (M.) taurinensis* (Sacco), Neog., Italy; *3a,b,* LV ext., RV ext., ×3 (Sacco, 1904).

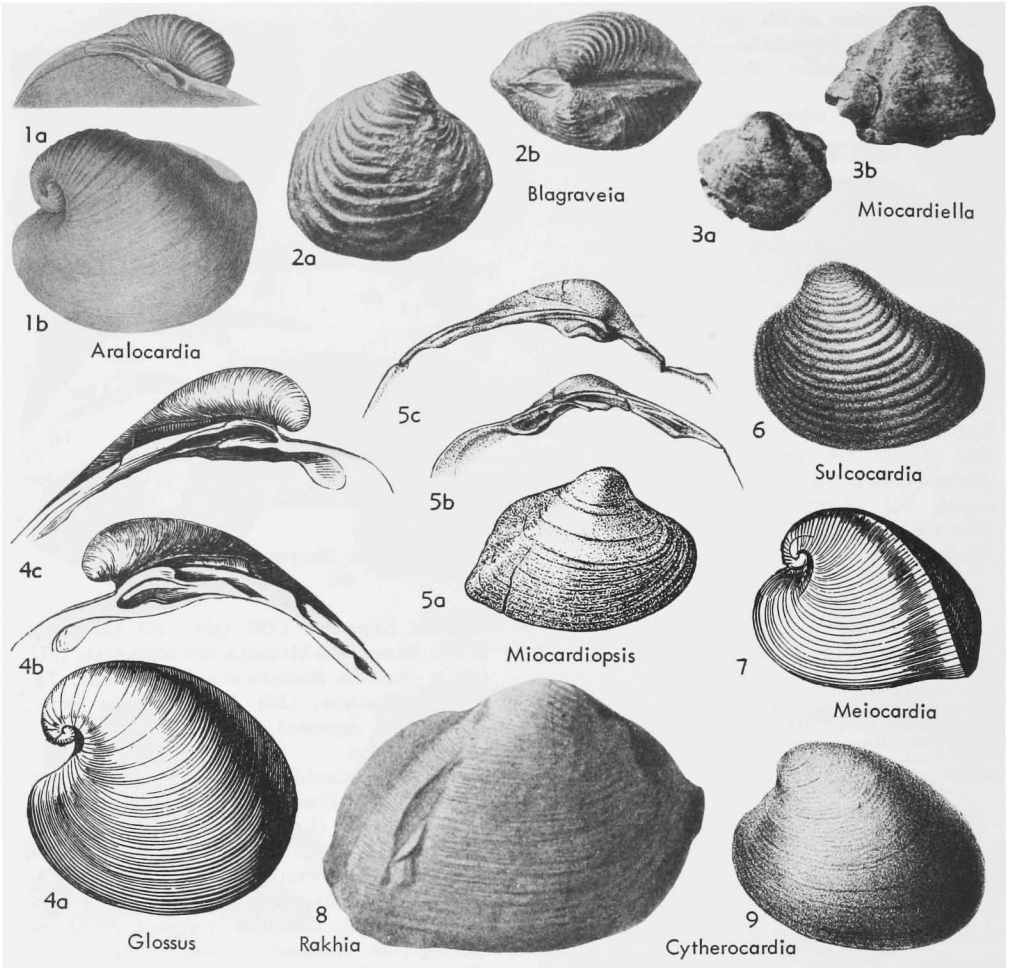


FIG. E134. Glossidae (p. *N657-N658*).

G. (Miocardiopsis) GLIBERT, 1936 [**Anisocardia eocaenica* BAYAN, 1873; OD]. Ovate, beaks not twisted; hinge with 1 cardinal absent in RV and only 1 anterior lateral. *Eoc.*, Eu.——FIG. E134,*5*. **G. (M.) eocaenicus* (BAYAN), Belg.; *5a*, RV ext., ×2; *5b,c*, RV and LV hinges, ×3 (Glibert, 1936).

G. (Sulcocardia) ROVERETO, 1898 [**Isocardia justinensis* MAYER, 1893; OD]. Small, oblique, not carinate, with incised concentric grooves, no lunule; hinge of LV with 2 cardinals, *2a* medium-sized, *2b* stronger, obliquely arcuate. *Oligo.*, Eu. ——FIG. E134,*6*. **G. (S.) justinensis* (MAYER), Italy; LV ext., ×2 (Mayer, 1893).

?Blagraveia Cox, 1933 [**B. corrugata*; OD]. Trigonally ovate, inequilateral, shell thin; sculpture of concentric undulations; lunule deeply set, forming lamina within shell cavity; hinge with 2 cardinal teeth in either valve, no laterals; pallial line and muscle scar outlines not evident in type material. *Eoc.*, Asia.——FIG. E134,*2*. **B. corrugata*, M.Eoc., India; *2a,b*, RV ext., both valves dorsal, ×1 (Cox, 1933).

?Rakhia EAMES, 1951 [**R. trapezoidalis*; OD]. Quadrate, thin-shelled, umbones with concentric undulations; hinge and interior unknown. *L.Eoc.*, Asia.——FIG. E134,*8*. **R. trapezoidalis*, Pak.; RV ext., ×1 *(288)*.

Family DICEROCARDIIDAE Kutassy, 1934

[Materials for this family prepared by L. R. Cox]

Shell medium-sized to large, equivalve,

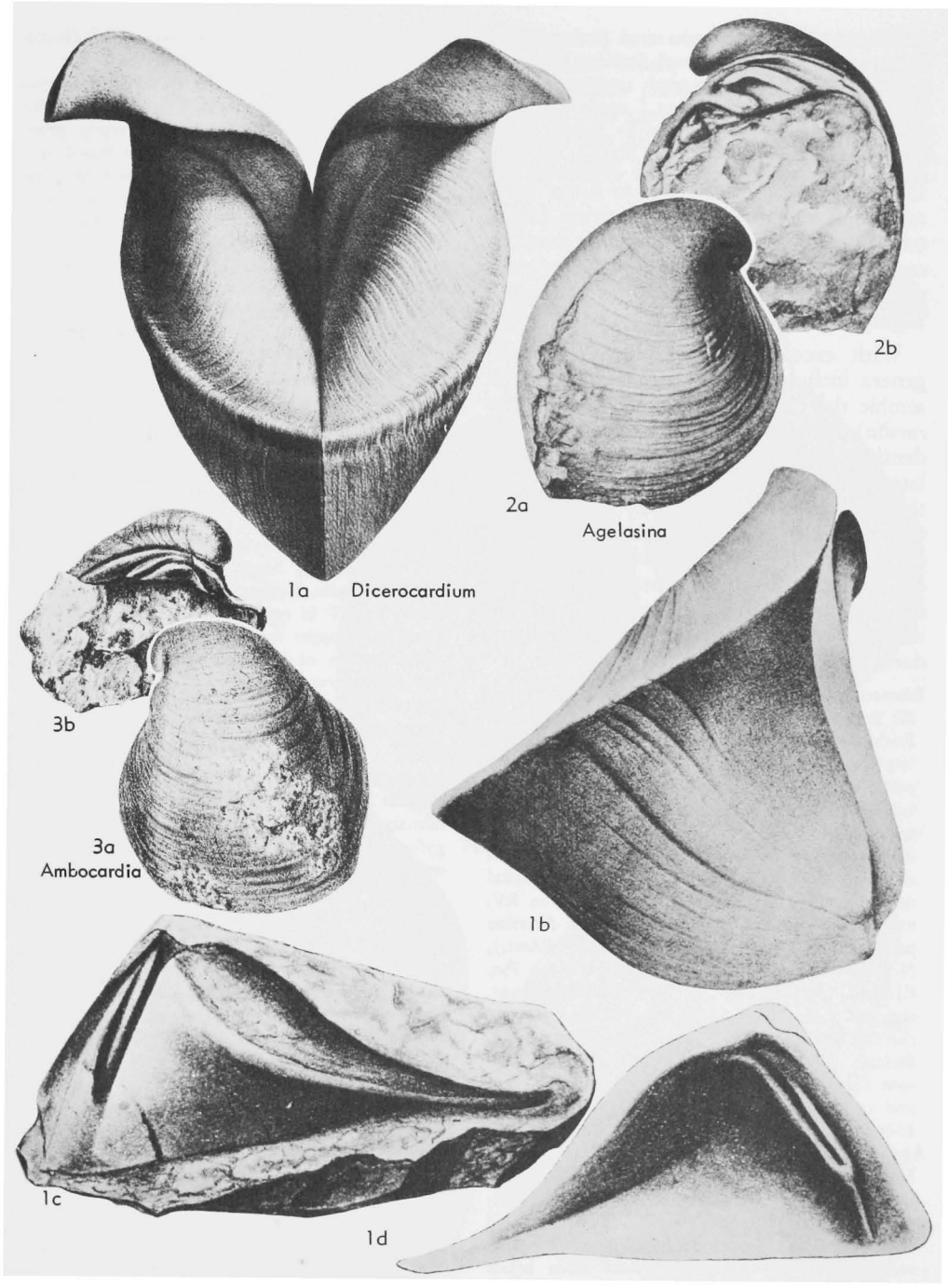


FIG. E135. Dicerocardiidae (p. *N660*).

with prominent umbones and prosogyrous, more or less anteriorly placed beaks; ligament external, opisthodetic; cardinal teeth usually two in both valves, but in some genera only one is present in one or other valve; teeth mostly oriented more or less longitudinally (i.e., parallel to hinge line) and well elongated; no posterior lateral teeth; pallial line entire; adductor scars inconspicuous, not observed so far in most genera; surface smooth or with growth rugae only. *U.Trias.-U.Cret.*

With exception of *Dicerocardium,* the genera included in this family strongly resemble the Cenozoic genus *Glossus* (=*Isocardia*) both in external characters and in dentition, except that they lack posterior lateral teeth. Separation of the family from the Glossidae is based partly on the view that the two groups originated independently during different geological periods and that the resemblances between them are due to convergence. The Dicerocardiidae are thought to be derived from the Megalodontidae.

Dicerocardium STOPPANI, 1865, p. 248 [**D. jani*; SD STOLICZKA, 1871, p. 229] [=*Diceratocardium* FISCHER, 1887 *(nom.van.)*]. Medium-sized to large, trigonal, with angular and usually sharply pointed ventral margin; truncated anteriorly, attenuated and in some specimens sharply rostrate posteriorly; umbones narrow, widely separated and even out-turned in some specimens; each valve with sharp carina running from beak to angle of ventral margin; hinge teeth elongate, 1 in LV, 2 in RV, extending posteriorly from below beak in direction parallel with hinge margin. *U.Trias.(Nor.-Rhaet.),* N. Alps-S. Alps-Hung.-Sicily-Himalayas. —— FIG. E135,*1a.* **D. jani,* Nor., N.Italy; viewed from ant. end, ×0.3 (Stoppani, 1865),——FIG. E135,*1b. D. curionii* STOPPANI, Nor., Sicily; LV ext., ×0.5 (Di Stefano, 1912).——FIG. E135,*1c,d. D. dolomiticum* (LORETZ), Nor., N.Italy, *1c,d,* LV int. mold and cast from it showing dentition, ×1 (Frech, 1904).

Agelasina RIEDEL, 1932, p. 57 [**A. plenodonta;* M]. Medium-sized, ovate, higher than long, with strongly prosogyrous and incoiled, terminal beaks; moderately and evenly inflated, without umbonal ridges; both valves with 2 longitudinally elongated cardinal teeth extending posteriorly from below beak, more posterior (upper) one slightly narrower; those of LV received respectively in recesses behind those of RV; muscle scars and pallial line not observed. *U.Cret.(Coniac.-Maastricht.),* W.Afr.——FIG. E135,*2.* **A. plenodonta,* Senon., Cameroons; *2a,b,* RV ext., RV int., ×0.7 (Riedel, 1932).

Ambocardia BERINGER, 1949, p. 212 [**Isocardia planidorsata* ZITTEL, 1865, p. 140; OD]. Medium-sized, rectangularly ovate, with strongly prosogyrous and incoiled, almost terminal beaks; with weak posterior and anterior umbonal ridges persisting to ventral margin but not forming distinct carinae; LV with stout, arcuate, longitudinally elongated main cardinal tooth adjoining lower margin of hinge plate in median position and lamellar posterior cardinal close to nymph; RV with strong, cuneiform anterior cardinal and slightly oblique, lamellar posterior cardinal; lateral teeth not observed. *U.Cret.(Senon.),* Eu.——FIG. E135,*3.* **A. planidorsata* (ZITTEL), Senon., Aus.; *3a,b,* LV ext. and dentition, ×1 (Zittel, 1865).

Cornucardia KOKEN, 1913, p. 34 [**Craspedodon hornigii* BITTNER, 1901, p. 8; M] [=*Craspedodon* BITTNER, 1901 *(non* DOLLO, 1883); *Conucardia* DIENER, 1923 *(nom.null.)*]. Medium-sized, ovate, higher than long, with strongly prosogyrous and incoiled beaks; valves not carinate but with posterior radial sulcus; hinge plate massive; RV with median arcuate, longitudinally elongated tooth received by LV in recess between 2 similarly elongated teeth, upper weak, lower strong and situated along margin of hinge plate; posterior adductor scar not observed. *U.Trias.,* N.Alps-S.Alps-Hung.-Timor.——FIG. E136,*4.* **C. hornigii* (BITTNER), Hung.; *4a-c,* LV int., RV int., RV ext., ×0.7 *(60).*

Megalocardia BERINGER, 1949, p. 212 [**Isocardia merrilli* HAMLIN, 1884, p. 43; OD]. Large medium-sized, trigonally ovate, with strongly prosogyrous and incoiled, terminal beaks; valves with weak posterior carina; known only as internal mold, so that details of dentition are uncertain. *L.Cret.(Alb.),* Syria.

Physocardia WÖHRMANN, 1894, p. 671 [**P. ogilviae*; M]. Medium-sized, ovate, inequilateral; beaks strongly prosogyrous and slightly incoiled; no posterior carina; 2 more or less elongate, parallel, longitudinal teeth in each valve, extending on both sides of beak, upper tooth in RV relatively weak. *U.Trias.(Carn.),* N.Alps.-S.Alps.——FIG. E136,*3.* **P. ogilviae,* S.Tyrol; *3a,* broken shell viewed from right side; *3b,c,* LV int., RV int., showing dentition, ×0.7 (Wöhrmann, 1894).

Platycardia BERINGER, 1949, p. 212 [**Isocardia zitteli* BÖHM, 1883, p. 502; OD]. Medium-sized, obliquely ovate, with very strongly prosogyrous and incoiled beaks; not carinate posteriorly; LV with 2 arcuate, longitudinally elongated teeth extending back from below beak and separated by recess for reception of single tooth of RV. *U.Jur. (Tithon.),* Czech.——FIG. E136,*2.* **P. zitteli* (BÖHM); *2a,b,* RV ext., LV dentition, ×1 (Böhm, 1883).

Pseudisocardia DOUVILLÉ, 1913, p. 459 [**Isocardia cordata* BUCKMAN in MURCHISON, 1844, p. 98; OD] [=*Ankistrocardia* BERINGER, 1949, p. 212 (obj.)]. Medium-sized, ovate, evenly inflated, with strongly prosogyrous and incoiled beaks which are placed well anteriorly but are not terminal; RV with elongate, arcuate, longitudinal posterior cardinal tooth joined at its anterior end to apex of short anterior cardinal, base of which lies along margin of hinge plate; these teeth are received in LV in recess between 2 arcuate teeth, lower one bordering margin of hinge plate. [Thickening of the lunular margin has been regarded by DOUVILLÉ as an anterior lateral tooth.] *M.Jur.*, EU.——FIG.

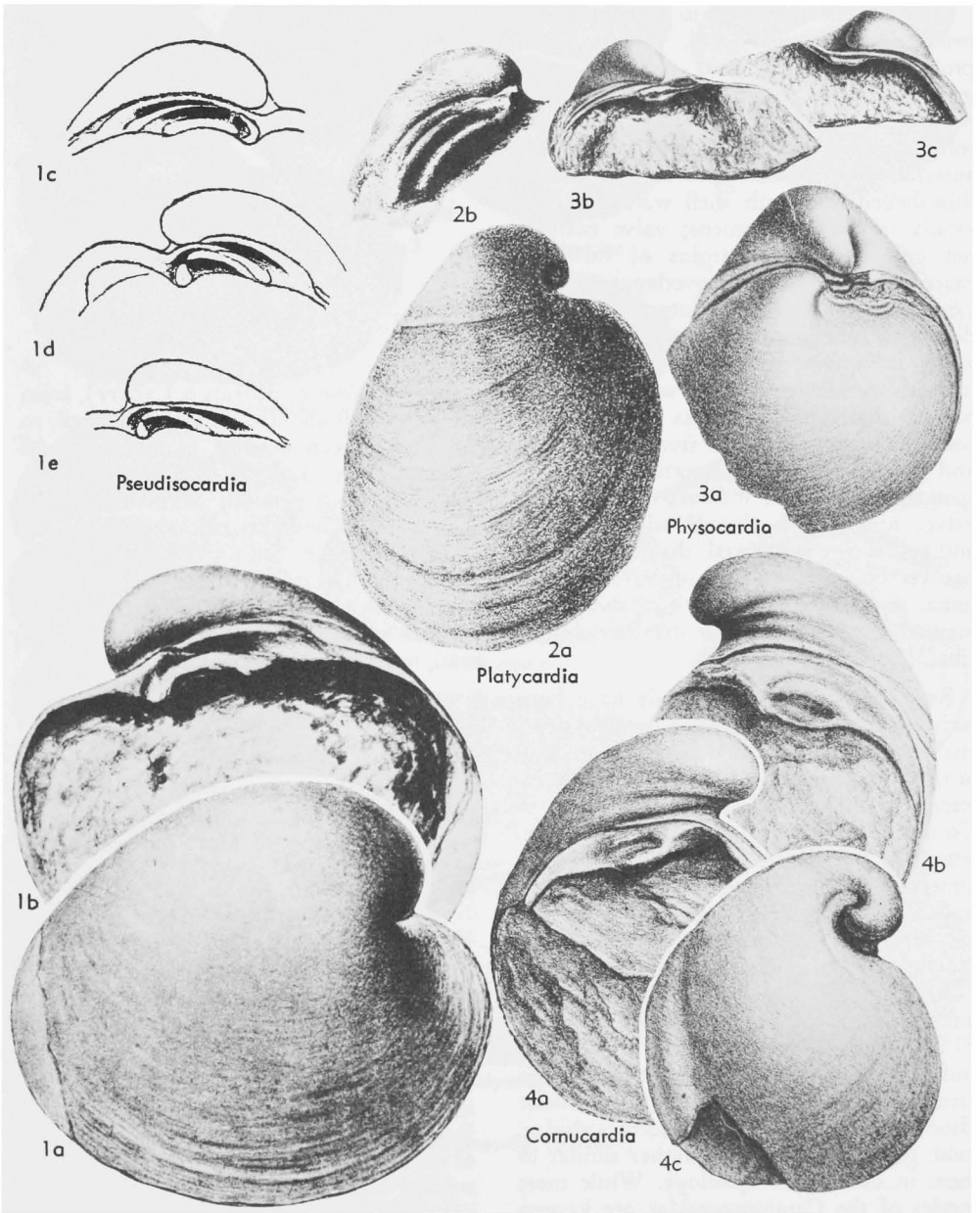


FIG. E136. Dicerocardiidae (p. *N660-N662*).

E136,*1*. **P. cordata* (BUCKMAN); *1a,b*, Bajoc., Eng., RV ext., RV int., ×1 (Benecke, 1905); *1c-e*, Aalen., France; LV, RV, and RV hinges, ×1 *(277)*.

Family CERATOMYOPSIDAE Cox, 1964

[Materials for this family prepared by L. R. Cox]

Shell small, medium- to medium-sized, ovate or subtrigonal, tall, gibbose, with prominent umbones and strongly prosogyrous, incoiled and outturned beaks; valves equally inflated but slightly dissimilar in some specimens, RV beak situated in more anterior position than that of LV; mostly thin-shelled, but with shell wall thickened locally in some specimens; valve margins not gaping; dorsal margins of valves in exact juxtaposition, not overlapping as in Ceratomyidae; ligament external, opisthodetic, its functional part inserted in each valve in groove adjoining posterodorsal margin, which groove is so deeply impressed that its track forms internal ridge coiling around to margin from below beak and giving rise in many specimens to corresponding groove on internal mold of each valve; hinge teeth absent; adductor scars and pallial line superficial, their impressions not yet observed on any of numerous internal molds studied; surface of shell ornamented with weak concentric or oblique ribs. *M.Jur.-U.Jur.*

Representatives of this family have been included in the Ceratomyidae by most modern authors, although before the erection of the type genus its species were mostly referred to *Glossus* [*Isocardia*] and not to *Ceratomya* [*Ceromya*]. The hinge structure, with the juxtaposed posterodorsal margins joined by a simple external but deeply inserted, opisthodetic ligament, is quite different from that characteristic of the Ceratomyidae, in which the margin of the right valve overlaps that of the left and a subinternal ligament lies between them (Fig. E137,*1;* F18,*1f*). The lack of hinge teeth and the usually thin shell distinguish the members of this family from the Glossidae [Isocardiidae] and the Dicerocardiidae, some genera of which are rather similar to them in external morphology. While most species of the Ceratomyopsidae are known only as internal molds, specimens of *Ceratomyopsis undulata* (MORRIS & LYCETT), from the English Bathonian, retain their shell, so that it has been possible to investigate its hinge structure and to confirm the conclusions of various previous workers that it is edentulous. The systematic position of the Ceratomyopsidae is uncertain, but (by analogy with certain Lucinacea which lack hinge teeth) it is suggested that they are edentulous Glossacea with a purely superficial resemblance to the Ceratomyidae.

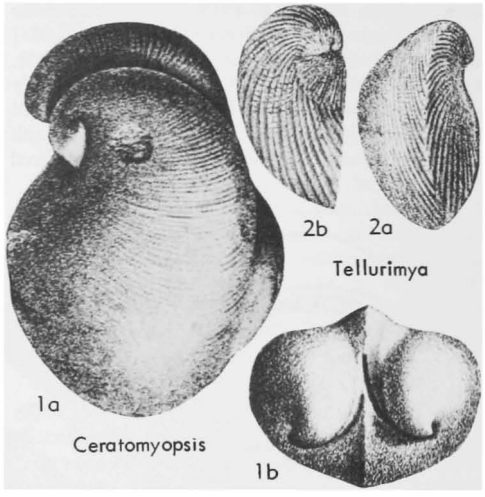


FIG. E137. Ceratomyopsidae (p. *N662*, *N664*).

Ceratomyopsis COSSMANN, 1915, p. 7 [*nom. subst. pro Ceromyopsis* DE LORIOL, 1897 (*non* MEEK, 1872)] [**Ceromyopsis helveticus (sic)* DE LORIOL, 1897, p. 80; SD ROLLIER, 1913, p. 269]. Shell oval, with small posterior lobe separated from main part of flank by sulcus; ornament of concentric or oblique undulations of small amplitude; other characters as defined for family. *M.Jur.-U.Jur. (Bajoc.-Kimmeridg.)*, Eu.-Asia-Afr.——FIG. E137, *1*. **C. helvetica* (DE LORIOL), U.Jur.(U.Oxford.), Switz.; *1a,b*, lat. and dorsal views of int. molds showing impressions of ligamental grooves, ×1 (de Loriol, 1897).

Tellurimya Cox, 1964, p. 41 [**Cardium telluris* LAMARCK, 1819, p. 19; OD]. Shell small medium-sized, subtrigonal, higher than long, with prominent, almost median ridge dividing its surface into 2 parts, each bearing series of flattened, oblique ribs separated by narrow furrows; 2 series of ribs meeting along ridge at acute, downward-pointing angle; regularly spaced growth furrows commonly divide ribs into rectangular or rhomboid segments. *M.Jur.(Bathon.-Callov.)*, France-

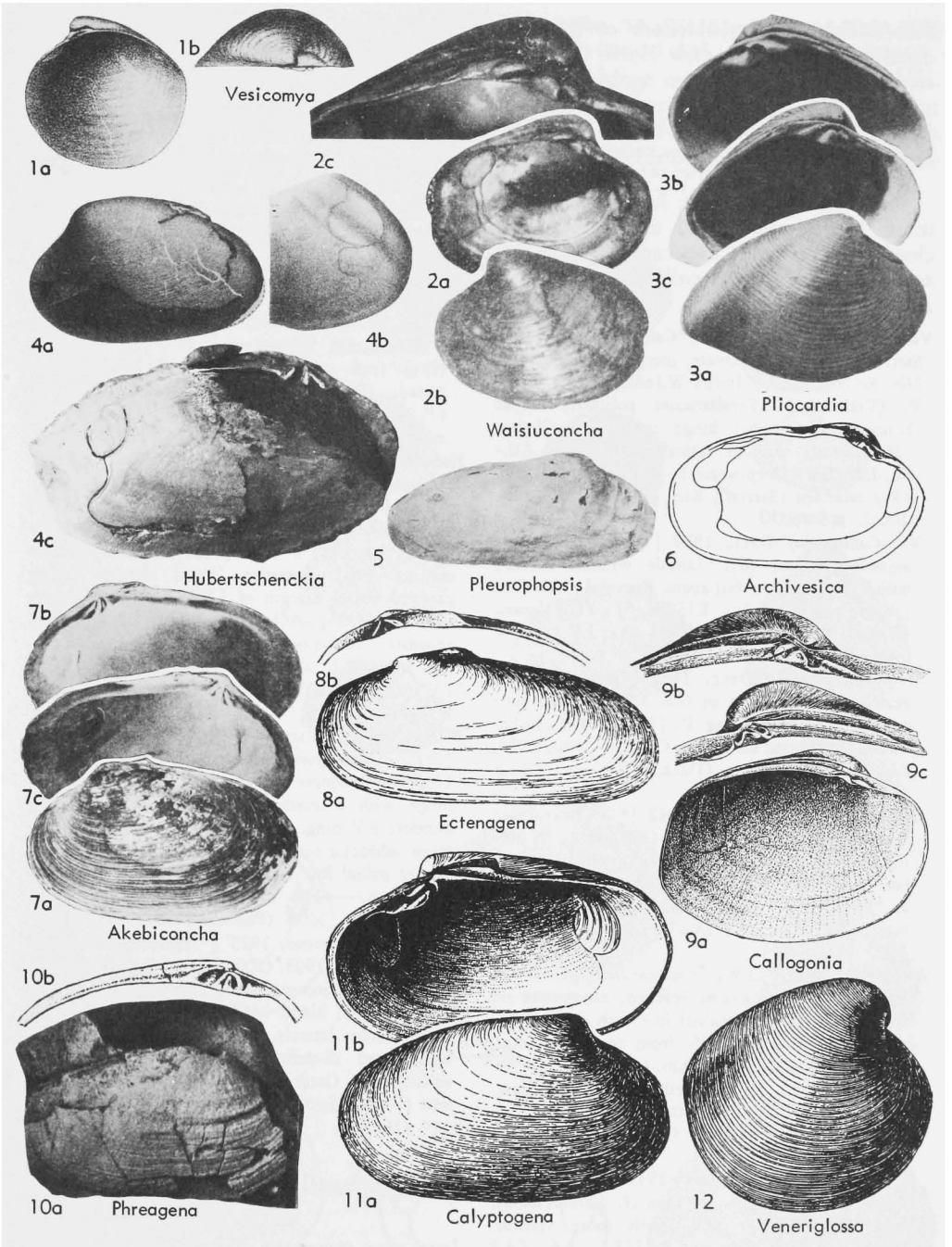


FIG. E138. Vesicomyidae (p. *N664*).

NE.Afr.-E.Afr.——Fig. E137,*2*. **T. telluris* (Lamarck), Callov., E.Afr.; *2a,b*, lat. and ant. views, ×1 (Müller, 1900).

Family VESICOMYIDAE Dall, 1908

[*nom. correct.* Keen, herein (*pro* Vesicomyacidae)]
[Materials for this family prepared by Myra Keen]

Shell ovate to elongate; lunule incised in most; hinge with up to three teeth, not clearly differentiated into cardinals and laterals; with or without pallial sinus. *Oligo.-Rec.*

Vesicomya Dall, 1886 [**Callocardia atlantica* Smith, 1885; OD[. Ovate, inequilateral, smooth. *Mio.-Rec.*, Atl.-Eu.-E.Indies-W.Indies.

V. (Vesicomya). Periostracum polished; lunule bounded by groove; hinge resembling *Glossus (Meiocardia)* without laterals. *Mio.-Rec.*, Atl.-Eu.-E.Indies. [Deep-water.]——Fig. E138,*1*. **V. (V.) atlantica* (Smith), Rec., Atl.; *1a,b*, RV int., dorsal, ×5 *(852)*.

V. (Callogonia) Dall, 1889 [**Callocardia (Callogonia) leeana*; M]. Lunule without border; pallial sinus shallow but acute. *Rec.*, Atl.-W.Indies. [Deep-water.]——Fig. E138,*9*. **V. (C.) leeana* (Dall), W.Indies; *9a*, LV int., *9b,c*, LV and RV hinges, ×2 *(217)*.

V. (Veneriglossa) Dall, 1886 [**Cytherea (V.) vesica*; M]. Beaks as in *Glossus* but hinge veneroid, young resembling *V. (Vesicomya)*; pallial sinus of moderate size. *Rec.*, Carib.——Fig. E138, *12*. **V. (V.) vesica* (Dall); RV ext., ×1.5 (Dall, 1890).

V. (Waisiuconcha) Beets, 1942 [**W. alberdinae*; OD]. Resembling *Lioconcha* (Veneridae) in outline; LV with 3 cardinal teeth; pallial line entire. *Mio.-Rec.*, W.N.Am.-E.Indies——Fig. E138, *2*. **V. (W.) alberdinae* (Beets), Mioplio., Celebes; *2a,b*, LV int., LV ext., ×1.5; *2c*, LV hinge, ×2.5 (Beets, 1942).

Archivesica Dall, 1908 [**Callocardia gigas* Dall, 1890; OD]. Modioliform, inflated, lunule not set off; hinge plate short; pallial line with small sinus, descending almost vertically from posterior adductor scar. *Neog.-Rec.*, W.C.Am.-Japan.

A. (Archivesica). Hinge teeth tending to radiate. *Rec.*, W.C.Am. [Deep-water.]——Fig. E138,*6*. **A. (A.) gigas* (Dall), Gulf Calif.; LV int., ×0.3 (Dall, 1908).

A. (Akebiconcha) Kuroda, 1943 [**Akebiconcha kawamurai*; M]. Smaller than *A. (Archivesica)*, less inflated; hinge with teeth more vertical. *Neog.-Rec.*, Japan.——Fig. E138,*7*. **A. (A.) kawamurai* (Kuroda); *7a-c*, LV ext., RV int., LV int., ×0.5 (Kuroda, 1943).

Calyptogena Dall, 1891 [**C. pacifica*; M]. Elongate, smooth, of earthy texture, with periostracum; escutcheon present, no lunule; ligament external, deep-seated; pallial line entire. *Mio.-Rec.*, N.Am.-Japan.

C. (Calyptogena). Hinge with 1 anterior and 1 posterior lateral tooth in either valve, RV cardinal triangular, LV cardinal hook-shaped. *Mio.-Rec.*, W.N.Am.-Japan.——Fig. E138,*11*. **C. (C.) pacifica*, Dall, Rec., USA(Alaska); *11a,b*, RV ext., int., ×0.7 (Dall, 1895).

C. (Ectenagena) Woodring, 1938 [**C. elongata* Dall, 1916; M]. Shell thinner and longer than *C. (Calyptogena)*, anterior tooth wanting in RV. *Rec.*, W.N.Am.——Fig. E138,*8*. **C. (E.) elongata* Dall, USA(Calif.); *8a,b*, LV ext., RV hinge, ×1 (Dall, 1921; Woodring, 1938).

C. (Phreagena) Woodring, 1938 [**P. lasia;* OD]. Hinge teeth more vertical than in *C. (Calyptogena)*. *Plio.*, W.N.Am.——Fig. E138,*10*. **C. (P.) lasia* (Woodring), USA(Calif.); *10a,b*, RV ext., LV hinge, ×1 (Woodring, 1938).

Hubertschenckia Takeda, 1953 [**Tapes ezoensis* Yokoyama, 1890; OD]. Thick, elongate; prosogyrate beaks well forward; escutcheon present; hinge of LV with two cardinals and posterior lateral; RV with 2 teeth parallel to margin, one cardinal bifid, posterior lateral slender, fitting grooved dorsal margin of LV; pallial line slightly sinuate. *U.Oligo.*, Japan.——Fig. E138,*4*. **H. ezoensis* (Yokoyama), Hokkaido; *4a,b*, LV ext., part int. mold, ×0.5; *4c*, part RV int. mold and LV int., ×0.7 (Yokoyama, 1890; specimen, Univ. Hokkaido).

Pleurophopsis Palmer, 1919 [**P. unioides*; M] [=*Pleurophoropsis* Cossmann, 1920 *(nom.van.)*]. Elongate, sculpture of concentric growth lines, LV hinge with 2 cardinals, posterior large, anterior slender; RV hinge with 2 subequal cardinals; anterior adductor scar embedded, bordered by flange above; pallial line entire. *Oligo.*, W.Indies-C.Am.-NW.S.Am.——Fig. E138,*5*. **P. unioides*, Trinidad; RV ext., ×0.5 (Palmer, 1919).

Pliocardia Woodring, 1925 [**Anomalocardia bowdeniana* Dall, 1903; OD]. Resembling *Vesicomya*, with lunule circumscribed, but posterior end of shell rostrate; hinge with double anterior laterals, no posterior laterals, 1 cardinal in either valve, broad and ill-defined; pallial line with small sinus. *Mio.*, Carib.——Fig. E138,*3*. **P. bowdeniana* (Dall), Jamaica; *3a-c*, RV ext., int., LV int., ×4 *(1005)*.

Superfamily CORBICULACEA Gray, 1847

[*nom. transl.* Tryon, 1882 (*ex* Corbiculidae Gray, 1847)]
[=Cyrenacea Gray, 1840] [Materials for this superfamily prepared by Myra Keen and Raymond Casey]

Rounded-trigonal to ovate, porcelaneous; sculpture concentric, striate; ligament external; hinge with up to three cardinal teeth

in either valve, pivotal cardinal in RV; pallial line entire or with small sinus. *?L. Jur., M.Jur.-Rec.*

Family CORBICULIDAE Gray, 1847

[*nom. correct.* Dall, 1889 (*pro* Corbiculadae Gray, 1847, ICZN pend.)] [=Cyrenidae Gray, 1840] [Materials for this family prepared by Myra Keen and Raymond Casey]

Small to moderately large shells; shell material dense, with well-developed periostracum; hinge commonly with strong posterior and anterior lateral teeth, somewhat serrate. [Recent forms in brackish to fresh water; fossil forms also in marine environments.] *?L.Jur., M.Jur.-Rec.*

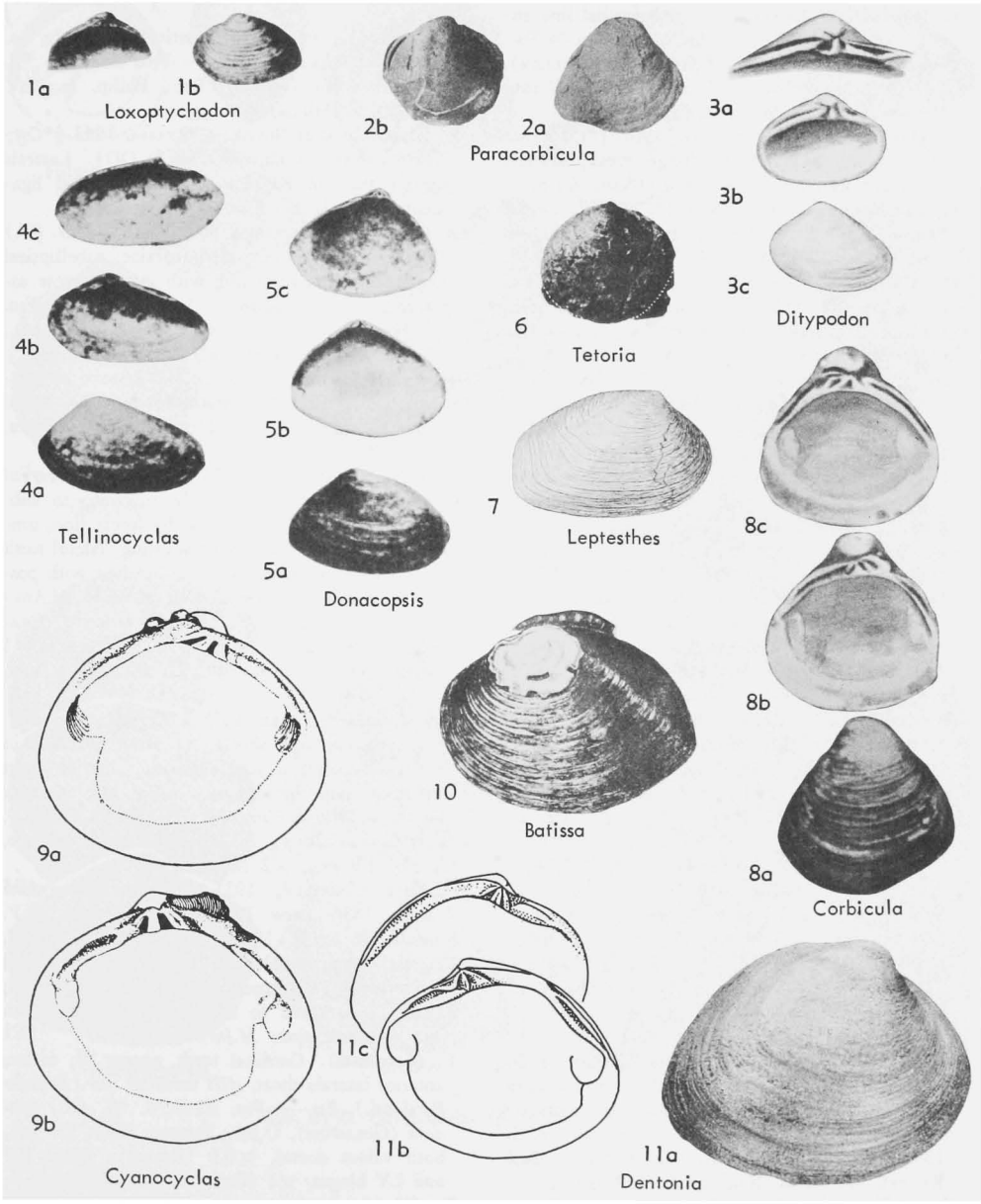


Fig. E139. Corbiculidae (p. *N666*).

Corbicula MERGELE VON MÜHLFELD, 1811 [**Tellina fluminalis* MÜLLER, 1774 (designated ICZN, 1955)] [=*Cyrena* LAMARCK, 1818 (type, *C. cor*; SD CHILDREN, 1823); *Eucorbicula* CROSSE & FISCHER, 1894 (genus without cited species); *Serrilaminula* LINDHOLM, 1933 (type, *Corbicula minima* VON MARTENS, 1874; OD)]. Rounded-trigonal; concentric sculpture present; lateral teeth mostly serrate. *L.Cret.-Rec.*, cosmop.

C. (Corbicula). Lateral teeth long, pallial line entire. *U.Cret.-Rec.*, Asia-Afr.-Eu.-N.Am.-W.Pac. ——FIG. E139,*8*. **C. (C.) fluminalis* (MÜLLER), Rec., Asia Minor; *8a-c*, LV ext., RV int., LV int., ×1 (Kennard & Woodward).

C. (Corbiculella) VON IHERING, 1907 [**Corbicula (C.) tenuis*; M]. Ovate, hinge weak, laterals short, not serrate. *?U.Mio., Plio.-Pleist.*, S.Am.

C. (Corbiculina) DALL, 1903 [**Corbicula angasi* PRIME, 1864; OD]. Small; viviparous; living in fresh water. *Rec.*, Orient.

C. (Cyanocyclas) DE BLAINVILLE, 1818 [**Tellina limosa* MATON, 1811; SD DALL, 1903] [=*Neocorbicula* FISCHER, 1887 (type, *Cyrena variegata* D'ORBIGNY, 1835; OD)]. With small pallial sinus; animal viviparous. *?Eoc., Plio.-Rec.*, S.Am. ——FIG. E139,*9*. **C. (C.) limosa* (MATON), Rec., Brazil; *9a,b*, LV int., RV int., ×2 (Parodiz & Hennings, 1965).

C. (Cyrenodonax) DALL, 1903 [**C. formosana*; OD]. Small, thin, trigonal, beak at posterior 3rd; smooth, inflated. *Pleist.-Rec.*, E.Asia.

C. (Donacopsis) SANDBERGER, 1872 [**Cyrena acutangularis* DESHAYES, 1858; SD DALL, 1903]. Donaciform, posterior end shorter; pallial sinus short, wide. *Paleoc.-Eoc.*, Eu.——FIG. E139,*5*. **C. (D.) acutangularis* (DESHAYES), Eoc., France; *5a-c*, LV ext., RV int., LV int., ×1 (Cossmann & Pissarro).

C. (Leptesthes) MEEK, 1871 [**Cyrena fracta* MEEK, 1870; OD]. Subtrigonal to long-ovate; lunule defined by incised line; pallial sinus short, wide, triangular. *U.Cret.*, C.USA.——FIG. E139, *7*. **C. (L.) fracta* (MEEK), USA(Wyo.); RV ext., ×0.5 (Meek).

C. (Loxoptychodon) SANDBERGER, 1872 [**Cyrena intermedia* MELLEVILLE, 1843; SD DALL, 1903]. Subtrigonal, anterior end shorter; cardinals 2 in LV; anterior laterals shorter than posterior; pallial line broadly sinuous. *Paleoc.-L.Eoc.*, Eu.——FIG. E139,*1*. **C. (L.) intermedia* (MELLEVILLE), L.Eoc., Eng.; *1a,b*, LV int., ext., ×1 (Morris).

C. (Paracorbicula) KOBAYASHI & SUZUKI, 1939 [**Corbicula sanchuensis* YABE & NAGAO, 1926; OD]. Obliquely ovate to subcircular; posterolateral teeth long and crenulate; pallial line distinctly sinuate. *L.Cret.("Wealden")*, Japan.——FIG. E-139,*2*. **C. (P.) sanchuensis* YABE & NAGAO; *2a,b*, RV ext., int. mold, ×0.5 (Yabe & Nagao).

C. (Tellinocyclas) DALL, 1903 [**Cyrena tellinella* DESHAYES, 1825; OD]. Like *C. (Donacopsis)* but with short, distant lateral teeth. *Paleoc.-Eoc.*, Eu.——FIG. E139,*4*. **C. (T.) tellinella* (DESHAYES), Sparnac., France; *4a-c*, LV ext., RV int., LV int., ×1 (Cossmann & Pissarro).

Acyrena LEBEDEV, 1958 [**A. jenissijensis*; OD?]. *M.Jur.*, USSR(W.Sib.).

Batissa GRAY, 1853 [**Cyrena tenebrosa* HINDS, 1842; SD STOLICZKA, 1871]]. Large, heavy, ovate; lateral teeth serrate to crenulate. *M.Jur.-Rec.*, Orient.

B. (Batissa). Pallial line entire or nearly so. *U.Jur.-Rec.*, Asia-E.Indies.——FIG. E139,*10*. **B. (B.) tenebrosa* (HINDS), Rec., Philip. Is.; LV ext., ×0.5 (Hinds).

B. (Cyrenobatissa) SUZUKI & OYAMA, 1943 [**Corbicula subsulcata* CLESSIN, 1878; OD]. Laterals shorter than in *B. (Batissa)*, nymph and ligament not so large. *Eoc.-Rec.*, Orient.

B. (Tetoria) KOBAYASHI & SUZUKI, 1937 [**B. (T.) yokoyamai*; OD]. Of medium size, subelliptical to subcircular; pallial line with deep, narrow ascending sinus. *M.Jur.*, Japan-China.——FIG. E139,*6*. **B. (T.) yokoyamai*, Japan; RV ext., ×0.5 (Kobayashi & Suzuki).

Costocyrena HAYAMI, 1965, *ex* MATSUMOTO & KANMERA, 1952, MS [**C. matsumotoi*; OD]. Shell radially ribbed; hinge resembling that in *Eomiodon*. *L.Cret.*, Japan.

Dentonia STEPHENSON, 1953 [**Cytherea leveretti* CRAGIN, 1893; OD]. Broadly subovate to subtrigonal; lunule long, bounded by feeble line; umbonal ridge weak; escutcheon wanting; lateral teeth smooth, anterior teeth short; pallial line with posterior truncation. *U.Cret.(Cenoman.)-Eoc.*, N.Am.-France.——FIG. E139,*11*. **D. (C.) leveretti* (CRAGIN), U.Cret., USA(Tex.); *11a*, RV ext., ×1 (Stephenson); *11b,c*, RV int., LV int., ×1 (Casey, after Stephenson).

Ditypodon SANDBERGER, 1875 [**Cyrena suesii*; M]. Oval, anterior end shorter; 1 stout cardinal in either valve; lateral teeth smooth, anterior short and stout, posterior longer; pallial line obtusely sinuous. *U.Mio.-L.Plio.*, Eu.——FIG. E139,*3*. **D. suesii* (SANDBERGER), Plio., Italy; *3a-c*, LV hinge, LV int., LV ext., ×2 (Sandberger).

Eocallista DOUVILLÉ, 1921 [**Venus brongniarti* RÖMER, 1836 (*non* PAYRAUDEAU, 1826) (=*V. caudata* GOLDFUSS, 1840); SD FRIZZELL, 1936]. Trigonal-ovate; no lunule or escutcheon; lateral teeth smooth, *PII* merged into margin, *PIII* absent; *2a* and *1* attached to laterals; pallial line with posterior truncation. *M.Jur.-U.Jur.*, Eu.

E. (Eocallista). Cardinal teeth, except *3b*, entire; anterior laterals short, *AIII* wanting. *Jur.(Bathon-Portland.)*, Eu.——FIG. E140,*10*. **E. (E.) caudata* (GOLDFUSS), U.Jur., France; *10a,b*, LV ext., both valves dorsal, ×0.5 (Romer); *10c,d*, RV and LV hinges, ×1 (Casey, from specimens).

E. (Hemicorbicula) CASEY, 1955 [**Cyclas parva* J. DE C. SOWERBY, 1836; OD]. Cardinal teeth *1*,

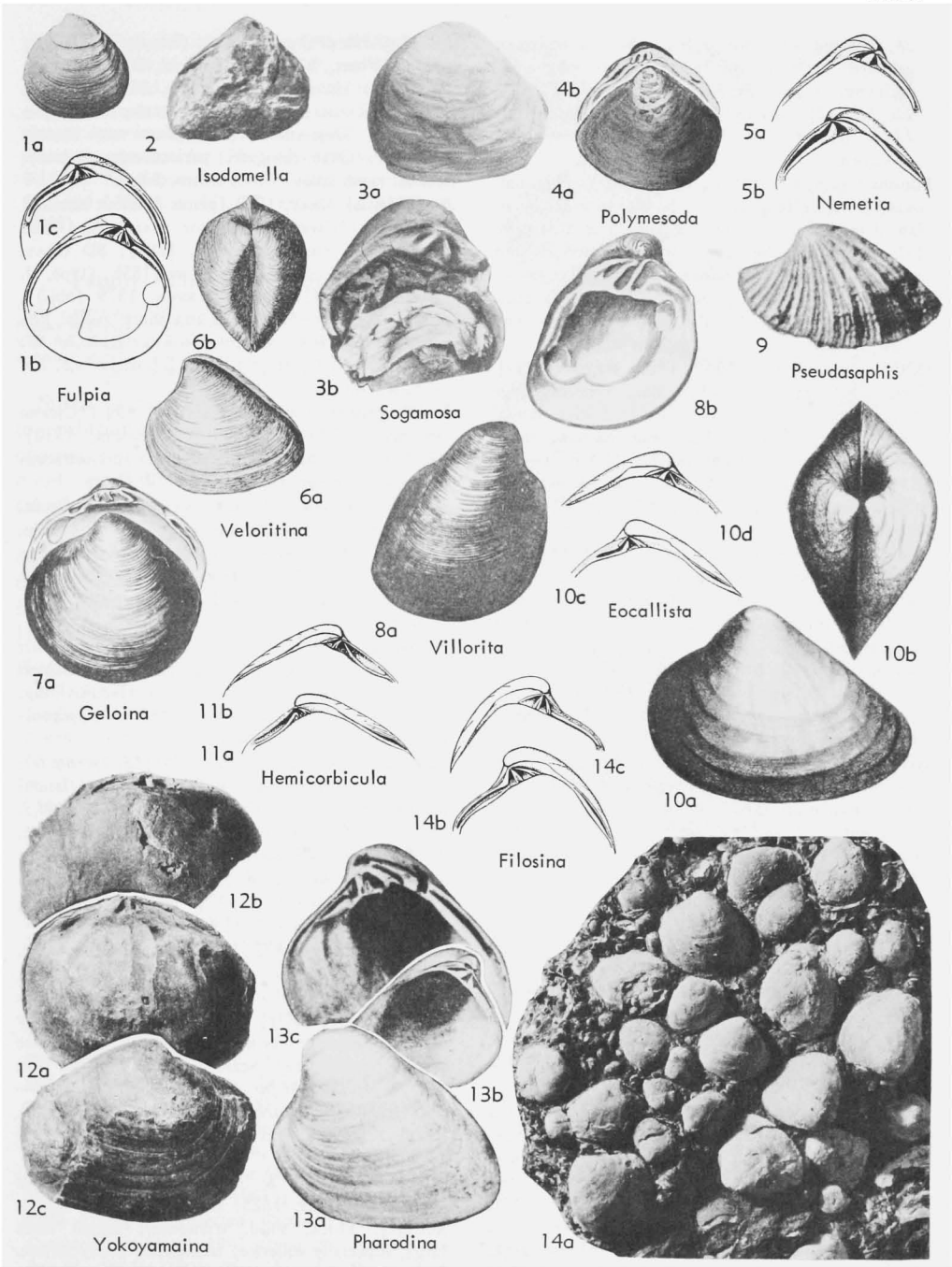


FIG. E140. Corbiculidae (p. *N666*, *N668-N669*).

3b, 2b, and *4b* more or less bifid; *2a* entire or grooved; anterior laterals moderately long, *AIII* incipient. *U.Jur.-(Purbeck.)*, Eu.——Fig. E140, *11*. **E. (H.) parva* (Sowerby), U.Jur., Eng.; *11a,b,* RV and LV hinges, ×2 (Casey, from specimens).

Filosina Casey, 1955 [**F. gregaria*; OD]. Trigonal-ovate or subrectangular; no lunule or escutcheon; lateral teeth finely striate, *PII* merged into margin, *PIII* wanting; pallial line truncate posteriorly but not sinuate. *L.Cret.(Wealden-Apt.)*, Eu.-Syria.——Fig. E140,*14*. **F. gregaria,* L.Cret.(Wealden), Eng.; *14a-c,* slab, ×1, RV and LV hinges, enl. (Casey).

Fulpia Stephenson, 1946 [**F. pinguis*; OD]. Trigonal-ovate; umbo subangular; posterior ridge weak; lunule bounded by impressed line; lateral teeth finely striate; pallial sinus narrow, deep, ascending. *U.Cret.(Cenoman.)*, N.Am.——Fig. E140,*1*. **F. pinguis,* USA(Tex.); *1a,* LV ext., ×1 (Stephenson); *1b,c,* LV int., RV int,. ×1 (after Stephenson).

Isodomella Kobayashi & Suzuki, 1939 [**Cyrena shiroensis* Yabe & Nagao, 1926 (=**C. naumanni* Neumayr, 1890); OD]. Subtrapezoidal, rounded in front, truncate behind; posterior-lateral teeth longer than anterolaterals; *2b* and *1* long, wedge-shaped; *3b* very thin; pallial line simple. *L.Cret. ("Wealden")*, Japan.——Fig. E140,*2*. **I. naumanni* (Neumayr); RV ext., ×1 (Kobayashi & Suzuki).

Nemetia Casey, 1955 [**Platopis triangularis* Whitfield, 1891; OD]. Subtrigonal, with strong posterior angulation; no lunule or escutcheon; cardinal teeth entire, *1* and *2a* attached to laterals; *PIII* wanting. *L.Cret.(Apt.)*, Syria.——Fig. E140,*5*. **N. triangularis* (Whitfield), Syria; *5a,b,* LV and RV hinges, ×2 (after Vokes).

?Pharodina Stephenson, 1953 [**P. ferrana*; OD]. Obliquely trigonal; posterior slope subangular; umbo prominent, rounded; beaks strongly prosogyrate; hinge as in *Nemetia* but with anterior laterals shorter and distinctly separated from *2a* and *1*. *U.Cret.(Cenoman.)*, N.Am.——Fig. E140, *13*. **P. ferrana,* USA(Tex.); *13a-c,* LV ext., LV int., RV int., ×1 *(890)*.

Polymesoda Rafinesque, 1828 [**Cyclas caroliniana* Bosc. 1801; OD] [=*Egetaria* Mörch, 1860 (type, *P. (E.) pullastra*; M); *Cyprinella* Gabb, 1864 (*non* Girard, 1856); *Diodus* Gabb, 1868 (*pro Cyprinella*) (type, *Cyprinella tenuis* Gabb, 1864; M); *Leptosiphon* Fischer, 1872 (obj.); *Americana* Clessin, 1879 (obj.)]. Medium-sized to large; beaks prominent, inturned; inequilateral; cardinal teeth 3, LV with 1 anterior and 1 long posterior lateral against 2 in RV. *Eoc.-Rec.*, C.Am.-Japan-S.Am.-Carib.

P. (Polymesoda). Pallial line with deep, narrow sinus. *Rec.*, E.N.Am.-E.C.-Am.-W.C.Am.——Fig. E140,*4*. **P. (P.) caroliniana* (Bosc), USA(Fla.); *4a,b,* RV ext., LV int., ×1 (Bosc, 1801).

P. (Egeta) H.Adams & A.Adams, 1858 [**Cyrena anomala* Deshayes, 1858; SD Baker, 1930] [*pro Anomala* Deshayes, 1855 (*non* von Block, 1799)]. Ovate-elongate, periostracum velvety; pallial sinus small. *Rec.*, C.Am.-S.Am.

P. (Geloina) Gray, 1842 [genus without nominal species] [**Cyrena zeylanica* Lamarck, 1818 (=**Venus coaxans* Gmelin, 1791); SD Gray, 1847)] [=*Isodoma* Deshayes, 1858 (type, *I. cyprinoides*; M); *Indica* Clessin, 1879 (obj.)]. Large, lateral teeth smooth and short; pallial line entire. *Eoc.-Rec.*, Orient.——Fig. E140,*7*. **P. (G.) coaxans* (Gmelin), Rec., E.Indies; *7a,b,* LV ext., RV int., ×0.25 *(124)*.

P. (Neocyrena) Crosse & Fischer, 1894 [**Cyrena nicaraguana* Prime, 1869; SD Baker, 1930]. Surface concentrically corrugated, periostracum smooth, shining. *Rec.*, E.C.Am.-W.C.Am.

P. (Pseudocyrena) Bourguignat, 1854 [**Cyclas maritima* d'Orbigny in Sagra, 1842; OD] [=*Cyrenocapsa* Fischer, 1872 (type, *Cyrena floridana* Conrad, 1816; M)]. Thin-shelled, pallial sinus minute; living in brackish to salt water. *Rec.*, Carib.

?Pseudasaphis Matsumoto, 1938 [**P. japonicus*; OD]. Small, elongate, subtrigonal; lunular region excavated; surface with radial costae; laterals long, smooth. *Cret.*, Japan.——Fig. E140,*9*. **P. japonicus*; LV ext., ×1 (Matsumoto).

Sogamosa Pilsbry & Olsson, 1935 [**S. cyrenoides*; OD]. Like *Polymesoda* but hinge with no lateral teeth on flat plate. *U.Eoc.*, S.Am.——Fig. E140,*3*. **S. cyrenoides,* Colomb.; *3a,b,* RV ext., LV hinge, ×1 (Pilsbry & Olsson).

?Soleilletia Bourguignat, 1885 [**S. abbadiana;* SD Pilsbry & Bequaert, 1927]. Shell thin, fragile; lateral teeth wanting. *Rec.*, Afr.

Veloritina Meek, 1872 [**Cyrena durkeei* Meek, 1870; OD] [=*Mesocorbicula* Suzuki & Oyama, 1943 (type, *Corbicula tetoriensis* Kobayashi & Suzuki, 1939; OD)]. Gibbous trigonal; lunular and ligamentary areas deeply depressed; pallial line posteriorly truncate. Scarcely sinuate; hinge like that of *Filosina*. *M.Jur.-U.Cret.*, Japan-N.Am.——Fig. 140,*6*. **V. durkeei* (Meek), U.Cret., USA (Mont.); *6a,b,* LV ext., both valves dorsal, ×0.5 (White).

Villorita Griffith & Pidgeon, 1834 [**Cyrena cyprinoides* Gray, 1825; OD] [=*Velorita* Gray, auctt.]. Thick, solid, triangular; lateral teeth large, especially anterior, triangular, finely striate. *Rec.*, Orient.——Fig. E140,*8*. **V. cyprinoides* (Gray); *8a,b,* RV ext., LV int., ×1 (Chenu).

?Yokoyamaina Hayami, 1958 [**Cyrena elliptica* Yokoyama, 1904 (*non* Dunker, 1843, =*Y. hayamii* Keen & Casey, herein, new name); OD]. Valves inequilateral, elliptical, inflated; surface

nearly smooth, few radial threads ventrally; hinge formula, *AI 3a 3b PI/AII 2 4b PII*, with *2* and *3b* conical, *3a* and *4b* close to nymph, anterior laterals tubercular, posterior short and weak; adductor scars small, subequal, impressed, pallial line distinctly sinuate. *Jur.(Hettang.)*, E.Asia.——Fig. E140,*12*. **Y. hayamii* Keen & Casey, Japan; *12a-c*, RV and LV int. molds, RV ext., ×0.7 (Hayami, 1958).

Family PISIDIIDAE Gray, 1857

[*nom. correct.*, ICZN, 1955, *ex* Pisidiadae; =Cycladidae Forbes & Hanley, 1853; Sphaeriidae Jeffreys, 1862] [Materials for this family prepared by Myra Keen, with advice on technical details of classification from Mr. Peter Dance, British Museum (Natural History)]

Small to minute shells, oval or quadrate to subtriangular; shell texture thin to opaque, some forms appearing porous. Ligament partially to completely immersed (rarely external); hinge curved, narrow, with anterior and posterior lateral teeth in both valves; cardinal teeth small, not more than two, those of RV straight or united into inverted V, of LV wholly separate. [Fresh-water.] *?U.Jur., Cret.-Rec.*

Pisidium Pfeiffer, 1821 [**Tellina amnica* Müller, 1774; SD Gray, 1847 (+ICZN, Op. 335, 1955)] [=*Euglesa* Gray, 1840, auctt. *(nom. invalid., in synon.); Galileja* da Costa, 1840, auctt. (type, *G. tenebrosa, spec. dub.;* M); *Pera* Sowerby, 1842, *ex* Alder, 1831 [*in synon.*] (obj.; M); *Pisum* "Megerle" Gray, 1847, *et* auctt. (*non* Megerle von Mühlfeld, 1811, *nom. dub.*); *Cordula* Gray, 1852 (*ex* Leach MS) (obj.); *Cycladina* Clessin, 1871 (*non* Cantraine, 1835); *Fossarina* Clessin in Westerlund, 1873 (*non* Adams & Angas, 1864); *Fluminina* Westerlund, 1873 (obj.); *Flumininea, Fluminea (nom. null.); Rivulina* Clessin in Westerlund, 1873 (type, *Pisidium supinum* Schmidt, 1851; SD Clessin, 1879); *Amnicana* Fagot, 1892 (obj.; SD Boettger, 1961); *?Pusillana* Fagot, 1892 (type, *Tellina pusilla* Gmelin, 1791, SD Boettger, 1961, *spec. dub.*); *Roseana* Fagot, 1892 (type, *Pisidium roseum* Scholtz, 1843; SD Boettger, 1961); *Casertiana* Fagot, 1892 (type, *Cardium casertanum* Poli, 1795; SD Boettger, 1961); *Henslowiana* Fagot, 1892 (type, *Tellina henslowana* Sheppard, 1825; SD Boettger, 1961); *Cyclocalyx* Dall, 1903 (type, *P. scholtzii* Clessin, 1873; OD); *Cymatocyclas* Dall, 1903 (type, *P. compressum* Prime, 1851; OD); *Tropidocyclas* Dall, 1903 (type, *Tellina henslowana* Sheppard, 1825; OD); *Clessinia* Piaget, 1913 (*non* Döring, 1877); *Pseudeupera* Germain, 1913 (type, *Pisidium landeroini* Germain, 1909; OD); *Lacustrina* Sterki, 1916 (type, *Pisidium idahoense* Roper, 1890; M); *Fontinalina* Sterki, 1916 (type, *Cyclas fontinalis* Draparnaud, 1801 (=*Cardium casertanum* Poli, 1795); M); *Eupisidium* Odhner, 1921 (obj.; SD Boettger, 1961); *Cletella* Strand, 1928 (*pro Clessinia* Piaget) (type, *Pisidium profundum* Clessin, 1877; OD); *Australpera* Iredale, 1943 (type, *P. etheridgii* Smith, 1882; OD); *Glacipisum* Iredale, 1943 (type, *G. kosciusko;* OD *nom. nud.*); *Speleopisidium* Zhadin, 1952 (type, *P. subterraneum* Zhadin, 1932; SD Boettger, 1961)]. Small, globose or subtriangular, inequilateral, beaks nearer posterior end; lateral teeth double in RV, single in LV; cardinals 2 in LV, 1 in RV; animal with single siphon. *U.Cret.-Rec.*, cosmop.

P. (Pisidium). Animal with 2 pairs of gills. *U. Cret.-Rec.*, N.Am.-Eurasia.——Fig. E141,*1*. **P. (P.) amnicum* (Müller), Rec., Eu.; *1a-c*, RV ext., int., LV int., ×3 *(294)*.

P. (Afropisidium) Kuiper, 1962 [**P. lepus* Kui-

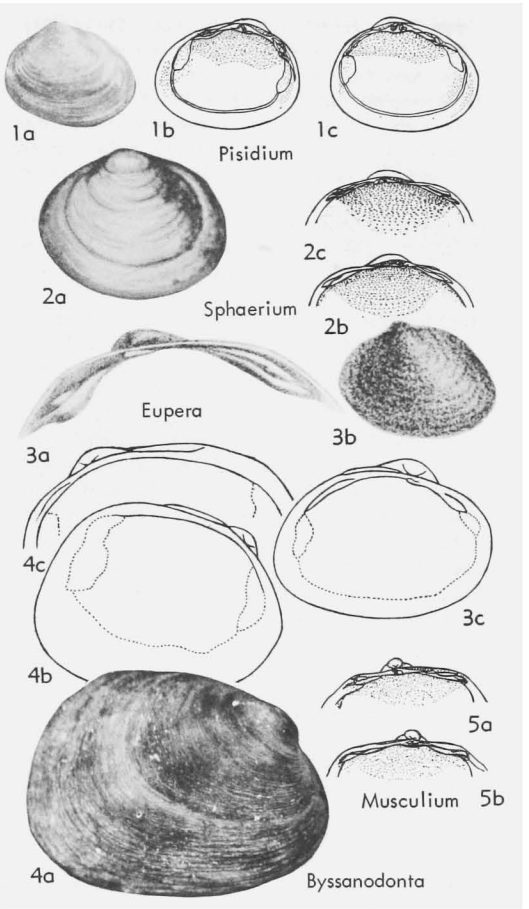


Fig. E141. Pisidiidae (p. *N669-N670*).

PER, 1957 (=**P. pirothi* JICKELI, 1881); OD]. With one pair of gills; ligament external, its fossette turned outward. *Rec.*, Afr.-Asia-N.Z.

P. (Neopisidium) ODHNER, 1921 [**P. torquatum* STELFOX, 1918 (=**P. moitessierianum* PALADILHE, 1866); SD HABE, 1951)]. Gills reduced to one pair, ligament internal, enclosed in fossette. *Rec.*, E.Afr.-N.Asia-N.Eu.-?N.Am.

P. (Odhneripisidium) KUIPER, 1962 [**P. stewarti* PRESTON, 1909; OD]. Shell and animal as in *P. (Neopisidium)* but ligament deeply immersed. *Rec.*, Asia-W.Eu.

Byssanodonta D'ORBIGNY, 1846 [**B. paranensis;* M]. Rhomboidal, very inequilateral, cardinal teeth evanescent, anterior lateral tooth present, low. *Rec.*, S.Am.——FIG. E141,*4*. **B. paranensis*, Argentina; *4a-c*, RV ext., LV int., RV hinge, ×3 (*4a*, U.S. Natl. Museum specimen; *4b*, Klappenbach, 1960; *4c*, unpublished drawing).

Eupera BOURGUIGNAT, 1854 [**Pisidium (E.) moquinianum* (=*?Cyclas modioliformis* ANTON, 1837); M] [=*Limosina* CLESSIN, 1872 (*non* MACQUART, 1835); *Clessinella* WAAGEN, 1905 (type, *Sphaerium sturanyi;* M)]. Resembling *Byssanodonta* but with cardinal teeth evident in at least LV. *Eoc.-Rec.*, Eurasia-N.Am.-S.Am.-Afr.——FIG. E141,*3a,b*. **E. moquiniana* (BOURGUIGNAT), Rec., Brazil, *3a,b*, RV hinge, LV ext., ×4 (Bourguignat, 1854).——FIG. E141,*3c*. *E. platensis* DOELLO-JURADO, Rec., Argentina; LV int., ×4 (Klappenbach, 1960).

Sphaerium SCOPOLI, 1777 [**Tellina cornea* LINNÉ, 1758 (fixed, ICZN Opinion 94)] [=*Cyclas* BRUGUIÈRE, 1798 (genus without named species; type, *C. rivicola* LAMARCK, 1818; SD CHILDREN, 1823); *Cornea* MEGERLE VON MÜHLFELD, 1811 (obj.); *Corneocyclas* DE BLAINVILLE, 1818 (type, *Cyclas cornea* "DRAPARNAUD" (=*C. rivicola* LAMARCK, 1818); SD PILSBRY & BEQUAERT, 1927); *Amesoda* RAFINESQUE, 1820 (type, *Cyclas similis* SAY, 1819; SD HANNIBAL, 1912); *Cycladites* KRUEGER, 1823 (obj.); *?Euglesa* GRAY, 1852 *ex* LEACH MS (type, *E. henslowiana; spec. dub.*); *Cyrenastrum* BOURGUIGNAT, 1854 (type, *Cyclas solida* NORMAND, 1844; M); *Cycladella* CARPENTER, 1865 (type, *C. papyracea;* M); *Corneola* WESTERLUND, 1873 (*non* HELD, 1837); *Serratisphoerium* GERMAIN, 1909 (type, *Sphaerium courteti*; M); *Trigonosphaerium* KOBELT, 1913 (type, *S. alticola;* M); *Sphaerinova* IREDALE, 1943 (type, *Sphaerium macgillivrayi* SMITH, 1882; OD)]. Oval, quadrate, bluntly triangular in some, shell moderately solid, concentrically striate; beaks nearly median; animal with 2 siphons. *?U.Jur.; Cret.-Rec.*, Eu.-N.Am.-Holarctic-Afr. [=*Sphaeriastrum* BOURGUIGNAT, 1854 (type, *Cyclas rivicola* LAMARCK, 1818; SD KOBELT, 1881).]

S. (Sphaerium). Beaks rounded, not set off by projecting caps. *?U.Jur., Cret.-Rec.*, Holarctic-Afr.——FIG. E141,*2a-c*. **S. (S.) corneum* (LINNÉ), Rec., Eng.; *2a*, LV ext., ×2 (Jeffreys); *2b,c*, LV and RV hinges, ×2 *(294)*.

S. (Musculium) LINK, 1807 [**Tellina lacustris* MÜLLER, 1774; M] [=*Phymesoda* RAFINESQUE, 1820 (obj.); *Calyculina* CLESSIN, 1872 (obj.); *Carneola* WESTERLUND, 1873 (obj.); *Primella* COOPER, 1890 (obj.) (type, *Cyclas calyculata* DRAPARNAUD, 1805 =*Tellina lacustris* MÜLLER, 1774; SD KEEN, herein)]. Hinge plate weak, embryonal shell prominent, commonly set off by a groove. *Mio.-Rec.*, Eu.-N.Am.——FIG. E141, *5*. **S. (M.) lacustre* (MÜLLER), Rec., Eng.; *5a,b*, LV and RV hinges, ×2 *(294)*.

S. (Pseudocorbicula) DAUTZENBERG, 1908 [**P. alluaudi;* M]. Like *Corbicula* in form but with hinge of *Sphaerium*. *Rec.*, Afr.

S. (Sulcastrum) STERKI, 1930 [**Sphaerium sulcatum* LAMARCK, 1818; OD]. Densely microscopically rugulose. *Rec.*, N.Am.-Eu.

Superfamily VENERACEA Rafinesque, 1815

[*nom. correct.* MENKE, 1830 (*pro* Veneridia RAFINESQUE, 1815)] [Materials for this superfamily prepared by MYRA KEEN]

Ovate shells, ornamentation predominantly concentric but also radial in some, with spines or lamellae, especially near posterior slope; beaks anterior, prosogyrate. Ligament external, opisthodetic. Cardinal hinge teeth generally three in either valve; pallial sinus usually present. *L.Cret.-Rec.*

Family VENERIDAE Rafinesque, 1815

[*nom. transl. et correct.* LEACH, 1819 (*ex* Veneridia RAFINESQUE, 1815)]

Lunule and escutcheon usually well developed. Cardinal teeth three in either valve, with *1* and *2b* commonly thicker than *3a* and *2a;* posterior lateral teeth feeble or wanting, anterior laterals present in some groups, absent in others; pallial sinus varying in size and shape. *L.Cret.-Rec.*

This family probably is polyphyletic in origin. Subfamily divisions here used do not necessarily reflect genetic relationships but are adopted for convenience in arrangement.

Subfamily VENERINAE Rafinesque, 1815

[*nom. transl. et correct.* SWAINSON, 1840 (*ex* Veneridia RAFINESQUE, 1815)]

Sculpture usually both radial and concentric. Anterior lateral tooth *(All)* present in left valve. *M.Eoc.-Rec.*

Venus LINNÉ, 1758 [**V. verrucosa;* SD GRAY, 1847 (ICZN, 1950)] [=*Venusarius* DUMÉRIL, 1805 (obj.); *Clausina* BROWN, 1827 (obj.); *Ventricola* RÖMER, 1867 (obj.)]. Escutcheon smooth, large, beveled in LV; hinge with *AII* small to pustular; pallial sinus short. *Oligo-Rec.*, Eu.-Afr.-E.Indies-N.Am.

V. (Venus). Sculpture of concentric ribs intersected over part of surface by divaricate radial ribs; *AII* minute *(711)*. *Oligo.(Aquitan.)-Rec.*,

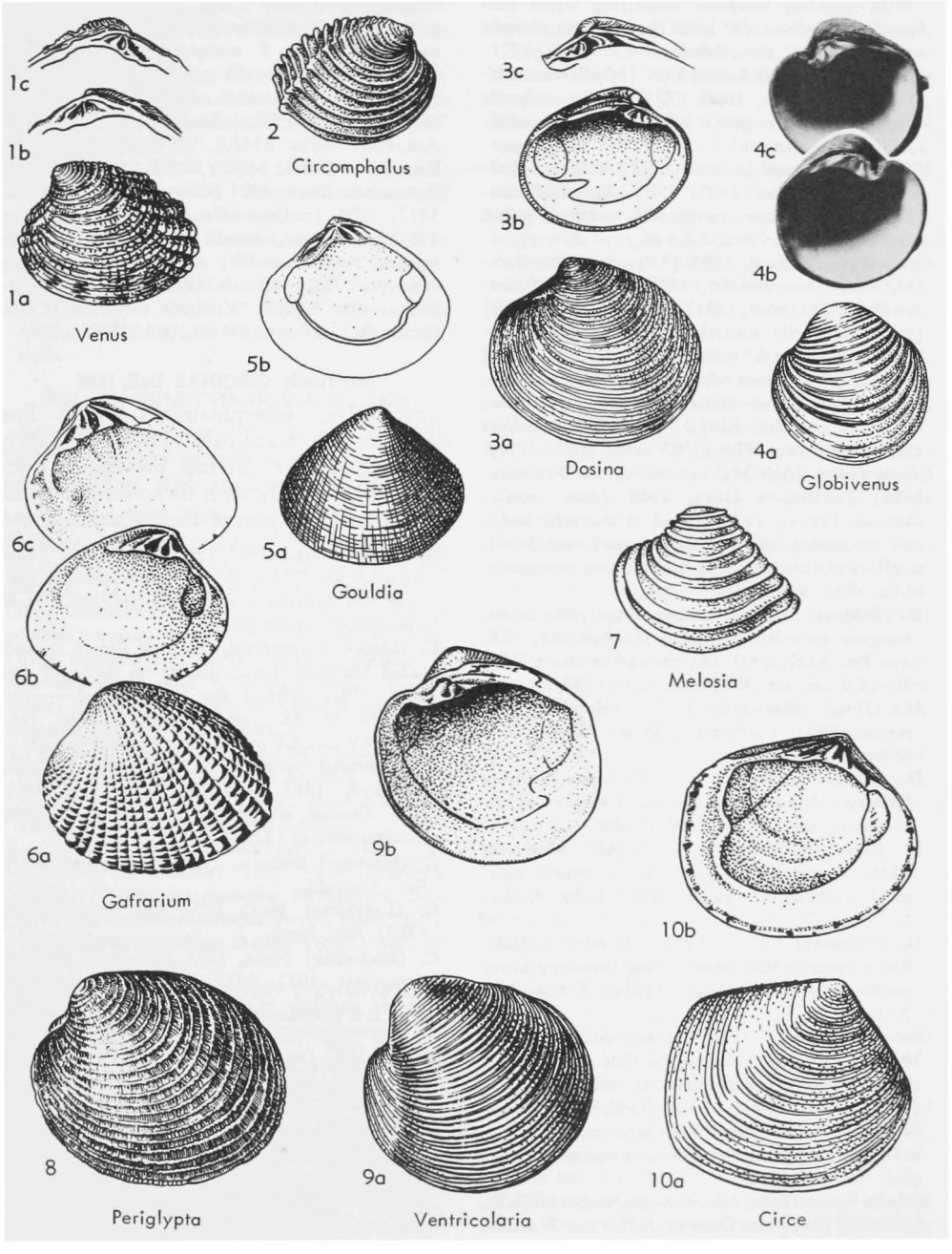


FIG. E142. Veneridae (Venerinae) *(1-4,7-9)* (Circinae) *(5-6,10)* (p. *N671-N673*).

S.Eu.-N.Afr.——Fig. E142,*1*. **V. (V.) verrucosa* Linné, Rec., Medit.; *1a-c*, LV ext., RV and LV hinges, ×0.5 *(124b)*.

V. (Antigona) Schumacher, 1817 [**A. lamellaris;* OD] [=*Omphaloclathrum* Mörch, 1853 (obj.)]. With radiating sculpture underlying raised concentric lamellae; *All* small but evident; lunule sunken *(329a)*. *Rec.*, E.Indies.

V. (Ventricoloidea) Sacco, 1900 [**Cytherea multilamella* Lamarck, 1818; OD]. Radial sculpture wanting; *All* elongate *(329a)*. *Oligo.-Rec.*, Eu.-E.Indies-E.N.Am.

?**Ameghinomya** von Ihering, 1907 [**Chione argentina* von Ihering, 1897; OD]. Sculpture concentric to cancellate; escutcheon wanting; pallial sinus small. *Tert., ?Rec.*, S.S.Am.

Circomphalus Mörch, 1853 [**Venus plicata* Gmelin, 1791 (*non* Barbut, 1788) (=**V. foliaceolamellosa* Dillwyn, 1817); SD Sacco, 1900] [=*Mioclausinella* Kautsky, 1936 (invalidly proposed)]. Trigonal, compressed, cordate, lunule impressed, escutcheon well defined, larger in LV; sculpture of raised lamellae *(329a)*. *Mio.-Rec.*, Eu.-W.Afr.——Fig. E142,*2*. **C. foliaceolamellosa* (Dillwyn), Rec., Medit.; RV ext., ×0.5 *(124)*.

Dosina Gray, 1835 [**D. zelandica;* SD Frizzell, 1936] [=*Dorsina* Gray, 1840 *(nom. null.)*; *Dosinula* Finlay, 1926 (obj.)]. Concentric sculpture predominating; *All* small to moderate; lunule small, sculptured; pallial sinus short, triangular. *M.Eoc.-Rec.*, S.Pac.

D. (Dosina). Medium in size; hinge plate broad; marginal crenulations strong. *U.Oligo.-Rec.*, N.Z. ——Fig. E142,*3*. **D. (D.) zelandica* Gray, N.Z.; *3a-c*, LV ext., int., RV hinge, ×0.5 *(592)*.

D. (Hina) Marwick, 1927 [**Marama (H.) pinguis;* OD]. Cardinals *2a-2b* not joined *(592)*. *M.Eoc.-L.Mio.*, N.Z.

D. (Kuia) Marwick, 1927 [**Chione vellicata* Hutton, 1873; OD]. Like *D. (Dosina)* but *All* markedly larger *(592)*. *L.Oligo.-Mio.*, N.Z.

D. (Marama) Marwick, 1927 [**M. murdochi;* OD]. Hinge plate narrow, *2a-2b* joined; marginal crenulations fine *(592)*. *U.Eoc.-L.Plio.*, N.Z.

D. (Plurigens) Finlay, 1930 [**P. phenax;* OD]. Early sculpture thin lamellae later becoming heavy sulcations at ends of shell *(392a)*. *U.Mio.-Rec.*, N.Z.

Globivenus Coen, 1934 [**Venus effossa* Philippi, 1836; M]. Like *Ventricolaria* but with lunule also channeled, escutcheon not beveled in LV *(329a)*. *Rec.*, Medit.——Fig. E142,*4*. **G. effossa* (Philippi), Italy; *4a-c*, LV ext., int., RV int., ×1 (Specimen, Station Oceanographique, Monaco).

Melosia Dall, 1915 [**Cytherea glyptoconcha* Dall, 1903; M] [=*Artena* Conrad, 1870 (*non* Walker, 1858); *Netara* Frizzell, 1936 (*pro Artena*) (type, *Cytherea staminea* Conrad, 1839; OD)]. Trigonal, escutcheonal area large, nearly smooth, equal in both valves; sculpture of concentric lamellae. *Mio.*, E.N.Am.——Fig. E142,*7*. **M. glyptoconcha* (Dall), USA(Fla.); LV ext., ×1 (Dall, 1900).

Periglypta Jukes-Browne, 1914 [*pro Cytherea* Röding, 1798 (*non* Fabricius, 1794)] [**Venus puerpera* Linné, 1758; OD] [=*Proxichione* Iredale, 1929 (type, *P. materna*, OD); *Tigammona* Iredale, 1930 (type, *T. persimilis*; OD)]. Quadrate, heavy, pallial sinus rounded; sculpture cancellate *(455a)*. *Oligo.-Rec.*, Eu.-E.N.Am.-W.N.Am.-Pac.——Fig. E142,*8*. **P. puerpera* (Linné), Rec., Pac.; LV ext., ×0.5 *(124b)*.

Ventricolaria Keen, 1954 [**Venus rigida* Dillwyn, 1817; OD] [=*Ventricola* auctt. (*non* Römer, 1867)]. Globose, lunule depressed, escutcheon smooth, beveled in LV; sculpture predominantly concentric. *Oligo.-Rec.*, E.N.Am.-W.N.Am.-Medit.-Pac.——Fig. E142,*9*. **V. rigida* (Dillwyn), Rec., Carib.; *9a,b*, LV ext., RV int., ×0.5 *(711)*.

Subfamily CIRCINAE Dall, 1896

Equivalve, subequilateral; pallial line nearly entire. Cardinals smooth or faintly grooved; anterior laterals present. Surface sculptured, usually with dichotomous radial ribbing on some part of shell. *Paleoc.-Rec.*

Circe Schumacher, 1817 [**C. violacea* (=**Venus scripta* Linné, 1758); M]. Trigonal, umbones low; lunule and escutcheon narrow. *Oligo.-Rec.*, Eu.-E. Indies-Pac.-Australia-Japan.

C. (Circe). Compressed, ligament deeply sunken, radial sculpture weak, usually on umbonal area only *(329a)*. *L.Oligo.-Rec.*, Eu.-E.Indies.——Fig. E142,*10*. **C. (C.) scripta* (Linné), Rec., Pac.; *10a,b*, RV ext., LV int., ×1 (Sowerby, 1851-53).

C. (Circentia) Jousseaume, 1888 [**Venus arabica* Dillwyn, 1817 (*ex* Chemnitz, nonbinom.); OD]. Convex, sculpture feebly concentric, inner margins smooth *(329a)*. *Rec.*, Pac.

C. (Fluctiger) Iredale, 1924 [**F. royanus;* OD]. *Rec.*, Australia.

C. (Laevicirce) Habe, 1951 [**L. soyoae;* OD] *(365)*. *Rec.*, Japan.

C. (Microcirce) Habe, 1951 [**Meretrix gordonis* Yokoyama, 1927; OD]. Small, *All* long, with groove posterior to it *(365)*. *Pleist.-Rec.*, Japan.

C. (Parmulophora) Dall, 1915 [*pro Parmulina* Dall, 1902 (*non* Pénard, 1902)] [**Venus corrugata* Dillwyn, 1817; OD]. Inner margins finely crenulate *(329a)*. *Rec.*, Pac.

C. (Privigna) Dall, Bartsch, & Rehder, 1938 [**C. (P.) pilsbryi;* OD] *(659)*. *Rec.*, Hawaii.

C. (Redicirce) Iredale, 1936 [**R. mistura;* OD] *(659)*. *Rec.*, Australia.

Gafrarium Röding, 1798 [**Venus pectinata* Linné; SD Dall, 1902] [=*Crista* Römer, 1857 (obj.)]. Sculpture of nodose radial ribs dichotomous medial-

ly; pallial sinus small. *L.Mio.-Rec.,* Pac.——Fig. E142,*6*. **G. *pectinatum* (Linné), Rec., E.Indies; *6a-c,* LV ext., int., RV int., ×1 *(711)*.

Gouldia C. B. Adams, 1847 [**Thetis cerina* Adams, 1845; SD von Martens, 1882]. Small, lunule long, escutcheon wanting; pallial sinus small. *Paleoc.-Rec.,* Eu.-N. Am.-Carib.-Japan-Pac.-Australia.

G. (Gouldia). Sculpture fine, concentric or reticulate. *Paleoc.-Rec.,* Eu.-E.N.Am.——Fig. E142,*5*. **G. (G.) cerina* (Adams), Rec., Carib.; *5a,b,* RV ext., int., ×2 *(217)*.

G. (Crenocirce) Habe, 1960 [**Dorisca (C.) picta;* OD]. With crenulate inner ventral margin; otherwise like *Dorisca. Rec.,* Japan.

G. (Dorisca) Dall, Bartsch, & Rehder, 1938 [**D. cookei;* OD]. Radial sculpture stronger, more divergent *(659)*. *Rec.,* Pac.

G. (Gouldiopa) Iredale, 1924 [**G. australis* Angas, 1865; OD]. Smooth *(329a)*. *Rec.,* Australia.

Subfamily SUNETTINAE Stoliczka, 1870

Ligament in a deeply excavated escutcheon; shell surface smooth or with concentric ribbing; hinge with elongate *All. Eoc.-Rec.*

Sunetta Link, 1807 [**Donax scripta* Linné, 1758; SD Dall, 1902] [=*Cuneus* Megerle von Mühlfeld, 1811 (*non* da Costa, 1778); *Meroë* Schumacher, 1817 (type, *Venus meroë* Linné, 1758; OD); *Sunemeroë* Iredale, 1930 (type, *Sunetta adelinae* Angas, 1868, ?=*S. scripta* (Linné); OD)]. Elongate-oval, beaks commonly posterior to mid-line; hinge with *4b* short, *3b* smooth and entire; pallial sinus ample, rounded; inner margin crenulate. *U.Oligo.-Rec.,* W.Pac.-Eu.

S. (Sunetta). Elongate, sculpture concentric. *U. Oligo.-Rec.,* Eu.-W.Pac.-S.Pac.——Fig. E143,*10*. **S. (S.) scripta* (Linné), Rec., Pac.; *10a,b,* RV ext., LV int., ×1 (Sowerby, 1851-53).

S. (Cyclosunetta) Fischer-Piette, 1939 [*pro Sunettina* Jousseaume, 1891 (*non* Pfeiffer, 1869)] [**Sunettina sunettina* Jousseaume, Sept. 1891 (=**Sunetta contempta* Smith, June, 1891); OD]. Short, escutcheon shallow *(659)*. *Rec.,* W. Pac.

S. (Sunettina) Pfeiffer, 1869 [**Cytherea solanderii* Gray, 1825; M] [=*Solanderina* Dall, 1902 (obj.)]. Inflated, smooth *(659)*. *Rec.,* Pac.

Meroena Jukes-Browne, 1908 [**Cytherea trigonula* Deshayes, 1825; OD]. Nearly equilateral, ligament only moderately deep; hinge with *3b* deeply grooved; inner margin smooth *(455)*. *Eoc.,* Eu. ——Fig. E143,*9*. **M. trigonula* (Deshayes), France; *9a,* RV ext., ×1; *9b,c,* RV and LV hinges, ×1.5 (Cossmann & Pissarro, 1904).

Subfamily MERETRICINAE Gray, 1847

[*nom. correct.* Fischer, 1887 (*pro* Meretricina Gray, 1847)]

Elongate-ovate; sculpture subdued or wanting; hinge with cardinal teeth tending to radiate, anterior lateral teeth in RV commonly flanked with denticles above and below. *U.Cret.-Rec.*

Meretrix Lamarck, 1799 [**Venus meretrix* Linné, 1758; T] [=*Cytherea* Lamarck, 1805 (*non* Fabricius, 1794); *Nympha* Mörch, 1853 (*non* Fitzinger, 1826)]. Large, trigonal, smooth, lunule and escutcheon faint; teeth large; pallial sinus broad. *U.Mio.-Rec.,* E.Indies.——Fig. E143,*1*. **M. meretrix* (Linné), Rec., E.Indies; *1a-c,* RV int., LV int., RV ext., ×0.5 *(711)*.

Aeora Conrad, 1870 [**A. cretacea;* M]. Smooth, hinge with nymphs smooth or weakly rugose, *All* distant from *2a;* pallial sinus deep, rounded, somewhat ascending. *U.Cret.,* E.N.Am.——Fig. E143, *3*. **A. cretacea,* Cret., USA(N.J.); *3a-c,* LV ext., RV int., LV int., ×1 *(711)*.

Bassinaria Marwick, 1928 [**B. macclurgi;* OD]. Resembling *Bassina* but RV with deep pit for reception of *All. M.Plio.,* N.Z.——Fig. E143,*11*. **B. macclurgi;* RV int., ×0.7 *(593)*.

Eomeretrix Turner, 1938 [**Pitaria martini* Dickerson, 1914; OD]. Like *Meretrix* but with V-shaped pallial sinus and a well-defined lunule *(695)*. *Eoc.,* W.N.Am.

Grateloupia Desmoulins, 1828 *(emend.)* [**G. donaciformis* (=**Donax irregularis* Basterot, 1825)] [=*Gratelupia* Desmoulins, 1828 *(nom. imperf.)*]. With parallel ridges on nymphs. *Eoc.-Mio.,* Eu.-N.Am.-S.Am.

G. (Grateloupia). Pallial sinus long and acute. *Oligo. (Aquitan.)-Mio. (Helvet.),* Eu. —— Fig. E143,*7*. **G. (G.) irregularis* (Basterot), Mio., France; RV int., ×1 *(1007)*.

G. (Cytheriopsis) Conrad, 1865 [**Cytherea hydana* Conrad, 1833; OD] [=*Grateloupina* Dall, 1902 (obj.)]. Pallial sinus small *(711)*. *Eoc.-Mio.,* E.N.Am.-S.Am.

G. (Xenoloupia) Clark & Durham, 1946 [**X. carmenensis;* OD]. With a flangelike escutcheon *(695)*. *Eoc.,* S.Am.

Meretrissa Jukes-Browne, 1908 [**Cytherea depressa* Deshayes, 1858; OD]. Small, nearly smooth; hinge weak; pallial sinus short, rounded *(455)*. *Oligo.,* Eu.——Fig. E143,*6*. **M. depressa* (Deshayes), France; *6a,b,* LV int., RV int., ×4 (Keen, n, Stanford Univ. Coll.).

Tivela Link, 1807 [**Venus tripla* Linné, 1771; SD Kobelt, 1881] [=*Trigona* Megerle von Mühlfeld, 1811 (*non* Jurine, 1807)]. Medium-sized to large, trigonal, smooth; nymph bifid or trifid, resembling cardinal tooth. *Eoc.-Rec.,* N.Am.-C. Am.-S.Am.-Afr.-Ind.O.

T. (Tivela). Medium in size, inner margin smooth. *Mio.-Rec.,* E.N.Am.-W.C.Am.-W.Afr.-Ind.O.—— Fig. E143,*4*. **T. (T.) tripla* (Linné), Rec., W. Afr.; *4a,b,* LV ext., RV int., ×1 *(124b; 1007)*.

T. (Comus) Cox, 1930 [**Venus platyaulax* Tomlin, 1924; OD]. Sculptured with heavy concentric undulations *(329a)*. *Pleist.-Rec.*, SE.Afr.

T. (Eutivela) Dall, 1891 [**T. perplexa* (*ex* Stearns, MS) (=**Venus isabelleana* d'Orbigny, 1846); OD]. Inner margins crenulate *(329a)*. *Rec.*, E.S.Am.

T. (Pachydesma) Conrad, 1854 [*pro Trigonella*

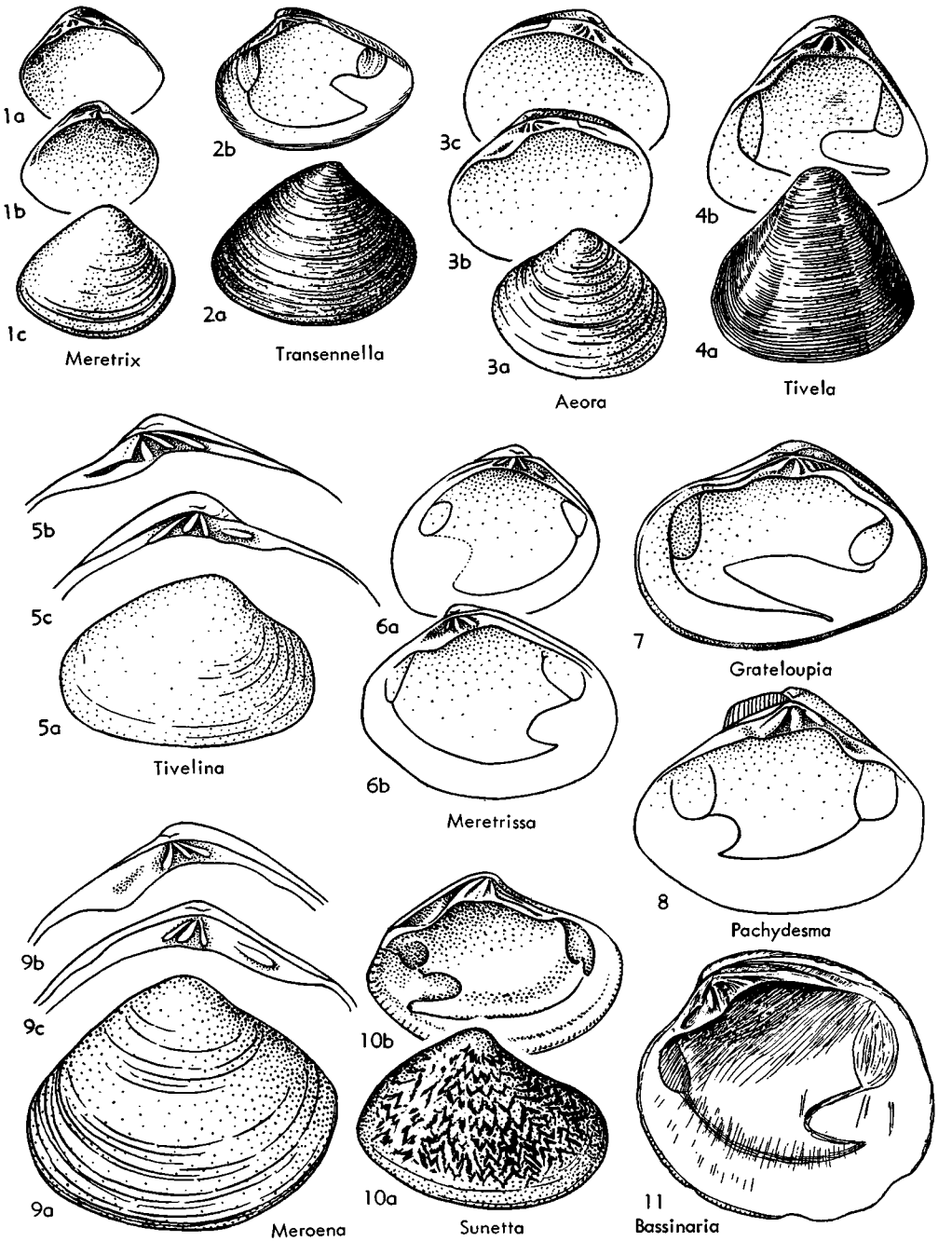


Fig. E143. Veneridae (Sunettinae)*(9-10)*, (Meretricinae) *(1-8,11)* (p. *N673-N675*).

CONRAD, 1837 (*non* DA COSTA, 1778)] [**Cytherea crassatelloides* CONRAD, 1837 (=*Donax stultorum* MAWE, 1823);M]. Large and heavy, inner margins smooth; nymph not bifid but set off from *4b*. *L. Eoc.-Rec.*, E. N. Am.-W. N. Am.——FIG. E143,*8*. **T. (P.) stultorum* (MAWE), Rec., USA (Calif.); LV int., ×0.25 *(711;* Keen, n, Stanford Univ. Coll.).

T. (Planitivela) OLSSON, 1961 [**Cytherea planulata* BRODERIP & SOWERBY, 1829; OD]. Compressed, lunule elliptical, nymphal area forming high plate set off by deep groove. *Rec.*, W.C.Am.-S.Am.

Tivelina COSSMANN, 1886 [**Cytherea rustica* DESHAYES, 1825; SD CROSSE, 1886]. Small, compressed cardinal teeth short; pallial sinus small, rounded, ascending *(329a)*. *L.Eoc.-L.Mio.*, Eu.——FIG. E143,*5*. **T. rustica* (DESHAYES), Eoc., France; *5a-c*, RV ext., RV and LV hinges, ×2 (Cossmann & Pissarro, 1904).

Transennella DALL, 1883 [**Cytherea (T.) conradina* DALL, 1883; OD]. Small, pallial sinus rounded; valve margins tangentially grooved *(711)*. *Eoc.-Rec.*, E.N.Am.-W.N.Am.-S.Am.——FIG. E143,*2*. **T. conradina* (DALL), Rec., Carib.; *2a,b*, RV ext., int., ×2 *(222;* Dall, 1900, 1904).

Subfamily PITARINAE Stewart, 1930

Inequilateral, beaks anterior. Cardinal teeth not tending to radiate, anterior laterals well developed. *L.Cret.-Rec.*

Pitar RÖMER, 1857 [**Venus tumens* GMELIN, 1791; M] [=*Caryatis* RÖMER, 1862 (*non* HÜBNER, 1816); *Pitaria* DALL, 1902 *(nom. van.)*]. Oval or subtrigonal, smooth or finely concentrically lamellate; lunule superficial, escutcheon not defined; hinge with *2b* triangular, joined to a thin *2a, 3a* and *1* separate. *Eoc.-Rec.*, cosmop.

P. (Pitar). Smooth or finely striate, pallial sinus deep and pointed; *4b* confluent with nymph. *Eoc.-Rec.*, N.Am.-W.Afr.-Pac.——FIG. E144,*10*. **P. (P.) tumens* (GMELIN), Rec., W.Afr.; *10a,b*, RV ext., int., ×1 *(711)*.

P. (Calpitaria) JUKES-BROWNE, 1908 [**Cytherea sulcataria* DESHAYES, 1825; OD]. With fine concentric lamellae; nymphs striate; pallial sinus short, rounded *(455)*. *Eoc.*, Eu.-W.N.Am.-SE. Asia.

P. (Costellipitar) HABE, 1951 [**Caryatis chordata* RÖMER, 1876; OD]. Small, concentric ribs evident *(365)*. *Rec.*, Pac.-Japan.

P. (Hyphantosoma) DALL, 1902 [**Cytherea carbasea* GUPPY, 1866; OD]. With zigzag concentric grooves *(228)*. *Oligo.-Plio.*, W.Indies-N.Z.

P. (Hysteroconcha) DALL, 1902 [*pro Dione* GRAY, 1847 (*non* HÜBNER, 1819)] [**Venus dione* LINNÉ, 1758; OD]. Like *P. (Lamelliconcha)* but with posterior area bordered by spines *(228)*. *U.Oligo.-Rec.*, C.Am.——FIG. E144,*9*. **P. (H.) dione* (LINNÉ), Rec., Carib.; *9a,b*, LV ext., RV int., ×1 *(1007)*.

P. (Katherinella) TEGLAND, 1929 [**Callocallista arnoldi* WEAVER, 1916; OD]. Lunule pouting; *All* bladelike, buttressed under upper margin of hinge plate *(329a)*. *Oligo.-Rec.*, W.N.Am.

P. (Lamelliconcha) DALL, 1902 [**Cytherea concinna* SOWERBY, 1835; OD]. With thin concentric lamellae; hinge plate excavated and attenuated behind, nymphs logitudinally striate; pallial sinus obtuse *(711)*. *Eoc.-Rec.*, N.Am.-W.N.Am.-S.Am.

P. (Meisenia) MAKIYAMA, 1936 [**M. tateiwai;* OD]. Lunule wanting *(329a)*. *Mio.*, Korea.

P. (Nanopitar) REHDER, 1943 [**P. (N.) pilula;* OD]. Small, smooth, rounded, inner margins smooth *(695)*. *Rec.*, Carib.

P. (Omnivenus) PALMER, 1927 [**Cytherea discoidalis* CONRAD, 1833; OD]. Resembling *P. (Tinctora);* nymphs rugose *(711)*. *Eoc.*, E.N.Am.

P. (Pitarella) PALMER, 1927 [**Callocardia gatunensis* DALL, 1903; OD]. *All* much reduced *(711)*. *Eoc.-Mio.*, Carib.

P. (Pitarenus) REHDER & ABBOTT, 1951 [**Pitaria cordata* SCHWENGEL, 1951; OD]. Ventral margin crenulate; hinge as in *P. (Pitarella) (695)*. *Rec.*, Carib.

P. (Pitarina) JUKES-BROWNE, 1913 [**Cytherea citrina* LAMARCK, 1818; OD]. Nymphs smooth; *4b* wholly free and oblique; pallial sinus short *(329a)*. *Rec.*, Pac.

P. (Rhabdopitaria) PALMER, 1927 [**Callocardia astartoides* GARDNER, 1923; OD]. Shell smooth but middle layer radially ribbed; inner ventral margin finely crenulate; nymphs smooth *(711)*. *M.Eoc.*, E.N.Am.

P. (Tinctora) JUKES-BROWNE, 1914 [*pro Callizona* JUKES-BROWNE, 1913 (*non* DOUBLEDAY, 1846-50)] [**Cytherea vulnerata* BRODERIP, 1835; OD] [=*Jukes-Brownia* COSSMANN, 1920 (obj.); *Callizonata* STRAND, 1926 (obj.)]. Thick-shelled, round, glosssy; valve margins crenulate *(455a)*. *Rec.*, W.C.Am.

Amiantis CARPENTER, 1864 [**Cytherea callosa* CONRAD, 1837; M]. Large, thick-shelled; nymphs rugose; pallial sinus generally pointed. *Eoc.-Rec.*, N.Am.-S.Am.

A. (Amiantis). Concentric ribs commonly anastomosing *(711)*. *U.Oligo.-Rec.*, E.N.Am.-W.N.Am.——FIG. 39,*1*. **A. (A.) callosa* (CONRAD), Rec., USA (Calif.); *1a,b*, RV int., LV ext., ×0.5 (Keen, n; Stanford Univ.Coll.).

A. (Eucallista) DALL, 1902 [**Cytherea purpurata* LAMARCK, 1818; OD]. Thinner than *A. (Amiantis)*, ribs weak on posterior *(711)*. *Rec.*, E.N. Am.-S.Am.

A. (Venidia) CLARK & DURHAM, 1946 [**V. steinekei;* OD]. Smooth, escutcheon stronger than in *A. (Amiantis)*, lunule weaker *(695)*. *Eoc.*, W.S. Am.

Anofia REYMENT, 1955 [**A. aro;* OD]. Lenticular,

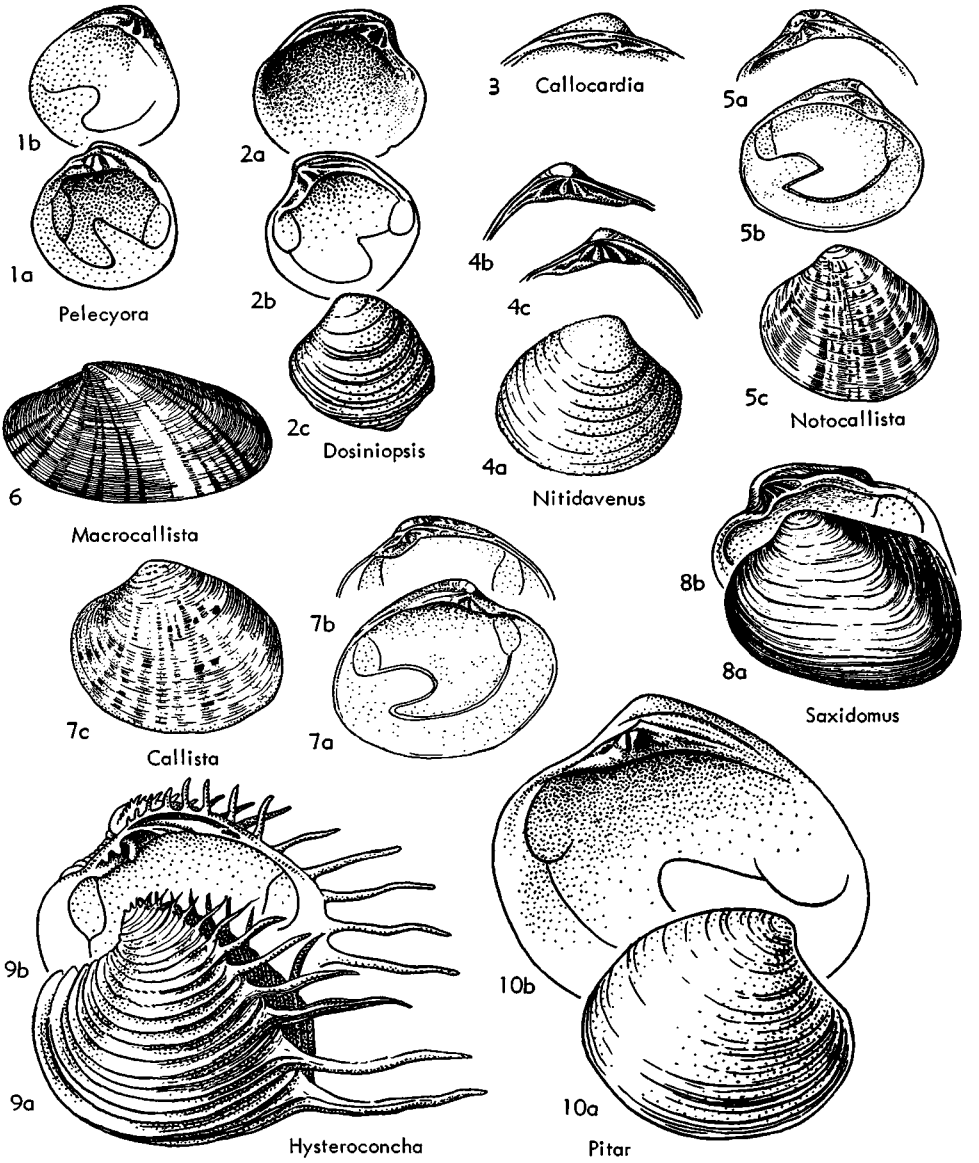


FIG. E144. Veneridae (Pitarinae) (p. *N675*, *N677-N679*).

resembling *Naulia* but with cardinals more separated; an excavated ligamental pit in front of nymph. *U.Cret.*, W.Afr.

Aphrodina CONRAD, 1869 [**Meretrix tippana* CONRAD, 1858; OD] [=*Callistina* JUKES-BROWNE, 1908 (type, *Venus plana* SOWERBY, 1813; OD)]. Cardinal teeth divergent, *All* rugose; pallial sinus deep, ascending. *L.Cret.-U.Eoc.*, S.Am.-N.Z.-N.Am.-Eu.-Afr.

A. (Aphrodina). Escutcheon wanting. *L.Cret.-U. Eoc.*, Eu.-Afr.-N.Am.-S.Am.——FIG. E145,*4*. **A. (A.) tippana* (CONRAD), U.Cret., USA(N.Car.); *4a-c*, RV ext., int., LV hinge, ×0.5 *(887)*.

A. (Sechurina) OLSSON, 1944 [**A. (S.) australis*; OD]. With well-marked escutcheon *(695)*. *Cret.*, S.Am.(Peru).

A. (Tikia) MARWICK, 1927 [**Callista thomsoni* WOODS, 1917; OD]. With strong concentric

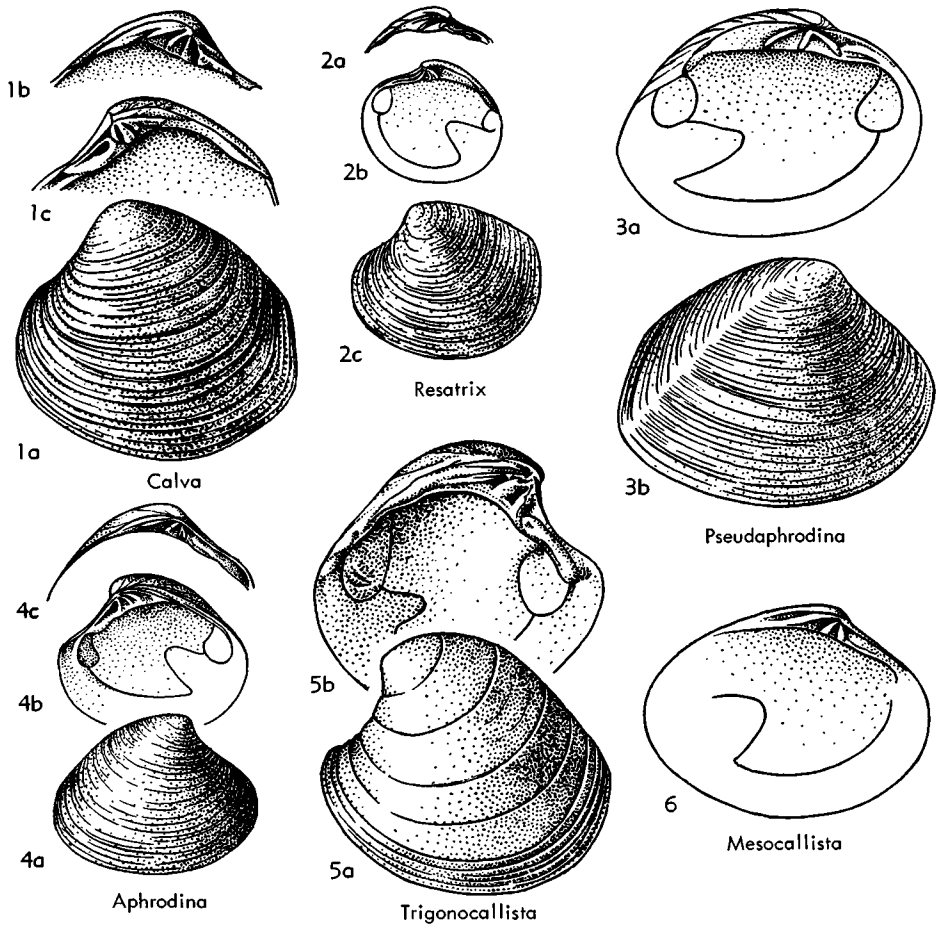


FIG. E145. Veneridae (Pitarinae) (p. *N678-N679*).

ridges; *All* extremely long, with a knobbed posterior end *(592)*. *Cret.*, N.Z.

Callista POLI, 1791 [**Venus chione* LINNÉ, 1758; SD MEEK, 1876] [=*Callistoderma* POLI, 1795 (obj.)]. Glossy, with or without sculpture; pallial sinus wide, horizontal, pointed; *3b* narrow. *Paleoc.-Rec.*, Eu.-N.Am.-C.Am.-Carib.-Asia-N.Z.-E.Indies.

C. (Callista). Smooth, ovate; *3b* with a slight groove *(711)*. *Eoc.-Rec.*, E.N.Am.-Eu.——FIG. E144,7. **C. (C.) chione* (LINNÉ), Rec., Medit.; *7a-c*, LV ext., int., RV int., ×0.5 *(592)*.

C. (Chionella) COSSMANN, 1886 [*pro Chione* GRAY, 1838 (*non* MEGERLE VON MÜHLFELD, 1811)]. [**Cytherea ovalina* DESHAYES, 1858; SD CROSSE, 1886] [=*Paradione* DALL, 1909 (obj.)]. Small, nearly smooth, with obsolete concentric folds *(392a)*. *Eoc.-Oligo.*, Eu.-C.Am.

C. (Costacallista) PALMER, 1927 [**Venus erycina* LINNÉ, 1758; OD]. Sculpture strong, of flat concentric ridges; hinge plate excavated, *2a* grooved *(711)*. *Paleoc.-Rec.*, E.N.Am.-W.N.Am.-Asia-Eu.-N.Z.

C. (Macrocallista) MEEK, 1876 [**Venus gigantea* GMELIN, 1791 (=**V. nimbosa* LIGHTFOOT, 1786)]. Elongate-ovate, smooth or with concentric grooves; *3b* not grooved *(711)*. *Eoc.-Rec.*, E.N.Am.-W.N.Am.-E.Indies.——FIG. E144,6. **C. (M.) nimbosa* (LIGHTFOOT), Rec., Carib.; LV ext., ×0.25 *(124b)*.

C. (Microcallista) STEWART, 1930 [**Cytherea proxima* DESHAYES, 1858; OD]. No groove on *2a (892)*. *Eoc.*, Eu.-E.N.Am.-W.N.Am.

Callocardia A.ADAMS, 1864 [**C. guttata;* M] [="*Callocallista* Adams," WEAVER, 1916 *(nom. null.)*]. Thin; hinge plate narrow, excavated, 2 cardinals in each valve united as curved arches. *Eoc.-Rec.*, N.Am.-Asia-E.Indies-Eu.

C. (Callocardia). Very thin-shelled, pallial sinus

nearly obsolete. *Rec.*, E.N.Am.-W.N.Am.-E.Asia. ——Fig. E144,*3*. **C. (C.) guttata* Adams, Rec., Korea; LV hinges, ×2 *(711)*.

C. (Agriopoma) Dall, 1902 [**Cytherea texasiana* Dall, 1892; OD] [=*Agriodesma* Dall, 1916 (*nom. null.; non* Dall, 1909)]. Dull white, thicker than *C. (Callocardia);* pallial sinus sharply angular *(711)*. *M.Eoc.-Rec.*, E.N.Am.

C. (Aphrodora) Jukes-Browne, 1914 [*pro Leucothea* Jukes-Browne, 1913 (*non* Mertens, 1833)] [**Callista birtsi* Preston, 1905; OD]. Hinge teeth weak *(455a)*. *Rec.*, Ceylon.

C. (Atopodonta) Cossmann, 1886 [**Venus conformis* Deshayes, 1858; SD Crosse, 1886]. Small but not extremely thin; pallial line entire *(329a)*. *Eoc.-Mio.*, Eu.-E.Indies.

C. (Nitidavenus) Vokes, 1939 [**Cytherea nitida* Deshayes, 1858; OD]. Lunule large, impressed, escutcheon wanting; pallial sinus well developed. *L.Eoc.*, Eu.-W.N.Am.——Fig. E144,*4*. **C. (N.) nitida* (Deshayes), Eoc., France; *4a-c*, RV ext., RV and LV hinges, ×1 (Vokes, 1939).

Calva Popenoe, 1937 [**C. regina;* OD]. Resembling *Trigonocallista* but more elongate, with bifid *3b*, nymph smooth, laterals close to cardinals. *L.Cret.-U.Cret.*, Eu.-N.Am.

C. (Calva). With escutcheon or depressed dorsal area. *L.Cret.-U.Cret.*, Eu.-N.Am. *(92)*.——Fig. E145,*1*. **C. (C.) regina* Popenoe, U.Cret., USA Calif.); *1a-c;* LV ext., LV and RV hinges, ×1 *(748)*.

C. (Chimela) Casey, 1952 [**Venus caperata* J. de C. Sowerby, 1826; OD]. Dorsal area not depressed *(92)*. *L. Cret.(Alb.)*, Eu.

Dollfusia Cossmann, 1886 [**D. crassa;* M]. Resembling *Pelecyora* in outline but small, hinge with *3b* bifid; pallial sinus short, rounded, wide *(329a)*. *Eoc.*, Eu.

Dosiniopsis Conrad, 1864 [**D. meeki;* SD Tate, 1868]. Large, smooth, lenticular; anterior lateral teeth and sockets rugose, near cardinals, *3b* deeply bifid; pallial sinus deep and angular, not ascending. *Paleoc.-Eoc.*, E. N. Am.-W. N. Am.-Eu. —— Fig. E144,*2*. **D. meeki*, Eoc., USA(Md.); *2a-c*, LV int., RV int., LV ext., ×0.5 *(711)*.

Gilbertharrisella F. Hodson & H. Hodson, 1927 [**Pitaria lynei;* OD]. Like *Pitar* but thick-shelled, sculpture of concentric folds; lunule large; *All* peglike; heavy ridge behind anterior muscle scar *(695)*. *U.Cret.*, S.Am.(Venez.).

Lepidocardia Dall, 1902 [**Chione floridella* Gray, 1838; OD]. Small, compressed, smooth, posteriorly attenuated; hinge short, teeth crowded *(228)*. *Rec.*, W.Afr.

Lioconcha Mörch, 1853 [**Venus castrensis* Linné, 1758; SD Stoliczka, 1870]. Hinge strong, resembling *Pitar;* lunule present; pallial sinus shallow. *Plio.-Rec.*, Pac.-E.Indies.

L. (Lioconcha). Surface smooth, with zigzag streaks or spots of color *(329a)*. *Plio.-Rec.*, Pac.

L. (Sulcilioconcha) Habe, 1951 [**Cytherea philippinarum* Hanley, 1844; OD]. With concentric ribs *(365)*. *Rec.*, Japan.-E.Indies.

Loxo Dailey & Popenoe, 1966 [**L. decore;* OD]. Smaller, longer than *Calva*. *U.Cret.*, N.Am.

Marwickia Finlay, 1930 [*pro Finlaya* Marwick, 1927 (*non* Theobald, 1903)] [**Finlaya parthiana* Marwick, 1927; OD]. Oval, lunule concave, sculpture of weak concentric grooves; *2b* large, *All* distant from *2a (329a)*. *U.Cret.*, N.Z.

Megapitaria Grant & Gale, 1931 [**Cytherea aurantica* Sowerby, 1831; OD]. Like *Pitar* but much larger and heavier *(329a)*. *Plio.-Rec.*, W.C.Am.

Mesocallista Cox, 1952 [**Meretrix andersoni* Newton, 1909; OD]. Ovate, lunule shallow, narrow, incised; hinge as in *Aphrodina* but *All* not corrugated. *U.Cret.*, Afr.-Asia-Eu.-S.Am.-N.Am.

M. (Mesocallista). Small, sculpture weak, concentric *(695)*. *U.Cret.*, W.Afr.-India-Eu.-W.S.Am. ——Fig. E145,*6*. **M. (M.) andersoni* (Newton), W.Afr.; LV int., ×1 (Cox, 1952).

M. (Larma) Stephenson, 1953 [**Callistina (L.) munda;* OD]. Larger, with irregular concentric ribs bearing secondary threads and some fine radial lines *(695)*. *U.Cret.(Cenoman.)*, E.N.Am.

Nagaoella Hayami, 1965 [**Dosiniopsis corrugata* Nagao, 1934; OD]. Near *Dosiniopsis* but smooth margined within. *L.Cret.*, Japan.

Naulia Cox, 1952 [**N. orbicularis;* OD]. More orbicular than *Aphrodina;* hinge with *3b* not so conspicuously bifid, *4b* down-curved distally, hinge plate flattened behind *4b;* pallial sinus shallower *(695)*. *U.Cret.*, W.Afr.

Notocallista Iredale, 1924 [**Cytherea kingi* Gray, 1827; OD]. Sculptured with irregular concentric grooves and ridges; otherwise like *Callista*. *Oligo.-Rec.*, Australia-N.Z.

N. (Notocallista). Large, periostracum thick. *Rec.*, Australia.——Fig. E144,*5*. **N. (N.) kingi* (Gray); *5a-c*, RV hinge, LV int., ext., ×0.5 *(597)*.

N. (Fossacallista) Marwick, 1938 [**Paradione parki* Marwick, 1926; OD]. Ligament deeply sunken *(597)*. *Oligo.-Mio.*, N.Z.

N. (Striacallista) Marwick, 1938 [**Cytherea multistriata* Sowerby, 1852; OD]. Small, periostracum thin, extremities of shell concentrically grooved *(597)*. *Oligo.-Rec.*, N.Z.-Australia.

Pelecyora Dall, 1902 [**Cytherea hatchetigbeensis* Aldrich, 1886: OD] [=*Sinodia* Jukes-Browne, 1908 (type, *Artemis trigona* Reeve, 1850; OD)]. Ovately trigonal, inflated, lunule faint. *Eoc.-Rec.*, Eu.-Asia-N.Am.-Afr.

P. (Pelecyora). Pallial sinus long, angular, ascending; cardinal teeth divergent, *All* well removed, near lower margin of hinge plate. *Eoc.-Rec.*, Eu.-Asia-N.Am.——Fig. E144,*1*. **P. (P.) hatchetigbeensis* (Aldrich), Eoc., USA(Ala.); *1a,b*, RV int., LV int., ×1 *(711)*.

P. (Cordiopsis) Cossmann, 1910 [**Venus incras-*

sata SOWERBY, 1817 (*non* BROCCHI, 1814) =*V. suborbicularis* GOLDFUSS, 1841; OD] [=*?Cyprinopsis* CONRAD, 1869 (*non* FITZINGER, 1832) (type, *Artemis elliptica* SOWERBY in SMITH, 1847 =*Cyprina isocardioides* LAMARCK, 1818; OD; Mio., Eu.)]. Pallial sinus moderate to short, rounded, cardinal teeth not markedly divergent, *AII* near *2a*, not marginal *(912)*. *Eoc.-Mio.*, Eu.-Afr.-Asia.

P. (Sinodiopsis) EAMES, 1957 [**S. coxi;* OD]. Hinge plate thinner than in *P. (Pelecyora)*, *2a* not grooved. *Eoc.*, W.Afr.

Pseudamiantis KURODA, 1933 [**Meretrix tauyensis* YOKOYAMA, 1927; OD]. Resembling *Amiantis* but concentric sculpture more regular, intersected by fine radial lines; pallial sinus rounded *(365)*. *Plio.*, Japan.

Pseudaphrodina CASEY, 1952 [**Venus ricordeana* D'ORBIGNY, 1845; OD]. Compressed, with carinate escutcheon; cardinals widely diverging. *L.Cret.*, Eu.——FIG. E145,*3*. **P. ricordeana* (D'ORBIGNY), Eng.; *3a,b*, LV int., RV ext., ×1 *(92)*.

Resatrix CASEY, 1952 [**R. dolabra;* OD]. Trigonally ovate, smooth or concentrically striate, lunule faint; hinge with *AII* scarcely detached from or joined to *2a*. *L.Cret.*, Eu.

R. (Resatrix). *AII* and *AIII* long, laminar, *PII* also present. *L.Cret.*, Eu.——FIG. E145,*2*. **R. (R.) dolabra* (CASEY), Eng.; *2a-c*, LV hinge, RV int., LV ext., ×1 *(92)*.

R. (Dosiniopsella) CASEY, 1952 [**R. (D.) cantiana;* OD]. With *2b* bifid, *AII* striate *(92)*. *L. Cret.*, Eu.

R. (Vectorbis) CASEY, 1952 [**Venus vectensis* FORBES, 1845; OD]. Laterals present in young but weak to absent in adults *(92)*. *L.Cret.*, Eu.

Rohea MARWICK, 1938 [**Paradione trigonalis* MARWICK, 1927; OD]. Sculpture of concentric grooves; hinge plate flat, *3a* long, *AII* distant from cardinals *(597)*. *Oligo.*, N.Z.

Saxidomus CONRAD, 1837 [**S. nuttalli;* M] [=*Ezocallista* KAMADA, 1962 (*ex* KIRA, 1955, *nom. invalid.*) (type, *S. brevisiphonatus* CARPENTER, 1865; OD)]. Large, oval, concentrically corrugated, without lunule or escutcheon; hinge curved, with irregular teeth *(228)*. *U.Oligo.-Rec.*, W.N.Am.-Japan.——FIG. E144,*8*. **S. nuttalli*, Rec., USA (Calif.); *8a,b*, LV ext., RV int., ×0.5 *(124b)*.

Trigonocallista RENNIE, 1930 [**Meretrix umzambiensis* WOODS, 1906; OD]. Trigonal; lunule and large escutcheon well marked; *3b* entire, *AII* very long, nymph rugose *(92)*. *U.Cret.*, S.Afr.——FIG. E145,*5*. **T. umzambiensis* (WOODS); *5a,b*, LV ext., int., ×0.5 (Woods, 1906).

Subfamily SAMARANGIINAE Keen, new subfamily

Shells inequilateral, quadrate, resembling some Arcticidae, surface unsculptured; hinge veneroid, with *AII* pustular, *2b* tending to be deeply bifid; pallial line entire. *Rec.*

Samarangia DALL, 1902 [**Venus quadrangularis* ADAMS & REEVE, 1850; OD] [=*Petroderma* KURODA, 1945 (type, *P. thaanumi;* OD)]. Periostracum present, encrusted with agglutinated sandy material. *Rec.*, E.Indies.——FIG. E146,*7*. **S. quadrangularis* (ADAMS & REEVE), E.China Sea; *7a-c*, LV int., RV int., RV ext., ×0.5 (Kuroda, 1945).

Subfamily DOSINIINAE Deshayes, 1853

[*nom. correct.* ADAMS & ADAMS, 1858 (*ex* Dosiniana DESHAYES, 1853)]

Equivalve, lenticular, concentrically striate; hinge strong, with *AII* present. *U.Cret.-Rec.*

Dosinia SCOPOLI, 1777 [**Chama dosin* ADANSON, 1757 (=**Venus concentrica* BORN, 1778, fide FISCHER-PIETTE, 1942); M] [=*Dosinidia* DALL, 1902 (obj.); *Bonartemis* IREDALE, 1929 (type, *B. stabilis;* OD); *Pardosinia* IREDALE, 1929 (type, *P. colorata;* OD); *Fallartemis* IREDALE, 1930 (type, *F. armina;* OD); *Meridosinia* IREDALE, 1930 (type, *M. nedigna;* OD); *Semelartemis* IREDALE, 1930 (type, *S. aetha;* OD)]. Compressed, nearly orbicular; lunule well defined. *L.Eoc.-Rec.*, cosmop.

D. (Dosinia). With periostracum; escutcheon wanting; sculpture of concentric grooves, none lamellose. *L.Oligo.-Rec.*, tropics-Atl.-Pac.——FIG. E146,*3*. **D. (D.) concentrica* (BORN), Rec., USA(Fla.); *3a,b*, LV ext., int., ×0.5 *(711)*.

D. (Asa) BASTEROT, 1825 [**Venus lincta* PULTENEY, 1799 (=*V. lupinus* LINNÉ, 1758, fide FISCHER-PIETTE, 1942); M?] [=*Arctoë* RISSO, 1826 (obj.); *Dosinia, s.s.*, AUCTT. (*non* SCOPOLI)]. Lunule deep, escutcheon narrow, bordered by lamellose sculpture *(329a)*. *Mio.-Rec.*, Eu.-W.Afr.

D. (Austrodosinia) DALL, 1902 [**Cytherea anus* PHILIPPI, 1848; OD]. Escutcheon with strong crest; pallial sinus horizonal *(228)*. *U.Oligo.-Rec.*, N.Z.

D. (Dosinella) DALL, 1902 [**Cytherea angulosa* PHILIPPI, 1847; OD]. Lunule shallow; pallial sinus deep *(228)*. *Rec.*, SW.Pac.

D. (Dosinisca) DALL, 1902 [**Artemis alata* REEVE, 1859; OD]. Lunule and escutcheon pouting; radial sculpture sometimes present *(288)*. *Rec.*, N.Pac.-S.Pac.

D. (Dosinorbis) DALL, 1902 [**Artemis bilunulata* GRAY, 1838; OD]. Lunule bounded by raised cords *(228)*. *Rec.*, Japan.

D. (Kakahuia) MARWICK, 1927 [**D. (K.) suteri;* OD]. Roundly trigonal; lunule shallow *(592)*. *M.Eoc.*, N.Z.

D. (Kaneharaia) MAKIYAMA, 1936 [**D. kaneharai* YOKOYAMA, 1926; OD]. Cardinal teeth not bifid *(392a)*. *Mio.*, Korea.

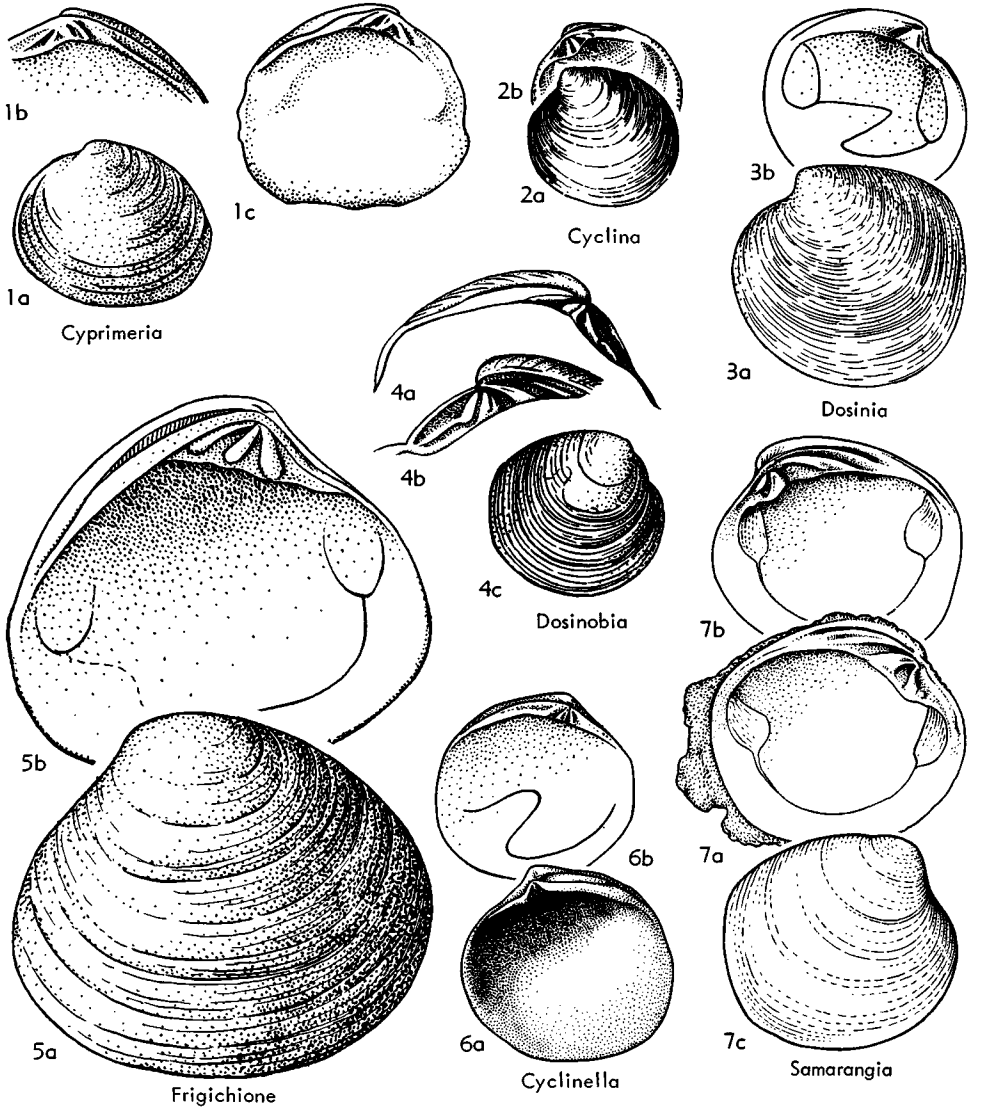


FIG. E146. Veneridae (Samarangiinae) *(7)*, (Dosiniinae) *(3-4)*, (Cyclininae) *(1-2,5-6)* (p. *N679-N681*).

D. (Kereia) MARWICK, 1927 [**D. greyi* ZITTEL, 1864; OD]. Sculpture of spaced sharp lamellae *(592)*. *L.Eoc.-Rec.*, N.Z.

D. (Pectunculus) DA COSTA, 1778 [**P. capillaceus* (=**Venus exoleta* LINNÉ, 1758; SD JUKES-BROWNE, 1911)] [=*Arthemis, Arthemiderma* POLI, 1795 (obj.; M) (*Artemis* AUCTT., *nom. van.*); *Orbiculus* MEGERLE VON MÜHLFELD, 1811 (obj.; SD DALL, 1902); *Exoleta* BROWN, 1827 (obj.; T); *Cerana* GISTEL, 1848 (obj.; *pro Artemis*); *Ampithaea* GRAY (*ex* LEACH MS), 1852 (obj.; M)]. Escutcheon wanting; pallial sinus narrow. *Oligo.-Rec.*, S.Eu.

D. (Phacosoma) JUKES-BROWNE, 1912 [**Artemis japonica* REEVE, 1850; OD]. Escutcheon pouting, defined by raised ridges; margins of RV grooved posteriorly *(329a)*. *Rec.*, N.Pac.-S.Pac.

D. (Raina) MARWICK, 1927 [**D. (R.) bensoni;* OD]. Lunule shallow; *3b* much broader than *1 (592)*. *M.Oligo.-M.Plio.*, N.Z.

Dosinobia FINLAY & MARWICK, 1937 [**Dosinia ongleyi* MARWICK, 1927; OD]. Resembling *Dosinia* but with less sunken lunule; hinge teeth are more spread out, *AII* scarcely separate from *2a (695)*. *U.Cret.*, N.Z.——FIG. E146,*4*. **D ongleyi* (MARWICK), Cret., N.Z.; *4a-c*, LV and RV hinges, RV ext., ×1 *(592)*.

Subfamily CYCLININAE Frizzell, 1936

Like Dosiniinae in form but without anterior lateral teeth or incised lunule; sculpture concentric with few faint radial traces. *L.Cret.-Rec.*

Cyclina DESHAYES, 1850 [**Venus sinensis* GMELIN, 1791; SD DALL, 1902] [=*Eocyclina* DALL, 1908 (obj.)]. Sculpture weak; lunule faint or absent. *Oligo.-Rec.*, Asia.

C. (Cyclina). No lunule or escutcheon; inner ventral margin crenate. *Oligo.-Rec.*, Asia *(228)*.——FIG. E146,*2*. **C. (C.) sinensis* (GMELIN), Rec., China; *2a,b*, LV ext., RV int., ×0.5 *(124b)*.

C. (Cyclinorbis) MAKIYAMA, 1926 [**C. (C.) lunulata;* OD]. With faint lunular area, beaks more central than in *C. (Cyclina)*, sculpture finer, entirely concentric; inner ventral margin smooth *(329a)*. *L.Mio.*, Korea.

Cyclinella DALL, 1902 [**Dosinia tenuis* RÉCLUZ, 1852; OD]. Margins smooth, faint lunular area present; *3b* bifid. *Eoc.-Rec.*, E.N.Am.-W.N.Am.——FIG. E146,*6*. **C. tenuis* (RÉCLUZ), Rec., Carib.; *6a,b*, RV int., LV int., ×1 *(711)*.

Cyprimeria CONRAD, 1864 [**Cytherea excavata* MORTON, 1833; M]. Subcircular, valves flattened, bent to left posteriorly; lunule wanting, escutcheon deep; sculpture weakly concentric; cardinal teeth diverging, nymphs rugose; pallial line hardly sinuated; inner margins smooth. *L.Cret.-Eoc.*, N.Am.-Eu.——FIG. E146,*1*. **C. excavata* (MORTON), Cret., USA(N.J.); *1a-c*, LV ext., RV hinge, LV int., ×0.5 (Weller, 1907).

Frigichione FLETCHER, 1938 [**Chione permagna* TATE, 1900; OD]. Concentric sculpture strong but not lamellar; middle layer of shell with radial riblets; pallial sinus shallow. *U.Tert.*, Antarctic.

F. (Frigichione). Hinge relatively heavy and massive, *2a* stronger than *2b (695)*. *U.Tert.*, Antarctic.——FIG. E146,*5*. **F. (F.) permagna* (TATE); *5a,b*, LV ext., int., ×0.8 (Fletcher, 1938).

F. (Paleomarcia) FLETCHER, 1938 [**P. tatei;* OD]. Hinge thinner than in *F. (Frigichione)* (Fletcher, 1938). *U.Tert.*, Antarctic.

Luciploma OLSSON, 1942 [**L. panamensis;* OD]. Margins smooth; no lunule; hinge as in *Cyclina* but without ligamental nymphs *(695)*. *L.Plio.*, C.Am.

Subfamily GEMMINAE Dall, 1902

Small, polished, with marginal grooves and denticles simulating posterior and anterior lateral teeth; inner ventral margin crenulate. *Eoc.-Rec.*

Gemma DESHAYES, 1853 [**Venus gemma* TOTTEN, 1834; T] [=*Totteniana* PERKINS, 1869 (obj.)]. Ovate, pallial sinus triangular *(695)*. *Eoc.-Rec.*, E.N.Am.——FIG. E147,*6*. **G. gemma* (TOTTEN), Rec., W.Atl.; *6a,b*, RV ext., int., ×10 (Dall, 1900).

Parastarte CONRAD, 1862 [**Astarte triquetra* CONRAD, 1846; OD] [=*Callicistronia* DALL, 1883 (obj.)]. Trigonal, ligament high, beneath beaks; pallial sinus small *(711)*. *Mio.-Rec.*, E.N.Am.——FIG. E147,*1*. **P. triquetra* (CONRAD), Rec., W.Atl.; *1a-c*, LV int., ext., RV int., ×16 (Dall, 1883).

Plesiastarte FISCHER, 1887 [*pro Anomala* COSSMANN, 1886, *non* VON BLOCK, 1799] [**Cyrena crenulata* DESHAYES, 1858; OD]. Subtrigonal, concentrically striate; inner margins minutely crenulate; pallial line hardly flexuous. *Eoc.*, Eu.——FIG. E147,*5*. **P. crenulata* (DESHAYES), France; *5a-c*, RV ext., RV int., LV hinge, ×7 (Deshayes, 1858).

?Rohini SEMPER, 1862 *(nom. dub.)* [**"Woodia lamellosa* SANDBERGER" (*?nom. nud.*; =*Venus woodiaeformis* SANDBERGER, 1863); M]. Resembling *Digitaria* in Astartidae but with a veneroid hinge and small pallial sinus; shell surface striate to cancellate. *Oligo.*, Eu.

Subfamily CLEMENTIINAE Frizzell, 1936

[*nom. transl.* KEEN, 1951 (*ex* Clementiidae FRIZZELL, 1936)]

Shell thin, inequilateral; without escutcheon; sculpture subdued or wanting; inner ventral margin smooth; hinge without lateral teeth. *U.Cret.-Rec.*

Clementia GRAY, 1842 [**Venus papyracea* GRAY, 1825; SD GRAY, 1847] [=*Blainvillia* HUPÉ, 1854 (*non* ROBINEAU-DESVOIDY, 1830)]. Ovate, concentrically waved; no lunule; pallial sinus deep. *Eoc.-Rec.*, N.Am.-Eu.-Asia-Afr.-Pac.

C. (Clementia). Hinge thin with deep niche in front of anterior cardinals; pallial sinus wide *(711)*. *Eoc.-Rec.*, N.Am.-Eu.-Asia-Afr.——FIG. E147,*2*. **C. (C.) papyracea* (GRAY), Rec., Pac.; *2a,b*, LV ext., RV int., ×0.5 *(124b)*.

C. (Egesta) CONRAD, 1845 [**Venus inoceriformis* WAGNER, 1840; M]. Like *C. (Clementia)* but larger, heavier, pallial sinus narrower; posterior slope truncate *(711)*. *Mio.-Rec.*, E.N.Am.-W.N.Am.-Japan.

C. (Terentia) JUKES-BROWNE, 1914 [**C. granulifera* SOWERBY, 1852; OD] [=*Euterentia* COSSMANN, 1920 (obj.)]. With irregular divaricate or reticulate striae *(455a)*. *Rec.*, Pac.

Compsomyax STEWART, 1930 [**Clementia subdiaphana* CARPENTER, 1864; OD]. Shell thicker than in *Clementia*, undulating sculpture wanting; hinge with *3b* strongly bifid. *Eoc.-Rec.*, W.N.Am.-S.Am.-Japan.——FIG. E147,*7*. **C. subdiaphana* (CARPENTER), Rec., USA(Wash.); *7a,b*, RV int., ext., ×0.5 (*219*; Jukes-Browne, 1913).

Psathura DESHAYES, 1858 [**Erycina fragilis* LAMARCK, 1805; M]. Hinge teeth small, *3b* bifid and *1* grooved; pallial sinus wanting. *Eoc.*, Eu.——FIG. E147,*4*. **P. fragilis* (LAMARCK), France; *4a-c*, RV and LV hinges, LV ext., ×1 *(124b)*.

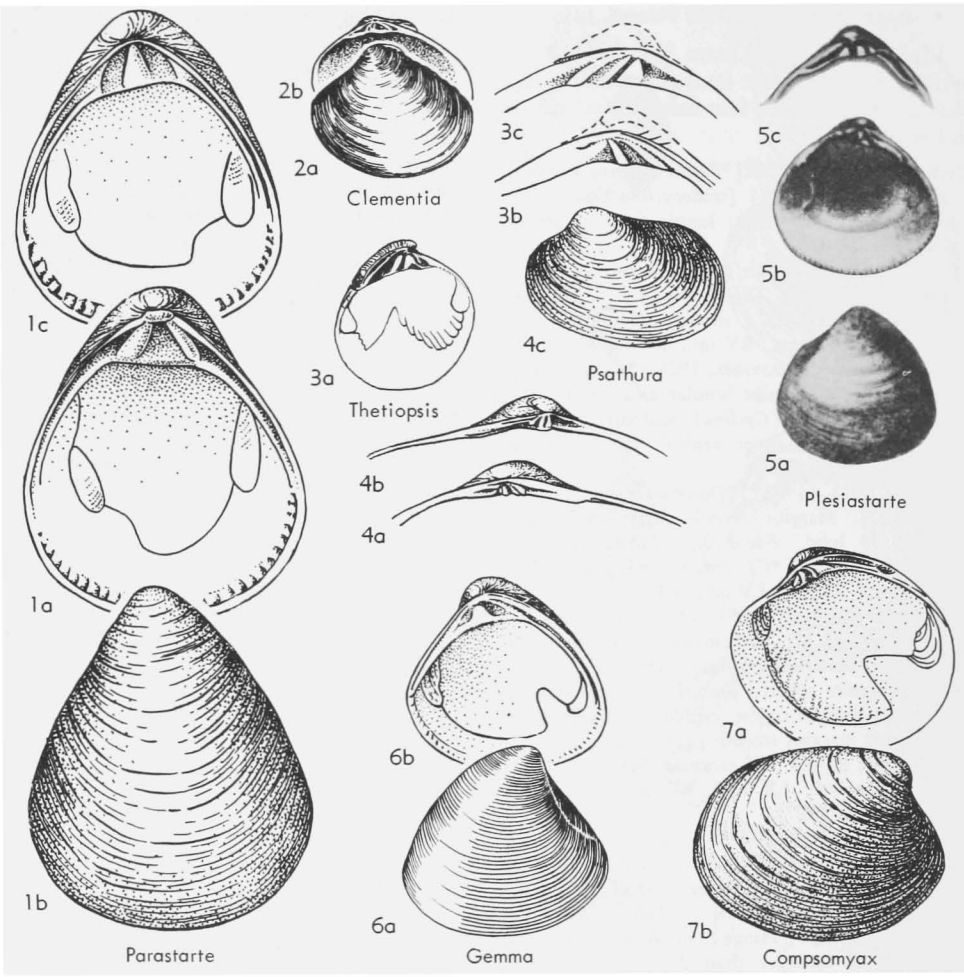


FIG. E147. Veneridae (Gemminae) *(1,5-6)*, (Clementiinae) *(2-4,7)* (p. *N*681-*N*682).

Thetiopsis MEEK, 1875 [**Venus circularis* MEEK & HAYDEN, 1856; M]. Small, sculpture faint, concentric only; pallial sinus sharply ascending; hinge with *2b* stout. *U.Cret.*, N.Am.——FIG. E147,*3*. **T. circularis* (MEEK & HAYDEN), USA(Mont.); *3a-c*, LV int., RV and LV hinges, ×1 (Keen,n, Stanford Univ. Coll.; Meek, 1876).

Subfamily TAPETINAE Adams & Adams, 1857

Ovate to elongate, shell surface somewhat polished, inner margins smooth on at least posterior third; hinge plate narrow, with cardinals *3a* entire, *3b* normally entire, others frequently bifid; lateral teeth wanting. *L.Cret.-Rec.*

Tapes MEGERLE VON MÜHLFELD, 1811 [**Venus literata* LINNÉ, 1758; M] [=*Parembola* RÖMER, 1857 (obj.; M)]. Oblong, rhomboidal, somewhat compressed, higher posteriorly; sculpture weak; lunule incised, escutcheon bordered by low carina. *Mio.-Rec.*, E.Indies-Afr.-Eu.-Pac.-Asia.

T. (Tapes). Surface concentrically grooved. *Pleist.-Rec.*, W.Pac.——FIG. E148,*4*. **T. (T.) literatus* (LINNÉ), Rec., E.Indies; *4a-c*, LV ext., RV and LV hinges, ×0.5 *(124b)*.

T. (Myrsopsis) SACCO, 1900 [**Venerupis pernarum* BONELLI in MICHELOTTI, 1839; OD]. Ovoid; sculpture irregular; ligament in deep pit excavated in nymph. *Mio.-Plio.*, Eu.

T. (Ruditapes) CHIAMENTI, 1900 [**Venus decussata* LINNÉ; SD DALL, 1902] [=*Amygdala* RÖMER, 1857 (*non* GRAY, 1825); M]. Sculpture weakly decussate posteriorly, obscure anteriorly. *Mio.-Rec.*, Eu.-W.Pac.

T. (Siratoria) OTUKA, 1937 [**Paphia siratoriensis* OTUKA, 1934; OD]. Radial and concentric ribs coarse, of equal strength. *Mio.*, Japan.

T. (Taurotapes) SACCO, 1900 [**Venus craverii* MICHELOTTI, 1847; OD]. Elongate, concentrically with irregular striae; left cardinal teeth not joined above, *1* bifid, *3b* widely divergent. *Mio.*, Italy.

Cyclorisma DALL, 1902 [*pro Cyclothyris* CONRAD, 1875 (*non* M'COY, 1844)] [**Cyclothyris carolinensis* CONRAD, 1875; M]. Ovate to subcircular, concentrically striate; hinge with *2a* and *2b* of equal size, *3b* deeply bifid; pallial sinus narrow, deep. *U.Cret.*, E.N.Am.——FIG. E148,*10*. **C. carolinensis* (CONRAD), U.Cret., USA(N.Car.); *10a,b*, LV int., ext., ×0.5 (Dall).

Cyclorisimina MARWICK, 1927 [**C. woodsi*; OD]. Like *Dosinia* but without anterior lateral teeth; anterior cardinals divergent. *U.Cret.*, N.Z.——FIG. E148,*9*. **C. woodsi*; *9a-c*, RV, LV, and RV hinges, ×1 *(592)*.

Eumarcia IREDALE, 1924 [**Venus fumigata* SOWERBY, 1853; OD]. Moderate in size to large; lunule weakly incised, escutcheon not defined; inner margins smooth, pallial sinus ample. *L.Oligo.-Rec.*, N.Z.-Australia.

E. (Eumarcia). Surface smooth. *M.Oligo.-Rec.*, N.Z.-Australia.

E. (Atamarcia) MARWICK, 1927 [**E. (A.) sulcifera*; OD]. Concentric grooves well spaced, polished. *L.Oligo.-M.Plio.*, N.Z.——FIG. E148, *6a,b*, **E. (A.) sulcifera*, U.Oligo.; *6a,b*, LV ext., RV hinge, ×0.5 *(592)*.——FIG. E148,*6c*. *E. (A.) curta* (HUTTON), U.Oligo.; LV hinge, ×0.5 *(592)*.

E. (Opimarcia) MARWICK, 1948 [**E. (O.) healyi*; OD]. Markedly inflated; sculpture fine and wavy. *Plio.*, N.Z.

Eurhomalea COSSMANN, 1920 [*pro Rhomalea* JUKES-BROWNE, 1914 (*non* KOCH, 1837)] [**Venus rufa* LAMARCK, 1818; OD]. Quadrate, nearly smooth, with faint radial striae; inner margins smooth. *Rec.*, W.S.Am.

Flaventia JUKES-BROWNE, 1908 [**Venus ovalis* SOWERBY, 1827; OD]. Ovate, lunule well defined; *3b* long and deeply bifid, its laminae of unequal length *(228)*. *U.Cret.*, Eu.-W.N.Am.——FIG. E148, *2*. **F. ovalis* (SOWERBY), Eng.; *2a-d*, RV int., LV ext., both valves dorsal, LV hinge, ×1 *(1008)*.

Gomphina MÖRCH, 1853 [**Venus undulosa* LAMARCK, 1818; M]. Trigonal, nearly equilateral, smooth; dorsal margins grooved and beveled beyond hinge plate; pallial sinus short, rounded. *L.Plio.-Rec.*, W.Pac.-Australia-N.Z.-Japan-S.Atl.

G. (Gomphina). Valves relatively solid, tumid; hinge with *4b* and right nymph rugose *(228)*. *Rec.*, W.Pac.-Australia.

G. (Gomphinella) MARWICK, 1927 [**G. maorum* SMITH, 1902; OD]. Small, beaks subcentral. *L.Plio.-Rec.*, N.Z.——FIG. E148,*3*. **G. (G.) maorum* SMITH, Rec.; *3a-c*, RV ext., RV int., LV int., ×4 *(592)*.

G. (Jukesena) IREDALE, 1915 [*pro Acolus* JUKES-BROWNE, 1913 (*non* FÖRSTER, 1856)] [**Psephis foveolata* COOPER & PRESTON, 1910; OD]. Small, pallial line only slightly flexed. *Rec.*, S.Atl.

G. (Macridiscus) DALL, 1902 [**Donax aequilatera* SOWERBY, 1825; OD]. Thinner than *G. (Gomphina)*; nymphs smooth. *Pleist.-Rec.*, Japan.

Irus SCHMIDT, 1818 [*ex* OKEN, 1815; nonbinom., ICZN Op. 417] [**Donax irus* LINNÉ, 1758; T]. Subquadrate, with raised concentric lamellae intersected by weaker radial ribs; hinge weak, cardinals *1, 2a, 2b, 3b* bifid; shell commonly distorted by growth in crevices. *Oligo.-Rec.*, Eu.-C.Am.-N.Am.-N.Z.

I. (Irus). Lamellae well spaced. *Oligo.-Rec.*, Eu.-W.N.Am.——FIG. E148,*8*. **I. (I.) irus* (LINNÉ), Rec., France; *8a*, LV ext., ×1; *8b,c*, RV and LV hinges, ×2 *(124b;* Keen, n, Stanford Univ. Coll.).

I. (Notirus) FINLAY, 1928 [*pro Irona* FINLAY, 1927 (*non* SCHIÖDTE & MEINERT, 1883)] [**Venerupis reflexa* GRAY, 1843; OD]. Concentric lamellae closely spaced. *Pleist.-Rec.*, N.Z.

I. (Notopaphia) OLIVER, 1923 [**Venerupis elegans* DESHAYES, 1854; OD]. Radial sculpture fine, concentric lamellae closely spaced; lunule incised; inner ventral margin crenulate anteriorly; pallial sinus nearly horizontal, angular. *Pleist.-Rec.*, N.Z.

I. (Paphonotia) HERTLEIN & STRONG, 1948 [**Petricola* SOWERBY, 1834; OD]. Like *I. (Notopaphia)* but radial sculpture coarser, concentric lamellae wider spaced; hinge with *2a* large; pallial sinus ascending. *Rec.*, W.C.Am.

Katelysia RÖMER, 1857 [**Venus scalarina* LAMARCK, 1818; SD KOBELT, 1881] [=*Catelysia* AUCTT., *nom. null.*]. Concentric ribbing irregular anteriorly, radial sculpture weak; pallial sinus medium-sized to short; cardinal teeth radiating. *?Paleoc.; Eoc.-Rec.*, Eu.-N.Am.-Pac.-Japan-Australia.

K. (Katelysia). Compressed, markedly inequilateral; pallial sinus short. *?Paleoc.; Eoc.-Rec.*, Eu.-E.N.Am.-Pac.——FIG. E148,*5*. **K. (K.) scalarina* (LAMARCK), Rec., Australia; *5a-c*, LV ext., RV int., LV int., ×1 *(711)*.

K. (Nipponomarcia) IKEBE, 1941 [**K. (N.) nakamurai*; OD]. Hinge as in *K. (Katelysia)* but otherwise resembling *Eumarcia*. *Mio.*, Japan.

K. (Textivenus) COSSMANN, 1886 [**Venus texta* LAMARCK, 1905; SD DALL, 1902]. Sculpture reticulate to zigzag. *Eoc.*, Eu.-E.N.Am.

Legumen CONRAD, 1858 [**L. ellipticus*; SD STOLICZKA, 1871] [=*Baroda* STOLICZKA, 1870 (type, *Venus fragilis* D'ORBIGNY, 1845; *non* FABRICIUS, 1780; OD)]. Elongate, slender, subelliptical, beaks at anterior fourth; sculpture concentric only; no lunule or escutcheon; hinge plate narrow; pallial sinus moderate. *L.Cret.-U.Cret.*, E.N.Am.-W.N.Am.-India-Eu.——FIG. E148,*1*. **L. ellipticus*, U.Cret., USA(Miss.); *1a,b*, LV and RV hinges, ×1; *1c*, RV ext., ×0.5 *(889)*.

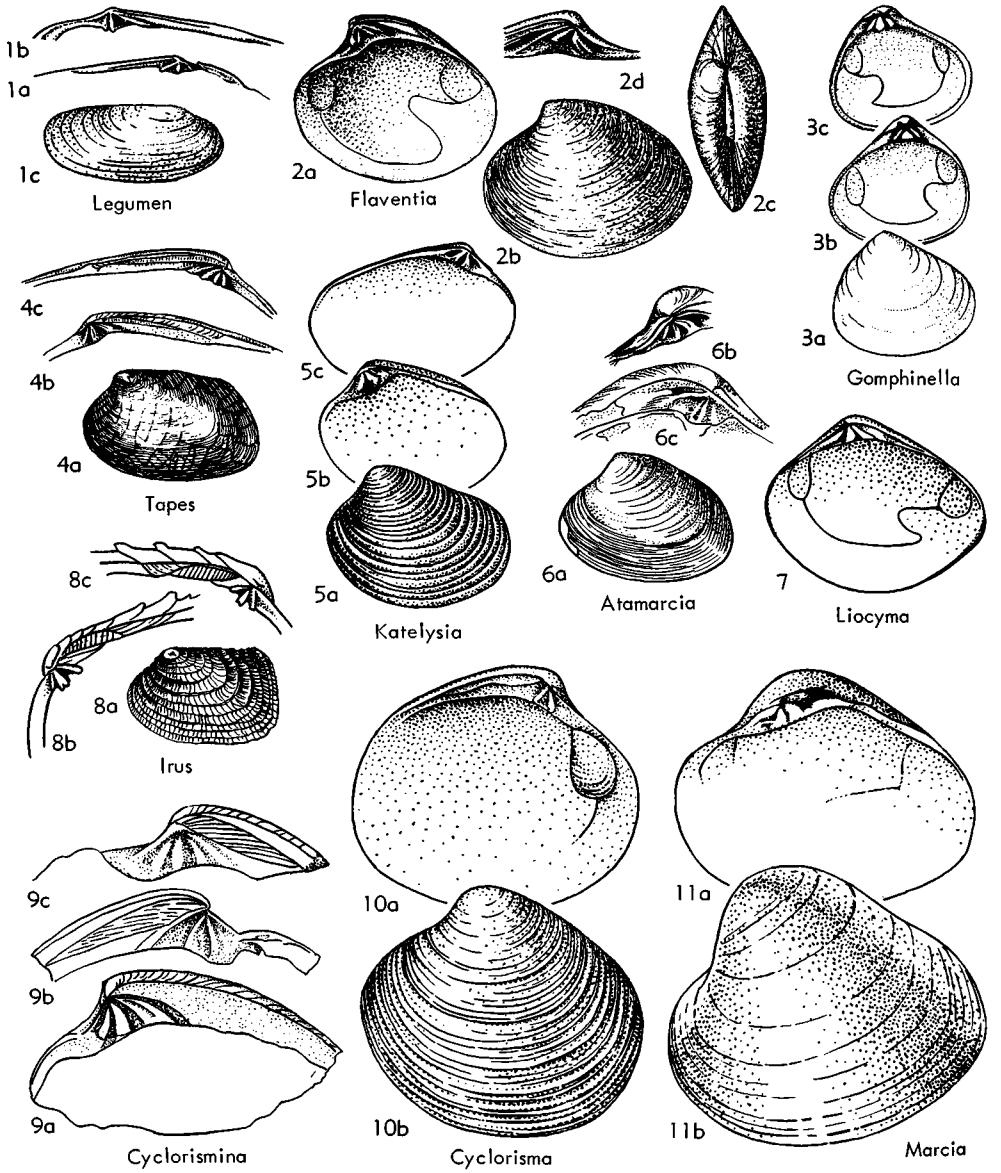


FIG. E148. Veneridae (Tapetinae) (p. *N*682-*N*685).

Liocyma DALL, 1870 [**Venus fluctuosa* GOULD, 1841; OD]. Oblique-oval, surface concentrically striate; hinge with *1* and *2b* feebly grooved, nymphs smooth; pallial sinus short, rounded. *Pleist.-Rec.*, N.Atl.-N.Pac.——FIG. E148,*7*. **L. fluctuosa* (GOULD), Rec., NW.Atl.; RV int., ×1 (Jukes-Browne, 1913).

Marcia H.ADAMS & A.ADAMS, 1857 [*"*Venus pinguis* CHEMNITZ" *(nonbinom.)* (=**V. opima* GMELIN, 1791); SD KOBELT, 1881] [=*Hemitapes* RÖMER, 1864 (obj.; SD STOLICZKA, 1870); *Levimarcia* Cox, 1927 (obj.; OD)]. Ovate-cordate, inflated, smooth; lunule convex, escutcheon depressed but not sharply delimited; cardinal teeth radiating, *1, 2b, 3b* bifid; pallial sinus oval, horizontal. *Eoc.-Rec.*, N.Am.-Afr.-E.Indies-Australia-Eu.

M. (Marcia). Of medium size; pallial sinus well developed. *L.Mio.-Rec.*, Afr.-E.Indies.——FIG. E148,*11*. **M. (M.) opima* (GMELIN), Rec.,

E.Indies; *11a,b,* RV int., LV ext., ×1 (Jukes-Browne, 1913).

M. (Gomphomarcia) KAUTSKY, 1929 [**G. abeli;* OD]. Subtrigonal, lunule and escutcheon well defined. *Mio.,* Eu.

M. (Granicorium) HEDLEY, 1906 [**G. indutum;* OD]. Lunule not well defined. *Rec.,* Australia.

M. (Mercimonia) DALL, 1902 [**Venus bernayi* COSSMANN, 1886; OD]. Hinge with *2b* weak; pallial sinus small. *Eoc.-Mio.,* Eu.-E.N.Am.-W.N.Am.

M. (Similivenus) COSSMANN, 1910 [**Venus solida* DESHAYES, 1824 (*non* SCHRÖTER, 1802) (=*S. insolida* KEEN, 1954); OD]. Small, lunule lanceolate, escutcheon beveled, teeth crowded. *Eoc.-Oligo.,* Eu.

Paphia RÖDING, 1798 [**P. alapapilionis* (=*Venus rotundata* LINNÉ, 1758); SD DALL, 1902] [=*Textrix* RÖMER, 1857 (*non* SUNDEVALL, 1833; obj., SD STOLICZKA, 1870); *Paratapes* STOLICZKA, 1870 *(pro Textrix); Eutapes* CHIAMENTI, 1900 (obj.; OD); *Acritopaphia* IREDALE, 1936 (type, *A. transfusa;* OD)]. Elongate, compressed, surface glossy. *Oligo.-Rec.,* Pac.-N.Z.-Asia-Eu.

P. (Paphia). Nearly smooth, with faint concentric ribbing. *Plio.-Rec.,* W.Pac.——FIG. E149,*2*. **P. (P.) rotundata* (LINNÉ), Rec.; *2a-c,* LV ext., RV and LV hinges, ×0.5 (Marwick, Chenu).

P. (Callistotapes) SACCO, 1900 [**Venus vetula* BASTEROT, 1825; OD] [=*Hemitapes* AUCTT., *non* RÖMER]. Concentric ridges close, well defined. *Oligo.(Aquitan.)-Rec.,* Eu.-Asia-N.Z.

P. (Protapes) DALL, 1902 [**Venus gallus* GMELIN, 1791; OD]. Concentric ribs evident; shell shorter and more tumid than *P. (Paphia). Rec.,* W.Pac.

Paraesa CASEY, 1952 [**Venus faba* J. DE C. SOWERBY, 1827; OD]. Ovate, concentrically striate, lunule faint; resembling *Flaventia* but with *3b* less deeply bifid, *2a* not wedge-shaped, *2b* reaching base of hinge plate. *L.Cret.(U.Alb.)-U.Cret. (Senon.),* Eu.——FIG. E149,*1*. **P. faba* (SOWERBY), L.Cret., Eng.; *1a-c,* LV and RV hinges, LV ext., ×1 *(92)*.

Psephidia DALL, 1902 [*pro Psephis* CARPENTER, 1865 (*non* GUENÉE, 1854)] [**Chione lordi* BAIRD, 1863; OD] [*non Psephidia* POMEL, 1872 *(nom. nud.)*]. Small, ovate-trigonal, polished, sculpture faint, concentric; lunule narrow, feeble; escutcheon wanting; pallial sinus distinct, angular. *Plio.-Rec.,* W.N.Am.——FIG. E149,*4*. **P. lordi* (BAIRD), Rec., USA(Wash.); *4a-c,* LV ext., RV int., LV int., ×3 *(228)*.

Sinonia STEPHENSON, 1953 [**S. levis;* OD]. Elongate-ovate, nearly smooth, with irregular concentric ridges; no lunule or escutcheon; pallial sinus small, directed upward. *U.Cret.(Cenoman.),* USA(Tex.).——FIG. E149,*5*. **S. levis; 5a-c,* RV int., LV hinge, ext., ×1 (Stephenson, 1953).

Venerella COSSMANN, 1886 [**Venerupis hermonvillensis* DESHAYES, 1858; SD CROSSE, 1886]. Like *Marcia* but hinge teeth divergent, extending beyond edge of narrow hinge plate *(329a)*. *Eoc.,* Eu.-Asia.

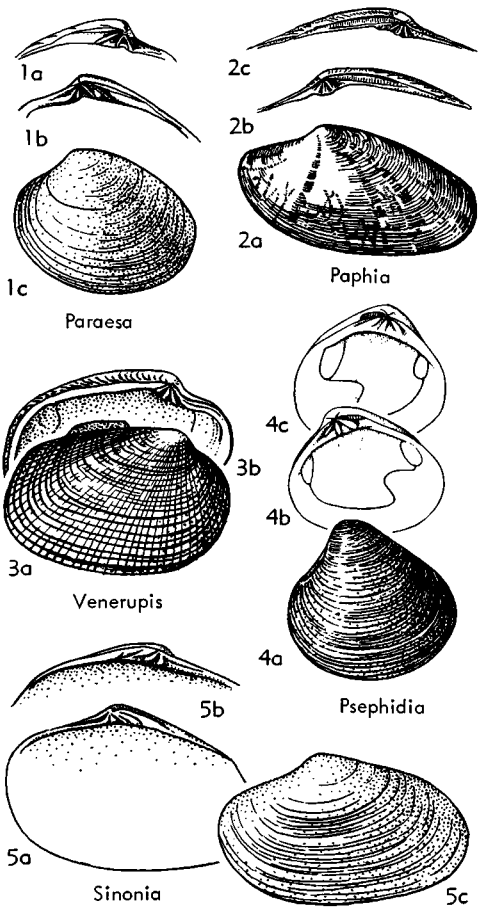


FIG. E149. Veneridae (Tapetinae) (p. *N685-N686*).

Veneritapes COSSMANN, 1886 [**Psammobia bervillei* DESHAYES, 1858; M]. Smooth, anteriorly attenuated; teeth small, *3a* weak or obsolete *(329a)*. *Eoc.,* Eu.

Venerupis LAMARCK, 1818 [**Venus perforans* MONTAGU, 1803 (=*Venus saxatilis* FLEURIAU DE BELLEVUE, 1802); SD CHILDREN, 1823] [=*Pullastra* SOWERBY, 1826 (type, *Venus pullastra* MONTAGU, 1803; *T*); *Myrsus* H. ADAMS & A. ADAMS, 1853 (type, "*M. corrugata* DESHAYES," =*Venus corrugata* GMELIN, 1791; SD STOLICZKA, 1870); *Polititapes* CHIAMENTI, 1900 (type, *Venus aurea* GMELIN, 1791; SD DALL, 1900); *Aureitapes, Cyaneitapes* CHIAMENTI, 1900 (type, *V. aurea* GMELIN, 1791; SD KEEN, 1954)]. Ovate-elliptic; sculpture of irregular radial and concentric or

slightly zigzag riblets, with stronger concentric lamellae at ends. *L.Eoc.-Rec.*, Eu.-Afr.-N.Z.

V. (Venerupis). Sculpture present throughout; distortion, due to growth in crevices, common. *Plio.-Rec.*, Eu.-W.Afr.——Fig. E149,*3*. **V. (V.) saxatilis* (Fleuriau de Bellevue), Rec., Eu.; *3a,b*, RV ext., LV int., ×1 (Brown).

V. (Paphirus) Finlay, 1927 [**Venus largillierti* Philippi, 1847; OD]. Radial sculpture absent on posterior slope. *L.Eoc.-Rec.*, N.Z.

Subfamily CHIONINAE Frizzell, 1936

[*nom. transl.* Keen, 1951 (*ex* Chionidae Frizzell, 1936)]

Ovate-trigonal, inequilateral, sculpture cancellate; lunule normally present; escutcheon, if present, beveled; inner margins usually crenulate; hinge plate and teeth well developed, cardinals *2a* and *1* large; pallial sinus mostly short, ascending. *M.Eoc.-Rec.*

Chione Megerle von Mühlfeld, 1811 [**Venus dysera* Linné (of Gmelin, 1791) (*non* Linné, 1758) (=**V. cancellata* Linné, 1767); SD Gray, 1847]. Cordate; lunule and escutcheon mostly well defined; concentric sculpture strong, frilled in some forms. *Oligo.-Rec.*, N.Am.-S.Am.-C.Am.-N.Z.

C. (Chione). Pallial sinus small; cardinal teeth smoothly or only faintly grooved. *U.Oligo.-Rec.*, E.N.Am.-W.N.Am.-S.Am.——Fig. E150,*1*. **C. (C.) cancellata* (Linné), Rec., Carib.; *1a-c*, RV ext., int., LV int., ×1 *(711)*.

C. (Austrovenus) Finlay, 1927 [*"**Venus stutchburyi* Gray" (=**V. stutchburii* Wood, 1828); OD]. Sculpture of low radial ribs crossed by irregular concentric lamellae *(695)*. *M.Plio.-Rec.*, N.Z.

C. (Chionista) Keen, 1958 [**Venus fluctifraga* Sowerby, 1853; OD]. Lunule and escutcheon wanting; concentric sculpture irregular, beaded. *Pleist.-Rec.*, W.N.Am.

C. (Chionopsis) Olsson, 1932 [**Venus amathusia* Philippi, 1844; OD] [=*Gnidiella* Parker, 1949 (type, *Venus gnidia* Broderip & Sowerby, 1829; OD)]. Pallial sinus well developed; one or more cardinal teeth in each valve bifid or strongly grooved *(329a)*. *Mio.-Rec.*, E.N.Am.-W.N.Am.

C. (Iliochione) Olsson, 1961 [**Venus subrugosa* Wood, 1828; OD] [=*Anomalocardia* auctt. (*non* Schumacher)]. Sculpture of undulating concentric folds, mostly obsolete toward ventral margin. *Rec.*, W.C.Am.-S.Am.

C. (Lirophora) Conrad, 1863 [**Circomphalus athleta* (=**Venus latilirata* Conrad, 1841); SD Dall, 1902]. Concentric lamellae of broad thickened rolls that may coalesce medially. *Oligo.-Rec.*, E.N.Am.-W.N.Am.——Fig. E150,*2*. **C. (L.) latilirata* (Conrad), Mio., USA(Md.); RV ext., ×1 (Glenn, 1904).

C. (Panchione) Olsson, 1964 [**Grateloupia mactropsis* Conrad, 1865; OD]. Intermediate between *C. (Lirophora)* and *C. (Iliochione)*, with foliaceous posterior area of former and outline of latter. *Mio.*, C.Am.——Fig. E150,*3*. **C. (P.) mactropsis* (Conrad), Panama; LV ext., ×1 (Olsson, 1964).

C. (Securella) Parker, 1949 [**Venus securis* Shumard, 1858; OD]. Ligament deeply sunken; concentric sculpture underlain by radical, appearing cancellate on eroded surfaces; *2b* deeply grooved with posterior part larger and higher than anterior *(695)*. *Oligo.-Plio.*, NW.N.Am.

Anomalocardia Schumacher, 1817 [**Venus flexuosa* Linné, 1767; OD] [=*Triquetra* de Blainville, 1828 (type, *Venus flexuosa* Linné, 1767; SD Anton, 1839); *Cryptogramma* Mörch, 1853 (obj.); *Murcia* Römer, 1857 (*non* Koch, 1835)]. Shell thick, with undulating concentric folds crossed by radial riblets; lunule large, impressed. *Mio.-Rec.*, C.Am.-S.Am.-Afr.-E.Indies-W.Pac.

A. (Anomalocardia). Radial sculpture subordinate; *4b* rugose. *Mio.-Rec.*, E.C.Am.-S.Am.-W.Afr.——Fig. E150,*5*. **A. (A.) flexuosa* (Linné), Rec., W.Afr.; *5a,b*, LV int., LV ext., ×1 *(711)*.

A. (Anomalodiscus) Dall, 1902 [*"**Cytherea squamosa* Lamarck" (=**Venus squamosa* Linné, 1758); OD]. Sculpture reticulate, ventral margin crenulate, hinge teeth without rugosities *(228)*. *U.Mio.-Rec.*, E.Indies.

A. (Cryptonemella) Kuroda & Habe, 1951 [*pro Cryptonema* Jukes-Browne, 1914 (*non* Bigsby, 1868)] [**A. (C.) producta* (*pro Venus impressa* Anton, 1839; *non* de Serres, 1829); OD]. Sculpture weak, radial, internal margin nearly smooth *(695)*. *Rec.*, W.Pac.

Bassina Jukes-Browne, 1914 [**Venus paucilamellata* "Sowerby" (i.e., *Mercenaria paucilamellata* Dunker, 1858) (=**V. pachyphylla* Jonas, 1839); OD]. Resembling *Chione* but without escutcheon; inner margins crenate; *2b* large, *3b* grooved. *Oligo.-Rec.*, E.Indies-Australia-N.Z.

B. (Bassina). Thick-shelled; sculpture of thin, spaced concentric lamellae *(592)*. *Mio.-Rec.*, E. Indies-S.Australia.

B. (Callanaitis) Iredale, 1917 [**Venus yatei* Gray, 1835; OD] [=*Salacia* Jukes-Browne, 1914 (*non* Lamouroux, 1816) (type, *Venus lamellata* Lamarck, 1818; OD); *Eusalacia* Cossmann, 1920 *(pro Salacia)*]. Thin-shelled, somewhat quadrate, compressed, cencentric lamellae strong. *Oligo.-Rec.*, N.Z.——Fig. E150,*9*. **B. (C.) yatei* (Gray), Rec., N.Z.; *9a-c*, LV int., ext., RV hinge, ×0.5 *(592)*.

Chamelea Mörch, 1853 [**Venus gallina* Linné, 1758; SD Bucquoy, Dautzenberg, & Dollfus, 1893] [=*Ortygia* Brown, 1827 (*non* Boie, 1826) (obj.; SD Herrmannsen, 1847); *Hermione* Gray, 1852, *ex* Leach MS (*non* Meigen, 1800)]. With narrow close concentric lamellae, no radial sculp-

ture; cardinal teeth not bifid. *Oligo.-Rec.*, E.N.Am.-Eu.——Fig. E150,*7*. **C. gallina* (Linné), Rec., Medit.; *7a-c*, LV ext., LV and RV hinges, ×1 *(711)*.

Clausinella Gray, 1851 [**"Chione fasciata"* (i.e., **Pectunculus fasciatus* da Costa, 1778); M] [=*Zucleica* Gray, 1852, *ex* Leach MS (obj.); *Anaitis* Römer, 1857 (*non* Duponchel, 1778)]. Sculpture of recurved, spaced concentric ridges; inner margins crenate. *Oligo.-Rec.*, Eu.-E.N.Am.-N.Z.——Fig. E150,*4*. **C. fasciata* (da Costa), Rec., Medit.; *4a-c*, LV ext., RV and LV hinges, ×1 *(711)*.

Hinemoana Marwick, 1927 [**Chione accuminata*

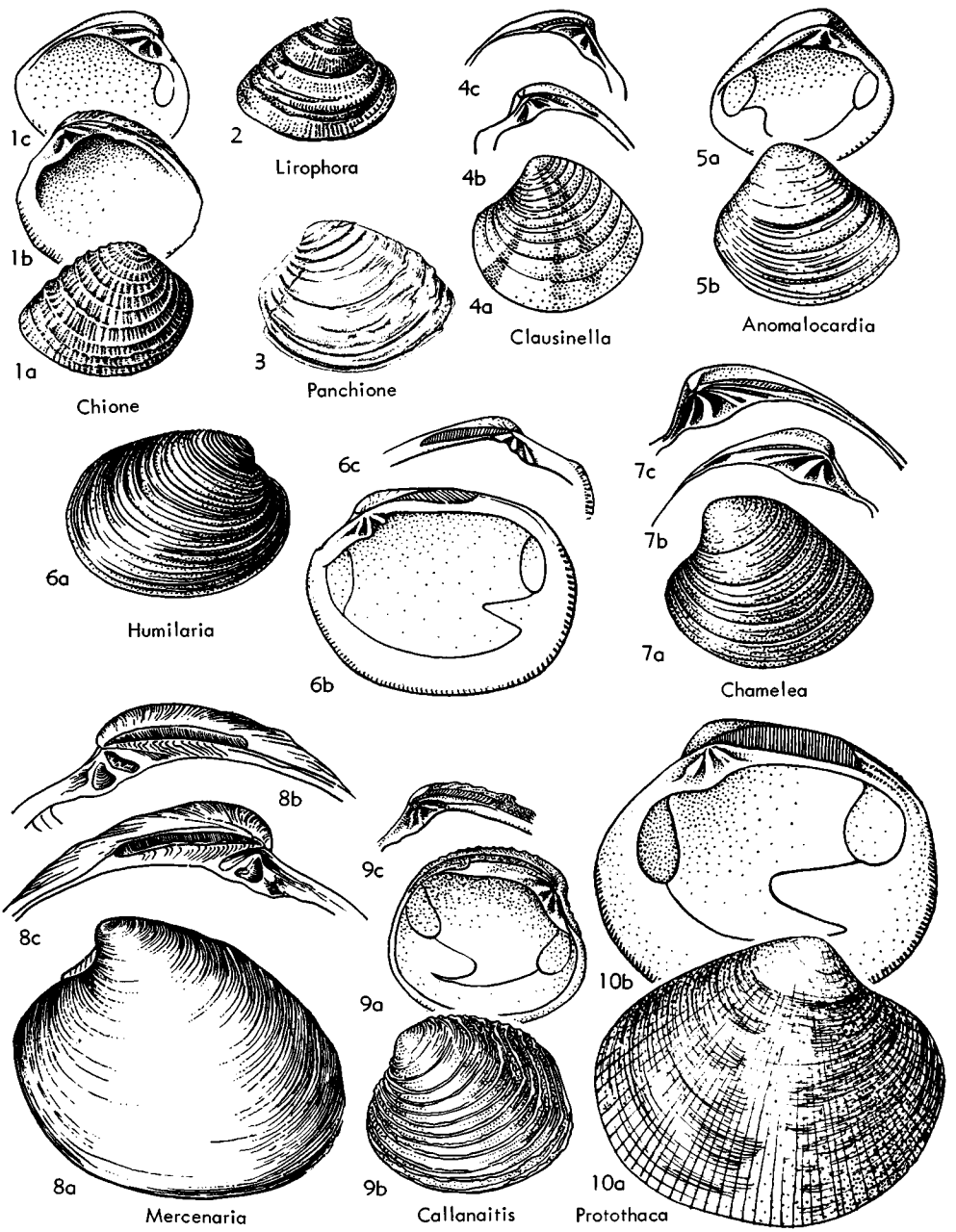


Fig. 150. Veneridae (Chioninae) (p. *N686-N688*).

HUTTON, 1873; OD]. Sculpture concentric, with fine subsurface radial threads; RV with grooved margin simulating posterior lateral tooth *(592)*. *?Oligo.*, N.Z.

Humilaria GRANT & GALE, 1931 [**Venus kennerleyi* REEVE, 1863; OD]. With heavy concentric ribs, no radial sculpture; inner margins crenate; *2a* large, bifid in some; pallial sinus short, angular. *Plio.-Rec.*, W.N.Am.——FIG. E150,*6*. **H. kennerleyi* (REEVE), Rec., USA (Wash.); *6a-c*, RV ext., int., LV hinge, ×0.5 *(288;* Keen, n, Stanford Univ. Coll.).

Mercenaria SCHUMACHER, 1817 [**M. violacea* (=*Venus mercenaria* LINNÉ, 1758); T] [=*Crassivenus* PERKINS, 1869 (obj.)]. Like *Chione* in in form but larger, radial sculpture obsolete; ligamental nymphs rugose. *Oligo.-Rec.*, N.Am.-Japan. ——FIG. E150,*8*. **M. mercenaria* (LINNÉ), Rec., W.Atl.; *8a-c*, LV ext., RV and LV hinges, ×0.5 *(711)*.

Placamen IREDALE, 1925 [**Venus placida* PHILIPPI, 1844; OD]. Concentric sculpture as in *Lirophora;* lunule deep, heart-shaped *(329a)*. *Mio.-Rec.*, Australia.

Protothaca DALL, 1902 [**Chama thaca* MOLINA, 1782; OD]. Ovate, convex, sculpture reticulate; lunule normally present; escutcheon absent or in LV only; *2b* and *1* bifid; pallial sinus moderate in size, pointed. *Mio.-Rec.*, N.Am.-S.Am.-Asia-Carib.-C.Am.

P. (Protothaca). Radial sculpture predominating on anterior and middle slopes, concentric on posterior; inner margins crenate *(228)*. *Mio.-Rec.*, N.Am.-S.Am.-Japan.——FIG. E150,*10*. **P. (P.) thaca* (MOLINA), Rec., W.S.Am.; *10a,b*, RV ext., int., ×0.7 (Philippi, 1847).

P. (Antinioche) OLSSON, 1961 [**Nioche (A.) beili;* OD]. Sculpture as in *Periglypta* but hinge and escutcheon as in *P. (Leukoma)*. *Rec.*, W.C.Am.-S.Am.

P. (Callithaca) DALL, 1902 [**Tapes tenerrima* CARPENTER, 1857; OD]. Sculpture uniformly reticulate; lunule feeble, escutcheon wanting; inner margins smooth *(228)*. *Mio.-Rec.*, W.N.Am.-Japan.

P. (Colonche) OLSSON, 1961 [**C. ecuadoriana;* OD]. Resembling *P. (Antinioche)* but lunule and escutcheon are wanting. Valves inflated. *Rec.*, W.S.Am.

P. (Leukoma) RÖMER, 1857 [**Venus granulata* GMELIN, 1791; SD KOBELT, 1881] [=*Nioche* HERTLEIN & STRONG, 1948 (type, *Venus asperrima* SOWERBY, 1835; OD); not preoccupied by *Leucoma* HÜBNER, 1822]. Radial ribs fine, concentric sculpture reduced; lunule radially ribbed, incised; left valve with beveled escutcheon *(329a)*. *Mio.-Rec.*, Carib.-E.C.Am.-W.C.-Am.

P. (Notochione) HERTLEIN & STRONG, 1948 [**Venus columbiensis* SOWERBY, 1835; OD]. Ribs heavy, predominantly radial; shell rounded-trigonal *(695)*. *Neog.-Rec.*, Japan-W.C.Am.-S. Am.

P. (Novathaca) HABE, 1951 [**Chione euglypta* SOWERBY, 1914; OD]. Radial sculpture weak, absent at ends of shell *(365)*. *Rec.*, Japan.

P. (Protocallithaca) NOMURA, 1937 [**Venus adamsi* REEVE, 1863; OD]. Sinus shorter and more pointed than in *P. (Callithaca) (365)*. *Plio.-Rec.*, Japan.

P. (Tropithaca) OLSSON, 1961 [**Venus grata* SAY, 1830; OD]. Resembling *P. (Protothaca)* but smaller, sculpture weaker, escutcheon reduced; color variability extreme. *Rec.*, W.C.Am.-S.Am.

P. (Tuangia) MARWICK, 1927 [**Venus crassicosta* DESHAYES, 1835; OD]. Radial ribs heavy, shell elongate to rounded-quadrate *(592)*. *Plio.-Rec.*, Japan-N.Z.

Tawera MARWICK, 1927 [**Venus spissa* DESHAYES, 1835; OD]. Resembling *Chamelea* but lunule less deeply sunken; cardinal teeth more divergent. *L.Eoc.-Rec.*, N.Z.

T. (Tawera). Sculpture of levelled smooth ridges. *L.Eoc.-Rec.*——FIG. E151,*7*. **T. (T.) spissa* (DESHAYES), Rec., N.Z.; *7a-c*, LV int., RV int., LV ext., ×1 *(592)*.

T. (Turia) MARWICK, 1927 [**Turia chattonensis*; OD]. Small, sculpture of thin, spaced concentric lamellae with irregular crests *(592)*. *L.Eoc.-L.Mio.*, N.Z.

Timoclea BROWN, 1827 [**Venus ovata* PENNANT, 1777; M] [=*Pasiphaë* GRAY (*ex* LEACH, MS), 1852 (obj.); *Parvivenus* SACCO, 1900 (type, *Venus marginata* HÖRNES, 1861; OD); *Veremolpa* IREDALE, 1930 (type, *V. ethica;* OD)]. Small, rather compressed, sculpture predominantly radial; escutcheon smooth. *U.Oligo.-Rec.*, Eu.-C.Am.-W. Pac.-Australia-E.Indies.

T. (Timoclea). Concentric sculpture present as nodes on ribs. *U.Oligo.(Aquitan.)-Rec.*, Eu.-E.C.Am.-W.C.Am.-W.Pac.——FIG. E151,*5*. **T. (T.) ovata* (PENNANT), Rec., Medit.; *5a-b*, RV int., LV int., ×2; *5c-e*, RV ext., RV and LV hinges, ×1.3 *(711;* Keen, n, Stanford Univ. Coll.).

T. (Chioneryx) IREDALE, 1924 [**Venus striatissma* SOWERBY, 1853 (=*Erycina cardioides* LAMARCK, 1818); M]. Subrostrate posteriorly; lunule striate, colored *(329a)*. *Rec.*, Australia.

T. (Glycydonta) COTTON, 1936 [**Venus marica* LINNÉ, 1758; OD]. Concentric sculpture of raised lamellae on posterior slope *(695)*. *Pleist.-Rec.*, E.Indies-Australia.

Family PETRICOLIDAE Deshayes, 1839

Oval, with no lunule or escutcheon; sculpture radial or obsolete. Hinge without lateral teeth; three cardinals in left valve, *2b* bifid, right valve with *1* and *3b* only; pallial sinus well developed. *Eoc.-Rec.*

Petricola LAMARK, 1801 [**P. costata* (=**Venus lapicida* GMELIN, 1791); SD SCHMIDT, 1818] [=*Naranio* GRAY, 1853 (obj.; SD LAMY, 1922)]. With radial sculpture, at least in young; commonly distorted by nestling. *Eoc.-Rec.*, N.Am.-W.Pac.-Australia-Asia-Eu.-Carib.

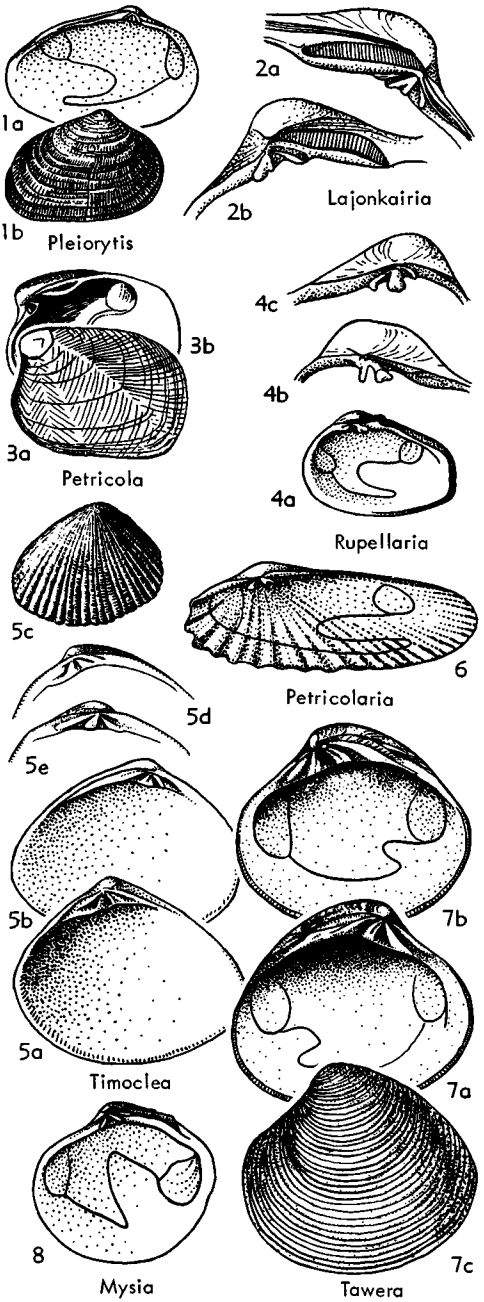


FIG. E151. Veneridae (Chioninae) *(5,7)*; (Petricolidae) *(1-4,6,8)* (p. *N*688-*N*689).

P. (Petricola). Sculpture of fine radial, divaricate, or zigzag riblets *(515)*. *Rec.*, E.N.Am.-W.N.Am.-W.Pac.——FIG. E151,*3*. **P. (P.) lapicida* (GMELIN), Carib.; *3a,b*, LV ext., RV int., ×1 (Brown, 1844).

P. (Claudiconcha) FISCHER, 1887 [**Venus monstrosa* GMELIN, 1791; M]. Sculpture cancellate, lamellose posteriorly; posterior margin thick; RV may overlap LV ventrally. *Rec.*, W.Pac.-Australia.

P. (Lajonkairia) DESHAYES, 1854 [**Venerupis decussata* (=**V. lajonkairii* PAYRAUDEAU, 1826); T] [=*Lajonkairea* AUCTT. *(nom. null.)*]. Sculpture cancellate; boring habit not developed. *Oligo.-Rec.*, Eu.-Japan.——FIG. E151,*2*. **P. (L.) lajonkairii* (PAYRAUDEAU), Rec., Medit.; *2a,b*, LV and RV hinges, ×2 *(515)*.

P. (Petricolaria) STOLICZKA, 1870 [**P. pholadiformis* LAMARCK, 1818; OD] [=*Gastranella* VERRILL, 1872 (type, *G. tumida;* M)]. Elongate, with nodose radial sculpture; hinge plate narrow, teeth small, *2a* may be obsolete *(515)*. *Oligo. (Aquitan.)-Rec.*, Eu.-E.N.Am.-W.N.Am.——FIG. E151,*6*. **P. (P.) pholadiformis* (LAMARCK), Rec., E.N.Am.; RV int., ×1 *(1007)*.

P. (Petricolirus) HABE, 1951 [**P. aequistriata* SOWERBY, 1874; OD]. Radial striae subequal, numerous, over entire shell; posterior end truncate *(365)*. *Rec.*, Japan.

P. (Pseudoirus) HABE, 1951 [**P. mirabilis* DESHAYES, 1853; OD]. Shell thick, compressed, not burrowing *(365)*. *Rec.*, Japan.

P. (Rupellaria) FLEURIAU, 1802 [**Venus lithophaga* RETZIUS, 1786; M] [=*Choristodon* JONAS, 1844 (type, *C. typicum;* M)]. Sculpture of coarse radial riblets. *Eoc.-Rec.*, Eu.-E.N.Am.-W.N.Am.-W.Pac.-Japan.——FIG. E151,*4*. **P. (R.) lithophaga* (RETZIUS), Rec., Medit.; *4a*, RV int., ×1; *4b,c*, RV and LV hinges, ×2 *(515, 1007)*.

P. (Velargilla) IREDALE, 1931 [**Naranio rubiginosa* ADAMS & ANGAS, 1863; OD]. Thinner than *P. (Petricola);* burrowing in ooze, not boring *(695)*. *Rec.*, Australia.

Mysia LAMARCK, 1818 (*ex* LEACH MS) [**Venus undata* PENNANT, 1777; M] [=*Lucinopsis* FORBES & HANLEY, 1848 (obj.)]. Smooth, resembling *Cyclinella* but with only 2 cardinal teeth in RV *(515)*. *Rec.*, Eu.-Australia.——FIG. E151,*8*. **M. undata* (PENNANT), Rec., Eu.; RV int., ×1 *(695)*.

Pleiorytis CONRAD, 1862 [**P. ovata* (=*Petricola centenaria* CONRAD, 1833); M]. Shell thin, hinge with *3b* weak to obsolete. *Mio.*, E.N.Am.——FIG. E151, *1*. **P. centenaria* (CONRAD), USA(Md.); *1a,b*, LV int., RV ext., ×0.5 (Glenn, 1904).

Family COOPERELLIDAE Dall, 1900

Shell thin, ovate-quadrate, moderately inflated; hinge without lateral teeth, right

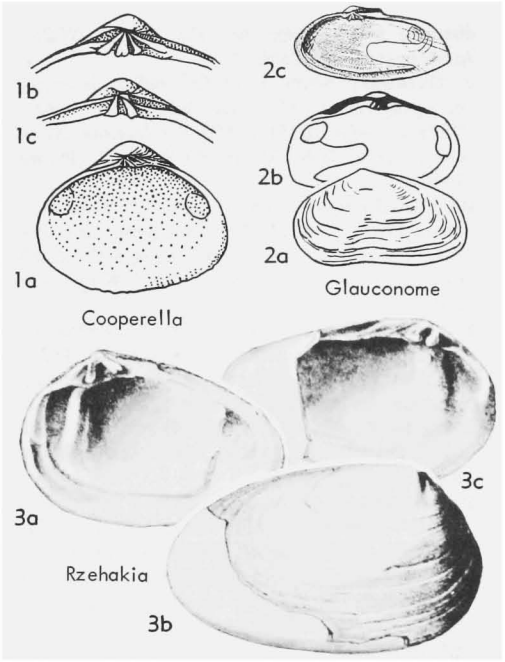


FIG. E152. Cooperellidae *(1)*; Glauconomidae *(2)*; Rzehakiidae *(3)* (p. *N690*).

valve with two thin cardinals, *1* and bifid *3b;* left valve with three cardinals, *2b* bifid; ligament depressed, seated on laminar nymph; pallial sinus wide. *Mio.-Rec.*

Cooperella CARPENTER, 1864, p. 639 [**Oedalia (C.) scintillaeformis,* p. 639 (=**O. subdiaphana,* p. 639); M (synonymy of generic and specific names established by first reviser, DALL, 1900] [=*Oedalia* CARPENTER, 1864 *(non Oedalea* MEIGEN, 1820); *Oedalina* CARPENTER, 1865 *(pro Oedalia)*]. *Mio.-Rec.*

C. (Cooperella). Hinge with *2b* deeply divided; pallial sinus deep, its apex rounded. *Mio.-Rec.,* E.N.Am.-W.N.Am.-S.Am.——FIG. E152,*1*. **C. (C.) subdiaphana* (CARPENTER), Rec., USA (Calif.); *1a,* RV int., ×1.3; *1b,c,* LV and RV hinges, ×2 *(515*; Arnold, 1903).

C. (Cooperellopsis) WOODRING, 1925 [**C. (C.) thaumasta;* OD]. More quadrate and inflated than *C. (Cooperella); 2b* not deeply bifid; pallial sinus obscure *(695). Mio.,* Carib.

Family GLAUCONOMIDAE Gray, 1853

[=Glauconomyidae CHENU, 1862; Glaucomyidae, Glauconomeidae (spelling errors)]

Elongate shells, smooth, with conspicuous periostracum; hinge with three cardinal teeth in either valve, lateral teeth wanting. *Rec.*

Glauconome GRAY, 1828 [**G. chinensis;* M] [=*Glauconomya* BRONN, 1838 (obj.); *Glaucomya* WOODWARD, 1854 *(nom. van.); Glauconoma* CHENU, 1862 *(nom. null.); Glauconometta* IREDALE, 1936 (type, *G. plankta;* OD); *Glauconomella* ALLAN, 1950 *(nom. null.)*]. Periostracum light to dark green, smooth or wrinkled. [Habitat, marine to brackish water.] *Rec.,* IndoPac.-Australia. ——FIG. E152,*2*. **G. chinensis,* E.Indies; *2a,b,* LV ext., int., ×1 (Habe, 1954); *2c,* RV int., ×1 *(305)*.

Family RZEHAKIIDAE Korobkov, 1954

[=Onchophoridae DAVIDASCHVILI, 1934]

Ovate, moderately small, strongly inequilateral, nearly smooth, beaks low; hinge lacking lateral teeth, with two cardinals in right valve *(1* and *3b),* and three in left *(2a, 2b,* and *4b);* anterior adductor muscle scar deeply sunken, bordered by ridge posteriorly; pallial sinus shallow *(716)*. [Apparently aberrant brackish-water descendants of marine Tapetinae.] *M.Mio.-U.Mio.*

Rzehakia KOROBKOV, 1954 [*pro Oncophora* RZEHAK, 1882 (*non* DIESING, 1851)] [**Oncophora socialis* RZEHAK, 1882; OD]. Cardinal teeth slightly bifid. *M.Mio.-U.Mio.,* E.Eu.——FIG. E152,*3*. **R. socialis* (RZEHAK), Mio., Czech.; *3a-c,* RV int., ext., LV int., ×1 (Rzehak).

Order MYOIDA Stoliczka, 1870

[*nom. correct.* NEWELL, 1965 (*ex* order Myacea STOLICZKA, 1870)] [Adapedonta AUCTT., in part] [Diagnosis by N. D. NEWELL]

Thin-shelled, burrowing forms with well-developed siphons; strongly inequilateral, equivalve or inequivalve; isomyarian or anisomyarian; one cardinal tooth in each valve, or edentulous; lunule and escutcheon absent, or poorly developed; shell not nacreous. *Carb.-Rec.*

Suborder MYINA Stoliczka, 1870

[*nom. transl. et correct.* NEWELL, 1965 (*ex* order Myacea STOLICZKA, 1870)] [Diagnosis by N. D. NEWELL]

Hinge edentulous or with one cardinal tooth on each valve; ligament external, borne on well-marked nymphs, in some forms with internal resilium; sinupalliate. *Perm.-Rec.*

Superfamily MYACEA Lamarck, 1809

[*nom. transl.* GILL, 1871 (*ex* family Myacea GOLDFUSS, 1820) (=myaires LAMARCK, 1809)] [Materials for this superfamily prepared by MYRA KEEN]