# LOBOIDOTHYRIDOIDEA

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## Superfamily LOBOIDOTHYRIDOIDEA Makridin, 1964

[*nom. correct.* Lee, Smirnova, & Dagys, herein, *pro* Loboidothyracea Dagys, 1968, p. 88, *nom. transl. ex* Loboidothyrinae Makridin, 1964, p. 213]

Shell of adult small to very large, commonly smooth, rarely costate anteriorly, or capillate; commonly ventribiconvex, rarely planoconvex; outline commonly subpentagonal to elongate oval; anterior commissure commonly rectimarginate to biplicate or sulciplicate; foramen commonly large; permesothyrid; dental plates absent; no median septum, cardinal process commonly well developed; outer hinge plates well developed; inner hinge plates rare; loop deltiform, commonly long flanged; commonly 0.4 to 0.6 dorsal valve length; transverse band commonly strongly arched; loop ontogeny may be complex; developmental stages unknown for most genera. *Triassic–Lower Cretaceous.*

### Family LOBOIDOTHYRIDIDAE Makridin, 1964

[*nom. correct.* Katz & Popov, 1974a, p. 22, *pro* Loboidothyridae Dagys, 1968, p. 194, *nom. transl. ex* Loboidothyrinae Makridin, 1964, p. 213]

Small to large, rectimarginate to sulciplicate, commonly smooth, rarely capillate or anteriorly costellate; outer hinge plates dorsally attached to crural bases; terminal points moderately short or weakly developed. *Lower Jurassic (Toarcian)–Lower Cretaceous (Valanginian).*

### Subfamily LOBOIDOTHYRIDINAE Makridin, 1964

[*nom. correct.* Cooper, 1983, p. 44, *pro* Loboidothyrinae Makridin, 1964, p. 213]

Smooth or rarely finely capillate, planoconvex to ventribiconvex, foramen commonly large, permesothyrid, crural bases close to or anterior of midloop. *Lower Jurassic (Toarcian)–Lower Cretaceous (Valanginian).*

**Loboidothyris** Buckman, 1918, p. 112 (Buckman, 1914, p. 2, *nom. nud.*) [**L. latovalis;* OD] [=*Dundrythyris* Alméras, 1971, p. 188 (type, *Terebratula perovalis* J. de C. Sowerby, 1825 in 1823–1825, p. 51)]. Medium to very large, subcircular to elongate oval, smooth, ventribiconvex, anterior commissure rectimarginate to uniplicate to sulciplicate; beak large, short, foramen large, circular, commonly labiate, permesothyrid; symphytium usually hidden; pedicle collar short; cardinal process low, lobate; outer hinge plates short, narrowly triangular, dorsally attached to crural bases; crural processes anterior of midloop; loop triangular, 0.35 to 0.45 dorsal valve length; transverse band with low arch, flattened medially; terminal points fairly short. *Lower Jurassic (Toarcian)–Middle Jurassic (Bajocian):* Europe, Asia, South America.——Fig. 1378,*4a–c.* **L. latovalis,* Aalenian, Dorset, England; dorsal, lateral, and anterior views of holotype, BGS GSM 31976, ×1 (Muir-Wood, 1965a).——Fig. 1378,*4d. L. perovalis* (J. de C. Sowerby), Bajocian, England; interior of dorsal valve, ×1 (Cooper, 1983).

**Avonothyris** Buckman, 1918, p. 102 [**A. plicatina;* OD]. Small to medium size; subtriangular to subpentagonal, smooth, with radial capillae where exfoliated; ventribiconvex, anterior commissure sulciplicate; beak short, suberect, foramen large, permesothyrid, symphytium partly visible; cardinal process small, semielliptical; outer hinge plates very narrow, close to valve floor; loop 0.4 to 0.45 dorsal valve length, widely triangular, transverse band with low arch. *Middle Jurassic (Bathonian–Callovian):* England, France, Egypt, ?Tunisia, Tibet.——Fig. 1378,*1a–d.* **A. plicatina,* Bathonian, England; *a–b,* dorsal and lateral views of holotype; *c,* anterior view of holotype, BGS 51326, ×1 (Muir-Wood, 1965a); *d,* interior of dorsal valve, ×1 (Cooper, 1983).

**Arabatia** Cooper, 1989, p. 70 [**A. concava;* OD] [=*Arabicella* Cooper, 1989, p. 70 (type, *A. subpentagonalis,* OD); *Arapsopleurum* Cooper, 1989, p. 73 (type, *A. arabicum,* OD); *Arapsothyris* Cooper, 1989, p. 74 (type, *A. magna,* OD)]. Medium to large, subpentagonal to elongate oval, smooth, planoconvex to ventribiconvex, anterior commissure sulciplicate; broad costae may form peripherally; beak erect to incurved; foramen small to medium, mesothyrid to permesothyrid; symphytium usually hidden; cardinal process small, loop 0.4 to 0.5 dorsal valve length. *Middle Jurassic (Bathonian–Callovian):* Saudi Arabia.——Fig. 1378,*2a–d.* **A. concava,* Callovian; *a–c,* dorsal, lateral, and anterior

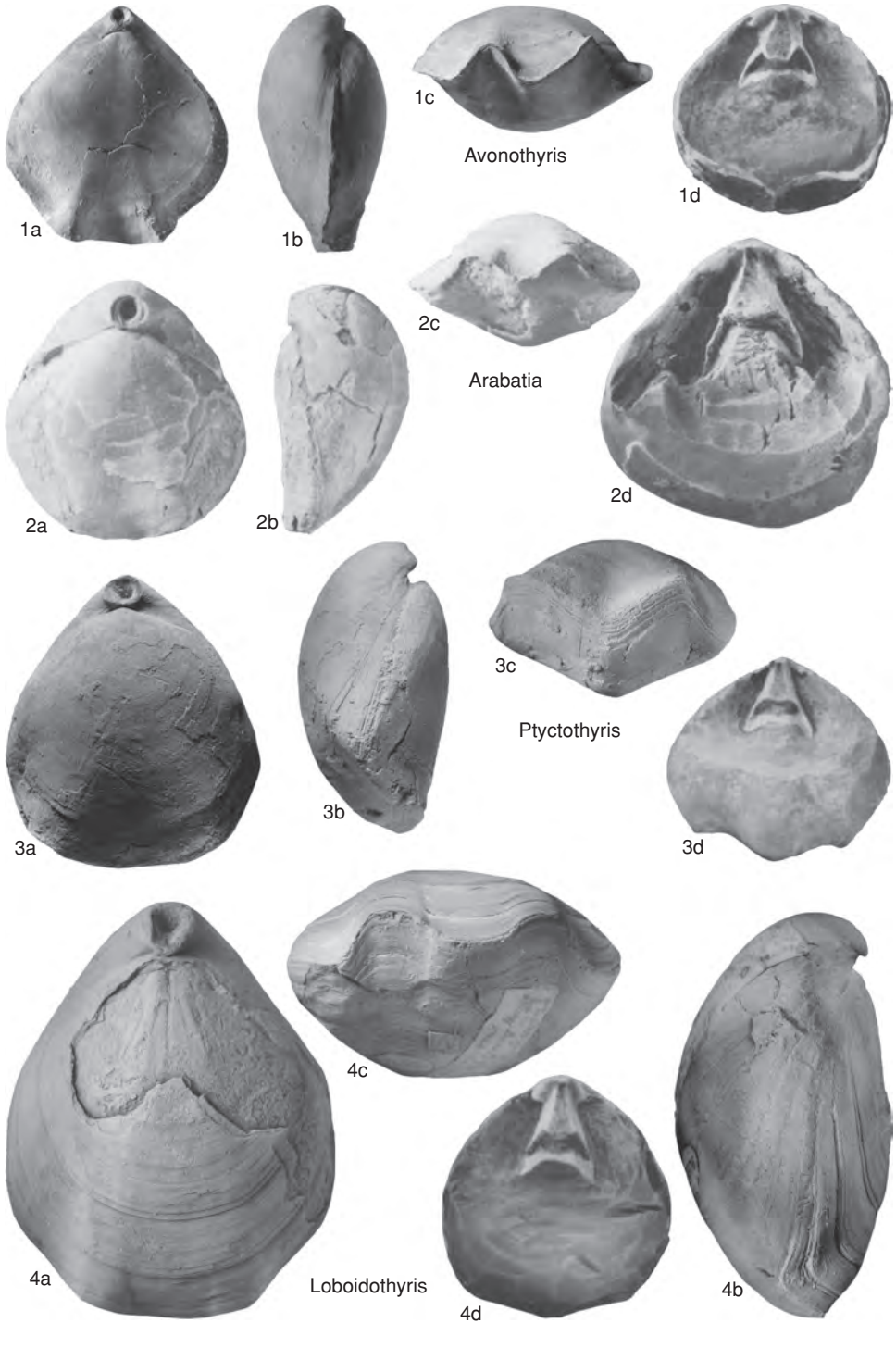


FIG. 1378. Loboidothyrididae (p. 2082–2084).

views of holotype, USNM 380462a; *d,* interior of dorsal valve, ×1 (Cooper, 1989).

**Bihenithyris** Muir-Wood, 1935, p. 110 [**B. barringtoni;* OD]. Medium size, subpentagonal, smooth, ventribiconvex, anterior commissure sulciplicate to bisulcate, beak massive, suberect to incurved, symphytium hidden, foramen large, permesothyrid; pedicle collar present; cardinal process short, broad, medianly depressed; hinge plates wide, tapering, forming deep U-shape with socket ridge; loop 0.45 dorsal valve length; transverse band almost horizontal, terminal points moderately long. *Middle Jurassic (Callovian):* Somalia, Egypt, Saudi Arabia, Israel.——Fig. 1379,*3a–d.* **B. barringtoni; a–c,* dorsal, lateral, and anterior views of holotype, BMNH B 85648, Somalia, ×1 (Muir-Wood, 1965a); *d,* interior of dorsal valve of specimen, Israel, ×1 (Cooper, 1983).

**Charltonithyris** Buckman, 1918, p. 106 (Buckman, 1915, p. 78, *nom. nud.*) [**Terebratula uptoni* Buckman, 1895, p. 455; OD]. Large, subpentagonal, smooth, planoconvex to ventribiconvex, anterior commissure rectimarginate to uniplicate; beak short, foramen large, permesothyrid, symphytium exposed, beak ridges strong; cardinal process small; hinge plates short, triangular, concave, forming V-shaped troughs; loop widely triangular, 0.4 dorsal valve length; transverse band broad, with high, medially horizontal arch. *Middle Jurassic (Bajocian):* England.——Fig. 1379,*6a–d.* **C. uptoni* (Buckman); *a–c,* dorsal, lateral, anterior views of paratype, ×1 (Muir-Wood, 1965a); *d,* interior of dorsal valve of specimen with slightly damaged loop, ×1 (Cooper, 1983).

**Colosia** Cooper, 1983, p. 67 [**Terebratula zieteni* Loriol, 1876–1878, p. 168; OD]. Medium to large, elongate-oval, smooth, ventribiconvex, anterior commissure uniplicate in juveniles to sulciplicate in adults, beak erect, foramen large, mesothyrid, symphytium partly exposed; pedicle collar short; hinge plates wide, short; loop 0.25 to 0.45 dorsal valve length, highly variable in juvenile specimens, transverse band broad. *Upper Jurassic (Kimmeridgian):* Switzerland, Germany.——Fig. 1379,*1a–d.* **C. zieteni* (Loriol), Switzerland; *a–c,* dorsal, lateral, anterior views ×1; *d,* closeup of loop, ×1 (Cooper, 1983).

**Dolichobrochus** Cooper, 1983, p. 73 [**Terebratula excavata* Deslongchamps, 1856b, p. 97; OD]. Small, subpentagonal, smooth, ventribiconvex, anterior commissure sulciplicate; foramen small, permesothyrid; crura long, broad; loop long, narrow, 0.45 dorsal valve length. *Middle Jurassic (Callovian):* France, ?Saudi Arabia.——Fig. 1379,*2a–d.* **D. excavata* (Deslongchamps), France; *a–c,* dorsal, lateral, and anterior views, ×1; *d,* interior of dorsal valve, ×1 (Cooper, 1983).

**Ectyphoria** Cooper, 1989, p. 79 [**E. inflata;* OD]. Medium size, subpentagonal, smooth, strongly biconvex, anterior commissure biplicate; foramen small, permesothyrid, ventral umbo carinate, dorsal umbo sulcate, cardinal process bilobed, loop long, transverse band not seen. *Middle Jurassic (Bathonian–Callovian):* Saudi Arabia.——Fig. 1379,*4a–c.* **E. inflata;* dorsal, lateral, and anterior views of holotype, USNM 380413, ×1 (Cooper, 1989).

**Pinaxiothyris** Dagys, 1968, p. 86 [**P. campestris;* OD]. Medium size, oval, gently biconvex, smooth, anterior commissure rectimarginate, beak short, foramen large, permesothyrid; symphytium low, partly hidden; pedicle collar short; cardinal process large, outer hinge plate horizontal in section, loop 0.35 dorsal valve length, widely triangular, transverse band arched. *Upper Jurassic (Kimmeridgian)–Lower Cretaceous (Valanginian):* Asia (Northern Urals, northern Siberia).——Fig. 1379,*5a–d.* **P. campestris,* Tithonian, northern Siberia; *a–c,* dorsal, lateral, anterior views, ×1; *d,* reconstruction of loop, approximately ×1 (Cooper, 1983).

**Pseudoglossothyris** Buckman, 1901, p. 234 [240] [**Terebratula curvifrons* Davidson, 1878a, p. 153; SD Muir-Wood, 1965a, p. 786; *non* Oppel, 1858, p. 423, =*Aulacothyris leckhamptonensis* Rollier, 1919, p. 347]. Medium to large, subpentagonal, smooth, planoconvex to ventribiconvex, anterior commissure unisulcate; beak short, foramen large, permesothyrid, symphytium exposed, beak ridges strong; cardinal process large, lobate; loop widely triangular, 0.4 dorsal valve length; transverse band broad, with high, narrow arch. *Middle Jurassic (Bajocian):* England, France.——Fig. 1380,*5a–d.* **P. leckhamptonensis* (Rollier), England; *a–c,* dorsal, lateral, and anterior views, ×1 (Muir-Wood, 1965a); *d,* interior of dorsal valve, ×1 (Cooper, 1983).

**Ptyctothyris** Buckman, 1918, p. 101 (Buckman, 1914, p. 2, *nom. nud.*) [**Terebratula stephani* Davidson, 1877, p. 75; OD] [=*Systenothyris* Cooper, 1983, p. 156 (type, *S. triangulata,* OD)]. Large, subtriangular, smooth, ventribiconvex, with prominent ventral fold, anterior commissure rectimarginate to sulciplicate; beak large, incurved, foramen large, permesothyrid, symphytium partly visible; cardinal process small, hinge plates short, close to valve floor, loop 0.3 to 0.4 dorsal valve length, triangular, transverse band wide, with flattened arch. *Middle Jurassic (Bajocian–Bathonian, ?Callovian):* England, France, Egypt.——Fig. 1378,*3a–d.* **P. stephani* (Davidson), Bajocian, England; *a–c,* dorsal, lateral, and anterior views, ×1 (Muir-Wood, 1965a); *d,* interior of dorsal valve, ×1 (Cooper, 1983).

**Sphaeroidothyris** Buckman, 1918, p. 115 (Buckman, 1914, p. 2, *nom. nud.*) [**S. globisphaeroidalis;* OD] [=*Pachythyris* Boullier, 1976, p. 154 (type, *Terebratula arduennensis* Douvillé, 1886, p. 65), *non* Felder, 1874, Lepidoptera; *Pionopleurum* Cooper, 1989, p. 83 (type, *P. obesum*)]. Small to medium size, subcircular, planoconvex to ventribiconvex to globose; smooth, anterior commissure rectimarginate to slightly uniplicate; beak short, incurved, foramen large, permesothyrid, symphytium hidden;

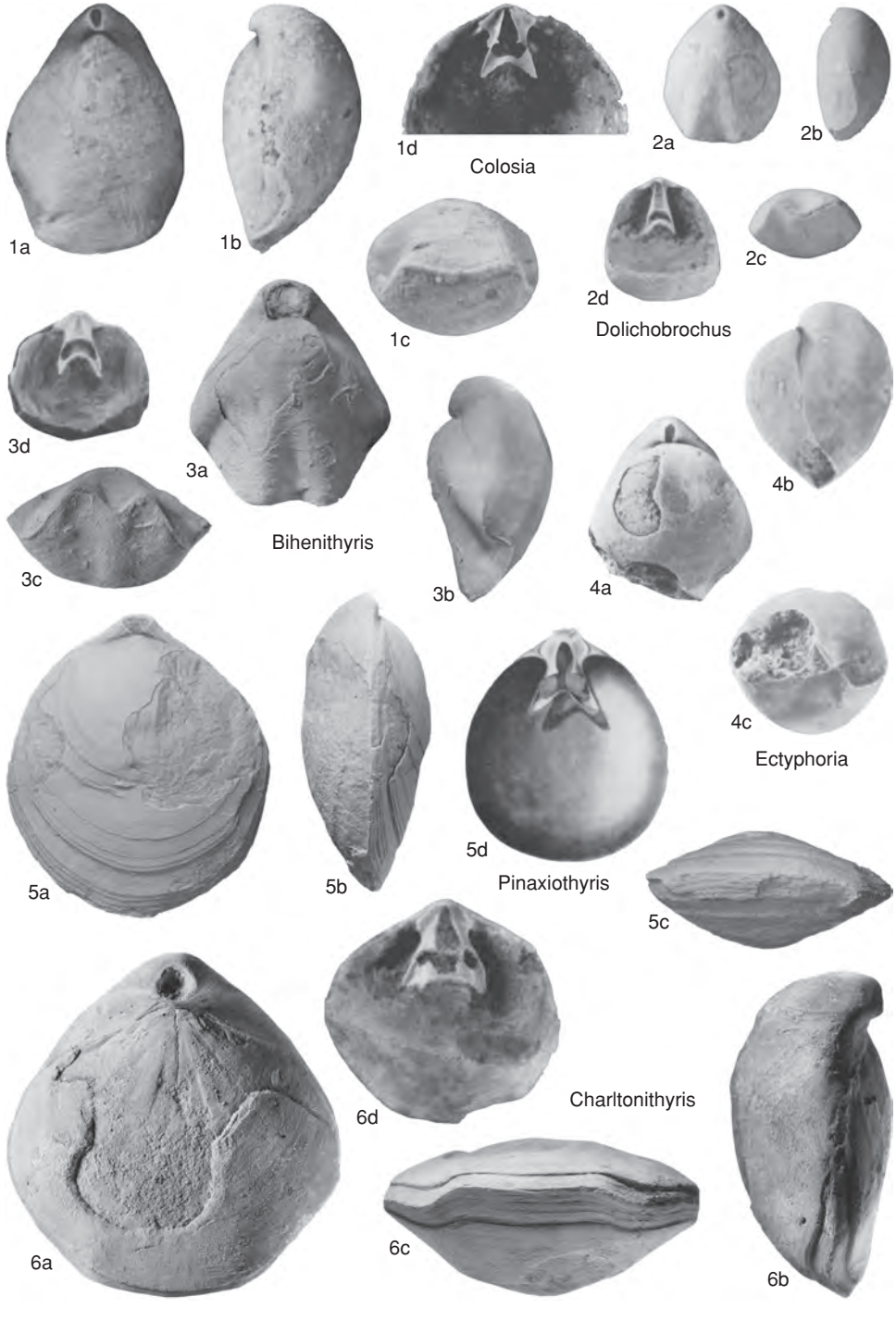


FIG. 1379. Loboidothyrididae (p. 2084).

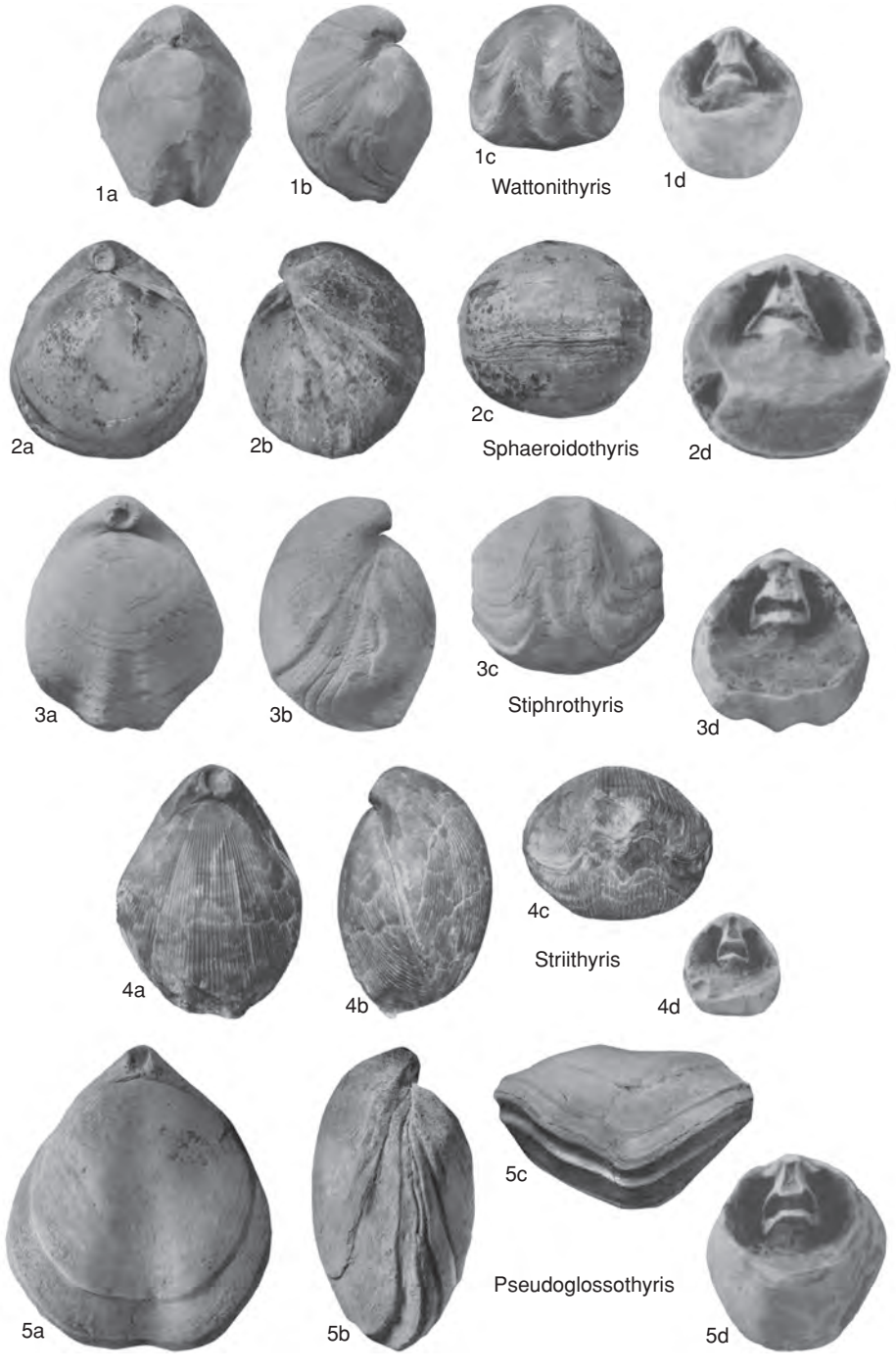


FIG. 1380. Loboidothyrididae (p. 2084–2087).

cardinal process prominent, lobate, medianly depressed; hinge plates short, triangular, thin, close to valve floor; loop 0.3 to 0.4 dorsal valve length, widely triangular, transverse band with angular arch. *Middle Jurassic (Bajocian–Bathonian):* England, France, Germany, Saudi Arabia, Tibet.——FIG. 1380,*2a–d. *S. globisphaeroidalis,* Bajocian, England; *a–c,* dorsal, lateral, and anterior views, ×1 (Muir–Wood, 1965a); *d,* interior of dorsal valve, ×1 (Cooper, 1983).

**Stiphrothyris** BUCKMAN, 1918, p. 109 (BUCKMAN, 1915, p. 78, *nom. nud.*) [**Terebratula globata* var. *tumida* DAVIDSON, 1878a, p. 149; OD]. Medium size, concavoconvex, becoming strongly ventribiconvex; smooth, anterior commissure sulciplicate, beak short, incurved in older specimens, symphytium usually visible, foramen large, permesothyrid; cardinal process narrow, bilobed, protuberant, outer hinge plates short, narrowly triangular, forming narrow, U-shaped troughs with crural bases; loop 0.4 to 0.5 dorsal valve length, widely triangular; transverse band with high arch. *Middle Jurassic (Bajocian–Bathonian):* England; Saudi Arabia, *?Bajocian.*——FIG. 1380,*3a–d. *S. tumida* (DAVIDSON), Bajocian, England; *a–c,* dorsal, lateral, and anterior views, ×1 (Muir-Wood, 1965a); *d,* interior of dorsal valve, ×1 (Cooper, 1983).

**Striithyris** MUIR-WOOD, 1935, p. 129 [**S. somaliensis;* OD]. Medium size, elongate-oval, ventribiconvex, finely costellate, anterior commissure uniplicate to sulciplicate, beak short, massive, foramen large, permesothyrid, symphytium partly visible; cardinal process low, medianly depressed; hinge plates short, narrow, tapering, forming broad, U-shaped troughs with crural bases; loop 0.4 to 0.5 dorsal valve length, transverse band with low arch. *Middle Jurassic (Callovian)–Upper Jurassic (Oxfordian):* Somalia, Saudi Arabia, Israel.——FIG. 1380,*4a–d. *S. somaliensis,* Oxfordian; *a–c,* dorsal, lateral, and anterior views, Somalia, ×1 (Muir-Wood, 1965a); *d,* interior of dorsal valve of specimen, Saudi Arabia, ×1 (Cooper, 1983).

**Wattonithyris** MUIR-WOOD, 1936, p. 91 [**W. wattonensis;* OD] [=*Pseudowattonithyris* ALMÉRAS, 1971, p. 393 (type, *Terebratula circumdata* DESLONGCHAMPS, 1885 in 1862–1885, p. 131)]. Small to medium size, oval to subpentagonal, smooth, ventribiconvex, anterior commissure sulciplicate to bisulcate; beak suberect to incurved, foramen small, permesothyrid; pedicle collar present; cardinal process small, with shallow median sulcus; hinge plates ventrally concave, clubbed; loop 0.4 to 0.5 dorsal valve length, widely triangular, with nearly straight sides, transverse band with broad arch. *Middle Jurassic (?Bajocian, Bathonian):* England, France, Bulgaria, Poland, Russia, Morocco, ?Saudi Arabia, Tibet.——FIG. 1380,*1a–c. *W. wattonensis,* Bathonian, England; dorsal, lateral, and anterior views, ×1 (Muir–Wood, 1965a).——FIG. 1380,*1d. W. fullonica* MUIR-WOOD, Bathonian, England; interior of dorsal valve, ×1 (Cooper, 1983).

## Subfamily BOTHROTHYRIDINAE Cooper, 1983

[Bothrothyridinae COOPER, 1983, p. 45]

Large, rhomboidal, smooth, concavoconvex, anterior commissure unisulcate; crural processes anterior of midloop. *Middle Jurassic (Callovian).*

**Bothrothyris** COOPER, 1983, p. 61 [**B. curiosa;* OD]. Beak short, incurved, foramen small, mesothyrid; cardinal process thick, shafted, bilobed; crural bases round, solid; outer hinge plates narrow; crura long, narrow, descending lamellae long, thin; loop triangular, 0.4 dorsal valve length; transverse band strongly arched. *Middle Jurassic (Callovian):* Egypt.——FIG. 1381,*1. *B. curiosa;* ventral view of dorsal valve of interior of holotype, USNM 551007, ×1 (Cooper, 1983).

## Subfamily CERERITHYRIDINAE Cooper, 1983

[Cererithyridinae COOPER, 1983, p. 45]

Smooth or anteriorly costate; loops with shorter terminal points than Loboidothyridinae and crural processes close to or posterior of midloop. *Middle Jurassic (Bajocian)–Upper Jurassic (Oxfordian).*

**Cererithyris** BUCKMAN, 1918, p. 109 (BUCKMAN, 1914, p. 2, *nom. nud.*) [**Terebratula intermedia* J. SOWERBY, 1813 in 1812–1815, p. 48; OD]. Medium to large, ventribiconvex, smooth, anterior commissure rectimarginate to uniplicate or sulciplicate, beak short, foramen large, permesothyrid, symphytium partly visible; cardinal process small, hinge plates short, narrowly triangular, forming short, V- or U-shaped troughs with socket ridges; loop 0.5 dorsal valve length, widely triangular, transverse band with high arch. *Middle Jurassic (Bathonian):* England, France, Bulgaria, Tibet.——FIG. 1381,*5a–d. *C. intermedia* (J. SOWERBY), England; *a–c,* dorsal, lateral, and anterior views of lectotype, ×1 (Muir–Wood, 1965a); *d,* interior of dorsal valve, ×1 (Cooper, 1983).

**Animonithyris** COOPER, 1983, p. 52 [**Terebratula dorenbergi* FELIX, 1891, p. 176; OD]. Medium size, subcircular, smooth, ventribiconvex, anterior commissure rectimarginate to sulciplicate; beak short, erect, foramen large, meso- to submesothyrid, deltidial plates small, conjunct, pedicle collar short, excavate; cardinal process broad, semielliptical; crural processes at midloop; loop widely triangular, about 0.4 dorsal valve length. *Upper Jurassic (Oxfordian):* Mexico.——FIG. 1381,*2a–d. *A. dorenbergi* (FELIX); *a–c,* dorsal, lateral, and anterior views, ×1; *d,* interior of dorsal valve, ×1 (Cooper, 1983).

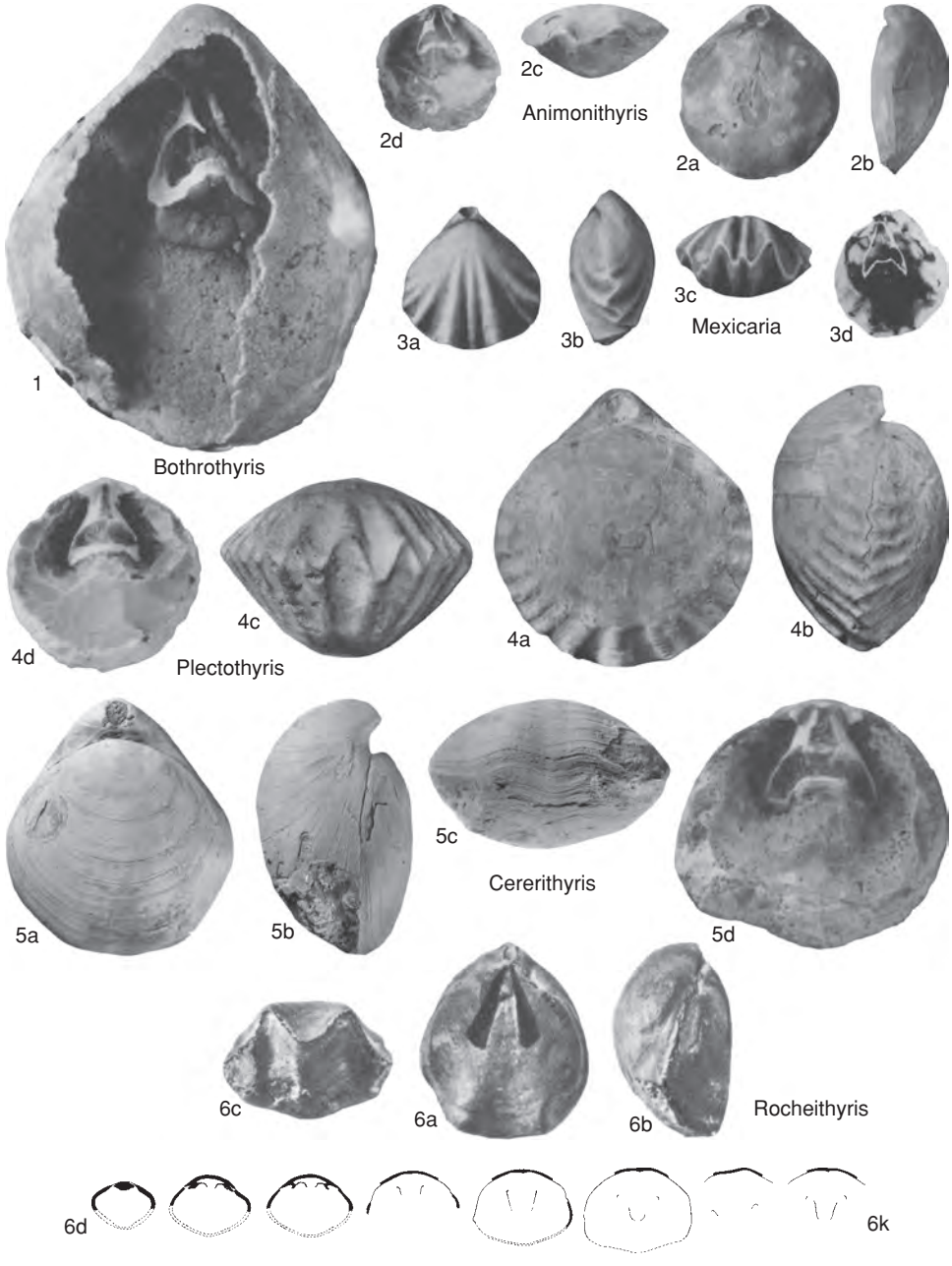


FIG. 1381. Loboidothyrididae (p. 2087–2089).

**Mexicaria** COOPER, 1983, p. 114 [**Parathyridina mexicana* OCHOTERENA, 1960, p. 24; OD]. Small, subpentagonal, ventribiconvex, anteriorly strongly but variably costate; anterior commissure sulciplicate, but with 2 or 3 costae on fold; beak short, suberect, foramen large, mesothyrid, loop similar to that of *Animonithyris. Upper Jurassic (Oxfordian):* Mexico.——FIG. 1381,*3a–d. *M. mexicana* (OCHOTERENA); *a–c,* dorsal, lateral, and anterior views, ×1; *d,* interior of silicified dorsal valve, ×1 (Cooper, 1983).

**Plectothyris** Buckman, 1918, p. 121, *non* Rollier, 1918, p. 252 (Buckman, 1914, p. 2, *nom. nud.*) [**Terebratula fimbria* J. Sowerby, 1822 in 1821–1822, p. 27; OD]. Medium to large, subcircular, plano- to ventribiconvex, anterior third to half of adult shell strongly costate; anterior commissure rectimarginate; beak short, foramen large, permesothyrid; cardinal process small, bilobed; loop broadly triangular. *Middle Jurassic (Bajocian):* England, France, ?Saudi Arabia.——Fig. 1381,*4a–d. P. fimbria* (J. Sowerby), England; *a–c,* dorsal, lateral, and anterior views, ×1 (Muir-Wood, 1965a); *d,* interior of dorsal valve, ×1 (Cooper, 1983).

**Rocheithyris** Alméras, 1971, p. 345 [**R. curvata;* OD]. Medium size, subpentagonal, smooth, biconvex, anterior commissure sulciplicate; beak short, foramen small, permesothyrid to mesothyrid, symphytium not exposed, pedicle collar present; cardinal process planoconvex, hinge plates in section club shaped, loop 0.5 dorsal valve length. *Middle Jurassic (Bajocian–Bathonian):* France.——Fig. 1381,*6a–k. *R. curvata; a–c,* dorsal, lateral, and anterior views of holotype, FSL 47917, ×1; *d–k,* serial transverse sections, 3.8, 5.5, 5.9, 7.5, 8.5, 11.5, 11.8, 13.9 mm from ventral umbo, ×1 (Alméras, 1971).

## Family PLECTOCONCHIDAE Dagys, 1974

[*nom. transl.* Lee, Smirnova, & Dagys, herein, *ex* Plectoconchinae Dagys, 1974, p. 197; *emend.,* Cooper, 1983, p. 38]

Medium size, semicostate to costate, beak labiate, anterior commissure rectimarginate to uniplicate, outer hinge plates dorsally attached to crural bases, loop short, wide. *Upper Triassic–Lower Jurassic.*

**Plectoconcha** Cooper, 1942, p. 233 [**Rhynchonella aequiplicata* Gabb, 1864, p. 35; OD]. Subrounded, strongly ventribiconvex, anterior commissure uniplicate, beak erect, foramen large, permesothyrid, labiate; pedicle collar strong; cardinal process broadly elliptical; outer hinge plates narrow, tapering anteriorly; crural processes close to anterior end of hinge plates; loop wide, transverse band thin, broadly arched. *Upper Triassic:* USA (Nevada).——Fig. 1382,*2a–f. *P. aequiplicata* (Gabb); *a–d,* dorsal, ventral, lateral, and anterior views, ×1 (Sandy & Stanley, 1993); *e–f,* dorsal and lateral views of imperfect loop, ×2 (Cooper, 1983).

**Merophricus** Cooper, 1983, p. 113 [**M. dubari;* OD; =*Terebratula* cf. *semiarata* Dubar, 1942, p. 63]. Subcircular, ventribiconvex, anterior commissure rectimarginate to uniplicate, beak short, suberect, foramen large, incomplete; outer hinge plates broad, flatly concave, crura not developed, loop short (0.3 dorsal valve length), wide, transverse band thin. *Lower Jurassic:* Morocco, Greece.——Fig. 1382,*1a–d. *M. dubari; a–c,* dorsal, lateral, and anterior views, ×1; *d,* dorsal view of imperfect loop, ×3 (Cooper, 1983).

## Family TRIADITHYRIDIDAE Pearson, 1977

[*nom. transl.* Lee, Smirnova, & Dagys, herein, *ex* Triadithyridinae Pearson, 1977, p. 42]

Medium to large, smooth, biconvex, anterior commissure rectimarginate to biplicate, cardinal process distinct, outer hinge plates narrow, with ventrally directed crural bases; loop about 0.4 to 0.6 dorsal valve length, transverse band high arched, formed of secondary elements that evolved in ontogeny on ventral part of vertical plate; flanges usually long. *Triassic–Upper Jurassic (Tithonian).*

**Triadithyris** Dagys, 1963, p. 187 [**Terebratula gregariaeformis* Zugmayer, 1880, p. 13; OD]. Medium size, subpentagonal, ventribiconvex, anterior commissure sulciplicate, beak short, suberect, foramen permesothyrid; pedicle collar present; cardinal process large, bilobed, outer hinge plates narrow, horizontal in section, crural bases indistinct; loop about 0.5 dorsal valve length, with diverging, descending lamellae. *Upper Triassic (Norian–Rhaetian):* Alps, Balkans, Carpathians, Crimea, Caucasus, Pamir.——Fig. 1383,*4a–s. *T. gregariaeformis* (Zugmayer); *a–c,* dorsal, lateral, and anterior views, ×1.7; *d–r,* serial transverse sections 0.8, 1.6, 2.4, 2.5, 2.7, 3.0, 3.3, 3.6, 3.75, 4.05, 4.5, 5.25, 6.45, 6.6, 6.75 mm from ventral umbo, ×1; *s,* loop reconstruction, ×1 (Pearson, 1977).

**Inversithyris** Dagys, 1968, p. 92 [**I. rhomboidalis* Dagys, 1968, p. 93; OD]. Medium size, biconvex, anterior commissure inicipiently unisulcate, beak short, foramen mesothyrid; pedicle collar present; cardinal process large, undivided, outer hinge plates horizontal or sloping; crural bases perpendicular to hinge plates, directed ventrally and dorsally; loop about 0.5 dorsal valve length, with flanges. *Middle Jurassic:* northeastern Siberia.——Fig. 1383,*1a–q. *I. rhomboidalis; a–c,* dorsal, lateral, and anterior views, ×1; *d–q,* serial transverse sections 0.0, 2.2, 2.6, 2.8, 3.9, 4.4, 4.7, 5.2, 5.8, 6.9, 8.8, 9.7, 10.2, 11.2 mm from first section, ×1 (Dagys, 1968).

**Laevithyris** Dagys, 1974, p. 198 [**Lobothyris rossochae* Dagys, 1965, p. 143; OD]. Medium size, elongate-oval, anterior commissure slightly uniplicate; beak short, permesothyrid; pedicle collar short; cardinal process low, undivided, outer hinge plates narrow, horizontal, crural bases high, directed ventrally, loop 0.4 dorsal valve length, with short flanges. *Triassic:* northeastern Siberia, Primorye.——Fig. 1383,*2a–c. *L. rossochae* (Dagys), Norian, Siberia; dorsal, lateral, and anterior views, ×1 (Dagys, 1968).

**Lenothyris** Dagys, 1968, p. 100 [**L. perflexus;* OD]. Large, subrounded, juveniles thin, with flattened dorsal valve; adults strongly biconvex, geniculate; anterior commissure rectimarginate; beak short, foramen permesothyrid; pedicle collar short; cardinal process thickened, undivided; outer hinge plate

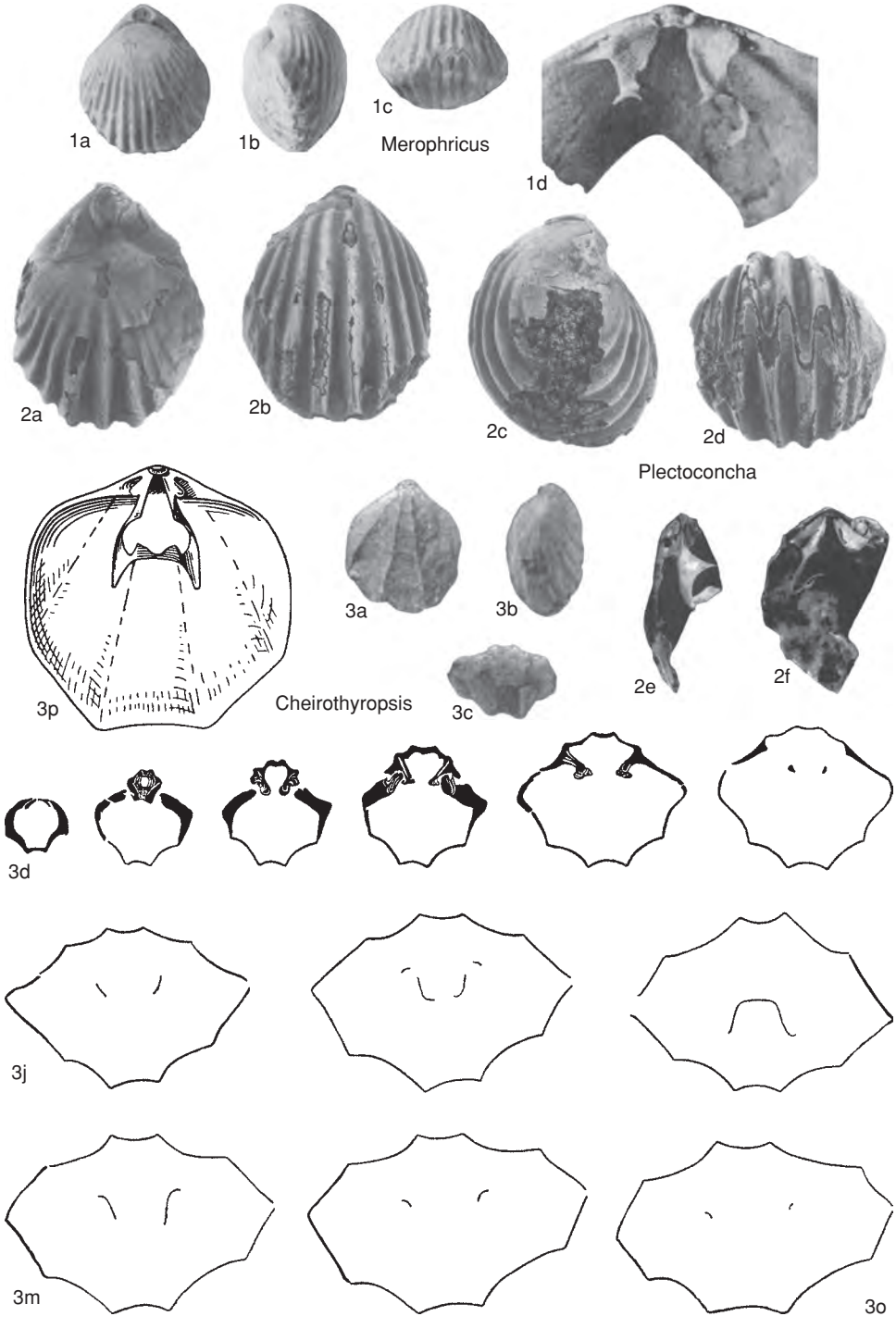


FIG. 1382. Plectoconchidae and Cheirothyropsidae (p. 2089–2096).

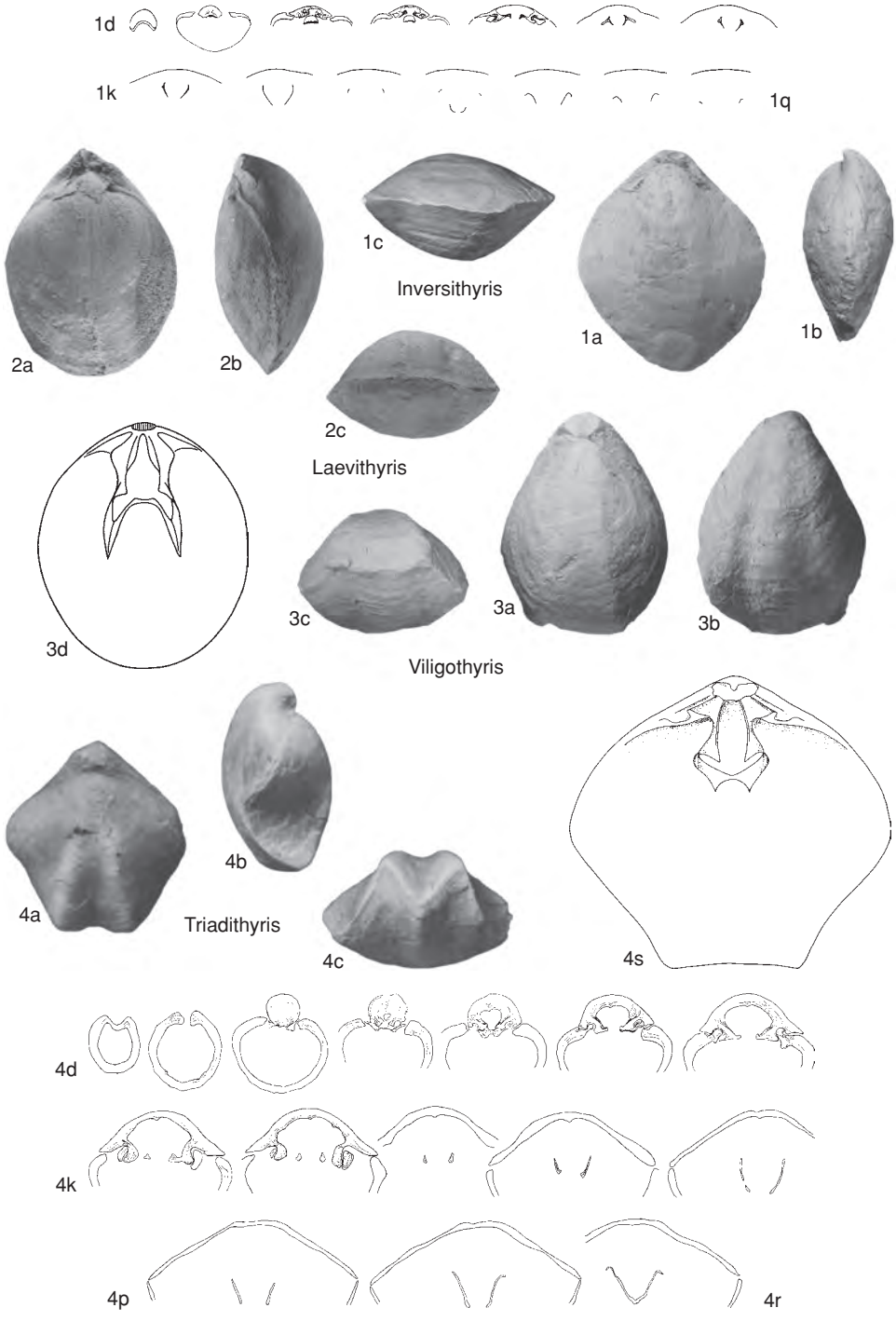


FIG. 1383. Triadithyrididae (p. 2089–2092).

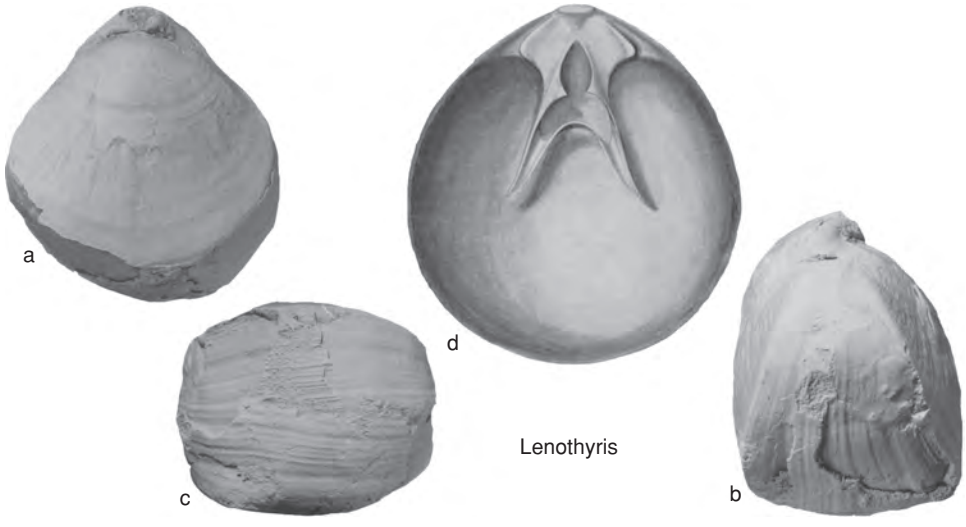


FIG. 1384. Triadithyrididae (p. 2089–2092).

subhorizontal in section, crural bases distinct; loop about 0.5 dorsal valve length, with long flanges. *Upper Jurassic (Tithonian):* Northern Siberia.——FIG. 1384*a–d.* **L. perflexus,* Volgian; *a–c,* dorsal, lateral, and anterior views, ×1 (Dagys, 1968); *d,* reconstruction of loop, ×1 (Cooper, 1983).

**Viligothyris** DAGYS, 1968, p. 89 [**V. orientalis;* OD]. Medium size, biconvex, elongate-oval, anterior commissure uniplicate to paraplicate; beak short, foramen permesothyrid; pedicle collar distinct; cardinal process low, undivided, outer hinge plates narrow, subhorizontal in section; crural bases low, directed ventrally; narrow, inner hinge plates present; loop about 0.6 dorsal valve length, with long, anterior flanges. *Lower Jurassic (Pliensbachian):* northeastern Siberia.——FIG. 1383,*3a–d.* **V. orientalis; a–c,* dorsal, ventral, and anterior views, ×2 (Dagys, 1968); *d,* loop reconstruction, ×1 (Cooper, 1983).

## Family BOREIOTHYRIDIDAE Dagys, 1968

[*nom. correct.* SMIRNOVA, 1990a, p. 98, *pro* Boreiothyridae DAGYS, 1968, p. 110]

Large to very large, smooth, rectimarginate to unisulcate; beak short, foramen large, permesothyrid; crural process distinct, crural plates connected with valve floor or enveloping low septum, forming broad septalium; loop about 0.5 dorsal valve length, high arched, with long flanges; transverse band formed from secondary elements that evolve on ventral part of vertical plate during ontogeny. *Lower Jurassic–Lower Cretaceous (Hauterivian).*

**Boreiothyris** DAGYS, 1968, p. 110 [**B. bojarkensis;* OD]. Very large, subtrigonal to elongate-oval, ventribiconvex, anterior commissure rectimarginate; pedicle collar thick; cardinal process massive, undivided, outer hinge plates narrow, crural plates long, inclined to valve floor, enveloping low septum forming septalium. *Middle Jurassic (Callovian)–Upper Jurassic (Kimmeridgian):* northeastern Siberia.——FIG. 1385*a–p.* **B. bojarkensis,* Kimmeridgian; *a–c,* dorsal, lateral, and anterior views, ×1; *d–p,* serial transverse sections 3.6, 4.4, 5.1, 5.5, 5.9, 7.1, 9.1, 10.6, 12.1, 15.1, 17.1, 18.6, 24.6 mm from ventral umbo, ×1 (Dagys, 1968).

**Omolonothyris** DAGYS, 1968, p. 132 [**O. inopinatus;* OD]. Large, oval, biconvex, anterior commissure rectimarginate; pedicle collar present; cardinal process low, undivided; outer hinge plates broad, subhorizontal in section, crural plates very short, perpendicular to hinge plates, connected with valve floor some distance from low septum. *Lower Jurassic (Toarcian):* northeastern Siberia.——FIG. 1386,*1a–c.* **O. inopinatus;* dorsal, lateral, and anterior views, ×1 (Dagys, 1968).

**Pamirothyropsis** OVTSHARENKO, 1979, p. 126, *nom. nov. pro Pamirothyris* OVTSHARENKO, 1975, p. 116, *non* DAGYS, 1974, p. 195 [**Pamirothyris vialovi* OVTSHARENKO, 1975, p. 117; OD]. Large, concavoconvex, anterior commissure broadly unisulcate, beak short, hinge teeth massive; cardinal process short, bilobate; hinge plates slightly inclined dorsally, crural plates derived from dorsal ends of crural bases almost perpendicular to valve floor; resting on short septal lamellae; ventral ends of crural processes strongly curved laterally. *Middle Jurassic*

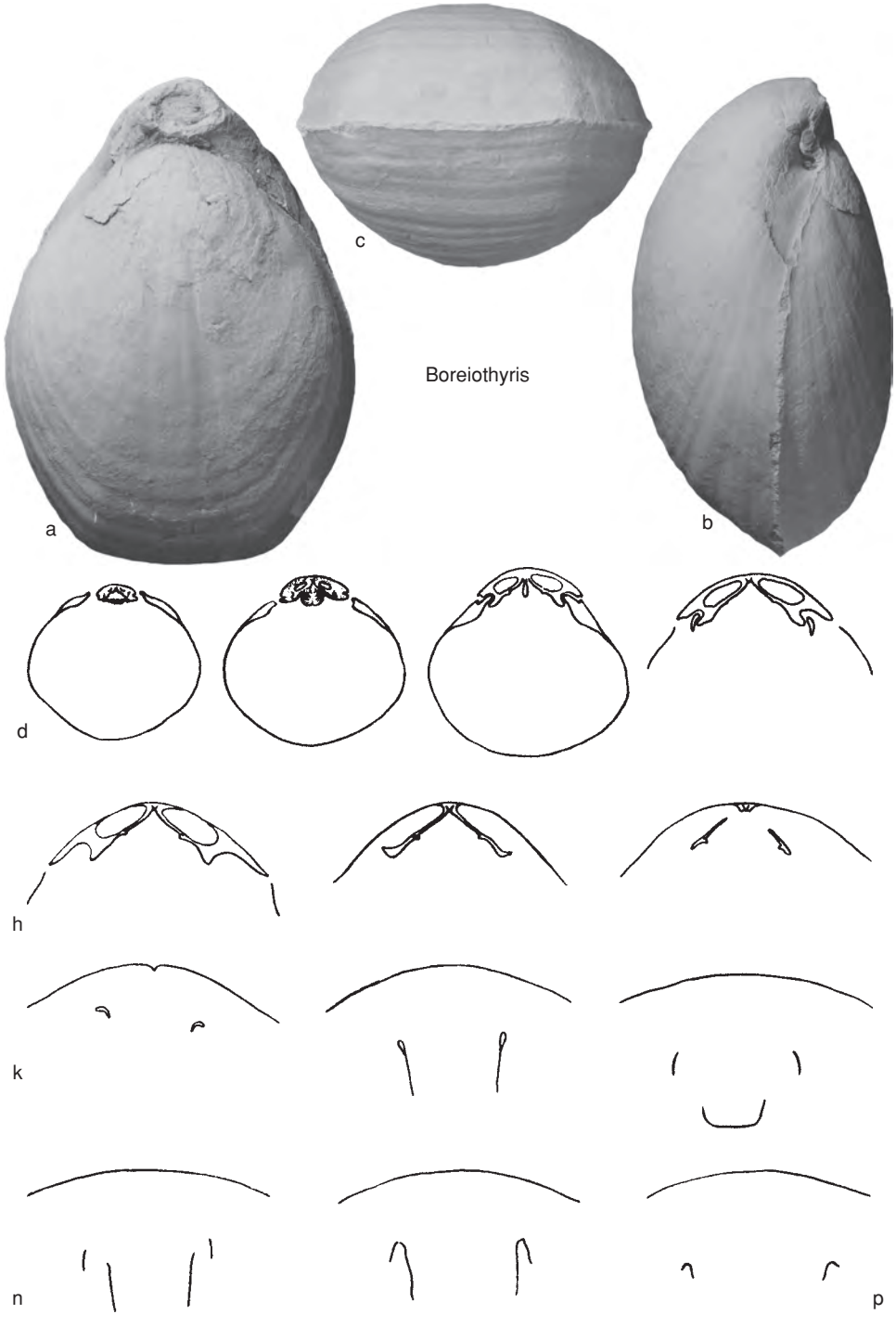


FIG. 1385. Boreiothyrididae (p. 2092).

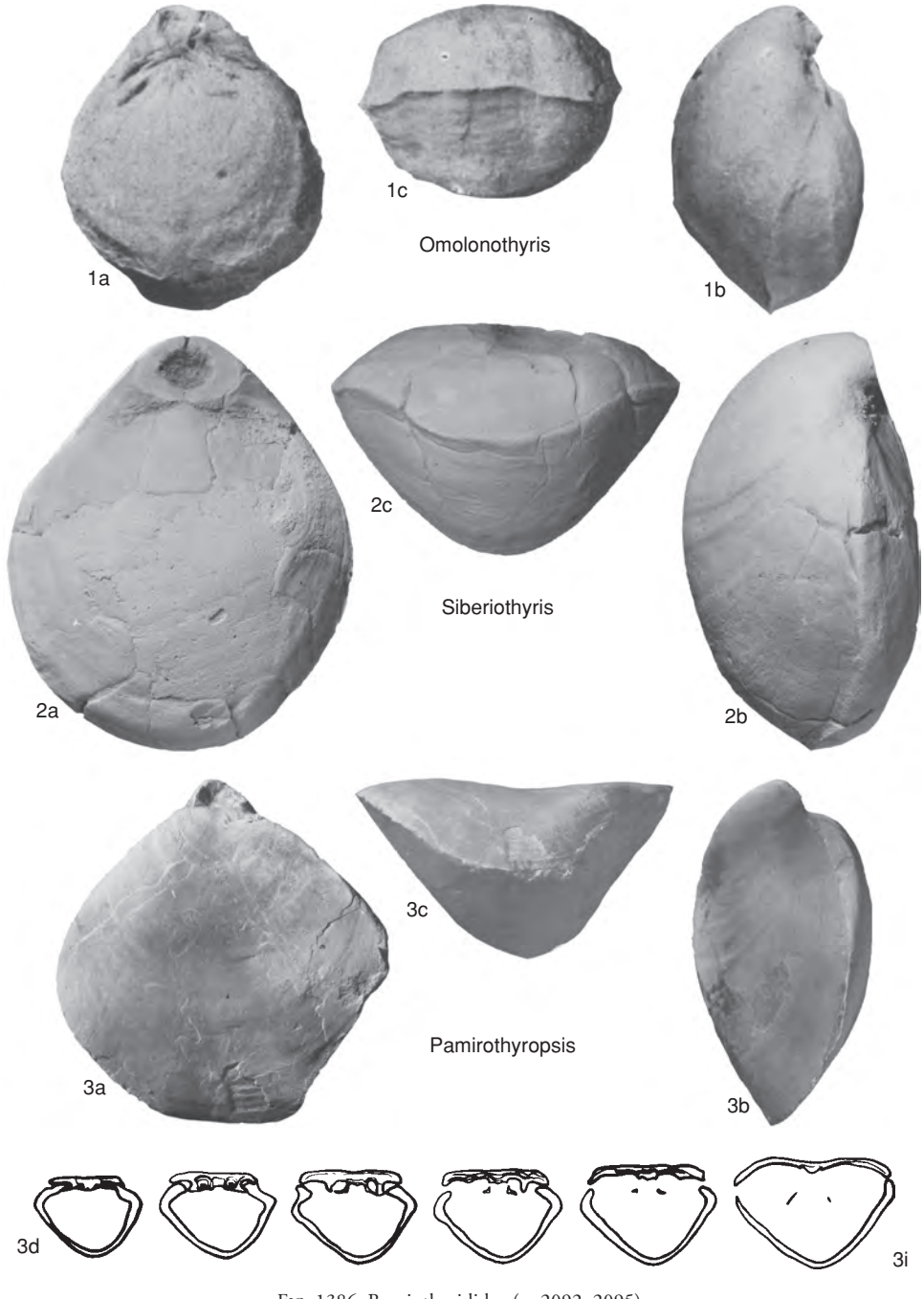


FIG. 1386. Boreiothyrididae (p. 2092–2095).

*(Callovian):* Tadzhikistan, Pamirs.——FIG. 1386,*3a–i. *P. vialovi* (OVTSHARENKO), Pamirs; *a–c,* dorsal, lateral, and anterior views; *d–i,* serial transverse sections 2.4, 3.6, 4.1, 4.5, 5.2, 7.1 mm from ventral umbo, ×1 (new).

**Siberiothyris** DAGYS, 1968, p. 128 [**S. crassus;* OD]. Very large, planoconvex, anterior commissure broadly unisulcate, beak thick, short, suberect; pedicle collar massive; cardinal process low, undivided, crural plates weakly diverging, connected

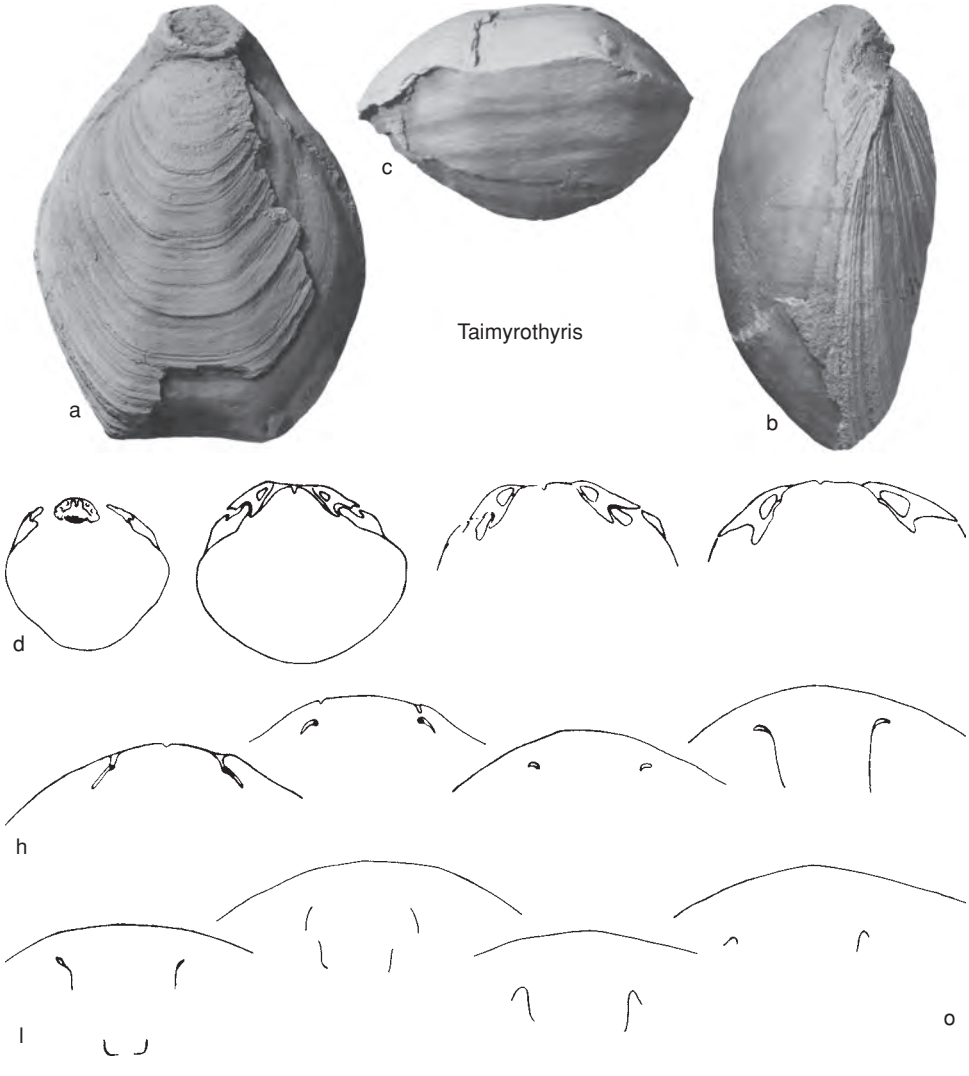


FIG. 1387. Boreiothyrididae (p. 2095).

with valve floor; septalium lacking. *Lower Cretaceous (Berriasian–Hauterivian):* Northern Urals, northern Siberia.——FIG. 1386,*2a–c.* **S. crassus,* Valanginian, northern Siberia; dorsal, lateral, and anterior views, ×1 (Dagys, 1968).

**Taimyrothyris** DAGYS, 1968, p. 118 [**T. bisulcatus;* OD]. Large, biconvex, may have sulcus on both valves; anterior commissure rectimarginate; pedicle collar distinct; cardinal process low, undivided, outer hinge plates narrow, crural plates diverging, attached to valve floor some distance from low median septum. *Upper Jurassic–Lower Cretaceous (Tithonian–Valanginian):* Northern Siberia.——FIG. 1387*a–o.* **T. bisulcatus,* Tithonian; *a–c,* dorsal, lateral, and anterior views, ×1; *d–o,* serial transverse sections 4.7, 7.3, 8.3, 10.0, 12.5, 13.0, 13.8, 14.8, 18.5, 19.3, 21.9, 25.3 mm from ventral umbo, ×1 (Dagys, 1968).

## Family CHEIROTHYROPSIDAE Cooper, 1983

[Cheirothyropsidae COOPER, 1983, p. 45]

Medium size, subpentagonal; both valves with four opposite, ridgelike plications, anterior commissure rectimarginate. *Middle Jurassic (Callovian).*

**Cheirothyropsis** MAKRIDIN, 1964, p. 267 [**Terebratula pseudotrigonella* TRAUTSCHOLD, 1877, p. 102; OD]. Biconvex, ornament reticulate, four radial carinae on each valve; beak short, slightly incurved, foramen large, circular, mesothyrid; symphytium exposed; pedicle collar small; cardinal process bi- or trilobed; hinge plates divided, loop about 0.5 dorsal valve length, with long flanges; transverse band strongly arched. [Homeomorph of the zeilleriid *Cheirothyris*.] *Middle Jurassic (Callovian):* Russian Platform, Crimea, ?Western Europe.——FIG. 1382,*3a–p.* **C. pseudotrigonella* (TRAUTSCHOLD), Russia; *a–c,* dorsal, lateral, and anterior views, ×1; *d–o,* serial transverse sections 2.0, 3.0, 3.3, 3.7, 4.5, 4.9, 6.5, 9.0, 9.1, 9.4, 10.2, 10.8 mm from ventral umbo, ×1; *p,* loop reconstruction, ×2 (Makridin, 1964).

## Family CHENIOTHYRIDIDAE Muir-Wood, 1965

[Cheniothyrididae MUIR-WOOD, 1965a, p. 800]

Small, subpentagonal to elongate; ornament of steplike, squamose lamellae with numerous papillae, loop short. *Middle Jurassic (Bajocian).*

**Cheniothyris** BUCKMAN, 1918, p. 128 (BUCKMAN, 1915, p. 79, *nom. nud.*) [**Terebratula morierei* EUDES-DESLONGCHAMPS in DAVIDSON, 1852b, p. 256; OD]. Moderately biconvex, each valve with median depression forming gently bilobate anterior margin; shell folding ligate, anterior commissure rectimarginate, foramen large, permesothyrid, symphytium high; cardinal process low, short, hinge plates in section thick, somewhat trigonal, ventrally directed and concave; loop about 0.3 valve length, with strongly arched transverse band, not fully known. *Middle Jurassic (Bajocian):* England, France.——FIG. 1388,*1a–l.* **C. morierei* (EUDES-DESLONGCHAMPS); *a–c,* dorsal, lateral, and anterior views, ×2; *d–l,* serial transverse sections, distances between sections unknown, ×1.4 (Muir-Wood, 1965a).

## Family DICTYOTHYRIDIDAE Makridin, 1964

[*nom. correct. et transl.* MUIR-WOOD, 1965a, p. 801, *ex* Dictyothyrinae MAKRIDIN, 1964, p. 260]

Small to medium size, subpentagonal, shell ornament reticulate, anterior commissure plicosulcate. *Middle Jurassic–Lower Cretaceous (Hauterivian).*

**Dictyothyris** DOUVILLÉ, 1879, p. 267 [**Terebratulites coarctatus* PARKINSON, 1811, p. 229; OD]. Ventribiconvex; folding ligate, anterior commissure strongly plicosulcate; ornament reticulate with low nodes or spines at point of intersection; beak long, erect; foramen large, mesothyrid, symphytium may be exposed; cardinal process large, bilobed, medianly flattened, with posterior umbonal cavity; outer hinge plates small, triangular, thick and flattened, attached ventrally to crural bases; crura short, crural processes long, slender, ventrally directed, anterior of midloop; loop 0.4 dorsal valve length, very wide; transverse band strongly arched, medially flattened, protuberant, with short flanges. *Middle Jurassic (Bathonian)–Lower Cretaceous (Hauterivian):* England, France, Russia, Crimea.——FIG. 1388,*3a–d.* **D. coarctata* (PARKINSON), Bathonian, England, France; *a–c,* dorsal, lateral, and anterior views, ×1.8 (Muir-Wood, 1965a); *d,* interior of dorsal valve of specimen, France, ×2 (Cooper, 1983).

## Family DIENOPIDAE Cooper, 1983

[Dienopidae COOPER, 1983, p. 42]

Medium size, elongate-pentagonal, ornament reticulate, anterior commissure parasulcate, loop very long. *Middle Jurassic (Callovian).*

**Dienope** COOPER, 1983, p. 72 [**Terebratula trigeri* DESLONGCHAMPS, 1856b, p. 97; OD]. Ventribiconvex, ornament of fine, radial capillae crossed by fine, concentric threads, beak suberect, foramen large, mesothyrid; cardinal process bilobed, protuberant; outer hinge plates welded to socket ridges, moderately convex toward ventral valve; crural processes wide, sharply pointed, loop extremely long, about 0.7 dorsal valve length, descending lamellae narrow, slender, transverse band moderately broad. *Middle Jurassic (Callovian):* France.——FIG. 1388,*2a–e.* **D. trigeri* (DESLONGCHAMPS); *a–b,* dorsal and anterior views, ×1; *c–d,* ventral and lateral views of loop of another specimen, ×1; *e,* somewhat idealized loop reconstruction, ×1 (Cooper, 1983).

## Family HESPERITHYRIDIDAE Cooper, 1983

[Hesperithyrididae COOPER, 1983, p. 42]

Smooth, strongly plicate, outer hinge plates narrow, ventrally attached to crural bases. *Lower Jurassic.*

**Hesperithyris** DUBAR, 1942, p. 78 [**Terebratula renierii* CATULLO, 1827, p. 167, var. *sinuosa* DUBAR, 1942, p. 83; OD]. Small to large, strongly ventribiconvex, anterior commissure uniplicate, ornament of broad, subangular plicae, alternating on opposite valves, normally 2 on fold, 1 in sulcus, and 2 bounding sulcus; beak long, protuberant, foramen large, symphytium exposed; cardinal process large, wide, bilobed; outer hinge plates small, fused with crural bases; loop short, not fully known. *Lower Jurassic:* Morocco, Portugal, Alps, Timor.——FIG. 1388,

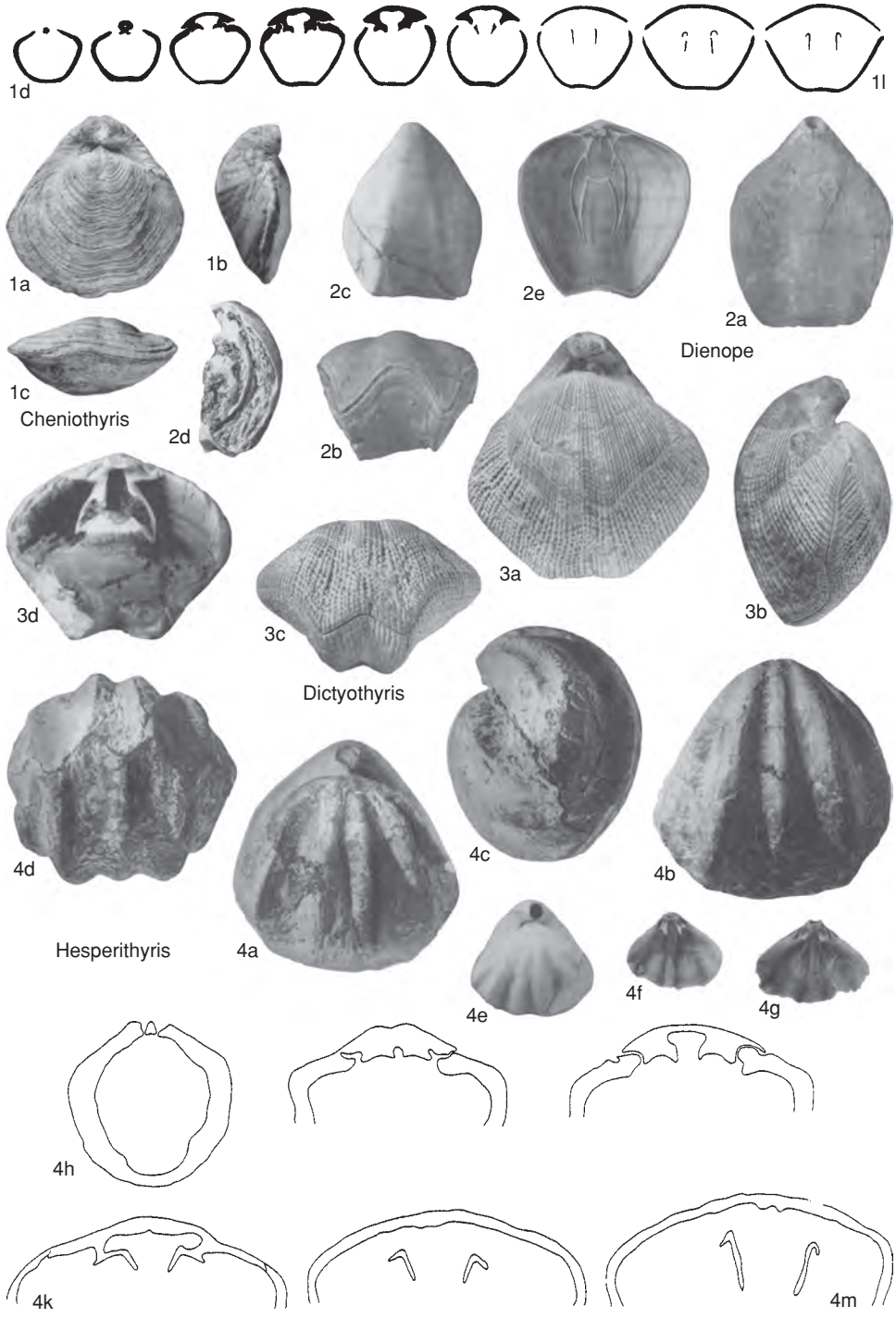


FIG. 1388. Cheniothyrididae, Dictyothyrididae, Dienopidae, and Hesperithyrididae (p. 2096–2098).

*4a–g. *H. sinuosa* (Dubar), Morocco; *a–d,* dorsal, ventral, lateral, and anterior views, ×1 (Muir-Wood, 1965a); *e–g,* dorsal and interior views, ×1 (Cooper, 1983).——Fig. 1388,*4h–m. H. ribeiroi* (Choffat), Sinemurian, Portugal; serial transverse sections 4.7, 5.5, 5.9, 6.9, 7.8, 8.6 mm from first sections, ×2 (Ager & Walley, 1977).

## Family LISSAJOUSITHYRIDIDAE Cooper, 1983

[*nom. transl.* Lee, Smirnova, & Dagys, herein, *ex* Lissajousithyridinae Cooper, 1983, p. 43]

Small to large, smooth, commonly ventribiconvex, commonly rectimarginate, uniplicate or sulciplicate, loop long, variable in width, outer hinge plates dorsally attached to crural bases, crural processes posterior of midloop, terminal points may be very long. *Lower Jurassic (Toarcian)–Upper Jurassic.*

### Subfamily LISSAJOUSITHYRIDINAE Cooper, 1983

[Lissajousithyridinae Cooper, 1983, p. 43]

Transverse band without deep reentrant on posterior side. *Lower Jurassic (Toarcian)–Upper Jurassic.*

**Lissajousithyris** Alméras, 1971, p. 164 [**Terebratula matisconensis* Lissajous in Arcelin & Roche, 1936, p. 80; OD]. Medium size, elongate-oval; anterior commissure uniplicate to sulciplicate, sulcus broad; beak short, foramen mesothyrid, symphytium wide, exposed; pedicle collar short; teeth massive; cardinal process small, outer hinge plates short, triangular, loop very long, 0.4 to 0.6 dorsal valve length, terminal points very long, webbed, transverse band high, narrow arch, flattened medially. *Middle Jurassic (Bajocian):* France.——Fig. 1389,*1a–d. *L. matisconensis* (Lissajous); *a–c,* dorsal, lateral, and anterior views, ×1 (Alméras, 1971); *d,* interior of dorsal valve, ×1 (Cooper, 1983).

**Apatecosia** Cooper, 1983, p. 53 [**Cererithyris nutiensis* Bague, 1955, p. 219; OD] [=*Gyrosina* Cooper, 1983, p. 86 (type, *G. rotunda,* OD)]. Medium size, oval, anterior commissure sulciplicate; beak narrow, labiate, foramen mesothyrid, symphytium partly visible; cardinal process small, outer hinge plates short, narrow; loop 0.45 dorsal valve length, transverse band narrowly arched. *Middle Jurassic (Callovian):* France, Saudi Arabia, Tibet.——Fig. 1389,*3a–d. *A. nutiensis* (Bague), France; *a–c,* dorsal, lateral, and anterior views, ×1; *d,* dorsal valve interior, ×1 (Cooper, 1983).

**Arcelinithyris** Alméras, 1971, p. 173 [**Terebratula arcelini* Lissajous in Arcelin & Roche, 1936, p. 83; OD]. Medium size, elongate oval; anterior commissure rectimarginate; beak suberect, labiate, foramen large, permesothyrid, symphytium exposed; pedicle collar short, teeth narrow, elongate; cardinal process small, outer hinge plates wide, triangular, flat, loop elongate triangular, 0.5 dorsal valve length. *Middle Jurassic (Bajocian):* France.——Fig. 1389,*2a–d. *A. arcelini* (Lissajous); *a–c,* dorsal, lateral, and anterior views, ×1; *d,* loop, ×2 (Cooper, 1983).

**Dorsoplicathyris** Alméras, 1971, p. 437 [**Terebratula dorsoplicata* Suess, 1855, in Deslongchamps, 1856b, p. 97; OD] [=*Pentithyris* Cooper, 1983, p. 127 (type, *Terebratula pelagica* Rollier, 1918, p. 233); *Stenorina* Cooper, 1989, p. 91 (type, *S. parallela*); *Tanyothyris* Cooper, 1989, p. 94 (type, *T. angustata*)]. Large, elongate oval, anterior commissure uniplicate to sulciplicate; beak short, labiate, foramen large, permesothyrid; cardinal process small; outer hinge plates long, close to valve floor; crural processes at midloop; loop long, triangular, flanges long, narrow. *Middle Jurassic (Bathonian)–Upper Jurassic (Oxfordian):* France, Switzerland, Germany, Turkmenia, Crimea, Saudi Arabia, Nepal, Tibet.——Fig. 1390,*2a–d. *D. dorsoplicata* (Suess), Callovian, France; *a–c,* dorsal, lateral, and anterior views, ×1; *d,* dorsal valve interior, ×2 (Cooper, 1983).

**Eristenosia** Cooper, 1983, p. 78 [**E. circularis;* OD]. Small, nearly circular, anterior commissure rectimarginate, beak short, erect, foramen small, permesothyrid; cardinal process very small, outer hinge plates short, narrow, deeply concave; loop 0.4 dorsal valve length, very narrow, terminal points long, webbed, transverse band very narrow, forming an angular arch. *Upper Jurassic (Kimmeridgian):* France.——Fig. 1390,*1a–d. *E. circularis; a–c,* dorsal, lateral, and anterior views, ×1; *d,* dorsal valve interior, ×2 (Cooper, 1983).

**Monsardithyris** Alméras, 1971, p. 198 [**Terebratula ventricosa* Zieten, 1830 in 1830–1833, p. 52; OD]. Large, elongate oval; anterior commissure rectimarginate to broadly uniplicate to sulciplicate; beak short, suberect, labiate, foramen large, permesothyrid; pedicle collar short, excavated, teeth long, narrow; cardinal process small, outer hinge plates short, narrow, triangular, concave, often notched anteriorly, loop long, triangular, 0.5 dorsal valve length, terminal points very long, webbed, transverse band and loop variable. *Lower Jurassic (Toarcian)–Middle Jurassic (Bajocian):* France, England, Germany, Algeria, Morocco, Arabia, Tibet.——Fig. 1390,*5a–d. *M. ventricosa* (Zieten), Bajocian; *a–c,* dorsal, lateral, and anterior views, Germany, ×1 (Alméras & Moulan, 1988); *d,* interior of dorsal valve, France, ×1 (Cooper, 1983).

**Rouillieria** Makridin in Licharew, Makridin, & Rzhonsnitskaya, 1960, p. 295 [**Terebratula michalkowii* Fahrenkohl, 1856, p. 228; OD]. Large to very large, subcircular to elongate-oval, anterior commissure uniplicate to sulciplicate, beak very short, foramen large, mesothyrid; pedicle collar present, hinge teeth long, narrow; cardinal process broad, thin dorsal septum reaching 0.5 valve length; outer hinge plates broad, crural bases

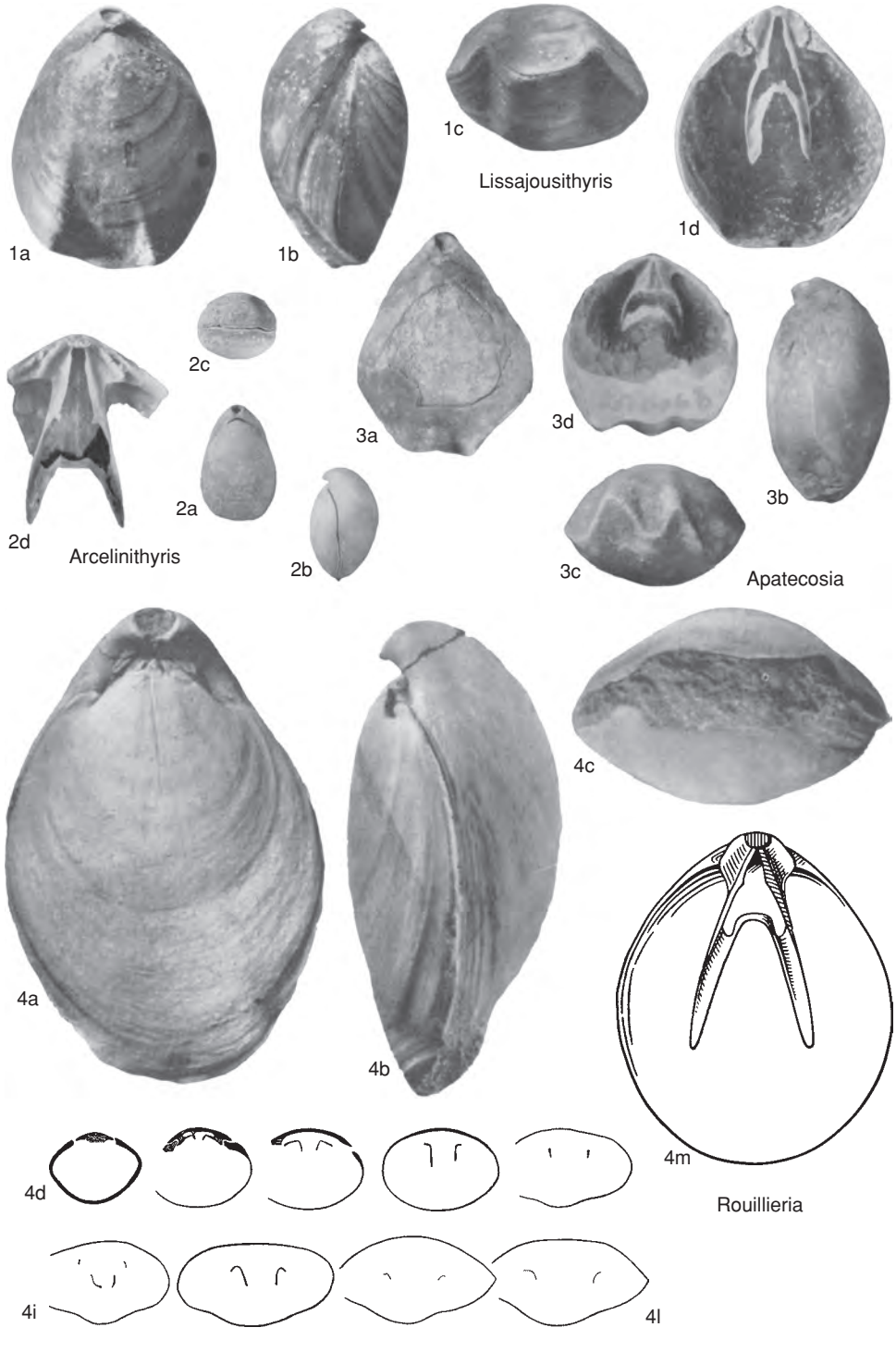


FIG. 1389. Lissajousithyrididae (p. 2098–2101).

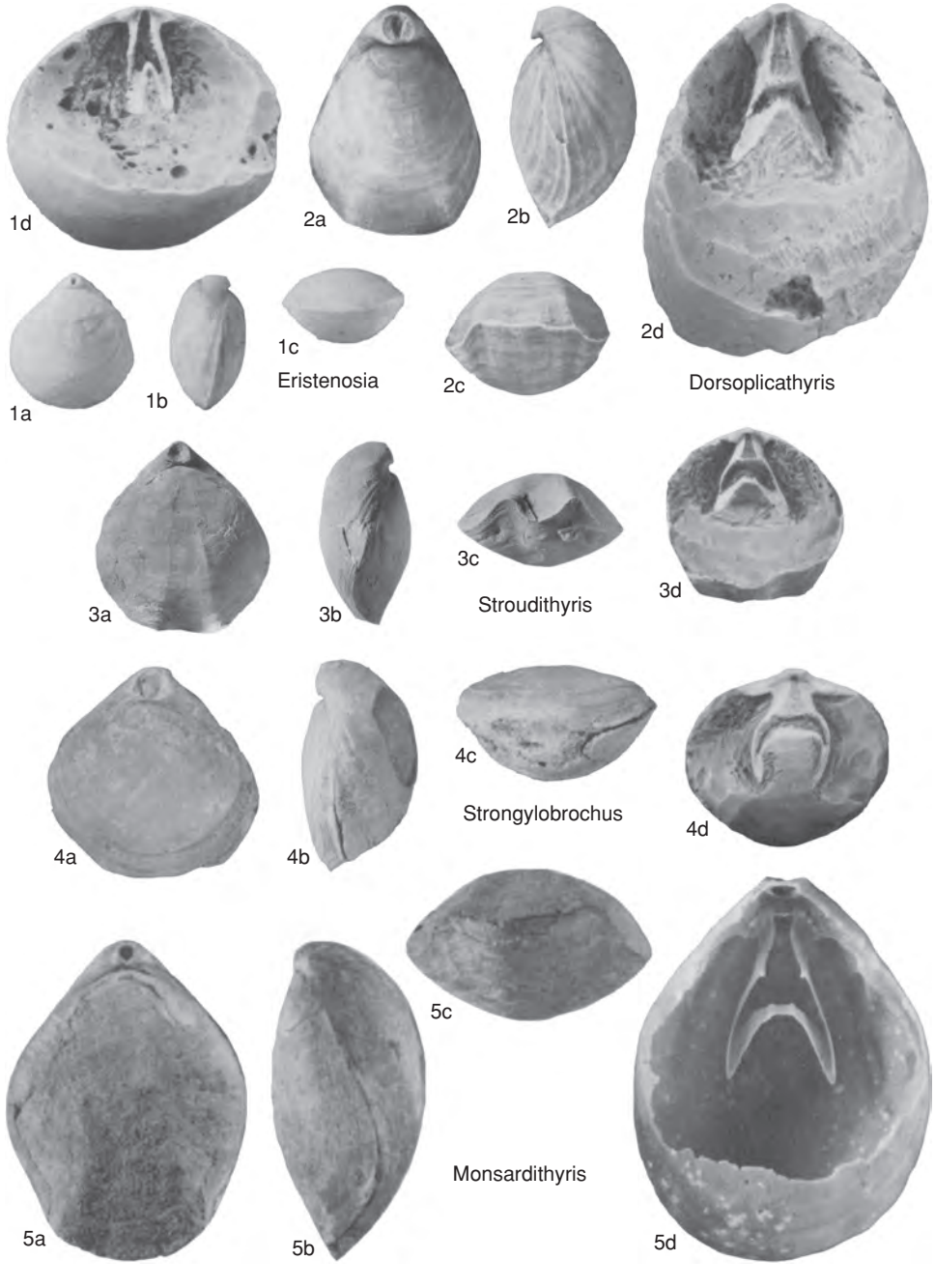


FIG. 1390. Lissajousithyrididae (p. 2098–2101).

forming lateral umbonal cavities reaching valve floor; loop slender, very long, 0.6 to 0.7 dorsal valve length, terminal points very long, webbed; transverse band narrow. *Upper Jurassic:* Russian Platform, Urals, Poland, England.——FIG. 1389,*4a–m.* **R. michalkowii* (FAHRENKOHL), Russia; *a–c,* dorsal, lateral, and anterior views, ×1; *d–l,* serial transverse sections 6.8, 8.7, 10.1, 12.6, 16.2, 18.0, 21.0, 29.6, 32.3 mm from ventral umbo, ×1; *m,* reconstruction of loop, ×1 (Makridin, 1964).

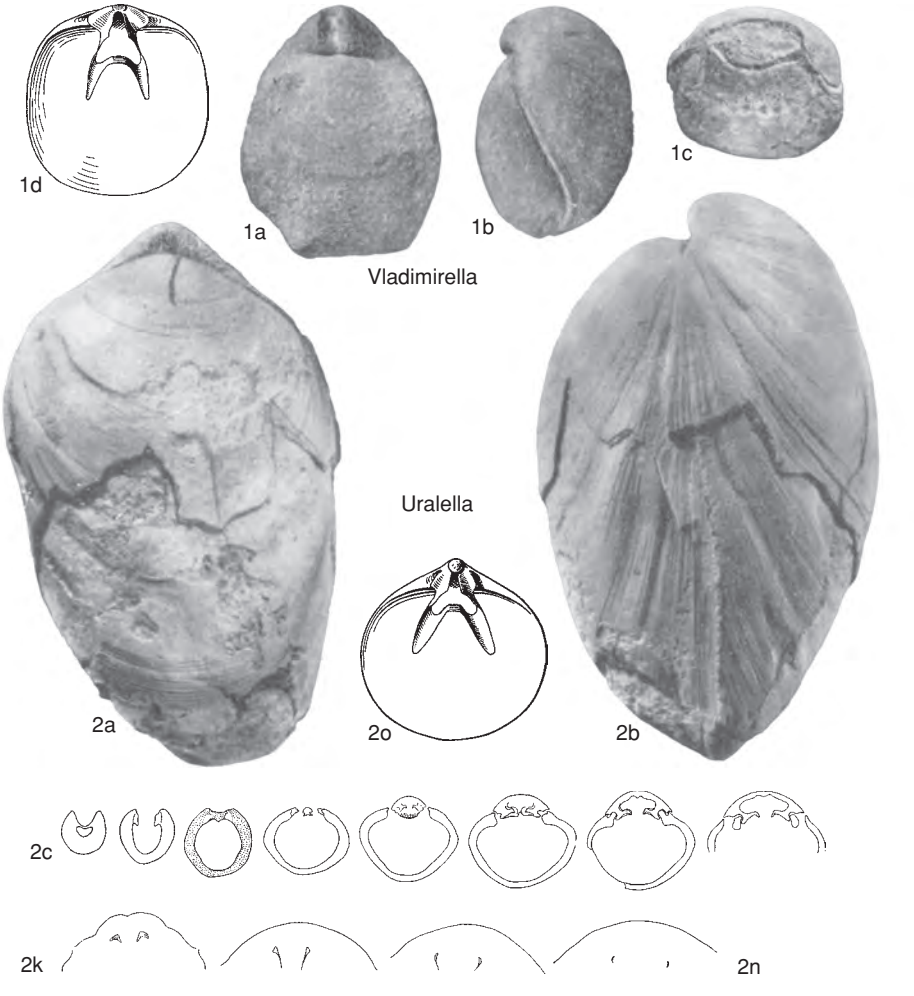


FIG. 1391. Lissajousithyrididae (p. 2101–2102).

**Strongylobrochus** COOPER, 1983, p. 155 [**Terebratula omalogastyr* ZIETEN, 1830 in 1830–1833, p. 54; OD]. Large, subpentagonal to broadly ovate, planoconvex, anterior commissure rectimarginate to gently uniplicate, beak large, protuberant, foramen large, permesothyrid, symphytium visible; cardinal process thin, narrow, outer hinge plates narrow, close to valve floor; loop 0.6 dorsal valve length, descending branches thin, widely bowed; terminal points long, webbed, bowed inwardly; transverse band broad, flattened arch. *Middle Jurassic (Bajocian):* Germany.——FIG. 1390,*4a–d.* **S. omalogastyr* (ZIETEN); *a–c,* dorsal, lateral, and anterior views, ×1; *d,* dorsal valve interior, ×1 (Cooper, 1983).

**Stroudithyris** BUCKMAN, 1918, p. 111 (BUCKMAN, 1915, p. 78, *nom. nud.*) [**Terebratula pisolithica* BUCKMAN, 1886, p. 41; OD] [=*Saucrobrochus* COOPER, 1983, p. 145 (type, *Terebratula whaddonensis* BUCKMAN, 1910, p. 101)]. Medium size, subpentagonal, anterior commissure sulciplicate, beak short, suberect, labiate, foramen large, mesothyrid, symphytium mainly concealed; cardinal process small, no umbonal cavity, outer hinge plates narrow, deeply concave, loop 0.5 dorsal valve length, terminal points long, webbed, transverse band high. *Lower Jurassic (Toarcian)–Middle Jurassic (Bajocian):* England, France, Switzerland, Italy, Spain, Portugal, North Africa (Algeria).——FIG. 1390,*3a–d.* **S. pisolithica* (BUCKMAN), Bajocian, England; *a–c,* dorsal, lateral, and anterior views, ×1 (Muir-Wood, 1965a); *d,* interior of dorsal valve, ×1 (Cooper, 1983).

**Uralella** MAKRIDIN in LICHAREW, MAKRIDIN, & RZHONSNITSKAYA, 1960, p. 295 [**Terebratula strogonofii* D'ORBIGNY, 1845b, p. 483; OD]. Very large, elongate-oval, anterior commissure rectimarginate, beak large, foramen circular,

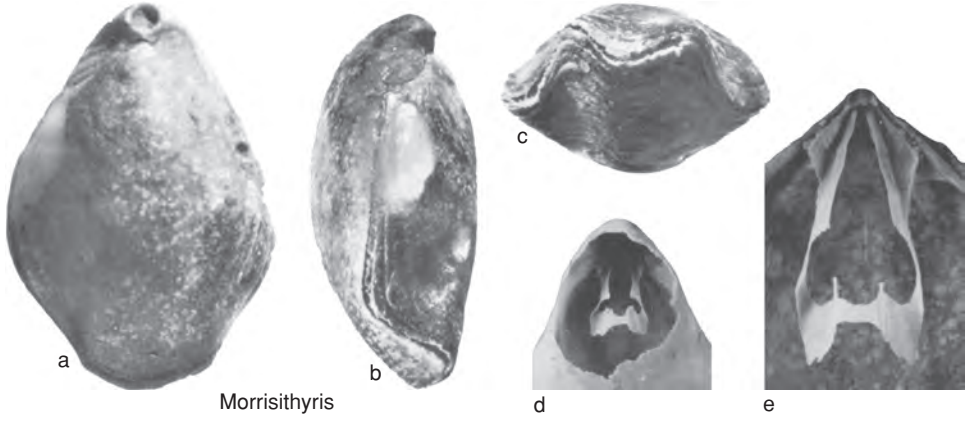


FIG. 1392. Lissajousithyrididae (p. 2102).

permesothyrid; pedicle collar well developed; cardinal process large, almost quadrate in section; crural bases thick, may touch valve floor, forming lateral cavities; median septum well developed, especially in juveniles; loop poorly known, apparently long, widely triangular, with long terminal points. *Upper Jurassic (Tithonian):* Northern Urals, northern Siberia, ?England.——FIG. 1391,*2a–n. *U. strogonofii* (D'ORBIGNY), Urals; *a–b,* dorsal and lateral views ×0.6 (Makridin, 1964); *c–n,* serial transverse sections, ×1 (Dagys, 1968).——FIG. 1391,*2o. U. gigantea* MAKRIDIN; reconstruction of loop, ×1 (Makridin, 1964).

**Vladimirella** POPOV, 1994, p. 106, *nom. nov. pro Nalivkinella* POPOV in KATZ & POPOV, 1974a, p. 23, *non* SOSHKINA, 1939 [**Terebratula retrocarinata* NALIVKIN, 1910, p. 19; OD; *non* ROTHPLETZ, 1886, p. 101; =*Nalivkinella nalivkini* POPOV in KATZ & POPOV, 1974a, p. 23]. Large, elongate to subpentagonal, anterior commissure slightly unisulcate or bisulcate, beak incurved, foramen large, epithyrid; cardinal process small, outer hinge plates delicate, directed laterally; loop 0.5 dorsal valve length, loop flanges long. *Upper Jurassic:* Russian Platform, Crimea, Caucasus, central Asia, Western Europe. ——FIG. 1391,*1a–d. *V. nalivkini* (POPOV), Russia; *a–c,* dorsal, lateral, and anterior views, ×1; *d,* reconstruction of loop, ×0.5 (Makridin, 1964).

## Subfamily MORRISITHYRIDINAE Cooper, 1983

[Morrisithyridinae COOPER, 1983, p. 44]

Transverse band with deep reentrant on posterior side. *Middle Jurassic (Bajocian–Callovian).*

**Morrisithyris** ALMÉRAS, 1971, p. 131 [**Terebratula phillipsi* MORRIS in MORRIS & DAVIDSON, 1847, p. 255; OD]. Large, elongate-pentagonal, anterior commissure strongly sulciplicate; beak long, narrow, labiate, foramen large, permesothyrid; pedicle collar short, excavated, teeth long, narrow; cardinal process small, outer hinge plates long, narrow, triangular, concave, loop triangular, 0.3 to 0.4 dorsal valve length, terminal points long, webbed; loop, transverse band, and terminal points variable. *Middle Jurassic (Bajocian–Callovian):* Europe, Russia, Caucasus, Crimea, Turkmenistan, ?South America.——FIG. 1392*a–e. *M. phillipsi* (MORRIS), Bajocian, France; *a–c,* dorsal, lateral, and anterior views, ×1 (Alméras, 1971); *d,* loop of young specimen, ×1; *e,* loop of adult specimen, ×2 (Cooper, 1983).

## Family LOBOTHYRIDIDAE Makridin, 1964

[*nom. transl.* LEE, SMIRNOVA, & DAGYS, herein, *ex* Lobothyridinae COOPER, 1983, p. 44, *nom. correct. pro* Lobothyrinae MAKRIDIN, 1964, p. 204]

Small to very large, smooth, crural processes posterior or anterior of midloop, loop 0.3 to 0.6 dorsal valve length; terminal points long to very long, may be webbed. *Lower Jurassic–Upper Jurassic (Kimmeridgian).*

## Subfamily LOBOTHYRIDINAE Makridin, 1964

[*nom. correct.* COOPER, 1983, p. 44, *pro* Lobothyrinae MAKRIDIN, 1964, p. 204]

Medium to very large; rectimarginate to uniplicate or unisulcate, crural processes posterior of midloop, loop 0.4 to 0.6 dorsal valve length, terminal points moderately long to very long, may be webbed. *Lower Jurassic–Middle Jurassic (Bajocian).*

**Lobothyris** Buckman, 1918, p. 107 (Buckman, 1914, p. 2, *nom. nud.*) [**Terebratula punctata* J. Sowerby, 1813 in 1812–1815, p. 46; OD] [=*Loboidothyropsis* Sučić-Protić, 1971, p. 16 (type, *L. typica,* OD); *Mirisquamea* Sučić-Protić, 1971, p. 38 (type, *Lobothyris punctata clevelandensis* Ager, 1956, p. 2, OD); *Pirotothyris* Sučić-Protić, 1971, p. 31 (type, *P. fortis,* OD); *Squamiplana* Sučić-Protić, 1971, p. 8 (type, *S. piroidea,* OD)]. Large to very large, moderately biconvex, rectimarginate, beak suberect to incurved, foramen epithyrid to permesothyrid, symphytium short; pedicle collar present; cardinal process broad, flat, comblike; hinge plates and inner socket ridges in section slightly concave ventrally, clubbed, gently inclined dorsally; crural processes posterior of midloop, loop about 0.4 dorsal valve length, with moderately long terminal points. *Lower Jurassic (Sinemurian)–Middle Jurassic (Bajocian):* England, Scotland, France, Germany, Spain, Portugal, Sicily, Bulgaria, Romania, Yugoslavia, China, Thailand, Canada (British Columbia), USA (Nevada), Argentina, New Zealand.——Fig. 1393,*6a–v.* **L. punctata* (J. Sowerby), Pliensbachian, England; *a–c,* dorsal, lateral, and anterior views of lectotype, BMNH B61522, ×1 (Ager, 1990); *d,* interior of dorsal valve of calcite-encrusted specimen, ×1 (Cooper, 1983); *e–v,* serial transverse sections 0.6, 1.0, 1.2, 2.2, 3.6, 4.0, 4.4, 4.8, 5.0, 5.6, 5.8, 6.2, 7.0, 7.4, 7.6, 7.8, 8.2, 10.0 mm from ventral umbo, ×1 (Ager, 1990).——Fig. 1393,*6w. L. subpunctata* Dubar, Lower Jurassic, France; dorsal valve interior, ×1 (Cooper, 1983).

**Cuersithyris** Alméras & Moulan, 1982, p. 32 [**C. cuersensis;* OD]. Medium size, thick shelled; elongate oval, strongly ventribiconvex to globose, anterior commissure rectimarginate to slightly unisulcate; pedicle collar short, beak incurved, foramen permesothyrid; loop 0.45 to 0.6 dorsal valve length. *Lower Jurassic (Pliensbachian–Toarcian):* France, ?England, Spain, Hungary, Yugoslavia, Argentina.——Fig. 1393,*1a–l.* **C. cuersensis,* Pliensbachian, France; *a–c,* dorsal, lateral, and anterior views of holotype, FSL305094, ×1; *d–l,* serial transverse sections 1.8, 3.3, 4.6, 5.4, 6.5, 8.2, 10.3, 11.6, 14.4 mm from ventral umbo, ×1 (Alméras & Moulan, 1982).

**Exceptothyris** Sučić-Protić, 1971, p. 37 [**E. expressa;* OD]. Externally similar to *Lobothyris,* but with crural processes close to hinge plates; loop long (resembling that of *Rouillieria*), 0.6 dorsal valve length, terminal points very long, webbed; transverse band very narrow. *Lower Jurassic:* France, Italy, Yugoslavia.——Fig. 1393,*2.* **E. expressa,* Yugoslavia; reconstruction of loop, ×1 (Cooper, 1983).

**Inaequalis** Sučić-Protić, 1971, p. 12 [**I. dubari;* OD] [=*Pyraeneica* Sučić-Protić, 1971, p. 23 (type, *P. numerosa,* OD); *Senokosica* Sučić-Protić, 1971, p. 28 (type, *S. matura,* OD); *Serbiothyris* Sučić-Protić, 1971, p. 25 (type, *S. medioliassica,* OD)]. Externally similar to *Lobothyris,* but with narrow transverse band and longer terminal points. *Lower Jurassic:* France, Germany, Yugoslavia, England.——Fig. 1393,*7a–c.* **I. dubari,* Yugoslavia; *a–b,* dorsal and anterior views, ×1 (Sučić-Protić, 1971); *c,* reconstruction of loop, ×1 (Cooper, 1983).

**Notosia** Cooper, 1983, p. 122 [**N. chiliensis;* OD]. Medium size, oval, ventribiconvex; anterior commissure rectimarginate to slightly uniplicate, foramen permesothyrid; loop widely and roundly triangular, with long terminal points. *Lower Jurassic:* Chile.——Fig. 1393,*4a–d.* **N. chiliensis; a–c,* dorsal, lateral, and anterior views of holotype, USNM 551049a, ×1; *d,* close-up of loop, ×1 (Cooper, 1983).

**Rhapidothyris** Tuluweit, 1965, p. 72 [**R. arciferens;* OD]. Similar to *Lobothyris,* but medium size, subcircular, biconvex; anterior commissure rectimarginate to unisulcate. *Lower Jurassic (Pliensbachian):* Germany, England.——Fig. 1393,*5a–c.* **R. arciferens,* Germany; dorsal, lateral, and anterior views of holotype, IMGPT Br 1244/13, ×1 (Tuluweit, 1965).

**Telothyris** Alméras & Moulan, 1982, p. 136 [**Terebratula jauberti pyrenaica* Dubar, 1931, p. 51; OD]. Similar to *Cuersithyris,* but subcircular in outline, biconvex, rectimarginate to slightly sulciplicate; shorter loop, 0.39–0.49 dorsal valve length. *Lower Jurassic:* France, Spain, Romania, Morocco, Algeria, Argentina.——Fig. 1393,*3a–c.* **T. pyrenaica* (Dubar), Toarcian, France; dorsal, lateral, and anterior views, ×1 (Alméras & Moulan, 1982).

## Subfamily LOPHROTHYRIDINAE Cooper, 1983

[Lophrothyridinae Cooper, 1983, p. 44]

Small to medium size, uniplicate to sulciplicate or biplicate; outer hinge plates dorsally attached to crural bases; crural processes anterior of midloop; terminal points of intermediate length. *Middle Jurassic (Bajocian)–Upper Jurassic (Kimmeridgian).*

**Lophrothyris** Buckman, 1918, p. 114 (Buckman, 1914, p. 2, *nom. nud.*) [**L. lophus;* OD]. Small to medium size, subcircular to subpentagonal, ventribiconvex, anterior commissure strongly uniplicate, rarely sulciplicate; beak short, foramen epithyrid, symphytium narrow; cardinal process small; outer hinge plates short, narrow, dorsally attached; loop broadly triangular, about 0.4 to 0.5 dorsal valve length, with moderately long terminal points; transverse band broad. *Middle Jurassic (Bajocian):* England, France, China.——Fig. 1394,*1a–d.* **L. lophus,* England; *a–c,* dorsal, lateral, and anterior views of holotype, BGS GSM 31990, ×1 (Muir-Wood, 1965a); *d,* interior of dorsal valve, ×2 (Cooper, 1983).

**Argovithyris** Rollet, 1972b, p. 95 [**Terebratula birmensdorfensis* Moesch, 1867, p. 312; OD]. Small, biconvex, anterior commissure rectimarginate to uniplicate or weakly sulciplicate; beak strongly incurved, may touch dorsal umbo, foramen small, epithyrid, often labiate; pedicle collar

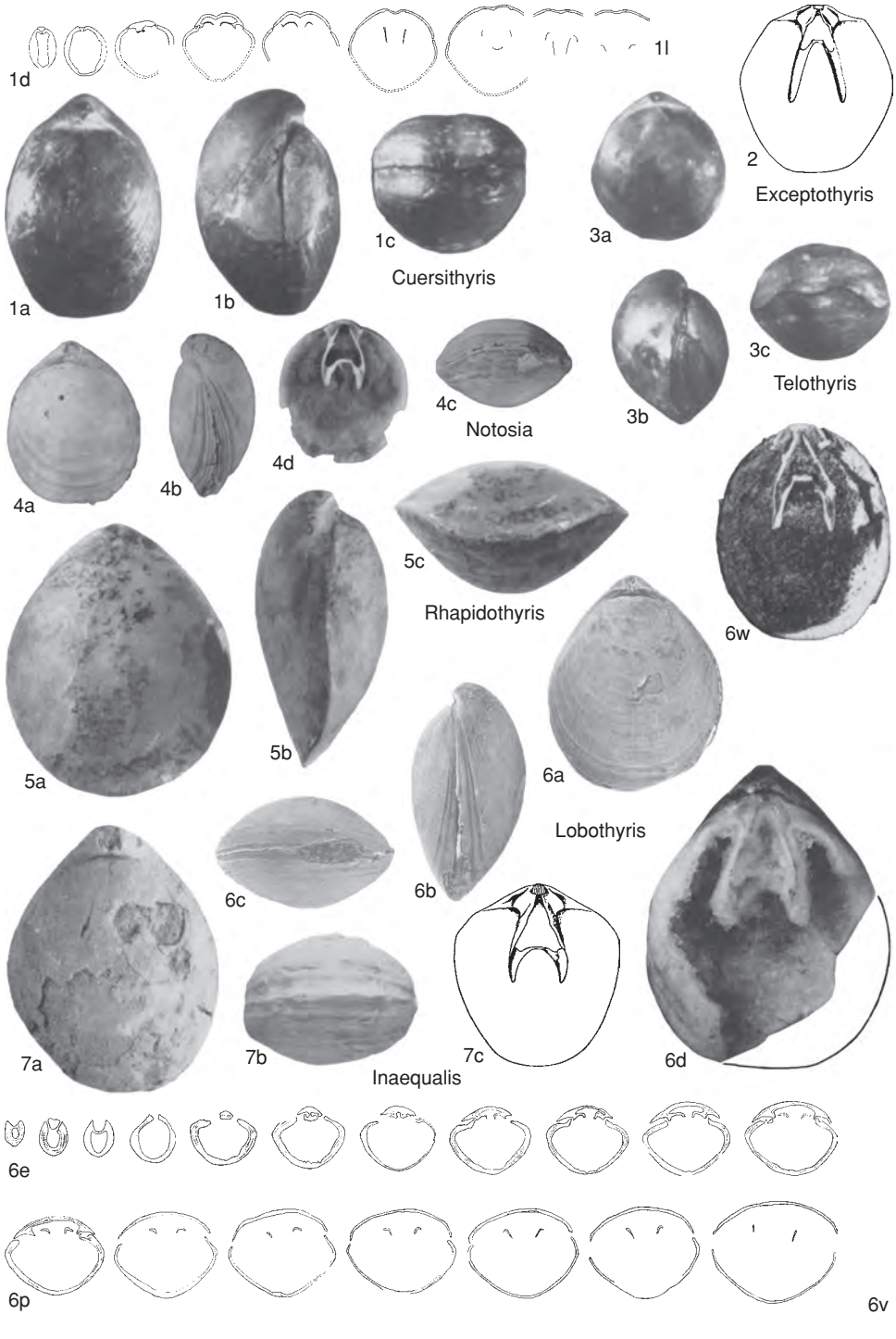


FIG. 1393. Lobothyrididae (p. 2103).

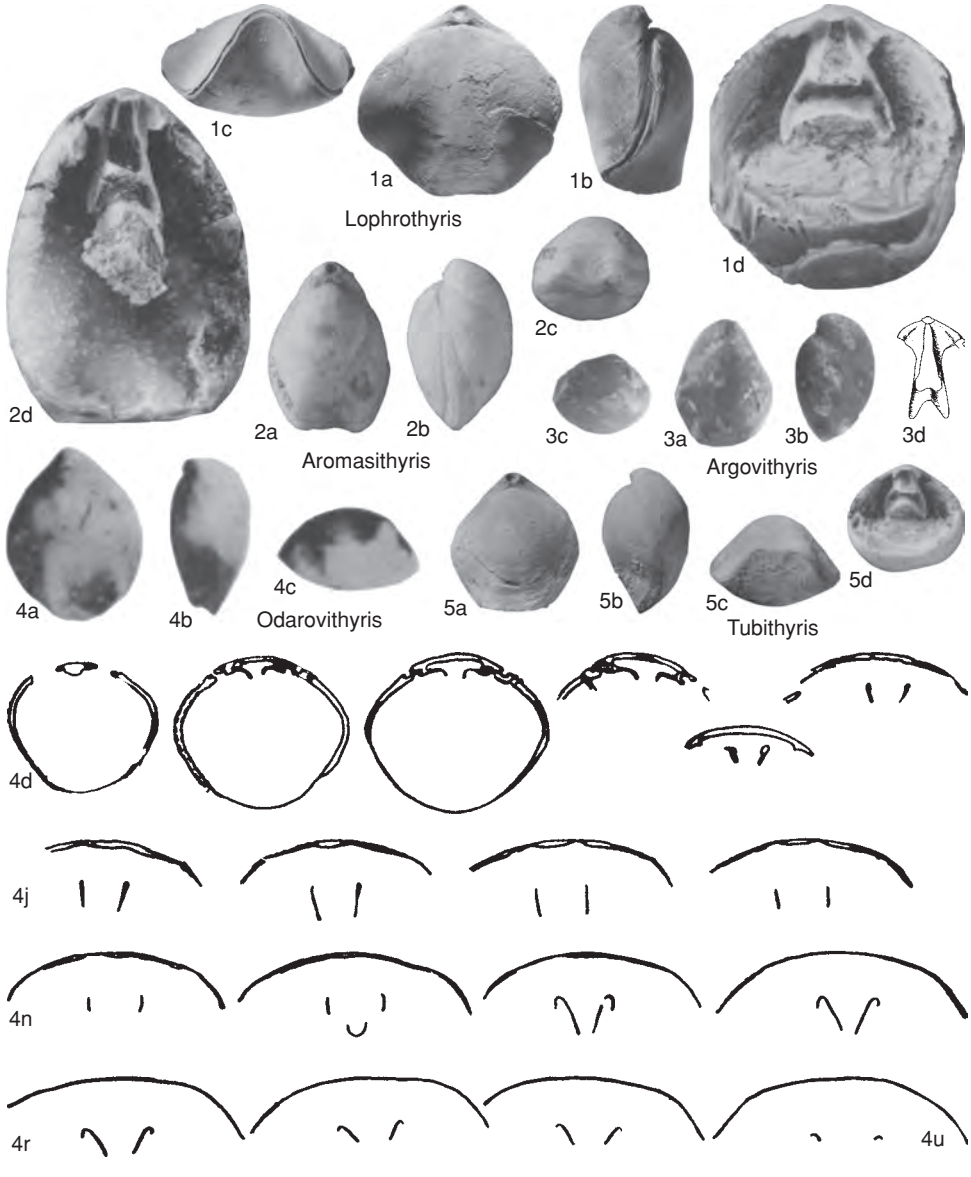


FIG. 1394. Lobothyrididae (p. 2103–2106).

present; cardinal process small, hinge plates thin and flat; loop with subparallel sides, 0.3 to 0.4 dorsal valve length, transverse band broad. *Upper Jurassic (Oxfordian–Kimmeridgian):* France, Germany, Switzerland, Poland.——FIG. 1394,*3a–d.* **A. birmensdorfensis* (MOESCH), Oxfordian, Switzerland; *a–c,* dorsal, lateral, and anterior views, ×1; *d,* reconstruction of loop, ×2 (Boullier, 1976).

**Aromasithyris** ALMÉRAS, 1971, p. 544 [**Terebratula balinensis* SZAJNOCHA, 1879, p. 203; OD]. Medium size, pentagonal, biconvex, anterior commissure uniplicate to weakly sulciplicate or paraplicate; beak incurved; pedicle collar present; cardinal process small; hinge plates flat and thin, loop 0.3 to 0.4 dorsal valve length, transverse band very strongly arched. *Middle Jurassic (Callovian):* Poland, France, Germany, Portugal, Russia.——FIG. 1394,*2a–d.* **A. balinensis* (SZAJNOCHA), Poland; *a–c,* dorsal, lateral, anterior views, ×1; *d,* interior of dorsal valve, ×2 (Cooper, 1983).

**Odarovithyris** TCHORSZHEVSKY, 1971a, p. 62 [**O. odarovi;* OD]. Medium size, smooth,

ventribiconvex, anterior commissure biplicate; beak short, incurved; foramen small, permesothyrid; cardinal process low, outer hinge plates wide, thin; loop 0.5 dorsal valve length, transverse band strongly folded, loop flanges long. *Middle Jurassic (Bajocian):* Transcarpathians.——Fig. 1394,*4a–u.* **O. odarovi; a–c,* dorsal, lateral, anterior views, ×1; *d–u,* serial transverse sections 0.25, 1.4, 2.05, 2.35, 2.85, 4.1, 4.3, 5.1, 5.6, 5.9, 6.55, 6.85, 7.05, 7.2, 8.1, 8.5, 9.2, 9.5 mm from first section, ×1 (Tchorszhevsky, 1971a).

**Tubithyris** Buckman, 1918, p. 115 (Buckman, 1915, p. 78, *nom. nud.*) [**Terebratula wrighti* Davidson, 1855, p. 20; OD] [=*Pseudotubithyris* Alméras, 1971, p. 361 (type, *Terebratula globata* J. de C. Sowerby, 1823–1825, p. 51)]. Small to medium, subcircular, biconvex to spheroidal, anterior commissure uniplicate to sulciplicate, beak short, incurved, foramen tubular, permesothyrid; symphytium narrow, visible; cardinal process bilobed, prominent; hinge plates narrow, triangular, deeply concave; loop 0.5 dorsal valve length, very wide, transverse band moderately arched. *Middle Jurassic (Bajocian–Bathonian):* England, France, Switzerland, Italy, Morocco, Egypt, Kenya, Saudi Arabia, Turkmenia.——Fig. 1394,*5a–d.* **T. wrighti* (Davidson), Bajocian, England; *a–c,* dorsal, lateral, and anterior views, ×1 (Muir-Wood, 1965a); *d,* interior of dorsal valve, ×1 (Cooper, 1983).

## Family MUIRWOODELLIDAE Tchorszhevsky, 1974

[Muirwoodellidae Tchorszhevsky, 1974, p. 51]

Smooth, outer hinge plates well developed; loop long flanged, 0.3 to 0.5 dorsal valve length; transverse band formed from ring arising from ventral margin of vertical plate of acuminate (centronelliform) loop. *Middle Jurassic–Lower Cretaceous (Berriasian).*

### Subfamily MUIRWOODELLINAE Tchorszhevsky, 1974

[Muirwoodellinae Tchorszhevsky, 1974, p. 51]

Outer hinge plates not supported by crural plates. *Middle Jurassic.*

**Muirwoodella** Tchorszhevsky, 1974, p. 52 [**M. muirwoodae;* OD]. Medium size, anterior commissure unisulcate or slightly bisulcate; beak incurved; foramen mesothyrid or permesothyrid; cardinal process small, oval; outer hinge plates slightly inclined dorsally; crural processes slightly curved. *Middle Jurassic (Bajocian):* Carpathians, Transcarpathia, Russia.——Fig. 1395,*2a–q.* **M. muirwoodae,* Carpathians; *a–c,* dorsal, lateral, and anterior views, ×0.6; *d–q,* serial transverse sections 0.3, 0.7, 1.9, 2.7, 2.9, 3.7, 4.2, 5.95, 6.7, 7.7, 8.3, 11.4, 13.4, 14.7 mm from first section, ×1 (Tchorszhevsky, 1974).

**Goniothyropsis** Ovtsharenko, 1983b, p. 155 [**G. indigena;* OD]. Rounded to subpentagonal, ventribiconvex; anterior commissure biplicate; beak incurved, foramen large; deltidial plates conjunct; cardinal process short, flattened; crural bases joined dorsally to outer hinge plates, forming small, ventral keels, descending branches and flanges short, loop about 0.3 dorsal valve length. *Middle Jurassic:* Tadzhikistan, Pamirs.——Fig. 1395,*1a–k.* **G. indigena; a–c,* dorsal, lateral, and anterior views, ×1; *d–k,* serial transverse sections 2.6, 3.5, 4.3, 4.6, 5.0, 6.3, 6.9, 8.2 mm from first section, ×1 (Ovtsharenko, 1983b).

### Subfamily KARADAGITHYRIDINAE Tchorszhevsky, 1974

[Karadagithyridinae Tchorszhevsky, 1974, p. 56]

Outer hinge plates may be supported by crural plates. *Middle Jurassic–Upper Jurassic.*

**Karadagithyris** Tchorszhevsky, 1974, p. 55 [**K. babanovae;* OD]. Medium to small, foramen small, mesothyrid, symphytium short, narrow; cardinal process oval, high, undivided; outer hinge plates broad, thin, curved in an arc dorsally; at point of attachment to crura, narrow, ventrally directed, and semicircular in cross section; crura and crural processes thick, broad, slightly convergent ventrally; outer hinge plate processes are well developed, reaching level of transverse band of loop, but resting on valve floor only apically. *Middle Jurassic–Upper Jurassic:* Crimea, Poland, Hungary, Yugoslavia.——Fig. 1396,*2a–v.* **K. babanovae,* Bajocian, Crimea; *a–c,* dorsal, lateral, and anterior views, ×1; *d–v,* serial transverse sections 3.1, 3.2, 3.45, 3.85, 4.35, 4.65, 5.05, 5.25, 6.05, 6.65, 7.3, 8.1, 9.85, 10.25, 10.85, 11.85, 12.75, 13.75, 14.65 mm from ventral umbo, ×1 (Tchorszhevsky, 1974).

**Karadagella** Babanova, 1965, p. 95 [144] [**K. moisseievi;* OD]. Large, oval, strongly ventribiconvex, foramen mesothyrid, crural plates attached to outer hinge plates by ventral ends; in early ontogeny resting on dorsal valve floor, becoming free in later stages; loop with long flanges. *Middle Jurassic (Bajocian):* Crimea.——Fig. 1396,*1a–d.* **K. moisseievi; a–c,* dorsal, lateral, and anterior views, ×1; *d,* reconstruction of loop, ×1 (Babanova, 1965).

### Subfamily UNCERTAIN

**Dzharithyris** Ovtsharenko, 1989, p. 96 [**Inaequalis dzharensis* Ovtsharenko, 1983b, p. 130; OD]. Medium, rounded to subpentagonal, ventribiconvex, strongly uniplicate, outer hinge plates broad, fused with inner socket ridges; loop about 0.5 dorsal valve length; flanges about 0.3 loop length. *Middle Jurassic:* Tadzhikistan, Pamirs.——

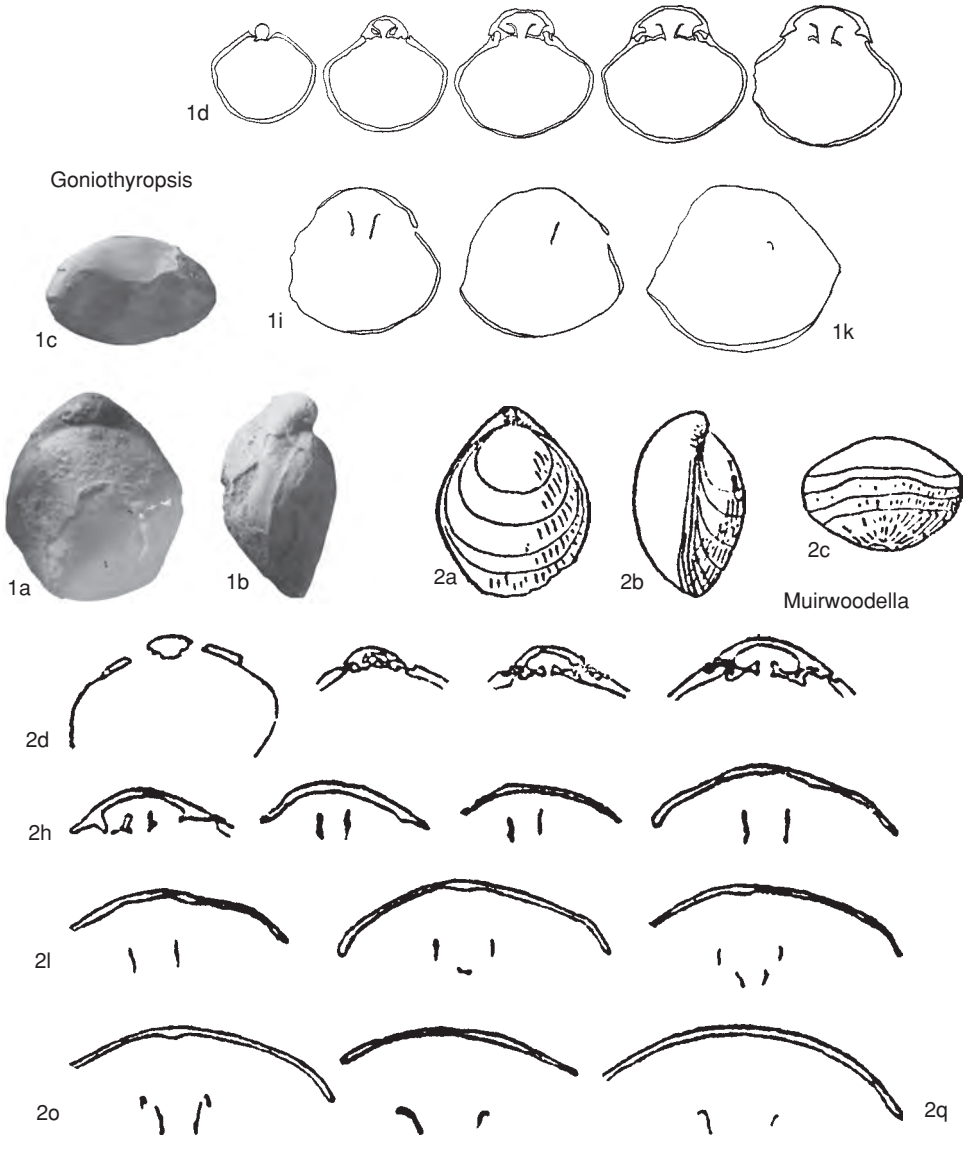


FIG. 1395. Muirwoodellidae (p. 2106).

FIG. 1397,*3a–q. *D. dzharensis* (OVTSHARENKO); *a–c,* dorsal, lateral, and anterior views, ×1; *d–q,* serial transverse sections 0.2, 1.8, 2.6, 2.8, 3.4, 4.9, 5.1, 5.9, 6.9, 7.3, 8.4, 9.2, 9.6, 10.4 mm from first section, ×1 (Ovtsharenko, 1983b).

**Negramithyris** PROSOROVSKAJA, 1985, p. 114 [**N. negramensis;* OD]. Small to medium size, elongate oval, planoconvex; anterior commissure rectimarginate or slightly uniplicate; beak massive, short, suberect, foramen large, mesothyrid; cardinal process large; outer hinge plates very thin, curved acutely toward dorsal valve, hinge plate processes resting on floor of dorsal valve; loop short (about 0.3 dorsal valve length), transverse band of loop high, narrow; flanges well developed. *Middle Jurassic (Bajocian):* Armenia (Transcaucasus).——FIG. 1397,*2a–k. *N. negramensis; a–c,* dorsal, lateral, and anterior views of holotype, ×1; *d–k,* serial transverse sections 5.2, 5.3, 5.7, 6.1, 6.7, 8.4, 8.6, 9.0 mm from ventral umbo, ×1 (Prosorovskaja, 1985).

**?Praegoniothyris** OVTSHARENKO, 1983b, p. 142 (OVTSHARENKO, 1977, p. 38, *nom. nud.*)

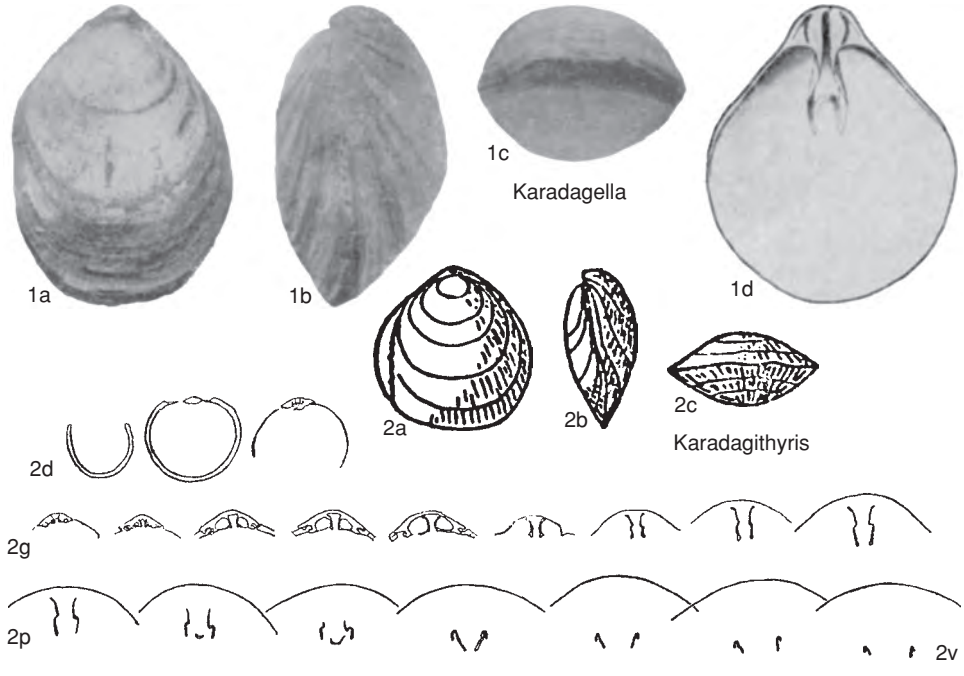


FIG. 1396. Muirwoodellidae (p. 2106).

[**P. salangurensis;* OD]. Medium size, oval, ventribiconvex, beak short, rounded, strongly incurved; cardinal process short, no umbonal cavity; outer hinge plates ventrally convex, dorsally inclined with small processes, crural bases on dorsal side of hinge plates; crura short, low, almost parallel, loop less than 0.5 dorsal valve length; low dorsal septum present posteriorly. [Internal structures not fully known.] *Lower Jurassic:* Tadzhikistan, Pamirs.——FIG. 1397,*1a–l. *P. salangurensis; a–c,* dorsal, lateral, and anterior views, ×1; *d–l,* incomplete serial transverse sections 1.0, 1.3, 1.8, 2.2, 2.6, 2.8, 2.9, 3.7, 4.1 mm from first section, ×1 (Ovtsharenko, 1983b).

**Svaljavithyris** TCHORSZHEVSKY, 1989a, p. 75 (TCHORSZHEVSKY, 1974, p. 54, *nom. nud.*) [**Terebratula carpathica* ZITTEL, 1870, p. 77; OD]. Small, oval to subtrigonal, beak incurved, foramen small, mesothyrid, umbonal cavity infilled with callus; beak short, symphytium low, planoconvex, cardinal process small, with myophore; outer hinge plates wide, thin, short, or slightly concave dorsally, thin crural plates resting on dorsal valve floor as far as transverse band of loop; loop about 0.5 dorsal valve length, with long flanges. *Upper Jurassic (Tithonian)–Lower Cretaceous (Berriasian):* Carpathians, Italy.——FIG. 1398*a–t. *S. carpathica* (ZITTEL), Tithonian, Ukraine; *a–c,* dorsal, lateral, and anterior views, ×1; *d–t,* serial transverse sections, distances between sections not given, ×2 (Tchorszhevsky, 1989a).

## Family POSTEPITHYRIDIDAE Tchorszhevsky, 1974

[Postepithyrididae TCHORSZHEVSKY, 1974, p. 50]

Rectimarginate to strongly biplicate, commonly smooth, rarely capillate or peripherally costate, loop long (0.4 to 0.6 dorsal valve length), outer hinge plates attached dorsally to crural bases, crural processes at or posterior of midloop, flanges of moderate length. *Lower Jurassic (Toarcian)–Lower Cretaceous.*

**Postepithyris** MAKRIDIN in LICHAREW, MAKRIDIN, & RZHONSNITSKAYA, 1960, p. 294 [**Terebratula cincta* COTTEAU, 1857, p. 137; OD]. Medium size, subcircular, smooth, anterior commissure weakly sulciplicate; beak long, erect, foramen large, permesothyrid, symphytium partly visible; pedicle collar short; cardinal process semielliptical, outer hinge plates triangular, short, flatly concave, attached to dorsal part of crural base; loop an elongate triangle, about 0.5 dorsal valve length, terminal points very long, webbed, transverse band highly arched, with flattened bridge. *Upper Jurassic (Oxfordian–Kimmeridgian):* Europe, Crimea, Caucasus, Russia.——FIG. 1399,*4a–s. *P. cincta* (COTTEAU), France; *a–c,* dorsal, lateral, and anterior views, ×1; *d,* interior of dorsal valve, ×1 (Cooper, 1983); *e–s,* serial transverse sections 3.4, 4.0, 4.3,

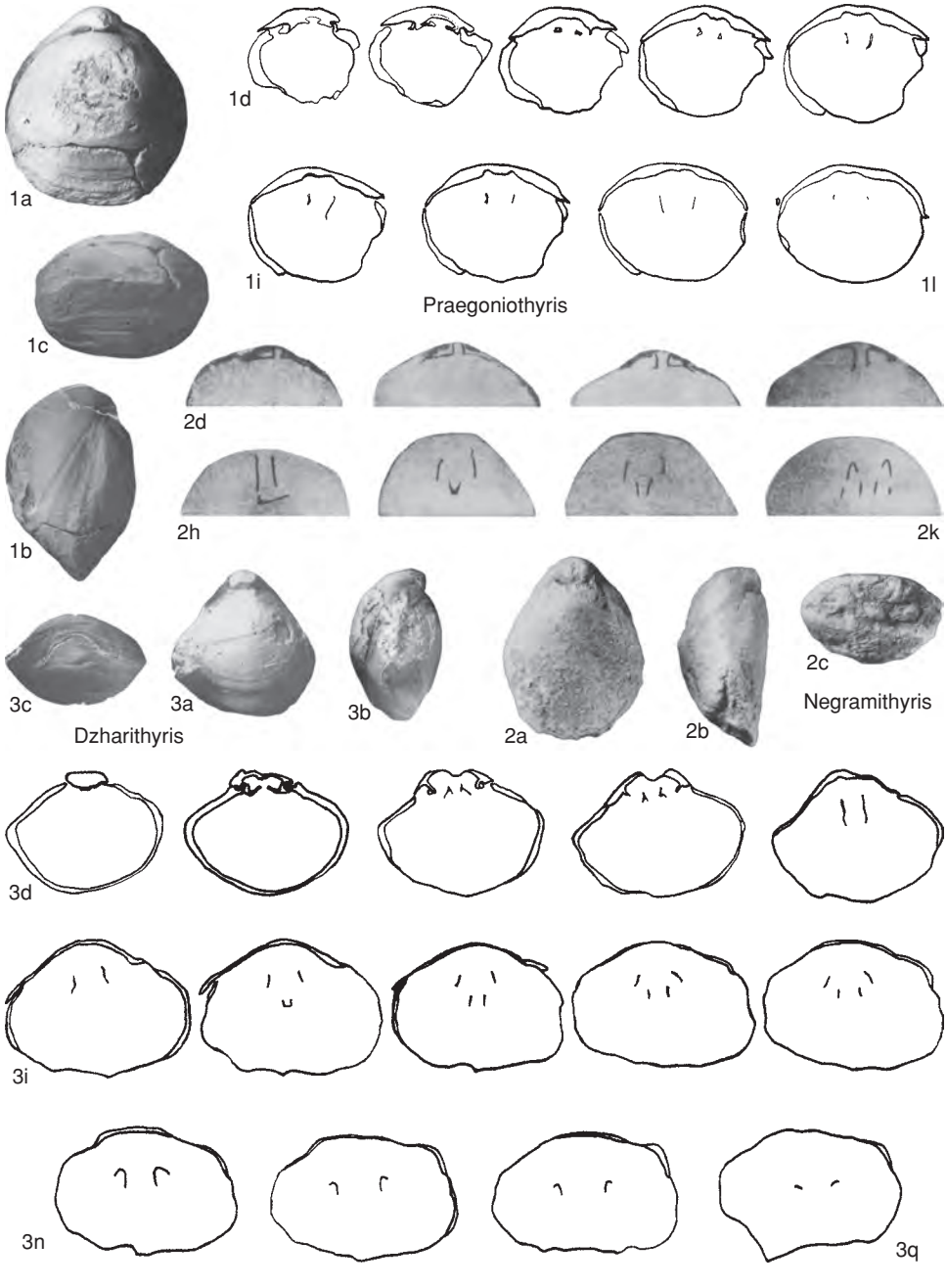


FIG. 1397. Muirwoodellidae (p. 2106–2108).

5.2, 5.6, 7.5, 8.5, 9.1, 10.7, 11.9, 12.9, 13.4, 15.6, 16.5, 18.8 mm from ventral umbo, ×1 (Makridin, 1964).

**Arceythyris** ROLLET, 1964, p. 38 [**Terebratula diptycha* OPPEL, 1856, p. 496; OD]. Medium size, biconvex, anterior commissure uniplicate in juveniles, becoming bisulcate; beak short, slightly recurved, foramen permesothyrid, symphytium hidden; pedicle collar present; cardinal process prominent, may be grooved, hinge plates club shaped, poorly differentiated from socket ridges, loop 0.4 to 0.5 dorsal valve length, transverse band horizontal. *Middle*

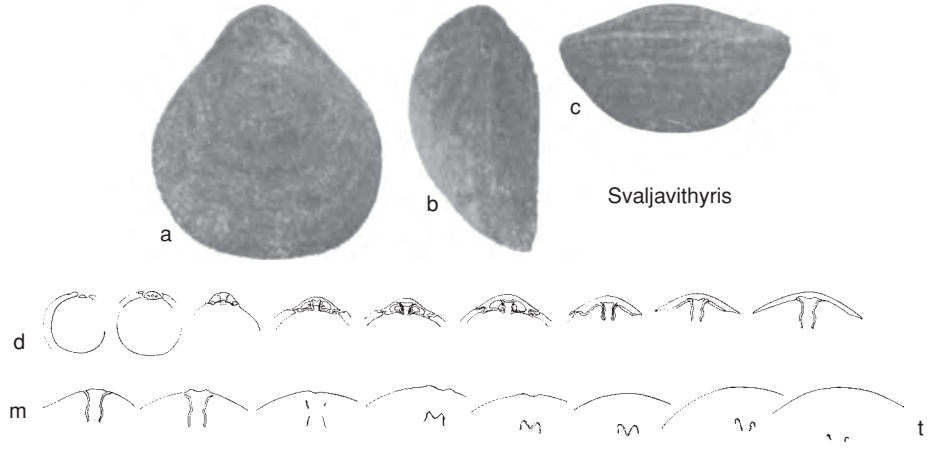


FIG. 1398. Muirwoodellidae (p. 2108).

*Jurassic (Bajocian–Callovian):* France, Germany, Switzerland.——FIG. 1399,*3a–d. *A. diptycha* (OPPEL), Bathonian, France; *a–c,* dorsal, lateral, and anterior views, ×1 (Alméras & Moulan, 1988); *d,* loop reconstruction, ×1 (Contini & Rollet, 1970).

**Caryona** COOPER, 1983, p. 62 [**Terebratula saemani* OPPEL, 1857, p. 272; OD]. Small, smooth, pentagonal, anterior commissure uniplicate; beak short, foramen large, permesothyrid; symphytium partially to wholly visible; cardinal process small, wide; outer hinge plates short, deeply concave, attached to dorsal edge of crural bases; crural processes short, blunt; loop triangular, 0.4 to 0.5 dorsal valve length. *Middle Jurassic (Callovian):* France.——FIG. 1399,*5a–d. *C. saemani* (OPPEL); *a–c,* dorsal, lateral, and anterior views; *d,* dorsal valve interior, ×1 (Cooper, 1983).

**Conarothyris** COOPER, 1983, p. 69 [**C. opima* COOPER, 1983, p. 71; OD] [=*Pionothyris* COOPER, 1983, p. 130 (type, *Terebratula eudesiana* BUCKMAN in DAVIDSON, 1884, p. 255, OD); *Toxonelasma* COOPER, 1989, p. 95 (type *T. arabicum,* OD)]. Medium size, smooth, roundly oval to subpentagonal, strongly biconvex, anterior commissure sulciplicate; beak erect, foramen permesothyrid, symphytium concealed; pedicle collar long; outer hinge plates broad, short, tapering; crural processes short, pointed; loop wide, 0.4 to 0.5 dorsal valve length, descending lamellae nearly straight, transverse band strongly arched. *Middle Jurassic (Aalenian–Bajocian):* England, France, Saudi Arabia.——FIG. 1399,*2a–d. *C. opima,* Bajocian, England; *a–c,* dorsal, lateral, and anterior views, ×1; *d,* dorsal valve interior, ×2 (Cooper, 1983).

**Epithyris** PHILLIPS, 1841, p. 55, *non* KING, 1850, p. 146 [**Terebratula maxillata* J. DE C. SOWERBY, 1823 in 1823–1825, p. 52; SD BUCKMAN, 1906b, p. 321] [=*Dielasma* KING, 1859, p. 256 (type, *Terebratulites elongatus* SCHLOTHEIM, 1816, p. 27)]. Large, subpentagonal, smooth, biconvex, anterior commissure uniplicate to sulciplicate, beak short, foramen large, mesothyrid, symphytium partly concealed; pedicle collar present; cardinal process small, bilobed; outer hinge plates triangular, short, thick, concave (may be so thickened as to appear flat); crural processes at midloop, acutely pointed, loop widely triangular, about 0.4 dorsal valve length, transverse band wide, strongly arched, with flattened, protuberant median bridge, terminal points long, webbed. *Middle Jurassic (Bathonian):* England, France.——FIG. 1399,*1a–c. *E. maxillata* (J. DE C. SOWERBY), England; dorsal, lateral, and anterior views of holotype, BMNH B.61550, ×1 (Muir-Wood, 1965a).——FIG. 1399,*1d. E. oxonica* ARKELL, England; interior of dorsal valve, ×1 (Cooper, 1983).

**Euidothyris** BUCKMAN, 1918, p. 101 (BUCKMAN, 1915, p. 78, *nom. nud.*) [**Terebratula euides* (broad form) BUCKMAN, 1886, p. 218; OD; =*E. extensa* BUCKMAN, 1918, p. 101]. Large, smooth, broadly subpentagonal, biconvex, anterior commissure sulciplicate, foramen large, permesothyrid; cardinal process trilobed, outer hinge plates short, concave, attached to dorsal margin of crural bases, crural processes narrow, acute, transverse band strongly arched, loop wide, about 0.5 dorsal valve length. *Middle Jurassic (Bajocian):* England, France.——FIG. 1400,*1a–d. *E. extensa* BUCKMAN, England; *a–c,* dorsal, lateral, and anterior views of holotype, ×1 (Muir-Wood, 1965a); *d,* interior of dorsal valve, ×1 (Cooper, 1983).

**Ferrythyris** ALMÉRAS, 1971, p. 218 [**Terebratula ferryi* DESLONGCHAMPS in FERRY, 1861, p. 27; OD]. Medium size, smooth, rounded triangular to subpentagonal, globose, anterior commissure strongly paraplicate; beak large, foramen large, circular, permesothyrid to epithyrid; symphytium concealed; pedicle collar long; cardinal process long, elevated, grooved; loop similar to that of *Conarothyris,* 0.5 to 0.6 dorsal valve length. *Lower Jurassic (Toarcian)–*

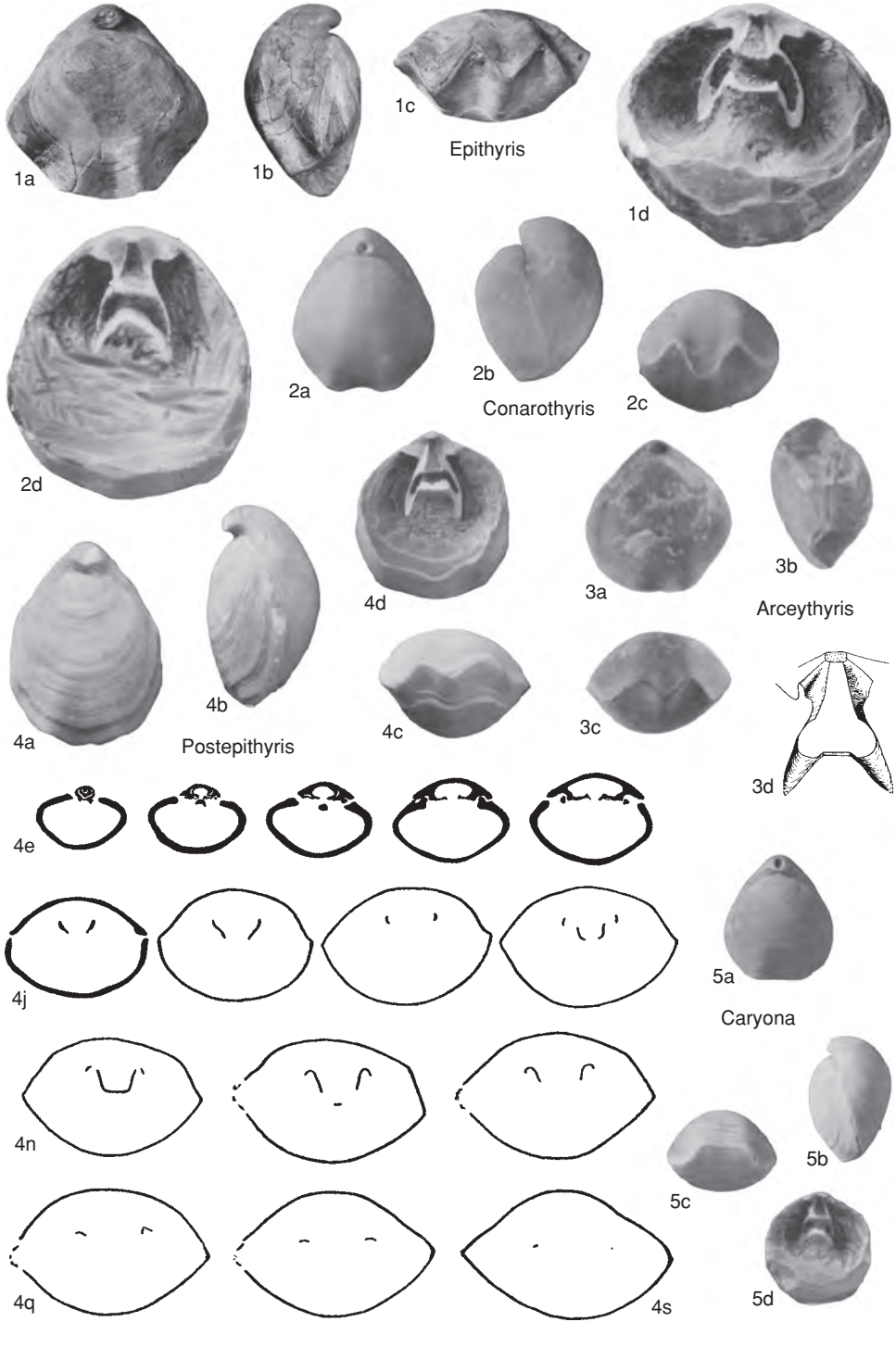


FIG. 1399. Postepithyrididae (p. 2108–2110).

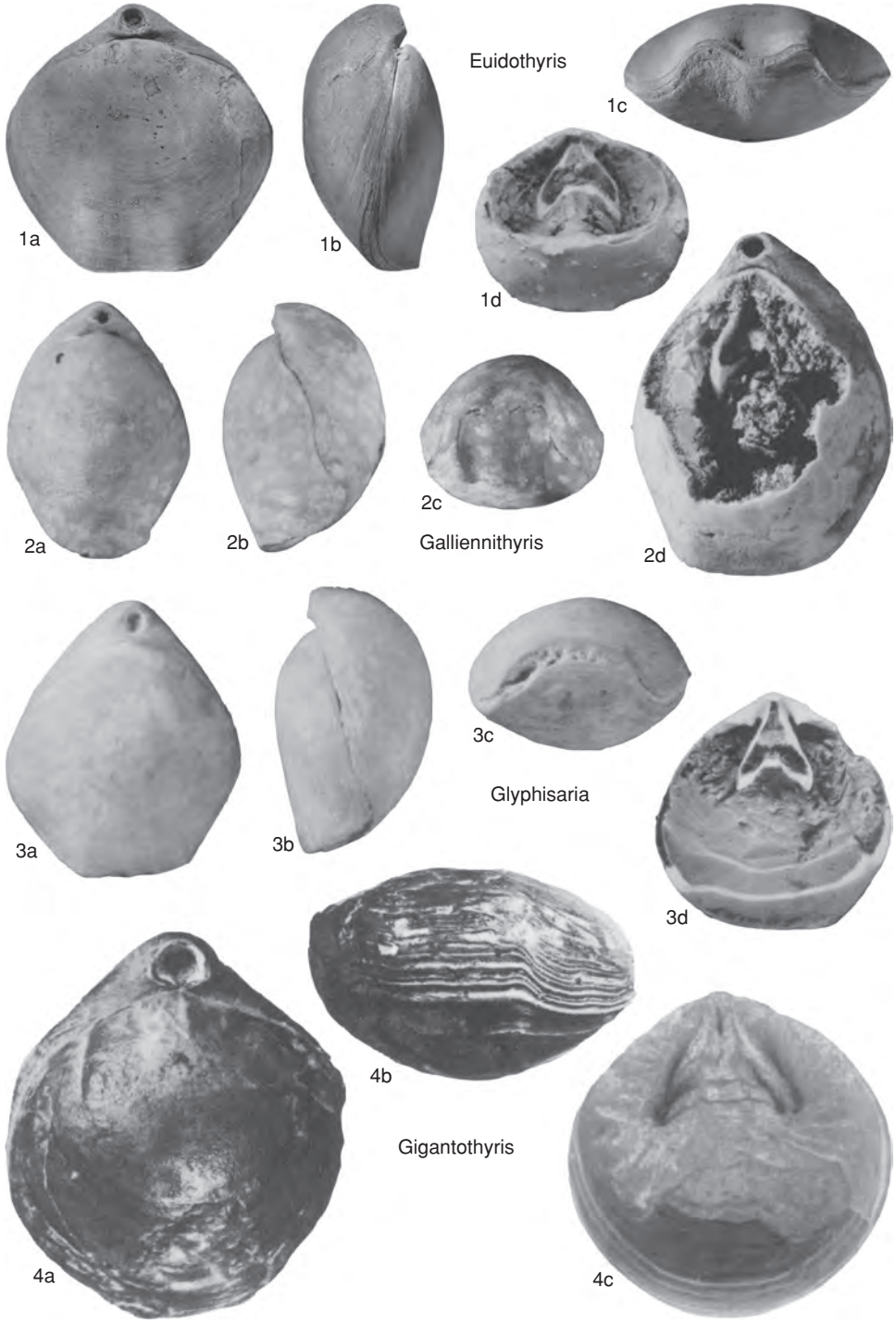


FIG. 1400. Postepithyrididae (p. 2110–2113).

*Middle Jurassic (Bathonian):* France, England, Germany, Switzerland, Yugoslavia.——Fig. 1401,*1a–c.* **F. ferryi* (Deslongchamps), Bajocian, France; dorsal, lateral, and anterior views, ×1 (Alméras, 1971).

**Galliennithyris** Rollet, 1966, p. 304 [**Terebratula galliennei* d'Orbigny, 1850 in 1847–1851, p. 377; OD]. Large, elongate oval, ventribiconvex, anterior commissure rectimarginate to sulciplicate, beak short, foramen small, permesothyrid, symphytium visible; pedicle collar present; cardinal process thin, narrow, semiellipse, medially indented with concave myophore; outer hinge plates flatly concave, narrowly triangular, attached to dorsal edge of crural bases; loop with long terminal points, transverse band narrow, high arched. *Middle Jurassic (Callovian)–Upper Jurassic (Oxfordian):* Switzerland, France.——Fig. 1400,*2a–d.* **G. galliennei* (d'Orbigny), Oxfordian, Switzerland; *a–c,* dorsal, lateral, and anterior views, ×1; *d,* dorsal valve interior with incomplete loop, ×2 (Cooper, 1983).

**Gigantothyris** Seifert, 1963, p. 180 [**G. gigantea;* OD]. Very large, rounded pentagonal, planoconvex to ventribiconvex; anterior commissure uniplicate to sulciplicate, beak erect, foramen large, permesothyrid; symphytium concealed; outer hinge plates short, loop wide, triangular; about 0.4 dorsal valve length, transverse band broad, moderately arched and medially flattened. *Middle Jurassic (Bajocian):* Germany.——Fig. 1400,*4a–c.* **G. gigantea; a–b,* dorsal and anterior views of holotype, IMGPT Br 3/49/101, ×1; *c,* interior of dorsal valve, ×1 (Seifert, 1963).

**Glyphisaria** Cooper, 1983, p. 83 [**G. uniplicata;* OD]. Large, subpentagonal, ventribiconvex, anterior commissure uniplicate, beak erect, foramen permesothyrid, symphytium exposed; cardinal process small, elliptical with concave myophore; outer hinge plates very narrow as socket ridges and crural bases unite dorsally to form V-shaped troughs, notched at junction with crural bases; loop widely triangular, about 0.4 dorsal valve length. *Middle Jurassic–Upper Jurassic:* France, Saudi Arabia.——Fig. 1400,*3a–d.* **G. uniplicata,* Oxfordian, France; *a–c,* dorsal, lateral, and anterior views of holotype, USNM 551085, ×1; *d,* dorsal valve interior, ×1 (Cooper, 1983).

**Habrobrochus** Cooper, 1983, p. 87 [**Terebratula subsella* Leymerie, 1846, pl. 10,*5;* OD]. Externally similar to *Xestosina,* but with a more delicate loop, thinner, flatter transverse band, and shorter terminal points. *Upper Jurassic (Kimmeridgian):* Germany, France, Saudi Arabia, ?Mexico.——Fig. 1401,*6a–d.* **H. subsella* (Leymerie), Germany; *a–c,* dorsal, lateral, and anterior views, ×1; *d,* dorsal valve interior, ×1 (Cooper, 1983).

**Heimia** Haas, 1890, p. 87 [**Terebratula mayeri* Choffat in Haas, 1883, p. 254; OD]. Medium size, subtriangular, planoconvex, smooth, anterior commissure unisulcate to paraplicate, beak short, foramen permesothyrid, symphytium concealed; cardinal process short, prominent, outer hinge plates short, crural processes wide angled; loop not fully known, 0.4 dorsal valve length, transverse band strongly arched, with broad, flattened bridge. *Middle Jurassic (Bajocian):* England, France, Switzerland.——Fig. 1401,*2a–g.* **H. mayeri* (Choffat), Switzerland; *a–c,* dorsal, lateral, and anterior views, ×1 (Muir-Wood, 1965a); *d–g,* incomplete serial transverse sections approximately 1.5, 1.7, 3.0, 4.3 mm from ventral umbo, ×1 (Singeisen-Schneider, 1976).

**Holcothyris** Buckman, 1918, p. 125 (Buckman, 1915, p. 78, *nom. nud.*) [**H. angulata;* OD]. Medium size, smooth, finely capillate where exfoliated, subpentagonal, biconvex, anterior commissure unisulcate to paraplicate, beak suberect, foramen possibly permesothyrid, symphytium usually concealed; pedicle collar moderately long; cardinal process bilobate, medianly depressed; hinge plates concave ventrally, club shaped posteriorly; loop 0.5 dorsal valve length. *Middle Jurassic (Bathonian):* Burma, China, India, Europe, New Zealand.——Fig. 1401,*7a–m.* **H. angulata,* Burma; *a–c,* dorsal, lateral, and anterior views of holotype, ×1 (Muir-Wood, 1965a); *d–m,* serial transverse sections of specimen, France, 2.1, 3.1, 3.5, 4.0, 5.2, 5.8, 7.6, 10.0, 10.5, 10.9 mm from ventral umbo, ×1 (Alméras, 1971).

**Juralina** Kyansep, 1961, p. 29 [**J. procerus;* OD]. Large, elongate oval, smooth, planoconvex or biconvex, anterior commissure rectimarginate to gently uniplicate; beak elongate, straight to suberect; foramen large, permesothyrid; symphytium high, exposed (externally homeomorphic with *Rectithyris*); pedicle collar present; cardinal process prominent, medianly depressed; crural bases ventrally directed from hinge plates; loop triangular, strongly arched, with flattened bridge, 0.4 dorsal valve length. *Upper Jurassic (Oxfordian–Kimmeridgian):* Germany, France, Switzerland, Russia, Caucasus, Crimea, Malaysia, ?Morocco.——Fig. 1401,*4a–b.* **J. procerus,* Kimmeridgian, Crimea; dorsal and lateral views of holotype, ×1 (Muir-Wood, 1965a).——Fig. 1401,*4c–d. J. cervicula* Rollier, Upper Jurassic, Germany; *c,* dorsal view; *d,* ventral view of dorsal valve interior, ×1 (Cooper, 1983).

**Karakulithyris** Ovtsharenko, 1991, p. 63 [**Terebratula bobkovi* Moisseev, 1938, p. 225–226; OD] [=*Klunnikovithyris* Ovtsharenko, 1991, p. 91 (type, *Terebratula klunnikovi* Moisseev, 1938, p. 235, OD)]. Medium to large, oval to subpentagonal; beak short, foramen large, mesothyrid; cardinal process small; loop triangular, 0.35 to 0.5 dorsal valve length, transverse band strongly arched. *Upper Jurassic:* India (Pamirs).——Fig. 1401,*3a–c.* **K. bobkovi* (Moisseev); *a–b,* dorsal and lateral views, ×1; *c,* reconstruction of loop, ×1 (Ovtsharenko, 1991).

**Kutchithyris** Buckman, 1918, p. 113 (Buckman, 1915, p. 78, *nom. nud.*) [**Terebratula acutiplicata* Kitchin, 1897, p. 9; OD] [=*Eurypthyris* Ovtsharenko, 1983b, p. 117 (type, *Terebratula euryptycha* Kitchin, 1900, p. 25, OD)]. Medium size,

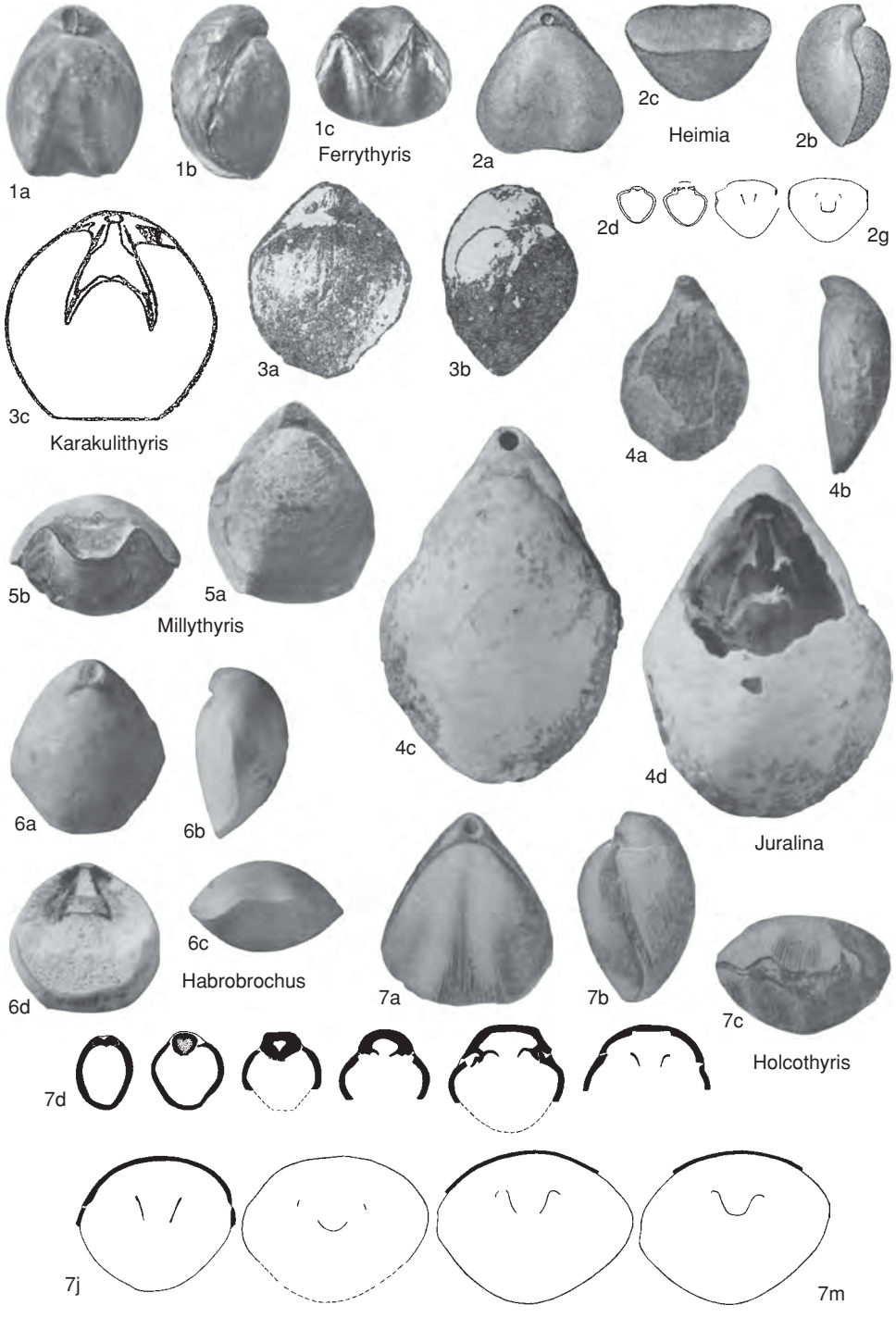


FIG. 1401. Postepithyrididae (p. 2110–2115).

subpentagonal; strongly ventribiconvex, smooth, or rarely finely capillate, with two broad plicae developing anteriorly; anterior commissure uniplicate to sulciplicate, beak short, incurved, attrite; foramen large, mesothyrid to epithyrid; symphytium hidden; cardinal process prominent, grooved; hinge plates wide, concave, flattening anteriorly, not well demarcated from inner socket ridges; crural bases low where attached to hinge plates, passing into high, thin, slightly flanged crural processes; hinge plates and crural processes clubbed; descending lamellae thin; loop not fully known; transverse band high arched, loop 0.4 to 0.5 dorsal valve length, with long terminal points. *Middle Jurassic–Upper Jurassic:* Burma, India, Pakistan, China, Tajikistan, Russia, Europe, North Africa, New Zealand.——Fig. 1402,*1a–o. *K. acutiplicata* (Kitchin), Upper Jurassic, Kutch, India; *a–d,* dorsal, ventral, lateral, anterior views of lectotype, GSI Type no. 6601, ×1; *e–o,* serial transverse sections 3.4, 4.9, 5.45, 7.05, 8.9, 10.2, 11.85, 13.2, 13.75, 14.25, 14.55 mm from ventral umbo, ×1 (Mukherjee & others, 2003).

**Maritimithyris** Smirnova in Smirnova & Konovalov, 1986, p. 76 [**M. lautus* Smirnova in Smirnova & Konovalov, 1986, p. 77; OD]. Large, pyriform or rounded, biconvex, ventral sulcus broad, commissures curved, beak massive, strongly incurved, foramen large; hinge teeth directed vertically in dental sockets, cardinal process broad, hinge plates inclined strongly to valve floor; crural bases broad with sharp angle inclined to hinge plates; crural processes broad, loop long, transverse band strongly curved, flanges long. *Lower Cretaceous:* Russia (Far East).——Fig. 1402,*2a–u. *M. lautus; a–c,* dorsal, lateral, and anterior views of slightly crushed holotype, ×1; *d–u,* serial transverse sections 0.0, 1.1, 1.3, 1.5, 2.1, 4.0, 4.5, 5.0, 6.9, 7.4, 8.5, 8.7, 9.4, 9.6, 10.8, 11.0, 11.8, 12.5 mm from first section, ×1 (new).

**Millythyris** Alméras, 1971, p. 245 [**M. millythyris;* OD]. Medium size, oval to rounded pentagonal, biconvex, anterior commissure paraplicate; beak straight, symphytium low, narrow; foramen circular, permesothyrid; pedicle collar long. Interior features as for *Conarothyris. Middle Jurassic (Toarcian)–Upper Jurassic (Bathonian):* France, England, Germany.——Fig. 1401,*5a–b. *M. millythyris,* Bajocian, France; dorsal and anterior views, ×1 (Alméras, 1971).

**Moeschia** Boullier, 1976, p. 333 [**Terebratula alata* Rollet, 1972a, p. 24; OD]. Large, subpentagonal, planoconvex to ventribiconvex, smooth, anterior commissure broadly uniplicate to weakly sulciplicate, beak short, incurved; foramen permesothyrid; pedicle collar present; cardinal process prominent, hinge plates wide, flat to concave, thin; loop 0.3 to 0.4 dorsal valve length, transverse band moderately arched, narrow; terminal points well developed. *Upper Jurassic:* France, Switzerland, Poland, Romania, Russia, Iran.——Fig. 1403,*2a–d. *M. alata* (Rollet), Oxfordian, Jura, France; *a–c,* dorsal, lateral, and anterior views, ×1; *d,* loop reconstruction, ×1 (Boullier, 1976).

**Moisseevia** Makridin, 1964, p. 243 [**M. sokolovi;* OD]. Large, elongate oval, smooth, beak strongly curved, foramen small; pedicle collar well developed; cardinal process short; low, short dorsal septum (possibly myophragm), loop more than 0.3 dorsal valve length, with long flanges. [No loop illustrations are available, therefore placement in family is uncertain.] *Upper Jurassic:* Europe, Russian Platform, Caucasus, Crimea.——Fig. 1403,*3a–c. *M. sokolovi,* Oxfordian, Russia; dorsal, lateral, and anterior views, ×1 (Makridin, 1964).

**Peculneithyris** Smirnova in Smirnova & Terekhova, 1972, p. 76 [**P. longiusculus;* OD]. Elongate oval, lateral margins flattened, anterior margin uniplicate, valves moderately convex, equally convex along whole surface; beak low, foramen small, permesothyrid; pedicle collar massive, funnel-like, cardinal process small, not lobate, with distinct, longitudinal crenulation; hinge plates thin, inclined to symmetry plane; crural bases distinct, broad, prominent dorsally, oriented with sharp angle to hinge plates, parallel to symmetry plane; inner socket ridges high, distinguishable from hinge plates; dorsal septum short, crural processes broad; loop slender, about half length of dorsal valve, transverse band broad, trapeziform flanges long. *Lower Cretaceous:* Russia (northeastern Siberia, Kamchatka, Khabarovsk region).——Fig. 1403,*1a–x. *P. longiusculus; a–c,* dorsal, lateral, and anterior views, ×1; *d–x,* serial transverse sections 2.0, 2.3, 2.6, 2.8, 3.1, 3.4, 3.7, 4.0, 4.7, 5.2, 6.2, 7.0, 7.4, 9.0, 9.3, 10.3, 10.8, 12.8, 13.1, 14.8, 17.6 mm from first section, ×0.3 (Smirnova & Terekhova, 1972).

**Perrierithyris** Alméras, 1971, p. 423 [**Terebratula dorsoplicata* var. *perrieri* Deslongchamps,1859, p. 22; OD]. Large, subtriangular, strongly biconvex, beak short, anterior commissure paraplicate, foramen large, circular, symphytium exposed; pedicle collar present; cardinal process short, trilobed; hinge plates forming a deep V; loop 0.5 to 0.6 dorsal valve length, transverse band subhorizontal. *Middle Jurassic (Callovian)–Upper Jurassic (Oxfordian):* France, Switzerland, Germany, Portugal.——Fig. 1404,*1a–k. *P. dorsoplicata perrieri* (Deslongchamps), France; *a–c,* dorsal, lateral, and anterior views of neotype, FSL47667, ×1; *d–k,* serial transverse sections 2.8, 3.7, 4.1, 5.2, 8.4, 11.4, 12.4, 15.8 mm from ventral umbo, ×1 (Alméras, 1971).

**Petalothyris** Cooper, 1983, p. 128 [**Terebratula simplex* J. Buckman, 1845, pl. 7,*5;* OD]. Large, planoconvex, externally like *Gigantothyris;* loop large, triangular, 0.5 dorsal valve length, transverse band wide, steeply arched, with flat bridge. *Middle Jurassic (Bajocian):* England.——Fig. 1404,*3a–d. *P. simplex* (J. Buckman); *a–c,* dorsal, lateral, and anterior views, ×1; *d,* dorsal valve interior, ×1 (Cooper, 1983).

**Plectoidothyris** Buckman, 1918, p. 122 (Buckman, 1914, p. 2, *nom. nud.*) [**Terebratula polyplecta* Buckman, 1901, p. 242; OD] [=*Oligorhytisia* Cooper, 1983, p. 125 (type, *O. magnifica,* OD);

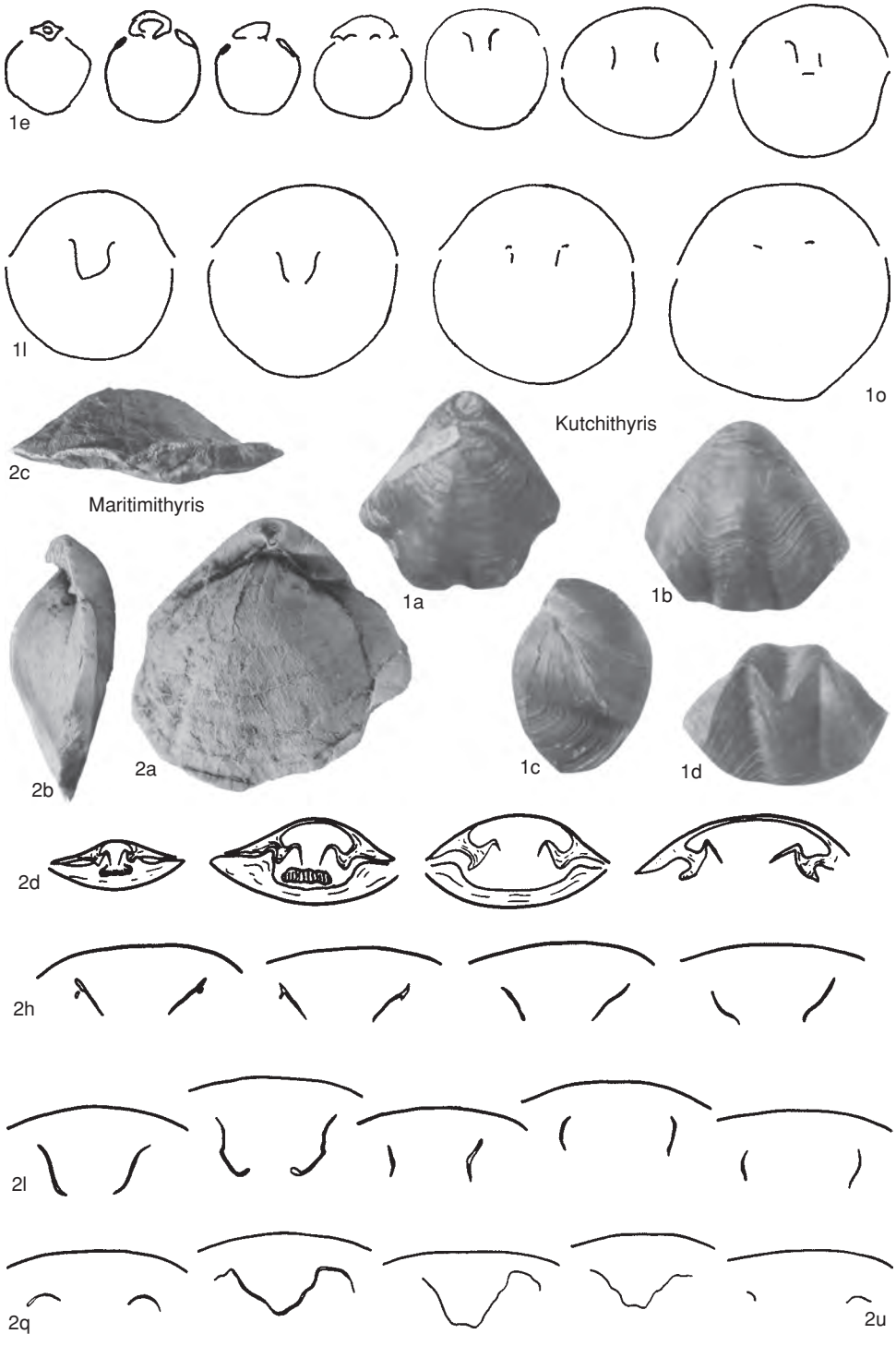


FIG. 1402. Postepithyrididae (p. 2113–2115).

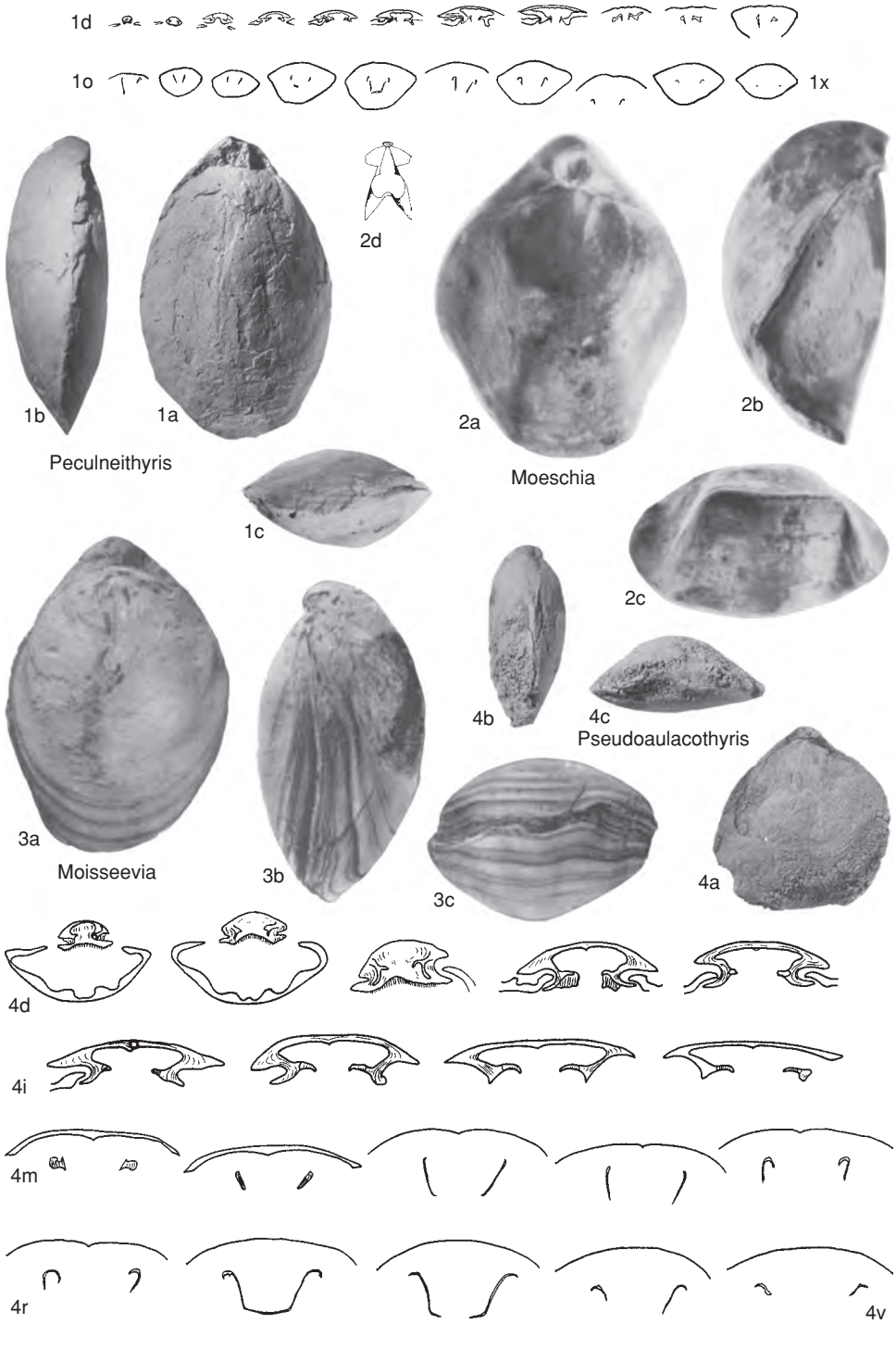


FIG. 1403. Postepithyrididae (p. 2115–2119).

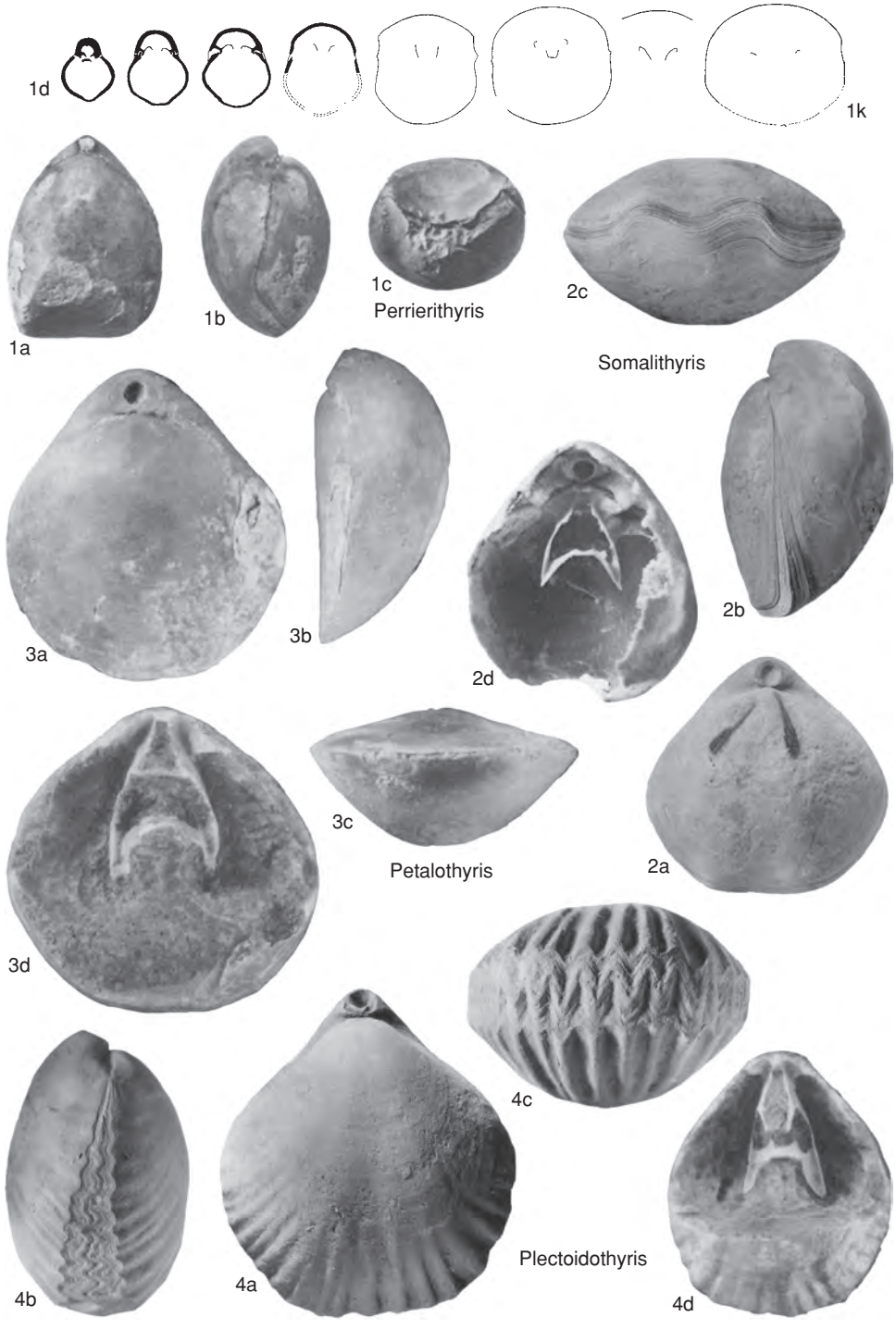


FIG. 1404. Postepithyrididae (p. 2115–2119).

*Pleuraloma* COOPER, 1989, p. 84 (type, *P. labiatum,* OD); *Dissoria* COOPER, 1989, p. 97 (type, *D. costata,* OD)]. Large, ventribiconvex, subpentagonal to elongate oval, smooth in juveniles, irregular, rounded costae developing anteriorly; anterior commissure rectimarginate to uniplicate, becoming multiplicate, beak short, foramen permesothyrid, symphytium partly visible; pedicle collar present; cardinal process small, thin, bilobed; outer hinge plates short, narrow, deeply concave; loop 0.5 to 0.6 dorsal valve length, with strongly webbed, long terminal points; transverse band narrow, strongly arched. *Middle Jurassic (Bajocian–Callovian):* England, France, Saudi Arabia.——FIG. 1404,*4a–d.* **P. polyplecta* (BUCKMAN), Bajocian, England; *a–c,* dorsal, lateral, and anterior views of holotype, ×1 (Muir-Wood, 1965a); *d,* dorsal valve interior, ×1 (Cooper, 1983).

**Pseudoaulacothyris** SMIRNOVA, 1990a, p. 93 [**P. pandus;* OD]. Medium size, subcircular, slightly biconvex, smooth, with sulcus on dorsal valve, ventral valve carinate; anterior commissure unisulcate, beak low, broad; foramen small, epithyrid; pedicle collar thin; cardinal process concave, bilobate; hinge plates slightly concave, not differentiated from inner socket ridges; loop about 0.5 dorsal valve length; flanges of moderate length. *Lower Cretaceous:* Russia (northeastern Siberia, Kamchatka).——FIG. 1403,*4a–v.* **P. pandus; a–c,* dorsal, lateral, and anterior views of holotype, ×1; *d–v,* serial transverse sections 0.6, 0.7, 0.9, 1.1, 1.9, 2.1, 3.0, 3.2, 3.9, 4.2, 5.1, 5.3, 6.1, 6.3, 7.0, 7.3, 8.6, 9.4, 11.2 mm from first section, ×1 (new).

**Somalithyris** MUIR-WOOD, 1935, p. 124 [**S. macfadyeni;* OD]. Medium size, subpentagonal to subcircular; ventribiconvex; anterior commissure uniplicate to sulciplicate; beak short, suberect, symphytium hidden; foramen large, permesothyrid; cardinal process bilobed; loop 0.4 dorsal valve length. *Upper Jurassic (Oxfordian–Kimmeridgian):* Somalia, Saudi Arabia.——FIG. 1404,*2a–c.* **S. macfadyeni,* Oxfordian, Somalia; dorsal, lateral, and anterior views of holotype, BMNH B 85655, ×1 (Muir-Wood, 1965a).——FIG. 1404,*2d. S. ovata,* Kimmeridgian, Saudi Arabia; interior of dorsal valve, ×1 (Cooper, 1989).

**Xestosina** COOPER, 1983, p. 166 [**X. arguta;* OD]. Externally similar to *Sellithyris,* but with widely triangular loop, 0.5 dorsal valve length, with moderately long terminal points. *Upper Jurassic (Kimmeridgian):* France.——FIG. 1405*a–d.* **X. arguta; a–c,* dorsal, lateral, and anterior views, ×1; *d,* interior of dorsal valve, ×1 (Cooper, 1983).

## Family TCHEGEMITHYRIDIDAE Tchorszhevsky, 1972

[Tchegemithyrididae TCHORSZHEVSKY, 1972, p. 36]

Small to large, smooth, rectimarginate to uniplicate to sulciplicate, crural processes anterior of midloop, outer hinge plates attached dorsally to crural bases; loop long, with long flanges; transverse band with narrow bridge; loop development may be complex. *Middle Jurassic (Callovian)–Upper Jurassic.*

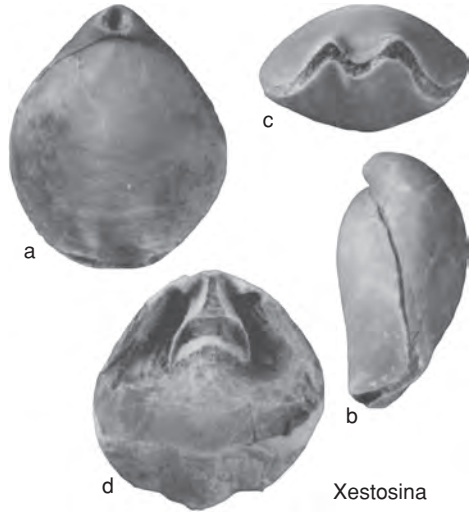


FIG. 1405. Postepithyrididae (p. 2119).

### Subfamily TCHEGEMITHYRIDINAE Tchorszhevsky, 1972

[Tchegemithyridinae TCHORSZHEVSKY, 1972, p. 36]

Loop about 0.6 dorsal valve length. *Middle Jurassic (Callovian)–Upper Jurassic (Oxfordian).*

**Tchegemithyris** TCHORSZHEVSKY, 1972, p. 36 [**Terebratula tchegemensis* MOISSEEV, 1934, p. 97; OD]. Small to medium size, subcircular to subpentagonal; strongly biconvex or globose, anterior commissure uniplicate; beak strongly incurved, symphytium short; foramen mesothyrid or epithyrid, pedicle collar weakly developed; outer hinge plates thick, crural processes derived from anterior margin of hinge plates. *Middle Jurassic (Callovian)–Upper Jurassic (Oxfordian):* Turkmenia, Caucasus, Lebanon, Syria.——FIG. 1406,*1a–v.* **T. tchegemensis* (MOISSEEV), Oxfordian, Caucasus; *a–c,* dorsal, lateral, and anterior views, ×1 (Moisseev, 1934); *d–u,* serial transverse sections 1.0, 3.5, 4.25, 5.3, 6.2, 6.8, 7.3, 8.15, 9.0, 9.85, 10.1, 10.5, 11.35, 12.65, 13.25, 14.3, 16.45, 16.75 mm from first section, ×1 (Tchorszhevsky, 1972); *v,* reconstruction of loop, ×3.5 (Cooper, 1983).

## Subfamily TURKMENITHYRIDINAE Tchorszhevsky, 1974

[Turkmenithyridinae Tchorszhevsky, 1974, p. 50]

Loop about 0.3 dorsal valve length. *Upper Jurassic.*

**Turkmenithyris** Prosorovoskaja, 1962, p. 109 [**T. krimholzi;* OD] [=*Bejrutella* Tchorszhevsky, 1972, p. 40 (type, *B. bejrutica,* OD)]. Medium to large, subpentagonal, ventribiconvex, strongly uniplicate to sulciplicate; beak incurved, concealing symphytium, foramen large, mesothyrid; pedicle collar present; cardinal process large, bilobed; hinge plates short, slightly concave, posteriorly U-shaped, becoming V-shaped anteriorly; crural processes high, their ventral ends deflected laterally, loop short (about 0.3 dorsal valve length), widely triangular, transverse band thin, strongly arched, loop flanges very long. *Upper Jurassic:* Turkmenia, Crimea, Lebanon, Syria.——Fig. 1406,*2a–v.* **T. krimholzi,* Turkmenia; *a–c,* dorsal, lateral, and anterior views of holotype, ×1; *d–u,* serial transverse sections 2.2, 6.6, 6.8, 8.0, 8.1, 9.2, 9.6, 10.0, 10.5, 10.6, 10.9, 11.4, 12.0, 13.2, 14.0, 15.4, 16.0, 18.2 mm from ventral umbo, ×1; *v,* reconstruction of loop, ×1 (Prosorovoskaja, 1962).

## Family TEGULITHYRIDIDAE Muir-Wood, 1965

[Tegulithyrididae Muir-Wood, 1965a, p. 801]

Smooth or rarely capillate, anterior commissure biplicate or parasulate. *Lower Jurassic (Toarcian)–Middle Jurassic (Callovian).*

**Tegulithyris** Buckman, 1918, p. 123 (Buckman, 1915, p. 78, *nom. nud.*) [**Terebratula bentleyi* Davidson, 1851, p. 58; OD]. Medium size, subpentagonal, ventribiconvex; anterior commissure strongly biplicate; dorsal sulcus becoming median fold, and angular folds separating deep ventral sulcus from concave flanks; smooth or rarely capillate; beak long, erect; foramen large, permesothyrid, symphytium exposed; cardinal process small, bilobed; outer hinge plates short, narrow, concave, may be thickened, attached dorsally to crural bases; crura short, loop long, 0.5 dorsal valve length, transverse band strongly arched, medially flattened, protuberant, with short flanges. *Middle Jurassic (Bathonian–Callovian):* England, France, Germany, Russia.——Fig. 1407,*1a–e.* **T. bentleyi* (Davidson), Callovian, England; *a–d,* dorsal, ventral, lateral, and anterior views, ×1; *e,* dorsal valve interior, ×2 (Cooper, 1983).

**Prototegulithyris** Alméras, Elmi, & Benshili, 1988, p. 67 [**P. khadijae;* OD]. Description as for *Tegulithyris,* but smooth, rounded pentagonal in outline, and anterior commissure gently parasulcate. *Lower Jurassic (Toarcian)–Middle Jurassic (Aalenian):* Morocco, Sicily, Italy, Bavaria.——Fig. 1407,*3a–q.* **P. khadijae,* Toarcian, Morocco; *a–c,* dorsal, lateral, and anterior views of holotype, FSL 306466, ×1; *d–q,* serial transverse sections 1.2, 4.4, 5.1, 5.6, 7.6, 8.2, 8.4, 8.6, 9.8, 10.8, 11.0, 11.2, 12.0, 12.7 mm from ventral umbo, ×1 (Alméras, Elmi, & Benshili, 1988).

## Family ALABUSHEVOTHYRIDIDAE Smirnova, 1994

[Alabushevothyrididae Smirnova, 1994, p. 40]

Biconvex, smooth, rectimarginate, dental plates massive, diverging; cardinal process trilobate, loop anteriorly spinose. *Lower Cretaceous.*

**Alabushevothyris** Smirnova, 1994, p. 41 [**A. angusta;* OD]. Medium size, elongate oval; beak erect, interarea high; beak cavities fused with callus; cardinal process trilobed, strongly grooved; loop about 0.5 length of dorsal valve. *Lower Cretaceous:* Russia (Kamchatka).——Fig. 1407,*2a–v.* **A. angusta; a–c,* dorsal, lateral, and anterior views of holotype, MGU138/350, ×1; *d–v,* serial transverse sections 0.0, 0.2, 0.6, 1.5, 2.0, 4.0, 4.8, 5.8, 6.8, 7.6, 8.6, 9.0, 9.3, 9.8, 10.8, 12.0, 13.0, 14.4, 16.4 mm from first section, ×1 (new).

## Family CLATHRITHYRIDIDAE Smirnova, 1974

[Clathrithyrididae Smirnova, 1974, p. 47]

Smooth or with reticulate ornament, unisulcate; dental plates present; inner hinge plates may be present; adult loop deltiform; loop ontogeny may involve septal pillar in early stages. *Lower Cretaceous.*

**Clathrithyris** Smirnova, 1974, p. 48 [**C. clathriensis;* OD]. Medium size, dorsibiconvex with deep dorsal sulcus and prominent, ventral median fold; growth lamellae squamose and overlapping, radial costae thin, low, flattened, ornament reticulate; beak erect; foramen small, epithyrid, deltidial plates conjunct; beak cavity infilled with callus; dental plates broad, pedicle collar present; no cardinal process, hinge plates broad, inclined; deep septalium consisting of high median septum and wide, inner hinge plates; septalium infilled with callus in adult shells; crural bases massive, fused with inner hinge plates; crural processes broad; adult loop about 0.5 length of valve, anteriorly spinose, transverse band broad, flattened. *Lower Cretaceous:* Russia (Kamchatka).——Fig. 1408,*3a–w.* **C. clathriensis; a–c,* dorsal, lateral, and anterior views of holotype, MGU 138/331, ×1; *d,* closeup of ornament, ×5; *e–v,* serial transverse sections 0.8, 1.0, 1.8, 2.2, 2.7, 2.8, 3.1, 3.3, 3.8, 4.4, 5.1, 5.8, 6.2, 6.9, 7.7, 8.1, 8.9, 10.8

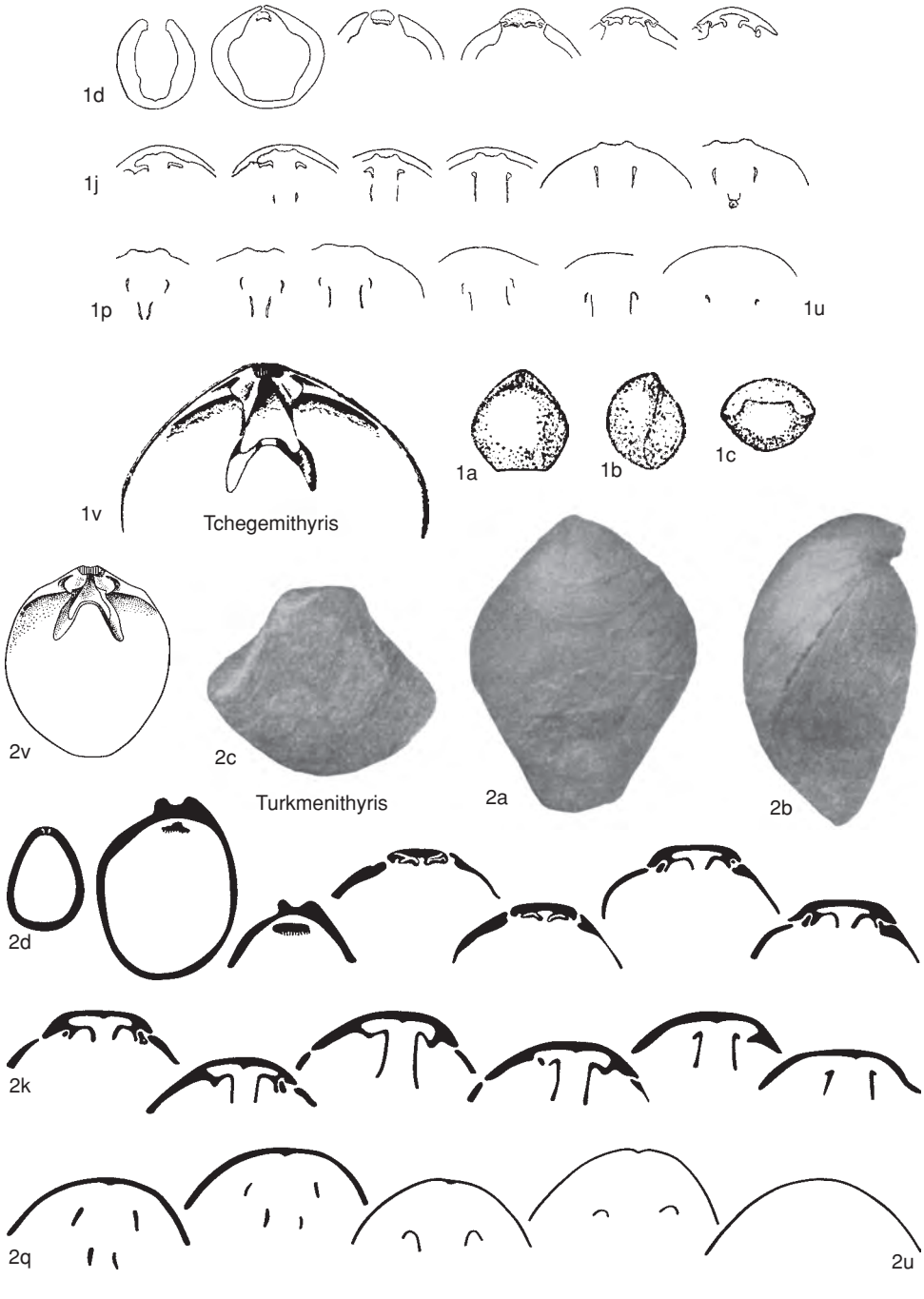


FIG. 1406. Tchegemithyrididae (p. 2119–2120).

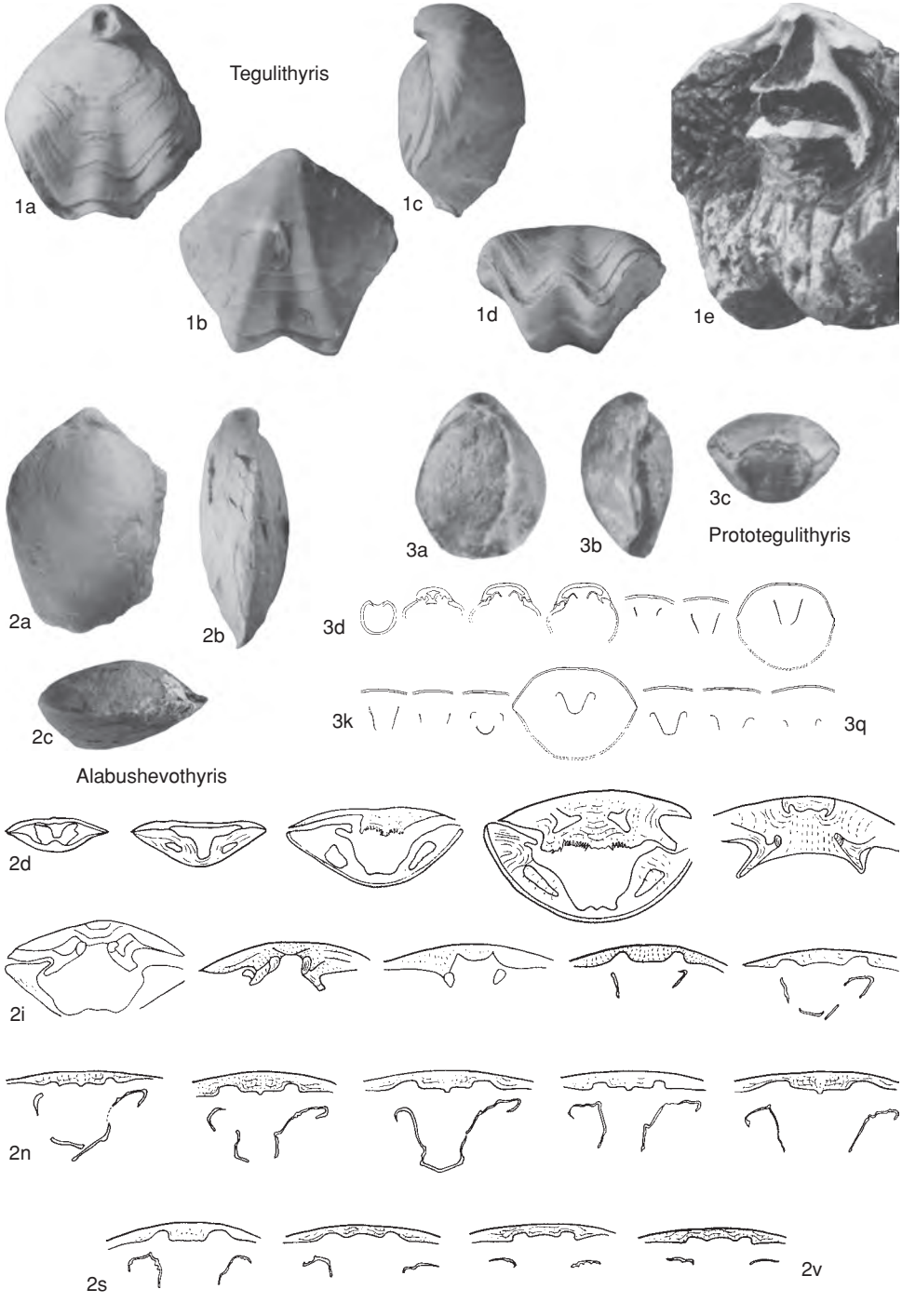


FIG. 1407. Tegulithyrididae and Alabushevothyrididae (p. 2120).

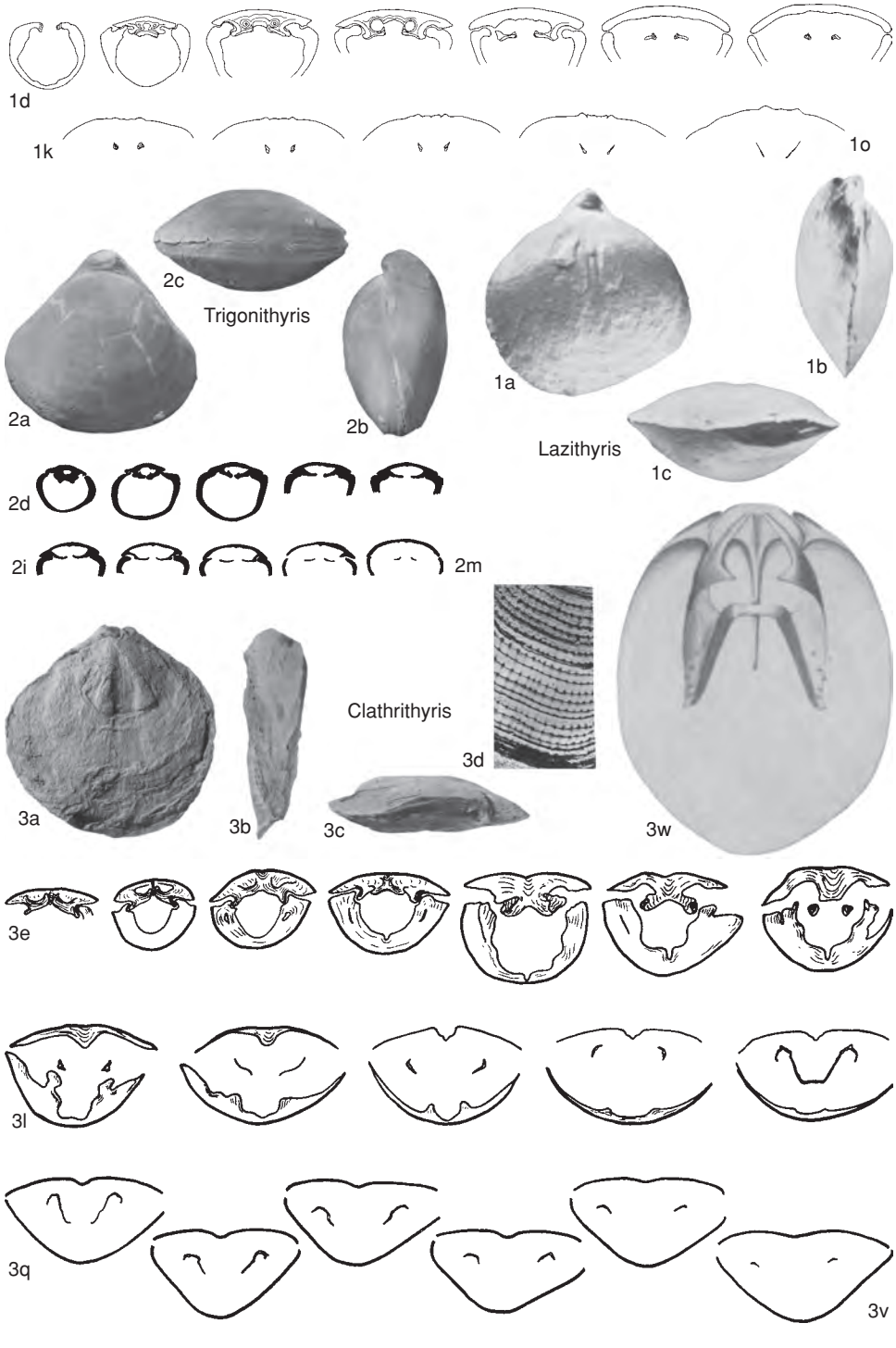


FIG. 1408. Clathrithyrididae and Trigonithyrididae (p. 2120–2129).

mm from first section, ×1; *w,* reconstructed loop, ×2.5 (Smirnova, 1974).

## Family HARPOTOTHYRIDIDAE Smirnova, 1990

[Harpotothyrididae Smirnova, 1990b, p. 53]

Medium to large, smooth; biconvex, pedicle collar present; cardinal process small, crural bases broad, concave, inclined almost perpendicularly to hinge plates; loop with long flanges. *Lower Cretaceous.*

**Harpotothyris** Smirnova, 1990b, p. 53 [**H. karakhabdaensis;* OD]. Elongate oval to rounded trigonal; anterior commissure rectimarginate to uniplicate; beak high, strongly incurved; cardinal process small, concave, often medially convex; crural bases high, crescent shaped in section, inclined almost perpendicularly to narrow, flattened hinge plates; short median ridge present; transverse band of loop thin, flanges long, slender. *Lower Cretaceous:* Kazakhstan.——Fig. 1409,*5a–w. *H. karakhabdaensis; a–c,* dorsal, lateral, and anterior views of holotype, MGU 139/700, ×1; *d–w,* serial transverse sections 0.0, 0.3, 3.0, 3.2, 4.0, 4.3, 5.0, 5.6, 6.2, 6.8, 7.9, 8.0, 9.5, 9.8, 11.9, 12.4, 13.4, 14.6, 15.9, 17.9 mm from first section, approximately ×1 (new).

**Atelithyris** Smirnova, 1975c, p. 77 [**A. crestensis;* OD]. Elongate oval, slightly uniplicate; beak long, foramen large, epithyrid, beak ridges rounded; cardinal process low, hinge plates slightly inclined, flattened; inner socket ridges indistinct, crural processes high; loop about 0.5 dorsal valve length, transverse band slender, strongly arched, flanges long. *Lower Cretaceous (Hauterivian):* Russia (Russian Platform).——Fig. 1409,*2a–d. *A. crestensis; a–c,* dorsal, lateral, and anterior views of holotype, MGU 138/477, ×1; *d,* reconstruction of loop, ×1 (Smirnova, 1975c).

**Convexothyris** Smirnova, 1994, p. 37 [**C. tylokrilica;* OD]. Large, elongate oval, anterior commissure rectimarginate to slightly uniplicate, beak massive, incurved; cardinal process small; hinge plates broad, ventrally convex, crural bases concave with pointed dorsal ends; dorsal septal platform may be developed, loop with long flanges, transverse band trapeziform in section. *Lower Cretaceous:* Russia (Kamchatka).——Fig. 1409,*4a–c. *C. tylokrilica;* dorsal, lateral, and anterior views of holotype, MGU138/518, ×1 (Smirnova, 1994).

**Lissothyris** Smirnova, 1987, p. 35 [**L. piriformis* Smirnova, 1987, p. 37; OD]. Large, subpentagonal, anterior commissure uniplicate to biplicate; beak high, foramen large; pedicle collar not seen; cardinal process low, broad; hinge plates broad, parallel to valve floor, slightly demarcated from inner socket ridges; crural bases with strongly concave inner surface and high, sharp, ventral ends; short dorsal ends of crural bases almost fused with hinge plates; transverse band strongly curved, rectimarginate in section; loop slender with long flanges; cardinal structures may be fused with callus. *Lower Cretaceous:* Russia (Russian Platform).——Fig. 1409,*3a–c. *L. piriformis;* dorsal, lateral, and anterior view of holotype, MGU139/547, ×1 (Smirnova, 1987).

**Okathyris** Smirnova, 1975c, p. 71 [**O. chevkinensis;* OD]. Medium size, subcircular, slightly unisulate or bisulcate; foramen epithyrid, beak ridges obscure; cardinal process low, slightly concave; hinge plates narrow, steeply inclined to plane of symmetry; inner socket ridges high, crural bases inclined to hinge plates; crural processes long; loop about 0.5 dorsal valve length, transverse band broadly arched. *Lower Cretaceous (Berriasian):* Russia (Russian Platform), England.——Fig. 1409,*1a–d. *O. chevkinensis; a–c,* dorsal, lateral, and anterior views of holotype, MGU 139/91, ×1 (Smirnova, 1975c); *d,* loop reconstruction, ×1 (Cooper, 1983).

## Family MAMETOTHYRIDIDAE new family

[Mametothyrididae Smirnova & Lee, herein] [type genus, *Mametothyris* Smirnova in Smirnova & Pergament, 1969, p. 34]

Large, smooth, anterior commissure rectimarginate, foramen small, no pedicle collar, crural bases fused with hinge plates, loop long with long flanges. *Lower Cretaceous (Albian).*

**Mametothyris** Smirnova in Smirnova & Pergament, 1969, p. 34 [**M. mametica;* OD]. Rounded trigonal, beak short, incurved, cardinal process low, concave, hinge plates ventrally concave; loop slender, long, 0.5 dorsal valve length; transverse band high, rounded. *Lower Cretaceous (Albian):* Russia (Kamchatka).——Fig. 1410*a–x. *M. mametica; a–c,* dorsal, lateral, and anterior views of holotype, MGU138/64, ×1; *d–x,* serial transverse sections 0.3, 0.5, 0.8, 1.4, 2.1, 2.3, 2.8, 3.3, 3.6, 3.8, 5.2, 5.4, 6.9, 7.2, 7.6, 8.1, 8.6, 9.9, 11.1, 11.7, 12.9 mm from first section, ×2 (Smirnova & Pergament, 1969).

**Penzhinothyris** Smirnova in Smirnova & Pergament, 1969, p. 36 [**P. plana;* OD]. Subcircular, thick shelled, slightly biconvex or dorsibiconvex, beak slightly incurved, beak ridges sharp; interarea high, smooth; cardinalia massive, cardinal process trilobed, hinge plates inclined to symmetry plane, demarcated from inner socket ridges by a groove; loop long, more than 0.5 dorsal valve length; transverse band broad, high, trapeziform in section; loop flanges long; septal platform massive, consisting of three ridges. *Lower Cretaceous (Albian):* Russia (Kamchatka).——Fig. 1411*a–r. *P. plana; a–c,* dorsal, lateral, and anterior views of holotype, MGU138/63, ×1; *d–r,* serial transverse sections 0.2, 2.1, 4.1, 5.4, 6.3, 6.9, 8.0, 8.1, 9.2, 9.4, 10.6, 11.4, 13.2, 14.6, 16.1 mm from first section, ×1.5 (Smirnova & Pergament, 1969).

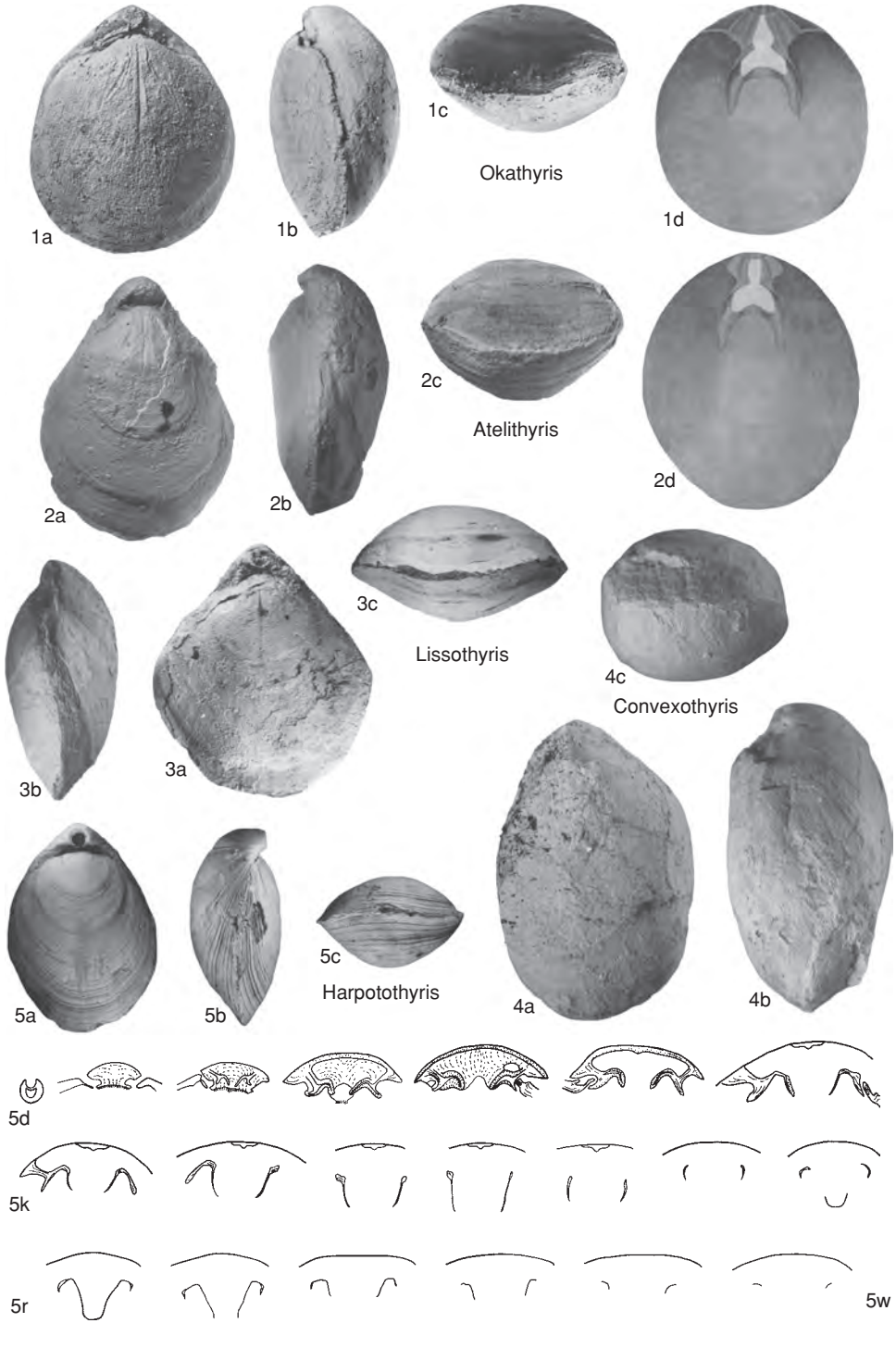


FIG. 1409. Harpotothyrididae (p. 2124).

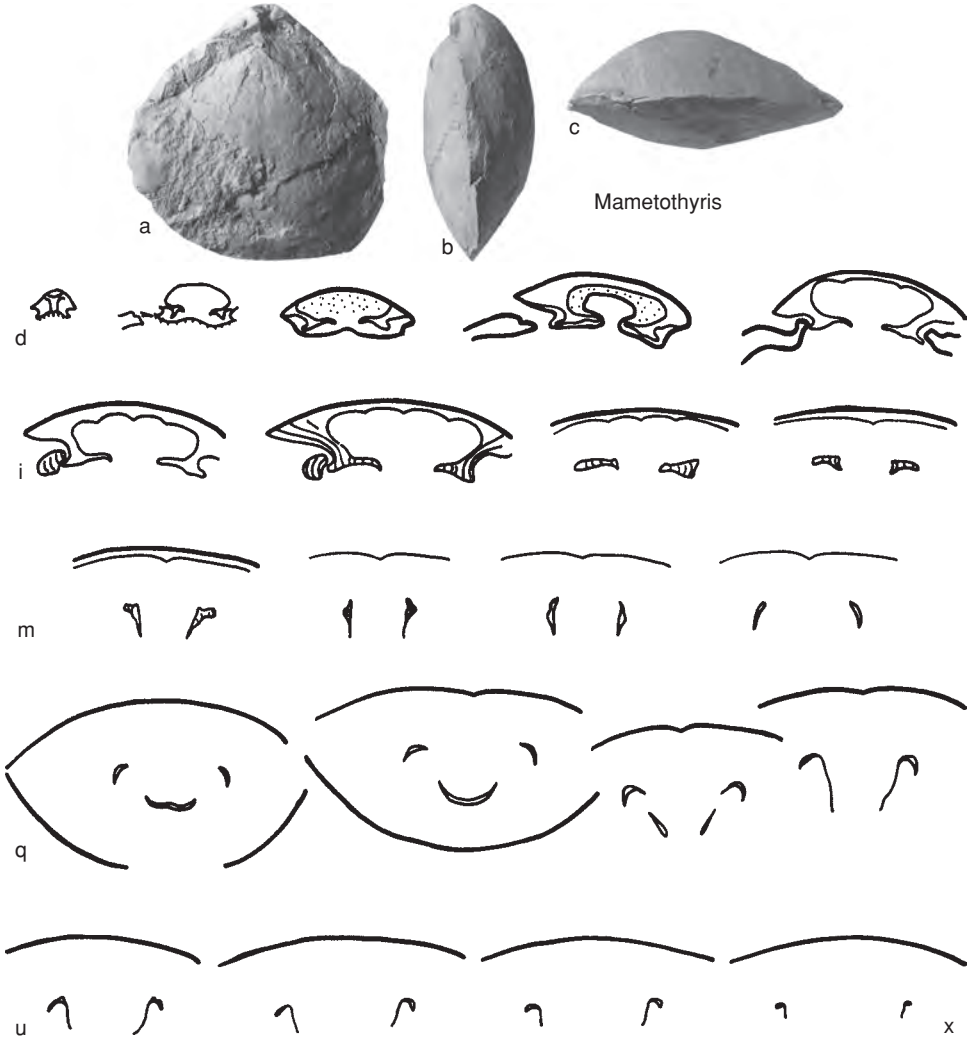


FIG. 1410. Mametothyrididae (p. 2124).

## Family SPASSKOTHYRIDIDAE Smirnova, 1977

[*nom. transl.* SMIRNOVA 1990a, p. 104, *ex* Spasskothyridinae SMIRNOVA, 1977, p. 74]

Medium to large, smooth, pedicle collar may be present; crural bases with well-developed ventral and dorsal ends, inner hinge plates may be present; loop narrow with long flanges. *Lower Cretaceous.*

**Spasskothyris** SMIRNOVA, 1975c, p. 74 [**S. rjasanensis;* OD]. Large, elongate oval; slightly bisulcate; beak long; foramen large, epithyrid; pedicle collar rounded; cardinal process low; crural bases with long ventral and dorsal extremities separating inner and outer hinge plates, and in contact with floor of dorsal valve, much reduced anteriorly; ventral extremities of crural bases forming ridgelike projections adjacent to hinge plates, passing into inner hinge plates; outer hinge plates broad, concave; crural bases and crural processes concave; loop narrow, 0.5 to 0.6 length of dorsal valve; flanges very long. *Lower Cretaceous (Berriasian):* Russia (Russian Platform).——FIG. 1412*a–cc.* **S. rjasanensis; a–c,* dorsal, lateral, and anterior views of holotype, MGU 139/65; *d,* reconstruction of loop, ×1 ; *e–cc,* serial

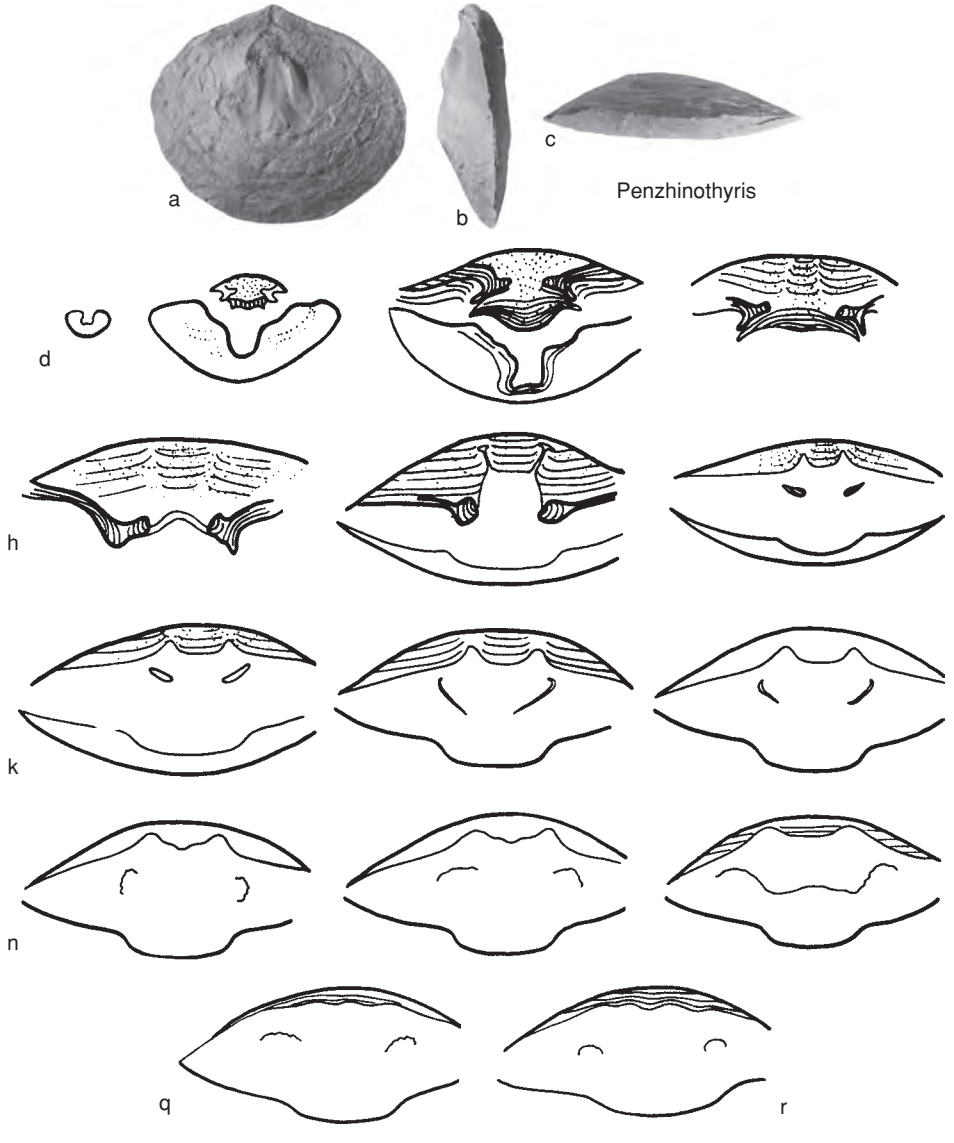


FIG. 1411. Mametothyrididae (p. 2124).

transverse sections 0.0, 0.2, 6.2, 6.7, 7.2, 7.7, 8.0, 8.5, 9.0, 10.2, 10.7, 11.3, 11.7, 13.0, 13.7, 14.7, 16.2, 17.9, 18.7, 19.1, 20.3, 21.5, 23.6, 26.3, 29.3 mm from first section, ×1 (Smirnova, 1975c).

**Volgathyris** SMIRNOVA, 1987, p. 38 [**V. sublatus;* OD]. Rounded-pentagonal, biconvex, uniplicate; beak massive, foramen large; no pedicle collar; hinge teeth large, wedge shaped with distinct denticulum; cardinal process narrow, denticulated; hinge plates dorsally inclined to midvalve, planar, gradually transformed into broad socket ridges at right angles to crural bases; crural bases broad with long ventral and shorter dorsal ends, inclined to symmetry plane with sharp angle; crural processes broad; loop narrow with thin branches, transverse band highly trapeziform, flanges long. *Lower Cretaceous:* Russia (Russian Platform).——FIG. 1413*a–u.* **V. sublatus; a–c,* dorsal, lateral, and anterior views of holotype, MGU139/509, ×1; *d–u,* serial transverse sections 1.1, 1.6, 2.0, 2.4, 2.6, 2.8, 3.2, 3.5, 4.0, 4.6, 5.0, 7.8, 9.1, 11.9, 12.5, 14.4, 15.4, 16.4 mm from first section, ×1 (Smirnova, 1987).

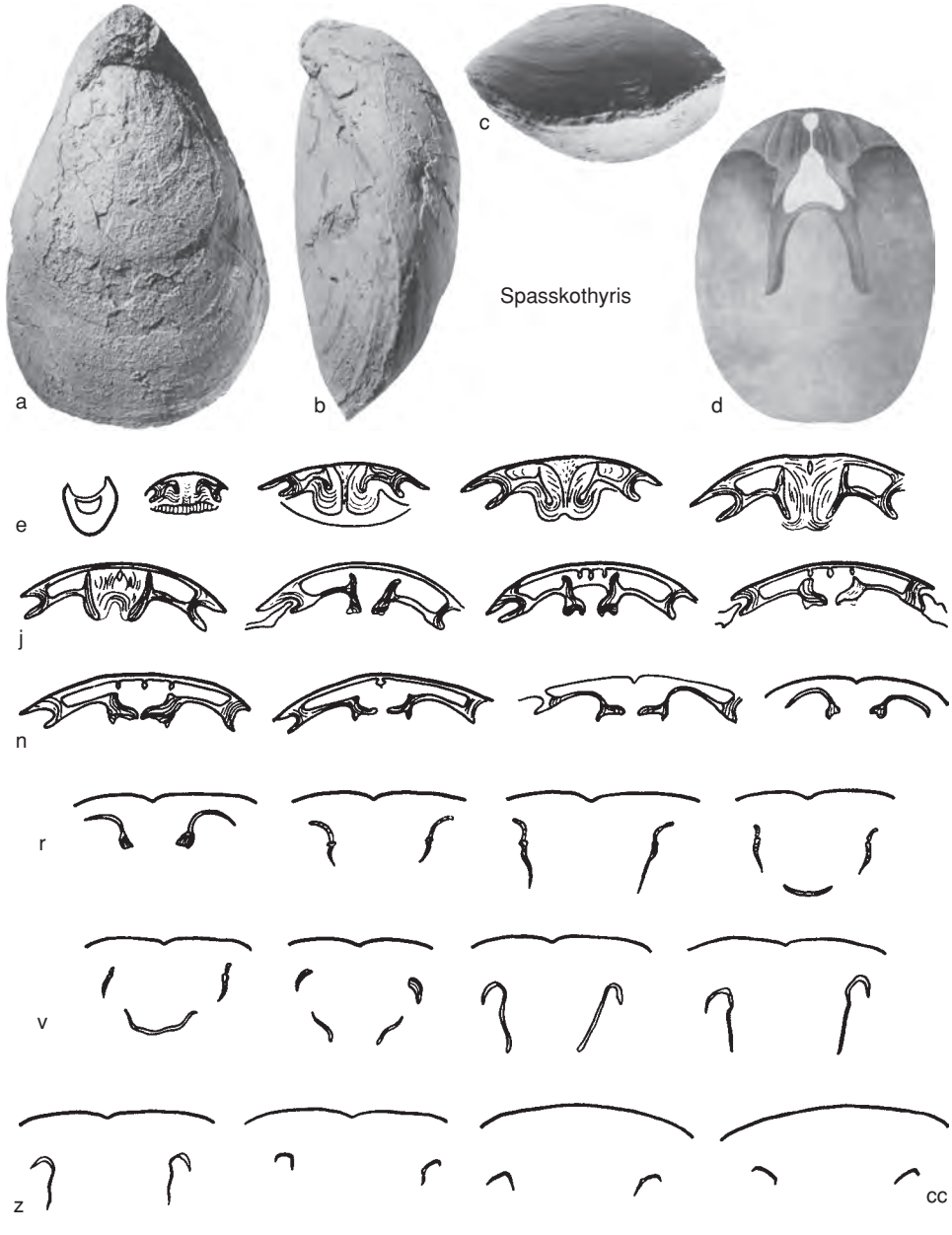


FIG. 1412. Spasskothyrididae (p. 2126–2127).

**Family TRIGONITHYRIDIDAE Radulović, 1986**

[Trigonithyrididae RADULOVIĆ, 1986, p. 44]

Medium to large, smooth, biconvex, anterior commissure rectimarginate to slightly unisulcate, foramen large, no pedicle collar; outer hinge plates broad, subhorizontal to dorsally inclined; crura long and narrow, loop narrow, thin, about 0.4 to 0.5 dorsal valve length. *Middle Jurassic (Bajocian)–Upper Jurassic (Oxfordian).*

**Trigonithyris** MUIR-WOOD, 1935, p. 131 [**T. eruduwensis;* OD]. Medium size, trigonal, anterior commissure rectimarginate; beak short, foramen

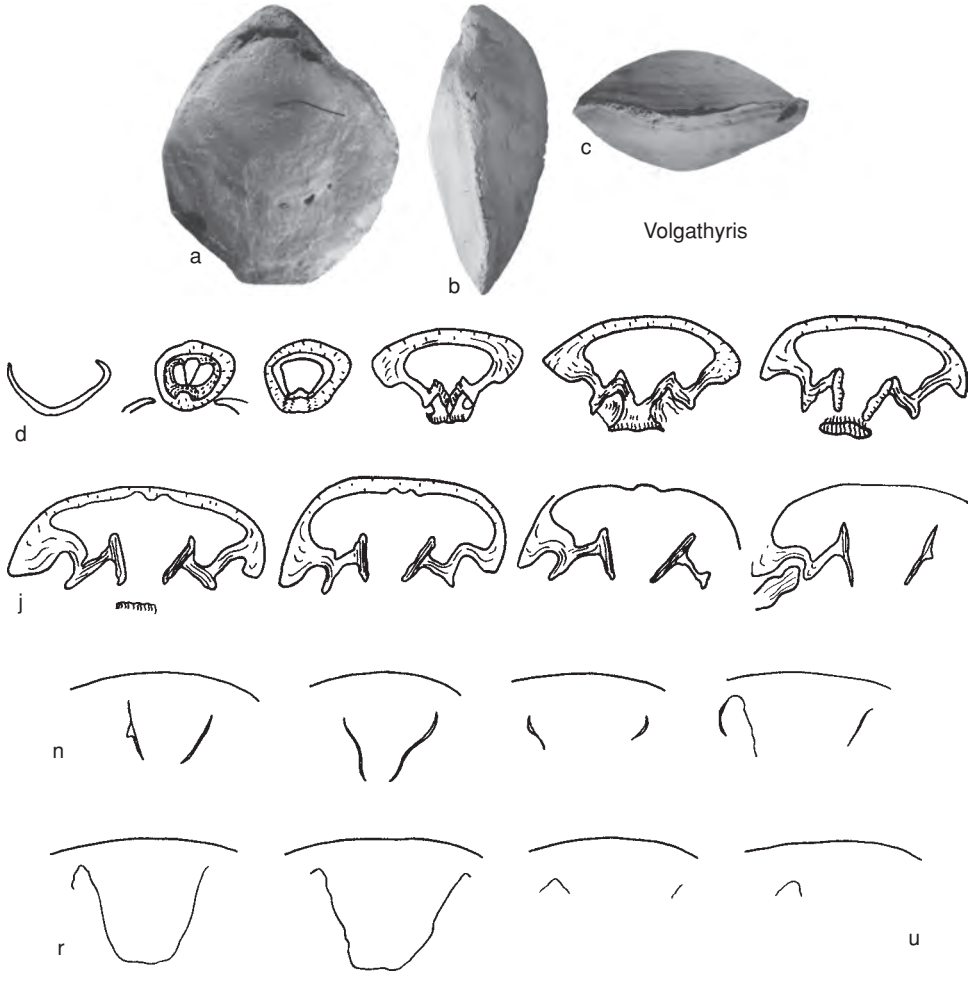


FIG. 1413. Spasskothyrididae (p. 2127).

epithyrid, symphytium visible; cardinal process broad, medianly depressed, with posterior umbonal cavity; outer hinge plates well developed, horizontal or becoming slightly convex ventrally; crura long and narrow, crural processes well anterior of outer hinge plates; loop about 0.5 dorsal valve length, not known fully. *Upper Jurassic (Oxfordian):* Somalia. ——FIG. 1408,*2a–m. *T. eruduwensis; a–c,* dorsal, lateral, and anterior views, ×1; *d–m,* serial transverse sections, no measurements available, ×1 (Muir-Wood, 1965a).

**Lazithyris** RADULOVIĆ, 1986, p. 45 [**L. andjelkovici;* OD]. Medium to large, circular to elongate oval, anterior commissure rectimarginate to slightly unisulcate; beak short, narrow, erect, foramen hypothyrid; symphytium short; deltidial plates weakly developed, disjunct; cardinal process bilobate; loop about 0.4 dorsal valve length, not known fully. *Middle Jurassic (Bajocian–Bathonian):* Yugoslavia (Carpathians, Balkanides).——FIG. 1408,*1a–o. *L. andjelkovici; a–c,* dorsal, lateral, and anterior views of holotype, ×1; *d–o,* serial transverse sections 2.5, 3.5, 4.1, 4.7, 4.9, 5.5, 5.7, 5.9, 6.1, 6.3, 6.7, 7.5 mm from ventral umbo, ×1.6 (Radulović, 1986).

## Family UNCERTAIN
## Subfamily GONIOTHYRIDINAE Tchorszhevsky, 1971

[Goniothyridinae TCHORSZHEVSKY, 1971b, p. 45]

Medium to large, beak short, strongly truncated, dorsal valve strongly convex; loop long, outer hinge plates convex ventrally. *Middle Jurassic (Aalenian–Bajocian).*

**Goniothyris** BUCKMAN, 1918, p. 117 (BUCKMAN, 1914, p. 2, *nom. nud.*) [**Terebratula gravida* SZAJNOCHA, 1881, p. 74; OD]. Trigonal to subpentagonal, strongly dorsibiconvex, ventral valve convex to carinate, anterior commissure rectimarginate; foramen epithyrid to permesothyrid, symphytium narrow; pedicle collar very short; cardinal process very small, hinge plates in section convex ventrally and deflected dorsally, keeled; loop of type species unknown; loop of *G. poleymiensis* moderately long, narrow, with broad transverse band, crural processes near midloop, terminal points. Moderately long. *Middle Jurassic (Aalenian–Bajocian):* England, France, Czech Republic, Slovakia, Austria, Hungary, Transcarpathia.——FIG. 1414,*1a–d. *G. gravida* (SZAJNOCHA), Carpathians; holotype, dorsal, ventral, lateral, and anterior views, ×1 (Szajnocha, 1881).

## Subfamily HETEROBROCHINAE Cooper, 1983

[Heterobrochinae COOPER, 1983, p. 42]

Medium size, subpentagonal, anterior commissure sulciplicate, loop wide angled, crural processes posterior of midloop, outer hinge plates ventrally attached to crural bases, transverse band broad, medially protuberant. *Upper Jurassic (Kimmeridgian).*

**Heterobrochus** COOPER, 1983, p. 89 [**H. incultus* COOPER, 1983, p. 90; OD]. Large, subpentagonal, smooth, beak short, erect; foramen large, permesothyrid; cardinal process small, bilobed; outer hinge plates small, flattened to concave, attached to ventral edge of crural bases; loop very wide. *Upper Jurassic (Kimmeridgian):* Germany.——FIG. 1414,*3a–d. *H. incultus; a–c,* dorsal, lateral, and anterior views, ×1; *d,* closeup of loop, ×2 (Cooper, 1983).

## Subfamily PSEBAJITHYRIDINAE Tchorszhevsky, 1974

[Psebajithyridinae TCHORSZHEVSKY, 1974, p. 47]

Medium to large, uniplicate to weakly sulciplicate, loop short, narrow, about 0.3 dorsal valve length, outer hinge plates attached to ventral edges of crura, transverse band broad, nearly horizontal; transverse band developing from vertical plate of acuminate (centronelliform) loop. *Upper Jurassic.*

**Psebajithyris** TCHORSZHEVSKY, 1974, p. 48 [**P. rostovtsevi;* OD]. Large, oval to subpentagonal, anterior commissure uniplicate, beak thick, strongly curved, foramen large, oval, beak ridges rounded; pedicle collar short; cardinal process very small, delicate, oval; outer hinge plates delicate, rather long, hooklike, dorsally curved. *Upper Jurassic (Oxfordian):* northwestern Caucasus, Russia.——FIG. 1414,*5a–s. *P. rostovtsevi,* Crimea; *a–c,* dorsal, lateral, and anterior views, ×1; *d–s,* serial transverse sections 3.6, 3.7, 3.9, 4.1, 4.4, 5.2, 5.7, 5.8, 6.5, 6.8, 7.0, 7.45, 7.75, 8.3, 8.55, 8.75 mm from first section, ×1 (adapted from Tchorszhevsky, 1974).

**Placothyris** WESTPHAL, 1970, p. 38 [**Terebratula rollieri* HAAS, 1893, p. 124; OD]. Medium to large, elongate subpentagonal, ventribiconvex; anterior commissure uniplicate to sulciplicate, beak labiate; pedicle collar present, hinge plates pendant; loop 0.3 valve length, with broad transverse band and blunt crural processes. *Upper Jurassic:* Germany, Switzerland, France.——FIG. 1414,*4a–n. *P. rollieri* (HAAS), Oxfordian, Switzerland; *a–c,* dorsal, lateral, and anterior views, ×1; *d–m,* serial transverse sections 0.5, 1.1, 1.9, 2.7, 3.3, 3.9, 4.9, 5.3, 5.5, 5.7 mm from ventral umbo, ×1 (Boullier, 1976); *n,* oblique view of silicified loop, ×2 (Cooper, 1983).

**Unkurithyris** OVTSHARENKO, 1991, p. 75 [**U. unkurensis;* OD]. Small to large, subcircular, strongly biconvex or planoconvex, uniplicate, cardinal process small, flat; outer hinge plates planar, loop short, with short flanges. *Upper Jurassic:* Pamirs.——FIG. 1414,*2a–n. *U. unkurensis; a–c,* dorsal, lateral, and anterior views, ×1; *d–m,* serial transverse sections 0.5, 1.2, 1.7, 2.5, 3.3, 3.6, 4.2, 4.9, 5.0, 5.2 mm from first section, ×1; *n,* reconstruction of loop, ×1 (Ovtsharenko, 1991).

## Family and Subfamily UNCERTAIN

**Gibbithyrella** OVTSHARENKO, 1989, p. 87 [**G. kurtensis;* OD]. Medium size, strongly biconvex, anterior commissure bisulcate, beak ridges rounded, foramen small, oval, mesothyrid; hinge plates broad; crural bases dorsally curved; loop about 0.3 dorsal valve length, loop flanges short. *Middle Jurassic:* Tadzhikistan (Pamirs).——FIG. 1415,*2a–i. *G. kurtensis; a–c,* dorsal, lateral, and anterior views, ×1; *d–i,* serial transverse sections 0.1, 1.2, 3.0, 3.5, 4.7, 5.2 mm from first section, ×1 (Ovtsharenko, 1989).

**Jaisalmeria** SAHNI & BHATNAGAR, 1958, p. 421 [**J. taylori;* OD]. Small to medium size, biconvex, finely capillate; anterior commissure rectimarginate to uniplicate to biplicate; beak ridges angular; foramen small, submesothyrid; deltidial plates disjunct; loop unknown. *Upper Jurassic:* India, Pakistan.——FIG. 1415,*3a–d. *J. taylori,* India; *a–c,* dorsal, lateral, and anterior views, ×1; *d,* dorsal valve showing capillae, ×1 (Muir-Wood, 1965a).

**Kendzhilgithyris** OVTSHARENKO, 1983b, p. 82 [**K. kendzhilgensis;* OD]. Medium size, subrounded, beak short, anterior commissure rectimarginate; pedicle collar present; cardinal process small, outer hinge plates broad, horizontal or slightly curved, loop narrow, with long, diverging flanges. *Lower Jurassic:* Tadzhikistan, Pamirs.——FIG. 1415,*7a–m. *K. kendzhilgensis,* Tadzhikistan; *a–c,* dorsal, lateral, and anterior views, ×1; *d–m,* serial transverse sections 2.4, 2.8, 3.1, 4.0, 4.8, 5.0, 6.0, 7.6, 8.3, 8.7 mm from ventral umbo, ×1 (new).

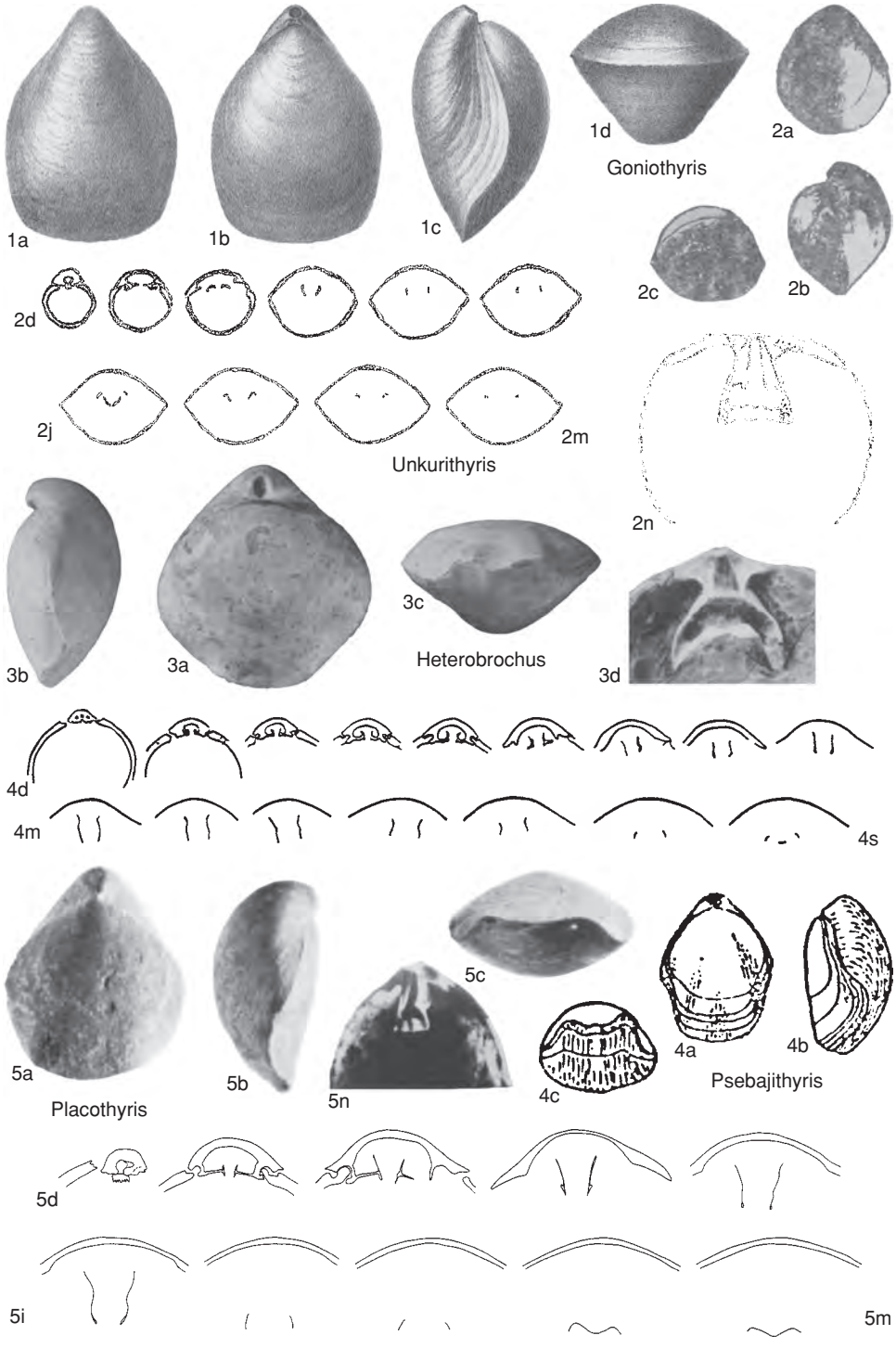


FIG. 1414. Uncertain (p. 2130).

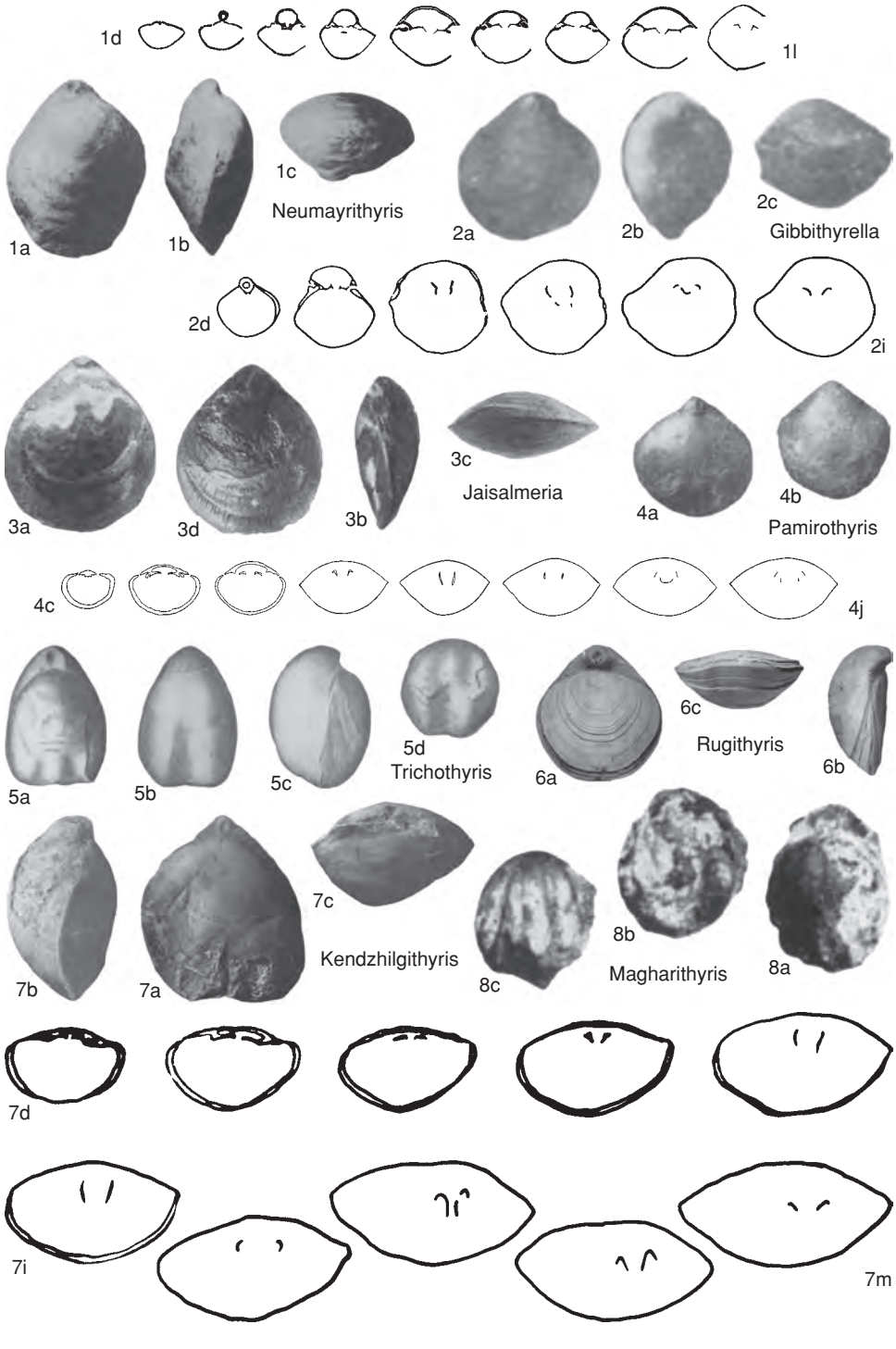


FIG. 1415. Uncertain (p. 2130–2133).

**?Lobothyroides** Xu, 1978, p. 307 [**L. striata;* OD]. Medium to small, subpentagonal in outline; capillate; rectimarginate; interior details uncertain. *Upper Triassic:* China (Sichuan).——Fig. 1416,*1a–d.* **L. striata; a–c,* dorsal, lateral, and anterior views, ×1; *d,* closeup of shell ornament, ×2 (Xu, 1978).

**?Magharithyris** Farag & Gatinaud, 1962, p. 77 [**M. triplicata;* OD]. Medium size, globose, said to be closely related to *Parathyridina,* but shell more elongate, folding uniplicate, triplicate, or multiplicate. [Genus based on one imperfectly preserved specimen; internal characters unknown.] *Middle Jurassic (Bathonian):* Egypt, ?Saudi Arabia.——Fig. 1415,*8a–c.* **M. triplicata;* dorsal, lateral, and anterior views, ×1 (Farag & Gatinaud, 1962).

**Naradanithyris** Tokuyama, 1958a, p. 2 [**N. kuratai;* OD]. Small to medium size, oval to pentagonal, shell rarely capillate; biconvex, anterior commissure angularly biplicate, beak short, incurved, foramen large, possibly mesothyrid or permesothyrid; symphytium short, usually concealed; beak ridges obscure; no pedicle collar; cardinal process short, wide, hinge plates in section inclined dorsally, separated from inner socket ridges by shallow sulcus; loop less than 0.5 dorsal valve length; internal characters poorly known. *Middle Jurassic (Bajocian)–Upper Jurassic:* Japan, ?Pamirs, *Bajocian–Bathonian;* Asia, *Upper Jurassic.*——Fig. 1416,*2a–c.* **N. kuratai,* Japan; dorsal, lateral, and anterior views of holotype, ×1 (Tokuyama, 1958a).

**Neumayrithyris** Tokuyama, 1958b, p. 120 [**N. torinosuensis;* OD]. Medium size, smooth, biconvex, anterior commissure uniplicate, beak short, suberect to incurved, beak ridges rounded, foramen permesothyrid; cardinal process short, medianly depressed, commonly with posterior umbonal cavity; hinge plates in section almost horizontal, merging into socket ridges; crural bases given off ventrally at angle to hinge plates. *Middle Jurassic–Upper Jurassic:* Europe, *Middle Jurassic;* Crimea, Japan, Sarawak, *Upper Jurassic.*——Fig. 1415,*1a–l.* **N. torinosuensis,* Upper Jurassic, Japan; *a–c,* dorsal, lateral, and anterior views of holotype, ×1; *d–l,* serial transverse sections 0.5, 1.05, 1.55, 1.95, 2.05, 2.2, 2.65, 2.75, 3.05 mm from first section, ×1 (Tokuyama, 1958b).

**Pamirothyris** Dagys, 1974, p. 195 [**Lobothyris kushlini* Dagys, 1963, p. 184; OD]. Small, smooth, biconvex, anterior commissure rectimarginate, beak incurved; foramen mesothyrid to permesothyrid; pedicle collar short, cardinal process low; hinge plates wide, lying in plane of valves, crural bases developed poorly, crura narrow, loop short (0.3 dorsal valve length), extremities rounded. *Triassic (Norian–Rhaetian):* Pamir.——Fig. 1415,*4a–j.* **P. kushlini* (Dagys); *a–b,* dorsal and lateral views of holotype, IGIG 200/62, ×1; *c–j,* serial transverse sections 0.0, 2.1, 3.4, 3.8, 4.4, 5.0, 6.1, 6.5 mm from first section, ×1 (Dagys, 1963).

**Rarithyris** Tchorszhevsky, 1989a, p. 79 [**R. rarus;* OD]. Small, strongly biconvex, smooth, anterior commissure unisulcate, beak short, incurved; foramen small, epithyrid, deltidial plates conjunct; cardinal process small, pedicle collar thin; outer hinge plates broad, horizontal or inclined dorsally, crura slender, arc shaped, loop short (about 0.25 dorsal valve length), rounded, transverse band low, wide. *Upper Jurassic (Tithonian):* Carpathians.——Fig. 1416,*3a–k.* **R. rarus; a–c,* dorsal, lateral, and anterior views of holotype, Kharkov University 10/5056, ×1; *d–k,* serial transverse sections 0.6, 1.3, 1.7, 4.0, 4.2, 4.4, 4.7, 4.8 mm from first section, ×2 (Tchorszhevsky, 1989a).

**Rugithyris** Buckman, 1918, p. 127 (Buckman, 1915, p. 79, *nom. nud.*) [**Terebratula subomalogaster* Buckman, 1901, p. 259; OD]. Medium size, planoconvex, surface ornament of squamose growth lamellae; anterior commissure rectimarginate to uniplicate or sulciplicate; beak incurved, foramen permesothyrid; cardinal process short, lobate; hinge plates narrow, slightly concave; loop not fully known. *Middle Jurassic (Bajocian):* England, ?Russia.——Fig. 1415,*6a–c.* **R. subomalogaster* (Buckman), England; dorsal, lateral, and anterior views, ×1 (Muir-Wood, 1965a).

**Taurothyris** Kyansep, 1961, p. 27 [**T. avundaensis;* OD]. Large, biconvex, elongate oval, smooth but decorticated shell capillate; anterior commissure rectimarginate to uniplicate; beak very small, suberect, tapering; symphytium exposed; cardinal process massive, bilobate; hinge plates and inner socket ridges in section slightly deflected ventrally and slightly concave; crural bases given off ventrally; loop possibly short, triangular, not fully known. *Upper Jurassic (Oxfordian):* Crimea, Russia.——Fig. 1416,*4a–k.* **T. avundaensis; a–c,* dorsal, ventral, and lateral views, ×1 (Kyansep, 1961); *d–k,* serial transverse sections 0.0, 0.2, 0.9, 1.4, 1.5, 1.8, 1.9, 2.1 mm from first section, ×1 (Muir-Wood, 1965a).

**Trichothyris** Buckman, 1918, p. 125 (Buckman, 1915, p. 78, *nom. nud.*) [**Dictyothyris compressa* Kitchin, 1897, p. 28; OD]. Small, biconvex, finely capillate, anterior commissure uniplicate to parasulcate; beak short, foramen large, epithyrid, with discrete deltidial plates. Internal features unknown. *Middle Jurassic (Callovian):* Pakistan.——Fig. 1415,*5a–d.* **T. compressa* (Kitchin); dorsal, ventral, lateral, and anterior views, ×1 (Muir-Wood, 1965a).

**Tshemsarythyris** Ovtsharenko, 1983a, p. 38 [**T. tshemsarensis;* OD]. Small, subtrigonal, biconvex, anterior commissure slightly bisulcate, beak short, foramen mesothyrid; pedicle collar small; outer hinge plates broad, loop about 0.3 dorsal valve length, loop narrow, with long flanges. *Upper Jurassic:* Tadzhikistan, Pamirs.——Fig. 1417,*2a–m.* **T. tshemsarensis,* Tadzhikistan; *a–c,* dorsal, lateral, and anterior views; *d–m,* serial transverse sections 2.8, 3.4, 3.9, 4.3, 4.5, 5.3, 5.6, 6.0, 6.35, 6.9 mm from ventral umbo, ×1 (new).

**Viallithyris** Vörös, 1978, p. 62 [**Terebratula gozzanensis* Parona, 1880, p. 196; OD]. Medium to large, subpentagonal to subcircular, ventribiconvex, capillate; anterior commissure broadly

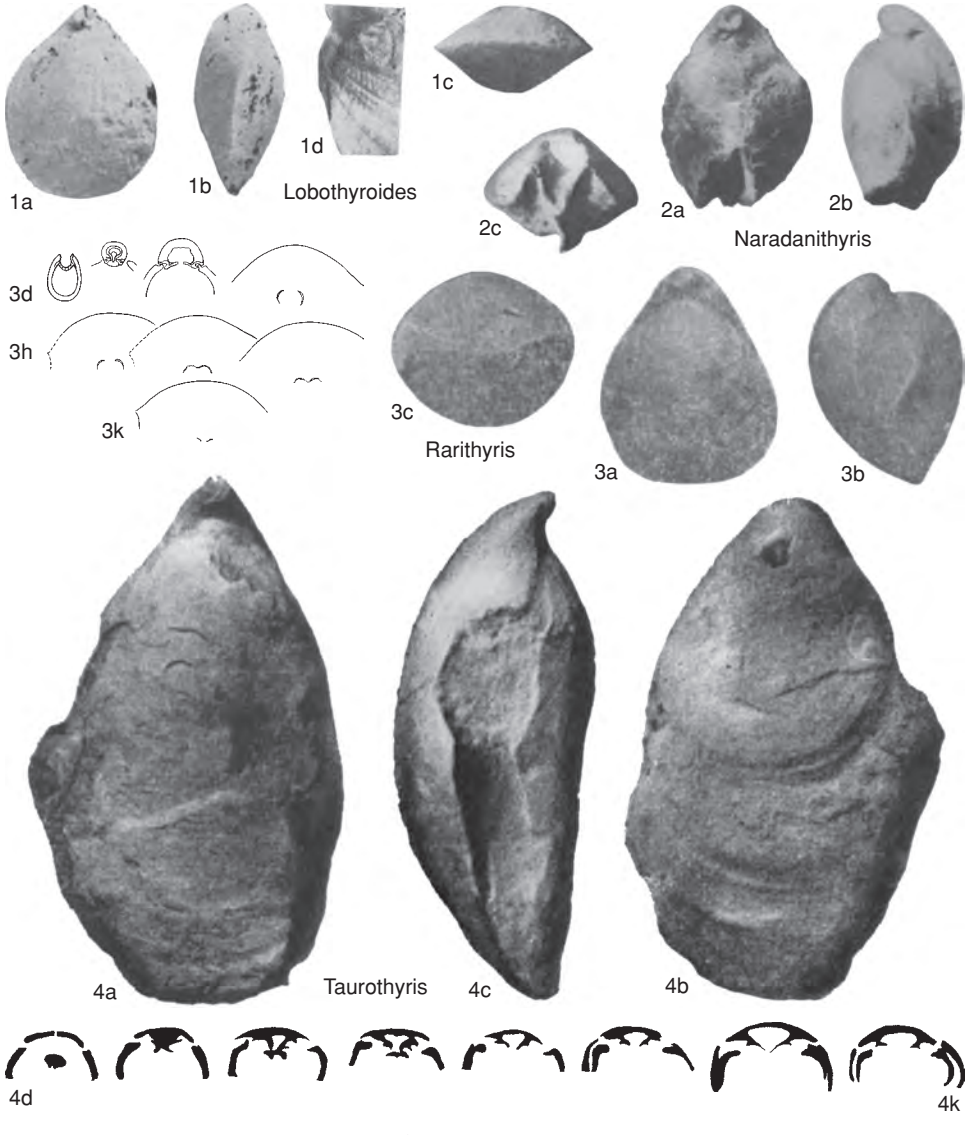


FIG. 1416. Uncertain (p. 2133).

unisulcate; foramen large, mesothyrid to permesothyrid; pedicle collar long; outer hinge plates thin, horizontal in section; crural bases given off dorsally; crural processes small, poorly defined; loop short (0.25 dorsal valve length), narrow, with fairly long terminal points; loop supported by variable narrow plates resting on valve floor. *Lower Jurassic (Pliensbachian):* Italy, Hungary.——FIG. 1417,*1a–p. *V. gozzanensis* (PARONA); *a–c,* dorsal, lateral, and anterior views, ×1; *d–p,* serial transverse sections 1.30, 1.65, 2.0, 2.2, 2.3, 2.5, 3.4, 3.9, 4.5, 4.7, 5.0, 5.3, 5.9 mm from ventral umbo, ×1 (Vörös, 1978).

**Weldonithyris** MUIR-WOOD, 1952, p. 130 [**W. weldonensis;* OD]. Small to medium size, biconvex,

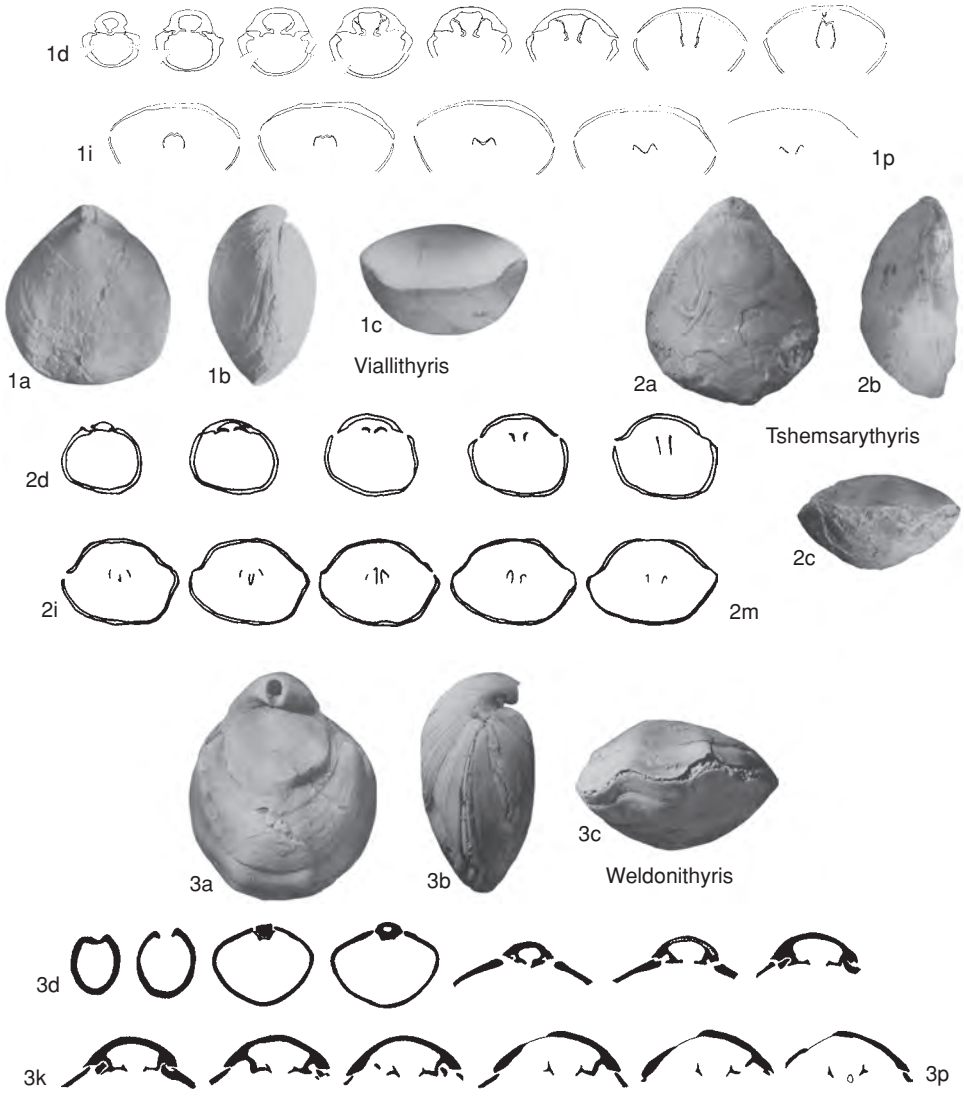


FIG. 1417. Uncertain (p. 2133–2135).

smooth, anterior commissure uniplicate to sulciplicate, beak incurved in adult, foramen large, epithyrid, labiate, concealing symphytium; cardinal process low, medianly depressed; hinge plates and inner socket ridges in section slightly deflected dorsally, gently concave, keeled; loop approximately 0.3 dorsal valve length, high arched, with medianly horizontal transverse band. *Middle Jurassic (Bajocian):* England.——FIG. 1417,*3a–p. *W. weldonensis; a–c,* dorsal, lateral, and anterior views of holotype, SM J,34,866, ×1; *d–p,* incomplete serial transverse sections of posterior region of shell, no distances given, ×1 (Muir-Wood, 1952).

# DYSCOLIOIDEA

D. E. Lee

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## Superfamily DYSCOLIOIDEA Fischer & Oehlert, 1891

[*nom. correct.* Lee, herein, *pro* Discoliacea Manceñido, 1993, p. 203, *nom. transl. ex* Dyscoliidae Fischer & Oehlert, 1891, p. 23]

Adult shells small to very large; commonly biconvex, rarely planoconvex; may be subtriangular to subrounded in outline; commonly smooth but may be finely capillate; foramen commonly mesothyrid or permesothyrid; anterior commissure rectimarginate, unisulcate, or with dorsal median sulcus and ventral fold posteriorly, sometimes developing as two lateral lobes in young and fusing in adult to enclose median perforation; no median septum or dental plates; cardinal process commonly small; hinge plates often poorly defined; loop deltiform, very short, commonly wide and rounded anteriorly, with inconspicuous crural processes commonly anterior of midloop; living species may be strongly spiculate. *Lower Jurassic–Holocene.*

### Family DYSCOLIIDAE Fischer & Oehlert, 1891

[Dyscoliidae Fischer & Oehlert, 1891, p. 23]

Small to very large, smooth or capillate, capillae often in zigzag pattern; loop short, variable, commonly with thin, narrow transverse band that is horizontal or directed anteriorly; outer hinge plates often poorly defined; crural bases indistinct posteriorly; crural processes anterior of midloop. *Lower Cretaceous–Holocene.*

### Subfamily DYSCOLIINAE Fischer & Oehlert, 1891

[*nom. correct.* Thomson, 1927, p. 172, *pro* Discoliinae Beecher, 1893, p. 377, *nom. transl. ex* Dyscoliidae Fischer & Oehlert, 1891, p. 23]

Medium to very large, exterior smooth or with fine, zigzag capillae; anterior commissure rectimarginate; beak commonly truncated, labiate; loop short, scooplike, outer hinge plates poorly defined; crura narrow, crural bases indistinct posteriorly; crural processes anterior of midloop; transverse band nearly horizontal or directed anteriorly, anterolateral extremities of loop rounded or subangular; living species strongly spiculate. *Upper Cretaceous (Cenomanian)–Holocene.*

**Dyscolia** Fischer & Oehlert, 1890, p. 70 [**Terebratulina wyvilli* Davidson, 1878b, p. 436; OD; *emend.,* Fischer & Oehlert, 1891, p. 70]. Medium to very large, subtrigonal to elongate oval; ventribiconvex; surface smooth or with fine, zigzag capillae; beak short, suberect, often truncated or labiate; foramen large, epithyrid to submesothyrid; symphytium almost concealed; pedicle collar long, anteriorly excavated; cardinal process not developed, diductor muscles attached to apical pit; outer hinge plates very weakly developed; crural processes weak, blunt; loop small (less than 0.3 dorsal valve length), thin, with rounded, anterolateral extremities; lophophore small, modified schizolophe; spicules very abundant; four main mantle canals in each valve, branching pattern pinnate. *Neogene (Pliocene)–Holocene:* Mediterranean (Sicily, Italy), *Pliocene–Pleistocene;* Indian Ocean, East Atlantic Ocean (off Africa, France, Spain), Caribbean, Pacific Ocean (New Caledonia), ?Antarctic Ocean, *Holocene.*——Fig. 1418,*3a–e.* **D. wyvillei* (Davidson), Holocene; *a–c,* dorsal, lateral, and anterior views of holotype, Caribbean, ZB1356, ×1; *d,* valves separated showing mantle canals and imperfect loop, Caribbean, ×1 (Muir-Wood, 1965a); *e,* interior of dorsal valve, off northwestern Africa, ×1 (Cooper, 1983).

**Goniobrochus** Cooper, 1983, p. 260 [**Dyscolia ewingi* Cooper, 1973b, p. 19; OD]. Large, subcircular; surface ornament of radial, zigzag capillae; beak truncated, suberect, labiate; foramen large, mesothyrid to submesothyrid; pedicle collar short; cardinal process not developed, diductor muscles attached to apical pit; sockets wide; crural bases narrow troughs between weakly developed, narrow hinge plates and stout socket ridges; crura short, narrow; loop wide, almost square in outline. *Holocene:* off Argentina.——Fig. 1419*a–d.* **G. ewingi* (Cooper); *a–c,* dorsal, lateral, and anterior views of holotype, USNM 550461a, ×1; *d,* interior of dorsal valve of holotype, ×1 (Cooper, 1973b).

**Moraviaturia** Sahni, 1960, p. 19 [**Terebratula diphimorpha* Stoliczka, 1872, p. 25; OD]. Large, subtrigonal, ventribiconvex; anterior margin geniculate; surface capillate with steplike growth lamellae; beak massive, slightly incurved, symphytium narrow; foramen large, beak ridges obscure; internal characters unknown, probably dyscoliid. *Upper*

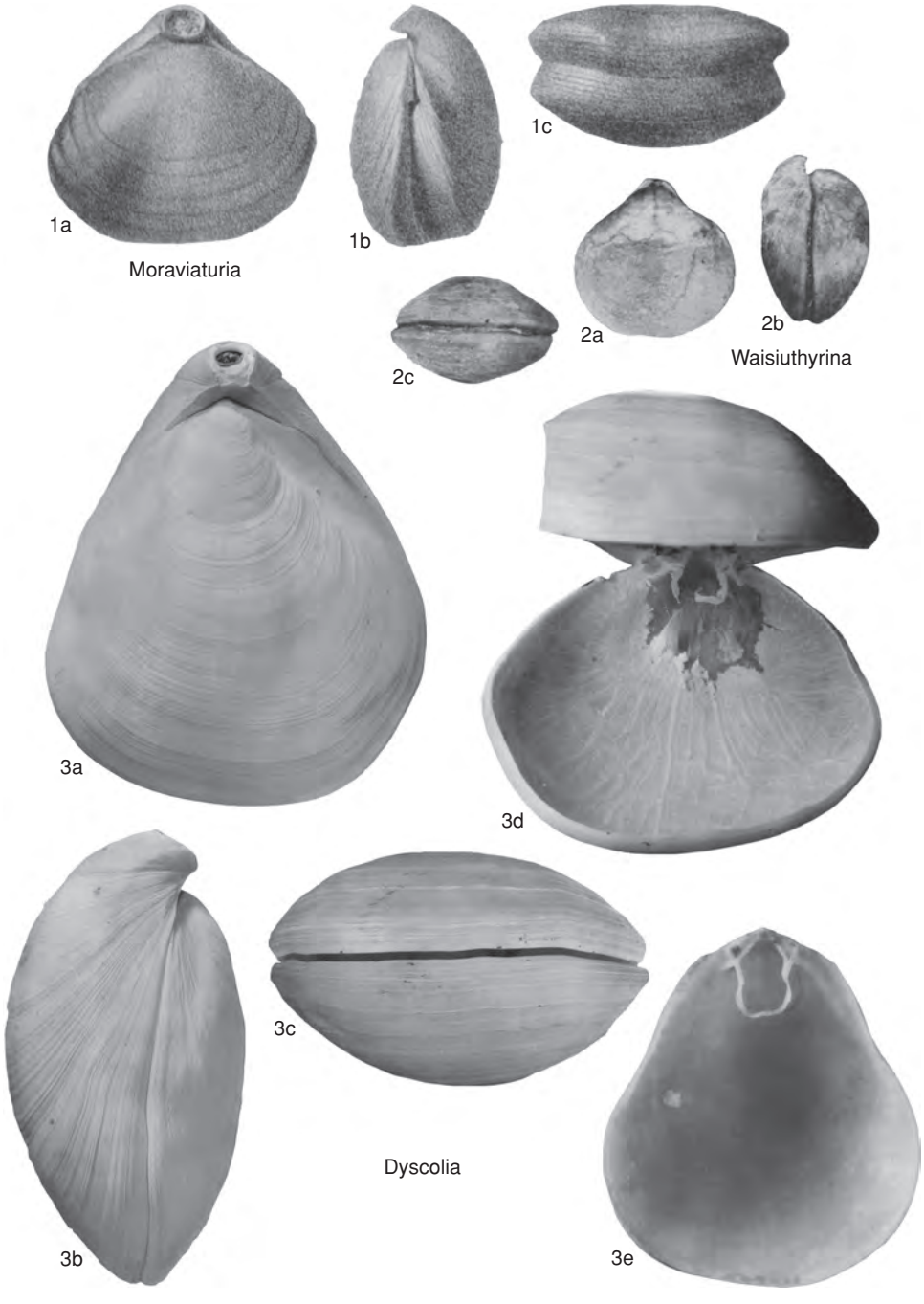


FIG. 1418. Dyscoliidae (p. 2136–2138).

*Cretaceous (Cenomanian):* southern India.——FIG. 1418,*1a–c. *M. diphimorpha* (STOLICZKA); dorsal, lateral, and anterior views of holotype, ×1 (Muir-Wood, 1965a).

**Waisiuthyrina** BEETS, 1943, p. 341 [**W. margineplicata;* OD]. Large, subcircular, dorsibiconvex; smooth; beak truncated, labiate; foramen large, mesothyrid or epithyrid; symphytium narrow;

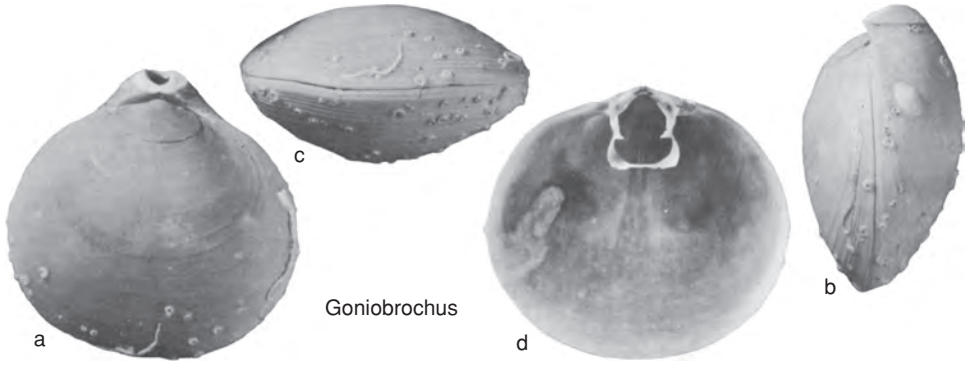


FIG. 1419. Dyscoliidae (p. 2136).

pedicle collar absent, hinge teeth small, grooved; cardinal process small, transverse, bilobed; loop unknown, probably dyscoliid. *Neogene (Pliocene):* southeastern Asia (Sulawesi).——FIG. 1418,*2a–c.* **W. margineplicata;* dorsal, lateral, and anterior views of holotype, ×0.5 (Muir-Wood, 1965a).

## Subfamily AENIGMATHYRIDINAE Cooper, 1983

[Aenigmathyridinae COOPER, 1983, p. 40]

Small to medium size, rectimarginate to strongly unisulcate, smooth or may be lamellose or faintly capillate; foramen commonly permesothyrid; loop short, outer hinge plates poorly defined, crura commonly narrow, crural processes near or anterior to midloop; transverse band commonly convex anteriorly with narrow median fold. *Paleogene (Danian)–Holocene.*

**Aenigmathyris** COOPER, 1971, p. 3 [**A. stearnsi;* OD]. Shell medium, widely ovate, ventribiconvex, anterior commissure rectimarginate to unisulcate; ornament of faint capillae; beak short, labiate, foramen permesothyrid, symphytium concave; pedicle collar narrow, elevated; cardinal process small, transverse; loop variable, but narrower and more strongly folded than in *Dyscolia. Paleogene (Eocene):* Eua, Tonga.——FIG. 1420,*2a–d.* **A. stearnsi,* Eua; *a–c,* dorsal, lateral, and anterior views of holotype, USNM 550447a, ×1; *d,* closeup view of loop, ×3 (Cooper, 1983).

**Abyssothyris** THOMSON, 1927, p. 190; *emend.,* MUIR-WOOD, 1960, p. 521 [**Terebratula wyvilli* DAVIDSON, 1878b, p. 436; OD; *emend.,* THOMSON, 1927, p. 190]. Small to medium, oval to subpentagonal in outline, ventribiconvex, smooth, thin shelled; anterior commissure unisulcate; beak small, suberect; foramen large, permesothyrid; symphytium partly visible; pedicle collar short, teeth small; cardinal process small, semielliptical, outer hinge plates narrowly triangular, tapering anteriorly to bluntly pointed crural processes located at midloop; crural bases narrow; transverse band broad, gently folded medially, anterior part of loop variable, anterolateral extremities rounded to subangular; lophophore plectolophous with small median coil. [THOMSON (1927) confused the terebratulid genus *Abyssothyris* with the rhynchonellid genus *Neorhynchia* in his original diagnosis. Subsequently, MUIR-WOOD (1960) redefined the genus *Abyssothyris* and disentangled the two homeomorphs.] *Neogene (Miocene)–Holocene:* Fiji, *Miocene;* Pacific Ocean (Alaska, Galapagos Islands, Chile, New Guinea, New Caledonia, South Australia, New Zealand, Antarctica), South Atlantic Ocean at abyssal depths (825 m to >5,000 m), *Holocene.*——FIG. 1420,*4a–d.* **A. wyvillei* (DAVIDSON), Holocene, off South Australia; *a–c,* dorsal, lateral, and anterior views of lectotype, NHM B12501, ×2 (Muir-Wood, 1965a); *d,* Holocene, off California; closeup of loop, ×2 (Cooper, 1983).

**Acrobelesia** COOPER, 1983, p. 247 [**Gryphus cooperi* D'HONDT, 1976, p. 6; OD]. Small to medium, subcircular, ventribiconvex, lamellose with faint radial capillae; foramen large, submesothyrid; deltidial plates disjunct; pedicle collar short, anteriorly excavate; cardinal process small, bilobed myophore; crura short, thin, ribbonlike; crural processes anterior to midloop; loop very short (0.2 dorsal valve length); transverse band of loop convex anteriorly. *Holocene:* Atlantic Ocean, France (Gulf of Gascogne), Canary Islands.——FIG. 1420,*3a–d.* **A. cooperi* (D'HONDT); *a–c,* dorsal, lateral, and anterior views, ×2; *d,* dorsal valve interior, ×4 (Cooper, 1983).

**Ceramisia** COOPER, 1983, p. 227 [**Terebratula meneghiniana* SEGUENZA, 1865, p. 29; OD]. Small to medium, subcircular, biconvex; unisulcate; lamellose without radial capillae; foramen large, mesothyrid, deltidial plates conjunct or disjunct; pedicle collar short, excavate; cardinal process small, transverse; hinge plates not developed; transverse band of loop convex anteriorly. *Neogene (Pliocene):* Sicily.——FIG. 1420,*1a–d.* **C. meneghiniana*

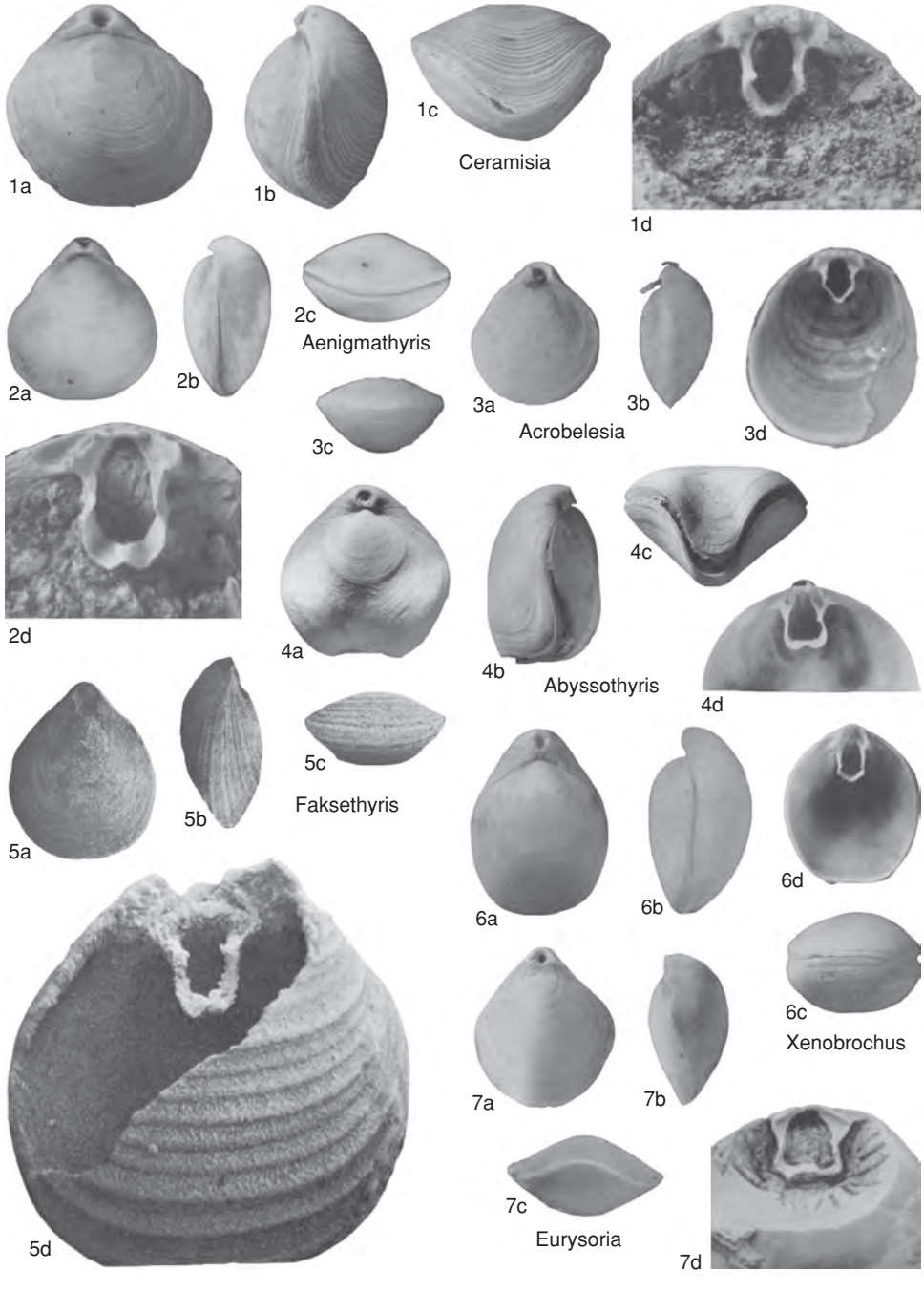


FIG. 1420. Dyscoliidae (p. 2138–2140).

(SEGUENZA); *a–c,* dorsal, lateral, and anterior views, ×2; *d,* closeup of loop, ×5 (Cooper, 1983).

**Faksethyris** ASGAARD, 1971, p. 385 [**F. nielseni* ASGAARD, 1971, p. 386; OD; =*Terebratula cincta* NIELSEN, 1911, p. 609, *non* COTTEAU, 1857]. Small, ovate, biconvex, lamellose; anterior margin rectimarginate; beak straight, foramen submesothyrid, large, attrite; deltidial plates conjunct;

pedicle collar long; cardinal process weak, transverse; hinge plates not developed; crural processes posterior to midloop, loop narrow, rounded anteriorly. *Paleogene (Danian):* Denmark.——Fig. 1420,*5a–d. *F. nielseni; a–c,* dorsal, lateral, and anterior views of lectotype, MMH 574, ×10; *d,* interior of dorsal valve, ×25 (Asgaard, 1971).

**Xenobrochus** Cooper, 1981, p. 19 [**Gryphus africanus* Cooper, 1973a, p. 8; OD]. Small to medium, oval, ventribiconvex, smooth; anterior commissure rectimarginate; beak long, erect, labiate, foramen large, permesothyrid, symphytium visible; pedicle collar short, teeth large; cardinal process broad, semielliptical; hinge plates narrow, poorly defined; loop narrow, rounded, transverse band convex anteriorly. *Holocene:* Indian Ocean, western Pacific, off Philippines and New Caledonia, ?Atlantic, ?Mediterranean.——Fig. 1420,*6a–d. *X. africanus* (Cooper), Durban Bay, Indian Ocean; *a–c,* dorsal, lateral, and anterior views of holotype, USNM 550375a, ×4; *d,* interior of dorsal valve, ×4 (Cooper, 1983).

## Subfamily EURYSORIINAE Cooper, 1983

[Eurysoriinae Cooper, 1983, p. 40]

Small to medium, subpentagonal, smooth or faintly capillate; anterior commissure uniplicate; crural processes obtuse, anterior to midloop; outer hinge plates and crural bases poorly defined; loop short. *Lower Cretaceous.*

**Eurysoria** Cooper, 1983, p. 189 [**E. texana;* OD]. Ventribiconvex; beak ridges strong; foramen mesothyrid, deltidium partially resorbed; cardinal process small; outer hinge plates wide, attached to narrow crural bases; loop short, wide, almost square in outline, transverse band broad, convex posteriorly. *Lower Cretaceous:* USA (Texas).——Fig. 1420,*7a–d. *E. texana; a–c,* dorsal, lateral, and anterior views of holotype, USNM 550572a, ×1; *d,* closeup of loop, ×2 (Cooper, 1983).

## Family PYGOPIDAE Muir-Wood, 1965

[Pygopidae Muir-Wood, 1965a, p. 801; *emend.,* Dieni, Middlemiss, & Owen, 1975, p. 192]

Shell medium to large, smooth, commonly subtriangular to subrounded in outline; rectimarginate to strongly unisulcate; shell may develop two lateral lobes that curve toward each other and may fuse in adult stage, enclosing median perforation; hinge plates horizontal to slightly convex in serial section, tapering, or with rounded inner edges, which pass forward as horizontal structures to join crura; loop very short, with low-arched transverse band. *Lower Jurassic (Pliensbachian)–Lower Cretaceous (Barremian).*

## Subfamily PYGOPINAE Muir-Wood, 1965

[*nom. transl.* Dieni, Middlemiss, & Owen, 1975, p. 192, *ex* Pygopidae Muir-Wood, 1965a, p. 801]

Pygopidae in which shell may develop two lateral lobes, which may curve toward each other and fuse in adult stage, enclosing a median perforation. *Upper Jurassic (Kimmeridgian)–Lower Cretaceous (Barremian).*

**Pygope** Link, 1830, p. 451 [**Terebratula antinomia* Catullo, 1827, p. 169 (pl. 5,*r*); SD Buckman, 1906a, p. 445; =*T. deltoidea* Valenciennes in Lamarck, 1819, p. 250; *T. diphya* von Buch, 1835, p. 88] [=*Antinomia* Catullo, 1851, p. 74 (type, *Terebratula dilatata* Catullo, 1851, p. 75); *Pugites* Bronn, 1838, p. 653, obj.]. Shell medium to large, subtriangular to subrounded in outline, umbo erect to incurved; foramen oval, permesothyrid; beak ridges rounded; anterior commmissure rectimarginate to uniplicate; shell strongly sulcate in juvenile, developing two lateral lobes that come into contact and fuse in adult stage, enclosing median perforation; perforation central or posterior of center. [Few authors (with the exception of Buckman, 1906 and Muir-Wood, 1965) have used any name but *Terebratula diphya* von Buch, 1835, for the type species of *Pygope.* The ICZN has not further considered the positions of the names *Terebratula deltoidea* Valenciennes, 1819 and *T. diphya* von Buch, 1835 (ICZN, 1988).] *Upper Jurassic (Kimmeridgian)–Lower Cretaceous (Barremian):* Europe, North Africa, Greenland.——Fig. 1421,*2a–m. *P. diphya* (von Buch), Tithonian, Italy; *a–d,* dorsal, ventral, lateral, and anterior views, ×1; *e–m,* serial transverse sections 1.2, 4.0, 5.2, 5.6, 6.0, 6.8, 7.6, 8.0, 8.4 mm from ventral umbo, ×2 (Dieni & Middlemiss, 1981).

**Pygites** Buckman, 1906a, p. 449 [**Terebratula diphyoides* d'Orbigny, 1849 in 1849–1852, p. 87; OD]. Similar to *Pygope* but ventral valve with sulcus in median fold posterior to perforation, dorsal sulcus with similar median fold; large central perforation in adult; cardinal process low; posterior umbonal cavity developed; hinge plates in section dorsally deflected, slightly concave ventrally, tapering, not well demarcated from long inner socket ridges. *Upper Jurassic (Tithonian)–Lower Cretaceous (Barremian):* Europe, North Africa, Arctic.——Fig. 1421,*1a–e. *P. diphyoides* (d'Orbigny), Berriasian; *a–d,* dorsal, ventral, lateral, and anterior views, France, ×1 (Muir-Wood, 1965a); *e,* close up of loop, Czech Republic, Slovakia, ×2 (Cooper, 1983).

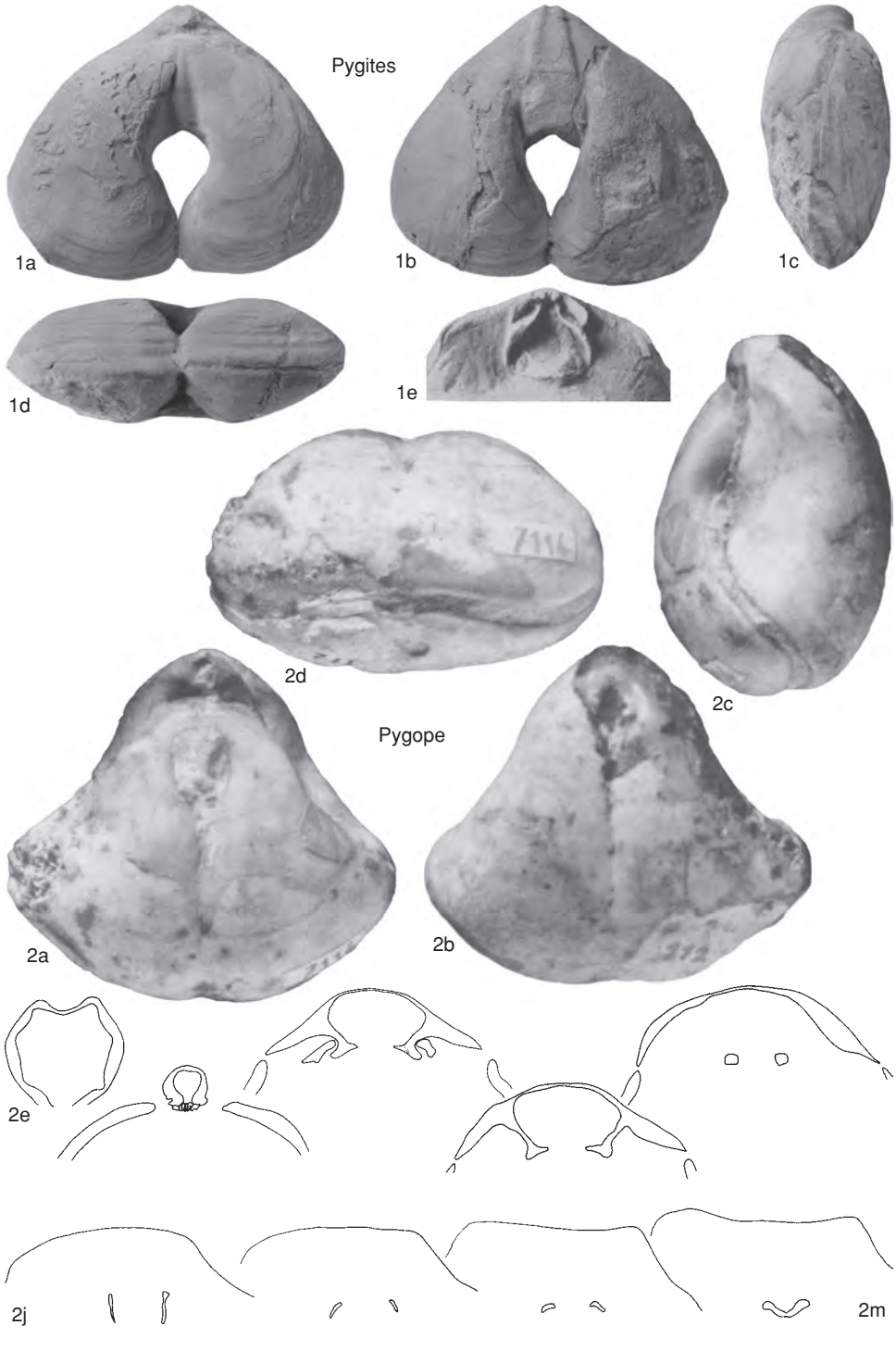


FIG. 1421. Pygopidae (p. 2140).

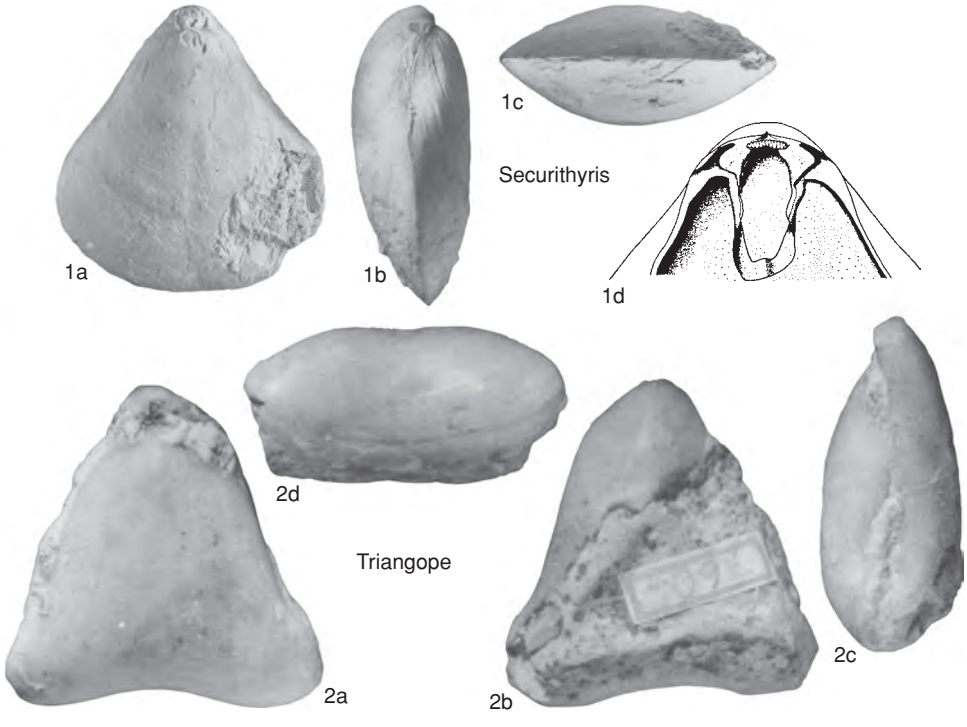


FIG. 1422. Pygopidae (p. 2142).

## Subfamily TRIANGOPINAE Manceñido, 1993

[Triangopinae MANCEÑIDO, 1993, p. 203]

Similar to Pygopinae but imperforate. *Lower Jurassic (Pliensbachian)–Lower Cretaceous (Barremian).*

**Triangope** DIENI & MIDDLEMISS, 1981, p. 39 [**Terebratula triangulus* VALENCIENNES in LAMARCK, 1819, p. 250; OD]. Shell triangular, beak suberect to incurved; foramen oval, permesothyrid; hinge plates slightly convex, crural bases given off dorsally from anterior ends of hinge plates. *Upper Jurasssic (Kimmeridgian)–Lower Cretaceous (Barremian):* Europe, North Africa.——FIG. 1422,*2a–d.* **T. triangulus* (VALENCIENNES), Tithonian, Italy; dorsal, ventral, lateral, and anterior views, ×1 (Dieni & Middlemiss, 1981).

**Securithyris** VÖRÖS, 1983, p. 13 [**Terebratula adnethensis* SUESS, 1855b, p. 31; OD]. Medium to large, subtriangular, slightly to strongly biconvex, anterior commissure wide, rectimarginate, ligate or unisulcate; pedicle collar well developed; cardinal process wide, crenulated; hinge plates reduced or absent; crura given off from inner socket ridges; loop short, narrow. *Lower Jurassic (Pliensbachian):* Mediterranean, Sicily, Italy, Hungary, Greece, Spain, Morocco.——FIG. 1422,*1a–d.* **S. adnethensis* (SUESS), Bakony Mountains, Hungary; *a–c,* dorsal, lateral, and ventral views, ×1; *d,* reconstruction of loop, ×2 (Vörös, 1983).

## Family NUCLEATIDAE Schuchert, 1929

[*nom. transl.* COOPER, 1983, p. 39, *ex* Nucleatinae SCHUCHERT in SCHUCHERT & LEVENE, 1929a, p. 24]

Small to medium size, smooth, moderately to strongly unisulcate; loop short, crural bases indistinct, crural processes blunt, anterior to midloop; outer hinge plates poorly defined; transverse band anteriorly rounded. *Lower Jurassic–Upper Cretaceous (Cenomanian).*

**Nucleata** QUENSTEDT, 1868 in 1868–1871, p. 25 [**N. collina;* OD; =*Terebratulites nucleatus* VON SCHLOTHEIM, 1820, p. 281] [=*Glossothyris* DOUVILLÉ, 1879, p. 267, obj.; *Vjalovithyris* TCHORSZHEVSKY, 1989b, p. 33 (type, *V. pinguis* TCHORSZHEVSKY, 1989b, p. 34, OD)]. Small to medium, subrounded to subpentagonal in outline;

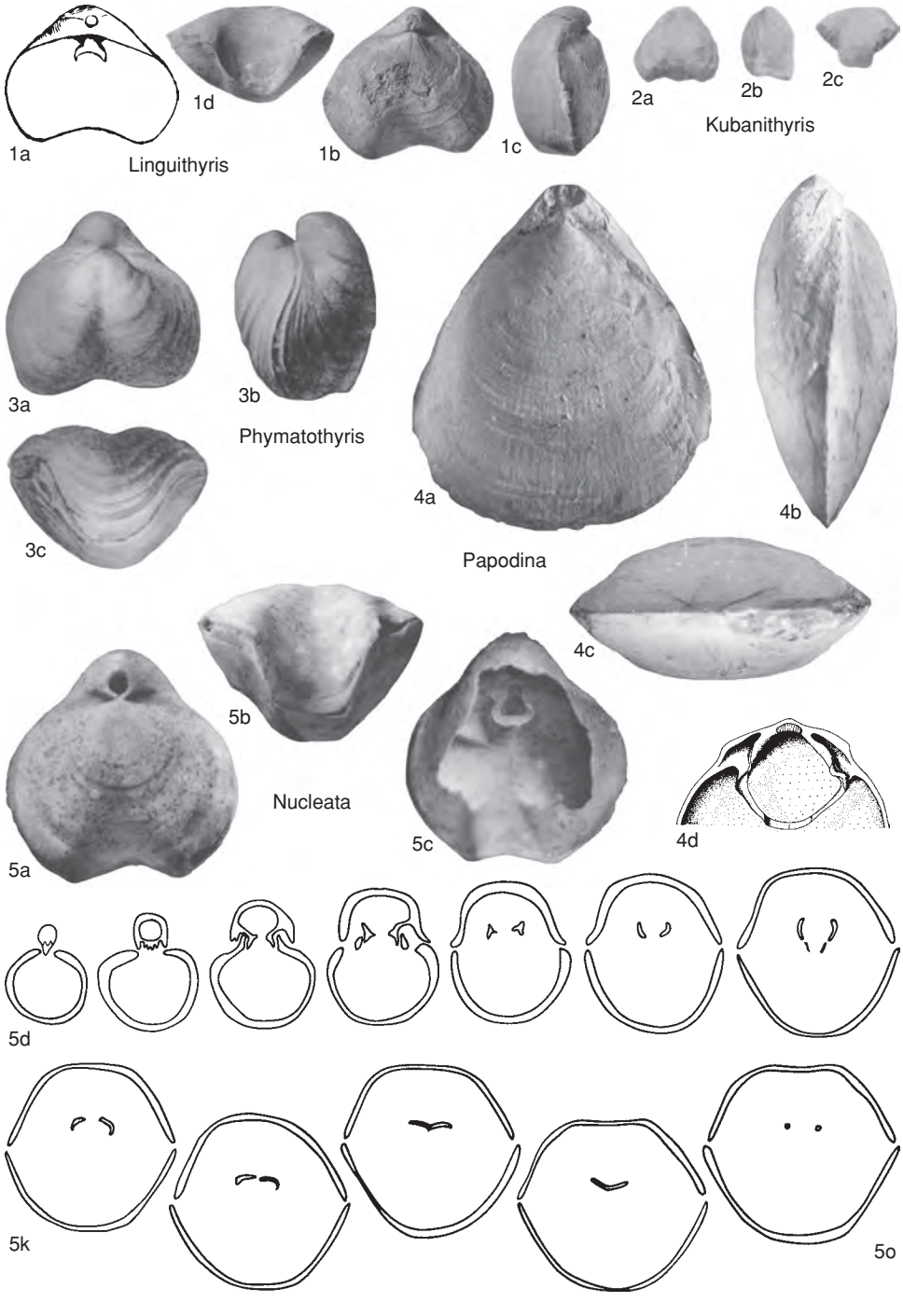


FIG. 1423. Nucleatidae and Uncertain (p. 2142–2144).

ventribiconvex or planoconvex, anterior commissure unisulcate; beak short, truncated by small to medium foramen, beak ridges obscure, no symphytium; cardinal process small; short crural bases expanding directly into crural processes and curving into wide transverse band of very short, wide, rounded loop. *?Middle Jurassic (Bathonian), Upper Jurassic (Oxfordian)–Upper Cretaceous (Cenomanian):* Europe, Crimea, Caucasus, North Africa, Greenland; *Upper Jurassic:* Indonesia (Sula Islands).——FIG. 1423,*5a–o. *N. nucleata* (SCHLOTHEIM), White Jura, Bavaria, Germany; *a–b,* dorsal and anterior views of silicified specimen, ×2; *c,* ventral valve with loop exposed, ×2 (Cooper, 1983); *d–o,* serial transverse sections, 1.2, 1.7, 2.2, 2.5, 2.9, 3.5, 4.1, 4.4, 4.7, 4.9, 5.3, 5.7 mm from first section, ×1 (Barczyk, 1969).

**Kubanithyris** TCHORSZHEVSKY, 1989b, p. 29 [**K. parvus;* OD]. Small, planoconvex; anterior commissure unisulcate; beak ridges sharp; foramen small, mesothyrid; cardinal process small, bilobate; outer hinge plates narrow, dorsally inclined; no crural bases; loop short. *Middle Jurassic:* Caucasus, ?England.——FIG. 1423,*2a–c. *K. parvus,* Caucasus; dorsal, lateral, and anterior views, ×1 (Tchorszhevsky, 1989b).

**Linguithyris** BUCKMAN, 1918, p. 99 (BUCKMAN, 1914, p. 2, *nom. nud.*) [**Terebratula bifida* ROTHPLETZ, 1886, p. 114; OD]. Small to medium, biconvex, anterior commissure strongly unisulcate, beak incurved, beak ridges angular, epithyrid, symphytium narrow; cardinal process low, short, lobate; hinge plates in transverse section short, slightly concave ventrally, tapering, well demarcated from inner socket ridges; loop about 0.25 of valve length, transverse band slightly arched, rounded. *Lower Jurassic–Middle Jurassic:* Europe, North Africa; New Zealand, *Lower Jurassic.*——FIG. 1423,*1a. *L. bifida* (ROTHPLETZ), Middle Inferior Oolite, Dorset, England; reconstruction of loop, ×1 (Muir-Wood, 1965a).——FIG. 1423,*1b–d. L. umbonata* BUCKMAN, Middle Inferior Oolite, England; dorsal, lateral, and anterior views, ×1 (Muir-Wood, 1965a).

**Phymatothyris** COOPER & MUIR-WOOD, 1951, p. 195, *nom. nov. pro Pallasiella* RENZ, 1932, p. 40, *non* SARS, 1895 [**Pallasiella kerkyraea* RENZ, 1932, p. 41; OD]. Small to medium, smooth, planoconvex, anterior commissure unisulcate; umbones swollen, strongly incurved; foramen concealed by swollen beak of ventral valve; loop presumably short; muscle scars similar to those of nucleatids. *Lower Jurassic (Hettangian–Toarcian):* Italy, Albania, Hungary, Greece, Alps.——FIG. 1423,*3a–c. *P. kerkyraea* (RENZ), Greece; dorsal, lateral, and anterior views, ×1 (Muir-Wood, 1965a).

## Family UNCERTAIN

**Papodina** VÖRÖS, 1983, p. 15 [**Terebratula bittneri* GEYER, 1889, p. 11; OD]. Medium to large, subtrigonal, biconvex, finely capillate; anterior commissure rectimarginate to ligate; beak high, suberect; foramen mesothyrid; pedicle collar well developed; cardinal process small, low, crenulated; no hinge plates; loop wide, short, dorsally arched transverse band. *Lower Jurassic (Sinemurian–Pliensbachian):* Hungary.——FIG. 1423,*4a–d. *P. bittneri* (GEYER), Pliensbachian; *a–c,* dorsal, lateral, and anterior views ×2; *d,* reconstruction of loop, ×2 (Vörös, 1983).

# CANCELLOTHYRIDOIDEA

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## Superfamily CANCELLOTHYRIDOIDEA Thomson, 1926

[*nom. correct.* Lee, herein, *pro* Cancellothyridacea Cooper, 1973c, p. 373, *nom. transl. pro* Cancellothyrididae Muir-Wood, 1965a, p. 807, *nom. correct. pro* Cancellothyridae Muir-Wood, 1955, p. 93, *nom. transl. ex* Cancellothyrinae Thomson, 1926, p. 525]

Adult shells small to medium in size; outline elongate-oval, subcircular, or subtriangular; capillate, costate, or costellate; anterior commissure commonly rectimarginate, rarely unisulcate, uniplicate, or sulciplicate; foramen small to large, commonly margined by narrow deltidial plates. Dental plates commonly absent, median septum rarely present, outer hinge plates commonly absent, inner hinge plates absent, socket ridges strong, elevated, crural bases attached to socket ridges; loop short (0.3 of dorsal valve length); crural processes may be disjunct or united to form a ringlike loop or tube; dorsal pedicle muscles attached to floor of dorsal valve between adductors; lophophore spirolophous or plectolophous. Mantle and body wall usually strongly spiculate. *Lower Jurassic (Pliensbachian)–Holocene.*

### Family CANCELLOTHYRIDIDAE Thomson, 1926

[*nom. correct.* Muir-Wood, 1965a, p. 807, *pro* Cancellothyridae Muir-Wood, 1955, p. 93, *nom. transl. ex* Cancellothyrinae Thomson, 1926, p. 525]

Valves capillate or costellate; crural processes of loop united to form a ring with transverse band; lophophore usually plectolophous. *Lower Jurassic (Pliensbachian)–Holocene.*

### Subfamily CANCELLOTHYRIDINAE Thomson, 1926

[*nom. correct.* Muir-Wood, 1965a, p. 807, *pro* Cancellothyrinae Thomson, 1926, p. 525] [=Terebratulinae Dall, 1870, p. 99, *partim*]

Valves rostrate, ovate with narrow hinge; crural processes fused in adult forming complete ringlike loop. *Upper Jurassic–Holocene.*

**Cancellothyris** Thomson, 1926, p. 525 [**Terebratula cancellata* Koch in Küster, 1844, p. 35; OD; *non* Eichwald, 1829, p. 276; =*Terebratulina hedleyi* Finlay, 1927 (March), p. 533; *Cancellothyris australis* Thomson, 1927, p. 188)]. Small to medium sized, ovate to subpentagonal, valves biconvex; anterior commissure uniplicate to sulciplicate; surface finely capillate; umbo short, massive, suberect; foramen large, epithyrid, labiate; deltidial plates conjunct. Pedicle collar developed; cardinal process low, bilobed; loop wide, transverse band broad, slightly arched ventrally, lophophore plectolophous. *Neogene (Miocene)–Holocene:* New Zealand, *Miocene;* South Africa, *Pliocene–Pleistocene;* South Australia, Tasmania, off southwestern New Zealand (6–366 m), *Holocene*.——Fig. 1424,*1a–d.* **C. hedleyi* (Finlay), Holocene, South Australia; *a–c,* dorsal, lateral, and anterior views, ×1.2; *d,* dorsal valve interior with loop, ×1.2 (Muir-Wood, 1965a).

**Murravia** Thomson, 1916a, p. 45 [**Terebratulina davidsoni* Etheridge, 1876, p. 16; OD; *non* Boll, 1856, p. 37; =*Terebratulina catinuliformis* Tate in Tate & Dennant, 1896, p. 130 (footnote)]. Small, thick shelled, thick, ovate, planoconvex, with wide hinge line, anterior commissure rectimarginate or unisulcate; surface costellate; foramen hypothyrid, deltidial plates disjunct. Pedicle collar present, myophragm may be present; cardinal process prominent, swollen anteriorly; socket ridges strong; internal margin of both valves crenulate. *Paleogene (Oligocene)–Holocene:* Australia; New Zealand, *Oligocene*.——Fig. 1424,*4a–c.* **M. catinuliformis* (Tate), Miocene, Victoria, Australia; dorsal view, interior views of ventral and dorsal valves, ×3 (Muir-Wood, 1965a).——Fig. 1424,*4d–e. M. exarata* Verco, Holocene, South Australia; holotype, dorsal and lateral views, ×6 (Muir-Wood, 1965a).

**Ortholina** Calzada Badia, 1984b, p. 5 [**Terebratella decorata* Vidal, 1921, p. 56; OD]. Small to medium size, subcircular in outline, planoconvex, hinge line wide, almost straight; anterior commissure rectimarginate; surface finely costellate; foramen small, submesothyrid, deltidial plates disjunct. Cardinal process small, bilobed, loop wide, myophragm present. *Upper Cretaceous:* Spain.——Fig. 1424,*5a–c.* **O. decorata* (Vidal), Maastrichtian; dorsal, ventral, and lateral views, ×1.5 (Calzada Badia, 1984b).——Fig. 1424,*5d. O. lujana* Vidal, Maastrichtian; interior of dorsal valve, ×3 (Calzada Badia, 1984b).

**Rhynchonellopsis** Vincent, 1893, p. 51, *non* Böse, 1894, *nec* De Gregorio, 1930 [**Terebratulina nysti* Bosquet, 1862, p. 349; OD]. Small, thick shelled, rounded, convexoplane; anterior commissure

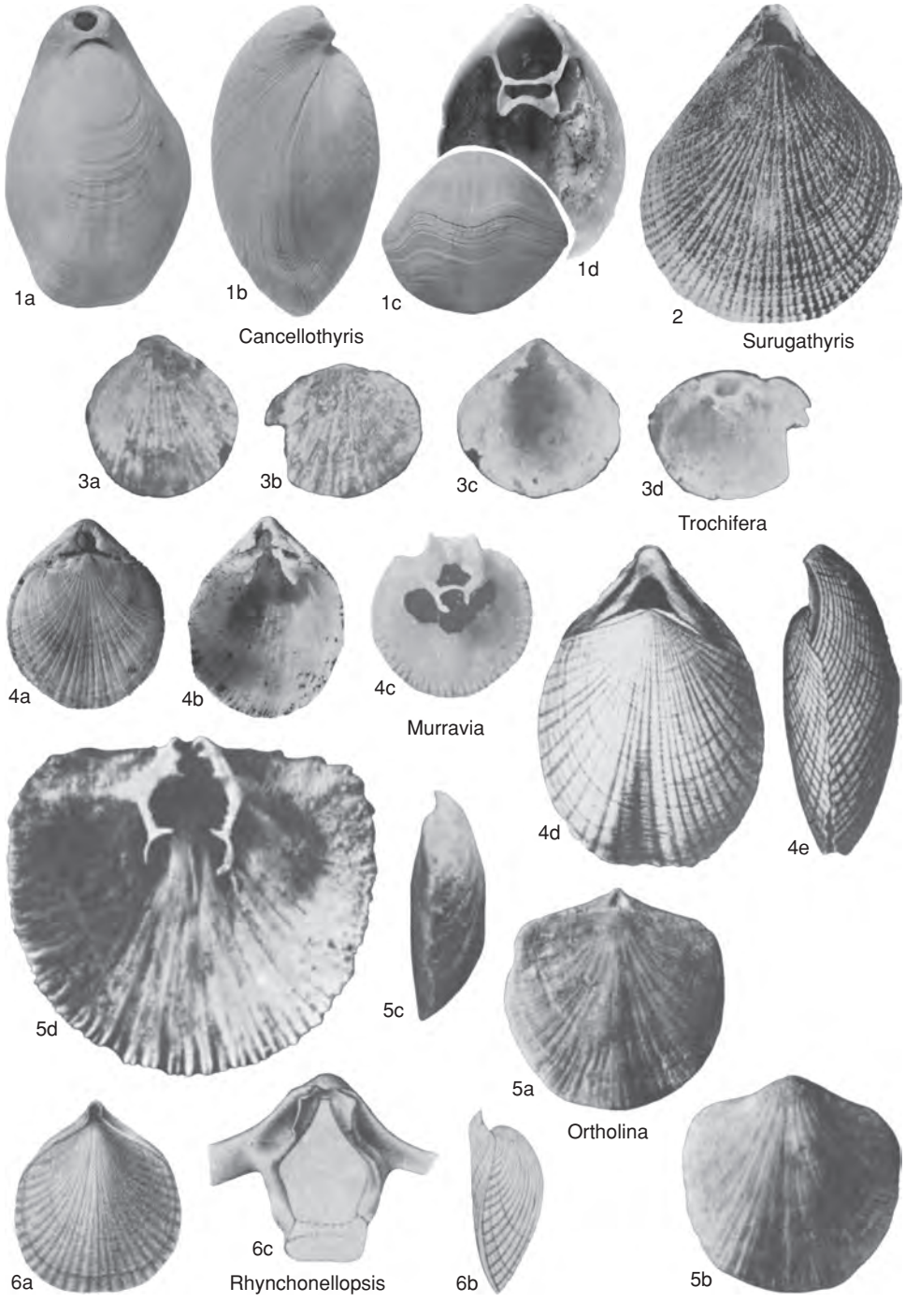


FIG. 1424. Cancellothyrididae (p. 2145–2147).

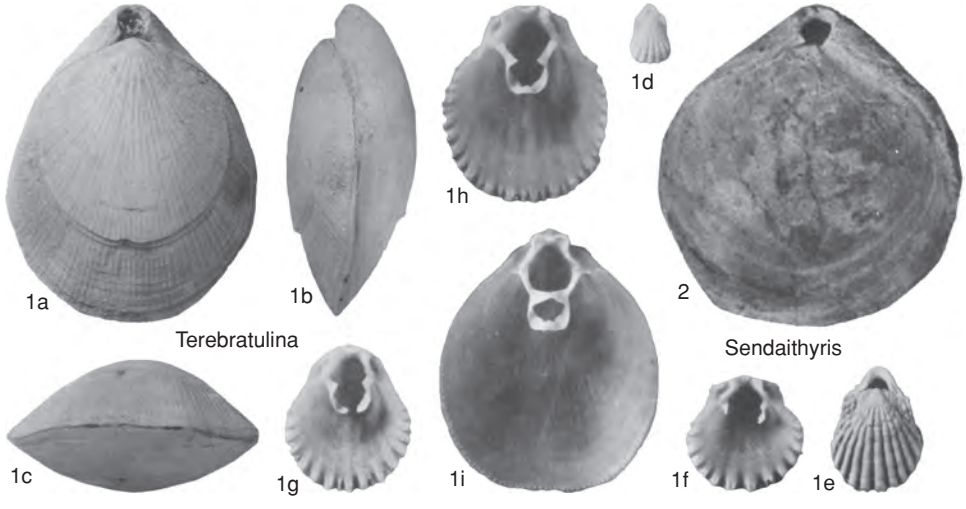


FIG. 1425. Cancellothyrididae (p. 2147).

rectimarginate to gently uniplicate; surface capillate; umbo small, short, suberect, beak ridges obscure; foramen small, deltidial plates disjunct. Hinge plates absent, socket ridges prominent and united with crural bases, crura converging, loop probably terebratulinid; inner shell margin crenulated. *Paleogene (Oligocene):* Belgium, The Netherlands, Germany, Russia.——FIG. 1424,*6a–c. *R. nysti* (BOSQUET), Belgium; *a–b,* dorsal and lateral views, ×3; *c,* dorsal valve interior with loop, restored, ×9 (Muir-Wood, 1965a).

**Sendaithyris** HATAI, 1940, p. 253 [**S. otutumiensis;* OD]. Medium size, circular, biconvex, anterior commissure rectimarginate; surface indistinctly costellate. Interior imperfectly known; cardinalia and loop said to be as in *Terebratulina,* but with short, bifurcated septum in dorsal valve. *Neogene (Miocene):* Japan.——FIG. 1425,*2. *S. otutumiensis,* Rikuzen; dorsal valve view, ×1 (Muir-Wood, 1965a).

**?Surugathyris** YABE & HATAI, 1934, p. 587 [**S. (Terebratulina) suragaensis;* OD]. Imperfectly known, may be immature form of some species of *Terebratulina. Holocene:* Japan.——FIG. 1424,*2. *S. suragaensis;* dorsal valve view, ×2.4 (Muir-Wood, 1965a).

**Terebratulina** D'ORBIGNY, 1847 in 1847–1851, p. 249 [**Anomia retusa* LINNAEUS, 1758, p. 701; OD; =*A. caputserpentis* LINNAEUS, 1767, p. 1,153, *non* LINNAEUS, 1758, p. 703]. Small to large, ovate to subpentagonal, slightly auriculate, valves biconvex; anterior commissure rectimarginate to uniplicate; surface costellate, costellae may be enlarged or granular, with prominent nodules in young; umbo suberect, foramen incomplete, mesothyrid to permesothyrid, deltidial plates disjunct. Pedicle collar present, median septum and hinge plates absent; cardinal process small; socket ridges and crural bases fused, forming prominent ridge, hinge teeth without swollen bases, but with sulcus on inner face; crura converging, crural processes united to form ringlike loop, transverse band ventrally arched. *Upper Jurassic–Holocene:* Europe, *Upper Jurassic–Cretaceous;* cosmopolitan, *Paleogene–Holocene.*——FIG. 1425,*1a–i. *T. retusa* (LINNÉ), Holocene; *a–c,* dorsal, lateral, and anterior views, off Norway, ×2 (Muir-Wood, 1965a); *d–e,* dorsal valve views, Gulf of Gascogne, France, ×5; *f–h,* dorsal valve interiors showing loop ontogeny, Gulf of Gascogne, France, ×5; *i,* dorsal valve interior showing adult loop, Gulf of Gascogne, France, ×2 (Cooper, 1981).

**Trochifera** JIN & YE in JIN & others, 1979, p. 68 [**T. bangonica;* OD]. Small, elliptical to roundly pentagonal, ventribiconvex; anterior commissure rectimarginate or incipiently uniplicate; costellae low, rounded and bifurcate; beak straight; beak ridges angular; interarea narrow and flattened; foramen large, subcircular, submesothyrid to hypothyrid; deltidial plates disjunct. Pedicle collar short or absent; ventral muscle scar obscure and petallike; myophragm narrow. Cardinal process low, bilobate; socket ridges raised above posterior margin and buttressed by small, curved plates; crural bases attached to ends of inner socket ridges; crura converging; crural processes united to form ring; loop very short; transverse band gently arched ventrally; dorsal median ridge low and bifurcating anteriorly. *Cretaceous (Albian):* northern Tibet (Bangon).——FIG. 1424,*3a–d. *T. bangonica; a–b,* holotype, dorsal, and ventral views, ×3; *c–d,* interior of ventral and dorsal valves, ×3 (Jin & others, 1979).

## Subfamily CRICOSIINAE Cooper, 1973

[Cricosiinae Cooper, 1973c, p. 383] [=Cruralininae Smirnova, 1990a, p. 53]

Small, costellate or capillate, subcircular, with nearly tubular loop. *Upper Jurassic–Paleogene (Danian).*

**Cricosia** Cooper, 1973c, p. 384 [**Terebratulina filosa* Conrad, 1866, p. 77; OD]. Small, subcircular to oval, finely costellate; anterior commissure nearly rectimarginate; foramen small, oval, hypothyrid; deltidial plates small, disjunct, extended adjacent to dorsal valve margin and obliquely raised; pedicle collar narrow. Thin, elevated socket ridges join with thickened posterior area that serves as cardinal process; crura stout, narrow; crural processes united to form narrow, tubelike loop. *Upper Cretaceous:* southwestern USA (Texas).——Fig. 1426,*1a–f.* **C. filosa* (Conrad); *a–d,* dorsal, ventral, lateral, and anterior views, ×2; *e–f,* ventral and posterior views of reconstructed loop, ×4 (Cooper, 1973c).

**Bisulcina** Titova, 1977, p. 81 [**Terebratulina tunicata* Vantschurov in Vantschurov & Kalugin, 1966, p. 121; OD]. Small to medium size, rounded to oval, slightly biconvex; beak blunt, foramen large, deltidial plates disjunct; shell capillate (up to 100 ribs present), small tubercles prominent in posterior and lateral parts of shell. Pedicle collar present, hinge teeth narrow with denticulum; inner socket ridges more prominent than outer. *Upper Cretaceous–Paleogene (Danian):* western Turkmenia; Western Europe, *Upper Cretaceous.*——Fig. 1426,*2a–u.* **B. tunicata* (Vantschurov), Danian, western Turkmenia; *a–d,* dorsal, ventral, lateral, and anterior views, ×5; *e–u,* serial transverse sections 0.10, 0.25, 0.45, 0.55, 0.65, 0.75, 0.90, 1.05, 1.35, 1.80, 2.00, 2.15, 2.30, 2.55, 2.70, 3.05, 3.25 mm from ventral umbo, ×3 (Titova, 1977).

**Cruralina** Smirnova, 1966, p. 32 [**C. cruralinica* Smirnova, 1966, p. 33; OD]. Small, rounded to pentagonal, anterior margin rectimarginate to uniplicate; costellate; beak suberect or slightly incurved, beak ridges sharp, with false interarea; foramen large, pedicle collar present. Cardinal process small, inner margins of hinge plates forming projections on valve floor that connect with crural bases; crural bases close together, separated by depressions from inner socket ridges that are low, parallel to, and almost united with valve floor; crura short, crural processes join to form single cross piece that is strongly curved ventrally; transverse band bent ventrally medianly at acute angle. *Lower Cretaceous–Upper Cretaceous:* Crimea, Europe, *Lower Cretaceous;* USA (Texas), Cuba, *Upper Cretaceous.*——Fig. 1427,*2a–jj.* **C. cruralinica,* Lower Cretaceous, Crimea; *a–d,* holotype, dorsal, ventral, lateral, and anterior views, ×1; *e–f,* ventral and lateral views of reconstructed loop, ×2 (Smirnova, 1966); *g–jj,* serial transverse sections 0.0, 0.3, 0.5, 0.9, 1.2, 1.3, 1.32, 1.35, 1.37, 1.40, 1.45, 1.50, 1.55, 1.60, 1.63, 1.68, 1.71, 1.81, 1.91, 2.01, 2.11, 2.21, 2.31, 2.41, 2.51, 2.61, 2.71, 2.81, 2.91, 3.01 mm from ventral umbo, ×2 (Smirnova, 1990a).

**Gyrosoria** Cooper, 1973c, p. 386 [**Terebratulites gracilis* Schlotheim, 1813, p. 112, pl. 3,*3;* OD]. Small, outline elongate-oval in juveniles, subcircular in adults; planoconvex; costellae strong, often granulose or beaded; beak short, incurved; foramen small, deltidial plates disjunct, extended adjacent to dorsal valve margin; pedicle collar absent, teeth strong. Cardinalia narrow, socket ridges stout, cardinal process small, supported by short ridge; crura thick, oblique, supporting a narrow, tubelike loop. *Upper Cretaceous (Campanian–Maastrichtian):* Denmark, England.——Fig. 1428*a–k.* **G. gracilis* (Schlotheim), Trimingham, Norfolk, England; *a–d,* dorsal, ventral, lateral, and anterior views, ×3; *e,* dorsal valve interior, ×4; *f–g,* interiors of dorsal and ventral valves, ×4 (Cooper, 1973c); *h–k,* growth stages, 1.4 mm, 2.1 mm, 4.8 mm, 10.7 mm (Surlyk, 1972).

**Symphythyris** Smirnova, 1966, p. 37 [**Terebratulina arguinensis* Moisseev in Weber, 1949, p. 117; OD]. Small to medium size, rounded trigonal, gently biconvex; anterior commissure rectimarginate to uniplicate; surface finely costellate; beak very elongated, suberect or gently incurved; foramen large, circular, mesothyrid or submesothyrid, symphytium long, convex. No pedicle collar; cardinal process small, outer hinge plates fused with high, massive socket ridges that project deeply into beak cavity, socket ridges buttressed by small, curved plates that reach valve floor on either side of low median septum; crural processes forming broad transverse band, slightly convex ventrally; loop almost tubular. *Upper Jurassic–Lower Cretaceous:* Crimea, Caucasus, Switzerland, Czech Republic.——Fig. 1427,*1a–b.* **S. arguinensis* (Moisseev), Valanginian, Crimea; dorsal and lateral views, ×1 (Smirnova, 1990a). ——Fig. 1427,*1c–h. S. neocomiensis* d'Orbigny, Neocomian, Switzerland; *c–f,* dorsal, ventral, lateral, and anterior views, ×2 (Cooper, 1973c); *g–h,* reconstructions of loop, ×2 (Smirnova, 1972).

## Subfamily ALITHYRIDINAE Sun, 1981

[Alithyridinae Sun, 1981, p. 242]

Small, subcircular, with dental plates. *Upper Cretaceous.*

**Alithyris** Sun, 1981, p. 242 [**A. shiquanheensis;* OD]. Small, subcircular, biconvex, anterior commissure rectimarginate; beak short, slightly incurved; delthyrium open; surface with subangular plicae

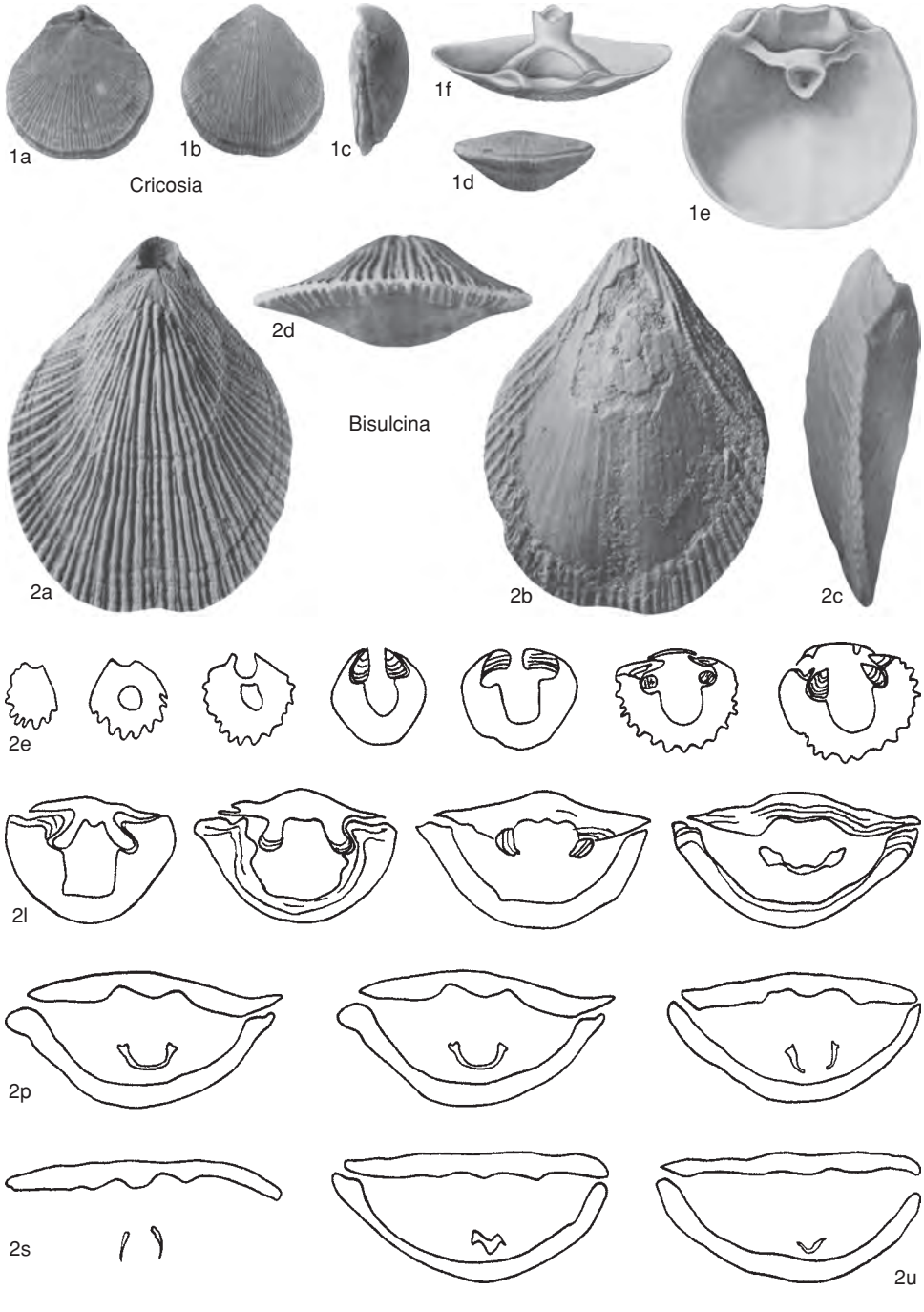


FIG. 1426. Cancellothyrididae (p. 2148).

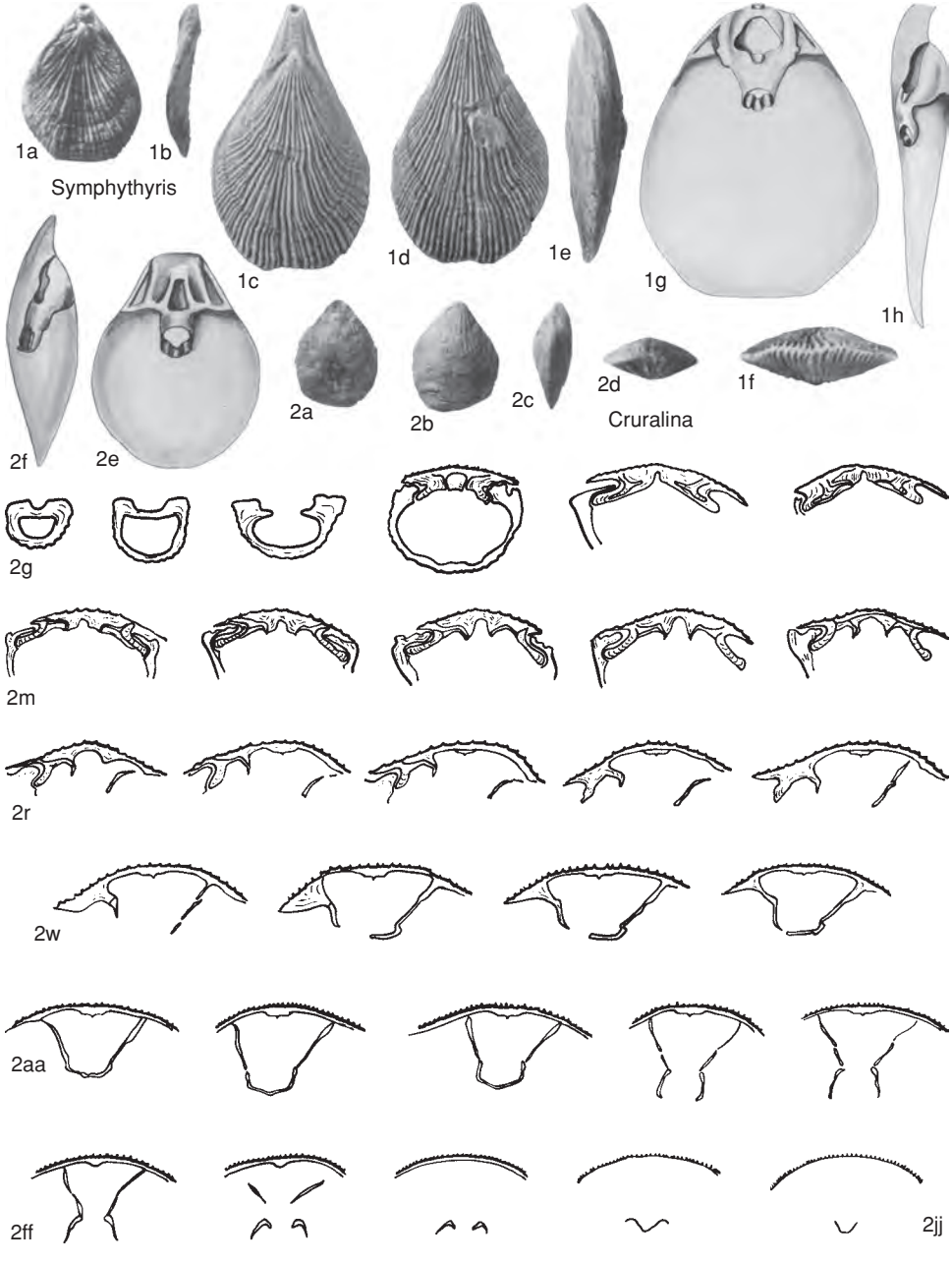


FIG. 1427. Cancellothyrididae (p. 2148).

and weak capillae; foramen obscure. Dental plates recessive and slightly diverging; umbonal cavities narrow, teeth small and obtusely circular; cardinal process a low, short platform, bilobate; inner socket ridges high, projecting over cardinal margin and fused with outer hinge plates; crura falcifer; crural processes uniting to form ringlike loop; descending branches short; transverse band incurved ventrally with low arch. *Upper Cretaceous:* Tibet.——FIG. 1429*a–t.* **A. shiqanheensis; a–d,* dorsal, ventral, lateral, and anterior views, ×3; *e–t,* serial transverse sections 0.5, 0.7, 7.0, 7.2, 7.3, 7.4, 7.5, 7.7, 8.0, 8.1, 8.15, 8.25, 8.3, 8.4, 8.45, 8.5 mm from ventral umbo, ×6 (Sun, 1981).

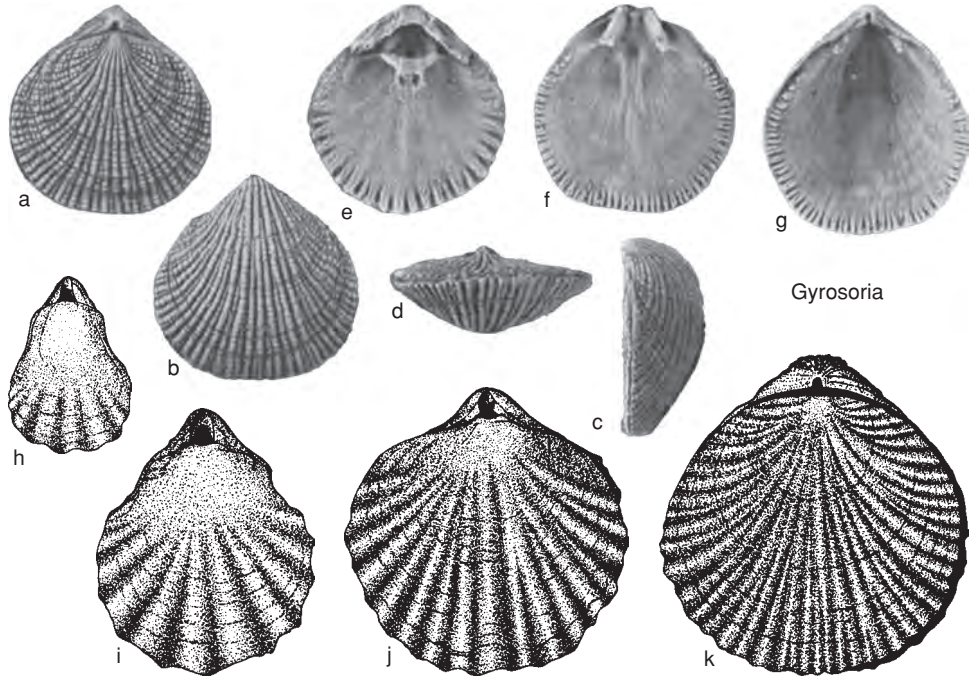


FIG. 1428. Cancellothyrididae (p. 2148).

## Subfamily UNCERTAIN

**Cooperithyris** TCHORSZHEVSKY, 1988, p. 31 [**C. tenuicostata;* OD]. Small, biconvex, anterior commissure rectimarginate; capillate with fine, sharp ribbing; beak small, foramen small, deltidial plates conjunct. Pedicle collar narrow, adminicula well developed in ventral valve. Cardinal process small; septal ridge extending for 0.3 dorsal valve length; crural bases strong, crural processes high, arcuate, uniting to form high half ring; transverse band low, narrow; loop tapering anteriorly. *Lower Jurassic (Pliensbachian–Toarcian):* Transcaucasus.——FIG. 1430*a–y.* **C. tenuicostata,* Pliensbachian; *a–c,* dorsal, ventral, and anterior views, ×3; *d–y,* serial transverse sections, 0.2, 0.5, 0.8, 0.9, 1.1, 1.2, 1.4, 1.6, 1.8, 2.2, 2.4, 2.6, 2.8, 3.0, 3.1, 3.2, 3.4, 3.6, 3.9, 4.1, 4.4, 4.45 mm from first section, ×4 (Tchorszhevsky, 1988).

## Family CHLIDONOPHORIDAE Muir-Wood, 1959

[*nom. transl.* COOPER, 1973c, p. 386, *ex* Chlidonophorinae MUIR-WOOD, 1959, p. 295]

With characteristic cardinalia of superfamily but with crural processes of loop never united to form ring. *Lower Jurassic (Pliensbachian)–Holocene.*

## Subfamily CHLIDONOPHORINAE Muir-Wood, 1959

[Chlidonophorinae MUIR-WOOD, 1959, p. 295]

Transverse band of loop directed anteroventrally; lophophore subplectolophous. *Lower Jurassic (Pliensbachian)–Holocene.*

**Chlidonophora** DALL, 1903, p. 1,538 [**Terebratulina? incerta* DAVIDSON, 1878b, p. 438; OD]. Small, semicircular, valves moderately biconvex, anterior commissure rectimarginate to gently uniplicate; hinge line wide, straight, interarea short; beak short, foramen incomplete; deltidial plates narrow, disjunct, pedicle collar developed. Socket ridges broad, projecting above hinge line and uniting with transverse cardinal process; crura short, crural processes concave inwardly and sharply pointed; anterior part of loop flat and ribbonlike, directed anteriorly; pedicle variable but characteristically frayed into numerous strands; lophophore subplectolophous. *?Upper Cretaceous, Holocene:* Spain, *?Upper Cretaceous;* Atlantic, Caribbean, Gulf of Mexico

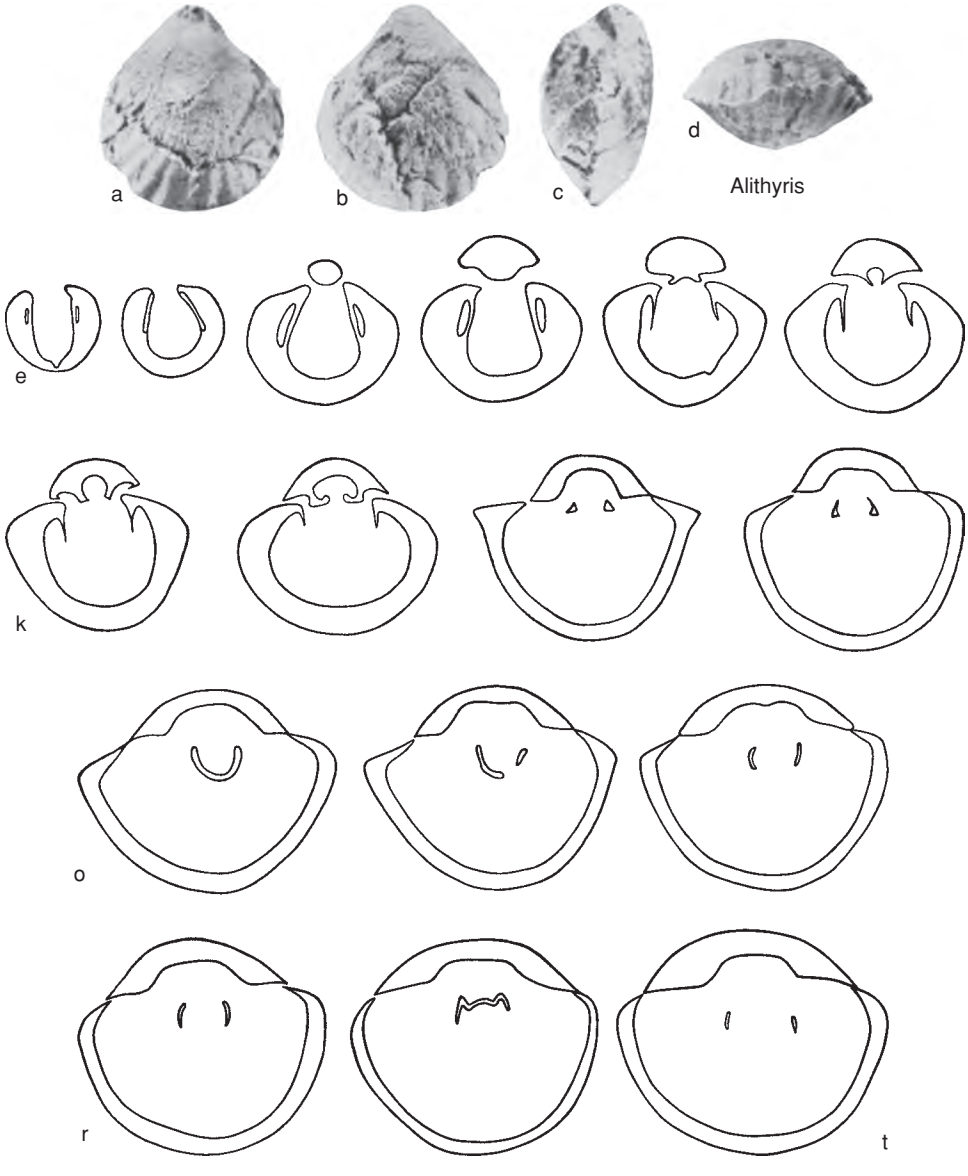


FIG. 1429. Cancellothyrididae (p. 2148–2150).

(534–3,384 m), Indian Ocean (680–1,660 m), ?Pacific, *Holocene.*——FIG. 1431,*1a–f. *C. incerta* (DAVIDSON), Holocene, North Atlantic Ocean; *a–c,* holotype, dorsal, lateral, and anterior views, ×2.5 (Muir-Wood, 1965a); *d–e,* laterally tilted and ventral view of dorsal valve interior with loop, ×4 (Cooper, 1973b); *f,* ventral valve interior showing teeth and mantle canals, ×3 (Muir-Wood, 1965a).——FIG. 1431,*1g–h. C. chuni* BLOCHMANN, Holocene, Maldive Islands, Indian Ocean; *g,* dorsal valve view with long, divided pedicle attached to *Globigerina,* ×2; *h,* subplectolophous lophophore, ×10 (Muir-Wood, 1965a).

**Deslongchampsithyris** LEE & TCHORSZHEVSKY, herein, p. 2,255, *nom. nov. pro Deslongchampsia* TCHORSZHEVSKY, 1988, p. 33, *non* MORRIS & LYCETT, 1851, *nec* ROCHÉ, 1939 [**Deslongchampsia moiseevi* TCHORSZHEVSKY, 1988, p. 33; OD; = *Terebratella*

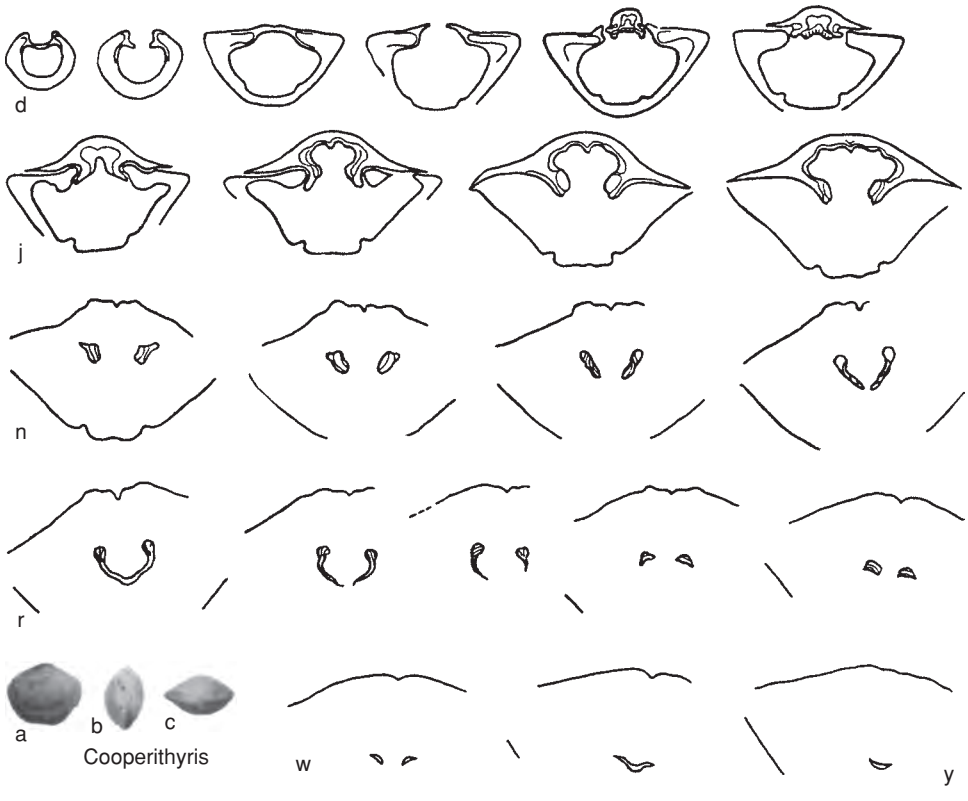


FIG. 1430. Cancellothyrididae (p. 2151).

*liasina* MOISSEEV, 1934, p. 156, *non* DESLONGCHAMPS, 1863, *nec* RAU, 1902]. Small, subcircular, biconvex; beak small, triangular; anterior commissure uniplicate; costellae low, narrow; foramen small, subapical, deltidial plates conjunct. Cardinal process small, flat, with distinct myophore; crural bases heavy, oval in cross section, arcuate; loop narrow. *Lower Jurassic (Pliensbachian):* Crimea, Transcaucasus, England, Germany.——FIG. 1432,*3a–t.* **D. moiseevi* (TCHORSZHEVSKY), Crimea; *a–c,* dorsal, lateral, and anterior views, ×1; *d,* dorsal valve, ×3; *e–t,* serial transverse sections, 0.0, 0.1, 0.5, 0.9, 1.15, 1.35, 1.5, 1.80, 2.15, 2.35, 2.65, 2.85, 3.05, 3.15, 3.35, 3.55 mm from first section, ×4 (Tchorszhevsky, 1988).

**Disculina** DESLONGCHAMPS, 1884a, p. 147 [**Terebratula hemisphaerica* J. SOWERBY, 1826 in 1826–1829, p. 69; OD]. Small, subcircular, valves concavo- to planoconvex, anterior commissure rectimarginate to incipiently unisulcate; valves finely capillate and nodose; umbo incurved, foramen large, incomplete, mesothyrid; deltidial plates disjunct, small interarea in ventral valve. Pedicle collar present; cardinal process small; socket ridges broad and long; crura oblique with disjunct crural processes and anteriorly ventrally protuberant transverse band. *Middle Jurassic (Bathonian)–Upper Jurassic (upper Oxfordian):* England, France.——FIG. 1431,*4a–d.* **D. hemisphaerica* (J. de C. SOWERBY), Bathonian, France; *a–c,* dorsal, ventral, and lateral views, ×4, *d,* dorsal view of loop, ×5 (Cooper, 1973c).

**Gisilina** STEINICH, 1963, p. 735 [**Terebratula gisii* ROEMER, 1841, p. 40; OD]. Small, rounded, auriculate, valves biconvex, with narrow interarea; anterior commissure rectimarginate or incipiently uniplicate; capillae simple, prominent, smooth or enlarged at intersection with growth lines; umbo short, suberect or erect; foramen ovoid, mesothyrid; deltidial plates disjunct. Pedicle collar present; hinge teeth with swollen bases; loop ventrally directed, crural processes converging, lophophore from spicule arrangement probably plectolophous. *Upper Cretaceous–Paleogene (Danian, ?Eocene):* Denmark, Germany, Romania, England, *Upper Cretaceous;* Ukraine, *Danian, ?Eocene;* Australia, *Santonian–Campanian.*——FIG. 1432,*1a–i.* **G. gisii* (ROEMER), Rugen; *a–b,* dorsal and lateral views, ×3; *c–f,* dorsal, lateral, anterior, and ventral valve interior views, ×4 (Muir-Wood, 1965a); *g,* dorsal

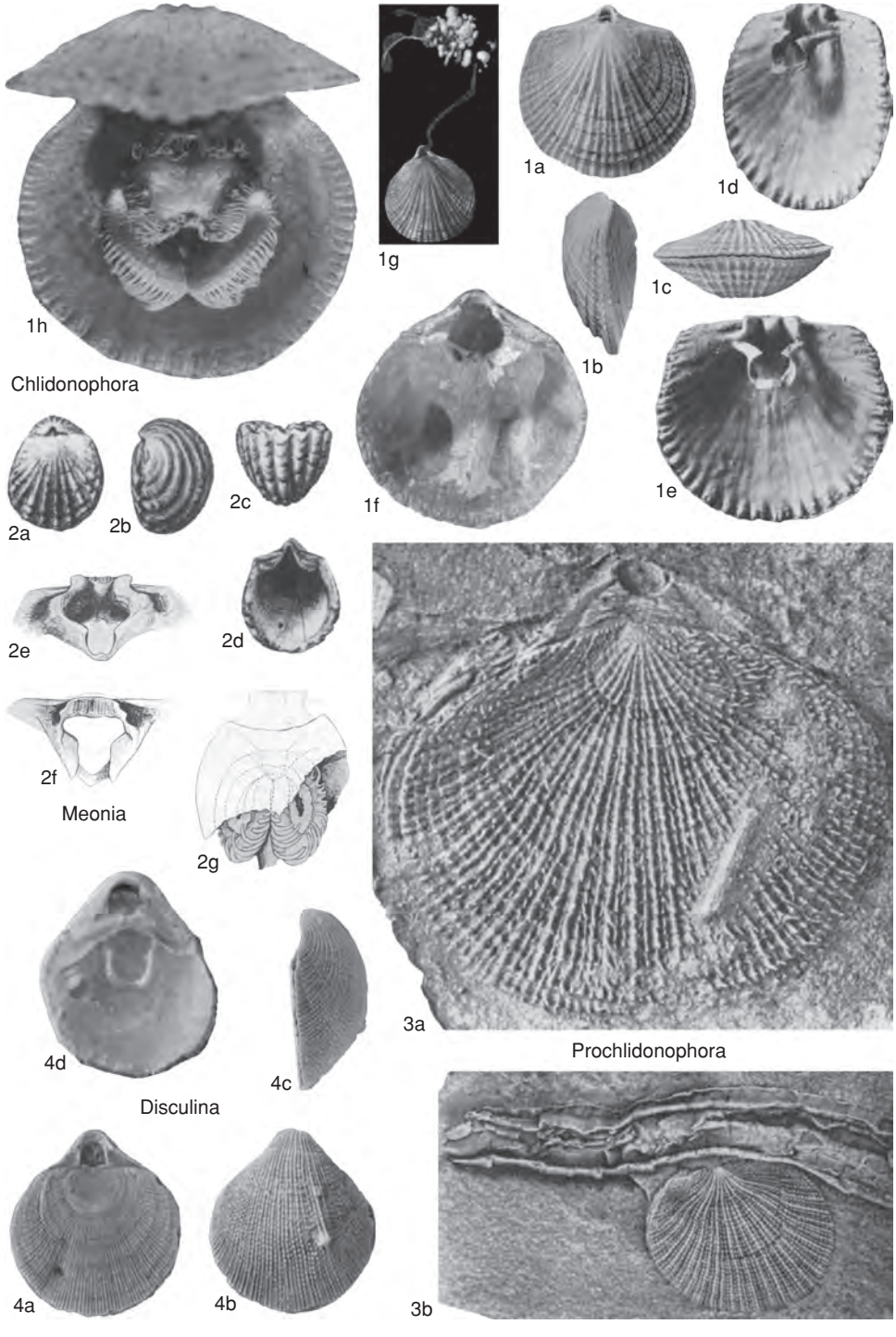


FIG. 1431. Chlidonophoridae (p. 2151–2156).

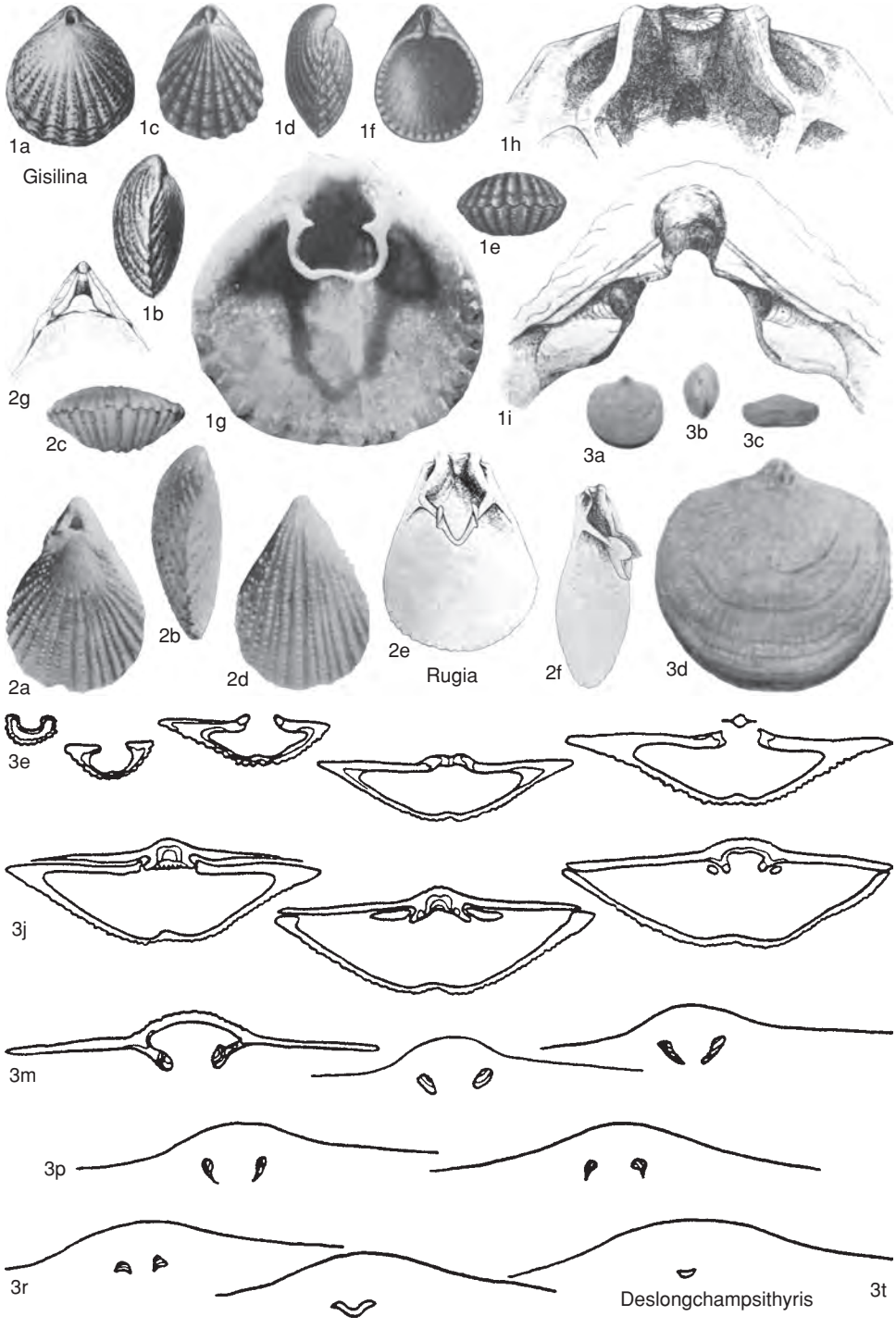


FIG. 1432. Chlidonophoridae (p. 2152–2156).

valve interior with loop, ×10; *h–i,* dorsal valve interior, ventral valve interior, ×11 (Steinich, 1963).

**Meonia** Steinich, 1963, p. 732 [**Terebratula semiglobularis* Posselt, 1894, p. 35; OD]. Small, rounded shells with straight hinge line and narrow interarea, strongly planoconvex; anterior commissure rectimarginate or slightly sulcate; umbo short, foramen small, mesothyrid; capillae simple, granular. Cardinal process crenulated; hinge teeth with deep sockets on inner face; loop short, ventrally projecting; crural processes scarcely developed, narrow transverse band uniting broader converging crura; lophophore probably spirolophous, with spirals set at angle to plane of symmetry. *Upper Cretaceous, Paleogene (?Danian, ?Eocene):* Denmark, Sardinia, Spain, ?Gulf of Gascogne, *Upper Cretaceous;* Denmark, *?Danian;* Ukraine, *?Eocene.*——Fig. 1431,*2a–g. *M. semiglobularis* (Posselt); *a–d,* dorsal valve, lateral, anterior, ventral valve interior, ×3 (Muir-Wood, 1965a); *e–f,* dorsal valve interior showing loop, same, more posterior view; *g,* dorsal valve interior with brachial spirals silicified and part of interior restored, ×10 (Steinich, 1963).

**Prochlidonophora** Thomson & Owen, 1979, p. 28 [**P. muirwoodae;* OD]. Small, subcircular, costellate with spinules, planoconvex to incipiently biconvex; beak short, erect; foramen large, circular, mesothyrid; hinge line slightly extended, interarea long, beak ridges distinct; delthyrium well exposed, deltidial plates conjunct. Cardinalia and loop unknown. *Lower Cretaceous:* Antarctica (Alexander Island).——Fig. 1431,*3a–b. *P. muirwoodae; a,* holotype, silicone rubber cast from external mold, ×5; *b,* latex cast from external mold of ventral valve, ×2 (Thomson & Owen, 1979).

**Rugia** Steinich, 1963, p. 735 [**R. tenuicostata;* OD]. Minute, resembles *Terebratulina* in hinge characters and probable plectolophous lophophore, but differs in small size of adult shells, rectimarginate commissure, more elongate umbo, long tapering deltidial plates and long pedicle collar, hypothyrid foramen, and more granular shell surface. *Upper Cretaceous:* Denmark, Germany, Poland, England, Sweden, Spain.——Fig. 1432,*2a–g. *R. tenuicostata; a–d,* dorsal, ventral, lateral, and anterior views; *e–f,* dorsal valve interior showing loop and crural processes in ventral and lateral views; *g,* ventral valve umbo showing deltidial plates, ×10 (Steinich, 1963).

## Subfamily EUCALATHINAE Muir-Wood, 1965

[Eucalathinae Muir-Wood, 1965a, p. 811]

Transverse band of loop medially directed toward dorsal valve; lophophore spirolophous. *Paleogene (Eocene)–Holocene.*

**Eucalathis** Fischer & Oehlert, 1890, p. 72 [**Terebratulina? murrayi* Davidson, 1878b, p. 437; OD]. Small, subtrigonal, auriculate, ventribiconvex, anterior commissure rectimarginate or incipiently uniplicate, hinge straight; surface capillate with rare intercalations or granular; umbo short, obliquely truncate; deltidial plates short, triangular, disjunct. Pedicle collar present, loop chlidonophorid but transverse band dorsally directed, socket ridges as narrow plates uniting with cardinal process, and anteriorly with crural bases; lophophore with 2 single whorl spirals set at angle to plane of symmetry, filaments long. *Paleogene (Eocene)–Holocene:* USA, *Eocene;* Italy, *Miocene;* cosmopolitan (185–3,870 m), *Holocene.*——Fig. 1433,*2a–e. *E. murrayi* (Davidson), Holocene, off Fiji Islands, Pacific Ocean; *a,* dorsal view, ×16; *b–c,* lateral and anterior views, ×9; *d–e,* dorsal valve interior showing lophophore, with loop, ×20 (Muir-Wood, 1965a).——Fig. 1433,*2f–j. E. ergastica* Fischer & Oehlert, Holocene, North Atlantic Ocean; *f–h,* dorsal, lateral, anterior views; *i,* ventral valve interior; *j,* dorsal valve interior with loop, ×4 (Muir-Wood, 1965a).

**Bathynanus** Foster, 1974, p. 79 [**B. tenuicostatus* Foster, 1974, p. 80; OD]. Very small, faintly capillate, subpentagonal in outline; foramen small, hypothyrid; deltidial plates disjunct. Cardinal process indistinct, socket ridges fusing with crural bases; crural plates extending anteriorly as low, narrow ridges on valve floor, crura short, flat, converging slightly; loop incomplete, lophophore zygolophous. *Holocene:* Pacific, Indian, Atlantic Oceans (3,843–5,160 m).——Fig. 1433,*1a–f. *B. tenuicostatus,* southeastern Pacific Ocean; *a,* holotype, dorsal valve view, USNM 550282A; *b–c,* interior views of ventral and dorsal valves; *d,* dorsal valve interior, ×5; *e–f,* drawing of dorsal valve and dorsal valve interior, ×12.5 (Foster, 1974).

**Nanacalathis** Zezina, 1981a, p. 162 [**N. minuta;* OD]. Minute, biconvex, costate; beak suberect, foramen mesothyrid, deltidial plates conjunct. Cardinal process small, socket ridges fusing with crural bases; crura short, converging slightly; loop incomplete. *Holocene:* Indian Ocean, Atlantic Ocean (289–3,731 m).——Fig. 1434,*1a. *N. minuta,* Indian Ocean; dorsal view, ×23 (Zezina, 1981c).——Fig. 1434,*1b–e. N.* sp, Atlantic Ocean; *b–c,* exterior and interior of dorsal valve, ×10; *d–e,* exterior and interior of ventral valve, ×10 (Cooper, 1973b).

**Notozyga** Cooper, 1977, p. 105 [**N. lowenstami;* OD]. Small, subpentagonal in outline, biconvex, hinge wide, costellae beaded. Differs from *Eucalathis* in having thick, wide crural bases, thick, angular crural processes, and a broad, rounded transverse band that does not extend anteriorly to crural processes. *Holocene:* Caribbean, Indian Ocean, Pacific Ocean.——Fig. 1434,*2a–e. *N. lowenstami,* Caribbean; *a–d,* holotype, dorsal,

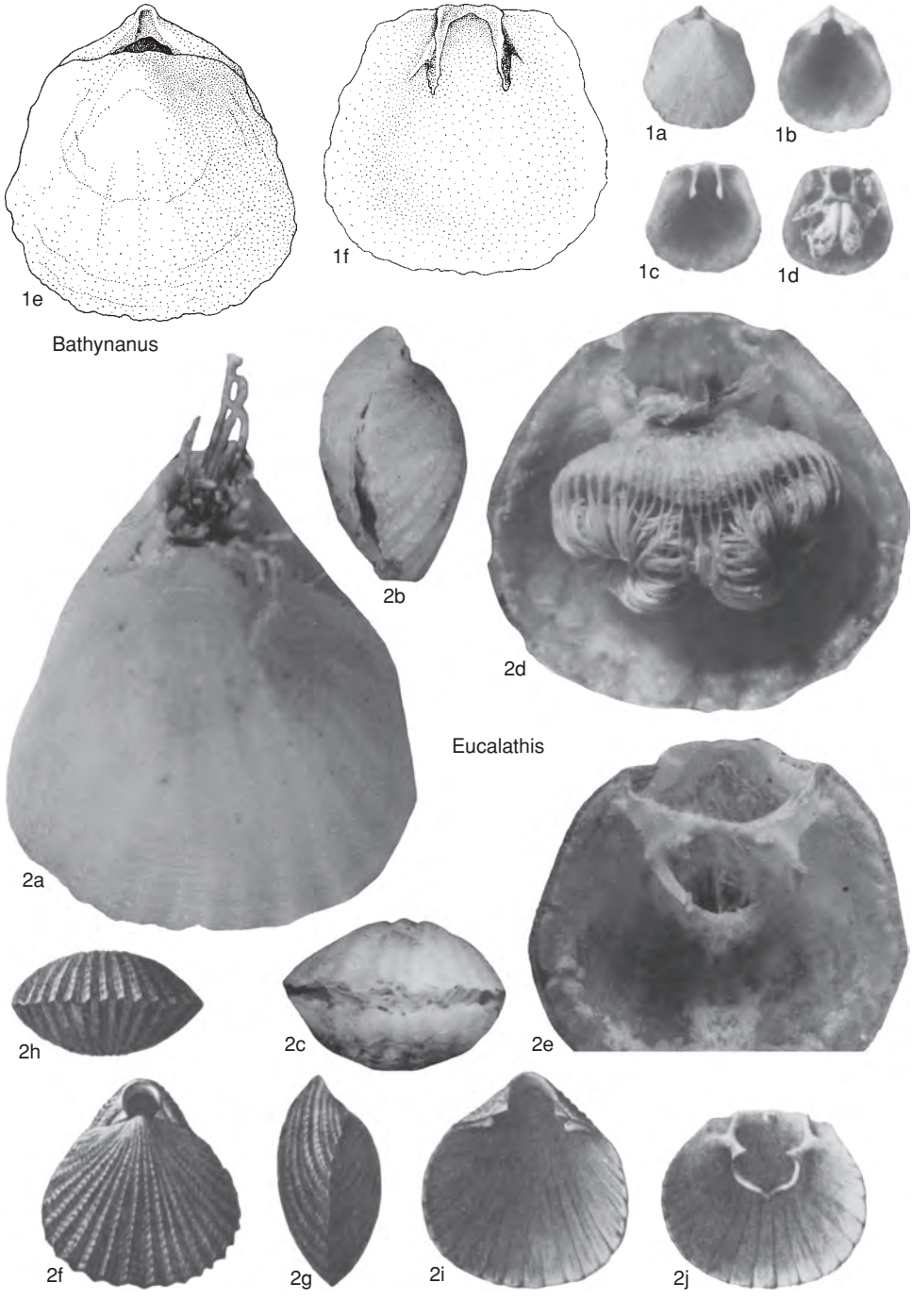


FIG. 1433. Chlidonophoridae (p. 2156).

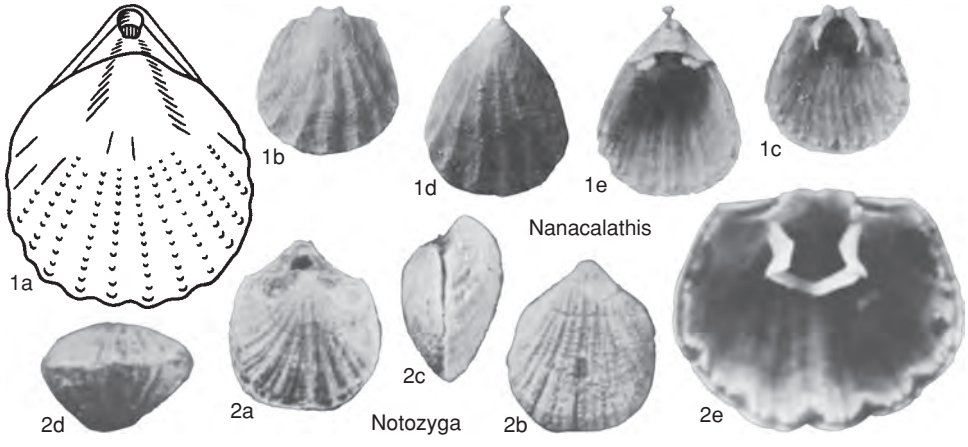


FIG. 1434. Chlidonophoridae (p. 2156–2158).

ventral, lateral, and anterior views, USNM 550591a, ×10; *e,* interior of dorsal valve, ×15 (Cooper, 1977).

## Subfamily AGULHASIINAE Muir-Wood, 1965

[Agulhasiinae MUIR-WOOD, 1965a, p. 812]

With greatly elongated ventral beak and long pedicle collar. *Neogene (lower Miocene)–Holocene.*

**Agulhasia** KING, 1871, p. 109 [**A. davidsoni;* OD]. Small, rounded trigonal; rostrate, with greatly elongated ventral beak one-third of valve length; biconvex, with faint, ventral median sulcus, anterior commissure rectimarginate to unisulcate; deltidial plates disjunct, separated by long, narrow, sunken apical plate forming elongated pedicle collar; foramen anterior, hypothyrid. Hinge teeth longitudinally grooved and articulating with socket ridges, cardinal process large, knoblike; loop rather long, narrow, and anteriorly rounded; internal shell margin strongly crenulated. *Neogene (lower Miocene)–Holocene:* South Africa, *lower Miocene;* South Atlantic and southern Indian Ocean (off South Africa, 78–800 m), *Holocene.*——FIG. 1435,*1a–g. *A. davidsoni,* Holocene, Agulhas Bank; *a–d,* dorsal, ventral, lateral, and anterior views, ×6; *e–f,* interior of ventral and dorsal valve, ×6; *g,* dorsal valve interior showing loop, ×12 (Cooper, 1973b).

## Subfamily DRACIINAE Steinich, 1967

[Draciinae STEINICH, 1967, p. 1,145]

Small, dorsal valve smooth, ventral valve ribbed; foramen amphithyrid, transverse band strongly arched posteroventrally. *Upper Cretaceous (Campanian–Maastrichtian).*

**Dracius** STEINICH, 1967, p. 1,146 [**D. carnifex;* OD]. Small, planoconvex to concavoconvex, anterior commissure rectimarginate; beak short; foramen amphithyrid; dorsal valve nearly smooth, ventral valve ribbed; deltidial plates disjunct. Socket ridges high, projecting above hinge line, cardinal process absent; crura flattened, with short, ventrally directed crural processes; transverse band strongly arched toward posterior margin; lophophore subplectolophous. *Upper Cretaceous (Campanian–Maastrichtian):* Germany, Denmark, England.——FIG. 1435,*3a–f. *D. carnifex,* lower Maastrichtian, Rugen; *a–d,* holotype, dorsal valve, ventral valve, lateral, and anterior views, ×9; *e–f,* dorsal valve interiors, ×15 (Steinich, 1967).

## Subfamily ORTHOTHYRIDINAE Muir-Wood, 1965

[Orthothyridinae MUIR-WOOD, 1965a, p. 813]

Small, costate, concavoconvex chlidonophorids. *Upper Cretaceous.*

**Orthothyris** COOPER, 1955a, p. 64 [**O. radiata;* OD]. Small, subcircular in outline with wide, straight hinge, slightly biconvex, becoming concavoconvex; anterior commissure broadly sulcate; ornament of coarse costae medianly and anteriorly, and posteriorly mediolaterally directed costellae; delthyrium margined by elevated deltidial plates, interarea well developed, beak ridges strong, foramen small. Sockets deep, with erect socket ridges; crura short, stout, crural processes large, expanded; loop a thin ribbon, projecting ventrally, attached to socket ridges; interior margin scalloped anteriorly. *Upper Cretaceous:*

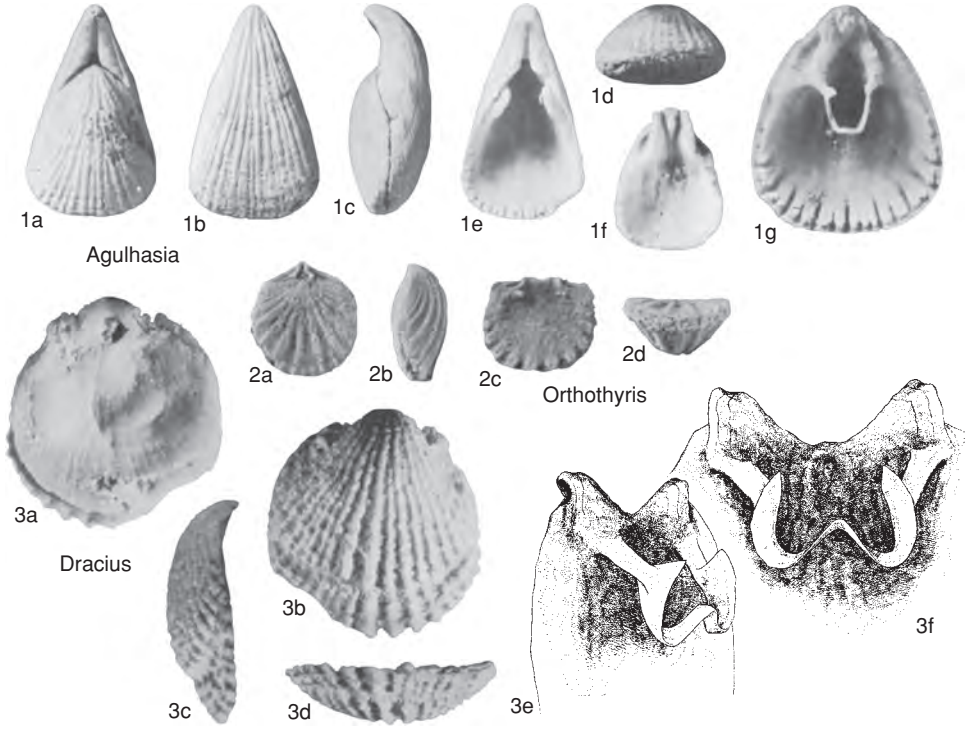


FIG. 1435. Chlidonophoridae (p. 2158–2159).

Caribbean, India.——FIG. 1435,*2a–d. *O. radiata,* Habana Province, Cuba; *a–c,* holotype, dorsal, lateral, and anterior views, USNM 108687; *d,* dorsal interior view, ×8 (Cooper, 1973c).

## Family CNISMATOCENTRIDAE Cooper, 1973

[Cnismatocentridae COOPER, 1973c, p. 389]

Small to large, smooth or capillate with ornament of radial striae; deltidial plates conjunct; cardinalia with strong, elevated socket ridges, no definable outer hinge plates; crural processes anterior, loop very wide and slightly arched, narrow transverse band; musculature like that of *Terebratulina* with dorsal adjustors on dorsal valve floor. *Upper Cretaceous–Holocene.*

### Subfamily CNISMATOCENTRINAE Cooper, 1983

[Cnismatocentrinae COOPER, 1983, p. 45]

Large, capillate, uniplicate; foramen large. *Holocene.*

**Cnismatocentrum** DALL, 1920, p. 321 [**Terebratula (Liothyris) sakhalinensis* DALL, 1908, p. 28; OD]. Large, stout, biconvex, anterior commissure uniplicate, surface smooth or anteriorly capillate; umbo stout; foramen large, deltidial plates conjunct, symphytium exposed. Pedicle collar with short septum; cardinal process small, prominent; low median ridge in dorsal valve; socket ridges attached to valve wall and prolonged anteriorly over flat crura at their bases; crural processes short; loop very wide, slender, almost flattened, transverse band narrow and medially folded; lophophore

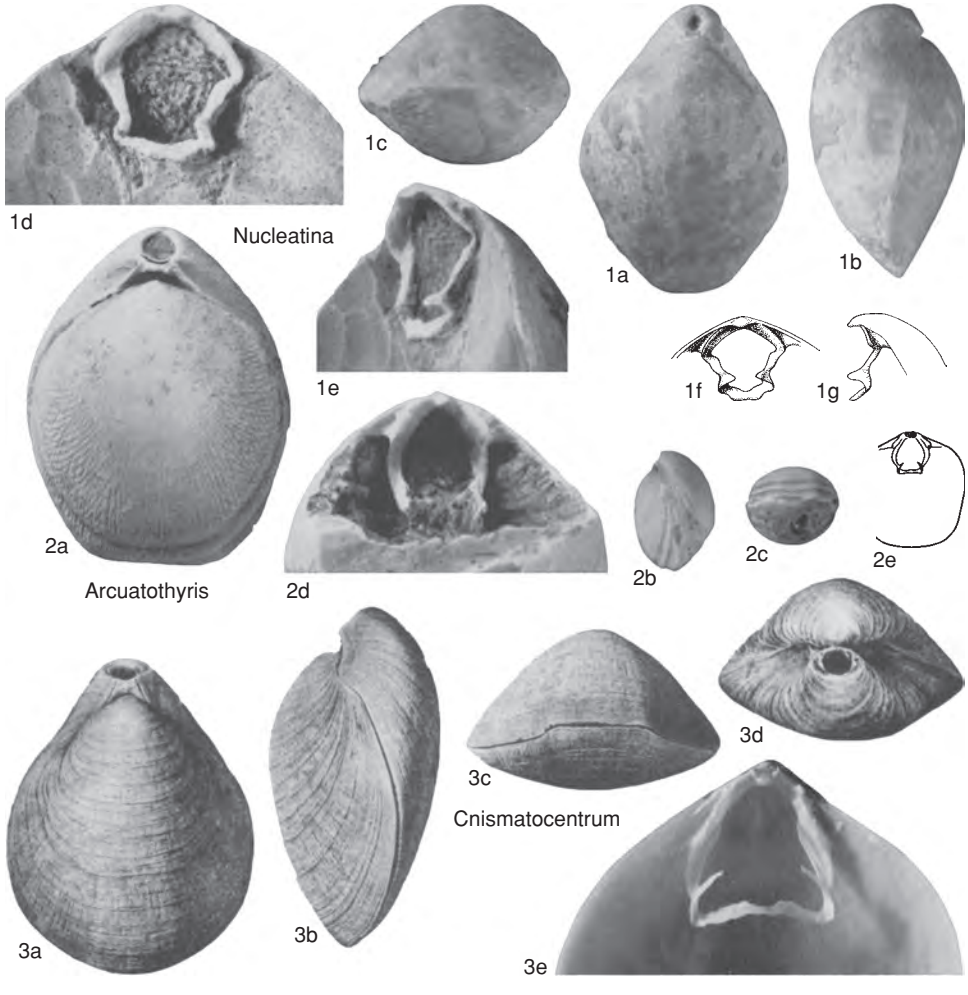


FIG. 1436. Cnismatocentridae (p. 2159–2161).

plectolophous. *Holocene:* Sakhalin Island, Okhotsk Sea, Japan, USA (Alaska).——FIG. 1436,*3a–e*. **C. sakhalinensis* (DALL); *a–d,* holotype, dorsal valve, lateral, anterior, and posterior views, off Sakhalin, USNM 110786A, ×1; *e,* interior of dorsal valve, Chignik Bay, Alaska, ×2 (Cooper, 1983).

## Subfamily ARCUATOTHYRIDINAE Katz, 1974

[*nom. transl. et correct.* COOPER, 1983, p. 221, *ex* Arquatothyrididae KATZ, 1974, p. 267]

Small to medium, smooth or with ornament of radial striae, rectimarginate to slightly uniplicate or unisulcate, loop short, crural processes small and anterior. *Upper Cretaceous.*

**Arcuatothyris** POPIEL-BARCZYK, 1972, p. 136 [**Terebratula arcuata* ROEMER, 1841, p. 44; OD]. Shell medium size, biconvex, oval to pentagonal in outline, anterior commissure rectimarginate or unisulcate, shell ornament of irregular, radial striae; beak large, suberect, foramen large, permesothyrid, symphytium distinct. Cardinal process small with distinct myophore; socket ridges stout, long, high; crural bases narrow, small, triangular; thin plate separating socket ridge and fulcral plate; loop short, straight, transverse band narrow, nearly horizontal ribbon attached just beyond anterior end of crural processes. *Upper Cretaceous (Cenomanian):* Germany, England, France, Poland, Russia.——FIG.

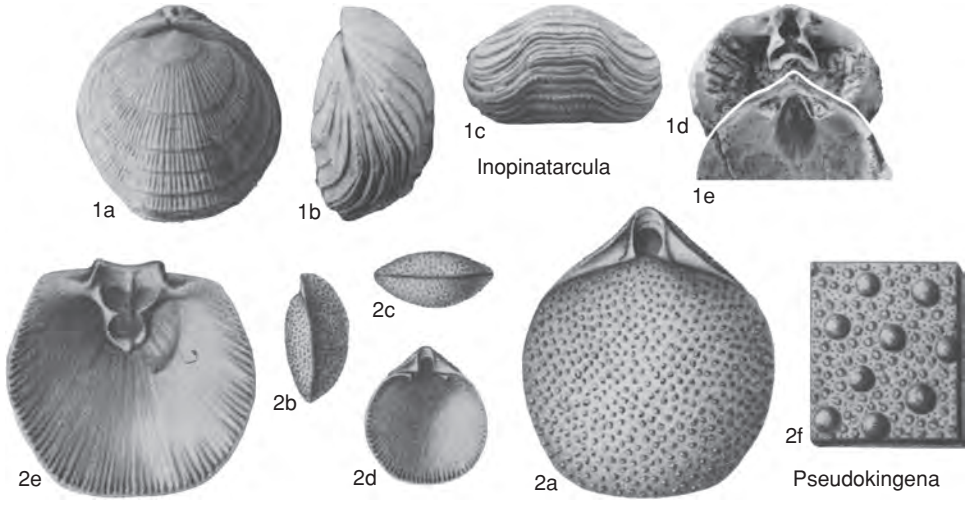


FIG. 1437. Inopinatarculidae and Uncertain (p. 2161–2162).

1436,*2a–e. *A. arcuata* (ROEMER), Rouen, France; *a,* dorsal view, ×3; *b–c,* ventral and anterior views, ×1; *d,* dorsal valve with cardinalia exposed, ×3; *e,* drawing of ventral view of loop, ×1 (Cooper, 1983).

**Nucleatina** KATZ, 1962, p. 135 [**Terebratula nanclasi* COQUAND, 1862, p. 237; OD]. Medium to large, subcircular to elongate pentagonal, biconvex, anterior commissure uniplicate; smooth or with faint radial ornament; beak short, suberect; foramen large, permesothyrid, symphytium hidden. Cardinal process small, narrow, semielliptical; inner socket ridges well developed, incurved laterally; crural bases developing directly from lateral valve sides in front of socket ridges; loop short, wide posteriorly, narrow and truncated anteriorly. *Upper Cretaceous:* France, Russia, Spain, central Asia, southern India, northern Africa, southern Europe.——FIG. 1436,*1a–g. *N. nanclasi* (COQUAND), Santonian, Rouen, France; *a–c,* dorsal, lateral, and anterior views, ×1; *d–e,* dorsal valves showing loops; *f–g,* drawings of loops, ×1 (Cooper, 1983).

## Family INOPINATARCULIDAE Muir-Wood, 1965

[*nom. transl.* COOPER, 1983, p. 45, *ex* Inopinatarculinae MUIR-WOOD, 1965a, p. 800]

Small, costellate, foramen small, anterior commissure uniplicate; crural processes large, transverse band fairly broad longitudinally, moderately arched. *Lower Cretaceous (Albian)–Upper Cretaceous (Campanian).*

**Inopinatarcula** ELLIOTT, 1952, p. 2 [**Trigonosemus acanthodes* ETHERIDGE, 1913, p. 15; OD]. Small, subcircular in outline, biconvex, anterior commissure uniplicate; surface finely costellate, costellae with short spines; beak short, suberect; foramen minute, permesothyrid, symphytium triangular, transversely rugose. Cardinal process small, trilobed; socket ridges erect, massive; fulcral plates thick, massive, no outer hinge plates; crural bases concealed beneath thickened socket ridges; crura short, crural processes short; transverse band broad, medially arched. *Lower Cretaceous (Albian)–Upper Cretaceous (Campanian):* Australia, *Santonian–Campanian;* New Zealand, *Albian.*——FIG. 1437,*1a–e. *I. acanthodes* (ETHERIDGE), Senonian, Australia; *a–c,* dorsal, lateral, and anterior views, ×2; *d–e,* dorsal valve, ventral valve interiors, ×2 (Cooper, 1983).

## Family UNCERTAIN

**Pseudokingena** BOESE & SCHLOSSER, 1900, p. 177 [**Terebratulina deslongchampsi* DAVIDSON, 1850c, p. 450; OD]. Small, rounded or quadrate, ventribiconvex; dorsal valve may have shallow sulcus; anterior commissure rectimarginate or slightly folded; shell surface granular, with 2 sizes of tubercles; beak short, palintrope well defined; beak ridges well defined; foramen hypothyrid; deltidial plates narrow, disjunct. Pedicle collar present; dental plates absent; inner shell surface around margins capillate. Cardinalia like those of *Terebratulina;* loop short (about 0.3 dorsal valve length), similar to that of *Eucalathis. Lower Jurassic:* England, France,


FIG. 1438. Uncertain (p. 2162).

Italy.——FIG. 1437,*2a–f.* **P. deslongchampsi* (DAVIDSON), France; *a,* dorsal view, ×4; *b–c,* lateral and anterior views, ×2; *d,* interior of ventral valve, ×2; *e,* interior of dorsal valve, ×4; *f,* ornament, enlarged (Muir-Wood, 1965a).

## Superfamily UNCERTAIN

**Goliathyris** FELDMAN & OWEN, 1988, p. 4 [**G. lewyi;* OD]. Very large, thick shelled, smooth, subpentagonal in outline, concavoconvex or planoconvex, ventral valve almost carinate; strongly unisulcate, foramen small, permesothyrid; beak incurved; cardinal process massive, bilobate; hinge plates weakly differentiated from inner socket ridges, horizontal, becoming concave toward floor of dorsal valve; loop unknown. *Middle Jurassic (Callovian):* Sinai.——FIG. 1438*a–h.* **G. lewyi; a–c,* dorsal, lateral, and posterior views of holotype, GSI M7261a, ×1; *d–h,* serial transverse sections, ×0.5 (Feldman & Owen, 1988).

## INVALID GENERIC NAME ASCRIBED TO BRACHIOPODA

**Eudesites** RIOULT, 1966, p. 74 [**E. deslongchampsia;* OD]. Parageneric name applied to brachiopod spicules.