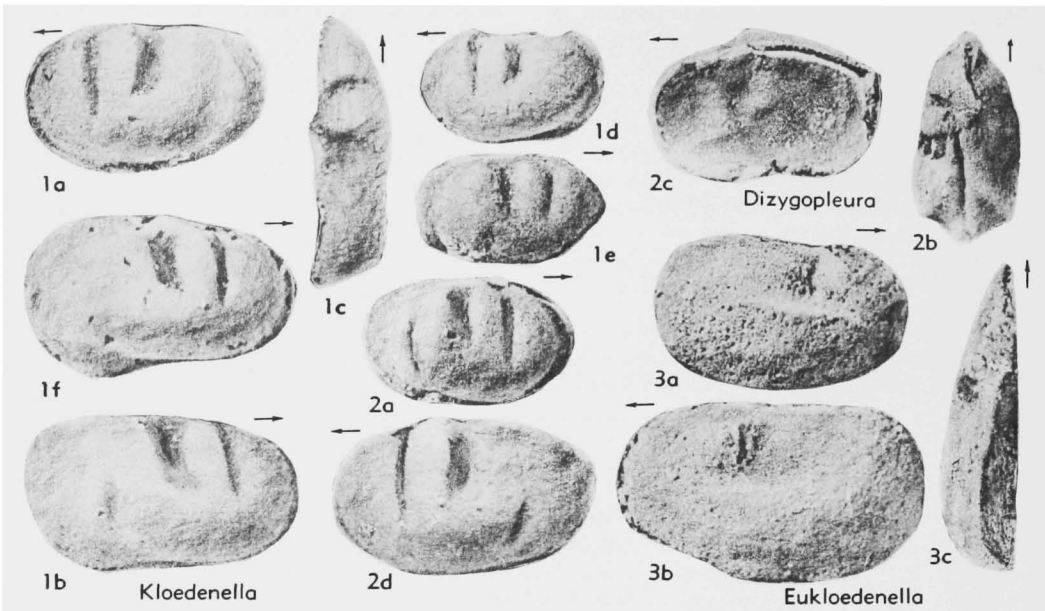

FIG. 118. Kloedenellidae (p. Q181-Q182).

Suborder KLOEDENELLOCOPINA Scott, n. suborder

[Diagnosis prepared by H. W. SCOTT, University of Illinois]

Strongly calcified carapaces with smooth or ribbed, sulcate or nonsulcate surface; dorsal margin straight, ventral margin convex or somewhat rarely concave; valves unequal, larger overreaching smaller along all or part of free edge; dimorphism by posterior inflation or nondimorphic. *L.Ord.-U.Jur.*

The Kloedenellocopina are not a wholly natural group. They include both dimorphic and nondimorphic forms. The most conspicuous feature common to all is strong overlap of the smaller valve by the larger around all or a portion of the free margin. The Kloedenellacea show dimorphism by swelling of the posterior part of the female carapace. Dimorphism in the Paraparchitacea may be represented by a slight enlargement of the posterior half of the carapace. Some specimens of an adult population show the greatest width to be medial, whereas other specimens of the same population show that the greatest width is behind the mid-length. These two types are probably dimorphs but further work on a large number of specimens is needed.

Superfamily KLOEDENELLACEA Ulrich & Bassler, 1908

[*nom. transl.* SCOTT, herein (*ex* Kloedenellinae ULRICH & BASSLER, 1908)] [Diagnosis by H. W. SCOTT, University of Illinois]

Carapace with strongly unequal valves, larger overlapping smaller around all or part of free margin. Cardinal angles rounded, hinge line impressed, hinge straight, of tongue-and-groove type, with anterior toothlike overlap or with overlapping valve extending to hinge. Surface smooth, or reticulated, with pit, sulci and with or without costae. Dimorphic in width of posterior part, nonvelate, except Knoxinidae. [A dimorphic inner partition has been reported in the Lichviniidae. A row of spines along the free margins of both valves in some specimens of *Sansabella* has been interpreted as a velate structure or pseudovelum; it is believed to be merely ornamental and not to represent an outfolding of the inner chitin layer, thus being unrelated to dimorphism.] *?U.Ord., L.Sil.-M. Perm.*

The stratigraphic distribution of Kloedenellacean ostracode genera is shown in Figure 117.

Family KLOEDENELLIDAE Ulrich & Bassler, 1908

[*nom. transl.* Ulrich & Bassler, 1923 (*ex* Kloedenellinae Ulrich & Bassler, 1908)] [=Dizygopleurinae Egorov, 1950] [Materials for this family prepared by I. G. Sohn, United States Geological Survey]

Straight-backed, subrhomboidal, sulcate, small; posterior 0.7 of hinge incised; one valve overlapping other along free margins and with anterior toothlike process that fits over exterior of opposing valve; rest of hinge ridge-and-groove. Dimorphic in width of posterior. *?U.Ord., L.Sil.-U.Penn., ?L. Perm.-?M.Perm.*

Kloedenella Ulrich & Bassler, 1908 [**Kloedenia pennsylvanica* Jones, 1889]. LV overlapping RV,

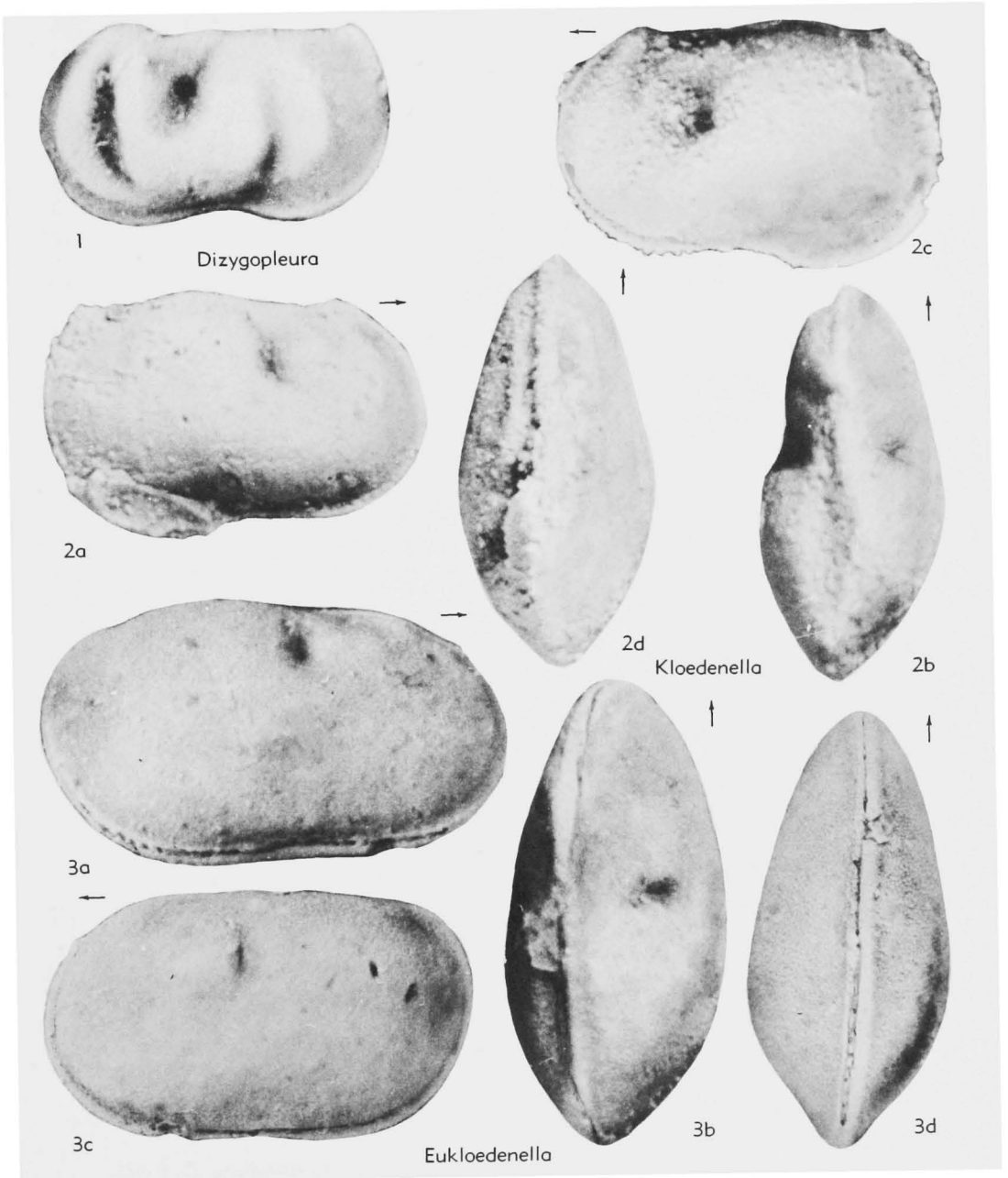

Fig. 119. Kloedenellidae (p. Q181-Q182).

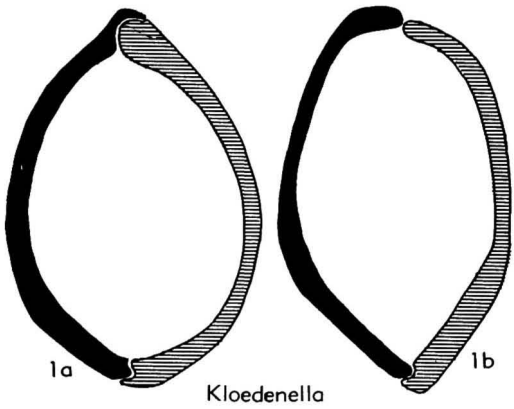

FIG. 120. Kloedenellidae (p. Q181).

2 sulci in anterodorsal half. *Sil.-Dev., ?Miss.*, N. Am.-Eu.-Asia.——FIGS. 118,*1*, 119,*2*, 120,*1*. *K. nitida* ULRICH & BASSLER, Sil., USA(Md.); 119, *2a-d*, carapace (holotype) R lat., dors., L lat., vent., ×40 (Sohn, n); 120,*1a,b*, transv. secs., ant. 3rd, post. 3rd, ×67 (Sohn, n).——FIG. 118,*1d-f*. *K. bipustulata* SWARTZ & WHITMORE, L.Dev. (Manlius Ls.), N.Y.; *1d,e*, ♂ LV lat. RV lat. (syntypes), ×30; *1f*, ♀ RV lat., ×30 (78).——FIG. 118,*1a-c*. *K. parvisulcata* SWARTZ & WHITMORE, U.Sil. (Decker Ls.), N.J.; *1a*, ♂ LV (holotype) lat., ×30; *1b,c*, ♀ RV lat., dors., ×30 (78).

Dizygopleura ULRICH & BASSLER, 1923 [**D. swartzi*]. LV overlapping RV, 3 sulci, at least one of which reaches ventral 0.3 of valve. *Sil.-Dev.*, N.Am.-Eu.——FIGS. 24, 119,*1*. **D. swartzi*, Sil., USA(Md.); 119,*1*, lectotype (herein), ×40 (Sohn, n); 24, serial transv. secs., ×20 (399).——FIG. 118,*2*. *D. angustisulcata* SWARTZ & WHITMORE, U.Sil. (Decker Ls.), USA(N.J.); *2a,b*, ♂ carapace (holotype) R, dors.; *2c*, ♂ RV int.; *2d*, ♀ LV lat.; all ×30 (78).

?**Eukloedenella** ULRICH & BASSLER, 1923 [**E. umbilicata*]. LV overlapping RV, one sulcus in anterodorsal half of valve. [Eight syntypes (USNM 63622) comprise 8 specimens that lack most if not all shell material.] *?U.Ord., Sil.-Dev.*, N.Am.-?Eu.——FIG. 119,*3*. **E. umbilicata*, Sil., USA(Md.); *3a-d*, carapace (syntype) R lat., dors., L lat., vent., ×40 (Sohn, n).——FIG. 24. *E. sinuata* ULRICH & BASSLER, Sil., USA(Pa.); serial transv. secs., ×20 (399).——FIG. 118,*3*. *E. cicatrix* SWARTZ & WHITMORE, U.Sil. (Decker Ls.), USA(N.J.); *3a*, ♂ RV (syntype) lat., ×30; *3b,c*, ♀ LV (syntype) lat., dors., ×30 (78). [=*Punctoprimitia* STEWART, 1945 (*fide* H. W. SCOTT.]

Oliganisus GEIS, 1932 [**O. sulcatus*] [=*?Ellipsella* CORYELL & ROGATZ, 1932; *?Neokloedenella* CRONEIS & FUNKHOUSER, 1939; *Oliganiscus* NEAVE, 1940]. RV overlapping LV, with or without shallow anterodorsal sulcus. *M.Miss.-U.Penn., ?L. Perm.-?M.Perm.*, N.Am.——FIG. 121,*1a,b*. **O. sulcatus*, U.Miss., USA(Ind.); *1a,b*, carapace (holotype) L, dors., ×30 (Sohn, n).——FIG. 121,*1c,d*. *O. punctatus* GEIS, U.Miss., USA(Ind.); *1c,d*, carapace (holotype) L, dors., ×30 (Sohn, n).

?**Poloniella** GÜRICH, 1896 [**P. devonica*]. Differs from *Dizygopleura* in ventral union of terminal sulci; seemingly lacks anterior toothlike process. [Juvenile *Dizygopleura* have joined terminal sulci, but have anterior toothlike process.] *Dev.*, Poland.

Family GEISINIDAE Sohn, n. fam.

[?=Perprimitiinae EGOROV, 1950] [Materials for this family prepared by I. G. SOHN, United States Geological Survey]

Straight-backed; smooth, punctate, or pitted, subquadrate to subelliptical, small; anterodorsal half sulcate; overlap slight; probably ridge-and-groove hinge; inner lamella narrow, of even width along free margins, feathering towards cardinal angles; dimorphic in width of posterior part. [SOHN suggests that this family belongs to the Podocopida because of a duplicature in *Geisina*. It is being included in the Kloedenellacea until further evidence is obtained.] *M.Dev.-M.Perm.*

Geisina JOHNSON, 1936 [**Beyrichiella gregaria* ULRICH & BASSLER, 1906] [*?Nuferella* BRADFIELD, 1935; *?Perprimitia* CRONEIS & GALE, 1939; *Hastifaba* COOPER, 1946; *?Neobeyrichiopsis* TASCH, 1953; *?Perijonesina* HOU, 1955; *?Prosopeionum* STOVER, 1956]. Bisulcate, with anterior sulcus shallow or missing; RV overlapping LV to cardinal angles; hinge incised behind sulcus; postero-

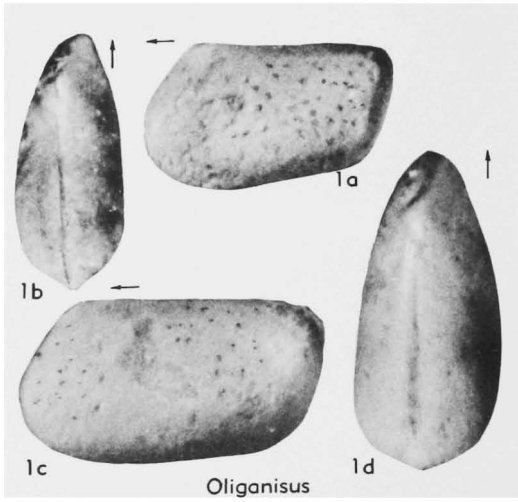

FIG. 121. Kloedenellidae (p. Q182).

dorsal spine present. *?Dev., Miss.-Perm.*, N.Am.-Eu.-Asia.——Fig. 122,*3*. **G. gregaria* (Ulrich & Bassler), U.Penn., USA(Mo.); RV (syntype) lat., ×40 (Sohn, n).

Hypotetragona Morey, 1935 [**H. impolita*] [=*?Janetina* Coryell & Malkin, 1936; *Kloedenellina, Gillina* Coryell & Johnson, 1939; *?Limnoprimitia* Kummerow, 1949; *Knoxiella, ?Kules-*

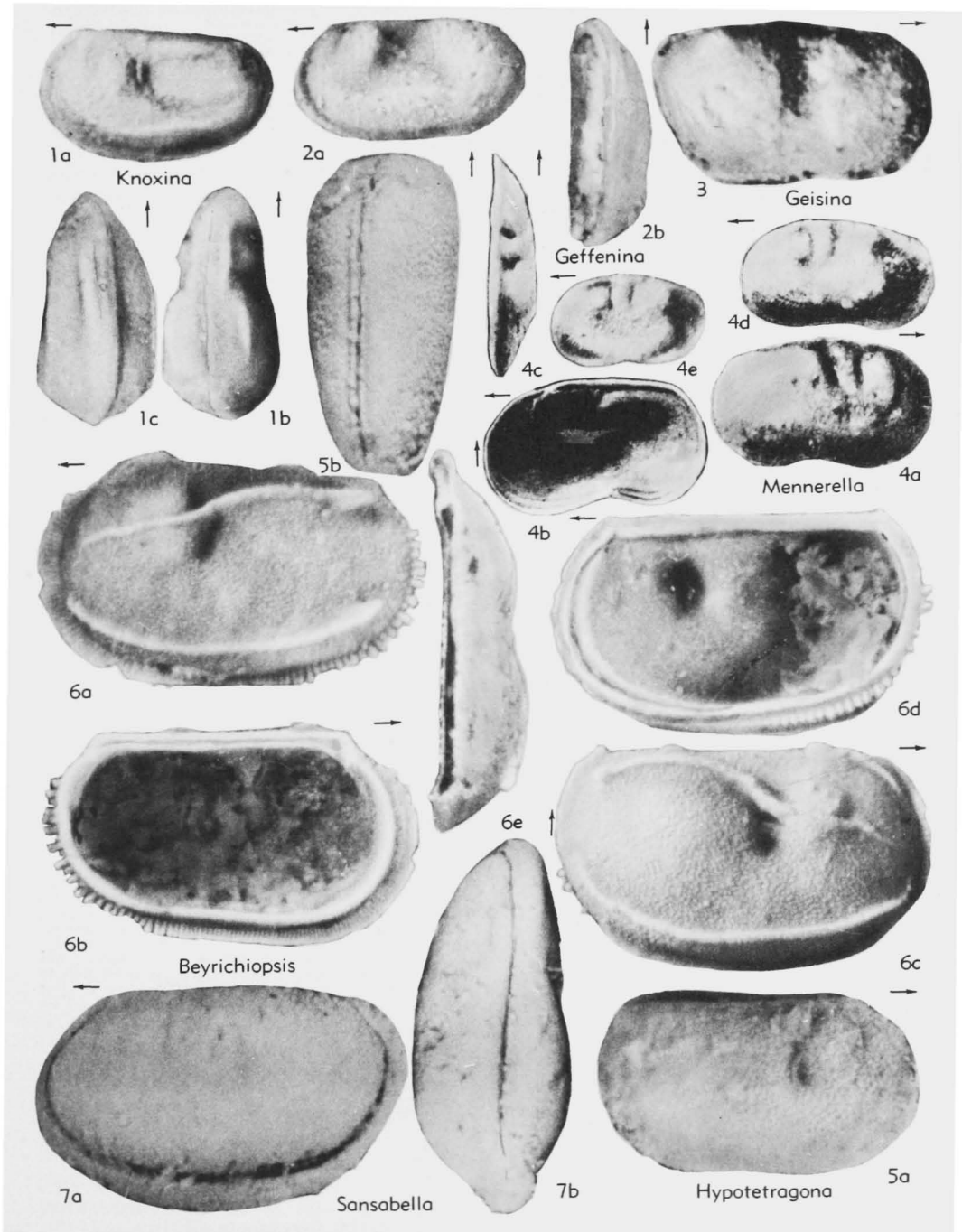

Fig. 122. Geisinidae, Beyrichiopsidae, Sansabellidae (p. Q182-Q183, Q185-Q187).

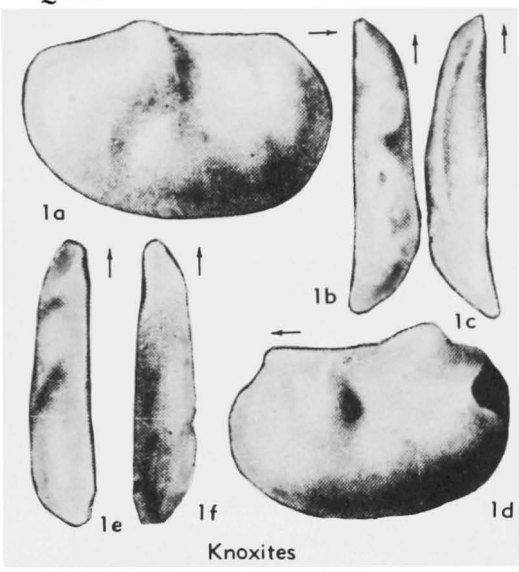

FIG. 123. Geisinidae (p. Q184).

chovkia EGOROV, 1950; *Plavskella* SAMOILOVA, 1951]. Differs from *Geisina* in absence of posterodorsal spine. *M.Dev.-Penn.*, N.Am.-Eu.-Asia. ——FIG. 122,*5*. **H. impolita*, Miss., USA(Mo.); *5a,b*, carapace (holotype) R lat., dors., ×40 (Sohn, n).

Knoxites EGOROV, 1950 [**K. menneri*]. Differs from *Geisina* in having a posterodorsal tubercle. *U.Dev.*, Eu.——FIG. 123,*1*. **K. menneri*, Russia; *1a-c*, ♀ RV (holotype) lat., dors., vent.; *1d-f*, ♀ LV lat., dors., vent.; all ×40 (144).

?**Pseudoleperditia** SCHNEIDER, 1956 [**P. tuberculifera*]. Like *Geisina* but differs in having anterodorsal spine and lacking an incised hinge. *L.Carb.*, USSR.——FIG. 124,*1*. **P. tuberculifera; 1a,b*, carapace L, dors., ×30 (238).

Family GLYPTOPLEURIDAE Girty, 1910

[Materials for this family prepared by H. W. SCOTT, University of Illinois]

Carapace costate, straight-backed, cardinal angles obtuse; RV larger than LV overlapping it around free margin; S_2 present as short sulcus or pit; hinge channel terminated by anterior and posterior cardinal teeth; dimorphic. *?M.Dev., M. Miss.-M. Perm.*

Glyptopleura GIRTY, 1910 [**G. inopinata*] [=*Ceratopleurina, Glyptopleurites* CORYELL & JOHNSON, 1939; *Mesoglypha* COOPER, 1941]. Subquadrate to subovate; dorsum straight in lateral view, venter broadly convex, cardinal angles obtuse; with 2 or more transverse simple or bifurcated costae; S_2 as short sulcus or pit; hinge channel terminated by strong anterior and posterior cardinal teeth, teeth of RV fit into sockets on LV; dimorphic. *M.Miss.-M.Perm.*, N.Am.-Eu.(Eng.-Russia).—— FIG. 125,*1a-c*. **G. inopinata*, U.Miss., USA(Ill.); *1a-c*, carapace L, dors., post., ×27 (Scott, n).—— FIG. 125,*1d*. *G. adunca* CRONEIS & THURMAN, U. Miss., USA(Ill.); ♀ carapace dors., ×40 (Scott, n).——FIG. 125,*1e,f*. *G. varicostata* CRONEIS & THURMAN, U.Miss., USA(Ill.); *1e-f*, RV int. showing cardinal teeth, LV int. showing hinge sockets, ×60 (Scott, n).

Glyptopleurina CORYELL, 1928 [**G. montifera*] [=*Idiomorpha* CRONEIS & GALE, 1938 (*non* FÖRSTER, 1869); *Idiomorphina* CRONEIS & GALE, 1939 (*pro Idiomorpha*)]. Carapace ornamented with inosculating costae that may terminate in either or both anterodorsal and posterodorsal lobes or nodes; faint frill rarely present; otherwise like *Glyptopleura*. *M.Miss.-Penn.*, N.Am.——FIG. 125, *2*. **G. montifera*, M.Miss., USA(Ill.); *2a-c*, ♀ carapace L, dors., post., ×40 (Scott, n).

?**Svantovites** POKORNÝ, 1950 [**S. primus*]. Carapace subquadrangular, dorsum straight to gently arched, venter straight to broadly convex; greatest height in anterior portion, greatest width in posterior half; distinctly inequivalve, larger valve (left) overlapping smaller around free margin; with costae (interconnected in some by fine ribs) oblique to dorsal surface; hingement by cardinal teeth (RV) and sockets (LV) and connecting hinge bar and groove. Similar to *Glyptopleura* but lacking pit or S_2 and with more oblique costae. *M.Dev.*, Eu.(Czech.).——FIG. 125,*3*. **S. primus; 3a-c*, carapace R, dors., vent.; *3d*, LV int., ×77 (Scott, n).

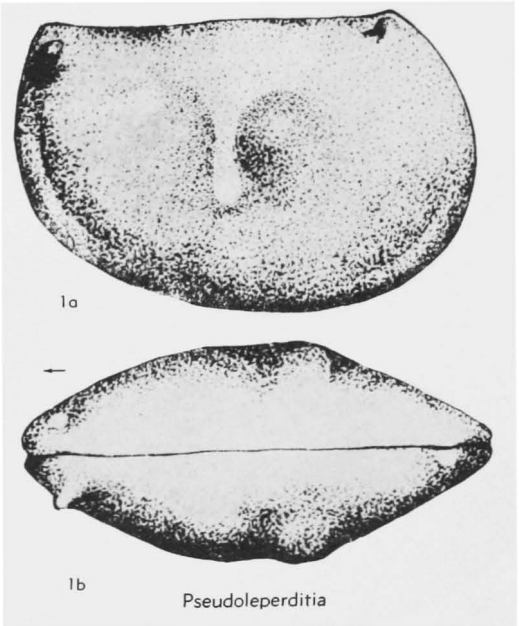

FIG. 124. Geisinidae (p. Q184).

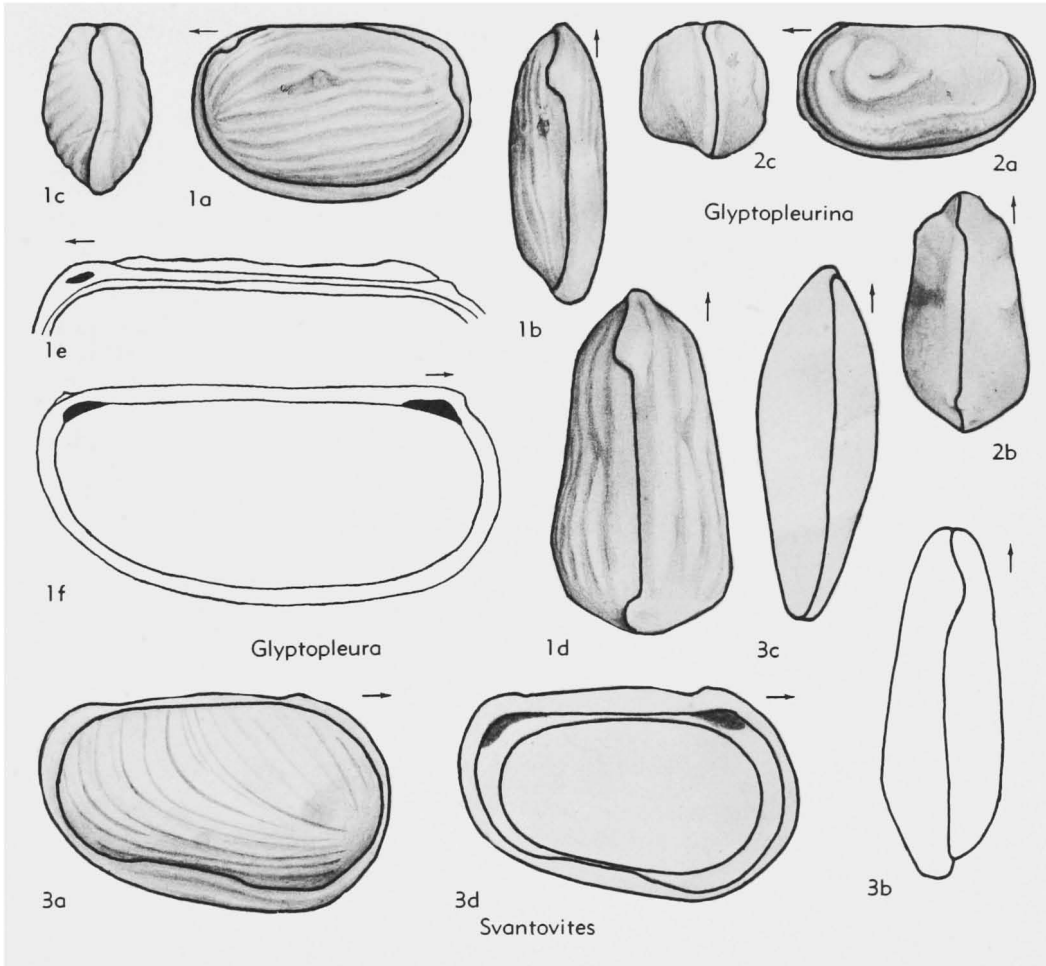

FIG. 125. Glyptopleuridae (p. Q184).

Family BEYRICHIOPSIDAE Henningsmoen, 1953

[=Knoxinae EGOROV, 1950 (invalid because this family-group taxon contains no nominate genus, such as *Knoxa, Knoxus,* or *Knoxum,* from which the subfamily name Knoxinae could be derived); likewise, Knoxidae EGOROV, 1950 (*nom. transl.* POLENOVA, 1960, in USSR Treatise) is unavailable. Knoxinae and Knoxidae are not derivable from *Knoxina* and regardless of EGOROV's intentions as to type species of Knoxinae, this name is not emendable to Knoxininae.—Editor.] [Materials for this family prepared by I. G. SOHN, United States Geological Survey] [Includes ?Mennerellidae POLENOVA, 1960]

Straight-backed, small, bilobate or trilobate; velate, with or without crests on valve surface; ridge-and-groove hinge; overlap slight, even, restricted to free margins; dimorphism exhibited in width of posterior part. *U.Dev.-M.Perm.*

Beyrichiopsis JONES & KIRKBY, 1886 [**B. fimbriata;* SD ULRICH & BASSLER, 1908] [=*Deloia* CRONEIS & THURMAN, 1939; *Leightonella* CRONEIS & GALE, 1939; *Denisonella* CRONEIS & BRISTOL, 1942 (*pro Denisonia* CRONEIS & BRISTOL, 1939; *non* KREFT, 1869); *?Lokius* CORYELL & JOHNSON, 1939]. Bilobate or trilobate, with one or more elongate crests. *L.Carb.(Miss.),* ?Eu.-N.Am.——FIG. 122,6. *B. fortis* JONES & KIRKBY, L.Carb., Scot.; *6a,b,* LV lat., int., ×40; *6c-e,* RV lat., int., dors., ×40 (Sohn, n).

Beyrichiella JONES & KIRKBY, 1886 [**B. cristata*] [=*Kirkbyia* COSSMAN, 1899 (*pro Synaphe* JONES & KIRKBY, 1896; *non* HUEBNER, 1825); *?Kirkbyina* ULRICH & BASSLER, 1908]. Bilobate, crest parallel and adjacent to dorsal margin; sulcus submedian, curves backward at ventral 0.3 of valve. *L.Carb.,* Eu.(G.Brit.).

?Geffenina CORYELL & SOHN, 1938 [**G. marmerae*]. Differs from *Knoxina* in absence of crests. *Miss.,* N.Am.——FIG. 122,2. **G. marmerae,* U.Miss., USA(W.Va.); *2a,b,* LV (topotype), lat., vent., ×40 (Sohn, n).

Kloedenellitina EGOROV, 1950 [**Beyrichia? sygmae-*

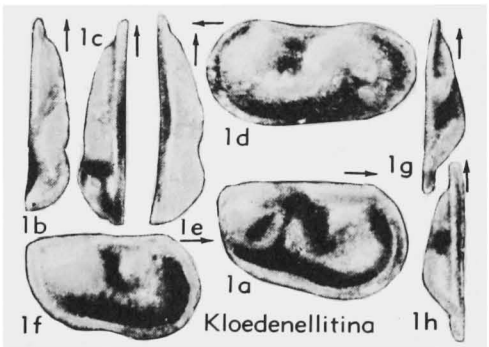

FIG. 126. Beyrichiopsidae (p. Q185).

formis BATALINA, 1941]. Differs from *Geffenina* in presence on posterior lobe of vertical sulcus that opens ventrally. *U.Dev.*, Eu.——FIG. 126,*1*. **K. sygmaeformis*, Russia; *1a-c*, ♀ RV (neotype) lat., dors., vent.; *1d,e*, ♀ LV lat., vent.; *1f-h*, ♂ RV lat., dors., vent.; all ×25 (144).

Knoxina CORYELL & ROGATZ, 1932 [**K. lecta*] [=*?Coryella* HARRIS & LALICKER, 1932; *?Chesterella* CRONEIS & GUTKE, 1939; *?Mennerites* EGOROV, 1950]. Trilobate, small, with or without subdued horizontal crests, velum usually not preserved but reflected as inconspicuous flange. *U. Dev$_2$-M.Perm.*, N.Am.-?Eu.——FIG. 122,*1*. **K. lecta*, M.Perm., USA(Tex.); *1a-c*, carapace (holotype) L, dors., vent., ×40 (Sohn, n).

?Mennerella EGOROV, 1950 [**M. tuberosa*]. Differs from *Knoxina* in ventrolateral inflation instead of crest, and in tuberculate lobes. *U.Dev.*, Eu.——FIG. 122,*4*. **M. tuberosa*, Russia; *4a-c*, ♂ RV lat., int., dors.; *4d,e*, ♀ LV lat., immature specimens; all ×22.5 (144).

?Tambovia SAMOILOVA, 1951 [**T. prima*] [=*?Marginia* POLENOVA, 1952]. Bilobate, with one or more crests parallel to each of end margins. *U.Dev.*, Eu.——FIG. 127,*1*. *T. sculpta* (POLENOVA), Russia; *1a,b*, carapace (holotype) L, dors., ×40; *1c,d*, carapace (paratype) L, dors., ×40 (277). [**T. prima* probably is based on juvenile instars.]

Family LICHVINIIDAE Posner in Egorov, 1950

[*nom. transl.* SOHN, herein (*ex* Lichvininae POSNER in EGOROV, 1950)] [=Lichwininae POSNER in POLENOVA, 1952] [Materials for this family prepared by I. G. SOHN, United States Geological Survey]

Straight-backed, subelliptical, punctate, or reticulate; small; with ocular protuberance and one or more subcentral sulci or pits; hinge of RV with groove in anterior third and posterior bar, that of LV with anterior bar and posterior groove; marginal rim along all margins, disconnected along dorsal margin where posterior part may continue as loop around concavity. Dimorphism indicated by internal ?partition in posterior 0.3 of female carapace. *U.Dev.-M. Perm.*

Lichvinia POSNER in EGOROV, 1950 [**L. lichvinensis*]. Marginal rim extending as loop around ?single concavity. *Carb.*, Eu.——FIG. 128,*2*. *L. malevkensis* POSNER in EGOROV, Carb., Russia; *2a*, ♂ LV lat.; *2b-d*, ♀ carapace L, dors., vent.; all ×40 (144).

Evlanella EGOROV, 1950 [**E. ljaschenkoi*]. Marginal rim not extending around single concavity, which has elongate ventral rib below it. *U.Dev.-M.Perm.*, Eu.——FIG. 128,*1*. **E. ljaschenkoi*, U.Dev., Russia; *1a,b*, ♂ RV (holotype) lat., vent.; *1c,d*, ♀ LV (paratype) lat., vent.; *1e*, ♀ RV lat.; all × 40 (144).

Kalugia EGOROV, 1950 [**K. ivanovi*]. With 2 subcentral pits. *U.Dev.*, Russ.——FIG. 128,*3*. **K. ivanovi; 3a,b*, ♀ LV (holotype) lat., int.; *3c,d*, ♀ LV lat., dors.; *3e,f*, ♂ RV lat., vent.; all ×40 (144).

?Trinota HOU, 1955 [**T. costata*]. Ventral ridge and 3 nodes, with central node above subcentral pit. *U.Dev.*, E.Asia.——FIG. 129,*1*. **T. costata*, China(Hupeh); *1a,b*, RV (holotype) lat., LV (paratype) lat., ×? (176).

?Family MILTONELLIDAE Sohn, 1950

[Materials for this family prepared by I. G. SOHN, United States Geological Survey]

Straight-backed, reticulated, sulcate, with narrow, shallow groove that extends backward from anterior cardinal angle and curves around and below center of valve subconcentric with free margin; marginal frill narrow or dentate. *?U.Miss., M. Perm.*

Miltonella SOHN, 1950 [**M. shupei*]. Groove outlining 0.7 of lateral surface. *M.Perm.*, N.Am.——FIG. 130,*3*. **M. shupei*, M.Perm. (Leonard or Word), USA(Tex.); *3a*, carapace (holotype) dors.

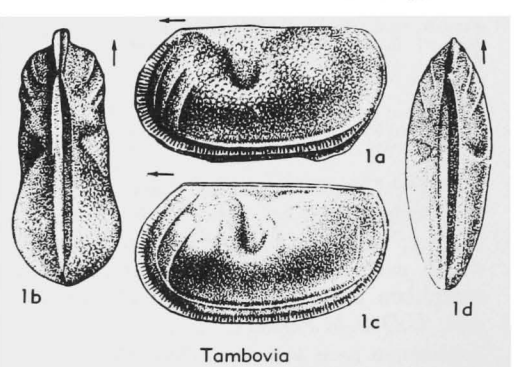

FIG. 127. Beyrichiopsidae (p. Q186).

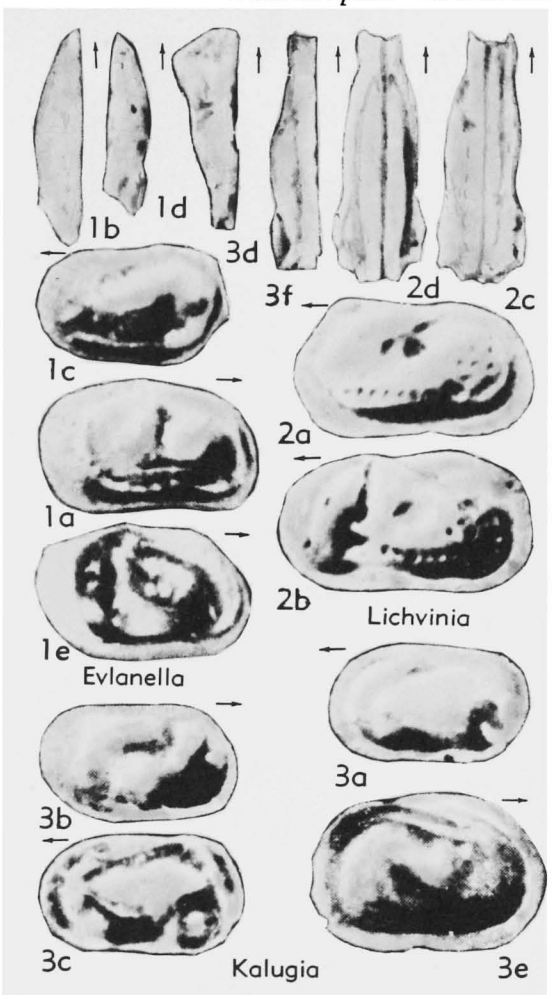

FIG. 128. Lichviniidae (p. Q186).

(333); *3b,* LV (paratype), int. (333); *3c,* LV lat. (73); all ×20.

Sanniolus SOHN, 1954 [**S. sigmoides*]. Sine-like lobe within area outlined by miltonellid groove. *Perm.*, N.Am.——FIG. 130,*2*. **S. sigmoides*, Perm. (Leonard or Word), USA(Tex.); *2a-c,* RV (holotype), lat., int., dors., ×54 (73).

?Savagellites PŘIBYL, 1953 [*pro Savagella* GEIS, 1932 (*non* FOERSTE, 1920)] [**Kirkbya lindahli* ULRICH, 1891]. Differs from *Miltonella* in nearness of lateral groove to free margins with termination at dorsoposterior angle. *U.Miss.*, N.Am. ——FIG. 130,*1*. **S. lindahli*, USA(?Ill.); *1a-c,* carapace L, dors., vent., ×? (385).

Family SANSABELLIDAE Sohn, n. fam.

[Materials for this family prepared by I. G. SOHN, United States Geological Survey]

Straight-backed, unlobed, ?velate, small, with or without subcentral pit; larger valve overlapping opposite valve along free margin; ridge-and-groove hinge; surface texture unknown. Dimorphism indicated by width of posterior part. *M.Miss.-M.Penn.*

Sansabella ROUNDY, 1926 [**S. amplectens*] [=*Persansabella* CORYELL & SOHN, 1938; *?Lamarella, Carboprimitia* CRONEIS & FUNKHOUSER, 1939; *Reversabella* CORYELL & JOHNSON, 1939; *?Lochriella* SCOTT, 1942]. Dorsum incised along entire length of hinge; pseudovelum of some specimens preserved as spines on free margins of both valves; reversal of overlap usual. *M.Miss.-M.Penn.*, N. Am.-Eu.-Asia.——FIG. 122,*7*. **S. amplectens*, Miss., USA(Tex.); *7a,b,* carapace (lectotype, herein) ?L. lat., dors., ×60 (Sohn, n).

?Superfamily LEPERDITELLACEA Ulrich & Bassler, 1906

[*nom. transl.* LEVINSON, herein (*ex* Leperditellidae ULRICH & BASSLER, 1906)] [Diagnosis by H. W. SCOTT, University of Illinois]

Unisulcate, smooth or ornamented, straight-backed ostracodes. Includes many forms previously classified as primitiids. *L. Ord.-U.Jur.*

Except for a single genus *(Coryellina)* all known representatives of the Leperditellacea are restricted to pre-Carboniferous strata; they are most numerous and varied in Ordovician deposits. The stratigraphic dis-

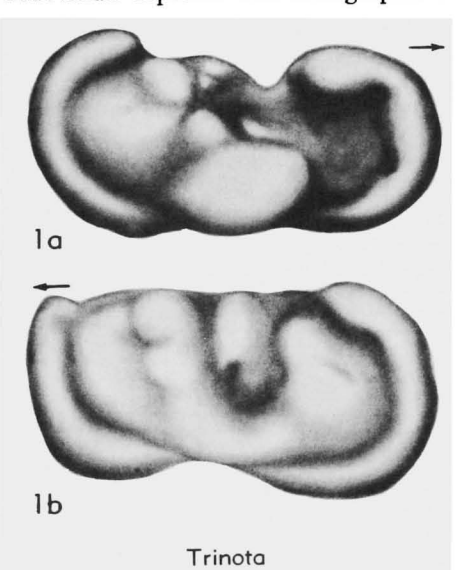

FIG. 129. Lichviniidae (p. Q186).

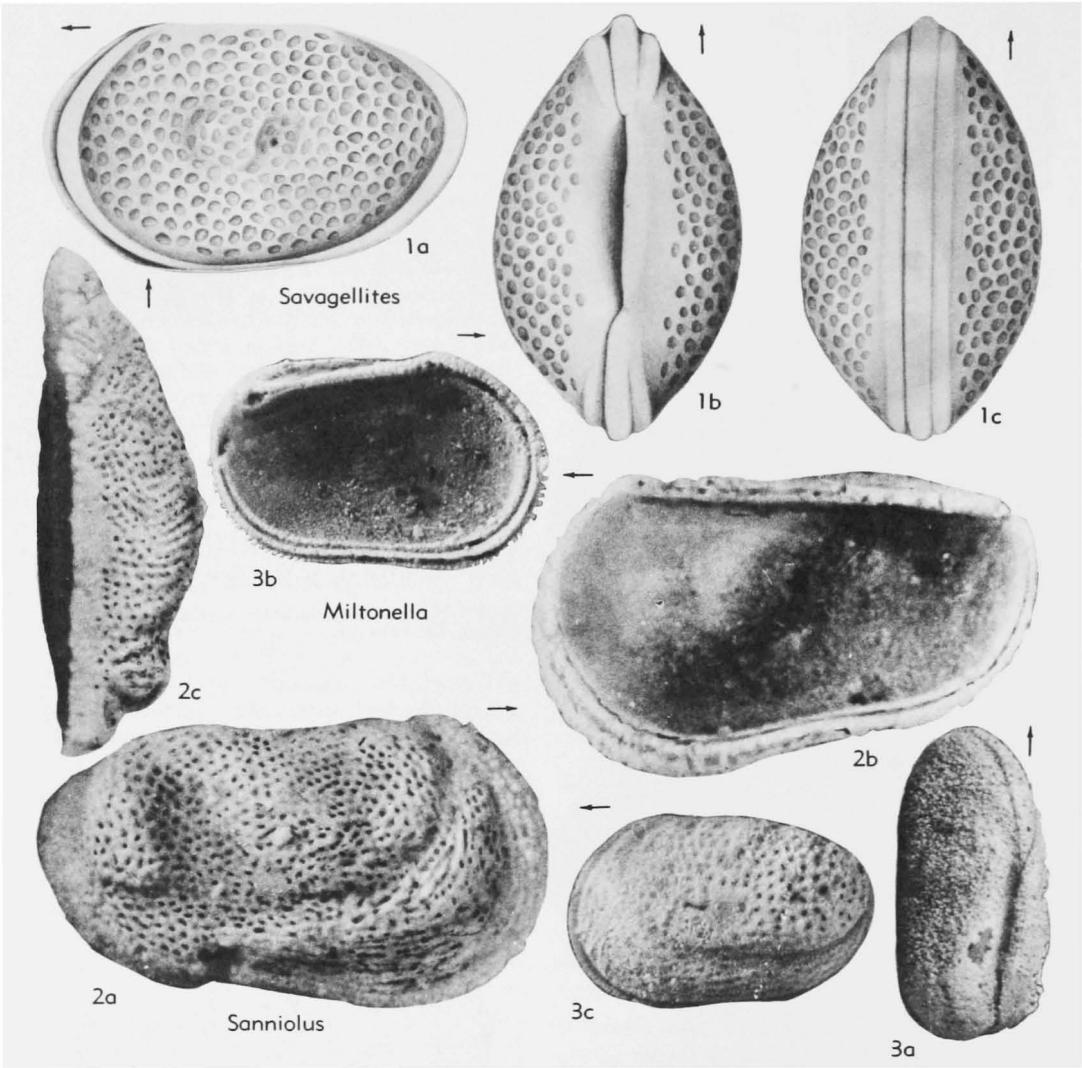

FIG. 130. Miltonellidae (p. Q186-Q187).

tribution of leperditellacean ostracode genera is shown graphically in Figure 131.

Family LEPERDITELLIDAE Ulrich & Bassler, 1906

[=Primitiidae ULRICH & BASSLER, 1923; Conchoprimitiinae, Eridoconchinae HENNINGSMOEN, 1953] [Materials for this family prepared by S. A. LEVINSON, Humble Oil & Refining Company, and R. C. MOORE, University of Kansas, with contributions from others as recorded, with additions by IVAR HESSLAND, University of Stockholm, and H. W. SCOTT, University of Illinois]

Straight-hinged, unisulcate, without marginal frill, velate structures, or pronounced flanges at extremities of hinge line. *L.Ord.-U.Jur.*

Leperditella ULRICH, 1894 [**L. rex* CORYELL & SCHENCK, 1941 (*nom. subst. pro Leperditia inflata* ULRICH, 1892, *non* MURCHISON, 1839; *nec* MUNSTER, 1830)]. Elongate oval, with barely perceptible, shallow S_2; anterior and posterior ends evenly rounded. *M.Ord.-U.Ord.*, N.Am.-Eu.——FIG. 132, *1*. **L. rex* CORYELL & SCHENCK, *M.Ord.*, USA (Ky.); *1a,b*, LV (holotype) lat., ×10, ×15 (*1a*, 386; *1b*, Levinson, n).

?**Aparchitella** IVANOVA, 1955 [**A. major*]. Large, straight-backed ostracodes with convex free margin; surface partially or wholly reticulate; valves unequal, large left valve overlaps right along margin; tubercle in anterodorsal area of left valve, reflected internally by deep pit; shallow furrow

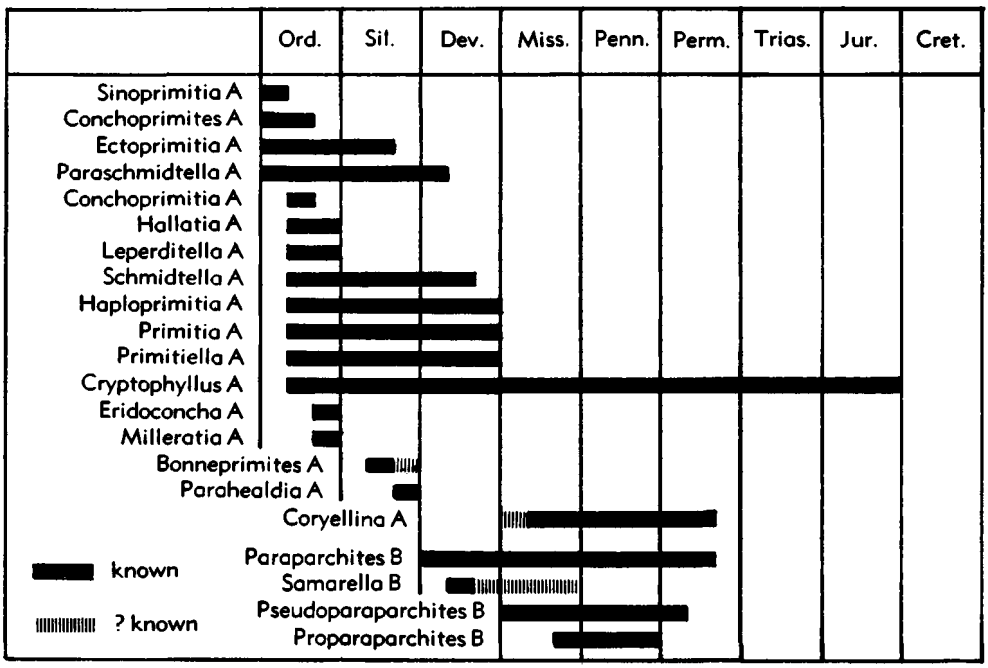

FIG. 131. Stratigraphic distribution of (A) leperditellacean and (B) paraparchitacean ostracode genera (Moore, n).

(S_2?) behind tubercle; large spine on right valve in anteroventral position directed anterolaterally, spine absent on left valve. Muscle-scar pattern unknown. *Ord.*, Russia.——FIG. 134*A,1*. **A. major; 1a,b*, RV (young stage), LV (int. mold) ×15 (179).

Bonneprimites SWARTZ & WHITMORE, 1956 [**Primitia bonnemai* SWARTZ, 1936] [=*Eoprimitia* HARRIS, 1957]. Like *Leperditella* but with S_2 prominent, slightly curved. *M.Sil., ?U.Sil.*, Eu.-?N.Am. ——FIG. 134,*5*. **B. bonnemai* (SWARTZ), M.Sil., Gotl.; LV lat., ×33 (74).

Conchoprimites HESSLAND, 1949 [**C. reticulifera*]. Somewhat preplete, LV larger than RV; unisulcate, short S_2 being generally rather deep, with anterior margin steeper than posterior; low presulcal node; groove (inferred retention line of larval stage), in some shells combined with steplike difference in level, extending along anterior or posterior margin or both, or along entire free margin; adventral structures and dimorphism not observed. *L.Ord.-M.Ord.*, Eu.(Baltoscandia).——FIG. 134,*7a*. **C. reticulifer*, L.Ord.(Llanvirn.), Swed.; LV (holotype) lat., ×30 (30).——FIG. 134,*7b*. *C. tolli* BONNEMA, M.Ord., Est.; LV lat., ×13 (58). [HESSLAND.]

Conchoprimitia ÖPIK, 1935 [**C. gammae*] [=*Conchoides* HESSLAND, 1949]. Like *Conchoprimites* but without sulcus; concentric grooves parallel to free margin due to retained molts, as in *Conchoprimites, L.Ord.-M.Ord.*, Eu.-N.Am. ——FIG. 132,*9a,b*. **C. gammae*, L.Ord.(Arenig.), Est.; *9a,b*, carapace (holotype) L, vent., ×20.—— FIG. 134,*9*. *C. symmetrica* (ULRICH), M.Ord. (Decorah Sh.), USA(Minn.); *9a-c*, LV lat., int., RV int., ×20 (J. R. Cornell, n.).——FIG. 132,*9c-f*. *C.* sp., M.Ord. (Edinburg F.), USA(Va.); *9c-f*, carapace L, R, dors., LV int., ×20 (J. C. Kraft, n). [*Hyperchilarina* HARRIS, 1957, classed as synonym of *Conchoides* and accordingly of *Conchoprimitia*. —SCOTT.] [According to HESSLAND, differences in gibbosity of carapaces suggest that *Conchoprimitia* is dimorphic. In his opinion, forms illustrated in Figs. 132,*9c-f*, and 134,*9* are doubtfully assignable to this genus.—ED.]

Coryellina BRADFIELD, 1935 [**C. capax*]. Unisulcate, S_2 prominent; posterior border angularly truncated with straight posterodorsal half disposed at right angle with dorsal margin and straight posteroventral half that meets upper portion at 120-degree angle; posterior spine usually present near mid-height; hinge line with small cardinal flanges. *?L.Miss., U.Miss.-M.Perm.*, N.Am.-Eu.——FIG. 132,*7*. **C. capax*, M.Penn.(Deese F.), Okla.; *7a,b*, carapace R, dors., ×50 (11).

Cryptophyllus LEVINSON, 1951 [**Eridoconcha oboloides* ULRICH & BASSLER, 1923]. Umbonate, each valve with 2 to 6 wide concentric ridges parallel to free margins of carapace, separated from one

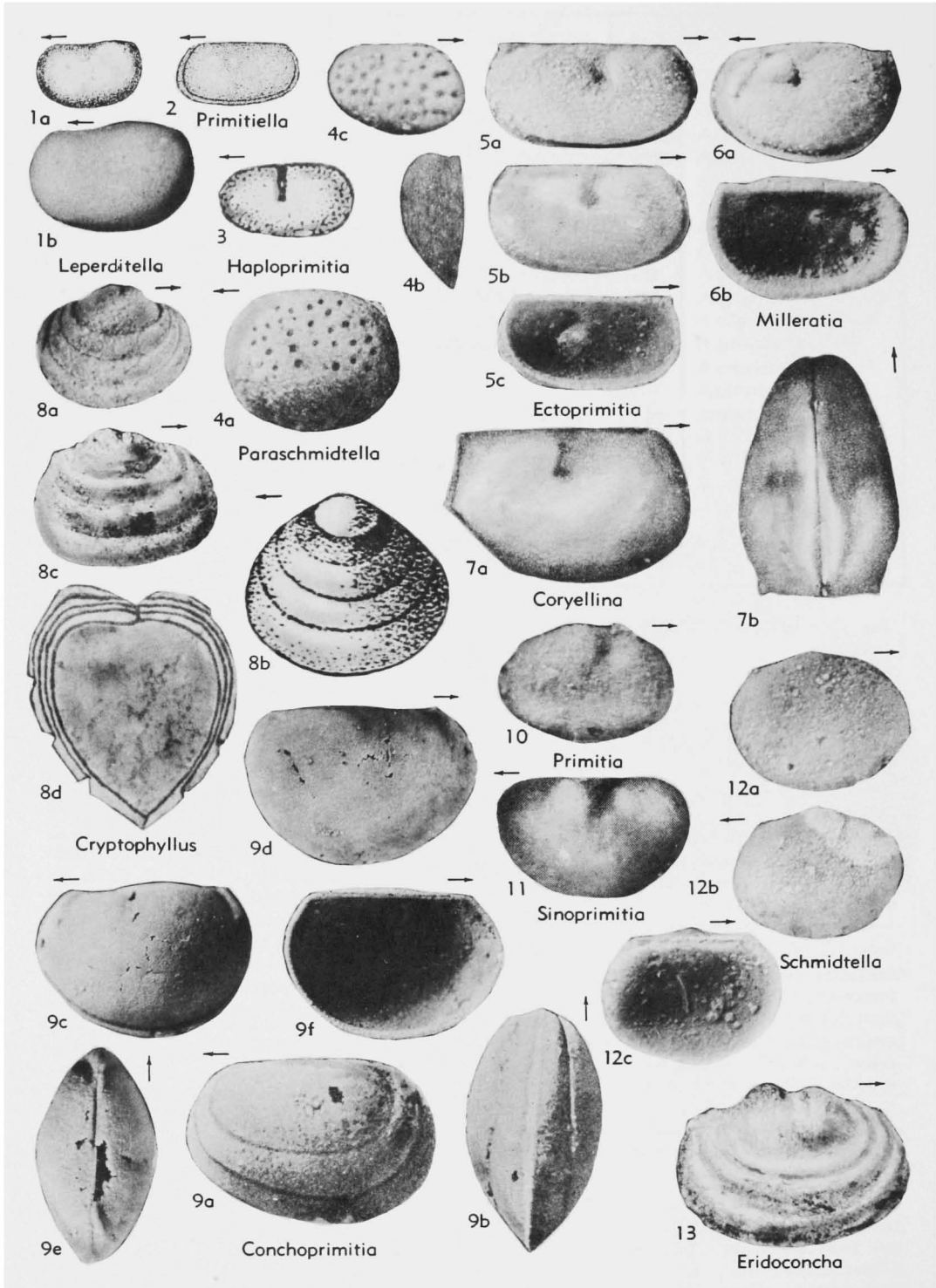

FIG. 132. Leperditellidae (p. Q188-Q193).

another by narrow V-shaped troughs; S_2 short and usually seen only in dorsal view; L_2 and L_3 developed in some specimens into small lobes, L_3 invariably larger than L_2. Similar to *Eridoconcha* except that ridges are separated from one another by narrow V-shaped troughs; differs from *Conchoprimitia* and *Conchoprimites* in shortness of hinges. [Transverse sections of carapaces demonstrate that the parallel grooves and ridges represent distal parts of retained molts.] *M.Ord.-U.Jur.*, Eu.-N. Am.——FIG. 132,*8a,b*. **C. oboloides* (ULRICH & BASSLER), M.Ord. (Decorah Sh.), USA(Minn.); *8a*, RV lat., ×50 (J. R. Cornell, n); *8b*, ?LV lat., ×40 (86).——FIG. 132,*8c,d*. *C. sulcatus* LEVINSON, U. Ord. (Richmond.), USA(Ind.); *8c*, ?RV lat., ×40; *8d*, carapace transv. sec., showing shell layers of retained molts; ×80 (49).

Ectoprimitia BOUČEK, 1936 [**Primitia corrugata* KRAUSE, 1892]. Like *Primitiella* except for deeper sulcus, that is more extended dorsally and with steeper anterior and posterior margins; cardinal angles sharp, unequal. *Ord.*, Eu.-N.Am.——FIG. 132,*5*. *E.* sp., M.Ord. (Edinburg F.), USA(Va.); *5a-c*, RV lat., RV lat., LV int., ×20 (J. S. Kraft, n).

Eridoconcha ULRICH & BASSLER, 1923 [**E. rugosa*]. Commonly umbonate with 1 to 5 narrow concentric ridges separated from one another by U-shaped troughs. S_2 short to elongate, L_2 and in some species L_3 developed into lobes, when developed L_3 always larger. Similar to *Cryptophyllus* except that ridges are separated by U-shaped troughs; ridges marking edges of individual molts not completely shed. *U.Ord.*, N.Am.——FIG. 132, *13*. *E. multiannulata* LEVINSON, U.Ord. (Richmond.), USA(Ohio); RV lat., ×50 (49).——FIG. 134,*3*. *E. marginata* (ULRICH), U.Ord. (Maquoketa F.), USA(Iowa); *3a-d*, LV lat., RV int., dors., vent., ×33 (118).

Hallatia KAY, 1934 [**H. healeyensis*]. Small, valves subequal, elongate oval, hinge line straight, ventral margin broadly convex, moderately deep short sulcus dividing valves into 2 broad, relatively flat lobes; cardinal angles obtuse; valves extended posteroventrally into histial-like structure; surface smooth. Hinge of tongue-and-groove type; interior of valves divided by ridge corresponding to S_2 sulcus of exterior, broad chambers thus formed uniting ventrally. [Dimorphism doubtfully recognizable in some species (e.g., *H. convexa*), which, if established, would indicate propriety of assigning genus to Sigmoopsidae.] *M.Ord.-U.Ord.*, N. Am.——FIG. 133,*1a-d*. *H.* sp., M.Ord. (Edinburg F.), USA(Va.); *1a-d*, RV lat., dors., vent., int., ×24 (J. C. Kraft, n).——FIG. 133,*1e-g*. *H. convexa* KAY, M.Ord. (Decorah Sh.), USA(Minn.); *1e-g*, RV lat., LV lat., LV int., ×36 (J. R. Cornell, n). [MOORE-SCOTT.]

Haploprimitia ULRICH & BASSLER, 1923 [**Primitia minutissima* ULRICH, 1894]. Like *Primitia* except

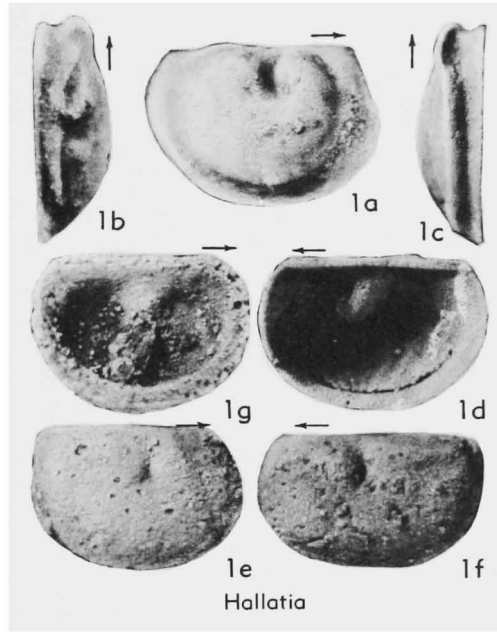

FIG. 133. Leperditellidae (p. Q191).

that S_2 is very thin and straight; carapace usually elongate similar to *Primitiella*. *L.Ord.-U.Dev.*, Eu.-N.Am.——FIG. 132,*3*. **H. minutissima* (ULRICH), M.Ord., USA(Minn.); LV lat., ×30 (83).

?Kayina HARRIS, 1957 [**K. hybosa*]. Straight-backed ostracodes with the left valve slightly larger than the right and overlapping it around free margin; greatest height and width posterior; posterodorsal knob on left valve; faint internal partition suggests primitive sulcus similar to that found in *Leperditella*. *M.Ord.*, N.Am.——FIG. 134*A,3*. **K. hybosa*, M.Ord. (Tulip Creek Ls.), USA(Okla.); *3a-d*, LV, RV, post., dors., ×17 (161).

Milleratia SWARTZ, 1936 [**Beyrichia cincinnatiensis* MILLER, 1875]. Hinge long, straight; S_2 extending from dorsal margin to mid-height, commonly terminating ventrally in a pit; L_2 and L_3 in dorsal half of valve usually strongly inflated, L_3 larger than L_2; faint marginal ridge may be present near free borders. Males more elongate than females. *M.Ord.-U.Ord.*, N.Am.(Ohio-Ind.-Mich.).——FIG. 134,*4*. **M. cincinnatiensis* (MILLER); *4a,b*, ♀ RV lat., ♂ RV lat., ×40 (49); *4c-h*, LV lat., int., RV lat., LV int., dors., carapace vent., ×33 (J. H. Burr, Jr., n); (*4a,b*, Richmond., Ohio; *4c-h*, Maquoketa F., Iowa).——FIG. 132,*6*. *M.* sp., M.Ord. (Edinburg F.), USA(Va.); *6a,b*, LV lat., int., ×30 (J. C. Kraft, n).

Parahealdia CORYELL & CUSKLEY, 1934 [**P. pecorella*]. Unisulcate, with 2 posterior spines; surface

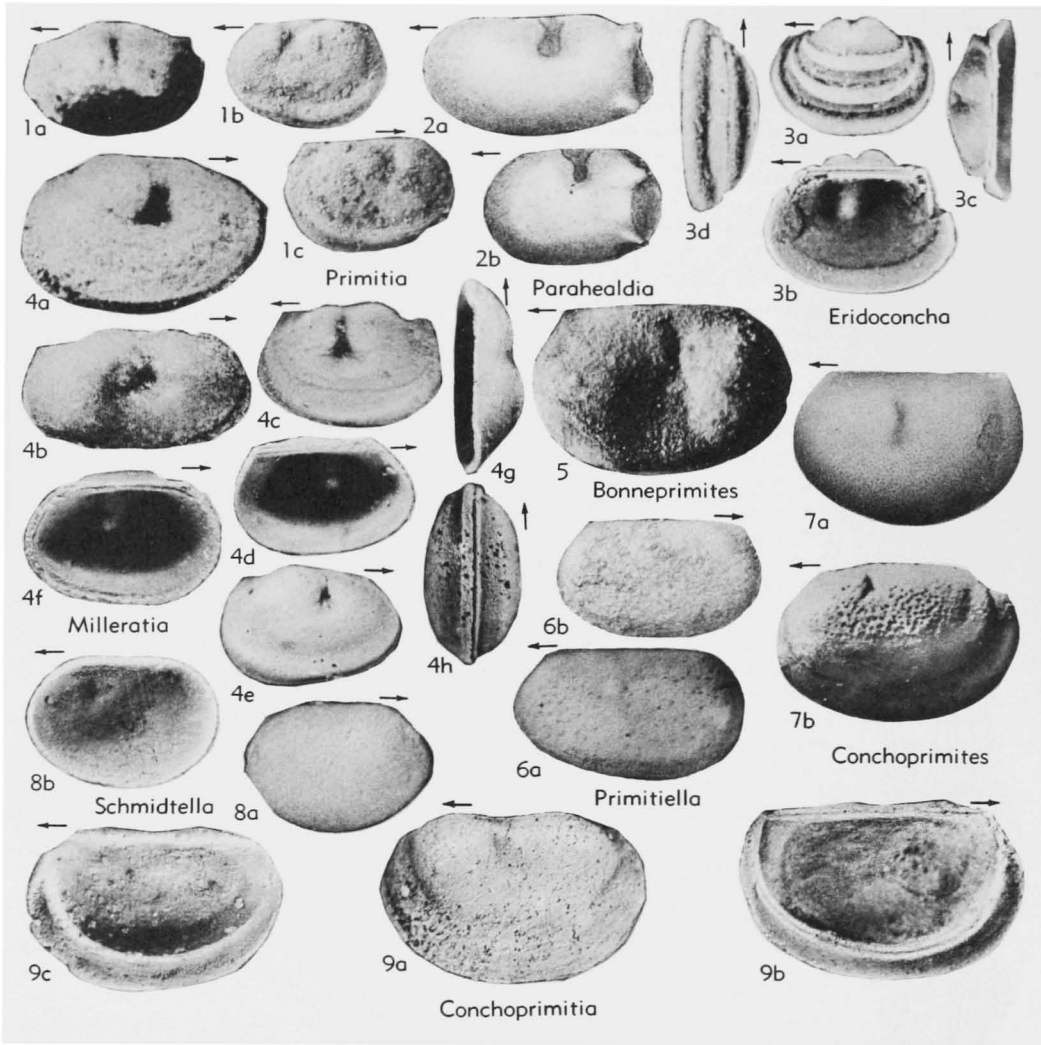

FIG. 134. Leperditellidae (p. Q189-Q193).

granulose or smooth. *L.Dev.*, N.Am.——FIG. 134, *2*. **P. pecorella*, Haragan Sh., USA(Okla.); *2a,b*, ♂ LV lat., ♀ LV lat., ×13 (125).

Paraschmidtella SWARTZ, 1936 [**P. dorsopunctata*]. Amplete, cardinal angles obtuse, umbones broad and protruding above hinge line; nonsulcate; surface deeply pitted; dimorphism not observed. *Ord.-Dev.*, N.Am.-Eu.-E.Asia.——FIG. 132,*4a,b*. **P. dorsopunctata*, L.Dev., USA(Pa.); *4a,b*, LV (holotype, internal mold), lat., post., ×30 (74).——FIG. 132,*4c*. *P. ovata* (KAY), M.Ord. (Decorah Sh.), USA(Minn.); RV lat., ×50 (J. R. Cornell, n). [HESSLAND.]

Primitia JONES & HOLL, 1865 [**Beyrichia mundula* JONES, 1885 (ICZN pend.)]. Unisulcate, S_2 prominent and slightly curved. *L.Ord.-U.Dev.*, Eu.-N. Am.——FIG. 134,*1a*. **P. mundula* (JONES), Sil., Ger.; *1a*, LV lat., ×33 (387).——FIG. 134,*1b,c*. *P. tumidula* ULRICH; U.Ord. (Maquoketa Sh.), USA(Iowa); *1b,c*, LV lat., RV lat., ×23 (J. R. Cornell, n).——FIG. 132,*10*. *P. mammata* ULRICH, M.Ord. (Decorah Sh.), USA(Minn.); RV lat., ×50 (J. R. Cornell, n).

Primitiella ULRICH, 1894 [**P. constricta* ULRICH]. Like *Leperditella* except more elongate. *L.Ord.-U.Dev.*, Eu.-N.Am.——FIG. 132,*2*. **P. constricta* ULRICH, M.Ord., USA(Minn.); LV lat., ×30 (83).——FIG. 134,*6a*. *P. unicornis* (ULRICH), M. Ord. (Decorah Sh.), USA(Minn.); *6a*, LV lat., ×33 (J. R. Cornell, n).——FIG. 134,*6b*. *P. plattevillensis* KAY, M.Ord. (Decorah Sh.), USA(Minn.); *6b*, RV lat., ×30 (J. R. Cornell, n).

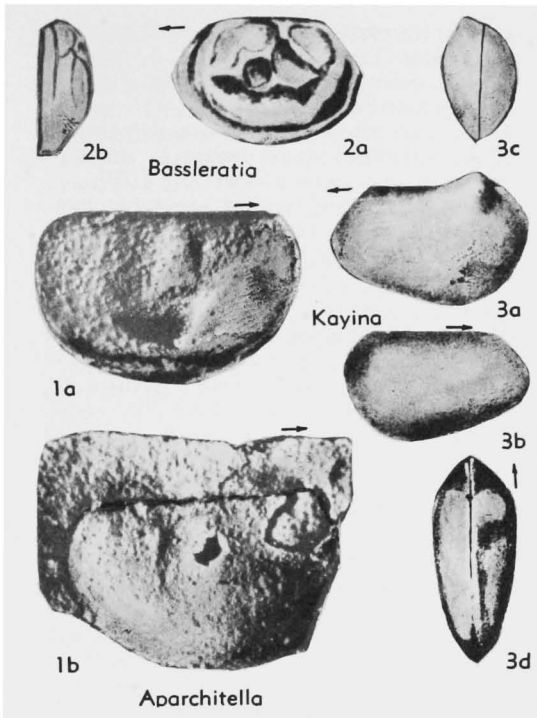

FIG. 134A. Bassleratiidae, Leperditellidae (p. Q140, Q188, Q191).

Schmidtella ULRICH, 1892 [**S. crassimarginata*]. Subovate, moderately convex, most inflated in dorsal region, which tends to be umbonate; RV slightly larger than LV, overlapping it ventrally; no sulcus present but faint central pit and elevation in some species; carapace may retain immature molts, as in *Cryptophyllus* and *Conchoprimitia*. *M. Ord.-M.Dev.*, N.Am.-Eu.——FIG. 134,*8*. *S. incompta* ULRICH, U.Ord. (Maquoketa F.), USA (Iowa); *8a,b*, RV lat., int., ×33 (J. R. Cornell, n). ——FIG. 132,*12*. *S. umbonata* ULRICH, M.Ord. (Decorah Sh.), USA(Minn.); *12a-c*, RV lat., LV lat., int., ×50 (J. R. Cornell, n).

Sinoprimitia HOU, 1953 [**S. sinensis*]. Unisulcate, with median oblique sulcus extending to dorsal margin, small node at each side of sulcus; surface smooth; similar to *Milleratia* but nodes smaller and valves not as inflated, *L.Ord.*, E.Asia(China). ——FIG. 132,*11*. **S. sinensis;* LV lat., ×? (175).

Superfamily PARAPARCHITACEA Scott, 1959

[Diagnosis by H. W. SCOTT, University of Illinois]

Nonsulcate, nonlobate, nonvelate palaeocopid ostracodes with unequal valves, the larger overlapping the smaller around all or most of the free margin. *L.Dev.-M.Perm.*

The Paraparchitacea are a relatively small assemblage of mostly robust late Paleozoic ostracodes. Their stratigraphic distribution is shown in Figure 131.

Family PARAPARCHITIDAE Scott, 1959

[Materials for this family prepared by H. W. SCOTT, University of Illinois]

Nonsulcate, nonlobate, nonvelate, and smooth to punctate, some with posterodorsal spine; dorsum straight to gently convex;

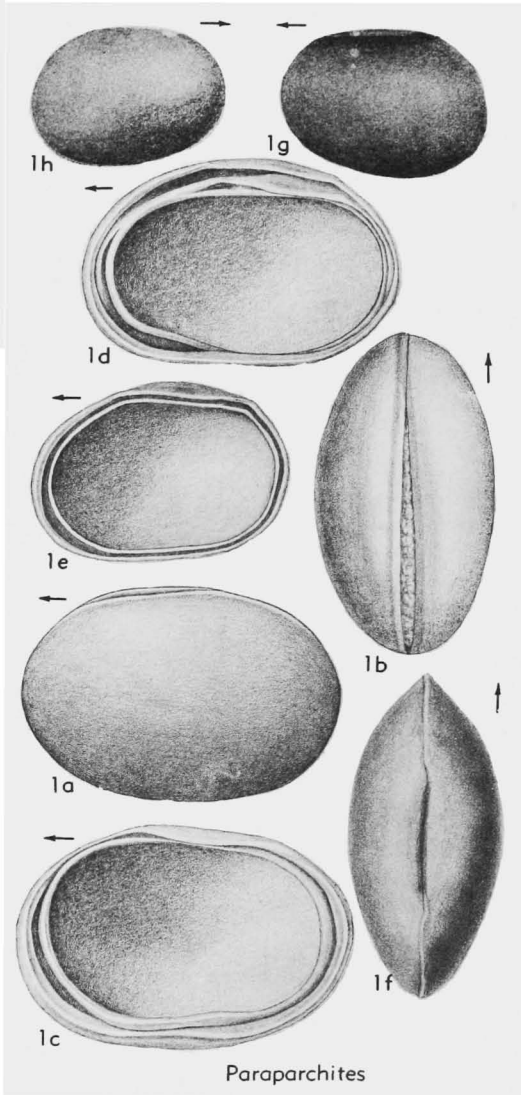

FIG. 135. Paraparchitidae (p. Q194).

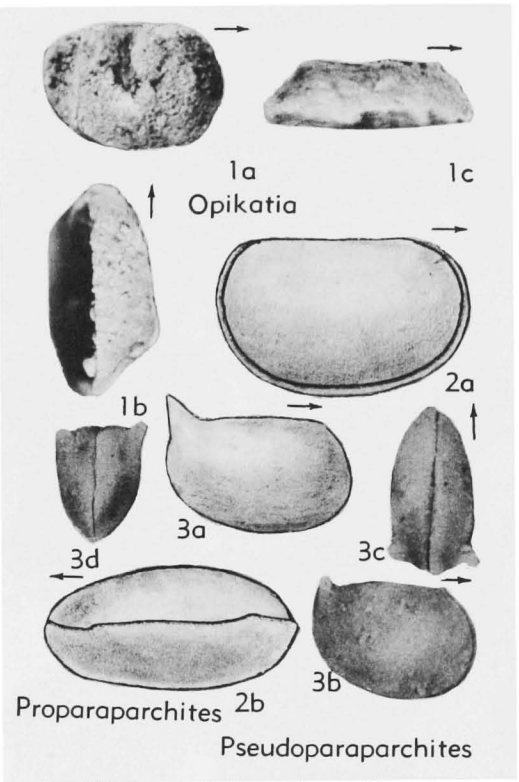

FIG. 136. Paraparchitidae, Palaeocopida, Suborder and Family Uncertain (p. Q194-Q195).

valves unequal, larger overlapping smaller along free margin, subovate to elongate-ovate, ends broadly rounded; hinge channel straight or interrupted at ends by faint to moderately strong posterior and anterior cardinal indentations where overlap begins; one valve may slightly overreach other dorsally, but dorsal shoulders usually of equal height. *L.Dev.-M.Perm.*

Paraparchites ULRICH & BASSLER, 1906 [**P. humerosus*] [=*Antiparaparchites* CORYELL & ROGATZ, 1932; *Ardmorea* BRADFIELD, 1935; *Coelonella* STEWART, 1936; *Microcoelonella* CORYELL & SOHN, 1938]. Subovate to elongate-ovate, smooth except for posterodorsal spine in a few species; LV usually overlapping RV along free margin; hinge channeled; cardinal teeth poorly to well defined on exterior at cardinal points; greatest height medial or forward, greatest width medial in males, posterior in females, forward swing pronounced in some species. Dimorphism generally but not invariably observable. Valves may appear double- or triple-layered, owing to retention of molts. *L. Dev.-M.Perm.*, N.Am.——FIG. 135,*1a-f*. **P. humerosus*, L.Perm. (Admire), USA(Kans.); *1a,b*, carapace (lectotype) L (slightly tilted to show hinge channel), vent.; *1c-e*, RV int., 3 specimens showing instar valves retained inside adult; *1f*, carapace (paratype) dors.; all ×21 (324).——FIG. 135,*1g,h*. *P. reversus* (CORYELL & ROGATZ), L. Perm., USA(Tex.) (type species of *Antiparaparchites*); *1g,h*, carapace L, R, ×30 (128).

Paraparchitella COOPER, 1946 [**P. ovata*]. Like *Paraparchites* except that hinge channel is shallow and narrow; greatest width in posterior half; ventral overlap strong. *L.Penn.*(Seville Ls.), USA(Ill.). [SCOTT.]

Proparaparchites COOPER, 1941 [**P. ovatus*]. Like *Paraparchites* but carapace subrectangular, without pronounced swing, ends similarly rounded. *U. Miss.-Penn.*, N.Am.——FIG. 136,*2*. **P. ovatus*, U.Miss., USA(Ill.); *2a,b*, carapace R, dors., ×64 (Scott, n).

Pseudoparaparchites KELLETT, 1933 [**P. kansensis*] [=*Microparaparchites* CRONEIS & GALE, 1938]. Like *Paraparchites* but strongly swollen in posterodorsal area and bearing spines on posterodorsal corners of each valve; smooth or punctate; greatest width medial in males, posterior in females. *Miss.-Penn.*, N.Am.——FIG. 136,*3a*. **P. kansensis*, Penn., USA(Kans.); carapace R, ×40 (Scott, n). ——FIG. 136,*3b-d*. *P. brazoensis* (CORYELL & ROGATZ), Penn., USA(Tex.); *3b-d*, carapace R, dors., post., ×32 (21).

?Samarella POLENOVA, 1952 [**S. crassa*]. Dorsal margin straight to gently convex, ventral margin convex; LV overlapping RV strongly along ventral margin and slightly along anterior and posterior ends, RV overlapping and overreaching LV along dorsal margin; hinge straight in dorsal view without channel or tooth indentations, greatest width medial; surface smooth to slightly granular. [This genus is related to Carboniferous forms previously classified as *Paraparchites*.] *M.Dev., ?L.Carb.*, Eu.——FIG. 109,*2*. **S. crassa*, USSR; *2a-c*, carapace R, L, dors., ×50 (277).

PALAEOCOPIDA, Suborder and Family UNCERTAIN

[Materials for this section prepared by authors as severally recorded at end of generic descriptions]

Acanthobolbina HARRIS, 1957 [**A. loeblichi*]. Elongate, hinge line straight, with prominent S_2 extending from dorsal border to slightly below mid-height, curved around weakly-developed small node (*?L.*$_2$), very large spine projecting outward from ventral region; velar ridge present. *M.Ord.*, Okla.——FIG. 136A,*11*. **A. loeblichi; 11a,b*, carapace R, dors., ×30 (161) [KESLING.]

Ctenonotella ÖPIK, 1937 [**C. elongata*]. Elongate, with straight, very long hinge line bearing row of spines pointing backward; anterior cardinal angle obtuse, posterior angle acute, in some specimens

prolonged into spine; velar structure wide, restricted, surrounding anterior, ventral, and part of posterior margins; L_2 and L_3 elongate and narrow, L_1 and L_4 lacking or indistinct, only S_2 well developed; subvelar area unknown. Dimorphism not observed. *M.Ord.*, Eu.——FIG. 136A,*14*. **C. elongata*, Est.; LV (holotype), lat., ×24 (200, from 58). [Probably belongs in Quadrijugatoridae.] [HESSLAND.]

Dicranella ULRICH, 1894 [**D. bicornis*]. Straight-hinged, with pronounced swing, L_1 a node or spine, in some species extending above hinge line; L_2, if present, a small node on base of L_1, in some species inconspicuous; L_3 a prominent spine; S_2 a sharply defined sulcus or pit, L_1 and L_3 being joined in some specimens to form low ridge below S_2; frill from anterior corner to posteroventral part of free border. [This genus may be close to *Piretella*, as SCHMIDT (69) suggested. According to KAY (194), dimorphism is indicated by a broad frill in inferred females and a narrow frill or velate ridge in inferred males.] *M.Ord.*, N.Am.——FIG. 136A,*16a-d*. **D. bicornis*, USA(Minn.); *16a,b*, LV lat., carapace vent., ×33 (J. R. Cornell, n); *16c,d*, LV lat., ant., ×20 (200).——FIG. *16e-g*. *D. marginata* KAY, Decorah F., USA(Minn.); *16e*, RV lat., ×33 (J. R. Cornell, n); *16f,g*, LV lat., ant., ×20 (200) [KESLING.]

Editia BRAYER, 1952 [**E. elegantis*]. Like *Amphisites* but differs in absence of nodes and kirkbyan pit, and in presence of eye tubercle, which excludes genus from Kirkbyidae. *M.Miss.*, N.Am.-Eu.——FIG. 136A,*13*. **E. elegantis*, USA(Mo.); *13a,b*, carapace (topotype) R, dors., ×60 (Sohn, n).

Haplobolbina HARRIS, 1957 [**H. arcuata*]. Hinge line straight, L_3 a node tangent to dorsal border, slightly anterior; low node at anterior corner ($?L_1$); sulci very weakly developed; valves wide ventrally, with shallow, broad channel on marginal surface; velar ridge complete. *M.Ord.*, N.Am. ——FIG. 136A,*3*. **H. arcuata*, USA(Okla.); *3a-c*, RV lat., dors., ant., ×25 (161). [KESLING.]

?Karlsteinella BOUČEK, 1936 [**K. reticulata*]. Large, equivalved, with straight hinge; S_2 well developed, anterior and posterior lobes broad; anterior and posterior ends somewhat extended; surface reticulate. [Genus based on a single specimen; proper allocation to family impossible.] *U.Sil.(Ludlov.)*, Czech. [SCOTT.]

Kayatia ÖPIK, 1953 [**K. prima*]. Unisulcate (sulcus mainly in dorsal half); with dorsoventrally elongate nodes (one on each side of sulcus); inequivalved (LV larger, rabbeted to receive edge of RV); with 2 to 4 ridges that may be partly developed as frills concentric to free margin (possibly velar, histial and carinal structures); dimorphism not observed. *Sil.*, Austral.——FIG. 136A,*6*. **K. prima; 6a,b*, LV (holotype) lat., oblique ventral view of silicified specimen showing adventral structures, ×13; *6c*, LV dors., ×26; *6d*, carapace transv. sec., ×26 (271). [HESSLAND.]

Kozlowskiella PŘIBYL, 1953 [*non* BOUCOT, 1957] [**Ulrichia (Kozlowskiella) kozlowskii*]. Approximately amplete, nonlobate, with distinct rounded sulcal pit, single dorsal bulb on each side of sulcal pit (posterior larger); adventral structure consisting of ridge along entire free margin; surface pitted; dimorphism not reported. Hinge with ridge in LV and corresponding furrow in RV. *M.Dev.*, Poland.——FIG. 136A,*1*. **K. kozlowskii*, Givet.; *1a,b*, carapace R, dors., ×13 (160). [Probably belongs in Bassleratiidae.] [HESSLAND.]

Nanopsis HENNINGSMOEN, 1954 [**Beyrichia nanella* MOBERG & SEGERBERG, 1906]. Preplete, unisulcate or bisulcate (if sulcus-like depression parting 2 anterodorsal nodes corresponds to S_1); no adventral structures; dimorphism not observed. *L.Ord.*, NW.Eu.(Scand.).——FIG. 136A,*2*. **N. nanella* (MOBERG & SEGERBERG), M.Ord.(Tremadoc.); *2a*, LV (lectotype, 167), lat., (Swed.), ×33; *2b*, RV (Norway), lat., ×17 (*2a*, 252; *2b*, 167). [Probably belongs in Leperditellacea.] [HESSLAND.]

Opikatia KAY, 1940 [**O. emaciata*] [=*Oepikatia* HENNINGSMOEN, 1953 (as *Öpikatia*); seemingly KAY's original spelling must be preserved, since no indication is given that the generic name is derived from ÖPIK]. Truncate oval, valves subequal, medium-sized; dorsal margin slightly sinuous, rather long, free margins well rounded; dimorphic, tecnomorphs with median sulcus or pit bordered on posterior side of distinct lobe, heteromorphs with 3 rounded nodes adjacent to posterodorsal, mid-posterior, and posteroventral margins and corresponding internal pouches; surface smooth or slightly pitted. *M.Ord.*, N.Am.——FIG. 136,*1*. **O. emaciata*, U.Decorah Sh., USA(Minn.); *1a-c*, RV lat., carapace dors., LV vent., ×50 (J. R. Cornell, n). [MOORE.]

Pinnatulites HESSLAND, 1949 [**Primitiella procera* KUMMEROW, 1924]. Nonsulcate; inequivalved (RV larger); posterior part of swollen ventral area projecting backward into small process that is somewhat depressed laterally; no adventral structure, unless developed as angled or rounded bend *(Umbiegungskante)*; dimorphism not observed. [May belong among Leperditellidae.] *Ord.*, NW. Eu. (Baltoscandia)-E.Asia.——FIG. 136A,*4*. **P. procera* (KUMMEROW), L.Ord.(Arenig.), Swed.; *4a,b*, LV lat., ant., ×20; *4c*, RV lat., with shell partly removed to show internal mold, ×20 (30). [HESSLAND.]

Piretopsis HENNINGSMOEN, 1953 [**P. donsi*]. Quadrilobate, with straight, long hinge line, approximately amplete; L_1 with hornlike projection directed laterally backward; L_2 tiny, nodelike; L_3 well defined; L_4 low, poorly defined; crests on all lobes except L_2, C_4 apparently not confluent with C_1-C_3; velate structure wide and incurved in the only specimen found, extending along anterior and

ventral borders. *M.Ord.*, Eu.——Fig. 136A,*15*. **P. donsi*, Norway; RV ext. mold (holotype) lat., ×20 (166). [Hessland.]

Polyzygia Gürich, 1896 [**P. symmetrica*]. Quadrilobate, with straight and long dorsal margin, practically amplete, LV larger than RV; lobes dis-

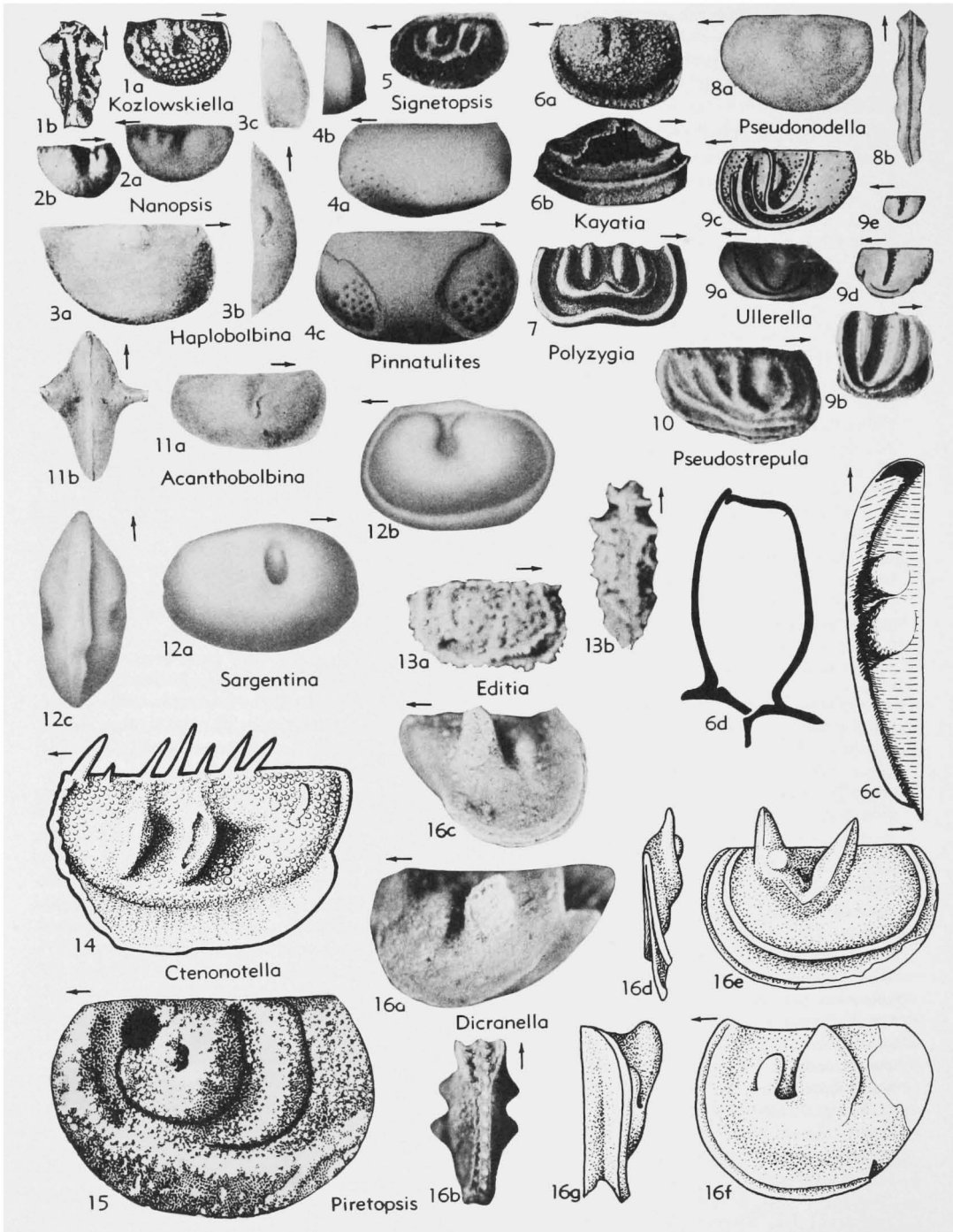

Fig. 136A. Palaeocopida, Suborder and Family Uncertain (p. Q194-Q197).

tinct, extending to dorsal margin, L_1 and L_4 joined by connecting structure; adventral structure probably velar, entire, indicated as *"Randwulst"*; subvelar area channeled; dimorphic, males being more elongate; surface may be spinulose. [Probably belongs to Bassleratiidae.] *M.Dev.*, Eu.(Pol., Russia). ——FIG. 136A,*7*. **P. symmetrica*, Pol.; RV (holotype) lat., ×20 (156). [HESSLAND.]

Pseudonodella ZASPELOVA, 1952 [**P. plana*]. Small, approximately amplete, flattened, shallow sulcal depression with low swellings on each side (anterior may have been formed by fusion of 3 lobes); adventral structure developed in many shells as low ridge; dimorphism not reported; surface smooth. *U.Dev.*, USSR.——FIG. 136A,*8*. **P. plana; 8a,b*, carapace L lat., dors., ×47 (Orientation according to Zaspelova) (407). [HESSLAND.]

Pseudostrepula ÖPIK, 1937 [**Strepula kuckersiana* BONNEMA, 1909]. Small, LV larger than RV, dorsal margin straight, long, hinge depressed, more or less preplete; L_2 knoblike, S_2 crescent-shaped, other lobes and sulci not clearly developed; crests bifurcated dorsally, 2 ventrally connected ridges may correspond to C_1-C_3, other crests questionable; velar structure entire, ridgelike, in some apparently wider, possibly indicating dimorphism; subvelar area gently channeled; marginal structure developed as ridge. *Ord.*, Eu.——FIG. 136A, *10*. **P. kuckersiana* (BONNEMA), M.Ord., Est.; RV lat., ×27 (58). [Probably belongs among Quadrijugatoridae.] [HESSLAND.]

Sargentina CORYELL & JOHNSON, 1939 [**S. allani*]. [=*?Semilukiella, ?Uchtovia* EGOROV, 1950; *Perimarginia* HOU, 1955]. Like *Sansabella* but differs in possessing subcentral sulcus and in curved dorsal margin of larger valve; spinose velum and reversal of overlap unknown. *?U.Dev., Miss.-Penn.*, N.Am.-Eu.-Asia.—— FIG. 136A,*12*. **S. allani*, Miss., USA(Ill.); *12a-c*, carapace (holotype) R, L, dors., ×30 (Sohn, n). [SOHN.]

Signetopsis HENNINGSMOEN, 1954 [**S. quadrilobata*]. Dorsal margins straight or slightly convex, outline almost amplete to postplete; quadrilobate to bilobate with comma-like ridge adherent to L_2 posteriorly ventral to S_2; adventral structure entire, developed as flange, widest posteriorly, where it is apparently dimorphic, confluent with entire dorsal ridge; subvelar area unknown. *M.Sil.-U.Sil.*, NW. Eu.——FIG. 136A,*5*. **S. quadrilobata*, Norway; tecnomorph LV (holotype) lat., ×24 (167). [May belong in Bassleratiidae.] [HESSLAND.]

Strepula JONES & HOLL, 1886 [**S. concentrica*]. Differs from *Amphissites* in absence of nodes and kirkbyan pit. [Referred to Tetradellidae by HENNINGSMOEN, 29.] Sil., Eng.

Ullerella HENNINGSMOEN, 1950 [*nom. subst. pro Ullia* HENNINGSMOEN, 1949 (*non* ROEWER, 1943)] [**Ullia ulli* DONS, 1949]. Preplete, S_2 distinct surrounded by 2 or 3 (rarely 4) U-shaped ridges that generally reach dorsal margin, except posterior branch of outer ridge(s) which may be developed in ventral part only; inner arc may correspond to L_2 and L_3 being connected ventrally and an outer arc to L_1 and L_4 united by connecting lobe; velar structure comprising ridge or moderately wide frill; dimorphism not stated. [May belong in Sigmoopsidae.] *Ord.*, NW.Eu. ——FIG. 136A,*9a,b*. **U. ulli* (DONS), M.Ord. Norway; *9a*, LV (holotype) lat., ×7; *9b*, LV (cast from internal mold) showing velate structure, ×7 (141).——FIG. 136A,*9c-e*. *U. ventroplicata* HENNINGSMOEN, M.Ord., Norway; *9c*, LV lat., ×10; *9d,e*, LV (larval instars) lat., ×10 (166). [HESSLAND.]

Order PODOCOPIDA, Müller, 1894

[*nom. correct.* POKORNÝ, 1953 (*pro* Podocopa MÜLLER, 1894 =Podocopa SARS+Platycopa SARS)] [Diagnosis by P. C. SYLVESTER-BRADLEY, University of Leicester]

Ostracoda with dorsal margin curved, or, if straight, shorter than total length. Duplicature narrow or wide. Adductor muscle-scar pattern a circular aggregate of many scars in more primitive members of order (Metacopina); number of individual scars reduced in others, either aggregate and biserial (Platycopina), or discrete and variously arranged (Podocopina). Hinge margin undifferentiated in Platycopina and some Metacopina, commonly differentiated into three or more elements in Podocopina. *L.Ord.-Rec.*

The Podocopida were presumably derived from the Palaeocopida in Ordovician times, but may be polyphyletic.

Suborder PODOCOPINA Sars, 1866

[*nom. correct.* SWAIN, herein (*pro* Podocopa SARS, 1866)] [Diagnosis by F. M. SWAIN, University of Minnesota, and P. C. SYLVESTER-BRADLEY, University of Leicester; description and discussion by F. M. SWAIN and H. V. HOWE, Louisiana State University]

Ostracoda with four pairs of postoral appendages, usually with well-developed eyes, exopodite of antennae poorly developed, and having barlike furcal ramus; carapace without permanent aperture anteriorly, and with mid-ventral incurvature of outer valve margin. Muscle-scar pattern of discrete scars, in which adductor scars are commonly developed in a group distinct from scars of muscles operating appendages. Duplicature commonly wide, with or without vestibule; free-margin bearing a selvage, which overlaps that of opposite valve, thus sealing

carapace when valves are closed. Hinge commonly differentiated into three or four elements, any or all of which may be denticulate. [Marine and fresh-water, rarely terrestrial; world-wide.] *L.Ord.-Rec.*

The antennules (first antennae of some authors) of Podocopina are uniramous (Fig. 137,*1*) and exopodites are lacking. The basal portion (protopodite) consists of a single divided podomere or of two podomeres; the

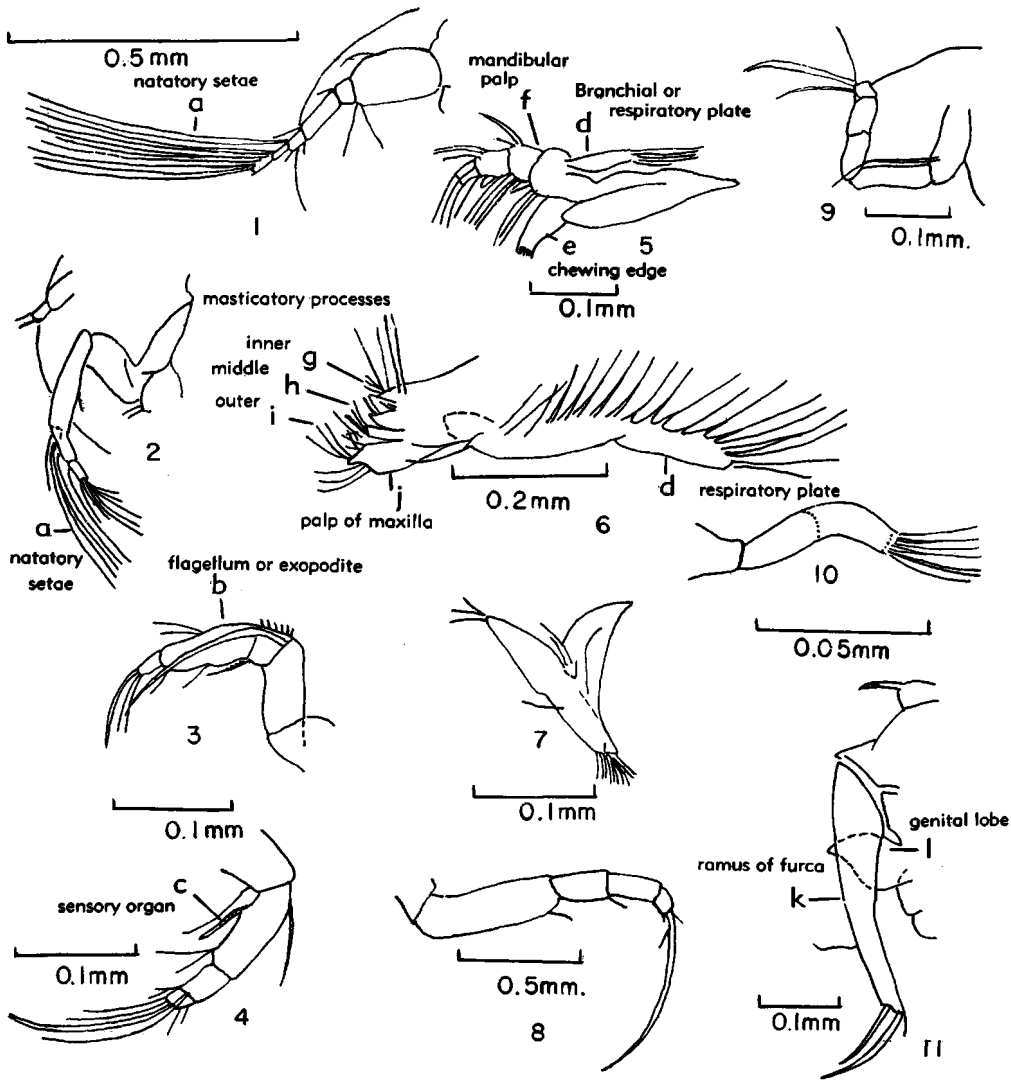

FIG. 137. Appendages of podocopine ostracodes (from 31).——*1. Cypricercus reticulatus* (ZADDACH), left antennule (*a*, natatory setae).——*2. Cypricercus reticulatus* (ZADDACH), left antenna (*a*, natatory setae).——*3. Limnocythere verrucosa* HOFF, left antenna of female (*b*, flagellum or exopodite).——*4. Candona fluviatilis* HOFF, right antenna (*c*, sensory organ).——*5. Candona indigena* HOFF, left mandible (*d*, branchial or respiratory plate; *e*, chewing edge; *f*, mandibular palp).——*6. Candona acuta* HOFF, left maxilla (*d*, respiratory plate; *g*, inner masticatory process; *h*, middle masticatory process; *i*, outer masticatory process; *j*, palp of maxilla).——*7. Candona fluviatilis* HOFF, first thoracic leg of right side.——*8. Candona biangulata* HOFF, second thoracic leg.——*9. Candona suburbana* HOFF, third thoracic leg.——*10. Limnocythere verrucosa* HOFF, brush-form sensory organ of male.——*11. Candona acuta* HOFF, furca of female (*k*, ramus of furca; *l*, genital lobe characteristic of many Candonidae).

endopodite in Cyprididae typically has five podomeres, reduced in fresh-water Cytheridae of North America to three or four podomeres (31, p. 43). The antennules generally bear short, stiff clawlike bristles for digging and climbing (in Cytheridae and Darwinulidae), or long-feathered swimming setae (Fig. 137,*1a*) (in most Cyprididae).

The antennae (Fig. 137,*2*) (second antennae of some authors) consist of a protopodite with one or two podomeres, and an endopodite with three or four podomeres. The exopodite comprises a scale having three setae in Cyprididae, a long bent seta (Fig. 137,*3b*) that contains an adhesive-secreting duct in the Cytheridae, and is completely vestigial in the Darwinulidae. The first podomere of the endopodite in living Cypridacea (except Eucandonidae) commonly bears a group of five natatory setae (Fig. 137,*2a*) located near the distal end; these setae are greatly reduced in the Darwinulidae and most living Cytheracea and are absent in the Eucandonidae. This same podomere bears a sensory organ (Fig. 137, *4c*) on the posterior margin. The ultimate podomere of the endopodite is claw-bearing. The antennae function in locomotion and feeding as sensory structures, and in males for grasping the female during copulation.

Mandibles are composed of two podomeres, a palp representing the endopodite and a modified exopodite that may form a branchial plate (Fig. 137,*5d*) or be reduced to a few setae. Its basal portion is highly chitinized (Fig. 137,*5e*) for attachment of mandibular muscles. The truncate distal end bears strongly chitinized teeth. The mandibular palp (Fig. 137,*5f*) is composed of the second podomere of the base of the mandible and three podomeres of the endopodite; it bears claws and setae.

Maxillae are characterized by a basal portion having three narrow distal masticatory processes (Fig. 137, *6g,h,i*) and a palp (Fig. 137,*6j*) of two or three podomeres. The exopodite is well developed, forming a branchial plate (Fig. 137,*6d*). The number and shape of the setae on the outer masticatory process, lying next to the palp, are taxonomically important; in some living Cytheracea the palp and processes may be reduced.

The first thoracic leg in living Cytheracea consists (Fig. 137,*7*) of a forward-directed protopodite with a pediform endopodite of three or four podomeres, and exopodite or branchial plate being absent. In living Cypridacea the first leg commonly is much modified, resembling the maxilla, the basal podomere ending in a setaceous masticatory process and the endopodite being modified as a palp that in many forms consists of a single podomere; the exopodite typically is a branchial plate but it may be reduced to one or a few setae, as in Eucandonidae and Cypridopsinae (Cyprididae); the palp in males may be modified as a prehensile claw of one or two podomeres for use in copulation.

The second thoracic legs are uniramous, consisting of a protopodite and a backward-directed pediform endopodite (Fig. 137,*8*) which terminates in a curved claw. The endopodite typically is composed of three or four podomeres, but an additional one may result from division of the next-to-last podomere. An exopodite is lacking.

The third thoracic legs typically have five podomeres (Fig. 137,*9*), resembling the second legs in living Cytheracea and in Darwinulacea, but in living Cypridacea the third legs are represented by basal podomeres and endopodites consisting of three podomeres, one of which may be divided. This leg in living Cypridacea is bent dorsally and modified for use as a cleaning foot.

Living cytheracean males may display structures interpretable as a fourth pair of thoracic appendages; these are the so-called "brushlike organs" (Fig. 137,*10*), which have a tuft of setae and are provided with nerves; they may be sexual sensory organs.

At the posterior end of the body in living Cypridacea are paired appendages termed furcal rami, which are believed to be remains of the abdomen. Each typically consists of a basal ramus (Fig. 137,*11k*) articulated with the body and ending distally in two setae and two claws. In the Cypridopsinae the furcal rami are reduced to small bases with a dorsal seta and terminal whiplike flagellum. Furcal rami in living Cytheracea are much reduced and in the Darwinulacea they are absent.

The nervous, respiratory, circulatory, excretory, and digestive systems (and processes) of Podocopa are described in an introductory section.

Paired ovaries in living cypridacean fe-

males lie in a space between lamellae of each valve; in living Cytheracea these lie lateral to the mid-gut in the body of the animal. The testes in living male Cypridacea lie in a cavity of the valves, and consist of about four branches that unite to form a vas deferens connected (after making a series of loops) to an ejaculatory duct. Testes in living Cytheracea adjoin the intestine in the body proper and no ejaculatory duct is present (68, 31).

Sars (65, p. 10) erected the suborder Podocopa [Podocopina] to include the families Cypridae [*recte* Cyprididae] *(Cypris, Cypria, Paracypris, Notodromas, Candona, Pontocypris, Argilloecia, Bairdia)* and Cytheridae *(Cythere, Cythereis, Cyprideis, Cytheridea, Cytheropsis, Ilyobates, Loxoconcha, Xestoleberis, Cytherura, Cytheropteron, Bythocythere, Pseudocythere, Sclerochilus, Paradoxostoma)*. This was based on anatomical grounds, since the cited families and genera all possess an antenna (second antenna of various European authors) modified essentially for walking rather than swimming, as observed in other known living ostracodes. The name is derived from Greek words meaning "foot-oar," the antennae being conceived to serve the ostracodes as oars.

Sars (312, p. 44-45) considered the mid-ventral carapace structure to be important in classification, stating that ". . . ventral edges of the valves in the oral region [are] conspicuously bent inwards and somewhat bowed, so as to overlap each other. . .," noting also that ". . . the peculiar closure of the valves in the oral region [of Podocopina] is very characteristic, no trace of such a closure being found in any of the forms belonging to the three preceding suborders [Platycopina, Myodocopina, Cladocopina], whereas in all known Podocopa [Podocopina] its existence may be demonstrated."

In 1888 (p. 288) Sars erected the family Bairdiidae for the genus *Bairdia* and in

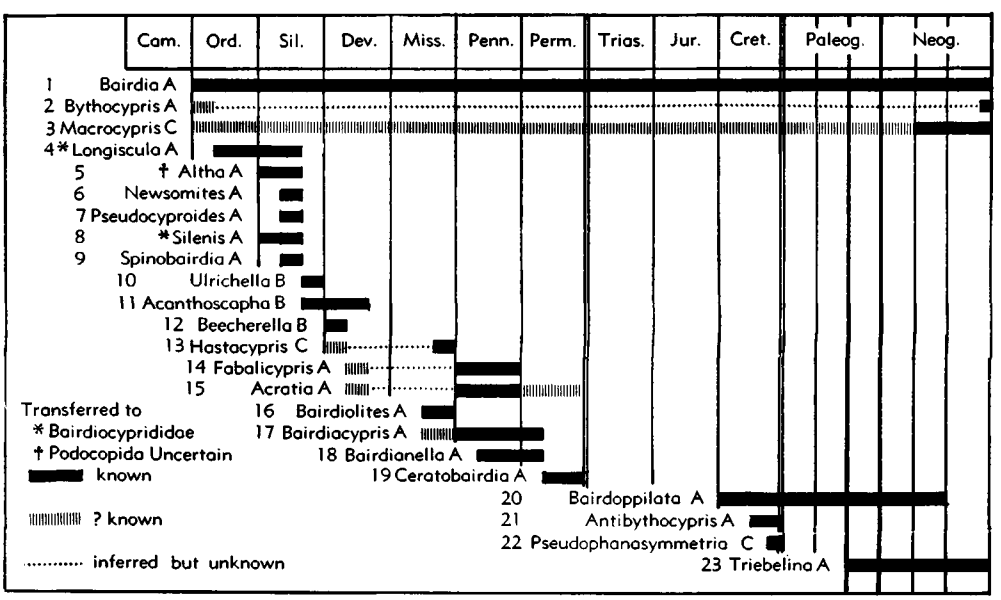

Fig. 138. Stratigraphic distribution of bairdiacean ostracode genera (Moore, n). Classification of the genera in families is indicated by letter symbols (A—Bairdiidae, B—Beecherellidae, C—Macrocpyrididae) and the following alphabetical list furnishes a cross reference to the serially arranged numbers on the diagram.

Generic Names with Index Numbers

Acanthoscapha—11
Acratia—15
Altha—5
Antibythocypris—21
Bairdia—1
Bairdiacypris—17
Bairdianella—18
Bairdiolites—16
Bairdoppilata—20
Beecherella—12
Bythocypris—2
Ceratobairdia—19
Fabalicypris—14
Hastacypris—13
Longiscula—4
Macrocypris—3
Newsomites—6
Pseudocyproides—7
Pseudophanasymmetria—22
Silenis—8
Spinobairdia—9
Triebelina—23
Ulrichella—10

1923 added *Bythocypris* to this family. The family Darwinulidae was introduced by BRADY & NORMAN in 1889 (p. 121).

The Cyprididae, Darwinulidae, Cytheridae, and Bairdiidae of early authors are here considered as superfamilies, but regardless of the taxonomic rank assigned to them, it is evident that they are related anatomically in possessing antennae modified in such a manner as to permit their use as ambulatory organs. All have calcified shells with distinctive characteristics that may be used by paleontologists. Most cytherid genera have well-developed hinge teeth and muscle scars arranged in a vertical or nearly vertical row of four to six closing muscle scars, with additional mandibular scars in front. Cypridid genera have an irregular grouping of closing scars, with mandibular scars below and in front of the closing scars. Bairdiid and darwinulid genera exhibit muscle scars arranged in a more or less oval pattern, the darwinulid scars showing a somewhat radial pattern about a common center.

The Darwinulacea are sufficiently different from the Cypridacea in anatomical and shell features to warrant classification as separate superfamilies.

The Quasillitacea of CORYELL & MALKIN (22) resemble the Podocopina in over-all shape of their carapaces and possession of a tripartite hinge and calcareous inner lamella, but they show a muscle-scar arrangement suggestive of the Platycopina, which G. W. MÜLLER (53) considered merely a division of the Podocopa [Podocopids) because the platycopina antennae could be used for walking. The antennae of the Platycopina, however, differ distinctly from those of Podocopina in their strongly biramous flattened character, and typically in the Cytherellidae, the carapace also is different in shape and in the manner of articulation, having a peripheral lock, the furrow being in the larger right valve. The Quasillitacea here are placed in the Metacopina.

The Thlipsuracea, although classified in the present *Treatise* with the Metacopina, have several podocopine characters, including terminally differentiated hinge features *(Strepulites)*, calcified inner lamellae *(Stibus)*, a bairdiid type of muscle-scar pattern *(Thlipsura)*, and, most importantly, mid-ventral incurvature of the valve margins. Accordingly, this superfamily might be arranged with the Podocopina. Worthy of notice, however, are the lack of demonstrated occurrence in all genera of a calcified inner lamella, bairdiid muscle-scar, and ventral incurvature.

Superfamily BAIRDIACEA Sars, 1888

[*nom. transl.* SYLVESTER-BRADLEY, 1948 (*ex* Bairdiidae SARS, 1888)] [Diagnosis and discussion by P. C. SYLVESTER-BRADLEY, University of Leicester]

Convex-backed Podocopina with wide duplicature, wide vestibule at anterior end, narrow or wide vestibule at posterior end. Muscle-scar pattern consisting of discrete scars, more or less radially arranged. Hinge various, some genera having structures not developed in other superfamilies (e.g., *Macrocypris*); denticles develop in some forms along contact margins, and are not confined to hinge margin (e.g., *Bairdia, Bairdoppilata*). [Marine.] *L.Ord.-Rec.*

The main development of the superfamily was in Late Paleozoic time. *Bairdia* is the longest-ranging ostracode genus known (Ord.-Rec.), and is probably the only Paleozoic member of the Bairdiidae to survive into the Mesozoic (Fig. 138). *Bairdia* has often been regarded as a close relative of the fresh-water genus *Cypris* (Pleist.-Rec.), and united with that genus in the family Cyprididae. However, the geological history of the two genera has been distinct from at least Carboniferous time onward, and in this work each is regarded as the type of a distinct superfamily. The Bairdiacea underwent a major radiation in Paleozoic time. The Cypridacea are well represented but inadequately known in the late Paleozoic and Mesozoic; they underwent an extensive radiation in early Cenozoic time, when many of the genera known to occur in Recent sediments were evolved.

Family BAIRDIIDAE Sars, 1888

[=Nesideidae G. W. MÜLLER, 1912] [Materials for this family by R. H. SHAVER, Indiana University and Indiana Geological Survey, with additions by IVAR HESSLAND, University of Stockholm]

Carapace convex-backed, mostly with asymmetrical, angulated, convex and concave, rounded and acuminate so-called "bairdian" shape in lateral view; lateral outlines mostly symmetrically convex and terminally acuminate in dorsal view; LV larger

than RV, both overreaching and overlapping it; with short, ridge-and-groove hingement and prominent duplicature and vestibule; muscle-scar pattern composed of several discrete spots. *L.Ord.-Rec.*

The family is especially characterized by a wide duplicature, which is well developed terminally, less so ventrally, with conspicuous vestibule, wide zone of fusion with the outer lamella, and long radial pore canals, but along the hinge margin the duplicature is either absent or so tightly compressed against the outer lamella that many contact marginal structures are absent (Figs. 139,*1,2*). The marginal ridges and grooves are differentially prominent or weak around the edges of either valve and are conspicuously modified dorsally into a short, ridge-and-groove hingement (Fig. 140). The adductor muscle-scar pattern forms a rosette or other shape, composed of discrete spots that commonly range in number from 7 to 12 (Fig. 139,*3-7*). The Bairdiidae have an unusually long range, being reported from early Paleozoic to the present, but basic morphological characters vary little; slight modifications of the marginal elements and sculpturing are mostly employed for generic differentiation.

The present classification is more restricted than that of some authors in excluding healdiids, cypridids, and others previously assigned to this family, mostly on the basis of a "convex-back." The Bairdiidae are easily differentiated from the Healdiidae by their wide duplicatures and associated vestibules and by muscle scars containing fewer spots. They are less easily separated from the Cyprididae by their commonly more complex hingement, contact margins, and muscle scars. Bairdian shape, overworked for taxonomic purposes at the species level, becomes significant as a family character when emphasis is placed on the nature of marginal structures and muscle-scar pattern.

Bairdia McCoy, 1844 [**B. curtus*] [=*Nesidea* Costa, 1849; *Morrisitina* Gibson, 1955 (*pro Morrisites* Gibson, 1955, *non* Buckman, 1921); *Acratinella* Schneider, 1956]. Carapace mostly elongate

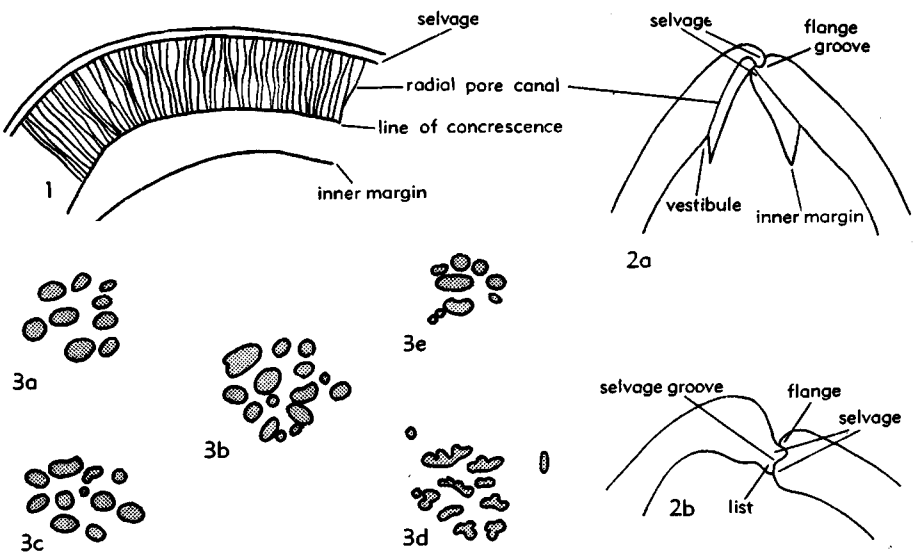

Fig. 139. Morphological features of Bairdiidae.

1. *Bairdia minor* Müller, Rec., Medit., showing radial pore canals at anterior extremity of valve interior, ×145 (53).
2. *Bairdia oklahomensis* Harlton, Penn., USA (Ill.); *2a,* long. sec. through anterior margin of carapace, ×65; *2b,* transv. sec. through hinge, ×120. (Shaver, n).
3. Bairdiid muscle-scar patterns. *3a, Bairdoppilata* sp., U.Cret., USA(Tex.); from RV ext., ×100 (Shaver, n). *3b, Bairdia golcondensis* Croneis & Gale, U.Miss., USA(Ill.); from RV ext., ×100 (Shaver, n). *3c, B. menardensis* Harlton, Penn., USA(Ill.); from RV ext., ×75 (Shaver, n). *3d, B. formosa* Brady, Rec., Medit.; from LV int.; ×70 (Sylvester-Bradley). *3e, Bythocypris bosquetiana* (Brady), Rec., Medit.; from LV ext., ×60 (Shaver, n).

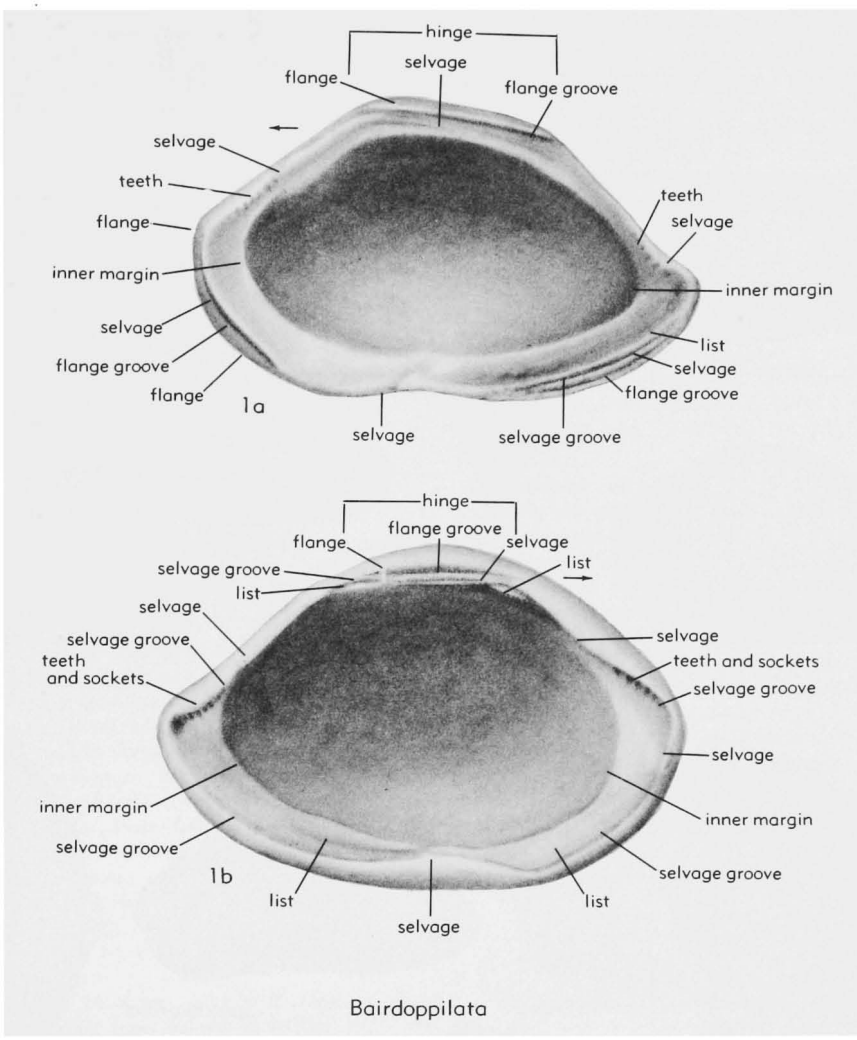

FIG. 140. Morphological features of typical bairdiid, *Bairdoppilata* sp., Upper Cretaceous of Texas; *1a,b,* right valve interior, left valve interior, ×57 (Shaver, n).

fusiform in lateral view, with broadly arched dorsum that becomes concave terminally, especially at the rear; venter centrally straight but curved upward terminally so that extremities are nearly at mid-height, anterior end generally higher and better rounded than the posterior, which generally is acuminate; in dorsal view, lateral outlines symmetrically convex and extremities acuminate; surface of valves smooth, punctate, or rarely with protuberances; LV larger than RV, mostly overreaching it around entire margin and overlapping it, especially ventrally, around contact margin. Short ridge-and-groove hingement commonly marked by prominent cardinal angles, especially in RV; contact margins complex, with wide duplicature, vestibule, and associated structures; adductor-muscle scar pattern of several discrete spots (21, 43, 53). *Ord.-Rec.*, cosmop.——FIG. 141,*2a,b*. *B. oklahomensis* HARLTON, Penn., USA(Ill.); *2a,b,* carapace R, dors., ×35 (Shaver, n).——FIG. 141,*2c,d*. *B. formosa* BRADY, Rec., Medit.; *2c,d,* LV int., RV int., ×50 (363).

?Acratia DELO, 1930 [**A. typica*] [=*Acratina* EGOROV, 1953]. Carapace terminally acuminate in lateral view, especially posteriorly, with broadly arched dorsal border making acute angles with venter so that extremities are low and pointed; venter with anterior upswept concavity; internal morphology unknown. *?M.Dev., Penn., ?Perm.,* N.Am.-Eu.——FIG. 142,*1*. **A. typica,* Penn., USA(Tex.); *1a,b,* carapace R, dors., ×36 (138).

Antibythocypris JENNINGS, 1936 [**A. gooberi*]. Carapace subreniform, resembling *Bythocypris* in lateral view; with short, simple, posterodorsal,

ridge-and-groove hingement near that of *Bairdia;* surface coarsely punctate and ridged (181). [Although original orientation and reported RV over LV overlap by the author is incorrect, the genus is considered distinct from *Bythocypris* because of its sculpture, muscle scar, hinge, and contact-marginal structures.] *U.Cret.,* N.Am.——Fig. 144, *5. *A. gooberi,* USA(N.J.); *5a,b,* carapace R, dors., ×75 (Shaver, n).

Bairdiacypris Bradfield, 1935 [*non Bairdiocypris*

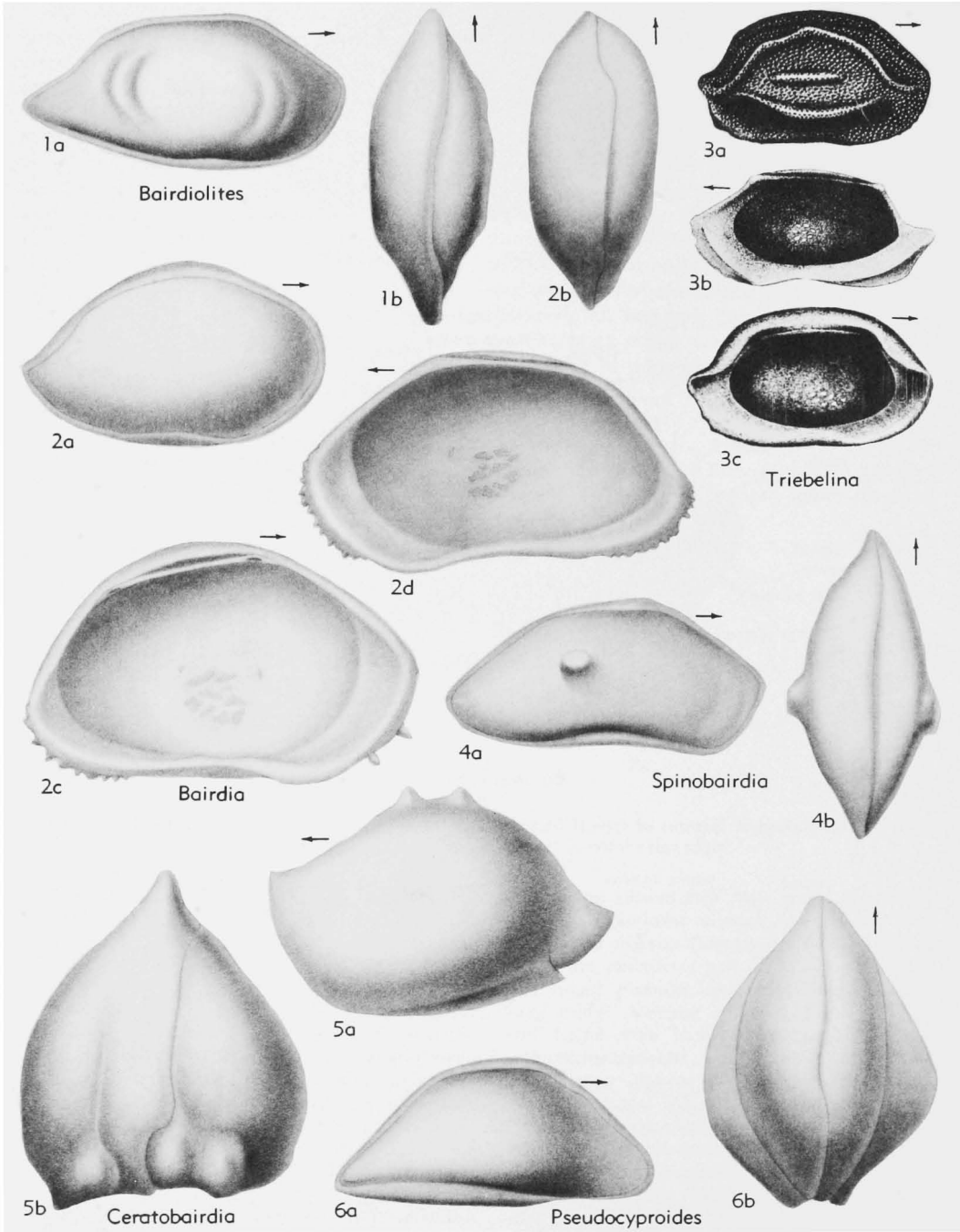

Fig. 141. Bairdiidae (p. Q202-Q207).

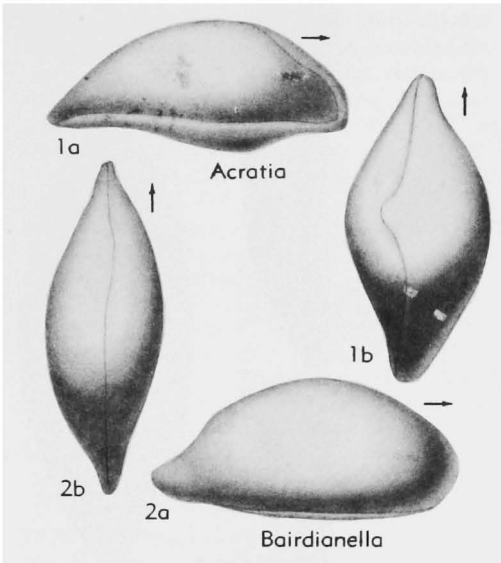

FIG. 142. Bairdiidae (p. Q203-Q205).

KEGEL, 1932 (*Bairdiocyprididae*)] [**B. deloi*] [=*Actuaria* SCHNEIDER, 1956]. Elongate, subreniform, resembling *Argilloecia* (Pontocyprididae) in lateral view but with slight angulation and nearly straight dorsal slopes suggestive of *Bairdia;* hinge, duplicature, and associated structures like those of *Argilloecia, Bairdia,* and *Fabalicypris* (11, 21). *?U.Miss., Penn.-L.Perm.,* N.Am.-Eu.——FIG. 144,*1a,b*. **B. deloi,* Penn., USA(Okla.); *1a,b,* carapace R, dors., ×40 (Shaver, n).——FIG. 144, *1c,d*. *B. haydenbranchensis* (PAYNE), Penn., USA (Ill.); *1c,* long. sec. through ant. margin, ×65 (Shaver, n); *1d,* transv. sec. through hinge, ×65 (Shaver, n).

Bairdianella HARLTON, 1929 [**B. elegans*]. Type species differs from *Bairdia* in its lack of all but ventral overlap and by its low posterior area, both suggestive of molts of *Bairdia;* imperfectly known. *M.Penn.-L.Perm.,* N.Am.——FIG. 142,*2*. **B. elegans,* Penn., USA(Tex.); *2a,b,* carapace R, dors., ×50 (Shaver, n).

Bairdiolites CRONEIS & GALE, 1939 [**B. crescentis*]. Like *Bairdia* but with 2 crescentic ridges located antero- and posterocentrally on each valve (20). *U. Miss.,* N. Am. (Ill., Okla.)-Eu.(Eng.).—— FIG. 141,*1*. **B. crescentis; 1a,b,* carapace R, dors., ×60 (132).

Bairdoppilata CORYELL, SAMPLE & JENNINGS, 1935 [**B. martyni*]. Like *Bairdia* but each valve with short series of transverse teeth and sockets in antero- and posterodorsal positions, in selvage of RV and selvage groove of LV. *L.Cret.-Tert.,* cosmop., USA-Venez.-Alg.——FIGS. 139,*3,* 140,*1*. *B.* sp., U.Cret., USA(Tex.); 139,*3,* muscle-scar pattern from RV ext., ×100; 140,*1a,b,* RV int., LV int., ×57 (Shaver, n).

Bythocypris BRADY, 1880 [**B. reniformis* (=*Bairdia bosquetiana* BRADY, 1866)]. Carapace reniform in lateral view, with straighter venter and more rounded dorsum and extremities; mostly lacking angulation and asymmetry of *Bairdia,* but with similar overlap and overreach, ridge-and-groove hinge, duplicature, vestibule, and associated structures, including muscle scar (53). [Many modern species are defined partly on the basis of soft parts, whereas numerous Paleozoic species do not exhibit the muscle scar and marginal structure of Recent *Bairdia* and other Bairdiidae. Altogether, the genus is in an unsatisfactory condition, nearly all Paleozoic species being doubtfully assigned to it.] *?L.Ord., Rec.,* cosmop.——FIG. 144,*4*. **B. reniformis,* Rec.; *4a-c,* carapace L, dors., RV lat., N.Atl., ×50 (13); *4d,* carapace vent., ×40 (13); *4e,* LV, from ext., ×40 (53).

Ceratobairdia SOHN, 1954 [**C. dorsospinosa*]. Like *Bairdia* but with ventral alae; one or more centrodorsal spines or knobs on LV. *M.Perm.-U.Perm.,* N.Am.——FIG. 141,*5*. **C. dorsospinosa,* USA (Tex.); *5a,b,* carapace L, post., ×30 (73).

Fabalicypris COOPER, 1946 [**F. wileyensis*]. Carapace tumid, elongate-elliptical in lateral view, mostly lacking suggestion of bairdian shape but apparently one end of a complete, *Bairdia-Bairdiacypris-Fabalicypris* gradational series; LV over RV overlap abruptly offset anteroventrally; hinge and contact margins near those of *Bairdia* (21). *?M.*

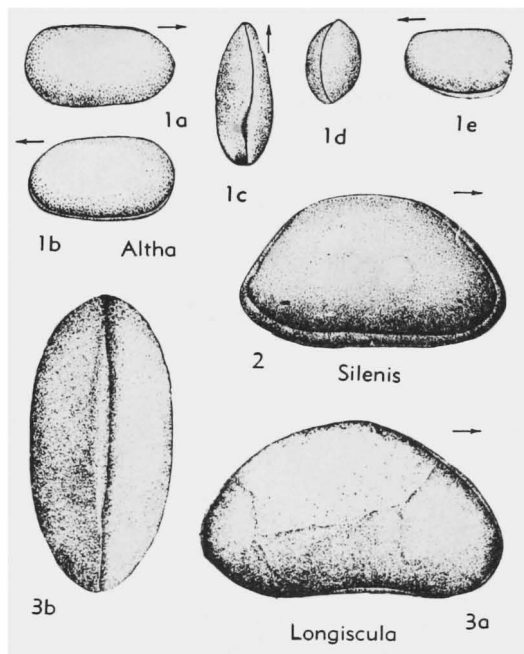

FIG. 143. Bairdiocyprididae (doubtful) and Podocopida (classification uncertain) (p. Q366-Q367, Q383-Q384).

Dev., Penn., N.Am.-?Eu.——FIG. 144,*2a,b*. **F. wileyensis*, Penn., USA(Ind.); *2a,b*, carapace R, vent., ×40 (21).——FIG. 144,*2c-e*. *F.* sp., Penn., USA(Ill.); *2c*, long. sec. through ant. margin, ×65 (Shaver, n); *2d,e*, transv. secs. through hinge and venter, ×65 (Shaver, n).

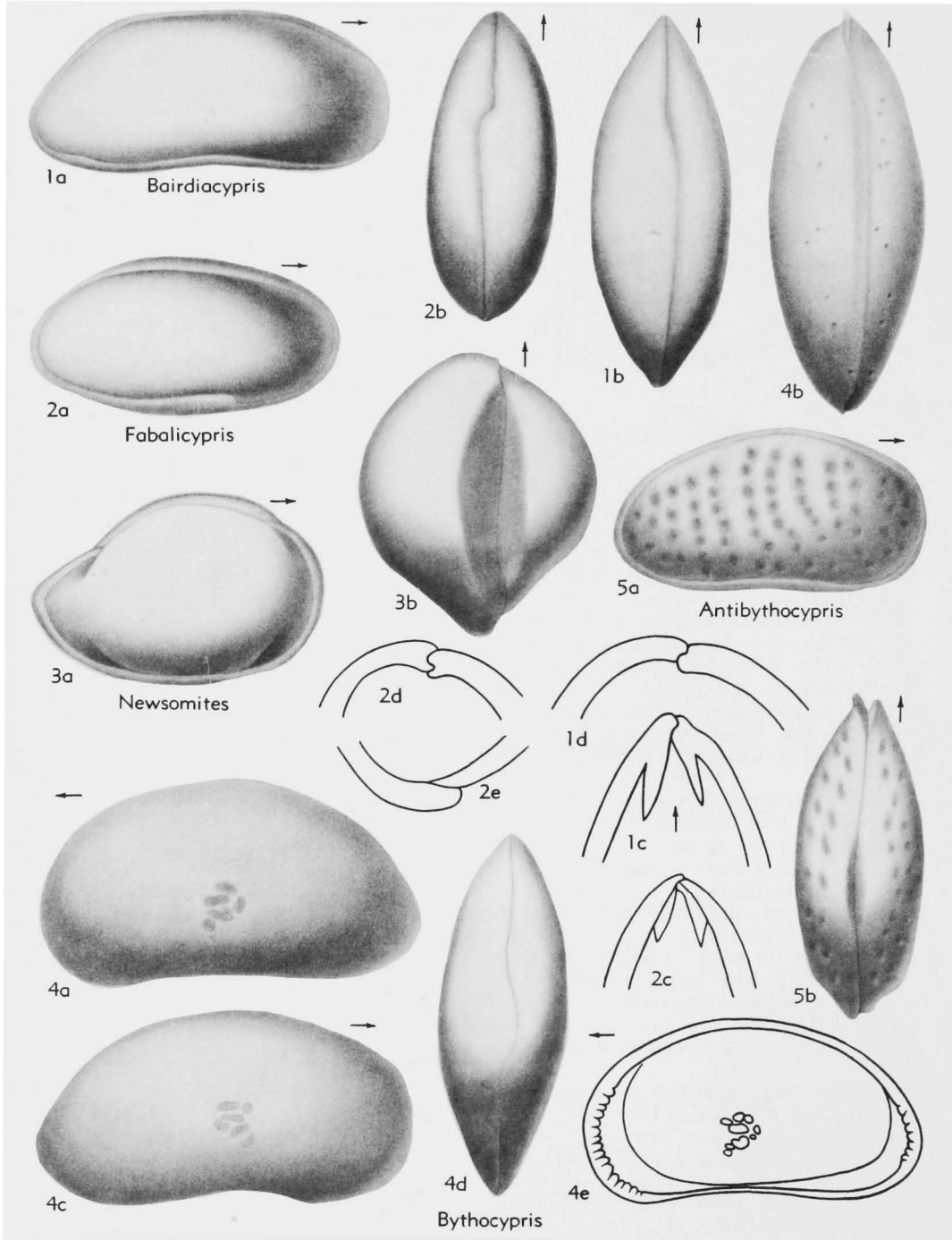

FIG. 144. Bairdiidae (p. Q203-Q207).

Newsomites MORRIS & HILL, 1952 [**N. pertumidus*]. Nearly bairdian in lateral view but carapace very tumid, nearly as thick as long, with lateral-dorsal inflation causing strong depression of hinge; reversal of normal LV over RV overlap and overreach common; imperfectly known. *M.Sil.*, N.Am. ——FIG. 144,*3*. **N. pertumidus*, USA(Tenn.); *3a,b*, carapace R, dors., ×45 (254).

Pseudocyproides MORRIS & HILL, 1952 [**P. alatus*]. Bairdian in outline excepting abnormally low extremities, strong alate extensions jointly from lateral and ventral surfaces producing triangular outline in end view, imperfectly known. *M.Sil.*, N.Am.——FIG. 141,*6*. **P. alatus*, USA(Tenn.); *6a,b*, carapace R, dors., ×80 (Shaver, n).

Spinobairdia MORRIS & HILL, 1952 [**S. kellettae*]. Bairdian in outline but with large projecting spine subcentrally on each valve; imperfectly known. *M.Sil.*, N.Am.——FIG. 141,*4*. **S. kellettae*, USA (Tenn.); *4a,b*, carapace R dors., ×45 (Shaver, n).

Triebelina VAN DEN BOLD, 1946 [**T. indopacifica*] [=*Glyptobairdia* STEPHENSON, 1946]. Differs from *Bairdia* in conspicuously pitted and ridged surface and presence of simple, weak tooth at each end of RV hinge-bar and corresponding sockets in LV. *Oligo.-Rec.*, cosmop.——FIG. 141,*3*. *T. coronata* (BRADY), Rec., Cuba; *3a,b*, RV lat., int., ×40; *3c*, LV int., ×40 (343).

Family BEECHERELLIDAE Ulrich, 1894

[=Alanellidae BOUČEK, 1936] [Materials for this family prepared by JEAN BERDAN, U. S. Geological Survey]

Long, smooth, slightly asymmetrical ostracodes with adont hinge, and spines on posterior end and also in some carapaces anterior end of one or both valves. Muscle scar unknown. *U.Sil.-M.Dev.*

Beecherella ULRICH, 1891 [**B. carinata*]. Venter flat, carinate at outer margins. Carinae produced as spines anteriorly and posteriorly on each valve, posterior spine being larger. Cross-section subtriangular. Duplicature well developed. *L.Dev.*, NE.N.Am.——FIG. 145,*3*. **B. carinata*, N.Y.; *3a*, RV (lectotype) int. showing duplicature, ×23; *3b,c*, RV (topotype) int., lat., ×20; *3d*, LV lat., ×20 (Berdan, n).

Acanthoscapha ULRICH & BASSLER, 1923 [**Beecherella navicula* ULRICH, 1891] [=*Alanella* BOUČEK, 1936]. Spindle-shaped, with ends of both valves acuminate, on LV both ends produced as spines which wrap around pointed ends of RV; contact margins of both valves a flattened flange that projects as a keel anteroventrally and posteroventrally. *U.Sil.-M.Dev.*, Eu.-N.Am.——FIG. 145,*1a-c*. **A. navicula*, L.Dev., N.Y.; *1a,b*, LV (lectotype), int., lat., ×23; *1c*, RV (topotype) lat., ×23 (Berdan, n).——FIG. 145,*1d,e*. *A. bohemica* (BOUČEK), U. Sil. (Budňany), Czech.; *1d*, RV (holotype) lat., ×40; *1e*, RV (topotype), ×40 (10).

?Ulrichella BOUČEK, 1936 [**U. remesi*]. Long, cylindrical ostracodes with anterior end of each valve spindle-shaped and posterior produced as a sharp spike; two slight constrictions perpendicular to hinge line divide shell into three nearly equal parts; hinge not known. *U.Sil.*, Eu.——FIG. 145,*2*. **U. remesi*, U.Sil., Czech.; *2a*, LV (holotype) lat., ×40; *2b*, RV (topotype) lat., ×40 (10).

Family MACROCYPRIDIDAE Müller, 1912

[*nom. correct.* SYLVESTER-BRADLEY herein, *pro* Macrocypridae *nom. transl.* SYLVESTER-BRADLEY, 1948 (*ex* Macrocyprinae MÜLLER, 1912)] [Materials for this family by P. C. SYLVESTER-BRADLEY, University of Leicester]

Carapace elongate, with arcuate dorsal border, adductor muscle scars forming rosette pattern, anterior and posterior duplicature with wide vestibules. [All Recent forms are marine bottom-dwellers.] *?L.Ord.-?Mio., Plio.-Rec.*

Macrocypris BRADY, 1867 [**Cythere minna* BAIRD, 1850]. Carapace smooth, compressed, elongate, dorsal margin arched, anterior margin rounded, ventral margin straight or concave, posterior acuminate; RV larger than LV, overreaching it on all margins except anterior. Selvage of both valves projecting prominently in center of ventral margin, that of RV overlapping LV when carapace is closed; duplicature with wide anterior and posterior vestibules; radial pore canals straight, crowded at anterior and posterior ends; normal pore canals small, few, scattered; hinge of 5 elements, in LV terminal elements (both anterior and posterior) being long, denticulate ridges that project, median element a smooth groove, locellate grooves (shorter than the other elements) between terminal elements and median element, RV with reverse arrangement; muscle-scar pattern consisting of central rosette of about 9 scars, with 3 others close above it and 2 small separated scars in front of and above main group. [Many fossils ranging from Ordovician upward have been assigned to this genus, but no pre-Tertiary fossils have been demonstrated to possess the muscle-scar pattern, duplicature and hinge characteristics of type species.] *?Ord.-?Mio., Plio.-Rec.*; cosmop.——FIG. 146,*1*; 244,*8a,b*. **M. minna* (BAIRD) Rec., Norway; 146,*1a*, carapace L; *1b,c*, LV int., RV int.; *1d,e*, LV, RV vent.; *1f*, carapace vent.; all ×30 (Sylvester-Bradley, 1948); 244,*8a,b*, LV dors., RV dors., ×125 (Sylvester-Bradley, 1948).

Macrocypria SARS, 1923 [**Macrocypris sarsi* MÜLLER, 1912 (*pro* **Bairdia angusta* SARS, 1866, *non Cythere (Bairdia) angusta* (MÜNSTER) JONES 1850)]. Like *Macrocypris*, but anterior acuminate. *Rec.*, Norway.——FIG. 146,*2*. **M. sarsi* (MÜLLER) Rec., Norway; ♀ carapace L, ×40 (312).

BAIRDIACEA, Family UNCERTAIN

[Materials prepared by authors as recorded at end of generic descriptions]

Hastacypris CRONEIS & GUTKE, 1939 [**H. bradyi*]. Resembling *Macrocypris* in shape and overlap of RV over LV but described as lacking ventral overlap and concavity of *Macrocypris;* poor preservation of holotype of type species makes relationship to Paleozoic and Recent species of *Macrocypris* uncertain. *?L.Dev., U.Miss.,* ?Eu.(Czech.)-N.Am.(Ill.).——FIG. 146A,*1*. **H. bradyi; 1a,b,* carapace L, dors., ×30 (133). [SHAVER.]

Pseudophanasymmetria SOHN & BERDAN, 1952 [**Phanassymetria foveata* VAN VEEN, 1936]. Small, fat, markedly asymmetrical; hinge straight, simple; smooth or punctate, and with a shallow posterodorsal depression. *U.Cret.,* Eu.——FIG. 146A,*2*. **P. foveata* (VAN VEEN), Maastr., Holl.; *2a,b,* carapace (paratype) R, ×113, dors., ×70;*2c,* LV int., ×70 (334a). [SOHN-BERDAN.]

Superfamily CYPRIDACEA Baird, 1845

[*nom. transl. et correct.* DANA, 1849 (*ex* Cypridae BAIRD, 1845)] [Diagnosis and discussion by F. M. SWAIN, University of Minnesota]

Carapace variable in size, shape, and surface ornamentation; calcareous or corneous; mid-ventral margin curved inward. Hinge of ridge-and-groove type or rabbeted; muscle scars a median group of spots, typically not radially or linearly arranged, with additional more anteroventral spots in most genera; inner lamellae present; line of concrescence and inner margin typically separated. [Fresh-water and marine.] *?Sil.-?Perm., Trias.-Rec.*

The Cypridacea include most genera of living fresh-water ostracodes as well as a few marine forms. Fossil cyprids are recorded from fresh-water deposits as old as

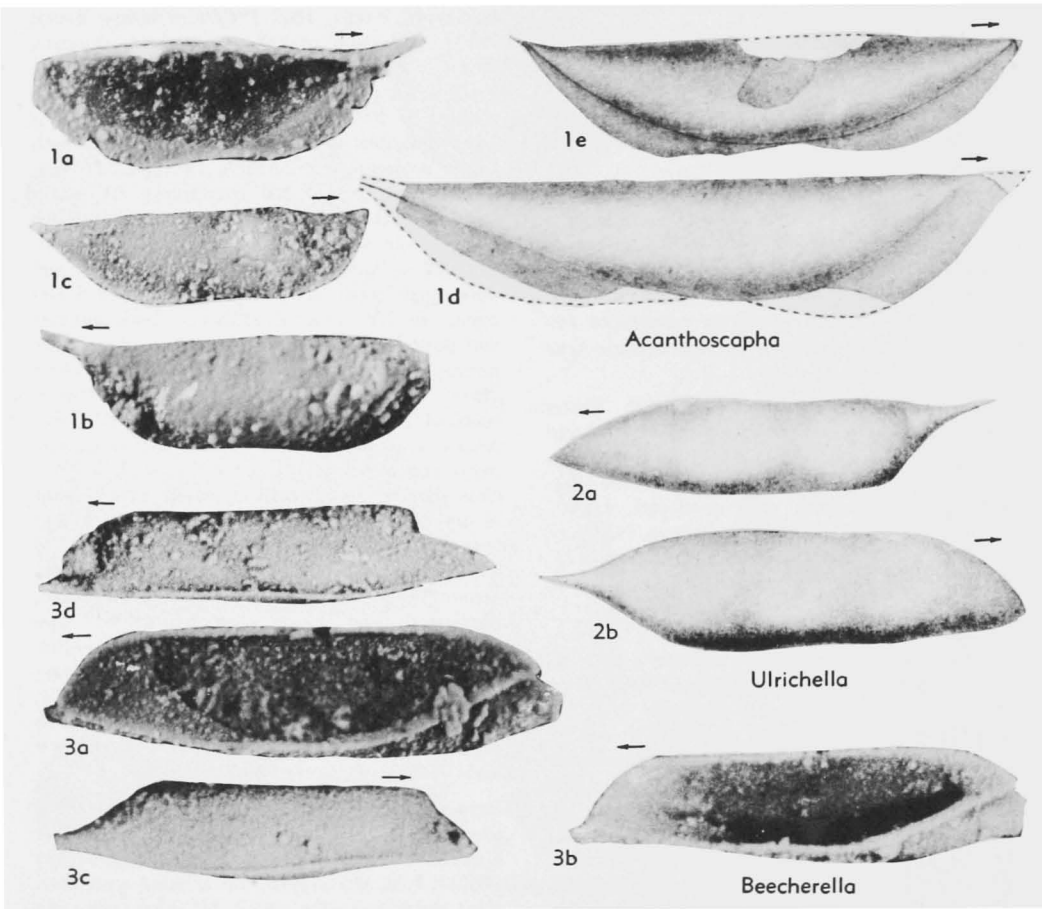

FIG. 145. Beecherellidae (p. Q207).

Carboniferous and from marine strata as far back as Ordovician.

Zoological characters. Definition of the superfamily by zoologists has been based mostly on characters of the soft parts. Although these are not preserved in fossils, the paleontologist cannot ignore features of soft-parts anatomy because these may be reflected in structures and form of the shell, as pointed out by TRIEBEL (82). The following diagnosis by HOFF (31) concisely states significant zoological characters.

Surface of the shell usually smooth, dorsal margin without interlocking teeth. Eyes developed

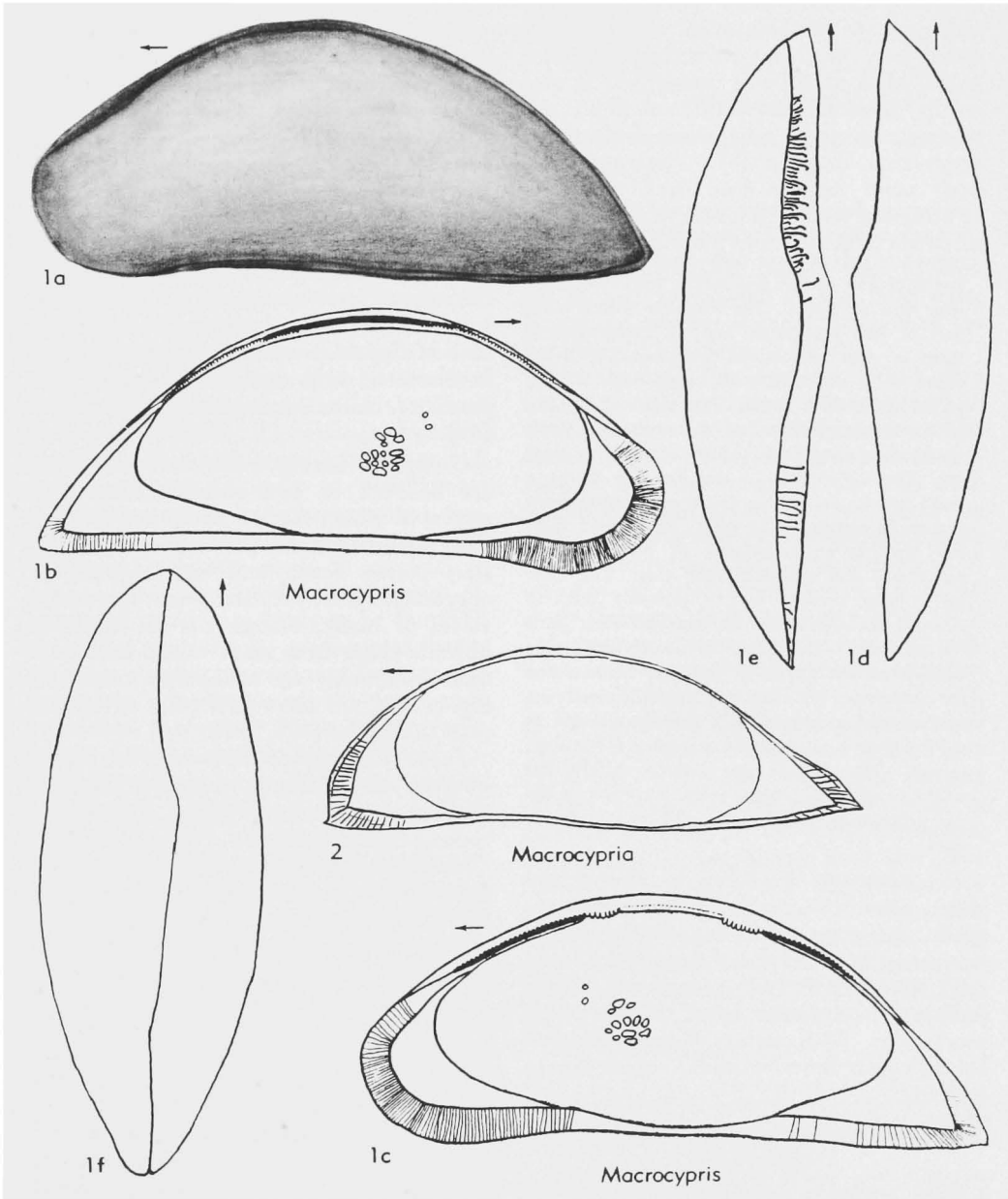

FIG. 146. Macrocyprididae (p. Q207).

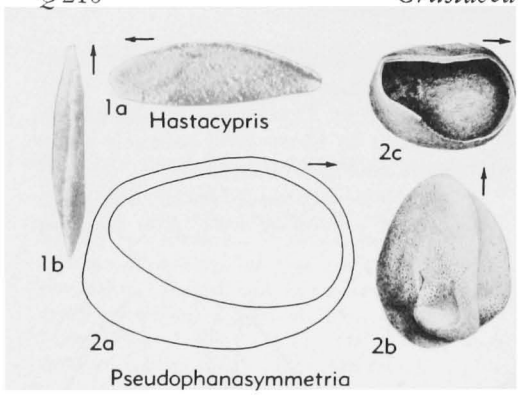

FIG. 146A. Bairdiacea, Family Uncertain (p. Q208).

to varying degrees; either separated or fused into a single median eye. The antennules with a basal portion of two or three podomeres and an endopodite of four or five podomeres, with swimming setae well developed. The antennae with a basal part of two podomeres and an endopodite of three or four podomeres. The expodite is reduced to a small scale-like appendage bearing at the most three setae. First thoracic leg not pediform but modified as a mouth part, with the anterior margin of the base adapted for feeding. The endopodite of the first leg forms a small palp in the female, but is enlarged to form prehensile organs in the male. The second thoracic leg has an endopodite of three or four podomeres and a strong distal claw. The third leg is bent dorsally and is probably used in cleaning the respiratory surfaces and other parts of the body. The third leg usually has three distal setae but the distal end may be modified for grasping. The furca is typically well developed and rod-shaped but may be reduced to a "flagellum" or whiplike structure (Cypridopsinae). The gonads are located within the valves of the shell. In the male, a portion of the vas deferens is modified to form an ejaculatory duct.

Reproduction. Probably in most fresh-water ostracodes, including cypridids, reproduction is syngamic, but in some species it is partly or entirely parthenogenetic. HOFF (31) recognized four groups of Illinois fresh-water ostracodes, based on type of reproduction. With citation of representatives belonging to the Cyprididae, these are as follows:

Types of Reproduction in Fresh-water Ostracodes

1. Males unknown, reproduction parthenogenetic (several species of *Eucandona, Cypricercus, Cyprinotus* and *Cypridopsis*).
2. Males found in some localities, reproduction usually parthenogenetic (*Eucandona, Ilyocypris, Cyprinotus*).
3. Males found in small numbers, reproduction both syngamic and parthenogenetic (*Cypricercus, Potamocypris*).
4. Males invariably present, reproduction syngamic (*Eucandona, Cyclocypris, Cypria, Physocypria, Cypricercus, Notodromas, Cyprois*).

Some species (e.g., *Cyprinotus incongruens*) reproduce syngamically in one locality and parthenogenetically in another. According to HOFF, all Illinois cypridids studied by him are oviparous. On the other hand, a species of the Darwinulidae (*Darwinula stevensoni*) retains eggs in a posterior shell cavity during their development. Egg cases of many oviparous species can withstand freezing and desiccation, in fact, the eggs of some species require desiccation before development can begin (24). The egg shell of *Cypridopsis vidua* is about 0.1 mm. in diameter; it is double-walled and composed of chitin impregnated with calcite (45).

Ontogeny. Living fresh-water ostracodes are believed to pass through nine molt stages, of which the last comprises the sexually mature animal (31). The earlier instars possess fewer and simpler pairs of appendages than the later ones. The instar valves of many, though not all cypridids differ in shape from adult valves. Immature molts commonly are relatively shorter and higher and are more triangular in outline than the adults (325, 352).

Food. The food of fresh-water ostracodes consists of diatoms, bacteria, organic detritus, and among larger Cyprididae, bodies of dead animals.

Habitats. Although most fresh-water ostracodes belong in the Cypridacea, a few genera of the Cytheracea (including *Limnocythere, Cytherissa,* and *Entocythere*) and Darwinulacea occur in this general habitat. In central North America (Illinois) fresh-water ostracodes are recorded (31) in the following environments: (1) temporary ponds and ditches; (2) permanent lakes and swamps; (3) temporary streams and pools left in stream beds after flow has ceased; (4) permanent streams of all sizes; and (5) underground waters. In general, fewer species of ostracodes are present in running waters than in still waters. Restriction to one

or another of these habitats is mostly on the species level. *Cyclocypris, Notodromas (Cypridacea), Limnocythere* (Cytheracea), and *Darwinula* (Darwinulacea) generally occur only in permanent still waters; however, nonmarine ostracodes probably are not found commonly in planktonic communities.

Regarding physical conditions affecting ostracode distribution, HOFF provides the following information which probably applies fairly generally. (1) Temperature of water has little effect on distribution. (2) Detailed knowledge is lacking as to influence of bottom conditions on the distribution of ostracode species, but present information suggests that relatively few species are affected by type of bottom; species of *Eucandona* prefer a mud bottom, probably owing to their crawling locomotion, and *Cypricercus reticulatus* occurs only on a mud bottom. (3) Presence or absence of currents is of major importance in distribution of many ostracodes, certain species of *Eucandona, Cypria, Cypricercus, Notodromas,* and *Darwinula* being confined to still waters, occurring mostly in plant zones where wave action is not pronounced. Several species of *Eucandona, Ilyocypris* and *Cyprinotus* typically occur in streams; in general, large, rectangular, compressed, ornamented species are likely to be found in running water, whereas more tumid species are more closely restricted to still water. (4) Strongly acid waters are not likely to contain ostracodes, particularly forms having large, heavily calcified shells; some species of *Cypria, Cypridopsis,* and *Physocypria* tolerate acid waters, probably because their small shells bear a thick organic covering.

Seasonal distribution. Many fresh-water ostracode species are seasonally distributed, some being found only in the spring, others in spring and summer, and a few (including species of *Eucandona* and *Ilyocypris*) throughout the year.

Classification and distribution. Genera of the Cypridacea are arranged here in seven families (Pontocyprididae, Paracyprididae, Cyprididae, Cyclocyprididae, Eucandonidae, Ilyocyprididae, and Notodromadidae). In addition some subfamilies are recognized, and several unassigned genera are grouped in a family-uncertain category.

Except for the subfamily Cyprideinae, which became extinct in the Tertiary Period, all families and subfamilies of the Cypridacea are extant. The species and even genera of living cypridids are based mostly upon characteristics of the appendages and other decomposable structures, rather than upon carapace features, thus limiting attempts by paleontologists to compare fossil and living species. Nevertheless, a good deal of progress is being made in the comparative study of Tertiary and Quaternary members of the family; this has brought to notice slight but important carapace differences which permit use of these ostracodes in stratigraphy. When fossil fresh-water ostracodes have been studied more thoroughly, almost surely it will be necessary to design classification more suited to the needs of the paleontologist, but, in view of present limited knowledge of the fresh-water faunas, no attempt at reorganization of the families of Cypridacea is feasible.

Distribution. The doubtful record of a single cypridacean genus *(Pontocypris)* in Ordovician rocks and the likewise unconfirmed record of *Cypridopsis* and *Eucandona* in Permian strata are the only indications of extant genera of this superfamily in pre-Mesozoic deposits. Several genera are confined to Jurassic and Cretaceous rocks. A majority of cypridacean genera are exclusively Cenozoic, so far as known (Fig. 147).

Literature. Among more important published works on the Cyprididae, attention may be directed to papers by SARS (65, 68), G. W. MÜLLER (54), BRADY and co-workers (12, 13, 14, 15, 16), BRONSTEIN (18), HOFF (31), and KAUFMANN (40). The internal carapace structures are very important to an understanding of the fossil Ostracoda. Discussion of hinge, muscle spots, and other internal features of the Cyprididae are found in papers by HOWE and others (33, 35, 178), KESLING (44), MARTIN (51), SCOTT (323), SWAIN (349, 350), SYLVESTER-BRADLEY (79), TRIEBEL (82), and ZALANYI (405).

Family CYPRIDIDAE Baird, 1845

[*nom. correct.* BAIRD, 1850 (*pro* Cypridae BAIRD, 1845)] [Materials for this family prepared by F. M. SWAIN, University of Minnesota; diagnosis of a few genera by W. A. VAN DEN BOLD, Louisiana State University, and R. A. REYMENT, University of Stockholm]

Carapace variable in shape and size (to several mm. in length), typically subovoid to subtriangular, with greatest height median

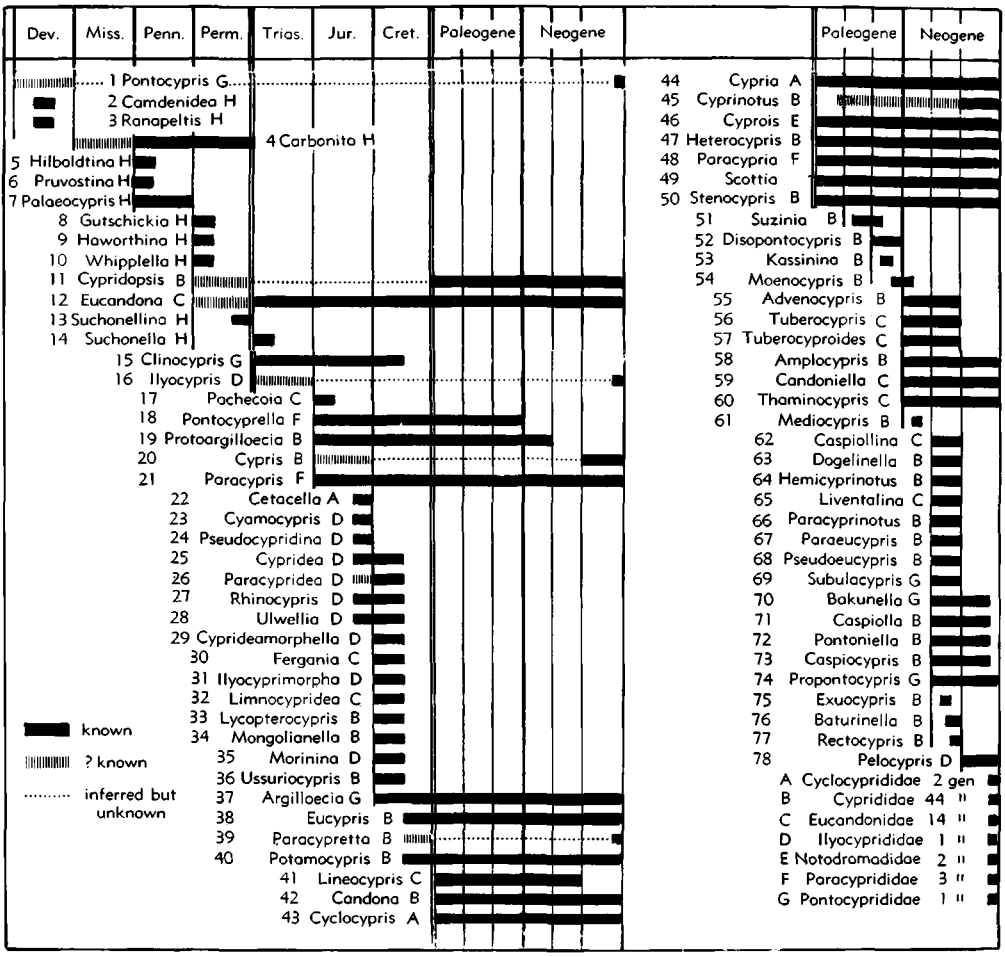

FIG. 147. Stratigraphic distribution of cypridacean ostracode genera (Moore, n). Classification of the genera in families is indicated by letter symbols according to the following tabulation and for the purpose of locating any wanted genus an alphabetical list furnishes cross reference to the serially arranged numbers on the diagram. Index letters for families of Cypridacea: A—Cyclocyprididae; B—Cyprididae; C—Eucandonidae; D—Ilyocyprididae; E—Notodromadidae; F—Paracyprididae; G—Pontocyprididae; H—Family Uncertain.

Generic Names with Index Numbers

Advenocypris—55
Amplocypris—58
Argilloecia—37
Bakunella—70
Baturinella—76
Camdenidea—2
Candona—42
Candoniella—59
Carbonita—4
Caspiocypris—73
Caspiolla—71
Caspiollina—62
Cetacella—22
Clinocypris—15
Cultella[1]
Cyamocypris—23
Cyclocypris—43
Cypria—44
Cypridea—24
Cyprideamorphella—29
Cypridopsis—11
Cyprinotus—45
Cypris—20
Cyprois—46
Disopontocypris—52
Dogelinella—63
Eucandona—12
Eucypris—38
Exuocypris—75
Fergania—30
Gutschickia—8
Haworthina—9
Hemicyprinotus—64
Heterocypris—47
Hilboldtina—5
Ilyocyprimorpha—31
Ilyocypris—16
Kassinina—53
Limnocypridea—32
Lineocypris—41
Liventalina—65
Lycopterocypris—33
Mediocypris—61
Moenocypris—54
Mongolianella—34
Morinina—35
Pachecoia—17
Palaeocypris—7
Paracypretta—39
Paracypria—48
Paracypridea—26
Paracyprinotus—66
Paracypris—21
Pareucypris—67
Pelocypris—78
Pontocyprella—18
Pontocypris—1
Pontonella—72
Potamocypris—40
Propontocypris—74
Protoargilloecia—19
Pruvostina—6
Pseudocypridina—24
Pseudoeucypris—68
Ranapeltis—3
Rectocypris—77
Rhinocypris—27
Scottia—49
Stenocypris—50
Subulacypris—69
Suchonella—14
Suchonellina—13
Suzinia—51
Thaminocypris—60
Tuberocypris—56
Tuberocyproides—57
Ulwellia—28
Ussuriocypris—36
Whipplella—10

[1] *Cultella*, Trias., USSR, added in press.

to anteromedian, posterior end more pointed than anterior; LV generally larger than RV; surface commonly with tiny pits, pustules, or reticulations. Hinge line curved or rarely long and straight, consisting of groove in larger valve for reception of simple edge of smaller valve; muscle scars comprising rather compact median to anteromedian groups of 4 or 5 spots and 1 or 2 additional anteroventral spots. [Fresh-water and marine. Almost certainly a polyphyletic assemblage.] *?Perm., L.Jur.-Rec.*

Subfamily CYPRIDINAE Baird, 1845

[*nom. transl.* Kaufmann, 1900 (*ex* Cyprididae Baird, 1850, *nom. correct. pro* Cypridae Baird, 1845)] [=Ctenocyprina *(partim)*, Synopsida *(partim)*, Zygopsida *(partim)* Daday, 1900; Eucypridae Alm, 1915; Eucyprides *(partim)* Sars, 1925; Cypriformes Skogsberg, 1920, Cyprinotini+Eucyprini+Hungarocyprini+Scottini Bronstein, 1947, Cypridina Pokorný, 1958] [Includes Mediocyprinae (*recte* Mediocypridinae), Baturinellinae, Advenocyprinae (*recte* Advenocypridinae Schneider, 1960)]

Carapace subtriangular, subelliptical, ovoid or rarely subquadrangular, with variable surface ornamentation; typically with anteroventral flangelike process, and posteroventral flanges, spines or caudal processes; marginal structures variable. Soft parts as described for family; furcal rami typically well developed, not reduced as in Cypridopsinae. *L.Jur.-Rec.*

Cypris O. F. Müller, 1776 [**C. pubera;* SD Baird, 1846] [=*Eurycypris* G. W. Müller, 1898]. Elongate subtriangular, dorsum strongly convex, angulate medially; venter flattened, slightly concave, terminal margins spinose, posterior end bluntly pointed, extended below; valves subequal; surface smooth or pitted. Inner lamellae moderate in width, broadest in front (68). [Fresh-water.] *?Jur., Pleist.-Rec.*, cosmop.——Fig. 148,*1*. **C. pubera*, Pleist., Eng.; *1a,b*, LV lat., RV lat.; *1c,d*, LV int., RV int.; *1e*, carapace vent.; all ×20 (Sylvester-Bradley, n).

Acocypris Vávra, 1895 [**A. capillata*]. Elongate acuminate, compressed; hinge margin nearly straight or slightly convex, venter slightly sinuous, ends narrowly rounded, extended below; LV with posteroventral blunt spinose projection, larger than RV; surface smooth [Fresh-water.] *Rec.*, Afr. ——Fig. 148,*2a,b*. **A. capillata; 2a,b*, carapace L, dors., ×15 (393).——Fig. 148,*2c-e*. *A. hyalina* Lowndes; *2c,d*, carapace L, dors.; *2e*, RV int.; all ×15 (217).

Advenocypris Schneider, 1956 [**A. alpherovi*]. Shell subtriangular, convex, valves dissimilar in shape, LV strongly overreaching RV; anterior end typically more steeply slanted and higher; posterior end of LV curved and strongly extended below, truncate to slightly concave above, posterior end of RV less curved. Pore-canal zone narrow, with straight pore canals that commonly terminate in ampule-like expansions, inner lamellae broad terminally; contact line of valves not depressed, hinge of RV consisting of knife-edge ridge which fits over a rabbet groove on left. Surface smooth or ornamented. [Fresh-water.] *Mio.-Plio.*, SE.Eu.————Fig. 149,*2*. **A. alpherovi*, U.Mio.(Sarmat.) N.Caucasus; *2a,b*, carapace L, R, ×33; *2c*, LV int., ×64 (50).

Afrocypris Sars, 1924 [**A. barnardi*]. Very large, elongate, subquadrate, highest anteromedially, convexity moderate; dorsum nearly straight, venter slightly concave, ends rounded, truncated on dorsal slopes, posterior slightly narrowed to pointed below; LV larger than RV; surface smooth or with compressed terminal rims and surface nodes. Inner lamellae narrow. [Fresh-water.] *Rec.*, Afr. ——Fig. 148,*3*. **A. barnardi; 3a,b*, carapace L, dors., × 10 (313).——Fig. 149,*1*. *A. biconica* Klie; *1a,b*, LV lat., dors., ×10; *1c*, RV int., ×15 (217a).

Amplocypris Zalanyi, 1944 [**A. sinuosa;* SD Swain, herein]. Large, elongate subelliptical to subtrapezoidal; dorsal margin straightened medially with broadly obtuse, poorly defined anterior cardinal angle and less obtuse posterior cardinal angle; ventral margin nearly straight to slightly concave; anterior margin broadly rounded, truncated above; posterior margin sharply rounded and extended below, truncate above; convexity of valves low to moderate; surface mostly smooth. Inner lamellae relatively broad terminally and in some species ventrally; pore canals short and widely spaced. *Neog.* C.Eu.(Hung.).——Fig. 149, *5*. **A. sinuosa; 5a,b*, carapace R, dors., ×40 (406).

Astenocypris G. W. Müller, 1912 [*pro Leptocypris* Sars, 1903 (*non* Boulenger, 1900)] [**Leptocypris papyracea* Sars, 1903]. Elongate, highest medially, much compressed; dorsum moderately arched; venter sinuous, posterior margin truncate; surface longitudinally striated. Inner lamellae very narrow (309). *Rec.*, E.Asia.——Fig. 149,*3*. **A. papyracea* (Sars); *3a,b*, carapace L, dors., ×20 (309).

Baturinella Schneider, 1956 [**B. kubanica*]. Shell large, subreniform, elongate, length twice height, moderately convex, with greatest convexity median and on dorsal hump of RV; anterior margin rounded; posterior end rounded below, beveled above; dorsal margin straight, without cardinal angles; ventral margin concave anteromedially; surface smooth. Hinge of RV a median groovelike depression, at both ends of which are platelike teeth; hinge of LV a corresponding median knife-edge ridge with elongated depressions at each end; pore-canal zone wide, canals closely spaced and numerous, some ampule-like at terminations without reaching margin of valve; inner lamellae of same width as canal zone, well developed terminally.

[Fresh-water.] *U.Plio.*, SE.Eu.——Fig. 149,*4*. **B. kubanica*, Caucasus (Kuban); *4a*, RV lat., ×27; *4b-d*, LV lat., dors., vent., ×27; *4e,f*, LV hinge, RV hinge, ×43 (50).

Bradycypris Sars, 1924 [**Cypris intumescens* Brady, 1907]. Short, tumid, highest in front of middle; LV larger than RV, overlapping it anteriorly; venter concave, ends nearly equally rounded; front end of RV with striated marginal zone; surface smooth. [Fresh-water.] *Rec.*, S.Afr.——Fig. 150, *2*. **B. intumescens* (Brady); *2a,b*, carapace R, dors., ×30 (313).

Centrocypris Vávra, 1895 [**C. horrida*]. Strongly tumid, subquadrate; valves subequal, with anteromedian weak sulcus; surface spinose. [Fresh-water.] *Rec.*, Afr.——Fig. 149,*6*. **C. horrida; 6a,b*, carapace L, dors., ×30 (393).

Chlamydotheca Saussure, 1858 [**Cypris (Chlamydotheca) azteca*]. Subtriangular, relatively short and high, compressed; dorsum strongly arched,

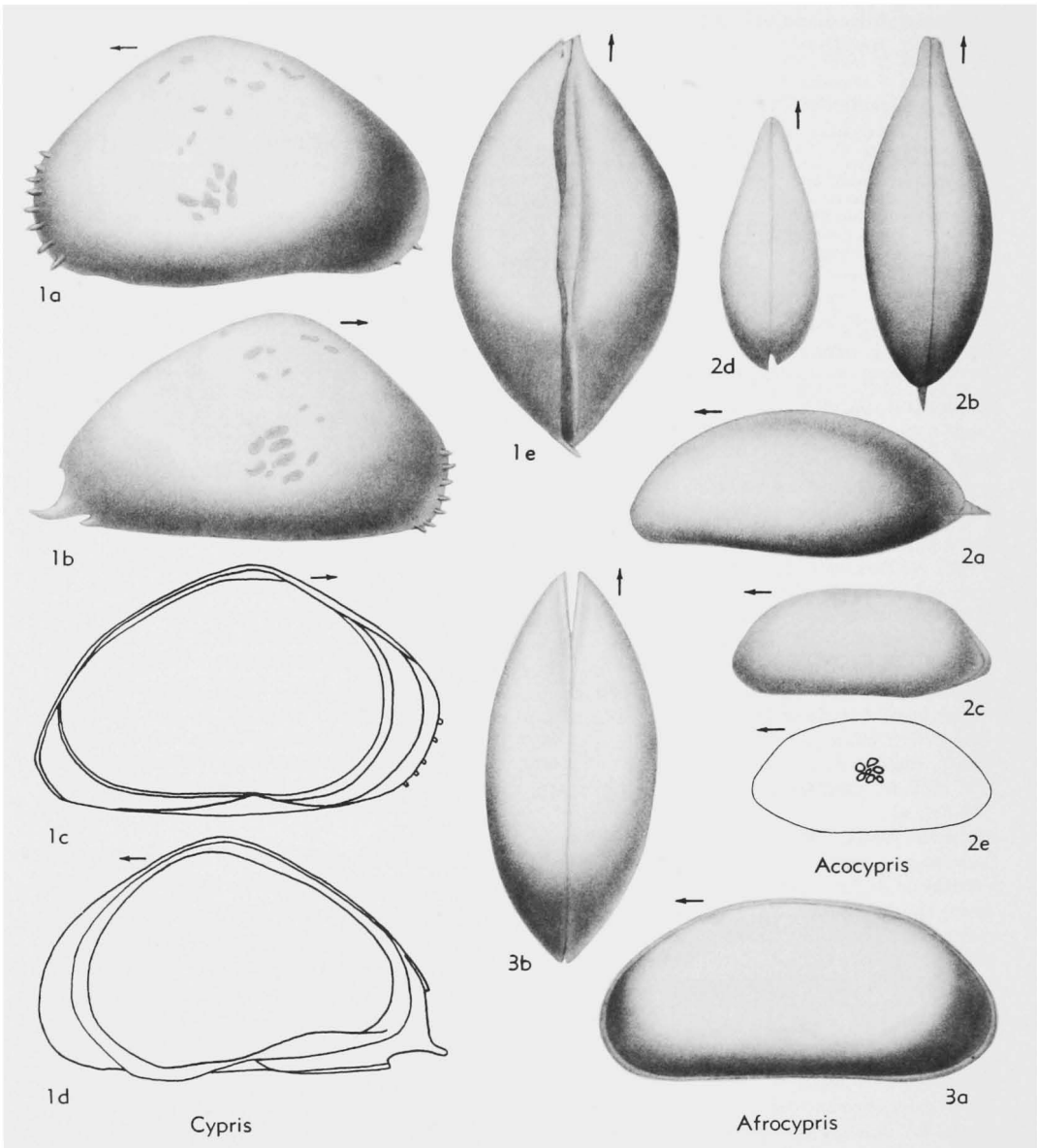

Fig. 148. Cyprididae (Cypridinae) (p. Q213).

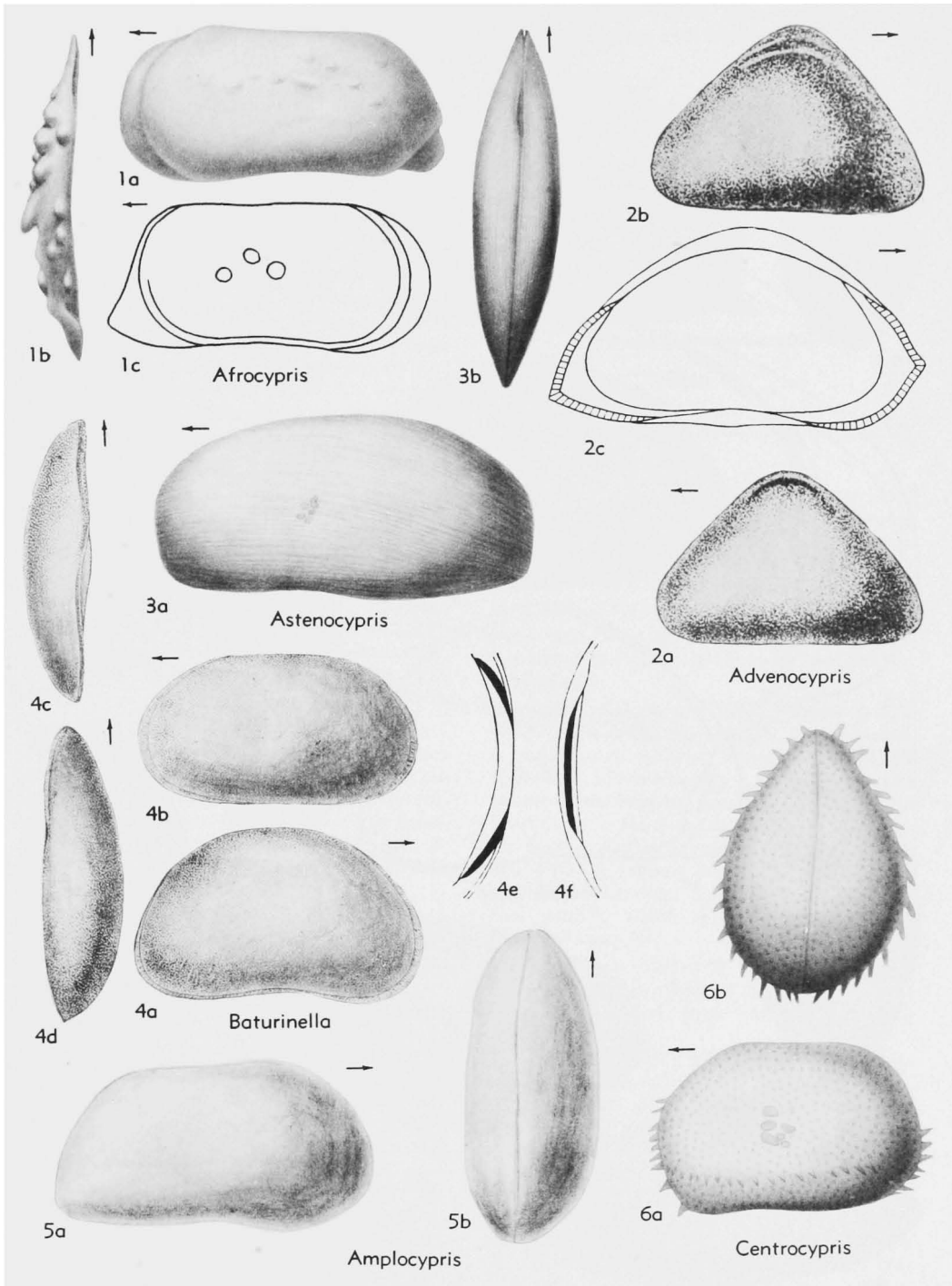

FIG. 149. Cyprididae (Cypridinae) (p. Q213-Q214).

venter slightly sinuous, with ventroterminal flanges at one or both ends, posterior extremity more pointed; RV larger than LV; surface smooth or pitted (374). [Fresh-water.] *Rec.*, N.Am.-S.Am. ——Fig. 150,*1a-e*. *C. rudolphi* Triebel, Brazil; *1a,b,* carapace R, dors., ×10; *1c,* LV int., ×10,

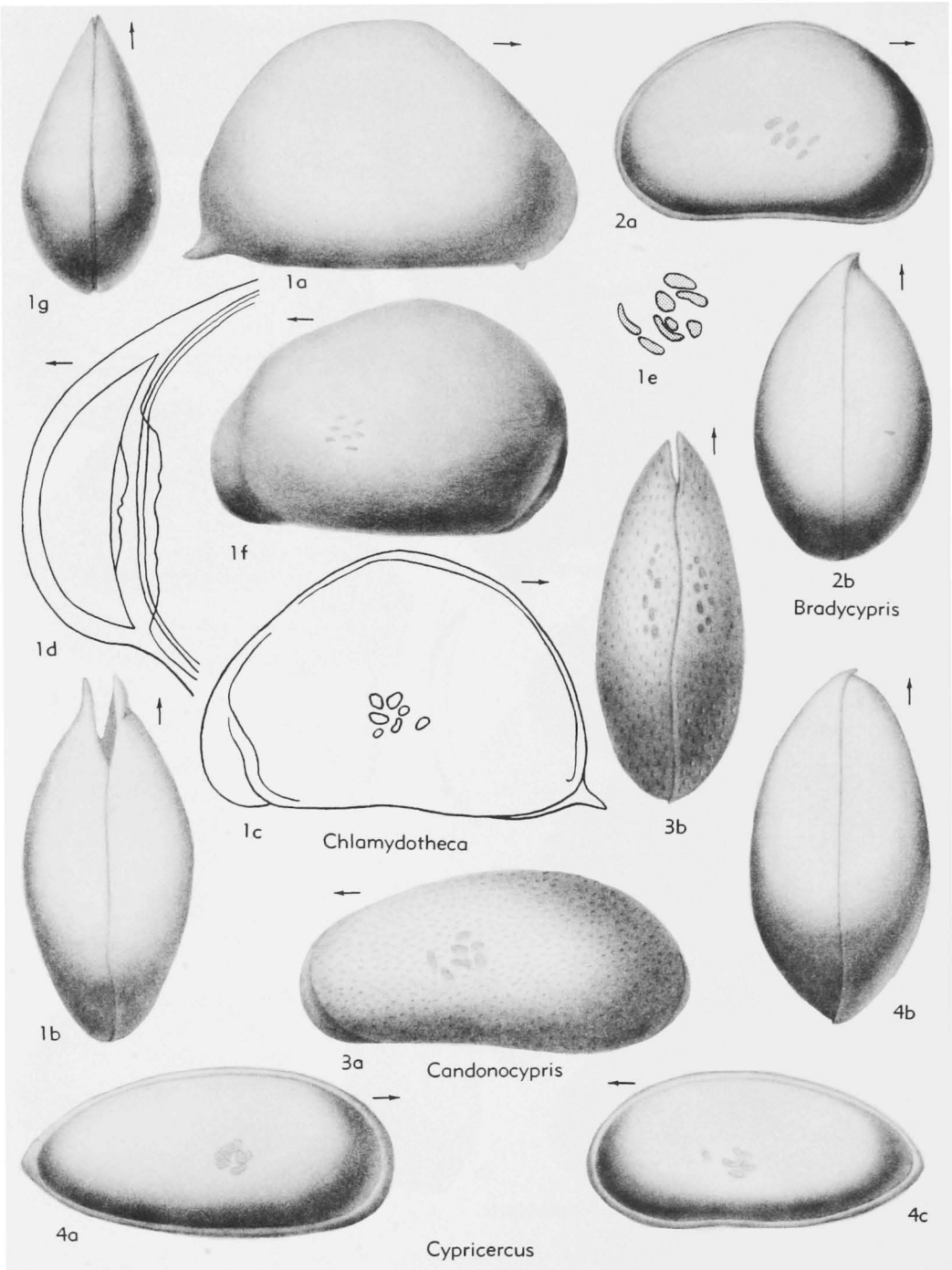

Fig. 150. Cyprididae (Cypridinae, Candoninae) (p. Q214-Q217, Q233).

1d, RV int., ant. part., ×20; *1e*, muscle scar, ×20 (374).——Fig. 150,*1f,g*. **C. azteca* (Saussure), Mexico; *1f,g*, carapace L, dors., ×15 (330).

Chrissia Hartmann, 1957 [**C. levetzovi*]. Carapace procumbent, greatest height less than half of length; shell wall thin and fragile, not distinctly punctate as in *Stenocypris;* LV without inner list along ventral and posterior margins, vestibule present, contact zone equally broad along anterior, ventral and posterior margins; radial pore canals scarcely visible, very small; false marginal pore canals each bearing a bristle distributed over most of surface, canals unbranched; fused secondary pore canals such as characteristically present along sinuous line of concrescence in *Stenocypris* lacking; lamellae not united by transverse septa. Males unknown. [Fresh-water.] *Rec.*, S.Afr.(Transvaal).——Fig. 151,*1*. **C. levetzovi;* carapace R, ×25 (164). [Reyment-Swain.]

Cypricercus Sars, 1895 [**C. cuneatus*]. Elongate, moderately convex; highest medially, dorsum not strongly arched, venter nearly straight, rear margin more narrowly rounded than front; LV larger than RV, overlapping it anteriorly and ventrally but RV may extend backward beyond LV. Anterior inner lamellae broad (313). [Fresh-water.] *Rec.*, Eu.-Afr.-Austral.——Fig. 150,*4*. **C. cuneatus*, S.Afr.; *4a,b*, ♀ carapace R lat., dors., ×15; *4c*, ♂ carapace L lat., ×30 (313).——Fig. 152,*1*. *C. fuscatus* (Jurine), Norway; RV lat. ×30 (314).

Cypriconcha Sars, 1926 [**Cypris barbata* Forbes, 1893]. Elongate, subelliptical, compressed; dorsum nearly straight, venter slightly sinuous, ends broadly rounded, slightly truncate above; valves subequal; surface smooth. Inner lamellae fairly broad, particularly toward rear. [Fresh-water.] *Rec.*, N. Am.——Fig. 152,*3*. **C. barbata* (Forbes); *3a,b*, RV lat., LV int., ×15 (315).

Cyprinotus Brady, 1886 [**C. cingalensis*] [=*Cypridonotus* Claus, 1892]. Subtriangular, valves compressed; dorsum strongly convex, subangulate medially, venter slightly concave, posterior margin angulate below midheight, truncate above and below; free margins of RV finely spinose; terminal margins of LV with hyaline border; LV overlapping RV terminally but RV may extend beyond LV dorsally; surface smooth. Inner lamellae rather narrow, broadest anteriorly (308). [Fresh-water.] *?Tert., Pleist.*(incl. *Rec.*), Eu.-N.Am.-Asia.

C. (Cyprinotus). Distinguished by soft parts. [Fresh-water.] *?Tert., Pleist.*(incl. *Rec.*), Eu.-Asia.——Fig. 152,*2a-c*. **C. cingalensis*, Rec., Ceylon; *2a-c*, carapace L, dors., ant., ×30 (108).——Fig. 152,*2d,e*. *C. salinus* (Brady), Rec., Eu.; *2d,e*, carapace L, dors., ×40 (314).

C. (Cyprinotoides) Masi, 1928 [**Cyprinotus (Cyprinotoides) somalicus*]. Distinguished by soft parts. [Fresh-water.] *Rec.*, E.Afr.(Somaliland).

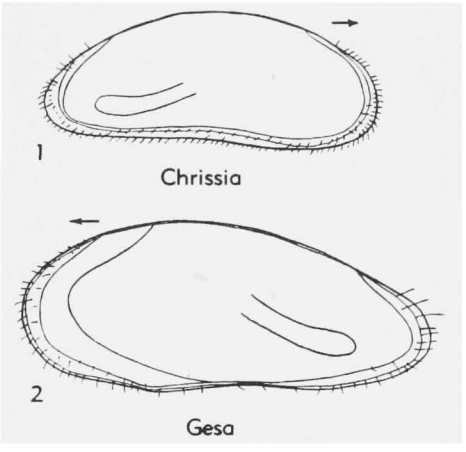

Fig. 151. Cyprididae (Cypridinae) (p. Q217-Q221).

Dogelinella Schneider in Mandelstam *et al.*, 1957 [**D. taeniata*]. Carapace subequivalved, elongate, swollen, ends compressed, with straight dorsal margin. Surface smooth. *Plio.*, SW.Asia(Fergana).——Fig. 153,*1*. **D. taeniata; 1a,b*, carapace R, dors., ×40 (238a). [Bold.]

Dolerocypria Tressler, 1937 [**D. taalensis*]. Differs from *Dolerocypris* in soft parts. *Rec.*, SW.Pac. (Philippines).

Dolerocypris Kaufmann, 1900 [**Cypris fasciata* O.F.Müller, 1785]. Sublanceolate, highest medially, compressed; posterior margin narrower; RV larger than LV, overlapping it terminally; surface smooth. Inner lamellae very broad (68). [Fresh-water.] *Rec.*, Eu.-Asia-E.Indies.——Fig. 154,*1*. **D. fasciata* (O.F.Müller), Eu.; *1a,b*, ♀ LV lat., int., ×30; *1c*, carapace dors., ×30; *1d,e*, RV lat. and int. ant. margin, ×30, ×100; *1f*, LV int. vent. margin, ×100; *1g*, carapace dors., ×30; (*1a-c*, 314; *1d-g*, 56).

Drieschia Brehm, 1923 [**D. mammillata*]. Shell tuberculate and generally as in *Centrocypris* but more elongate and more compressed. [Fresh-water.] *Rec.*, China.

Eucypris Vávra, 1891 [**Monoculus virens* Jurine, 1820; SD Sars, 1928] [=*Amphicypris* Sars, 1902]. Elongate-subovate, moderately convex; dorsum moderately arched, truncated behind and in front of greatest height, venter slightly concave to markedly sinuous, not appreciably flattened, ends rounded, not spinose, posterior margin narrow and extended ventral to mid-height; valves subequal, LV slightly larger than RV; surface smooth. Inner lamellae broad, concentrically striated (68). [Fresh-water.] *U.Cret.-Rec.*, cosmop.——Fig. 154,*2a-c*. **E. virens* (Jurine), Rec., Eu.; *2a,b*, ♀ carapace L, dors.; *2c*, juv. carapace L, ×20 (314).——Fig. 154,*2d-f*. *E. crassa* O.F.

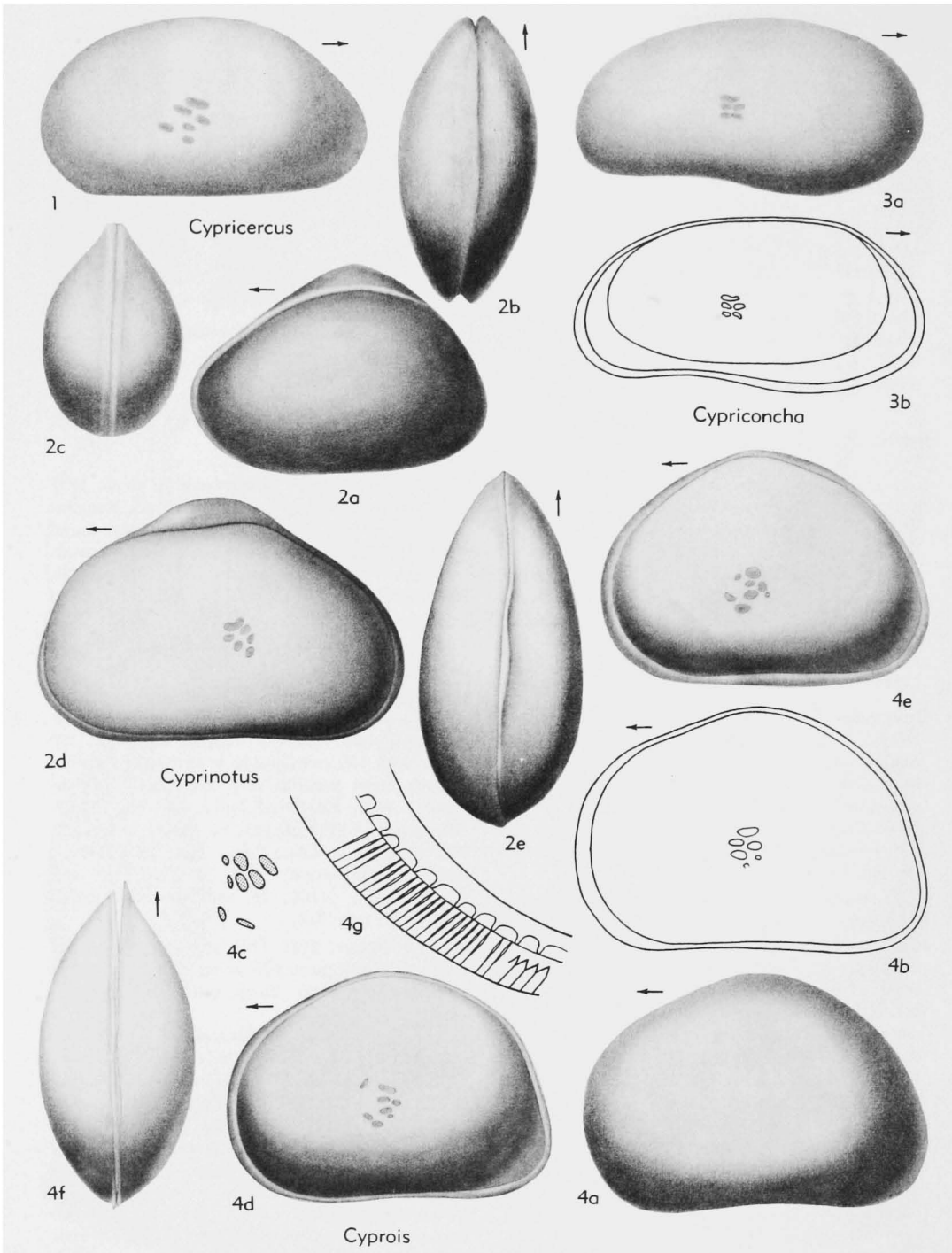

FIG. 152. Cyprididae (Cypridinae), Notodromadidae (p. Q217, Q245).

MÜLLER, Rec., N.Eu.; *2d,* ♀ LV int., *2e,f,* carapace L, dors.; all ×30 (314).

Exuocypris MANDELSTAM, 1956 [**E. extorris*]. Carapace kidney-like, elongate oval, rather large (1.25 by 0.75 mm.), thin-walled; anterior end truncated; exterior margin overhanging interior margin; surface smooth. Pore-canal zone occupying both exterior overhang of valve and part recessed within outer margin, canals being long and widening toward outer ends; wide tonguelike, extended inner lamellae adjacent to pore canals; muscle scar cypridid-like. [Fresh-water, complete carapace unknown.] *M.Plio.,* SW.Asia(Turkmen).——FIG. 154,*3.* **E. extorris; 3a,b,* LV int., ant. and marginal areas showing pore canals, ×64 (50).

Gesa HARTMANN, 1957 [**G. dubia*]. Procumbent,

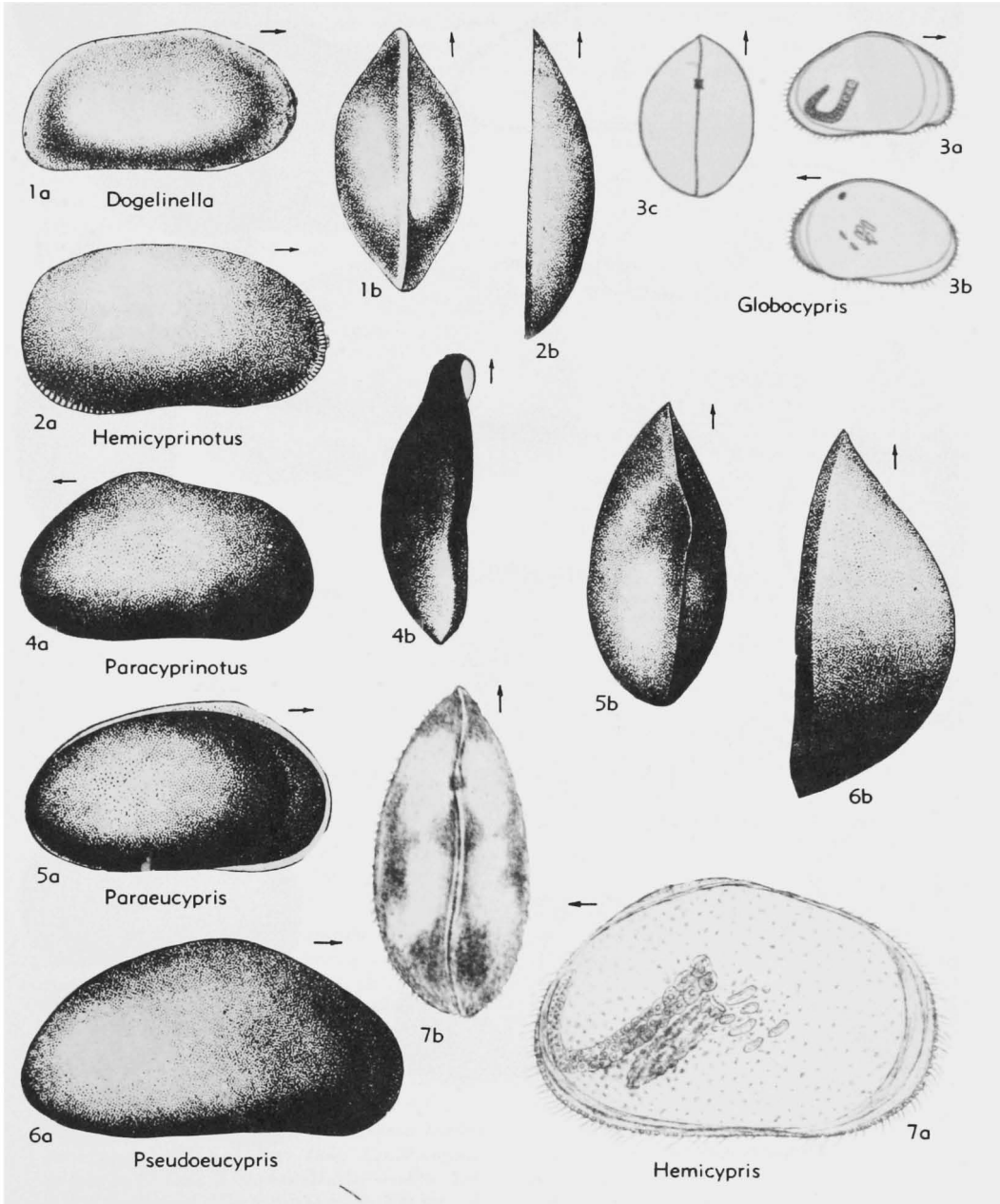

FIG. 153. Cyprididae (Cypridinae) (p. Q217-Q227).

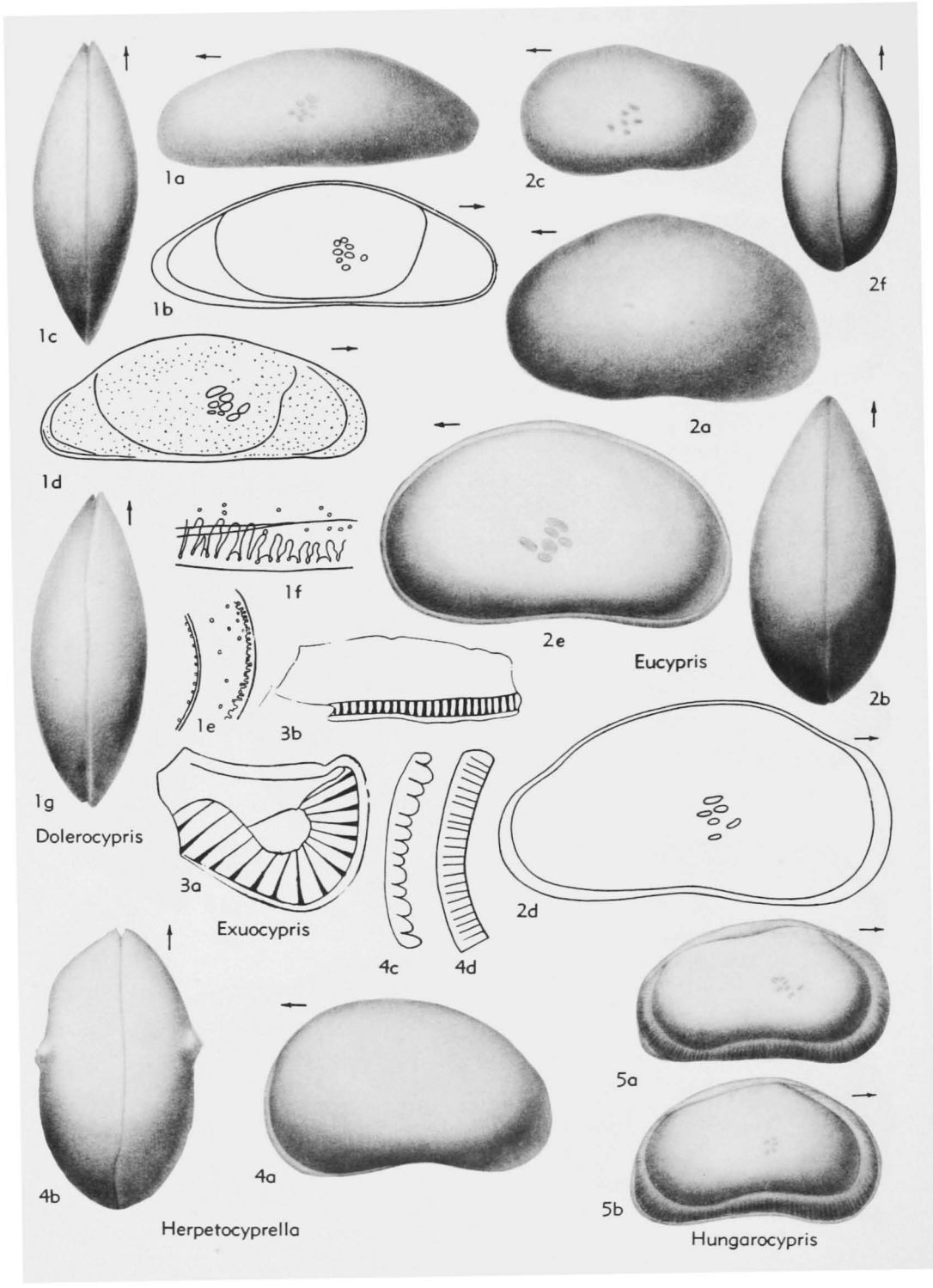

FIG. 154. Cyprididae (Cypridinae, Candoninae) (p. Q217-Q221, Q233).

slender, similar in form to various species of *Stenocypris;* carapace resembles *Chrissia levetzovi* in outline; surface features unknown; greatest height less than half of length, in front of middle; posterior sharply rounded, anterior regularly and broadly rounded; ventral margin with median conconcavity; inner margin and line of concrescence distinctly separated from margin anteriorly but posteriorly the two margins close together and parallel. Marginal pore canals not proven, few normal canals. Males unknown. [Fresh-water.] *Rec.,* S.Afr. (Transvaal).——Fig. 151,*2*. **G. dubia;* carapace L, ×55 (164). [Reyment-Swain.]

Globocypris Klie, 1939 [**G. trisetosa*]. Subovate, strongly tumid; venter sinuous; RV larger than LV, with extended anterior lip; surface pitted. Inner lamellae rather narrow. [Fresh-water.] *Rec.,* Afr.——Fig. 153,*3*. **G. trisetosa,* Kenya; *3a,b,* RV lat., LV lat.; *3c,* carapace dors., all ×15 (221).

Hemicyprinotus Schneider in Mandelstam *et al.*, 1957 [**H. valvaetumidus*]. Carapace elongate, moderately swollen; dorsal margin arched, posterior end vertically truncate or broadly rounded. Surface smooth. [Fresh-water.] *Plio.,* China (Sinkiang).——Fig. 153,*2*. **H. valvaetumidus; 2a,b,* RV lat., dors., ×30 (238a). [Bold.]

Hemicypris Sars, 1903 [**Cyprinotus pyxidata* Moniez, 1892]. Like *Cyprinotus* but RV overlapping LV. [Fresh-water.] *Rec.,* E.Indies.——Fig. 153,*7*. **H. pyxidata* (Moniez); *7a,b,* LV lat., carapace dors., ×15 (309).

Heterocypris Claus, 1893 [**Cypris incongruens* Ramdohr, 1808]. Subovate-elongate, medium-sized, moderately convex, thickest postmedially; dorsum moderately arched, subangulated postmedially, venter nearly straight to slightly concave, anterior margin narrowed; LV overlapping RV anteriorly and ventrally; general surface smooth except for scattered pits, edge of LV tuberculate anteriorly and posteroventrally (68). [Fresh-water.] *Paleoc.-Rec.,* cosmop.——Fig. 155,*5*. **H. incongruens* (Ramdohr), Rec., Eu.; *5a,b,* carapace R, dors.; *5c,* RV int.; *5d,e,* ♀ carapace dors., ♀ LV int.; all ×30 (316).

Homocypris Sars, 1924 [**H. conoidea*]. Elongate, highest behind middle, moderately convex, flattened medially; dorsum moderately arched, venter concave, terminal margins about equally rounded, front end compressed; valves perfectly equal; surface smooth. Inner lamellae very broad anteriorly. [Fresh-water.] *Rec.,* S.Afr.——Fig. 155,*1*. **H. conoidea; 1a-c,* carapace R, L, dors., ×20 (313).

Hungarocypris Vávra, 1906 [**Notodromas madaraszi* Orley, 1886]. Differs from *Candonocypris* in soft parts. *Rec.,* S.Eu.-Asia-N.Afr.——Fig. 154, *5*. **H. madaraszi* (Orley); *5a,b,* ♀ LV int., ♂ LV int., ×15 (18).

Isocypris G.W.Müller, 1909 [**I. priomena;* SD Swain, herein] [=*Hyalocypris* Brady, 1913]. Elliptical, compressed; ends equally rounded; distinct marginal anterodorsal notch; surface smooth (313). [Fresh-water.] *Rec.,* S.Afr.——Fig. 155,*4*. **I. priomena; 4a,b,* carapace L, dors., ×30 (313).

Kassinina Mandelstam, 1960 [*pro Kassinia* Mandelstam, 1956 (*non* Khabakov, 1937)] [**Kassinia kassini* Mandelstam, 1956]. Carapace elongated-oval, kidney-like; LV overlapping RV; anterior end lower and more inclined than posterior; dorsal margin convex, ventral margin straight to slightly concave; inner lamellae moderately developed at ends of valves; surface densely tuberculate, presenting a shagreen appearance; LV hinge a groove open at ends for reception of sharpened edge of RV. *M.Oligo.,* SW.Asia(Kazakhstan).——Fig. 155, *6*. **K. kassini* (Mandelstam); *6a,b,* LV lat., int., ×30 (50).

Liocypris Sars, 1924 [**L. grandis*]. Like *Homocypris* but much larger (4.5 mm.), equivalved, more compressed and more pointed posteriorly. *Rec.,* S.Afr.——Fig. 155,*7*. **L. grandis; 7a,b,* carapace L, dors., ×10 (313).

Lycopterocypris Mandelstam, 1956 [**Cypris faba* Egger, 1910]. Carapace thin-walled, kidney-like, with maximum height in anterior third (about 0.85 by 0.45 mm.); LV larger than RV; anterior end more broadly rounded than posterior; dorsal margin strongly curved, ventral margin nearly straight; RV hinge formed of narrowed valve edge which fits over steplike groove in LV. *L. Cret.,* NE.Asia(Transbaikalia-Sib.-Mongolia).——Fig. 155,*2*. *L. eggeri* Mandelstam, Transbaikalia; RV lat., ×27 (50).

Mediocypris Schneider, 1956 [**M. brodi*]. Carapace elongate, thick-walled, large, with length 3 times height; anterior margin rounded, posterior rounded below, truncate above; dorsal margin slightly convex, merging gradually with ends; ventral margin concave medially; surface sculptured by 4- and 5-sided pits; venter of each valve bearing narrow submarginal ridge or rim. Pore-canal zone narrow, with straight pore canals; inner lamellae approximately of same width as pore-canal zone; RV hinge consisting of extended platelike valve edge corresponding to steplike depression in LV, which overlaps RV ventrally. [Fresh-water.] *M.Mio.,* SE.Eu.(Caucasus).——Fig. 156,*1*. **M.brodi,* N.Ossetia; *1a,b,* RV lat., int., *1c,d,* LV int., dors.; all ×27 (50).

Megalocypris Sars, 1898 [**M. princeps*]. Very large, elongate subelliptical, moderately convex; dorsum straight, with very obtuse cardinal angles, venter slightly concave, ends compressed, margins rounded, posterior end slightly pointed; valves subequal; surface smooth. Inner lamellae broadest anteriorly. [Fresh-water.] *Rec.,* S.Afr.——Fig. 156,*2*. **M. princeps; 2a,b,* carapace L, dors., ×7.5 (307).

Mesocypris Daday, 1908 [**M. pubescens*]. Subreniform, moderately thick at each end but flattened medially; dorsum strongly arched, venter concave, posterior margin more pointed than anterior and extended ventrally; RV larger than LV; surface finely granulose. Inner lamellae broad, with median finger-like projection at each end (137). [Fresh-water.] *Rec.*, E.Afr.——Fig. 156,*3*. **M.* pubescens; *3a,b*, LV lat., RV lat.; *3c*, carapace dors., ×50 (137).

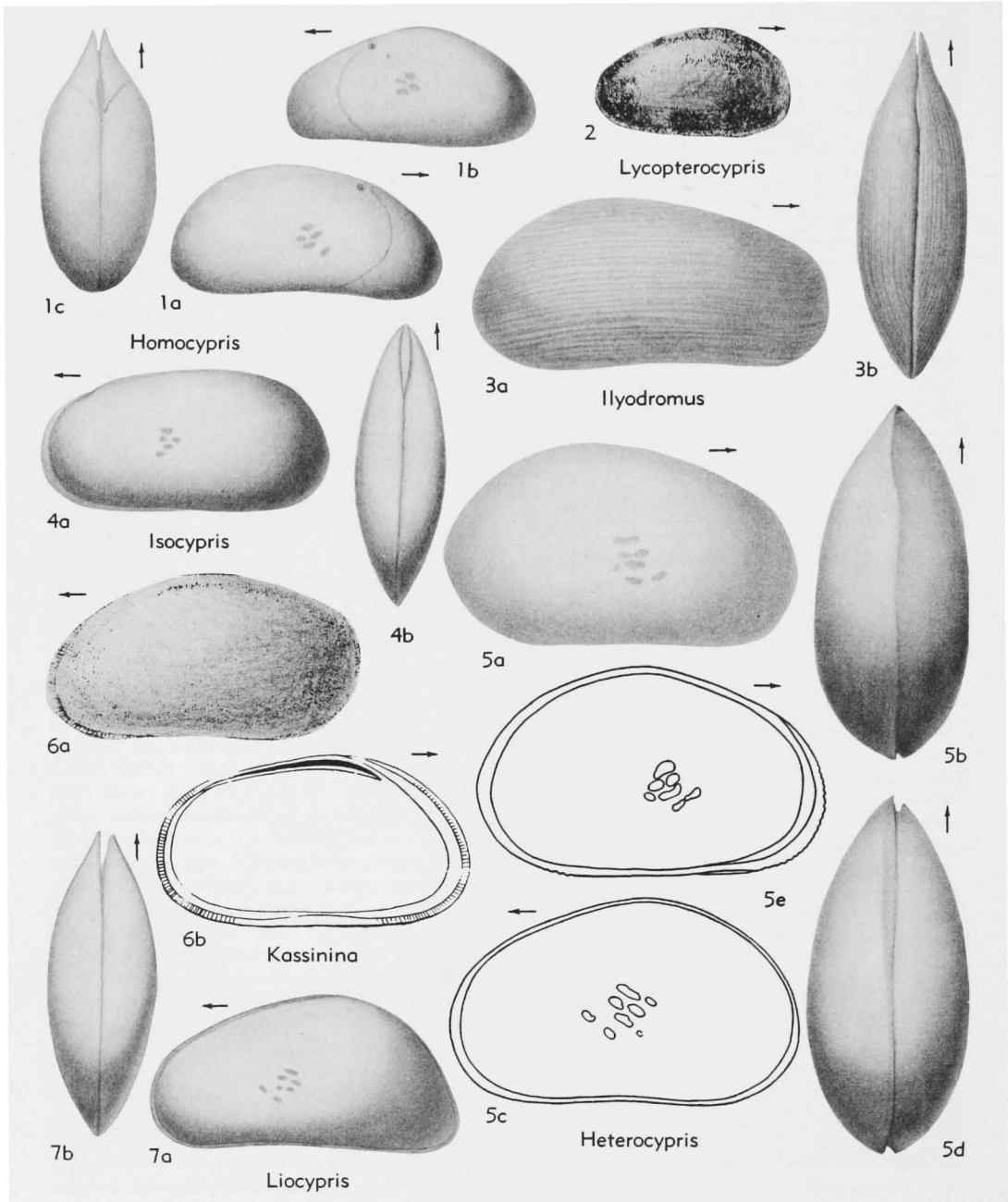

Fig. 155. Cyprididae (Cypridinae, Candoninae) (p. *Q221*, *Q233*).

Moenocypris TRIEBEL, 1959 [**M. francofurtana*]. Carapace kidney-shaped in lateral view, greatest height about in middle, anterior and posterior margins rounded, passing into lateral margins without angularity; LV larger than RV, with ventral overlap; surface smooth. Ventral margin of LV between line of concrescence and inner margin with isolated round spot in which both shell lamellae coalesce; selvage marginal in LV, near-marginal at ends of RV; zone of concrescence narrow; anterior and posterior pore canals short, anterior ones mostly forked, ventral margin with longer marginal canals and shorter submarginal canals, entire free margin also bearing finely branching secondary pore canals; central muscle field with 4 large adductor spots, 2 large mandibular spots, 2 small antennal spots; LV hinge a narrow furrow, margin of right fitting into this. Females larger than males. [Fresh-water to brackish.] *U.Oligo.-L.Mio.*, Eu.(Ger.). —— FIG. 157,*1*. **M. francofurtana*, L.Mio., Mainz Basin; *1a,b*, ♀ RV lat. (showing muscle scars and traces of ovaries), ♂ RV lat. (coiled impressions of testicles), ×33; *1c*, ♀ RV int., central muscle field, ×125; *1d*, ♀ LV int., vent. margin, ×200 (381). [REYMENT.]

Mongolianella MANDELSTAM, 1956 [**M. palmosa*]. Medium large (length 1.2 mm.), thick-walled, elongate; LV larger than RV; anterior end higher than posterior, broadly rounded and slightly truncated above; posterior end pointed and extended below; dorsal margin convex, straightened medially; ventral margin concave; surface smooth; line of contact of valves not coinciding with interior margin of shell. RV hinge an anterior platelike tooth passing backward into ridge, LV hinge with

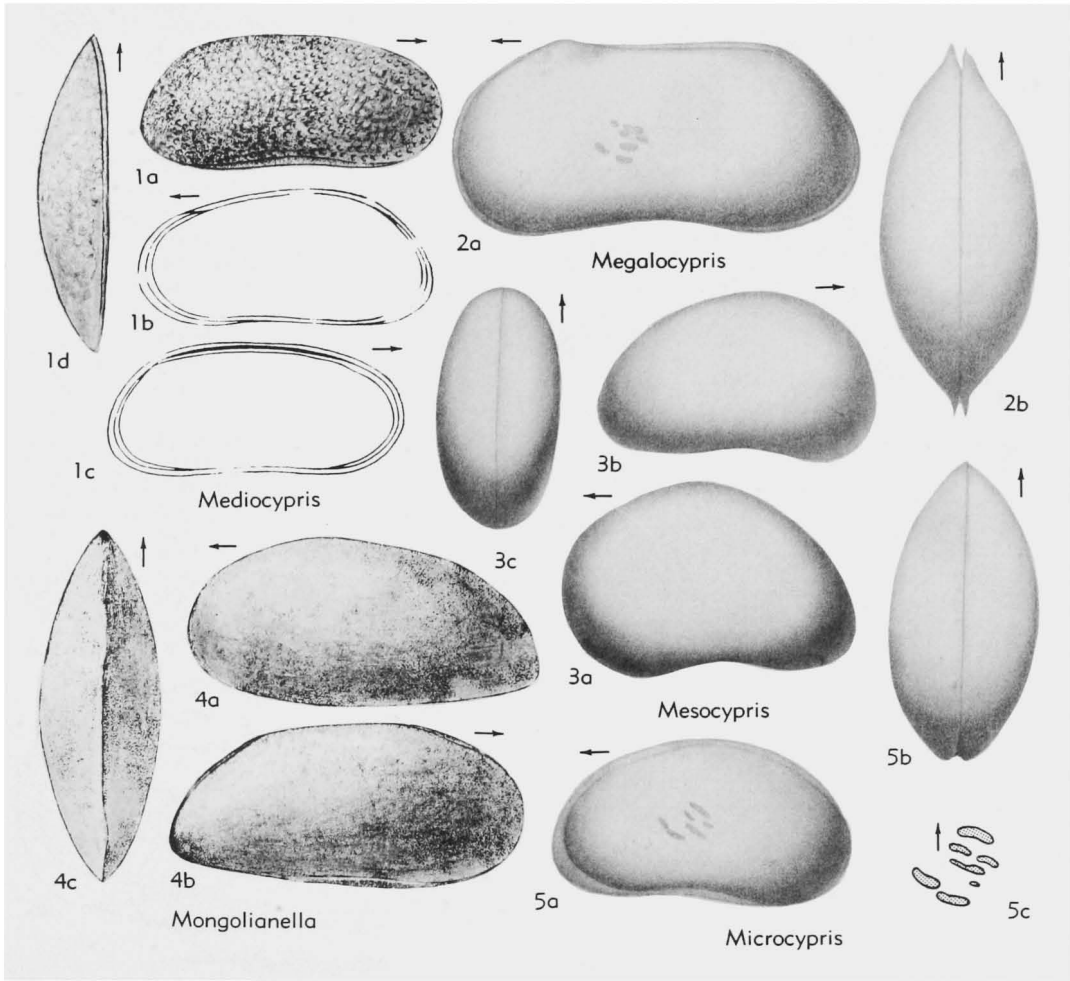

FIG. 156. Cyprididae (Cypridinae, Candoninae) (p. Q221-Q223, Q234).

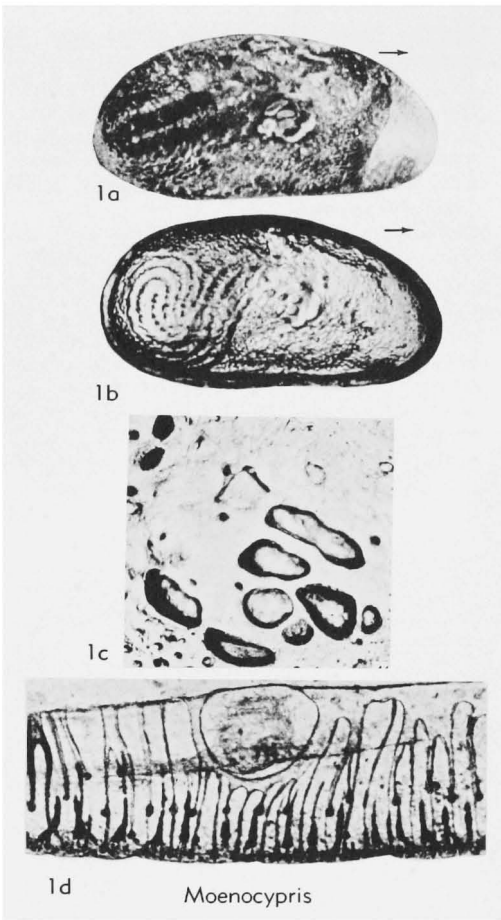

FIG. 157. Cyprididae (Cypridinae) (p. Q223).

corresponding groove and anterior elongate socket; inner lamellae broadest at anterior end; adductor scar comprising anteromedian group of about 6 spots and 2 additional anteroventral spots. [Fresh-water.] *L.Cret.*, E.C.Asia(Transbaikalia-Mongolia).——FIG. 156,*4*, 158,*1*. **M. palmosa*, E. Transbaikalia; 156,*4a-c*, carapace L, R, vent.; 158,*1a,b*, LV int., RV int.; all ×27 (50).

Neocypridopsis KLIE, 1940 [**N. debilis*]. Reniform-subtriangular, not elongated, moderately convex; dorsum strongly and evenly arched, venter concave, posterior margin narrower, both ends extended below; LV larger than RV; surface pitted. Inner lamellae of moderate width. [Fresh-water.] *Rec.*, Eu.——FIG. 165,*1*. **N. debilis; 1a,b*, RV int., LV int.; *1c*, carapace dors., all ×100 (222).

Neozonocypris KLIE, 1944 [**N. congensis*]. Differs from *Zonocypris* mainly in soft parts. *Rec.*, Afr.

Oncocypria DADAY, 1908 [**O. mülleri*]. Differs from *Oncocypris* in presence of anteromedian sulcus and weaker surface ornamentation. Dimorphic, males more pointed posteriorly and more elongate than females (137). *Rec.*, E.Afr.——FIG. 159,*3*. **O. muelleri; 3a-c*, carapace L, dors., RV int., ×50 (137).

Oncocypris G.W.MÜLLER, 1898 [**O. voeltzkowi*]. Small subovate to subquadrate, strongly inflated, thickest postmedially; dorsum moderately arched, venter slightly convex, sinuous; front portion compressed, margin with keel, anterior edges of valves bent toward right; LV larger than RV; surface rugose. Inner lamellae narrow, line of concrescence scalloped. [Fresh-water.] *Rec.*, Afr. ——FIG. 159,*2a,b*. *O. omercooperi* LOWNDES; *2a,b*, LV int., carapace dors., ×60 (233).——FIG. 159, *2c-e*. **O. voeltzkowi; 2c-e*, carapace L, dors., LV int., ×75 (256).

Pachycypris CLAUS, 1893 [**P. incisa*; SD SWAIN, herein]. More elongate and inflated than *Chlamydotheca*; flange at anterior end; surface pitted or pustulose. *Rec.*, S.Am.——FIG. 160,*2*. **P. incisa; 2a,b*, carapace L, dors., ×25; *2c*, ant. margin, ×45 (19).

Paracypretta SARS, 1924 [**P. ampullacea*]. Subovate-reniform, very strongly inflated; dorsum arched, venter slightly concave, markedly flattened, ends rounded, posterior narrower than anterior; LV decidedly larger than RV, projecting beyond it forward; surface longitudinally striate. Inner lamellae broadest anteriorly; RV with thick, chitinized front marginal transverse septa. Parthenogenetic. [Fresh-water.] *?U.Cret., Rec.*, S.Afr.——FIG. 160, *3*. **P. ampullacea*, Rec.; *3a-c*, carapace R, dors., ant., ×40; *3d*, RV int., ×40 (313).

Paracyprinotus SCHNEIDER in MANDELSTAM *et al.*, 1957 [**P. similis*]. Carapace elongate reniform, swollen, dorsal margin straight, forming obtuse angle with anterior margin, ends rounded, anterior end higher than posterior; radial pore canals straight, hinge simple, RV fitting into groove on

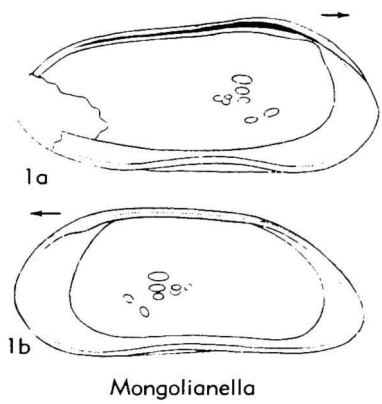

FIG. 158. Cyprididae (Cypridinae) (p. Q224).

LV. Surface smooth. *Plio.*, C.Asia(Kazakhstan). ——FIG. 153,*4*. **P. similis; 4a,b,* LV lat., dors., ×30 (238a). [BOLD.]

Paraeucypris SCHNEIDER in MANDELSTAM *et al.*, 1957 [**P. tota*]. Carapace elongate, ovate, smooth, ends rounded; dorsal margin arched, forming obtuse angle with anterior margin; hinge simple, RV fitting into groove on LV. *Plio.*, SW.Asia(Kirghizia).——FIG. 153,*5*. **P. tota; 5a,b,* carapace R, dors., ×30 (238a).

Platycypris HERBST, 1957 [**P. baueri*]. Elongate subelliptical, venter slightly sinuous, dorsum gently convex; ends rounded; valves compressed; inner lamellae very narrow except anteriorly; resembles *Scottia* but probably differs in structure of appendages. *Rec.*, Austral.——FIG. 161,*1*. **P. baueri; 1a,* ♂ carapace R; *1b,c,* ♀ carapace R, dors., ×25 (168).

Protoargilloecia MANDELSTAM, 1956 [**Bairdia silicula minor* JONES & HINDE, 1890]. Carapace small (length 0.45 mm.), thin-walled, smooth, podlike in form; RV larger than LV; anterior margin rounded, extended above, posterior margin extended and pointed below; dorsal margin convex, ventral margin convex in RV, concave in LV. RV hinge a minute groove for reception of sharpened edge of LV; inner lamellae weakly developed at anterior end; pore-canal zone narrow, perforated by thin, straight pore canals; adductor muscle scar like that of other cypridids. *Jur.-Mio.*, W.Eu.-SW.

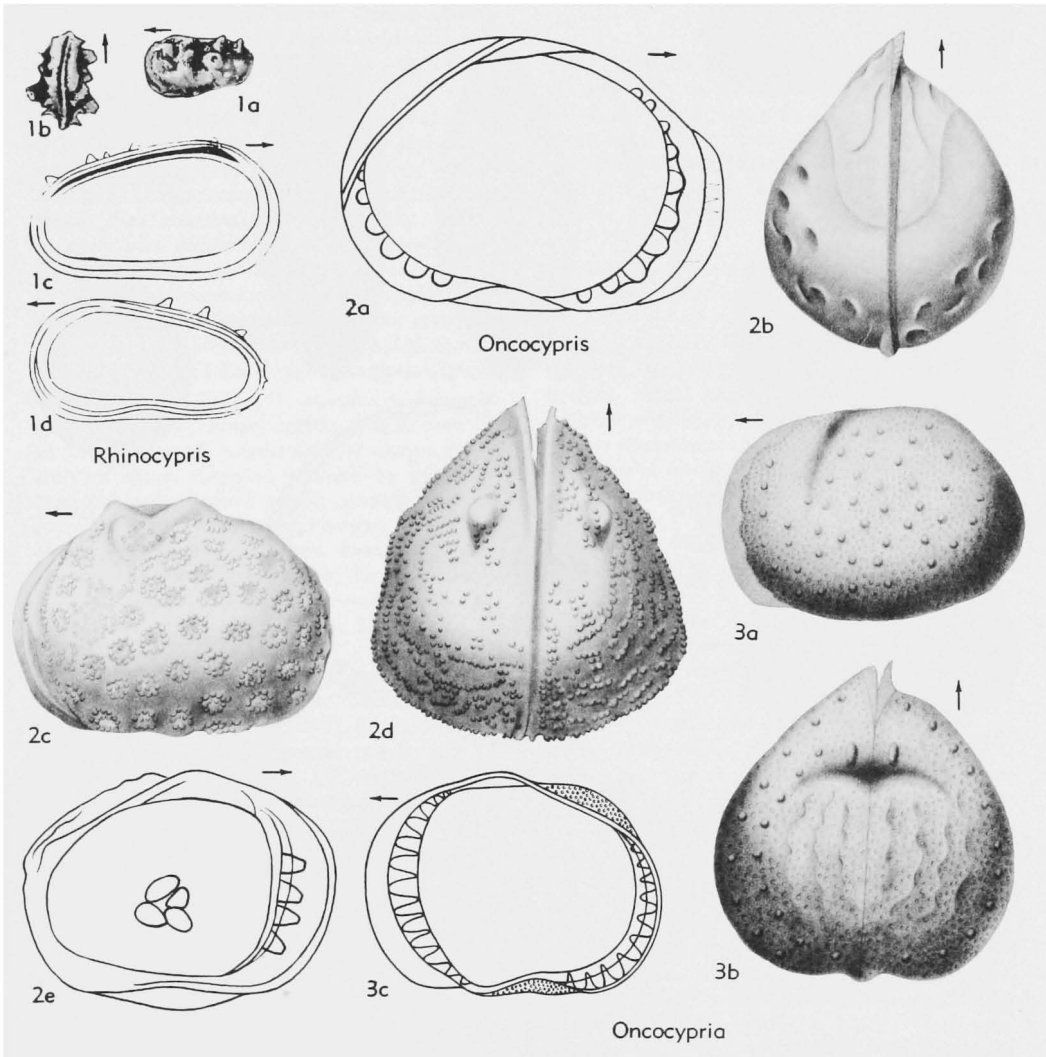

FIG. 159. Cyprididae (Cypridinae), Ilyoclyprididae (p. Q224, Q241).

Asia(Kazakhstan).——Fig. 160,*1*. **P. *minor* (Jones & Hinde), Cret., Eng.; *1a,b*, LV lat., RV lat., ×25 (50).

Pseudocypretta Klie, 1932 [**P. *maculata*]. Subtriangular, tumid; dorsum strongly convex, umbonate medially, venter nearly straight, ends nearly equally rounded; RV overlapping LV dorsally; surface smooth. *Rec.*, Afr.——Fig. 160,*5*. **P.*

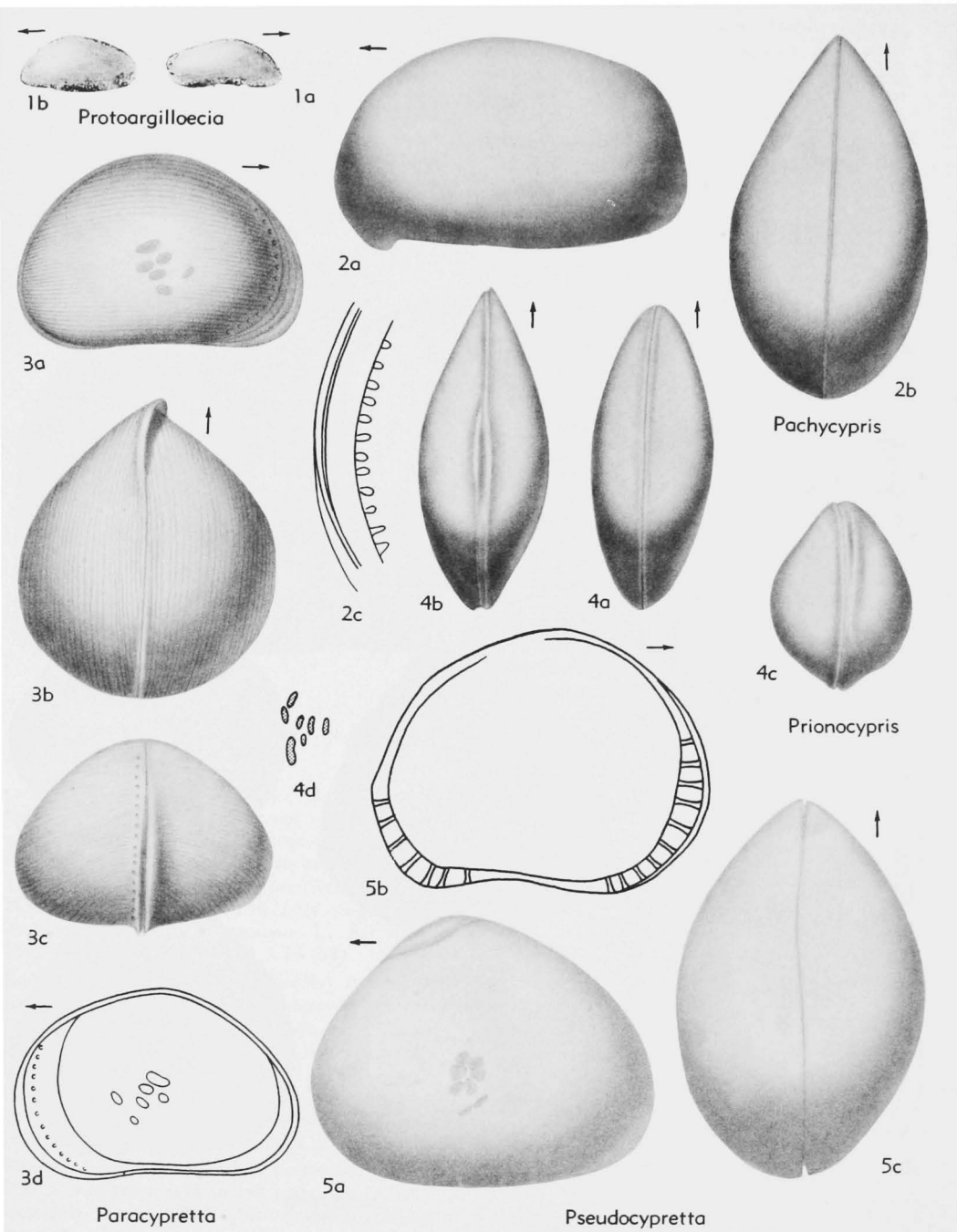

Fig. 160. Cyprididae (Cypridinae, Candoninae) (p. Q224-Q227, Q234).

maculata; 5a-c, LV lat., int., carapace dors., ×100 (217).

Pseudocypris DADAY, 1908 [**P. bouvieri*]. Subtriangular to ovoid; dorsum arched, broadly angulate medially, venter nearly straight, front margin rounded, rear narrower and acuminate ventrally; valves subequal; longitudinal flange or false keel parallel to ventral margin; surface smooth. Inner lamellae moderate in width (137). [Fresh-water.] *Rec.,* Afr.——FIG. 162,*3.* **P. bouvieri; 3a-c,* carapace R, L, dors., ×30 (137).

Pseudoeucypris SCHNEIDER in MANDELSTAM *et al.,* 1957 [**P. eboris*]. Carapace elongate, kidney-shaped, swollen; dorsal margin arched, posterior end usually truncate; hinge with sharp edge in RV which fits into groove in LV. Typical are outline and swollen ventral portion. Surface smooth. [Fresh-water.] *Plio.,* SW.Asia(Kazakhstan).——FIG. 153,*6.* **P. eboris; 6a,b,* RV lat., dors., ×20 (238a). [BOLD.]

Rectocypris SCHNEIDER in MANDELSTAM *et al.,* 1958 [**R. schwejeri* SWAIN, herein, *pro Bythocypris reniformis* SCHWEJER, 1949 (*non* BRADY, 1880)]. Carapace elongate-ovate, swollen, anterior end higher than posterior, which is usually truncate in upper part, narrowly rounded in lower; dorsal margin arcuate; inner lamella 2 or 3 times size of zone of concrescence, pore canals straight; hinge consisting of sharp margin of RV with projection in anterior part, fitting into groove in LV. Surface smooth. *U.Plio.,* SE.Eu.(Volga-Caucasus). [BOLD.]

Sclerocypris SARS, 1924 [**S. clavularis*]. Subquadrate, compressed; hinge margin straight and 0.5 to 0.75 of carapace length; anterior margin broad, truncate above, extended ventrally to provide a marginal anteroventral notch; posterior margin narrow, extended below mid-height; valves subequal; surface granular. [Fresh-water.] *Rec.,* Afr.——FIG. 162,*2a-c.* **S. clavularis; 2a-c,* carapace R lat., dors., RV int., ×15 (313).——FIG. 162,*2d,e.* *S. jenkinae* KLIE; *2d,e,* RV int., LV dors., ×10 (217).

Scottia BRADY & NORMAN, 1889 [**Cypris browniana* JONES, 1850] [*non Scottia* BOLIVAR, 1912] [=*Scottiana* CARUS, 1890 (obj.)]. Small, subovate, inflated; dorsum convex, venter nearly straight, posterior margin narrower; LV overlapping RV along hinge; surface with scattered pits. [Fresh-water.] *Tert.-Rec.,* Eu.-?N.Am.; *Pleist.,* Eu.(Brit. Is.).——FIG. 162,*4.* **S. browniana* (JONES); *4a,b,* carapace R, dors., ×60 (15).

Stenocypria G.W.MÜLLER, 1901 [*Cypris fischeri* LILLJEBORG, 1883]. Differs from *Eucandonia* in soft parts and marginal shell structure. *Rec.,* Eu.-N. Am.——FIG. 162,*1.* **S. fischeri* (LILLJEBORG), Eu.; *1a,b,* carapace L, dors.; *1c,* LV lat.; *1d,* RV lat. post. margin, ×20 (*1a,* 18; *1b-d,* 258).

Stenocypris SARS, 1889 [**Cypris malcolmsonii* BRADY, 1886]. Very elongate, subelliptical, much compressed; dorsum nearly straight with broadly

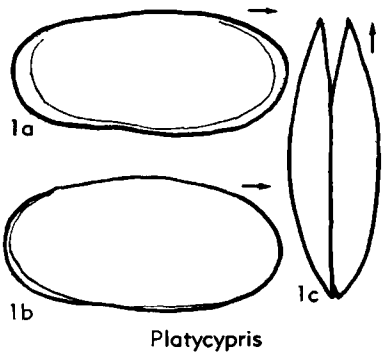

FIG. 161. Cyprididae (Cypridinae) (p. Q225).

obtuse cardinal angles, ventral margin slightly concave, ends about equally rounded, truncated above; LV slightly larger than RV; surface smooth. Inner lamellae very broad anteriorly, line of concrescence S-shaped. [Fresh-water.] *Tert.-Rec.,* Afr.-Austral.-E.Indies.——FIG. 163,*1.* **S. malcolmsonii* (BRADY); Rec., India; *1a,b,* carapace R, dors., ×30 (305a).

Strandesia STUHLMANN, 1888 [**Cypris* (*Strandesia mercatorum* VÁVRA, 1895; SD VÁVRA, 1895)] [=*Acanthocypris* CLAUS, 1893; *Neocypris* SARS, 1901; *Spirocypris* SHARPE, 1903]. Elongate, subelliptical, moderately convex; hinge margin nearly straight, venter slightly sinuate, ends rounded, posterior slightly narrower and commonly with spinose extension; dorsum of RV with large winglike process; margin of LV tuberculate; valves subequal; surface smooth. Inner lamellae broad (393). [Fresh-water.] *Rec.,* S.Hemis.——FIG. 162,*5.* **S. mercatorum* (VÁVRA), Zanzibar; *5a,* carapace L, showing winglike process on RV, ×20; *5b,* carapace dors., ×20; *5c,* muscle scar, enlarged (393).——FIG. 163,*4a-c.* *S. centrura* KLIE, Brazil; *4a-c,* carapace L, R, dors., ×30 (KLIE, 1940).——FIG. 163, *4d-f.* *S. bicuspis* (CLAUS) (type species of *Acanthocypris*), S.Am.; *4d,e,* carapace L, dors., ×40; *4f,* LV ant. end, ×100 (19).

Suzinia SCHNEIDER, 1956 [*pro Ilowaiskya* SUZIN, 1956 (*non* VIALOV, 1940)] [**Ilowaiskya transcaucasica* SUZIN, 1956]. Carapace smooth, elongate, with rounded ends; LV larger than RV, overlapping it ventroterminally; hinge of LV bearing groove, closed at its ends, for reception of knife-edge of RV. Inner lamellae broad anteriorly and ventrally, becoming narrower posteriorly; inner margin with deep re-entrant anteriorly where it nearly joins line of concrescence; broad pore-canal zone thickly supplied with narrow straight canals. [Marine.] *M.Eoc.-L.Oligo.,* Caucasus-Armenia.——FIG. 163,*2.* **S. transcaucasica* (SUZIN), L.Oligo, Armenia; *2a,b,* carapace R lat., dors.; *2c,* RV int.; all ×30 (50).

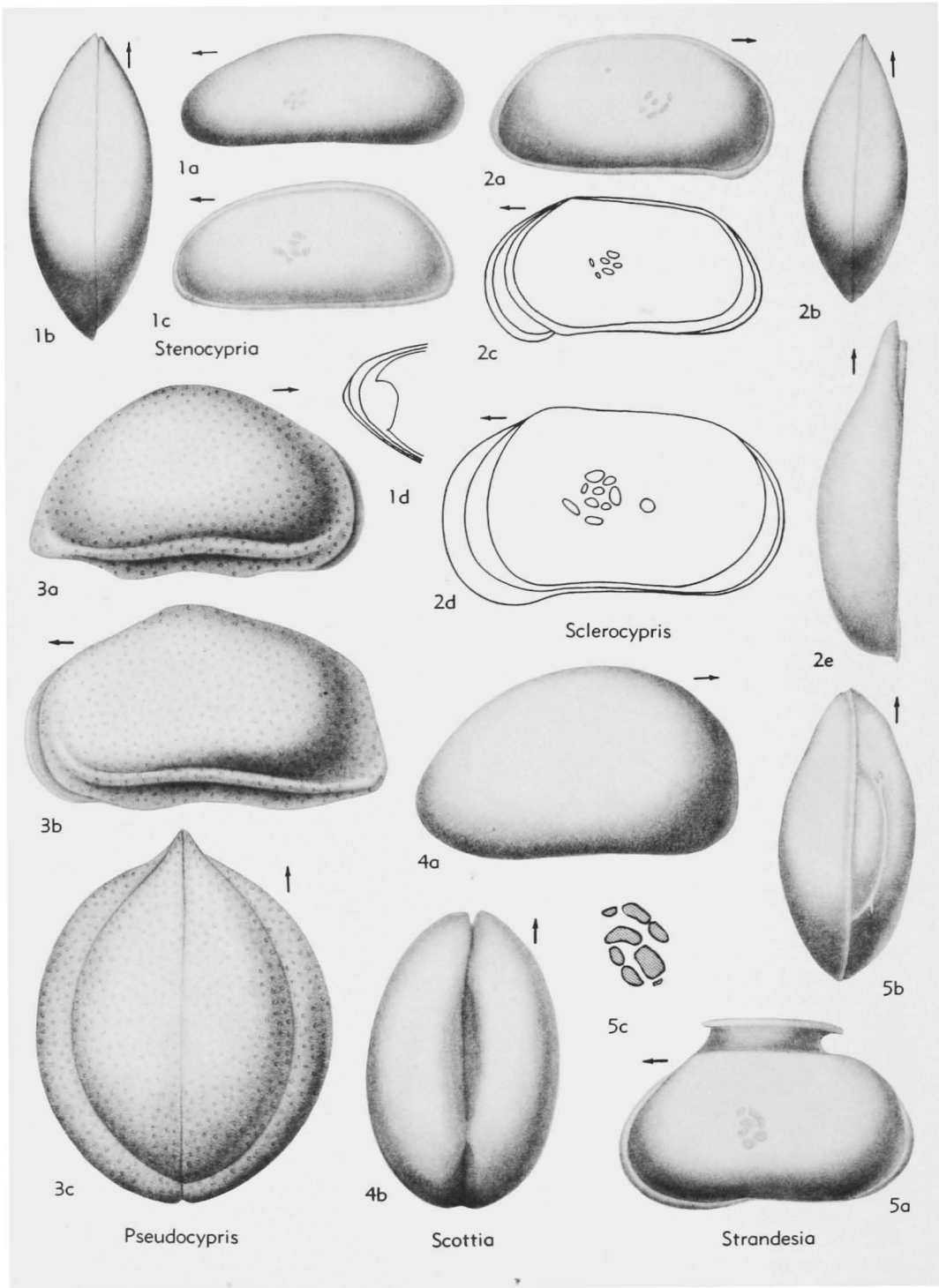

FIG. 162. Cyprididae (Cypridinae) (p. Q227).

Ussuriocypris MANDELSTAM, 1956 [**U. ussurica*]. Kidney-shaped, about 1.45 by 0.55 mm.; LV larger than RV, anterior end more uniformly rounded than posterior, which has truncate margin above; dorsal margin convex but straightened medially in most specimens, ventral margin nearly straight to slightly concave; surface smooth. Hinge consisting of benchlike depression in LV and sharpened edge in RV. *L.Cret.*, NE.Asia(E.Sib.).——FIG. 163,*3*. **U. ussurica; 3a,b,* RV lat., LV lat., ×13 (50).

Zonocypris G.W.MÜLLER, 1898 [**Z. madagascarensis*]. Similar to *Paracypretta* but valves only slightly unequal, LV larger than RV; surface concentrically striated; sexes separate. [Fresh-water.] *Rec.*, Afr.——FIG. 163,*5*. **Z. madagascarensis; 5a,b,* carapace L, dors., ×80; *5c,* RV int., ×80 (256).

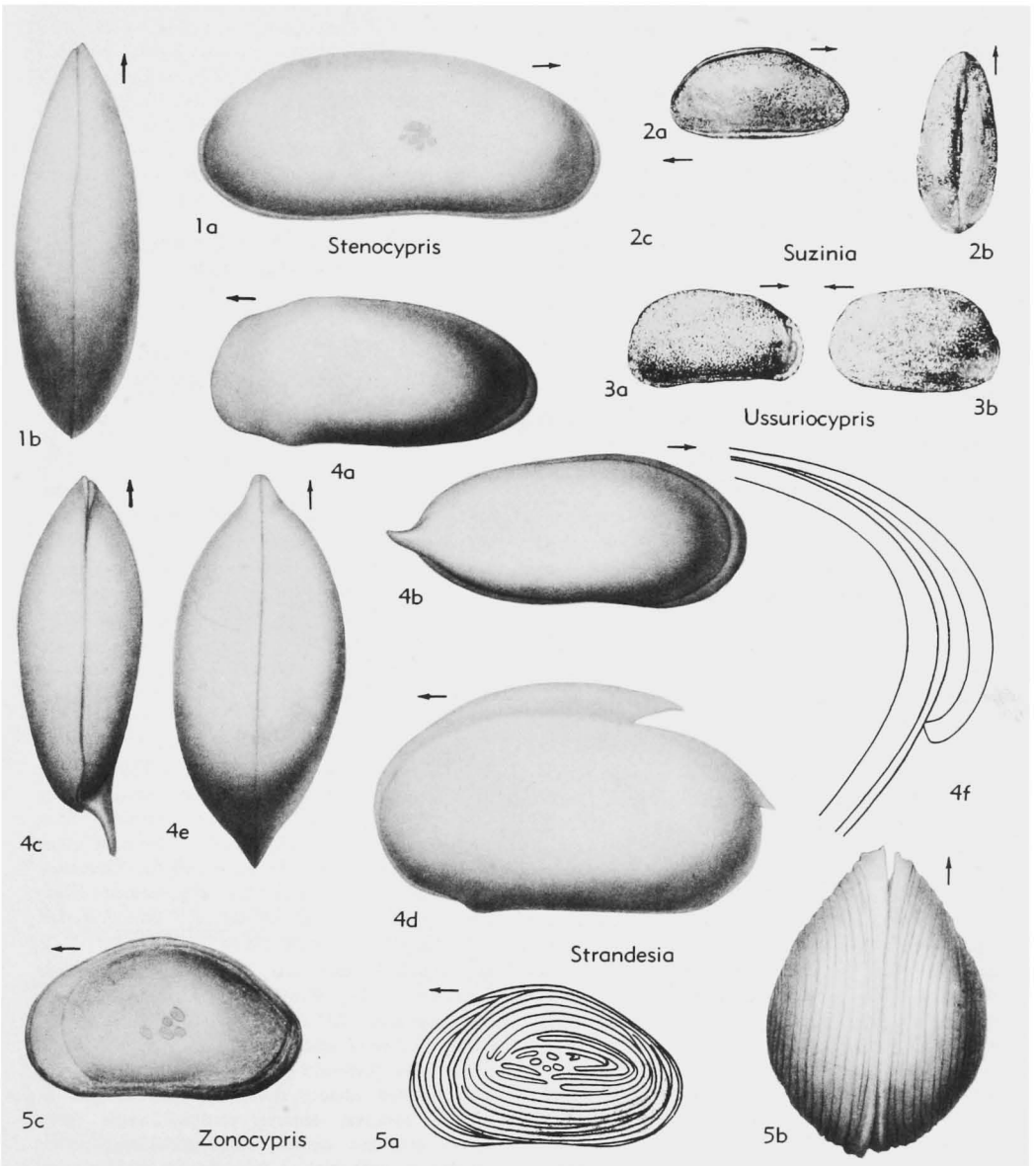

FIG. 163. Cyprididae (Cypridinae) (p. Q227-Q229).

Subfamily CYPRIDOPSINAE Kaufmann, 1900

[=Cypridopsides Sars, 1925; Cypridopsini Bronstein, 1947]

Carapace small to medium-sized (generally less than 1 mm.), reniform to subtriangular; dorsum moderately to strongly arched, venter typically concave, ends rounded, extended below mid-height; valves more or less unequal; surface smooth, densely pitted, pustulose or spinose. Inner lamellae typically very narrow; furcal ramus reduced to a base which ends distally in a seta. [Fresh-water.] *?Perm., U.Cret.-Rec.*

Cypridopsis Brady, 1867 [**Cypris vidua* O.F.Müller, 1776; SD Brady & Norman, 1889] [=*Pionocypris* Brady & Norman, 1896 (obj.); *Proteocypris* Brady, 1905]. Reniform, subtriangular, not elongated, moderately convex, thickest postmedially; dorsum strongly arched, angulated medially, truncated on either side of position of greatest height, venter concave, anterior margin narrower; RV slightly larger than LV; surface pitted, pustulose, spinose. In part parthenogenetic (44). [Fresh-water, brackish-water.] *?Perm., U.Cret.-Rec.*, cosmop.——Fig. 164,*1*. **C. vidua* (O.F.Müller), Rec., Eu.-N.Am.; *1a,b*, carapace L, dors., ×70; *1c,d*, LV int., vent., ×70 (Sars, 1925); *1e*, ♀ carapace dors., ×70 (55).

Cypretta Vávra, 1895 [**Cypridopsis (Cypretta) tenuicauda*] [=*Cypridella* Vávra, 1895 (*non* De Koninck, 1841)]. Possibly more tumid than *Cypridopsis*, otherwise differing from that genus in soft parts. [Fresh-water.] *Rec.*, S.Afr.——Fig. 164,*2a,b*. **C. tenuicauda* (Vávra); *2a,b*, carapace R, dors., ×60 (393).——Fig. 164,*2c-e*. *C. dubiosa* (Daday); *2c*, carapace dors.; *2d,e*, LV int., RV int., ×50 (18).

Cypridopsella Kaufmann, 1900 [**Monoculus villosus* Jurine, 1820; SD Sars, 1928] [=*Candonella* Claus, 1891]. Differs from *Potamocypris* in stronger dorsal and lesser ventral overlap of LV by RV, more posterior position of greatest height and narrower inner lamellae. In part parthenogenetic (68). [Fresh-water.] *Rec.*, Eu.-S.Am.-?Asia.——Fig. 164,*3*. **C. villosa* (Jurine); *3a,b*, carapace L, dors.; *3c*, LV int.; all ×70 (314).

Cyprilla Sars, 1924 [**C. arcuata*]. Subreniform, compressed, thickest medially; dorsum strongly convex, venter slightly concave, terminal margins extended below, posterior truncate, bluntly pointed below; greatest length near venter; RV larger than LV, strongly overlapping dorsally but overlapped by LV ventrally and posteriorly; surface pitted. [Fresh-water.] *Rec.*, S.Afr.——Fig. 165,*3*. **C. arcuata; 3a,b*, carapace L, dors.; *3c,d*, LV int., RV int.; all ×100 (313).

Paracypridopsis Kaufmann, 1900 [**P. zschokkei*] [=*Poracypridopsis* Kaufmann, 1900]. Elongate, subquadrate, compressed; dorsum not strongly arched, angulated anteromedially, truncate in front and behind greatest height, venter concave, terminal margins extended below, posterior truncate above; RV overlapping LV dorsally but LV overlapping RV terminally; surface pitted or pustulose. Inner lamellae narrow, broadest anteriorly. [Fresh-water.] *Rec.*, Eu.——Fig. 165,*2*. **P. zschokkei; 2a*, carapace L, ×50; *2b*, muscle scar, ×110 (40).

Potamocypris Brady, 1870 [**Bairdia fulva* Brady, 1868]. Elongate-reniform, compressed, highest medially; dorsum moderately arched, venter concave, terminal margins extended below, posterior slightly narrower; RV strongly overlapping LV dorsally and ventrally; surface densely pitted. Inner lamellae moderately broad at both ends (14). [Fresh-water.] *U.Cret.-Rec.*, cosmop.——Fig. 165, *4*. **P. fulva* (Brady), *Rec.*, Brit.Is.; *4a-c*, carapace L, R, dors., ×80; *4d*, RV int., ×80 (53).

Subfamily DISOPONTOCYPRIDINAE Mandelstam, 1956

[*nom. correct.* Swain, herein (*pro* Disopontocyprinae Mandelstam, 1956)]

Form variable, LV much larger than RV and commonly with thickened dorsal margin; anterior end higher than posterior; surface smooth or rarely perforated or reticulate. Pore-canal zone comparatively wide, with numerous straight canals; inner lamellae well developed anteriorly. *Oligo.-Rec.*

Disopontocypris Mandelstam, 1956 [**Pontocypris oligocaenica* Zalanyi, 1929]. Kidney-shaped, elongate oval, or subtrapezoidal; medium-sized (±0.8 mm.); anterior end higher than curved posterior end, which in RV is narrowly rounded and strongly extended below; dorsal margin straight, with distinct step at anterior end of RV; ventral margin nearly straight, but with mid-ventral incurvature of margin; surface smooth or rarely with honeycomb ornamentation and median pits; pore-canal zone narrow, with dense straight pore canals; inner lamellae broader anteriorly than elsewhere; hinge of LV groove, curved at ends, for reception of RV edge. *Oligo.*, SE.Eu.(Caucasus-Hung.).——Fig. 166,*3*. **P. oligocaenica* (Zalanyi), Caucasus; *3a,b*, LV lat., RV lat.; *3c,d*, LV int., RV int.; all ×30 (50).

Caspiocypris Mandelstam, 1956 [**Bairdia candida* Livental, 1929]. Reniform, elongate oval, about 1.2 mm. long; LV larger than RV; anterior end broadly rounded and usually higher than narrowly rounded posterior end, which is extended below, beveled above; dorsal margin straight to slightly concave; anterior cardinal angle more obtuse and less distinct than posterior; surface smooth or with pits or tubercles in middle part. Inner lamellae best developed anteriorly; pore-canal zone narrow, with widely spaced canals

anterior steplike terminus; LV hinge a groove hinge formed of knifelike valve edge which has anterior steplike terminus; LV hinge a groove open at both ends. *Plio.-Rec.*, SE.Eu.(Yugosl.-Caucasus-Caspian Region-Roumania-Albania-living in Caspian Sea).——FIG. 166,2. *C. candida* (LIVENTAL) *Rec.*, Caspian; *2a,b*, RV lat., LV lat.; *2c,d*, RV int., LV int., ×27 (50).

Caspiolla MANDELSTAM, 1960 [*pro Caspiella* MANDELSTAM, 1956 (*non* THIELE, 1928)] [**Bairdia*

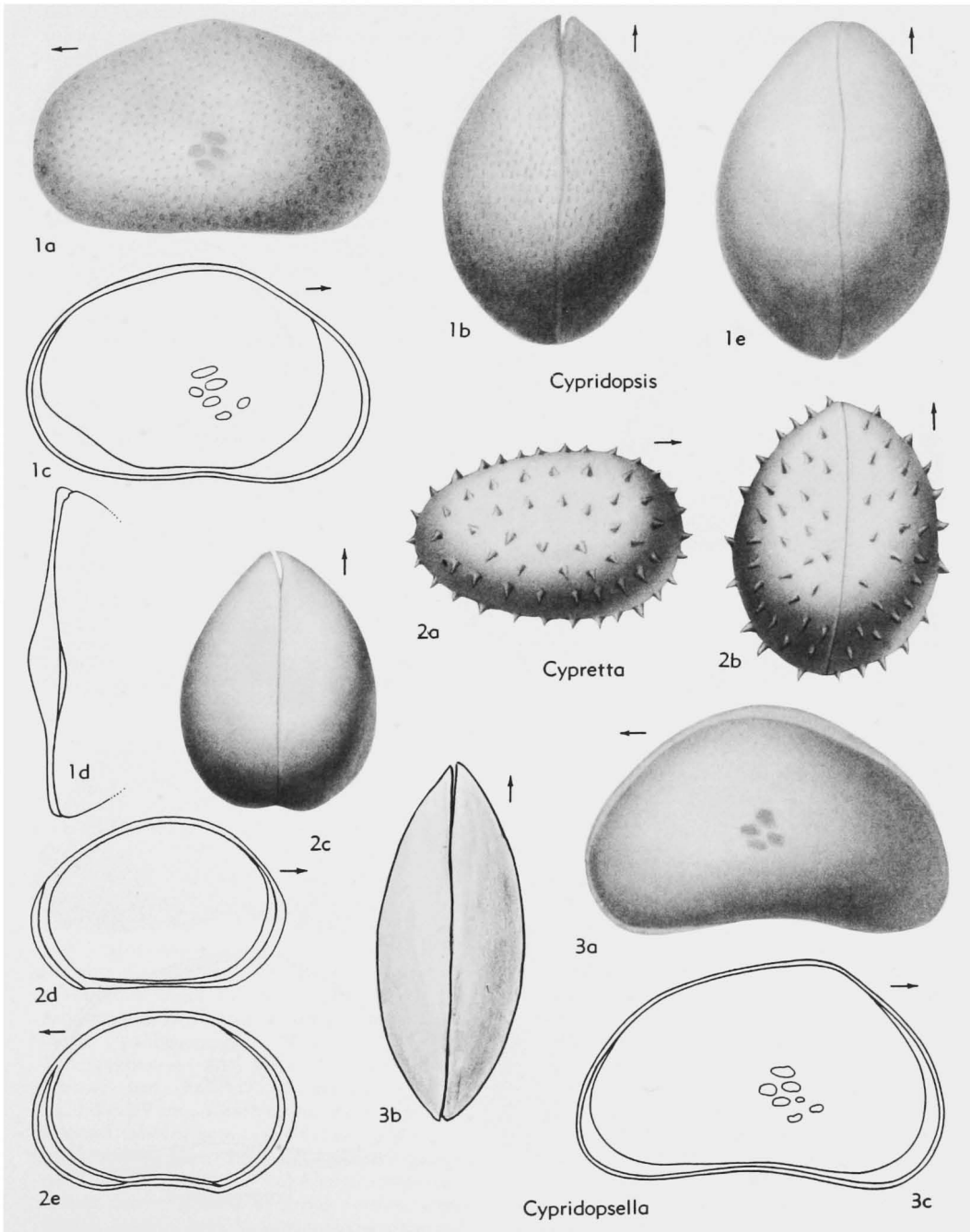

FIG. 164. Cyprididae (Cypridopsinae) (p. Q230).

acronasuta LIVENTAL, 1929]. Large, irregular reniform; LV larger than RV; anterior end high and broadly curved, posterior end pointed and extended below, truncated above; dorsal margin convex or straight; ventral margin straight to sinuous, margins curved inward mid-ventrally; surface smooth, rarely with angular tubercles; hinge of RV consisting of knifelike valve margin with small step

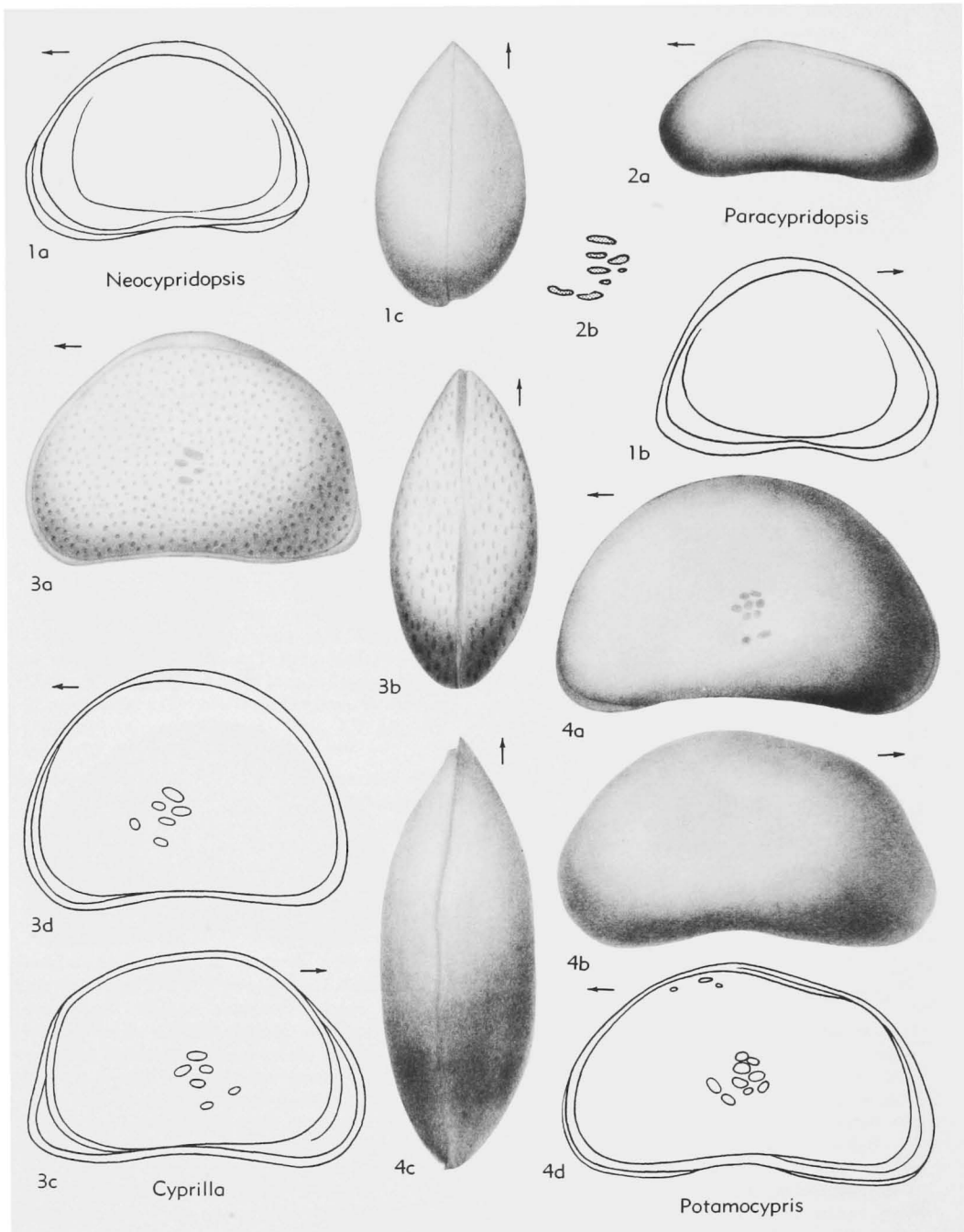

FIG. 165. Cyprididae (Cypridinae, Cypridopsinae) (p. Q224, Q230).

at anterior end; LV hinge a groove, open at both ends. Inner lamellae broadest anteriorly; pore-canal zone narrow, perforated by dense, narrow pore canals located ventrally; adductor muscle scar comprising anteromedian group of 6 spots and 2 additional more anteroventral spots. *Plio.-Pleist.*, SE.Eu.(Yugosl. - Caucasus). —— FIG. 166,*4*. **C. acronasuta* (LIVENTAL), Plio., Caucasus; *4a,b*, LV lat., RV lat., ×40; *4c,d*, LV int., RV int., ×30 (50).

Pontoniella MANDELSTAM, 1960 [*pro Pontonella* MANDELSTAM, 1956] [**Paracypria acuminata* ZALANYI, 1929]. Elongate, podlike, small length about 1 mm.); LV larger than RV; anterior end high and broadly rounded; posterior pointed and strongly extended below, slightly concave above; dorsal margin slightly convex to straight; ventral margin concave; surface smooth or pitted; hinge of RV formed of knifelike margin with anterior step; LV with longitudinal groove, open at both ends, and overlapping outward extension of valve edge, weakly developed anteriorly. Inner lamellae best developed anteriorly; pore-canal zone narrow; canals straight, concentrated at front end; adductor muscle scar a group of 6 spots, median to slightly posteromedian in location. *Plio.-Pleist.*, SE.Eu.(Yugosl.-S.Russ.).——FIG. 166,*1*. **P. acuminata* (ZALANYI), U.Mio., Yugosl.; *1a,b*, LV lat., RV lat., ×25; *1c,d*, LV int., RV int., ×20 (50).

Subfamily CANDONINAE Daday, 1900

[=Herpetocypridinae KAUFMANN, 1900; Ctenocyprina *(partim)*, Euopsida *(partim)*, Synopsida *(partim)* DADAY, 1900; Candonides *(partim)* SARS, 1923; Eucyprides *(partim)* SARS, 1925; Herpetocyprini+Herpetocyprellini BRONSTEIN, 1947; Erpetocypridina POKORNÝ, 1958] [Includes Herpetocyprinae (*recte* Herpetocypridinae) SCHNEIDER, 1960]

Distinguished from other Cyprididae by rudimentary development of natatory setae on (posterior) antennae, resulting in lack of swimming power, but differing from Eucandonidae, in which swimming setae of the antennae are entirely absent. *Tert.-Rec.*

Candona BAIRD, 1845 [**Cypris reptans* BAIRD, 1835; SD BAIRD, 1846] [=*Erpetocypris* BRADY & NORMAN, 1889 (obj.); *Herpetocypris* SARS, 1890 (obj.)] [see *Eucandona*]. Large (2.5 mm.), elongate, subelliptical, compressed; dorsum nearly straight; venter concave; ends rounded, posterior broader; LV larger than RV; surface smooth; inner lamellae broadest anteriorly; complex radial canals; parthenogenetic. [Fresh-water.] *Tert.-Rec.*, cosmop.——FIG. 167,*2*. **Candona reptans* (BAIRD), Rec., Brit.Is.; *2a,b*, carapace L, dors., ×20; *2c*, RV int., ×20; *2d*, int. and vent. margin enlarged showing pore canals (314).

Candonocypris SARS, 1894 [**Cypris candonoides* KING, 1855]. Elongate suboblong, compressed; dorsum nearly straight to gently convex, venter slightly concave, ends rounded, anterior narrowed, greatest height postmedian; RV larger than LV, overlapping it strongly in front; surface smooth. Inner lamellae broad anteriorly. Parthenogenetic. [Fresh-water.] *Rec.*, ?Austral.-N.Z.-S.Afr.——FIG. 150,*3*. **C. candonoides* (KING), S.Afr.; *3a,b*, carapace L, dors., ×30 (67).

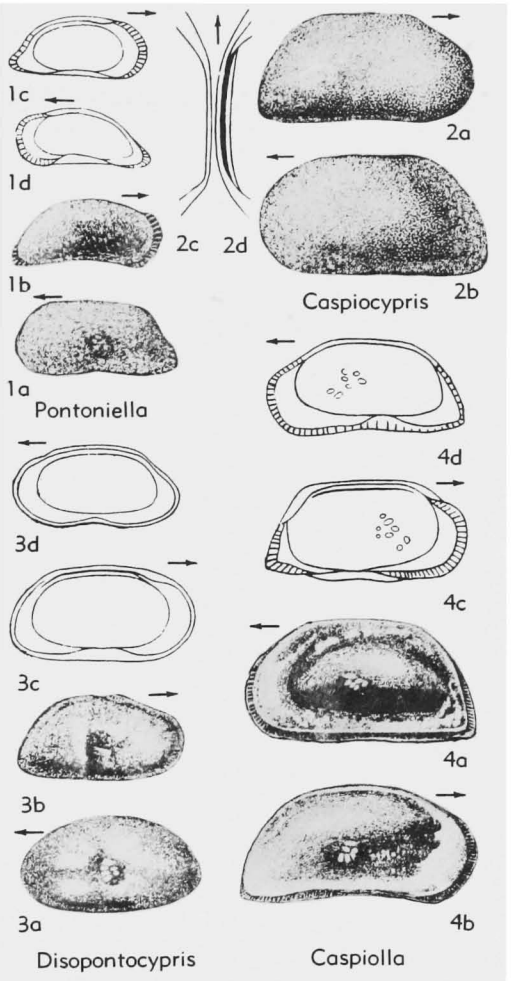

FIG. 166. Cyprididae (Disopontocypridinae) (p. Q230-Q233).

Herpetocyprella DADAY, 1909 [**H. mongolica*]. Differs from *Erpetocypris* in soft parts. *Rec.*, Asia. ——FIG. 154,*4*. **H. mongolica*, S.Asia, *4a,b*, carapace L, dors., ×30; *4c,d*, terminal pore canals, enlarged (18).

Ilyodromus SARS, 1895 [**Candona stanleyana* KING, 1855]. Elongate subelliptical, compressed; dorsum straight, with broadly obtuse cardinal angles, venter concave, ends rounded, posterior narrower; dorsal slopes truncated; LV slightly larger than RV; surface typically striated longitudinally. Inner lamellae very broad and shelflike. Parthenogenetic. [Fresh-water.] Rec., N.Z.——FIG. 153,*3*. **I.*

stanleyana (KING); *3a,b,* carapace R, dors., ×30 (306).

Microcypris KAUFMANN, 1900 [**M. reptans*]. Elongate-subreniform, moderately convex; dorsum moderately and evenly arched; venter concave; anterior end narrower, LV slightly larger than RV, surface with scattered pits. [Fresh-water.] *Rec.*, Eu.——FIG. 156,*5.* **M. reptans; 5a,b,* carapace L, dors., ×40; *5c,* muscle scars, ×50 (40).

Prionocypris BRADY & NORMAN, 1896 [**Candona serrata* NORMAN, 1862]. Elongate, subreniform, moderately convex; dorsum gently arched, venter slightly concave, ends about equally rounded and typically serrate; valves subequal; surface smooth. Inner lamellae broadest anteriorly. [Fresh-water.] *Rec.*, Eu.-Asia.——FIG. 160,*4.* **P. serrata,* W.Eu.; *4a,b,* carapaces dors., ×30; *4c,* carapace ant., ×30; *4d,* muscle scar, enlarged (107).

Family CYCLOCYPRIDIDAE Kaufmann, 1900

[*nom. transl.* SWAIN, herein (*ex* Cyclocypridinae KAUFMANN, 1900] [=Synopsida *(partim)* DADAY, 1900; Candocyprinae *(partim)* ALM, 1915; Cyclocyprides SARS, 1925; Cyclocyprinae HOFF, 1942; Cyclocyprini BRONSTEIN, 1947] [Materials for this family prepared by F. M. SWAIN, University of Minnesota]

Carapace small (less than 1 mm.), subovate to subtriangular, highest medially; dorsum strongly convex, venter nearly straight, ends rounded, anterior generally narrower; greatest length below mid-height; valves compressed to strongly convex, thickest in posterior half; valves subequal to strongly unequal; surface smooth, pitted, reticulated, or lined. Inner lamellae narrow. [Fresh-water.] *U.Jur.-Rec.*

Cyclocypris BRADY & NORMAN, 1889 [**Cypris globosa* SARS, 1863]. Subovate, tumid, highest medially; dorsum strongly convex, venter straight, anterior margin narrow, truncate above; RV slightly larger than LV; surface smooth, weakly pitted or reticulated (68). *Tert.-Rec.*, Eu.-Asia.-N.Am. ——FIG. 168,*4.* **C. globosa* (SARS), Rec., Eu.; *4a,b,* carapace L, dors., ×50; *4c-e,* ♀ carapace L, R, dors., ×60 (*4a,b,* 65; *4c-e,* 257).

?Cetacella MARTIN, 1958 [**C. inermis*]. Suboval in side view, LV larger than RV; characterized by regular finely ribbed surface ornament. Hinge composed of ridges and furrows; muscle field with 6 adductor spots, 2 smaller mandibular spots obliquely anteroventral from central field, and 1 or 2 antennal spots anterodorsal therefrom. Sexual dimorphism moderately strong, reflected in lengths and heights of carapaces. [Fresh-water to brackish environment.] *U.Jur.(Kimm.)*, Eu.——FIG. 169,*1.* **C. inermis,* Ger.; *1a,b,* LV lat., RV lat., ×60; *1c,* carapace, dors., ×60 (242).

Cyclocypria DOBBIN, 1941 [**C. kincaidia*]. Differs from *Cyclocypris* in nature of soft parts. *Rec.*, W. N.Am.

Cypria ZENKER, 1854 [**Cypris exculpta* FISCHER, 1854 (=*Cypria punctata* var. *striata* ZENKER, 1854); SD BRADY & NORMAN, 1889]. Subovate, compressed, highest medially to postmedially; dorsum strongly arched, venter straight to slightly concave; anterior margin narrower and more extended; LV slightly larger than RV; surface smooth or punctate (68). *Tert-Rec.*, cosmop.——FIG. 168, *2.* **C. exculpta* (FISCHER), Rec., Eu.; *2a,b,* ♀ carapace L, dors.; *2c,* ♂ carapace R; *2d,e,* ♀ carapace L, dors.; all ×60 (314).

Physocypria VÁVRA, 1898 [**P. bullata*]. Subovate to subtriangular, moderately convex, highest postmedially; dorsum strongly arched to umbonate, venter slightly convex, anterior margin narrower; valves strongly unequal with either LV or RV larger, overlapping strongly dorsally and ventrally; free margins of LV or RV serrate or spinose (54). *Rec.*, cosmop.——FIG. 168,*1a,b. P. pustulosa* (SHARPE), Eu.; *1a,b,* carapace L, vent. (22).—— FIG. 168,*1c-e. P. globula* FURTOS, Ohio; *1c,d,* carapace L, dors., ×60; *1e,* RV int., ×60 (22).

Family EUCANDONIDAE Swain, n. fam.

[=Candoninae KAUFMANN, 1900; =Candoninae *(partim)* DADAY, 1900; =Synopsida *(partim)* DADAY, 1900; =Typhlopsida DADAY, 1900; =Candocyprinae *(partim)* ALM, 1915; =Candonini BRONSTEIN, 1947] [Materials for this family by F. M. SWAIN, University of Minnesota, with assistance on some genera by R. A. REYMENT, University of Stockholm, W. A. VAN DEN BOLD, Louisiana State University, and R. H. SHAVER, Indiana University and Indiana Geological Survey] [Includes Lineocyprinae (*recte* Lineocypridinae), Paracandoninae SCHNEIDER, 1960]

Shell medium to large, more or less elongate, subreniform, compressed to moderately convex; typically higher behind middle; dorsum arched, venter more or less concave, anterior margin typically more narrowly rounded than posterior; valves equal or unequal; surface smooth or pitted. Inner lamellae typically broad. *?Perm., Trias.-Rec.*

Eucandona DADAY, 1900 [**Candona balatonica* DADAY, 1894; SD SWAIN, herein] [=*Candona* BRADY & NORMAN, 1889 (*non* BAIRD, 1845, obj.); *?Cyprida* GOLDENBERG, 1870]. [BRADY's (1846) designation of *Cypris reptans* as type species of *Candona* takes precedence over selection of this same species by BRADY & NORMAN (15) as the type species of *Erpetocypris,* and likewise of their designation of *Cypris candida* O.F.MÜLLER, 1776; as type species of *Candona;* accordingly *Erpetocypris* and SARS' *Herpetocypris,* which is an invalid emendation of *Erpetocypris,* must be classed as objective junior synonyms of *Candona.*] Elongate, medium-sized, subreniform, moderately convex, highest posterior to middle; dorsum strongly arched to nearly straight, venter concave; ends rounded, anterior margin generally narrower than posterior, LV slightly larger but RV may overlap along venter; surface smooth or finely punctate; shell substance cloudy white in Recent forms.

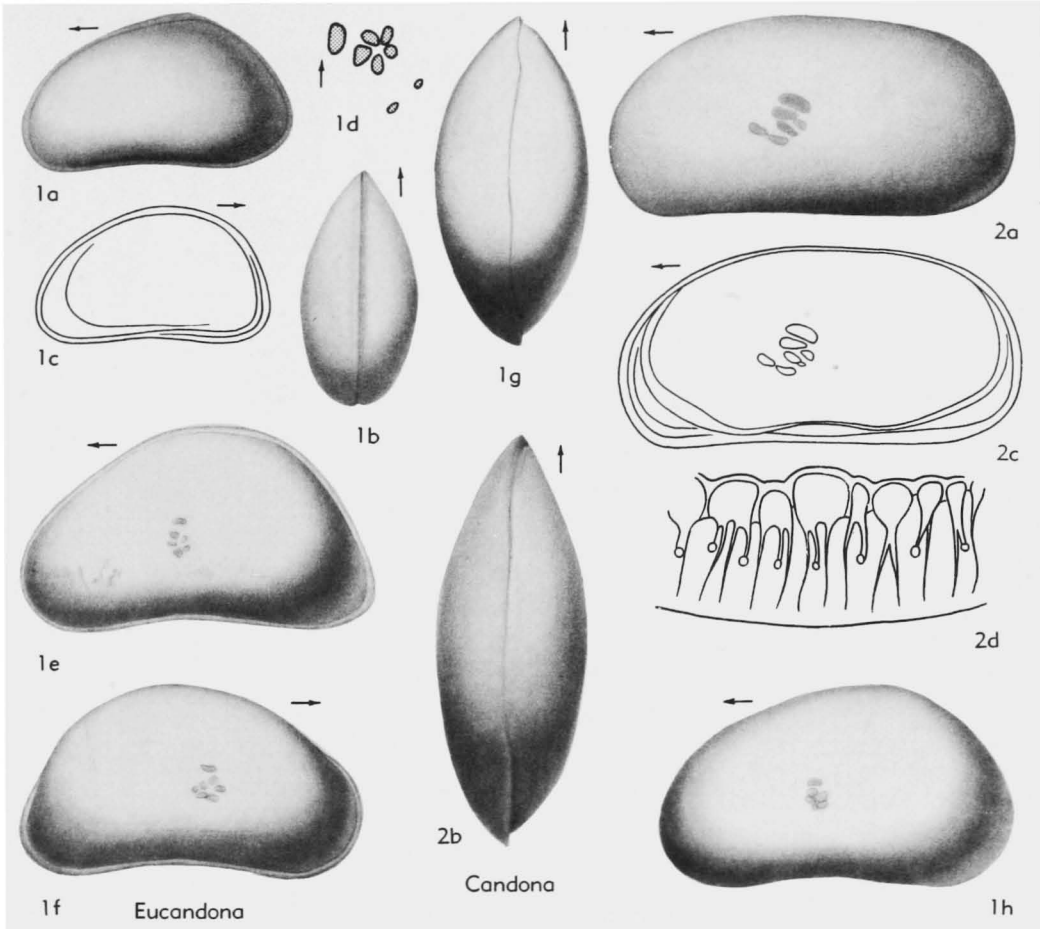

FIG. 167. Cyprididae (Candoninae), Eucandonidae (p. Q233-Q235).

Inner lamellae broadest anteriorly; radial canals few, simple, widely spaced. Males slightly larger than females, but nearly of same proportions; some species parthenogenetic (40, 68). [Fresh-water.] *?Perm., Trias.-Rec.,* cosmop.——FIG. 170, *1.* **E. balatonica* (DADAY) Rec., S.Eu.-W.Asia; *1a,* ♀ carapace L; *1b,* ♂ carapace L; both ×43 (18).——FIG. 167,*1. E. candida* (O.F.MÜLLER), Rec., Eu.; *1a,b,* ♀ carapace L, dors., ×40; *1c,* LV int., ×40; *1d,* muscle-scar pattern, ×65 (*1a-c,* 55, 1776; *1d,* 40, 1900); *1e-g,* ♀ carapace L, R, dors., ×40; *1h,* ♂ carapace L, ×40 (55).

Arunella BRADY, 1913 [**A. subsalsa*]. Differs from *Eucandona* in soft parts; appendages resemble those of *Bairdia. Rec.,* Eng.

Candocypria FURTOS, 1933 [**C. osburni*]. Differs from *Eucandona* in greater width of posterior inner lamellae. *Rec.,* N.Am.——FIG. 171,*1.* **C. osburni,* Ohio; *1a,b,* ♀ carapace L, dors.; *1c,* ♂ RV int. showing marginal area and muscle spots; all ×50 (24).

?Candoniella SCHNEIDER, 1956 [**C. suzini*]. [Status questionable, may =*Paracandona;* not to be confused with *Candonella* CLAUS, 1891 (=*Cypridopsis*)]. Carapace thin-walled, elongate oval in lateral view, height small in relation to length; LV larger than RV, anterior and posterior margin well rounded; dorsal margin straight, ventral margin convex. Surface smooth or ornamented with tiny punctae. Zone of concrescence narrow, numerous straight pore canals, vestibule in anterior part; RV hinge with sharp, straight edge; muscle-scar patterns typical of the family Cyprididae. [Fresh-water.] *Neog.,* Eu.——FIG. 172,*3.* **C. suzini,* USSR; *3a,b,* RV lat., int.; *3c,* LV int.; ×46 (50). [REYMENT.]

Candonopsis VÁVRA, 1891 [**Candona kingsleyi* BRADY & ROBERTSON, 1870] [*non Candonopsis* ALMEIDA, 1950]. More elongate and more compressed than *Eucandona;* valves subequal; inner lamellae very broad anteriorly; females relatively shorter and higher than males (68). *Rec.,* cosmop. ——FIG. 171,*2.* **C. kingsleyi* (BRADY & ROBERTSON); *2a,b,* RV int., carapace dors., ×60, ×50;

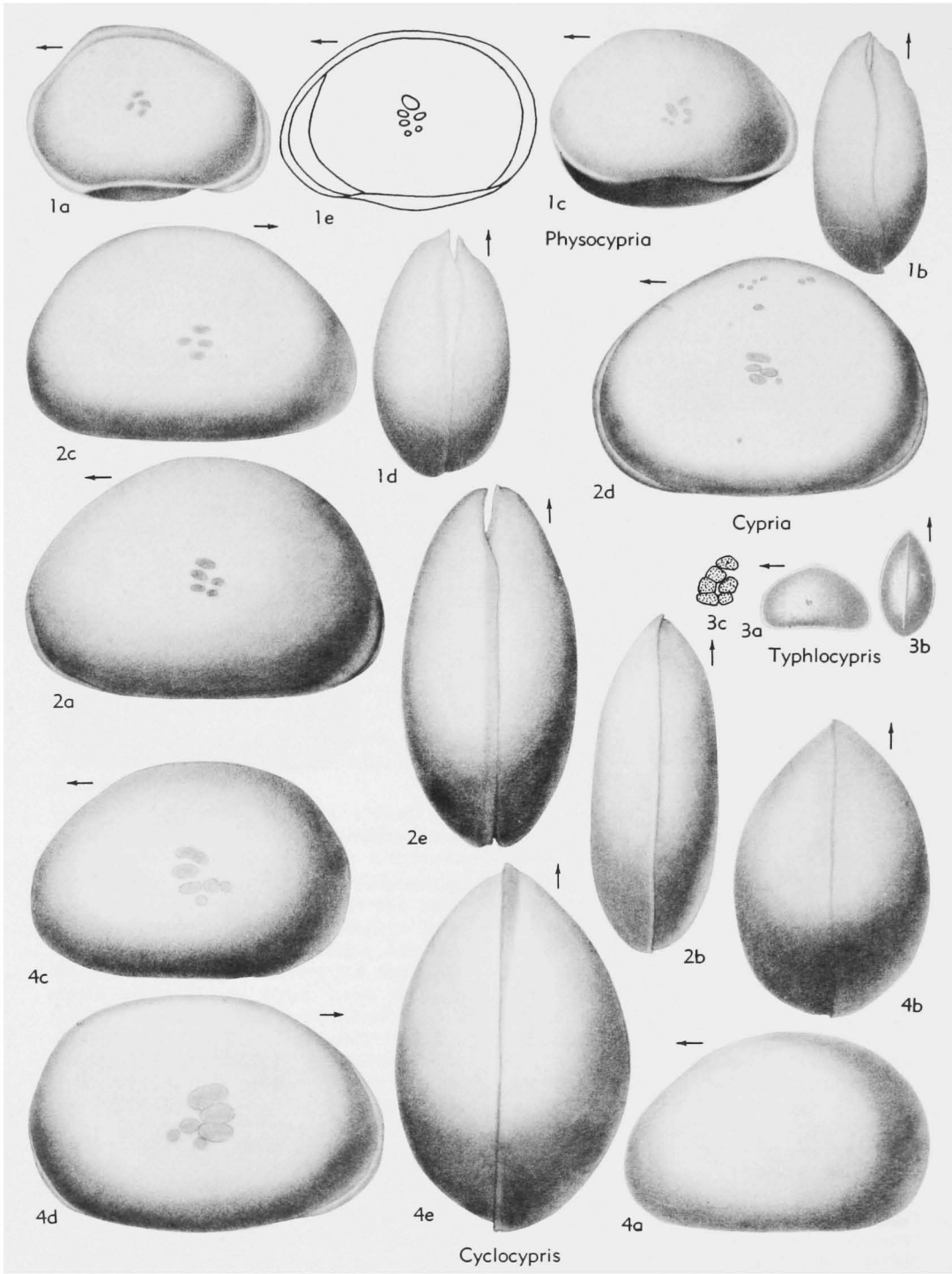

FIG. 168. Cyclocyprididae, Eucandonidae (p. Q234-Q239).

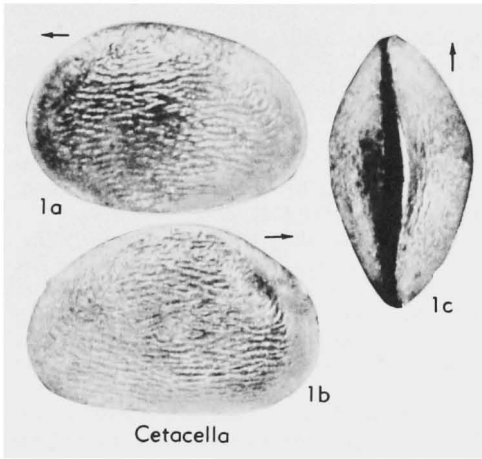

FIG. 169. Cyclocyprididae (p. Q234).

2c, muscle scar, ×110; *2d*, ♂ LV int., ×50; *2e*, ♂ carapace dors., ×50. (*2a-c*, 40; *2d,e*, 257).

Caspiollina MANDELSTAM, 1957 [**C. uschakensis*]. Carapace kidney-shaped, ends rounded, anterior lower than posterior, dorsal margin arched, ventral concave; LV overlapping along anterodorsal margin; inner lamella slightly broader than zone of concrescence, pore canals straight. *Plio.*, SW.Asia (W. Turkmenia).——FIG. 172,*4*. **C. uschakensis; 4a,b*, LV lat., RV lat., ×43 (238a).[BOLD.]

Cryptocandona KAUFMANN, 1900 [**C. vavrai*]. Small, subelliptical to subtriangular, highest medially, compressed; venter nearly straight; ends about equally rounded. Inner lamellae broad at both ends. *Rec.*, Eu.——FIG. 173,*4*. **C. vavrai; 4a,b*, RV int., carapace dors., ×40; *4c*, muscle scar, ×65 (40).

Fergania MANDELSTAM, in MANDELSTAM *et al.*, 1957 [**F. ferganensis*]. Carapace trapezoid, posterior end obliquely truncate, both ends finely denticulate; hinge in LV with groove into which sharp dorsal edge RV fits. [Fresh-water.] *L.Cret.* (Alb.), SW. Asia(Fergana).——FIG. 172,*6*. **F. ferganensis;* LV lat., ×64 (238a). [BOLD.]

Limnocypridea LYUBIMOVA, 1956 [**L. abscondida*]. Shell large, (1.2 to 1.8 mm.), thick-walled, irregularly oval or trapezoidal, with rounded cardinal angles, posterior more obtuse, maximum curvature or margin at posteroventral side of valves; LV larger than RV, overlapping it around entire periphery but chiefly along dorsal and ventral margins, dorsal overlap very strong in some species; ends nearly equal in height, both truncated above, rounded and slightly extended below; dorsal margin straight; ventral margin concave medially; RV hinge an elevated rounded ridge that widens terminally and extends a short distance down dorsal slopes; LV with corresponding groove. Surface reticulate and tuberculate on ventral part or smooth. Pore-canal zone wide, well developed terminally and ventrally; canals straight or slightly curved; inner lamellae broadest terminally. [Fresh-water.] *L.Cret.*, NE.Asia.——FIG. 174,*1*. **L. abscondida*, SE.Mongolia; *1a-c*, carapace L, R, dors., ×13; *1d,e*, LV int., RV int., ×17 (231).

Lineocypris ZALANYI, 1929 [**L. trapezoidea*]. Trapezoidal; straight dorsum with well-defined cardinal angles, venter slightly concave, anterior margin rounded, extended below and truncate above, posterior margin bluntly pointed and extended near venter, strongly truncate above; valves subequal; surface nearly smooth. Inner lamellae moderately wide anteriorly. [Fresh-water.] *Tert.*, Eu.

Liventalina SCHNEIDER in MANDELSTAM *et al.*, 1958 [**Herpetocypris dagadjikensis* MARKOVA, 1956]. Carapace elongate-ovate, narrow; dorsal margin arched, posterior end obliquely truncate and elongate; valves reticulate, especially in center; radial pore canals straight, vestibule present. *Plio.*, Aktchakyl stage; Turkmenia, Caucasus. [BOLD.]

Nannocandona EKMAN, 1950 [**N. faba*]. Like *Eucandona* but differing in soft parts. *Rec.*, Eu. (Swed.)

Pachecoia ALMEIDA, 1950 [**P. rodriguesi*]. Carapace subtriangular in lateral view, with strongly arched dorsum, somewhat resembling *Bairdia*, differing from many cypridids in having beaklike posterior termination, lateral borders nearly symmetrical in dorsal view; LV larger than RV; contact-marginal structures include narrow calcified inner lamella, posterodorsal hinge short, simple, with slight ridge in LV articulating in groove of RV; adductor muscle scar consisting of about 6 loosely-grouped elliptical spots. [Fresh-water.] [Simpler than Bairdiidae and reminiscent of the

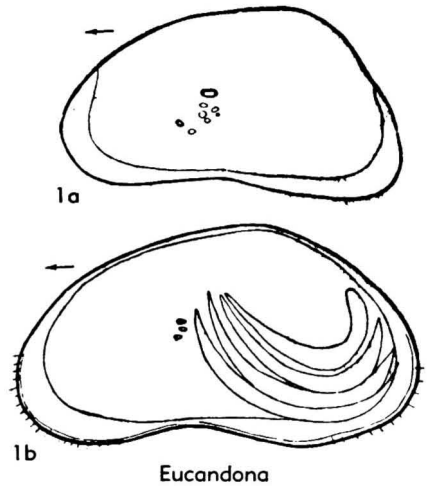

FIG. 170. Eucandonidae (p. Q235).

cypridid genus *Eucandona*.]. L.Jur., S.Am.(Braz.).——Fig. 172,*5*. **P. rodriguesi;* outline of RV int., ×20 (90). [Shaver.]

Paracandona Hartwig, 1899 [**Candona euplectella* Brady & Norman, 1889]. Elliptical, bean-shaped, tumid; dorsum nearly straight, venter slightly concave, ends broadly rounded; surface reticulate and tuberculate (24). *Rec.*, N.Am.-Eu.——Fig. 175,*3*. **P. euplectella* (Brady & Norman), Scot.; *3a,b*, carapace L, dors., ×75 (257).

Parapontoparta Hartmann, 1955 [**P. arcuata*]. Differs from *Pontoparta* in structure of appendages. [Marine.] *Rec.*, Brazil coast.

Pontoparta Vávra, 1901 [**P. rara*]. Resembles elliptical species of *Cryptocandona* but has greater convexity and much narrower inner lamellae. *Rec.*, Bismarck Arch.——Fig. 175,*2*. **P. rara; 2a,b*, ♀ carapace L, dors., ×70 (394).

Pseudocandona Kaufmann, 1900 [**Candona pubescens* Koch, 1837] [=*Metacandona* Bronstein, 1930; *?Archicandona* Bronstein, 1939]. Like *Eucandona* but smaller, with straighter hinge margin, narrower inner lamellae and pitted, reticulate, or tuberculose surface (18). *Rec.*, Eu.-Asia.——Fig. 175,*1a-d*. *P. tuberculata* Bronstein, USSR; *1a-d*, carapace L, dors., RV int., LV int., ×30 (18).——Fig. 175,*1e,f*. **P. pubescens*, USSR.; *1e,f*, carapace L, dors., ×20 (18).——Fig. 175, *1g-i*. *P. bispinosa* Bronstein (type species of *Metacandona*), USSR.; *1g,h*, ♂ carapace L, dors., ×40; *1i*, carapace L, ×40 (18).

?Riocypris Klie, 1936 [**R. uruguayensis*]. Resembles triangular species of *Cryptocandona* but has greater convexity, more compressed anterior end, larger RV, and prominent selvage ridge in RV. *Rec.*, Uruguay.——Fig. 173,*1*. **R. uruguayensis; 1a-c*, RV int., LV int., carapace dors., ×30 (218).

Siphlocandona Brady, 1910 [**Candona similis* Baird, 1845]. More elongate than *Eucandona;* dorsal margin straight or slightly arched, venter slightly concave, ends rounded, anterior slightly broader; valves equal. *Rec.*, Br.I.

Thalassocypria Hartmann, 1957 [**T. aestuarina*]. [Marine.] *Rec.*, El Salvador.

Thalassocypris Hartmann, 1955 [**T. elongata*].

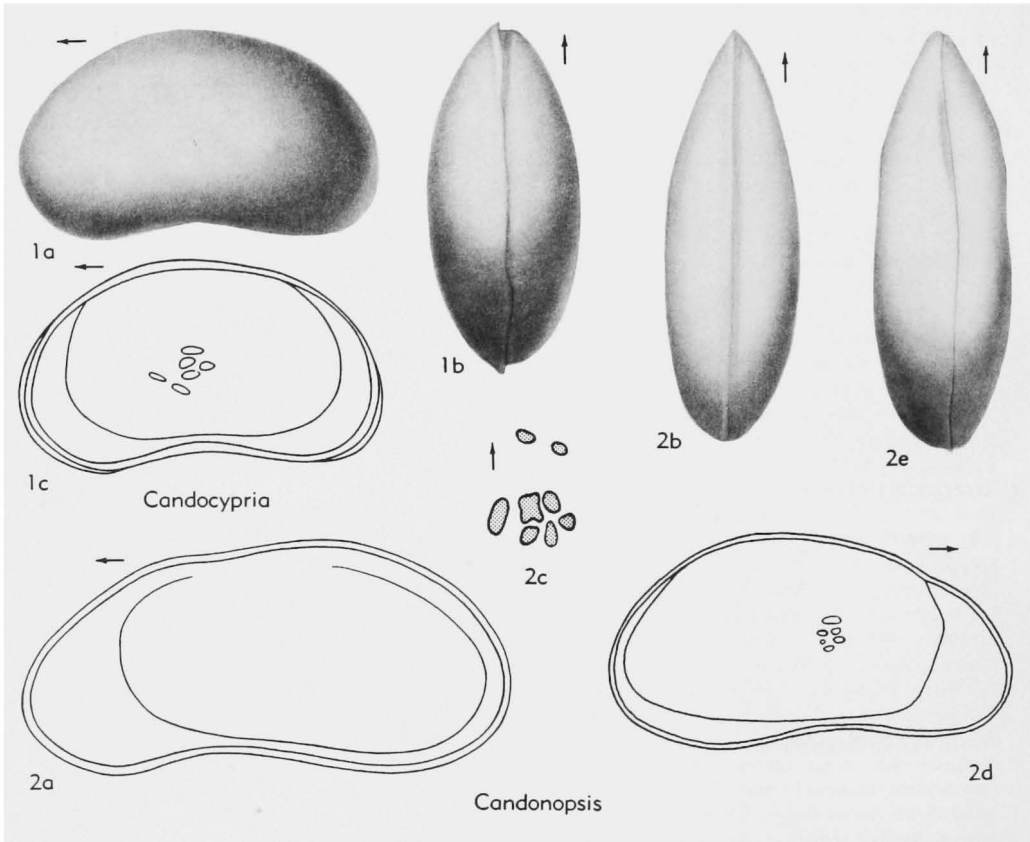

Fig. 171. Eucandonidae (p. Q235-Q237).

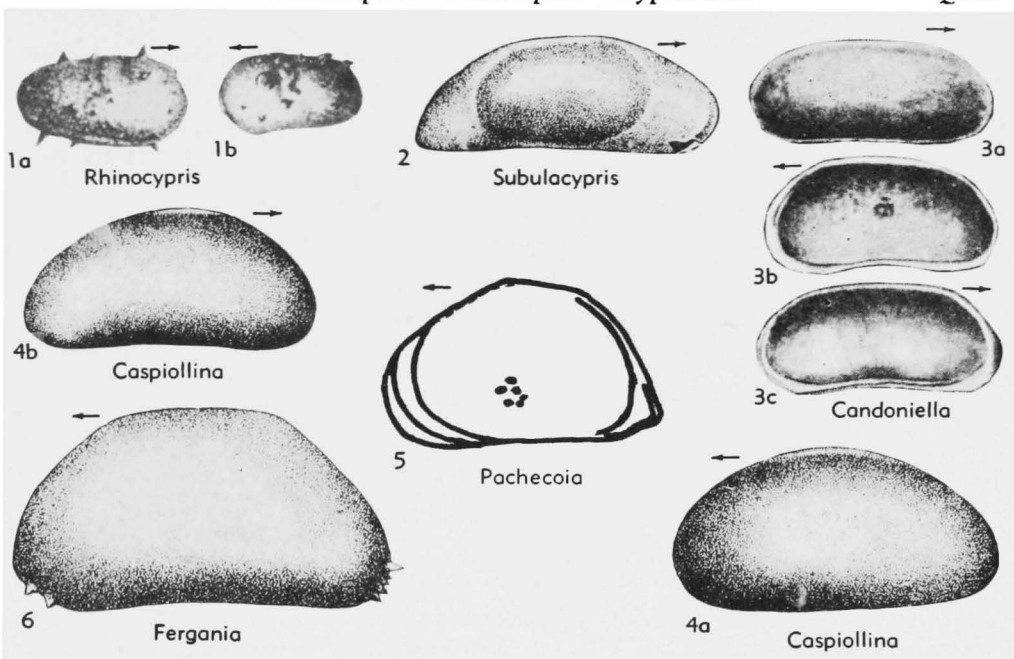

FIG. 172. Eucandonidae, Ilyocyprididae (Ilyocypridinae), Pontocyprididae (p. Q235-Q237, Q241, Q247).

Similar to *Dolerocypris* and *Dolerocypria,* but with appendages relating it to Candonidae and Eucandonidae. [Marine.] *Rec.,* Brazil coast.

Thaminocypris ZALANYI, 1944 [**T. declinata*]. *Eucandona*-like shell with straight hinge line, subacuminate ventrally, produced anterior margin; broader and bluntly angulated posterior margin, smooth surface; narrow inner lamellae; dysodont hinge. *Neog.,* Eu.——FIG. 173,2. **T. declinata; 2a-d,* carapace R, L, dors., vent., ×30 (406).

Tuberocypris SWAIN, 1947 [**T. acuminatus*]. Like *Eucandona* but with prominent median swollen area on each valve. *U.Tert.,* USA(Utah).——FIG. 173,3. **T. acuminatus; 3a-d,* RV lat., int., vent.; RV vent., all ×40 (351).

Tuberocyproides SWAIN, 1947 [**T. dipleura*]. Elongate subquadrate, convexity moderate; dorsum flattened, with hinge surface nearly straight, venter concave, anterior margin broadly rounded, truncate above, posterior margin acuminate, strongly extended ventrally; LV larger, overlapping RV along free margins, ventral half with strongly elevated ventrally projecting lobes; general surface pustulose. Inner lamellae broadest anteriorly. *U. Tert.,* N.Am.——FIG. 173,5. **T. dipleura,* USA (Utah); *5a,b,* LV lat., int., ×40 (351).

Typhlocypris VEJDOVSKY, 1882 [**Cypris eremita* VEJDOVSKY, 1880]. Similar to *Eucandona* but with antennae adapted for swimming; shell subtriangular, dorsum strongly arched, RV umbonate and extending beyond LV dorsally. Possibly close to *Pachecoia* ALMEIDA and *Bairdiocypris* KEGEL. *Rec.,* Eu.——FIG. 168,3. **T. eremita* (VEJDOVSKY); *3a,b,* carapace L, dors., ×17; *3c,* muscle scar, ×85 (391).

Family ILYOCYPRIDIDAE Kaufmann, 1900

[*nom. transl.* SWAIN, herein (*ex* Ilyocypridinae KAUFMANN, 1900] [Materials for this family prepared by F. M. SWAIN, University of Minnesota]

Shell subquadrate, compressed, thickest posteriorly, with one or more dorsomedian sulci; dorsum straight, venter straight to slightly concave, ends rounded, anterior broader; LV larger than RV; surface pitted, tuberculate or spinose. Inner lamellae rather narrow. [Fresh-water.] *Trias.-Rec. Cret.-Rec.*

Subfamily ILYOCYPRIDINAE Kaufmann, 1900

[=Jliocyprinae G.W.MÜLLER, 1900; Synopsida *(partim)* DADAY, 1900; Ilyocyprinae MASI, 1906; Eucypridae *(partim)* ALM, 1915; Ilyocyprides SARS, 1925]

Shell without anteroventral marginal notch and with soft parts as prescribed (KAUFMANN, 1900) for Ilyocypridinae. *?Trias., U.Jur.-Rec.*

Ilyocypris BRADY & NORMAN, 1889 [**Cypris gibba* RAMDOHR, 1808] [=*Jliocypris* MÜLLER, 1900; *Iliocypris* DADAY, 1900; *Ilyocyprois* MASI, 1906]. Elongate, subquadrate, compressed, bisulcate; with marginal compressed rim; surface pitted, pustulose

or tuberculate; dimorphic posterior thickening in females. *?Trias., Rec.,* cosmop.——Fig. 176,*1*. **I. gibba* (Ramdohr), *Rec.,* N.Eu.-N.Am.; *1a,b,* carapace L, dors., ×60; *1c,* LV int., ×60 (82).

Cyprideamorphella Mandelstam, 1956 [**C. tarbagataiensis*]. Kidney-shaped, thick-walled, oval with maximum height in anterior third, length about 1.3 mm.; RV larger than LV; both ends broadly rounded, anterior end higher; dorsal margin straight, ventral slightly concave; surface pitted and with one or more submarginal ridges; adductor muscle scars large; RV hinge an elongate groove, enlarged at anterior end; that of LV a corresponding bar with anterior expanded part. [Fresh-water.] *L.Cret.,* NE.Asia.——Fig. 176,*2*. **C. tarbagataiensis,* E.Transbaikalia; *2a,* carapace L; *2b,c,* hinge of RV and LV; all ×27 (50).

Iliocyprella Daday, 1900 [**Ilyocypris bradyi* var.

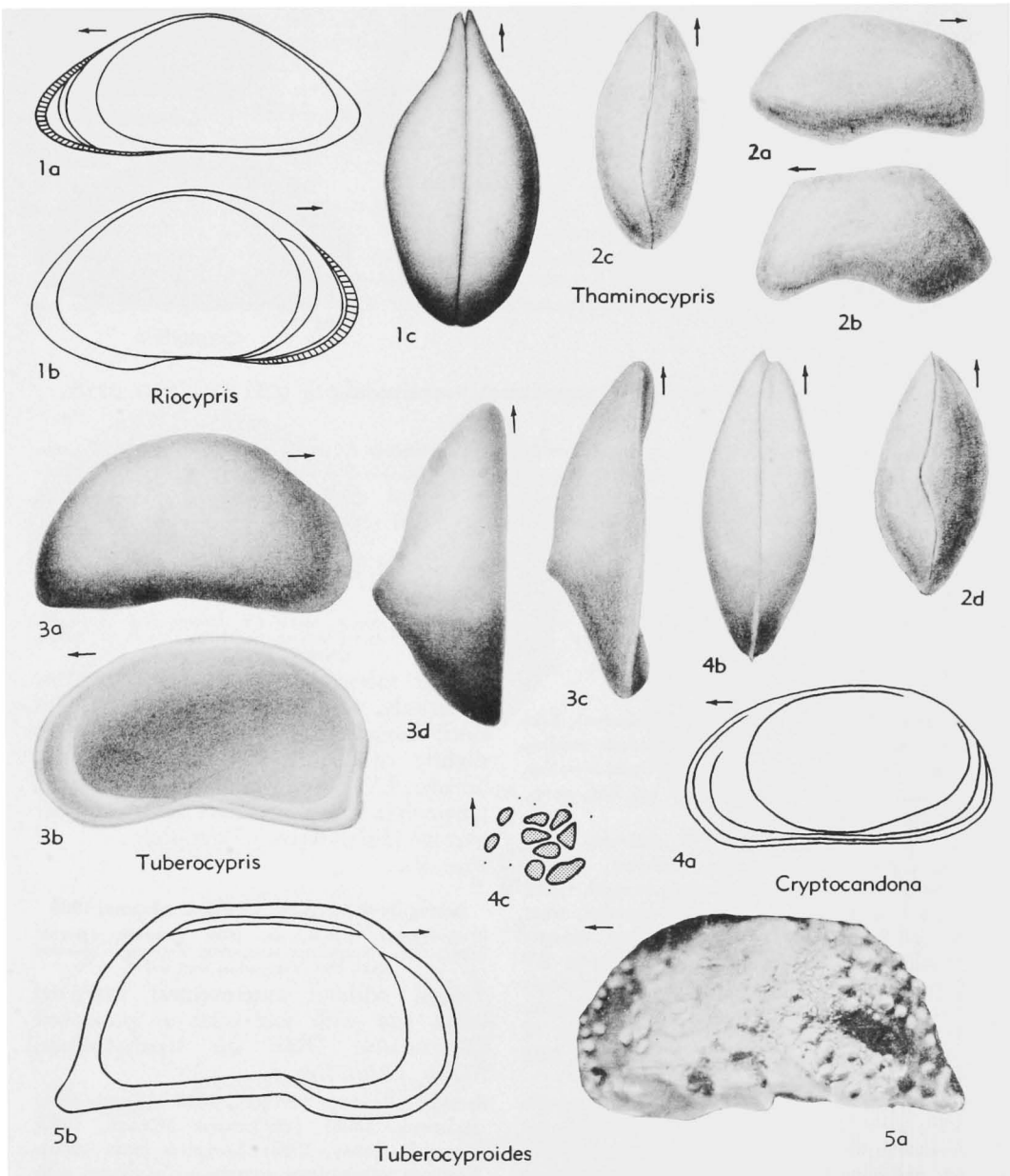

Fig. 173. Eucandonidae (p. *Q237-Q239*).

repons VÁVRA, 1891] [=*Ilyocyprella* SARS, 1925]. Differs from *Ilyocypris* in soft parts and lack of swimming power. *Rec.*, Eu.-Asia M.

Ilyocyprimorpha MANDELSTAM, 1956 [**I. palustris*]. Thick-walled, about 0.9 mm. in length, each valve with single obscure, wide, transverse median concavity or sulcus; RV larger than LV; anterior end higher than posterior; ends rounded; dorsal margin fairly straight; ventral margin slightly concave medially; surface with massive spines and weak reticulations; RV hinge consisting of anterior elongate broad groove at site of cardinal angle followed by median and posterior narrow groove; LV hinge an anterior flangelike tooth passing backward into narrow bar thickened at posterior end. Inner lamellae present terminally; pore canals few, narrow and straight; muscle scar a medial group of 4 or more spots plus one or more additional anteroventral spots. [Fresh-water.] *L.Cret.*, NE.Asia(S.Transbaikalia-Mongolia).——FIG. 176, *3. *I. palustris*, Transbaikalia; *3a,b*, LV lat., LV int.; *3c,d*, hinge of LV and RV; all ×43 (50).

Pelocypris KLIE, 1939 [**P. lenzil*]. Subquadrate; dorsum sinuous, with anterior high shoulder and medium dorsal depression, venter nearly straight; terminal margins spinose; dimorphic posterior thickening in females. *Pleist.-Rec.*, C.Am.——FIG. 176,*4a-d*. **P. lenzi; 4a,b*, ♀ carapace L, dors.; *4c*, ♂ RV int.; *4d*, ♂ LV dors.; all ×30 (215a). ——FIG. 176,*4e-i*. *P. zilchi* TRIEBEL, Pleist., C.Am. (El Salvador); *4e*, ♂ LV lat.; *4f-i*, ♀ RV lat., int., vent., dors.; all ×40 (82).

Rhinocypris ANDERSON, 1940 [**Ilyocypris jurassica* MARTIN, 1940; SD SYLVESTER-BRADLEY, herein] [=*Origoilyocypris* MANDELSTAM, 1956]. Carapace very small, ovoid; shell thin; LV slightly larger than RV; internally a narrow shelf of uniform width all round except dorsally; shallow groove extending from middle of dorsal margin almost to center of each valve with smaller groove anterior to this, carapace widest in front. Hinge simple, knurled anteriorly and flexed to right posteriorly; slight overlap of LV over RV on all margins except dorsally, greatest ventrally; ventral margin slightly concave; surface covered with minute closely arranged blunt spines or pustules of uniform size. RV hinge on elevated ?smooth ridge. [Fresh-water.] *U.Jur.-L.Cret.*, W.Eu.-SW. Asia(Caspian).——FIG. 159,*1*. *R. cirrita* MANDELSTAM, L.Cret.; *1a,b*, carapace L, dors., ×20; *1c,d*, LV int., RV int., ×65 (50).——FIG. 172,*1*. **R. jurassica*, U.Jur. or L.Cret., Eng.; *1a,b*, carapace R, L, ×55 (50).

Subfamily CYPRIDEINAE Martin, 1940

[=Rostrocyprinae ANDERSON, 1939 (invalid, lacking nominotypical genus)]

Shell subquadrate, compressed to moderately convex; dorsum nearly straight, venter slightly sinuate, converging posteriorly with dorsum; valves more or less unequal, each bearing anteroventral marginal notch and in typical forms ventral projection known as beak; surface smooth, pitted, pustulose, or weakly sulcate; hinge margin of larger valve grooved, with socket-like terminal, depressions commonly crenulate. [Fresh-water.] *Trias.-L.Cret.*

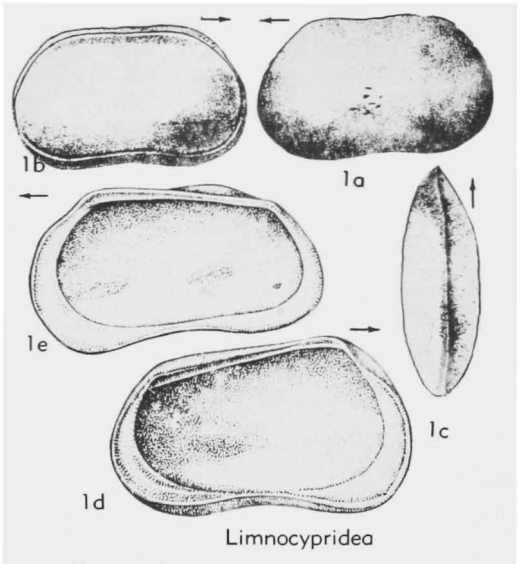

FIG. 174. Eucandonidae (p. Q237).

Cypridea BOSQUET, 1852 [**Cypris granulosa* SOWERBY, 1836; SD SYLVESTER-BRADLEY, 1947] [=*Dsunbaina* GALEEVA, 1955]. *M.Jur.-L.Cret.*, Eu.-N.Am.-S.Am.-Afr.-Japan.

C. (Cypridea). LV larger than RV; surface punctate or reticulate, with or without granules, tubercles, or spines. *U.Jur.-L.Cret.*, Eu.-N.Am.-S.Am. ——FIG. 177,*1a-d*. **C. (C.) granulosa* (SOWERBY), Jur., Eng.; *1a,b*, carapace L, R; *1c,d*, LV dors., RV dors.; all ×40 (79).——FIG. 177, *1e,f*. *C. (C.) propuncta* SYLVESTER-BRADLEY, Jur., Eng.; *1e,f*, LV int., RV int., ×50 (79).——FIG. 178,*1*. *C. (C.) wyomingensis* JONES, L.Cret. (Draney F.), USA(Idaho); *1a*, LV lat.; *1b-d*, carapace R, dors., vent., all ×35 (200).

C. (Cyamocypris) ANDERSON, 1939 [**Cypris valdensis* FITTON, 1836]. Large thin shell with exaggerated selvage. *U.Jur.*, Eu.——FIG. 177,*3a-c*. *C. (C.) tumescens* (ANDERSON), L.Cret., Eng.; *3a,b*, carapace R, L; *3c*, LV int.; all ×40 (*3a,b*, 91; *3c*, 79).——FIG. 177,*3d-f*. **C. (C.) valdensis* (FITTON), Eng.; *3d-f*, carapace L, R, vent., ×40 (51).

C. (Morinina) ANDERSON, 1939 [**M. dorsispinata*]. Distinguished by dorsal sulcus, large scattered normal canals, and smooth surface.*L.Cret.*,

Eu.——Fig. 179,*3*. **C. (M.) dorsispinata* (Anderson), L.Cret., Eng.; *3a-d*, carapace R, L, dors., vent., ×60 (91).

C. (Paracypridea) Swain, 1946 [**C. (P.) obovata*]. Like *C. (Cypridea)* but greatest height in postmedian position and RV overlapping LV. *U.Jur.* or *L.Cret.*, Brazil.——Fig. 177,*2*. **C. (P.) obvata; 2a,b*, LV (paratype) lat., LV (holotype) int., ×30; *2c*, LV lat., showing muscle-scar pattern, ×30 (350).

C. (Pseudocypridina) Roth, 1933 [**P. piedmonti*] [=*Langtonia* Anderson, 1939]. LV larger than RV; beak much reduced and notch very slight or absent; ornamentation weak or absent (79). *U.Jur.*, Eu.-N.Am.-S.Am.——Fig. 179,*1*. **C. (P.) piedmonti*, Brazil; *1a-c*, carapace L, dors., vent., ×30 (350).

C. (Ulwellia) Anderson, 1939 [**U. menevensis*]. Distinguished by reversal of valve overlap. *U.Jur.-L.Cret.*, Eu.——Fig. 179,*2*. **C. (U.) menevensis*

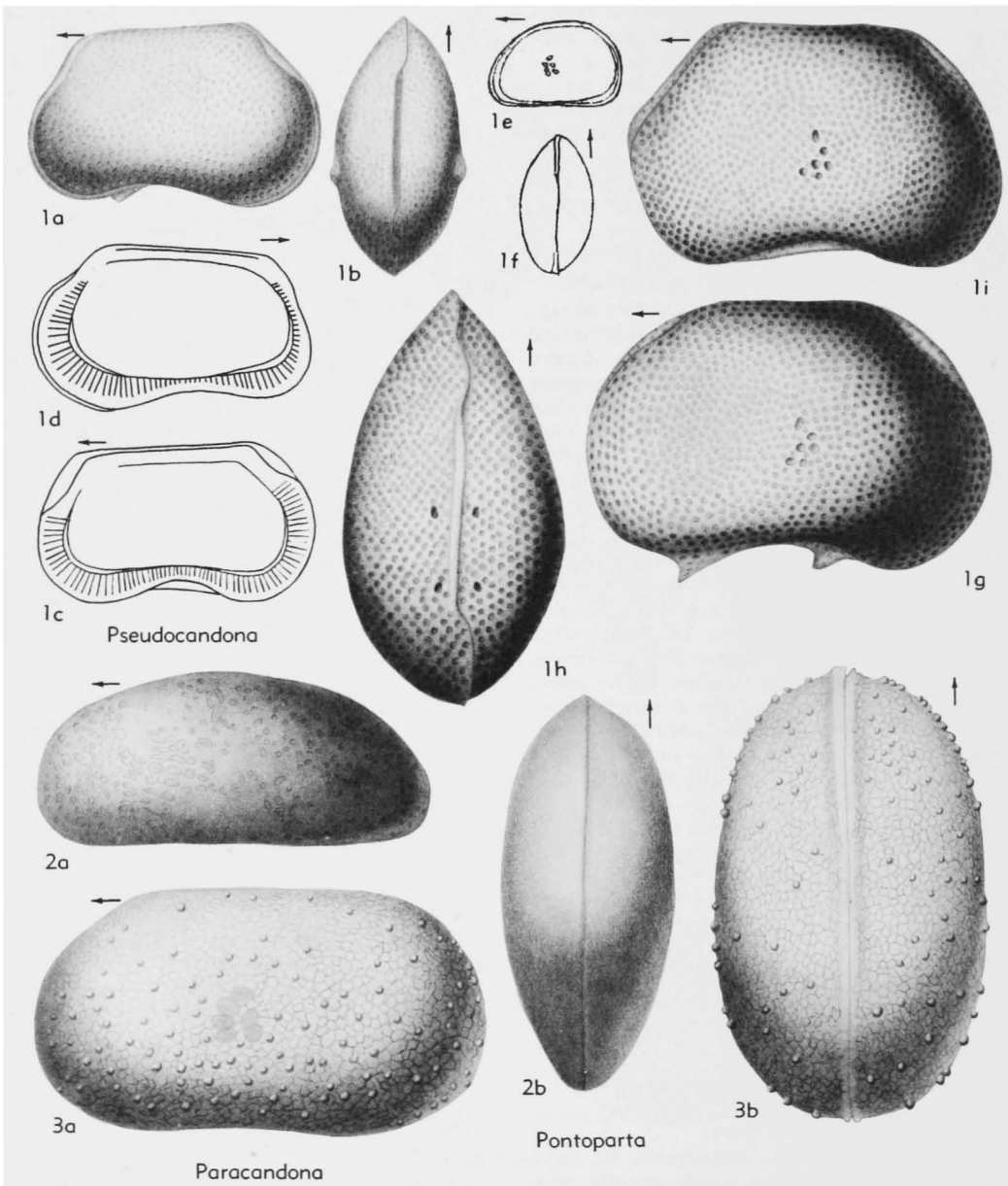

Fig. 175. Eucandonidae (p. *Q238*).

Jur., Eng.; *2a-d*, carapace R, L, dors., vent., ×50 (91).

C. (Yumenia) Hou, 1958 [*Y. *oriformis*]. Like *C. (Cypridea)* in shape, overlap, and anteroventral marginal sinuosity, but lacks anteroventral beak and notch. *L.Cret.*, Yumen Dist., Kansu. [Hanai.]

Cultella Lyubimova, 1959 [*C. *daedala*]. Medium-sized (0.85 mm.) thin-walled, irregularly oval, uniformly convex or with a small median to dorso-median swelling; LV larger than RV, slightly

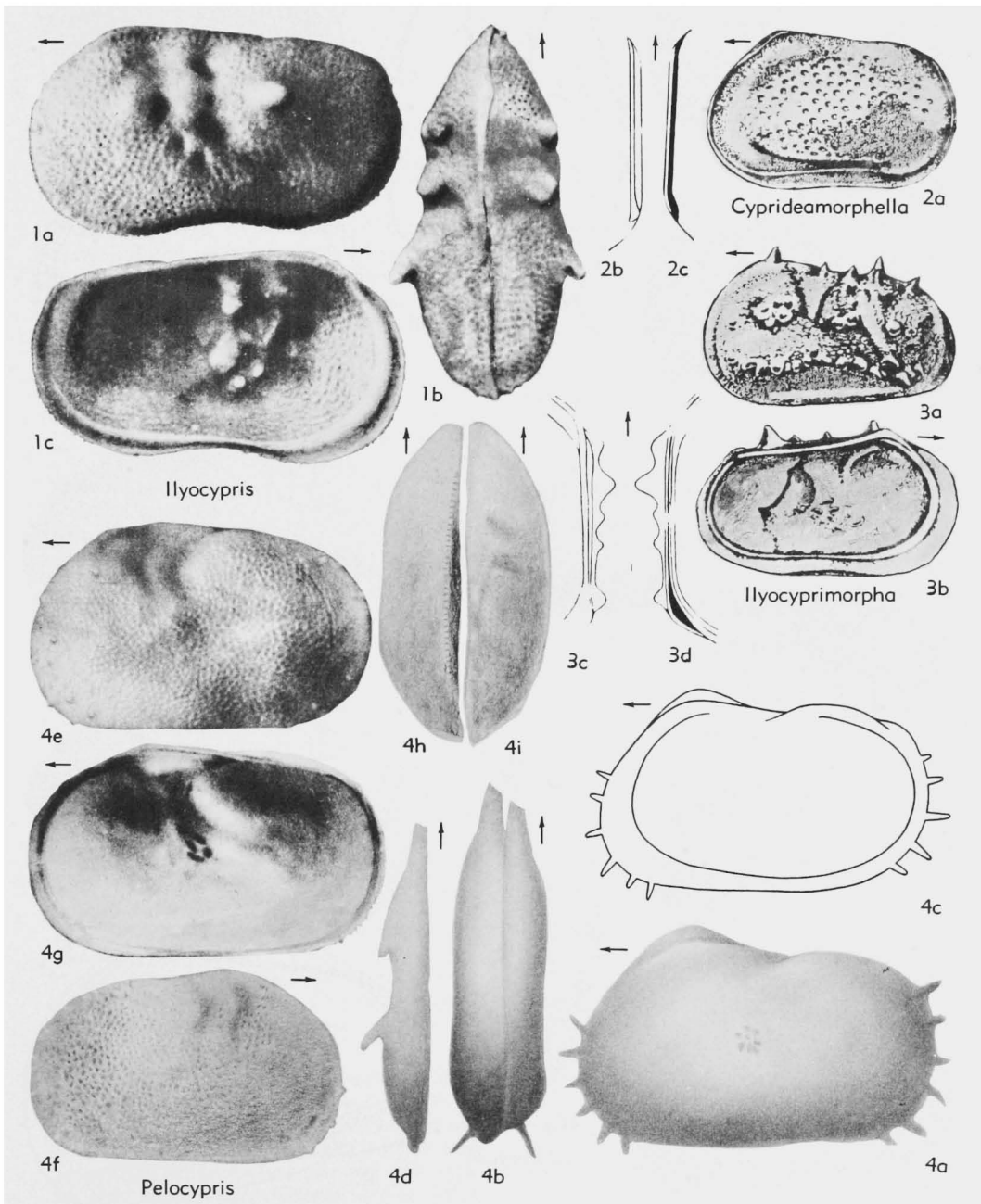

Fig. 176. Ilyocyprididae (Ilyocypridinae) (p. Q239-Q241).

overreaching RV along dorsal and ventral edges; terminal margins not of same height; anterior high, strongly truncated above, evenly rounded below; posterior end considerably lower and evenly rounded; dorsal margin straight and inclined toward posterior end; ventral margin straight or

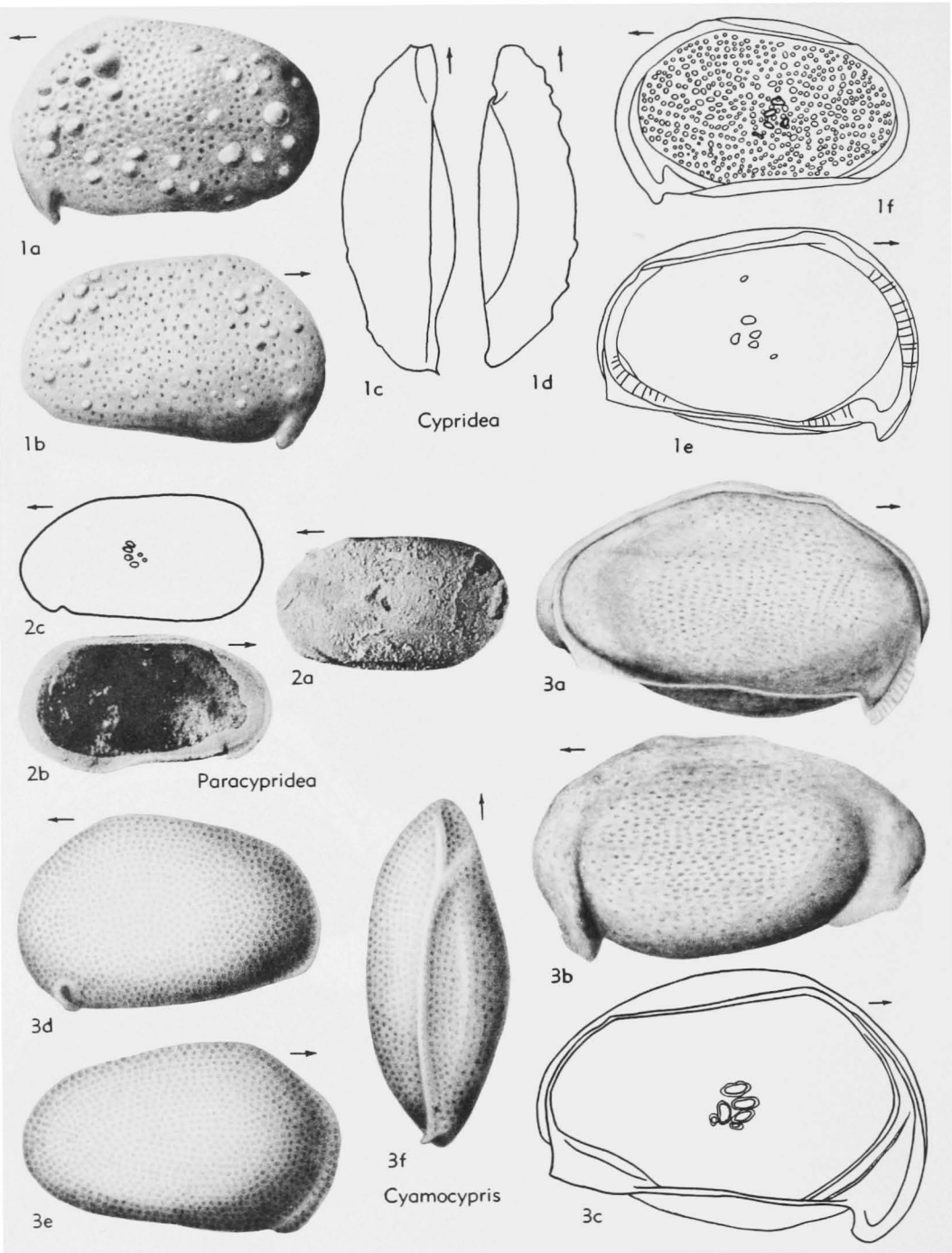

FIG. 177. Ilyocyprididae (Cyprideinae) (p. Q241-Q242).

slightly concave medially, with ends joined smoothly, valves pitted. Hinge consisting of groove in LV and corresponding projecting edge of RV; hinge groove of LV without terminal broadened portions of *Limnocypridea* and simpler than in *Cypridea*. *Trias.*, USSR(Tschelabinski Basin, Zatetschenski region).——FIG. 179A,*1*. **C. daedala;* RV lat., ×50 (231a).

Family NOTODROMADIDAE Kaufmann, 1900

[*nom. transl.* SWAIN, herein (*ex* Notodromadinae KAUFMANN, 1900] [=Zygopsida *(partim)* DADAY, 1900; Notodromides SARS, 1925; Notodrominae HOFF, 1942; Notodromini BRONSTEIN, 1947] [Materials for this family prepared by F. M. SWAIN, University of Minnesota]

Carapace small to medium in size, subovate, inflated, with arched dorsum, flattened carinate venter and rounded ends; valves subequal; surface smooth or pustulose; prominent anterodorsal eye spots. Inner lamellae broadest anteriorly. [Freshwater.] *Paleoc.-Rec.*

Notodromas LILJEBORG, 1853 [**Cypris monacha* O.F.MÜLLER, 1776]. Similar to *Newnhamia* but with surface smooth except for ventral keels; female smaller than male, with flattened venter and typically with posteroventral short spine; male with venter angulated behind mid-length and lacking posteroventral spine (68). *Rec.*, Eu.-Asia-E.Indies-N.Am.——FIG. 180,*1*. **N. monachus* (O.F.MÜLLER), Eu.; *1a-c*. ♀ carapace L, dors., vent., ×40; *1d*, ♂ carapace R, ×40; *1e,f*, ♀ carapace L, vent., ×40; *1g,h*, ♂ carapace L, dors., ×40; *1i*, LV int. ant. part, ×80 (*1a-d*, 314; *1e-i*, 55).

Cyprois ZENKER, 1854 [**Cypris marginata* STRAUSS, 1821]. Subovate, moderately convex; dorsum strongly arched, flattened on anterior slope, venter slightly concave, front margin broadly rounded but rear bluntly pointed, extended below; anterior and ventral marginal areas compressed; LV slightly larger than RV; surface smooth. Inner lamellae broad anteriorly; radial canals numerous toward front, fewer at rear (68). [Fresh-water.] *Paleoc.-Rec.*, Eu.-N.Am.——FIG. 152,*4*. **C. marginata* (STRAUSS), Rec., Eu.; *4a,b*, LV lat., RV int., ×30 (Sars, 1925); *4c*, muscle-scar pattern, ×50 (40); *4d-e*, ♀ and ♂ carapace L, ×30; *4f*, ♂ carapace dors.; ×30; *4g*, ♀ LV int. ant. margin, ×60 (256).

Newnhamia KING, 1855 [**N. fenestrata*]. Small, subovate, strongly convex, thickest posteriorly; venter flattened and somewhat depressed, with boatshaped keel; free edges with narrow compressed rim; surface coarsely pustulose. Male smaller than female. *Rec.*, S.Hemis.——FIG. 180,*2*. **N. fenestrata*, Austral.; *2a-c*, ♀ carapace L, dors., vent., ×70 (392).

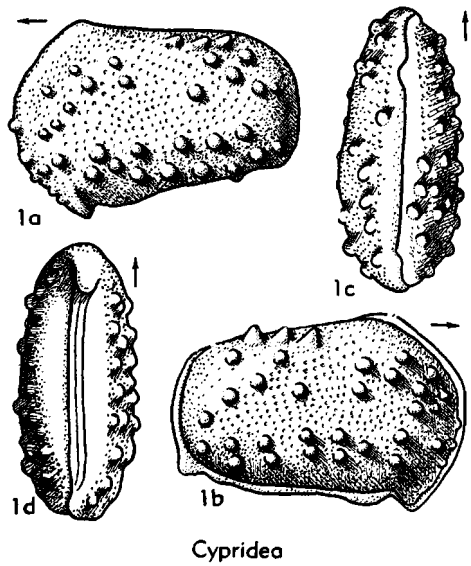

FIG. 178. Ilyocyprididae (Cyprideinae) (p. Q241).

Family PARACYPRIDIDAE Sars, 1923

[*nom. transl.* SWAIN, herein (*ex* Paracyprides SARS, 1923)] [Materials for this family prepared by F. M. SWAIN, University of Minnesota] [Includes Aglaiocyprinae (*recte* Aglaiocypridinae) SCHNEIDER, 1960]

Smooth, elongate, with wide duplicature, large anterior and posterior vestibules, and radial pore canals commonly branched. [Marine and fresh-water.] *?Sil., Jur.-Rec.*

Paracypris SARS, 1866 [**P. polita*]. Elongated, wedge-shaped, tapering to pointed-posterior; LV larger than RV, very broad inner lamellae, bifurcating radial pore canals. Shape resembles that of *Macrocypris* but carapace is smaller, dorsum less convex, and muscle-scar spots fewer. [Marine.] *?Sil., Jur.-Rec.*, cosmop.——FIG. 181,*1*. **P. polita, Rec.*, Norway; *1a,b*, ♀ carapace L, dors., ×40; *1c*, ♀ LV int., ×40; *1d*, muscle scar, ×120 (314).

Aglaiella DADAY, 1910 [**A. stagnalis*]. Differs from *Aglaiocypris* in soft parts. Radial pore canals branched. [Brackish-water.] *Rec.*, Egypt.—FIG. 181,*2*. **A. stagnalis; 2a,b*, ♀ carapace L, dors., ×50; *2c,d*, RV int., anteroventral margin, LV ext., posterior margin, ×200 (137).

Aglaiocypris SYLVESTER-BRADLEY, 1946 [1947] [**Aglaia pulchella* BRADY, 1868] [=*Aglaia* BRADY, 1868 (*non* RENIER,, 1804)]. Shell subelliptical in lateral view, highest medially; dorsal margin slightly convex, ventral margin straight to gently concave, ends broadly and nearly equally rounded, slightly extended below mid-height; valves subequal, with low convexity, greatest thickness median; surface smooth. Muscle scar a rosette group of several spots; inner lamellae moderate in

width, broadest anteriorly (15). [Marine, shallow-water.] *Rec.*, N.Atl.——FIG. 181,*3a,b*. **A. pulchella; 3a,b,* carapace L, dors., ×30 (12).——FIG. 181,*3c-e*. *A. complanata* (BRADY & ROBERTSON); *3c-e,* RV int., carapace dors., LV and RV dors., ×80 (53).

Paracypria SARS, 1910 [**Paracypris tenuis* SARS, 1905]. Carapace like *Paracypris,* but with terminal LV overreach. [Brackish- and fresh-water.] *Tert.-Rec.,* Eu.-Afr.-Chatham I.——FIG. 181,*4*. **P. tenuis,* Rec., Chatham I.; *4a-c,* carapace L, dors., RV int., ×75 (310).

Phlyctenophora BRADY, 1880 [**P. zealandica*]. Differs from *Paracypris* in soft parts. [Marine.] *Rec.,* S.Pac.

Pontocyprella LYUBIMOVA, 1955 [**Bairdia harrisiana* JONES, 1849]. Small kidney-shaped, with thickened valves, LV overlapping RV; length about 1 mm.; anterior end rounded, extended and angulated above; presumed posterior end narrower, somewhat extended below; dorsal margin convex; ventral margin straight to slightly concave; LV hinge a closed groove with pronounced overhang above; RV hinge formed of knifelike valve edge. Inner lamellae scarcely developed anteriorly, absent elsewhere; pore-canal zone rather broad, with straight, closely spaced canals. *Jur.-Paleog.,* C.Asia-W.Eu.-E.Eu.——FIG. 181,*5a,b*. **P. harrisiana* (JONES), Cret., Eng.; *5a,b,* carapace L, R, ×40 (37).——FIG. 181,*5c,d*. *P. aktagensis* MANDELSTAM, L.Cret., C.Asia; *5c,d,* carapace R lat., dors., ×30 (50).

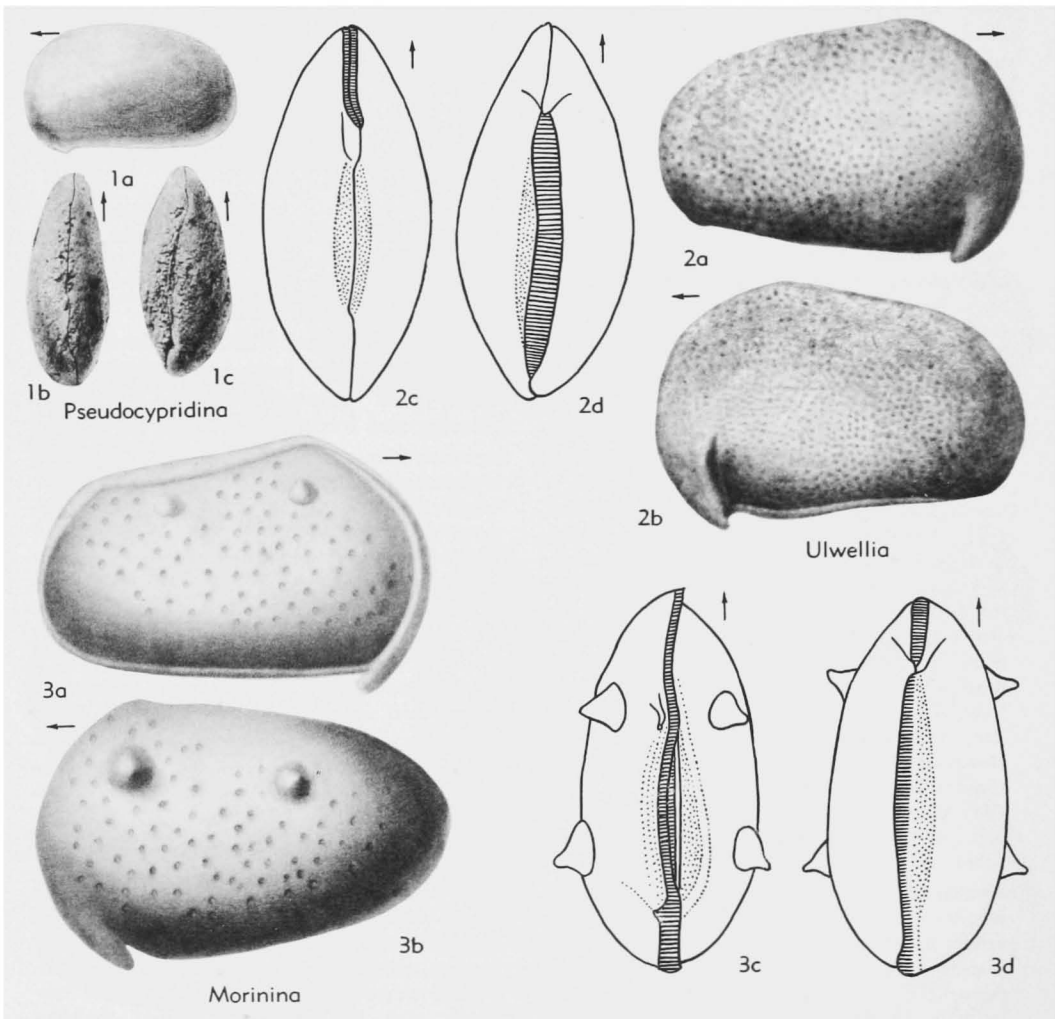

FIG. 179. Ilyocyprididae (Cyprideinae) (p. Q241-Q243).

Family PONTOCYPRIDIDAE G. W. Müller, 1894

[*nom. transl.* SWAIN, herein (*ex* Pontocypridinae, *nom. correct* KAUFMANN, 1900, *pro* Pontocyprinae G.W.MÜLLER, 1894)] [=Pontocypridae ALM, 1915] [Materials for this family prepared by F. M. SWAIN, University of Minnesota, with assistance on some genera by W. A. VAN DEN BOLD, Louisiana State University] [Includes Argilloeciinae, Clinocyprinae (*recte* Clinocypridinae) MANDELSTAM, 1960]

Shell elongate; dorsum arched; ventral border nearly straight; posterior end generally more pointed than anterior; valves nearly equal; typically smooth. *?Dev., Trias.-Rec.*

Pontocypris SARS, 1866 [**Cypris serrulata* SARS, 1863; SD BRADY & NORMAN, 1889 (=*Cythere (Bairdia) mytiloides* NORMAN, 1862)] [=*?Cytheropsis* MCCOY, 1849 (*non* SARS, 1866); *Erythrocypris* G.W.MÜLLER, 1894]. Medium size; elongate-acuminate, compressed, thickest anteromedially; dorsum arched, angulated in front of middle; posterior end strongly extended ventral to mid-height, acuminately pointed; valves subequal; surface smooth; posteroventral margin of RV serrate. Inner lamellae broad; muscle scar with few spots, forming a compact group. *?Dev., Rec.*, cosmop.——FIG. 182,*2*. **P. mytiloides, Rec.*, N. Atl., *2a,b*, ♀ carapace L, dors.; *2c,d*, ♂ LV lat., int.; all ×50 (*2a,b*, 65; *2c,d*, 67).

Argilloecia SARS, 1866 [**A. cylindrica*] [=*Argillaecia* BRADY, 1870]. Subelliptical, nearly cylindrical in cross section; mid-portion of shell somewhat flattened; posterior margin truncated; RV slightly larger than LV; inner lamellae typically very broad. Sexual dimorphism marked, males much smaller and more elongated than females. *Cret.-Rec.*, cosmop.——FIG. 182,*1*. **A. cylindrica;* Rec., Norway; *1a,b*, ♀ LV lat., int.; *1c*, ♀ carapace dors.; *1d*, ♂ LV lat.; all ×70 (65).

Bakunella SCHNEIDER in MANDELSTAM *et al.*, 1958 [**Pontocypris dorsoarcuata* ZALANYI, 1929]. Carapace irregularly pyriform, swollen, with posterior end pointed ventrally, truncate in upper part, dorsal margin arched, ventral margin concave, anterior end rounded. Inner lamella 4 times broader than zone of concrescence. *Plio.-Pleist.*, SE.Eu., SW.Asia. [BOLD.]

Clinocypris MANDELSTAM, 1956 [**C. scolia*]. Shell elongate, subreniform or lanceolate, length about 0.9 mm., height 0.4 mm.; LV larger than RV; anterior end high and broadly rounded, posterior pointed and strongly extended below; dorsal margin curved, most convex in anterior third, ventral nearly straight, slightly concave; surface smooth or pitted; RV hinge consisting of narrowed valve edge that fits over benchlike margin of LV. Inner lamellae equally wide at both ends; pore-canal zone narrow, with numerous canals. [Freshwater.] *Trias.-L.Cret.*, SW.Asia(Caspian)-NE.Asia (Dzungaria-Mongolia).——FIG. 182,*3*. **C. scolia*, L.Cret., Dzungaria; RV lat., ×27 (50).

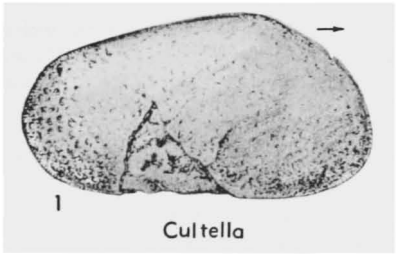

FIG. 179A. Ilyocyprididae (Cyprideinae) (p. Q243-Q245).

Pontocypria G.W.MÜLLER, 1894 [**P. spinosa*]. Like *Pontocypris*, but more equal-ended and with more convex ventral border; surface pustulose. Muscle scar a circlet of spots around central spot, as in *Bairdia*. *Rec.*, Medit.——FIG. 182,*4*. **P. spinosa; 4a,b*, carapace L, dors., ×120 (53).

Propontocypris SYLVESTER-BRADLEY, 1947 [**Pontocypris trigonella* SARS, 1866]. Shell like *Pontocypris*, but less elongate, and less acuminate posteriorly, and less angulated dorsally; posteroventral margin of RV not serrate. *Pleist.-Rec.*, Atl.-Medit. ——FIG. 182,*5*. **P. trigonella*, Rec., N.Atl.; *5a,b*, ♀ carapace L, dors.; *5c*, ♂ RV lat.; all ×100 (65).

Subulacypris SCHNEIDER in MANDELSTAM *et al.*, 1957 [**S. subtilis*]. Carapace elongate, not high, irregularly triangular; dorsal margin arched, especially at 0.3 from anterior end, posterior drawn out ventrally, zone of concrescence narrow, with straight pore canals, inner lamella 3 or 4 times broader; hinge with ridge in RV, groove in LV. Surface smooth. Close to *Clinocypris* but with broader inner lamella in both ends. *Plio.*, E.Asia (N.China).——FIG. 172,*2*. **S. subtilis;* RV lat., ×63 (238a). [BOLD.]

CYPRIDACEA, Family UNCERTAIN

[Materials for this section prepared by F. M. SWAIN, University of Minnesota]

Camdenidea SWAIN, 1953 [**C. camdenensis*]. Subtriangular, valves inflated; LV larger than RV; dorsal margin strongly convex, venter concave medially, ends narrowly rounded, extended below, posterior extremity pointed; surface smooth. Hinge straight, short, consisting of ridge and groove; shell with terminal compressed marginal zones; inner lamellae broadest ventrally; mid-ventral margin turned inward; muscle scar large, medially located, consisting of sinuous small spots. [With *Ranapeltis* perhaps represents an early link between Cyprididae and Bairdiidae. Marine.] *Dev.*, N.Am.——FIG. 182A,*2*. **C. camdenensis*, USA (Tenn.); *2a,b*, R lat., L int., ×30 (Swain, n). [SWAIN.]

Carbonita STRAND, 1928 [*pro Carbonia* JONES, 1870 (*non* ROBINEAU-DESVOIDY, 1863)] [**Carbonia*

agnes JONES, 1870]. Small, elongate, subquadrate, moderately convex, thickest posteriorly; hinge margin straight to slightly convex; venter slightly sinuous, ends rounded, anterior margin slightly narrower; small raised ridge near anteroventral margin; RV overlapping LV along free margins

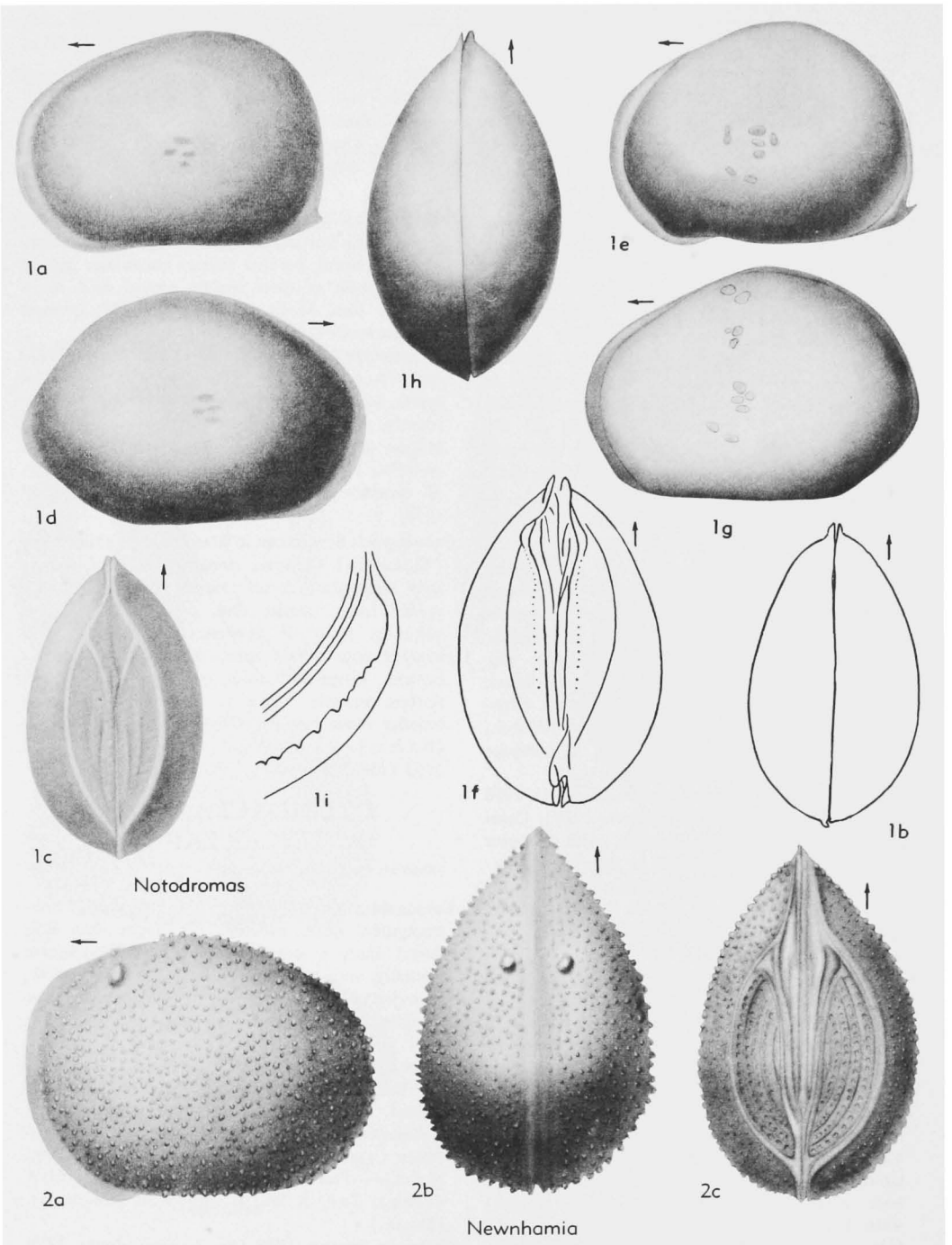

FIG. 180. Notodromadidae (p. Q245).

but LV extending slightly beyond RV dorsally; surface smooth or pitted. [Fresh-water, ?marine.] *?L.Carb., Penn.(U.Carb.)-Perm.,* Eu.-N.Am.——

FIG. 182A,*3*. **C. agnes* (JONES), U.Carb., S.Wales; *3a,b,* LV lat., dors., ×40 (183). [SWAIN.]

Gutschickia SCOTT, 1944 [**Whipplella ninevehensis*

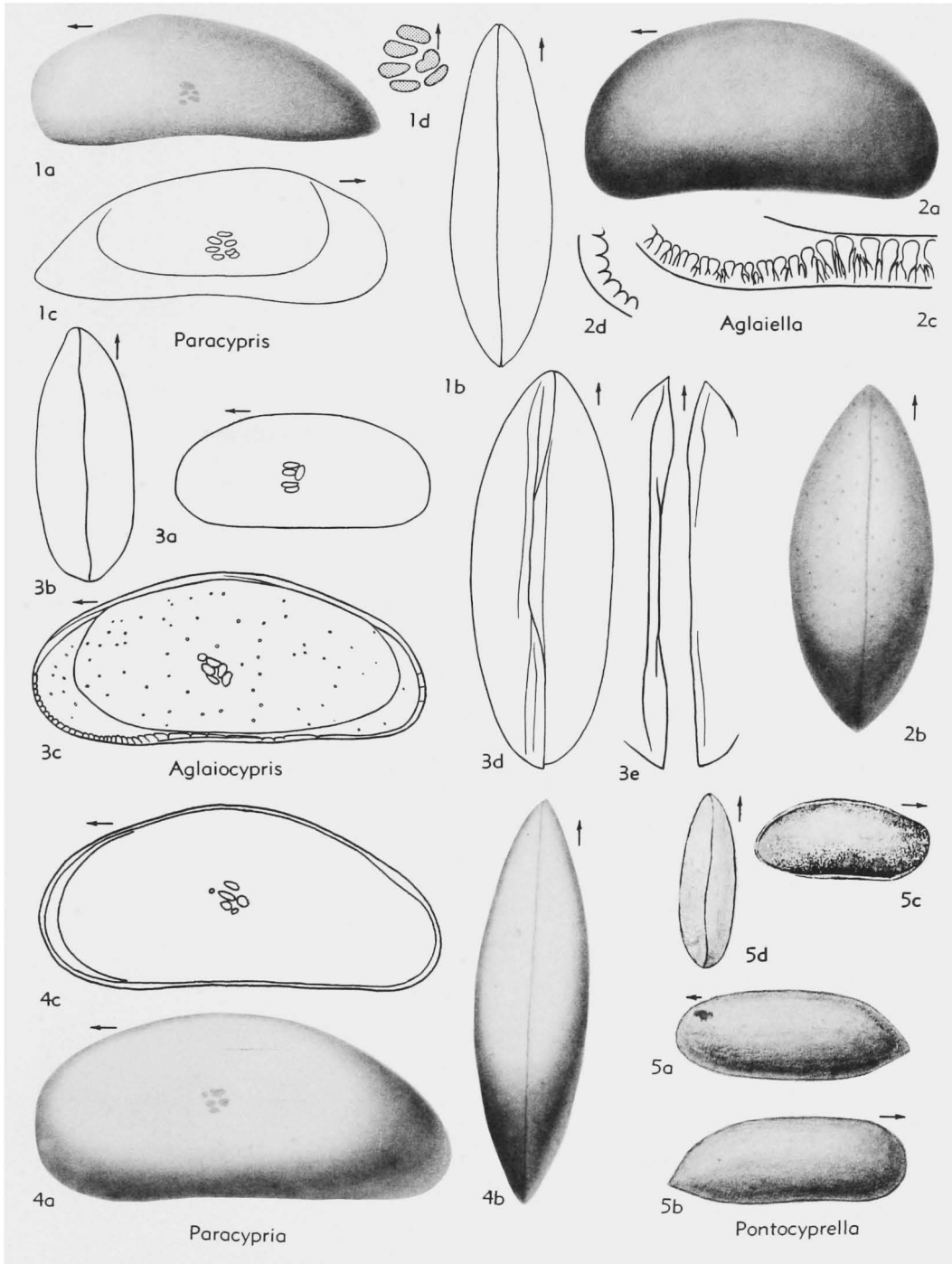

FIG. 181. Paracyprididae (p. Q245-Q246).

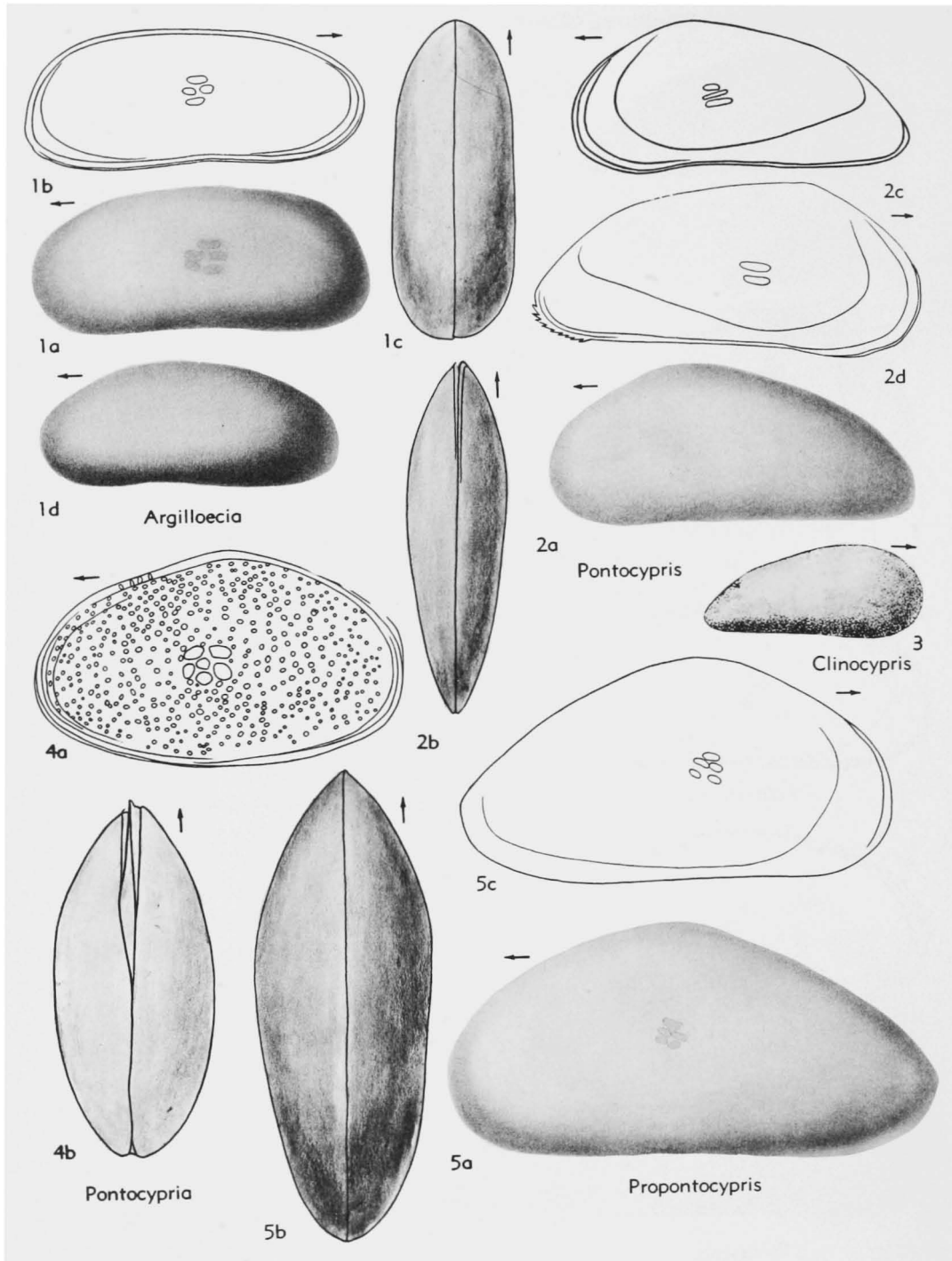

FIG. 182. Pontocyprididae (p. Q247).

HOLLAND, 1934]. Ovate-subtriangular, moderately tumid, ends compressed; dorsum strongly arched; venter nearly straight; terminal margins about equally rounded, extended below; LV overlapping RV dorsally but RV overlapping LV ventrally; surface smooth, pitted or granulose. [Freshwater.] *U.Penn.-L.Perm.*, N.Am.——FIG. 182A,*4*.

******G. ninevehensis* (HOLLAND), L.Perm., USA(Pa.); *4a-d*, carapace L, R, dors., vent., ×30 (323). [SWAIN.]

Haworthina KELLETT, 1935. [**Bairdia bulleta* HARRIS & LALICKER, 1932]. Resembling *Pontocypris* but its relationship uncertain to Paleozoic species doubtfully referred to *Pontocypris*. *L.Perm.*, N.Am.

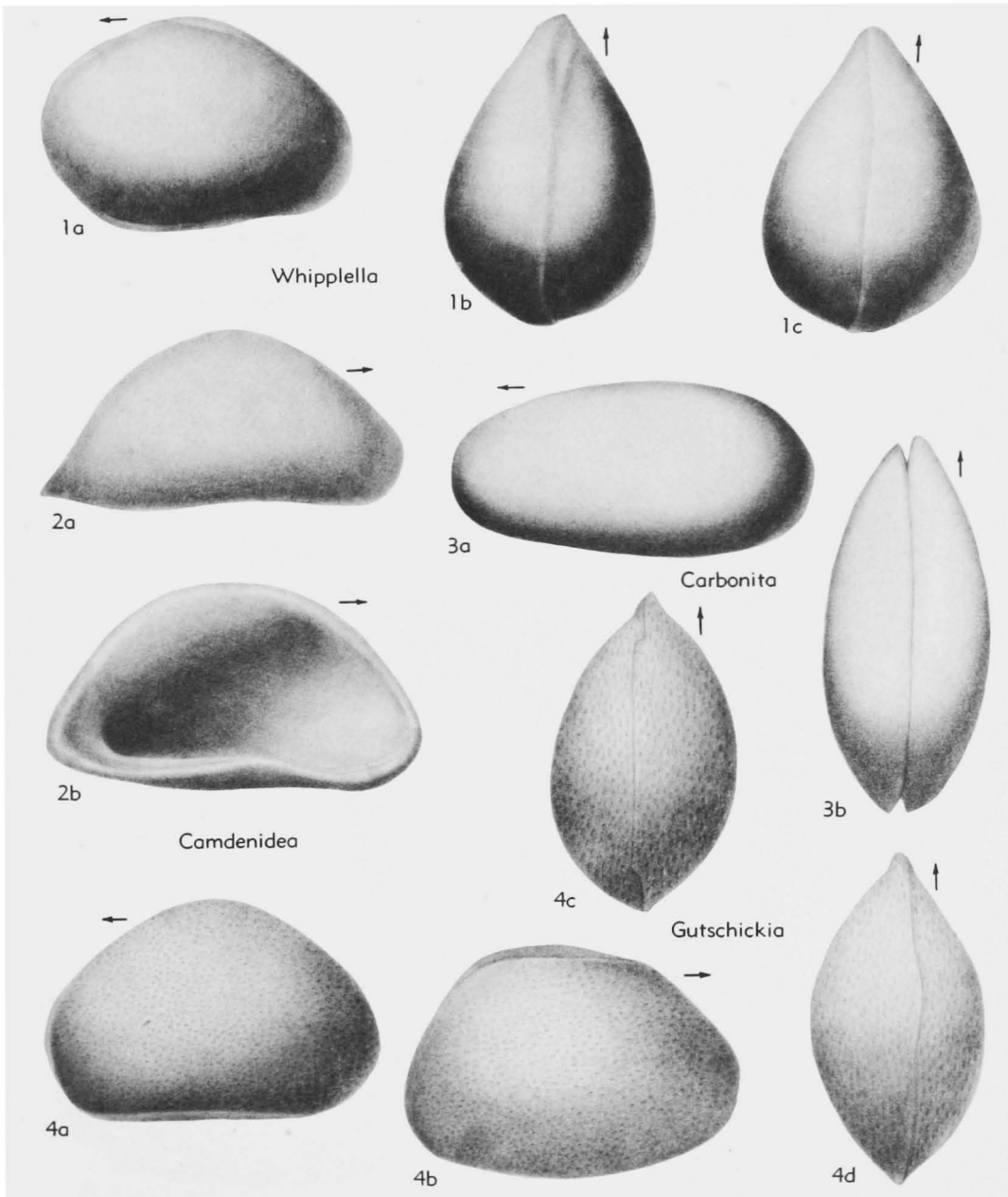

FIG. 182A. Cypridacea, Family Uncertain (p. Q247-Q253).

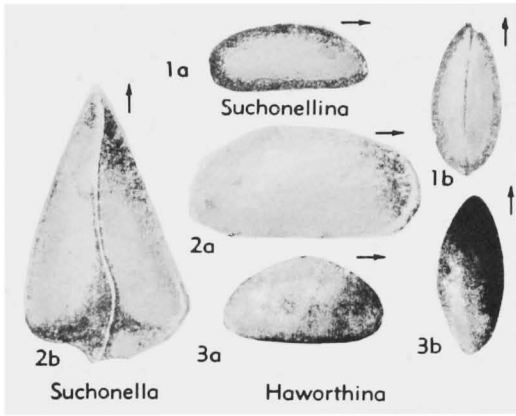

FIG. 182B. Cypridacea, Family Uncertain (p. Q251-Q253).

(Tex.-Kans.).——FIG. 182B,*3*. **H. bulleta* (HARRIS & LALICKER), USA(Kans.); *3a,b,* carapace R, dors., ×30 (198) [SHAVER.]

Hilboldtina SCOTT & SUMMERSON, 1943 [**H. multiplicata*]. Elongate-ovate, compressed; dorsum nearly straight, venter slightly convex, ends rounded, posterior extremity narrower and more pointed; RV overlapping LV; surface with longitudinal striae. [Fresh-water.] *L.Penn.(U.Carb.),* E.N.Am.-Eu.——FIG. 182C,*3*. **H. multiplicata,* L.Penn., USA(Tenn.); *3a-d,* carapace L, R, dors., vent., ×50 (326). [SWAIN.]

Palaeocypris BRONGNIART, 1876 [**P. edwardsii*]. Elongate, subquadrate to subreniform, highest anteromedially; dorsum convex in larger LV, straight in RV, rear end narrower; LV with strong dorsal extension beyond hinge line; surface pitted. Inner lamellae of moderate width anteriorly; soft parts known. [Fresh-water.] *Carb.,* Eu.(Fr.). [SWAIN.]

Pruvostina SCOTT & SUMMERSON, 1943 [**P. wanlessi*]. Like *Whipplella* but hinge longer and with hinge margin strongly impressed in prominent channel [Fresh-water.] *L.Penn.,* N.Am.——FIG. 182C,*2*. **P. wanlessi,* USA(Tenn.); *2a-d,* carapace L, R, dors., vent., ×40 (326). [SWAIN.]

Ranapeltis BASSLER, 1941 [**R. typicalis*]. Subreni-

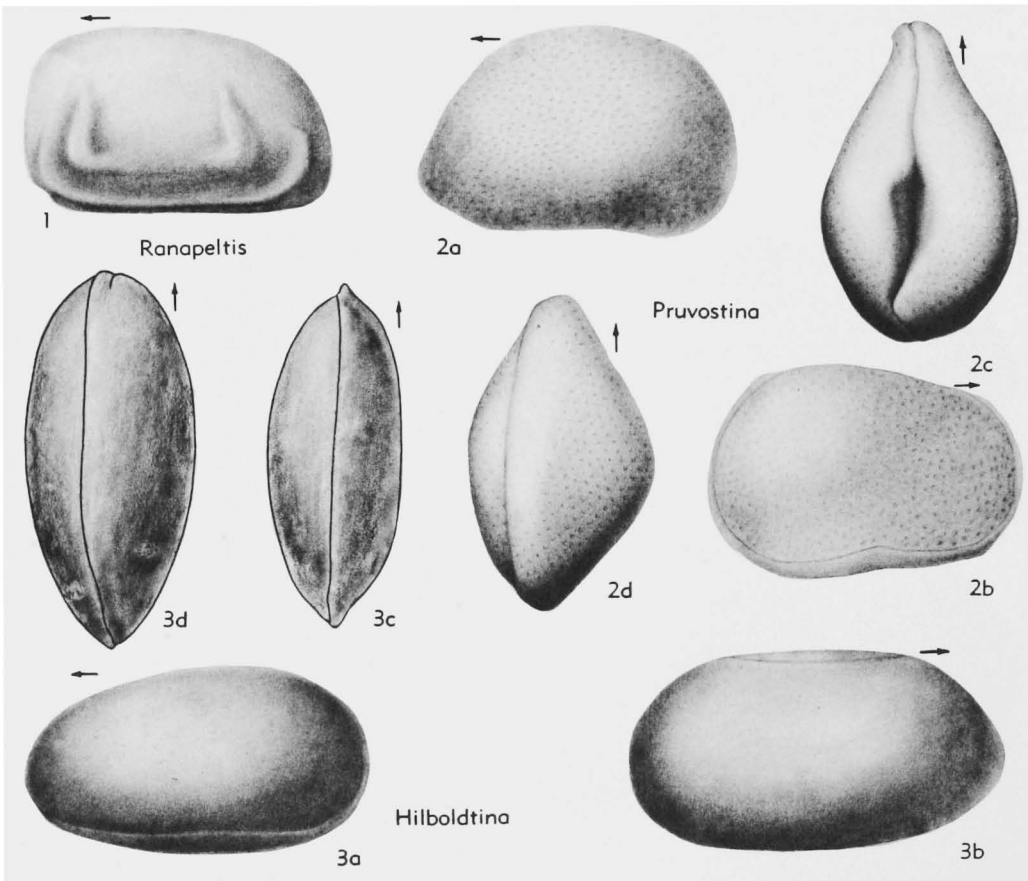

FIG. 182C. Cypridacea, Family Uncertain (p. Q252-Q253).

form-acuminate, strongly convex; dorsum arched but hinge surface nearly straight, venter slightly concave, front end broadly rounded, truncate above, posterior margin narrower, extended and acuminate below, truncate above; LV larger, overlapping RV along free margins; ventral surface with strongly elevated longitudinal ridges. Inner lamellae narrow; muscle scar with median group of radiating spots. [With *Camdenidea* perhaps represents early link between Cyprididae and Bairdiidae. Marine.] *M.Dev.*, N.Am.——Fig. 182C,*1*, 310B,*2*. **R. typicalis*, USA(Tenn.); 182C, *1*, LV lat., ×30 (Kesling); 310B,*2a,b*, LV lat., int., ×30 (Swain, n). [Swain.]

Scabriculocypris Anderson, 1940 [**S. trapezoides*]. Elongate subquadrate, anterior end more rounded than posterior; LV strongly overlapping RV, especially along venter; surface reticulate to spinose. Hinge resembling that of *Cythere*. *U.Jur.*, Eng. [Topotype specimens examined by Sylvester-Bradley have muscle scars suggestive of Cypridacea.]

Suchonella Spizharsky, 1937 [**S. typica;* SD Swain, herein]. Dorsum strongly arched, ventral margin straight, somewhat concave in front; widely wedge-shaped in dorsal view; posteroventral lateral surface with broad protuberance or smaller elevated horn; LV larger than RV, overlapping it on ventral and posterior margins. Hinge of RV with hemicylindrical groove corresponding to bar on LV; middle of valve marked by thickening, which separates front half from rear where eggs probably were accommodated; muscle imprint located in front half of valve defined as round spot in which weak ridges and grooves radiate from center. [Fresh-water.] *L.Trias.*(topmost *Tatar.*), Kuznetsk Basin, Sib. [337, 338; the latter apparently was original description, but publication was delayed 2 years after first appearance of name in print.].——Fig. 182B,*2*. **S. typica*, Suchonai-N. Dvina Basin, USSR; *2a,b*, carapace R, vent., ×35 (338) [Swain.]

Suchonellina Spizharsky, 1937 [**Cythere (Cytherella?) inornata* M'Coy & Jones, 1850 (*non* M'Coy, 1844); SD Swain, herein]. Elongate oval, anterior end blunt, posterior end sharply produced below; LV larger than RV, overlapping it on ventral and posterior margins; dorsal margin straight or slightly convex; ventral margin straight or slightly concave; valves very strongly inflated, with greatest convexity closer to posterior than anterior edge; in dorsal view rear edge blunter than front edge. Muscle imprint in front half of valves, from interior appearing as small rounded convexity, from center of which radiate little ridges and depressions; hinge a cylindrical groove on RV and bar on LV; hinge edge of RV however, loosely overlapping LV. Length 0.5 to 0.7 mm., height 0.25 to 0.3 mm. [Fresh-water.] [337, 338; the former apparently was intended to be original record but was delayed in publication.]. *U.Perm.*, Suchonai River Valley, USSR-Eng.——Fig. 182B, *1*. *S. yanichevski* Spizharsky, Tom River; *1a,b*, carapace R, dors., ×20 (337). [Swain.]

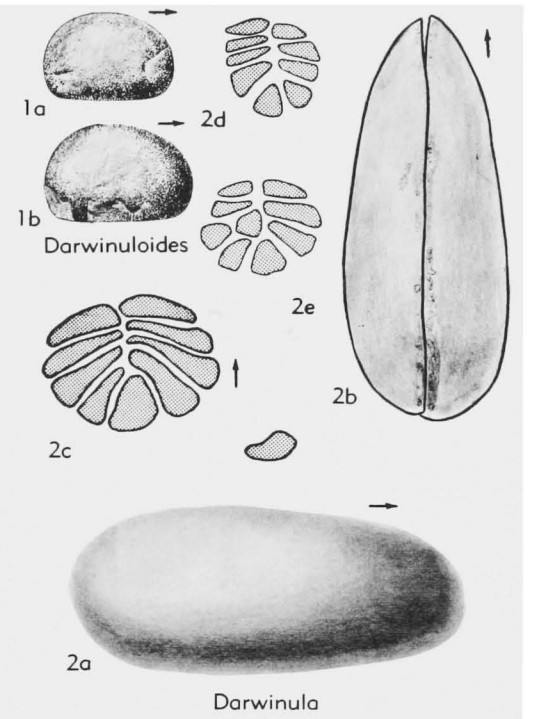

Fig. 183. Darwinulidae (p. Q254).

Whipplella Holland, 1934 [**W. cuneiformis*]. Subovate, strongly inflated in posterior half, compressed anteriorly; dorsum strongly arched, venter slightly concave, anterior margin narrower; valves unequal, overlap variable; surface pitted. [Fresh-water.] *L.Perm.*, N.Am.——Fig. 182A,*1*. **W. cuneiformis*, USA(Pa.); *1a-c*, carapace L, vent., dors., ×50 (323). [Swain.]

Superfamily DARWINULACEA Brady & Norman, 1889

[*nom. transl.* Swain, herein (*ex* Darwinulidae Brady & Norman, 1889) (=Darwinellidae Brady, Crosskey, & Robertson, 1874)] [Diagnosis by F. M. Swain, University of Minnesota]

Shell elongate-ovate; more narrowly rounded and less convex in front; surface typically smooth; RV larger than LV. Hinge simple, undifferentiated; muscle scar comprising numerous radially arranged spots. [Fresh- or brackish-water.] *?Ord., U.Carb. (Penn.)-Rec.*

Family DARWINULIDAE Brady & Norman, 1889

With characters of superfamily. *?Ord., U. Carb.(Penn.)-Rec.*

The Darwinulidae is a small long-ranging family, apparently monotypical, that seems always to have been restricted to fresh or brackish waters. Species have been found with reasonable certainty as far back as Late Carboniferous and may range to the Ordovician. The family was defined on anatomical characteristics by BRADY & NORMAN as follows: "Antennae destitute of swimming setae and of poison gland and duct. Mandible-palp 3-jointed; the basal joint large and densely setiferous. Two pairs of jaws, the first bearing a large branchial plate, the second a smaller branchial plate and a pediform palp. Two pairs of feet external to the valves. Post-abdominal lobes sub-conical, small." Though in general it is not desirable to erect a superfamily on the basis of only 2 genera, the genera are unique in many ways and the most satisfactory way of handling them seems to be to place them in a separate family and superfamily.

Darwinula BRADY & ROBERTSON, 1885 [*pro Darwinella* BRADY & ROBERTSON, 1872 (*non* MÜLLER, 1865); *pro Polycheles* BRADY, 1870 (*non* HELLER, 1862)] [**Polycheles stevensoni* BRADY & ROBERTSON, 1870] [=*Cyprione* JONES, 1885 (an example of nested valves)]. Elongate, oblong or ovate; RV much larger than LV. Hinge formed by simple RV overlap; muscle scar comprising about a dozen elongate, radially arranged spots anterior to middle; calcified inner lamellae lacking (Brady & Norman, 1889). [fresh- or brackish-water.] *?Ord., U.Carb. (Penn.)-Rec.,* cosmop.——FIG. 183,*2a-c*. **D. stevensoni* (BRADY & ROBERTSON), Rec., Eu.; *2a,b,* ♀ carapace R, dors., ×80; *2c,* muscle scar (RV lat.), ×1,000 (*2a-c,* Triebel; *2b,* Sars).——FIG. 183,*2d,e*. *D.* sp., Rec., Eng.; *2d,e,* muscle-scar patterns RV, LV, ×200 (Sylvester-Bradley, n).

Darwinuloides MANDELSTAM, 1956 [**Darwinula oviformis* MANDELSTAM, 1947]. Shell ellipsoidal, ovoid, highly convex; LV larger than RV; anterior end more broadly rounded than posterior; dorsal margin convex or straight; ventral margin generally convex, but may be slightly concave medially; surface smooth; pore-canal zone not well developed; adductor muscle scar stated to be as in *Darwinula;* hinge unknown; dorsally, valve edges depressed to form shallow groove along line of contact. [Fresh-water.] *Perm.-Trias.,* Sib.(Kuznetzk Basin).——FIG. 183,*1*. **D. oviformis* (MANDELSTAM); *1a,b,* RV lat., RV lat., ×45 (50).

Superfamily CYTHERACEA Baird, 1850

[*nom. transl.* ULRICH & BASSLER, 1923 (*ex* Cytheridae BAIRD, 1850)] [Diagnosis and discussion prepared by H. V. HOWE, Louisiana State University, and P. C. SYLVESTER-BRADLEY, University of Leicester]

Anatomically, as outlined by SARS (1866), here belong those members of the Podocopina possessing 3 similar pairs of legs adapted for locomotion; antennules generally subpediform; exopodite of the antennae developed as a long, curved, rodlike flagellum containing ducts of glands lying on each side of body. Adductor muscle scars detectable on most carapaces, usually arranged in nearly vertical row of 4 elements, with 1 or 2 antennal scars and usually 3 mandibular scars in front. A few adont families lack hinge teeth but most have a compound hinge characteristically divided into 3 or 4 elements, any or all of which may be dentate. *M.Ord.-Rec.*

The majority of cytheracean families are marine and many have highly ornamented carapaces. In our present state of knowledge, the dentition appears to be the firmest, though frankly an artificial basis for classification. It is supplemented by general shape and by characteristic subdivision of certain elements of the adductor muscle scars or of the antennal and mandibular scars. Likewise the character of the duplicature, the presence or absence of a vestibule, the number of radial pore canals and their nature, whether straight and simple, curved, bifurcating, or with bulbous enlargments, and the presence or absence of an eye tubercle are of family significance. The superfamily had its beginning early in the Paleozoic, but only in the Mesozoic and Cenozoic Eras does it become the dominant element in ostracode faunas. The stratigraphic distribution of cytheracean genera is indicated graphically in Figure 184.

Family CYTHERIDAE Baird, 1850

[Materials for this family prepared by H. V. HOWE, Louisiana State University] Includes Camptocytherides MANDELSTAM, 1960]

Ovate, subreniform to subquadrangular carapaces with subequal valves, RV tending to overlap LV dorsally and LV to overlap RV ventrally; smooth or reticulate with large, widely spaced, usually sievelike normal pore canals. Hinge typically antimerodont, though some but not all elements may be smooth; muscle scars in near-vertical row of 4 adductors, 1 or 2 antennal scars in front of upper part of row and usually a rounded mandibular scar below; marginal areas fairly broad, with only a few straight or wavy

Families with Index Letters

A—Acronotellidae
B—Berounellidae
C—Brachycytheridae
D—Bythocytheridae
E—Cytherettidae
F—Cytheridae
G—Cytherideidae
H—Cytherissinellidae
I—Cytheruridae
J—Entocytheridae
K—Hemicytheridae
L—Kliellidae
M—Leguminocythereididae
N—Leptocytheridae
O—Limnocytheridae
P—Loxoconchidae
Q—Paradoxostomatidae
R—Pectocytheridae
S—Permianidae
T—Progonocytheridae
U—Psammocytheridae
V—Schizocytheridae
W—Sinusuellidae
X—Tomiellidae
Y—Trachyleberididae
Z—Xestoleberididae
AA—Family Uncertain

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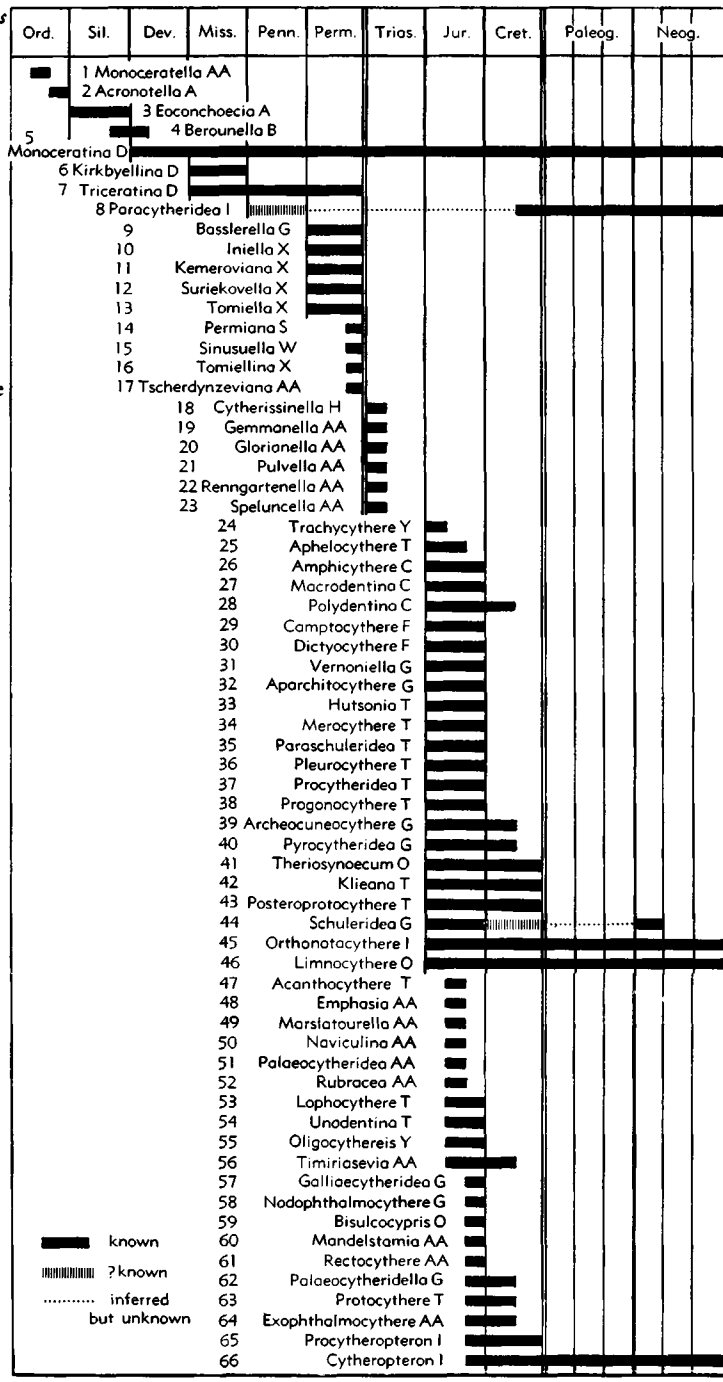

FIG. 184. Stratigraphic distribution of cytheracean ostracode genera (Moore, n). Classification of the genera in families is indicated by letter symbols according to the following tabulation and for the purpose of locating any wanted genus an alphabetical list furnishes a cross reference to the serially arranged numbers on the diagrams.

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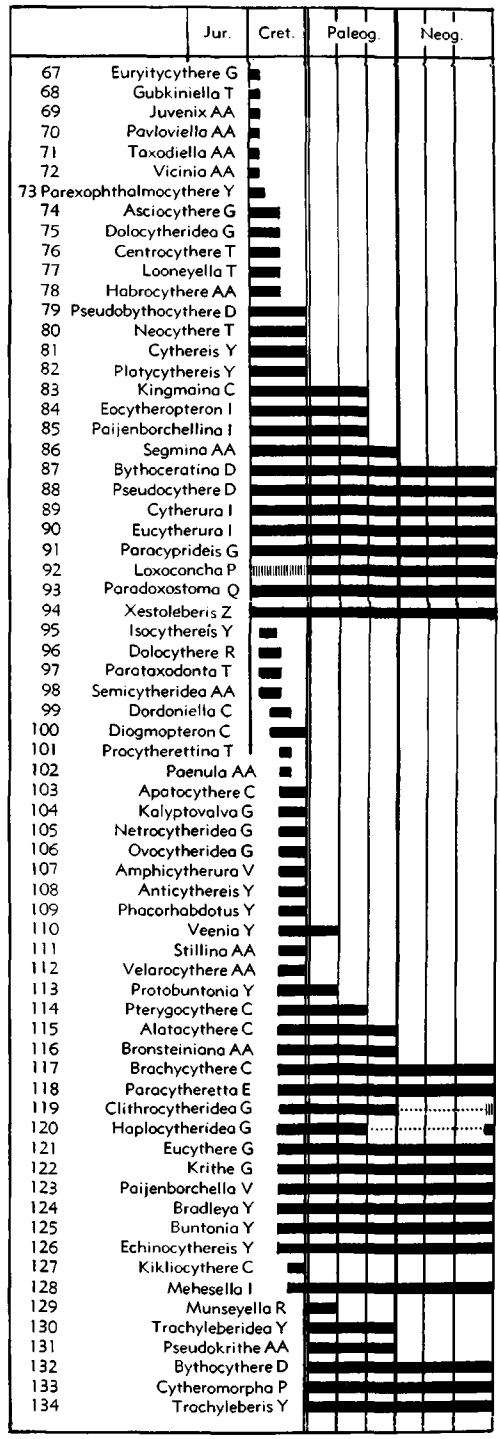


FIG. 184 *(Continued)*.

radial canals; a small vestibule may be present at the ends. *Jur.-Rec.*

Cythere O. F. MÜLLER, 1785 [**C. lutea;* SD BRADY & NORMAN, 1889] [=*Cytherina* LAMARCK, 1818; *?Cyclas* EICHWALD, 1857 (*non* LAMARCK, 1798)]. Carapace reniform in side view, elongate ovate dorsally; surface smooth, but finely pitted and bearing faint radial ribbing; RV overlapping LV dorsally, but LV overlapping RV ventrally; eye tubercle weak or lacking. Hinge antimerodont, with accommodation groove over slightly arched middle element of LV; adductor scars in slightly curved row of 4, with crescent-shaped antennal scar in front of uppermost adductor and oval mandibular scar in front of lower adductor; other scars weakly developed above adductors; marginal areas broad, with only trace of vestibule; radial canals few and wavy; normal canals widely spaced and funnel-shaped (15, 56, 98). *Rec.*, N.Atl.——FIG. 185,*1*. **C. lutea; 1a,b,* ♀ carapace L, dors.; *1c,d,* ♂ LV int., RV int.; all ×60 (*1a,b,* 314; *1c,d,* 362).

Camptocythere TRIEBEL, 1950 [**C. praecox*]. Carapace ovate, more broadly rounded in front; RV overlapping LV dorsally but LV overlapping RV ventrally; surface smooth except for large openings of widely spaced normal canals; adductor scars in somewhat curved row of 4, with 2 unequal antennal scars and oval mandibular scar in front; hinge similar to that of *Cythere* except front and median elements, which are essentially smooth. No eye. *Jur.*, Eu.——FIG. 186,*3*. **C. praecox*, Ger.; *3a,b,* RV lat., int., ×60; *3c,* LV lat., ×60; *3d,e,* carapace dors., ant., ×60; *3f,* LV ant. margin with radial canals, ×170; *3g,h,* LV and RV hinge margin, ×155 (all 376).

Cnestocythere TRIEBEL, 1950 [**C. lamellicosta*]. Carapace of medium size, subrhomboidal in side view, about equivalved but RV overlapping LV along mid-hinge and LV with raised knob which reaches over RV at back of hinge, also overlapping mid-ventrally; ornamentation reticulate, with strong raised longitudinal ribbing and distinct eye spots. Hinge antimerodont, with strong terminal elements; normal canals widely spaced, sievelike; marginal areas broad, with very few radial canals; adductor scars in nearly vertical row of 4, with large vertically elongate antennal scar in front. *Mio.*, Eu.——FIG. 185,*5*. **C. lamellicosta*, Aus. (Vienna Basin); *5a,* LV lat., ×60; *5b,* carapace dors., ×60; *5c,* RV hinge, ×110 (all 376).

Loxocythere HORNIBROOK, 1952 [**L. crassa*] [=*Tetracytherura* RUGGIERI, 1952]. Subquadrate to subtriangular in outline; RV overlapping LV

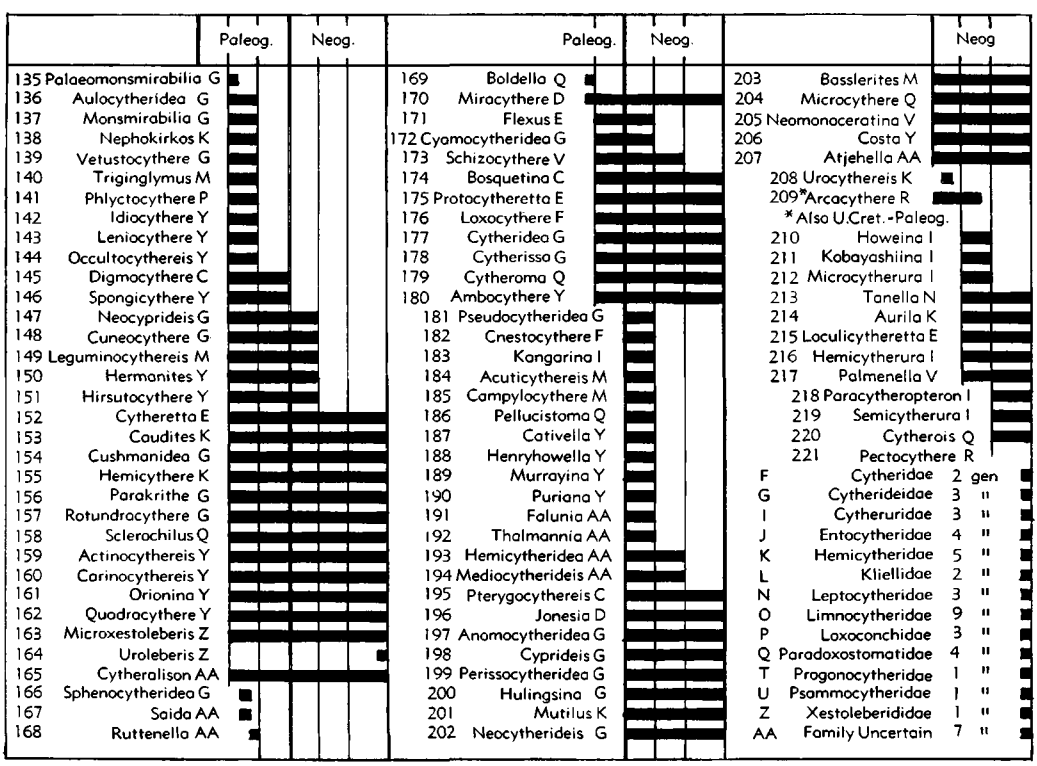


FIG. 184 *(Continued)*.

dorsally; surface reticulate. Adductor scars in row of 4, with at least one in front; normal canals widely scattered; hinge similar to that of *Cythere* but median element only faintly crenulate; marginal areas fairly regular, with small vestibules at ends; radial canals few and straight. Eye tubercle

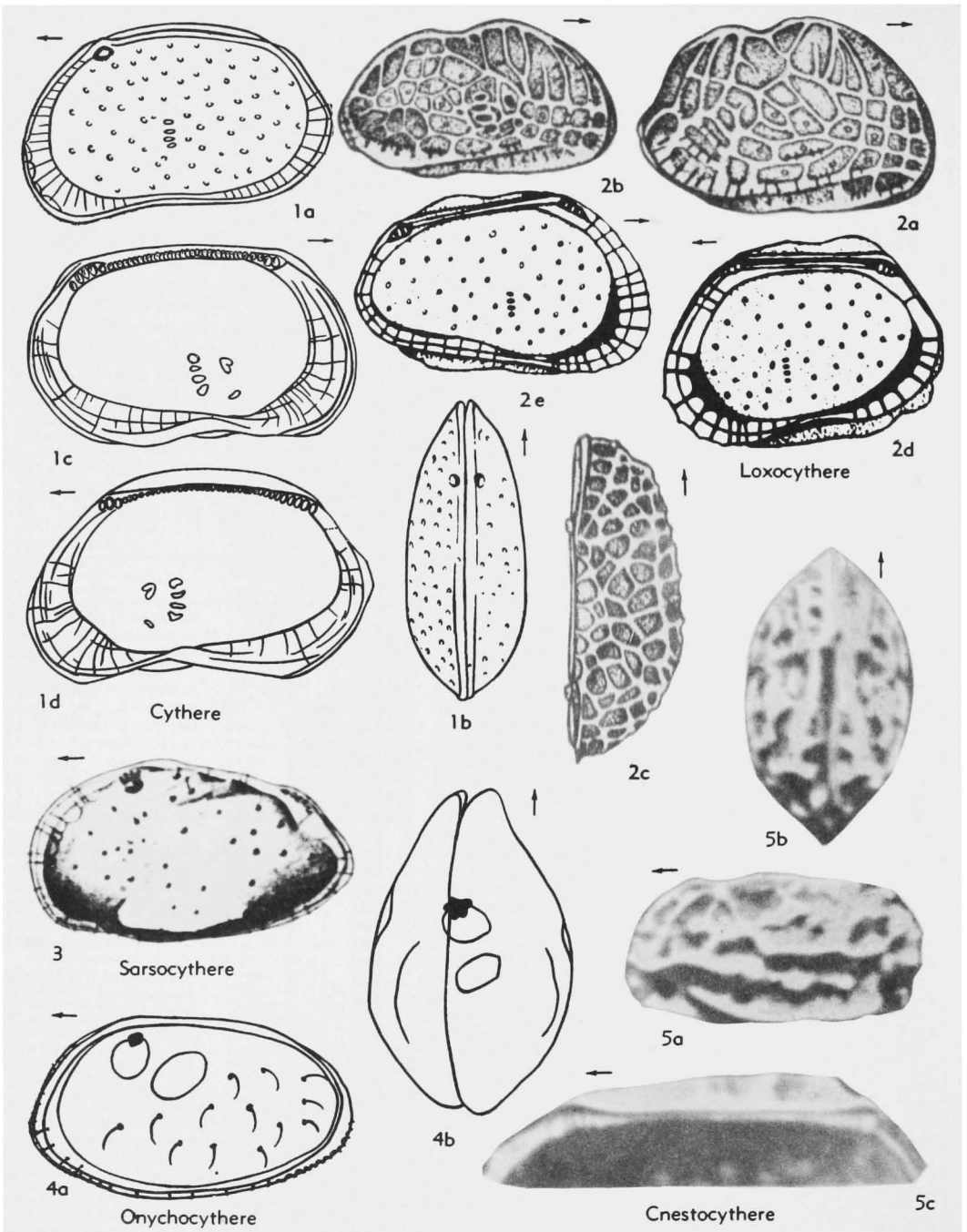


FIG. 185. Cytheridae (p. Q257-Q259).

lacking. Sexes distinct. *Oligo.-Rec.*, N.Z.——FIG. 185,*2*. **L. crassa*, Rec.; *2a,b*, ♀ RV lat., ♂ RV lat.; *2c*, ♀ RV dors.; *2d,e*, ♀ RV int., LV int.; all ×75 (32).

Onychocythere TRESSLER, 1939 [**O. alosa*]. Carapace ovate, more tumid than *Cythere*, RV larger than LV; unornamented. Marginal areas relatively narrow, with few radial canals; muscle scars in oblique row of 4; chiefly distinguished by unequal development of thoracic legs, 2nd being much longer than others. *Rec.*, Fla.——FIG. 185,*4*. **O. alosa; 4a,b*, carapace L, dors., ×45 (371).

Sarsocythere TRESSLER & SMITH, 1948 [**S. patuxiensis*]. Carapace stout, with prominent alae near venter, outline broadly rounded in front and somewhat pointed in rear; surface nearly smooth. Hinge well developed, with terminal crenulations; radial canals few, grouped. *Rec.*, E.N.Am.——FIG. 185,*3*. **S. patuxiensis*, Md.; LV lat., ×50 (372).

?Family ACRONOTELLIDAE Swartz, 1936

[Materials for this family prepared by R. V. KESLING, University of Michigan]

Carapace with subequal valves, straight hinge line, sulcus (S_2), and strong ventral projection that terminates sharply toward rear. *U.Ord.-U.Sil.*

Genera with various kinds of lobation have been assigned to this family, their chief common characters being a straight hinge line and prominent ventral projection. TEICHERT (368) and TRIEBEL (82) think that the ventral projection, which in many species ends in a spine, is a recurrent homeomorphic feature instead of a mark of taxonomic close relationship. Nonsulcate genera (such as *Boucekites, Gravia, Monoceratella, Mooreina, Pinnatulites, Pullvillites, Russia,* and *Tricornina*) assigned to this family by various authors here are rejected from inclusion in it, being treated as *incertae sedis*. Also, *Vltavina* is excluded because it lacks a well-defined ventral projection.

Acronotella ULRICH & BASSLER, 1923 [**A. shideleri*] [=*Acrotonella* PENEAU, 1927 *(errore)*]. Elongate, with projecting anterior corner; S_2 long, sloping, reaching nearly to anteroventral border; L_2 nodose, low, indistinct; central ventral area bearing large spine that projects outward and slightly backward. *U.Ord.*, N.Am.——FIG. 186,*1*. **A. shideleri*, Ind.; *1a,b*, carapace L, dors., ×30 (86).

?Eoconchoecia MOBERG, 1895 [**E. mucronata*]. Valves with long curved S_2, bearing blunt ventral and anterior projecting spines. *Sil.*, Eu.——FIG. 186,*2*. **E. mucronata*, Swed.; carapace R, ×? (251).

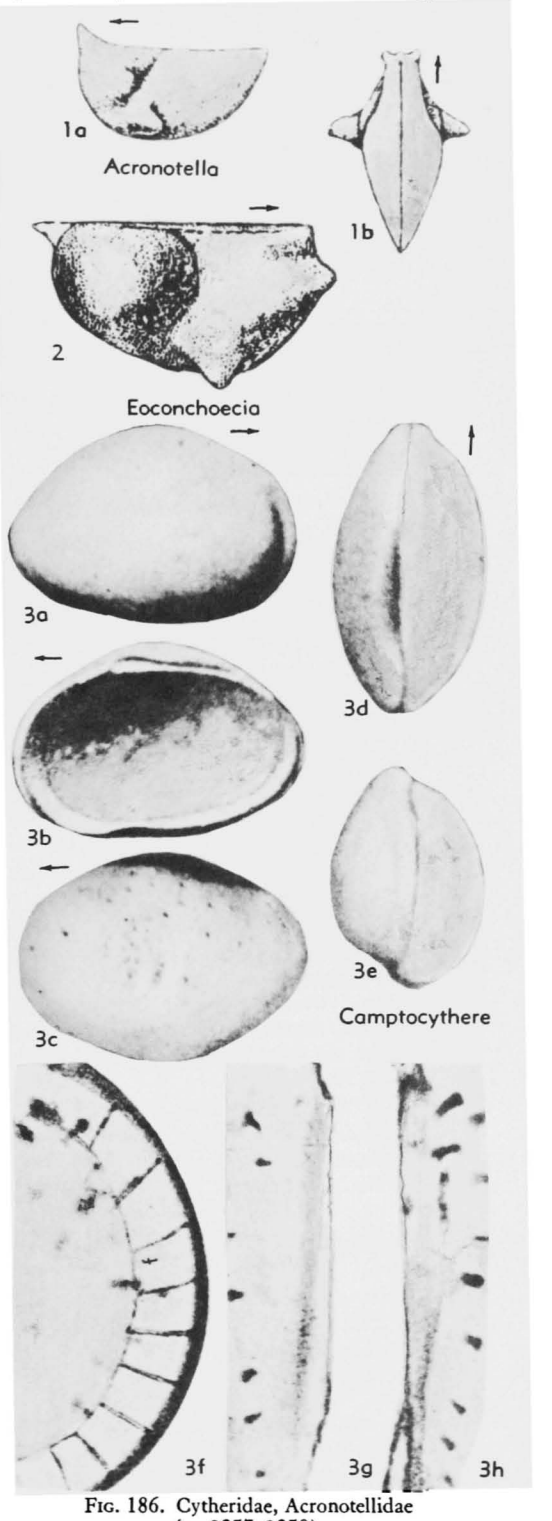
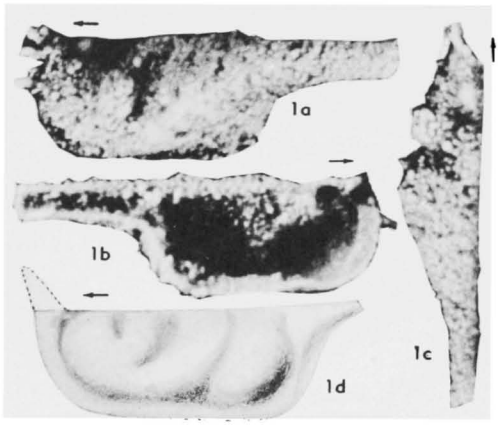


FIG. 186. Cytheridae, Acronotellidae (p. Q257-Q259).



Berounella

FIG. 187. Berounellidae (p. Q260).

?Family BEROUNELLIDAE Sohn & Berdan, 1960

[Materials for this family prepared by I. G. SOHN and JEAN BERDAN, U.S. Geological Survey]

Small, subquadrate, lobed and spinose, essentially symmetrical, with posterior extension of dorsal margin as a straight, narrow tube that may equal half or more of greatest length of main portion of carapace; no velate structure. Hingement simple, overlap inconspicuous; duplicature present. Surface smooth, possibly reticulate. *U.Sil.-L. Dev., ?L.Carb.*

Berounella BOUČEK, 1936 [**B. rostrata*]. Trilobate (?quadrilobate), spinose anterior margin, with or without additional spines on surface of valves. *U.Sil.-L.Dev.,* Eu.-N.Am.——FIG. 187,*1d.* **B. rostrata,* U.Sil., Czech.; LV lat., ×35 (10).——FIG. 187,*1a-c.* *B.* sp., L.Dev., N.Y.; *1a-c,* LV lat., int., dors., ×50 (Sohn, n).

?Kirkbyellina KUMMEROW, 1939 [**K. styliolata*]. Subcentral sulcus surrounded by wide lobe which trends toward posterior extension. *L.Carb.* (Viséan), Ger.

Family BRACHYCYTHERIDAE Puri, 1954

[*nom. transl.* HOWE, herein (*ex* Brachycytherinae PURI, 1954] [=Pterygocytheridae PURI, 1957] [Materials for this family prepared by H. V. HOWE, Louisiana State University, with aid of R. A. REYMENT, University of Stockholm] [Includes Pterygocytherides MANDELSTAM, 1960]

Carapace fairly large, plump, especially ventrally, commonly with ventral ridge or ala; broadly and usually obliquely rounded anteriorly, narrower posteriorly, tending to angulation at or below middle; in end view subcircular, subtriangular, or even strongly triangular; eye tubercle usually present; surface smooth to reticulate. Hinge an amphidont development from merodont hingement of Progonocytheridae, ranging from paramphidont to hemiamphidont or holamphidont, commonly with accommodation groove; adductor muscle scars may be in vertical row of 4 but modified by subdivision of upper 2 scars and by fusion of lower 2 scars (differences may occur within same genus), antennal scar usually crescent- or heart-shaped or occurring as 2 closely placed spots, mandibular scars oval, additional scars high in carapace; marginal areas fairly broad and regular, without vestibule; radial canals numerous and tending to be bulbous in mid-section; normal canals rather widely spaced. *Jur.-Rec.*

Brachycythere ALEXANDER, 1933 [**Cythere sphenoides* REUSS, 1854]. Carapace subtriangular to subovate in lateral view, plump ventrally, usually with small carina separating flattened ventral face from lateral face; ventral surface usually striated longitudinally, lateral surface smooth to weakly reticulate; eye spot distinct; anterior end broadly and obliquely rounded, posterior end subangulate at or below middle. Hinge hemiamphidont; adductor scars (in ALEXANDER's figure of supposed type species) in somewhat vertical row with uppermost scar L-shaped (possibly due to fusion of 2 scars), followed below by 2 oval scars obliquely side by side and below them a large oval scar, V-shaped antennal scar above oval mandibular scar in front of paired adductors (Paleocene species of this genus, however, with upper very oblique pair of adductors above 2nd less oblique pair, which in turn overlie 2 nearly fused elongate ovate scars); marginal areas regular, without vestibule; radial canals numerous, tending to be bulbous in mid-section; normal canals small, widely spaced [Characters of this genus cannot be defined adequately until topotype specimens from vicinity of Salzburg, Austria, are studied.] *U.Cret.-Rec.,* Eu.-N.Am.——FIG. 188,*1. ?*B. sphenoides* (REUSS), *U.Cret.,* Texas; *1a,b,* carapace R, RV int., ×45; *1c,* LV int., ×45; *1d-f,* int. marginal areas, ant., post., and muscle scars, ×90 (89).——FIG. 188,*4. B. ventricosa* (BOSQUET), Eoc., Fr.; *4a,b,* LV lat., dors. (U.Ypres.), ×60; *4c,* RV lat. (Lutet.), ×60; *4d,e,* LV int., RV hinge (U. Ypres.), ×75 (42).——FIG. 189,*1. B. plena* ALEXANDER, U.Cret., La.; *1a-c,* RV lat., dors., int., ×75 (200).

Alatacythere MURRAY & HUSSEY, 1942 [**Cythereis (Pterygocythereis?) alexanderi* HOWE & LAW, 1936 (*non* MORROW, 1934) (=**Alatacythere ivani* HOWE, 1951]. Identical in all essential features except hinge to *Pterygocythereis.* Hinge hemiamphi-

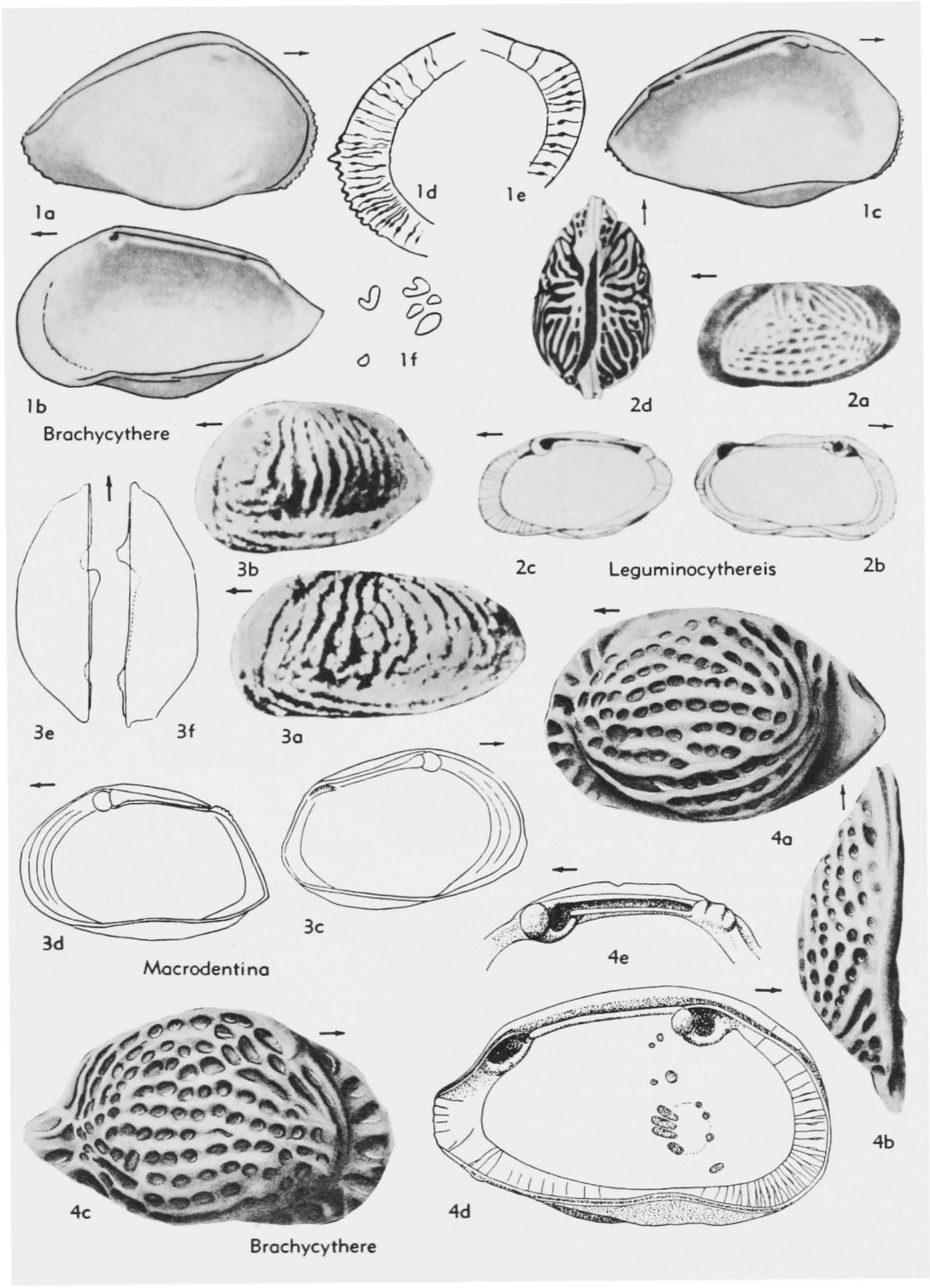


FIG. 188. Brachycytheridae, Leguminocythereididae (p.Q260-Q267, Q307).

dont, with very narrow accommodation groove over median bar of LV in type species. [Might well be considered a subgenus of *Pterygocythereis* but differs in range.] *U.Cret.-Oligo.*, N.Am.-Eu.——FIG. 189,*2*. *A. lemnicata* (ALEXANDER), Eoc., USA (Tex.); *2a-c*, RV lat., dors., int., ×27 (200).——FIG. 190,*4*. **A. ivani* HOWE, Oligo., Miss.; *4a,b*, LV lat., dors., ×37.5 (35); *4c,d*, LV int., RV int., ×37.5 (170).

Amphicythere TRIEBEL, 1954 [**A. semisulcata*]. Carapace ovate, ventrally inflated, narrowly compressed at ends; surface pitted and bearing nearly vertical sulcus in region of muscle attachment; eyenode distinct. Hinge strongly paramphidont; closing muscles in row of 4, antennal and mandibular scars unknown; marginal areas broad, with simple, straight radial canals. *Jur.*, Eu.——FIG. 192,*1*. **A. semiculcata*, Ger.; *1a-c*, carapace L, R, vent., ×60; *1d,e*, LV & RV hinge, ×100 (379).

?**Apatocythere** TRIEBEL, 1940 [**A. simulans*]. Externally like *Cytheridea* but hingement of amphidont-type (except that anterior socket of RV and tooth of LV are lacking); marginal areas broad, with numerous radial canals on anterior part that curves above middle; muscle scars in vertical row of 4, with a single scar in front. *U.Cret.*, Eu.——FIG. 190,*1*. **A. simulans; 1a,b*, ♀ RV and LV lat.; *1c,d*, ♂ carapace dors., ♀ LV dors.; *1e,f*, ♀ LV and RV int., ×45 (81).

Bosquetina KEIJ, 1857 [**Cythere pectinata* BOSQUET, 1852]. Carapace externally shaped like *Brachycythere* but lacks distinct eye tubercle. Hinge weakly holamphidont; adductor scars in vertical row of 4, with lower mandibular scar, 2 upper antennal scars, and at least one scar higher in carapace; marginal areas regular, with numerous bulbous radial canals; normal canals widely spaced, small. Dimorphous. *Oligo.-Rec.*, Eu.——FIG. 191, *5*. **B. pectinata* (BOSQUET), Plio., Fr.(Perpignan); *5a-c*, LV lat., int., dors., ×60; *5d*, RV hinge, ×60; (all 42).

Dictyocythere SYLVESTER-BRADLEY, 1956 [**Cythere retirugata* JONES, 1885]. Carapace shaped like that of *Macrodentina* but strongly reticulate. Hinge holamphidont, with stepped anterior tooth in RV; marginal areas regular, with few straight canals; normal canals widely spaced. *Jur.*, Eu.——FIG. 193, *2*. **D. retirugata*, Eng.; *2a,b*, carapace R, dors., ×40 (367).——FIG. 193,*3*. *D.* sp., diagram of RV hinge, ant. part, enlarged (235).

Digmocythere MANDELSTAM, 1958 [**Brachycythere russelli* HOWE & LEA in HOWE & LAW, 1936]. Externally shaped like *Brachycythere*, with weak eye spot. Hinge weakly paramphidont, anterior tooth of RV usually showing crenulations; adductor scars comprising a small upper pair, below them a larger oblique pair, then 2 single scars, in front of adductors a lower rounded mandibular scar, an upper crescent-shaped antennal scar, and

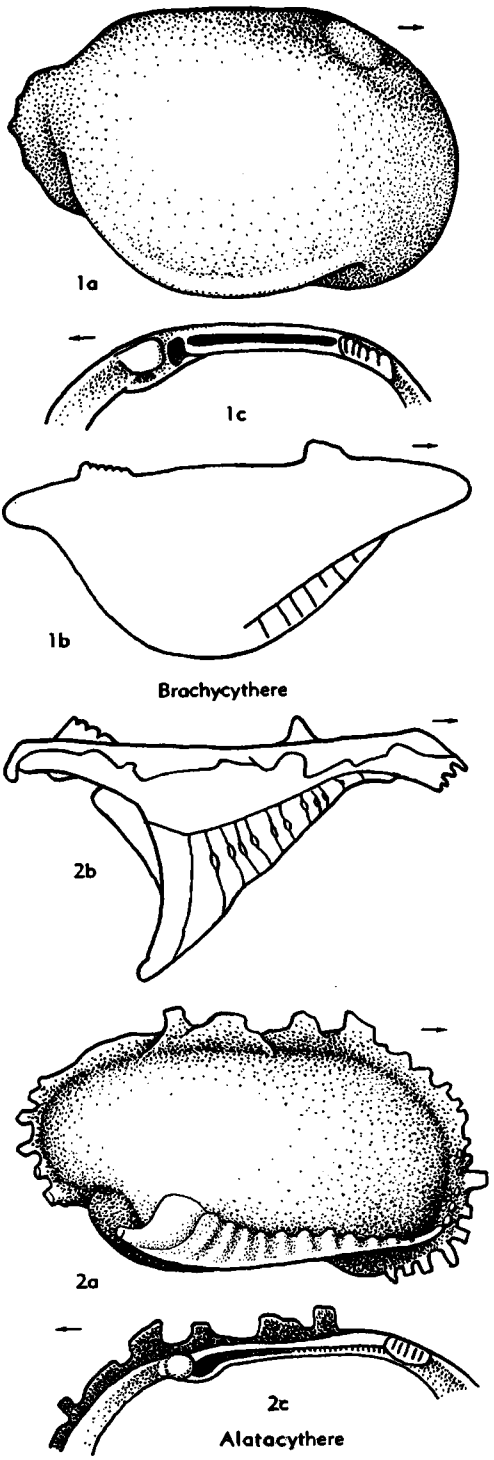


FIG. 189. Brachycytheridae (p. Q260-Q262).

at least 2 other scars high in carapace; marginal area regular, with numerous wavy radial canals; normal canals widely spaced, small. *Eoc.-Oligo.*, N.Am.

Diogmopteron HILL, 1954 [**Brachycythere lünensis* TRIEBEL, 1941]. Resembles *Alatacythere* but hingement partially reversed, accommodation groove being in RV instead of LV. *U.Cret.*, Eu.

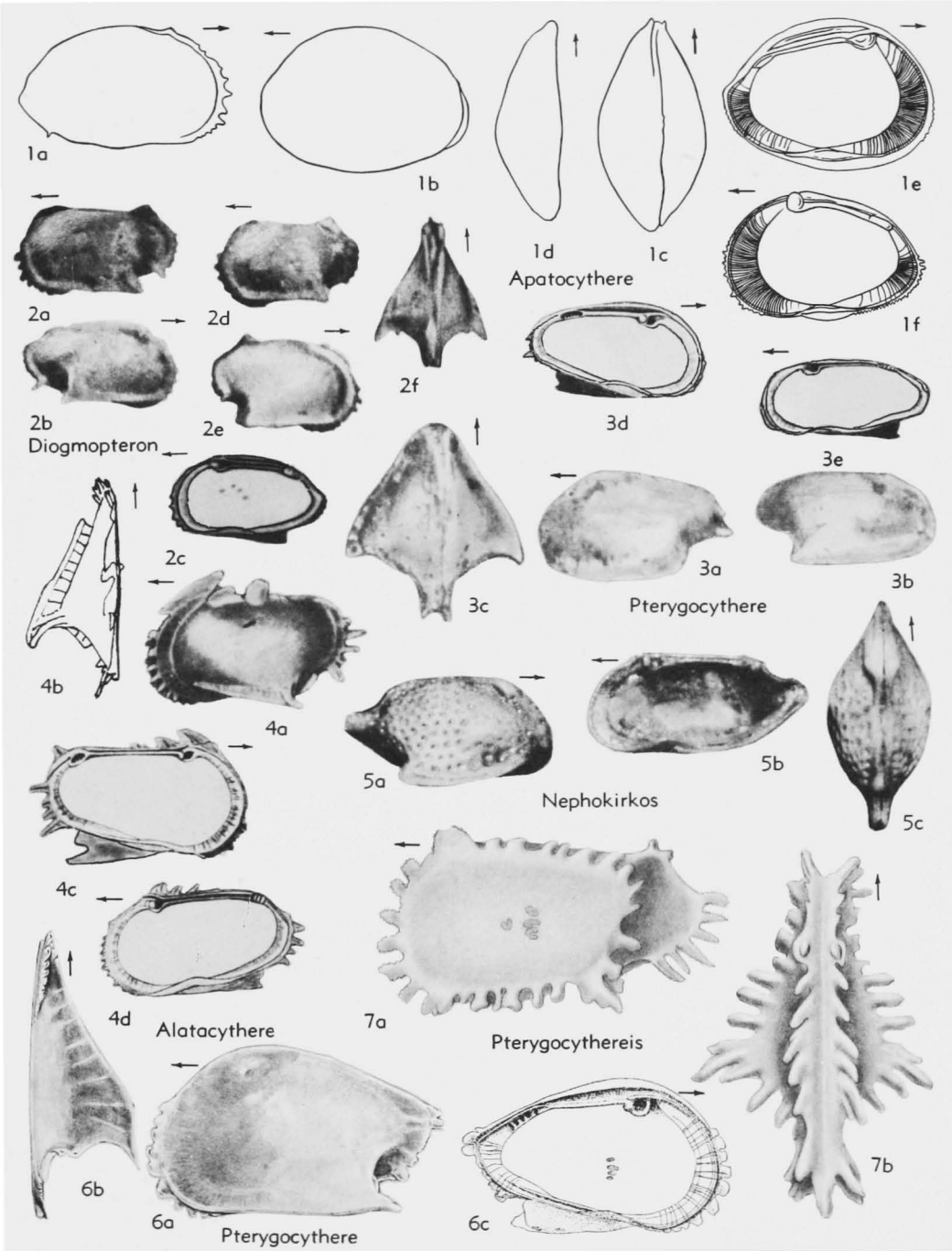


FIG. 190. Brachycytheridae, Hemicytheridae (p. Q262-Q267, Q305).

——Fig. 190,2. **D. luenensis,* Ger.; *2a,b,* ♂ LV and RV lat.; *2c,* ♂ RV int.; *2d,e,* ♀ LV and RV lat.; *2f,* ♀ carapace dors.; all ×35 (82, 169).

?**Dordoniella** Apostolescu, 1955 [**D. strangulata*]. Resembles *Apatocythere* in general external outlines, including possession of external sulcus in muscle area; LV overlapping RV along entire periphery. Hinge similar to that of *Apatocythere* but with crenulate posterior tooth; marginal areas broad, with small vestibule; radial canals not known; muscle scars in oblique row of 4, with antennal scar in front of middle of row and mandibular scar lower and farther forward. *U. Cret.(Cenom.),* Eu.——Fig. 193,*1. *D. strangulata,* Fr.; *1a-c,* carapace R, L, dors.; *1d,* LV int.; *1e,f,* RV int., dors.; all ×40 (92). [Reyment.]

Kikliocythere Howe & Laurencich, 1958 [**Cypridina favrodiana* Bosquet, 1847]. Carapace large, very inflated, superficially resembling *Brachycythere* but sides rounded so that end view is nearly circular instead of triangular and larger LV overlaps RV at ends of hinge line. Hinge holamphidont; adductor

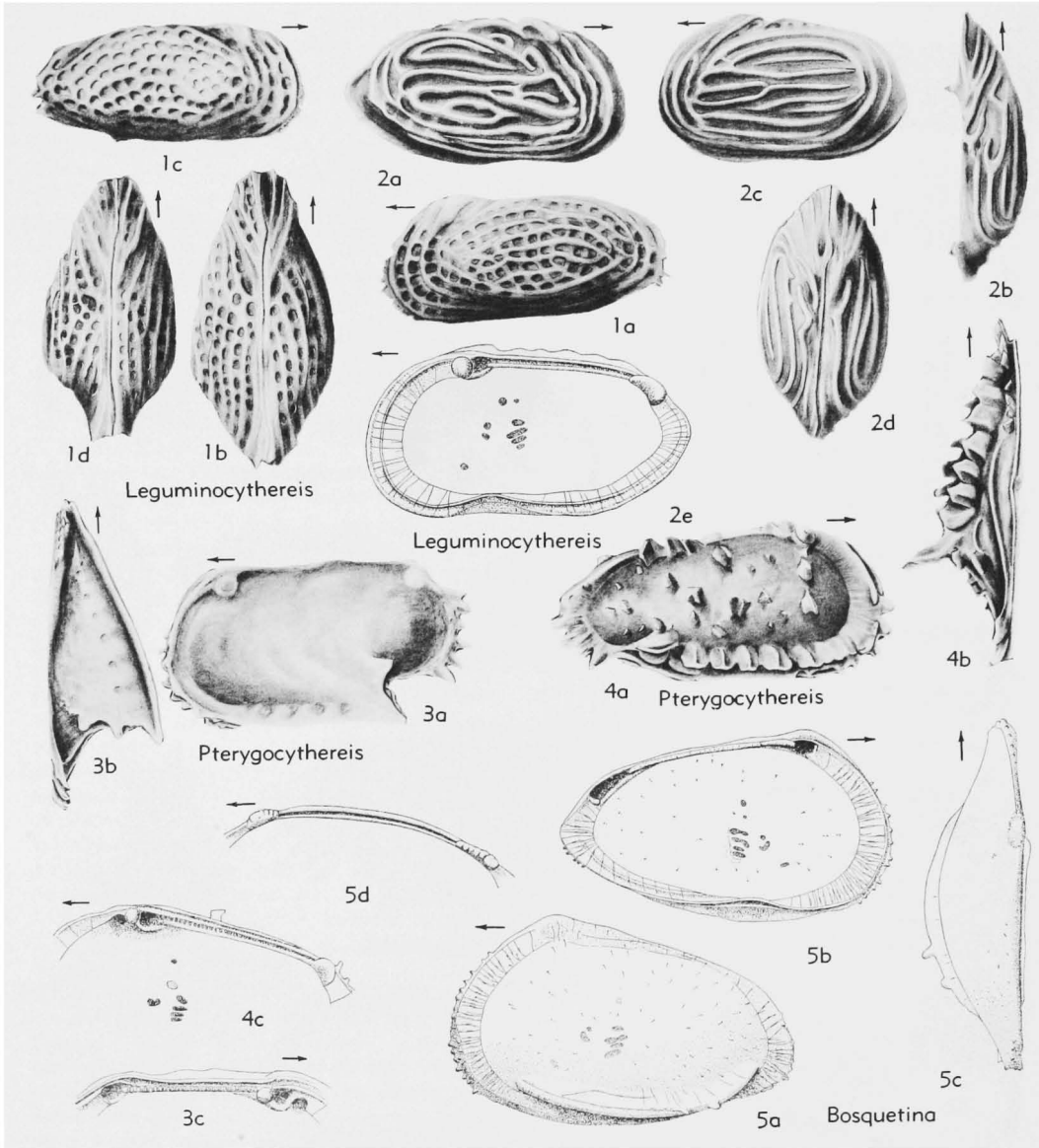


Fig. 191. Brachytheridae, Leguminocythereididae (p. Q262-Q267, Q307).

scars indistinct, but apparently in row of 4, with V-shaped antennal scar in front, other scars unknown; marginal areas regular, without vestibule; radial canals and normal canals unknown. *U.Cret.*

(Maastricht.), Eu.——Fig. 193,*4*. **K. favrodiana* (Bosquet), Holl.; *4a-c*, carapace L, dors., ant.; *4d,e*, RV int., LV int.; all ×30 (396).

Kingmaina Keij, 1957 [**Cythere forbesiana* Bos-

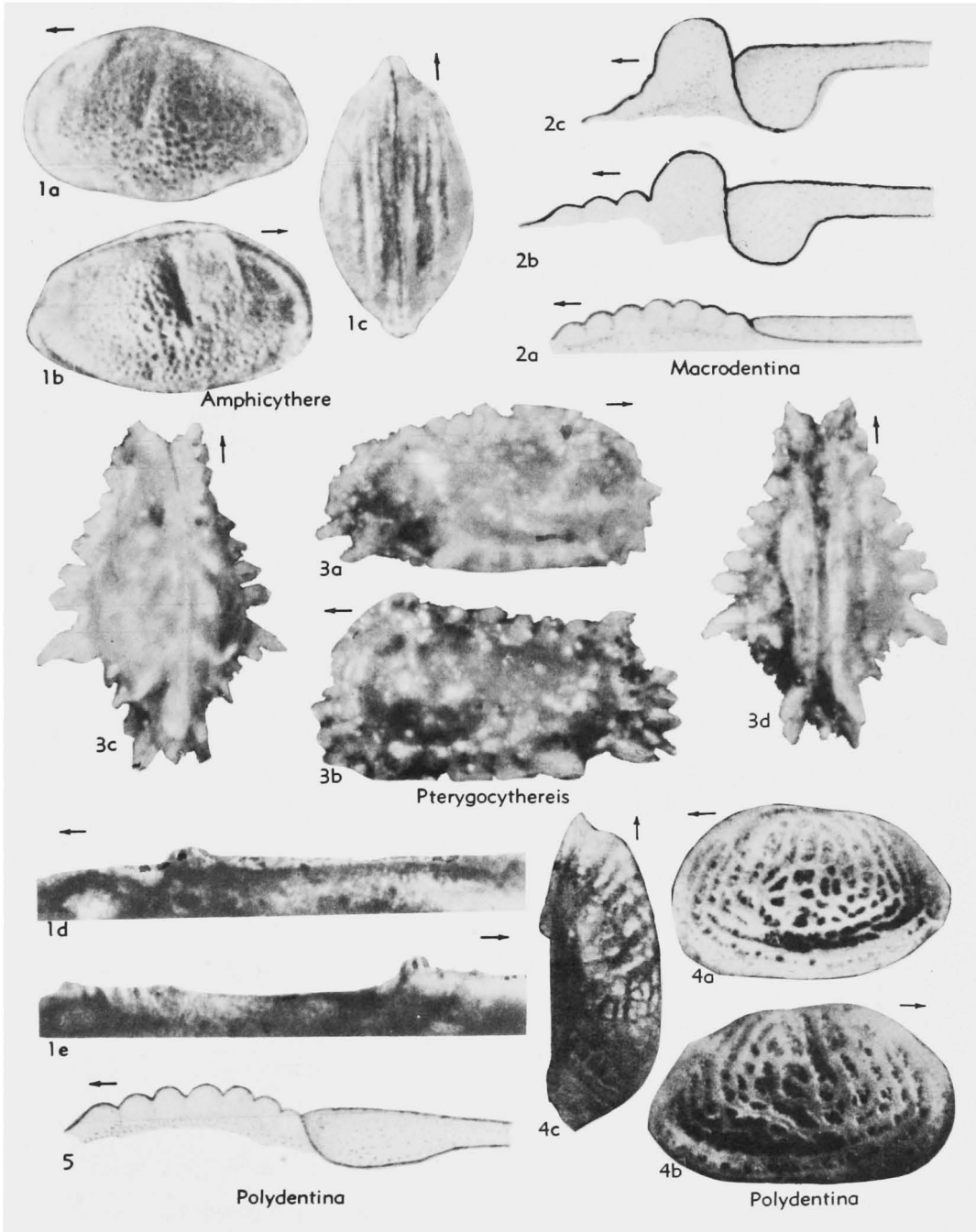


Fig. 192. Brachycytheridae (p. Q262-Q267).

QUET, 1852]. Carapace very inflated ventrally, with strong carina between rounded lateral and flattened ventral surfaces; obliquely rounded anteriorly, compressed posteriorly and subangulate below middle; surface ornamented with ridges or reticulate pits which have nearly vertical alignment; eye spot distinct; end view triangular. Hinge holamphidont but (like *Triginglymus*) with thickened protuberance of shell wall below and behind anterior hingement of each valve; adductors

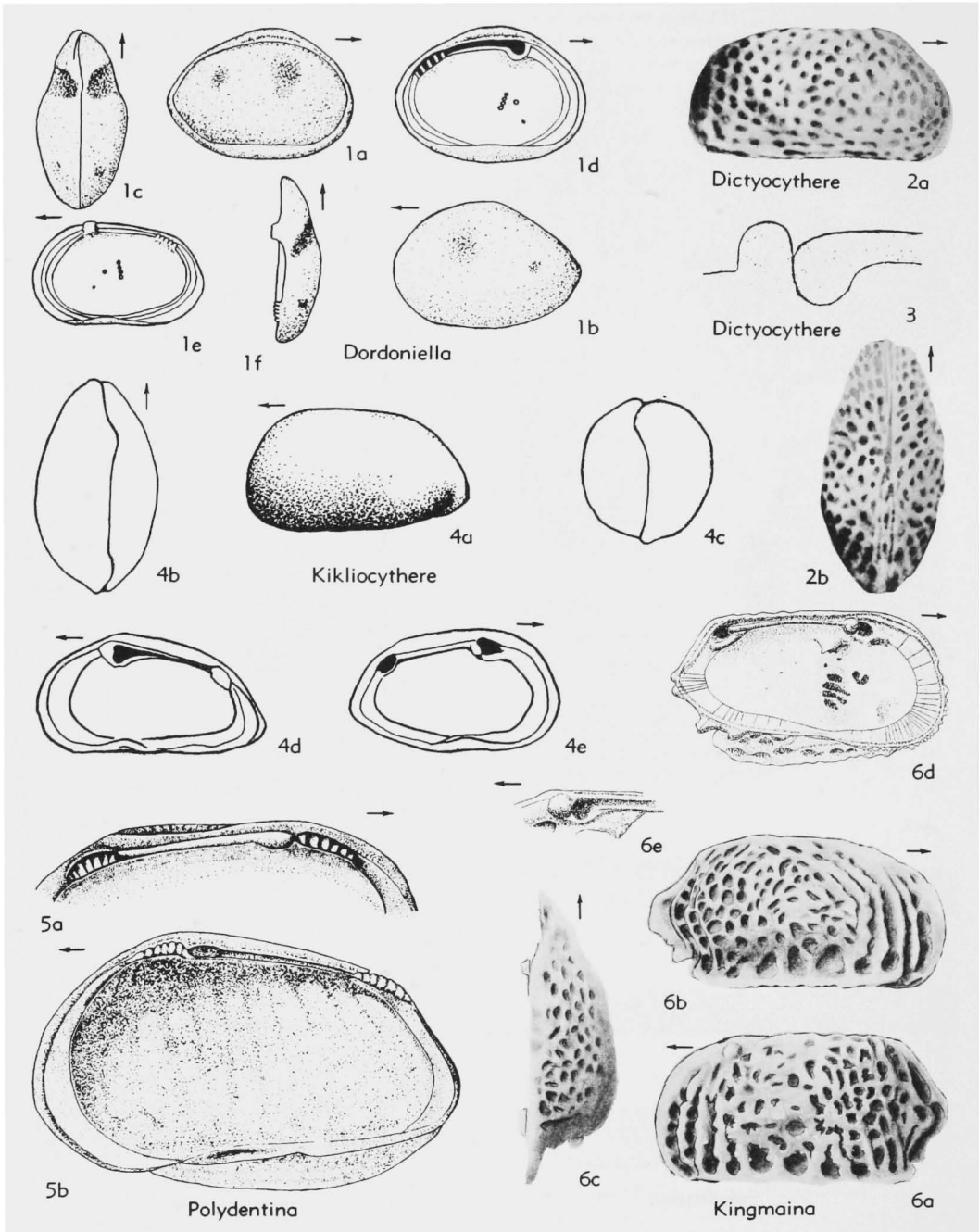


FIG. 193. Brachycytheridae (p. Q262-Q267).

in vertical row of 4 elongate scars in Tertiary type species (but in Cretaceous forms some of these scars are divided), mandibular scar subcircular, antennal scar U-shaped in type species but divided in Cretaceous species; marginal areas regular with numerous radial canals in anteroventral region, sparse elsewhere. *Cret.-Eoc.*, Eu.——FIG. 193,*6*. **K. forbesiana* (BOSQUET), Eoc., Fr.-Belg.; *6a-c*, LV lat., RV lat., RV dors. (U.Ypres., Paris Basin), ×60; *6d,e*, LV int., RV hinge ant. part (Barton., Belg.), ×60, ×93 (42).

Macrodentina MARTIN, 1940 [**M. lineata*] [*?=Rhysocythere* SYLVESTER-BRADLEY, 1956]. Dimorphous, with strong elongate-oval subequal valves, broadly rounded in front but less so posteriorly, dorsum arched, venter flattened and longitudinally ribbed, lateral surface finely to strongly pitted, reticulate or vertically ribbed; eye tubercle lacking. Hinge paramphidont, front tooth of RV having several stepped crenulations; muscle scars in vertical row of 4, mandibular scar oval, antennal scar crescent-shaped; on marginal areas regular, with rather widely spaced radial canals; normal canals widely spaced. *Jur.*, Eu.——FIG. 188,*3*. **M. lineata; 3a*, ♂ LV lat.; *3b*, ♀ LV lat.; *3c,d*, LV int., RV int.; *3e,f*, LV dors., RV dors.; all ×45 (51).——FIG. 192,*2*. *M.* sp., schematic diagram of ant. RV hinge; *2a*, young molt, *2b*, later instar, *2c*, adult, enlarged (235).

Polydentina MALZ, 1958 [**Clithrocytheridea? steghausi* KLINGLER, 1955]. Described as subgenus of *Macrodentina* with similar appearance but differing in less well-developed paramphidont hingement, anterior tooth of RV being a crenulate ridge and anterior end of median element of LV being a raised and thickened bar which fits in shallow socket behind anterior tooth of RV, hinge details variable. Sexual dimorphism strong. [Marine, brackish.] *Jur.-L.Cret.*, Eu.——FIG. 192,*4*; 193,*5*. **P. steghausi* (KLINGLER), U.Jur.(Kimm.), Ger.; 192,*4a-c*, ♀ LV lat.; ♀ RV lat., ♀ RV dors., ×65; 193,*5a,b*, ♀ LV and RV int., ×83 (235).——FIG. 192,*5*. *P.* sp., schematic diagram of RV hinge, ant. part (235).

Pterygocythere HILL, 1954 [**Cypridina alata* BOSQUET, 1847]. Identical in all features to *Alatacythere*, except for thicker shell material and hence broader accommodation groove in LV. *U.Cret.-Eoc.*, Eu.-N.Am.——FIG. 190,*3*. **P. alata* (BOSQUET), U.Cret.(Maastricht.), Holl.(Maastricht.); *3a,b*, LV lat., RV lat.; *3c*, carapace dors.; *3d,e*, LV int., RV int.; all ×37.5 (after 169).——FIG. 190,*6*. *P. hilli* KEIJ, Eoc. (Led.), Belg.; *6a,b*, ♀ LV lat., vent.; *6c*, LV int.; all ×60 (42).

Pterygocythereis BLAKE, 1933 [**Cythereis jonesii* BAIRD, 1850] [=*Fimbria* NEVIANI, 1928 (*non* BOHADSCH, 1761; *nec* MEGERLE, 1811; *nec* RISSO, 1826; *nec* COBB, 1894; *nec* BELON, 1896); *Pterigocythereis* VAN DEN BOLD, 1946 *(errore)*]. Carapace rather inflated ventrally, with strong pointed

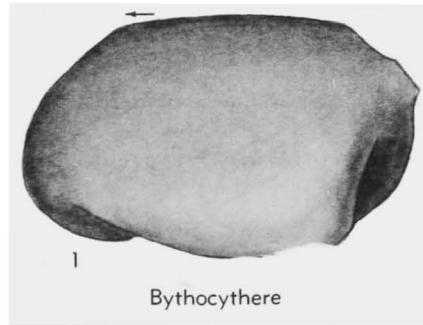


FIG. 194. Bythocytheridae (p. Q268).

alae, which in type species are broken into a row of spines, each spine surrounding a canal; lateral surface generally smooth but in some species bearing tubercles or spines and in most species bearing a bladelike dorsal ridge; eye spot distinct; anterior and posterior margins spiny; ventral surface flattened and usually bearing longitudinal ribs and in some species nodes. Hinge typically holamphidont but in some European species middle elements may be crenulate; adductor scars in vertical row of 4, with top and bottom scars smallest, antennal scar V-shaped, mandibular scar oval, at least 3 additional scars high in carapace; marginal areas regular, with 8 to 10 groups of 2 to 4 radial canals, each group leading to a marginal spine; normal canals widely spaced (99, 266). *L.Mio.-Rec.*, N.Am., *Eoc.-Rec.*, Eu.——FIGS. 190,*7*, 192,*3*. **P. jonesi* (BAIRD), Rec., N.Atl. (Scapa Flow); 190,*7a,b*, carapace L, dors., ×50 (Sars); 192,*3a-d*, RV lat., LV lat., carapace dors., carapace vent., ×50 (Howe, n).——FIG. 191,*3*. *P. cornuta* (ROEMER), Eoc. (Barton.), Belg.; *3a,b*, ♀ LV lat., vent., ×60; *3c*, LV hinge, ×75 (all 42).——FIG. 191,*4*. *P. fimbriata* (MÜNSTER), Oligo. (Rupel.), Belg.; *4a,b*, ♂ RV lat., vent., ×60; *4c*, RV hinge, ×75 (all 42).

Family BYTHOCYTHERIDAE Sars, 1926

[*nom. transl.* SYLVESTER-BRADLEY, herein (*ex* Bythocytherinae SARS, 1926)] [Materials for this family prepared by P. C. SYLVESTER-BRADLEY, University of Leicester, and R. V. KESLING, University of Michigan] [Includes Pseudocytherinae SCHNEIDER, 1960]

Hinge lophodont, with long median element, and various modifications. Short caudal process developed in most genera, and median dorsal sulcus in many. Adductor-muscle scars commonly in arcuate group of 5 or more scars, arranged within median sulcus if one is present. *Dev.-Rec.*

The Bythocytheridae comprise the longest-ranging family of the Cytheracea, *Monoceratina* being recorded continuously from Devonian to Recent. Doubt about the valid-

ity of identifying Paleozoic with post-Paleozoic species of *Monoceratina* has now been resolved, since SOHN reports that fluoritized Paleozoic specimens show duplicature and 5 adductor-muscle scars, as in post-Paleozoic forms.

Bythocythere SARS, 1866 [**B. turgida;* SD BRADY & NORMAN, 1889] [=*Bathocythere* NORMAN, 1867 *(errore)*]. Short, upturned caudal process; no median sulcus; venter inflated or alate. Hinge lophodont, with no accommodation groove; moderately wide anterior vestibule; radial pore canals sparse, straight; muscle-scar pattern with 5 adductor scars forming an arcuate group, concave toward front, and with 6th scar slightly more separated, directly above adductors; 2 antennal scars in front of adductor scars. *Tert.-Rec.,* cosmop.——FIGS. 194,*1*, 195,*4*. **B. turgida,* Rec., Eire; 194,*1*, LV lat.; 195,*4a,b*, RV int., LV int.; all ×60 (Sylvester-Bradley).

Bythoceratina HORNIBROOK, 1952 [**B. mestayerae*] [=*Bythocytherina* SOHN, 1957 *(errore)*]. Like Monoceratina but hinge differs in having long denticulate median element to otherwise lophodont hinge. Some species with caudal process below hinge line as in *Bythocythere* but others have this process in line with hinge (as in *Monoceratina*). *Cret.-Rec.,* N.Z.-Antarct.——FIG. 196,*3a-c*. **B. mestayerae,* Rec., N.Z.; *3a,* LV lat.; *3b,c,* RV int., dors.; all ×75 (32).——FIG. 196,*3d*. *B. maoria* HORNIBROOK, Mio., N.Z.; RV int., ×75 (32).——FIG. 196,*3e*. *B. tuberculata* HORNIBROOK, Rec., N.Z.; muscle scar, ×200 (32).

Jonesia BRADY, 1866 [**Cythere simplex* NORMAN, 1865 (*non Cythere auriculata simplex* CORNUEL, 1848) (=**Bythocythere acuminata* SARS, 1866)] [=*Macrocythere* SARS, 1926 (obj.); *Macrocytherina, Luvula* CORYELL and FIELDS, 1937]. Carapace more or less elongate, dorsal margin straight or convex, anterior end evenly rounded, ventral margin sinuous (concave in front of middle), posterior end sharply acuminate; no median sulcus. Hinge modified lophodont, with terminal elements reduced or missing, and median ridge in LV projecting farther at ends than in middle; muscle-scar pattern linear, with 5 scars sloping downward anteroventrally; wide anterior and posterior vestibules. *Mio.-Rec.,* cosmop.——FIG. 196,*1*. **J. acuminata* (SARS), Rec., Eng.-Norway; *1a-c,* carapace R, dors., vent., ×40; *1d,* LV lat., ×40; *1e,* muscle scar, ×85 (*1a-c,e,*107; *1d,* 315).

Miracythere HORNIBROOK, 1952 [**M. novaspecta*]. Median sulcus behind prominent anterodorsal swelling. Hinge modified lophodont, with median ridge of LV terminating backward in bladelike tooth which fits under posterior tooth of RV; adductor-muscle scars in closely-spaced row of 5. *U.Eoc.-Rec.,* N.Z.——FIG. 196,*2*. **M. novaspecta,* Rec.; *2a,* LV lat.; *2b,* carapace dors.; *2c,* LV (juv.) dors.; *2d,* RV int.; *2e,* muscle scar; *2a-d,* ×75, *2e,* ×150 (32).

Monoceratina ROTH, 1928 [**M. ventrale (sic)*] [=*Bythocytheremorpha* MANDELSTAM, 1958]. Typically elongate, with long, straight dorsal margin terminating in caudal process; median sulcus extending from dorsal margin to near center of valve, commonly surrounded by crescentic lobe which may bear one or more thornlike spines. Hinge modified lophodont, dominated by long median ridge in LV which in some species has a swollen posterior extremity; anterior element of RV reduced or absent; posterior element of RV a short swollen ridge; adductor-muscle scars of Paleozoic forms in arcuate group of 5, with 2 antennal scars in front (some post-Paleozoic species assigned to genus have only 4 adductor scars). *Dev.-Rec.,* cosmop.——FIG. 195,*3a-c*. **M. ventralis* ROTH, Penn., Okla.; *3a,b,* ♂? carapace L; ♀? carapace L; *3c,* carapace vent.; all ×50 (297).——FIG. 195,*3d-f*. *Monoceratina* sp., Oligo., Tex.; *3d,e,* LV lat., dors., ×50; *3f,* muscle scar, ×150 (82).——FIG. 195,*3g*. *M. herburyensis* SYLVESTER-BRADLEY, M.Jur., Eng.; RV int., ×80 (Sylvester-Bradley).

?Pseudobythocythere MERTENS, 1956 [**P. goerlichi*]. Posterior end subtriangular; no caudal process. Hinge antimerodont; adductor impression of 4 scars in front of median sulcus; duplicature rather wide; radial pore canals sparse. *Cret.,* Ger.——FIG. 195,*2*. **P. goerlichi,* L.Alb.; *2a-c,* LV lat., int., carapace dors., ×60; *2d,* RV int., ×60 (250).

Pseudocythere SARS, 1866 [**P. caudata*]. Carapace compressed, without lateral expansions; caudal process continuous with dorsal margin; no median sulcus. Duplicature broad; radial pore canals sparse; anterior vestibule extending to half width of marginal zone; 5 adductor-muscle scars. *Cret.-Rec.,* cosmop.——FIG. 195,*5*. **P. caudata,* Rec., Medit.; *5a,* RV int.; *5b,* carapace dors., ×100 (53).

Triceratina UPSON, 1933 [**T. urefordensis*]. Posterodorsal end attenuated; S_2 long, shallow; 1 or 2 nodes in anteroventral region and long backward-directed spine in ventral; surface punctate. *Miss.-Perm.,* N.Am.——FIG. 195,*1a,b*. **T. urefordensis,* L.Perm., USA(Neb.); *1a,b,* carapace L, vent., ×75 (390).——FIG. 195,*1c-f*. *T. inconsueta* COOPER, U.Miss., Ill.; *1c-f,* carapace R, vent., ant., post., ×75 (20).

Family CYTHERETTIDAE Triebel, 1952

[Materials for this family prepared by H. V. HOWE, Louisiana State University]

Carapace moderately large, heavy, with obliquely rounded ends, posterior end narrower; dorsal margin of LV tending to be raised over terminal teeth of RV. Surface smooth, longitudinally pitted, or reticulate, in some genera bearing 3 longitudinal ribs;

without appreciable muscle node but a pit may be present on interior valve surface; no eye socket or tubercle. Hinge very strongly holamphidont, with terminal teeth of RV pointing away from each other, anterior tooth of LV pointing downward behind anterior socket, which is only weakly inclosed ventrally, median element of hinge smooth or finely crenulate; marginal area parallel to outer margin only in upper half of back end, elsewhere of variable width owing to irregular embayments, but net effect being great breadth; commonly with small anterior vestibule, from which long sinuous

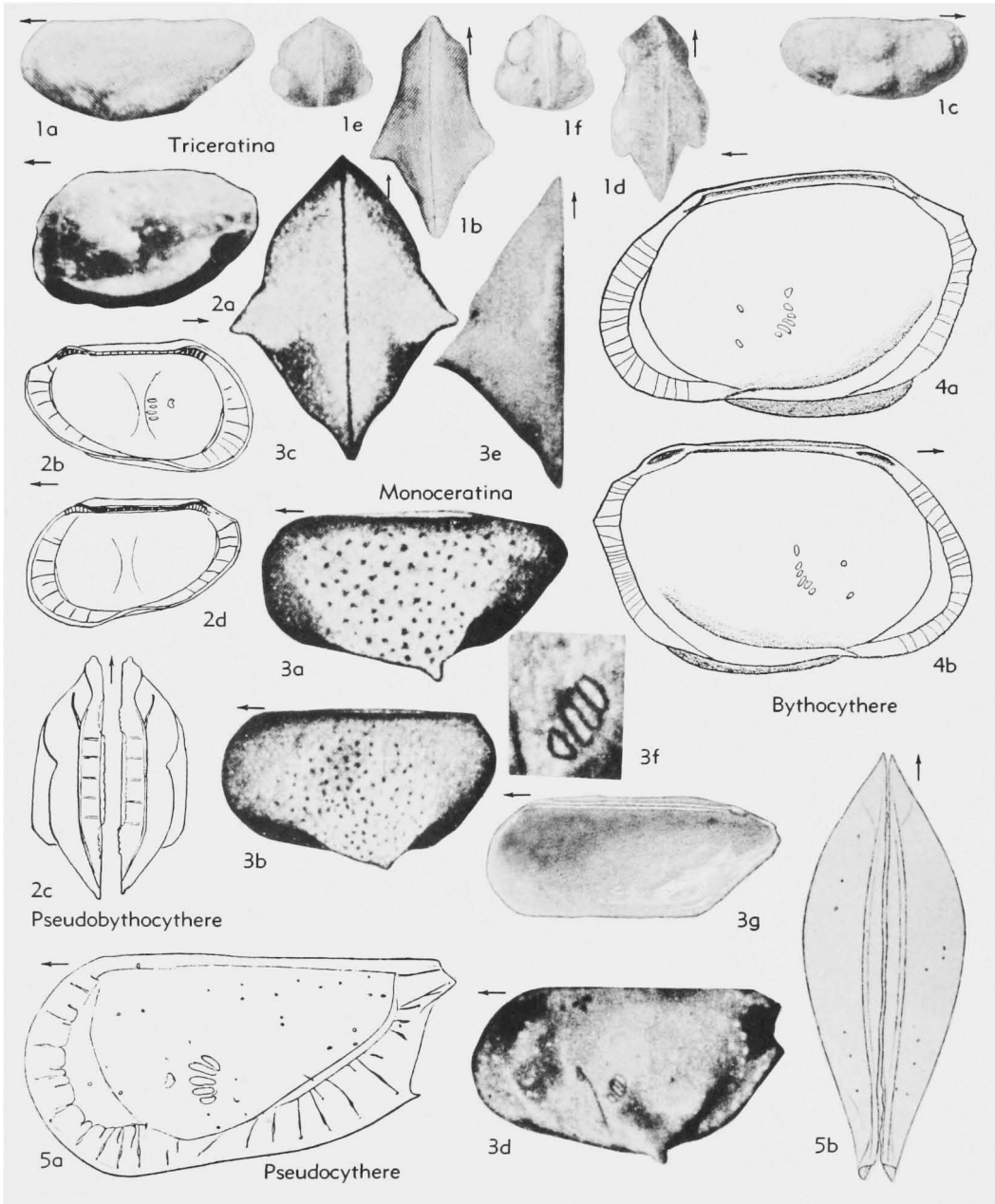


FIG. 195. Bythocytheridae (p. Q268).

to bulbous radial canals extend; muscle scars usually difficult to make out in their entirety owing to depth and thickness of shell, but consisting of vertical row of 4, in front of which antennal scars appear fused in V with mandibular scars much lower, near lobe of inner margin (several additional scars usually seen higher in carapace); normal canals obscure, if present. *U.Cret.-Rec.*

Cytheretta G.W.MÜLLER, 1894 [**C. rubra* (=**Cytherina subradiosa* ROEMER, 1838)] [=*Pseudocytheretta* CUSHMAN, 1906; *Cylindrus* NEVIANI, 1928 (*non* DESHAYES, 1824; *nec* FITZINGER, 1833; *nec* HERRMANNSEN, 1852); *Prionocytheretta* MEHES, 1941]. Carapace ovate, strong, LV larger and less elongate than RV and differently constructed; sur-

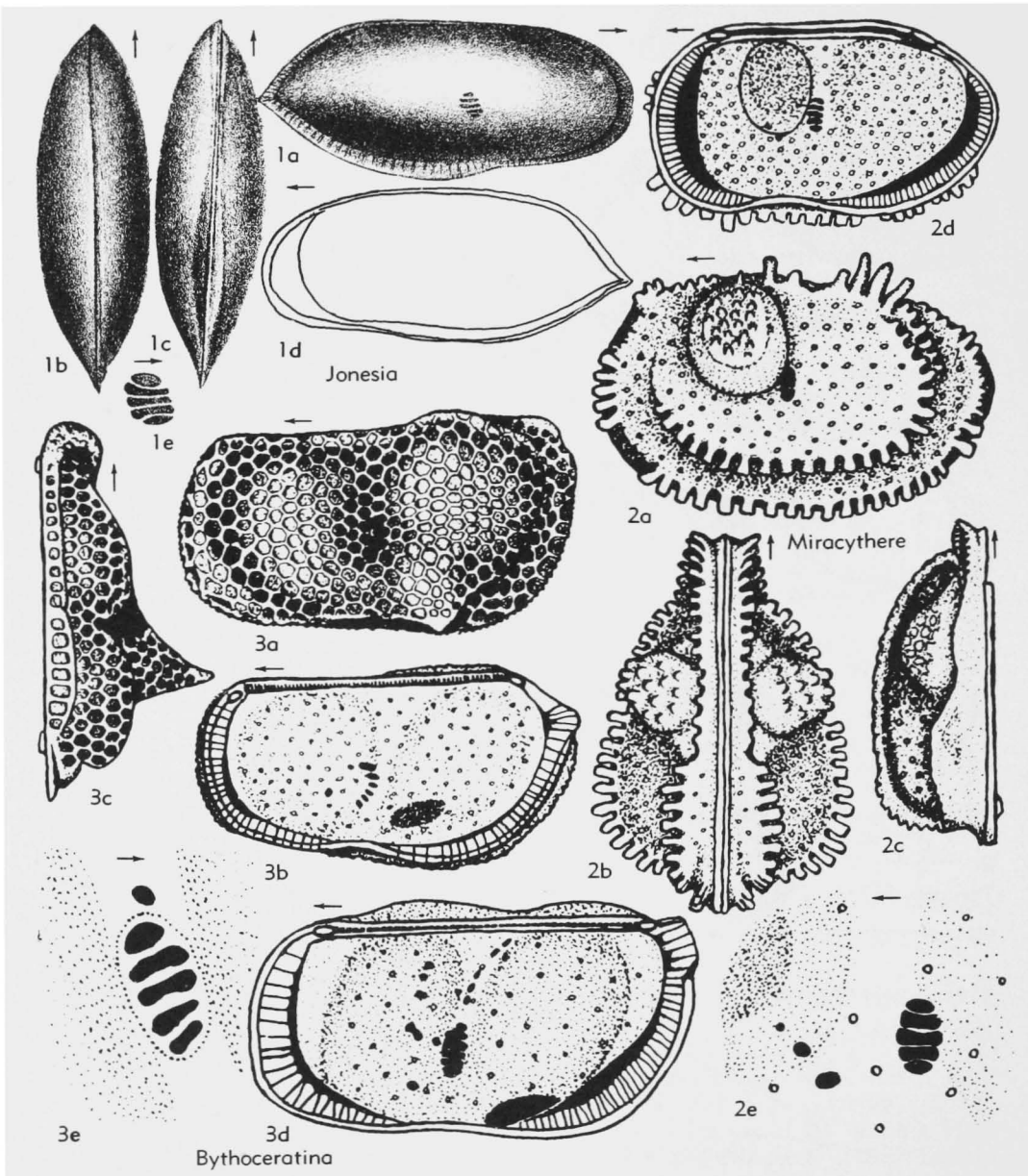


FIG. 196. Bythocytheridae (p. Q268).

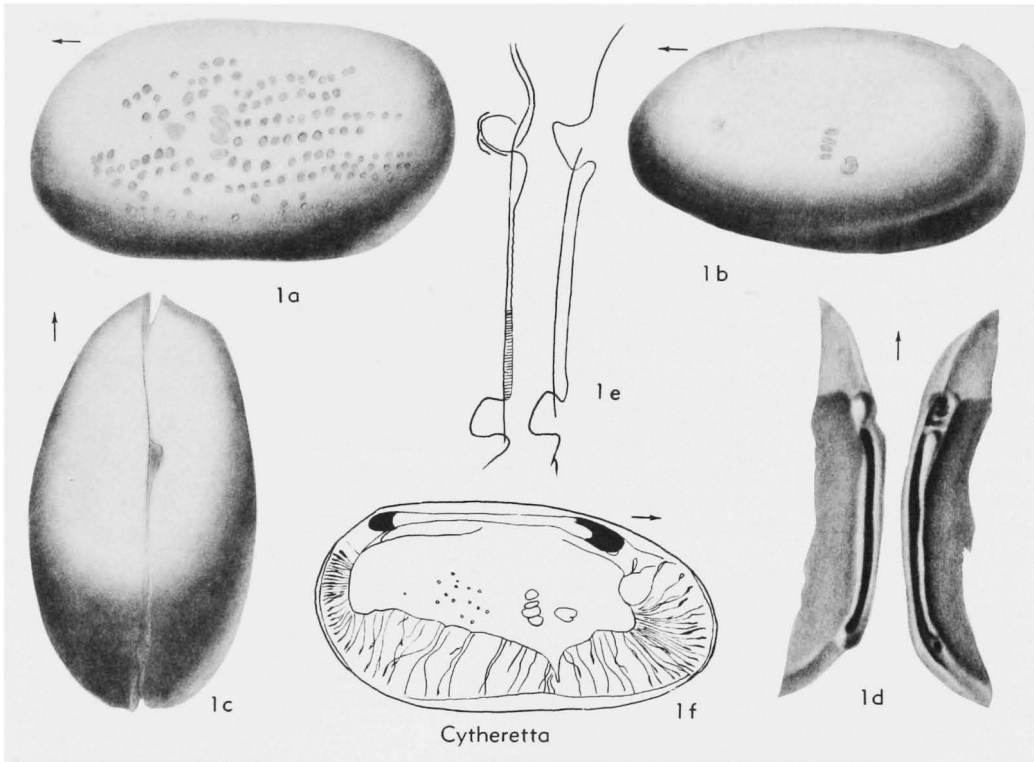


FIG. 197. Cytherettidae (p. Q270-Q271).

face smooth, irregularly pitted, or with pittings arranged in longitudinal reticulations. Hinge heavy holamphidont; marginal areas irregularly broad, with long curved and branching radial canals; adductor scars in vertical row of 4, with V-shaped adductor scar in front and mandibular scars near ventral inner margin (53, 134, 266, 300). *Eoc.-Rec.*, Eu.-N.Am.——FIG. 197,*1*. **C. subradiosa* (ROEMER), Rec., Medit.; *1a,b*, LV lat., ×70; *1c*, carapace dors., ×70; *1d,e*, hinge, LV and RV, ×70, ×90; *1f*, LV int., ×70 (all 53).——FIG. 198,*2*. *C. bambruggensis* KEIJ, Eoc.(Led.), Belg.; *2a,b*, LV lat., RV lat., *2c*, carapace dors.; *2d*, LV int., all ×90 (all 42).

Flexus NEVIANI, 1928 [**Cythere plicata* MÜNSTER, 1830] [=*Eucytheretta* PURI, 1958]. Carapace more elongate and tapering than *Paracytheretta*, smooth or reticulate, bearing 3 very elongate ridges; narrow posterior end of RV denticulate. Internal features like *Cytheretta*. *Oligo.-Mio.*, Eu. ——FIG. 199,*2*. **F. plicatus* (MÜNSTER), Mio., Ger.; *2a,b*, LV lat., RV lat., ×40 (378).

Loculicytheretta RUGGIERI, 1954 [**Cythere pavonia* BRADY, 1866]. Carapace rather small for this family, elongate ovate but with a high posterior angulation; females with 3 circular pits or loculi on posteroventral margin of each valve similar to those of certain Paleozoic ostracodes, but males without loculi, resembling *Cytheretta*. Surface bearing 3 longitudinal ridges which tend to merge near posterior angulation; pitted between ridges. Hinge holamphidont, in RV with sharp, high anterior tooth, nearly circular deep socket that tends to merge into a gradually narrowing furrow along hinge line, and blunt ovate posterior tooth, neither socket completely closed to interior in LV; marginal area broad and nearly regular, with numerous radial canals; muscle scars as in *Cytheretta*. *?Eoc., Plio.-Rec.*, Eu.-Sp.-Italy). ——FIG. 200,*1*. **L. pavonia* (BRADY), Plio., Italy; *1a-c*, ♀ LV lat., dors., vent., ×50; *1d*, ♀ RV dors., ×50 (303); *1e*, Rec., Sp., ♂ carapace vent., ×53; *1f*, ♀ RV int., post. part showing loculi and canals, ×130 (Reyment, n).

Paracytheretta TRIEBEL, 1941 [**P. reticosa*]. Carapace externally somewhat resembling *Cythereis*, reticulate, with 3 longitudinal ribs and LV overlapping RV at anterior hingement but internally like *Cytheretta*. *U.Cret.-Rec.*, Eu.-N.Am.-S.Pac. ——FIG. 198,*1*. **P. reticosa*, Paleoc., Ger.; *1a*, LV lat., ×45; *1b,c*, RV lat., int., ×45; (all 82).

Protocytheretta PURI, 1958 [**Cythere daniana* BRADY, 1869]. Carapace elongate-ovate, plump, with rounded ends, posterior extremity usually showing slight angulation but bearing spines; surface with 3 longitudinal ribs, faint muscle node,

and longitudinally reticulate pattern; LV overlapping RV strongly at anterior end of hinge and less so posteriorly. Hinge, marginal area, and muscle scars as in *Cytheretta*. *Oligo.-Rec.*, N.Am. ——FIG. 199,*1*. **P. daniana* (BRADY), Rec., Gulf Mexico(Fla.); *1a-c*, carapace L, R, dors., ×33 (291).

Family CYTHERIDEIDAE Sars, 1925

[*nom. transl.* SYLVESTER-BRADLEY & HARDING, 1953 (*ex* Cytherideinae SARS, 1925)] [Materials for this family prepared by H. V. HOWE, Louisiana State University, with contributions on some genera by W. A. VAN DEN BOLD, Louisiana State University, and R. A. REYMENT, University of Stockholm]

Carapace ovoid to pear-shaped; surface smooth, pitted, reticulate, or in some forms longitudinally ribbed, with outline generally resembling that of *Cytheridea*. Adductor muscle scars in vertical or inclined row of 4, usually with 2 or more scars in front, but in some specimens with single heart-shaped scar; hinge adont to merodont, smooth to crenulate. Subfamilies differentiated mainly on basis of hingement, marginal areas, and radial canals. *Perm.-Rec.*

Subfamily CYTHERIDEINAE Sars, 1925

[Includes Dolocytherideinae, Clithrocytherideinae MANDELSTAM, 1960]

Surface smooth, pitted or reticulate. Hinge antimerodont or holomerodont, some genera (e.g., *Haplocytheridea*) containing species with reversed valves, normal LV hinge appearing in RV and vice versa; marginal areas widest anteriorly where inner margin in most genera departs from line of concrescence (with similar but smaller departure common posteriorly); radial canals variable in number but in most genera rather abundant; muscle scars in vertical row

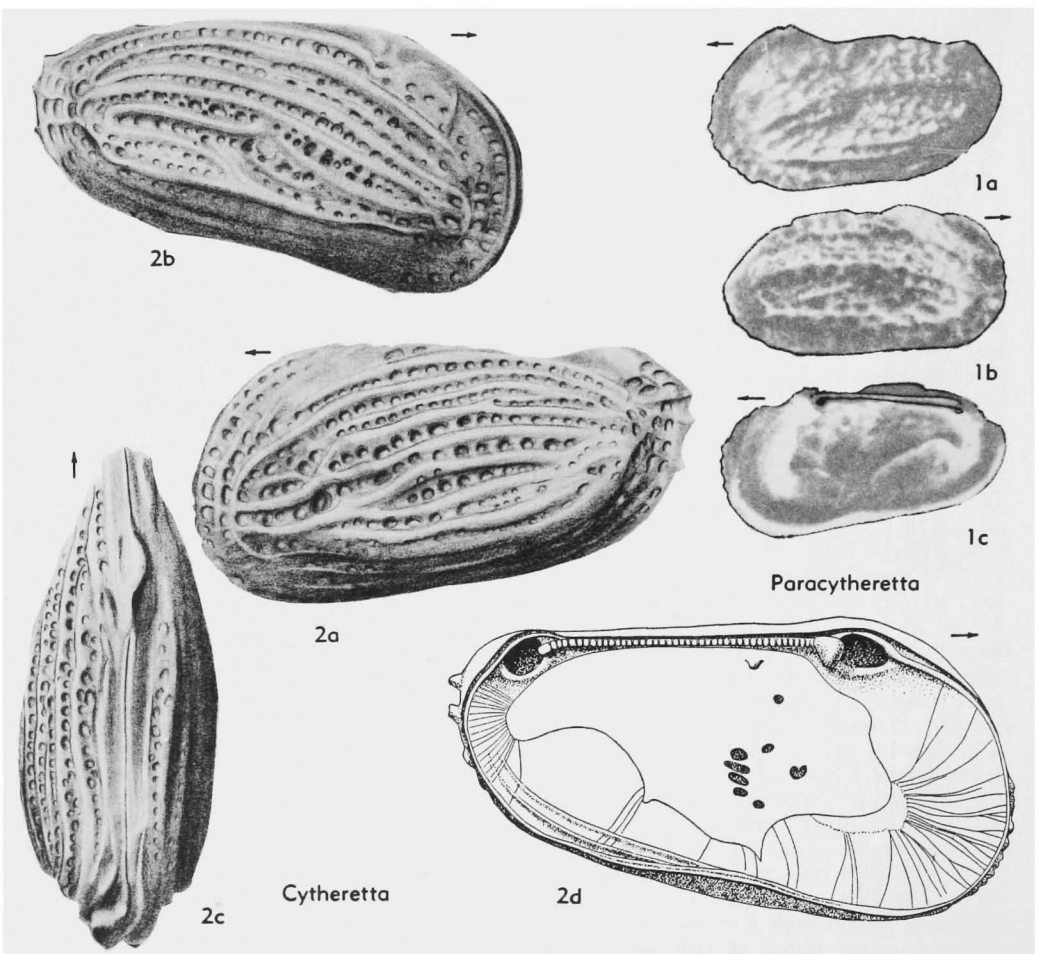


FIG. 198. Cytherettidae (p. Q271).

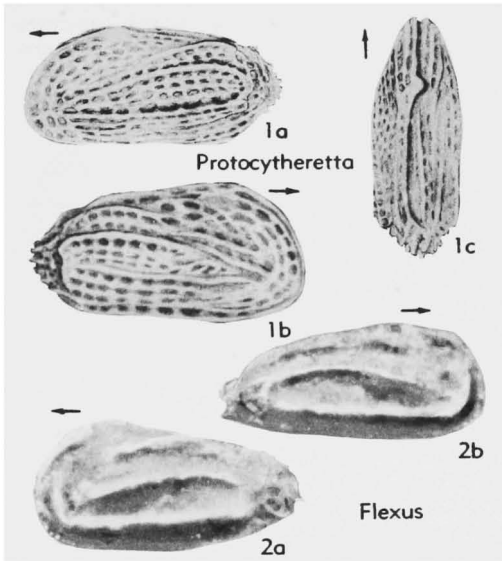


FIG. 199. Cytherettidae (p. Q271-Q272).

of 4, usually with 2 equally spaced ovate scars in front and commonly additional scars above and below. *Perm.-Rec.*

Cytheridea BOSQUET, 1852 [**Cythere mülleri* MÜNSTER, 1830; SD BRADY & NORMAN, 1889] [=*Eucytheridea* BRONSTEIN, 1930]. Carapace thick-shelled, subquadrangular in dorsal view, ovate-triangular in side view, anterior obliquely rounded, posterior oblique, bluntly pointed near venter, both ends tending to be denticulate. Hinge merodont, in LV with terminal crenulate sockets and crenulate median element set somewhat obliquely so that anterior portion projects as short bar, back portion being depressed as furrow; marginal area widest at ends where inner margin and line of concrescence may be separated; radial canals numerous, slightly thickened medially, occurring in groups on anterior; adductor muscle scars in vertical row of 4, with large distinct and smaller less distinct antennal scar in front of upper part usually fused together, and large mandibular scar in front of lower part with much smaller scar obliquely below and behind it, other scars higher in carapace (260, 341). *Oligo.-Rec.*, Eu.-?N.Am. ——FIG. 201,*1*. **C. muelleri* (MÜNSTER), U.Oligo., N.W.Ger.; *1a*, ♂ carapace (neotype) L, ×36; *1b,c*, ♂ and ♀ carapaces dors., ×36; *1d,e*, ♂ LV dors., ♂ RV dors., ×56; *1f*, ♂ LV int. ant., ×56; *1g*, muscle scars, ×100 (152).——FIG. 202, *4*. *C. pernota* OERTLI & KEIJ, Oligo.(Tongr.-Rupel.), Belg.; *4a,b*, ♀ RV lat., ♀ LV lat., ×60; *4c,d*, ♂ RV lat., LV lat., ×60; *4e*, ♀ RV int., ×75 (all 42).

Anomocytheridea STEPHENSON, 1938 [**Cytheridea floridana* HOWE & HOUGH in HOWE *et al.*, 1935] [=*Amonocythere* SOHN, 1951]. Like *Cyprideis* in all characters except anterior portion of median hinge element which forms short blunt smooth bar instead of crenulate ridge, and antennal scars distinct instead of forming a "V." [Might be considered subgenus of *Cyprideis*.] *Mio.-Rec.*, N.Am. ——FIG. 203. **A. floridana* (HOWE & HOUGH), Mio., Fla.; *1a*, ♀ LV lat., ×45; *1b*, both valves dors., ×45; *1c*, muscle scars, enlarged; *1d,e*, RV and LV hinge, enlarged; (all 342).

Asciocythere SWAIN, 1952 [**Bythocypris rotundus* VANDERPOOL, 1928]. Carapace plump, subovate, LV with crenulate terminal sockets separated by smooth median bar, above which is well-defined accommodation groove. Marginal areas narrow, with numerous radial canals. [*Palaeocytheridea* resembles *Asciocythere* in all described characters except that type species has straighter dorsal outline. *L.Cret.*, N.Am.-?Eu.——FIG. 202,*1*. **A. rotunda* (VANDERPOOL), ?Trinity, N.Car. (subsurface); *1a,b*, ?♀ and ?♂ carapace R; *1c*, ?♀ carapace dors.; *1d*, LV int.; all ×40 (354).

Basslerella KELLETT, 1935 [*non* HOWE, 1935 (=*Basslerites* HOWE in CORYELL & FIELDS, 1937), *nec* BOUČEK, 1936 (=*Boucia* AGNEW, 1942)] [**B. crassa*]. Externally similar to *Cytheridea* but hinge of LV with crenulate groove at and in front of

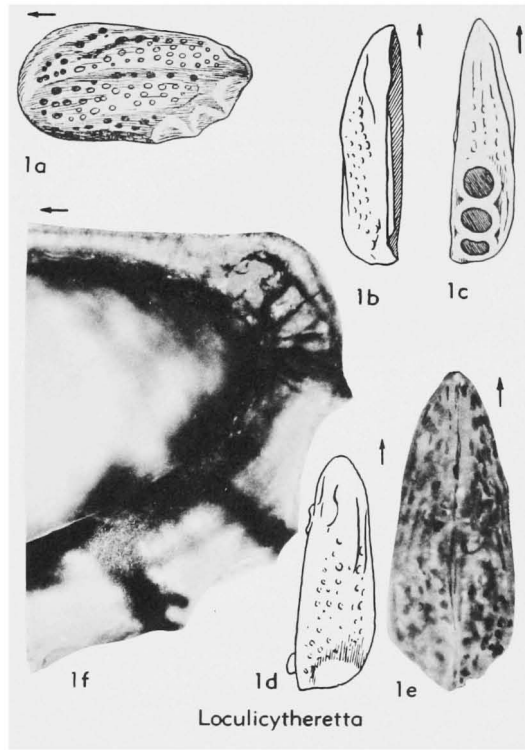


FIG. 200. Cytherettidae (p. Q271).

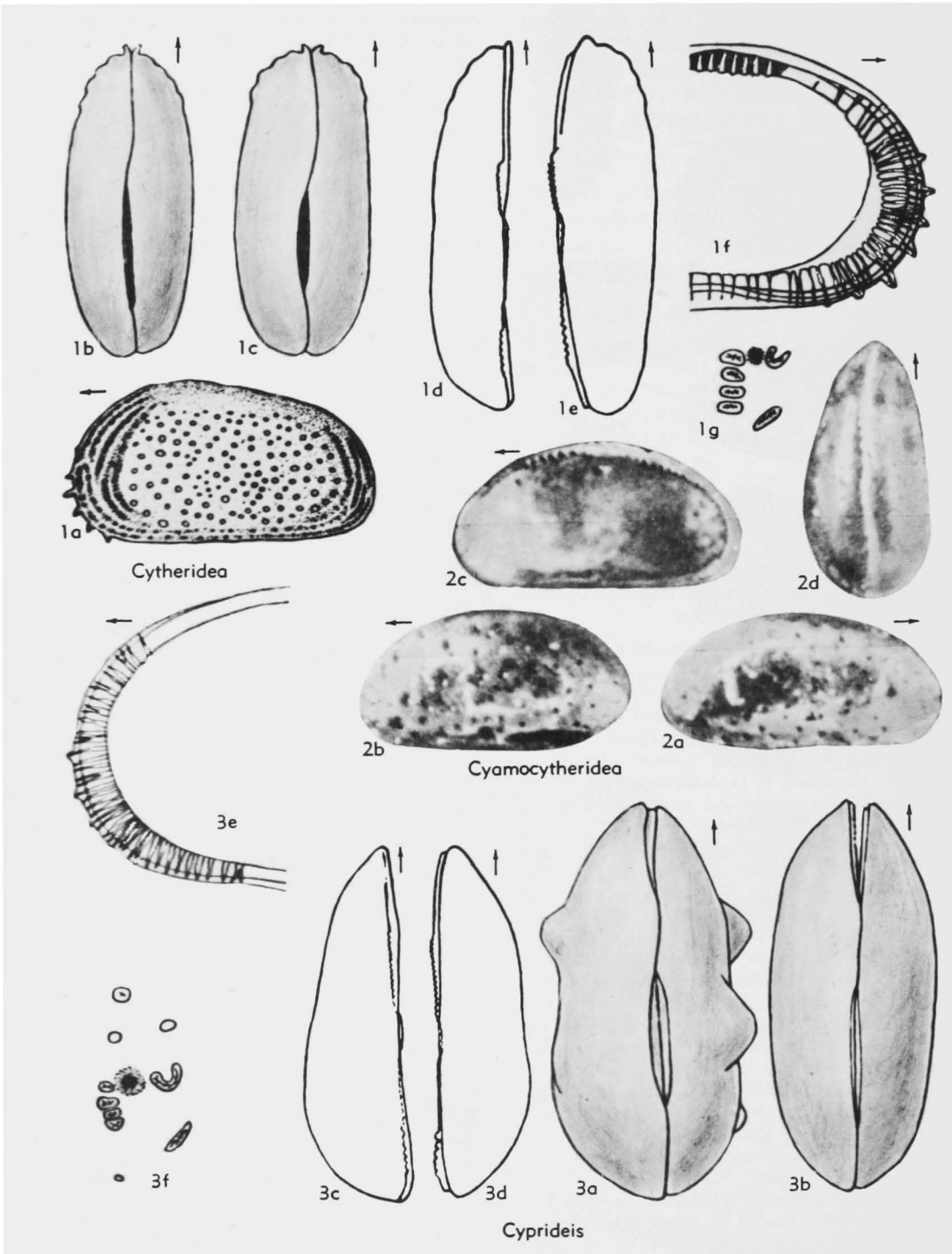


FIG. 201. Cytherideidae (Cytherideinae) (p. Q273-Q276).

center and marginal area of even medium width, inner margin not quite coinciding with line of concrescence. *Perm.*, USA.——Fig. 202,*3*. **B. crassa*, L.Perm., Kans.; *3a,b*, RV lat., LV int., ×60; *3c*, carapace dors., ×60 (198).

Clithrocytheridea Stephenson, 1936 [**Cytheridea garretti* Howe & Chambers, 1935] [=*Clithocytheridea* van den Bold, 1946]. Like *Cytheridea* in outline but commonly ornamented with reticulations and ridges. Hinge antimerodont, LV with terminal crenulate sockets separated by raised crenulate bar (type species with flattened dorsal margin above median bar but some others referred to genus having distinct accommodation groove);

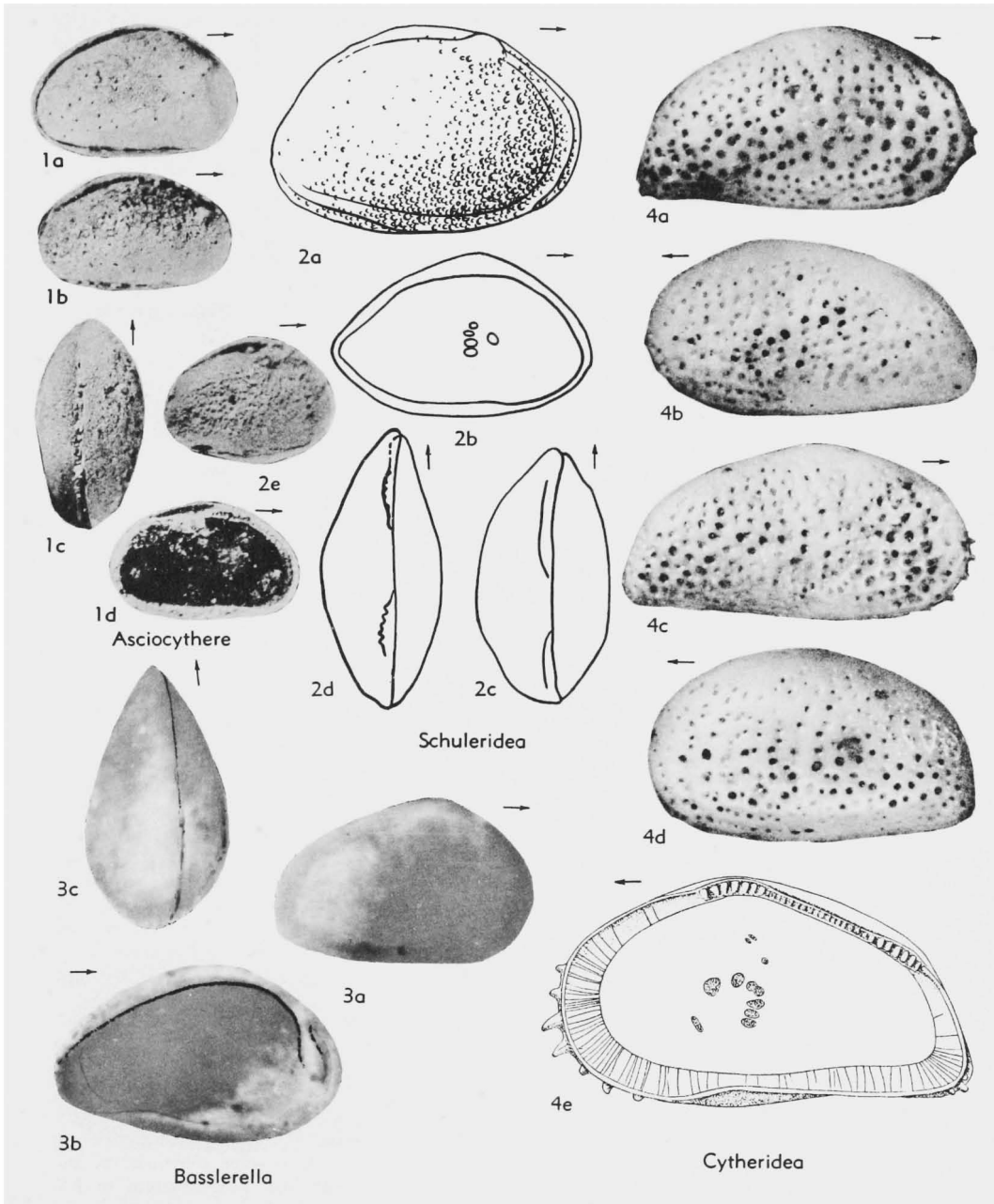


Fig. 202. Cytherideidae (Cytherideinae) (p. Q273-Q284).

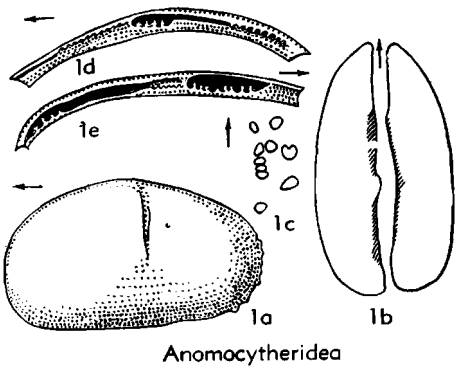


FIG. 203. Cytherideidae (Cytherideinae) (p. Q273).

marginal area fairly broad, with numerous radial canals; muscle scars in vertical row of 4, with V-shaped antennal scar in front and 2 oblique mandibular scars below. *U.Cret.-Oligo., ?Rec.*, N. Am.-Eu.——FIG. 204,*1a-d*. **C. garretti* (HOWE & CHAMBERS), Eoc., Ala.; *1a*, carapace R, ×45; *1b,c*, LV int., RV int., ×45; *1d*, LV lat., ×45; (all 33).——FIG. 204,*1e-g*. *C. lerichei* KEIJ, Eoc. (Lutet.), Fr.(Paris Basin); *1e,f*, ♂ LV lat., ♀ LV lat., ×60; *1g*, LV int., ×110 (all 42).

Cyamocytheridea OERTLI, 1956 [**Bairdia punctatella* BOSQUET, 1852]. Resembling *Haplocytheridea* in most characters, but more oval, with both ends rounded instead of being acuminate ventrally, and in having a distinct anterior vestibule. Females plumper than males posteriorly. *Oligo.-Mio.*, Eu. (Paris Basin).——FIG. 201,*2*. **C. punctatella* (BOSQUET), Oligo. (Chatt.), Switz.; *2a,b*, ♂ RV lat., ♂ LV lat.; *2c*, ♀ RV int.; *2d*, ♀ carapace dors.; all ×58 (57).

Cyprideis JONES, 1857 [**Candona torosa* JONES, 1850]. Similar to *Cytheridea* in shape but more ovate; type species with scattered tubercles on surface. Hinge an entomodont development similar to that in Progonocytherinae, consisting in LV of long crenulate anterior socket with about 15 pits, postjacent short high crenulate ridge merging into shallow furrow, and short posterior crenulate socket with about 6 pits; marginal areas regular, with fairly numerous straight radial canals; muscle scars in vertical row of 4 adductors, above which are 3 small scars, V-shaped antennal scar in front of top of row and mandibular scar in front of bottom of row, with 2nd mandibular scar near ventral margin. Sexual dimorphism pronounced; unlike *Cytheridea*, ripe ova received in shell cavity for development. [Habitat typically brackish-water.] (38, 68). *Mio.-Rec.*, Eu.——FIG. 201,*3*; 207,*1*. **C. torosa* (JONES), Pleist.(NW. Ger.)-Rec.(NE.Atl.); *3a,b*, ♀ and ♂ carapaces dors., ×58; *3c,d*, ♀ LV and RV dors., ×55; *3e*, ♀ RV int. ant., ×90; *3f*, muscle scars, ×115 (201,*3a-g*, Pleist., NW.Ger., 152); 207,*1a,b*, ♂ RV lat., ♀ LV lat., ×40; *1c*, ♀ LV int., ×83; *1d*, ♀ carapace long. sec., ×47 (207,*1a-d*, Rec., NE.Atl., 88, by permission of Mouton & Co., The Hague).

Dolocytheridea TRIEBEL, 1938 [**Cytherina hilseana* F. A. ROEMER, 1841]. Carapace egg-shaped to subcylindrical; surface smooth. Hinge of LV with 2 crenulate sockets connected by very short furrow; middle of RV hinge occupied by smooth ridge. *L.Cret.*, Eu.——FIG. 205,*2*. **D. hilseana* (ROEMER), Ger.; *2a,b*, carapace L, dors., ×45; *2c*, LV int., ×45 (373).

Galliaecytheridea OERTLI, 1957 [*G. dissimilis*]. Similar to *Asciocythere* but LV hinge has crenulate bar instead of smooth bar, and radial canals are rather few (10 to 15 in front); adductor scars in nearly vertical row of 4 with single antennal scar in front and 2 mandibular scars below it near ventral margin. *U.Jur.*, Eu.(Fr.).——FIG. 208,*1*. **G. dissimilis*, L.Kimm.; *1a,b*, ♀ RV lat., ♀ LV lat.; *1c,d*, ♂ LV lat., ♂ RV lat.; *1e,f*, ♀ and ? ♂ carapaces dors.; all ×50 (269).

Haplocytheridea STEPHENSON, 1936 [**Cytheridea montgomeryensis* HOWE & CHAMBERS, 1935] [=*Leptocytheridea* STEPHENSON, 1937; *Phractocytheridea* SUTTON & WILLIAMS, 1939]. Shaped like *Cytheridea* in lateral view but ovate with pointed ends in dorsal view. Hinge holomerodont, with terminal crenulate sockets connected by crenulate furrow; marginal area moderately broad; with slight if any vestibules but with numerous radial canals; muscle scars essentially as in *Cytheridea*. *U.Cret.-Rec.*, N.Am.-Eu.——FIG. 204,*2a-c*. **H. montgomeryensis* (HOWE & CHAMBERS), U.Eoc., La.; *2a*, carapace R, ×80; *2b,c*, hinge LV and RV, ×80 (33).——FIG. 204,*2d,e*. *H. heizelensis* KEIJ, Eoc. (Barton.), Belg.; *2d,e*, ♀ LV lat., ♂ LV lat., ×90 (42).

Heterocyprideis ELOFSON, 1941 [**Cythere (Cytheridea) sorbyana* JONES, 1857]. Carapace strong, plump, anterior end bearing spines and posteroventral corner of RV with single spine; surface somewhat rugose, lines and punctae tending to parallel margins both in molts and adults. Hinge antimerodont, with terminal crenulate sockets in LV separated by crenulate projecting bar (23, 38, 68). *Rec.*, North Sea.——FIG. 205,*3*. **H. sorbyana* (JONES); *3a*, LV lat., ×60; *3b*, carapace dors., ×60; *3c*, ant. margin with radial canals, enlarged (*3a,b*, 314; *3c*, 23).

Kalyptovalva HOWE & LAURENCICH, 1958 [**Cytheridea ovata* BOSQUET, 1854]. Carapace solid, thick-walled, inequivalved, egg-shaped, LV much larger than RV, overlapping it on all sides. Hingement consisting of continuous furrow around periphery of LV, lower edge of which is thickened along hinge margin and upper edge crenulated at anterior end of hinge line; hinge margin in RV thickened into bar that bears crenulations on its anterior end; marginal area widest at ends but

shell too thick for observation of radial canals; muscle scars in vertical row of 4 adductors with 2 scars in front. *U.Cret.*, Eu.(Belg.-Holl.).——FIG. 208,*3*. **K. ovata* (BOSQUET), Maastricht., Holl.; *3a-c*, ♀ carapace R, dors., ant., ×35; *3d,e*, ♂ RV int., ♀ LV int., ×45 (34).

Neocyprideis APOSTOLESCU, 1956 [*non* HANAI, 1959] [**N. durocortoriensis*] [=*Goerlichia* KEIJ, 1957]. Resembles *Cyprideis* in form (might be considered as subgenus) but median hinge element of LV is prominent undifferentiated crenulate bar. *Eoc.-Mio.*, Eu.——FIG. 205,*1*. *N. williamsoniana* (BOSQUET), (type species of *Goerlichia*), Oligo., Belg.; *1a*, ♂ LV lat., ×60; *1b,c*, ♂ and ♀ RV lat., ×60; *1d*, ♀ RV int., ×75; *1e,f*, LV and RV dors. showing hinge, ×75 (all 42).——FIG. 208,*4*. **N. durcortiensis*, L.Eoc., Fr.; *4a*, carapace dors.; *4b,c*, LV dors., RV dors.; *4d,e*, LV int., RV int.; all ×50 (93).

Netrocytheridea HOWE & LAURENCICH, 1958 [**Cypridina fusiformis* BOSQUET, 1847]. Sexually dimorphous, inequivalve, fusiform, with rounded

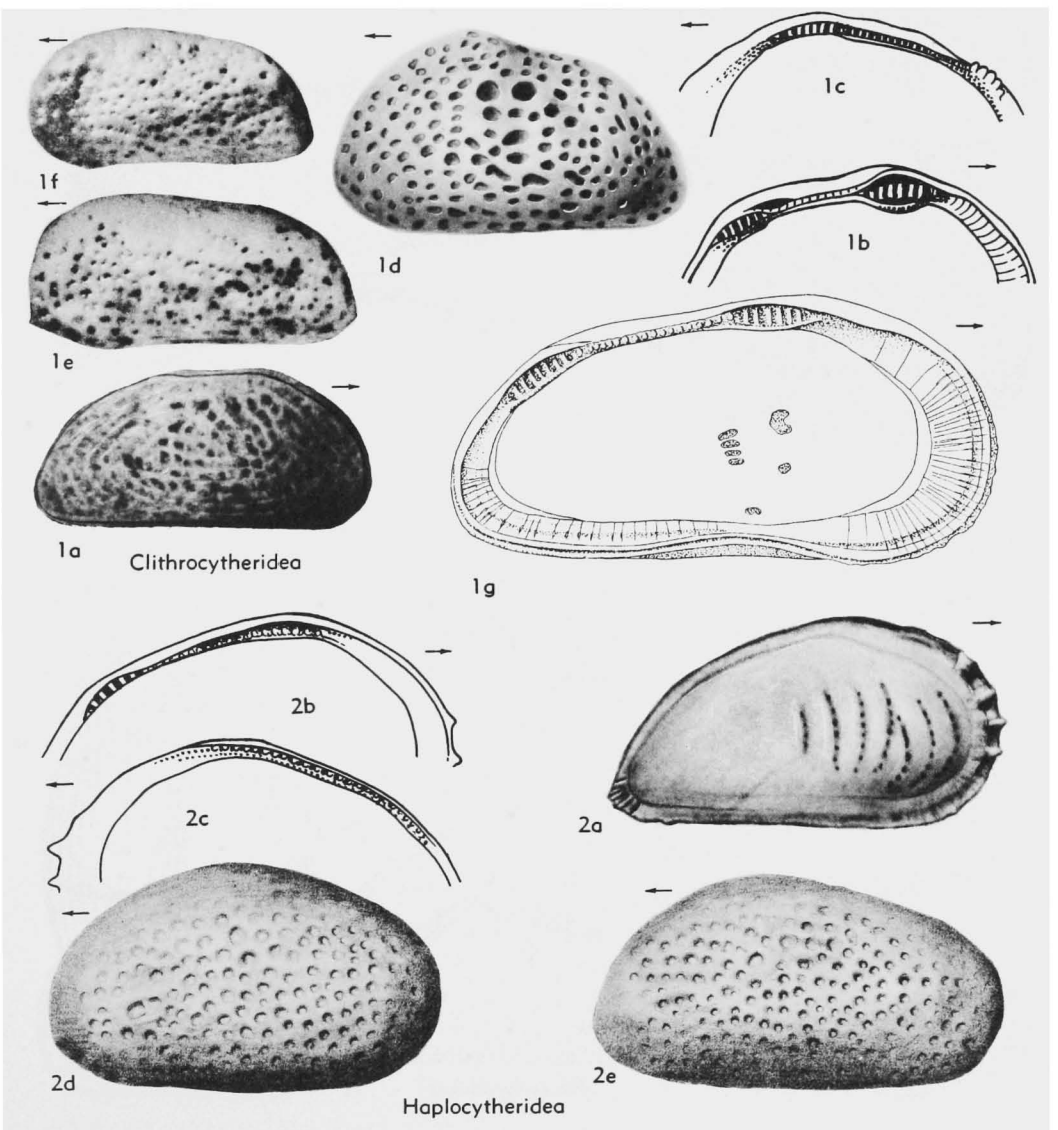


FIG. 204. Cytherideidae (Cytherideinae) (p. Q275-Q276).

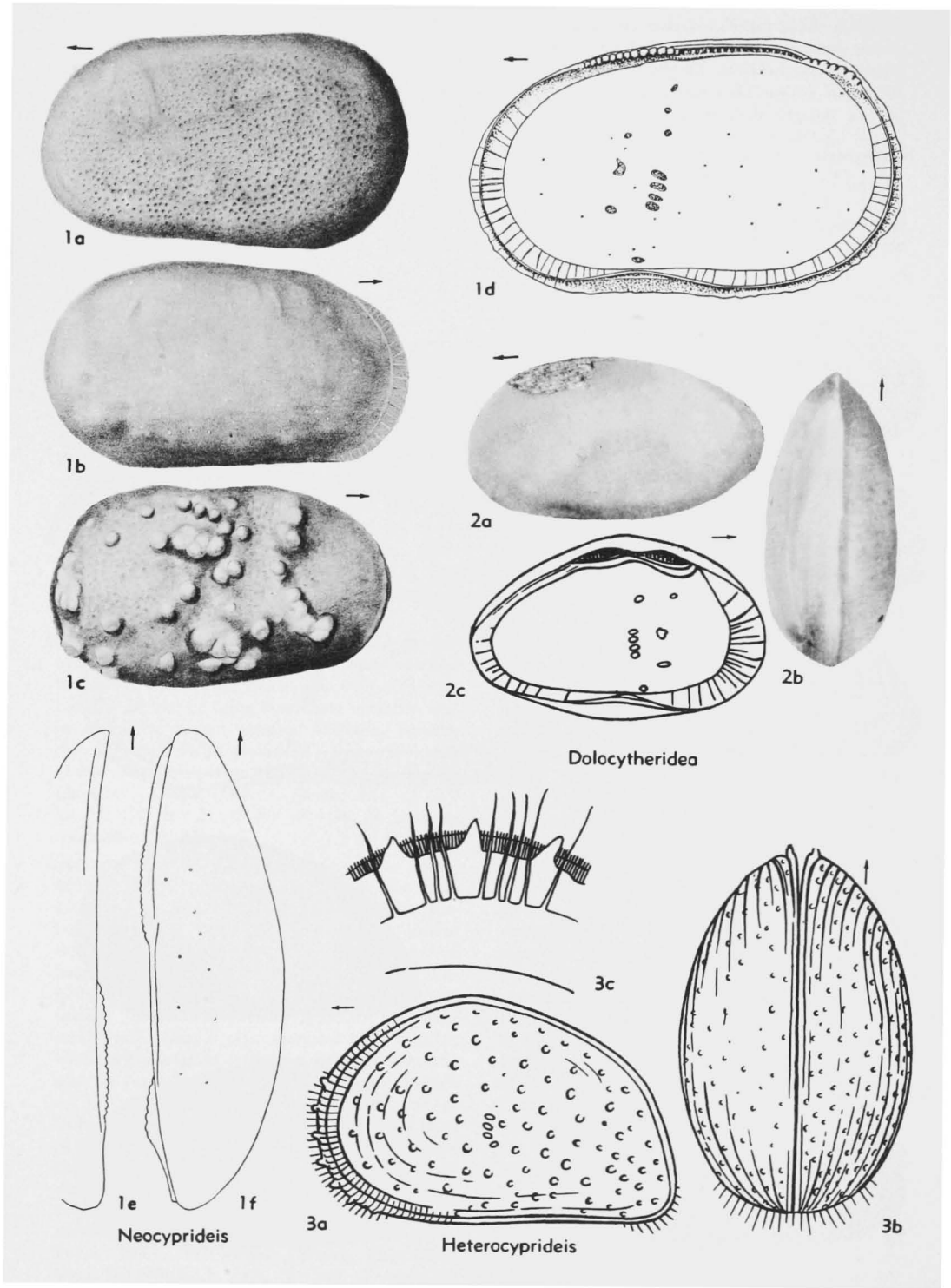


FIG. 205. Cytherideidae (Cytherideinae) (p. Q276-Q277).

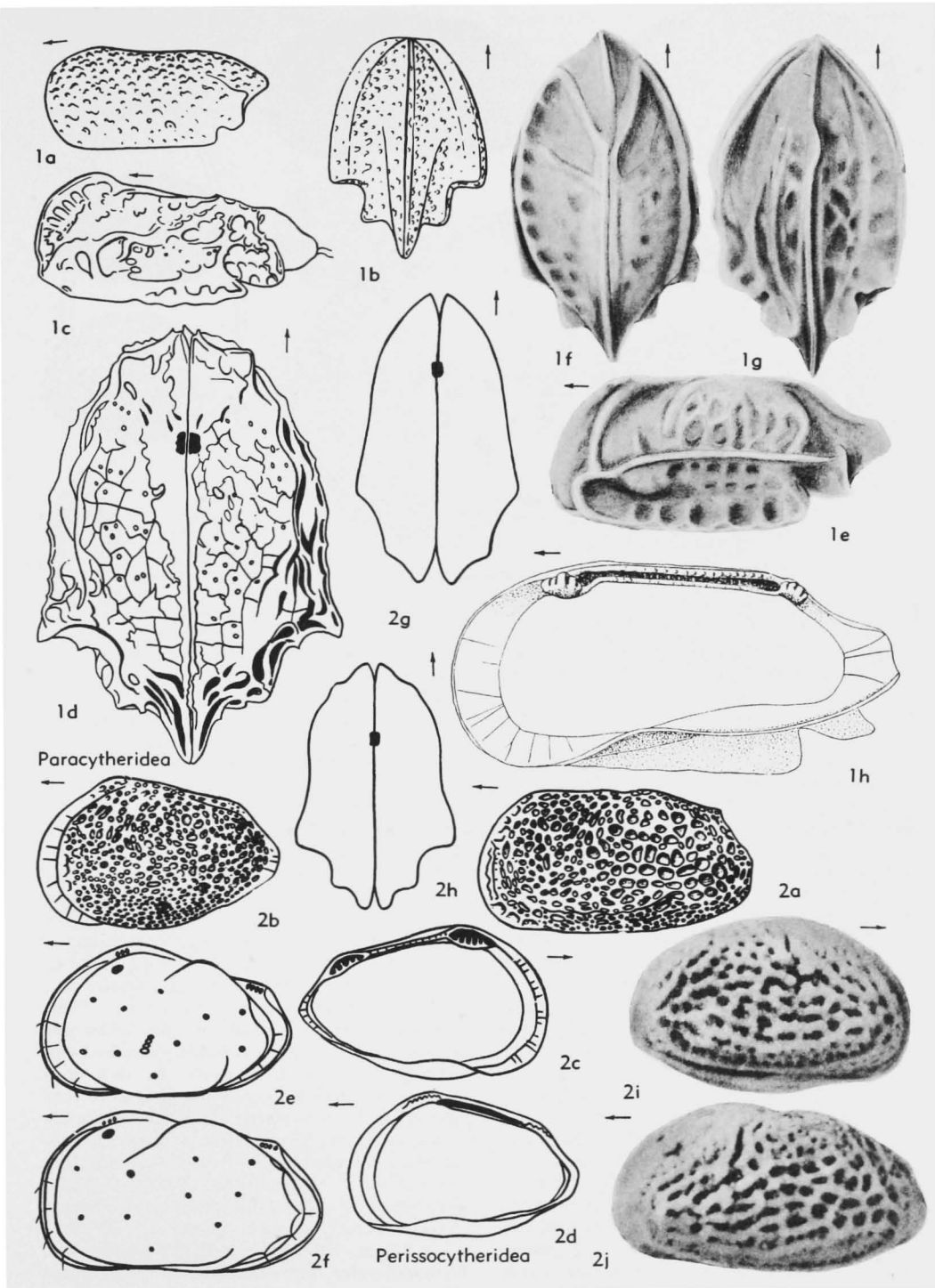


FIG. 206. Cytherideidae (Cytherideinae), Cytheruridae (p. Q281, Q299).

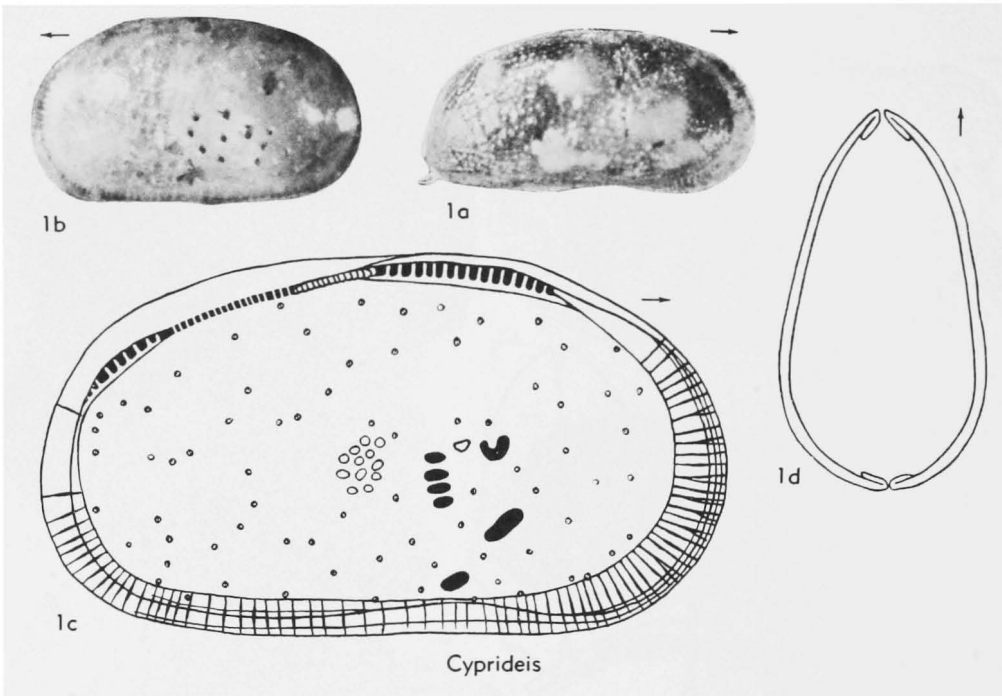


FIG. 207. Cytherideidae (Cytherideinae) (p. Q276).

front and somewhat pointed rear; dorsal and ventral margins subparallel; carapace thickest in middle. Hinge antimerodont, in RV with high terminal crenulate cusps separated by shallow crenulate furrow. *U.Cret.*, Eu.——FIG. 208,*2*. **N. fusiformis* (BOSQUET), Maastricht., Holl.; *2a,b*, carapace R, dors.; *2c*, RV int.; all ×50 (34).

Nodophthalmocythere MALZ, 1958 [**N. vallata*]. Sexually dimorphous, in side view females triangular, oval, males elongate-oval. Similar in most characters to *Schuleridea* except surface bears bumps or longitudinal swellings and eye tubercles are much more prominent. Inner margin and line of concrescence coincident, zone of concrescence broad; marginal pore canals straight, simple, close; normal pore canals with external pits, numerous; adductor muscle scars in vertical row of 4, with 2 scars in front. [Marine.] *U.Jur.*, NW.Eu.(Fr.-Ger.-Eng.).——FIG. 209,*1*. **N. vallata*, Fr.; *1a,b*, ♀ LV lat., ♀ RV lat., ×115, ×100; *1c*, ♀ LV hinge, ×135 (235). [HOWE-REYMENT.]

Ovocytheridea GREKOFF, 1951 [**O. nuda*]. Shape similar to that of *Cytheridea*, but thickest behind middle, some species with posterior extension, smooth; hinge of RV with strongly crenulated terminal teeth and uniting crenulated furrow, also accommodation groove; strongly notched terminal sockets and uniting crenulated bar; muscle scars in row of 4, with another above in front; marginal areas with straight canals; sexual dimorphism pronounced. *U.Cret.(Coniac.-Santon.)*, Afr.——FIG. 209,*2*. **O. nuda*, Campan., Cameroons; *2a,b*, ♂ carapace R, dors., ×60; *2c-e*, ♀ carapace R, dors., vent., ×60 (293).——FIG. 209,*3*. *O. symmetrica* REYMENT, Coniac., N.Nigeria; *3a-c*, carapace R, dors., vent., ×40 (293).——FIG. 209, *4*. *O. apiformis* REYMENT, Coniac., N.Nigeria; RV int., ×60 (293). [HOWE-REYMENT.]

Palaeocytheridella MANDELSTAM, 1958 [**Eucythere observata* SHARAPOVA, 1937]. Carapace elongate-ovate, LV overlapping, with small spines or single spine at posterior end of ventral margin, anterior and posterior end commonly equal in height, dorsal margin straight; duplicature with numerous straight pore canals; hinge in LV with anterior elongate socket divided into 8 parts, median bar, and posterior socket similar to anterior. [This genus apparently was erected to take species that LYUBIMOVA had assigned to *Palaeocytheridea* (with *Eucythere denticulata* as type). As such it is thought by HOWE & LAURENCICH (34) to be congeneric with *Asciocythere* SWAIN. However, the shape of SWAIN's genus differs in being more triangular and accordingly, *Palaeocytheridella* may well be valid.] *U.Jur.-L.Cret.*, Eu.-Asia(Kazakhstan-Siberia).——FIG. 210,*1*. **P. observata* (SHARAPOVA), L.Cret.(Neocom.), USSR; *1a*, RV lat.; *1b,c*, RV int., LV int.; all ×60 (329). [BOLD.]

Perissocytheridea STEPHENSON, 1938 [**Cytheridea matsoni* STEPHENSON, 1935] [?=*Ilyocythere* KLIE, 1939; *Iliocythere* HARTMANN, 1953]. Carapace small, subpyriform, with nearly straight dorsum,

convex venter, and broadly rounded anterior; surface with pits and ridges (smooth in *Ilyocythere* variant); sexual dimorphism strong. Hinge antimerodont; marginal areas broad with narrow terminal vestibules and rather widely spaced radial canals (342, 221). Brackish-water. *Mio.-Rec.*, N. Am.-S.Am. —— FIG. 206,*2a-d*. **P. matsoni* (STEPHENSON), Mio., La.; *2a*, ♂ LV lat., ×75; *2b,c*, ♀ LV lat., int., ×75; *2d*, ♀ RV int., ×75 (all 340).——FIG. 206,*2e-h*. *P. gibba* (KLIE), Rec.,

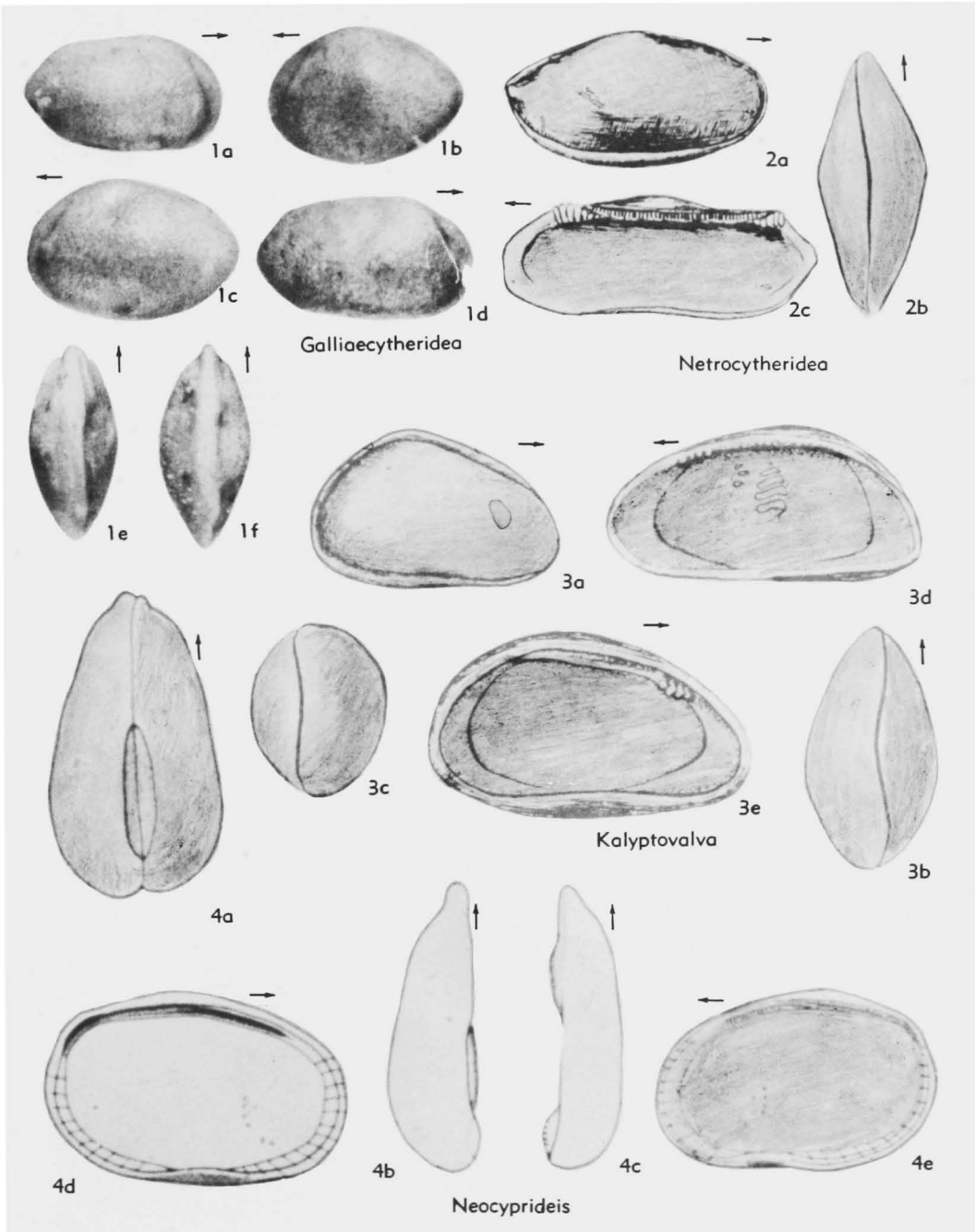


FIG. 208. Cytherideidae (Cytherideinae) (p. Q276-Q280).

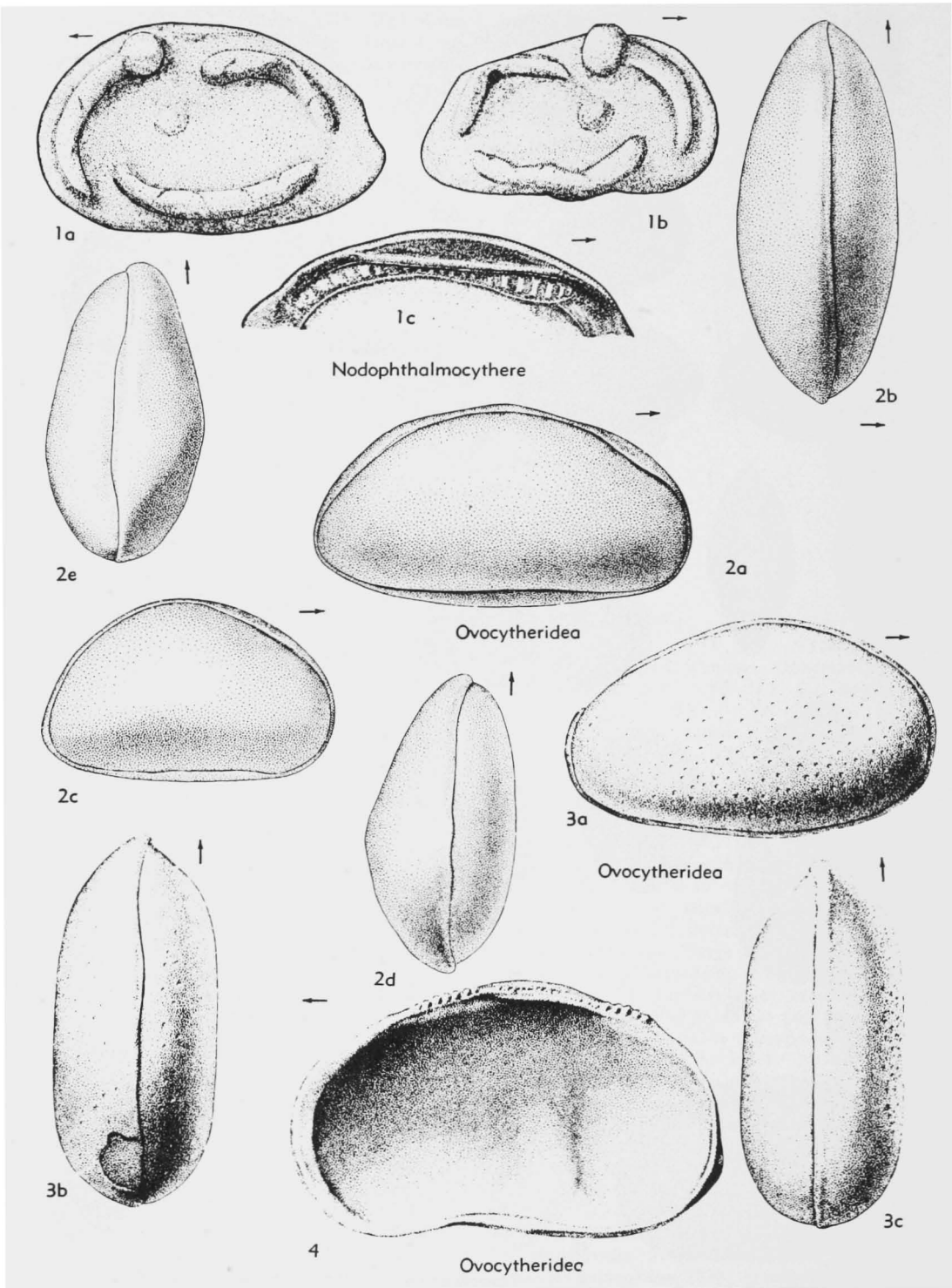


FIG. 209. Cytherideidae (Cytherideinae) (p. Q280).

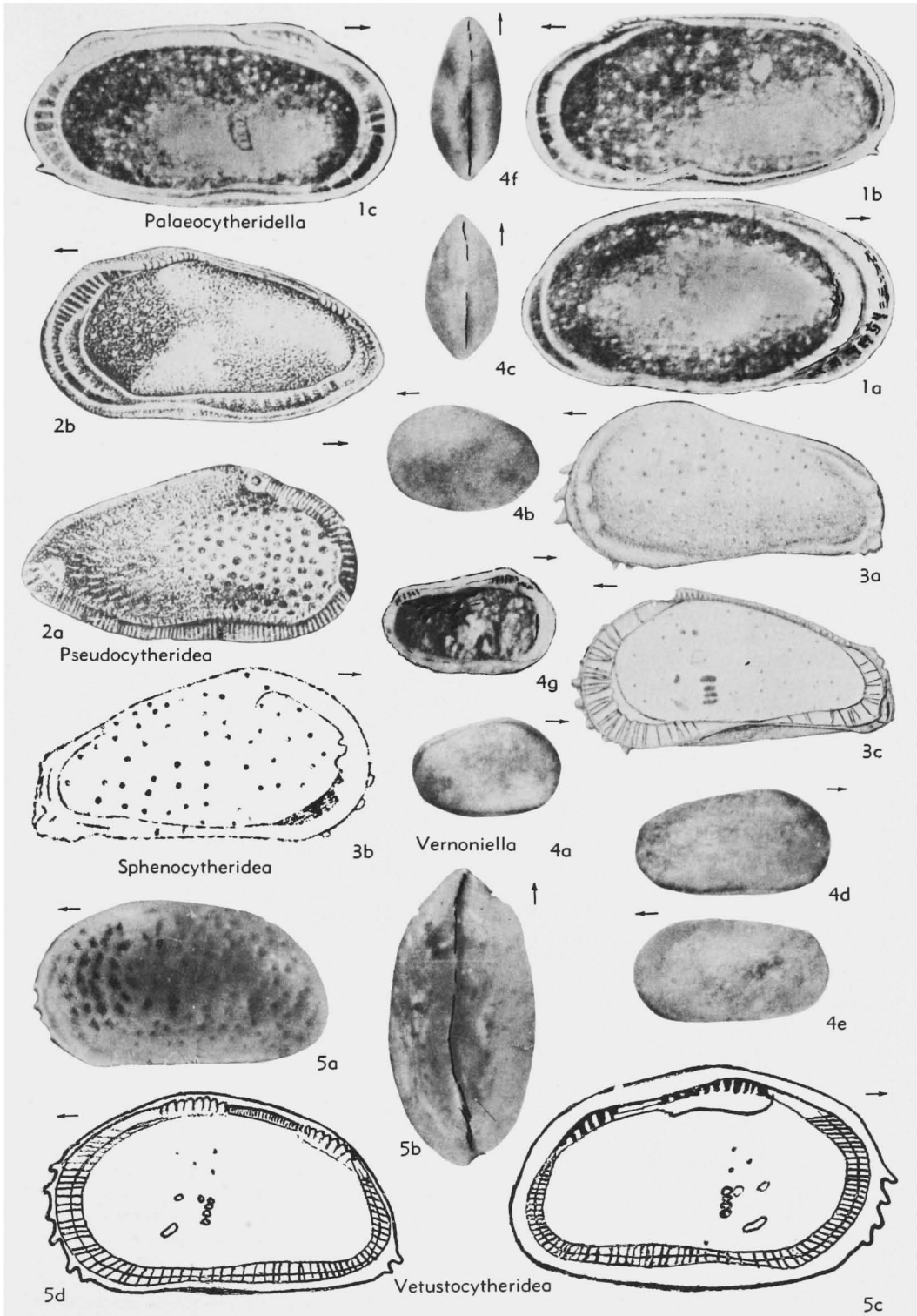


FIG. 210. Cytherideidae (Cytherideinae) (p. Q280-Q284).

Brazil (type species of *Ilyocythere*); *2e,f*, ♂ LV lat., ♀ LV lat., ×75; *2g,h*, ♂ and ♀ carapace dors., ×75 (all 221).——FIG. 206,*2i,j*. *P. rugata* SWAIN, Rec., Tex.; *2i*, ♂ carapace R; *2j*, ♀ LV lat., both ×75 (355).

Pseudocytheridea SCHNEIDER, 1949 [**Cytheridea? zalanyi* SCHNEIDER, 1939]. Carapace elongate, *Cytheridea*-like, with distinct eye spot; hinge with terminal elongate crenulate teeth in RV and median smooth groove. [Differs from *Schuleridea* in having hinge bar in LV, not RV; differs from *Clithrocytheridea* in having median hinge element not crenulate and in presence of eye spot.]. *U. Oligo.-Mio.*, Hung.-Caucasus-Crimea.——FIG. 210, *2*. **P. zalanyi* (SCHNEIDER), Mio., W. Caucasus; *2a,b*, RV lat., int., ×50 (321). [BOLD.]

Schuleridea SWARTZ & SWAIN, 1946 [**S. acuminata*] [=*Aequacytheridea* MANDELSTAM, 1947]. Shape resembling *Cytheridea*, LV larger than RV, overlapping it on all sides, being dorsally somewhat umbonate; distinct eye-tubercle in RV but less distinct in LV. Surface pitted to smooth. LV hinge originally described with crenulate terminal sockets and unknown median element but (as figured for another species by TRIEBEL, 379) shows straight smooth median furrow, above which is an accommodation groove; muscle scars in row of 4, with one in front of middle. *Jur., ?L.Cret., Mio.*, N.Am.-Eu.——FIG. 202,*2a-d*. **S. acuminata*, Jur., La.; *2a*, carapace R, ×60; *2b,c,d*, LV int., carapace dors., ×60 (77).——FIG. 202,*2e*. *S. hatterasensis* SWAIN, L.Cret. or Jur., N.Car. (subsurface); carapace R, ×35 (354).

Sphenocytheridea KEIJ, 1958 [**S. gracilis*]. Similar to *Haplocytheridea* in lateral outline and hinge but differs in having raised rim around anterior (fringed with small spines), ventral and posterior margins, and in having a distinct anterior vestibule where radial canals are clustered in groups of 3 or 4. Vertical row of 4 adductor scars and 1 antennal scar. Sexual dimorphism. *Eoc.(Lutet.)*, Eu. (Fr.).——FIG. 210,*3*. **S. gracilis; 3a*, LV lat.; *3b*, RV lat. showing pattern of normal pore canals; *3c*, RV int.; all ×100 (197). [HOWE-REYMENT.]

Vernoniella OERTLI, 1957 [**V. sequana*]. Carapace triangular to elliptical, smooth or pitted; sexual dimorphism strong; margins regular with few radial canals, RV hinge with terminal cusps divided 5 or 6 times, between which lies a smooth to finely crenulated furrow beneath a strong dorsal wall, LV with terminal notched sockets separated by strong median bar. *Jur.*, Eu.(Fr.).——FIG. 210,*4*. **V. sequana*, Fr.; *4a-c*, ♀ carapace R, L, dors.; *4d-f*; ♂ carapace R, L, dors.; *4g*, ♂ LV int.; all ×50 (269).

Vetustocytheridea APOSTOLESCU, 1956 [**Cytheridea (Vetustocytheridea) guitrancourtensis*]. Shaped and ornamented like *Haplocytheridea* but LV hinge with pronounced thickening of shell wall below anterior socket. *Eoc.*, Eu.(Fr.).——FIG. 210, *5*. **V. guitrancourtensis* (APOSTOLESCU), Fr.; *5a,b*, carapace L, dors., ×40; *5c,d*, LV int., RV int., ×50 (93).

Subfamily CUNEOCYTHERINAE Mandelstam, 1960

Carapace ovate to subtrapezoidal in side view and ovate, subquadrate to subrhomboidal in dorsal view, rather sturdily constructed; surface smooth, pitted, or reticulate; of medium size; LV larger than RV, overlapping it except in front. LV hinge with furrow below dorsal margin, lower edge of which is distinctly thickened and may form knobs at ends, particularly in front; RV hinge developed as bar, usually strongest at anterior end; marginal areas broad, particularly anteriorly, with numerous long radial canals which tend to curve toward upper and lower margins; muscle scars in vertical row of 4, with crescent-shaped antennal scar in front of middle, usually 2 mandibular scars located near ventral margin, and in some species as many as 3 additional scars high in carapace. *Jur.-Mio.*

Cuneocythere LIENENKLAUS, 1894 [**C. truncata* (=**Bairdia marginata* BOSQUET, 1852)]. Ovate, thick-shelled, in dorsal view almost wedge-shaped; surface pitted to reticulate. Marginal areas broad, with shallow vestibule and numerous long curved radial canals; hinge a smooth groove in LV, with distinct barlike development below the groove, bar developing a small knob at its anterior end; muscle scars in vertical row of 4, with a crescent-shaped antennal scar in front and 2 mandibular scars near ventral margin (42, 228). *Eoc.-Mio.*, Eu.——FIG. 211,*4*. **C. marginata* (BOSQUET), Oligo., Belg.; *4a*, ♀ LV (lectotype) lat.; *4b*, ♀ RV lat.; *4c*, ♂ carapace dors.; *4d*, ♀ LV int.; all ×60 (42).

Archeocuneocythere MANDELSTAM, 1947 [**A. reniformis*]. Similar to *Cuneocythere* but LV hinge groove opening widely toward front and RV hinge bar widening from knife-edge at back to club-shaped in front. Anterior marginal canals straight. [Marine.] *Jur.-L.Cret.*, SW.Asia.——FIG. 211,*2*. **A. reniformis*, M.Jur., USSR(Kazakhstan); *2a*, RV lat., ×35; *2b,c*, RV and LV hinge, ×64 (237). [HOWE-REYMENT.]

Monsmirabilia APOSTOLESCU, 1955 [**Bairdia perforata* BOSQUET, 1852 (*non* ROEMER, 1838) (=**Monsmirabilia subovata* APOSTOLESCU, 1955, *nom. nov.*)]. Somewhat more ovate than *Cuneocythere*, with smooth to pitted surface; anterior tooth of LV much more strongly developed, and with well-developed accommodation groove above LV hingement (92, 42). *Eoc.(Ypres.-Barton.)*,

Eu.(Fr.-Belg.-Holl.).——FIG. 211,*1*. **M. subovata* (APOSTOLESCU), Led., Belg.; *1a,b*, ♀ carapace R, dors.; *1c*, ♀ LV int.; *1d*, ♂ carapace R; all ×60 (42).

Paleomonsmirabilia APOSTOLESCU, 1956 [**P. paupera*]. Differs from *Monsmirabilia* in having obliquely rounded posterior end in side view and in possession of distinct eye spots. *L.Eoc.*, Eu. (Paris Basin).——FIG. 211,*3*. **P. paupera; 3a,b*, carapace R, L, ×28; *3c,d*, carapace dors., LV int., ×32 (93).

Subfamily EUCYTHERINAE Puri, 1954

Carapace shaped like that of Cytherideinae but internal characters quite different. Hingement lophodont or antimerodont but some carapaces almost toothless; marginal areas very broad in front, with vestibule and relatively few radial canals; muscle scars usually in oblique row of 4 or more adductors, in front of which lies a V-shaped ?antennal scar (287). *Jur.-Rec.*

Eucythere BRADY, 1868 [*pro Cytheropsis* SARS, 1866 (*non* M'COY, 1849)] [**Cythere declivis* NORMAN, 1865; SD BRADY & NORMAN, 1889]. Carapace shaped like that of *Cytheridea* except somewhat more triangular, males more elongate than females. Hinge lophodont, formed of interlocking flanges; marginal areas broad anteriorly where line of concrescence departs from inner margin, radial canals few; muscle scars in oblique row of 4 with large heart-shaped or V-shaped scar in front (divided in some Cretaceous species) (12, 267). *U.Cret.-Rec.*, Eu.-N.Atl.——FIG. 212,*2*. **E. declivis* (NORMAN), Rec., N.Atl.; *2a,b*, carapace L, dors., ×150 (15).——FIG. 213,*5*. *E. triordinis* SCHMIDT, Eoc. (Lutet.), Belg.; LV int., ×90 (42).

Euryitycythere OERTLI, 1959 [**E. subtilis* BARTENSTEIN & BRAND, 1959]. Carapace mainly triangular to trapezoidal in side view, with broad anterior margin, sides slightly inflated (apart from weak ventral wing), with narrow peripheral edge; eye tubercles present; weak, vertical impressed zone at about mid-length running from dorsal margin to wing; surface smooth, or with pitlets. Inner margin and line of concrescence coincident; marginal zone broad, with numerous threadlike pore canals (about 50 anterior), partly grouped in 3's; selvage well developed; LV hinge slightly arched with angled and broadened furrow, accommodation groove above anterior hinge section and RV with corresponding hinge bar. *L.Cret.(Valanginian-Hauteriv.)*, Eu.(Ger.-Fr.).——FIG. 214, *1a-c*. **E.*

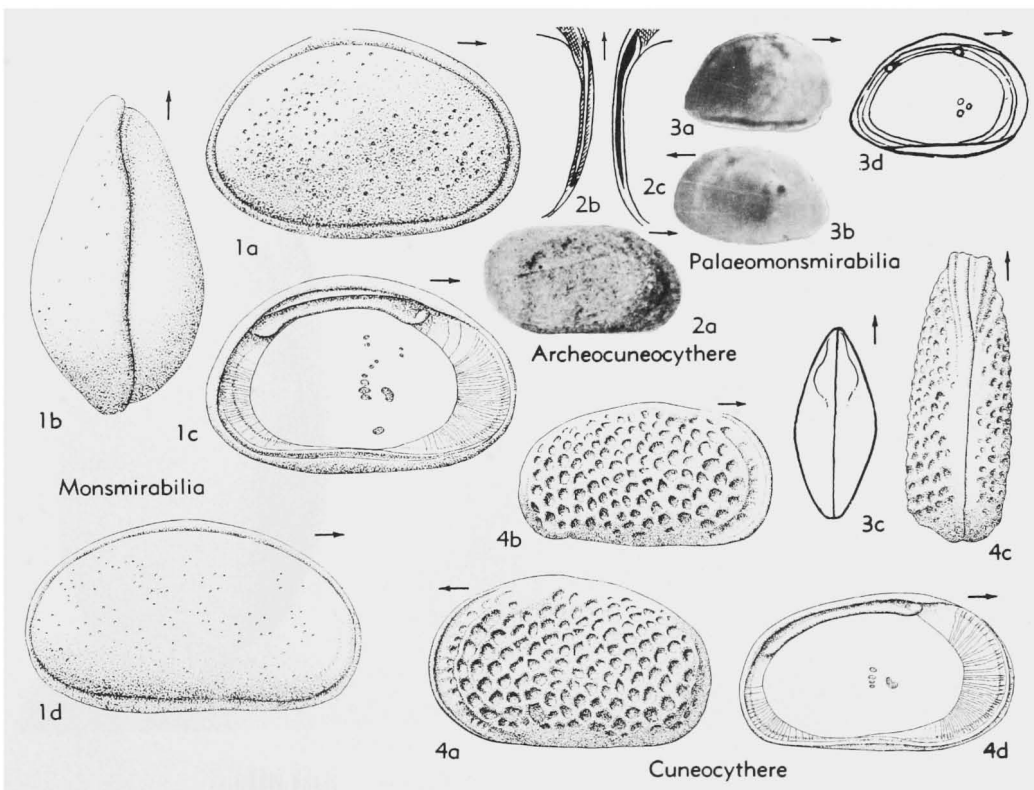


FIG. 211. Cytherideidae (Cuneocytherinae) (p. Q284-Q285).

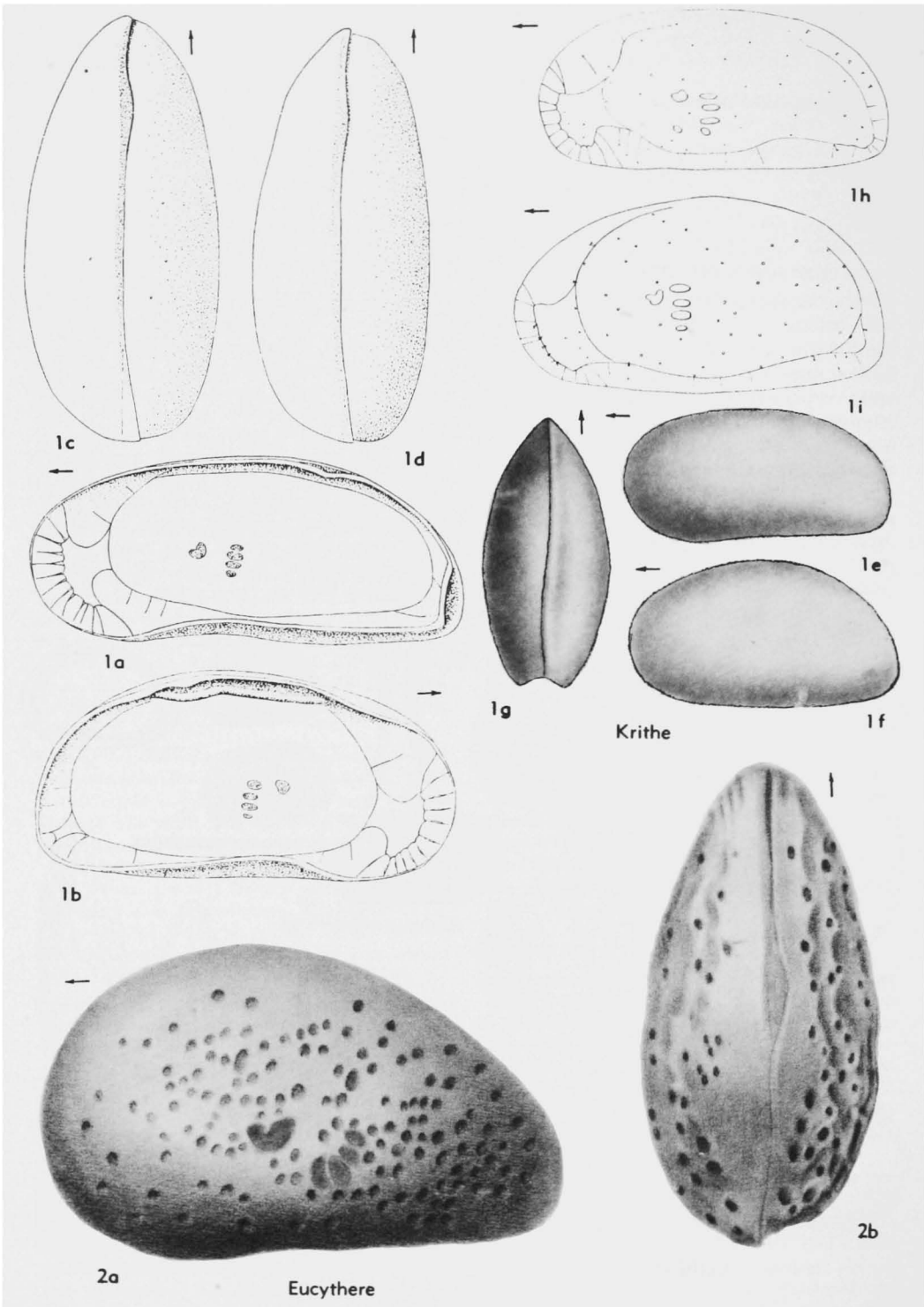


FIG. 212. Cytherideidae (Eucytherinae, Krithinae) (p. Q285-Q289).

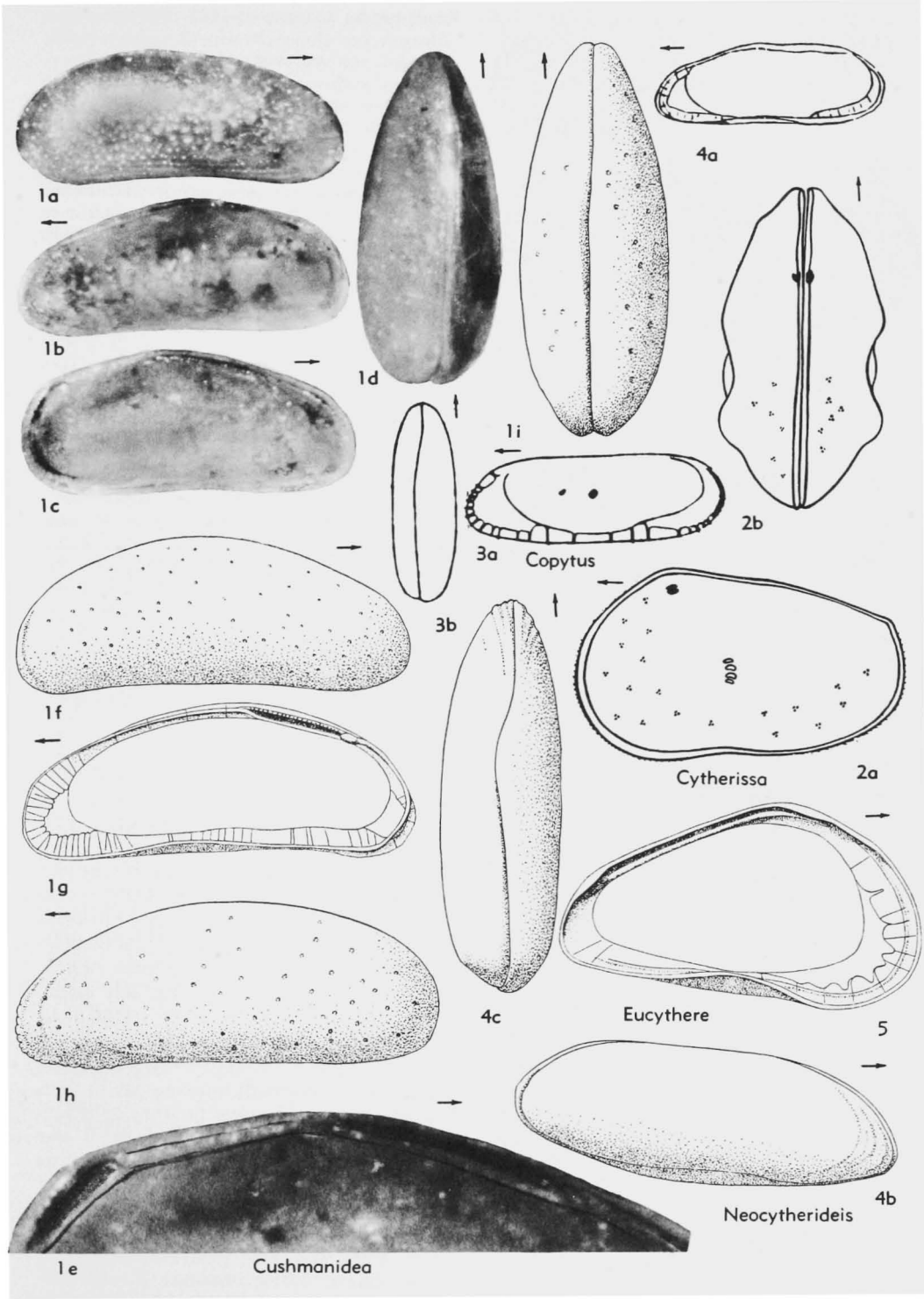


FIG. 213. Cytherideidae (Eucytherinae, Neocytherideidinae) (p. Q285-Q290).

subtilis BARTENSTEIN & BRAND, NW.Ger.; *1a,b,* LV lat., LV int.; *1c,* carapace dors.; all ×50 (96). ——FIG. 214,*1d-f*. *E. parisiorum* OERTLI, Fr. (Paris Basin); *1d-f,* carapace R, L, dors., ×58 (270). [REYMENT.]

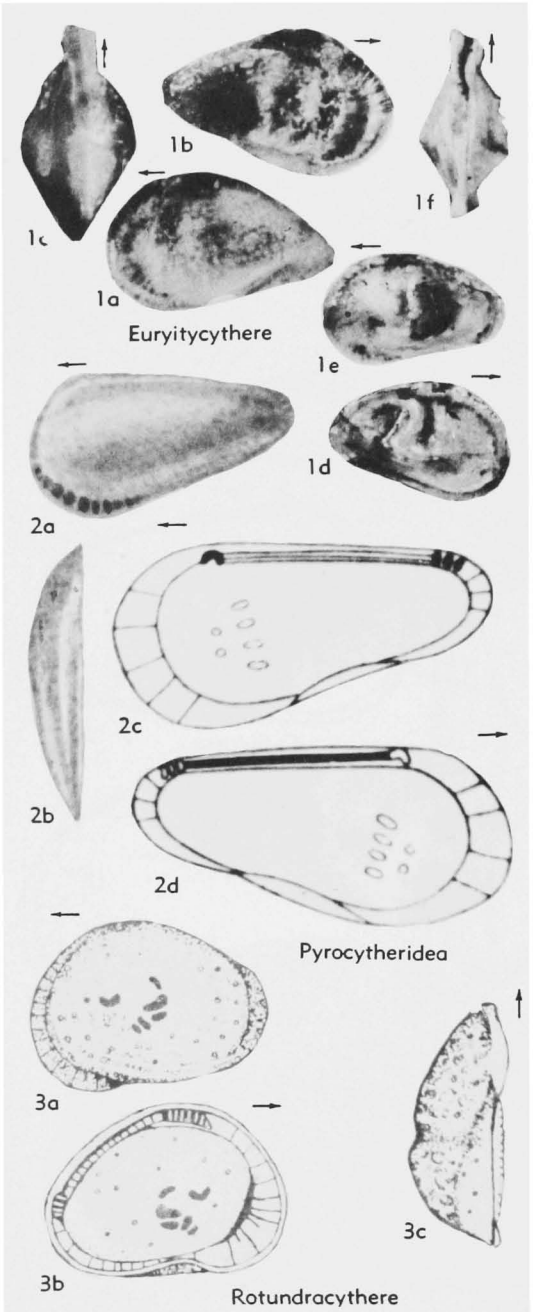


FIG. 214. Cytherideidae (Eucytherinae) (p. Q285-Q288).

Pyrocytheridea LYUBIMOVA, 1955 [*P. pergraphica*]. Elongate pear-shaped in side view, front broadly rounded, rear narrower, with long margins converging; surface smooth, LV hinge with small anterior curved tooth, straight median furrow, and small crenulate posterior tooth; RV hinge with crescent-shaped anterior socket, long straight median bar, and posterior pitted socket; marginal areas widest in front, with very few unbranched radial canals, narrow anterior vestibule sometimes; muscle scars in vertical row of 4 adductors, with 2 small scars in front. *Jur.-L.Cret.*, USSR.——FIG. 214,*2*. **P. pergraphica,* M.Jur.(Callov.), Samarskaia Luka; *2a,b,* LV lat., dors., ×50; *2c,d,* RV int., LV int. (diagrammatic), ×70 (230). [BOLD-REYMENT.]

Rotundracythere MANDELSTAM, 1958 [*"*Eucythere rotundata* HORNIBROOK, 1952"]. Carapace short, LV overlapping RV, with high, obliquely rounded anterior end, posterior end narrowly rounded ventrally, dorsal margin slightly convex; radial pore canals few in anterior end, rather widely spaced (although author reports pore canals to be numerous), vestibule crescent-shaped; LV hinge with terminal, crenulate sockets and median crenulate bar. *Eoc.-Rec.*, N.Z.——FIG. 214,*3*. **R. rotunda* (HORNIBROOK), Rec.; *3a-c,* LV (holotype) lat., int., dors., ×75 (32).

Subfamily KRITHINAE Mandelstam in Bubikan, 1958

Carapace elongate, dorsal margin nearly straight or weakly convex, ventral margin usually slightly concave, anterior end rounded, posterior usually obliquely truncate and commonly inturned so as to form a "V" when viewed from above; greatest thickness at or behind middle; surface smooth. Marginal areas very broad anteriorly, usually with large anterior vestibule from which only a moderate number of radial canals extend; small vestibule commonly present in posteroventral region; hingement essentially adont, with smooth or partially crenulate longitudinal furrow along dorsal margin of larger valve to receive sharp edge of opposite valve, reversal of hingement and valve size not unusual; muscle scars in vertical row of 4 adductors, in front of which usually lies a V-or U-shaped antennal scar and below which 1 or 2 mandibular scars may occur. *U.Cret.-Rec.*

Krithe BRADY, CROSSKEY & ROBERTSON, 1874 [**Cythere (Cytherideis) bartonensis* JONES, 1857; SD BRADY & NORMAN, 1889] [=*Ilyobates* SARS, 1866 (*non* KRAATZ, 1858)]. Carapace oblong, with greatest height at or behind mid-length, anterior end rounded, posterior obliquely truncate and

usually inturned, though not in type species; moderately to strongly tumid in dorsal view; surface smooth, but bearing widely spaced large normal canals. LV hinge with longitudinal furrow for reception of sharp dorsal edge of RV (hinge reversed in original description, based partially on another species); muscle scars in vertical row of 4 adductors, with usually a U-shaped antennal scar in front but this may be divided into 2 or more scars; mandibular scars usually 2 small spots in front of lower part of row. Dimorphism pronounced, females being shorter and plumper than males (68, 38, 14). *U.Cret.-Rec.*, Eu.-N.Am.-Asia. ——FIG. 212,*1a-d*. *K. papillosa* (BOSQUET), Mio., Fr.(Aquitaine); *1a,b*, ♂ RV int., ♀ LV int., ×75; *1c,d*, ♂ and ♀ carapace dors., ×75 (42). ——FIG. 212,*1e-g*. **K. bartonensis* (JONES), *1e,f*, ♂ and ♀ LV lat.; *1g*, carapace dors. (Quat., Br. I.), ×60 (14).——FIG. 212,*1h,i*. **K. bartonensis* (JONES), ♂ and ♀ LV lat. (Belg., Barton.), ×75 (42).

Parakrithe VAN DEN BOLD, 1958 [*Cytheridea (Dolocytheridea) vermunti* VAN DEN BOLD, 1946]. Similar to *Krithe* in external form; sexually dimorphous; reversal of overlap, valve size, and hingement occurs. Hinge similar to that of *Krithe* but posterior portion of hinge furrow in larger valve may show faint crenulation; differs from *Krithe* in having shallow anterior vestibule and much longer radial canals as a result. *Eoc.-Rec.*, W.Indies-Eu.-Ind.O.——FIG. 215,*1*. **P. vermunti* (VAN DEN BOLD), L.Oligo., Trinidad; *1a,b*, ♀ carapace R, dors.; *1c*, ♂ carapace dors.; *1d-f*, ♂ RV int., ♀ RV int., ♀ LV int.; all ×60 (102). [BOLD.]

Parakrithella HANAI, *nom. subst.* herein [*pro Neocyprideis* HANAI, 1959 (*non* APOSTOLESCU, 1956)] [**Neocyprideis pseudadonta* HANAI, 1959]. Carapace like that of *Krithe* but lacks posterior incision in dorsal view. Marginal area broad; line of concrescence close to anterior margin except at anteroventral corner where it is suddenly close to inner margin; radial pore canals bifurcated; LV hinge with longitudinal bar that fits groove in RV and has a faint crenulation along posterior one-fourth. *Rec.*, E.Asia.——FIG. 215,*2*. **P. pseudadonta*, Rec., Japan; *2a-c*, RV lat., RV int., LV int., ×90 (28).

Subfamily NEOCYTHERIDEIDINAE Puri, 1957

[*nom. subst.* PURI, 1957 (*pro* Cytherideisinae PURI, 1952, =Cytherideidinae, *nom. correct.* SYLVESTER-BRADLEY & HARDING, 1953, invalid because *Cytherideis* JONES, 1856, is junior synonym of *Cypridea* BOSQUET, 1852] [Includes Pontocytherinae MANDELSTAM, 1960]

Carapace externally shaped like that of Cytherideinae but in many genera more elongate, smooth, pitted, weakly to strongly reticulate, or even noded. Hinge generally lophodont, with terminal smooth sockets in LV, separated by a smooth median bar; marginal areas variable in width, commonly

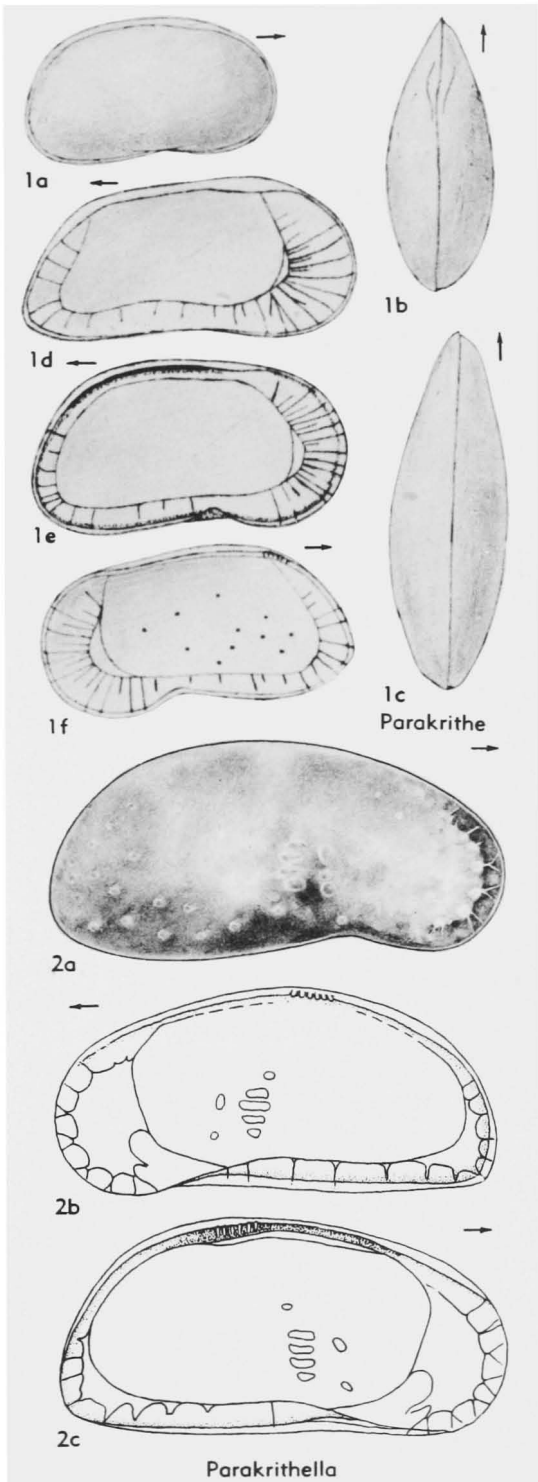


FIG. 215. Cytherideidae (Krithinae) (p. Q289).

with vestibule at one or both ends; muscle scars in vertical row of 4 adductors, with 1 or 2 antennal scars and 1 or 2 mandibular scars in front. *Jur.-Rec.*

Neocytherideis PURI, 1952 [**N. elongatus* PURI, 1952 (=**Cytherideis subulata* var. *fasciata* BRADY & ROBERTSON, 1874)] [=*Sahnia* PURI, 1952]. Carapace like that of *Cushmanidea* but anterior end narrower. Duplicature narrow, with large anterior vestibule; radial canals short, straight, widely spaced, few; muscle scars in vertical row of 4, with 6 additional scars in front and above row; hinge weakly lophodont. *Mio.-Rec.*, Eu.——FIG. 213,*4a*. **N. subulata fasciata*, Rec., Eng.; RV int., ×45 (285).——FIG. 213,*4b,c*. *N. linearis* (ROEMER), Mio., Fr.(Aquitaine); *4b,c*, carapace R, dors., ×75 (42).

Aparchitocythere SWAIN & PETERSON, 1952 [**A. typica*]. Ovate to subquadrate in outline, LV larger than RV; surface smooth except for normal canals. RV hinge with elongate terminal teeth formed by edge of shell, furrow along median part of dorsal margin, dentition not crenulate. *Jur.*, N.Am.——FIG. 216,*3*. **A. typica*, U.Jur.(Sundance), Wyo.; *3a,b*, ♀ carapace L, dors., ×45; *3c*, ♂ LV int., ×45 (358).

Aulocytheridea HOWE, 1951 [**A. margodentata*]. Carapace very solid, like *Cytheridea* in shape. RV hinge with smooth elongate teeth at ends and furrow below middle of dorsal margin, LV with terminal elongate sockets and straight bar between, separated from dorsal margin by accommodation groove; hinge elements smooth; marginal areas regular, with numerous radial canals; muscle scars in vertical row of 4 adductors, with heart-shaped antennal scar in front of top of row and one mandibular scar in front of base of row, 2nd obliquely below and behind near ventral margin (32). *Eoc.*, N.Am.——FIG. 216,*2a,b*. **A. margodentata*, U.Eoc., Fla.; *2a,b*, LV lat., int., ×50 (Howe, n).

Copytus SKOGSBERG, 1939 [**C. caligula*]. Elongate, low, with dorsal edge straighter than in *Cushmanidea;* no sexual dimorphism. Hinge seemingly without teeth; large vestibule at each end, bordered by moderate number of simple radial canals; muscle scars 4, in group near middle, and single scar in front. *Rec.*, Antarct.——FIG. 213,*3*. **C. caligula; 3a,b*, carapace L, dors., ×37.5 (332).

Cushmanidea BLAKE, 1933 [**Cytheridea seminuda* CUSHMAN, 1906] [=*Cytherideis* AUCTT. (*non* JONES, 1856); *?Sacculus* NEVIANI, 1928 (*non* GOSSE, 1851); *Pontocythere* DUBOWSKY, 1939; *Hemicytherideis* RUGGIERI, 1952]. Carapace elongate ovate, highest and thickest behind middle; surface smooth or reticulate, with pattern tending to parallel margins. Hinge lophodont, LV with elongate smooth terminal sockets and median projecting flange or bar which may show faint crenulation; anterior with serrate vestibule in which several radial canals are developed from each serration; muscle scars in vertical row of 4, with one large antennal scar in front and 2 mandibular scars obliquely set in front and below the row (99, 134). *Eoc.-Rec.*, N.Am.-Eu.——FIG. 213, *1a-e*. **C. seminuda* (CUSHMAN), Rec., W.Atl.(off R.I.); *1a,b*, RV lat., int., ×45; *1c*, LV int., ×45; *1d*, carapace dors., ×45; *1e*, LV hinge, ×110 (Howe, n).——FIG. 213,*1f-i*. *C. grosjeani* (KEIJ), Eoc.(Lutet.), Belg.; *1f,g*, RV lat., int.; *1h*, LV lat.; *1i*, carapace dors.; all ×75 (42).

Cytherissa SARS, 1925 [**Cythere lacustris* SARS, 1863] [=*Alexandrella* SCHWEYER, 1939 (*non* CHEVREUX, 1911, *nec* TONNOIR, 1926)]. Shape of carapace variable but generally resembling *Cytheridea,* in some species more rectangular both in lateral and end views. Hinge with terminal noncrenulate blades, weak; marginal areas narrow, with radial canals arranged in groups of 4, muscle scars as in *Cytheridea* (18, 68, 220). *?Oligo.* (Belg.)-*Rec.*(Eu.-Asia), recorded in glacial lakes of Scot., Norway, Swed., Sib.(Baikal).——FIG. 213, *2*. **C. lacustris* (SARS), Rec., Norway; *2a,b*, carapace L, dors., ×60 (314).

Hulingsina PURI, 1958 [**H. tuberculata*]. Shaped externally like *Cushmanidea* but with reticulate or papillate surface. Internal characters similar, but shell heavier, with strong development of selvage, particularly in RV where flange groove is very wide at posteroventral corner; other internal features as in *Cushmanidea. Mio.-Rec.*, N.Am.——FIG. 217,*1*. **H. tuberculata*, Rec., Gulf Mexico; *1a,b*, LV lat., int.; *1c,d*, RV lat., int.; *1e*, carapace dors.; all ×60 (291).

Paracyprideis KLIE, 1929 [**Cytheridea fennica* HIRSCHMANN, 1909]. Carapace like that of *Cytheridea* in shape but hinge teeth of RV and median bar of LV not crenulate; surface smooth except for large normal canals, which in fossil forms are sievelike; large vestibule in front part of interior with few short radial canals diverging from it; muscle scars in vertical row of 4, with usually 2 antennal scars in front of upper end of row, one scar being larger than the other; mandibular scars obliquely below, and additional scars higher in carapace (215, 171). *L.Cret.-Rec.*, Eu.-N.Am.——FIG. 216,*1a,b*. **P. fennica* (HIRSCHMANN), Rec., Baltic; *1a,b*, ♀ RV int., ♀ LV lat., ×45 (171).——FIG. 216,*1c-e*. *P. rarefistulosa* (LIENENKLAUS), Oligo.(Rupel.), Belg.; *1c,d*, ♀ RV lat., RV int., ×75; *1e*, ♂ LV int., ×75 (42).

Family CYTHERISSINELLIDAE Kashevarova, 1958

[*nom. transl.* VAN DEN BOLD, herein (*ex* Cytherissinellinae KASHEVAROVA, 1958) (attributed by KASHEVAROVA to SCHNEIDER, 1956, but seemingly in error)] [Materials for this family prepared by W. A. VAN DEN BOLD, Louisiana State University, and R. A. REYMENT, University of Stockholm]

Elongate suboblong, dorsal margin straight, anterior and posterior ends round-

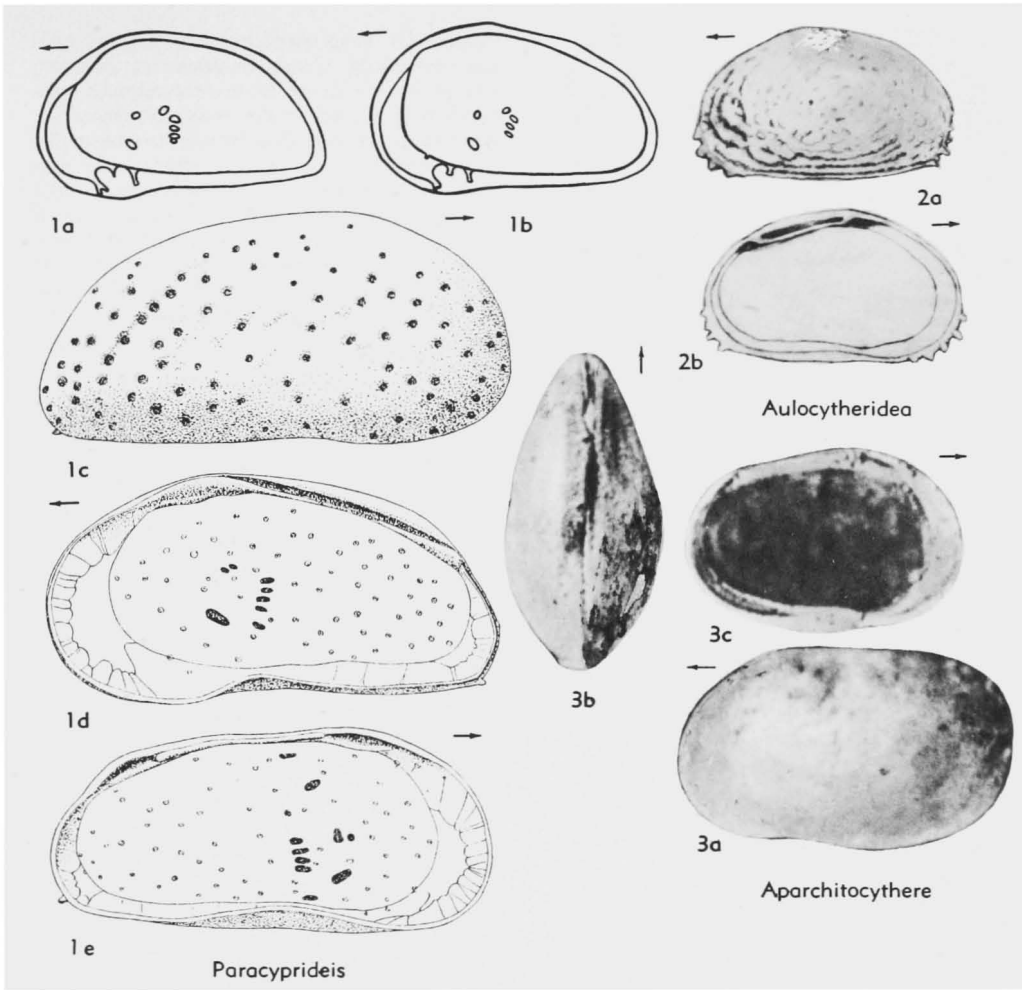


FIG. 216. Cytherideidae (Neocytherideidinae) (p. Q290).

ed, with faint to distinct narrow sulcus extending straight downward from mid-dorsal region; surface reticulate and may bear inconspicuous longitudinal ribs. *L.Trias.*

Cytherissinella SCHNEIDER, 1956 [**C. okrajantzi*]. Elongate trapezoidal, length twice height, inflation variable. LV overlapping RV all around but least strongly along straight dorsal margin, ventral margin straight to faintly concave, both margins converging slightly backward; anterior and posterior ends broadly rounded; ornament irregular, composed of reticulations and a flexed, longitudinal, lateral rib running from dorsal third of anterior margin to posterior third of side. LV hinge with terminal subsockets united by sharp, smooth bar. [Brackish water.] *L.Trias.*, USSR(Emba Region). ——FIG. 218,*1*. **C. okrajantzi; 1a,b,* carapace R, dors., ×64 (50).

Lutkevichinella SCHNEIDER, 1956 [**L. bruttanae*]. Carapace rather small, oblong, with greatest height in posterior half; dorsal margin straight, ventral margin feebly convex. Anterior and posterior margins rounded; midpoint of anterior slightly lower than that of posterior or of equal height. Surface ornamented with roughly concentric reticulations; central sulcus running from middle of dorsal margin vertically to below middle of valve. Hinge elements thin: LV hinge with bar terminating in shallow depressions, RV complementary, with feeble anterior and posterior swellings. *L.Trias.*, USSR(Emba Region).——FIG. 218,*2*. **L. bruttanae; 2a-d,* carapace R, dors., RV and LV hinge, ×64 (50).

Family CYTHERURIDAE G. W. Müller, 1894

[*nom. transl.* REYMENT, herein (*ex* Cytherurinae G.W.MÜLLER, 1894] [=Cytheropterinae HANAI, 1957] [Materials for this family prepared by R. A. REYMENT, University of Stockholm, with assistance on some genera by H. V. HOWE, Louisiana State University, and TETSURO HANAI, University of Tokyo] [Includes Procytheropterinae, Paracytherideinae, Eocytheropterinae MANDELSTAM, 1960]

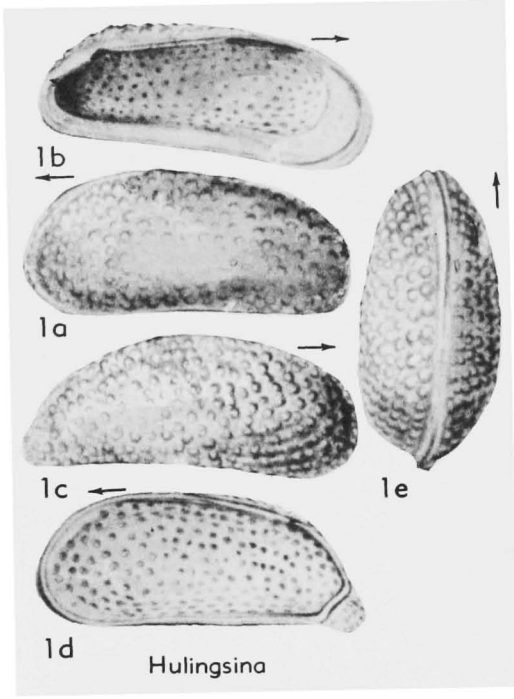


FIG. 217. Cytherideidae (Neocytherideidinae) (p. Q290).

Characterized in many genera by small size, presence of caudal processes and flattening of venter, and by occurrence of ventrolateral wing processes in some; surface mostly well ornamented, RV generally slightly larger than LV, especially along dorsal margin. Hinge modified entomodont (as defined by TRIEBEL), typically developed in *Cytheropteron,* which shows crenulated furrow between terminal teeth of protodont valve but altered in *Cytherura* and allied genera by thickening of both ends of hinge bar to form protodont sequence of tooth, socket, median furrow, and socket tooth; eyes present or absent; marginal zones commonly wide, in some genera extending from posterior end far into shell, with small marginal niches in some species; 4 vertically arranged adductor muscle scars and 1 or 2 scars in front. Sexual dimorphism strong in some genera but hardly discernible in others. [Marine and brackish-water environments.] *U.Jur.-Rec.*

Cytherura SARS, 1866 [**Cythere gibba* O.F.MÜLLER, 1785]. Carapace small, bilamellar, anterior margin broadly rounded but pointed in dorsal view, widening backward strongly, posterior margin usually with subdorsal caudal process; RV overhanging LV along dorsal margin; ornament variable, irregularly ribbed, reticulate, or punctate; eyes present in living forms; eye tubercles very feeble if developed; males commonly more inflated in dorsal view than females (owing to the bulky copulative organs). Adductor muscle scars in vertical row of 4, with another scar in front of most dorsal and 2 irregular scars in front of this one; 2 elongated mandibular scars at anteroventral angle; anterior and posterior parts of zone of concrescence extremely broad, internal margin and line of concrescence mostly coincident; radial pore canals few, unbranched, long, thin; normal pore canals open; RV hinge with 2 terminal smooth or weakly notched teeth, united by furrow that widens terminally, where it also becomes deeper. Larval forms slightly different, large instars having lower caudal process. Sexual dimorphism relatively strong. [Marine and brackish-water.] *Cret.-Rec.,* cosmop.——FIG. 219,*2,* 220,*4.* **C. gibba* (O.F.MÜLLER), Rec., Holl., Kijkduin; 219,*2a,b,* ♂ carapace R, L, ×60; 220,*4a,* ♀ carapace dors., ×83; 220,*4b,* ♂ LV int., ×130 (88, by permission Mouton & Co., The Hague).

Cytheropteron SARS, 1866 [**Cythere latissima* NORMAN, 1865 (=*C. convexum* SARS, 1866)] (=*Aversovalva* HORNIBROOK, 1952]. Carapace bilamellar, in lateral view roughly ovoid, with oblique caudal process that points obliquely upward (commonly drawn out strongly) and pointed ventrolateral winglike processes, which may be feebly developed; RV slightly larger than LV, overlapping it distinctly along hinge length; surface smooth or ornamented; no eye tubercles. Inner margin and line of concrescence coincident, apart from presence of narrow vestibule at front middle; RV hinge with terminal notched tooth plates united by crenulated furrow; marginal pore canals few, separated widely, undivided, some grouped in 2's and 3's; normal pore canals open; 4 subvertically arranged, elongated adductor muscle scars with V-shaped scar in front of dorsal end of adductor row, and small round scar inside V. Sexual dimorphism present but not pronounced. *U.Jur.-Rec.,* cosmop.——FIG. 219,*1a,* 220,*5.* **C. latissimum* (NORMAN), Rec., Holl., Kijkduin; 219, *1a,* LV lat., ×60; 220,*5a,b,* RV int., dors., ×115, ×100 (88, by permission of Mouton & Co., The Hague).——FIG. 219,*1b-g, C. aureum* (HORNIBROOK), Rec., N.Z. (type species of *Aversolvalva*); *1b-d,* LV lat., dors., int.; *1e-g,* RV lat., dors., int.; all ×75 (32).

Eocytheropteron ALEXANDER, 1933 [**Cytheropteron bilobatum* ALEXANDER, 1929]. Carapace subtrapezoidal in side view, egg-shaped in dorsal view, provided with short caudal process; LV overhanging RV strongly along dorsal margin, ventrally swollen, without side wings. LV hinge with longitudinal crenulated terminal sockets and feebly crenulated ridge between; marginal pore canals

few, straight, some branched. *L.Cret.-Eoc.*, N.Am. ——Fig. 219,*9*. **E. bilobatum* (Alexander), L. Cret.(Washita), Tex.; *9a*, carapace R, ×70; *9b,c*, LV and RV hinge margins, ×100 (89).

Eucytherura G.W.Müller, 1894 [**Cythere complexa* Brady, 1867; SD Alexander, 1936]. Carapace small, subrhombic to quadrate in side view, inflated, thin-walled; anterior margin broadly rounded, posterior margin with caudal process in dorsal half; surface tuberculate or reticulate; eye tubercle present. Adductor muscle scars 4 in vertical row and another dorsally situated; line of concrescence and inner margin usually coincident, zone of concrescence broad, with a few straight, simple canals, normal pore canals numerous; hinge of same type as in *Cytherura*. Sexual dimorphism slightly reflected by carapace features. *Cret.-Rec.*, N.Am.-Eu.——Fig. 219,*4*, 220,*1*. **E. complexa* (Brady), Rec., Medit.(Gulf of Naples); 219,*4*, LV lat., ×80 (401); 220,*1a,b*, carapace L, dors., ×150 (53).

Hemicytherura Elofson, 1941 [**Cythere cellulosa* Norman, 1865]. Carapace like that of *Cytherura*, RV clearly overhanging LV along dorsal margin; ornament of pits or coarse reticulations; eye tubercles present. Adductor muscle scars 4 in vertical row, 1 anterior to them; zone of concrescence broad anteriorly, narrow backward, triangular anteromarginal niche (if developed), niche in posteroventral section; marginal pore canals simple, few, anterior ones grouped in 3 bundles; RV hinge with 2 terminal tooth plates and intervening furrow. Males longer than females. *Plio.-Rec.*, N.Eu.-S.Eu.——Fig. 219,*3*, 220,*6*. **H. cellulosa* (Norman), Rec., Holl.; 219,*3a,b*, LV lat., RV lat., ×60; 220,*6a*, carapace long. sec., ×85; 220,*6b*, RV int., ×150 (88, by permission of Mouton & Co., The Hague).——Fig. 219,*7*. *H. clathrata* (Sars), Rec., N.Atl.; *7a,b*, RV lat., carapace dors., ×60 (88, by permission of Mouton & Co.).

Howeina Hanai, 1957 [**H. camptocytheroidea*]. Large, ovate; posterior caudal process indistinct; ventral surface with slight trace of winglike ridges. Hinge like that of *Cytherura* but anterior tooth of RV large and elongate; inner margin with modified S-shape along posterior margin; eye spot indistinct. *Plio.*, E.Asia(Japan).——Fig. 221,*1*. **H. camptocytheroidea; 1a*, RV lat., ×90 (Hanai, n); *1b,c*, LV int., RV int., ×90 (27). [Hanai.]

Kangarina Coryell & Fields, 1937 [**K. quellita*]. Carapace small, thick-walled, with subdorsal caudal process, strong ventral and dorsal ribs with additional lateral ribs, interspaces being pitted. Zone of concrescence broad, line of concrescence and inner margin separated; RV hinge with notched terminal tooth plates and notched median furrow. *Mio.*, C.Am.(Panama).——Fig. 219,*5*. **K. quellita*, M.Mio.(Gatun F.), Panama C.Z.; *5a-c*, RV lat., dors., int., ×100 (126).

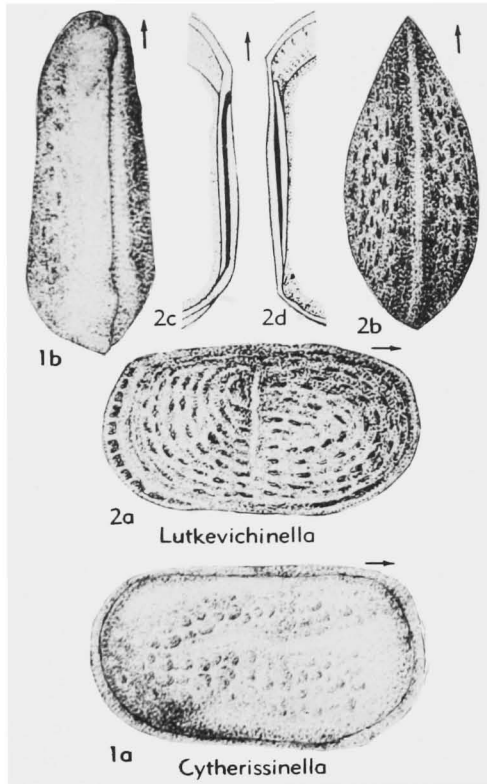


Fig. 218. Cytherissinellidae (p. Q291).

Kobayashiina Hanai, 1957 [**K. hyalinosa*]. Fragile nearly transparent with sharp-pointed alae, caudal process turned downward. Hinge intermediate between *Paijenborchella* and *Cytheropteron;* in RV, anterior tooth bilobate, with steplike projection just below it; median furrow arched and finely crenulate in anterior half, straight and coarsely crenulate in posterior half, and with shallow depression at anterior termination; posterior tooth consisting of single row of elongate knoblike teeth. Other characters similar to *Cytheropteron*. *Plio.*, E.Asia(Japan).——Fig. 222,*1*. **K. hyalinosa; 1a*, RV lat., ×90 (Hanai, n); *1b,c*, RV int., LV int., ×90 (27). [Hanai.]

Mehesella Reyment, 1960 [**M. paleobiafrensis*] [=*Budaia* Méhes, 1941 (*non* Wells, 1933)]. Subequivalved, LV usually overlapping RV slightly along dorsal margin, particularly posterodorsally but RV may overlap LV, ventral region tending to be much swollen; posterior margin drawn out into blunt caudal process; surface with numerous notched longitudinal riblets and/or reticulations, posterior half of ventral margin may be compressed into low but sharp keel; eye spot present, sometimes only discernible from inside. LV hinge with notched terminal sockets and fine uniting crenulated bar (in Eocene species anterior termi-

nation of bar may be thickened to form prominent tooth); moderately broad anterior and posterior marginal zones with 10 or 11 slightly flexed simple pore canals; inner margin and line of concrescence coincident; adductor muscle field composed of vertical row of 4 spots, also a dorsal field

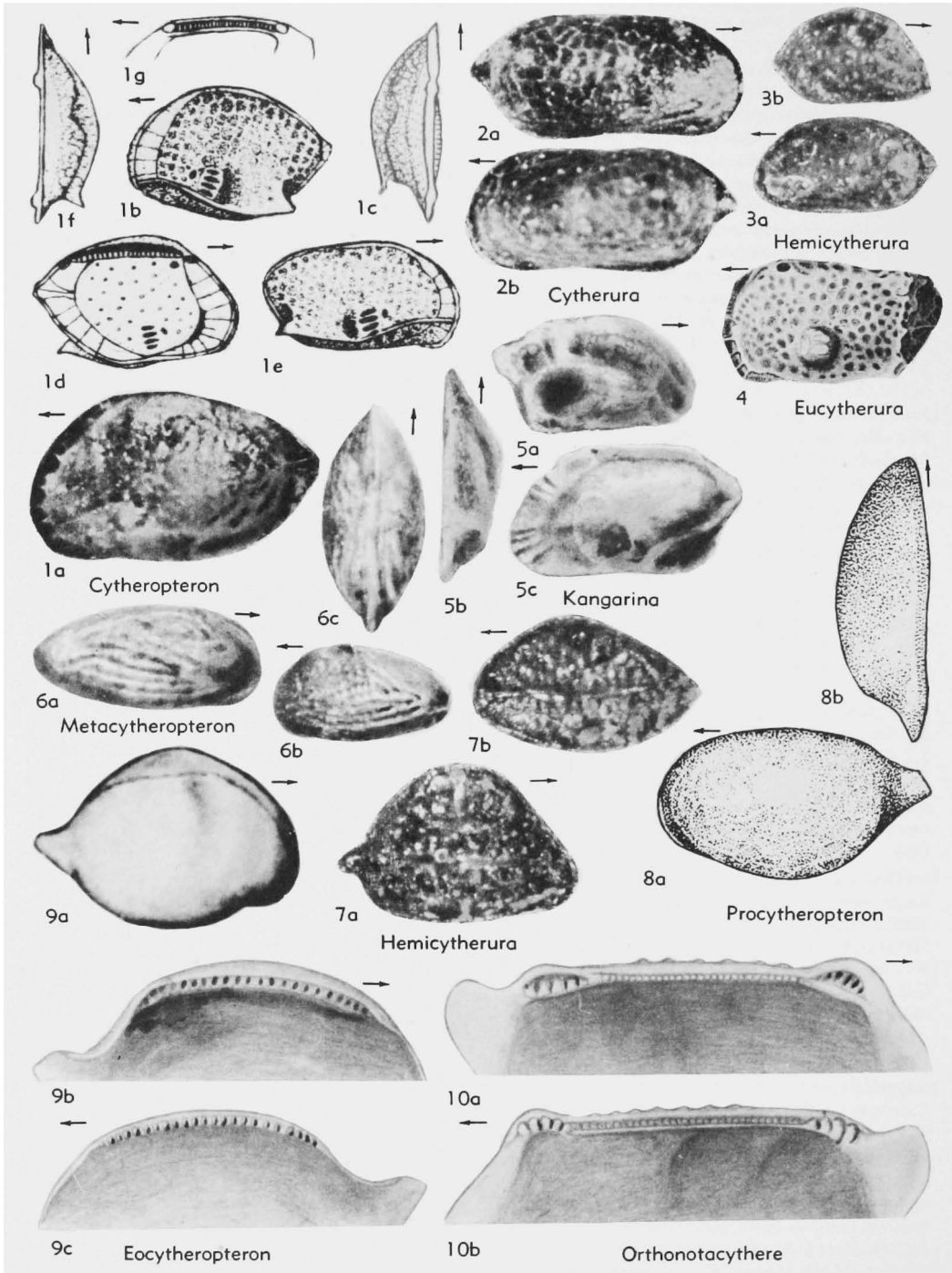


FIG. 219. Cytheruridae (p. Q292-Q299).

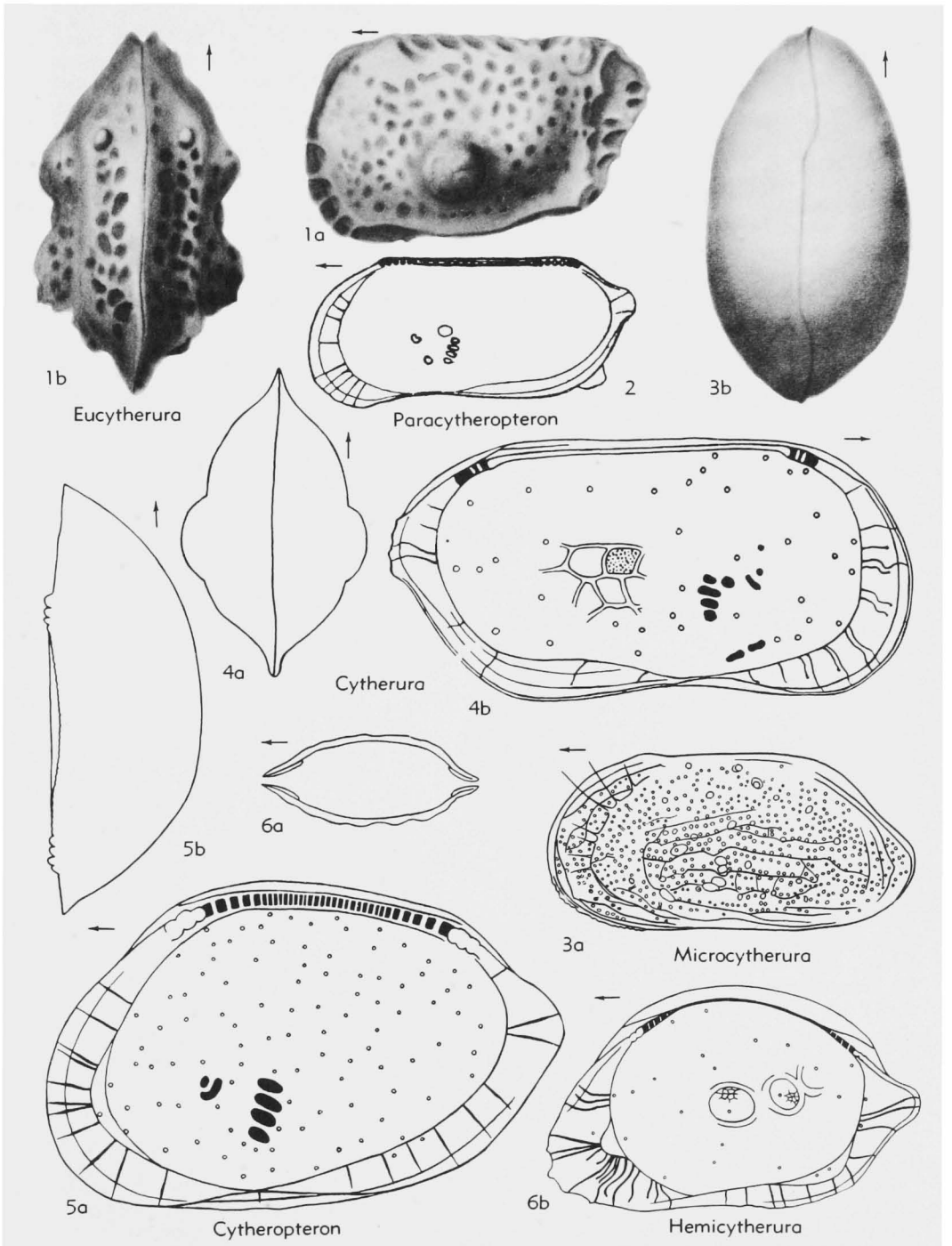


FIG. 220. Cytheruridae (p. Q292-Q299).

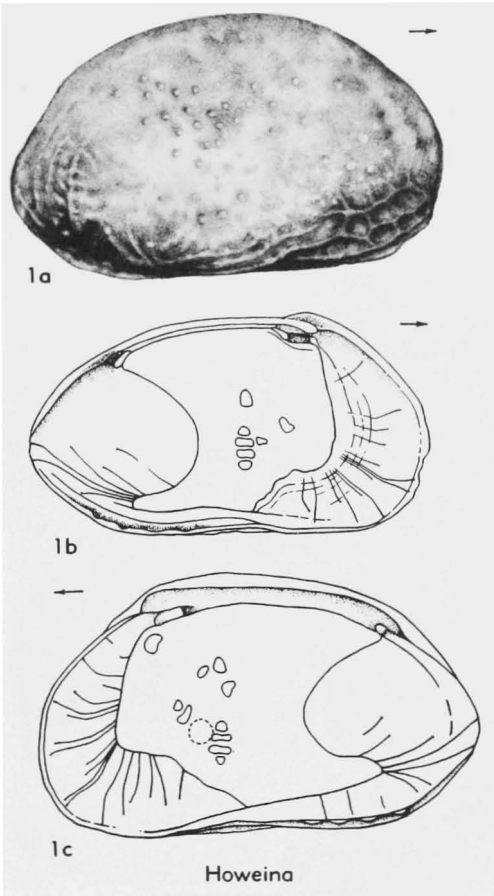


FIG. 221. Cytheruridae (p. Q293).

of 3 or 4 spots, and 2 antennal spots. Sexual dimorphism slightly reflected in morphology of carapace. *U.Cret.(U. Maastricht.)-Oligo.*, Eu.(Hung.)-W.Afr.(Nigeria).——FIG. 223,*3*. *M. biafrensis*, Maastricht., W.Nigeria; *3a*, carapace R, ×60; *3b-d*, LV lat., dors., vent., ×60 (293).——FIG. 224,*1*. **M. paleobiafrensis; 1a,b*, carapace L, dors., ×85; *1c*, RV ant. pore canals, ×135 (293).

Metacytheropteron OERTLI, 1957 [**M. elegans*]. More or less almond-shaped, like *Cytherura* but LV overlapping RV, elongated, especially along dorsal margin, as in *Eocytheropteron;* anterior end broadly rounded, with ventral part of this margin more sharply rounded than dorsal, posterior end bluntly pointed; weak eye tubercle. Inner margin coincident with line of concrescence, surface reticulate and bearing longitudinal ribs, marginal pore canals radial and simple, straight, few; hinge like that of *Cytheropteron*. Slight sexual dimorphism. *U.Jur.-L.Cret.*, Eu.——FIG. 219,*6*. **M. elegans*, U.Jur.(Kimm.), Fr.; *6a-c*, ♂ carapace R showing dorsal overlap and eye tubercles, ♀ carapace L, ♂ dors., all ×50 (269).

Microcytherura G.W.MÜLLER, 1894 [**M. nigrescens*]. Subquadrate in side view, egg-shaped in dorsal view, fragile, bilamellar; RV slightly larger than LV, overhanging it along dorsal margin; posterior caudal process weakly developed. LV hinge with weakly crenulated anterior furrow, smooth median bar, widened at its extremities, and posterior crenulated furrow with indistinct posterior termination; internal margin and line of concrescence coincident, marginal pore canals few, straight, simple, although some may branch; normal pore canals numerous, with sieve structure in outer opening; oblique row of 4 adductor scars and 2 anterodorsally located scars, 2 mandibular scars. Sexual dimorphism discernible. *Pleist.* (incl. *Rec.*), Eu.(Holl.-Italy).——FIG. 220,*3*. **M. nigrescens*, Rec., Holl.; *3a,b*, carapace L, dors., ×130 (53).

Orthonotacythere ALEXANDER, 1933 [**Cytheridea? hannai* ISRAELSKY, 1929] [=*Cytheropterina* MAN-

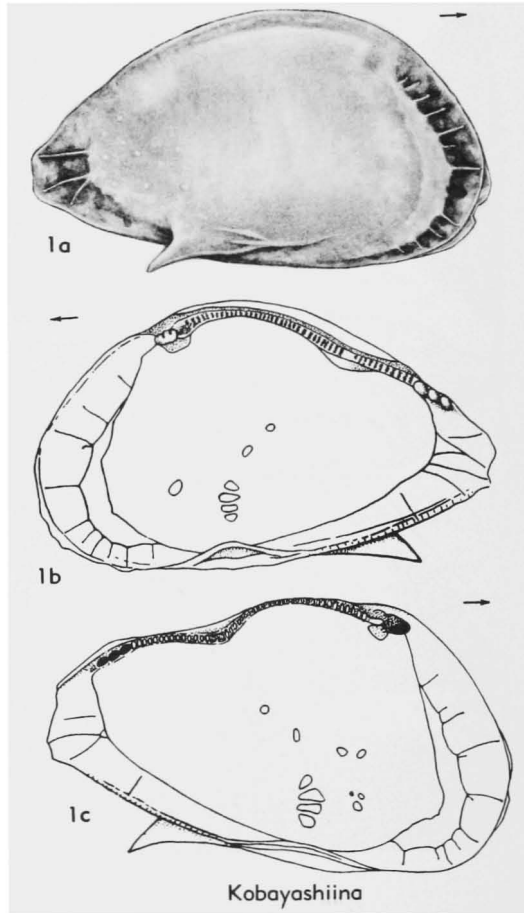


FIG. 222. Cytheruridae (p. Q293).

DELSTAM, 1956]. Subquadrangular, dorsal margin almost straight, ventral margin parallel to it, posterodorsal caudal extension present, greatest width ventral; surface with knobs and reticulations. Adductor muscle scars in vertical row of 4; marginal pore canals few, simple, straight, RV hinge with notched terminal tooth plates separated by strongly crenulated furrow. *Jur.-Rec.*, N.Am.—— FIG. 219,*10*. **O. hannai* (ISRAELSKY), Cret., Tex., Ark.; *10a,b*, LV hinge, RV hinge, ×100 (89). ——FIG. 225,*1*. *O. vegranda* (MANDELSTAM), Cret., USSR(Ukraine) (type species of *Cytheropterina*); *1a-c*, carapace R, RV and LV hinge, ×94 (50).

Otocythere TRIEBEL & KLINGLER, 1959 [**O. callosa*]. Shape in side view resembling that of human ear, small; LV slightly larger than RV, overhanging it along dorsal margin and upper part of broadly rounded anterior margin, greatest height in front of middle, posterior extremity drawn out in short caudal process, deepened by small furrow on both valves, so that unclosed posterior end looks like a pipe; dorsal outline of inferred females inflated in LV and thereafter straight, ventral margin convex, overhung by ventral inflation; surface with coarse folds and tubercles; strong adductor muscle tubercle in front of middle, bounded anteriorly and posteriorly by broad submarginal folds; no eye structures present. Inner margin and line of concrescence coincident, approximately parallel to outer margin; zone of concrescence rather narrow, marginal pore canals few, well spaced, straight, unbranched, submarginal canals lacking but a few sublateral canals occur, beginning proximally from line of concrescence and cutting marginal fields obliquely outside zone of concrescence; RV hinge with low terminal tooth plates, each with 6 to 9 toothlets, and intervening notched median furrow

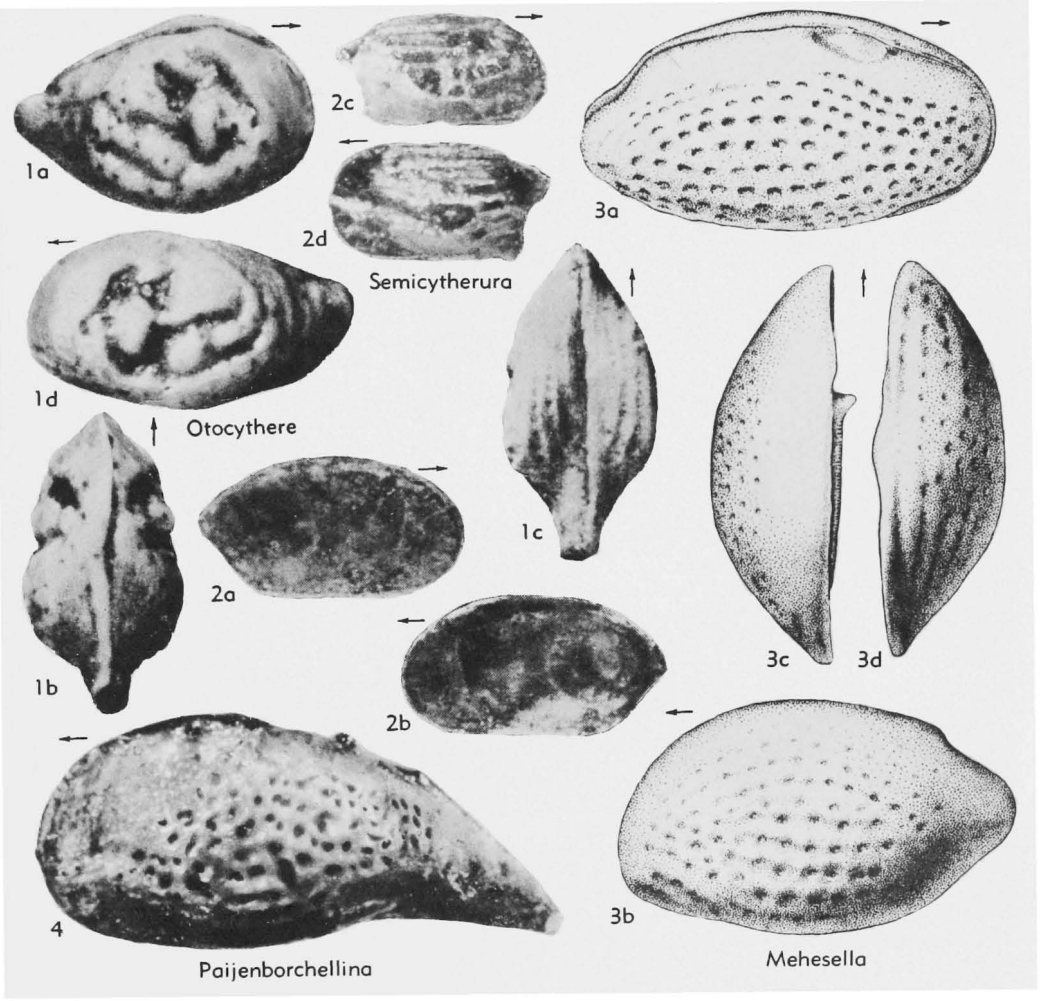


FIG. 223. Cytheruridae (p. Q293-Q300).

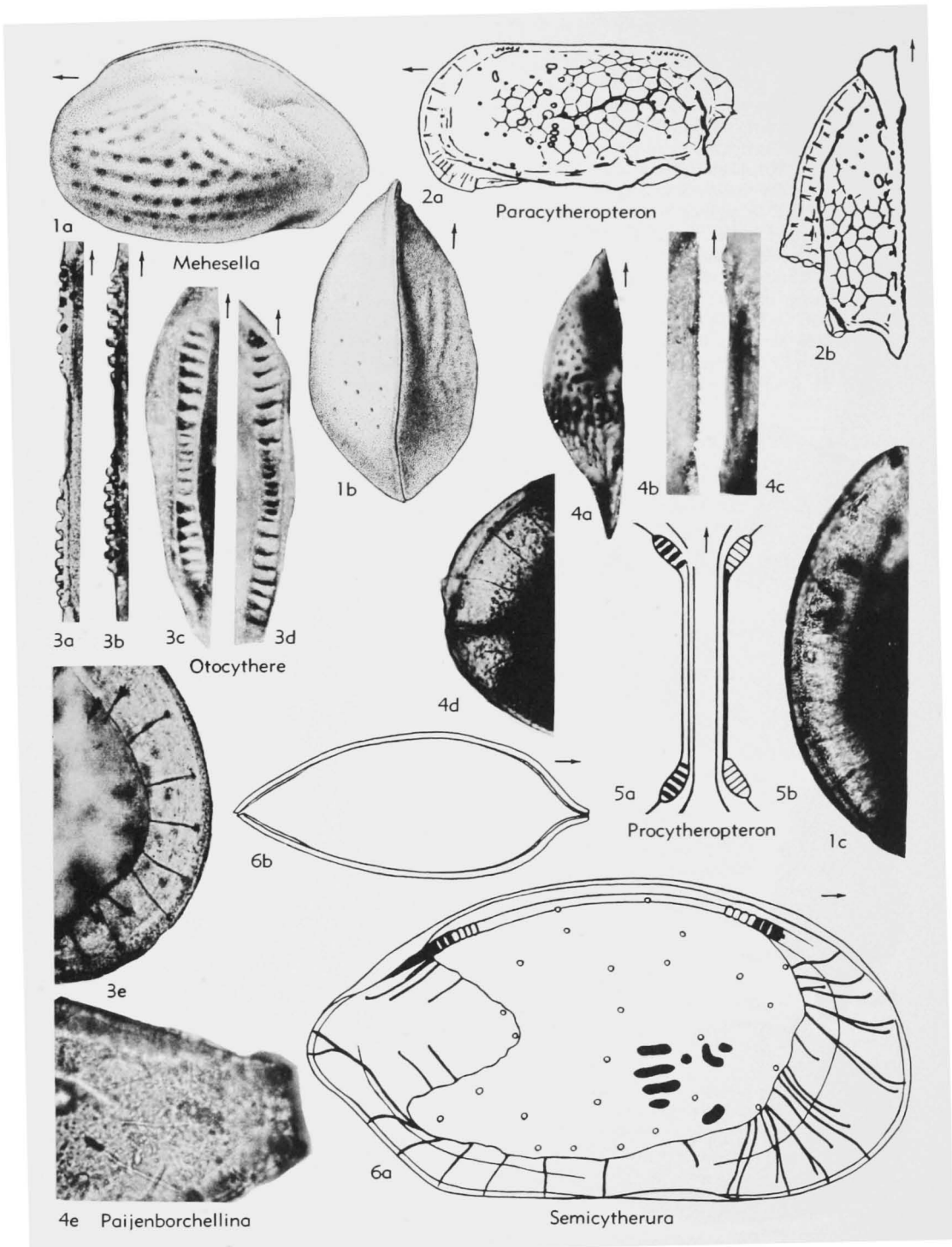


Fig. 224. Cytheruridae (p. Q293-Q300).

(this element shorter than terminal hinge elements in females and shorter than posterior tooth plate in males). [Marine.] *L.Jur.-M.Jur.*, Eu.——Fig. 223,*1*, 224,*3*. **O. callosa*, L.Jur., Ger.(Niedersachsen); 223,*1a-c*, ♀ carapace R, dors., vent., ×80; 223,*1d*, ♂ LV lat., ×80; 224, *3a,b*, ♂ and ♀ RV hinge dors., ×155, ×160; 224,*3c,d*, ♀ LV int., ♀ RV int., showing hinge, ×150; 224,*3e*, ♀ LV int. ant. margin showing radial pore canals, ×240 (382).

Paijenborchellina Kuznetsova, 1957 [**P. excelens*]. Carapace rather small, pear-shaped, with strongly produced caudal process, valves subequal but LV generally slightly larger than RV; ventral area gently rounded, on each valve bearing sharp rib that runs to base of posterior caudal projection and even onto it; weakly impressed zone from dorsal margin to middle of side; anterior margin fairly broad, provided with narrow outer lip through which canals do not penetrate, inner margin and line of concrescence coincident; anterior marginal pore canals few, straight, with 3 radially arranged canals in caudal process; selvage well developed, located near outer margin; RV hinge with anterior and posterior tooth plates and crenulated median furrow; eye spots feeble; muscle field and dimorphism unknown. Surface with small pits and weak ribs or reticulations. *L.Cret.(Neocom.)-Eoc.*, Eu.(USSR)-W.Afr.(Nigeria).——Fig. 223,*4*, 224, *4*. *P. ijuensis* Reyment, *Eoc.*, W.Nigeria; 223,*4*, LV lat., ×125; 224,*4a*, LV dors., ×83; 224,*4b,c*, hinge LV and RV, ×133; 224, *4d,e*, RV int., ant. and post., pore canals, ×430 (Reyment, n).

Paracytheridea G.W.Müller, 1894 [**P. depressa* (=**Cytheropteron bovettensis* Seguenza, 1880)] [?=*Mooreina* Harlton, 1935]. Carapace stout, very much broadened, with rounded anterior and pointed posterior extremities, backwardly directed aliform ridge and sundry swellings on either side. Hinge weak, with faint indications of sockets in left valve, hinge margin or crenulate bar between them; radial canals slender, thickened near middle 53, 54, 327). *?Penn., U.Cret.-Rec.*, Eu.-N.Am.——Fig. 206,*1a-d*. **P. bovettensis* (Seguenza), Rec., Italy; *1a,b*, carapace L and vent., ×60 (54); *1c,d*, carapace L and dors., ×75, ×110 (53).——Fig. 206,*1e-h*. *P. brusselensis* Keij, Eoc.(Lutet.), Belg.; *1e*, LV ext., ×75; *1f,g*, carapace dors., vent., ×75; *1h*, RV int., ×115 (all 42). [Howe.]

Paracytheropteron Ruggieri, 1952 [**Cytheropteron calcaratum* Seguenza, 1880, =*Paracytheridea (Paracytheropteron) calcarata* (Seguenza) Ruggieri, 1952]. Shape of carapace intermediate between that of *Paracytheridea* and *Cytherura* but with a cytheropteronoid hinge. Provided with moderately well-developed eye tubercles. Pore canals straight, unbranched, few in number, in posterior part confined to the caudal process. Inner margin and line of concrescence coincident or almost so. Adductor muscle field composed of a

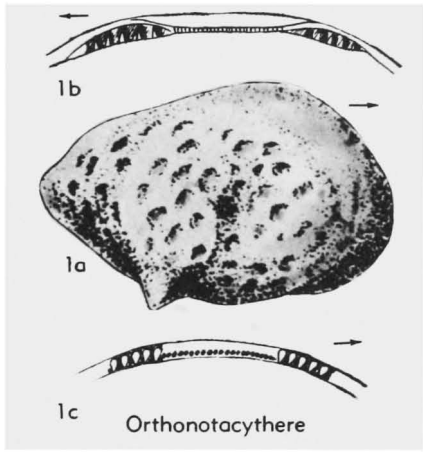


Fig. 225. Cytheruridae (p. Q296-Q297).

slightly inclined vertical row of four elongated spots and larger spot on top of row. At a distance anterior to the dorsalmost thereof a V-shaped spot and posteroventral from it a roundish spot. An elongated antennal spot occurs and there is a dispersed dorsal muscular field. Surface ornament of fine, large reticulations. Sexual dimorphism. *Mio.-Rec.*, Eu.——Fig. 220,*2*, 224,*2*. **P. calcaratum* (Seguenza), *Pleist.*, Italy; 220,*2*, RV int., ×70; 224,*2a,b*, LV lat., dors., ×100 (all 301).

Procytheropteron Lyubimova, 1955 [**P. obesum*]. Carapace shaped like that of *Eocytheropteron* and *Mehesella* but with even more pronounced caudal process, LV overlapping RV, ventral margin strongly convex, dorsal less strongly convex; surface with minute pits and feeble ribs. Normal pore canals possibly provided with sieve openings; zone of concrescence narrow, with numerous straight pore canals; RV hinge with terminal teeth (each with 5 notches) and median furrow, LV hinge complementary; muscle field reported to be cytherid in type. [Lyubimova (1955) ascribed genus to Mandelstam, designating *P. obesum* Lyubimova, n. sp., as type. Mandelstam (1956) published *Procytheropteron* as new genus of his own, designating *Cythere punctatula* var. *virginea* Jones, 1849, as type; neither of these actions is valid.] [Marine.] *U.Jur.(Volg.) - U. Cret. (Maastricht.)*, Eu.(USSR-Eng.)-Asia-N.Am. —— Fig. 219,*8*. **P. obesum*, U.Jur.(Volg.), USSR; *8a,b*, LV lat., dors., ×43 (230).——Fig. 224,*5*. *P. virgineum* (Jones), U.Cret.(Campan.), USSR (Emba); *5a,b*, LV and RV hinge, ×62 (50).

Semicytherura Wagner, 1957 [**Cythere nigrescens* Baird, 1838]. Carapace bilamellar, fragile, surface smooth or distinctly ornamented, RV slightly larger than LV, overhanging it along dorsal margin; with distinct caudal process. LV hinge with notched elongated anterior pit that is indistinctly terminated in front, short bar terminally thickened

and crenulated but with middle smooth, notched elongated posterior pit indistinctly terminated at rear; zone of concrescence broad, particularly in posterior part where it extends forward into carapace, in some rather far; line of concrescence and inner margin coincident; normal pore canals open, few; marginal pore canals few, long, commonly grouped, some divided; 4 vertically arranged adductor scars with a group of 3 scars in front, single mandibular scar. Sexual dimorphism pronounced. *Pleist.*(incl. *Rec.*), N.Eu.——Fig. 223,*2a,b*; 224,*6*. **S. nigrescens* (Baird), Rec., NE.Atl.; 223,*2a,b*, ♀ RV lat., ♀ LV lat., ×80; 224,*6a*, ♀ LV int., ×220; 224,*6b*, carapace long. sec., ×125 (88, by permission of Mouton & Co., The Hague).——Fig. 223,*2c,d*. *S. acuticostata* (Sars), Rec., NE.Atl.; *2c,d*, RV lat., LV lat., ×60 (88, by permission of Mouton & Co., The Hague).

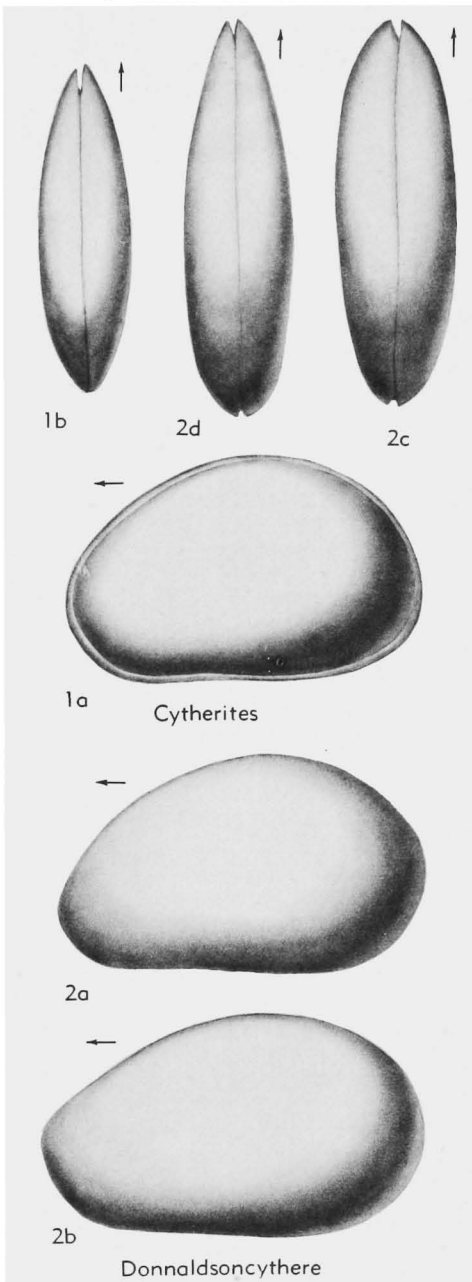


Fig. 226. Entocytheridae (p. Q300).

Family ENTOCYTHERIDAE Hoff, 1942

[*nom. transl.* Howe, herein (*ex* Entocytherinae Hoff, 1942)] [Materials for this family prepared by H. V. Howe, Louisiana State University]

Shell reniform to elliptical, thin, chitinous, laterally compressed, valves nearly equal, surface without protuberances or papillae, but in some species with slight sculpturing and a few hairs. [Commensal or subterranean.] *Rec.*, N.Am.-Eu.-Afr.

Entocythere Marshall, 1903 [**E. cambaria*]. Commensal or subterranean. *Rec.*, N.Am.

E. (Entocythere). Second antenna of ♀ with 3 distal claws. Commensal on crayfish. *Rec.*, N.Am.

E. (Cytherites) Sars, 1926 [**C. insignipes*]. Second antenna of ♀ with 2 distal claws. Commensal on crayfish. *Rec.*, N.Am.——Fig. 226,*1*. **E. (C.) insignipes; 1a,b*, carapace L, dors., ×100 (315).

E. (Donnaldsoncythere) Rioja, 1942 [**Entocythere donnaldsonensis* Klie, 1938]. Like *E. (Cytherites)* but differs in terminal portion of ♂ antenna. [Subterranean.] *Rec.*, N.Am.——Fig. 226,*2*. **E. (D.) donnaldsonensis; 2a,b*, ♀ and ♂ LV lat.; *2c,d*, ♀ and ♂ carapace dors., ×100 (220).

Sphaeromicola Paris, 1916 [**S. topsenti*]. Distal podomere of mandibular palp in most species spatulate in shape; respiratory plate of maxilla wanting and masticatory lobes vestigial; penis with shortened base. Commensals of Isopoda and Amphipoda. *Rec.*, S.Eu.-Afr.-N.Am.(Mexico).

Family HEMICYTHERIDAE Puri, 1953

[*nom. transl.* Howe, herein (*ex* Hemicytherinae Puri, 1953)] [Materials for this family prepared by H. V. Howe, Louisiana State University, with contribution on some genera by W. A. van den Bold, Louisiana State University, and R. A. Reyment, University of Stockholm]

Carapace ovate, subrectangular, or somewhat almond-shaped, broadly and obliquely rounded in front, somewhat truncate behind, with angulation at or above junction with ventral margin, in some genera (e.g., *Urocythere, Caudites, Nephokirkos*) with angulation produced into true caudal process; usually somewhat concave above angulation; surface smooth, pitted, reticulate, or longitudinally ribbed, with low keel com-

monly present near ventral margin. Hinge merodont in young but holamphidont in adults, except for *Nereina* which remains merodont in adult stage and is tentatively placed here because of its shape, marginal area, and muscle scars. Marginal areas with numerous radial canals, 25 to 80 in anterior region, line of concrescence tending to coincide with inner margin; muscle scars in vertical row of 4 (median scars divided dif-

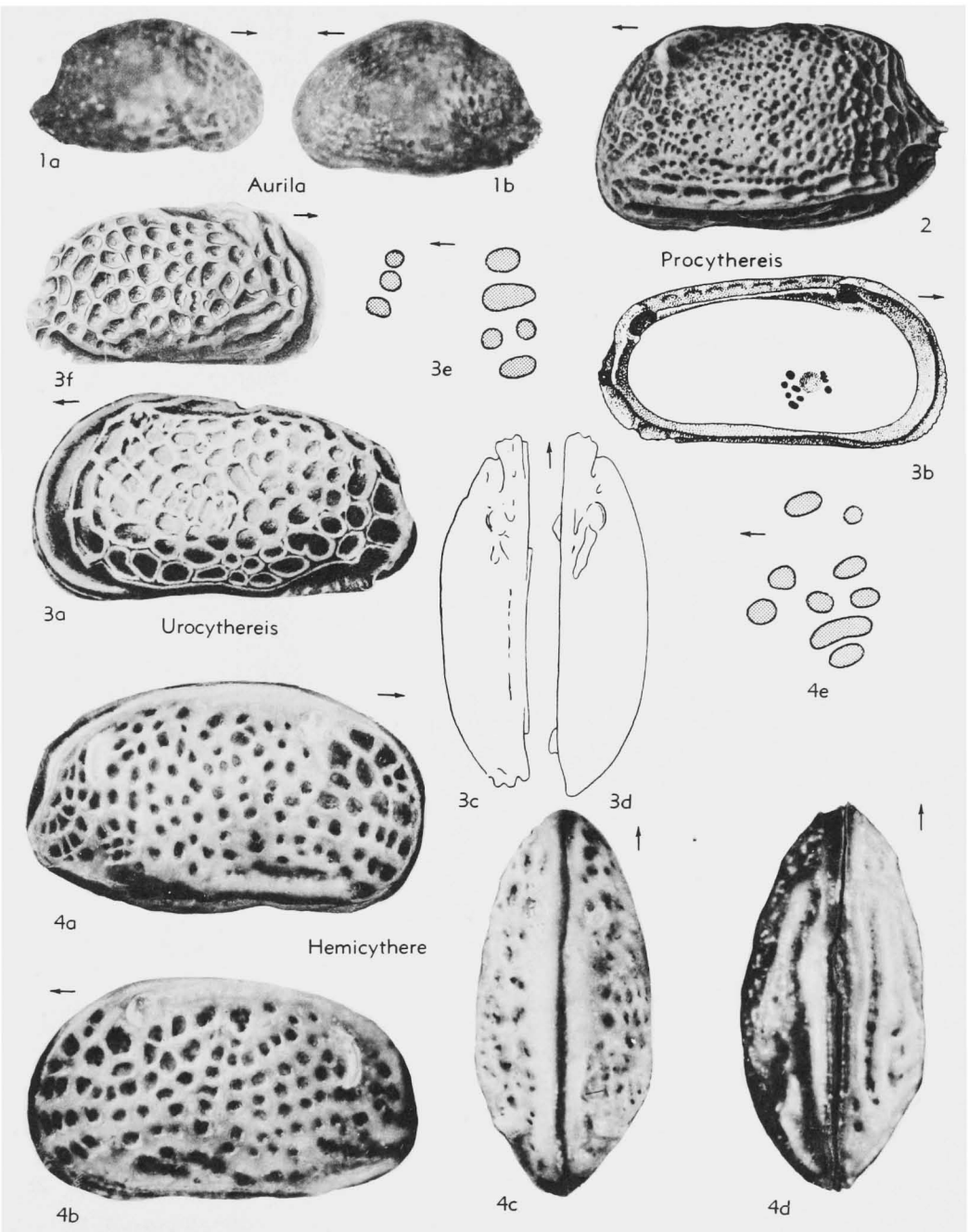


FIG. 227. Hemicytheridae (p. Q302-Q306).

ferently in various genera) with either 2 or 3 (mandibular-antennal) scars obliquely in front of upper part of vertical row (adductors). *Eoc.-Rec.*

Hemicythere SARS, 1925 [**Cythere villosa* SARS, 1866; SD EDWARDS, 1944] [?=*Eucythereis* KLIE, 1940 *(partim)*]. Carapace plump, subrectangular with rather concave posterodorsal margin; surface pitted or reticulate. Hinge holamphidont, heavy; marginal areas with numerous radial canals; muscle scars in vertical row of 4 (next to top element paired) and 2 antennal scars obliquely in front (68, 143, 222, 300). *Eoc.-Rec.*, cosmop.——FIG. 227,*4*. **H. villosa* (SARS), Rec., NE.Atl. (Norway-Swed.); *4a-d*, carapace R, L, dors., vent., ×80; *4e*, muscle scars, ×180 (Sylvester-Bradley, n).

Aurila POKORNÝ, 1955 [*pro Auris* NEVIANI, 1928 (*non* SPIX, 1827)] [**Cythere convexa* BAIRD, 1850 (=**Cythere punctata* MÜNSTER, 1830)]. Carapace almond-shaped, rounded in front, pointed behind; surface pitted, eye tubercles distinct. Hinge holamphidont; adductor muscle scars variable, oblique row of 3 antennal scars in front. *Plio.-Rec.*, Eu. ——FIG. 227,*1a,b*, 230,*1*. **A. convexa* (BAIRD), Rec., Eng.; 227,*1a,b*, RV lat., LV lat., ×40; 230, *1a*, RV int., ×100; 230,*1b*, hinge, dors., ×45 (all 88, by permission, Mouton & Co., The Hague). ——FIG. 228,*2a*. **A. punctata* (MÜNSTER), Plio., Fr. (Perpignan); LV lat., ×60 (42).——FIG. 228, *2b,c*. *A. cicatricosa* (REUSS), Plio., Fr.(Perpignan); *2b,c*, LV lat., int., ×60, ×75 (42).

Caudites CORYELL & FIELDS, 1937 [**C. medialis*]. Carapace small, elongate, thick-shelled, more compressed than *Hemicythere*, anterior end rounded,

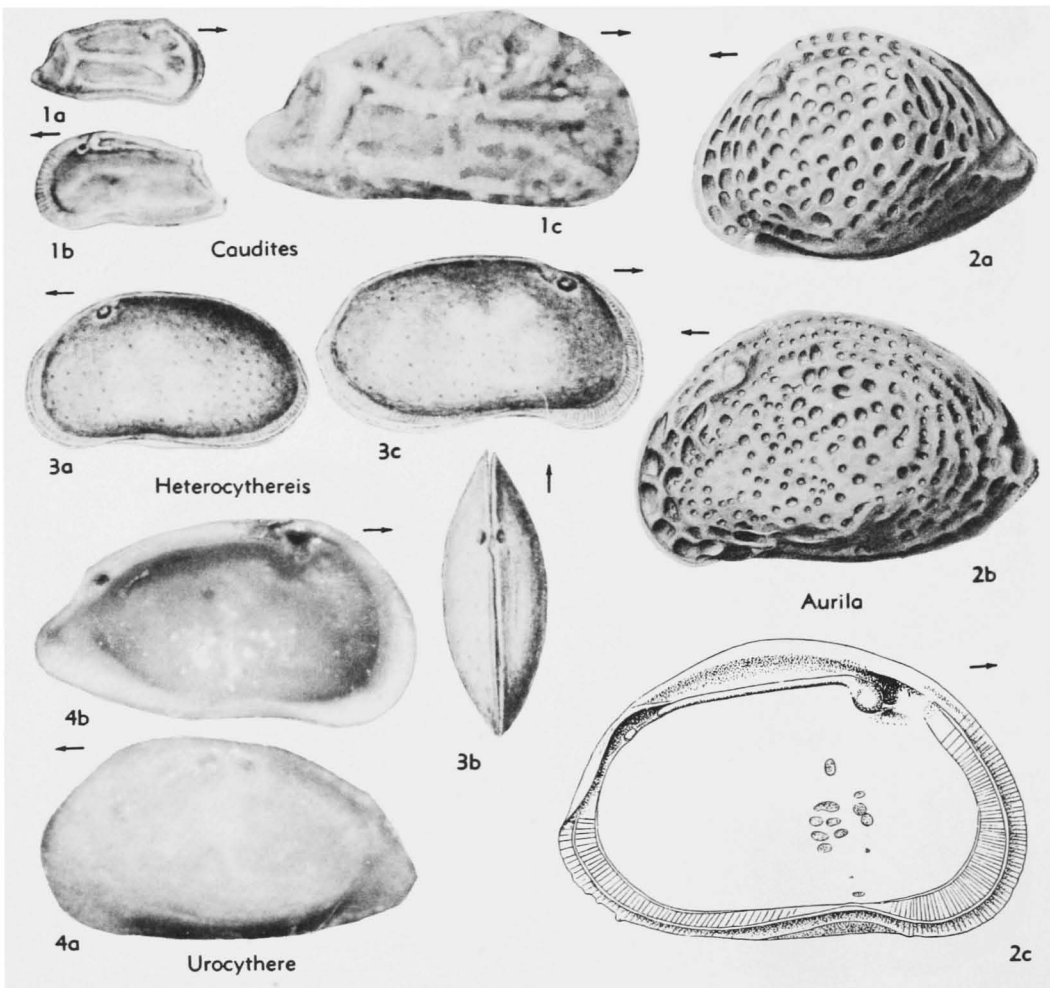


FIG. 228. Hemicytheridae (p. Q302-Q306).

with thickened rim, posterior attenuated and posteroventral corner produced; surface with one or more longitudinal ribs and commonly a transverse rib extending downward from posterocardinal angle. Hinge as in *Hemicythere*. *Eoc.-Rec.*, N. Am.——FIG. 228,*1a,b*. **C. medialis*, Mio., Panama; *1a,b*, RV lat., int., ×60 (126).——FIG. 228, *1c*. *C. jacksonvillensis* SWAIN, M.Eoc., N.Car.; *1c*, RV lat., ×80 (353).

Elofsonella POKORNÝ, 1955 [*pro Paracythereis* ELOF-

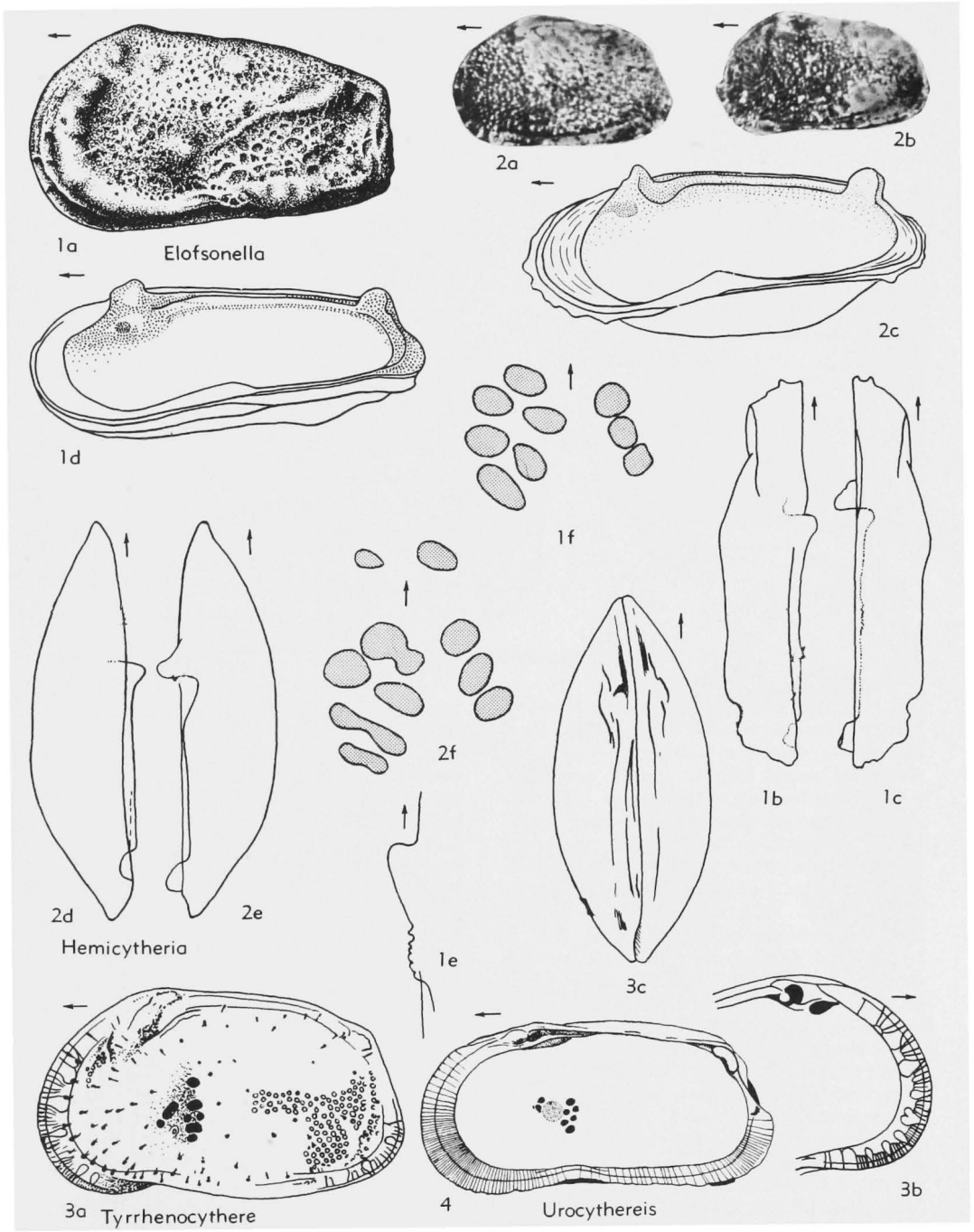


FIG. 229. Hemicytheridae (p. Q304-Q306).

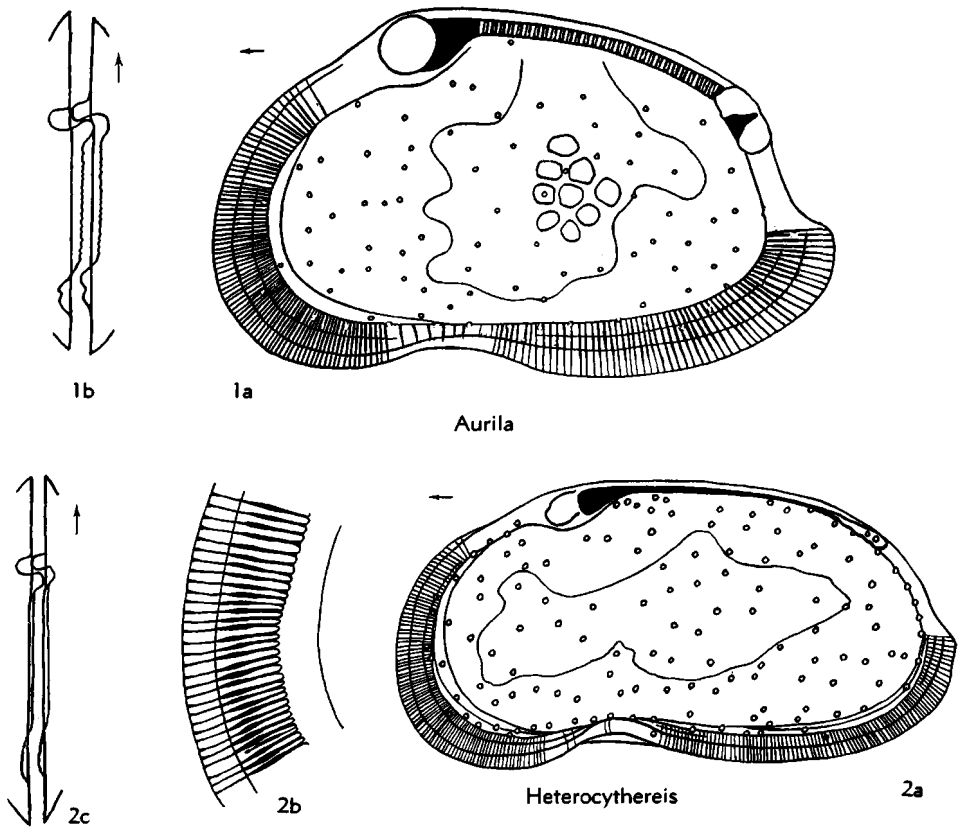


FIG. 230. Hemicytheridae (p. Q302-Q304).

SON, 1941 (*non* DELACHAUX, 1928; *nec* JENNINGS, 1936)] [**Cythere concinna* JONES, 1857]. Carapace oblong, highest at anterior cardinal angle, dorsal and ventral margins straight, converging, posterior end truncate; surface uneven, with marginal rim around anterior and ventral edges. Hinge holamphidont; radial canals numerous; muscle scars in vertical row of 4 (with 2 middle ones paired) and 3 antennal scars forming oblique row in front (38). *Pleist.-Rec.*, Eu.——FIG. 229,*1*. **E. concinna* (JONES), Rec., Swed.; *1a,b*, ♀ LV ext. and dors.; *1c,d*, ♀ RV dors. and int. oblique vent.; *1e*, juv. RV dors., ant. part of hinge; *1f*, muscle scars; *1a-d*, ×60; *1e-f*, ×200 (276).

Hemicytheria POKORNÝ, 1955 [**Cypridina folliculosa* REUSS, 1850]. Like *Hemicythere* in shape; surface pitted or latticed, with smooth eye tubercle. Hinge holamphidont; muscle scars as in *Hemicythere* except for presence of 3 antennal scars in front instead of 2. *Plio.*, Eu.——FIG. 229,*2*. **H. folliculosa* (REUSS), Aus.(Vienna basin); *2a,b*, ♂ LV ext., ♀ LV ext., ×35; *2c*, RV int. oblique vent., ×50; *2d,e*, LV and RV dors., ×50; *2f*, muscle scars, ×200 (276).

Heterocythereis ELOFSON, 1941 [**Cythere albomaculata* BAIRD, 1838]. Like *Hemicythere* in shape but shell thin and smooth. Hinge holamphidont in adult, merodont in young, anterior teeth strong, posteriors weak; marginal areas moderate in width, line of concrescence and inner margin nearly coincident, radial canals very numerous; muscle scars in vertical row of 4 (upper middle one paired) and row of 3 antennal scars in front. *Rec.*, N.Atl.——FIG. 228,*3*, 230,*2*. **H. albomaculata* (BAIRD); 228,*3a,b*, ♀ carapace L, dors., ×45; 228,*3c*, ♂ carapace R, ×45; 230,*2a,b*, ♂ RV int., part of ant. marginal area, ×75, ×200; 230,*2c*, hinge, dors., ×45; (228,*3*, 314; 230,*2*, 88, permission of Mouton & Co., The Hague).

Mutilus NEVIANI, 1928 [**Cythereis (Mutilus) laticancellata* NEVIANI, 1928 (=*Cythere retiformis* TERQUEM, 1878); SD RUGGIERI, 1956] [=*Mutila* NEVIANI, 1929 *(errore)*]. Plump, subrectangular, dorsum arched, ventral margin inturned near middle, anterior obliquely rounded, posterior subtruncate but angulated below middle and somewhat concave above angulation. Surface very coarsely reticulate, with normal canals in reticulations. Hinge holamphidont, front tooth of the RV stepped, back tooth reniform; adductor scars

in row of 4 (next to top paired), with oblique row of 3 antennal scars in front. *Mio.-Rec.*, Eu. ——FIG. 231,*1*. **M. retiformis* (TERQUEM), Calabrian(Plio.); *1a-c*, RV lat., int., dors.; *1d*, muscle scars, ×65 (305).

Nephokirkos HOWE, 1951 [**N. aquaplanus*]. Resembling *Cytheropteron* in shape of carapace because of well-developed caudal process, but more solidly constructed, with amphidont hinge, and distinct eye sockets and tubercles. Marginal area regular with about 25 radial canals on anterior. Muscle scars a vertical row of 4 (next to top divided) with 2 oblique antennal scars in front. *Eoc.*, SE.USA(Fla.).——FIG. 190,*5*. **N. aquaplanus; 5a,b*, RV lat., int.; *5c*, carapace, dors.; all ×60 (Howe, n).

Nereina MANDELSTAM in MANDELSTAM *et al.*, 1957 [**N. barenzovoensis*]. Carapace elongate, with ventral and smaller dorsal ridge or swelling and low subcentral node; hinge in LV consisting of terminal crenulate sockets, divided into 6 anteriorly and 5 posteriorly [each with 7 to 9 crenulations (VAN DEN BOLD)] and median smooth ridge [crenulate (VAN DEN BOLD)]; marginal area not

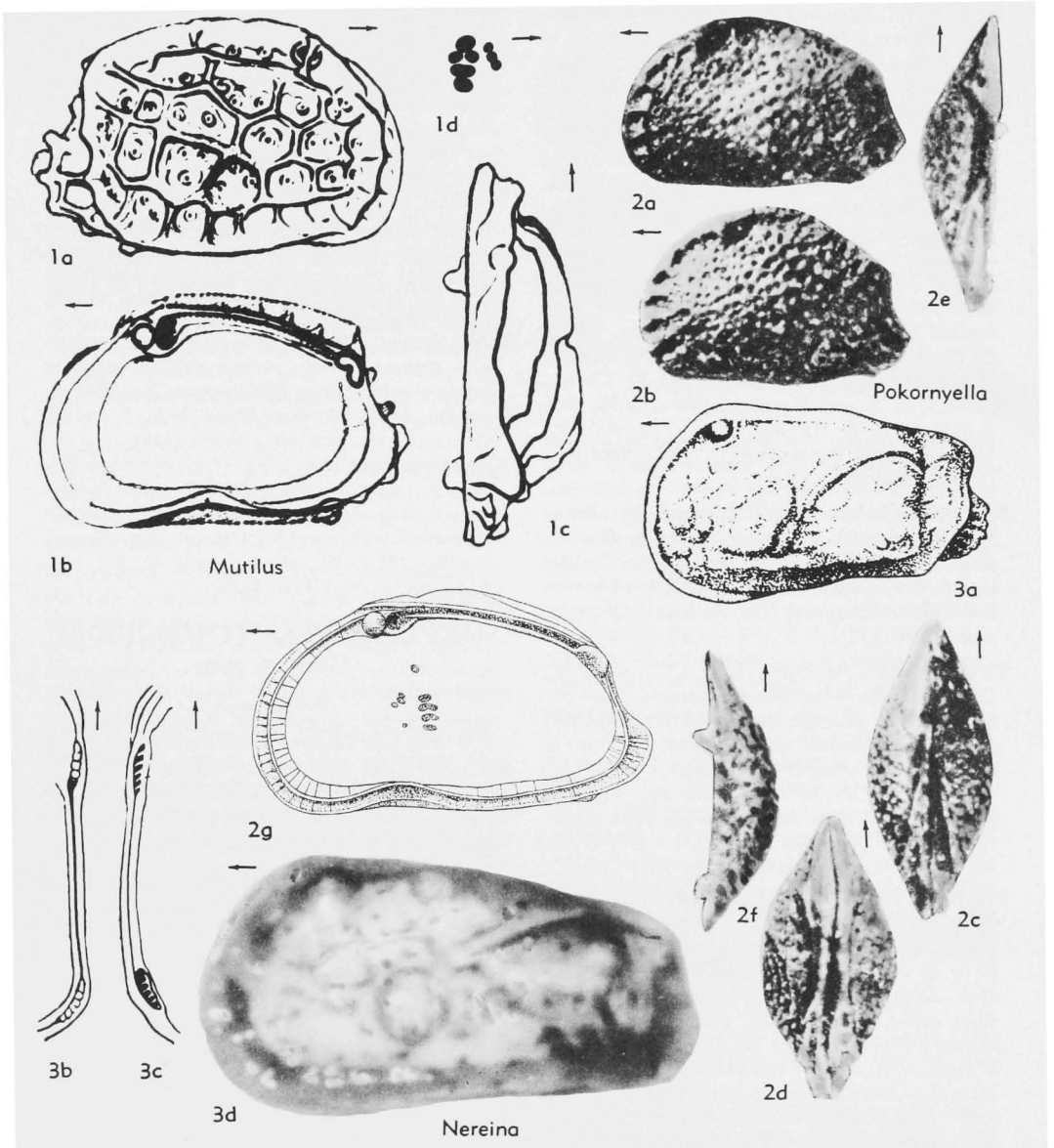


FIG. 231. Hemicytheridae (p. Q304-Q306).

described [line of concrescence and inner margin nearly coinciding in anterior end, pore canals very numerous, thin, some slightly sinuous, mostly apparently straight (VAN DEN BOLD)] muscle scars in posterior row of 4, of which middle 2 are subdivided into 2 scars each, and 3 additional scars in more or less oblique row in front. *Rec.*, N.Asia (Barentz Sea).——FIG. 231,*3*. **N. barenzovoensis; 3a*, LV lat., ×50; *3b,c*, RV and LV hinge, ×50 (238a); *3d*, LV lat. (Russian Harbor, Novaya Zemlya), ×75 (Howe, n). [BOLD.]

Pokornyella OERTLI, 1956 [**Cythere limbata* BOSQUET, 1852]. Egg- to kidney-shaped in side view, with distinct posteroventral process, ornament of reticulations or small pits, some shells with a posterodorsal swelling; small, glassy eye tubercles. Similar in appearance to *Hemicythere*, but has only about 25 radial canals on anterior, instead of 60 to 80. Inner margin and line of concrescence coincident; marginal pore canals fairly numerous, straight, single or grouped in pairs; adductor muscle field with vertical row of 4 spots, with round depression in front and 2 antennal spots located distally; RV hinge with simple, prominent anterior tooth and simple, narrow posterior tooth, a weak median groove with anterior depression. *Oligo.*, Eu.(Fr.-Belg.-Switz.).——FIG. 231,*2*. **P. limbata* (BOSQUET), Switz.-Fr.; *2a,b*, ♂ and ♀ LV lat., ×58; *2c,d*, ♂ and ♀ carapace dors., ×58; *2e,f*, ♂ LV dors., ♀ RV dors., ×58; *2g*, RV int., ×75 (*2a-f*, from Switz., 269; *2g*, from France, 42). [HOWE-REYMENT.]

Procythereis SKOGSBERG, 1928 [**Cythereis (Procythereis) torquata*]. Carapace shaped like *Hemicythere;* surface pitted and bearing strong alate ridge near flattened ventral margin. *Rec.*, S.Atl.-Pac.——FIG. 227,*2*. **P. torquata* (SKOGSBERG), S.Atl.; carapace L, ×50 (72).

Tyrrhenocythere RUGGIERI, 1955 [**T. pignattii*]. Like *Hemicythere* but anterior marginal areas distinguished by peculiar vestibule divided into several rounded pockets that terminate in series of slender, nearly straight radial canals with bulbous distal dilation, line of concrescence well separated from inner margin. *Rec.*, Medit.——FIG. 229,*3*. **T. pignattii*, Tyrrhen. Sea; *3a,b*, ?♀ LV lat., int., ×60; *3c*, ?♂ carapace, dors., ×60 (304).

Urocythere HOWE, 1951 [**U. attenuata*]. Sexually dimorphic, males resembling *Caudites*, females shorter, similar to *Hemicythere;* surface with little or no ornamentation. Hinge of left valve with deep anterior socket partitioned from ocular sinus, posterior socket ovate, median element consisting of high ridge that fits under dorsal margin of right valve, anterior end of ridge terminated by blunt downwardly directed tooth received by anterior socket of right valve; anterior marginal areas crossed by 8 to 10 pairs of widely spaced radial canals. *Eoc.*, SE.USA.——FIG. 228,*4*. **U. attenuata*, Fla.; *4a,b*, ♀ LV ext. and int., ×80 (Howe, n).

Urocythereis RUGGIERI, 1950 [**Cytherina favosa* ROEMER, 1838]. Carapace like *Hemicythere* in shape; surface reticulate. Hinge holamphidont, median groove of right valve deepest just behind elliptical-based anterior tooth, posterior tooth reniform; marginal areas with numerous radial canals; adductor muscle scars in vertical row of 4 (lower middle or both middle scars paired) and 3 antennal scars in front. *Mio.-Rec.*, Eu.——FIG. 227, *3*, 229,*4*. **U. favosa* (ROEMER), Plio., Italy-Fr.; 227,*3a*, juv. LV ext., ×75; 227,*3b*, ♀ LV int., ×50; 227,*3c,d*, LV, RV dors., ×50; 227, *3e*, muscle scars, ×200; 227, *3f*, ♂ RV ext., ×40 (227,*3a-e*, Italy, 300; 227,*3f*, Fr., 42); 229,*4*, ♂ RV int., ×75 (300).

Family KLIELLIDAE Schäfer, 1945

[*nom. transl.* HOWE, herein (*ex* Kliellinae SCHÄFER, 1945)] [Materials for this family prepared by H. V. HOWE, Louisiana State University]

Shell delicate, small, chitinous or slightly calcareous; smooth or with surface ornamentation; elongate, but narrowed at ends. Subterranean. *Rec.*

Kliella SCHÄFER, 1945 [**K. hyaloderma*]. Elongate-ovate chitinous shells, without definite hinge or surface ornamentation. Subterranean. *Rec.*, Greece. ——FIG. 232,*2*. **K. hyaloderma; 2a,b*, ♂ and ♀ RV ext.; *2c*, carapace dors., ×200 (318).

Nannokliella SCHÄFER, 1945 [**N. dictyoconcha*]. Elongate, slightly calcareous shell, with distinct drop-off from dorsal margin to posterior. Surface ornamented with lines. Subterranean. *Rec.*, Greece. ——FIG. 232,*1*. **N. dictyoconcha; 1a*, RV ext.; *1b*, carapace dors., ×300 (318).

Family LEGUMINOCYTHEREIDIDAE Howe, n. fam.

[Materials for this family prepared by H. V. HOWE, Louisiana State University]

Carapace medium to small in size, elongate ovate in side and dorsal views with greatest thickness generally behind middle, ovate to subcircular in end view; smooth to strongly reticulate, without dorsal and median ribs such as found generally in Trachyleberididae but a rib may be present at junction of lateral and ventral surfaces. External muscle node in some specimens. Hingement somewhat modified holamphidont, with anterior socket of RV triangular and elongated in direction of hinge furrow (in *Triginglymus* and some specimens of *Basslerites* with toothlike thickening of shell wall below and behind anterior hinge element of each valve). Marginal areas nearly regular but usually wider on anterior end,

where a vestibule develops; radial canals fairly numerous and straight, normal canals small and rather widely spaced; adductor muscle scars a vertical row of 4, usually with 2 adductors obliquely in front, but in most specimens of *Basslerites* these are fused into a V. [The 2 mandibular scars, set low and forward near the inner margin, are usually overlooked unless the shell is rotated slightly.] *Eoc.-Rec.*

Leguminocythereis Howe, 1936 [**L. scarabaeus* Howe & Law, 1936]. Carapace bean-shaped, with dorsum and venter subparallel, ends rounded, anterior broadest, greatest thickness behind middle; surface reticulate, with a vertical element in upper half and muscle node usually evident. Hinge holamphidont, with sharp anterior tooth in RV, behind which is a triangular socket, furrow, and oblique rounded posterior tooth; marginal areas regular, with small anterior vestibule; adductor muscle scars a vertical row of 4, with 2 antennal scars in front of lower pair and 2 small ovate mandibular scars just above ventral inner margin; normal canals large, widely spaced. *Eoc.-Mio.*, N.Am.-Eu.——Fig. 188,*2*. **L. scarabaeus*, Oligo., USA(Miss.); *2a,b*, LV lat., int.; *2c*, RV int.; *2d*, carapace, dors.; all ×40 (after 35).——Fig. 191, 2. *L. dumonti* Keij, Eoc.(Led.), Belg.; *2a,b*, ♂ RV lat., dors., ×40; *2c*, ♀ LV lat., ×40; *2d*, ♀ carapace dors., ×40; *2e*, RV int., ×47 (after 42).——Fig. 191,*1*. *L. genappensis* Keij, Eoc. (Lutet.), Belg.; *1a*, ♂ LV lat., ×40; *1b*, ♂ carapace dors., ×40; *1c*, ♀ RV lat., ×40; *1d*, ♀ carapace dors., ×40 (all 42).

Acuticythereis Edwards, 1944 [**A. laevissima*]. Carapace externally rather similar to *Campylocythere* but shorter and RV tending to be subangulate posteriorly. Surface smooth to strongly pitted or finely reticulate. Hinge holamphidont, with prominent pyramidal anterior tooth in RV, behind which triangular socket is less elongate than in *Campylocythere;* adductor scars a vertical row of 4, with 2 rounded antennal scars in front and 2 rounded mandibular scars just above ventral inner margin; normal canals rather large and moderately scattered. *Mio.*, N.Am.——Fig. 233,*1*. **A. laevissima*, USA(N.Car.); *1a-c*, LV lat., int., hinge, ×35; *1d-f*, RV lat., int., hinge, ×35; *1g*, carapace dors., ×35; *1h,i*, LV int., RV int., ×60 (*1a-g*, 143; *1h,i*, Howe, n).

Basslerites Howe in Coryell & Fields, 1937 [*pro Basslerella* Howe, 1935 (*non* Kellett, 1935; *nec* Bouček, 1936)] [*non Basslerites* Teichert, 1937 (=*Rayella* Teichert, 1939] [**Basslerella miocenica* Howe, 1935]. Ovate, small, dorsal and posterior margins forming near right angle; surface smooth or slightly wrinkled posteriorly. Hinge exceptionally strong, holamphidont, in RV with pointed anterior tooth, deep oblique socket drawn out toward hinge furrow, and oblique ovate posterior tooth; marginal area broadest anteriorly, with distinct vestibule and numerous radial canals; muscle scars a vertical row of 4 adductors, antennal scars generally fused into a V in front, and 2 ovate mandibular scars set obliquely just above ventral inner margin; normal canals thickly spaced on anterior end but widely spaced elsewhere. *Mio.-Rec.*, N.Am.-Eu.——Fig. 233,*3*. **B. miocenicus* (Howe), Mio., USA(Fla.); *3a,b*, carapace R, dors., ×60; *3c,d*, LV int., RV int., ×60 (all 178).

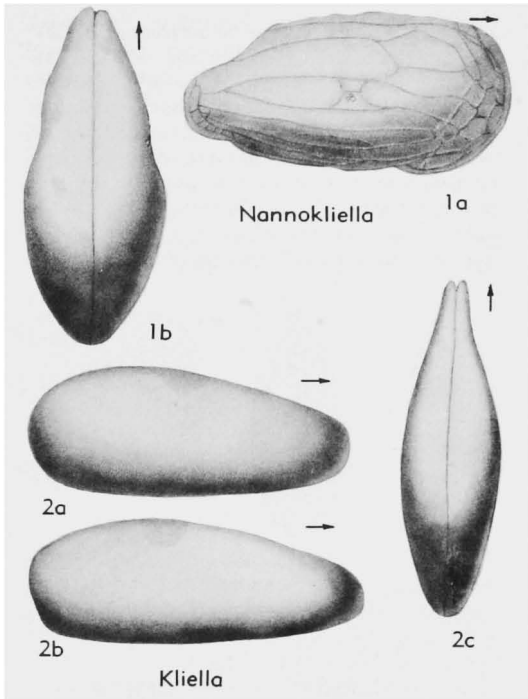


Fig. 232. Kliellidae (p. Q306).

Campylocythere Edwards, 1944 [**C. laeva*]. Carapace elongate ovate, LV larger than RV, overlapping it at anterior cardinal angle and venter; surface smooth or finely pitted. Hinge holamphidont, with sharp triangular anterior tooth in RV, behind which is a very elongate triangular socket, a faint furrow, and ovate posterior tooth. Margin widest anteriorly, with vestibule and numerous straight radial canals; normal canals small, scattered over entire carapace; adductor scars a vertical row of 4 with 2 antennal scars obliquely in front and 2 large ovate mandibular scars just above ventral inner margin. *Mio.*, N.Am.——Fig. 233,*2*. **C. laeva*, USA(N. Car.); *2a-c*, carapace L, dors., LV hinge, ×35 (143); *2d,e*, LV int., RV int., ×74 (Howe, n).

Triginglymus Blake, 1950 [**T. hyperochus*]. Carapace comparatively delicate, elongate, ovate, with distinct muscle node and tiny eye tubercles; plump-

est behind middle. Hinge holamphidont, in RV with sharp anterior tooth, behind which is an elongate V-shaped socket, a narrowing furrow, and an ovate posterior tooth; behind and below anterior elements of each valve thickened shell wall projects in a toothlike manner. Marginal area regular, with a small anterior vestibule and numerous straight radial canals, normal canals small, rather widely spaced; adductor scars in vertical row of 4, with 2 small antennal scars in front of upper part of row and 2 mandibular scars just above ventral inner margin. *Eoc.*, N.Am.——Fig. 233,*4*. **T. hyperochus*, USA(Ala.); *4a-c*, ♂ LV lat., int., dors.; *4d-f*, ♀ RV lat., int., dors.; all ×50 (6).

Family LEPTOCYTHERIDAE Hanai, 1957

[*nom. transl.* Hanai, herein (*ex* Leptocytherinae Hanai, 1957)] [Materials for this family prepared by Tetsuro Hanai, University of Tokyo]

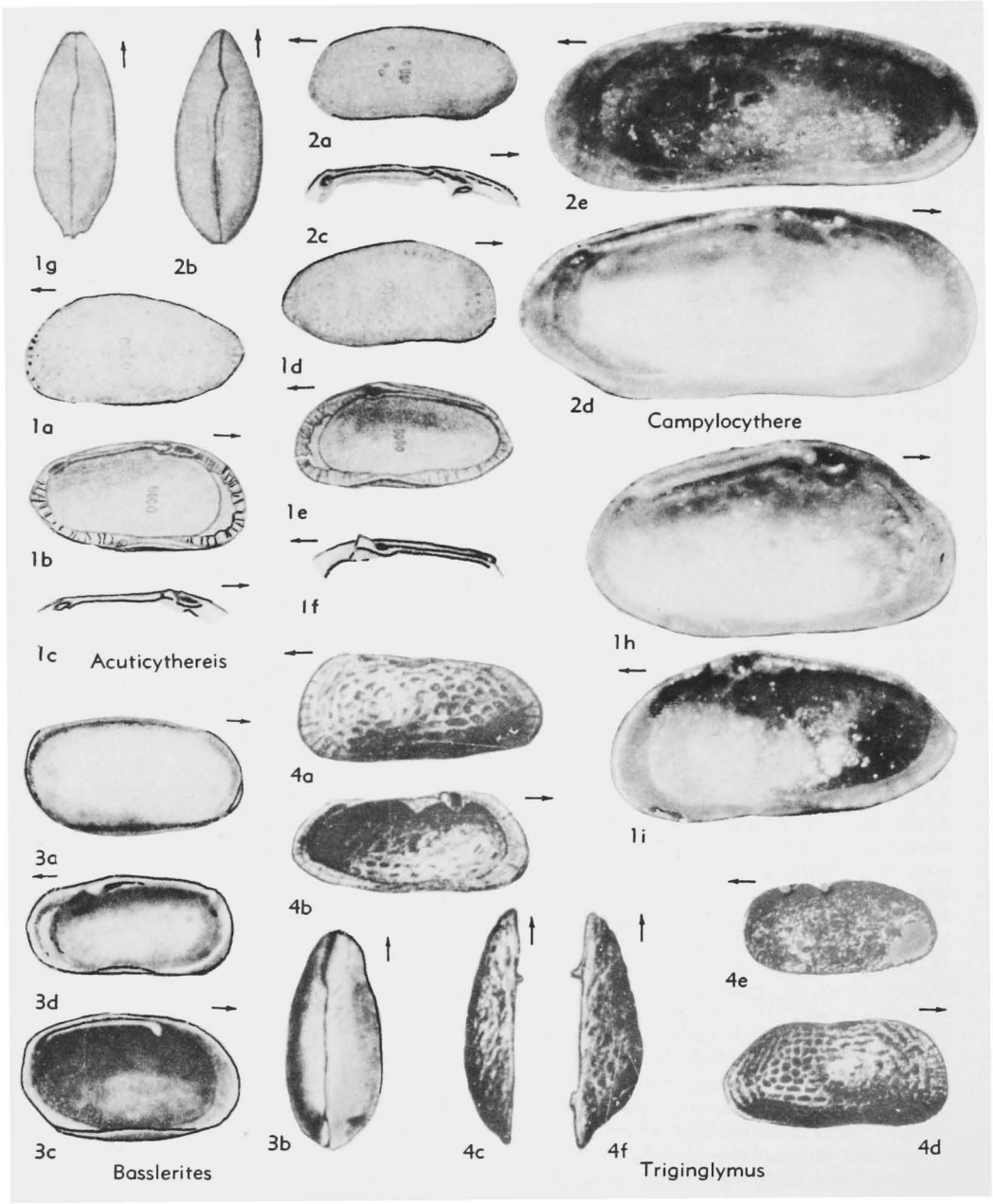


Fig. 233. Leguminocythereididae (p. Q307-Q308).

Carapace comparatively small, elongate to subquadrangular in lateral outline; with distinct posterior cardinal angle. Surface nearly smooth to deeply sculptured, some species with anterior and posteroventral marginal ridges. Marginal area broad with characteristic polyfurcated radial pore canals; hinge modified entomodont; groove below selvage and above median bar of LV receiving or accommodating median element of RV, opening into anterior and posterior sockets (anterior tooth-and-socket structure and two-fold median element varies in different genera); adductor muscle scars in vertical row of 4, with single heart-shaped scar in front. *?Jur., Tert.-Rec.*

Leptocythere SARS, 1925 [**Cythere pellucida* BAIRD, 1850] [=*Leptocythera* SARS, 1925 *(errore)*]. Elongate; surface nearly smooth to punctate. Vestibule moderate. Median hinge element of left valve has 1 tooth at anterior end; corresponding socket of right valve is obscure. *Rec.*, N.Atl.——FIG. 234,*1*. **L. pellucida; 1a-e*, ♀ carapace L, ♂ RV lat., ♀ carapace dors., LV int., RV int., all ×60 (*1a-c*, 314; *1d,e*, 25).

Callistocythere RUGGIERI, 1953 [**Cythere littoralis* MÜLLER, 1894] [=*Cryptocythere* MANDELSTAM, 1958 (obj.)]. Elongate to subquadrangular; surface sculptured by reticulation and undulating ridges. Vestibule poorly developed; more than 2 anterior terminal teeth of median hinge element of LV definitely enlarged, corresponding sockets of RV distinct. Color usually yellow. *?Jur., Tert.-Rec.*, cosmop.——FIG. 234,*2*. **C. littoralis; 2a,b*, LV lat., LV int., ×100 (*2a*, 53; *2b*,302).

Mesocythere HARTMANN, 1956 [**M. foveata*]. Carapace elongate, greatest height in median to postmedian position; surface pitted to reticulate; eye spots fused. Hinge ?without teeth, owing to decalcification. *Rec.*, S.Am.(Brazil).——FIG. 234,*3*. **M. foveata; 3a*, ♀ RV lat., ×93; *3b*, ♀ LV lat. outline (surface ornamentation not drawn), ×93; *3c,d*, LV and RV, dors. outline, ×60 (163).

Tanella KINGMA, 1948 [**T. gracilis*]. Elongate, tumid; surface sculptured by reticulations and ridges. Anterior tooth of RV replaced by elongate swelling of dorsal edge, in LV anterior socket lacking; anterior tooth of median bar represented by strong antislip tooth. *Plio.-Rec.*, SE.Asia.——FIG. 234,*4*. **T. gracilis; 4a-d*, LV int., LV lat., RV int. (hinge), carapace dors.; all ×100 (46).

Family LIMNOCYTHERIDAE Klie, 1938

[*nom. transl.* HOWE, herein (*ex* Limnocytherinae KLIE, 1938)] [=Limnicytherinae SARS, 1925] [Materials for this family prepared by H. V. HOWE, Louisiana State University]

Valves subequal, shell weakly to strongly calcified; surface smooth, reticulate, or noded. Normal pore canals in general not described; marginal area regular, fairly broad, with tendency to form vestibules at ends and with rather evenly spaced straight radial canals; adductor muscle scars in nearly vertical row of 4, divided in some, antennal scar somewhat crescent-shaped and mandibular scar oval where known (in most genera undescribed); hinge weak, usually adont, but some genera have terminal teeth in RV and sockets in LV. In genera with strong sexual dimorphism, selvage of valves tends to interlock along ventral margin. [Habitat fresh- to brackish-water.] *Jur.-Rec.*

Limnocythere BRADY, 1868 [**Cythere inopinata* BAIRD, 1843; SD BRADY & NORMAN, 1889] [=*Limnicythere* BRADY, 1868 (obj.); *Acanthopus* VERNET, 1878 (*non* KLUG, 1807; *nec* OKEN, 1816; *nec* DAHL, 1823; *nec* LATREILLE, 1829; *nec* DE HAAN, 1835; *nec* MÜNSTER, 1839; *nec* GIEBEL, 1872); *Limnocytheridea* FOREL, 1894 *(nom. nud.)*; *Acanthobus* MÜLLER, 1900; *Limnicytheridea* MÜLLER, 1912]. Carapace thin, horny, with reticulate, tuberculate, or spiny surface. Marginal areas broad, with numerous straight radial pore canals; adductor scars 4, with crescentic antennal and oval mandibular scars in front and additional scars above. *Jur.-Rec.*, cosmop.——FIG. 235,*2*. **L. inopinata* (BAIRD), Rec., NW.Eu.; *2a,b*, carapace L, dors., ×50 (54); *2c,d*, RV lat., LV lat., ×40; *2e*, LV int., ×135 (*2c-e*, 88, permission of Mouton & Co., The Hague).

Afrocythere KLIE, 1935 [**A. rostrata*]. Like *Limnocythere* except for different structure of mandibles and maxillae, surface of carapace smooth; only females known. *Rec.*, Afr.——FIG. 235,*4*. **A. rostrata; 4a-c*, ♀ carapace L, R, dors., ×60 (218).

Bisulcocypris PINTO & SANGUINETTI, 1958 [**B. pricei*]. Similar in shape to *Cytheridella*, females pyriform in dorsal view but having 2 sulci in anterior half of carapace instead of one; type species with valves reversed, RV larger than LV. Hinge with terminal sockets and projecting bar along median element; adductor scars in vertical row of 4 below middle, antennal and mandibular scars not described; marginal area and canals not described. *U.Jur.*, Brazil.——FIG. 236,*1a,b*. **B. ventrosa* (SWAIN); *1a,b*, carapace R, dors., ×45 (350).——FIG. 236,*1c-e*. **B. pricei; 1c,d*, ♀ RV lat., ♂ RV int.; *1e*, ♀ carapace dors.,×50 (274).——FIG. 237,*1*. **B. minnekahtensis* (ROTH), Morrison F., USA(S.Dak.); *1a-c*, ♀ carapace, L, dors., vent.; *1d-f*, ♂ carapace L, dors., vent.; all ×36 (200).

Cytheridella DADAY, 1905 [**C. ilosvayi*]. Sexual dimorphism strong, posterior 0.7 of female carapace much inflated. Hinge of RV formed of projecting selvage that fits in flange groove of LV; marginal areas broad, with small anterior vestibule and straight regularly spaced radial

canals; adductor scars in row of 4 set low on strong internal ridge. [Differs from *Bisulcocypris* in having only one strong external sulcus in muscle-scar region.] *Rec.*, S.Am.——Fig. 238,*1*. **C. ilosvayi*, Para.; *1a,b*, RV lat., LV lat.; *1c,d*, ♂ and ♀ carapace dors.; *1e*, RV int.; *1f*, muscle scars; *1a-e*, ×30; *1f*, ×100 (136).

Elpidium F. Müller, 1881 [**E. bromeliarum*]. Resembling *Metacypris* in shape but larger (to 1.3 mm. length) and with differences in appendages; ventral margin with strongly interlocking selvages; muscle scars in oblique row of 4 forward-downward from middle; hinge undescribed. [Freshwater.] *Rec.*, S.Am.——Fig. 238,*3*. **E. bromeliarum*, Brazil; *3a-c*, carapace R, dors., vent., ×40; *3d*, muscle scars, ×100 (*3a*, Howe, n; *3b,c*, 255).

Gomphocythere Sars, 1924 [**Limnicythere obtusata* Sars, 1910]. Sexually strongly dimorphous and from above looks like small *Cytheridella* but venter flattened and outlined by a distinct rim. *Rec.*, Afr.——Fig. 238,*2*. **G. obtusata* (Sars); *2a,b*, carapace R, dors., ×75 (311).——Fig. 236,*2*. *G. expansa* (Sars); *2a,b*, ♂ carapace R, vent.; *2c,d*, ♀ carapace dors., vent., ×50 (313).

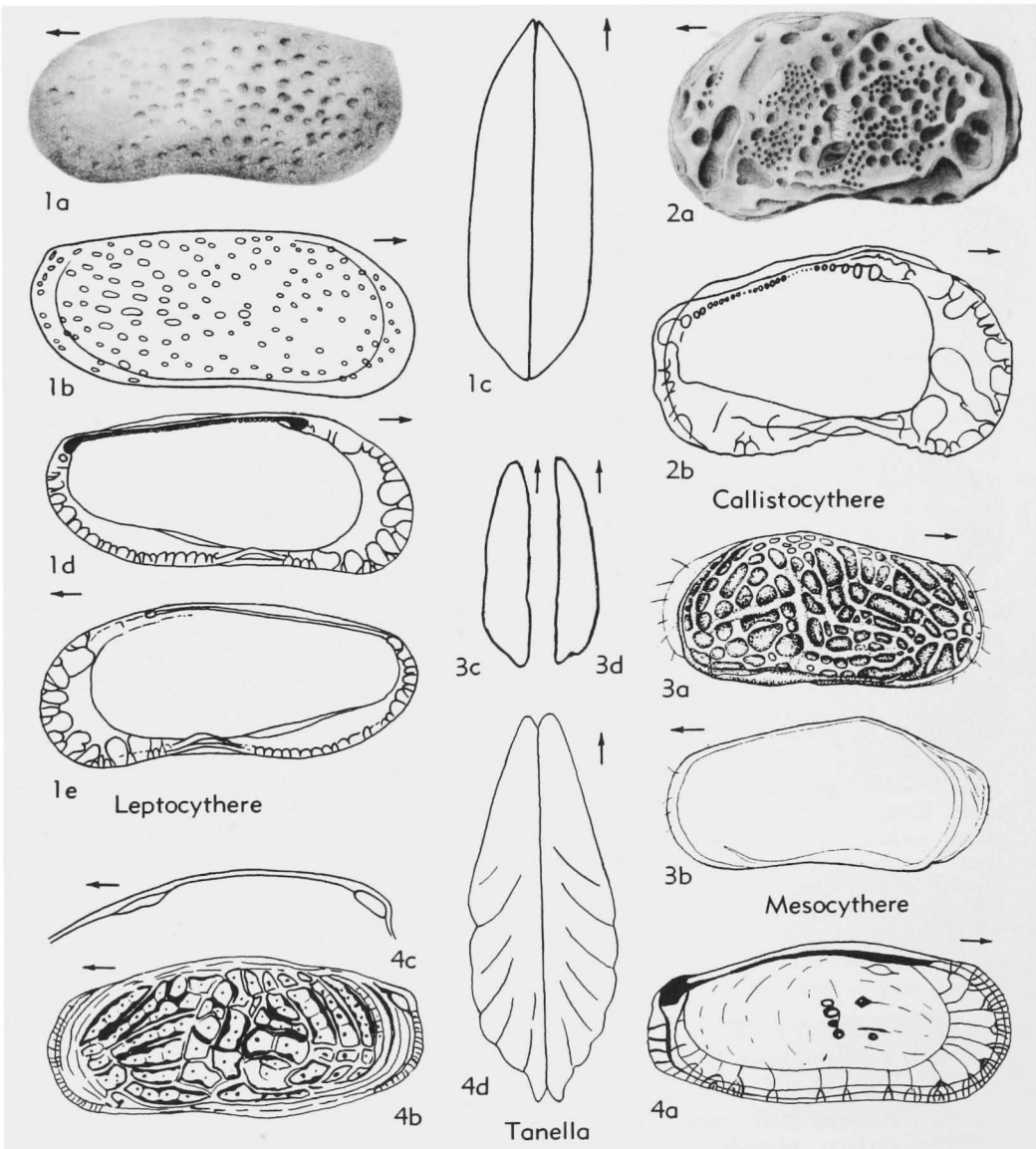


Fig. 234. Leptocytheridae (p. Q309).

Leucocythere KAUFMANN, 1892 [**L. mirabilis*]. Carapace like *Limnocythere* but soft parts of males distinct. *Rec.*, Eu.

Metacypris BRADY & ROBERTSON, 1870 [**M. cordata*]. Carapace subrhombic from side, female heart-shaped from above, with no sulcus, valve margins incurved except in front. Hinge of RV with laminated angular anterior projection and rectangular strongly produced posterior flange bearing a single sharply cut tooth. [Habitat freshwater.] *Rec.*, Eu.——FIGS. 237,*2*, 238,*4*. **M. cordata*, Rec., Eng.; 237,*2a-c*, carapace L, dors., post.; 238,*4*, carapace vent.; all ×100 (17).

Neolimnocythere DELACHAUX, 1928 [**N. hexaceros*]. Each valve bearing 3 backward-directed hornlike projections. [Genus defined mainly by nature of male copulatory appendage; only type species and one other (covered by short spines)

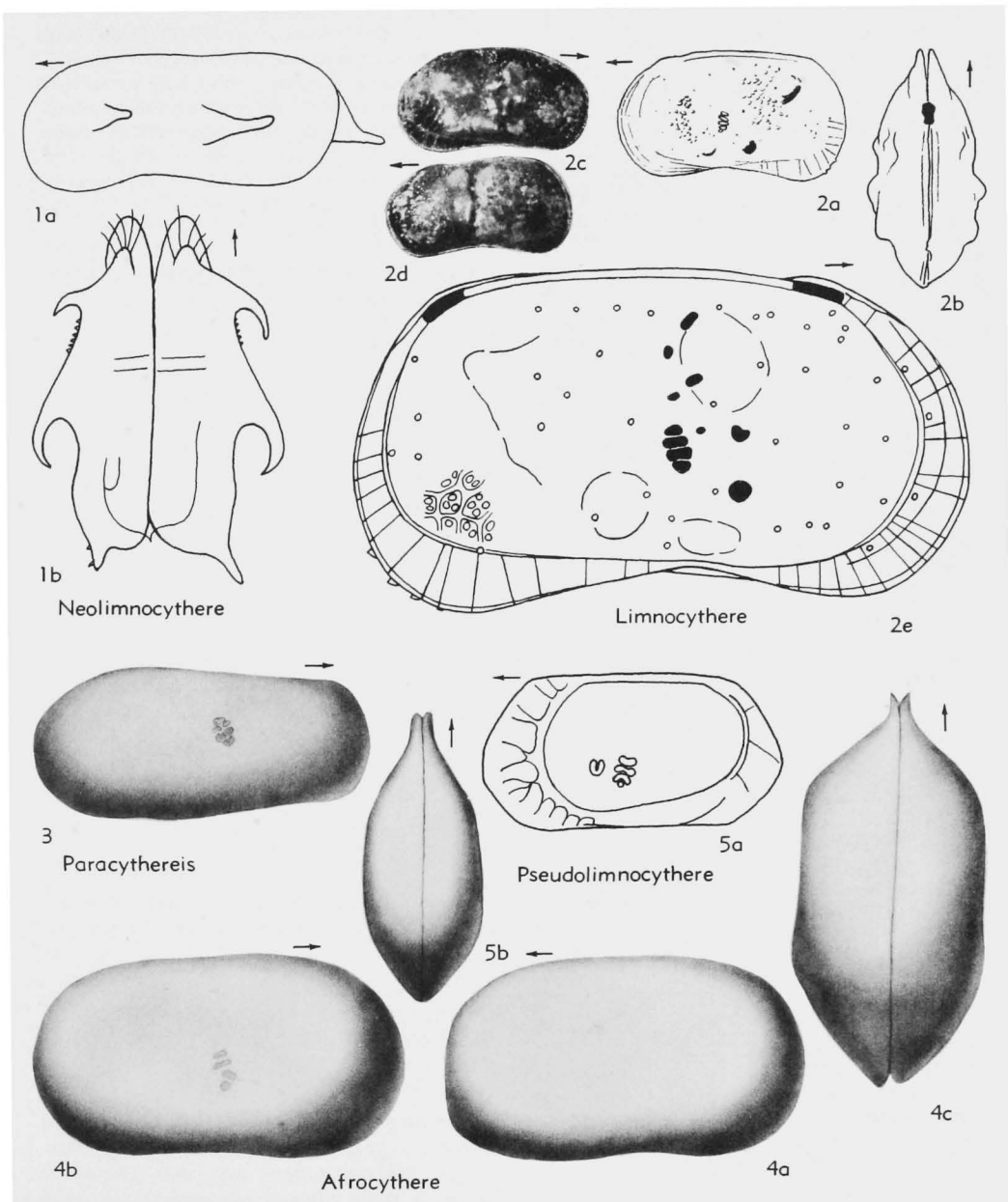


FIG. 235. Limnocytheridae (p. Q309-Q312).

described.] *Rec.*, S.Am.——FIG. 235,*1*. **N. hexaceros*, Peru; *1a,b*, ♂ carapace L, dors., ×45 (139).

Paracythereis DELACHAUX, 1928 [*non* JENNINGS, 1936; *nec* ELOFSON, 1941] [**P. impudica*]. Carapace shaped like *Limnocythere;* distinguished by male copulatory appendage and furca, which are chitinized, bearing median and terminal setae.

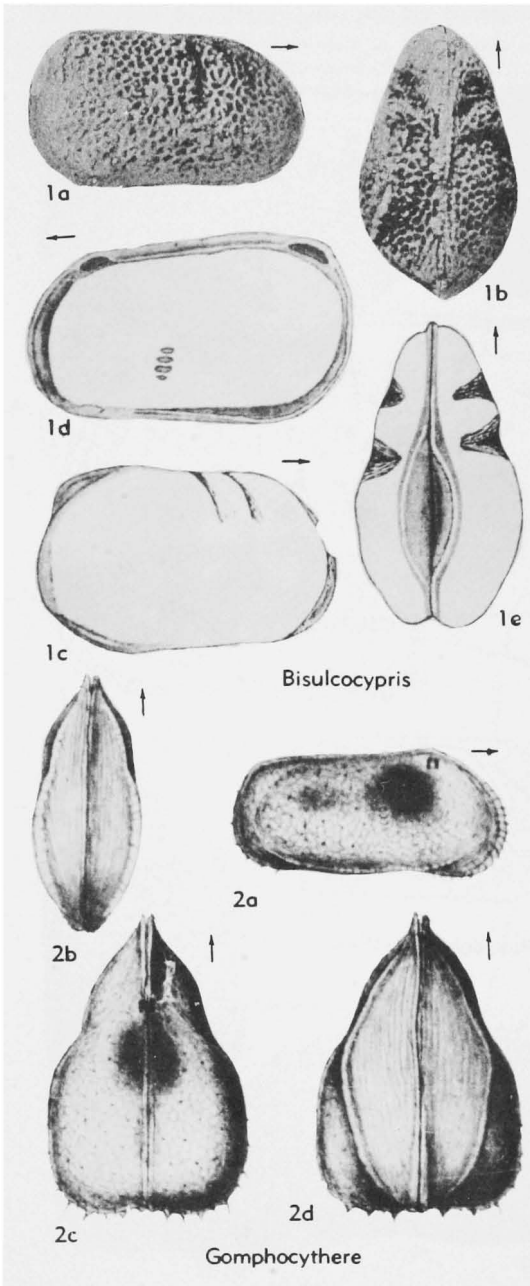


FIG. 236. Limnocytheridae (p. Q309-Q310).

Rec., S.Am.——FIG. 235,*3*. **P. impudica*, Peru; ♂ carapace R, ×60 (139).

?Pseudolimnocythere KLIE, 1938 [**P. hypogaea*]. Carapace elongate ovate, delicate. Marginal areas broad, with few branching radial pore canals; muscle scars in oblique row of 4 with heart-shaped scar in front. [Habitat subterranean.] *Rec.*, S.Eu.——FIG. 235,*5*. **P. hypogaea*, Italy, *5a,b*, ♀ carapace L, dors., ×120 (220).

Theriosynoecum BRANSON, 1936 [*pro Morrisonia* BRANSON, 1935 (*non* GROTE, 1874)] [**Morrisonia wyomingensis* BRANSON, 1935] [=*Theriosynecum* MANDELSTAM in GALEEVA, 1955]. Like *Cytheridella* but with strong nodes on swollen posterior region. Hinge straight and short, ridge of LV fitting groove in RV. [Habitat fresh-water.] *Jur.-Cret.*, N.Am.-Eu.-Asia.——FIG. 239,*1*. **T. wyomingense* (BRANSON), U.Jur. (Morrison F.), USA(Wyo.); *1a-c*, carapace R, dors., vent., ×25 (113).

Family LOXOCONCHIDAE Sars, 1925

[*nom. transl.* HOWE, herein (*ex* Loxoconchinae SARS, 1925)] [Materials for this family prepared by H. V. HOWE, Louisiana State University, with contributions on some genera by R. A. REYMENT, University of Stockholm] [Includes Cytheromorphinae MANDELSTAM, 1960]

Small, usually dimorphous carapaces, which may be nearly smooth but mostly are finely to coarsely pitted or reticulate; reniform to rectangularly ovate in lateral view with tendency to develop a posterior caudal process in some genera. Hinge typically gongylodont; in some species with anterior left and posterior right dentition appearing as 2 distinct teeth separated by deep pit but with these teeth normally united above by narrow crescentic ridge that makes horseshoe-shaped structure fitting over single tooth in opposite valve; marginal areas broad, tending to develop vestibules at ends; radial canals few, normal canals widely spaced, large, and in some genera sievelike; adductor scars in slightly oblique row of 4 elongate spots (divided in some), antennal scar U- or C-shaped, mandibular scars 2 oval spots obliquely below and forward. Habitat shallow marine or brackish-water. *Cret.-Rec.*

The genera *Loxoconchella, Phlyctocythere,* and *Elofsonia* resemble typical Loxoconchidae externally and in some of the internal characters but are placed in this family with much doubt. *Loxoconchella* differs from other forms assigned here in having an adont hinge and a lobate line of concrescence. *Phlyctocythere* also has an adont hinge, a high anterior vestibule, and small rounded antennal scar. *Elofsonia* has a hinge

that does not fit any described family, possessing in the LV a crenulate anterior ridge, a smooth median bar, and an elongate posterior crenulate socket, though its other characters fit with the loxoconchids very well.

Loxoconcha SARS, 1866 [**Cythere impressa* BAIRD, 1850 (*non* M'COY, 1844) (=*C. rhomboidea* FISCHER, 1855); SD BRADY & NORMAN, 1889 [=*Loxoleberis* SARS, 1866; *Normania* BRADY, 1866 (*non* BOWERBANK, 1869; *nec* BOECK, 1871)]. Carapace almond-shaped, with straight dorsal margin and sinuous venter; surface pitted or reticulate. Hinge gongylodont, middle element crenulate. Anterior and posterior vestibules with few straight canals; normal canals widely spaced; adductor scars 4, antennal scar crescent-shaped, mandibular scar oval. *Cret.-Rec.*, cosmop.——FIGS. 240,*1e-h*, 241,*3*. **L. rhomboidea* (FISCHER), Rec., NE.Atl.; 240,*1e,f*, ♀ carapace L, dors., ×45; 240,*1g*, ♂ RV lat., ×45; 240,*1h*, RV int. marginal area with radial canals, ×100; 241,*3a,b*, ♀ RV lat., LV lat., ×40; 241,*3c*, ♀ RV int., ×125 (240,*1e-g*, 220; 240,*1h*,379; 241,*3a-c*, 88, by permission of Mouton & Co., The Hague).——FIG. 241,*2*. *L. curryi* KEIJ, Eoc.(Led.), Eng.; *2a-c*, ♂ LV lat., int., dors., ×80 (42).——FIG. 240,*1a-d*. *L. gratelouprianа* (BOSQUET), Oligo.-Mio., Eu.; *1a-c*, ♀ LV lat., ♂ carapace R, dors., ×75 (Mio., Fr.); *1d*, ♂ RV int., ×75 (Oligo., Belg.) (all 42).——FIG. 241, *4*. *L. matagordensis* SWAIN, Rec., Gulf of Mexico (off Tex.); *4a,b*, ?♂ LV lat., RV int., ×50 (355).

Cytheromorpha HIRSCHMANN, 1909 [**C. albula* (=**Cythere fuscata* BRADY, 1869); SD SARS, 1925]. Carapace compressed elongate ovate, anterior slightly more broadly rounded than posterior, long margins nearly straight but ventral margin inturned in front of middle; surface smooth, pitted, or faintly reticulate. Hinge gongylodont; adductor scars 4, antennal scar crescent-shaped, mandibular scars oval, oblique; marginal areas wide with anterior and posterior vestibules and few straight radial canals; normal canals widely spaced, irregular (68). *Paleoc., Rec.*, Eu.-N.Am.——FIGS. 240,*3*, 241,*5*. **C. fuscata* (BRADY), Rec., NE.Atl.; 240,*3a*, ♂ RV lat., ×45; 240,*3b,c*, ♀ carapace L, dors., ×45; 241,*5*, ♂ RV int., ×125 (240,*3a-c*, 314; 241,*5*, 88, by permission Mouton & Co., The Hague).

?Elofsonia WAGNER, 1957 [**Loxoconcha baltica* HIRSCHMANN, 1909]. Carapace externally like *Loxoconcha*, subequivalved, smooth in type species. Hinge of LV with elongate crenulate anterior tooth, smooth median bar, and elongate crenulate posterior socket; adductor scars in oblique row of 4, antennal scar crescentic, mandibular scars 2, oval, oblique; marginal area broad, with vestibules at ends and few straight radial canals; normal canals large, widely spaced, sievelike. Sexual dimorphism weakly defined in shell features. *Rec.*, NW.Eu.——FIG. 242,*1*. **E. baltica* (HIRSCHMANN), Rec., Holl.; *1a,b*, LV lat., RV lat., ×60; *1c*, LV int.,×133; *1d*, carapace long. sec., ×80 (88, by permission Mouton & Co., The Hague). [HOWE-REYMENT.]

Hirschmannia ELOFSON, 1941 [*Cythere viridis* O.F. MÜLLER, 1785]. Carapace subreniform; surface smooth except for large normal pore canals. Hinge gongylodont, middle element smooth. Terminal part of antennule 3-jointed. *Rec.*, Eu.——FIG. 241, *1*. **H. viridis* (MÜLLER), NE.Atl.; *1a,b*, ♀ carapace L, dors., ×50 (315); *1c,d*, RV lat., LV lat., ×40; *1e*, RV int., ×115 (*1c-e*, 88, by permission of Mouton & Co., The Hague).

?Loxoconchella TRIEBEL, 1954 [**Loxoconcha honoluliensis* BRADY, 1880]. Carapace externally like

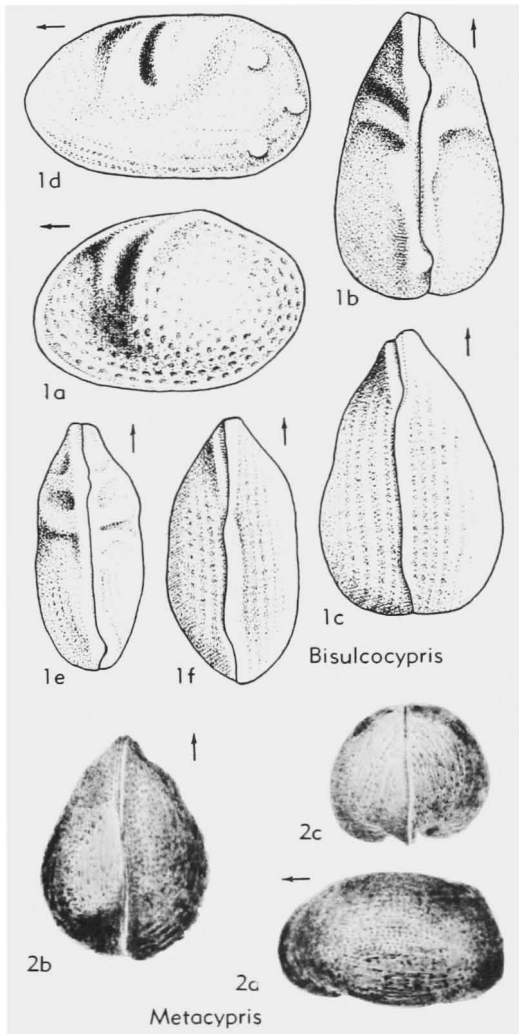


FIG. 237. Limnocytheridae (p. Q309-Q311).

Loxoconcha but with distinct caudal process above middle, valves subequal, surface smooth but with deep pits of normal canals. Hinge adont, furrow in RV and ridge in LV; adductor scars in oblique row of 4, antennal scars of different size, mandibular scars subequal, rounded, oblique; normal canals large, widely spaced. Vestibule extending from anterior to posterior and very lobate with 2 or 3 short straight radial canals extending from each indentation. *Rec.*, Pacific.——Fig. 240, *2. *L. honoluliensis; 2a,b,* LV lat., RV lat., ×60; *2c,* LV int., ×60; *2d,e,* RV int. with pore canals, ×300, ×60 (all 379).

?**Phlyctocythere** Keij, 1958 [**P. eocaenica*]. Smooth,

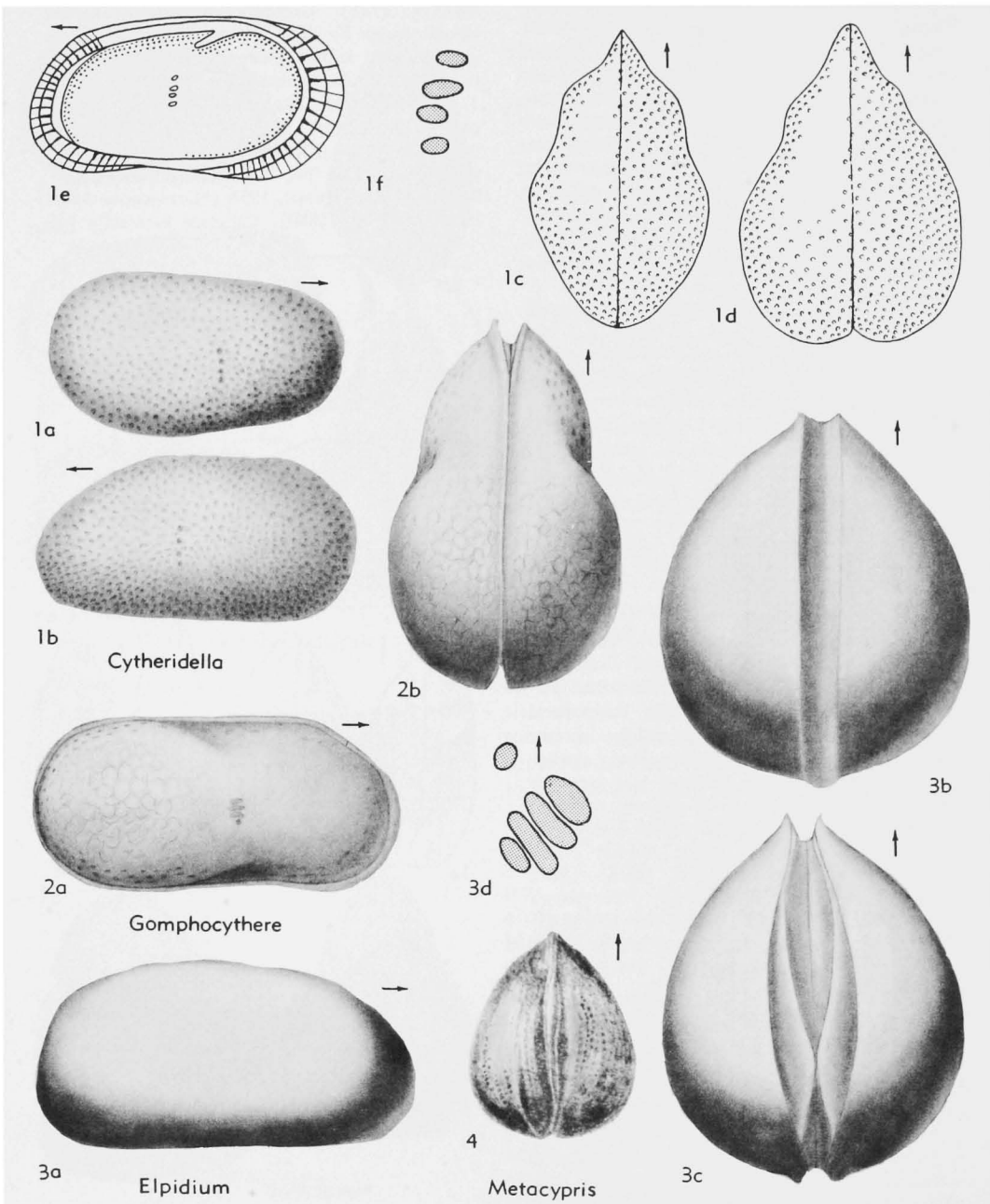


Fig. 238. Limnocytheridae (p. Q310-Q311).

externally much like *Loxoconchella;* internally adont, ridge in RV and furrow in LV; adductor scars in row of 4, antennal scar an oval spot, mandibular scars oval; marginal areas broad, with narrow, high anterior vestibule and shallow posterior vestibule; radial canals straight, numerous, unbranched; normal canals widely spaced. Sexual dimorphism pronounced; ?females shorter and more thick-set than ?males. *Eoc.,* Eu.(Fr.).——Fig. 243,*1*. **P. eocaenica; 1a-c,* LV lat., int., dors., ×80 (197).

Family PARADOXOSTOMATIDAE Brady & Norman, 1889

[Materials for this family prepared by P. C. Sylvester-Bradley, University of Leicester, and H. V. Howe, Louisiana State University]

Carapace elongate, thin-shelled, smooth, more or less compressed. Hinge lophodont (denticulate in some species of *Microcythere,* and in *Pellucistoma*). Adductor muscle leaving 3 to 6 elongate scars that form oblique linear pattern, sloping toward anteroventral margin; duplicature wide; vestibules wide or narrow. [This family includes some of the most abundant present-day ostracodes of the intertidal zone, being particularly common in rock pools, and amongst seaweed, but also abundant in deeper water. Fossils referable to the family seem to be rare, however.] *?Cret., Eoc.-Rec.*

The family can be divided into three subfamilies (Paradoxostomatinae, Microcytherinae, and Cytheromatinae) on the basis of appendages, but no carapace characters have yet been discovered which are diagnostic of them. Even some of the genera are difficult to distinguish on carapace characters alone.

Subfamily PARADOXOSTOMATINAE Brady & Norman, 1889

[*nom. transl.* G.W.Müller, 1894 (as Paradoxostominae); *nom. correct.* Sylvester-Bradley & Howe, herein (*pro* Paradoxostominae G.W.Müller, 1894)]

Distinguished mainly by features of appendages. *?Cret., Eoc.-Rec.*

Paradoxostoma Fischer, 1855 [**P. dispar*]. Ventral margin sinuous, concave in anterior third, highest point of carapace in posterior third; caudal process absent, or very blunt, though a slight posterodorsal sinuosity is common. Hinge lophodont; vestibule wide, continuous from anterior through venter to posterior end; radial pore canals sparse; muscle-scar pattern with 3 or 4 adductor scars. [Type-species imperfectly known.] *?Cret., Eoc.-Rec.,* cosmop.——Fig. 244,*2*. *P. variabile* (Baird), Rec., Neth.; *2a,b,* RV lat., int., ×60; *2c,* LV lat., ×60 (88).

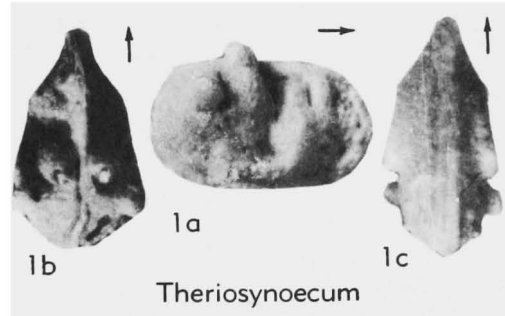


Fig. 239. Limnocytheridae (p. Q312).

?Boldella Keij, 1957 [**B. deldenensis*]. Carapace elongate, with obliquely rounded anterior end and upturned posterior extremity making posterodorsal obtuse angle in outline, posteroventral margin convex; LV slightly overlapping RV ventrally; surface smooth, striate, or faintly reticulate. Marginal areas broad except in front where deep vestibule occurs; radial pore canals numerous, generally bifurcating; adductor muscle scars in oblique row of 4, with scar in front and another anteroventrally. *U.Eoc., ?Mio.,* NW.Eu.——Fig. 244,*1*. **B. deldenensis,* U.Eoc., Belg.; *1a-c,* RV lat., int., dors.; *1d-e,* LV lat., int.; all ×90 (42).

Cytherois Müller, 1884 [**C. virens* (=**Paradoxostoma fischeri* Sars, 1866)]. Like *Paradoxostoma* but ventral margin less sinuous and with no trace of caudal process or posterodorsal sinuosity. *Pleist.-Rec.,* cosmop.——Fig. 244,*3a-c*. **C. fischeri* (Sars), Rec., Neth.; *3a,* LV lat., ×60; *3b,* RV lat., ×60; *3c,* LV int., ×50 (88).

Paracythere G. W. Müller, 1894 [**P. minima*]. Shell thin, fragile, smooth; closure without teeth, some with complete margin. Only females known. [Distinguished largely on nature of appendages.] *Rec.,* Medit. (Gulf of Naples).

Paracytherois Müller, 1894 [**P. striata* (=**Paradoxostoma flexuosum* Brady, 1868); SD Howe, 1955]. Carapace like that of *Paradoxostoma* but anterior vestibule more constricted. *Rec.,* cosmop. ——Fig. 244,*7*. **P. flexuosa* (Brady), Rec., Medit.; RV int., ×100 (53).

Sclerochilus Sars, 1866 [**Cythere contorta* Norman, 1862] [=*Sclerochylus* Sohn, 1951 *(errore)*]. Like *Paradoxostoma* but muscle-scar pattern with 5 adductor scars. *?Eoc., Rec.,* cosmop.——Fig. 244,*4*. **S. contortum* (Norman), Rec., Neth.; *4a,* LV lat.; *4b,c,* RV lat., LV int.; all ×60 (88).

Xiphichilus Brady, 1870 [**Bythocythere tenuissima* Norman, 1869; SD Brady & Norman, 1889] [=*Machaerina* Brady & Norman, 1889 (obj.)]. Like *Paradoxostoma* but acuminate or produced at both ends. *Rec.,* Eu.——Fig. 244,*6*. **X. tenuissimum* (Norman), Rec., Scot.; *6a,b,* carapace L, dors., ×40 (15).

Subfamily MICROCYTHERINAE Klie, 1938

Distinguished mainly by features of appendages. *Mio.-Rec.*

Microcythere MÜLLER, 1894 [**M. inflexa;* SD VAN DEN BOLD, 1946]. Carapace small, thin, fragile, flattened ventrally. Hinge seemingly lophodont in type species but denticulate and anomalous in other species hitherto assigned to genus; marginal areas wide at both ends, forming large vestibules; radial pore canals few, distinct; 4 adductor muscle scars, with a single large antennal scar in front. *Mio.-Rec.*, cosmop.——FIG. 245,*1*. **M. inflexa*, Rec., Medit.; *1a,b*, ♂ RV int., ♂ LV int.; *1c*, ♀ LV int.; *1d*, ♀ carapace dors.; all ×180 (53).

Subfamily CYTHEROMATINAE Elofson, 1939

[*nom. correct.* HOWE, herein (*pro* Cytherominae ELOFSON, 1939)]

Distinguished mainly by features of appendages. *Oligo.-Rec.*

Cytheroma G. W. MÜLLER, 1894 [**C. variabilis*].

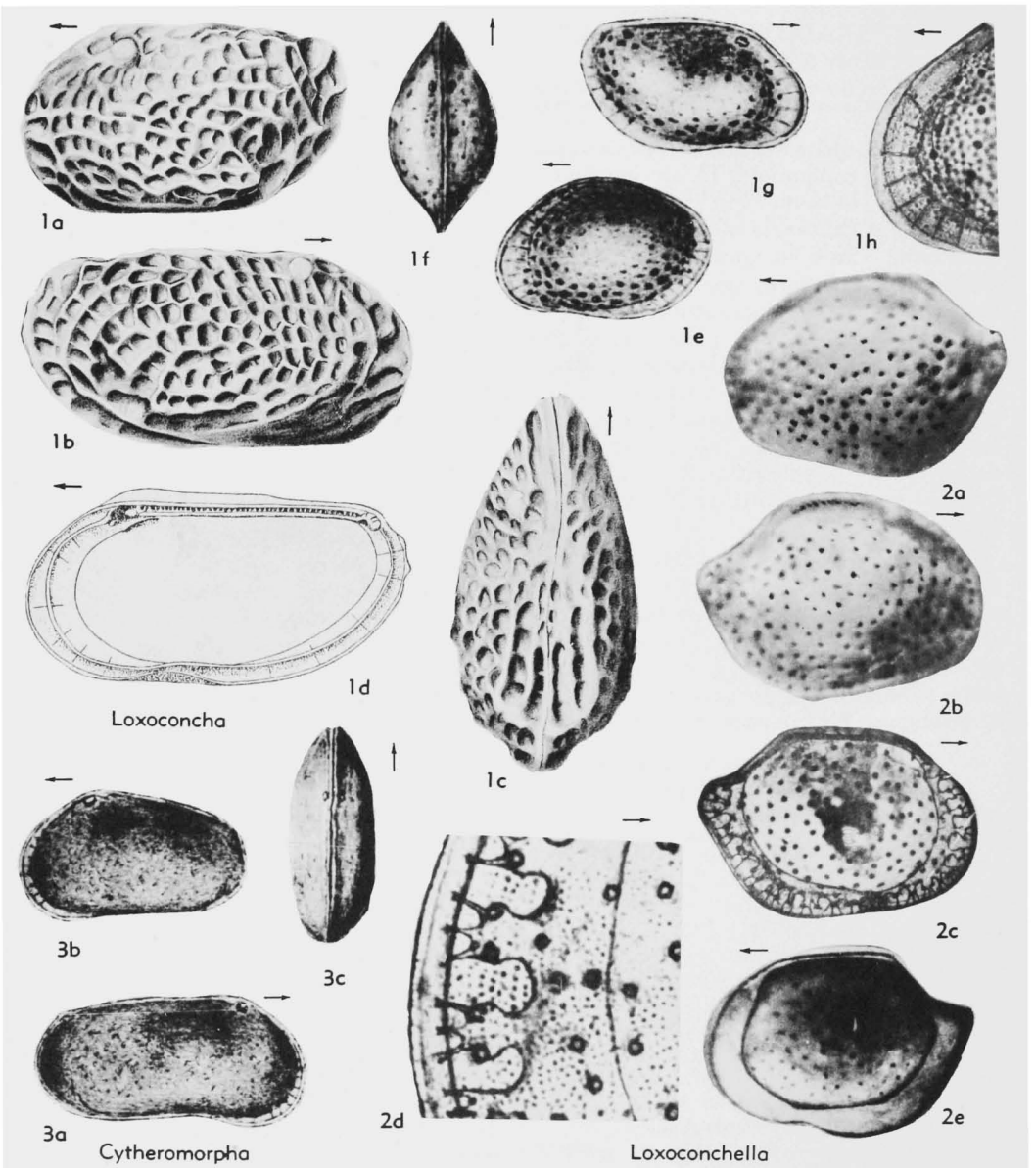


FIG. 240. Loxoxonchidae (p. Q313-Q314).

Carapace elongate, with rounded ends, anterior wider than posterior, lateral outline with venter less sinuous than in *Paradoxostoma*. Hinge lophodont; marginal areas broad except near midventral margin, with large, variably shaped vestibules at each end; radial pore canals (some of which may branch) causing line of concrescence to have lacy pattern. *Oligo.-Rec.*, cosmop.——Fig. 245,2. **C. variabilis*, Rec., Medit.; *2a,b*, RV lat., 2 specimens showing variation; *2c*, carapace dors.; all ×130 (53).

Paracytheroma Juday, 1907 [**P. pedrensis*]. Carapace like that of *Cytheroma*. *Rec.*, N.Am.

Pellucistoma Coryell & Fields, 1937 [**P. howei*]

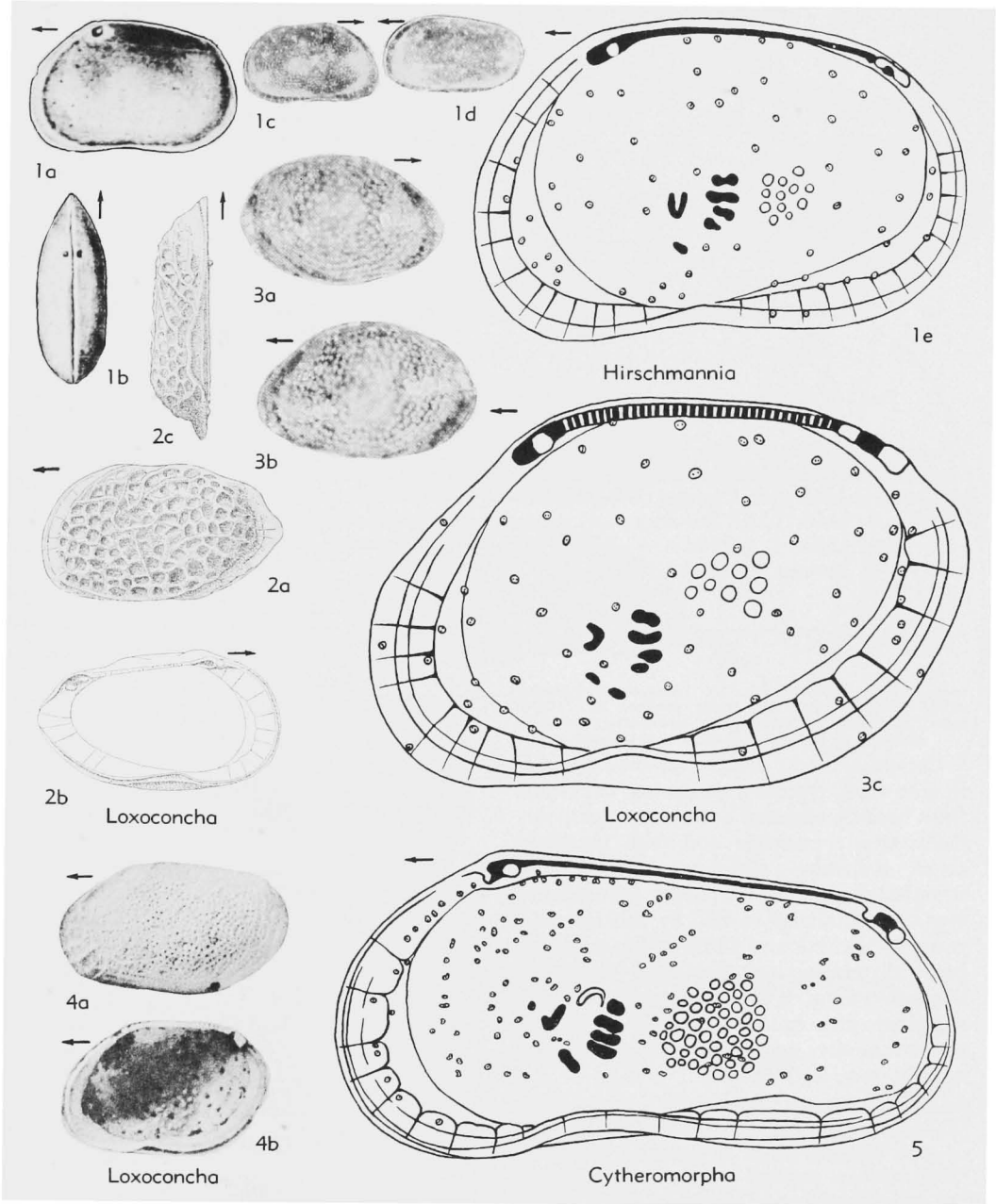


Fig. 241. Loxoconchidae (p. Q313).

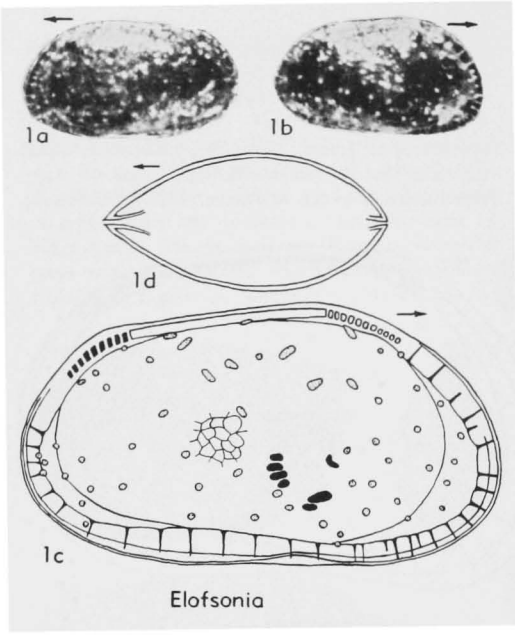


FIG. 242. Loxoconchidae (p. Q313).

[=*Javanella* KINGMA, 1948]. Less elongate and more inflated than other genera assigned to family, with marked caudal process, widely spaced radial pore canals (some branching) and merodont hinge. *Mio.,* C.Am.-N.Am.——FIG. 244,*5*. **P. howei,* Panama; *5a,* RV lat.; *5b,* LV dors.; ×75 (126).

Family PECTOCYTHERIDAE Hanai, 1957

[*nom. transl.* HANAI, herein (*ex* Pectocytherinae HANAI, 1957)] [Materials for this family prepared by TETSURO HANAI, University of Tokyo, with contributions on some genera by H. V. HOWE, Louisiana State University]

Carapace thick, small, subquadrangular in side view, typically narrowing backward from broadly rounded anterior margin; surface coarsely punctate and with marginal ridge accenting periphery. Hinge line straight, of modified merodont (pentodont) type, characterized in LV by anterior and posterior sockets and intervening crenulate bar with terminations that swell into knoblike projections, RV hinge complementary; marginal area broad, vestibule developed anteroventrally; radial pore canals simple, straight, few. *L.Cret.-Rec.*

Pectocythere HANAI, 1957 [**P. quadrangulata*]. Close to *Munseyella,* but very thick, oblong box-shaped; marginal ridge is extremely blunt and bold, having a tendency to circumscribe periphery of shell. Posterior end lacks spines. In LV, lower non-crenulate elements of terminal teeth at each end of median element are larger than upper. Anterior vestibule mostly crescent-shaped. Male slightly elongate. *Plio.-Pleist.,* E.Asia(Japan), N. Am.(Calif.).——FIG. 246,*1*. **P. quadrangulata,* Plio., Japan; *1a,* RV lat., ×105 (Hanai, n); *1b,c,* RV int., LV int., ×105 (26).

Arcacythere HORNIBROOK, 1952 [**A. chapmani*]. Carapace small, oblong, narrow, widest posteriorly, dorsal and ventral margins parallel, ends squarely truncate with heavy rims; LV overlapping RV conspicuously at anterodorsal angle; surface reticulate. Four posterior muscle scars and one anterior scar; normal canals not numerous; radial canals few, simple, wide at the bases; line of concrescence deviating slightly from inner margin; RV hinge with 2 terminal simple or crenulate teeth and straight, faintly crenulate, median groove; LV hinge complementary. [Differs from *Leptocythere* in its oblong boxlike form with RV conspicuously overlapping LV at anterodorsal angle.] *U.Cret.-M.Mio.,* N.Z.——FIG. 246,*2*. **A. chapmani; 2a-c,* LV (holotype) lat., RV int., carapace dors., ×100 (32).

Dolocythere MERTENS, 1956 [**D. rara*]. Carapace with rounded quadrangular outline, long margins converging slightly backwards; surface reticulate. LV hinge with terminal smooth sockets open to interior, between them a smooth bar, RV with smooth hinge furrow, upper portion of anterior and posterior margins thickening into false teeth which fit smooth sockets of LV, no accommodation groove; inner margin and line of concrescence coincident; radial canals 8 to 12 in front, about 6 behind, with some pseudoradial canals which reach outer surface; muscle scars in

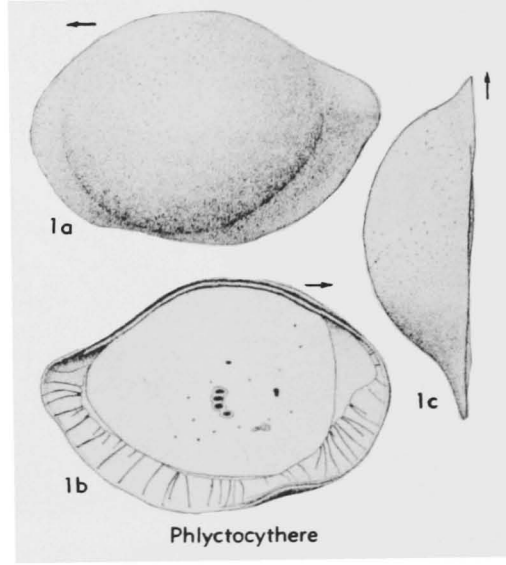


FIG. 243. Loxoconchidae (p. Q315).

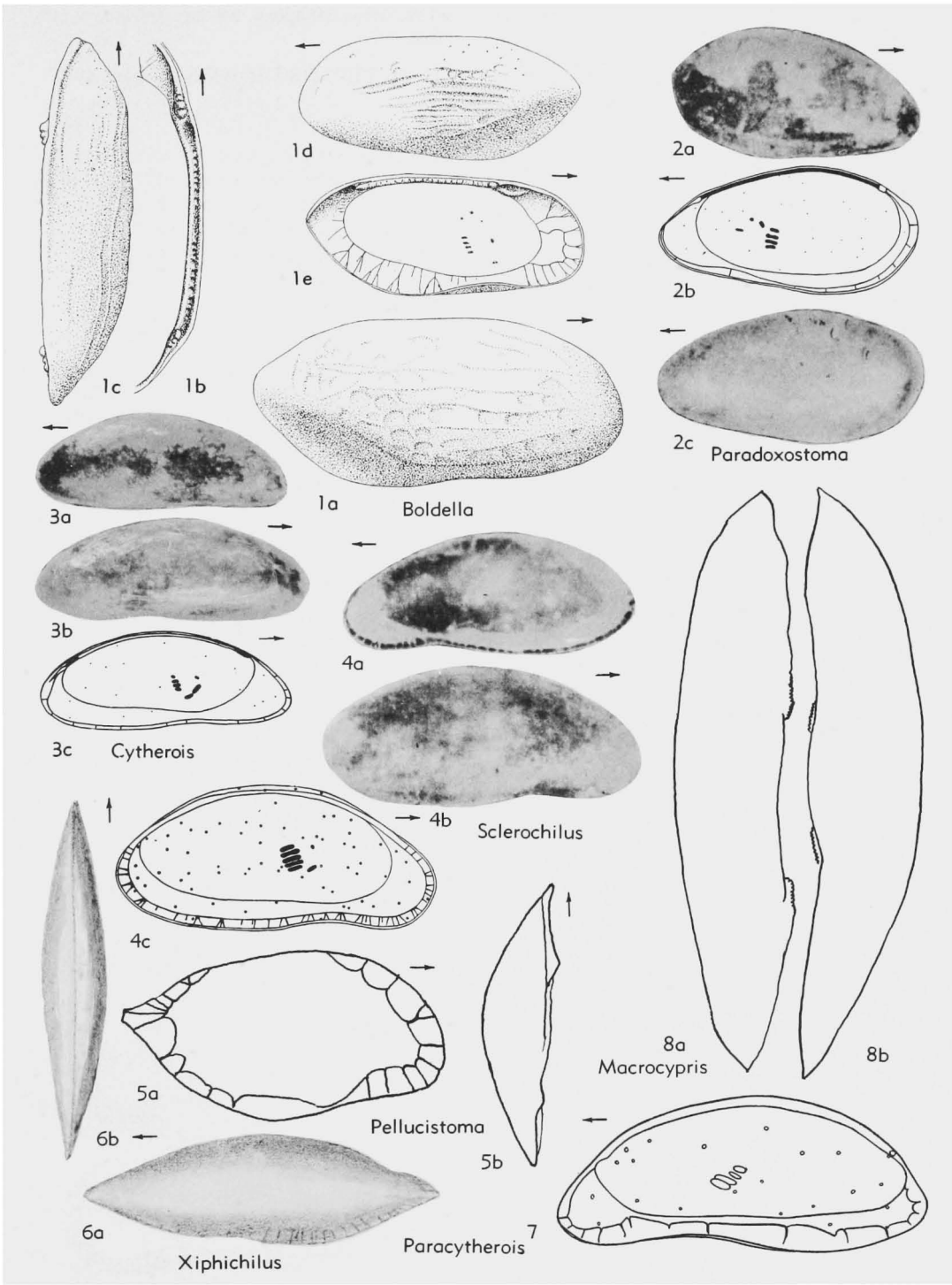


FIG. 244. Macrocyprididae, Paradoxostomatidae (p. Q207, Q315-Q318).

vertical row of 4, V-shaped scar in front opening forward. *L.Cret.(Apt.-Alb.)*, Eu.(Ger.).——FIG. 246,*4*. **D. rara*, L.Alb., NW.Ger.; *4a-d*, ♀ carapace (holotype) R, L, dors., vent., ×75; *4e*, RV lat., ×75; *4f,g*, LV int., RV int., ×100; *4h*, LV and RV from dorsal side, ×100 (250).

Munseyella VAN DEN BOLD, 1957 [*pro Toulminia* MUNSEY, 1953 (*non* ZITTEL, 1878)] [**Toulminia hyalokystis* MUNSEY, 1953]. Small, compressed, subquadrangular, with nearly straight posterior outline. Surface heavily ornamented; a marginal ridge nearly circumscribes the carapace. In hingement of LV, lower non-crenulate elements of anteromedian and posteromedian teeth are smaller than upper elements. Both upper and lower elements are usually fused together so as to make one knob-like projection. Radial canals straight and few, extending from vestibule. Adductor scars a row of 4 with at least one scar in front. *Paleoc.-Rec.*, N.Am., Japan.——FIG. 246, *3*, 246A,*1*. **M. hyalokystis* (MUNSEY), Paleoc. (U. Midway), USA(Ala.); 246,*3a,b*, RV ext., RV int., ×140 (259); 246A,*1a,b*, RV int., LV int., ×145 (Bold, n).

Family PERMIANIDAE Schneider, 1947

[Materials for this family prepared by W. A. VAN DEN BOLD, Louisiana State University, and R. A. REYMENT, University of Stockholm]

Large, subrectangular, distinct dorsal angles, rounded anteroventrally and posteroventrally, transverse groove extending downward from middle of dorsal margin. Muscle scars in vertical row of 3 with 2 scars in front. *U.Perm.*

Permiana SCHNEIDER, 1947 [**P. oblonga* SCHNEIDER, 1947]. Carapace elongate rectangular, with almost parallel, slightly concave ventral and dorsal margins and broadly, slightly uneven rounded anterior and posterior margins; RV overlapping LV weakly along dorsal margin; valves swollen ventrally with posteroventral winglike process; surface smooth, pitted or bearing small spines. Hinge simple, LV hinge with median furrow hav-

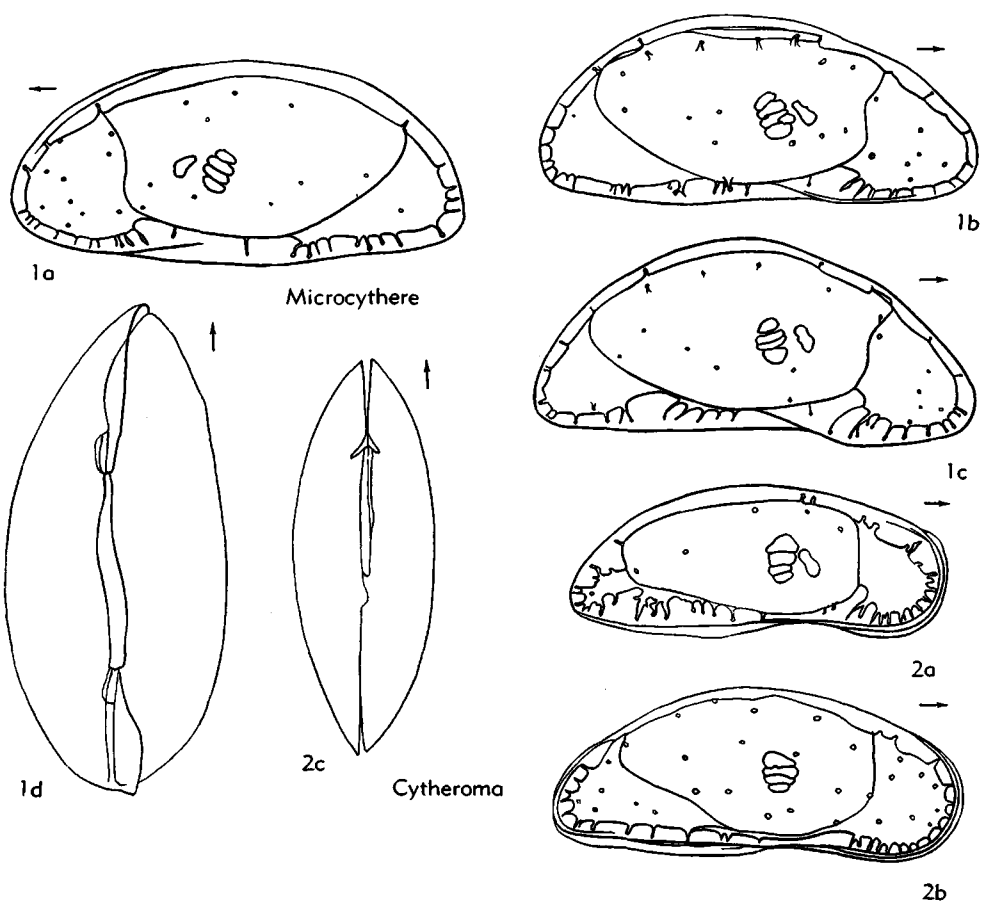


FIG. 245. Paradoxostomatidae (Microcytherinae, Cytheromatinae) (p. Q316-Q317).

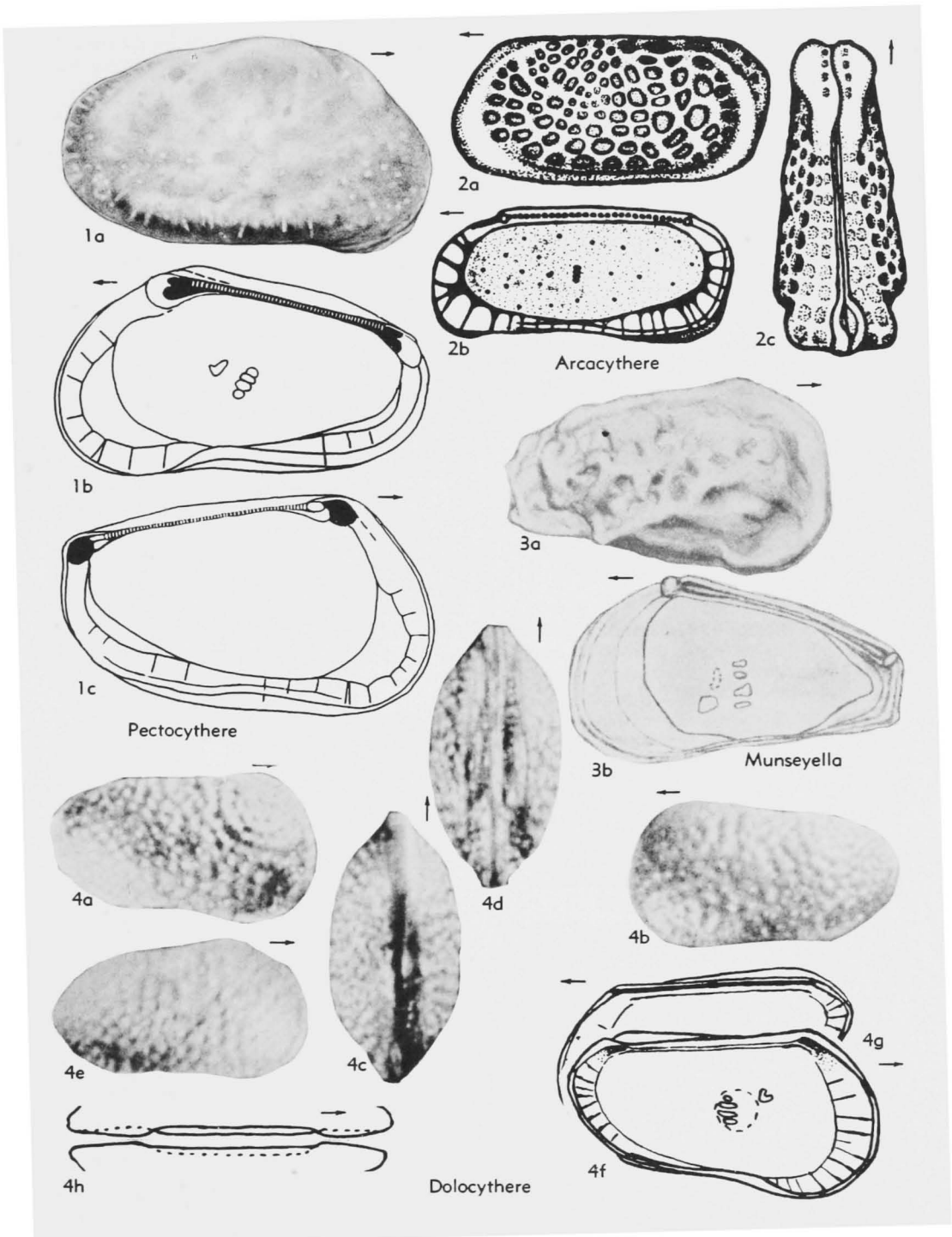


FIG. 246. Pectocytheridae (p. Q318-Q320).

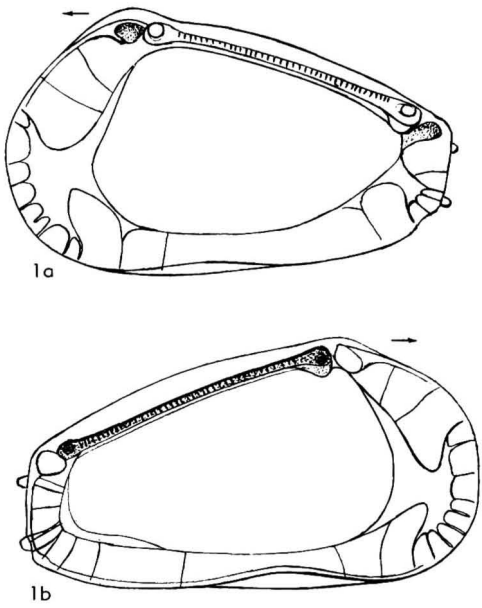


FIG. 246A. Pectocytheridae (p. Q320).

ing steplike sides and weak terminal thickenings corresponding to teeth, RV with shallow terminal impressions. *U.Perm.*, Eu.(USSR).——FIG. 247, *1a-d*. **P. oblonga* SCHNEIDER, Volga region; *1a,b*, LV lat., vent., ×45; *1c,d*, LV and RV hinge, ×53 (Schneider, 1947).——FIG. 247,*1e*. *P. tuberculata* KASHEVAROVA, N.Dvina Basin; LV lat., ×43 (192).——FIG. 247,*1f,g*. *P. cornuta* KASHEVAROVA, Troitsk-Petchora; *1f,g*, RV lat., vent., ×43 (192).

Family PROGONOCYTHERIDAE Sylvester-Bradley, 1948

[*nom. transl.* HOWE, herein (*ex* Progonocytherinae SYLVESTER-BRADLEY, 1948] [Materials for this family prepared by H. V. HOWE, Louisiana State University, with contributions from W. A. VAN DEN BOLD, Louisiana State University, and R. A. REYMENT, University of Stockholm]

Ovate to subtriangular in lateral view, rather plump in dorsal view; surface usually pitted or reticulate but may be nearly smooth, some species with nodes or more commonly with longitudinal folds or ribs; eye tubercles prominent in only a few genera. Hingement entomodont or merodont; marginal areas rather wide, radial canals not abundant, tending to be straight, 2 to 20 at anterior end; muscle scars (where described) in nearly vertical row of 4 oval spots for adductors, an oval or crescent-shaped antennal scar in front, and more rarely an oval mandibular scar. [A strictly synthetic family based largely on hingement and external form, since finer details of the carapace belonging to many Jurassic and Lower Cretaceous genera assigned here have not been described.] *?Penn., Jur.-Rec.*

On the basis of hingement the family may be divided into the subfamilies Progonocytherinae with strictly entomodont hingement, in which the median element is divided into two portions, the anterior one being crenulate; and the Protocytherinae, in which the hingement is merodont, either antimerodont or hemimerodont. In surveying genera assigned to the Progonocytheridae it is appropriate to mention a few forms which are excluded from the family. These are *Cyprideis,* which has entomodont hingement, *Perissocytheridea,* and some species of *Clithrocytheridea,* which may be difficult to distinguish from the Protocytherinae. Following custom these genera are included in the Cytherideidae, a procedure that appears justified, as for nearly a hundred years *Cyprideis* was confused with *Cytheridea,* the type genus of Cytherideidae. The case for *Perissocytheridea,* however, is not so clear, for its hinge is strongly anti-

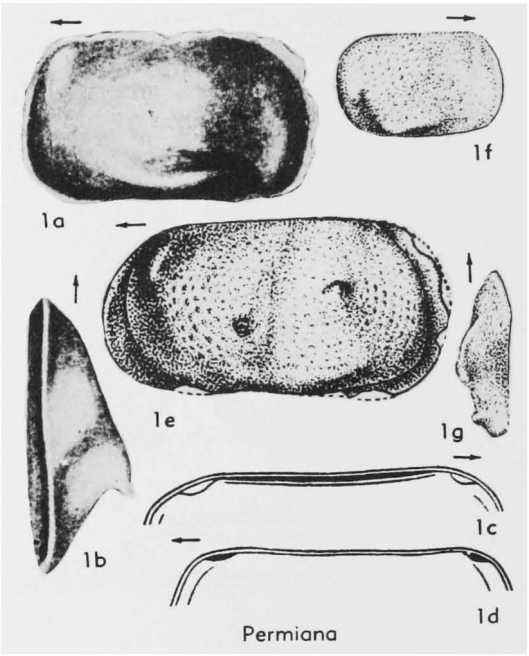


FIG. 247. Permianidae (p. Q320-Q322).

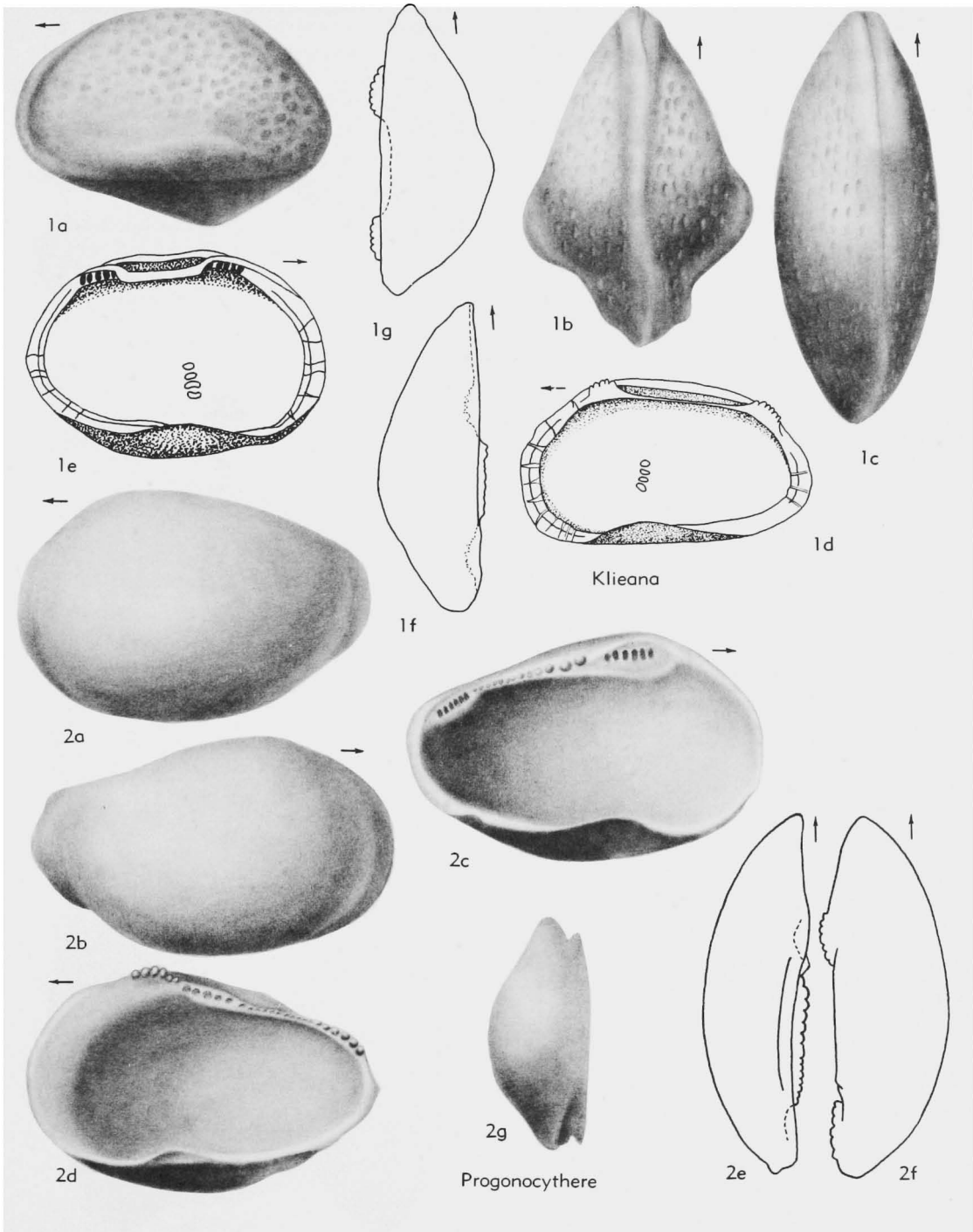


FIG. 248. Progonocytheridae (Progonocytherinae) (p. Q326-Q329).

merodont, its shape is unlike that of *Cytheridea* and close allies, and its ornamentation is much like that of protocytherine genera. The same is true of reticulate species of *Clithrocytheridea* having longitudinal ridges on their surface; these may well belong to a different genus classified as a Tertiary representative of the Progonocytheridae.

The Progonocytherinae appear to have

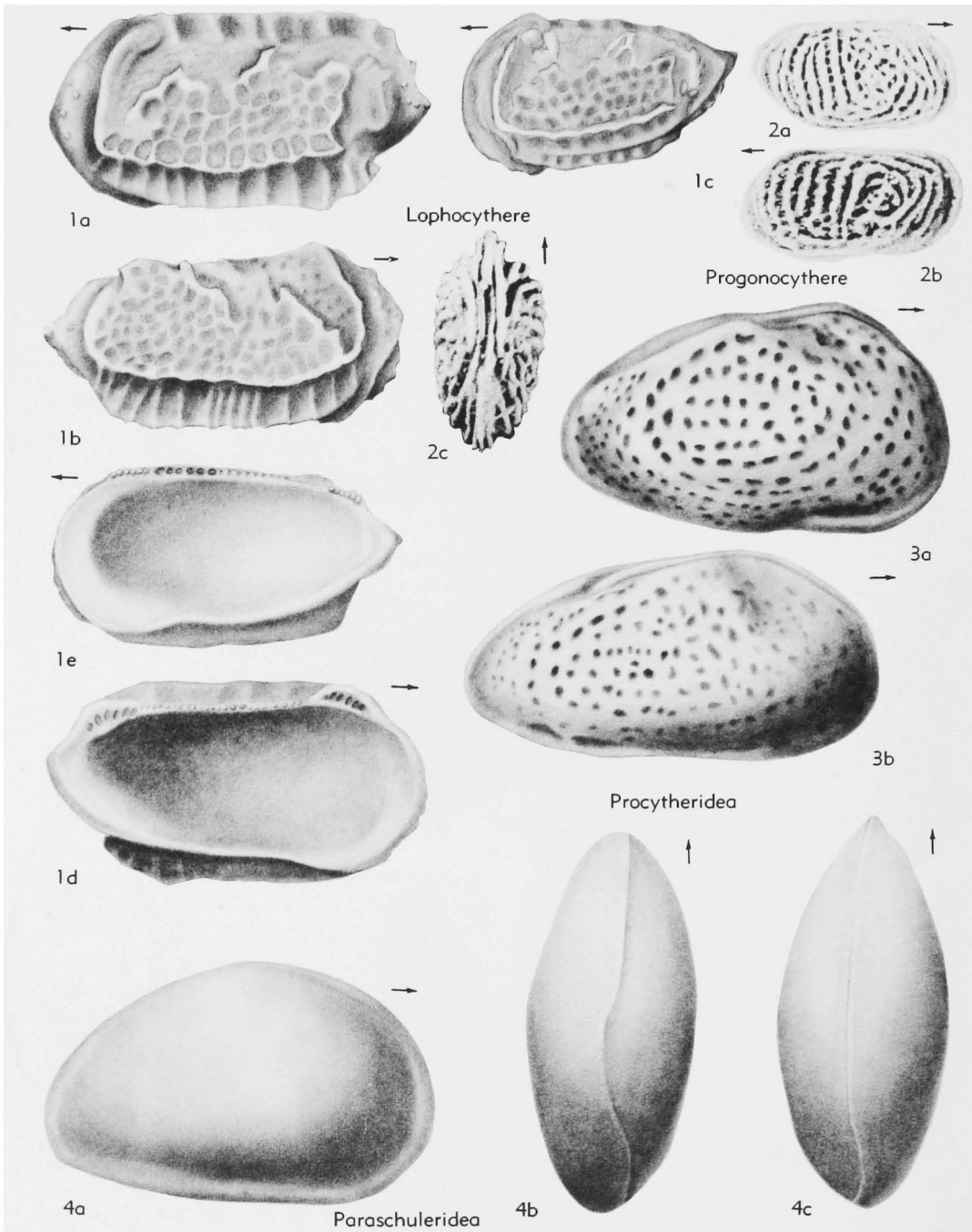


FIG. 249. Progonocytheridae (Progonocytherinae, Protocytherinae) (p. Q326-Q330).

developed from forms included in the Protocytherinae by a strengthening of the anterior crenulations of the middle element of the hinge. Both subfamilies, which are represented in early and middle Mesozoic ostracode assemblages, give evidence of being ancestral to other Upper Cretaceous and Tertiary families. Thus the Xestoleberi-

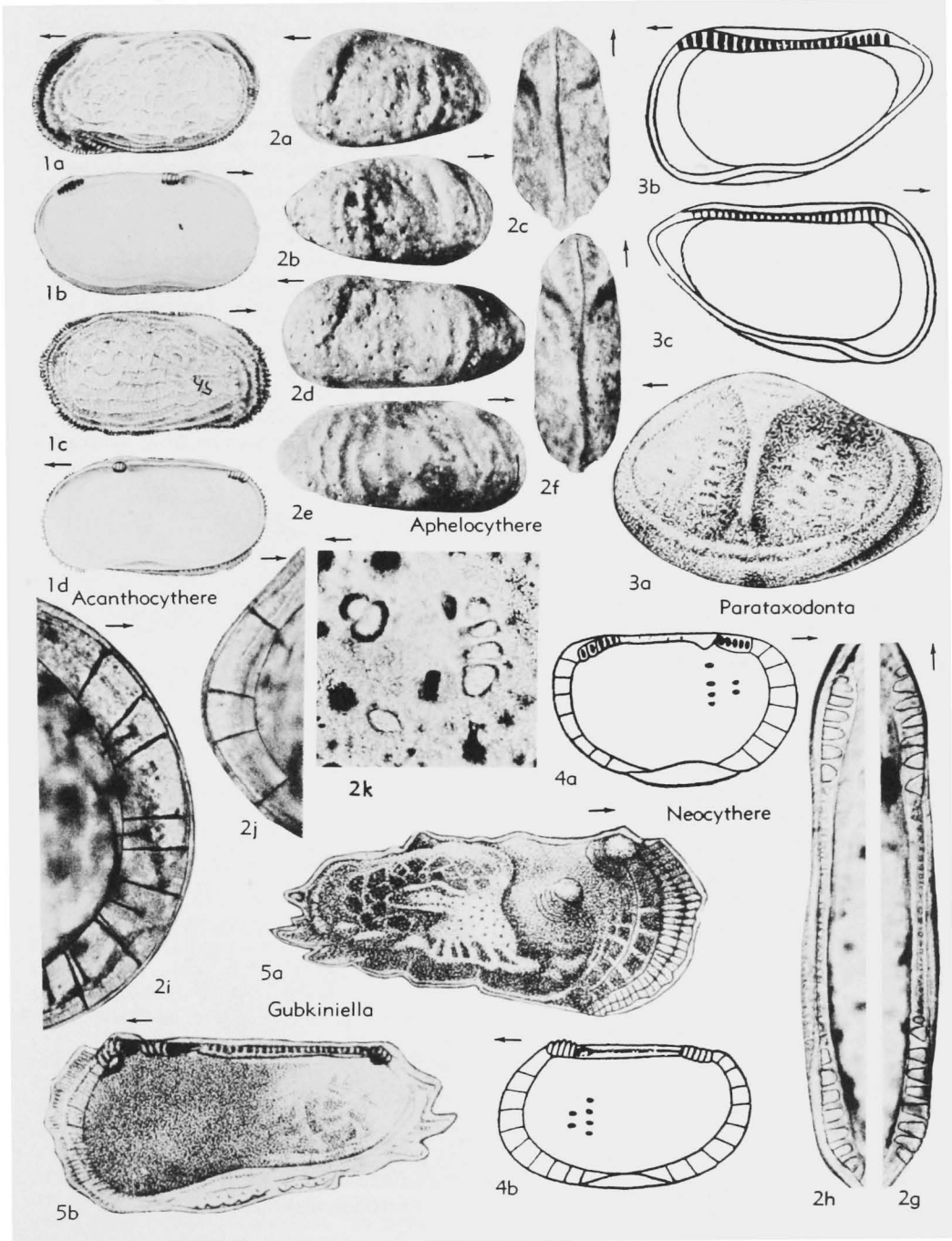


FIG. 250. Progonocytheridae (Progonocytherinae, Protocytherinae) (p. Q326-Q330).

didae, Cytherideidae, and Cytheridae, with their merodont hinges may be thought of as special developments from the Protocytherinae. The Leptocytheridae, Brachycytheridae, Hemicytheridae, Cytherettidae, Trachyleberididae, Campylocytheridae, and Schizocytheridae, with their amphidont and schizodont hinges are clearly developed from the older entomodont hingement of the Protocytherinae.

Subfamily PROGONOCYTHERINAE Sylvester-Bradley, 1948

[Includes Xenocytherinae MANDELSTAM, 1960]

Hinge entomodont. *Jur.-Rec.*

Progonocythere SYLVESTER-BRADLEY, 1948 [**P. stilla*]. Shape similar to *Brachycythere*, ventrally very plump; may be smooth, longitudinally wrinkled, or reticulate; hinge entomodont; muscle scars a vertical row of 4 with 2 in front; marginal area and radial canals not described; no eye tubercle. *Jur.*, Eu.——FIG. 248,*2*. **P. stilla*, M.Jur., Eng.; *2a,b*, LV lat., RV lat.; *2c,d*, LV int., RV int.; *2e-g*, LV dors., RV dors., LV post.; all ×75 (364).——FIG. 249,*2*. *P. hieroglyphica* SWAIN & PETERSON, U.Jur. (Sundance), USA(S.Dak.); *2a,b*, RV and LV ext.; *2c*, ♀ carapace dors., ×50 (357).

Acanthocythere SYLVESTER-BRADLEY, 1956 [**Cythere sphaerulata* JONES & SHERBORN, 1888]. Carapace with shape similar to that of *Echinocythereis* but with lobodont hinge, which is an intermediate stage in evolution of the typical entomodont hinge of the Progonocytheridae to typical amphidont hingement of the Trachyleberididae; carapace medium in size, plump, with straight long margins and rounded ends; surface covered with fine spines and apparently possessing broad eye tubercles. Normal canals large, sparse, about 20 to the valve; marginal area widest anteriorly, with few straight radial canals; muscle scars unknown. *M. Jur.(Bathon.)*, Eng.——FIG. 250,*1*. **A. sphaerulata* (JONES & SHERBORN); *1a,b*, ♂ LV lat., int.; *1c,d*, ♂ RV lat., int.; all ×47 (367).

Centrocythere MERTENS, 1956 [**C. denticulata*]. Egg-shaped, surface with concentric reticulations and nodes; obliquely rounded in front, narrower

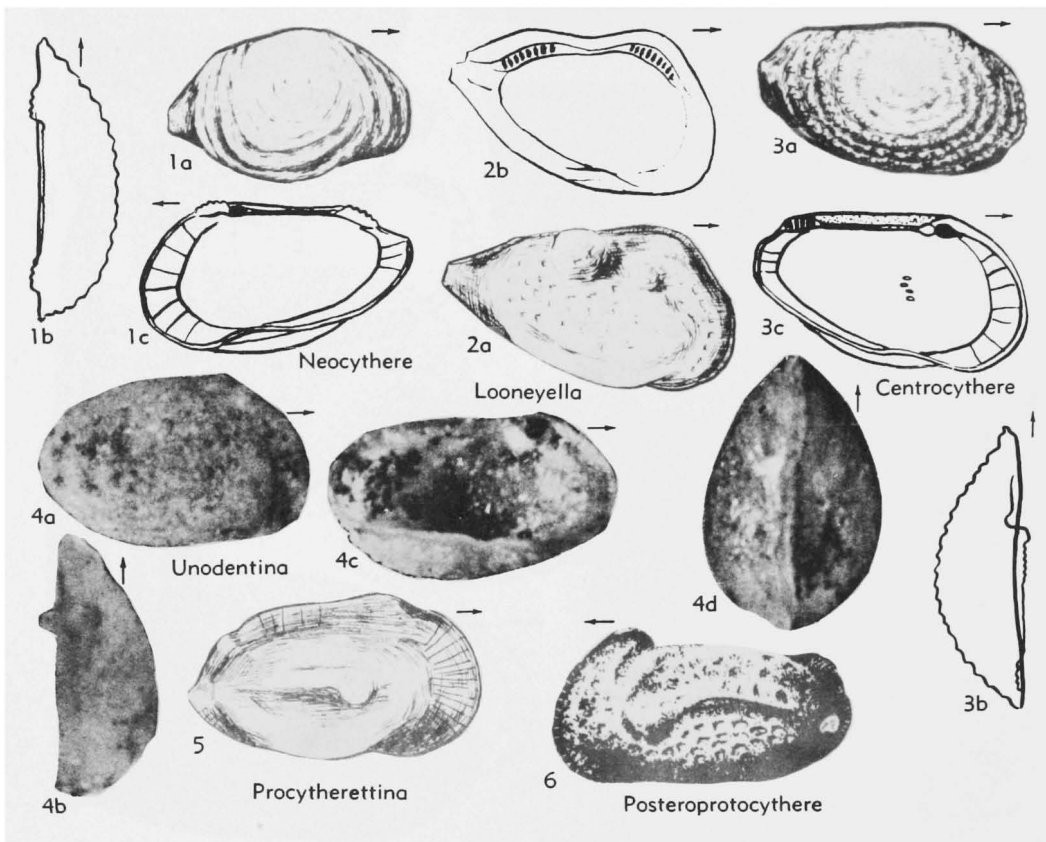


FIG. 251. Progonocytheridae (Progonocytherinae, Protocytherinae) (p. Q326-Q330).

behind. Hinge entomodont, crenulate in front part of median element; with accommodation groove in LV; marginal areas regular, radial canals sparse; muscle scars in near-vertical row of 4; mandibular and antennal scars not known. *L.Cret.*, Ger.—— FIG. 251,*3*. **C. denticulata*, M.Alb.; *3a-c*, RV lat., LV dors., LV int., ×50 (34).

?**Gubkiniella** KUZNETSOVA, 1956 [**G. miranda*] [=*Gubkinella* KUZNETSOVA, 1956 (original variant spel.)]. Elongate-ovate in side view, widest anteriorly; surface reticulate with muscle swelling in front of center, distinct eye spot. Marginal area wide, with about 25 straight radial canals; hinge modified entomodont, consisting in RV from front to back of crenulate tooth, socket, crenulate tooth, another socket, crenulated median furrow, posterior crenulate tooth; muscle scars not known. Sexual dimorphism pronounced, males longer than females, tapering backward, more strongly ornamented and with larger rear spines. *L.Cret.(Barrem.)*, SW. Asia-SE. Eu. (Caucasus-Caspian).—— FIG. 250,*5*. **G. miranda*, SE.Caucasus; *5a,b*, RV lat., RV int., ×80 (50). [HOWE-BOLD-REYMENT.]

Lophocythere SYLVESTER-BRADLEY, 1948 [**Cytheridea ostreata* JONES & SHERBORN, 1888]. Sexually dimorphous, more or less rectangular, surface reticulate with one or more keels parallel to long margins; eye node distinct; hinge entomodont; other internal details not described. *M.Jur.-U.Jur.*, Eu.——FIG. 249,*1*. **L. ostreata* (JONES & SHERBORN), M.Jur., Eng.; *1a,b*, LV lat., RV lat.; *1c*, juv. LV lat.; *1d,e*, LV int., RV int.; all ×70 (364).

Neocythere MERTENS, 1956 [**N. vanveeni*] [=*?Trochiscus* MANDELSTAM in MANDELSTAM *et al.*, 1956 (*non* HEYDEN, 1826); *?Trochinius* MANDELSTAM, 1957 (*nom. subst. pro Trochiscus* MANDELSTAM, 1956)]. Shape and ornamentation similar to that of *Centrocythere* but rear element of middle hinge bar of LV crenulate; other internal characters also similar. *L.Cret.(Barrem.)-U.Cret.(Maastricht.)*, Eu.(Ger.-Holl.-Fr.-?Eng.-?Urals)-?W.Sib.-?C.Asia.——FIG. 251,*1*. **N. vanveeni*, U.Alb., Ger.; *1a-c*, RV lat., dors., int., ×50 (34). ——FIG. 250,*4*. *N. punctatula* (JONES) (*fide* MANDELSTAM but identity with *Cythere punctatula*, Eng., type species of *Trochinius*, doubtful), Santon., N.Urals; *4a,b*, LV int., RV int., ×43 (50). [HOWE-BOLD-REYMENT.]

Posteroprotocythere MANDELSTAM in MANDELSTAM *et al.*, 1958 [**Orthonotacythere proparia* SHARAPOVA, 1939 (?=*O. propria* SHARAPOVA, 1939, p. 43, pl. 3, fig. 32)]. Carapace elongate-ovate, LV larger than RV, anterior end rounded, posterior end produced, dorsal margin straight; reminiscent of *Protocythere* but differs in having hinge subdivided into 4 elements, LV with anterior crenulate socket, postadjacent elongate tooth divided into 5 parts, median crenulate bar, and posterior socket divided into 5 parts. *L.Jur.-U.Cret.*, W.Eu.-SE.Eu.(Caucasus)-SW.Asia(Kazakhstan).—— FIG. 251,*6*. **P. propria* (SHARAPOVA), L.Cret.(Neocom.), SE.Russia; LV lat., ×50 (34). [BOLD.]

Procytherettina MANDELSTAM in MANDELSTAM *et al.*, 1958 [**Cythereis solus* SHARAPOVA, 1939]. Carapace kidney-shaped, LV overlapping; valves 3-ribbed, with subcentral tubercle; hinge in LV with anterior socket divided into 5 parts, postadjacent conical tooth with 5 crenulations, median crenulate bar, posterior ovate socket divided into 5 parts; marginal area moderately broad, pore canals moderately numerous, thin, equally spaced, coupled in some. [Differs from *Veenia* in having crenulate hinge teeth and from *Protocythere* in having 4 hinge elements.] *U.Cret.(Cenom.)*, E.Eu.(M. Volga-Ozinki).——FIG. 251,*5*. **P. sola* (SHARAPOVA); RV lat., ×50 (34). [BOLD.]

Unodentina MALZ, 1958 [**Macrodentina? spinosa* SCHMIDT, 1955]. Shape and most other characters similar to *Acanthocythere;* smooth anterior tooth in RV and smooth tooth in anteromedian part of LV hinge. *M.Jur.-U.Jur.*, W.Eu.——FIG. 251,*4*. **U. spinosa* (SCHMIDT), U.Jur., Ger.; *4a,b*, RV lat., dors.; *4c*, LV int.; *4d*, carapace dors.; all ×60 (320). [REYMENT.]

Xenocythere SARS, 1925 [**Cythere cuneiformis* BRADY, 1868]. Carapace wedge-shaped, highest in front, ventral face broad and flattened, valves subequal, moderately strong. Hinge of LV with terminal crenulate pits and between them bar bearing 2 or 3 small teeth at anterior end; marginal areas widest at ends where line of concrescence departs from inner margin; radial canals few; muscle scars in vertical row of 4 with 2 antennal and single mandibular scar in front. (314, 375). *Rec.*, N.Atl.——FIG. 256,*8*. **X. cuneiformis* (BRADY); *8a,b*, carapace L, R, ×75; *8c-e*, RV int. with pore canals, hinge, muscle scars, ×120 (375).

Subfamily PROTOCYTHERININAE Lyubimova in Lyubimova & Khabarova, 1955

[Although cited as a new subfamily introduced by MANDELSTAM, 1960 (USSR Treatise), the name Protocytherinae was first published by LYUBIMOVA in 1955.] [=?Palaeocytherididae MANDELSTAM, 1947; includes Pleurocytherinae, Paratoxodontinae MANDELSTAM, 1960]

Hinge merodont. *Jur.-Cret.*

Protocythere TRIEBEL, 1938 [**Cytherina triplicata* ROEMER, 1841] [=*Cytherettina* MANDELSTAM, 1956 (obj.)]. Carapace elongate, LV much larger than RV; surface with 3 longitudinal ridges or swellings. Hinge antimerodont; marginal areas broad, with long radial pore canals upturned in upper part of anterior end; muscle scars in vertical row of 4, with heart-shaped antennal scar in front. *U.Jur.-L.Cret.*, Eu.——FIG. 252,*1*. **P. triplicata* (ROEMER), L.Cret., Ger.; *1a,b*, ♀ LV lat., RV lat.; *1c*, ♀ carapace dors.; *1d,e*, ♂ LV lat., RV lat.; *1f,g*, ♀ LV int., RV int.; *1h,i*, ♀ LV dors., RV dors.; all ×50 (80).——FIG. 253,*2*. *P. quadricarinata* SWAIN & PETERSON, U.Jur.(Sun-

dance F.), USA(Wyo.); *2a-c,* carapace R, L, vent., ×50 (354).

Aphelocythere TRIEBEL & KLINGLER, 1959 [**A. undulata*]. Strongly dimorphous, ?males bigger and more elongated than ?females; carapace of medium size, irregularly quadrangular in side view, greatest height just in front of mid-point, LV slightly larger than RV, overhanging it dorsally and in upper part of posterior end; anterior margin broadly rounded, posterior end narrowly rounded to bluntly angled in lower half and almost flat in upper half, dorsal margin of ?females almost straight or weakly convex; surface with broad flat rib near anterior margin beginning at anterodorsal angle and fading below mid-line, central area of valves without coarse ornament, posterior area with few curved vertical riblets; eye spots and internal eye sockets apparently lacking. Inner margin and line of concrescence coincident; marginal pore canals undivided, widely separated, few; true submarginal canals lacking; normal canals large, sieve-shaped; 4 adductor muscle spots in slightly curved vertical row, lowermost scar largest, also frontal pair that may coalesce; RV hinge with terminal low, notched tooth plates and finely crenulated median furrow. [Marine.] *L.Jur.-M.Jur.,* W.Eu.——FIG. 250,2. **A. undulata,* L. Jur., NW.Ger.; *2a-c,* ♀ carapace L, R, dors., ×47; *2d-f,* ♂ carapace L, R, dors., ×47; *2g,h,* RV and LV hinge, int., ×145; *2i,j,* LV int. ant., post., ×195; *2k,* muscle scars, RV int., ×290 (382). [REYMENT.]

Hutsonia SWAIN, 1946 [**H. vulgaris*]. Carapace subpyriform in appearance from side, LV larger than RV; sides pitted or reticulate, venter ribbed, bisulcate above muscle scars (vertical row of 4 with crescent-shaped antennal scar in front); hinge hemimerodont. *Jur.,* N.Am.——FIG. 253,3. **H. vulgaris,* U.Jur., La.; *3a-c,* carapace R, L, and dors.; *3d,* LV int.; *3e,* carapace R; all ×70 (350).

Klieana MARTIN, 1940 [**K. alata*]. Small, with distinct sexual dimorphism; LV larger than RV, plump females with strongly developed winglike processes on ventral side of both valves, producing broad arrowhead outline in view from above; surface pitted. Hinge hemimerodont; duplicature rather narrow, with widely spaced radial canals in pairs; muscle scars in slightly oblique row of 4.

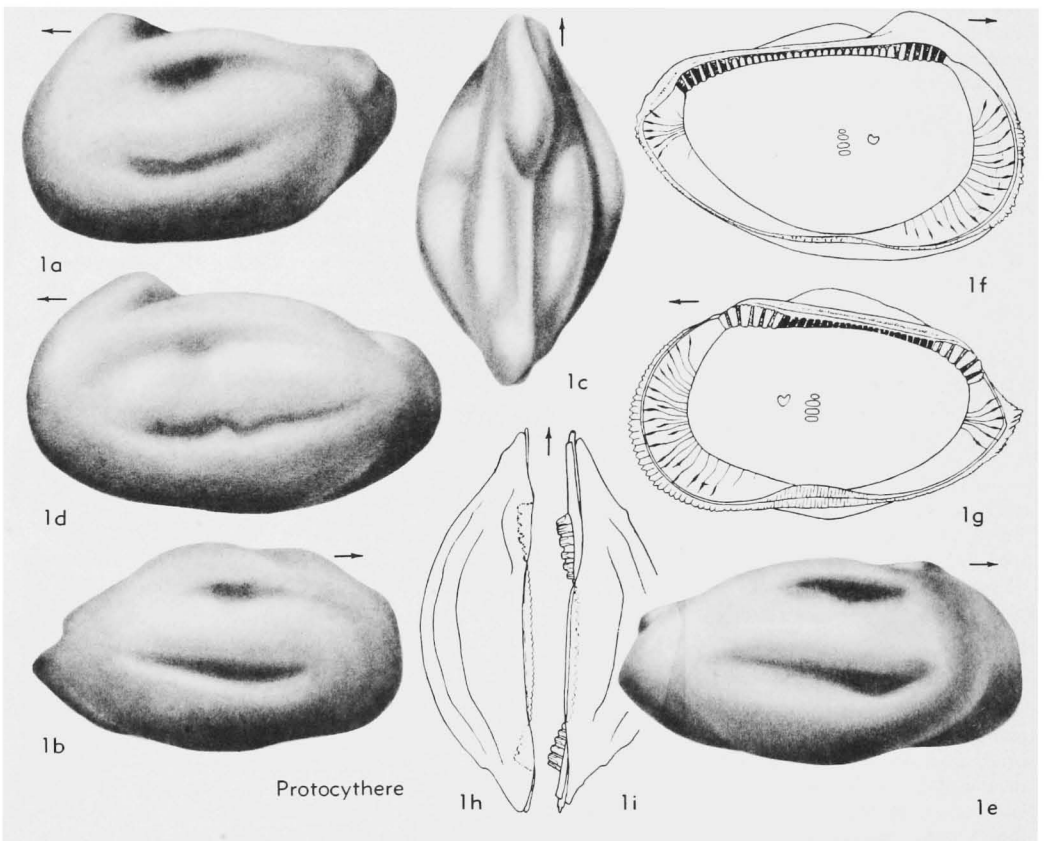


FIG. 252. Progonocytheridae (Protocytherinae) (p. Q327).

Jur.-Cret., Eu.——Fig. 248,*1*. **K. alata*, U.Jur., Ger.; *1a,b*, ♀ carapace L, dors.; *1c*, ♂ carapace dors.; *1d,g*, RV int., dors.; *1e,f*, LV int., dors.; all ×80 (51).

Looneyella Peck, 1951 [**Cythere monticula* Jones, 1893]. Subtrigonal to pyriform in side view, dorsal and ventral outlines converging toward well-developed caudal process, anterior end obliquely rounded; alate, with spines on certain species and in known forms reticulate on lateral surface and

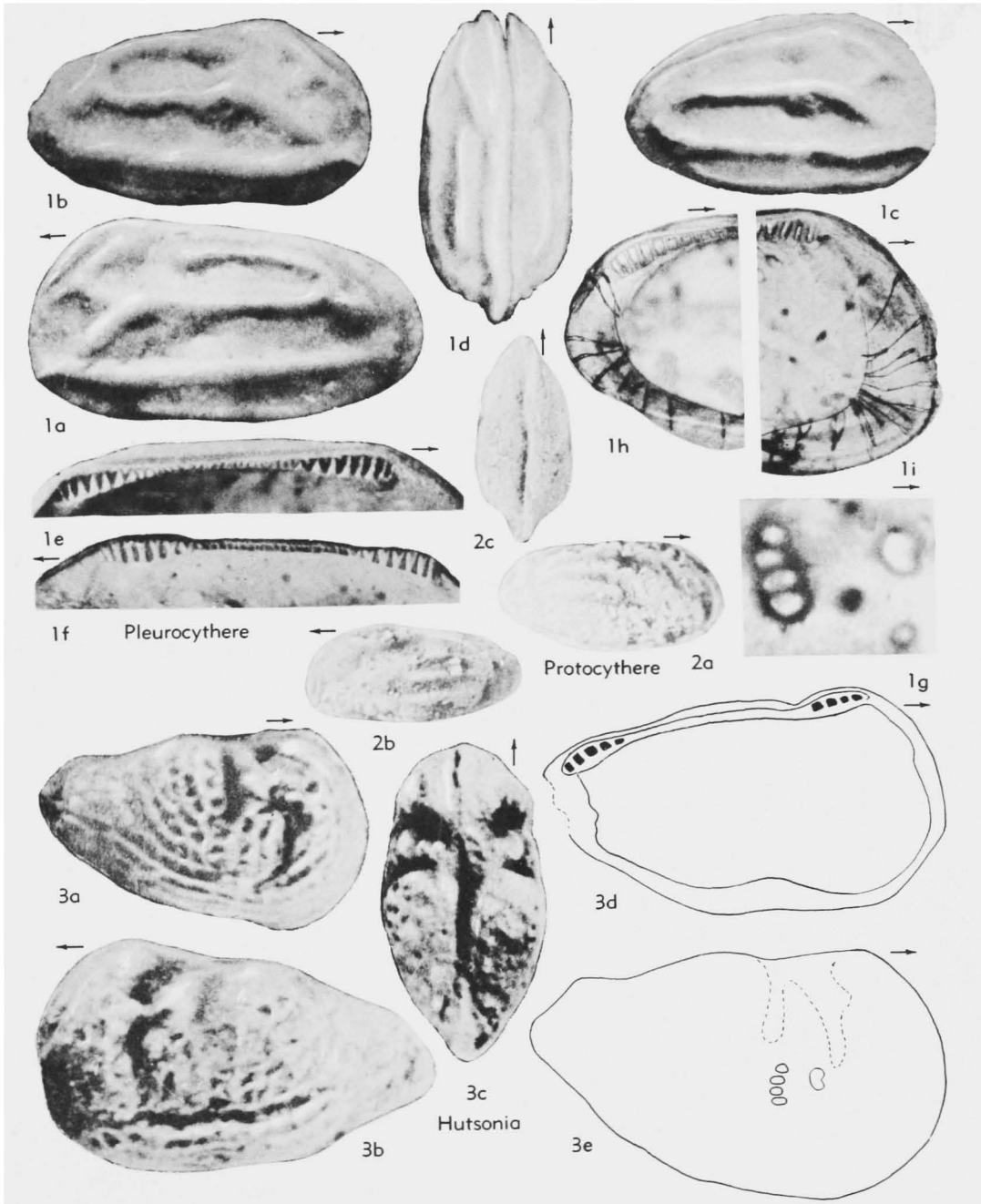


Fig. 253. Progonocytheridae (Protocytherinae) (p. Q327-Q330).

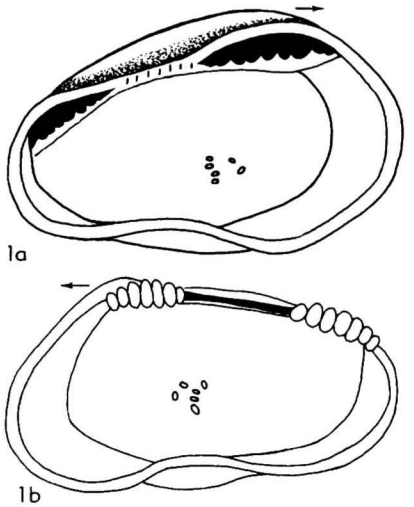


FIG. 254. Progonocytheridae (Protocytherinae) (p. Q330).

longitudinally ribbed on ventral surface. Hinge hemimerodont; muscle scars not known; marginal areas regular and radial canals few. *L.Cret.*, N. Am.——FIG. 251,*2*. **L. monticula* (JONES), Wyo.; *2a,b*, RV lat., LV int., ×50 (34).

Merocythere OERTLI, 1957 [**Clithrocytheridea plena* SCHMIDT, 1954]. Plump, subpyriform in lateral outline, surface pitted, no eye tubercles. Hinge hemimerodont; other internal details lacking. *Jur.*, Ger.

Paraschuleridea SWARTZ & SWAIN, 1946 [**P. anumbonata*]. Shape somewhat like that of the Cytherideidae, but muscle scars in vertical row of 4 with single large scar in front; marginal areas and canals not known. [Based on single specimen. Placed here because of hemimerodont hinge.] *Jur.*, N.Am.——FIG. 249,*4*. **P. anumbonata*, U.Jur., La.; *4a-c*, carapace R, dors., vent.; all ×60 (77).

?Parataxodonta MANDELSTAM, 1956 [**P. uralensis*]. Carapace elongate oval roughly, with maximum height just behind anterior third, with transverse concavity in side middle; ventral margin broadly rounded, dorsal margin strongly and irregularly arched, posterior half concave, anterior margin broadly and rather irregularly rounded with midpoint lower than posterior; rear margin blunt; LV larger than RV. Anterior zone of concrescence with only few pore canals, no vestibule. Eye spot distinct; surface smooth except for coarse, symmetrically aligned reticulations and weak ribs. LV hinge with crenulated bar with terminations becoming wider and toothlike. *L.Cret.(Apt.-Alb.)*, USSR (Urals-Kazakhstan). —— FIG. 250,*3*. **P. uralensis*, Urals; *3a*, LV lat., ×63; *3b,c*, RV int., LV int., ×43 (238). [REYMENT.]

Pleurocythere TRIEBEL, 1951 [**P. richteri*] [=*?Annosacythere* KUZNETSOVA, 1957]. Ovate, LV larger than RV and with dorsal keel that is missing on RV; lateral surface with slanting front rib and 3 long ribs connecting anteriorly. Hinge antimerodont; radial canals long, curved, with 2 aberrant canals near posterior hinge terminations; muscle scars in row of 4 with 2 in front. *Jur.*, Eu.——FIG. 253,*1*. **P. richteri*, M.Jur., Ger.; *1a*, ♂ LV lat.; *1b*, ♀ RV lat.; *1c,d*, ♀ carapace R, dors.; *1e,f*, LV and RV hinge; *1g*, LV int., muscle scars; *1h,i*, LV marginal areas post., ant.; *1a-d*, ×75; *1e,f,h,i*, ×150; *1g*, ×300 (377).

Procytheridea PETERSON, 1954 [**P. exempla*]. Ovate, highest at anterior cardinal angle, ventral margin sinuous; surface reticulate, with tendency to develop longitudinal ridges. Hinge antimerodont; marginal areas wide, few canals, line of concrescence nearly coinciding with inner margin; muscle scars in vertical row of 4 with several others in front. *Jur.*, N.Am.——FIGS. 249,*3*; 254,*1*. **P. exempla*, U.Jur., Wyo.; 249,*3a,b*, ♀ and ♂ carapace R; 254,*1a,b*, LV int., RV int.; all ×100 (273).

Family PSAMMOCYTHERIDAE Klie, 1938

[*nom. transl.* HOWE, herein (*ex* Psammocytherinae KLIE, 1938)] [Materials for this family prepared by H. V. HOWE, Louisiana State University]

Shell low, elongate, delicate, transparent. Hinge adont. No eye. [Marine.] *Rec.*, Eu.

Psammocythere KLIE, 1936 [**P. remanei*]. No sexual dimorphism; shells similar; height about 2/5 length; radial pore canals widely spaced in broad anterior marginal area. *Rec.*, Helgoland.——FIG. 255,*1*. **P. remanei; 1a,b*, RV ext. (by reflected and transmitted light); *1c*, RV dors.; all ×100 (219).

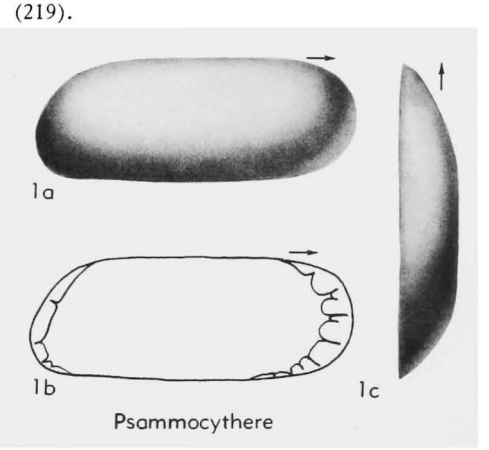


FIG. 255. Psammocytheridae (p. Q330).

Family SCHIZOCYTHERIDAE Howe, n. fam.

[Materials for this family prepared by H. V. Howe, Louisiana State University, with some contribution from P. C. Sylvester-Bradley, University of Leicester, and R. A. Reyment, University of Stockholm]

Characterized by schizodont dentition; marginal areas relatively broad, crossed by few radial canals; surface rough, commonly reticulate or strongly pitted, tending to develop longitudinal ridge near venter. Muscle scars very difficult to discern because of surface ornamentation but apparently consisting of a vertical or curved row of 4 adductors, in front of which are rounded antennal and mandibular scars. *U.Cret.-Rec.*

Schizocythere Triebel, 1950 [**S. hollandica*]. Carapace small to medium in size, ovate in side view, posterior extremity being slightly angulated near middle, above which it is weakly concave in RV, ovate in dorsal view; surface pitted to strongly reticulate, with distinct eye tubercle and in most species a tendency to have rib separating lateral and ventral surfaces. Hinge schizodont, in RV with split anterior tooth, deep socket divided in 2 parts at end, crenulate hinge furrow and lobed posterior tooth; anterior tooth bifid in LV; marginal areas very broad, with about 5 straight radial canals on anterior part; normal canals rather large, widely spaced, sieve-like; muscle scars in somewhat curved row of 4 adductors, in front of which are single rounded antennal and mandibular scars very difficult to see. *Eoc.-Mio.*, Eu.——Fig. 256, *1a-c. S. batjesi* Keij, Eoc.(Led.-Barton.), Belg.; *1a*, LV lat. (Barton.), ×67; *1b*, carapace dors. (Led.), ×77; *1c*, LV int. (Barton.), ×75 (42). ——Fig. 256,*1d. S. tessellata* (Bosquet), Eoc. (Lutet.), Fr.(Paris Basin); RV lat., ×65 (42).—— Fig. 256,*1e-g.* **S. hollandica*, Mio., Holl.; *1e*, RV lat., ×45; *1f*, RV hinge, ×100; *1g*, RV radial pore canals, ×137 (all 376).

Amphicytherura Butler & Jones, 1957 [**Cytherura? dubia* Israelsky, 1929]. Hinge schizodont. Like *Costa* but smaller, less elongate, and with median ridge straight or curved, concave upward, less well defined than in *Costa*. Externally resembles *Eucytherura. U.Cret.*, Eu.-N.Am.——Fig. 257,*1a-c.* **A. dubia* (Israelsky), USA(Ark.); *1a-c*, LV lat., RV int., carapace dors.; ×80, ×70, ×77 (34). ——Fig. 257,*1d. A. limburgensis* Howe & Laurencich, Belgium; LV lat.; ×80 (34). [Sylvester-Bradley.]

Neomonoceratina Kingma, 1948 [**N. columbiformis*]. Generally considered to be subgenus of *Paijenborchella* because similar in most features but with upturned caudal process (46). *Mio.-Rec.*, E.Indies-Eu.——Fig. 256,*5.* **N. columbiformis*, Rec., Sumatra; *5a,b*, RV int., LV int., ×50; *5c*, RV dors., ×50.——Fig. 256,*6. N. mediterranea* Ruggieri, Mio., Italy; *6a,b*, LV lat., int., ×50; *6c*, hinge, ×50 (302).

Paijenborchella Kingma, 1948 [**P. iocosa*] [=*Payenborchella* Keij, 1953]. Carapace with obliquely rounded anterior end and long caudal process near lower posterior margin, nearly vertical sulcus marking middle of valves at position of adductor muscles; valves widest near venter where ridge tends to form ala or develop spine, another horizontal ridge crossing sulcus near middle of valves. Hinge heavy, schizodont, with split anterior teeth, crenulate middle element, and lobed posterior tooth in RV; marginal areas broad, with very few radial canals; adductor scars on median ridge, in front of which appear to be single antennal and mandibular scars (148, 220). *U.Cret.-Rec.*, E.Indies-Eu.-N.Am.——Fig. 256,*2.* **P. iocosa*, Rec., E. Indies(Java), *2a*, carapace dors.; *2b,c*, LV int., RV int.; all ×30 (46).——Fig. 256,*3. P. eocaenica* Triebel, Eoc.(Barton.), Belg.; *3a*, RV lat., ×73 (42); *3b,c*, hinge and radial pore canals, enlarged (375).——Fig. 256,*4. P. longicosta* Keij, Eoc.(Lutet.), Belg.; *4a,b*, ♂ carapace R, dors., ×78; *4c*, ♀ carapace dors., ×78; *4d*, ♀ LV int., ×78 (42).

Palmenella Hirschmann, 1916 [**Cythereis limicola* Norman, 1865] [=*Kyphocythere* Sars, 1925]. Carapace subrectangular, dorsal margin marked by raised cardinal angles, compressed in dorsomedian region, much widened ventrally in form of subalate ridge; surface pitted or reticulate or both. Hinge schizodont; marginal areas broad, with few wavy radial pore canals; muscle scars in subvertical row of 4 with 2 scars in front (314, 375, 172). *Plio.-Rec.*, Eu.-N.Am.——Fig. 256,*7.* **P. limicola* (Norman); *7a,b*, carapace L, dors., ×40; *7c,d*, hinge and radial pore canals, ×67 (172).

Family SINUSUELLIDAE Kashevarova, 1958

[*nom. transl.* van den Bold, herein (*ex* Sinusuellinae Kashevarova, 1958)] [Materials for this family prepared by W. A. van den Bold, Louisiana State University]

Large, rectangular, with rounded antero- and posteroventral margins; swollen area overhanging mid-ventral part of valves; surface smooth or ornamented. Zone of concrescence forming a flattened fringe. *U. Perm.*

Sinusuella Spizharsky, 1939 [**S. ignota*]. Dorsal outline sinusoid, with process pointed backward; LV overlapping RV only along dorsal margin, entire free border with radially striate fringe or rim; surface smooth or reticulate. LV hinge with crenulate bar, teeth at extremities of bar, corresponding depressions in RV; muscle scars in vertical row of 4 with 2 scars in front. [The muscle-scar pattern of this poorly illustrated, inadequately known genus indicates placement within the

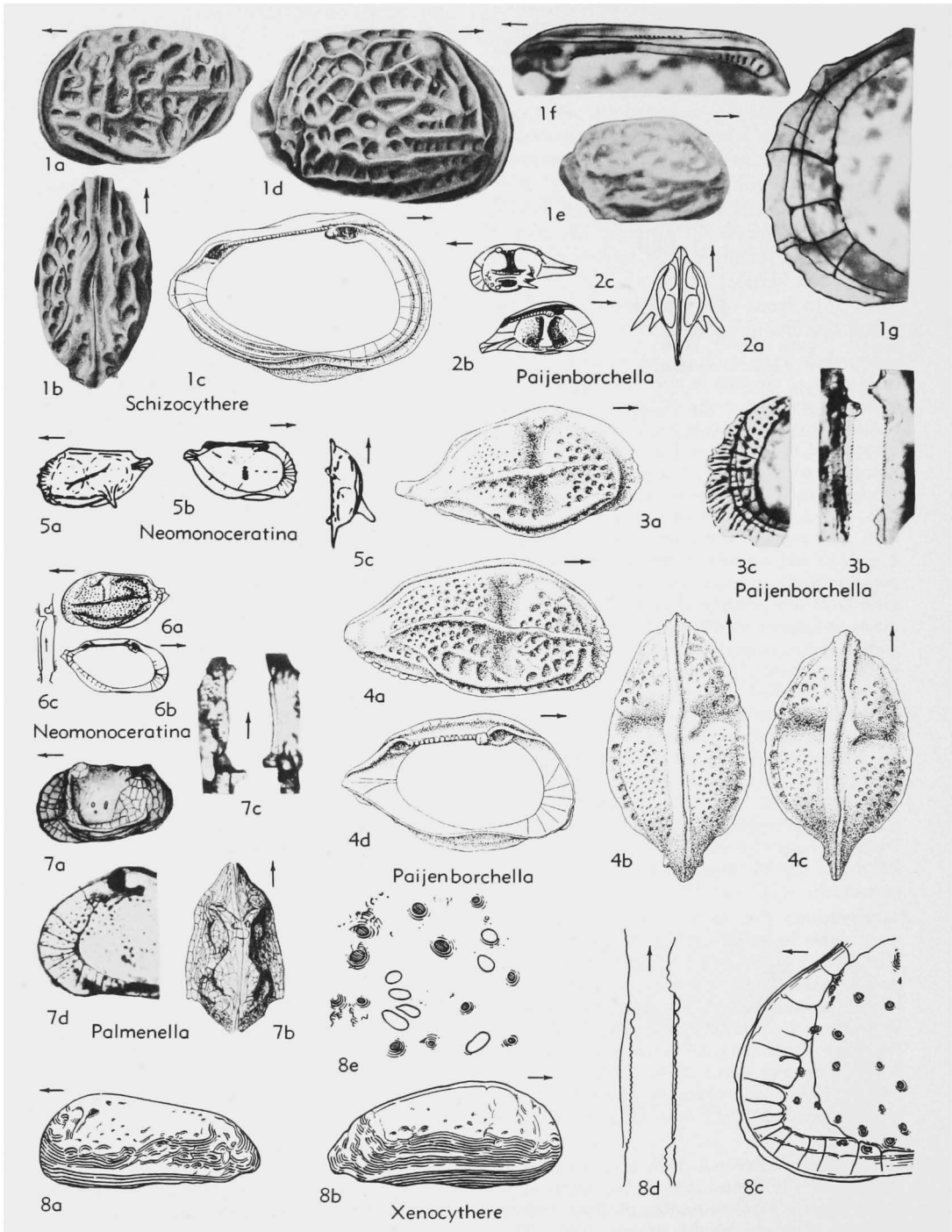


FIG. 256. Progonocytheridae, Schizocytheridae (p. Q327, Q331).

Cytheracea (Howe).] *U.Perm.(Ufim.-Tatar.)*, USSR(Sukhon Basin).

Family TOMIELLIDAE Mandelstam in Yavorsky, 1956

[Materials for this family prepared by W. A. van den Bold, Louisiana State University] [Includes Iniellinae Mandelstam, 1960]

Strongly varying in shape, ends rounded, dorsal margin straight, ventral margin straight or concave; valves with submedian transverse groove, commonly curved at posterior side, some genera with subcentral tubercle in front of this groove; surface reticulate, pitted, or smooth. Zone of concrescence well developed, radial pore canals widely spaced, vestibule in anterior end; muscle scars in vertical row of 4 with 2 in front; LV hinge with shallow groove which receives sharpened dorsal margin of RV. *Perm.*

Tomiella Spizharsky, 1937 [**T. yavorskyi* (=**Kirkbya oblongata* Jaishevsky, 1927)]. Anterior end rounded, commonly higher than posterior end, dorsal margin straight, ventral margin concave; valves with submedian transverse groove, usually obliquely rounded toward rear, some species with tubercle in front of this groove. Muscle scars on interior ridge that corresponds to external groove, 4 elongate scars (much like those of *Timiriasevia*) in oblique row; radial pore canals better developed in anterior end, inner lamella weak; LV hinge with narrow, smooth groove, slightly widened anteriorly into which fits sharp dorsal margin of RV. *Perm.*, USSR(Kuznetsk-Tungus region).——Fig. 258,*1*. **T. oblongata* (Jaishevsky), Kuznetsk; *1a*, RV lat., ×20 (337); *1b*, RV lat. (?another specimen), ×43 (238).

Iniella Mandelstam in Yavorsky, 1956 [**Leperditia kuznetskiensis* Spizharsky, 1937]. Elongate, subelliptical, anterior end higher than posterior or equally high, both ends rounded; dorsal margin straight, parallel to ventral margin or converging posteriorly. Muscle scars in vertical row of 4 with 2 in front; LV hinge with weak longitudinal depression in dorsal margin into which fits dorsal margin of RV. *Perm.*, USSR(Kuznetsk-Tungus region).——Fig. 258,*3*. **I. kuznetskiensis*, Kuznetsk; *3a,b*, LV lat., RV lat., ×43 (238).

Kemeroviana Mandelstam in Yavorsky, 1956 [**K. argulata*]. Irregularly elliptical to rounded rectangular, LV larger than RV, ends usually equally high, rounded; dorsal margin straight or sloping toward posterior end, ventral margin obliquely convex; surface with weak ribs that tend to be diagonal. Muscle scars situated in subcentral transverse groove. *Perm.*, USSR(Kuznetsk Basin).——Fig. 258,*5*. *K. argulata*, Kuznetsk; LV lat., ×43 (238).

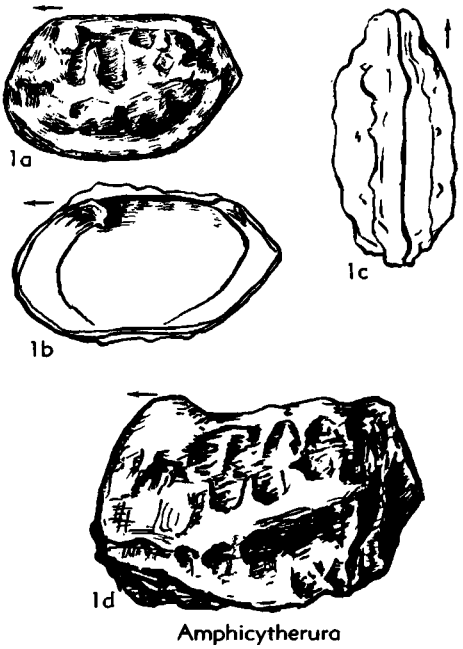


Fig. 257. Schizocytheridae (p. Q331).

Suriekovella Mandelstam, 1958 [**Iniella limbata* Mandelstam, 1956]. Carapace elongate, large, elliptical or elongate-ovate, anterior end with broad marginal area, also broad in ventral margin. Surface smooth. [Differs from *Iniella* in its straight dorsal margin and upturned posterior part.] *Perm.*, WC.Asia(Kuznetsk Basin).——Fig. 258,*4*. **S. limbata* (Mandelstam), Kuznetsk; RV lat., ×40 (238). [Bold.]

Tomiellina Mandelstam in Yavorsky, 1956 [**T. umbrata*]. Elongate, rectangular, LV larger than RV, anterior end slightly higher than posterior, both rounded; dorsal margin straight, ventral convex, upwardly bent in posterior end, central portion of valve with longitudinal concavity with angular to rounded reticulations. [Differs from *Tomiella* in lacking transverse groove, subcentral tubercle and blunt antero- and posterodorsal angles.] *U.Perm.*, USSR(Kuznetsk Basin).——Fig. 258,*2*. *T. umbrata*, Kuznetsk; LV lat., ×43 (238).

Family TRACHYLEBERIDIDAE Sylvester-Bradley, 1948

[*nom. correct.* Sylvester-Bradley & Harding, 1954 (*pro* Trachyleberidae Sylvester-Bradley, 1948)] [=Cythereidinae Berousek, 1952 (*nom. correct.* Sylvester-Bradley & Harding, 1954, *pro* Cythereisinae Berousek, 1952)] [Materials for this family prepared by P. C. Sylvester-Bradley, University of Leicester, with aid on some genera by H. V. Howe, Louisiana State University, and R. A. Reyment, University of Stockholm]

Sexual dimorphy common, males longer than females. Carapace subrectangular, dor-

sal and ventral margins parallel or slightly convergent toward rear, anterior margin broadly rounded, posterior margin subtriangular (or caudate in a few genera), posteroventrally more or less produced. Eye tubercles and ocular sinuses well developed (except in *Idiocythere*). Internal muscle-scar pit represented on exterior by an elevated process (subcentral tubercle). Carapace heavily ornamented with spines or ridges or both, or may be reticulate, or (in a few genera) smooth. Details of shape and ornament (coupled with variations in hinge, muscle-scar pattern and duplicature) are used to distinguish genera. Hinge in post-Jurassic adults strongly amphidont, juvenile molts merodont; accommodation groove narrow or absent; duplicature of average width, vestibule narrow or absent; normal pore canals large, of sieve-type, radial pore canals numerous, rather crowded, some crossing each other, in many species majority of canals widening at about middle; muscle-scar pattern mostly with vertical row of 4 just behind muscle-scar pit, and single U-shaped scar or pair of oval antennal scars within pit immediately in front; other genera show break up into greater number of scars. Species of this family are abundant in shallow-water and littoral zones, and extend into deep water. Abundant fossils from Cretaceous onward. Strong and characteristic ornament makes species easy to recognize and valuable for zonal stratigraphy. Apparently descended from *Oligocythereis* (M.Jur.). Caudal process not normally developed. Presence of subcentral tubercle and absence of caudal process serve to distinguish family from Hemicytheridae, but *Quadracythere* and *Orionina* have both caudal process and subcentral tubercle, and are here included in Trachyleberididae. Most Hemicytheridae have one of the adductor muscle scars divided, whereas in most Trachyleberididae they are undivided. *?L.Jur., M.Jur.-Rec.*

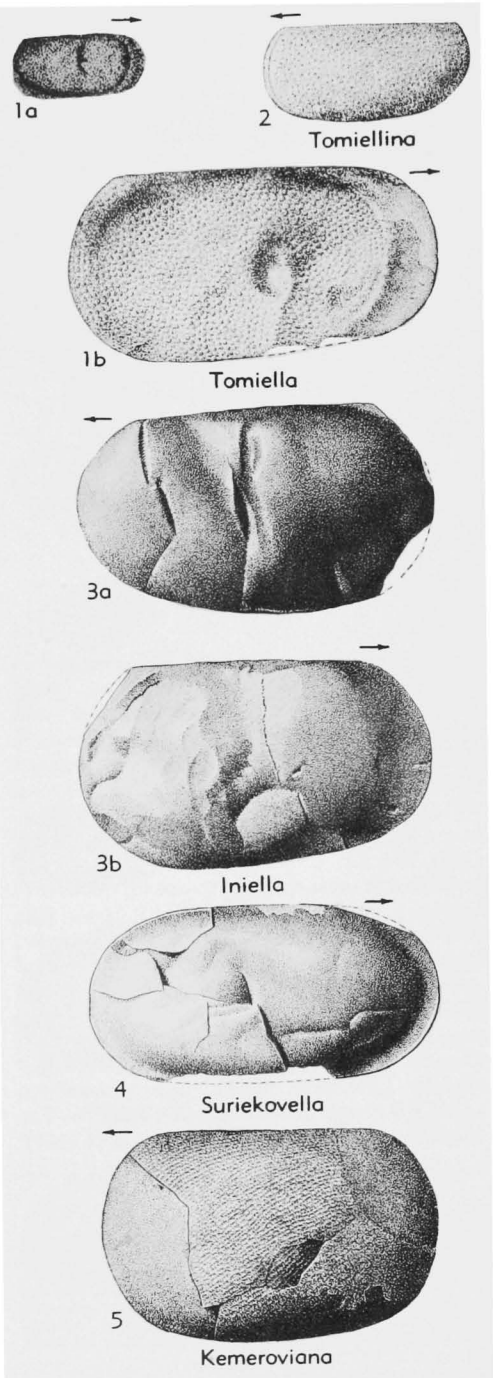


FIG. 258. Tomiellidae (p. Q333).

Trachyleberis BRADY, 1898 [**Cythere scabrocuneata* BRADY, 1880]. Hinge holamphidont. Ornament of spines, tubercles or blades, dominated by subcentral tubercle, and not arranged in longitudinal lines except on venter; in some species subsidiary reticulations also occur. *Paleoc.-Rec.*, cosmop.—— FIG. 259,*1*. **T. scabrocuneata* (BRADY), *Rec.*, Japan; *1a-c*, ♂ LV lat., ♂ RV lat., ♀ RV lat.; *1d,e*, ♂ LV int., ♀ RV int.; *1f,g*, ♂ LV dors., ♀ RV dors.; all ×50 (Sylvester-Bradley).

Actinocythereis PURI, 1953 [**Cythere exanthemata* ULRICH & BASSLER, 1904]. Hinge holamphidont. Ornament like *Costa* but all ridges broken up

into spines. *Eoc.-Rec.*, N.Am.——Fig. 259,2. **A. exanthemata* (Ulrich & Bassler), Eoc., USA (Fla.); *2a,b*, carapace R, dors., ×50 (286).

Ambocythere van den Bold, 1957 [**A. keiji*]. Carapace subquadrate, with distinct posteroventral projection; subcentral tubercle slight but

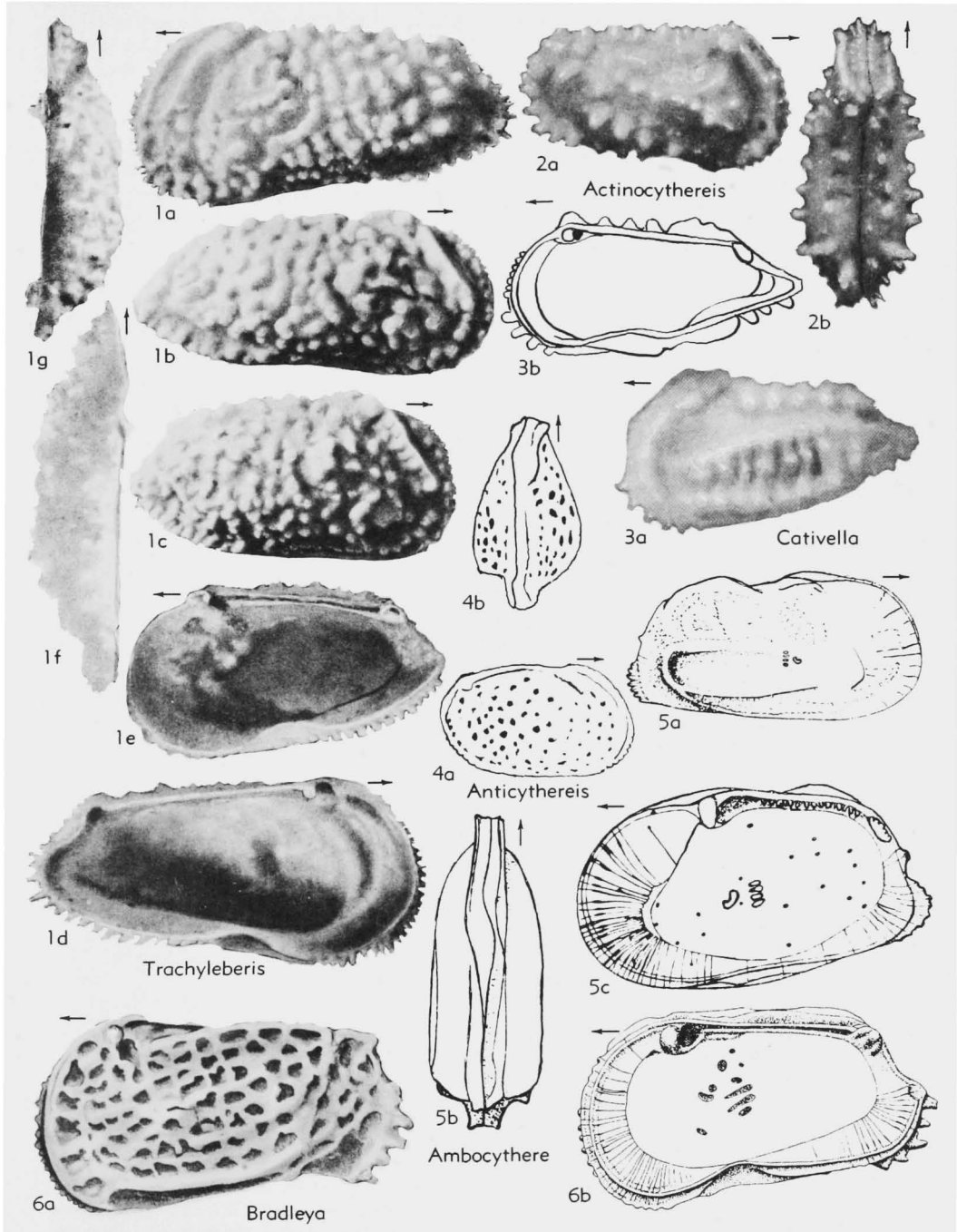


Fig. 259. Trachyleberididae (p. Q334-Q336).

definite; ornament of 2 or more thin carinae confined to posterior half of carapace; marginal rims sharply defined. Duplicature wide, with narrow vestibule; hinge hemiamphidont; antennal muscle scar large, crescentic, opening toward front. *Oligo.-Rec.*, Carib.——Fig. 259,*5*. **A. keiji*, Rec., Carib.; *5a,b*, carapace R, dors.; *5c*, RV int.; all ×90 (101).

Anticythereis van den Bold, 1946 [*pro Pseudocythereis* Jennings, 1936 (*non* Skogsberg, 1928)] [**Pseudocythereis reticulata* Jennings, 1936] [=*Stephensonaria* Coryell in Stephenson, 1946 (*nom. subst. pro Pseudocythereis*)]. Carapace plump, like *Echinocythereis*, but surface not spiny and RV larger than LV. *U.Cret.*, N.Am.——Fig. 259,*4*. **A. reticulata* (Jennings), USA(N.J.); *4a,b*, carapace R, dors., ×40 (34).

Archicythereis Howe, 1936 [**Cythereis yazooensis* Howe & Chambers, 1934]. Based on a juvenile molt that is generically indeterminable, but certainly belonging to Trachyleberididae; not generally recognized as valid generic name, but useful in the vernacular when immature stages of amphidont hinges are termed the "*Archicythereis* hinge." *Paleog.-Neog.*, cosmop.——Fig. 263,*1*. *A. holmani* LeRoy, Neog., Sumatra; *1a-c*, RV lat., int., LV int., ×24 (200).

Bradleya Hornibrook, 1952 [**Cythere arata* Brady, 1880]. Carapace subquadrate, smooth or reticulate, with distinct dorsal and ventral ridges and subcentral tubercle; no caudal process. Hinge hemiamphidont, with denticulate median element; antennal muscle scar double. Line of concrescence and inner margin coincident, marginal pore canals simple, widened in middle. Sexual dimorphism recorded. *U.Cret.-Rec.*, cosmop.——Fig. 260,*4*. **B. arata* (Brady), Rec., N.Z.; *4a*, LV lat.; *4b,c*, RV int., dors.; all ×50 (32).——Fig. 259,*6*. *B. approximata* (Bosquet), Eoc. (Lutet.), Fr.; *6a,b*, LV lat., RV int., ×50 (42). [Reyment.]

Buntonia Howe, 1935 [**B. shubutaensis*, juvenile (=**Cythereis? israelskyi* Howe & Pyeatt, 1935, adult)] [=*Pyricythereis* Howe, 1936; *Semicythereis* Elofson, 1944]. Hinge holamphidont, with median element smooth or denticulate. Surface smooth, or with longitudinal ridges and furrows. Carapace plump, tapering to narrow rounded posterior; eye tubercle present but not pronounced. [Included with some doubt in Trachyleberididae, as carapace lacks subcentral tubercle.]*?U.Cret., Eoc.-Rec.*, N.Am.-Eu.-Afr. (Nigeria-Cameroons)——Fig. 260,*1a-d*. **B.. shubutaensis*, Eoc., USA (La.); *1a,b*, carapace R, dors.; *1c,d*, RV int., LV int.; all ×80 (178).——Fig. 260,*1e*. *B. corpulenta* (Brady & Norman), Rec., Swed.; RV int., ×110 (294).

Carinocythereis Ruggieri, 1956 [**Cytherina carinata* Roemer, 1838]. Like *Trachyleberis* but subrectangular, dorsal and ventral borders almost parallel; ornament of ridges, spines and reticulations; subcentral tubercle bladelike, duplicature with narrow but definite anterior and posterior vestibules; hinge holamphidont tending to hemiamphidont (posterior tooth variable). [As here interpreted, the genus includes *Cythere rugipunctata* Ulrich & Bassler, hitherto assigned to *Puriana* (=*Favella*).] *Eoc.-Rec.*, N.Am.-C.Am.-Eu.——Fig. 260,*3*. **C. carinata* (Roemer), Rec., Italy; *3a,b*, RV lat., int., ×80 (305).

Cativella Coryell & Fields, 1937 [**C. navis*] [=*Navecythere* Coryell & Fields, 1937]. Hinge holamphidont. Like *Costa* but smaller, tapering strongly toward rear, with acuminate posterior end; ridges high, sharply defined, perforate in type species. *Mio.*, N.Am.-C.Am.——Fig. 259,*3*. **C. navis*, Fla.; *3a*, LV lat.; *3b*, RV int.; ×80 (286).

Costa Neviani, 1928 [**Cytherina edwardsi* Roemer, 1838; SD Howe, 1955] [=*Rectotrachyleberis* Ruggieri, 1952]. Hinge holamphidont. Ornament dominated by 3 subparallel ridges, with median ridge slightly diagonal to length, sloping down gently toward anterior end and bent downward rather abruptly at posterior end. Adductor muscle scars 4, in vertical row; antennal scar V-shaped, opening upward. *Mio.-Rec.*, Eu.-Asia-Afr.-?N.Am.——Fig. 261,*5*. **C. edwardsi* (Roemer), Plio.-Pleist., Fr.-Italy; *5a,b*, RV lat., int., ×75 (*5a*, 301; *5b*, 42).

Cythereis Jones, 1849 [**Cytherina ciliata* Reuss, 1846 (=**Cytherina ornatissima* Reuss, 1846); SD Sutton & Williams, 1939]. Hinge paramphidont. Type-species has ornament of low reticulations, but as currently understood, genus includes all reticulate, costate and spinose members of family with paramphidont hinge and simple muscle scar (4 vertically arranged adductor impressions, with V-shaped antennal scar in front). *L. Cret.-U.Cret.*, cosmop.——Fig. 260,*2*. **C. ornatissima* (Reuss), U.Cret.(Turon.), Ger.; *2a*, ♂ LV lat., ×50; *2b,c*, ♀ RV lat., ×50, ♂ RV lat., ×60; *2d*, RV dors., ×50 (380).——Fig. 261,*1*. *C. senckenbergi* Triebel, L.Cret.(Hauteriv.), Ger.; RV int., ×50 (380).

Echinocythereis Puri, 1954 [**Cythereis garretti* Howe & McGuirt, 1935]. Like *Trachyleberis* but more inflated, with rounded rather than triangular posterior end; ornament of rounded spines superimposed on reticulations, concentrically arranged in many species; young molts may lack spines. Antennal muscle scar split into 2. *U.Cret.-Rec.*, cosmop.——Fig. 261,*3*. **E. garretti* (Howe & McGuirt), Mio., USA(Fla.); *3a,b*, LV lat., int.; *3c*, RV int.; all ×30 (178).

Henryhowella Puri, 1957 [**Cythere evax* Ulrich & Bassler, 1904] [*pro Howella* Puri, 1956 (*non* Ogilby, 1899)]. Like *Actinocythereis* but ridges not continuing into anterior half of carapace, where spines are more or less concentrically arranged. *Mio.*, N.Am.——Fig. 261,*4*. **H. evax* (Ulrich &

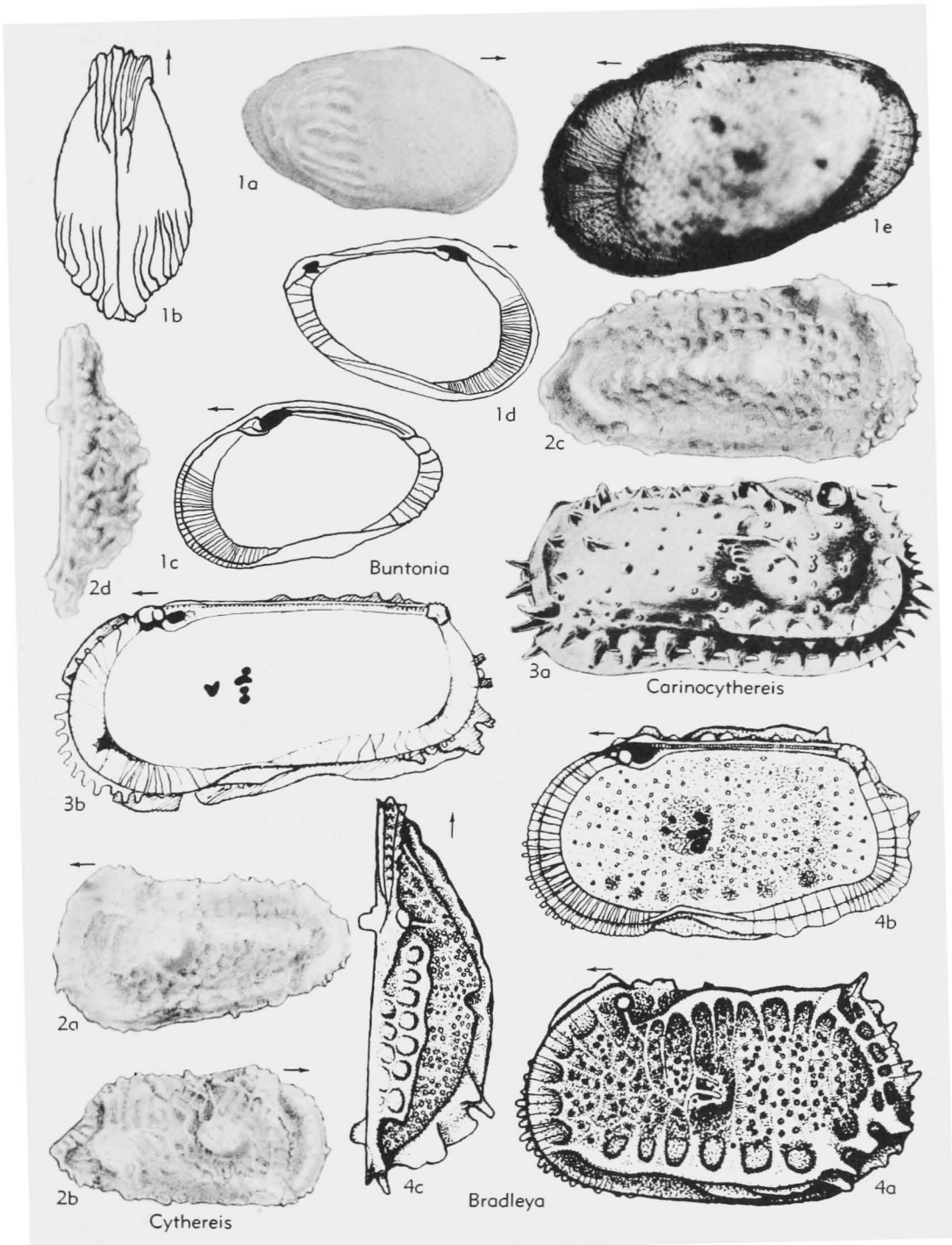


FIG. 260. Trachyleberididae (p. Q336).

Bassler), USA(Fla.); *4a,b,* LV lat., int., ×40 (290).

Hermanites Puri, 1955 [*pro Hermania* Puri, 1954 (*non* Monterosato, 1844)] [**Hermania reticulata* Puri, 1954]. Carapace subquadrate, reticulate, with pronounced subcentral tubercle, and dorsal and ventral ridges. Hinge holamphidont; antennal muscle scar single, crescentic. *Eoc.-Mio.,* N.Am.-Eu.——Fig. 261,*2*. **H. reticulatus* (Puri), *Mio.,* USA(Fla.); *2a,b,* RV lat., int.; *2c,* carapace vent.; all ×60 (288).

Hirsutocythere Howe, 1951 [**H. hornotina*]. Like

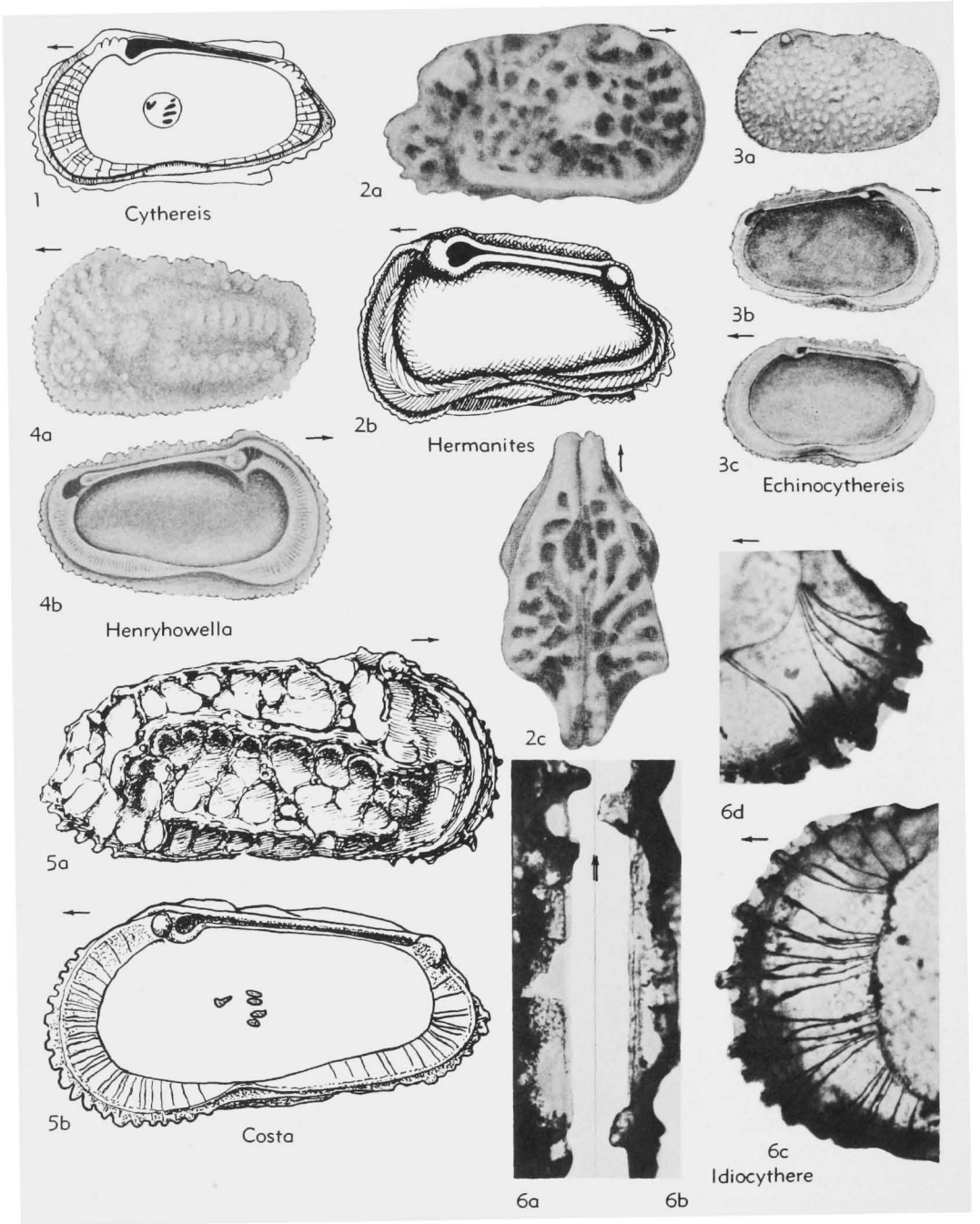


Fig. 261. Trachyleberididae (p. *Q336-Q339*).

Trachyleberis but spines more numerous, duplicature wider, and radial pore canals very numerous and very fine. Typically each marginal spine has 3 radial pore canals leading to it. *Eoc.-Mio.*, USA (Fla.).——Fig. 262,*6*. **H. hornotina*, Mio., USA (Fla.); LV int., ×60 (Howe, n).

Idiocythere Triebel, 1958 [**I. lutetiana*]. Hinge modified holamphidont, LV with additional strongly projecting conical-pessular tooth in front and above (dorsal to) socket for reception of anterior tooth of RV, with 2nd less strongly developed anterior tooth behind this socket, in usual position for amphidont dentition; hinge tubercles present on exterior of carapace, but eye tubercles not developed. Subcentral tubercle flat but readily discernible. *Eoc.*, Eu.——Figs. 261,*6*, 266,*3*. **I. lutetiana, Lutet.*, Fr.; 261,*6a,b*, LV, RV dors. showing hinge, ×100; 261,*6c,d*, RV int., ant. and post., ×160; 266,*3a-d*, carapace L, R, dors., vent., ×75 (380).

Isocythereis Triebel, 1940 [**I. fissicostis*]. Like *Cythereis* but hinge hemiamphidont, muscle scar much divided, duplicature wider, and radial pore canals sparser. *L.Cret.(Alb.)*, Ger.——Fig. 262, *4a-d*. **I. fissicostis; 4a,b*, carapace R, dors., ×120; *4c,d*, RV dors., int., ×100 (81).——Fig. 262,*4e*. *I. fortinodis* Triebel, Ger.; muscle scar of RV int., ×300 (81).

Leniocythere Howe, 1951 [**L. lebanonensis*]. Subrectangular, dorsal and ventral margins slightly sinuous; surface smooth or faintly reticulate about middle; eye tubercle and subcentral tubercle faint. Hinge holamphidont. *Eoc.*, N.Am.——Fig. 262,*1*. **L. lebanonensis;* Eoc., USA(Fla.); LV lat., ×30 (177).

Murrayina Puri, 1954 [**M. howei*]. Carapace elongate, reticulate, subrectangular, with well-marked ocular and subcentral tubercles and marginal rims but no longitudinal ridges. Hinge holamphidont. *Mio.*, N.Am.——Fig. 262,*3*. **M. howei, Mio.*, USA(Fla.); *3a,b*, RV lat., int.; *3c*, LV int.; all ×50 (*3a*, 287; *3b,c*, 177).

?**Normanicythere** Neale, 1959 [**Cythere leioderma* Norman, 1869]. Carapace like *Isocythereis* in general form. Hinge line straight, oblique to dorsal margin seen from side; inner margin and line of concrescence well separated anteriorly and at posteroventral angle; radial pore canals simple. *Pleist.* (incl. *Rec.*), NW.Atl.-NE.Atl.-Br.Is.——Fig. 263,*2*. **N. leioderma* (Norman), Rec., Spitzbergen *(2a,b)*, Shetland Is. *(2c,d)*; *2a,b*, ♀ LV int., dors., ×50; *2c,d*, ♂ RV int., dors., ×50 (261). [Moore.]

Occultocythereis Howe, 1951 [**O. delumbata*]. Hinge holamphidont; broad duplicature traversed by radial pore canals which midway along their length divide into 2 or more branches. *Eoc.*, N. Am.-Eu.——Fig. 267,*2*. **O. delumbata*, Eoc., USA(Fla.); *2a,b*, LV lat., int., ×50 (177).——Fig. 262,*2*. *O.* sp., Lutet., Fr.; *2a,b*, ♀ carapace R, vent. ×80; *2c*, ♂ carapace R, ×80; *2d*, RV int., anterior duplicature, ×200 (81).

Oligocythereis Sylvester-Bradley, 1948 [**Cythere fullonica* Jones & Sherborn, 1888]. Hinge entomodont. Ornament with prominent subcentral tubercle and well-marked dorsal, ventral, and anterodorsal ridges. *M.Jur.-U.Jur.*, Eu.——Fig. 264, *1*. **O. fullonica* (Jones & Sherborn), Eng.; *1a-c*, LV lat., int., dors., *1d-f*, RV lat., int., dors.; all ×80 (364).

Orionina Puri, 1954 [**Cythere vaughani* Ulrich & Bassler, 1904] [=*Jugosocythereis* Puri, 1957]. Reticulate, with sharp, straight median ridge sloping downward from posterodorsal complex and almost reaching anterior margin, posterior end with slight posteroventral extension. Hinge holamphidont. *Eoc.-Rec.*, cosmop.——Fig. 262,*5*. **O. vaughani* (Ulrich & Bassler), Mio., USA(Fla.); *5a,b*, RV lat., int.; *5c,d*, LV lat., int.; all ×50 (*5a,c*, 287; *5b,d*, 177).

?**Parexophthalmocythere** Oertli, 1959 [**P. rodewaldensis* Bartenstein & Brand, 1959]. In lateral aspect like *Cythereis*, although somewhat more extended with rather narrow, sharply triangular posterior extremity, front and rear margins strongly denticulate, with blunt to thorned ventral winglike process and bulge or strong tooth near dorsal margin; strong, protuberant eye tubercles; riblike bar of thorns along anterior margin between eye tubercle and uppermost tooth. Surface smooth or reticulate, sides only slightly inflated, very flat near anterior and posterior marginal zones; LV larger than RV in posterodorsal and ventral regions. Marginal zone very broad, proximal section of the inner shell lamella less strongly calcified; numerous threadlike radial pore canals (about 25 anterior); selvage strong; LV hinge with about 5 anterior and posterior small sockets, a median feebly notched bar on dorsal side of sockets (forms a continuation of the selvage); shallow accommodation groove. *L.Cret.(Valanginian-Hauteriv.)*, Eu.(Ger.-Fr.).——Fig. 264,*2*. **P. rodewaldensis*, Ger.; *2a,b*, LV lat., LV lat., ×58 (270). [Reyment.]

Phacorhabdotus Howe & Laurencich, 1958 [**P. texanus*]. Hinge holamphidont. Like *Costa* but less elongate, smoother, with ribs less well defined, subcentral tubercle wider, and wider duplicature. Eye tubercle present but indistinct. *U. Cret.*, N.Am.-Eu.——Fig. 264,*3*. **P. texanus*, Pecan Gap Chalk, USA(Tex.); *3a,b*, carapace L, dors.; *3c*, RV int.; all ×60 (34).

Platycythereis Triebel, 1940 [**Cythereis excavata* Chapman & Sherborn, 1893]. Hinge hemiamphidont. Sides flat, much compressed; subcentral tubercle bladelike, deflected backward. *L.Cret.-U. Cret.*, Eu.——Fig. 264,*6*. **P. excavata* (Chapman & Sherborn), U.Cret.(Turon.), Ger.; *6a,b*, cara-

pace R, dors., ×60; *6c,d,* RV int., dors., ×80 (81).

?**Protobuntonia** GREKOFF, 1954 [**P. numidica*]. Like *Buntonia* but posterior extremity pointed and anterior marginal pore canals straight, unbranched. *U.Cret.-Paleoc.,* Afr.(Tunisia-Algeria-Nigeria).——FIG. 265,*2a.* **P. numidica;* U.Cret.(Senon.), N.Afr. (Alg.); carapace L, ×65 (294).——FIG. 265,*2b-d.*

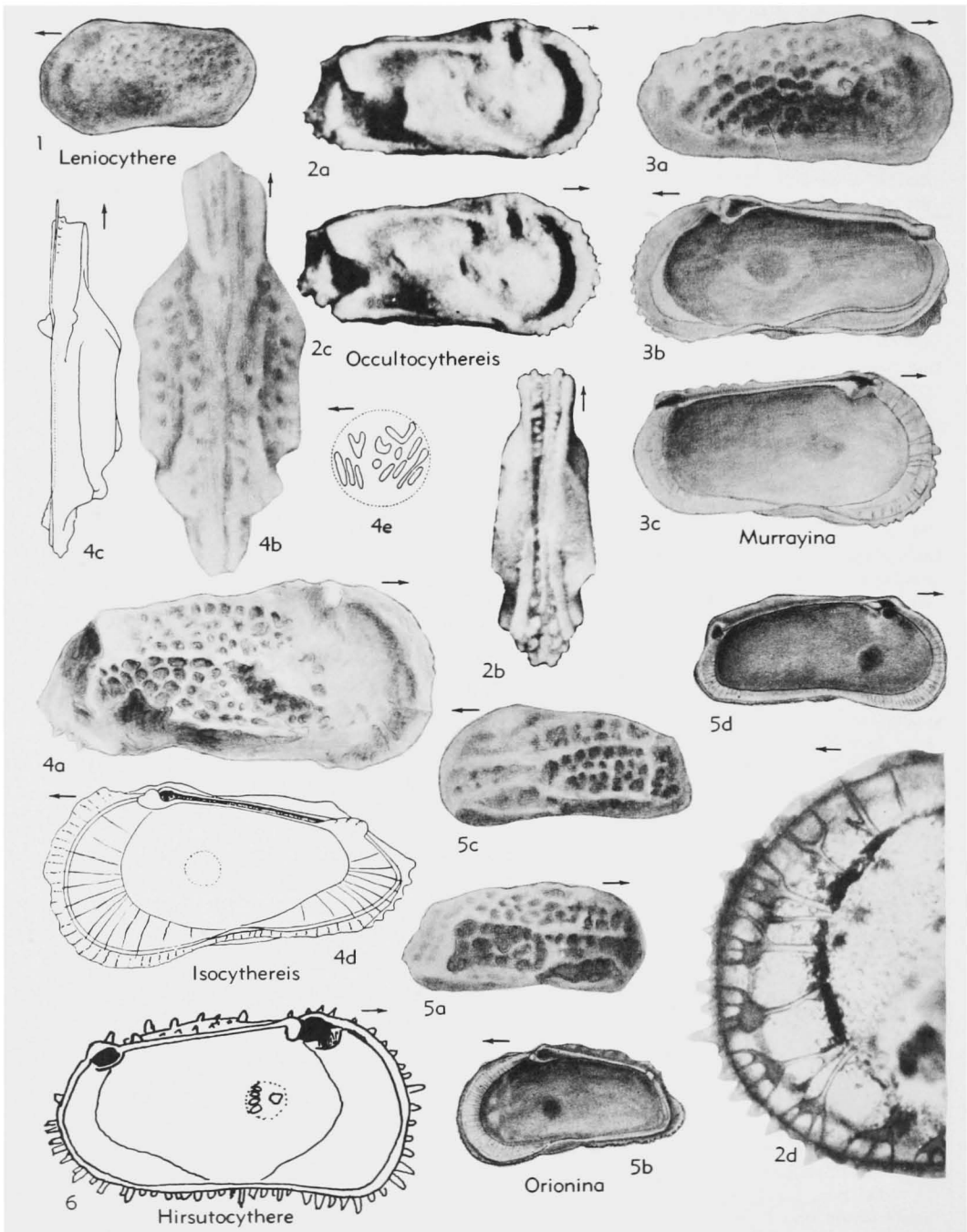


FIG. 262. Trachyleberididae (p. Q338-Q339).

P. ioruba REYMENT, Paleoc., W.Afr.(Nigeria); *2b*, RV lat., ×65; *2c,d*, RV int. (ant., post.), ×240 (294). [REYMENT.]

Puriana CORYELL & FIELDS, 1953 [*pro Favella* CORYELL & FIELDS, 1937 (*non* JORGENSEN, 1925)] [**Favella puella* CORYELL & FIELDS, 1937]. Hinge (according to original description) modified lophodont, with denticulate median element and entire terminal elements. Ornament of ridges and blades dominated by subcentral tubercle. [Genus has usually been interpreted by reference to *Cythere rugipunctata* ULRICH & BASSLER, which differs markedly in hinge and ornament from *P. puella* and is here referred to *Carinocythereis*. Perhaps *P. puella* is based on immature molts and the genus should be in same category as *Archicythereis*.] *Mio.*, C.Am.-N.Am.——FIG. 266,*1*. **P. puella* (CORYELL & FIELDS), Panama; *1a-c*, RV lat., int., dors., ×67 (126).

Quadracythere HORNIBROOK, 1952 [**Cythere truncula* BRADY, 1898]. Like *Bradleya* but even shorter and with distinct caudal process. *Eoc.-Rec.*, cosmop.——FIG. 267,*1*. **Q. truncula* (BRADY), Rec., N.Z.; *1a*, LV lat.; *1b,c*, RV int., dors.; all ×50 (32).——FIG. 264,*5*. *Q. vermiculata* (BOSQUET), Eoc.(Lutet.), Fr.; *5a,b*, carapace R, RV int., ×50 (42).

?Spongicythere HOWE, 1951 [**S. spissa*]. Hinge holamphidont, carapace inflated, with wide, sinuous anterior duplicature. Ornament of high, spongy reticulations; subcentral tubercle absent or obscure. *Eoc.Oligo.*, N.Am.——FIG. 264,*4*. **S. spissa*, Eoc., USA(Fla.); *4a,b*, LV lat., int., ×40 (177).

?Trachycythere TRIEBEL & KLINGLER, 1959 [**T. tubulosa*]. Carapace of medium size, irregularly quadrangular, LV slightly larger than RV, overhanging only at dorsal ends, front broadly rounded, rear narrowly rounded, greatest height near anterior end, ventral margin weakly convex; distinct eye spot and internal eye socket. Surface reticulate and warty, each wart with coarse sieve-type pore canals. Zone of concrescence fairly broad, inner margin and line of concrescence coincident; radial pore canals rather few, unbranched; both valves with thin bladelike outer list; RV hinge with terminal dentate ridges and fine, crenulate median furrow. *L.Jur.-M.Jur.*, Eu.——FIG. 265,*1*. **T. tubulosa*, Ger.; *1a,b*, RV lat., RV (transmitted light) showing radial pore canals, ×70; *1c*, LV lat., ×70; *1d,e*, carapace dors., vent., ×70; *1f,g*, LV int., RV int., showing hinge, ×165; *1h,i*, RV ant. (int.), RV post. (ext.) showing radial pore canals, ×220; *1j*, two warts, showing sieve-type pore canals, ×450 (382). [REYMENT.]

Trachyleberidea BOWEN, 1953 [**Cythereis prestwichiana* JONES & SHERBORN, 1887]. Like *Costa* but posterior tooth of hinge tending to be lobate (hemiamphidont), antennal muscle scar broken into 2, and median ridge of ornament discontinu-

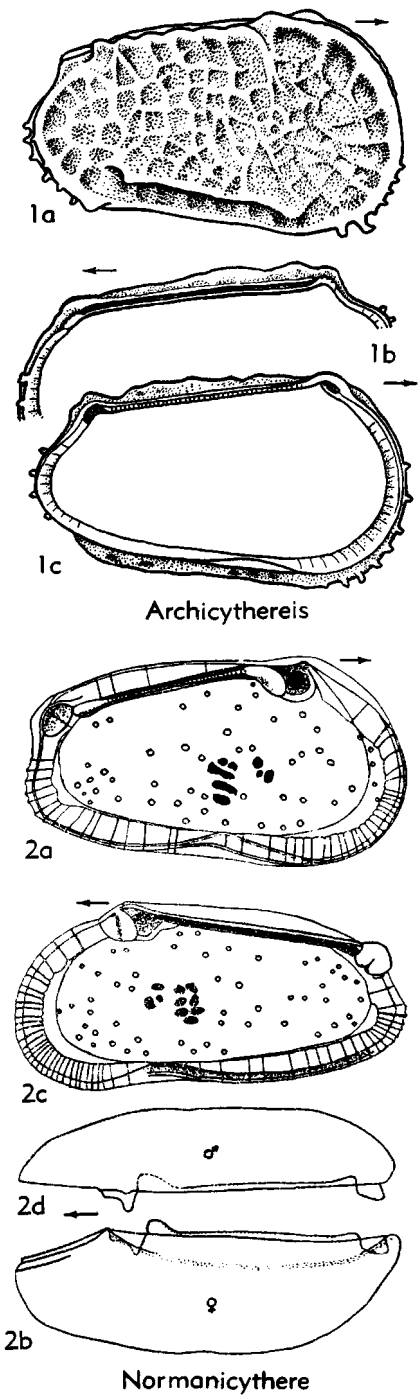


FIG. 263. Trachyleberididae (p. Q336-Q339).

ous, dominated by subcentral tubercle, not bent at posterior end. *Paleoc.-Oligo.*, Eu.-N.Am.—— FIG. 267,*4a*. **T. prestwichiana* (JONES & SHERBORN), Eoc.(Ypres.), Belg.; RV lat., ×75 (42).

——FIGS. 266,*2*, 267,*4b*. *T. aranea* (JONES & SHERBORN), Eoc.(Ypres.), Belg.; 266,*2*, LV lat., ×67; 267,*4b*, RV int., ×75 (42).

Veenia BUTLER & JONES, 1957 [**Cythereis ozanana*

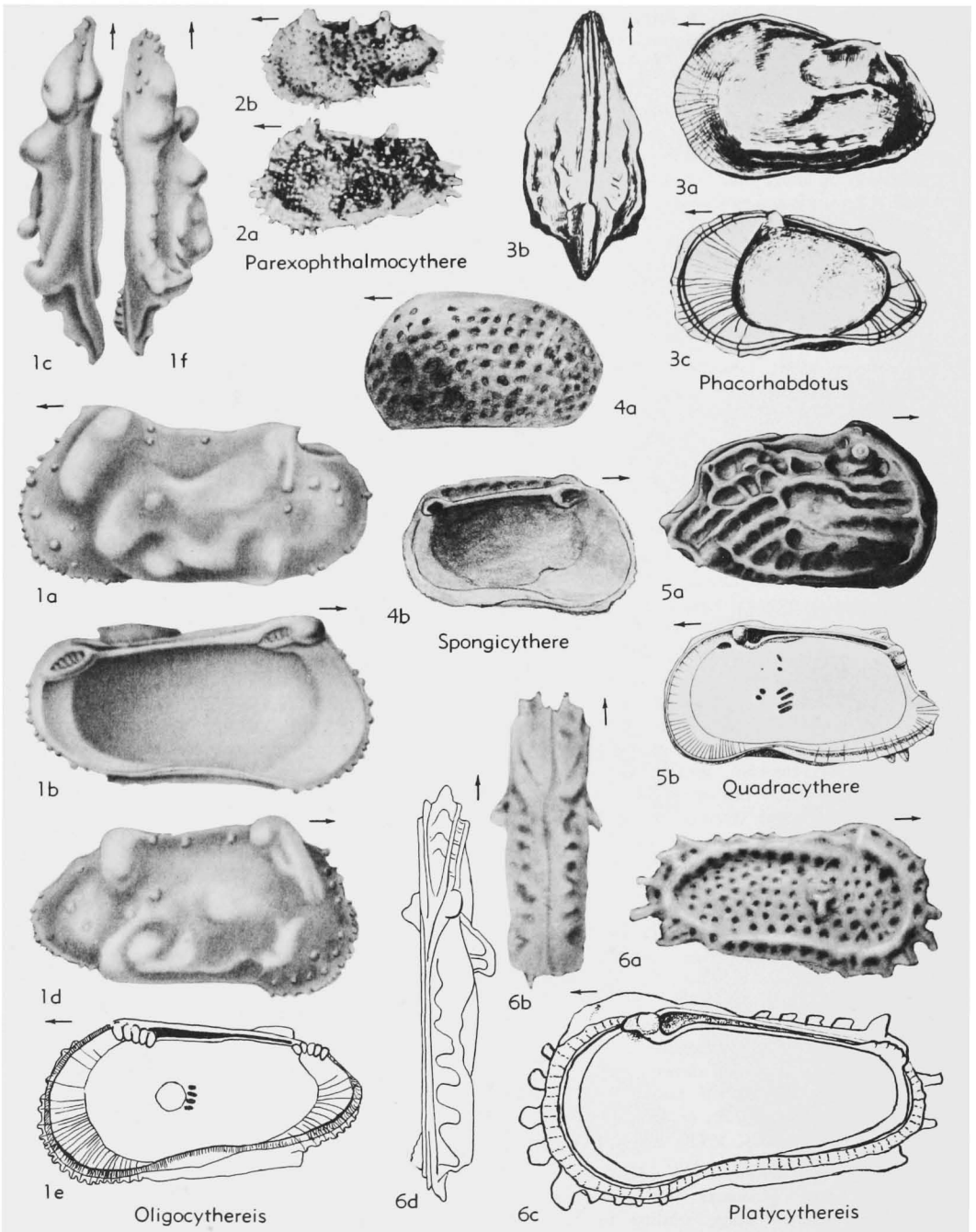


FIG. 264. Trachyleberididae (p. Q339-Q341).

ISRAELSKY, 1929]. Hinge holamphidont. Like *Costa* but ribs less well defined, median ridge straight or slightly curved, convex upward; externally may resemble *Protocythere*. Fairly strong sexual dimorphism. *U.Cret.-Paleoc.*, Eu.-N.Am. ——FIG. 267,*3a*. **V. ozanana* (ISRAELSKY), Ozan(Campan.), USA(Ark.); carapace R, ×50 (89).——FIG. 267,*3b,c*. *V. parallelopora* (ALEXANDER), Navarro(Maastricht.), USA(Tex.);*3b,c*, carapace R, LV int., ×50 (*3a*, 89; *3b,c*, 34).

Family XESTOLEBERIDIDAE Sars, 1928

[*nom. transl. et correct.* HOWE, herein (*ex* Xestoleberinae SARS, 1928)]

Shell stout; with smooth or pitted surface. Characteristically with reniform or arcuate scar below and behind eye region on inside of valves; hingement adont or merodont; adductor muscle scars in vertical row of 4, with more or less arcuate antennal scar in front of upper part of row and may have 2 mandibular scars below and in front of row, marginal areas broad, with vestibule in front; radial canals short. [Habitat marine.] *Cret.-Rec.*

Xestoleberis SARS, 1866 [**Cythere aurantia* BAIRD, 1838; SD BRADY & NORMAN, 1889]. Carapace ovate, LV larger than RV. Hinge merodont, with elongate crenulate terminal cusps in RV, separated by somewhat curved to nearly straight, finely crenulate to smooth furrow; marginal areas narrow except in front where vestibule is present; radial canals short, straight; adductor scars in vertical row of 4, with arrowhead-shaped antennal scar in front and 2 mandibular scars below in front, crescent-shaped scar above this group in eye region. *Cret.-Rec.*, cosmop.——FIG. 268,*4*. **X.*

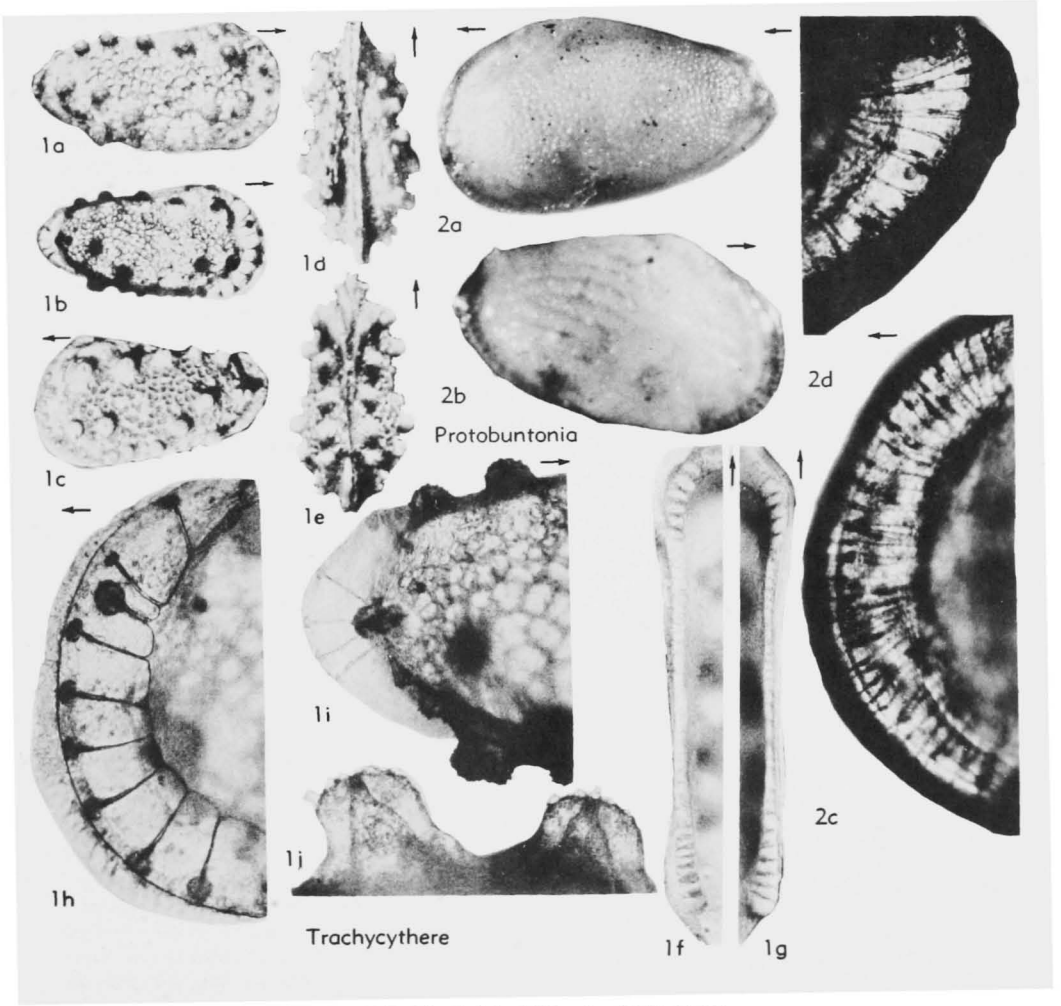


FIG. 265. Trachyleberididae (p. Q340-Q341).

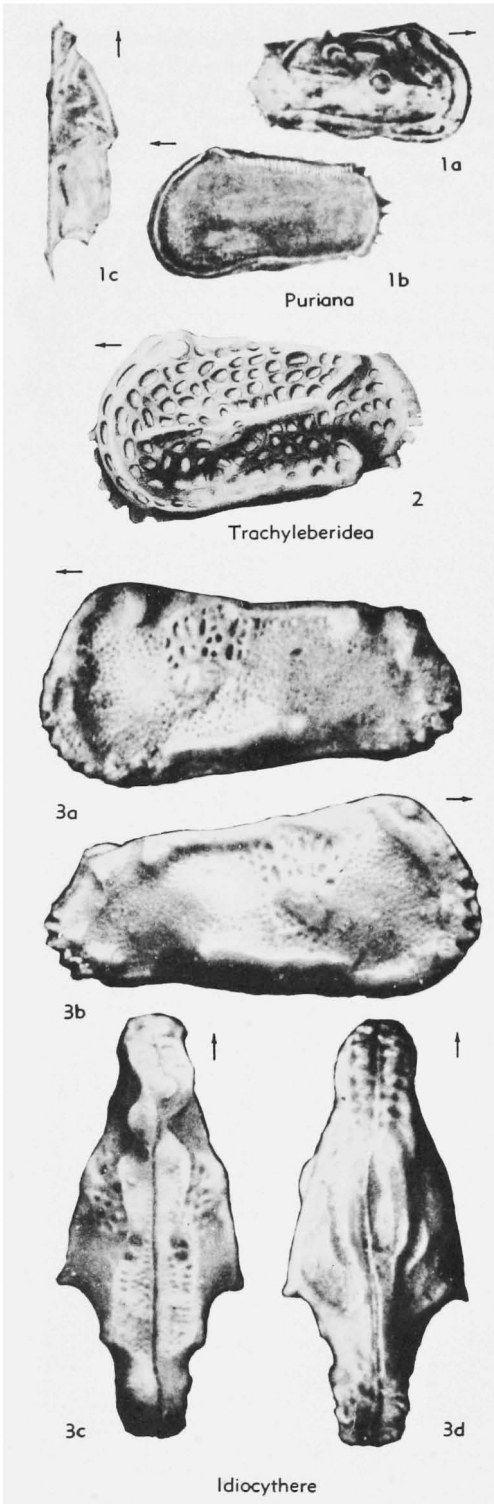


FIG. 266. Trachyleberididae (p. Q339-Q343).

aurantia (BAIRD), Rec.; *4a,b,* ♀ carapace R, dors. (Norway), ×100 (65); *4c,* LV and RV dors. (Baja California), ×100 (Sylvester-Bradley, n); *4d,* LV int. (NE.Atl.), ×145 (88, by permission of Mouton & Co., The Hague).——FIG. 269, *1. X. subglobosa* (BOSQUET), Eoc.(Lutet.), Fr. (Paris Basin); *1a-c,* LV lat., int., dors., ×75 (42).

Linocheles BRADY, 1907 [**L. vagans*]. Like *Xestoleberis* but distinguished from all Cytheracea in its greatly elongated threadlike 3rd pair of legs. *Rec.,* Antarct.——FIG. 268,*2. *L. vagans; 2a,b,* carapace L, dors., ×70; *2c,* 3rd leg, ×120 (110).

Microxestoleberis G.W.MÜLLER, 1894 [**M. nana*]. Small, elongate, with projection at posteroventral corner, venter flattened. Hinge adont; reniform muscle scar below eye region, as in *Xestoleberis. Eoc.-Rec.,* Eu.——FIG. 268,*1. *M. nana,* Rec., Medit.; *1a-c,* carapace L, dors., vent., ×130 (53).

Uroleberis TRIEBEL, 1958 [**Eocytheropteron parnensis* APOSTOLESCU, 1955]. Carapace short and high, with strongly arched dorsal outline; posterior end drawn out into caudal process; ventral region very plump; surface smooth or pitted. Shallow eye pits on inside but not external eye tubercles. Hinge of LV with elongate crenulate sockets separated by smooth middle bar above which lies an accommodation groove; marginal area distinct, with anterior vestibule, and straight radial canals; muscle scars in nearly vertical row of 4 with V-shaped antennal scar in front and 2 mandibular scars lower. *Eoc.-Rec.*——FIGS. 268,*3,* 269,*2. *U. parnensis* (APOSTOLESCU), Eoc.(Lutet.), Fr.; 268,*3,* ♀ LV int. eye spot with reniform scar below and behind it, ×165 (380); 269,*2a,* RV int., ×90 (42); 269,*2b-d,* ♀ carapace L, R, dors., ×80; 269,*2e,* RV int. showing eye spot and reniform scar, ×175; 269,*2f,g,* ♀ RV and LV hinge, int., ×225; 269,*2h,* ♀ LV int. ant., ×355 (269, *2b-h;* 380). [HOWE-REYMENT.]

Family UNCERTAIN

[Includes Speluncellinae, Glorianellinae SCHNEIDER, 1960; Timiriaseviinae, Palaeocytherideinae, Palaeocytherideides, Faluniinae, Mediocytherideisinae (*recte* Mediocytherideidinae) MANDELSTAM, 1960]

Absonocytheropteron PURI, 1957 [**A. carinata*]. Medium in size, with shape like that of *Eucytherura,* oblong, anterior end rounded broadly, posterior compressed, triangular; dorsal and ventral margins slightly concave; valves strongly alate, type species with vertical ribbing, flattened venter tending to be reticulate; eye spot and muscle node present. Hinge amphidont; muscle pattern arranged in a concentric pattern of 4 dorsal scars, 6 ventral scars and single posterior scar; anterior pore canals single, few, straight. *U.Eoc.,* N.Am.——FIG. 270,*1. **A. carinatum,* USA(Fla.-Miss.); *1a-c,* carapace L, dors., vent.; *1d,e,* RV lat., RV int.; all ×50 (290). [HOWE.]

Aspidoconcha DE VOS, 1953 [**A. limnoriae*]. Carapace with very peculiar shield shape; dorsally arched, laterally inflated, and ventrally flattened. Hingement adont; marginal areas narrow, with short straight canals; other shell features not described. [Commensal on *Limnoria* washed ashore on coast of Holland.] *Rec.*, North Sea.——FIG. 271,*1*. **A. limnoriae; 1a,* carapaces on abdomen of *Limnoria,* ×48; *1b-e,* "lat.", dors., vent., ×68; *1f,* surface sculpture, ×375 (all 398). [HOWE.]

Atjehella KINGMA, 1948 [**A. semiplicata*]. Elongate ovate, thickest near posterior margin, which appears truncate from side; surface with longitudinal ribbing in rear half. Marginal area very broad around anterior end and venter; radial canals long, few, branching. RV hinge with elongate, notched, terminal teeth, separated by narrow, finely crenulate groove; muscle scars with several small spots near center. *Neog.*, E.Indies(Java-Sumatra).——FIG. 270,*2*. **A. semiplicata; 2a,b,* LV lat., int.; *2c,* carapace dors.; *2d,* RV hinge, ×50 (46). [HOWE.]

Bronsteiniana MANDELSTAM, 1956 [**B. galba*]. Oval, smooth, LV larger than RV, greatly inflated posteriorly, both ends well rounded, mid-point of front margin slightly lower than that of rear; dorsal margin convex, ventral margin slightly convex to straight. Internal margin not coincident with line of concrescence, shallow anterior vestibule present; marginal pore canals distinct; muscle field typical of cytherids. *U.Cret.(Cenom.)-Paleoc.*, C.Asia(USSR).——FIG. 271,*3*. **B. galba,* U.Cret.(Cenom.); *3a,b,* carapace R, dors., ×57 (50). [REYMENT.]

Climacoidea PURI, 1956 [**C. pleurata*]. Carapace laterally subrectangular, with raised ridges roughly parallel to margins; area between ridges crossed by smaller transverse ridges; anterior broadly and obliquely rounded, posterior narrower but rounded. Hinge holamphidont, with well-developed ocular sinus in front of hingement, leading to small external eye tubercles; marginal area broad in front, with widely spaced radial canals; muscle scars in vertical row of adductors with 2 antennal and 2 mandibular scars in front. *Plio.* (or *Pleist.*), N.Am. ——FIG. 270,*6*. **C. pleurata,* USA(Fla.); *6a,b,* LV lat., RV lat., ×50 (289). [HOWE.]

Cytheralison HORNIBROOK, 1952 [**C. java*]. Large, subquadrate, valves subequal, strongly inflated, some with spines or ridges; anterior margin bearing flange, posterior with blunt caudal process, upper margin of which in LV strongly overlaps that of RV, both processes being convex laterally so as to form caudal chamber with posterior opening. Selvage prominent, isolating caudal chamber when valves are shut; shell thick, built of honeycomb lattice forming hexagonal cells, commonly with slitlike openings; muscle-scar pattern consisting of vertical group of large alternately

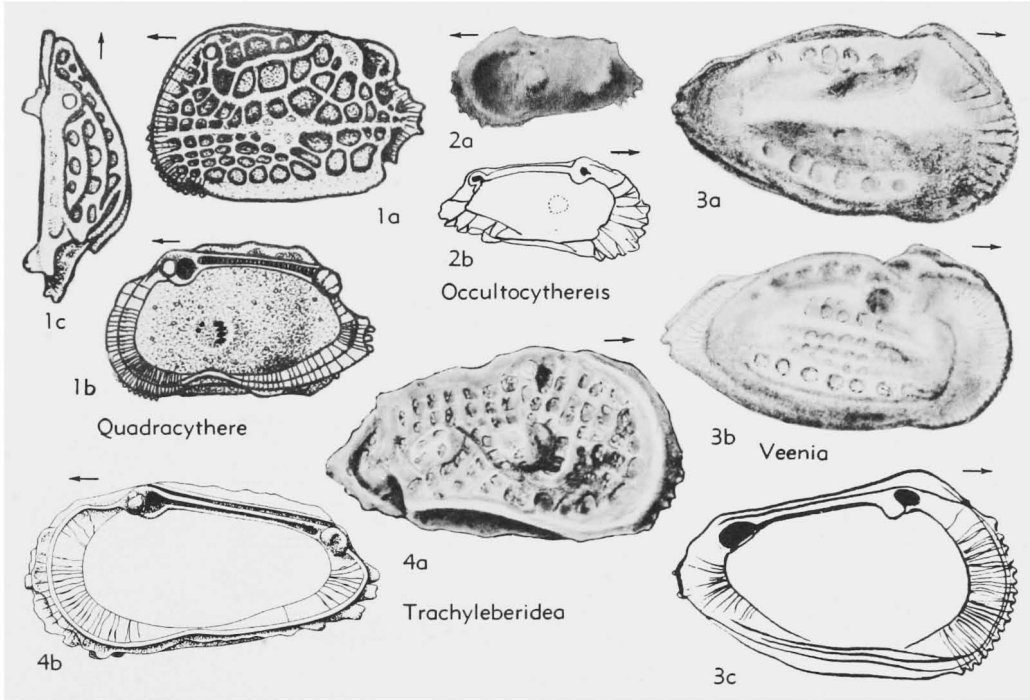


FIG. 267. Trachyleberididae (p. Q339-Q343).

placed spots, with 2 isolated spots above and in front, adductor muscle group marked externally by deep, elliptical, open chamber; LV hinge with straight simple bar between 2 terminal sockets; marginal pore canals fine and simple; line of concrescence coinciding with inner margin. *Eoc.-Rec.*, N.Z.-Austral.——Fig. 271,*2a-d*. **C. fava*, Rec., N.Z.; *2a-c*, LV (holotype) lat., dors., int.;

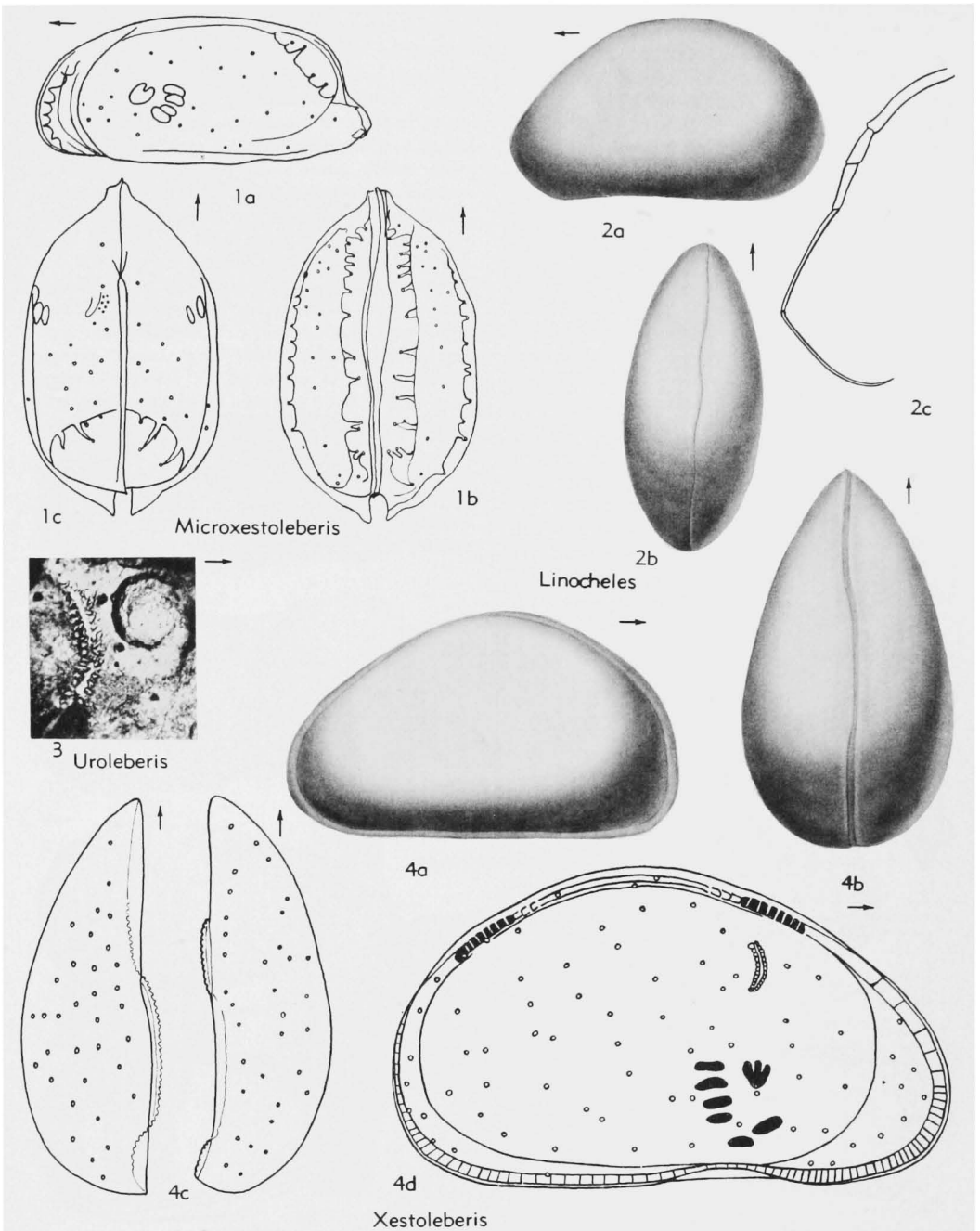


Fig. 268. Xestoleberididae (p. Q343-Q344).

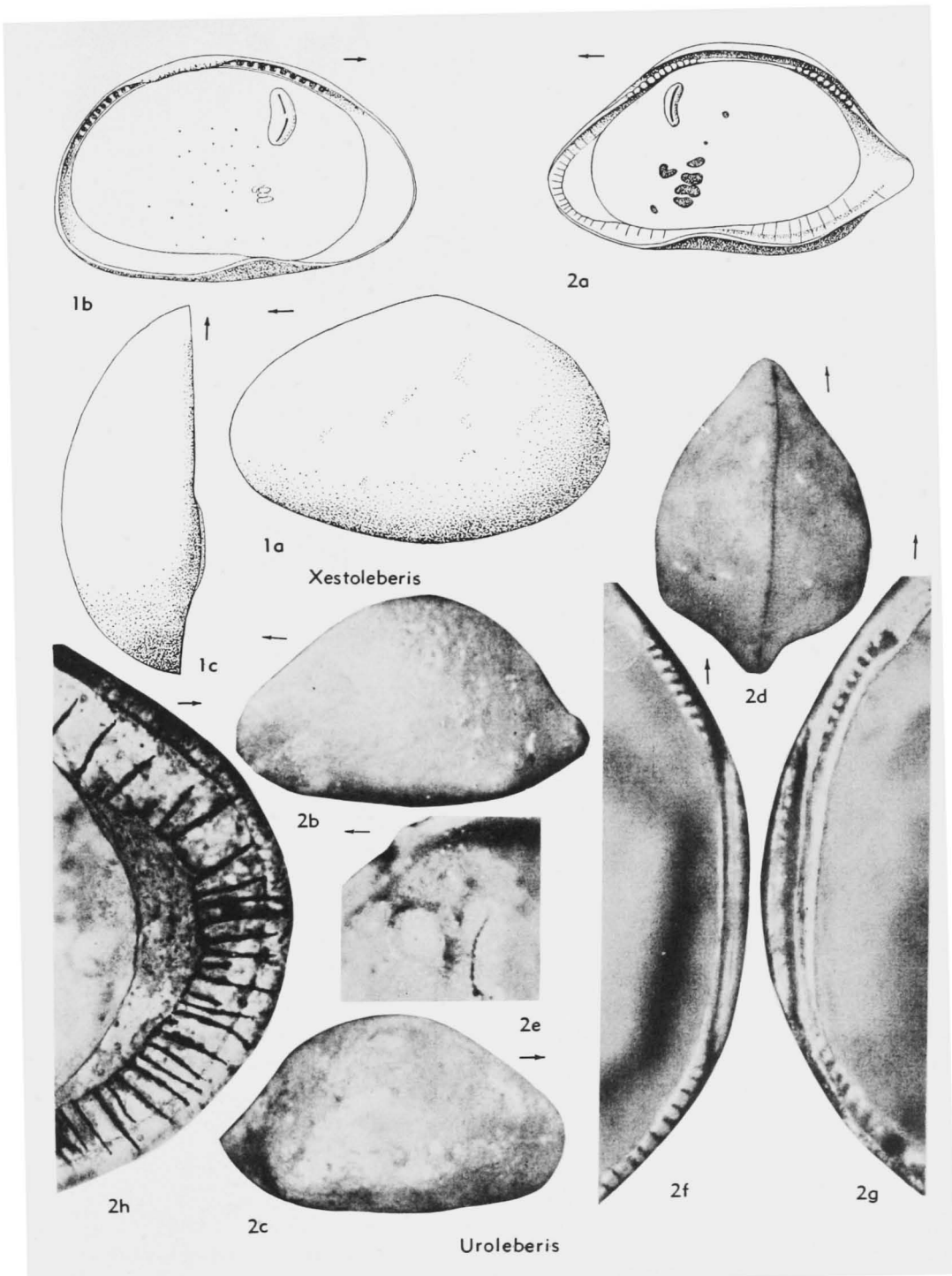


FIG. 269. Xestoleberididae (p. Q343-Q344).

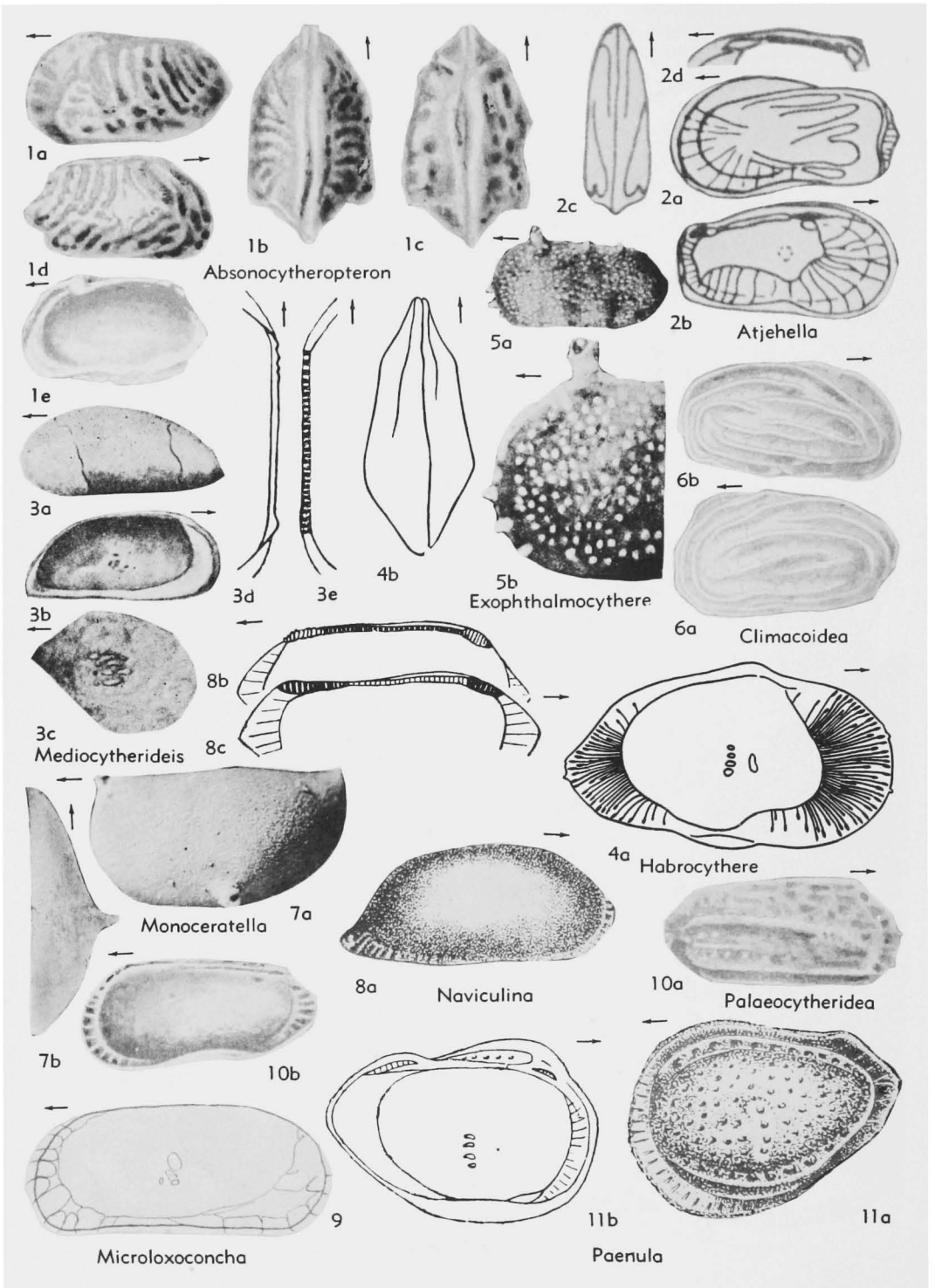


FIG. 270. Family Uncertain (p. Q344-Q353).

2d, carapace (paratype) post.; all ×50 (32).—— FIG. 271,*2e-g*. *C. parvacauda* HORNIBROOK, Rec., N.Z.; *2e-g*, LV lat., dors., int., ×50 (32). [REYMENT.]

Emphasia MANDELSTAM, 1956 [**E. ceratophaga*]. Inequivalved, slightly inflated, LV much larger than RV, each valve with 1 or 2 tubercles (including possible adductor muscle tubercle) and strong, winglike ventrolateral rib; anterior margin rounded, with mid-point lower than that of also rounded posterior margin, dorsal margin of LV strongly arched but that of RV almost straight;

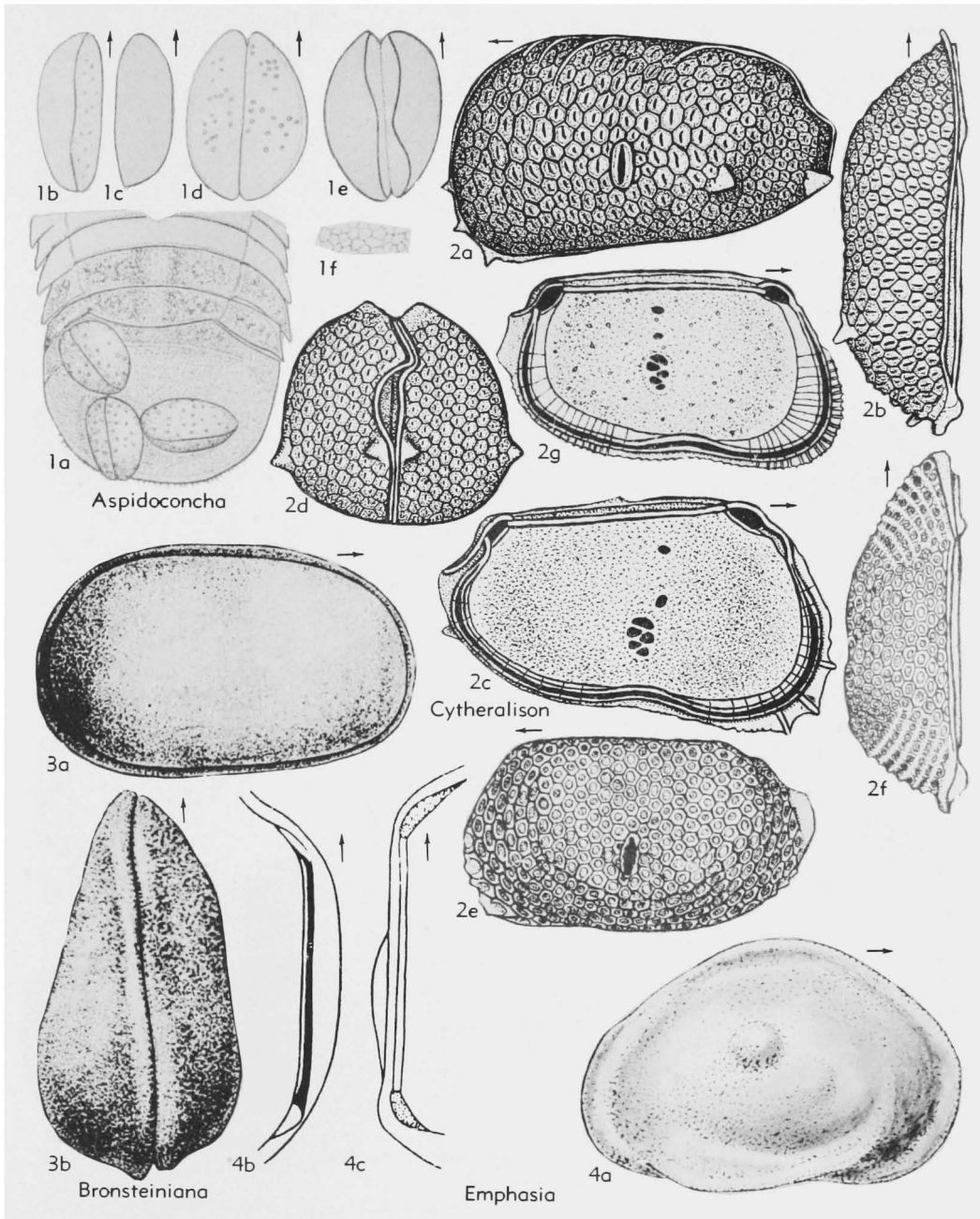


FIG. 271. Family Uncertain (p. Q345-Q350).

surface ornamented with minute pits and tubercles. Internal margin and line of concrescence anteriorly not coincident, making small vestibule; LV hinge with elongated terminal sockets and broad median bar, that of RV complementary, with platelike terminal teeth; muscle field typical of Cytheridae. *M.Jur.*, SW.Asia(USSR).——Fig. 271,*4*. **E. ceratophaga*, Kazakhstan; *4a*, carapace R, ×65; *4b,c*, RV int., LV int. showing hinge, ×43 (50). [Reyment-Bold.]

Exophthalmocythere Triebel, 1938 [**E. mamillata*]. Differs from other known cytherids in having well-developed eye stalks at anterodorsal angle of subrectangular carapace, which has evenly rounded anterior end somewhat wider than posterior extremity; ornament of small pits, tubercles and spines. Zone of concrescence broad, with few simple pore canals, line of concrescence and inner margin coincident, RV hinge with anterior and posterior teeth (latter notched in some forms) and median furrow with shallow anterior socket behind anterior tooth. *U.Jur.-L.Cret.*, Eu.——Fig. 270,*5*. **E. mamillata*, U.Jur., Ger.; *5a*, carapace L, ×30; *5b*, same, ant. part showing prominent eye stalk, ×60 (80). [Reyment.]

Falunia Grekoff & Moyes, 1955 [**F. girondica*]. Based on young molts with only partially developed hinge and lacking properly developed marginal areas and radial canals. *Mio.*, Eu.——Fig. 272,*2*. **F. girondica*, Fr.; *2a*, LV lat., ×?; *2b*, RV int., ×? (153). [Howe.]

Gemmanella Schneider, 1956 [**G. schweyeri*]. Oval, thin-walled, somewhat inflated in dorsal aspect, LV distinctly overlapping RV all around, dorsal margin straight in middle but curving evenly to join broadly rounded anterior and posterior margins, latter tending to be obtusely angular, ventral margin concave in anterior half, convex in posterior half; surface irregularly pitted, with short broad rib extending toward middle from posterior margin and few feeble ventral riblets, LV less strongly ornamented than RV. Hinge

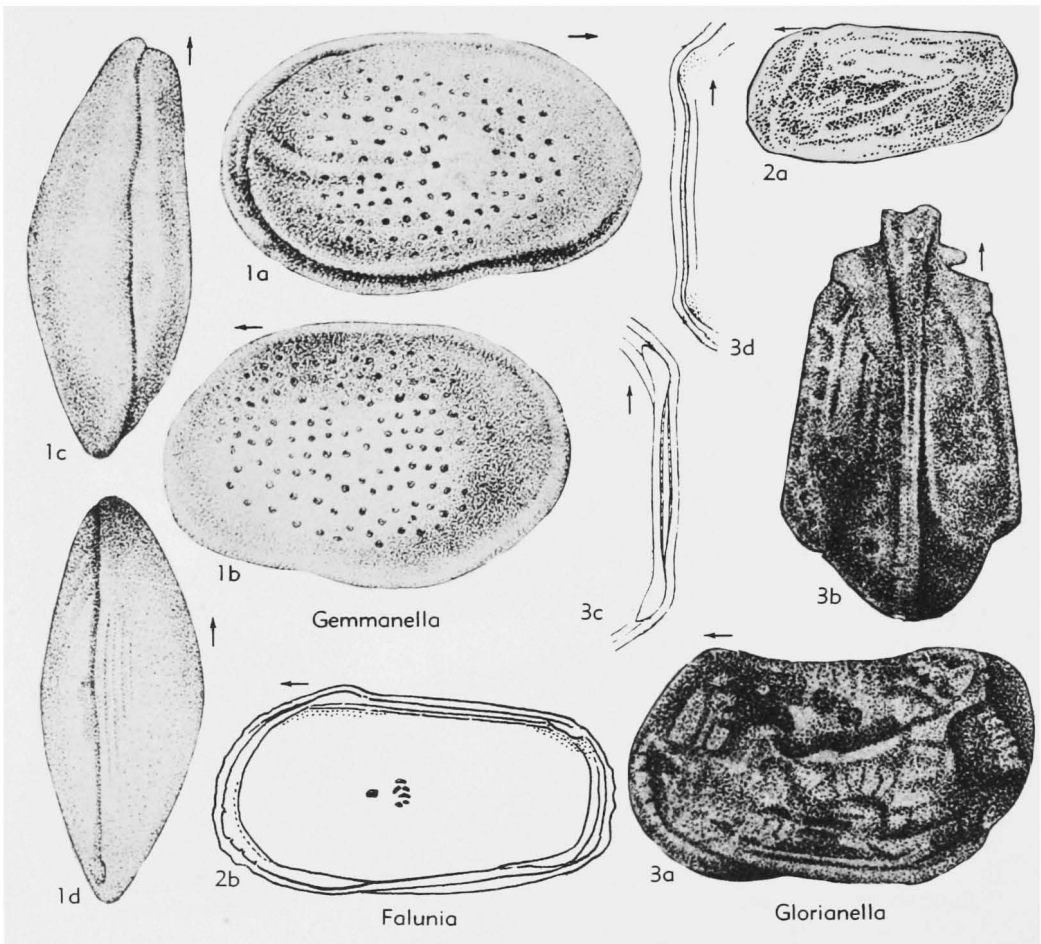


Fig. 272. Family Uncertain (p. Q350-Q351).

simple; LV with groove to accommodate sharp hinge margin of RV. [Marine.] *L.Trias.*, SE.Eu. ——FIG. 272,*1*. **G. schweyeri*, USSR(Emba Region); *1a-d*, carapace R, L, dors., vent., ×64 (50). [BOLD-REYMENT.]

Glorianella SCHNEIDER, 1956 [**G. efforta*]. Small to medium-sized oblong valves differently inflated (LV commonly larger than RV), length twice height, dorsal margin straight or weakly concave, anterior margin rounded, posterior margin blunt and obliquely truncate; surface ornamented with ribs, tubercles and pits. RV hinge with elongated terminal teeth separated by median furrow; muscle pattern of cytherid type. [Nonmarine.] *L.Trias.*, SE.Eu.——FIG. 272,*3*. **G. efforta*, USSR(Emba Region); *3a,b*, carapace L, dors.; *3c,d*, RV and LV hinge; all ×64 (50). [BOLD-REYMENT.]

Habrocythere TRIEBEL, 1940 [**H. fragilis*]. Small, egg-shaped, smooth; toothless. Marginal areas broad, with long radial pore canals; line of concrescence S-shaped; muscle scars in vertical row of 4 with one in front of middle of row. *L.Cret.*, Ger.——FIG. 270,*4*. **H. fragilis; 4a,b*, LV int., carapace dors., ×90 (81). [HOWE.]

Hemicytheridea KINGMA, 1948 [**H. reticulata*]. Medium in size, thick-shelled, valves subequal but RV higher than LV; surface reticulate. Marginal area moderately narrow; line of concrescence leaving inner margin at ends; radial pore canals straight, simple; RV hinge with crenulate anterior socket, serrate median groove and heavy crenulate, triangular posterior tooth. Dimorphism pronounced. *Neog.*, E.Indies(Sumatra-Java).——FIG. 273,*1*. **H. reticulata; 1a,b*, carapace R, dors.; *1c,d*, RV int., LV int.; *1e,g*, LV and RV hinge; all ×50 (46). [HOWE.]

Hemikrithe VAN DEN BOLD, 1950 [**H. occidentalis*]. Elongate ovate, with broadly rounded anterior margin and narrowed at rear which is incised somewhat as in *Krithe;* surface reticulate. RV hinge with elongate faintly notched terminal teeth and crenulate groove between; marginal areas very broad in front, with few long branching radial canals; muscle scars numerous, small, in 2 oblique rows of 4, with additional small spots. *Rec.*, E. Indies(Sumatra).——FIG. 273,*3*. **H. occidentalis; 3a-c*, LV lat., RV int., carapace dors., ×50 (100). [HOWE.]

Juvenix KUZNETSOVA in MANDELSTAM *et al.*, 1957 [**J. pseudocuspidatus*]. Carapace elongate-ovate, with small transverse sulcus and in some shells a ventral ridge; LV overlapping RV; anterior end higher than posterior; hinge in LV consisting of terminal crenulate sockets (divided into 4), median crenulate bar, crenulations stronger toward anterior end; anterior socket larger than posterior. Radial pore canals widely spaced. *L.Cret.(Barrem.)*, SE.Eu.(Caucasus)-SW.Asia(Caspian-Azerbaidjan).——FIG. 273,*5*. **J. pseudocuspidatus*, Azerbaidjan; *5a,b*, RV lat., dors.; *5c*, RV int.; all ×50 (238a). [BOLD.]

Laocoonella DEVOS & STOCK, 1956 [*pro Laocoon* DEVOS, 1953 (*non* NIERSTRASZ & ENTZ, 1922)] [**Laocoon commensalis* DEVOS, 1953]. Carapace small, inflated, greatest thickness behind middle, length more than twice height, ovate in dorsal or lateral view, though venter somewhat flattened; eyes confluent. Surface minutely concentrically reticulate. Marginal areas rather broad, with straight radial canals; muscle scars not known. [Commensal on *Limnoria*, Curaçao.] *Rec.*, W. Indies.——FIG. 273,*2*. **L. commensalis* (DEVOS); *2a*, carapace dors., ×82; *2b*, surface sculpture, enlarged (398).

Mandelstamia LYUBIMOVA, 1955 [**M. facilis*]. [Recorded as new genus by LYUBIMOVA in 1956, but actually already published elsewhere in March, 1955.] Elongate oval in side view, somewhat preplete, dorsal margin straight, anterior and posterior margins broadly rounded, ventral margin with middle concave zone; LV larger than RV; feeble sulcus in dorsal half just in front of mid-point; surface pitted, with or without small tubercles. Muscle field with posterior vertical row of 4 scars and 2 scars in front; anterior zone of concrescence broad, posterior zone narrow, line of concrescence not coincident with inner margin; marginal pore canals straight, widely separated; RV hinge with terminal teeth and median furrow. *U.Jur.*, Eu.(Ger. - USSR) - SW.Asia(Kazakhstan). ——FIG. 273,*11*. **M. facilis*, USSR(Lower Volga); *11a,b*, RV lat., vent., ×94; *11c,d*, RV int., LV int., ×130 (50). [REYMENT.]

Marslatourella MALZ, 1959 [**M. exposita*]. Valves subequal, roughly trapezoidal in side view, ventral area with or without blunt winglike developments; surface smooth. RV hinge with terminal notched teeth united by narrow, shallow notched furrow; inner margin coinciding with line of concrescence, zone of concrescence rather broad; eye tubercles strong, somewhat resembling those of *Exophthalmocythere;* muscle field unknown. *M.Jur.*, Fr. ——FIG. 273,*4*. **M. exposita; 4a-d*, carapace (holotype) R, L, dors., post.; *4e,f*, RV and LV hinge; all ×80 (236). [REYMENT.]

?**Mediocytherideis** MANDELSTAM, 1956 [**Cytheridea apatoica* SCHWEYER, 1949]. Elongate, low in relation to length, anterior margin well rounded, posterior pointed below mid-point; dorsal margin broadly and evenly arched, ventral margin straight to faintly concave; surface with small rounded pits, tubercles, or thin ribs arranged concentrically especially in anterior and ventral regions. Zone of concrescence moderately broad, with branched radial pore canals, vestibule broadest in anterior part; LV hinge with narrow notched anterior furrow, smooth central furrow and posterior rounded impression. [Muscle-scar pattern and some other

features suggest that this genus may be cypridacean, rather than cytheracean, as classed by MANDELSTAM.] Sexual dimorphism strong, inferred females posteriorly swollen. *Mio.-Plio.,* USSR(Caucasus-Volga Region).——FIG. 270,*3*. **M. apatoica* (SCHWEYER); Plio., Caspian Region; *3a,b,* LV lat., int., ×40; *3c,* RV muscle pattern, ×100; *3d,e,* RV and LV hinge, ×70 (50). [REYMENT-BOLD.]

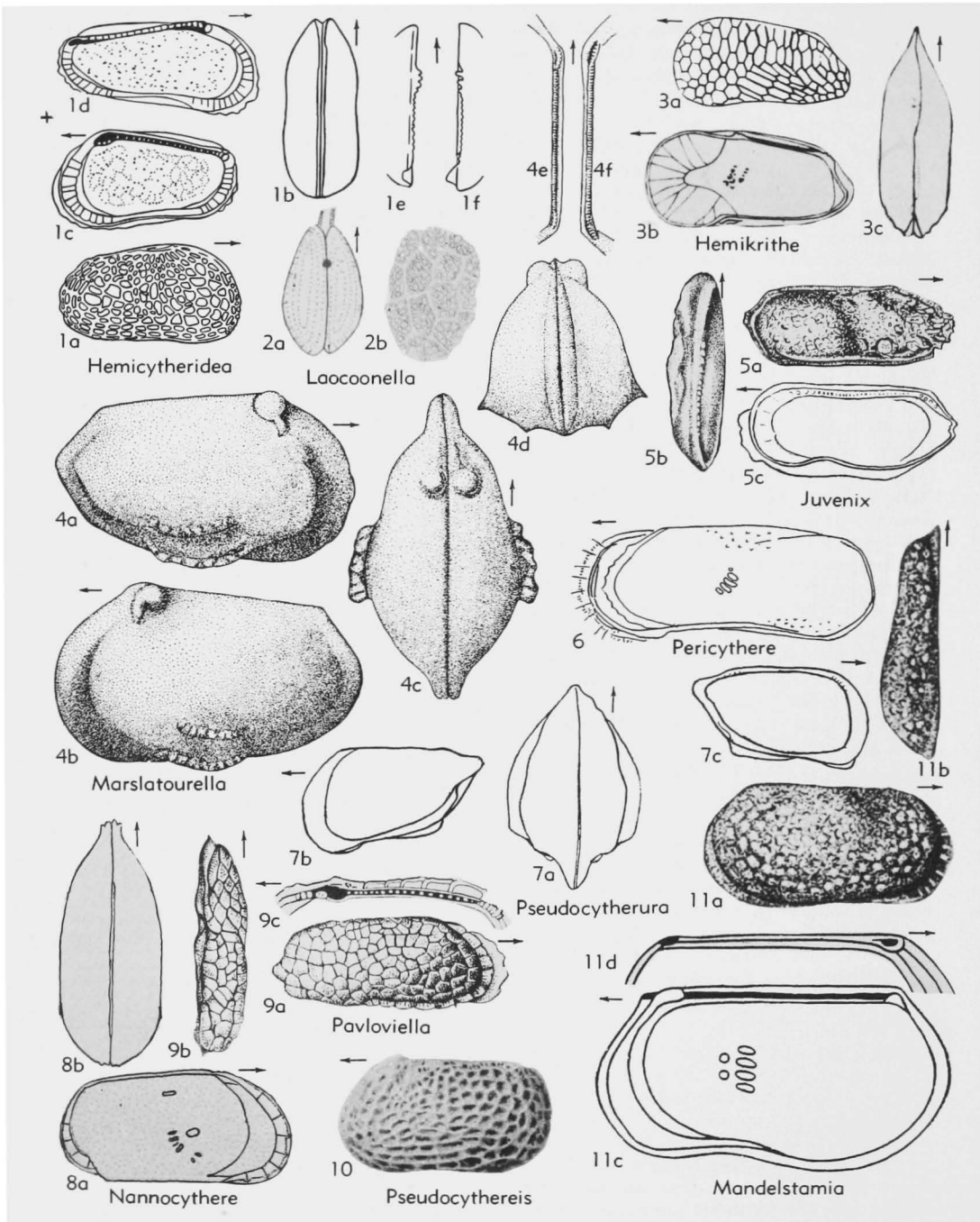


FIG. 273. Family Uncertain (p. Q351-Q354).

Microloxoconcha HARTMANN, 1954 [**M. compressa*]. Small, elongate-ovate, very thin and fragile, unornamented. Marginal areas broad at ends, with widely spaced radial canals; line of concrescence not coincident with inner margin, indented near some radial canals, particularly at rear; muscle scars in row of 4 with single small scar in front. *Rec.*, Medit.——FIG. 270,*9*. **M. compressa*; LV lat., ×155 (162). [HOWE.]

Monoceratella TEICHERT, 1937 [**M. teres*]. Subovate in side view, dorsal border nearly straight (with low hump extending above hinge line toward rear), cardinal angles sharp, nearly 90 degrees; ventral border straight or slightly concave; well-defined sulcus just in front of mid-length; surface smooth; spine projecting outward-backward from ventromedian surface and in some species additional spines in dorsal region. *M.Ord.*, Arct.Can. ——FIG. 270,*7*. **M. teres*, M.Ord.(Edinburg F.), USA(Va.); *7a,b*, LV lat., vent., ×20 (J. C. Kraft, n). [MOORE.]

Nannocythere SCHÄFER, 1953 [**N. remanei*]. Carapace rather delicate, with outswelling in back part of lower shell half, thus producing flat underside. Hinge teeth very small, hinge ledge smooth. Surface covered with numerous sieve-pore fields from which rather long hairs spring out; marginal area broad anteriorly with large vestibule, only few radial canals at each end; muscle scars in curved row of 4 adductors, with single antennal and 2 mandibular scars in front. Dimensions not reported. *Rec.*, Ger.——FIG. 273,*8*. **N. remanei; 8a,b*, RV lat., carapace dors., ×? (319). [HOWE.]

Naviculina KATZ in MANDELSTAM *et al.*, 1957 [**N. longa* LYUBIMOVA in MANDELSTAM *et al.*, 1957]. Carapace inverse boat-shaped, LV overlapping RV, posterior end pointed, dorsal margin almost straight; hinge in LV with anterior elongate socket, subdivided into 8 parts, median, low, crenulate bar slightly broadened toward ends with coarser crenulations, posterior socket less elongate than anterior one, subdivided into 6 parts; marginal area broad, with widely spaced pore canals. *M.Jur.(Baj.)*, E.Eu.(E.Ukraine).——FIG. 270,*8*. **N. longa* LYUBIMOVA; *8a-c*, RV lat., RV int., LV int., ×43 (238a).

Paenula KUZNETSOVA in MANDELSTAM *et al.*, 1957 [**P. superba*]. Greatest height in anterior 0.3, longitudinal ribs projecting over dorsal and ventral margin, dorsal margin straight; hinge in LV consisting of terminal slitlike sockets subdivided into 5 parts, median element a thin smooth ridge; muscle scars in vertical row of 4. Surface pitted. *U.Cret.(Cenom.)*, SE.Eu.(Caucasus)-SW.Asia(Caspian-Azerbaidjan).——FIG. 270,*11*. **P. superba*, Caspian-Azerbaidjan; *11a,b*, LV lat., int., ×70 (238a). [BOLD.]

Palaeocytheridea MANDELSTAM, 1947 [**P. bakirovi* (*non Eucythere denticulata* SHARAPOVA, 1937, invalid SD LYUBIMOVA, 1955)]. Elongate, ovate, higher anteriorly, dorsal margin straight, posterior end of LV angular; LV hinge with elongate, crescent-shaped, denticulate sockets and median smooth bar; line of concrescence and inner margin nearly coincident, pore canals straight, widely spaced; surface smooth, punctate, reticulate, or ridged. [Species assigned to this genus by MANDELSTAM and LYUBIMOVA seem to have only the hinge structure in common and are not all congeneric. *Eucythere denticulata* is judged to be congeneric with *Clithrocytheridea decumana* TRIEBEL but has been assigned by HOWE & LAURENCICH (1958) to *Asciocythere* SWAIN.] *M.Jur.*, SW. Asia(Kazakhstan).——FIG. 270,*10*. **P. bakirovi; 10a,b*, RV lat., int., ×50 (237). [BOLD.]

Pavloviella KUZNETSOVA in MANDELSTAM *et al.*, 1957 [**P. barremica*]. Elongate-ovate, with laterally much-compressed margin in anterior end; LV hinge with anterior rounded socket bearing postadjacent knob-shaped tooth, median part a crenulate groove ending in a posterior elongate curved socket; surface reticulate, with concentric pattern. [Figures published by the author suggest that the RV (not LV) has the median groove as indicated in the description.] *L.Cret.(Barrem.)*, SE.Eu.(Caucasus)-SW. Asia.(Azerbaidjan-Caspian). —— FIG. 273,9. **P. barremica*, Azerbaidjan; *9a-c*, RV lat., dors., hinge, ×43 (238a). [BOLD.]

Pericythere HARTMANN, 1957 [**P. foveata*]. Shell thin, fragile, very elongated in lateral view, without tubercles or pits, and commonly no ribs; eyes with coalesced pigment. Inner margin parallel to outer margin, selvage strong near the anterior margin, with hairlets, inner margin and line of concrescence apparently not coincident; 5 adductor muscle spots slightly in front of mid-length, hinge untoothed. [Brackish-water, mangrove environment.] *Rec.*, C.Am.-S.Am.——FIG. 273,*6*. **P. foveata*, El Salvador; LV lat., ×90 (164). [REYMENT-HOWE.]

Pseudocythereis SKOGSBERG, 1928 [**Cythereis (Pseudocythereis) spinifera*] [=*Pseudocytheretta* PURI, 1958]. Moderately large, ovate, resembling *Cytheretta* and *Echinocythereis* in shape, surface entirely covered with reticulations, each reticulum containing small pits. Hinge apparently holamphidont; internal shell characters not described, but from marginal bristles, it appears that radial canals are numerous; 5th appendage not differentiated as in *Cytheretta*, hence family assignment uncertain. *Rec.*, S.Atl.——FIG. 273,*10*. **P. spinifera* (SKOGSBERG); LV lat., ×30 (72). [HOWE.]

Pseudocytheromorpha PURI, 1957 [**P. elongata*]. Elongate, length nearly twice height, anterior end obliquely rounded, denticulate, posterior end obliquely rounded with tuft of 4 ventral spines; dorsal margin nearly straight, ventral margin concave in middle; surface smooth, pitted or reticulate.

Marginal areas very wide, especially at rear, radial pore canals numerous, long, straight; muscle scars in subcentral pit, arranged in 2 rows of 3 each, middle scar of ventral row showing tendency to divide; RV hinge with anterior crenulate tooth, postjacent socket, and posterior socket connected by median bar. *U.Eoc.*, SE.N.Am.——Fig. 274,*1*. **P. elongata*, Crystal River F., USA(Fla.); *1a-d*, RV (holotype) lat., int., dors., vent.; *1e,f*, LV (paratype) lat., int.; *1g,h*, carapace dors., vent.; all ×50 (290). [Howe.]

Pseudocytherura Dubowsky, 1939 [**P. pontica*]. Thick-shelled, sculptured, irregularly rhomboidal in side view, with broadly rounded anterior margin and drawn-out process at rear, greatest height 0.25 length from front; winglike processes increase to make greatest breadth 0.7 back from front. Marginal areas regular, radial pore canals undescribed; hinge crenulate at ends but smooth in mid-section. Length of females 1.12 mm., males unknown. *Rec.*, Black Sea.——Fig. 273,*7*. **P. pontica; 7a-c*, carapace dors., RV int., LV int., ×27 (142). [Howe.]

Pseudokrithe Mehes, 1941 [**P. dictyota*]. Rectangular, postplete, with parallel dorsal and ventral margins and almost equally rounded posterior and anterior margins; surface with reticulate ornament. *Paleog.*, Eu.(Hung.). ——Fig. 275,*3*. **P. dictyota; 3a,b*, RV lat., LV dors., ×? (249). [Reyment.]

Pseudoloxoconcha G.W.Müller, 1894 [*P. minima*]. Shell thin, fragile, elongate, very small, highest in front third. Marginal area broad; line of concrescence somewhat far from inner margin at ends but fused below; few radial pore canals, slender, not branched; hinge apparently adont. *Rec.*, Medit. (Gulf of Naples).——Fig. 275,*11*. **P. minima;* LV lat., ×220 (53). [Howe.]

Pulviella Schneider in Mandelstam *et al.*, 1957 [**P. ovalis*]. Ovate or egg-shaped, LV larger than RV, ends rounded, dorsal margin arched, greatest width in posterior half; hinge with groove in LV and sharp edge in RV. Surface weakly pitted or smooth, some with fine ribs in ventral portion. [Illustrations given show RV overlapping LV and carapace with a strong ventral ridge not mentioned in the description; also greatest height is located anteriorly.] *L.Trias.*, SE.Eu.(Emba region). ——Fig. 274,*5*. **P. ovalis; 5a,b*, carapace L, dors., ×40 (238a). [Bold.]

Rectocythere Malz, 1958 [*Clithrocytheridea? iuglandiformis* Klingler, 1955]. Valves subequal, LV slightly larger than RV, valves only in contact along ventral and both end margins, along dorsal margin LV overlapping RV only around both hinge angles; anterior margin thickened, cut off from strongly ornamented sides by shallow furrow; adductor muscle tubercle present; inner margin and line of concrescence coincident, zone of concrescence fairly broad, with few marginal pore canals, which are straight, unbranched; LV hinge with low, sharp knife-edge that fits into small furrow in RV, definite terminal teeth lacking. *U. Jur.*, W.Eu. —— Fig. 274,*9*. **R. iuglandiformis* (Klingler) M.Kimm.(NW.Ger.); *9a-c*, carapace L, R, dors., ×? (235). [Reyment.]

Redekea deVos, 1953 [**R. perpusilla*]. Small, thin, compressed, elongate; surface marked with widely spaced rounded pits; eyes confluent. Hingement adont; marginal areas rather wide, with vestibules and widely spaced radial canals; muscle scars not known. [Commensal on *Limnoria* washed ashore on coast of Holland.] *Rec.*, North Sea.——Fig. 274,*4*. **R. perpusilla; 4a-c*, carapace L, dors., vent., ×84 (398). [Howe.]

Renngartenella Schneider in Mandelstam *et al.*, 1957 [**R. pennata*]. Elongate-ovate, moderately swollen, with weak transverse sulcus, length twice height, ends compressed, with bladelike ridge in ventral portion of carapace; hinge in LV with narrow terminal sockets and median ridge; surface smooth, but some with spinelike projections. *L. Trias.*, SW.Asia(Astrakan).——Fig. 275,*7*. **R. pennata; 7a,b*, RV lat., dors., ×35 (238a). [Bold.]

Rubracea Mandelstam in Mandelstam *et al.*, 1957 [**R. artis* Lyubimova in Mandelstam *et al.*, 1957]. Elongate, with incised posterior end; hinge in LV with elongate, crenulate terminal sockets and median ridge, in RV with terminal teeth connected to elevated inner margin (?selvage); line of concrescence and inner margin not coinciding at ends. Surface smooth. *M.Jur.*(Callov.), W.Asia Transvolga-Saratov).——Fig. 275,*1*. **R. artis* Lyubimova, Saratov Region; *1a,b*, carapace R, dors., ×43; *1c*, RV int., ×60 (238a). [Bold.]

Ruggieria Keij, 1957 [**Cythere micheliniana* Bosquet, 1852]. Ovate with upturned posterior extremity, marginal spines in front and rear; distinct eye depression located near anterior hinge element; surface ornamented partly or entirely with reticulations or longitudinal ridges and with posteroventral spine. Marginal areas fairly broad, line of concrescence and inner margin coincident; radial pore canals moderately numerous, simple, wavy, widened in middle; muscle field with posterior row of 4 scars, single dorsally open horseshoe-shaped scar in front, and 3 scars above central field; RV hinge with conical anterior tooth and smooth or obscurely lobed posterior tooth, LV hinge with terminal sockets and a crenulated bar with a conical tooth at its anterior termination. Sexual dimorphism pronounced, inferred males more slender than females. [Marine.] *Mio.-Rec.*, Eu.—— Fig. 275,*9*. **R. micheliniana* (Bosquet), Mio. (Burdigal.), Fr. (Aquitaine Basin); *9a-c*, ♀ LV lat., ♂ RV lat., RV (lectotype) lat.; *9d,e*, ♀ LV int., ♂ RV hinge; all ×40 (42).

Ruttenella van den Bold, 1946 [**R. ovata*]. Elongate ovate, smooth, posterior cardinal angle pro-

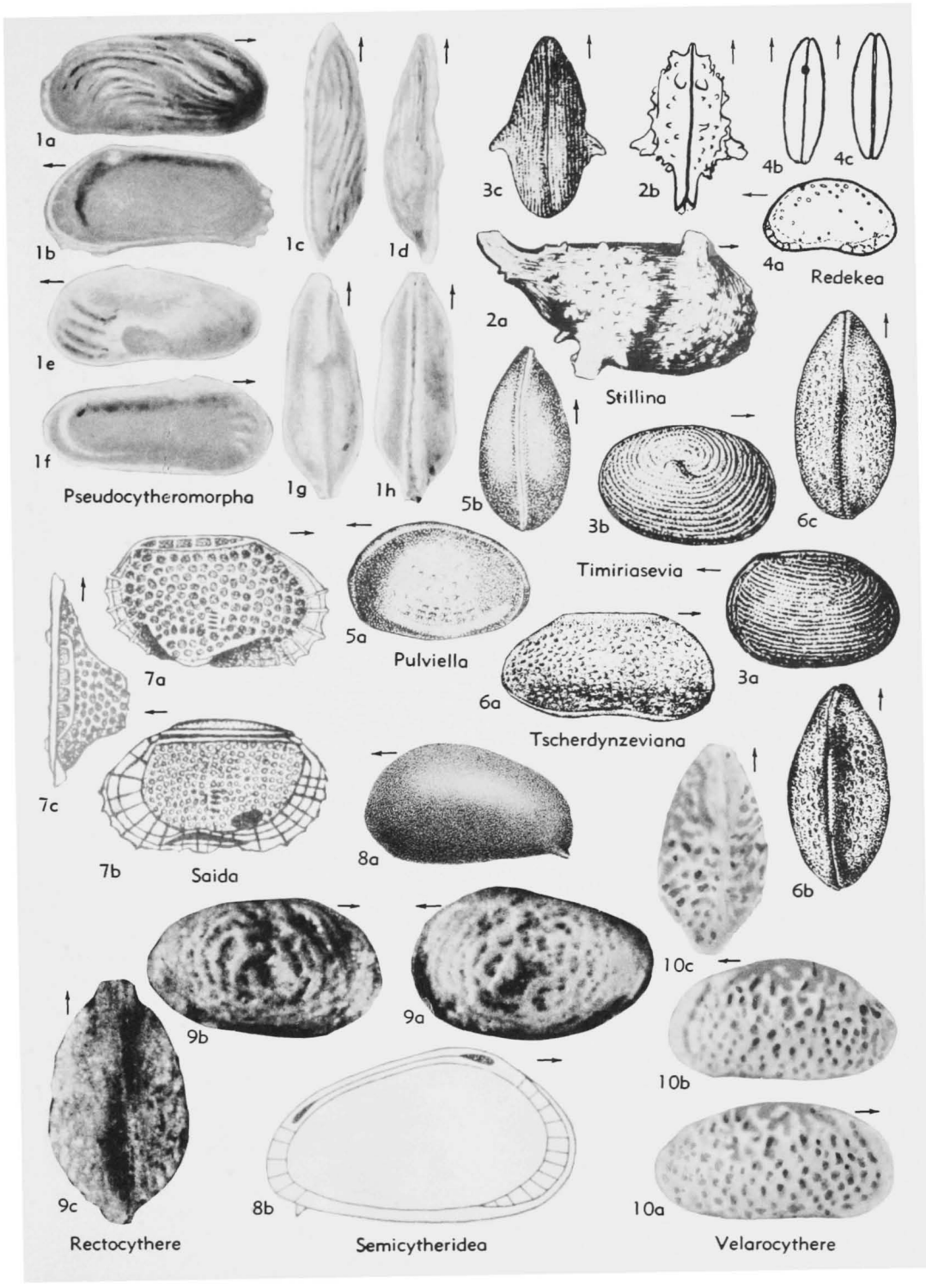


FIG. 274. Family Uncertain (p. Q353-Q358).

jecting slightly in LV. LV hinge with crenulate anterior socket, denticulate dorsal margin, and posterior cardinal area raised to fit over pointed tooth of RV; line of concrescence leaving inner margin at ends; radial pore canals numerous, in anterior region curving upward and downward from middle. *U.Eoc.*, Carib.(Bonaire Is.).——Fig. 275,*4*. **R. ovata; 4a,b,* carapace R., dors.; *4c,d,* LV int., RV int., ×50 (7). [Howe.]

Saida Hornibrook, 1952 [**S. truncata*]. Minute,

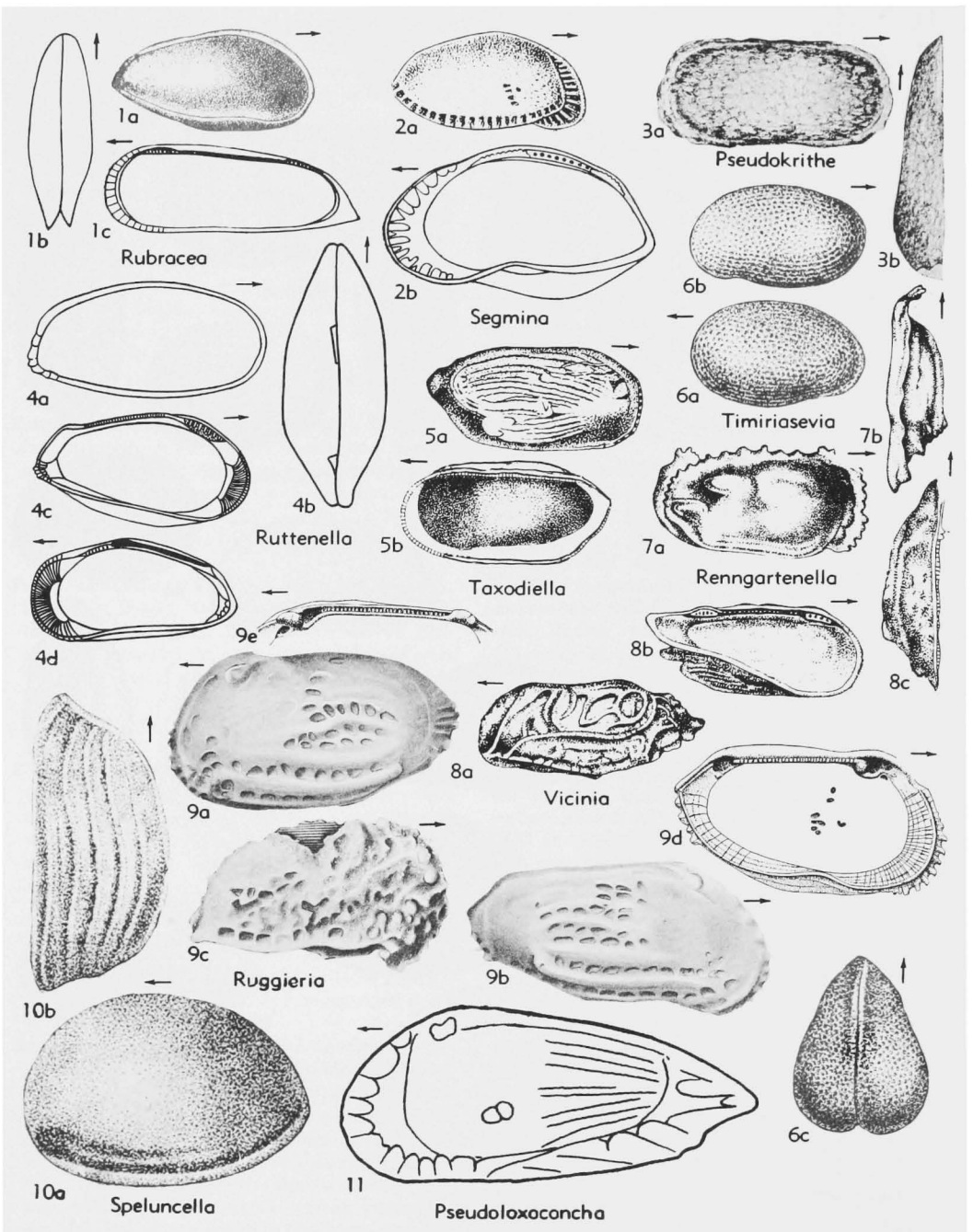


Fig. 275. Family Uncertain (p. Q354-Q358).

subrhomboidal; ventrolateral margins expanded to form blunt processes rather similar to *Cytheropteron;* hinge consisting of 2 terminal simple teeth in RV separated by straight, simple groove; LV with terminal sockets and horizontal, straight, simple bar between; caudal process absent; muscle-scar pattern consisting of 4 elongate scars, one above the other with a single scar in front; radial canals simple, not numerous; line of concrescence coinciding with inner margin; duplicatures wide. *M.Eoc.-Rec.,* N.Z.——Fig. 274,7. **S. truncata,* Rec.; *7a-c,* RV lat., int., dors., ×75 (32). [Howe.]

Segmina Mandelstam in Mandelstam *et al.,* 1957 [**Cytheropteron lunulare* Lienenklaus, 1894]. Carapace small, anterior end obliquely rounded, posterior narrowly rounded or pointed, dorsal margin arched, alate; radial pore canals few, widely spaced, vestibule crescent-shaped; hinge in LV with narrow crenulate ridge and terminal slitlike crenulate grooves, in RV with elongate, terminal, crenulate teeth connected by crenulate groove; muscle scars (*fide* Lienenklaus) in curved posterior row of 4 with 2 additional scars rather far in front. Surface smooth or reticulate. *L.Cret.-U.Oligo.,* W.Eu.-C.Asia-SW.Asia.——Fig. 275,2. *S. obvalla* Kuznetsova; *2a,b,* RV lat., int., ×73, ×100 (238a). [Bold.]

Semicytheridea Mandelstam, 1956 [**Cythere spirifera* Chapman & Sherborn, 1893]. Kidney-shaped, LV larger than RV, anterior broadly rounded, point of maximum height at about anterior 4th; posterior extremity more sharply rounded and with mid-point lower than that of anterior margin; dorsal margin strongly and irregularly arched, ventral margin less strongly convex and more regular, surface smooth except for openings of normal pore canals; strong spine at about posterior 3rd of LV. Anterior zone of concrescence well developed, provided with a few unbranched radial pore canals; muscle field reported to conform to that of Cytheridae; LV hinge with large elongated anterior socket and small elongated posterior socket, median bar thin. *L.Cret.(Apt.-Alb.),* W.Eu.-SE.Eu.(USSR).——Fig. 274,8. **S. spinifera* (Chapman and Sherborn), L.Alb.; *8a,b,* LV lat., int., ×50, ×63 (*8a,* 120; *8b,* 50). [Reyment-Bold.]

Speluncella Schneider, 1956 [**S. spinosa*]. Egg-shaped, inflated ventrally, height about 0.7 of length, dorsal margin strongly arched, mid-point of anterior margin slightly higher than that of posterior, which is pointed; ventral surface with 5 or 6 slightly flexed longitudinal ribs, stretching along entire length, surface otherwise smooth. LV hinge with median groove and terminal toothlets. [Fresh-water.] *L.Trias.* USSR(Emba area).——Fig. 275,*10.* **S. spinosa; 10a,b,* LV lat., vent., ×86 (50).

Stillina Laurencich, 1957 [**S. asterata*]. Teardrop-shaped in side view, with straight dorsal margin, rather evenly rounded at front and along ventral margin, acuminate at rear by reason of long, drawn-out, upturned posterior caudal process; plump, with greatest thickness below middle; divided by weak median sulcus into subequal broad lobes; eye tubercles strong; surface ornamented with spines and reticulations and marked by strong posteroventral spine. Hinge holomerodont, in RV consisting of crenulate bar with terminal crenulate cusps; marginal areas rather narrow, no vestibule; radial pore canals few. *L.Cret.,* N.Am.——Fig. 274,2. **S. asterata,* Alb.(Goodland F.), USA(Tex.); *2a,b,* carapace R, dors., ×72, ×60 (34).

Taxodiella Kuznetsova in Mandelstam *et al.,* 1957 [**T. fiscellaformis*]. Like *Cytheretta,* but differs in less asymmetry of valves; hinge of LV with denticulate bar, in RV with finely denticulate groove. Shape of carapace indicates relationship to *Cytherurinae* or *Bythocytherinae.* [Since characters of the muscle scars and marginal areas have not been described, no family assignment is possible.] *L.Cret.(Barrem.),* SE.Eu.(Caucasus)-SW. Asia (Caspian-Azerbaidjan).—— Fig. 275,*5.* **T. fiscellaformis,* Azerbaidjan; *5a,b,* RV lat., int., ×94 (238a). [Bold.]

Thalmannia LeRoy, 1939 [**T. sumatraensis*]. Roundly elongate rectangular, plump, LV larger than RV, overlapping it dorsally and ventrally; surface smooth except for large pits in longitudinal rows. RV hinge with elongate terminal teeth

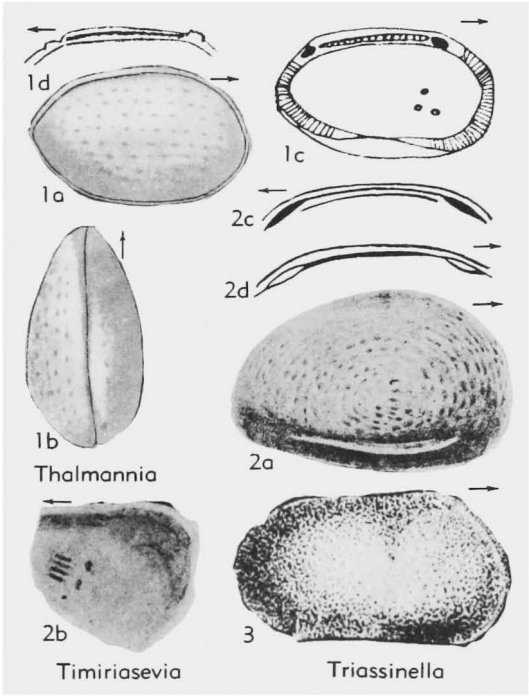


Fig. 276. Family Uncertain (p. Q358).

and furrow along dorsal margin, all elements of hinge showing tendency to crenulation, although terminal teeth may be smooth; radial canals numerous, straight; muscle scars 3 or 4, closely spaced. *Mio.*, E.Indies.——FIG. 276,*1*. **T. sumatraensis*, Sumatra; *1a,b*, carapace R, dors., *1c,d*, LV int., RV hinge; all ×40 (227). [HOWE.]

Timiriasevia MANDELSTAM, 1947 [**T. epidermiformis*]. Carapace roughly kidney-shaped, LV larger than RV, in some species anterior and posterior ends almost equally rounded, but anterior always more broadly rounded than posterior, dorsal margin almost straight to convex, ventral margin weakly convex in anterior third; surface with fine pits, small ribs, or irregular spines (placed usually in a row parallel to and at a short distance from anterior and posterior margins, or dorsocentrally). Zone of concrescence with only a few radial pore canals; inner margin and line of concrescence coincident; no eye spot; RV hinge provided with smooth median furrow and elongated terminal tooth plates; muscle scars in row of 4 adductors with 2 mandibular scars in front. Strong sexual dimorphism, inferred female carapaces being strongly swollen in posterior third. Very like *Metacypris* (syn. *Gomphocythere*) in general features but with different hinge. [Freshwater.] *M.Jur.-L.Cret.*, Eu.-Asia(USSR).——FIG. 276,*2*. **T. epidermiformis*, M.Jur., SW.Asia; *2a,b*, RV lat., RV muscle field, ×43, ×56 (237); *2c,d*, RV and LV hinge, ×43 (50).——FIG. 275, *6*. *T. polymorpha* MANDELSTAM, L.Cret., SW.Asia; *6a-c*, ♀ carapace L, R, dors., ×? (50).——FIG. 274,*3*. *T. acuta* MANDELSTAM, L.Cret., SW.Asia; *3a-c*, ?♂ carapace L, R, dors., ×? (50). [REYMENT.]

Triassinella SCHNEIDER, 1956 [**T. chramovi*]. Small, equivalved, valves slightly inflated, oblong; dorsal margin straight, in some forms gently rounded; anterior and posterior margins rounded, ventral margin straight to slightly convex; surface ornamented with fine pits, central part of valves with shallow transverse depression, posteroventral part provided with short spine. Hinge simple. [Marine.] *L.Trias.*, USSR.——FIG. 276,*3*. **T. chramovi*, Emba Region; RV lat., ×64 (50). [REYMENT-BOLD.]

Tscherdynzeviana KASHEVAROVA, 1958 [**T. busulukensis*]. Elongate oval, with rather truncate posterior end and regularly rounded anterior margin; RV overlapping LV along straight dorsal margin but with reverse overlap along ventral margin, which is gently concave in middle; surface pitted. Zone of concrescence well developed anteriorly but narrow. *U.Perm.* (Tatar.), USSR. ——FIG. 274,*6*. **T. busulukensis; 6a-c*, carapace R, dors., vent., ×43 (192). [BOLD-REYMENT.]

Velarocythere BROWN, 1957 [**V. scuffeltonensis*]. Medium in size, elongate ovate, with obliquely rounded, rimmed, toothed anterior margin, posterior extremity slightly narrower, rounded in LV and subangulate near middle in RV; dorsal outline slightly arched, with distinct eye spot; ventral outline irregular because of overhang of valves, ventral margin inturned in front of middle; surface rather coarsely reticulate and pitted near middle. Hingement holamphidont, with median elements finely crenulate; marginal areas rather broad at ends, with numerous long paired radial pore canals; muscle scars in vertical row of 3 with a large antennal scar in front. *U.Cret.*, N. Am.——FIG. 274,*10*. **V. scuffeltonensis*, USA (N.Car.), *10a-c*, carapace R, L, dors., ×50 (117). [HOWE.]

Vicinia KUZNETSOVA in MANDELSTAM *et al.*, 1957 [**V. sutilis*]. Reminiscent of *Paracytheridea* but LV hinge consisting of anterior socket with 4 crenulations, central denticulate bar with 3 larger teeth at its anterior end [only 2 visible in author's figure] and posterior elongate socket with 5 crenulations. *L.Cret.(Barrem.)*, SE.Eu.(Caucasus)-SW. Asia (Caspian-Azerbaidjan).——FIG. 275,*8*. **V. sutilis; 8a-c*, LV lat., int., dors., ×72 (238a). [BOLD.]

Suborder METACOPINA Sylvester-Bradley, n. suborder

[Diagnosis and discussion by P. C. SYLVESTER-BRADLEY, University of Leicester]

Hinge distinct, simple to tripartite; muscle scar consisting of secondary scars assembled in a compact group; inner lamella narrow, poorly developed or unknown. *?L.Ord., M. Ord.-L.Cret.*

The Metacopina are podocopids in which the muscle-scar pattern is a circular aggregate of many scars. The duplicature is variable in width. In the Healdiacea it is narrow, and often described as absent. Transverse sections (Fig. 277,*A*) show, however, a calcified inner lamella developed in some genera; this is joined to the outer lamella along a plane of concrescence oblique to the shell surface. This differs only in degree from the situation, common in the Podocopina, in which the plane of concrescence is parallel to the shell surface (Fig. 277,*B*), and in which, therefore, a duplicature is clearly recognizable. Other Podocopina show a plane of commissure which is intermediate in direction (Fig. 277,*C*). The duplicature in the Quasillitacea has not yet been investigated by modern methods; superficial examination suggests that it is intermediate in nature between the conditions described above for the Healdiacea and the Podocopina, respectively. The hinge in