SYSTEMATIC DESCRIPTIONS

Order FORAMINIFERIDA Eichwald, 1830

[*nom. correct.* T. L. JAHN & F. F. JAHN, 1949, p. 128 (*pro* order Foraminifera CLAPARÈDE & LACHMANN, 1859, p. 432, 434; EICHWALD, 1830 (Zoologia Specialis, v. 2) p. 21)]——[In synonymic citations superscript numbers refer to taxonomic rank assigned by authors (¹class, ²subclass, ³division, ⁴order, ⁵suborder, ⁶section, ⁷family); dagger (†) indicates *partim*]——[¹Foraminifères D'ORBIGNY, 1826, p. 131 (*nom. neg.*); =¹Foraminifères D'ORBIGNY in DE LA SAGRA, 1839, p. xxxi (*nom. neg.*); =⁷Foraminifera PRITCHARD, 1861, p. 201 (*nom. nud.*); =²Foraminiferiae DELAGE & HÉROUARD, 1896, p. 107; =²Foraminifera CALKINS, 1909, p. 38; =⁴Foraminíferos FERNÁNDEZ GALIANO, 1921, p. 26 (*nom. neg.*); =⁴Foraminiferae CHATTON, 1925, p. 76; =⁵Foraminifera MARKS, 1951, p. 377]——[=¹Polythalamiis BREYN, 1732 (*fide* SHERBORN, 1888, p. 18); =⁴Polythalamaceaꝛ DE BLAINVILLE, 1825, p. 375; =⁴Polythalamia EHRENBERG, 1838, p. 197, 200; =³Polythalamia MARRIOTT, 1878, p. 30; =Polythalamien HERTWIG, 1893, p. 158 (*nom. neg.*); =⁵Polythalamia DOFLEIN, 1911, p. 633; =⁵Politálamos FERNÁNDEZ GALIANO, 1921, p. 29 (*nom. neg.*)]——[=⁴Reticularia CARPENTER, 1861, p. 466; =⁴Reticulosa CARPENTER, PARKER & JONES, 1862, p. 17; =⁴Reticulariidaꝛ CALKINS, 1901, p. 106; =Reticulariidae CALKINS, 1909, p. 25]——[=Monothalamiaꝛ HAECKEL, 1862, p. 211; =⁵Monothalamiaꝛ FERNÁNDEZ GALIANO, 1921, p. 28; =⁵Monotálamosꝛ FERNÁNDEZ GALIANO, 1921, p. 28 (*nom. neg.*)]——[=⁴Polypes à rayonsꝛ LAMARCK, 1801, p. 360 (*nom. neg.*); =⁶Polypes coralligenesꝛ LAMARCK, 1801, p. 365 (*nom. neg.*); =Asiphoidea DE HAAN, 1825, p. 20; =Monosomatia EHRENBERG, 1839, table opp. p. 120; =Polysomatia EHRENBERG, 1839, table opp. p. 120; =Testaceaꝛ SCHULTZE, 1854, p. 52; =⁴Athalamiaꝛ SCHMARDA, 1871, p. 160; =⁴Rhizopoda imperforataꝛ SCHMARDA, 1871, p. 162; =Thalamophoraꝛ HERTWIG, 1876, p. 53; =⁴Thalamophoren HERTWIG, 1893, p. 156 (*nom. neg.*); =⁵Amoebaeaꝛ BÜTSCHLI in BRONN, 1880, p. 176; =Rhizopoda reticulosa testacea SCHOUTEDEN, 1906, p. 376; =⁵Arforaminiferia RHUMBLER, 1913, p. 341; =⁴Arreticularia RHUMBLER, 1913, p. 339 (*nom. van.*); =⁴Thalamia DEFLANDRE in GRASSÉ, 1953, p. 139]

Protoplasmic body protected by test composed of one or more interconnected chambers; wall may be imperforate, finely or coarsely perforate, primitively "chitinous," but may be variously modified, and composed of agglutinated particles, or of secreted material, rarely of silica or aragonite, more commonly of calcite, which may be porcelaneous, fibrous, or granular, hyaline-microgranular, or hyaline-radiate in structure, consisting of single layer or with two or more layers and may have canal system of varying complexity; commonly with one or more large openings or apertures in addition to smaller wall perforations which may be present; granuloreticulose pseudopodia protrude from apertures and perforations; reproduction characterized by alternation of asexual and sexual generations, although one generation may be secondarily repressed; gametes commonly flagellate (2-3 flagella) or more rarely amoeboid. [Habitat almost entirely marine to brackish waters but a few may occur in fresh waters; free-living, benthonic or pelagic, or attached to a substratum, rarely parisitic.] *?Precam., Cam.-Rec.*

Suborder ALLOGROMIINA Loeblich & Tappan, 1961

[Allogromiina LOEBLICH & TAPPAN, 1961, p. 217]——[In synonymic citations superscript numbers indicate taxonomic rank assigned by authors (¹order, ²division, ³suborder); dagger (†) indicates *partim*]——[Monothalamiaꝛ SCHULTZE, 1854, p. 52; =Monostomataꝛ SCHULZE, 1877, p. 28; ²Monothalamiaꝛ MARRIOTT, 1878, p. 30; =Monothalamien HERTWIG, 1893, p. 157 (*nom. neg.*); ¹Monothalamiaꝛ HAECKEL, 1894, p. 164; =Monothalamiaꝛ FERNÁNDEZ GALIANO, 1921, p. 21; =Monotálamos FERNÁNDEZ GALIANO, 1921, p. 28 (*nom. neg.*); =¹Archi-Monothalamida CALKINS, 1926, p. 354; =¹Monosomatiaꝛ COPELAND, 1956, p. 183]——[=¹Acystosporésꝛ DELAGE & HÉROUARD, 1896, p. 66 (*nom. neg.*); =¹Acystosporidiaꝛ DELAGE & HÉROUARD, 1896, p. 66; =Amphistomataꝛ AVERINTSEV, 1906, p. 316; =³Uniloculinideaꝛ SIGAL in PIVETEAU, 1952, p. 154]——[=¹Allogromidiaceae HARTOG in HARMER & SHIPLEY, 1906, p. 58; =¹Allogromiida FURSENKO, 1958, p. 22]

Test membranous or pseudochitinous, may have ferruginous encrustations or more rarely small quantities of agglutinated material. *U.Cam.-Rec.*

Superfamily LAGYNACEA Schultze, 1854

[*nom. correct.* LOEBLICH & TAPPAN, 1961, p. 274 (*pro* superfamily Lagynidea SIGAL in PIVETEAU, 1952, p. 154)]——[In synonymic citations superscript numbers indicate taxonomic rank assigned by authors (¹legio, ²family group, ³superfamily); dagger(†) indicates *partim*]——[=²Archi-Monothalamidiaꝛ RHUMBLER in KÜKENTHAL & KRUMBACH, 1923, p. 85; =²Monostomataꝛ RHUMBLER, 1928, p. 3; =³Microcometides POCHE, 1913, p. 175]——[=¹Allogromiidia DE SAEDELEER, 1934, p. 7, 52; =³Allogromioidea CHAPMAN & PARR, 1936, p. 141; =³Allogromiidea POKORNÝ, 1958, p. 158]

Characters of the suborder. *U.Cam.-Rec.*

Within this superfamily some genera are known to possess flagellate gametes and others amoeboid gametes. As so few have yet been studied in culture, the genera are separated into families on the basis of test composition, although, in addition, all those known to have flagellate gametes are placed in the Lagynidae and those with amoeboid gametes in the Allogromiidae.

Family LAGYNIDAE Schultze, 1854

[*nom. correct.* CARPENTER, 1861, p. 458 (*pro* family Lagynida SCHULTZE, 1854, p. 52)]——[In synonymic citations superscript numbers indicate taxonomic rank assigned by authors (¹group, ²family, ³subfamily, ⁴tribe); dagger(†) indicates *partim*] —— [=³Lagyninae GALLOWAY, 1933, p. 41]—— [=Monothalamia amphistomataꝛ HERTWIG & LESSER, 1874, p. 137 (*nom. nud.*); =²Monostominaꝛ LANKESTER, 1885, p. 845 (*nom. nud.*); [=³Monostominae CALKINS, 1901, p. 106 (*nom. nud.*)]——[=²Amoebaea reticulosaꝛ BÜTSCHLI in BRONN, 1880, p. 178 (*nom. nud.*); =²Monocyphiaꝛ VEJDOVSKÝ, 1881, p. 138; =³Plagiophryiinae VEJDOVSKÝ, 1881, p. 138; =²Diplophryidae TARÁNEK, 1882, p. 235; =³Nuditestidaeꝛ RHUMBLER, 1895, p. 93, 94 (*nom. nud.*); =³Myxothecinae RHUMBLER, 1895, p. 79; =³Armyxothecnia RHUMBLER, 1913, p. 343 (*nom. van.*); =¹Perforata BLOCHMANN, 1895, p. 20; =⁴Belariini DE SAEDELEER, 1934, p. 7, 79; =⁴Heterogromiini DE SAEDELEER, 1934, p. 7, 82]——[²Amphistominaꝛ BÜTSCHLI in BRONN, 1880, p. 188 (*nom. nud.*); =²Amphistominaeꝛ DELAGE & HÉROUARD, 1896, p. 116 (*nom. nud.*); =²Amphistomidaeꝛ SCHOUTEDEN, 1906, p. 358 (*nom. nud.*); =³Amphistominae CALKINS, 1933, p. 470 (*nom. nud.*); =³Amphistomini DE SAEDELEER, 1934, p. 8, 86 (*nom. nud.*); =²Anfistómidos GADEA BUISÁN, 1947, p. 16 (*nom. null., nom. neg., nom. nud.*)]——[=Polystomata AVERINTSEV, 1906, p. 129, 322 (*nom. nud.*); =¹Polystomata SCHOUTEDEN, 1906,

p. 373; =[2]Polystomidae Schouteden, 1906, p. 358 *(nom. nud.)*; =[3]Polystominae De Saedeleer, 1934, p. 8 *(nom. nud.)*; =[4]Polystomini De Saedeleer, 1934, p. 8, 83 *(nom. nud.)*]——[=[2]Microcometidae Poche, 1913, p. 175; =[2]Microcometesidae Grospietsch, 1958, p. 35, 57; =[2]Mikrogromiidae De Saedeleer, 1934, p. 7, 68; =[4]Mikrogromiini De Saedeleer, 1934, p. 7, 68; =[2]Microgromiidae Doflein & Reichenow, 1952, p. 730 *(nom. van.)*]

Test small, membranous to pseudochitinous and may have ferruginous encrustations or rarely agglutinated matter; may form colonies; aperture single, or numerous apertures not localized; gametes biflagellate

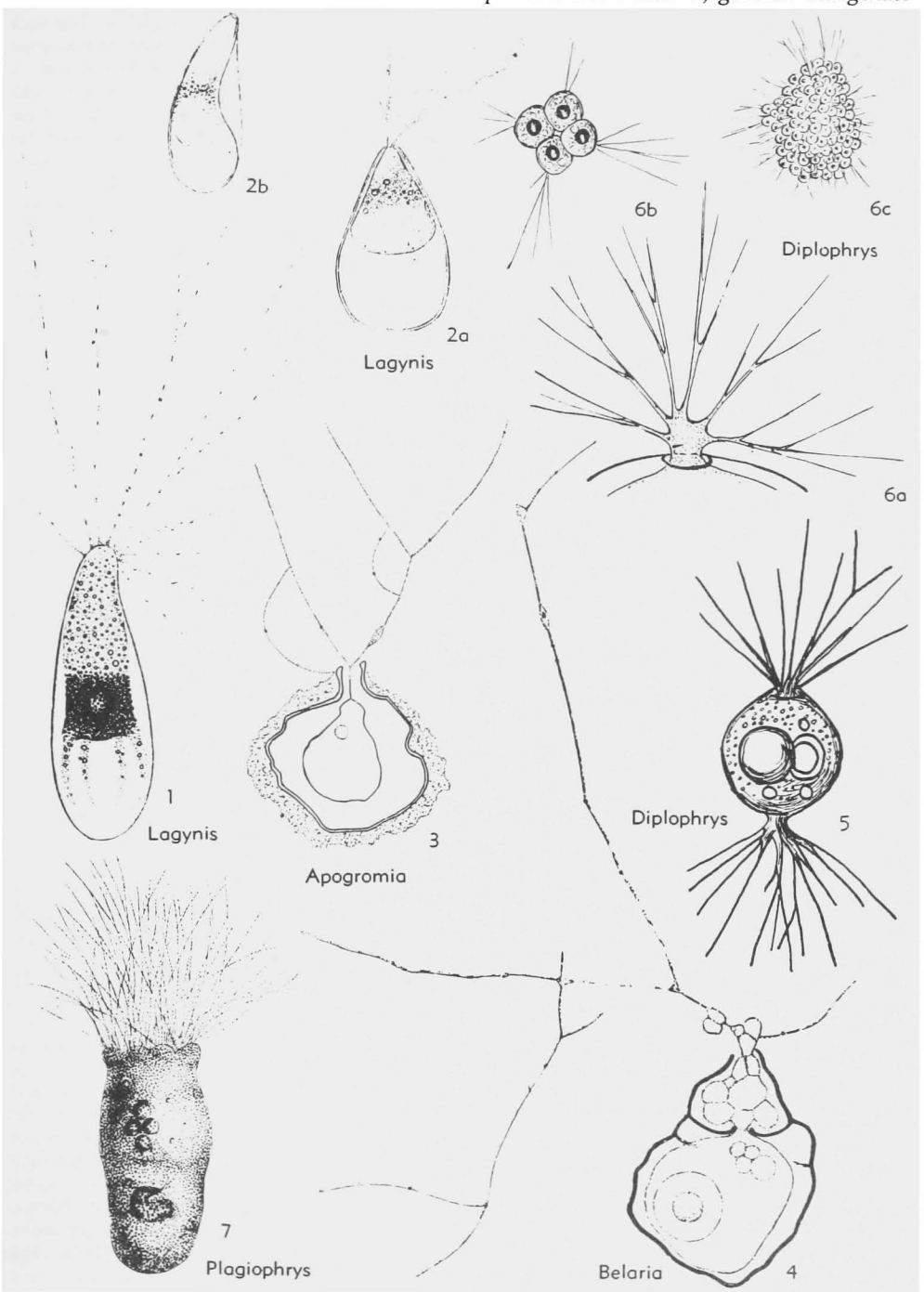

Fig. 84. Lagynidae; *1, 2, Lagynis; 3, Apogromia; 4, Belaria; 5, 6, Diplophrys; 7, Plagiophrys* (p. C166, C170).

(Myxotheca, Nemogullmia, Iridia, Cystophrys?). Rec.

Lagynis SCHULTZE, 1854, *1695, p. 56 [**L. baltica;* OD] [=*Difflugia (Exassula)* EHRENBERG, 1872, *688, p. 245 (type, *Difflugia (Exassula) baltica* SCHULTZE, EHRENBERG, =*Lagynis baltica* SCHULZE, 1854, SD LOEBLICH & TAPPAN, herein, (obj.); *Platoum* SCHULZE, 1875, *1698a, p. 115 (type, *P. parvum* SCHULZE, 1875)]. Test transparent, membranous, hyaline, elastic, elongate and ovate in shape or may be slightly flattened at one side, length 0.05 mm.; aperture small, rounded, terminal to slightly eccentric, with narrow lip; protoplasm not completely filling test, granular, central zone containing dark granules, oral portion being light in color; one or two small contractile vacuoles; nuclei large, light-colored and spherical, nearly filling width of test and located near aboral end; pseudopodia thin, elongate, branching and granular. [Marine.] *Rec.*, Eu.——FIG. 84,*1*. **L. baltica,* Baltic Sea; showing granular protoplasm with band of dark granules, posterior end with only a few bands of protoplasm, not filling test, and elongate granular pseudopodia, ×180 (*1695).——FIG. 84,*2*. *L. parva* (SCHULZE), Baltic Sea; *2a,b,* side and edge views showing test form, large, oval, light-colored nucleus, and dark, granular band of protoplasm, ×800 (*1698a).

Apogromia DE SAEDELEER, 1934, *1609, p. 76 [**Microgromia mucicola* ARCHER, 1877, *34a, p. 121, =*Mikrogromia mucicola* ARCHER, DE SAEDELEER, *1609, p. 76; OD]. Test 8-15μ in length, like *Cystophrys* but without internal septum at neck and therefore with symmetrical pseudopodial trunk. [Fresh water; marine species referred to this genus by some authors belong to *Kibisidytes*.] *Rec.*, Eu.——FIG. 84,*3*. **A. mucicola* (ARCHER), Belg.; with ferruginous coating, ×2,000 (*1609).

Belaria DE SAEDELEER, 1934, *1609, p. 79 [**B. bicorpor*; OD(M)]. Test 13-16μ in length, like *Cystophrys* but with symmetrical septum at base of neck and central perforation for extrusion of pseudopodial trunk; one contractile vacuole. [Fresh water.] *Rec.*, Eu.——FIG. 84,*4*. **B. bicorpor,* Belg.; ×2,000 (*1609).

Boderia WRIGHT, 1867, *2082, p. 335 [**B. turneri;* OD] [=*Arboderium* RHUMBLER, 1913, *1572b, p. 343 (obj.) *(nom. van.)*]. Test conical to platelike, membranous, colorless, length, 1.5-6.0 mm.; protoplasm brown or orange; single large nucleus or more rarely as many as 9 or 10 grouped in 2 clusters; pseudopodia few, commonly 3 or 4, protruding in bundles from openings at angles of platelike membrane; exhibits strong protoplasmic streaming. [Marine.] *Rec.*, N.Sea.——FIG. 90,*2*. **B. turneri;* platelike test and long reticulose pseudopodia; approx. ×3 (*2082).

Cystophrys ARCHER, 1869, *29, p. 259, pl. 17 [**C. haeckeliana*=*Gromia socialis* ARCHER, 1869, *30, p. 322, *31, p. 390; OD] [=*Mikrogromia* HERTWIG, 1874, *917, p. 33 (type, *Gromia socialis* ARCHER, 1869) (obj.); *Microgromia* ARCHER 1876, *32, p. 343 *(nom. van.)*]. Test small, length 25-35μ, spherical to pyriform, circular in section, may occur in colonies or small groups; aperture circular, terminal, commonly produced on short neck which is internally provided with asymmetrical septum resulting in asymmetrical development of pseudopodial trunk; protoplasm granular, only partially filling test; one contractile vacuole; pseudopodia elongate, may bifurcate or anastomose and arise from a distinct pseudopodial trunk; reproduction by longitudinal or transverse division and also by development of biflagellate "zoospores." [Although commonly referred to *Mikrogromia* (or its erroneous emendation *Microgromia*) the generic name *Cystophrys* clearly has priority. ARCHER originally included two species, *C. haeckeliana* and *C. oculea,* and although the type was not designated in the text it was effectively determined in the original publication by the citation as *gen. et sp. nov.* for *C. haeckeliana* and only *sp. nov.* for *C. oculea* on the explanation for plate 17.] [Fresh water.] *Rec.*, Eu.——FIG. 85,*1-3*. **C. haeckeliana*; Brit.I. *(1)*, Belg. *(2)*, Ger. *(3)*; *1a,* solitary individual, ×300; *1b,* colony, ×250 (*302a); *2,* individual showing internal septum, ×2,000 (*1609); *3,* loosely aggregated colony with one specimen *(a)* showing transverse division, approx. ×250 (*917).

Diplophrys BARKER, 1868, *81, p. 123 [**D. archeri;* OD (M)]. Test thin, hyaline, spherical and homogeneous, diam., 8-20μ, with simple circular aperture at each pole, may form colonies up to 30-60μ diam. which have amoeboid movement and may divide; protoplasm colorless, transparent, granular; single nucleus with single nucleolus; several contractile vacuoles and oil globules always present; pseudopodia elongate, radiating, straight or bifurcating, protruding from both apertures; reproduction by fission or tetrad division. [Fresh water.] *Rec.*, Eu.——FIG. 84,*5,6*. **D. archeri,* Ger. *(5)*, Neth. *(6)*; *5,* side view of single specimen, approx. ×1,000 (*921); *6a,* apert. part of test with pseudopodia, ×1,500; *6b,* tetrad division, ×600; *6c,* colony of small embryonic individuals, ×600 (*957).

Echinogromia SCHRÖDER, 1907, *1676, p. 345 [**E. multifenestrata;* OD] [=*Arechinogromium* RHUMBLER, 1913, *1572b, p. 344 (obj.) *(nom. van.)*]. Test spherical, or rarely blunt-triangular, wall membranous, hyaline, thickness approx. 2μ; diam., 0.5-1.0 mm.; 4 to 8 circular apertures with rim 16-20μ thick, outer secondary sheath with diam. approx. 3 mm., not closely attached to test, composed of abundant sponge spicules which show traces of protoplasm, probably from pseudopodia; protoplasm completely filling test, not differentiated into ecto- and endoplasm; 1 to 4 nuclei, approximately 0.2 mm. diam., no nucleoli; pseu-

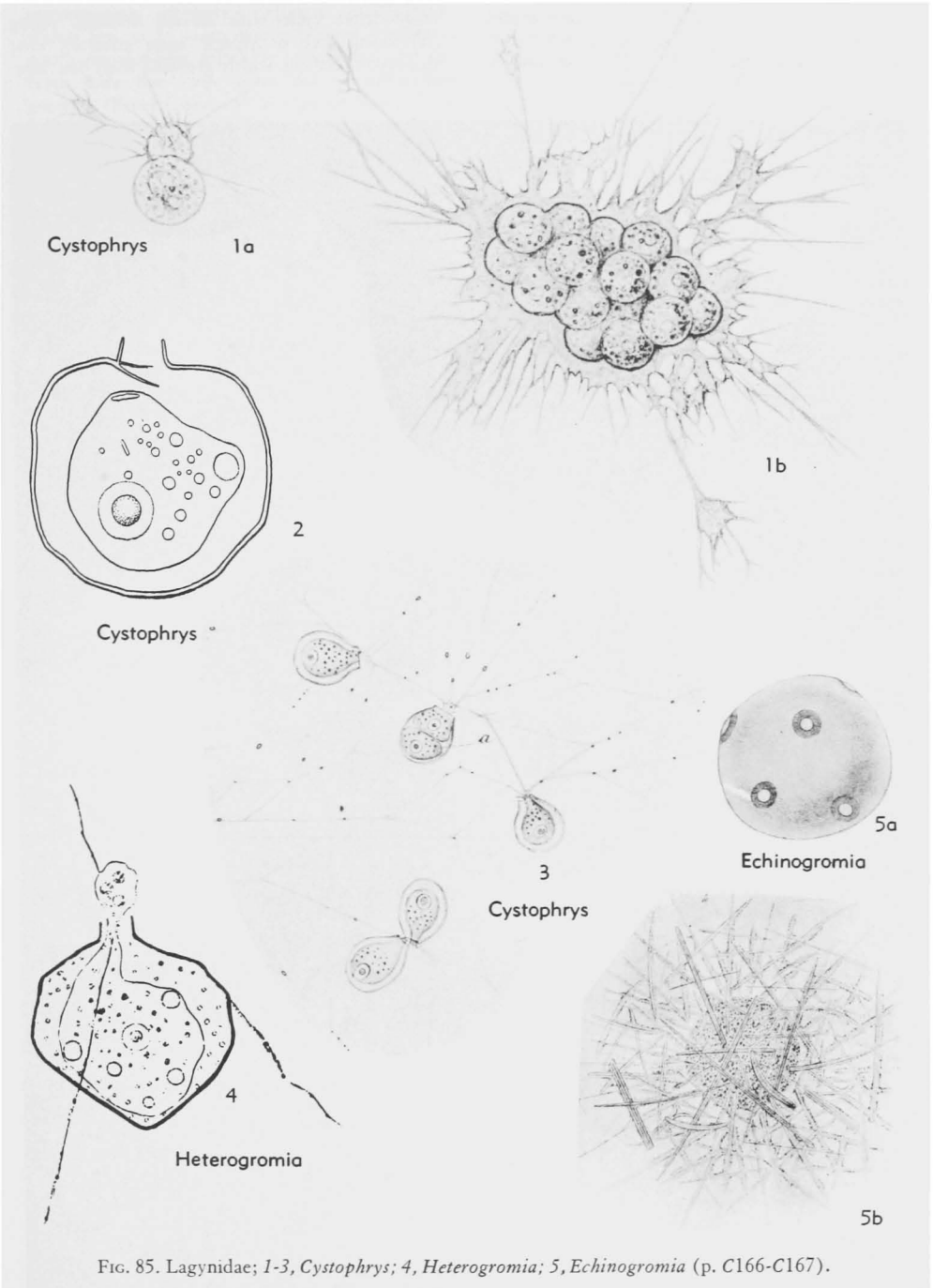

FIG. 85. Lagynidae; *1-3, Cystophrys; 4, Heterogromia; 5, Echinogromia* (p. C166-C167).

dopodial character unknown. [Marine.] *Rec.*, Antarctic.——FIG. 85,*5*. **E. multifenestrata; 5a*, test showing apertures, ×25; *5b*, specimen with outer sheath, ×15 (*1676).

Heterogromia DE SAEDELEER, 1934, *1609, p. 82 [**H. intermedia;* OD]. Test 9-11μ in length, like *Apogromia* but with numerous peripheral contractile vacuoles. [Fresh water.] *Rec.*, Eu.——FIG. 85,*4*. **H. intermedia*, Belg.; ×2,000 (*1609).

Iridia HERON-ALLEN & EARLAND, 1914, *910a, p. 371 [**I. diaphana;* OD]. Test attached, hemispherical or irregularly dome-shaped chamber with short irregularly tubular or branching projections; wall pseudochitinous or with some agglutinated

material on pseudochitinous base; apertures at ends of tubular projections; pseudopodia in adult elongate, bifurcating, and arising from stomostyle; reproductive cycle with asexual division, young developing free or pelagic stage ensuring their dispersion, during which globular body has non-

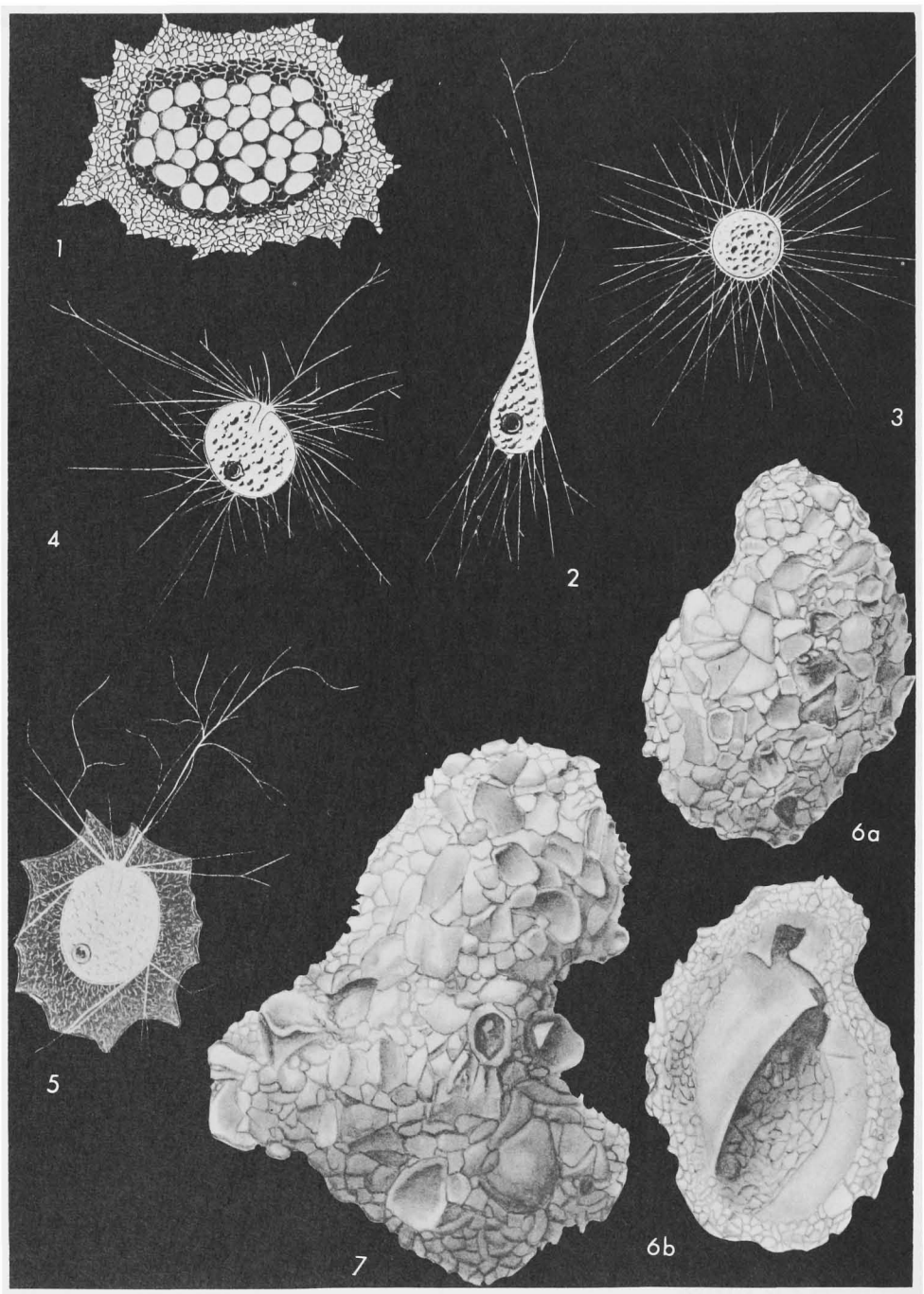

FIG. 86. Lagynidae; *1-7, Iridia* (p. C167-C169).

anastomosing, elongate, radiating pseudopodia; within few to 24 hours young become benthonic, resorb pseudopodia, attach to substratum, and develop test; this stage gives rise to biflagellate gametes (flagella unequal in length) which after fusion give rise to adult schizont indistinguishable from gamont (*1104). [Previously this genus has been placed with attached Saccamminidae (*486) or Astrorhizidae (*762). Here it is assigned to the Lagynidae because of its basically pseudochitinous test, stomostyle, and biflagellate gametes. Somewhat similar Allogromiidae have amoeboid gametes.] *Rec.,* Afr.-Carib.-Medit.——Fig. 86,*1-5*. **I. diaphana,* Medit.; *1,* detached adult schizont from beneath, showing asexually formed young, ×25; *2,* embryo after leaving parent test, showing pseudopodial trunk, ×135; *3,* pelagic stage with radiating pseudopodia, ×150; *4,* beginning of benthonic sedentary stage, showing stomostyle and normal pseudopodia, ×115; *5,* attached stage with small pseudopodia in process of test construction, normal pseudopodia extending beyond, ×115 (*1104). Fig. 86,*6,7*. **I. diaphana,* Madag.Str. (Kerimba Arch.); *6a,b,* upper and lower surfaces of empty test, showing agglutinated covering; *7,* irregular test, ×49 (*2117).——Fig. 87. *I. lucida* Le Calvez, Medit.; biflagellate gamete. ×6,000 (*1103).

Kibisidytes Jepps, 1934, *991, p. 125 [**K. marinus;* OD (M)]. Test small, saclike, brown, length, 10-14μ, commonly with ferruginous surface encrustation; aperture single, rounded; protoplasm opaque, only partially filling test; nucleus single; no contractile vacuole; pseudopodia delicate; granular, branching, but fairly short; reproduction by binary fission. [Lives in surface film of sea water or attached to floating objects in sea.] *Rec.,* Eu.——Fig. 88,*5*. **K. marinus,* Scot.; *5a,b,* living specimens showing test variation; *5c,* stained specimen showing nucleus, ×1,575 (*991).

Microcometes Cienkowski, 1876, *341, p. 46 [**M. paludosa;* OD]. Simple, rounded, membranous, transparent and pliable test which may have irregular, brown ferruginous crust, diam. 7-22μ, with 3 to 5 openings; protoplasm opaque, occupying about half interior of test and containing food inclusions; central nucleus; 1 to 6 contractile vacuoles; pseudopodia long, delicate, branching, granular. [Fresh water, among algae.] *Rec.,* Eu.——Fig. 88,*1,2*. **M. paludosa,* USSR *(1),* Brit.I. *(2)*; *1,* ×1,000 (*341); *2,* ×1,450 (*991).

Myxotheca Schaudinn, 1893, *1640, p. 18 [**M. arenilega;* OD]. [=*Armyxothecum* Rhumbler, 1913, *1572b, p. 343 (obj.) *(nom. van.)*]. Basically spherical to hemispherical form, diam., 0.16-0.56 mm., with gelatinous covering; commonly with loosely attached sand grains or other foreign matter; protoplasm granular, reddish, lacking separation into ecto- and endoplasm; single, large nucleus (39-75μ diam.); pseudopodia may appear at any position, up to 4 or 5 cm. in length, granular, and exhibit streaming. [Marine.] *Rec.,* Eu.——Fig. 89,*1*. **M. arenilega,* Adriatic Sea; *1a,* contracted specimen showing partially agglutinated upper surface covering; *1b,* same with altered form, from opposite lower side, showing extended pseudopodia and central nucleus; *1c,* transv. sec. showing nucleus, agglutinated upper surface, and clear lower surface, approx. ×300 (*1640).

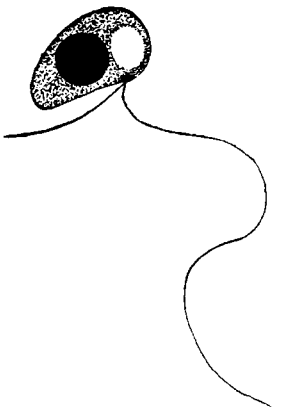

Fig. 87. Lagynidae; *Iridia* (p. C167-C169).

Nemogullmia Nyholm, 1953, *1375, p. 105 [**N. longevariabilis;* OD]. Test free or in empty worm tubes and foraminiferal tests, elongate, 1.6-19.0 mm. in length, smooth, transparent, white or pale red, chitinoid, straight or convoluted, may have constrictions in wall and bear some agglutinated detritus; temporary small apertures at ends of test; protoplasm opaque, commonly containing oil droplets; one or more nuclei; pseudopodia reticulose; reproduction by means of biflagellate gametes which develop within test after apertures are temporarily closed, multinucleate individuals reproducing by fission, specimens with single nucleus giving rise to gametes. [Marine.] *Rec.,* Eu.——Fig. 90,*4,5*. **N. longevariabilis,* Sweden (Gullmar Fjord); *4,* agglutinated detritus on elongate test, ×5 (*1378); *5,* specimen showing pseudopodia extending from apertures at ends of test, ×1.4 (*1375).

Ophiotuba Rhumbler, 1894, *1568a, p. 604 [**O. gelatinosa;* OD] [=*Arophiotubum* Rhumbler, 1913, *1527b, p. 350 (obj.) *(nom. van.)*]. Test, 2-5 mm. in length, firm convoluted membrane, rigid and chitinoid in appearance, without agglutinated matter, filling large empty tests of other foraminifers in which they are suspended by threadlike filaments, end of tube extending through aperture of sheltering test, with numerous radiating branches which are also protected by rigid membrane and may be individually convoluted; protoplasm reticulate under high magnification; nuclei small and numerous. [Marine.]

Rec., N.Atl.-N.Sea.——Fig. 90,*3*. **O. gelatinosa*, N.Atl.; convoluted body within empty test (*s*) of *Saccammina*, showing threadlike filaments (*f*) by which it is suspended and branching terminus of test (*t*), ×50 (*1568a).

Plagiophrys Claparède & Lachmann, 1859, *345,

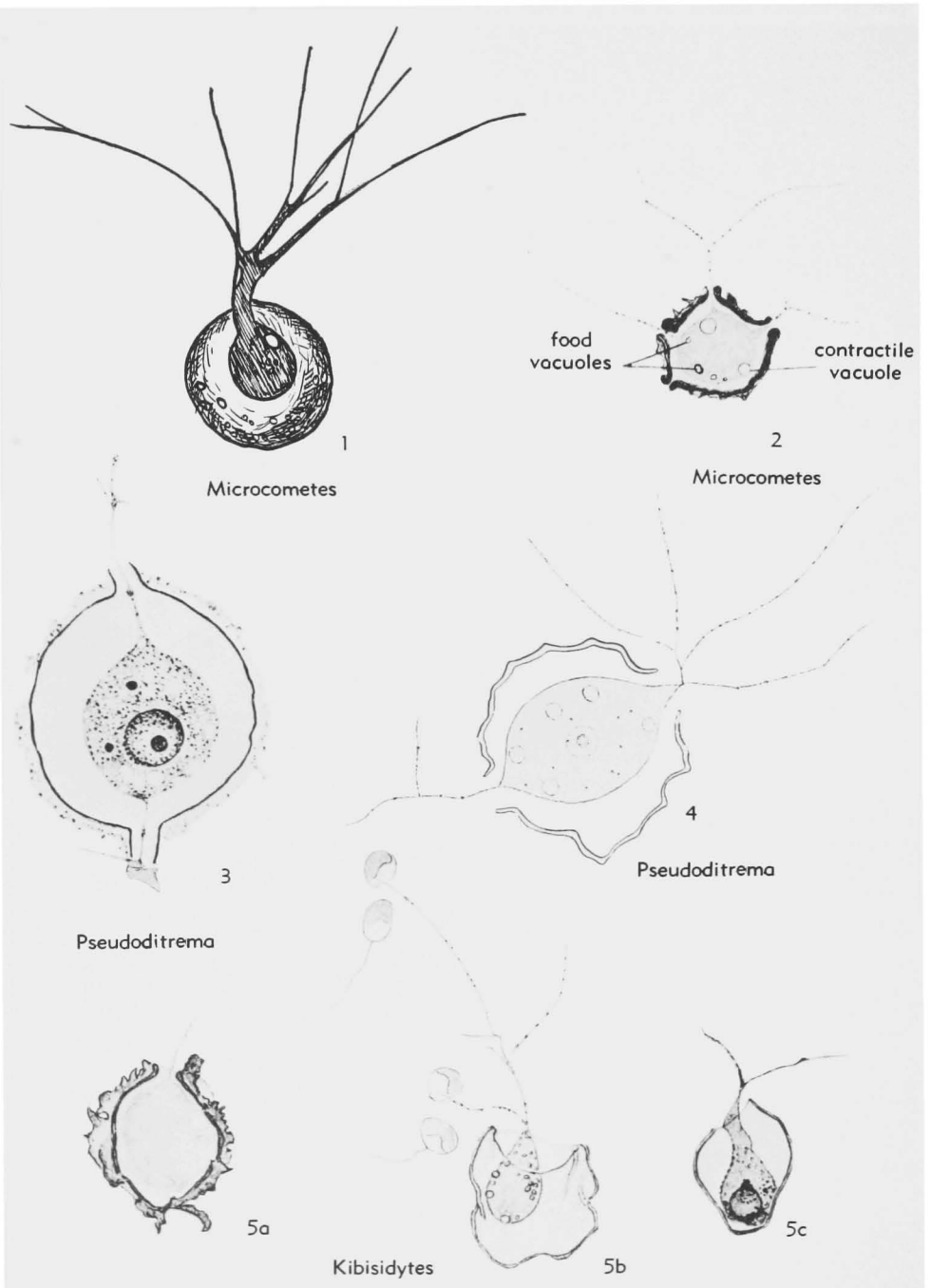

Fig. 88. Lagynidae; *1,2, Microcometes; 3-4, Pseudoditrema; 5, Kibisidytes* (p. C169, C172).

p. 453 [**P. cylindrica*; SD RHUMBLER, 1904, *1569, p. 200] [=*Arplagiophrum* RHUMBLER, 1913, *1572b, p. 343 (obj.) *(nom. van.)*]. Test membranous, flexible, approx. 0.13 mm. in length, elongate, sides subcylindrical, apertural margin scalloped; pseudopodia numerous, filose, granular; nucleus and contractile vacuole unknown. [?Fresh water.] *Rec.*, ?Ger.——FIG. 84,7. **P. cylindrica;* side view, approx. ×160 (*700).

[*Plagiophrys* was described in Berlin from a bottle of water and algae of unknown source; two originally included species were *P. cylindrica* and *P. spherica*. Some later references to the type-species seem questionable. PENARD (1902, *1435, p. 442) stated that *P. cylindrica* might belong to *Diaphorodon* and that *P. spherica* was identical to *Pamphagus hyalinus* (=*Lecythium*), but de-

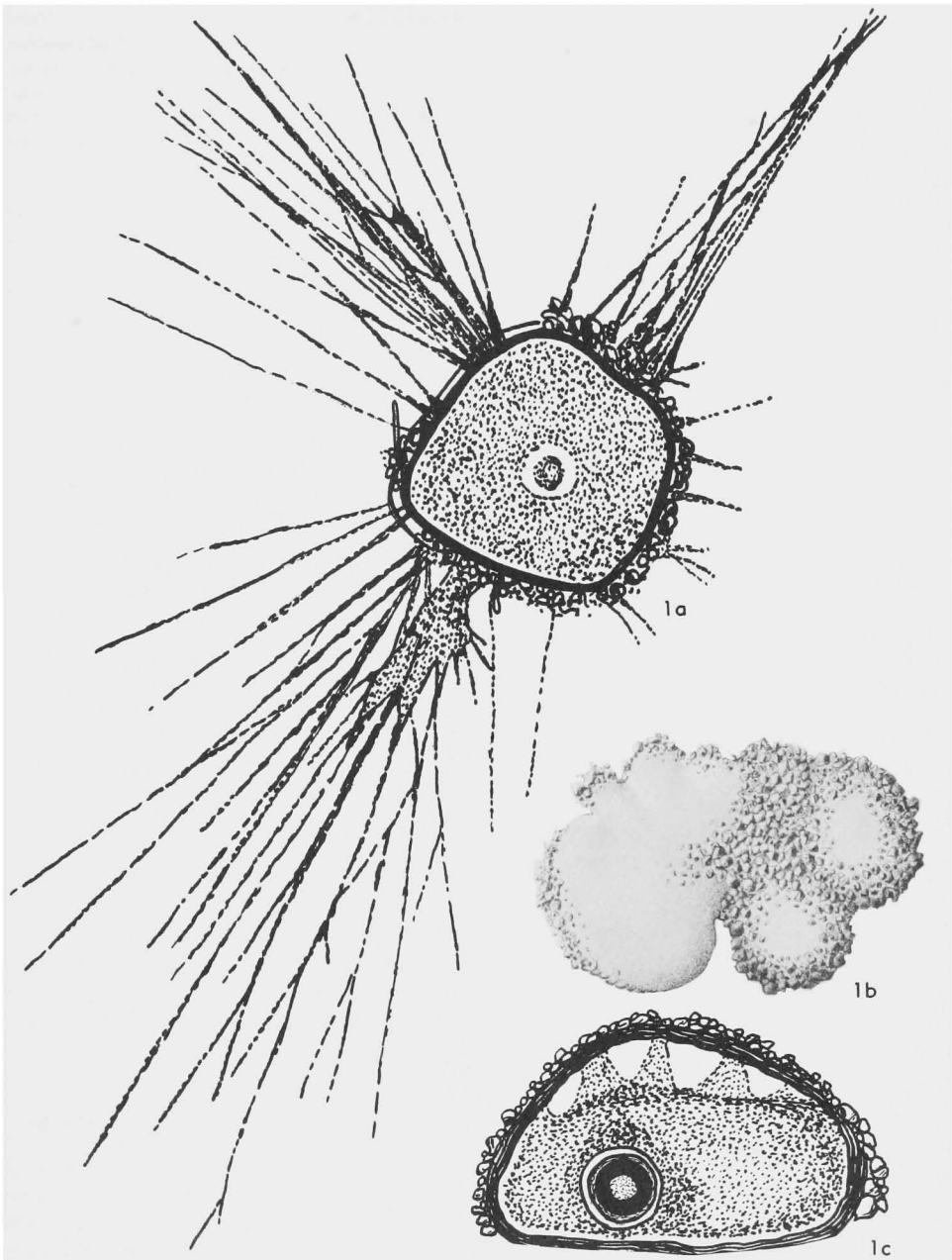

FIG. 89. Lagynidae; *1, Myxotheca* (p. C169).

scribed a new species as *Plagiophrys parvipunctata*. DEFLANDRE in GRASSÉ (1953, *810, p. 137) regarded *P. parvipunctata* as the only species belonging to the genus, but this species was not in the original list of species. RHUMBLER was correct in designating *P. cylindrica* as type.]

Pseudoditrema DEFLANDRE in GRASSÉ, 1953, *810, p. 143 [**Ditrema mikrous* DE SAEDELEER, 1934, *1609, p. 89; OD]. Similar to *Microcometes* but with only 2 opposite apertures; test 9-25μ in

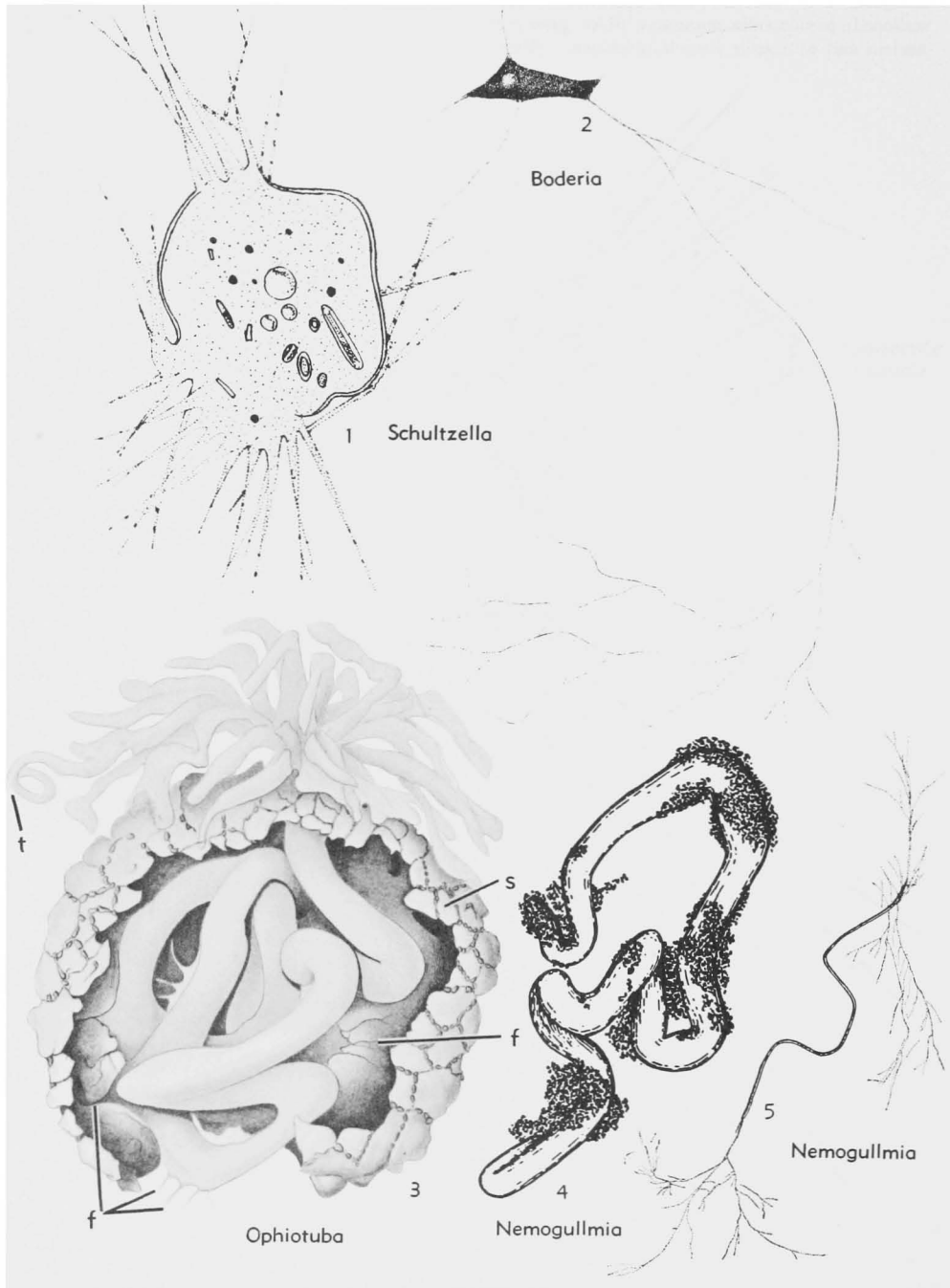

FIG. 90. Lagynidae; *1, Schultzella; 2, Boderia; 3, Ophiotuba; 4,5, Nemogullmia* (p. C166, C169-C170, C173).

length, ferruginous coating may occur; protoplasm partly filling test, containing numerous granules and contractile vacuoles; pseudopodia very thin, elongate, bifurcating and anastomosing. [Fresh water.] *Rec.,* Eu.——Fig. 88,*3,4*. **P. mikrous* (De Saedeleer), Eng. *(3),* Belg. *(4)*; *3,* living specimen (regarded as *Microcometes paludosa*); ×1,450 (*991); *4,* living specimen, ×2,000 (*1609).

Rhumblerinella Schmidt, 1929, *1674, p. 353 [**R. bacillifera;* OD]. Test irregular, ellipsoidal or spherical, 0.7 mm. in length; superficial layer of protoplasm contains numerous small, elongate, calcite spicules approx. 5μ long secreted by animal, densely packed and apparently without binding cement, some foreign matter may be agglutinated outside this plasma layer; no distinct aperture; large round nucleus with firm birefractive membrane; pseudopodia elongate, fine, with pronounced granular streaming, may be produced from any portion of test, but are predominantly around lateral margins. [Marine.] *Rec.,* Eu. (N.Sea).——Fig. 91,*1*. **R. bacillifera,* Helgoland; *1a,* entire specimen, ×47; *1b,* margin with pseudopodia, ×80; *1c,* isolated calcite spicules in polarized light, ×800 (*1674).

Schultzella Rhumbler, 1904, *1569, p. 197 [**Lieberkühnia diffluens* Gruber, 1884, *833, p. 484; OD] [=*Schultzia* Gruber, 1888, *834, p. 36 (obj.) (*non* Grimm, 1876; *nec* Graff, 1882); *Arschultzellum* Rhumbler, 1913, *1572b, p. 343 (obj.) *(nom. van.)*]. Test globular or hemispherical, diam. 0.22 mm., gelatinous, without foreign material; protoplasm finely granular, colorless; nuclei small, numerous; several vacuoles and oil globules; pseudopodia may protrude in any position through irregular holes in gelatinous cover. [Marine.] *Rec.,* Eu.——Fig. 90,*1*. **S. diffluens* (Gruber), Italy; ×150 (*1569).

Family ALLOGROMIIDAE Rhumbler, 1904

[*nom. correct*. Schouteden, 1906, p. 374 (*pro* family Allogromida Averintsev, 1906, p. 324, *nom. transl. ex* subfamily Allogromiinae Rhumbler, 1904, p. 202)]——[In synonymic citations superscript numbers refer to taxonomic rank assigned by authors (¹family, ²subfamily, ³tribus); dagger(†) indicates *partim*]——[=¹Monostominaꝑ Lankester, 1885, p. 845 *(nom. nud.)*; ¹Nuditestiidaeꝑ Rhumbler, 1895, p. 93, 94 *(nom. nud.)*; =²Monostominaeꝑ Calkins, 1901, p. 106 *(nom. nud.)*; =²Crateritininae Rhumbler, 1904, p. 196 (=Allogromiinae); =²Arrogromnia Rhumbler, 1913, p. 343 *(nom. van.)*;=²Rhynchogromiinae Galloway, 1933, p. 52; =²Lieberkuehniinae De Saedeleer, 1934, p. 7, 64; =³Lieberkuehniini De Saedeleer, 1934, p. 7, 64; =³Pleurophryini De Saedeleer, 1934, p. 7, 60; =³Allelogromiini De Saedeleer, 1934, p. 7, 67; =¹Allogromidae Dogel, 1951, p. 464 *(nom. van.)*; =¹Allogromiida Copeland, 1956, p. 183 *(nom. van.)*; =¹Alexandrellidae E. V. Bykova, 1958, p. 881 *(nom. nud.)*; =¹Maylisoriidae E. V. Bykova, 1961, p. 20]

Test pseudochitinous or with agglutinated matter on pseudochitinous base; forms known to show alternation of generations (e.g., *Allogromia*) have amoeboid gametes. *U.Cam.-Rec.*

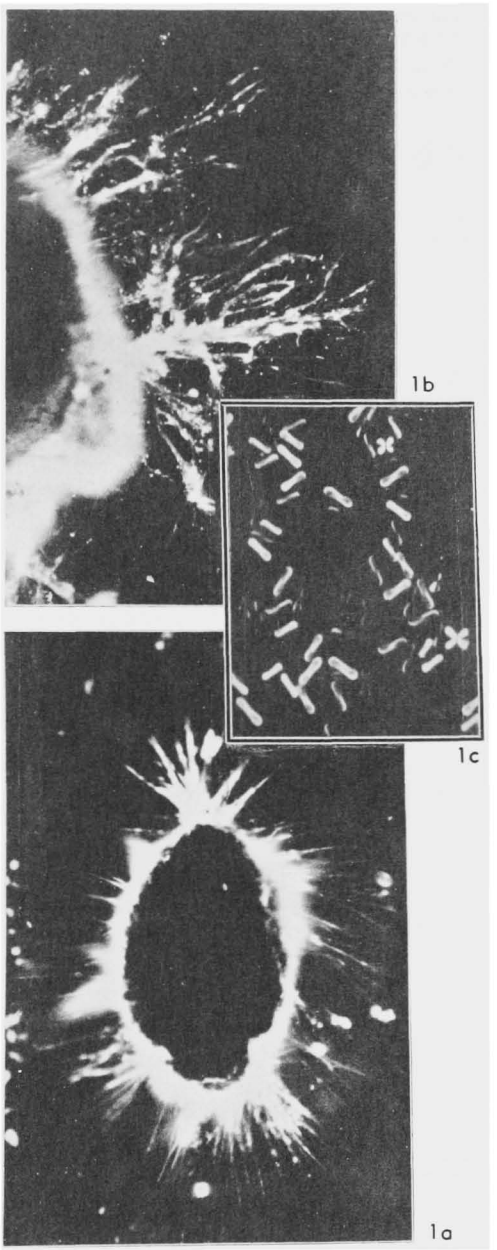

Fig. 91. Lagynidae; *1, Rhumblerinella* (p. C173).

Allogromia Rhumbler, 1904, *1569, p. 203 [**Craterina mollis* Gruber, 1884, *833, p. 488; OD] [=*Craterina* Gruber, 1884, *833, p. 488 (obj.) (*non* Curtis, 1826; *nec* Bory de St. Vincent, 1827); *Arrogromium* Rhumbler, 1913, *1572b, p. 343 (obj.) *(nom. van.)*]. Test free,

ovate to spherical, with thin pseudochitinous test, 0.08-0.5 mm. in length, may have agglutinated foreign matter; aperture terminal, rounded, with entosolenian tube serving as sheath for pseudopodial trunk; pseudopodia granular, much elongate and anastomosing, with typical protoplasmic streaming; reproduction both by asexual schizogamy and sexual, with production of amoeboid

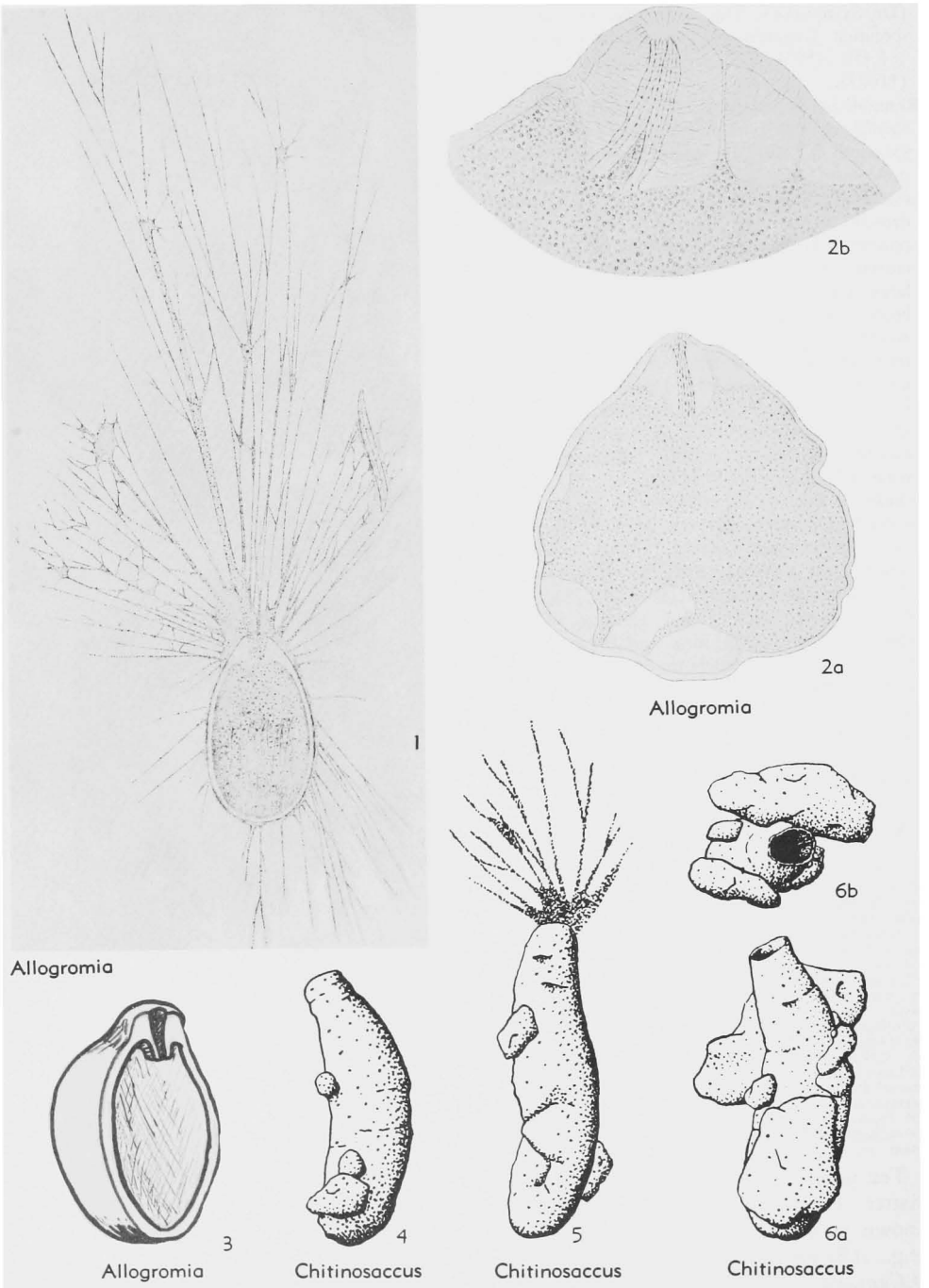

FIG. 92. Allogromiidae; *1-3, Allogromia; 4-6, Chitinosaccus* (p. C173-C176).

gametes but haploid and diploid adults morphologically similar. [Marine and fresh water.] *Rec.*, Eu.-N.Am.——Fig. 92,*1*. *A. ovoidea* Rhumbler, Adriatic Sea; anastomosing pseudopodia arising from pseudopodial trunk, ×35 (*1695).——Fig. 92,*2*. **A. mollis* (Gruber), Italy; *2a*, living example, ×100; *2b*, enlargement showing inverted aperture (*833).——Fig. 92,*3*. *A. laticollare* Arnold, USA(Fla.); diagram. sec. of test to show entosolenian tube or peduncular sheath, enlarged (*40).

[Wailes in Cash, Wailes and Hopkinson (1915, *302a, p. 138) stated that Dujardin's *Gromia fluvialis*, 1837, should be considered as type of *Allogromia*. De Saedeleer (1934, *1609, p. 55) concluded that *G. fluvialis* Dujardin, 1837, was also typically filose and thus belonged to the Gromiidae and he designated the granuloreticulose *G. fluviatilis* Dujardin, 1841, as type-species of *Allogromia*. However, Rhumbler (1904, *1569, p. 203) did not describe a new genus, but specifically stated that *Allogromia* was a *nom. nov.* for *Craterina* Gruber. The type-species must therefore be the same as that of *Craterina* Gruber (*C. mollis* Gruber) as stated by Rhumbler (*1569, p. 204).]

Archaeochitinia Eisenack, 1954, *694, p. 54 [**A. gotlandica;* OD]. Test free, unilocular, semiglobular; wall chitinous; aperture consisting of small pores or openings at end of short tubuli. *L.Sil.*, Eu.——Fig. 93,*1*. **A. gotlandica*, Llandov., Sweden(Gotl.); *1a*, side view, ×140; *1b*, apertures, enlarged (*694).

Archaeochitosa Eisenack, 1959, *695, p. 91 [**A. lobosa*; OD]. Test pseudochitinous membrane, forming single irregular chamber; one or more circular to oval apertures at ends of tubular extensions from central portion. *Ord.-Jur.*, Eu.——Fig. 93,*2*. **A. lobosa*, Ord. (Echinosphaeritenkalk), Est.; ×50 (*695).

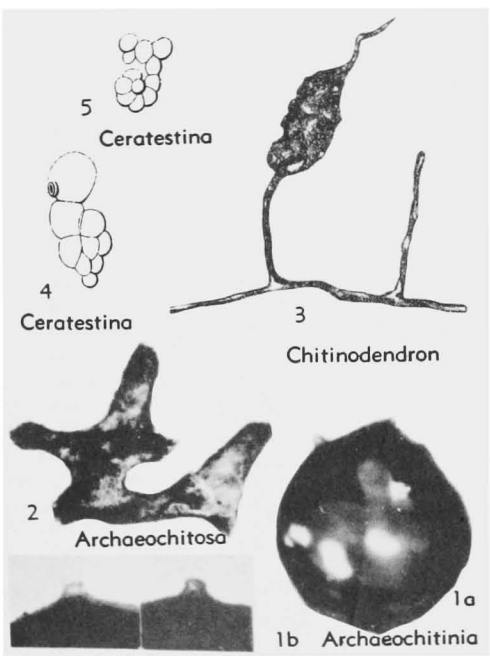

Fig. 93. Allogromiidae; *1, Archaeochitinia; 2, Archaeochitosa; 3, Chitinodendron; 4, 5, Ceratestina* (p. C175).

Fig. 94. Allogromiidae; *Chitinolagena* (p. C175).

Ceratestina Carter, 1880, *296, p. 448 [**C. globularis;* SD Galloway, 1933, *762, p. 294]. Similar to *Placopsilinella* in having dark brown pseudochitinous wall and attached, subglobular, irregularly arranged chambers, but differing in presence of stoloniferous intercameral connections and stoloniferous extensions from final chamber; differs from *Hospitella* in being attached but not parasitic, and in having more closely, less regularly arranged chambers. *Rec.*, Ind.O.——Fig. 93,*4,5*. **C. globularis*, *4,5*, entire individuals, approx. ×25 (*296).

[The original figures and description of this genus are quite similar to *Placopsilinella*, but as the types of *Ceratestina* were not found (stated to be in Liverpool Free Museum, but apparently destroyed during World War II) both genera are tentatively recognized, though additional material may prove their identity. Specimens of the type-species of *Placopsilinella* do not show the stoloniferous features described for *Ceratestina*.]

Chitinodendron Eisenack, 1937, *693b, p. 236 [**C. bacciferum;* OD]. Thin pseudochitinous branching tubes, which terminate in oval saclike chambers that commonly are axially symmetrical. *U.Cam.-Sil.*, USA-Eu.(Est.-Ger.).——Fig. 93,*3*. **C. bacciferum*, M.Ord.(Llanvirn.), Est.; ×60 (*693b).

Chitinolagena E. V. Bykova, 1961, *260, p. 31 [**C. gutta;* OD]. Test unilocular, with inflated base and wide elongated neck; wall chitinoid, dark brown, of labyrinthine structure; aperture terminal. [*Chitinolagena* is here recognized as a foraminifer, as interpreted by Bykova, but possibly should be placed with the Chitinozoa which it strongly resembles in form.] *U.Ord.(Caradoc.)*, USSR(Kazakh.).——Fig. 94. **C. gutta;* holotype, long. sec., ×330 (*2112).

Chitinosaccus Smitter, 1956, *1802, p. 285 [**C. zuluensis;* OD]. Test irregular, elongate, cylindrical sac, 0.65 mm. in length; pseudochitinous, somewhat flexible, with some foreign matter,

colorless to reddish-brown; aperture terminal, rounded, single; protoplasm filling test; pseudopodia branching and anastomosing. [Brackish water, sublittoral.] *Rec.*, S.Afr.——Fig. 92,*4-6*. **C. *zuluensis*,* Zululand; *4,5*, empty test and one with protruding pseudopodia; *6a,b*, side, top views, approx. ×60 (*1802).

Dactylosaccus Rhumbler, 1894, *1568a, p. 601

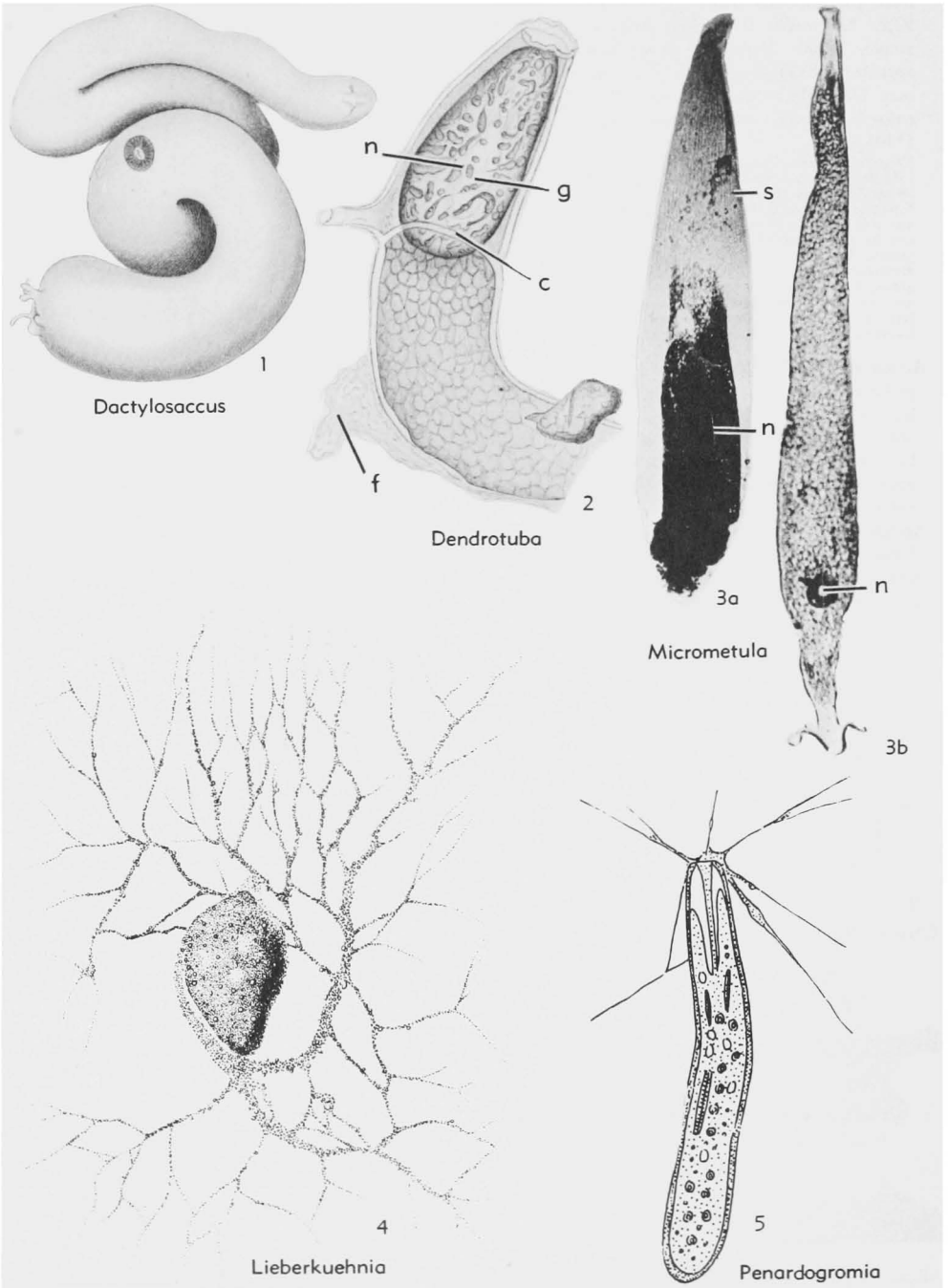

Fig. 95. Allogromiidae; *1, Dactylosaccus; 2, Dendrotuba; 3, Micrometula; 4, Lieberkuehnia; 5, Penardogromia* (p. C176-C177, C179, C181).

[**D. vermiformis;* OD] [=*Ardactylosaccum* RHUMBLER, 1913, *1572b, p. 343 (obj.) *(nom. van.)*]. Free-living or inhabiting empty foraminiferal tests; elongate, to 4 mm. in length, hyaline, chitinoid; sausage-shaped or convoluted tube, enlarging somewhat toward apertural end, from which lobose protuberances extend giving rise to pseudopodia; protoplasm with small vacuoles; 1 or 2 globular nuclei. [Marine, 40-250 m.] *Rec.*, N.Atl.-N.Sea.——FIG. 95,*1*. **D. vermiformis*, N.Atl.; ×45 (*1568a).

Dendrotuba RHUMBLER, 1894, *1568a, p. 606 [**D. nodulosa;* OD] [=*Ardendrotubum* RHUMBLER, 1913, *1572b, p. 350 (obj.) *(nom. van.)*]. Test, 0.7-5.0 mm. in length, growing inside empty foraminiferal tests and attached by rigid and tough threadlike filaments, tube much convoluted, may be branched, even in size except for some knotlike swellings; wall resistant, chitinoid sheath with ringlike constrictions; ends of tube tapering or clavate; nucleus single, large, approximately as wide as protoplasmic body, diam. 87-138μ, variable in position. [Marine, cold water.] *Rec.*, N.Atl.——FIG. 95,*2*. **D. nodulosa;* portion of tube with central constriction *(c)*, threadlike filaments *(f)*, large ovoid nucleus *(n)* and chromatin granules in nucleus *(g)*, ×250 (*1568a).

Diplogromia RHUMBLER, 1904, *1569, p. 214 [**Gromia brunneri* BLANC, 1886, *145, p. 362; SD CUSHMAN, 1928, *439, p. 60] [=*Ardiplogromium* RHUMBLER, 1913, *1572b, p. 344 (obj.) *(nom. van.)*; *Allelogromia* DE SAEDELEER, 1934, *1609, p. 67 (obj.)]. Test free, ovoid or pyriform, length, 0.06-0.25 mm.; wall 0.02 mm. thick, composed of small siliceous particles and foreign matter held in gelatinous cement; aperture terminal, round, extensible; protoplasm yellowish and extending from aperture in asymmetrical pseudopodial peduncle, protoplasmic body covered with fairly thick mucilaginous layer which separates it from external test and which apparently was originally regarded as an inner hyaline layer, though no trace of such 2-layered character can be seen in thin sections (*1437, p. 69); nucleus large, spherical, may have many smaller nuclei; vacuoles small, generally numerous; pseudopodia numerous, long, commonly anastomosing. [Fresh water.] *Rec.*, Eu.——FIG. 96,*1*. **D. brunneri* (BLANC), Switz.; ×110 (*1569).

Hospitella RHUMBLER, 1911, *1572a, p. 92, 227 [**H. fulva*; OD (M)] [=*Arhospitellum* RHUMBLER, 1913, *1572b, p. 440 (obj.) *(nom. van.)*; *Hospitellum* RHUMBLER, 1913, *1572b, p. 468 (obj.) *(nom. van.)*]. Test attached, pseudochitinous, brownish, imperforate, commonly occurring in empty tests of other foraminifers; chambers globular to ovate or flask-shaped with stoloniferous necks, in uniserial or irregularly branching arrangement, or may be closely piled on each other, influenced by size and shape of cavities in occupied test, neck and aperture may pierce shell of this test. [Differs from *Placopsilinella* in flask-shaped chambers and apparently parasitic habit. The type-species, regarded as fixed by monotypy as *H. fulva*, is the only described species included by RHUMBLER; *H. fusca* was mentioned (*1572a, p. 227) but not described and thus is a *nomen nudum*.] *Rec.*, Atl.——FIG. 97,*2*. **H. fulva;* ×95 (*1572a).

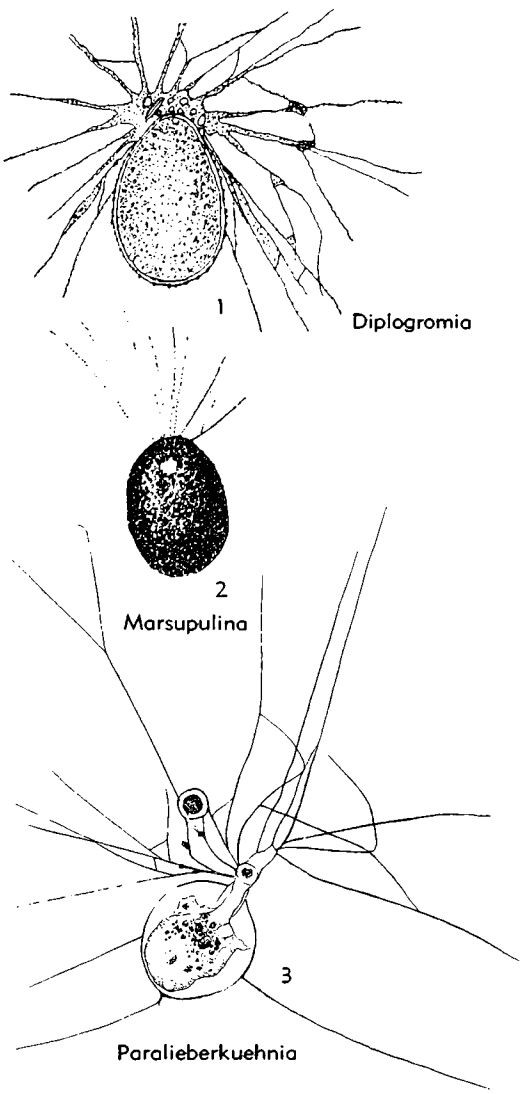

FIG. 96. Allogromiidae; *1, Diplogromia; 2, Marsupulina; 3, Paralieberkuehnia* (p. C177, C179, C181).

Labyrinthochitinia E. V. BYKOVA, 1961, *260, p. 58 [**L. tastikoliensis;* OD]. Test free or attached, subglobular to subellipsoidal, with inner partitions resulting in numerous somewhat indistinct cham-

berlets that intercommunicate by labyrinthine canals; wall thin, dark brown, chitinoid, labyrinthic in structure; no aperture other than canal-like wall openings. *U.Ord.(Caradoc.)*, USSR(N. Kazakh.).——Fig. 98,*1,2*. **L. tastikoliensis; 1*, holotype, *2*, paratype, ×330 (*2112).

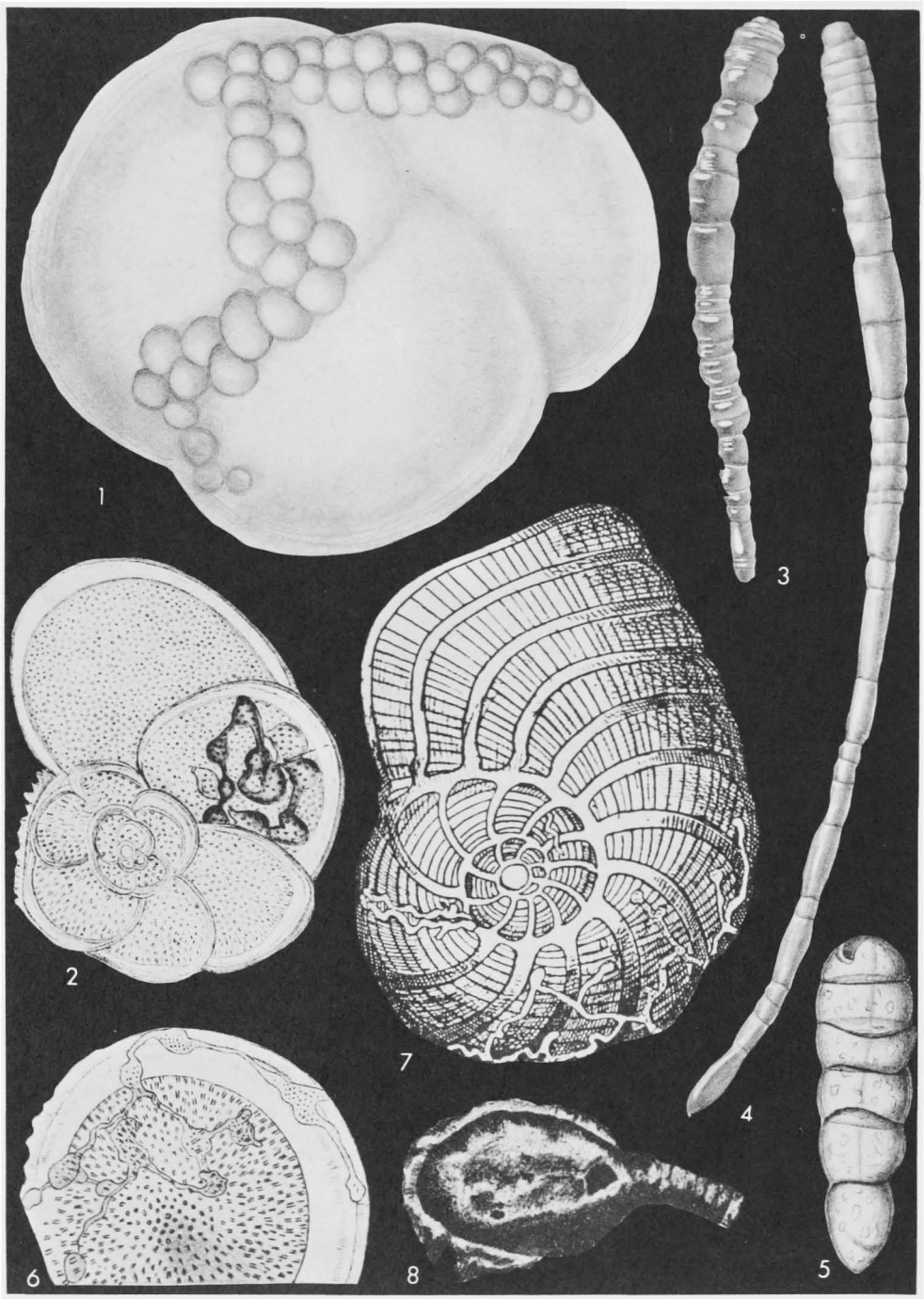

Fig. 97. Allogromiidae; *1, Placopsilinella; 2, Hospitella; 3, 4, Nodellum; 5, Turriclavula; 6, 7, Thalamophaga; 8, Xenotheka* (p. C177, C179-C181, C183).

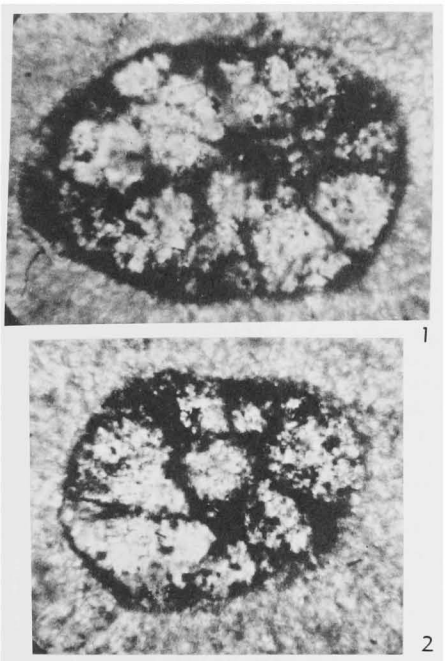

FIG. 98. Allogromiidae; *1,2, Labyrinthochitinia* (p. C177-C178).

Lieberkuehnia CLAPARÈDE & LACHMANN, 1859, *345, p. 464 [**L. wagneri*; OD (M)] [=*Arlieberkuehnium* RHUMBLER, 1913, *1572b, p. 343 (obj.) *(nom. van.)*]. Test 60-350μ in length, oval or spherical, membranous, smooth or thinly covered with foreign matter; aperture single, lateral or subterminal, may be narrow slit; protoplasm clear, slightly yellowish, distinctly granular with ribbon-like pseudopodial trunk extending through aperture and giving rise to pseudopodia or layer of protoplasm that may almost envelop test; one to many spherical nuclei, 80-150 in type-species; numerous contractile vacuoles; pseudopodia elongate, anastomosing, with pronounced granular streaming; reproduction by fission. [Fresh water and marine.] *Rec.*, Eu.——FIG. 95,*4. **L. wagneri* (bottle of water in Berlin from unknown source); approx. ×100 (*281).

Marsupulina RHUMBLER, 1904, *1569, p. 249 [**M. schultzei*; OD (M)] [=*Armarsupium* RHUMBLER, 1913, *1572b, p. 349 *(nom. van.)* (obj.)]. Test ovate, ellipsoid or reniform, 0.2 mm. in length; wall chitinoid, may be partially or wholly covered with deposit of amorphous, granular calcite; aperture rounded, eccentric; nucleus single; pseudopodia granulose. [Marine.] *Rec.*, Eu.——FIG. 96,*2. **M. schultzei*, Medit.(Italy); ×60 (*1569).

Maylisoria E. V. BYKOVA, 1961, *260, p. 31 [**M. pseudoscheda*; OD] [=*Alexandrella* E. V. BYKOVA, 1958, *259, p. 880 *(nom. nud.)* (*non* CHEVREUX, 1911; *nec* TONNOIR, 1926)]. Test free, irregularly ovate; wall thick, yellowish or brownish-gray, chitinoid and microgranular, labyrinthine in structure, pierced by narrow tubular pores or canals; without aperture other than tubular canals. *U.Ord. (Caradoc.)*, USSR(C.Kazakh.).——FIG. 99,*1,2. **M. pseudoscheda; 1a*, holotype, ×330; *1b*, diagram showing structure; *2*, paratype, ×330 (*2112).

Micrometula NYHOLM, 1952, *1374, p. 15 [**M. hyalostriata*; OD]. Test elongate, 0.7-1.2 mm. in length, tapering, imperforate, hyaline and chitinoid with fine longitudinal striations; rounded aperture at larger end, smaller temporary opening may be present at opposite end; cytoplasm without inclusions, although some detrital particles may accumulate at aperture; one nucleus. [Marine.] *Rec.*, Eu.——FIG. 95,*3. **M. hyalostriata*, Sweden(Gullmar Fjord); *3a*, side view showing striated test *(s)* and nucleus *(n)*, ×100; *3b*, long. sec. showing nucleus *(n)*, ×110 (*1374).

Nodellum RHUMBLER, 1913, *1572b, p. 443, 473 [**Reophax membranacea* BRADY, 1879, *196a, p. 53; OD] [=*Arnodellum* RHUMBLER, 1913, *1572b, p. 443 (obj.) *(nom. van.)*; *Chitinosiphon* THALMANN & BERMÚDEZ, 1954, *1906, p. 53 (type, *C. rufescens* THALMANN & BERMÚDEZ, 1954)]. Test free; oval proloculus followed by elongate, curved, and slightly enlarging tube with irregularly spaced transverse constrictions; wall thin, translucent, brown, pseudochitinous; aperture rounded, at slightly constricted end of tube. *Rec.*,

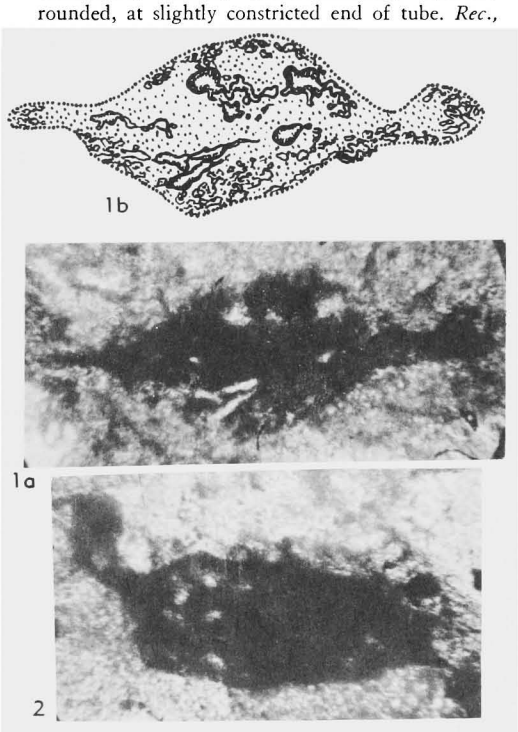

FIG. 99. Allogromiidae; *1,2, Maylisoria* (p. C179).

Atl.O.——Fig. 97,*3,4*. **N. membranacea* (Brady); *3*, topotype, S.Atl.; ×65 (*2117); *4*, holotype, refigured, of *C. rufescens* Thalmann & Bermúdez, ×50 (*2117).

[Because *Nodellum* was described as chambered and with sand grains attached to chitinoid wall, *Chitinosiphon* was recently proposed. Not only are the genera synonymous, but their type-species are identical. No attached sand occurs on topotypes of *Reophax membranacea*, hence pos-

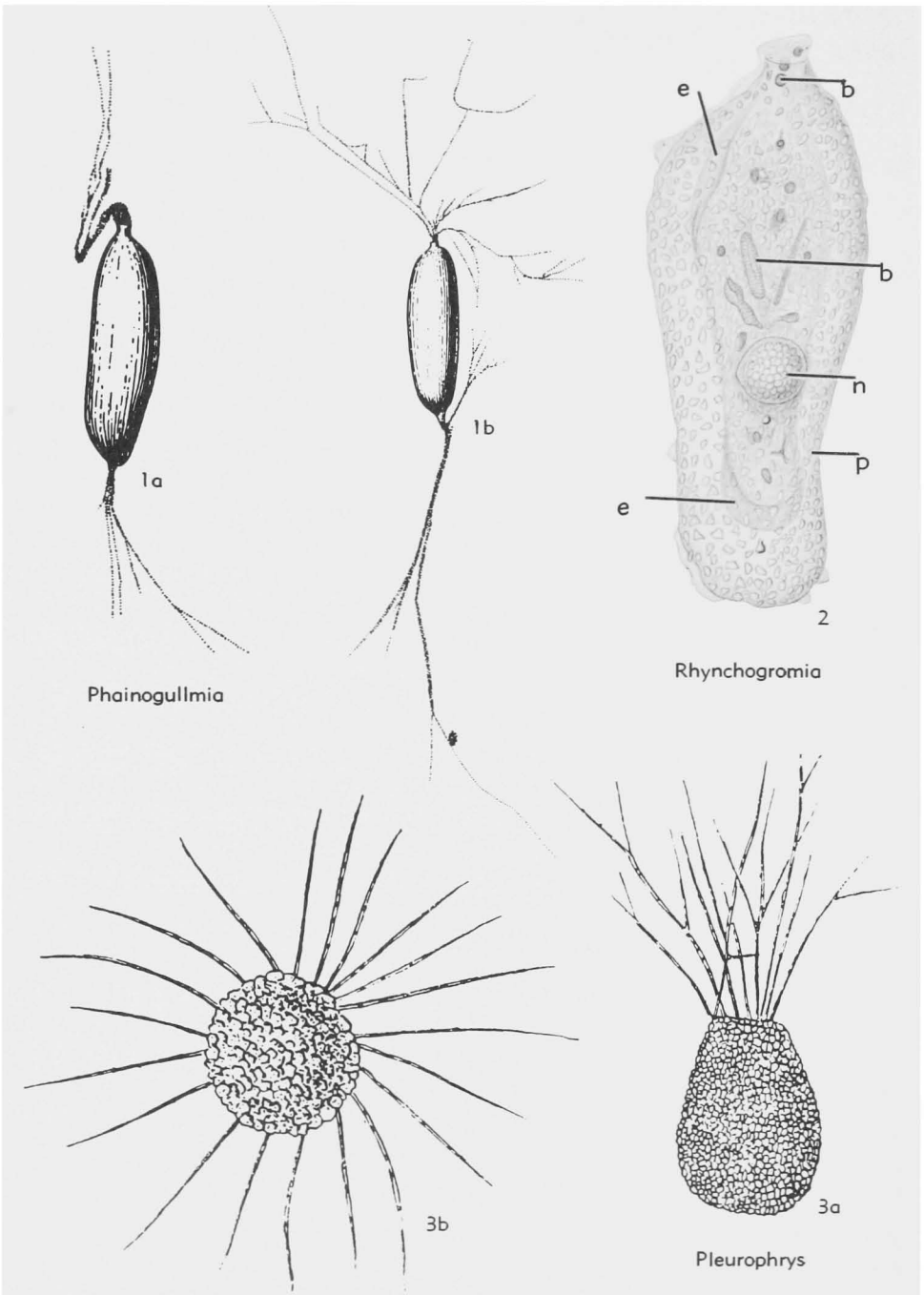

Fig. 100. Allogromiidae; *1, Phainogullmia: 2, Rhynchogromia; 3, Pleurophrys* (p. C181).

sibly extraneous material was originally mistaken for an agglutinated test. The specimens illustrated for *Chitinosiphon* include the holotype of *C. rufescens*, 3.14 mm. in length, and paratypes 1.49 to 2.9 mm. in length, the type of *R. membranacea* being about 1.4 mm. in length. Both type-species were described from deep water in the Atlantic.]

Paralieberkuehnia DE SAEDELEER, 1934, *1609, p. 52 [**Microgromia elegantula* PENARD, 1904, *1436, p. 416, OD] [=*Faralieberkuehnia* DE SAEDELEER, 1932, *1375, p. 619 *(nom. nud.)*]. Test, 20-25μ in length, thin, hyaline, pseudochitinous, rounded; protoplasm encloses brilliant grains, only partially filling test as globular mass, restricted toward aperture into pseudopodial trunk; nucleus subcentral; very large contractile vacuole near base of pseudopodial trunk; pseudopodia very fine, straight, long, granular and exhibit slow granular streaming. [Fresh water.] *Rec.*, Eu.——FIG. 96,*3*. **P. elegantula* (PENARD), Belg.; specimen with strong pseudopodial trunk and elongate pseudopodia, ×500 (*1609).

Penardogromia DEFLANDRE in GRASSÉ, 1953, *810, p. 140 [**Gromia linearis* PENARD, 1902, *1435, p. 567; OD (M)]. Test elongate, 220-230μ in length, tubular or fusiform, straight to slightly arcuate, thin, delicate, translucent, yellowish, consisting of extremely small platelets in clear groundmass, suggesting small longitudinal striations; aperture terminal; protoplasm yellowish, constricted toward aperture into distinct pseudopodial trunk; nucleus spherical, with large nucleoli, more rarely as many as 20 nuclei; small contractile vacuole; pseudopodia anastomosing and filamentous, extending from trunk. [DEFLANDRE cited the type-species as *"Gromia linearis* var. Penard, 1902," but in 1902 PENARD described no form under this name, only *"Gromia linearis* spec. nov."] [Fresh water.] *Rec.*, Eu.——FIG. 95,*5*. **P. linearis* (PENARD), Switz.; approx. ×250 (*1435).

Phainogullmia NYHOLM, 1955, *1377, p. 466 [**P. aurata;* OD]. Test cylindrical, 0.2-1.4 mm. in length, tapering at both ends, yellowish-brown, glossy, opaque, consisting of chitinoid lamellae; aperture at each end of test; food vacuoles in protoplasm; single nucleus; pseudopodia reticulose, extending from both apertures; asexual reproduction by formation of numerous nuclei, each accumulating protoplasm and becoming a new embryo, no sexual reproduction observed. [Marine.] *Rec.*, Eu.——FIG. 100,*1*. **P. aurata*, Sweden (Gullmar Fjord); *1a,b*, partially and fully extended pseudopodia, ×75 (*1377).

Placopsilinella EARLAND, 1934, *653, p. 95 [**P. aurantiaca;* OD]. Test tiny, commonly attached to other foraminifers; wall pseudochitinous, with some ferruginous cement; numerous rounded, plano-convex chambers, commonly arranged in double row, single row, or rarely with 3 chambers abreast, but without regularity in mode of increase or decrease, and without definite arrangement; no visible aperture nor evidence of communication between chambers. *Rec.*, Atl.——FIG. 97,*1*. **P. aurantiaca* (hypotype BMNH ZF3659), ×218 (*2117).

[A single specimen found by EARLAND showed an apparent early spiral development of the chambers, and he therefore considered the genus related to *Placopsilina*. However, this was apparently an accidental arrangement, since none of the other specimens show any indication of coiling. The composition of the wall also seems to exclude this genus from the Placopsilinidae, as likewise absence of an aperture or opening between chambers, and the complete absence of regularity of chamber arrangement. Because of the pseudochitinous wall, it is here placed in the Allogromiidae. It differs from *Ceratestina* and *Hospitella* in the absence of any visible aperture or stoloniferous intercameral necks.]

Pleurophrys CLAPARÈDE & LACHMANN, 1859, *345, p. 454 [**P. sphaerica*; OD (M)]. Test ovate, length, 30-72μ, of organic matter in which small foreign bodies and sand grains are cemented; aperture rounded; protoplasm wholly filling test; pseudopodia reticulose, granular. [*Lithocolla* SCHULTZE, 1874, regarded as a synonym of this genus (*762, p. 45), is now considered to be a heliozoan]. [Fresh water and marine.] *Rec.*, Eu. ——FIG. 100,*3*. **P. sphaerica*, Ger.; *3a,b*, side and basal views, approx. ×300 (*1609).

Rhynchogromia RHUMBLER, 1894, *1568a, p. 590 [**R. variabilis;* OD] [=*Arrhynchogromium* RHUMBLER, 1913, *1572b, p. 344 (obj.) *(nom. van.)*]. Test elongate-ovate, 0.28-0.92 mm. in length; wall single-layered, containing numerous elongate or platelike secreted bodies and some foreign matter; living in tests of other foraminifers; aperture at one end of test, second aperture rarely at opposite end; 1 to 3 globular nuclei. [Marine.] *Rec.*, N.Sea-N.Atl.——FIG. 100,*2*. **R. variabilis*, N.Atl.; showing nucleus *(n)*, ectoplasm *(e)*, foreign bodies *(b)* and secreted platelets *(p)*, ×220 (*1568a).

Rhynchosaccus RHUMBLER, 1894, *1568a, p. 595, 600 [**R. immigrans;* OD] [=*Arrhynchosaccum* RHUMBLER, 1913, *1572b, p. 344 (obj.) *(nom. van.)*]. Test ovate to elongate, length, 0.24-0.9 mm., rounded at ends, may be somewhat inflated toward apertural margin; wall thin, elastic, homogeneous, thickened toward aperture and with inverted entosolenian tube; similar apertures may occur at both ends; parasitic in tests of larger foraminifers or may occur in empty tests; nucleus globular. [Marine.] *Rec.*, N.Atl.-N.Sea.——FIG. 101,*1,2*. **R. immigrans*, N.Atl. *(1)*, France *(2)*; *1*, showing nucleus *(n)* and foreign bodies *(b)*, ×64 (*1568a); *2a,b*, transv. and long. secs. of apert. end showing entosolenian tube, ×200 (*1102).

Saedeleeria LOEBLICH & TAPPAN, 1960, *1175, p. 196 [**Gromia gemma* PENARD, 1899, *1434, p. 86; OD]. Test ovate to pyriform, 0.2-0.6 mm. in length, with thick, white, double-layered wall, outer layer with cemented, granular siliceous inclusions and inner, hyaline layer, homogeneous and thickened at aperture which is rounded, terminal, asymmetrical, and inverted; protoplasm yellowish, clear and colorless toward aperture where it extends as pseudopodial trunk; single large spherical nucleus, to 50μ in diam., or, rarely, more than one; pseudopodia long, numerous, anastomosing. [Fresh water.] *Rec.*, Eu. ——FIG. 101,*3,4*. **S. gemma* (PENARD), Switz.

(Lake Leman); *3,* exterior showing pseudopodia, approx. ×100; *4,* sectioned specimen showing 2-layered wall, protoplasmic body, and inverted neck, enlarged (*1434).

Shepheardella SIDDALL, 1880, *1737, p. 131 [**S. taeniformis;* OD] [=*Shepheardia* SIDDALL, 1880, *1737, pl. 15 *(nom. null.)*; *Arshepheardellum* RHUMBLER, 1913, *1572b, p. 343 (obj.) *(nom. van.)*; *Tinogullmia* NYHOLM, 1954, *1376, p. 36 (type, *T. hyalina*)]. Test elongate, 1.0-7.5 mm. in length, tubular, straight to slightly arcuate, tapering at both ends, wall firm, flexible, trans-

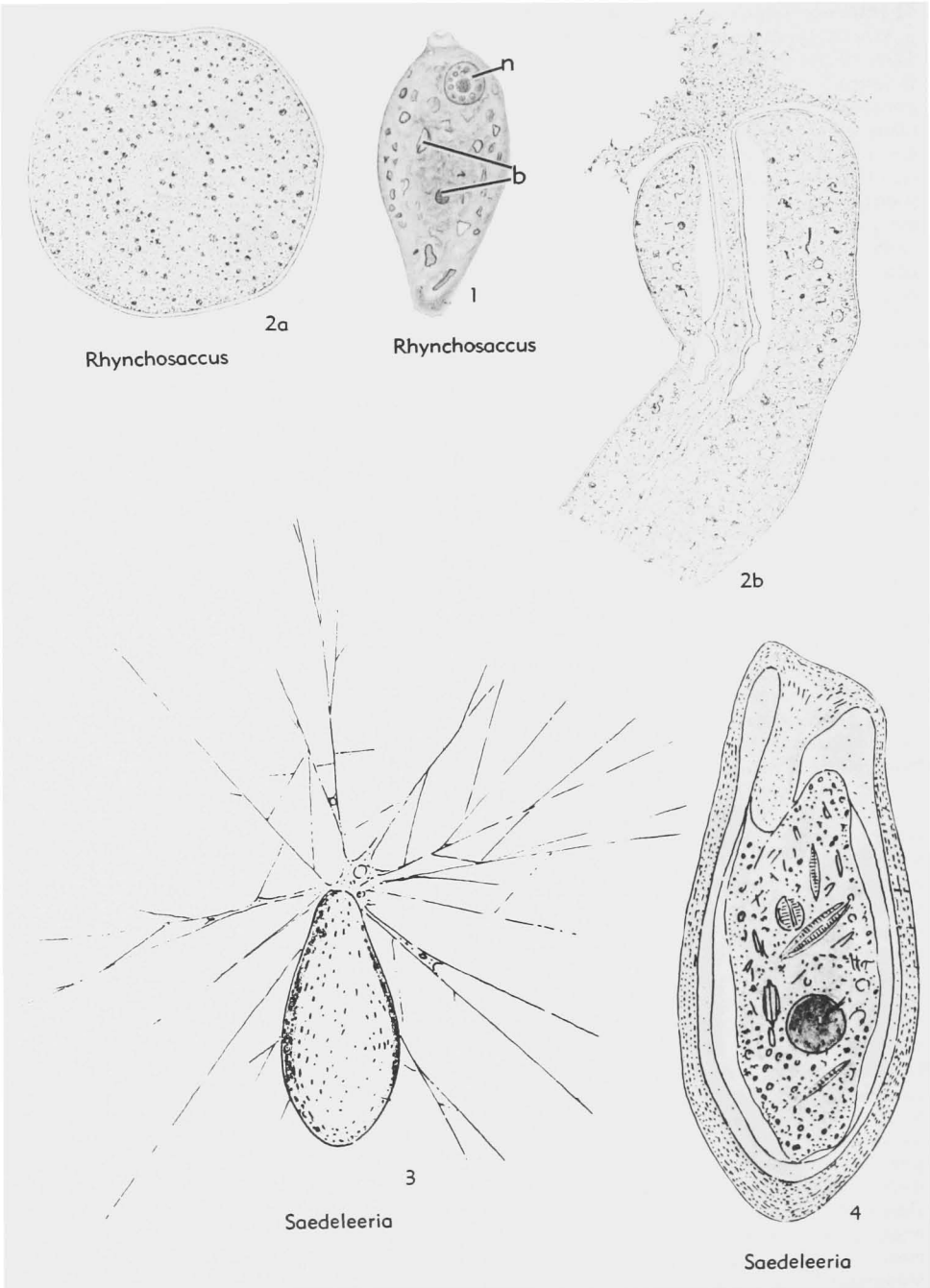

FIG. 101. Allogromiidae; *1, 2, Rhynchosaccus; 3, 4, Saedeleeria* (p. C181-C182).

parent, colorless, chitinoid; small aperture at each end; protoplasm yellowish, coarsely granular, with pronounced streaming, accumulating in small lump at each end and thinly coating exterior of test also; pseudopodia extending in outspread network from both apertures, rapid streaming within pseudopodia. [SIDDALL described the central oval body as a nucleus, but NYHOLM stated that the similar oval body in *Tinogullmia* was a vacuole and that the nucleus was visible only in sections.] [Marine.] *Rec.*, Eu.——FIG. 102,*1*. **S. taeniformis*, Eng.; *1a*, side view of slender test and long, branched pseudopodia, ×12; *1b*, aperture, ×170 (*1737).

Thalamophaga RHUMBLER, 1911, *1572a, p. 229 [**T. ramosa*; SD LOEBLICH & TAPPAN, herein] [=*Orbitophage* SCHLUMBERGER, 1903, *1663, p. 276 (*nom. neg.*); *Orbitophaga* RHUMBLER, 1911, *1572a, p. 230 (type, *O. ramosa*, =*Thalamophaga ramosa* RHUMBLER, 1911, SD, LOEBLICH & TAPPAN, herein, obj.); *Marsupophaga* RHUMBLER, 1911, *1572a, p. 231 (type, *M. ramosa*, =*Thalamophaga ramosa* RHUMBLER, 1911, SD, LOEBLICH & TAPPAN, herein, obj.); *Tubophaga* RHUMBLER, 1911, *1572a, p. 232 (type, *T. ramosa*, =*Thalamophaga ramosa* RHUMBLER, 1911, SD, LOEBLICH & TAPPAN, herein, obj.); *Nummophaga* RHUMBLER, 1911, *1572a, p. 232 (type, *N. ramosa*, =*Thalamophaga ramosa* RHUMBLER, 1911, SD, LOEBLICH & TAPPAN, herein, obj.); *Arthalamophagum* RHUMBLER, 1913, *1572b, p. 440 (obj.)]. Attached forms which burrow in test of other foraminifers and consist of inflated, irregular chambers 2-8μ in diam., connected by stolon-like tubes which may branch and may resorb calcite of occupied test so that very thin chitinoid wall of "parasite" merely lines such burrows. [The names *Orbitophaga, Nummophaga, Marsupophaga,* and *Tubophaga,* used by RHUMBLER to indicate burrowing foraminifers of *Thalamophaga* type found on different shells (e.g., *Orbitolites, Nummulites*), were not accompanied by any named species.] *Rec.*, Atl.——FIG. 97,*6*. **T. ramosa*; enlarged (*1572a).——FIG. 97,*7*. *T. incerta* (RHUMBLER); ×80 (*1572a).

Turriclavula RHUMBLER, 1911, *1572a, p. 85 [**T. interjecta*; OD]. Test small, approx. 0.15 mm. in length; wall membranous or with small inclusions; chambers few, uniserial, rectilinear; aperture terminal, ?slitlike. *Rec.*, Atl.——FIG. 97,*5*. **T. interjecta*, Cape Verde Is.; ×320 (*1572a).

Xenotheka EISENACK, 1938, *693b, p. 239 [**X. klinostoma*; OD]. Test attached, consisting of globular chamber with long tubular neck; wall pseudochitinous; rounded aperture at end of tubular neck. [This genus is similar to *Ammolagena* of the Tolypammininae, but has a pseudochitinous wall. Since the tests were from acid residues, an outer agglutinated layer may have been present but destroyed, and if so, the genus would be a synonym of *Ammolagena*. Lacking evidence of such an agglutinated layer in *Xenotheka* it is here recognized as belonging to the Allogromiidae.] *Sil.*, Eu.——FIG. 97,*8*. **X. klinostoma*, E. Prussia [Poland]; paratype, ×60 (*700).

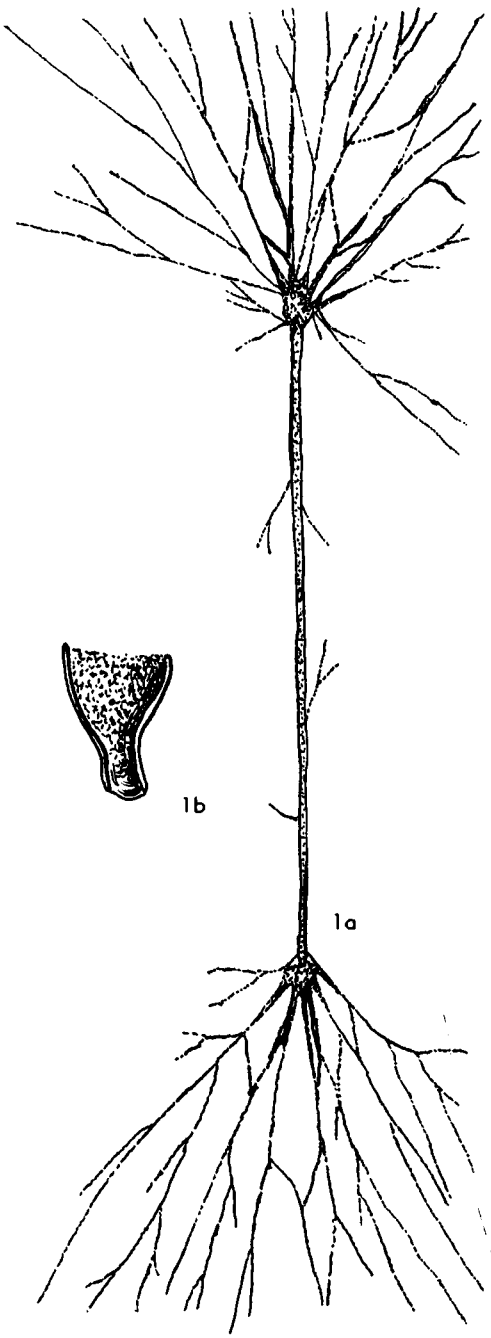

FIG. 102. Allogromiidae; *1*, *Shepheardella* (p. C182-C183).

Suborder TEXTULARIINA Delage and Hérouard, 1896

[*nom. correct.* Loeblich & Tappan, 1961, p. 217 (*pro* suborder Textulariidae Delage & Hérouard, 1896, p. 139)]——[In synonymic citations superscript numbers indicate taxonomic rank assigned by authors (¹class, ²subclass, ³order, ⁴suborder, ⁵group, ⁶tribu); dagger(†) indicates *partim*]——[=⁴Monosomatia† Ehrenberg, 1839, table opp. p. 120; =Foraminifera Monomera† Reuss, 1862, p. 362 (*non* Monomera Latreille, 1825, p. 408); =³Archimonothalamia Kühn, 1926, p. 127; =⁴Monothalamia De Saedeleer, 1934, p. 7, 52 (*non* Monothalamia Schultze, 1854); =⁴Monothalamia Avnimelech, 1952, p. 63 (*non* Monothalamia Schultze, 1854, *nec.* Marriott, 1878, *nec* Haeckel, 1894, *nec* De Saedeleer, 1934); =⁴Uniloculiniidea† Sigal in Piveteau, 1952, p. 154; =³Monosomatia† Copeland, 1956, p. 183]——[=³Helicostègues† d'Orbigny in de la Sagra, 1839, p. xxxviii, 27 (*nom. neg.*); =Helicostegia† Reuss, 1860, p. 151, 205; =⁵Helicoidea Schultze, 1854, p. 53; =³Cyclostègues† d'Orbigny, 1851, p. 192 (*nom. neg.*); =³Énallostègues† d'Orbigny in de la Sagra, 1839, p. xxxix, 125 (*nom. neg.*); =Enallostegia† Reuss, 1860, p. 151, 231; =Turbinoidea† Reuss, 1860, p. 151; =Foraminifera Polymera† Reuss, 1862, p. 365; =³Polystegia† Haeckel, 1894, p. 164; =⁴Biloculiniidea† Sigal in Piveteau, 1952, p. 157; =⁴Pluriloculiniidea† Sigal in Piveteau, 1952, p. 160]——[=²Perforata† Lankester, 1885, p. 847; =⁴Perforina† Calkins, 1901, p. 108; =³Orthostili (Perforata)† Silvestri, 1937, p. 89]——[=⁵Imperforata† Claus, 1872, p. 108; =²Imperforata† Lankester, 1885, p. 845; =⁴Imperforina† Calkins, 1901, p. 106]——[=⁶Orthoceratа† Latreille, 1825, p. 162; =³Physemariа† Haeckel, 1877, p. 221; =³Gastraeadа† Haeckel, 1877, p. 221; =Arenacea Carpenter, 1879, p. 375; =⁴Arenacidae Delage & Hérouard, 1896, p. 127; =Protammida Schubert, 1921, p. 145; =Schizostoma† Schubert, 1921, p. 179; =Metammida Schubert, 1921, p. 146; =³Dentata† Hofker, 1951, p. 14; =⁴Protoforaminata† Hofker, 1951, p. 42; =³Hellenoidea† Wedekind, 1937, p. 79]——[=³Astrorhizida Lankester, 1885, p. 846; =³Astrorhizidaceae Hartog in Harmer & Shipley, 1906, p. 59; =³Astrorhizida Calkins, 1909, p. 38; =⁴Astrorhizidea Jírovec, 1953, p. 334]——[=³Lituolidea Lankester, 1885, p. 847; =³Lituolidea Lister in Lankester, 1903, p. 142; =³Lituolidaceae Hartog in Harmer & Shipley, 1906, p. 59; =³Lituolida Calkins, 1909, p. 39]——[=³Textularidea Lankester, 1885, p. 847; =⁴Textulariidae Delage & Hérouard, 1896, p. 139; =³Textularidea Lister in Lankester, 1903, p. 143; =³Textulariaceae Hartog in Harmer & Shipley, 1906, p. 59; =³Textularida Calkins, 1909, p. 39; =³Textulinida† Calkins, 1926, p. 356; =³Textularidia Kühn, 1926, p. 150; =⁴Textulariacea Wedekind, 1937, p. 84; =⁴Textulariidea Jírovec, 1953, p. 335; =³Textulariida Fursenko, 1958, p. 23]——[=³Rotaliaridiа† Kühn, 1926, p. 152; =³Nodosalidiа† Calkins, 1926, p. 355; =Sektion Neohellenoideа† Wedekind, 1937, p. 72, 84; =⁴Haplophragmiacea Wedekind, 1937, p. 111; =³Ammodiscida Fursenko, 1958, p. 23; =³Ataxophragmiida Fursenko, 1958, p. 23]

Test composed of agglutinated foreign matter held by various cements. *Cam.-Rec.*

Superfamily AMMODISCACEA Reuss, 1862

[*nom. correct.* Loeblich & Tappan, 1961, p. 275 (*pro* superfamily Ammodiscoidea Chapman, Parr & Collins, 1934, p. 556)]——[In synonymic citations superscript numbers indicate taxonomic rank assigned by authors (¹superfamily, ²tribe, ³family group, ⁴legio); dagger(†) indicates *partim*]——[=²Astrorhizina Delage & Hérouard, 1896, p. 128; =¹Astrorhizidea Glaessner, 1945, p. 88; =Astrorhizidae Eimer & Fickert, 1899, p. 593; =¹Astrorhizicae Easton, 1960, p. 65]——[Arenacea Carpenter, 1879, p. 375; =Stichostegia† Eimer & Fickert, 1899, p. 674 (*non* Stichostègues d'Orbigny, 1826), (*nom. nud.*); =Psammatostichostegia Eimer & Fickert, 1899, p. 674 (*nom. nud.*); =Ascoforaminifera Eimer & Fickert, 1899, p. 673 (*nom. nud.*); =Cystoforaminifera (Vesiculata)† Eimer & Fickert, 1899, p. 670 (*nom. nud.*); =Siphonoforaminifera (Tubulata) Eimer & Fickert, 1899, p. 667 (*nom. nud.*); =³Archi-Monothalamidia† Rhumbler in Kükenthal & Krumbach, 1923, p. 85; =⁴Archithalamia De Saedeleer, 1934, p. 7]——[=¹Ammodiscidea Dain in Rauzer-Chernousova & Fursenko, 1959, p. 180]

Test irregular, spheroidal or tubular and straight, branching or enrolled; nonseptate or only irregularly constricted; wall agglutinated, simple or labyrinthic; aperture simple. *Cam.-Rec.*

Family ASTRORHIZIDAE Brady, 1881

[All names of family rank; dagger(†) indicates *partim*]——[=Astrorhizidae Brady, 1881, p. 41, 43; =Astrorhizina Lankester, 1885, p. 846; =Astrorhizinae Delage & Hérouard, 1896, p. 129; =Astrorhizida Haeckel, 1894, p. 185)]——[=Arenaceа† Bütschli in Bronn, 1880, p. 193 (*nom. nud.*); =Ammodinetta Haeckel, 1894, p. 164 (*nom. nud.*); =Ammoasconidae Eimer & Fickert, 1899, p. 673 (*nom. nud.*); =Serpuleidae Eimer & Fickert, 1899, p. 674 (*nom. nud.*)]——[=Rhabdamminina Lankester, 1885, p. 846; =Rhabdamminidae Rhumbler, 1895, p. 79; =Rhabdamminae Delage & Hérouard, 1896, p. 130; =Arrhabdammidia Rhumbler, 1913, p. 342 (*nom. van.*)]——[=Dendrophryida Haeckel, 1894, p. 185; =Dendrophyridae Eimer & Fickert, 1899, p. 669; =Saccorhizidae Eimer & Fickert, 1899, p. 670; =Rhizamminidae Wiesner, 1931, p. 79; =Botellinidae Loeblich & Tappan, 1961, p. 277]

Test free or attached, nonseptate, tubular or branching, not enrolled; wall simple, with pseudochitinous inner layer and agglutinated outer layer; aperture absent or terminal, rounded. *L.Cam.-Rec.*

Subfamily ASTRORHIZINAE Brady, 1881

[*nom. transl.* Brady, 1884, p. 61 (*ex* Astrorhizidae Brady, 1881, p. 41, 43)]——[All names of subfamily rank]——[=Rhabdammininae Brady, 1884, p. 64; =Arastrorhiznia Rhumbler, 1913, p. 344 (*nom. van.*); =Arrhabdamnia Rhumbler, 1913, p. 350 (*nom. van.*)]

Test free, with simple or branching tubes extending from central chamber; aperture at open ends of tubes. *M.Ord.-Rec.*

Astrorhiza Sandahl, 1858, *1625, p. 301 [**A. limnicola*; OD (M)] [=*Arenistella* Fischer in de Folin & Périer, 1875, *727Aa, p. 52 (type, *A. agglutinans, =?Ammodiscus lindahli* Carpenter & Jeffreys, 1870, *279, p. 159; *Astrodiscus* Schulze, 1875, *1697, p. 113 (type, *A. arenaceus, non Astrodiscus* Ludwig, 1866); *Haeckelina* Bessels, 1875, *136, p. 265 (type, *H. gigantea*); *Astrorhiza* Eimer & Fickert, 1899, *692, p. 594 (type, *A. limnicola* Sandahl, 1858, *1625, p. 301, SD Loeblich & Tappan, herein, obj.); *Arastrorhizum* Rhumbler, 1913, *1572b, p. 345 (obj.) *(nom. van.)*]. Test free, flattened, consisting of hollow central disc from which numerous tubular arms radiate; wall agglutinated of poorly cemented mud and sand, with little selectivity shown as to size or type of material used; interior of wall with pseudochitinous lining; apertures at ends of tubular arms. [Differs from *Astrammina* Rhumbler, 1931, in the discoid rather than inflated central chamber and in being completely encircled by radial arms.] *M.Ord.-Rec.*, cosmop.——Fig. 103,*1*. **A. limnicola,* Rec., N. Sea(Norway); ×8 (*2117).

Astrammina Rhumbler in Wiesner, 1931, *2063, p. 77 [**A. rara*; OD (M)] [=*Armorella* Heron-Allen & Earland, 1932, *914d, p. 256 (type,

A. sphaerica)]. Test free, spherical, consisting of single chamber with few radiating tubular extensions; wall agglutinated, incorporating sand and sponge spicules with much cement; apertures at open ends of tubular extensions. [Differs from *Astrorhiza* in having a globular instead of discoid center and only a few irregularly placed tubular arms.] *Rec.*, Atl.——Fig. 103,*2*. **A. rara*, Antarctic; ×14 (*2063).——Fig. 103,*3,4*. *A. sphaerica* (Heron-Allen & Earland), S.Atl.(S. Georgia Is.); *3*, lectotype, here designated and refigured (*914d, pl. 2, fig. 5), ×48; *4*, coarse-textured paratype refigured (*914d, pl. 2, fig. 10), ×48 (*2117).

Radicula Christiansen, 1958, *338, p. 51 [**R. limosa*; OD]. Test free, large, to 15 mm. in length, with numerous (to 15) very elongate, tubular, irregularly bifurcating and tapering arms, to 0.8 mm. max. diam., but lacking distinct central chamber; wall with pseudochitinous lining and outer very fine-grained agglutinated layer; apertures at open ends of tapering arms. *Rec.*, Eu.—— Fig. 104,*1*. **R. limosa*, Dröbak Sound, Oslo Fjord, Norway; holotype, ×8 (*338).

Rhabdammina M. Sars in Carpenter, 1869, *274, p. 61 [**R. abyssorum*; OD] [=*Rhabdammina* M. Sars, 1869, *1629, p. 248 (*nom. nud.*); *Rhabdammina* M. Sars in Carpenter, 1868, *273, p. 171, 172 (*nom. nud.*); *Rhabdammina* Eimer & Fickert, 1899, *692, p. 595 (type, *R. linearis* Brady, 1879, *196a, p. 37, SD Loeblich & Tappan, herein); *Arrhabdammum* Rhumbler, 1913,

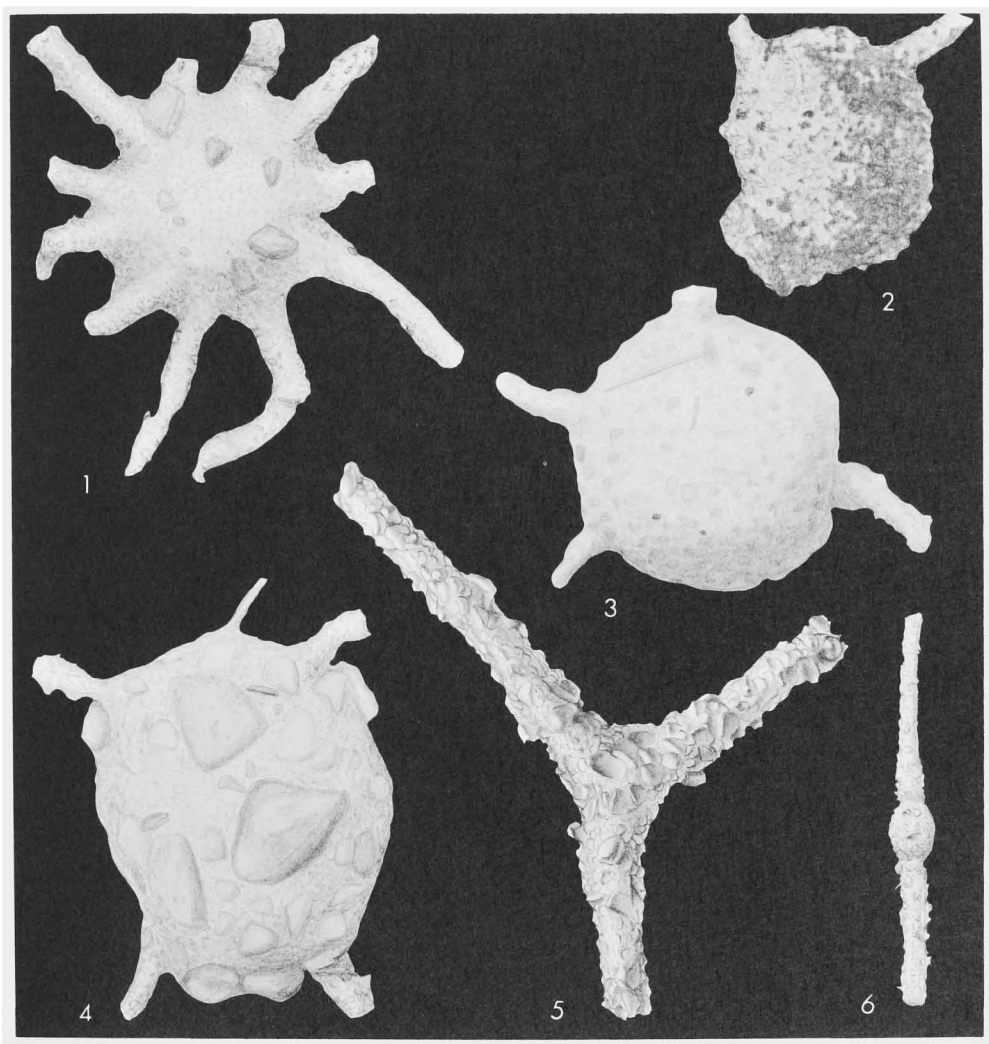

Fig. 103. Astrorhizidae (Astrorhizinae; *1, Astrorhiza; 2-4, Astrammina; 5, 6, Rhabdammina*) (p. C184-C186).

*1572b, p. 351 (obj.) *(nom. van.)*; *Oculosiphon* AVNIMELECH, 1952, *63, p. 65 (type, *Rhabdammina linearis* BRADY, 1879)]. Test free, large, to 20 mm. in length, with elongate tubular arms radiating from relatively small central chamber; wall agglutinated; apertures at open ends of tubular arms. *U.Ord.-Rec.*, cosmop.——FIG. 103,*5*. **R. abyssorum*, Rec., N.Atl., ×10 (*2117).——FIG. 103,*6*. *R. linearis* BRADY, Rec., N.Atl., ×11 (*2117).

Vanhoeffenella RHUMBLER, 1905, *1570, p. 105 [**V. gaussi*; OD] [=*Arvanhoeffenum* RHUMBLER, 1913, *1572b, p. 345 (obj.) *(nom. van.)*]. Test free, large, 0.4-2.6 mm. in length, discoidal to fusiform, with angular framework consisting of hollow agglutinated tube, with opposite pseudochitinous, nonagglutinated sides; apertures at ends of short tubular extensions at angles of test. *Rec.*, Antarctic-Ind.O.-Norway. —— FIG. 104,*2,3*. **V. gaussi*, Antarctic *(2)*, Norway, Oslo Fjord *(3)*; *2a,b*, typical discoidal form showing clear chitinoid sides and agglutinated framework, ×40 (*1570); *3a,b*, side and edge views of elongate form, pseudopodia protruding from apertures, ×40 (*338).

Subfamily RHIZAMMININAE Rhumbler, 1895

[Rhizammininae RHUMBLER, 1895, p. 82]——[All names of subfamily rank]——[=Arrhizamnia RHUMBLER, 1913, p. 350 *(nom. van.)*; =Psammosiphonellinae AVNIMELECH, 1952, p. 64; =Argillotubinae AVNIMELECH, 1952, p. 64; =Micatubinae AVNIMELECH, 1952, p. 65; =Bathysiphoninae AVNIMELECH, 1952, p. 66; =Testulosiphoninae AVNIMELECH, 1952, p. 66]

Test tubular, both ends open. *L.Cam.-Rec.*

Rhizammina BRADY, 1879, *196a, p. 39 [**R. algaeformis*; OD (M)] [=*Rhizammina* EIMER & FICKERT, 1899, *692, p. 595 (type, *R. algaeformis* BRADY, 1879, SD LOEBLICH & TAPPAN, herein, obj.); *Arrhizammum* RHUMBLER, 1913, *1572b, p. 350 (obj.) *(nom. van.)*; *Testulorhiza* AVNIMELECH, 1952, *63, p. 66 (type, *Rhizammina globigerinifera* HOFKER, 1930, *928b, p. 117); *Testulosiphon* AVNIMELECH, 1952, *63, p. 66 (type, *Rhizammina indivisa* BRADY, 1884, *200, p. 277)]. Test simple or branching tube; wall thin, with finely arenaceous groundmass and irregular covering of larger fragments, which may consist of larger sand grains, radiolarians, *Globigerina* shells, and other foreign matter (e.g., *Challenger* locs. 146, 299); apertures at open ends of tubular branches. *Rec.*, cosmop.——FIG. 105,*2*. **R. algaeformis*, Ind.O.; ×18 (*2117).——FIG. 105,*3*. *R. indivisa* BRADY, N.E.Atl.O.; ×7.5 (*2117).

[The type of wall is distinctly affected by type of substratum, varying from an arenaceous wall with some radiolarian tests, to a wholly calcareous covering of tiny specimens of *Globigerina*. The genera *Testulorhiza* and *Testulosiphon* were introduced for forms with wall composed of tests of other foraminifers agglutinated on a chitinoid base. Since the type-species of *Rhizammina* commonly contains large quantities of tests of *Globigerina* (as in the specimen figured), the mentioned forms are regarded as congeneric.]

Bathysiphon M. SARS in G. O. SARS, 1872, *1630, p. 251 [**B. filiformis*; OD] [=*Rhabdamminella* DE FOLIN, 1881, *724, p. 140 *(nom. nud.)*; *Rhabdamminella* DE FOLIN, 1887, *726a, p. 115 (type, *R. prismaeginosa*); *Arbathysiphum* RHUMBLER, 1913, *1572b, p. 352 *(nom. van.)*; *Hippocrepinella* HERON-ALLEN & EARLAND, 1932, *914d, p. 254 (type, *H. hirudinea*); *Arenosiphon* GRUBBS, 1939, *832, p. 544 (type, *A. gigantea*); *Psammosiphonella* AVNIMELECH, 1952, *63, p. 64 (type, *Bathysiphon arenacea* CUSHMAN, 1927, *435, p. 129); *Micatuba* AVNIMELECH, 1952, *63, p. 65 (type, *Bathysiphon flexilis* HÖGLUND, 1947, *924, p. 42); *Argillotuba* AVNIMELECH, 1952, *63, p. 64 (type, *Astrorhiza vermiformis* GOËS, 1896, *805, p. 20]. Test free, large, to 50 mm. in length, elongate, narrow, more or less flexible tube, which may have annular constrictions; wall agglutinated, commonly of siliceous sponge spicules and fine sand or other mineral matter in calcareous cement; aperture at one of open ends; protoplasm multinucleate, protoplasmic movement very sluggish, pseudopodia protruding only from one end of test where growth occurs, opposite end may be secondarily closed by secreted disc and contain intensely black matter consisting of waste rejected by protoplasm and packed into aboral end of test, additional disc secreted periodically to seal off such debris, filled sections of test eventually becoming detached (*1107). *L.Cam.-Rec.*, cosmop. ——FIG. 105,*4*. **B. filiformis*, Rec., Pac.O., ×8 (*2117).——FIG. 105,*5*. *B. gigantea* (GRUBBS), Sil. (Niagaran), USA(Ill.); ×16 (*2117).——FIG. 105,*6*. *B. arenacea* CUSHMAN, Rec., Pac.O.; holotype, refigured, ×39 (*2117).——FIG. 105,*7*. *B. flexilis* HÖGLUND, Rec., N.Sea; long. sec. showing imbricated layers of ?mica grains in fine-grained groundmass, ×880 (*924).——FIG. 105,*8-10*. *B. hirudinea* (HERON-ALLEN & EARLAND), Rec., S. Atl.(S.Georgia Is.); *8*, lectotype, here designated and figured, one of original syntypes but not figured previously (BMNH-ZF 3300); *9*, top view of paratype, also figured by HERON-ALLEN & EARLAND (*914d, pl. 1, fig. 10) (BMNH-ZF 3300); *10*, paratype, long. sec. redrawn, specimen figured (*914d, pl. 1, fig. 9) (BMNH-ZF 3301); all ×41 (*2117).

[*Bathysiphon* differs from *Rhizammina* in having a regular or slightly tapered, nonbranching tubular test. *Hippocrepinella* was defined as having slightly constricted apertures and a smoothly finished, transversely wrinkled wall. None of these characters serve to separate it from *Bathysiphon*. Furthermore, sectioned specimens of *Hippocrepinella* described by HERON-ALLEN & EARLAND (*914d, p. 258) showed the cavity "more or less completely filled with an ingested mass of foodstuffs, principally diatoms, and it depends upon the compactness of this mass whether the test preserves its outline after death, or suffers distortion and compression." This seems also to indicate congeneric status with *Bathysiphon*, since these filled sections were probably discarded waste-filled sections of the test, similar to those described in the type-species of *Bathysiphon*. The "apertural constrictions" may be due to contraction of the semiflexible test when dried.]

Marsipella NORMAN, 1878, *1363, p. 281 [**M. elongata*; OD (M)] [=*Armarsipellum* RHUMBLER, 1913, *1572b, p. 351 (obj.) *(nom. van.)*]. Test free, consisting of single undivided tubular, cyl-

indrical, or elongate-fusiform chamber, which may be slightly twisted; wall of agglutinated sand, sponge spicules, or tests of other foraminifers; apertures at open ends of tube. *U.Ord.-Rec.*, cosmop.——Fig. 105,*1*. **M. elongata*, Rec., N.Atl., ×14 (*2117).

Subfamily HIPPOCREPININAE Rhumbler, 1895

[Hippocrepininae Rhumbler, 1895 (*1568A, p. 83)]——[All names are of subfamily rank]——[=Hyperammininae Cushman, 1910, p. 59; =Arhippocrepnia Rhumbler, 1913, p. 352 (*nom. van.*)]

Test free, globular proloculus continuing

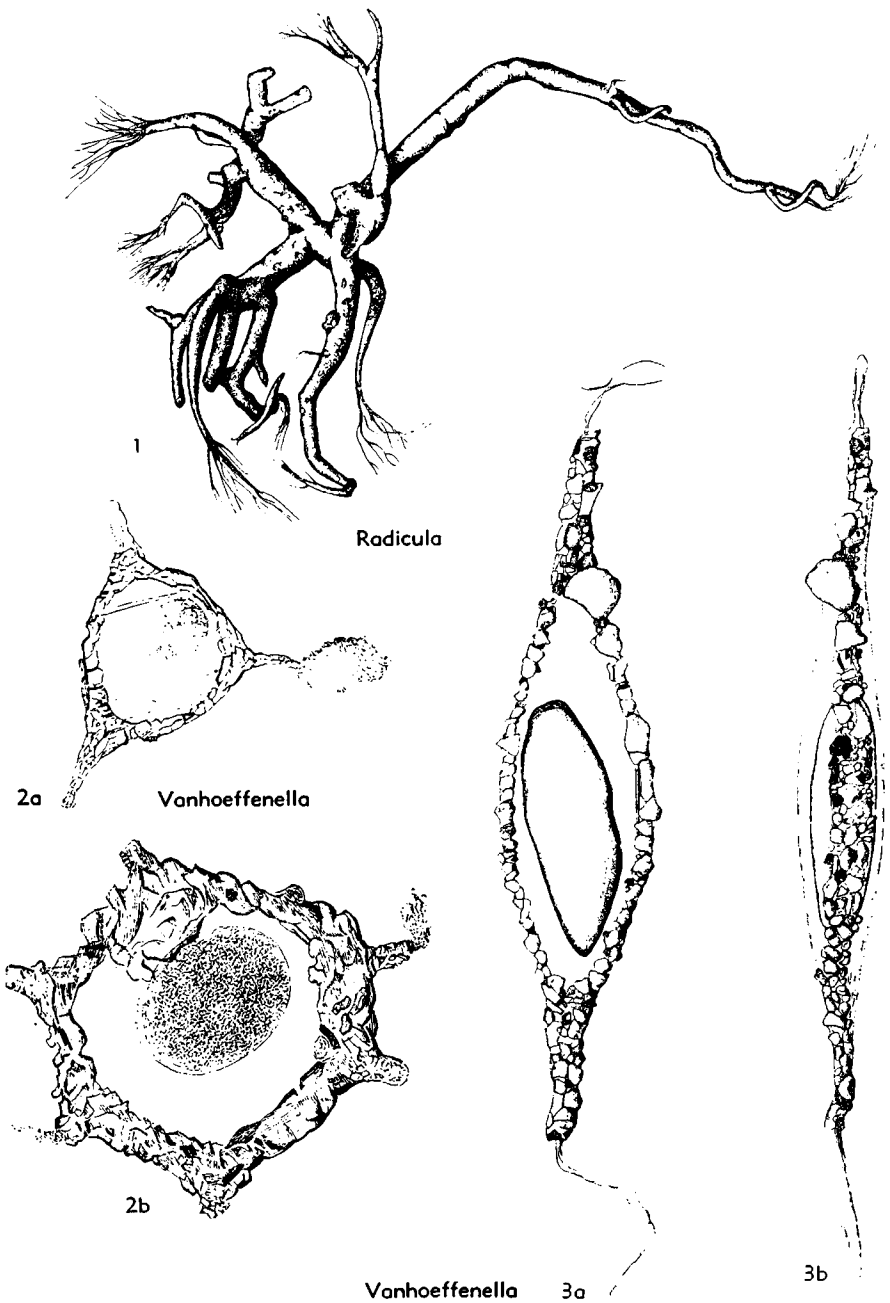

Fig. 104. Astrorhizidae (Astrorhizinae; *1, Radicula; 2,3, Vanhoeffenella*) (p. C185-C186).

into nonseptate tube; aperture at open end of tube. *L.Ord.-Rec.*

Hippocrepina PARKER in G. M. DAWSON, 1870, *565, p. 177 [**H. indivisa;* OD] [=*Arhippocrepum* RHUMBLER, 1913, *1572b, p. 352 (obj.) *(nom. van.)*; *Hyperamminella* CUSHMAN & WA-

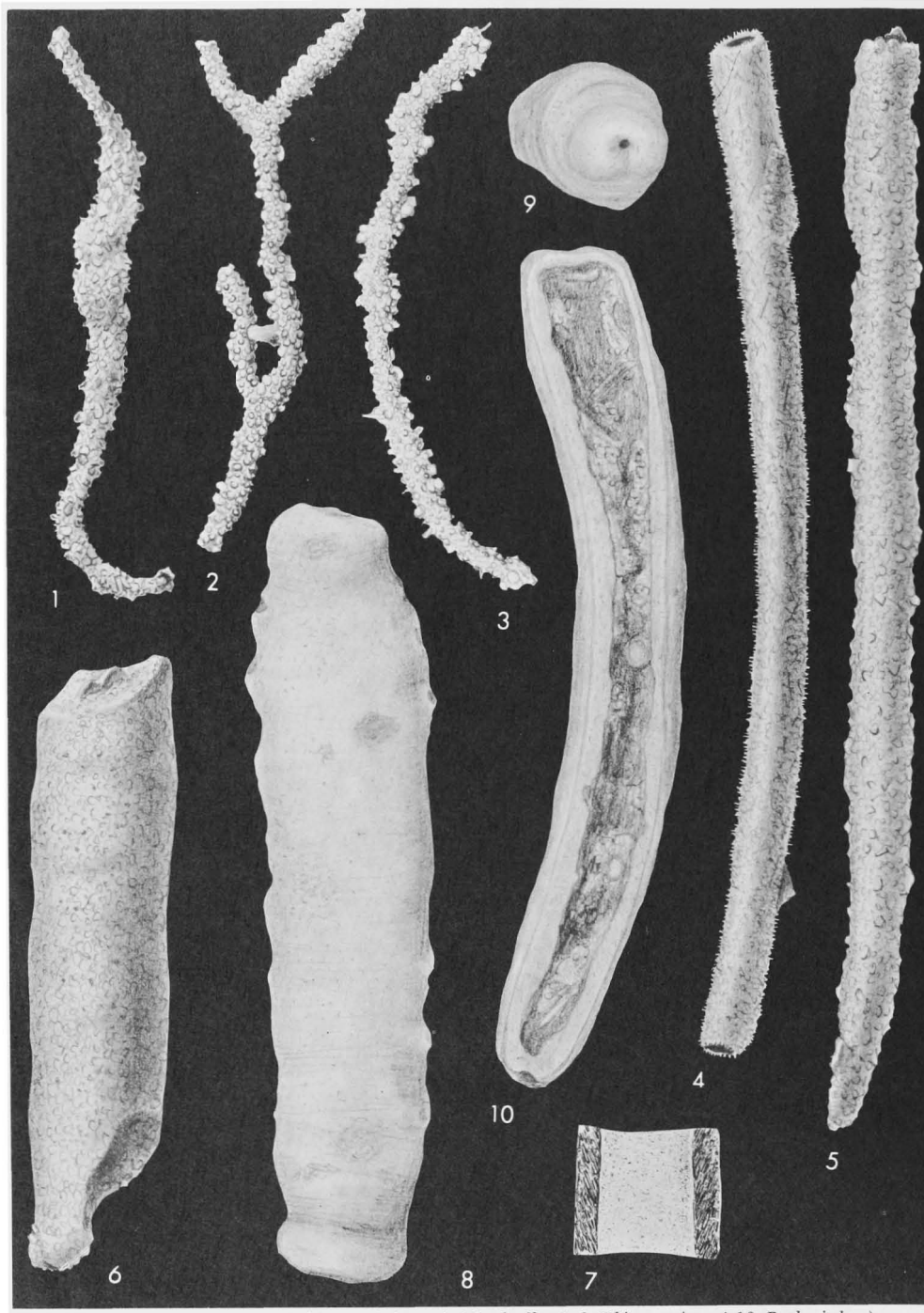

FIG. 105. Astrorhizidae (Rhizammininae; *1, Marsipella; 2, 3, Rhizammina; 4-10, Bathysiphon*) (p. C186-C187).

TERS, 1928, *535, p. 36 (type, *H. elegans*) (*non* DE FOLIN, 1881, 1887); *Hyperamminoides* CUSHMAN & WATERS, 1928, *537, p. 112 (*nom. subst. pro Hyperamminella* CUSHMAN & WATERS, 1928, *non* DE FOLIN)]. Test free, elongate, tapering, may have irregularly spaced transverse constric-

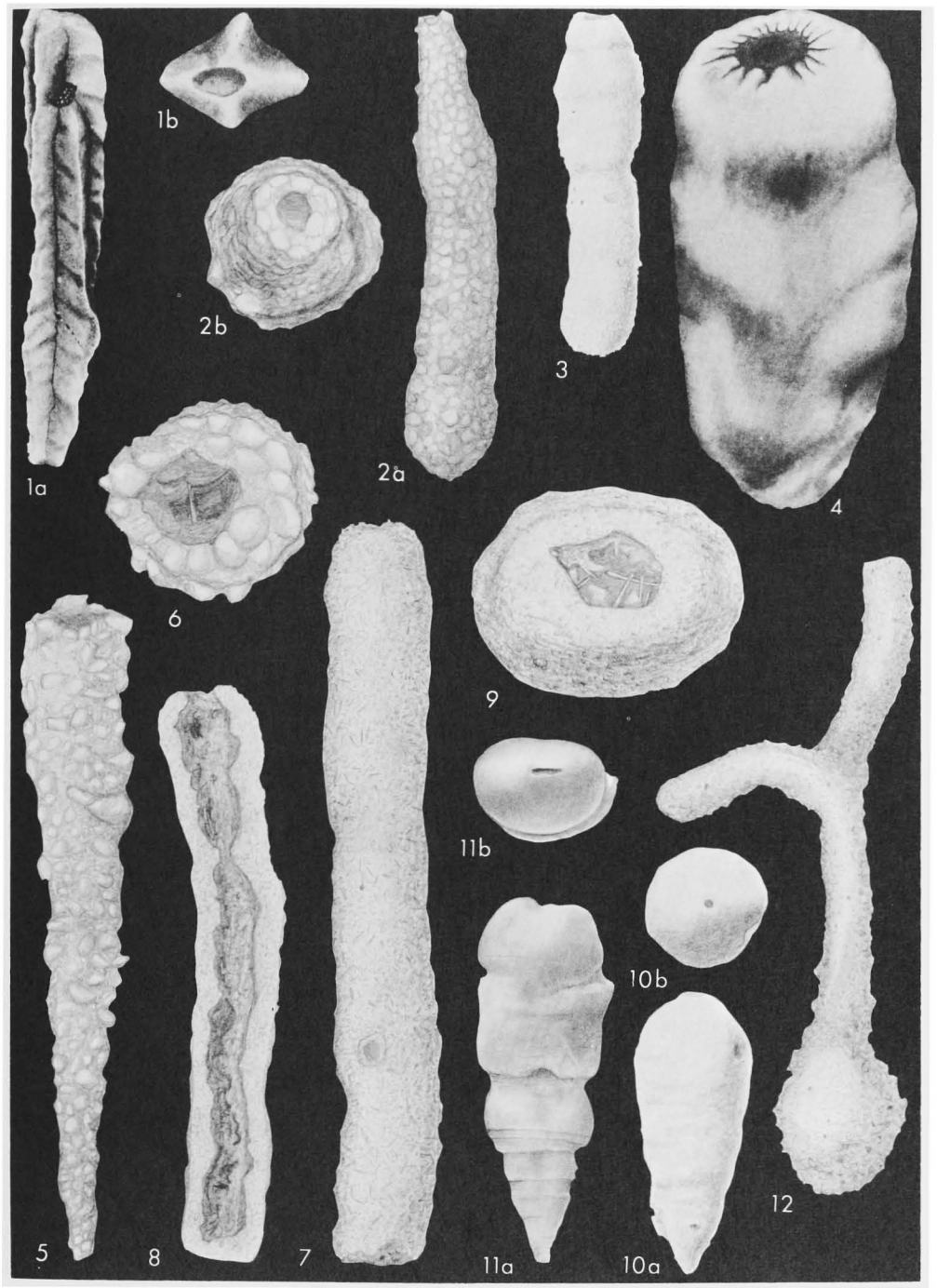

FIG. 106. Astrorhizidae (Hippocrepininae; *1, Giraliarella; 2, 3, Hyperammina; 4, Pseudohyperammina; 5, 6, Jaculella; 7-9, Protobotellina; 10, 11, Hippocrepina; 12, Saccorhiza*) (p. C188-C190).

tions but no internal septa, contracted and broadly rounded at apertural end; wall finely agglutinated, may have siliceous cement; aperture small, terminal, rounded, may have slightly raised margin. *U.Dev.-Rec.,* Eu.-N.Am.——Fig. 106,*10*. **H. indivisa,* Rec., N.Alaska(off Pt.Barrow); *10a,b,* side and top views, ×44 (*2117).——Fig. 106, *11*. *H. elegans* (Cushman & Waters), U.Penn. (Cisco), USA(Tex.); *11a,b,* side and top views of holotype (redrawn), ×32 (*2117).

[Late Paleozoic species have been referred to *Hyperamminoides* but without morphologic basis for separation from *Hippocrepina*. The "elongate" aperture reported in some fossil species is due to compression of the tests in preservation. Conklin (*378, p. 168) regarded *Hyperamminoides* as a synonym of *Hyperammina,* but the latter has a bulbous base and narrowed later portion, whereas typical *Hyperamminoides* has a finely arenaceous flaring test characteristic of the type-species of *Hippocrepina*.]

Giraliarella Crespin, 1958, *394, p. 56 [**G. angulata;* OD]. Similar to *Hippocrepina* but with triangular to quadrate section; wall finely agglutinated with siliceous cement. *Perm.,* W.Australia. ——Fig. 106,*1*. **G. angulata; 1a,b,* side and top views of holotype, ×40, ×104 (*394).

Hyperammina Brady, 1878, *195, p. 433 [**H. elongata*; OD (M)] [=*Rhabdopleura* G. M. Dawson, 1870, *565, p. 175 (type, *R. abyssorum*) (*non* Allman, 1869; *nec* deKoninck, 1881); *Hyperammina* Eimer & Fickert, 1899, *692, p. 603 (type, *H. friabilis* Brady, 1884, *200, p. 258, SD Loeblich & Tappan, herein); *Bactrammina* Eimer & Fickert, 1899, *692, p. 673 (obj.); *Arhyperammum* Rhumbler, 1913, *1572b, p. 351 (obj.) *(nom. van.)*]. Test free, elongate, cylindrical, consisting of bulbous proloculus and long tubular second chamber generally somewhat smaller than proloculus in diameter; wall agglutinated, commonly of angular quartz fragments with small amount of calcareous or ferruginous cement; aperture terminal, rounded, constricted. [*Hyperammina* differs from *Hippocrepina* in being more coarsely agglutinated and in having an inflated base and narrowed later portion.] *L.Ord.-Rec.,* cosmop.——Fig. 106,*2*. **H. elongata,* Rec., Cape Frazer (N.Polar Exped. 1875-76); *2a,b,* side and top views of lectotype (here designated and redrawn, BMNH-ZF 3604), ×28, ×48 (*2117). ——Fig. 106,*3*. *H. abyssorum* (G. M. Dawson), Rec., Canada (Lab.); ×7 (*2117).

Jaculella Brady, 1879, *196a, p. 35 [**J. acuta*; OD (M)] [=*Arjaculum* Rhumbler, 1913, *1572b, p. 352 (obj.) *(nom. van.)*]. Test free, elongate, conical, nonseptate tube; wall coarsely arenaceous, thick, firmly cemented, coarsely finished both on exterior and interior; rounded aperture at larger, open end of tube. [The genus has been stated to have a chitinoid interior lining (*486, p. 85), but this is not evident in Brady's type specimens. It has also been stated to be smoothly finished inside (*762, p. 75), but specimens of the type-species are equally roughened inside and out. *Jaculella* differs from *Protobotellina* in being conical rather than cylindrical.] *L.Jur.-Rec.,* cosmop.——Fig. 106,*5,6*. **J. acuta;* Rec., S.Atl.(off S.Am.); *5,* lectotype (here designated and redrawn from Brady, *196a, pl. 3, fig. 12, BMNH-ZF 1602), ×10; *6,* apert. view of paratype (Brady, *200, pl. 22, fig. 18, BMNH-ZF 1603), ×22 (*2117).

Protobotellina Heron-Allen & Earland, 1929, *914b, p. 326 [**P. cylindrica;* OD]. Test free, tubular, irregularly cylindrical, nonseptate, open only at one end; wall agglutinated, nonlabyrinthic, composed of broken sponge spicules and fine sand with little visible cement, exterior smoothly finished, inner surface rough, with numerous irregular cavities and projecting sponge spicules; aperture terminal, irregular in shape, with constricting grains and sponge spicules partially closing open end of tube. *Rec.,* Antarctic.——Fig. 106,*7-9*. **P. cylindrica,* S.Atl.; *7,* side view of lectotype (here designated and redrawn), ×5; *8,* sectioned paratype (redrawn, *914b, pl. 2, figs. 10, 11), ×5; *9,* top view of paratype (redrawn, *914b, pl. 2, fig. 12) ×10 (*2117).

[*Protobotellina* differs from *Botellina* in having a nonlabyrinthic interior, in being cylindrical, and in lacking an inflated bulbous base. It differs from *Jaculella* in its cylindrical instead of conical, flaring form. It is very like *Bathysiphon* except for being closed at one end. Sectioned specimens contained a black "protoplasm" reminiscent of the waste-filled discarded sections of *Bathysiphon,* but the closed base of agglutinated material and single aperture serve to separate *Protobotellina* from *Bathysiphon*.]

Pseudohyperammina Crespin, 1958, *394, p. 55 [**P. radiostoma*; OD]. Test similar to *Hippocrepina* but with less rapid flaring and subovate outline; wall thin, finely agglutinated; aperture ovate, with thickened border and radially arranged elongate grooves extending outward from apertural opening. *Perm.,* W.Australia.——Fig. 106,*4*. **P. radiostoma;* ×45 (*394).

Saccorhiza Eimer & Fickert, 1899, *692, p. 670 [**Hyperammina ramosa* Brady, 1879, *196a, p. 33; OD (M)]. Test free, with subglobular proloculus and long dichotomously branching tubular undivided chamber of nearly uniform diameter throughout; wall thick, agglutinated, consisting of medium to fine sand grains, commonly with abundant sponge spicules fastened almost at right angles to outer surface, giving very spinose, bristling appearance; apertures formed by open ends of tubes. [*Saccorhiza* differs from *Hyperammina* in its branching character.]. *L.Miss.-Rec.,* Atl.-Pac.——Fig. 106,*12*. **S. ramosa* (Brady), Rec., N.Pac.; lectotype (here designated and redrawn, BMNH-ZF 3602), ×22 (*2117).

Subfamily BOTELLININAE Chapman & Parr, 1936

[Botellininae Chapman & Parr, 1936, p. 146]

Globular proloculus with nonlabyrinthic interior followed by elongate, tubular, undivided chamber with labyrinthic interior; wall agglutinated, with inner pseudochitinous lining. *Rec.*

Botellina Carpenter, Jeffreys & Thomson, 1870,

*280, p. 443 [**B. labyrinthica* BRADY, 1881; SD (SM) BRADY, 1881, *196c, p. 48] [=*Arbotellum* RHUMBLER, 1913, *1572b, p. 351 (obj.) *(nom. van.)*]. Test elongate, cylindrical, with bulbous proloculus and undivided tubular later portion nearly filled with arenaceous, labyrinthic mate-

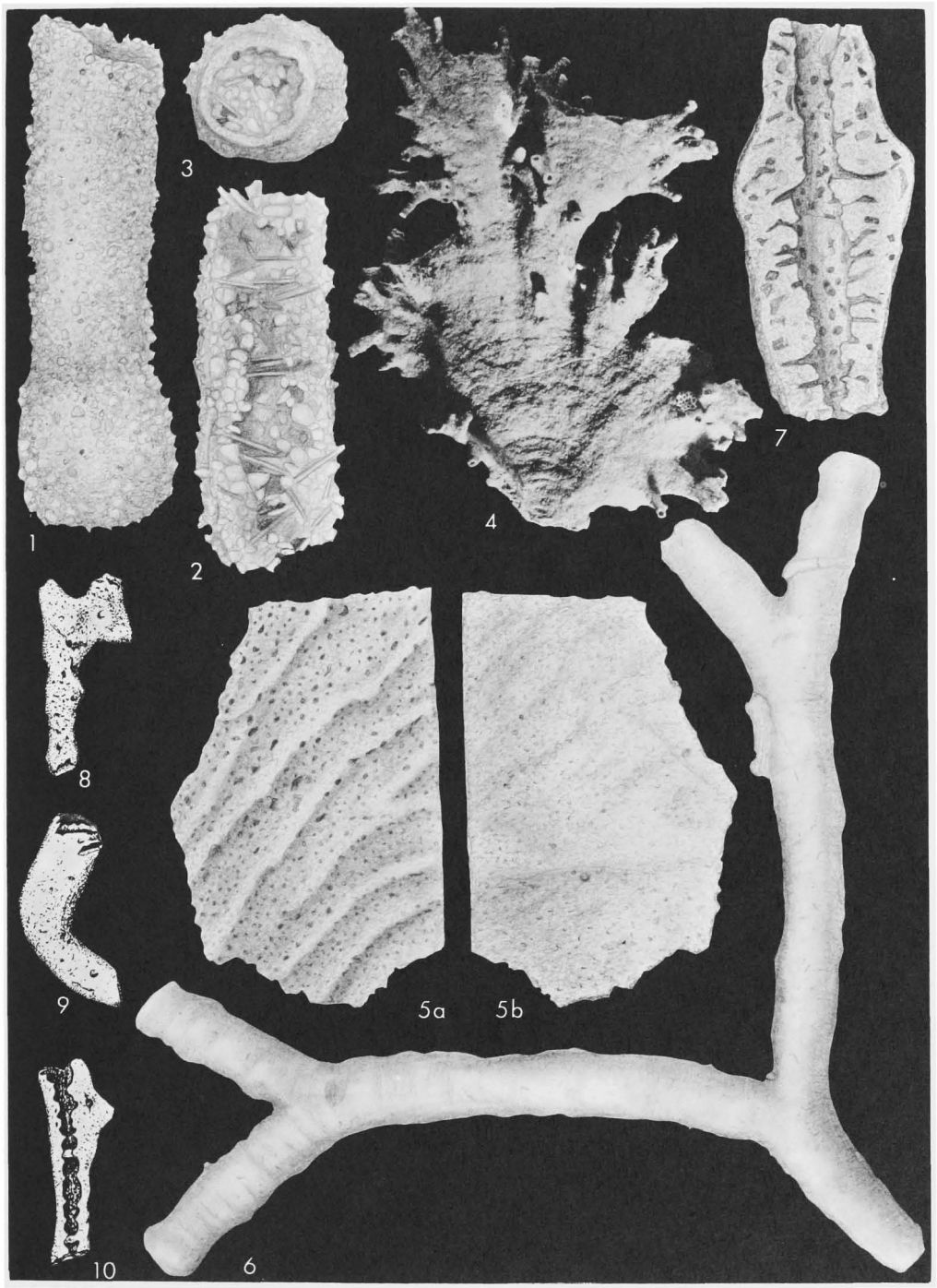

FIG. 107. Astrorhizidae (Botellininae; *1-3, Botellina*); Schizamminidae; *4, 5, Jullienella; 6-10, Schizammina* (p. C190-C194).

rial; may exhibit irregular growth constrictions; wall agglutinated, composed of sand grains and sponge spicules with comparatively little cement, rather smoothly finished inside of initial bulbous portion, but very rough, labyrinthic, and thick in tubular portion; apertures consisting of very slightly constricted open end of tube. *Rec.*, Atl.-Pac.-Antarctic.——FIG. 107,*1-3*. **B. labyrinthica*, N.Atl.(Faröe Channel); *1-3*, ext. view, long. sec., apert. view (all syntypes), ×8 (*2117).

Subfamily DENDROPHRYINAE Haeckel, 1894

[*nom. transl.* CUSHMAN, 1927, p. 14 (*ex* Dendrophryida HAECKEL, 1894, p. 185)]

Test attached, commonly branching or occurring in clusters. *Pleist.-Rec.*

Dendrophrya T. S. WRIGHT, 1861, *2081, p. 122 [**D. erecta*; SD CUSHMAN, 1918, *411a, p. 85] [=*Psammatodendron* NORMAN in BRADY, 1881, *197, p. 98 (type, *P. arborescens*); =*Ardendrophyrum* RHUMBLER, 1913, *1572b, p. 345 (obj.) *(nom. van.)*; *Dendrophyra* CUSHMAN, 1917, *407, p. 652 *(nom. null.)*]. Test attached by proloculus, later elongate, nonseptate, branching tubular portion growing erect and spreading; wall with pseudochitinous lining and outer agglutinated layer, may have ferruginous cement; apertures at open ends of tubular branches. [*Psammatodendron* has been recognized for some delicately branched species, but the differences are of only specific nature.] *Pleist.-Rec.*, Atl.——FIG. 108,*1*. **D. erecta*, Rec., N.Atl.(off Scot.); ×18 (*2117).——FIG. 108,*2*. *D. arborescens* (NORMAN), Rec., N.Atl. (off Scot.); ×13 (*2117).

Dendronina HERON-ALLEN & EARLAND, 1922, *911, p. 78 [**D. arborescens*; SD CUSHMAN, 1928, *439, p. 87]. Test commonly attached, with early expanded basal chamber or pad containing ramifying passages which converge to central cavity, or may grow free, with bulbous early portion, later development consisting of elongate tube which may branch dichotomously, or more than one such nonseptate tube may arise from basal expansion; wall fragile, consisting of fine sand grains and sponge spicules aligned in direction of test growth, upon pseudochitinous base; apertures are simple terminal openings at slightly constricted ends of branches, with spicules projecting somewhat beyond remainder of wall. [The "crown" of projecting spicules is somewhat less prominent in actual specimens than in restoration figured by HERON-ALLEN & EARLAND (*911, pl. 2, fig. 12), which has been recopied as representing a complete specimen. The actual types show fragmental material such as that here illustrated.] *Rec.*, S.Pac.——FIG. 108,*3,4*. **D. arborescens*, Rec., off N.Z.; *3*, lectotype (here designated and redrawn, BMNH-ZF 3608), showing basal expansion; *4*, paratype (BMNH-ZF 3609), showing branching, both ×22 (*2117).

Halyphysema BOWERBANK, 1862, *183, p. 1105 [**H. tumanowiczii*; OD (M)] [=*Gastrophysema* HAECKEL, 1877, *849, p. 4, 8, 24 (type, *Squamulina scopula* CARTER, 1877, *290, p. 311) *(nom. subst. pro Halyphysema tumanowiczii* BOWERBANK, 1862) SD LOEBLICH & TAPPAN, herein (obj.); *Haliphysema* HAECKEL, 1877, *849, p. 1 *(nom. van.)*; *Arhaliphysemum* RHUMBLER, 1913, *1572b, p. 352 *(nom. van.)*]. Test attached, with internally subdivided, spreading basal expansion and later erect conical or clavate chamber, which is tubular and even bifurcating in some species; wall agglutinated, that of basal expansion fine-grained and may include fragments of sponge spicules, erect portion with sand, other foraminiferal tests, or numerous elongate sponge spicules oriented in direction of test growth; aperture terminal and rounded, may be obscured by cluster of spicules; pseudopodial network with pronounced graunlar streaming, many nuclei. *Rec.*, Atl.-Carib.-Pac.——FIG. 108,*6,7*. **H. tumanowiczii*, Eng.(Sussex); *6*, lectotype (BMNH-ZF 3652), ×57; *7*, several paratypes showing attachment, ×17 (*1153).——FIG. 109, living specimen, showing pseudopodial network, ×70 (*1034).

Normanina CUSHMAN, 1928, *436, p. 7 [**Haliphysema confertum* NORMAN, 1878, *1363, p. 279; OD]. Test free, consisting of central mass from which tubular portions radiate, individual tubes expanding distally into globular or conical masses; wall of tubular portion flexible, agglutinated, composed of medium-sized grains; apertures not observed in type-species. *Rec.*, Atl.——FIG. 108,*8*. **N. conferta* (NORMAN), off Greenl.; *8a*, holotype (redrawn, BMNH-ZF 3657), entire specimen, ×48; *8b*, single individual, ×105 (*2117).

Nubeculariella AVERINTSEV, 1911, *62, p. 8 [**N. birulai*; OD]. Pseudochitinous tube with agglutinated coating, some grains so large as to suggest attachment to substratum; rounded aperture at somewhat flaring open end of tube. *Rec.*, Arctic O.——FIG. 108,*5*. **N. birulai*; approx. ×28 (*62)

Syringammina BRADY, 1883, *199, p. 159 [**S. fragilissima*; OD] [=*Arsyringammum* RHUMBLER, 1913, *1572b, p. 345 (obj.) *(nom. van.)*]. Test free or attached, consisting of bulbous base with many branching or anastomosing tubes forming rounded mass; wall finely agglutinated; apertures at ends of tubular portions. *Rec.*, N.Atl.(Faroe Channel).——FIG. 108,*9*. **S. fragilissima*; ×3.3 (*2117).

Family SCHIZAMMINIDAE Nørvang, 1961

[Schizamminidae NØRVANG, 1961, p. 171]

Test free, nonseptate, tubular, and dichotomously branching or spheroidal, may be flattened, interior cavity not subdivided;

wall agglutinated with organic cement, nonporous but with interstitial canals filled by protoplasm, no inner lining, but outer covering of tectine present; apertures consisting of simple rounded openings at ends of branches. *?Trias., Rec.*

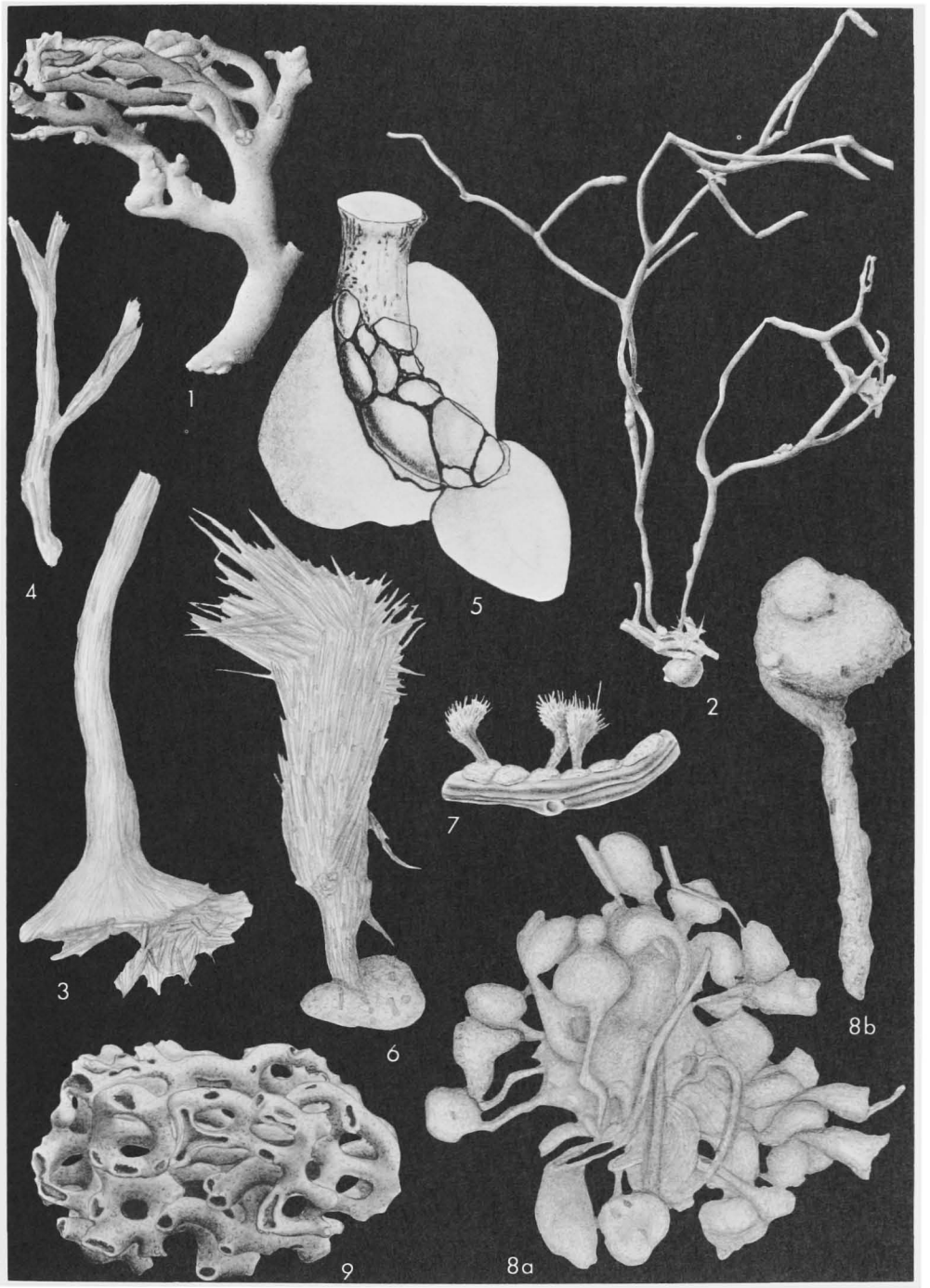

FIG. 108. Astrorhizidae (Dendrophryinae; *1,2, Dendrophrya; 3,4, Dendronina; 5, Nubeculariella; 6,7, Halyphysema; 8, Normanina; 9, Syringammina*) (p. C192).

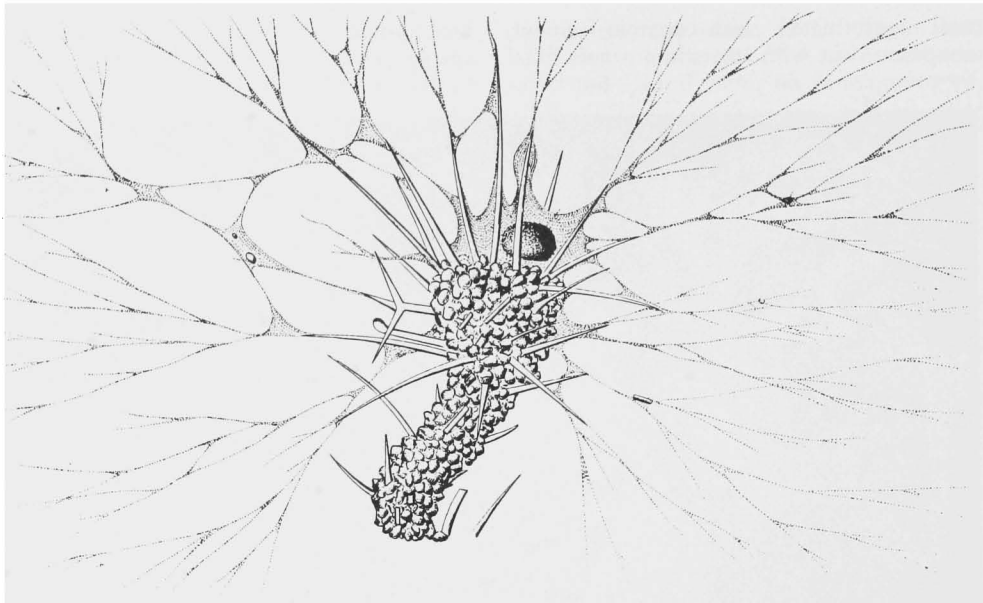

FIG. 109. Astrorhizidae (Dendrophryinae; *Halyphysema*) (p. C192).

Schizammina HERON-ALLEN & EARLAND, 1929, *914a, p. 103 [**S. labyrinthica*; SD CUSHMAN, 1930, *447, p. 73] [=*?Psammosiphon* RHUMBLER, 1911, *1572a, p. 43 (type, *Nodosinella wedmoriensis* CHAPMAN, 1895, *312, p. 320) (*non Psammosiphon* VINE, 1882); *Arpsammosiphoum* RHUMBLER, 1913, *1572b, p. 440 (*nom. van.*)]. Test free, consisting of nonseptate tube, dichotomously branching in single plane; wall finely agglutinated, exterior smoothly finished, interior labyrinthic but chamber cavity rather smoothly finished between pore openings, exterior with few transverse wrinkles; apertures at open ends of tubular chamber. [Differs from *Rhizammina* in possessing a labyrinthic wall.] *?Trias. (Rhaet.)*, Eng.; *Rec.*, Atl.——FIG. 107,*6,7*. **S. labyrinthica*, Rec., off French Equat. Afr. *(6)*, off Gabon *(7)*; *6*, lectotype (here designated and redrawn, BMNH-ZF 3653), ×5.2 (*2117); *7*, sectioned paratype, ×10 (*2117).——FIG. 107,*8-10*. *S. wedmoriensis* (CHAPMAN), Trias. (Rhaet.), Eng.; *8,9*, ext. views, ×5; *10*, long. sec., ×5 (*1572a).

Jullienella SCHLUMBERGER, 1889, *1653, p. 213 [**J. foetida*; OD (M)]. Test large, flabelliform, or may have large fan-shaped portions extending in 2 directions from central attachment, margin produced into numerous tubules; wall firm, finely agglutinated, with much ferruginous cement, insoluble in hydrochloric acid, labyrinthic, surface transversely wrinkled, interior irregularly subdivided by series of intermittent radiating ridges which are not reflected on exterior; interior surface with many large pores which constrict within wall to connect with smaller openings at outer surface; apertures numerous, comprising small rounded openings at ends of tubular extensions along periphery; reddish-brown. *Rec.*, Afr.(Liberia).——FIG. 107,*4,5*. **J. foetida*, topotypes; *4*, ext., showing flabelliform test, growth ridges, and apertures on tubular extensions, ×2; *5a,b*, fragments of surface and int., with discontinuous radiating ridges and large pores, ×10 (*1166).

Family SACCAMMINIDAE Brady, 1884

[*nom. correct*. EIMER & FICKERT, 1899, p. 671 (*pro* family Saccamminina LANKESTER, 1885, p. 846, *nom. transl. ex* subfamily Saccammininae BRADY, 1884, p. 64)]——[All names of family rank; dagger(†) indicates *partim*]——[=Arenaceaꝉ BÜTSCHLI in BRONN, 1880, p. 193 (*nom. nud.*); =Arenácidos GADEA BUISÁN, 1947, p. 17 (*nom. neg.*); =Protocystidae EIMER & FICKERT, 1899, p. 665 (*nom. nud.*); =Kyphamminidae EIMER & FICKERT, 1899, p. 672 (*nom. nud.*); =Ammoasconidaeꝉ EIMER & FICKERT, 1899, p. 673 (*nom. nud.*)]——[=Pilulinina LANKESTER, 1885, p. 846; =Pilulinida HAECKEL, 1894, p. 190; =Pilulinidae LISTER in LANKESTER, 1903, p. 141; =Saccamminae DELAGE & HÉROUARD, 1896, p. 130; =Psammosphaerida HAECKEL, 1894, p. 185; =Psammosphaeridae EIMER & FICKERT, 1899, p. 670; =Stegnamminidae MOREMAN, 1930, p. 48]

Test free or attached, subglobular, or in groups; aperture absent, single, or multiple. *Ord.-Rec.*

Subfamily PSAMMOSPHAERINAE Haeckel, 1894

[*nom. transl.* CUSHMAN, 1927, p. 11 (*ex* family Psammosphaerida HAECKEL, 1894, p. 185)]——[All names of subfamily rank]——[=Stegnamminae MOREMAN, 1930, p. 48; =Thekamminae DUNN, 1942, p. 326]

Test free, globular or with several loosely joined chambers, no aperture. *M.Ord.-Rec.*

Psammosphaera SCHULZE, 1875, *1697, p. 113 [**P. fusca*; OD] [=*Arpsammosphaerum* RHUMBLER, 1913, *1572b, p. 347 (obj.) *(nom. van.)*; *Psammella* RHUMBLER, 1935, *1574, p. 167 (type, *P. frankei*) (*non* LENDENFELD, 1887, *nom. nud.*); *Pilalla* RHUMBLER, 1935, *1574, p. 150 (type, *P. exigua*)]. Test free, single chamber, commonly globular; wall with thin pseudochitinous inner layer and outer, firmly cemented agglutinated layer; aperture indefinite. [Separate generic names have been proposed for forms with varying proportions of pseudochitin and sand and with varying grain size in the agglutinated wall. These are regarded here as of specific value only.] *M.Ord.-Rec.*, N.Am.-S.Am.-Eu.-Australia-Antarctic.——FIG. 110,*1*. **P. fusca*, Rec., Atl.; *1a,b*, ext. views, with side broken to show interior, ×30 (*2117).——FIG. 111,*1*. *P. frankei* (RHUMBLER) *forma sphaeroides* RHUMBLER, Rec., Ger.(Kieler Bucht); test broken open, showing remains of protoplasmic body, ×50 (*1574).——FIG. 111,*2*. *P. frankei* (RHUMBLER) *forma ellipsoides* (RHUMBLER), ext., ×50, Rec., Ger.(Kieler Bucht); ext., ×50 (*1574).——FIG. 111,*3*. *P. exigua* (RHUMBLER), Rec., Ger.(Kieler Bucht); in balsam, ×180 (*1574).

Amphifenestrella RHUMBLER, 1935, *1574, p. 169 [**A. wiesneri*; OD]. Test free, discoidal, flat sides of transparent pseudochitin, with peripheral area of agglutinated material; no definite apertures or tubular extensions of chamber. [Differs from *Vanhoeffenella* in lacking tubular extensions at angles of the test and in lacking definite apertures.] *Rec.*, Ger.——FIG. 111,*4*. **A. wiesneri*, Kieler Bucht; peripheral agglutinated border and transparent pseudochitinous side through which protoplasmic contents can be seen, ×50 (*1574).

Blastammina EISENACK, 1932, *693a, p. 261 [**B. polymorpha*; OD]. Test free, consisting of one or rarely more than one hemispherical rounded to subangular chamber, may be irregularly grooved or infolded; wall with brown, pseudochitinous layer sparsely covered with mosaic of sand grains; no distinct aperture. *Sil.*, Eu.——FIG. 111,*5-7*.

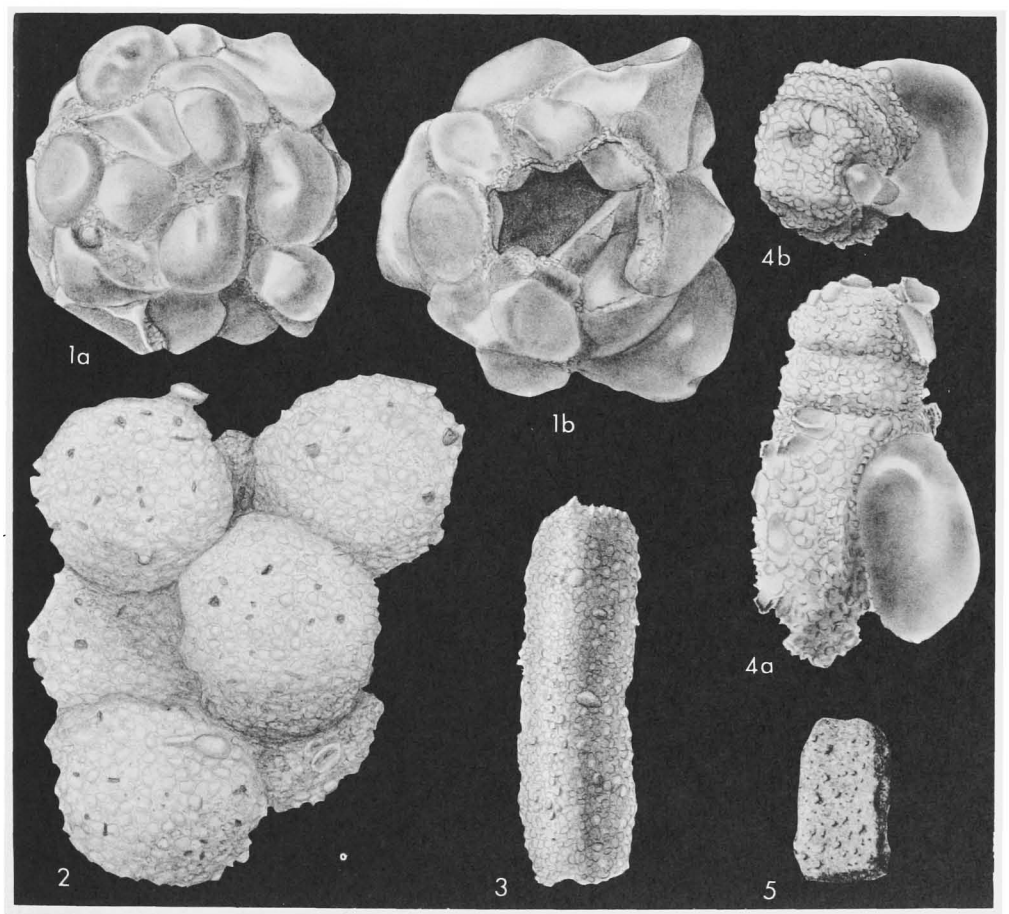

FIG. 110. Saccamminidae (Psammosphaerinae; *1, Psammosphaera; 2, Sorosphaera; 3-5, Stegnammina*) (p. C195-C196).

**B. polymorpha,* Sweden(Gotl.); *5,* neotype, ×67 (*694); *6,* hemispherical form, ×58 (*693a); *7,* irregularly grooved, ×40 (*693a).

Ceratammina IRELAND, 1939, *976, p. 194 [**C. cornucopia*; OD]. Test free, unilocular, conical and slightly curved; wall agglutinated of fine, well-cemented sand grains; aperture not apparent. *L.Dev.*, N.Am.——FIG. 111,*8*. **C. cornucopia,* Helderberg., USA(Okla.); ×40 (*976).

Pseudastrorhiza EISENACK, 1932, *693a, p. 259 [**P. silurica*; OD] [=*Parvistellites* O. WETZEL, 1951, *2048, p. 113 (type, *P. hospitalis*)]. Test of agglutinated quartz grains, with numerous (commonly 3-7) short, thick radiating arms, which are closed terminally, thus differing from *Astrorhiza*; aperture not visible. *Ord.-Paleoc.*, Eu.(Ger.-Est.)-N.Am.(Ill.).——FIG. 111,*9*. **P. silurica,* Ord., Est.; neotype, ×50 (*694).——FIG. 111,*10*. *P. hospitalis* (WETZEL), Paleoc. (Dan.), Ger., ×115 (*2048).

Sorosphaera BRADY, 1879, *196a, p. 28 [**S. confusa*; OD (M)] [=*Thuramminopsis* HAEUSLER, 1883, *853, p. 69 (type, *T. canaliculata*); *Arsorophaerum* RHUMBLER, 1913, *1572b, p. 347 (obj.) *(nom. van.)*; *Sorophaera* RHUMBLER, 1913, *1572b, p. 347 (obj.) *(nom. null.)*; *Psammophax* RHUMBLER in WIESNER, 1931, *2063, p. 80 (type, *P. consociata*); *Arenosphaera* SHCHEDRINA, 1939, *1724, p. 95 (type, *A. perforata*); *Danubica* FRENTZEN, 1944, *747, p. 325 (type, *D. gracilis*)]. Test free, consisting of variously arranged globular chambers with no apparent order of development; wall agglutinated of rather coarse grains and loosely cemented so that tests are easily broken; no distinct aperture apparent, communication of protoplasm with exterior probably between loosely cemented grains. [*Sorosphaera* differs from *Psammosphaera* in consisting of numerous loosely joined chambers. The type specimen of *S. confusa*, in the British Museum (Natural History) has disintegrated since its original description, probably owing to its extremely fragile nature.] *Sil.-Rec.*, Eu.-N.Am.-Arctic-Antarctic.——FIG. 110,*2*. **S. confusa,* Rec., Atl.; ×22 (*2117).——FIG. 111,*11*. *S. consociata* (RHUMBLER), Rec., Antarctic; ×23.5 (*2063).——FIG. 111,*12*. *S. gracilis* (FRENTZEN), Jur., Ger.; approx. ×30 (*747).——FIG. 111,*13*. *S. robusta* (FRENTZEN), Jur., Ger.; holotype, approx. ×20 (*747).——FIG. 111,*14*. *S. perforata* (SHCHEDRINA), Rec., USSR(Kara Sea); *14a,* 3-chambered specimen with last one broken; *14b,* portion of test wall, ×40 (*1724).

Stegnammina MOREMAN, 1930, *1309, p. 49 [**S. cylindrica*; OD] [=*Raibosammina* MOREMAN, 1930, *1309, p. 50 (type, *R. mica*); *Thekammina* DUNN, 1942, *648, p. 326 (type, *T. quadrangularis*)]. Test free, subcylindrical to angular, straight to curved; wall thin, agglutinated, well cemented; without definite aperture. [Modifications of chamber shape are not regarded as generic in importance. *Thekammina* was defined for a subquadrangular species, but one species of *Stegnammina* is triangular; hence, they are believed to be congeneric. *Raibosammina* was regarded as being slightly irregular and in having a chamber interior of varying diameter.] *Ord.-Dev.*, N.Am.——FIG. 110,*3*. **S. cylindrica,* Sil., USA(Okla.); lectotype (here designated and redrawn), ×62 (*2117).——FIG. 110,*4*. *S. mica* (MOREMAN), Ord., USA(Okla.); *4a,b,* side and end view, ×83 (*2117).——FIG. 110,*5*. *S. quadrangularis* (DUNN), Sil., USA(Ill.); ×24 (*648).

Storthosphaera SCHULZE, 1875, *1697, p. 113 [**S. albida*; OD] [=*Titanopsis* DE FOLIN, 1881, *724, p. 138 *(nom. nud.)*; *Titanopsis* DE FOLIN, 1887, *726a, p. 114 (type, *T. irregularis*); *Arstorthosphaerum* RHUMBLER, 1913, *1572b, p. 347 (obj.) *(nom. van.)*]. Single, free, irregular chamber; wall finely arenaceous, loosely cemented; aperture indefinite. *Rec.*, Atl.-Antarctic.——FIG. 111,*15-17*. **S. albida,* off Norway; *15,16,* side views, ×20; *17,* sectioned specimen showing wall thickness, ×20 (*200).

Subfamily SACCAMMININAE Brady, 1884

[Saccammininae BRADY, 1884, p. 64]——[All names of subfamily rank]——[=Arsaccamnia RHUMBLER, 1913, p. 347 *(nom. van.)*; =Pilulininae BRADY, 1884, p. 63; =Pelosininae CUSHMAN, 1927, p. 12]

Test free, definite aperture. *Ord.-Rec.*

Saccammina M. SARS in CARPENTER, 1869, *274, p. 61 [**S. sphaerica* BRADY, 1871, *188, p. 183; SD CUSHMAN, 1928, *439, p. 72 (see LOEBLICH & TAPPAN, 1961, *1180)] [=*Saccamina* CARPENTER, 1869, *274, p. 61 *(nom. null.)*; *Saccammina* M. SARS, 1869, *1629, p. 248 *(nom. nud.)*; *Arsaccammum* RHUMBLER, 1913, *1572b, p. 347 (obj.) *(nom. van.)*; *Placentammina* MAJZON, 1943, *1203, p. 62 (type, *Reophax placenta* GRZYBOWSKI, 1897, *836, p. 276)]. Test free, single globular chamber; wall with pseudochitinous base and outer agglutinated layer, firmly cemented; aperture rounded, may be produced on short neck. *Sil.-Rec.*, N.Am.-Eu.-Atl.-Pac.-Ant-arctic.——FIG. 112,*1*. **S. sphaerica,* Rec., Atl.; ×47 (*2117).

Brachysiphon CHAPMAN, 1906, *319, p. 83 [**B. corbuliformis*; OD] [=*Arbrachysiphum* RHUMBLER, 1913, *1572b, p. 351 (obj.) *(nom. van.)*; *Sacculinella* CRESPIN, 1958, *394, p. 43 (type, *S. australe*); *Hyperamminita* CRESPIN, 1958, *394, p. 54 (type, *Hyperammina(?) rudis* PARR, 1942, *1425, p. 105)]. Test free, elongate, subcylindrical; wall agglutinated, incorporating small foraminifers, shell fragments and mineral grains on pseudochitinous base or internal lining; aperture irregular opening at slightly constricted end of tube. [*Brachysiphon* differs from *Saccammina* in the elongate cylindrical form and from *Lagenammina* in having parallel sides and in lacking a

constricted neck. It differs from *Bathysiphon* in being relatively short and closed at one end.] *Perm.-Rec.*, N.Z.-Australia.——Fig. 112,2. **B. corbuliformis*, Rec., N.Z.(off Great Barrier Is.); 2*a,b*, side and top views of topotype, ×28 (*2117).——Fig. 112,3. *B. rudis* (Parr), Peru.,

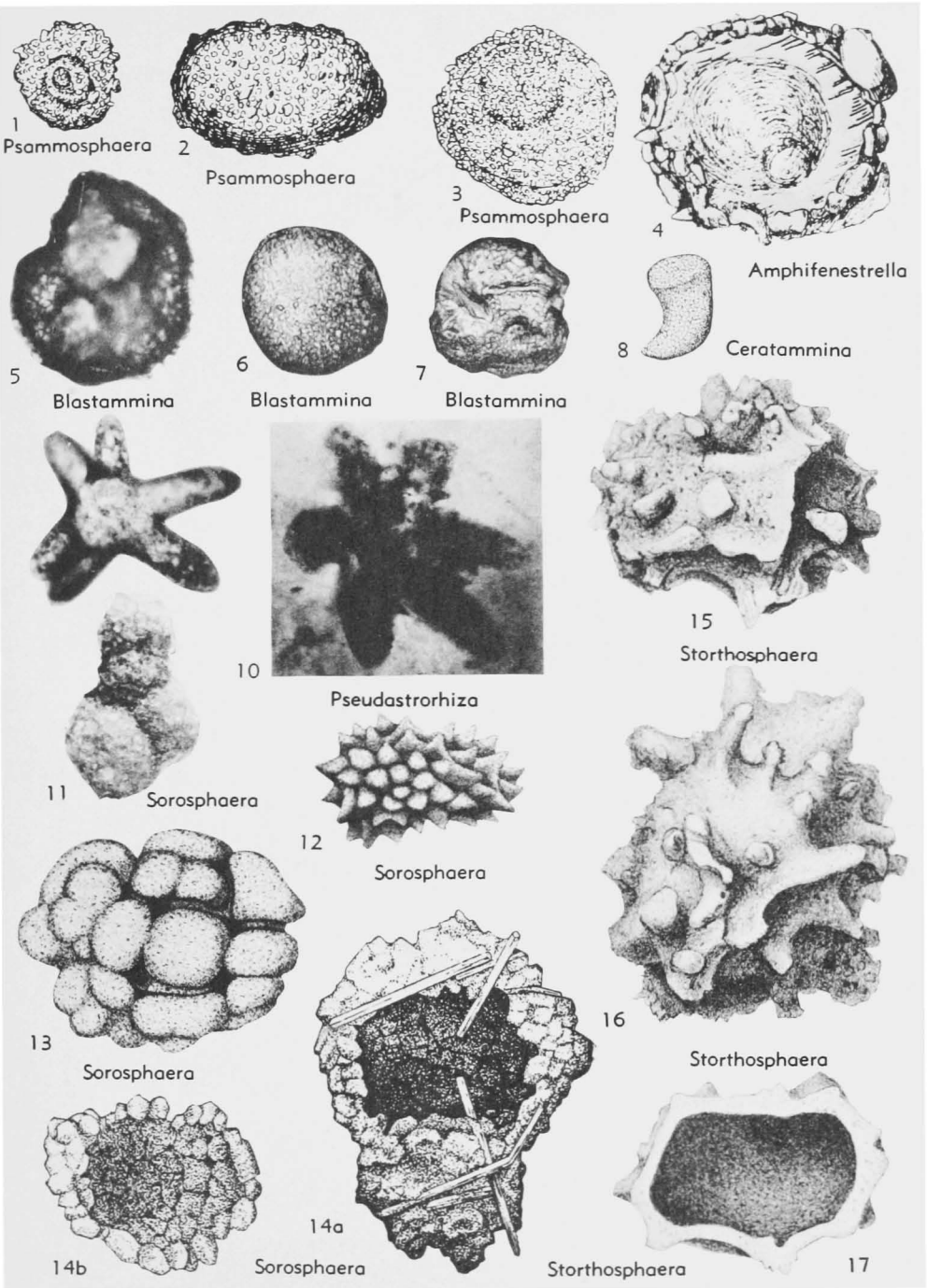

Fig. 111. Saccamminidae (Psammosphaerinae; *1-3, Psammosphaera; 4, Amphifenestrella; 5-7, Blastammina; 8, Ceratammina; 9,10, Pseudastrorhiza; 11-14, Sorosphaera; 15-17, Storthosphaera*) (p. C195-C196).

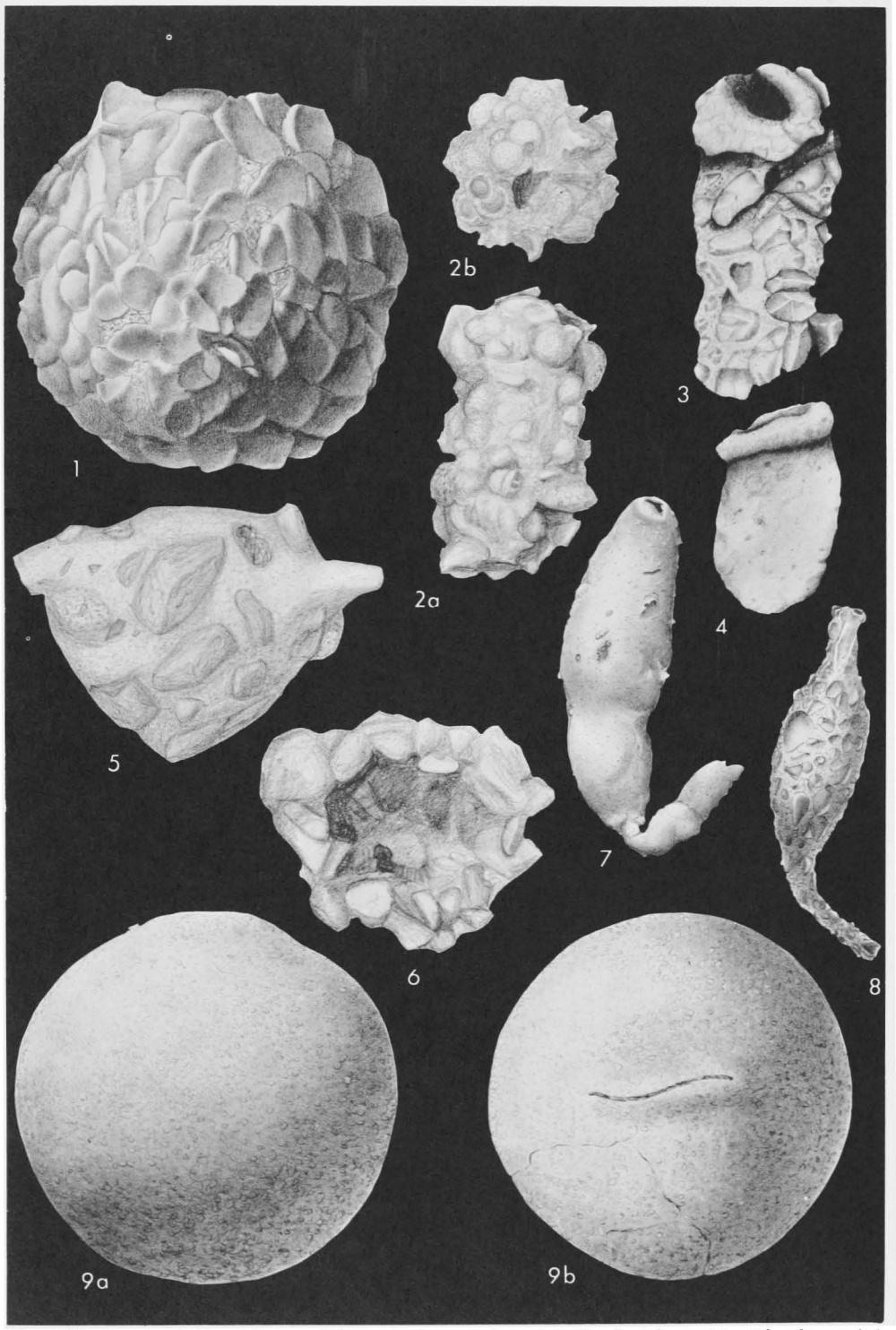

FIG. 112. Saccamminidae (Saccammininae; *1, Saccammina; 2-4, Brachysiphon; 5,6, Pelosphaera; 7,8, Pelosina; 9, Pilulina*) (p. C196-C201).

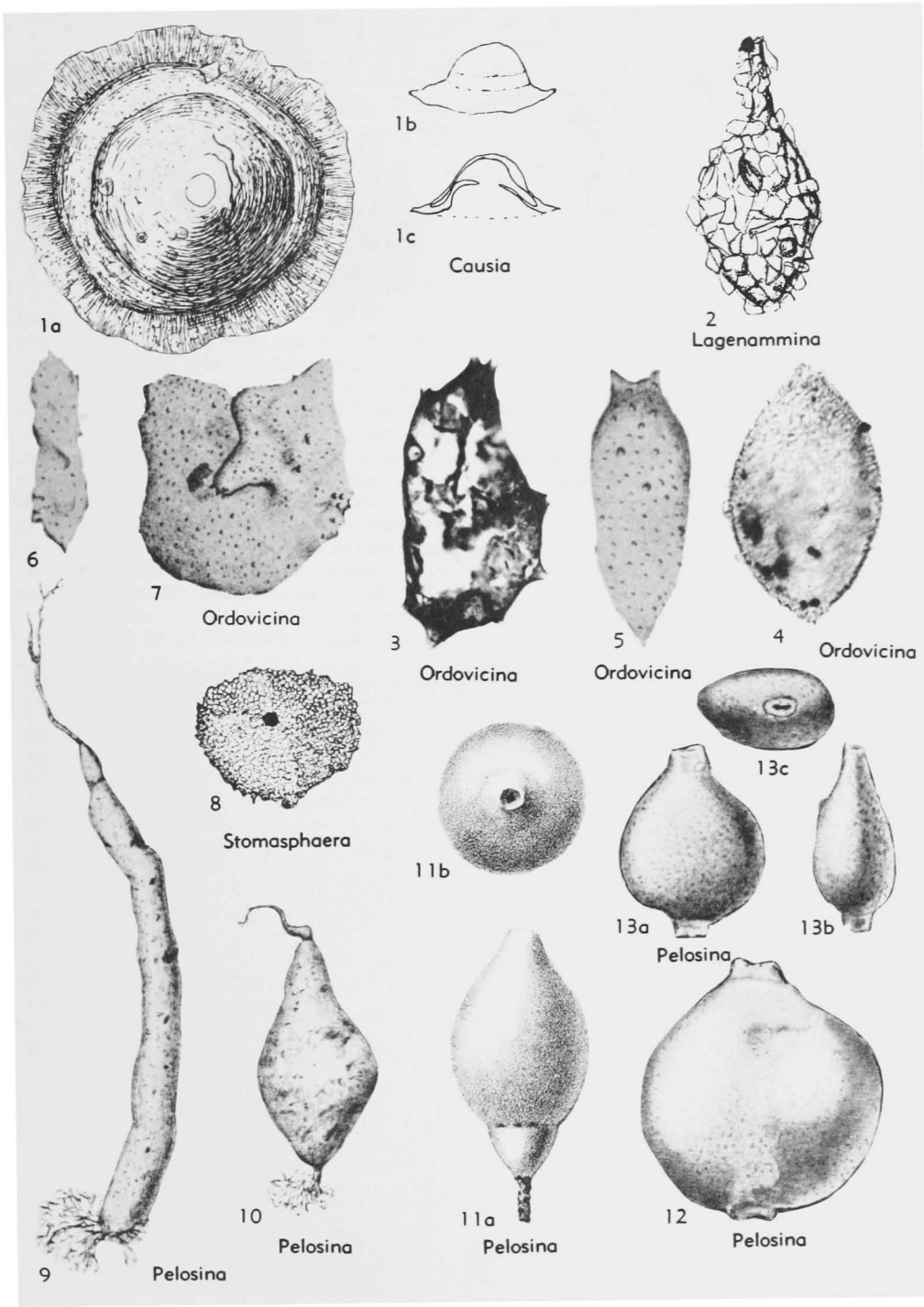

FIG. 113. Saccamminidae (Saccammininae; *1, Causia; 2, Lagenammina; 3-7, Ordovicina; 8, Stomasphaera; 9-13, Pelosina*) (p. C200-C202).

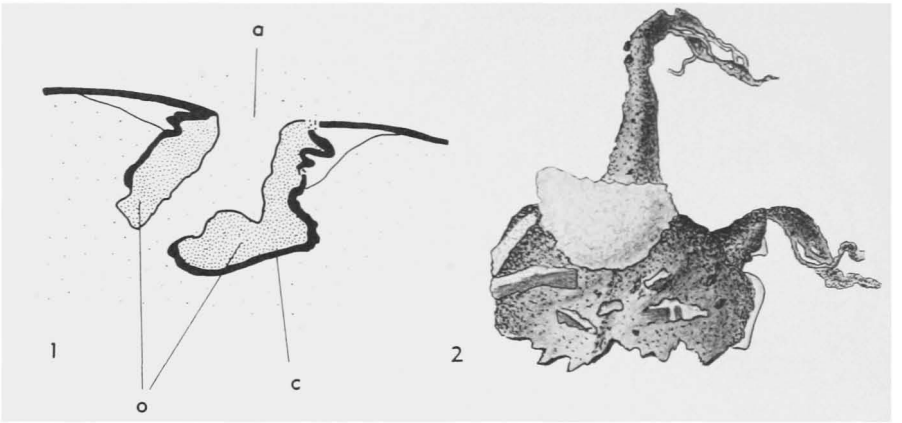

FIG. 114. Saccamminidae (Saccammininae; *1,2, Pelosphaera*) (p. C201).

Australia; ×28 (*394).——FIG. 112,*4. B. australe* (CRESPIN), Perm., W.Australia(Carnavon Basin); ×39 (*394).

Causia RHUMBLER, 1938, *1576, p. 171 [**C. injudicata*; OD]. Test free, unilocular, circular in plan, convex above and concave below, may have marginal flange; wall of pseudochitin with small amount of fine-grained agglutinated foreign matter; aperture small, rounded, at center of concave lower side. *Rec.,* N.Sea.——FIG. 113,*1. *C. injudicata,* Helgoland; *1a,* dorsal view, but with small rounded ventral aperture visible through semitransparent pseudochitinous wall, ×200; *1b,* diagram. edge view of marginal flange, ×110; *1c,* diagram. vert. sec., ×110 (*1576).

Lagenammina RHUMBLER, 1911, *1572a, p. 92, 111 [**L. laguncula*; OD(M)] [=*Arlagenammum* RHUMBLER, 1913, *1572b, p. 348 (obj.) *(nom. van.)*]. Test single flask-shaped chamber; wall with pseudochitinous inner layer, densely covered with agglutinated material; aperture terminal, produced on neck. *Sil.-Rec.,* N.Am.-Atl.——FIG. 113,*2. **L. laguncula,* Rec., N.Atl., ×218 (*1572a).

Ordovicina EISENACK, 1938, *693b, p. 234 [**O. oligostoma*; OD] [=*Amphitremoida* EISENACK, 1938, *693b, p. 235 (type, *A. citroniforma*); *Amphitremoidea* THALMANN, 1941, *1897e, p. 648 *(nom. van.)*; *Shidelerella* DUNN, 1942, *648, p. 328 (type, *S. bicuspidata*); *Croneisella* DUNN, 1942, *648, p. 334 (type, *C. typa*); *Gastroammina* DUNN, 1942, *648, p. 335 (type, *G. williamsae*)]. Test free, single ovate to irregularly shaped chamber, wall with pseudochitinous base and agglutinated outer layer; one or more apertures at ends of slight projections. [Because of the dominantly pseudochitinous wall and thin agglutinated layer, the fossil tests are commonly somewhat distorted, suggesting that restricted generic limits should not be based on test shape alone.] *Ord.-Sil.,* N.Am.-Eu.——FIG. 113,*3. **O. oligostoma,* Ord., Est.; ×95 (*694).——FIG. 113,*4. O. citroniforma* (EISENACK), Ord., Baltic; hypotype, ×140 (*694).——FIG. 113,*5. O. bicuspidata* (DUNN), Sil., USA(Ill.); ×35 (*648).——FIG. 113,*6. O. typa* (DUNN), Sil., USA(Ill.); ×27 (*648).——FIG. 113,*7. O. williamsae* (DUNN), Sil., USA (Mo.); ×27 (*648).

Pelosina BRADY, 1879, *196a, p. 30 [**P. variabilis;* SD CUSHMAN, 1910, *404a, p. 45] [=*Arpelosum* RHUMBLER, 1913, *1572b, p. 348 (obj.) *(nom. van.)*; *Pelosinella* PARR, 1950, *1429, p. 261 (type, *P. bicaudata*); *Globosiphon* AVNIMELECH, 1952, *63, p. 65 (type, *Pelosina variabilis* BRADY var. *sphaeriloculum* HÖGLUND, 1947, *924, p. 61); *Millettina* AVNIMELECH, 1952, *63, p. 64 (type, *Pelosina distoma* MILLETT, 1904, *1284f, p. 608); *Caudammina* MONTANARO GALLITELLI, 1955, *1301, p. 178 (type, *Saccammina? caudata* MONTANARO GALLITELLI, 1955, *1301, p. 178)]. Test free, subcylindrical, elongate, fusiform, nonseptate; wall thick, may be irregularly constricted, finely agglutinated, with thin, pseudochitinous base, well-preserved specimens with fine tubular extensions at either end; pseudochitinous lining may protrude farthest at one end; apertures at open end of tubular extension at one or both ends. *Cret.-Rec.,* Eu.-Sib.-Atl.-Pac.-Arctic-Antarctic.——FIG. 112,*7*; 113,*9. **P. variabilis,* Rec., off N.Z. (112,*7*), off Sweden (113,*9*); 112,*7,* topotype, ×8 (*2117); 113,*9,* specimen showing membranaceous dendritic "appendages," probably preserved pseudopodia, ×17 (*924).——FIG. 112,*8. P. bicaudata* (PARR), Rec., off Kerguelen Is.; ×44 (*1429).——FIG. 113,*10. P. sphaeriloculum* HÖGLUND, Rec., off Sweden; ×17 (*924).——FIG. 113,*11. P. distoma* MILLETT, Rec., Malay Arch.; *11a,b,* side and apert. views, ×115 (*1284f).——FIG. 113,*12,13. P. caudata* (MONTANARO GALLITELLI), Cret., N.Italy; *12,* holotype,

×100; *13a-c*, side, edge, and top views of paratype, ×100 (*1304).

HÖGLUND (*924) regarded the broader end of the test as apical and the smaller end as oral. In well-preserved specimens extremely delicate dendritic "appendages" at the broad end were regarded as holdfasts, though he also stated that they might be preserved threads of pseudopodia with adherent particles of bottom sediment, since his material was preserved in alcohol immediately after sampling. The latter explanation seems to us more likely, the broader end then appearing to be the apertural end, and in dried specimens (such as the illustrated topotype) it contains an opening. The opposite end had a few thin dendritic tubes in HÖGLUND's material, which could well have served as holdfasts. *Pelosinella*, *Millettina*, and *Caudammina* all were defined for species with openings at both ends, but because of the delicate nature of the tests, this is doubtless due to the state of preservation of the dried or fossil material upon which the species were based. Simple saclike species previously placed in *Pelosina* should be referred to *Saccammina*.]

Pelosphaera HERON-ALLEN & EARLAND, 1932, *914d, p. 255 [**P. cornuta*; OD(M)]. Test free, roughly spherical, with 2 or more projecting fragile, flexible, conical tubes of fine mud, equal in length to test diameter, repeatedly bifurcating near extremity, as in *Pelosina*, tubes commonly destroyed in dead specimens, so that test resembles *Saccammina*; wall with inner imperforate pseudochitinous layer and outer agglutinated layer; cement soft, flexible on surface but firm and smooth internally and may appear somewhat fibrous between grains in interior; aperture single, with distinctive oral apparatus consisting of pseudochitinous entosolenian tube with inner gellike capsule. *Rec.*, S.Georgia Is.-Antarctic.——FIG. 112,*5,6*; 114,*1,2*. **P. cornuta*, off S.Georgia (112,*5,6*), Antarctic (114,*1,2*); 112,*5*, lectotype (here designated, *914d, pl. 2, fig. 14, and redrawn), ×10 (*2117); 112,*6*, paratype (*914d, pl. 2, fig. 15, redrawn), broken to show interior, ×10 (*2117); 114,*1*, diagram. sec. through apertural region (*a*) and showing chitinous layer (*c*), entosolenian tube with gel-like oral capsule (*o*), ×155 (*890); 114,*2*, fragment of alcohol-preserved test, showing fine-grained, repeatedly bifurcating, tubular extensions, ×12.5 (*653).

Pilulina CARPENTER, 1870, *275, p. 5 [**P. jeffreysii* CARPENTER, 1875, *276, p. 532; SD (SM) CARPENTER, *276, p. 532] [=*Arpilulum* RHUMBLER, 1913, *1572b, p. 349 (*nom. van.*)]. Test free, globular; wall thick, of agglutinated loosely aggregated sand and sponge spicules, resulting in delicate test; aperture elongate slit, somewhat as in *Fissurina*, elevated on very slightly produced ridge. [Differs from *Saccammina* in the elongate slitlike aperture.] *Rec.*, Atl.-Pac.-Antarctic.——FIG. 112,*9*. **P. jeffreysii*, N.Atl.; *9a,b*, side, apert. views, ×13 (*2117).

Saccamminoides GEROCH, 1955, *783, p. 54, 57, 60 [*non* IRELAND, 1956] [**S. carpathicus*; OD]. Test free, consisting of few rapidly enlarging, irregularly arranged chambers; wall agglutinated, with siliceous cement; apertures rounded in each of last 2 or 3 chambers, may be slightly produced. [This genus is very similar to *Sorosphaera* except

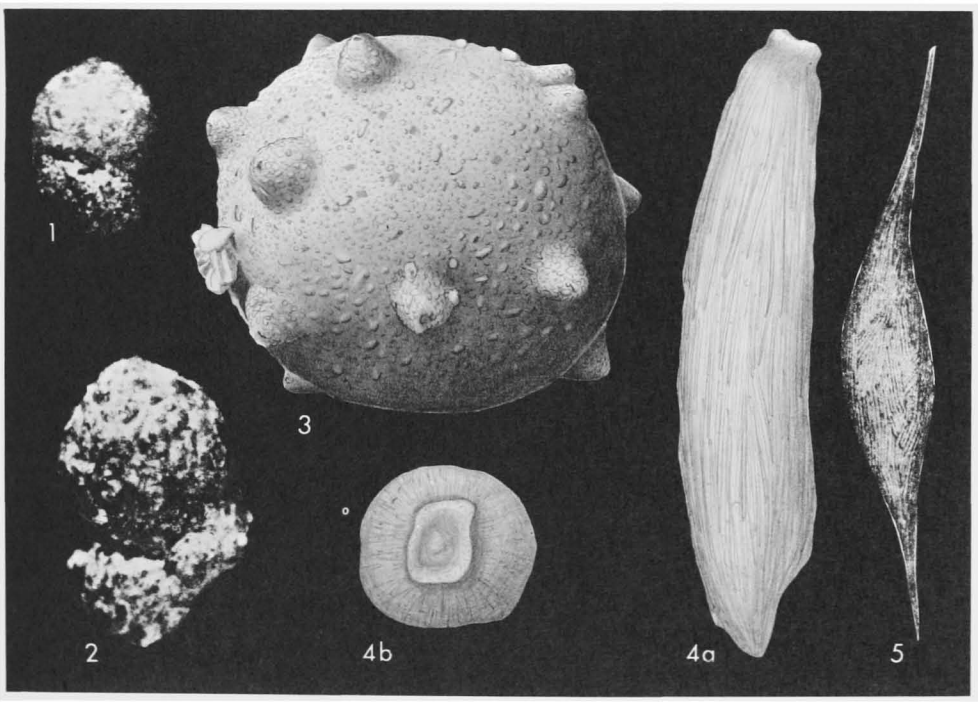

FIG. 115. Saccamminidae (Saccammininae; *1,2*, *Saccamminoides*; *3*, *Thurammina*; *4,5*, *Technitella*) (p. C201-C202).

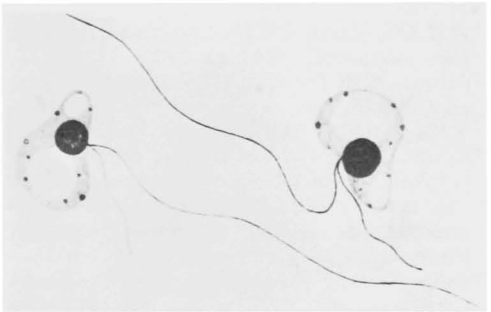

FIG. 116. Saccamminidae (Hemisphaeramminae; *Hemisphaerammina*) (p. C202).

for the presence of distinct apertures in the chambers.] *L.Eoc.*, Eu.(Pol.)——FIG. 115,*1,2*. **S. carpathicus*, W. Carpathians; *1,2*, holotype and paratype, ×33 (*783).

Stomasphaera MOUND, 1961, *1321, p. 28 [**S. brassfieldensis*; OD]. Test free, single subspherical or somewhat subangular chamber; wall agglutinated, medium to coarsely arenaceous, poorly to well cemented, surface rough; aperture single small, rounded opening. *L.Sil.*, N.Am.——FIG. 113,*8*. **S. brassfieldensis*, USA(Ind.); holotype, ×100 (*1321).

Technitella NORMAN, 1878, *1363, p. 279, 281 [**T. legumen*; SD CUSHMAN, 1910, *404a, p. 47] [=*Dioxeia* DE FOLIN, 1887, *726a, p. 115 (type, *D. richardi*); *Hyperamminella* DE FOLIN, 1881, *724, p. 140 (*non* CUSHMAN & WATERS, 1928) *(nom. nud.)*; *Hyperamminella* DE FOLIN, 1887, *726a, p. 114 (*non* CUSHMAN & WATERS, 1928), no species named; *Artechnitum* RHUMBLER, 1913, 1572b, p. 350 (obj.) *(nom. van.)*]. Test free, consisting of single elongate, oval, fusiform or cylindrical chamber; wall thin, composed of longitudinally aligned sponge spicules, with some sand grains; aperture terminal, rounded, may be on short neck. [*Technitella* differs from *Pelosina* in having a thin wall composed largely of sponge spicules, instead of a thick layer of fine agglutinated material on a pseudochitinous inner layer.] *Oligo.-Rec.*, S.Am.-Australia-Atl.-Antarctic.——FIG. 115,*4*. **T. legumen*, Rec., off Ire.; *4a,b*, side and top views of holotype (here refigured, BMNH ZF3628), ×64 (*2117).——FIG. 115,*5*. *T. richardi* (DE FOLIN), loc. and mag. not given (*726a).

Thurammina BRADY, 1879, *196a, p. 45 [**T. papillata*; SD CUSHMAN, 1910, *404a, p. 57] [=*Thyrammina* RHUMBLER, 1904, *1569, p. 236 (obj.) *(nom. van.)*; *Arthyrammum* RHUMBLER, 1913, *1569, p. 347 (obj.) *(nom. van.)*. Test free, single, nearly globular chamber; wall thin, finely agglutinated, surface smoothly finished; apertures several, commonly situated on small mammillate protuberances. [Differs from *Saccammina* in possessing numerous apertures on short protuberances.] *Sil.-Rec.*, N.Am.-Eu.-Atl.-Pac.-Indon.-Antarctic.——FIG. 115,*3*. **T. papillata*, Rec., S.Atl.; ×48 (*2117).

Subfamily HEMISPHAERAMMININAE Loeblich & Tappan, 1961

[Hemisphaeramminae LOEBLICH & TAPPAN, 1961, p. 277]

Test attached, consisting of one or more subglobular or hemispherical chambers. *Ord.-Rec.*

Hemisphaerammina LOEBLICH & TAPPAN, 1957, *1172, p. 223 [**H. batalleri*; OD] [=*Fairliella* SUMMERSON, 1958, *1858, p. 555 (type, *F. dicantha*); *Iridiella* SHCHEDRINA, 1962, *1726A, p. 57 (type, *I. marisalbi*)]. Test attached, consisting of single hemispherical chamber, may have bordering flange; wall agglutinated, with considerable cement; no apparent aperture. [This genus includes the agglutinated species previously referred to *Webbinella*, as the type-species of *Webbinella, W. hemispherica* PARKER, JONES & BRADY, is an attached polymorphinid (*1172).] *M.Dev.-Rec.*, Eu.-USSR-N.Am.-Atl.——FIG. 117,*1*. **H. batalleri*, U.Cret.(U.Santon.), Sp.; holotype, ×12 (*1172).——FIG. 117,*2*. *H. bradyi* LOEBLICH & TAPPAN, Rec., off Eng.; holotype, ×33 (*1172).——FIG. 117,*3*. *H. marisalbi* (SHCHEDRINA), Rec., White Sea; *3a*, dorsal view; *3b*, ventral view, ×30 (*1726A).——FIG. 116. *H. crassa* (LE CALVEZ), Rec., Atl.; biflagellate gametes, ×3,000 (*1106).

Ammopemphix LOEBLICH, 1952, *1152, p. 82 [**Urnula quadrupla* WIESNER, 1931, *2063, p. 82; OD] [=*Urnula* WIESNER, 1931, *2063, p. 82 (obj.) (*non* CLAPARÈDE & LACHMANN, 1857)]. Test attached when living, nearly circular in outline, flat on attached side, convex above, commonly consisting of 4 or more nearly equal chambers, usually symmetrically arranged, with few chambers in single whorl, or with outer ring of chambers; sutures depressed, septa visible from base on unattached specimens, thickness nearly equal to that of outer wall, which is finely arenaceous and white to yellowish, attachment wall very thin, delicate, translucent, and may be broken off when loosened from attachment, leaving chambers open ventrally; apertures rounded, dorsal, one at summit of each chamber. *Rec.*, Antarctic-Arctic.——FIG. 117,*7*. **A. quadrupla* (WIESNER), Antarctic (Weddell Sea); ×146 (*2117).

Amphicervicis MOUND, 1961, *1321, p. 29 [**A. elliptica*; OD]. Test attached, hemispherical, elliptical to circular in outline, with 3 chambers internally similar to *Psammosphaera* but completely enveloped by large final chamber, base flattened to concave; wall thick, agglutinated, fine- to medium-grained and well-cemented, surface smooth; 2 apertures, each a simple, round

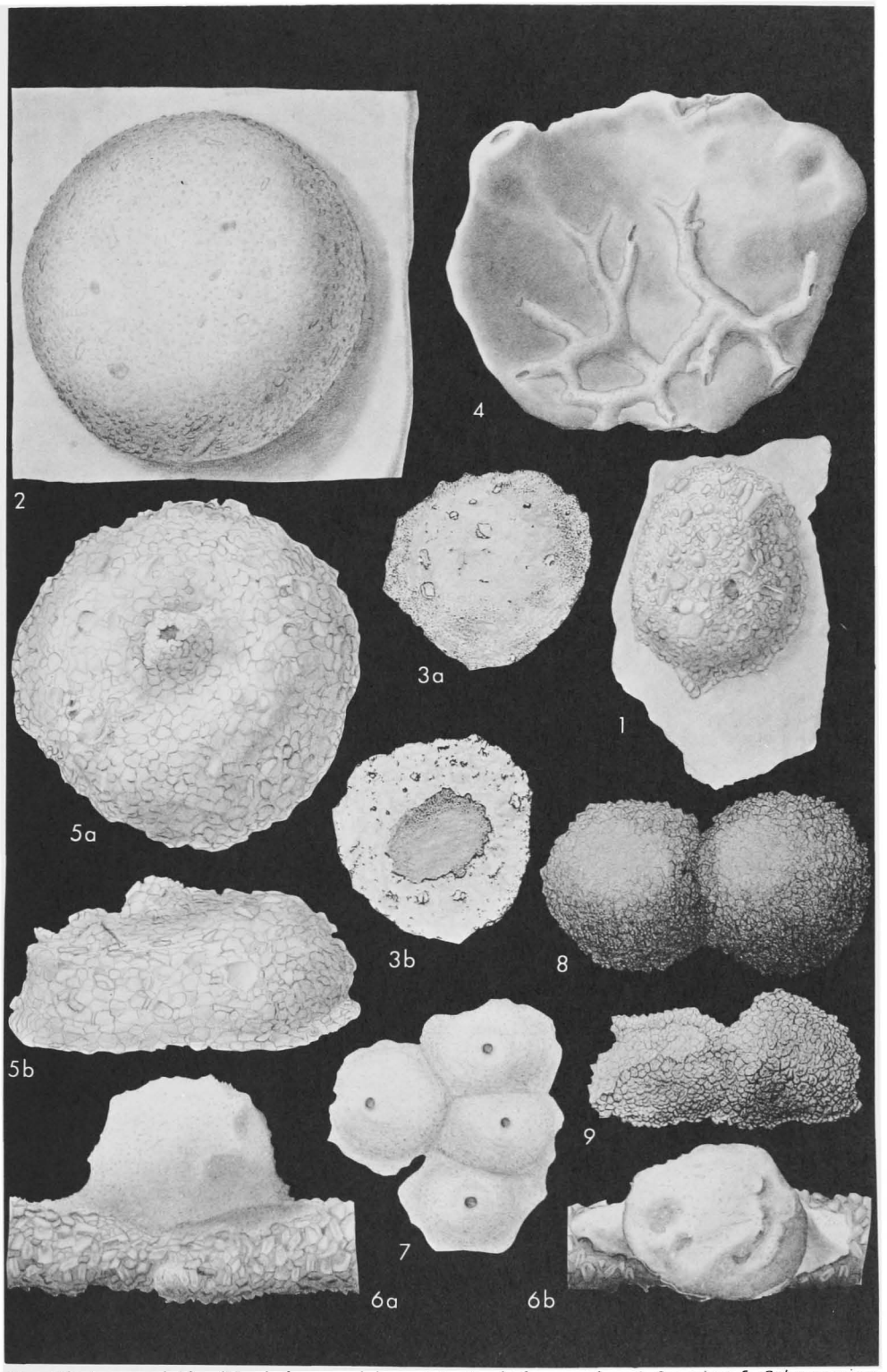

FIG. 117. Saccamminidae (Hemisphaeramminae; *1-3, Hemisphaerammina; 4, Sagenina; 5, Colonammina; 6, Tholosina; 7, Ammopemphix; 8,9, Webbinelloidea*) (p. C202, C204-C205).

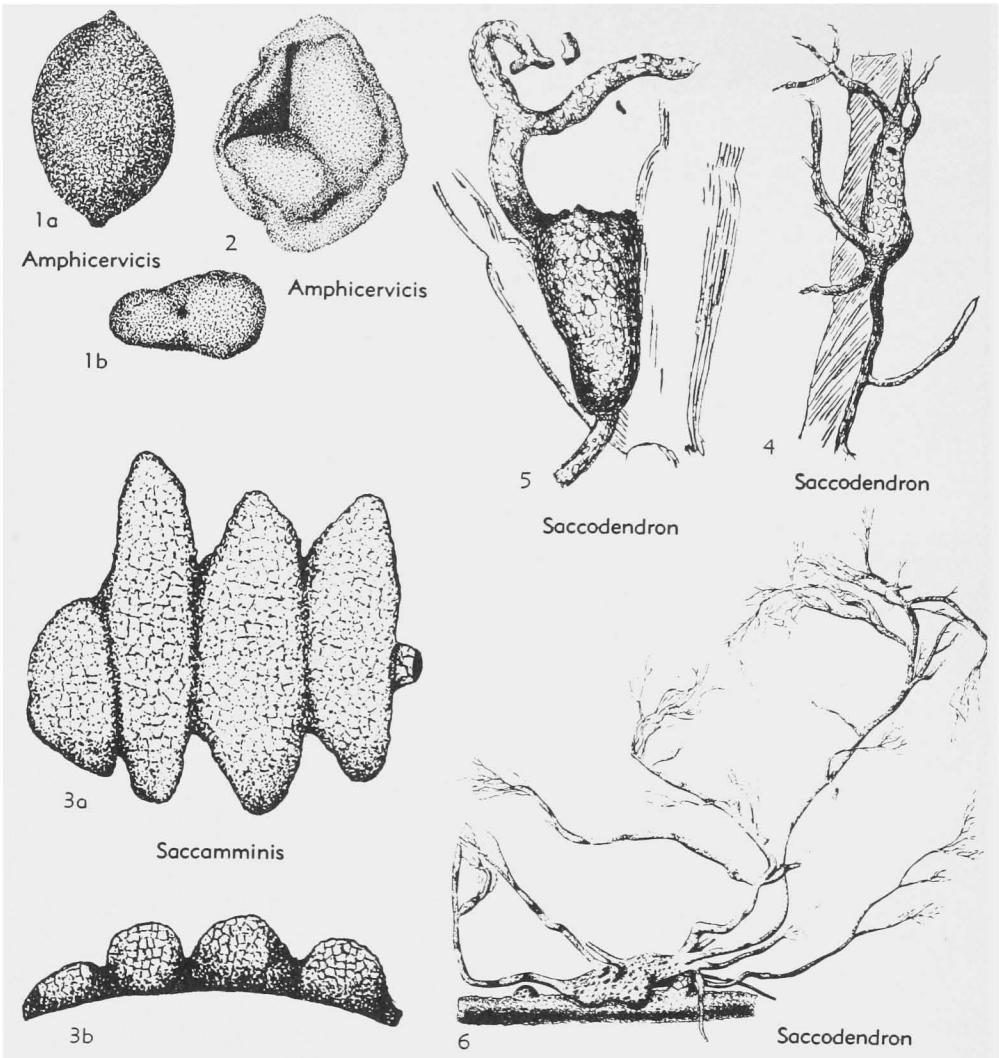

FIG. 118. Saccamminidae (Hemisphaeramminae; *1,2, Amphicervicis; 3, Saccamminis; 4-6, Saccodendron*) (*C202-C205*).

opening somewhat produced, and at opposite extremities of test. *L.Sil.*, N.Am.——FIG. 118,*1,2*. **A. elliptica*, USA(Ind.); *1a,b*, side and end view of holotype; *2*, paratype showing 3-chambered interior; both ×100 (*1321).

Colonammina MOREMAN, 1930, *1309, p. 55 [**C. verruca*; OD] [=*Psammoscene* RHUMBLER in WIESNER, 1931, *2063, p. 85 (*nom. nud.*); *Psammoscene* THALMANN, 1934, *1896, p. 243 (type, *P. craterula* RHUMBLER, 1931)]. Similar to *Ammopemphix*, but consisting of solitary chambers only, may have surrounding flange; single aperture at summit of chamber. *Sil.-Rec.*, N.Am.-Antarctic.——FIG. 117,5. **C. verruca*, Sil., USA(Okla.); *5a,b*, top and edge views, ×162 (*2117).

Goatapitigba NARCHI, 1962 (see p. C795).

Saccamminis IRELAND, 1960, *978, p. 1217 [*pro Saccamminoides* IRELAND, 1956, *977, p. 841 (*non* GEROCH, 1955)] [**Saccamminoides multicellus* IRELAND, 1956, *977, p. 841; OD]. Attached, similar to *Tholosina*, but with more than one hemispherical chamber, commonly in linear series; aperture terminal, at end of slight protuberance, against attachment. *U.Penn.*, N.Am.——FIG. 118,*3*. **S. multicellus* (IRELAND), Virgil., USA(Kans.); *3a,b*, top and edge views, ×80 (*977).

Saccodendron RHUMBLER, 1935, *1574, p. 173 [**S. heronalleni*; OD]. Test attached, hemispherical to ovate chamber with one or more elongate, bifurcating, tubular extensions arising from peripheral area; may grow free of attachment; wall agglutinated; apertures at ends of tubes. *Rec.*, Eu.——FIG. 118,*4-6*. **S. heronalleni*, Ger. (*4,5,* figured as *S. heronalleni* RHUMBLER *forma latericium* RHUMBLER, 1935), Sweden (*6*); *4,5,* side views, ×40, ×50 (*1574); *6,* specimen attached to *Rhabdammina,* ×7.5 (*924).

Sagenina CHAPMAN, 1900, *314, p. 4 [*pro Sagenella* BRADY, 1879, *196a, p. 41 (*non* HALL, 1851) [**Sagenella frondescens* BRADY, 1879, *196a, p. 41; OD(M)] [=*Arsagenum* RHUMBLER, 1913, *1572b, p. 345 (obj.) *(nom. van.)*]. Test attached throughout, consisting of dichotomously or irregularly branching tubes, finely agglutinated; apertures at open ends of tubes. *Eoc.-Rec.*, Philip.-Japan-S.Pac.——FIG. 117,*4*. **S. frondescens* (BRADY), topotype, Rec., S.Pac.(Admiralty Is.); ×10 (*2117).

Tholosina RHUMBLER, 1895, *1568A, p. 82 [**Placopsilina bulla* BRADY, 1881, *196c, p. 51; SD CUSHMAN, 1918, *411a, p. 63] [=*Pseudoplacopsilina* EIMER & FICKERT, 1899, *692, p. 672 (obj.); *Artholosum* RHUMBLER, 1913, *1572b, p. 346 (obj.) *(nom. van.)*]. Similar to *Hemisphaerammina*, but with 2 or more apertures flush with attachment or commonly at ends of irregular protuberances, just above base of test. *Ord.-Rec.*, Atl.-Antarctic-N.Am.-Eu.——FIG. 117,*6*. **T. bulla* (BRADY), Rec., Atl.; *6a,b,* side and top views, ×20 (*2117).

Webbinelloidea STEWART & LAMPE, 1947, *1838, p. 534 [**W. similis*; OD] [=*Sorosphaeroidea* STEWART & LAMPE, 1947, *1838, p. 534 (type, *S. polygonia*)]. Test attached, without visible aperture as in *Hemisphaerammina*, but with numerous chambers in linear or spreading arrangement, as in *Ammopemphix* or *Saccamminis*. *M.Dev.*, N.Am.——FIG. 117,*8*. **W. similis*, USA (Ohio); ×40 (*1838).——FIG. 117,*9*. *W. polygonia* (STEWART & LAMPE), USA(Ohio); ×40 (*1838).

Subfamily DIFFUSILININAE Loeblich & Tappan, n. subfam.

Test free or attached, with interior partially subdivided into chamberlets. *M.Ord.-Rec.*

Diffusilina HERON-ALLEN & EARLAND, 1924, *912, p. 614 [**D. humilis*; OD]. Test attached, commonly to algae, irregular in outline, consisting of mass of intricately ramifying tubes with finely agglutinated wall; apertures inconspicuous at ends of 1 to 4 small pustules on outer surface; dark-colored protoplasm completely filling test. [Differs from *Verrucina* in its very irregular character and unevenly spaced apertures.] *Rec.*, S.Pac.-Atl.——FIG. 119,*1,2*. **D. humilis*, S.Pac.(Lord Howe Is.); *1,2,* top views, ×26 (*2117).

Crithionina GOËS, 1894, *804, p. 14 [**C. mamilla*; SD RHUMBLER, 1904, *1569, p. 229] [=*Arcrithionum* RHUMBLER, 1913, *1572b, p. 346 (obj.) *(nom. van.)*]. Test attached, commonly to *Rhabdammina,* or later detached, subspherical to hemispherical, single chamber incompletely divided by ingrowth of wall which appears to form partial septum; wall thick, finely agglutinated, of sand, sponge spicules and foraminiferal tests, surface commonly roughened owing to dislodgement of some larger fragments embedded in wall; no apparent aperture in globular forms but tubular chitinoid or agglutinated projection which terminates in rounded aperture may occur at one side, probably at only one stage in life history (*924). [Redescription of the type-species by HÖGLUND (*924) based on the original material of GOËS requires modification of the generic definition.] *Rec.*, Atl.-Pac.-Carib.-N.Sea.——FIG. 120,*1-4*. **C. mamilla*, N.Sea(Skagerak); *1,2,* ext. and sec. showing internal septum, ×17; *3,* sec. of another specimen, ×30; *4,* specimen with tubular projection and rounded aperture, ×17 (*924).

Daitrona LOEBLICH & TAPPAN, 1961, *1181, p. 218 [**Crithionina lens* GOËS, 1896, *805, p. 24; OD]. Test free, 2-4 mm. diam., lenticular in section, rounded to oblong in plan; single chamber subdivided by radial semisepta or secondary partitions, projecting inward from wall, may subdivide test almost completely; wall finely agglutinated, loosely cemented; no localized aperture. [Differs from *Crithionina* in being free and in having numerous radiating secondary partitions subdividing the chamber. Differs from *Oryctoderma* in having a thin wall with secondary partitions nearly completely segmenting the test, rather than a thick wall with labyrinthine passages connecting the smoothly finished inner cavity to the exterior.] *Rec.*, Pac.——FIG. 120,*5-7*. **D. lens* (GOËS); *5a,b,* side, edge views; *6,7,* horiz. and vert. secs., ×11 (*805).

Discobotellina COLLINS, 1958, *375, p. 342 [**D. biperforata*; OD). Test discoidal, single chamber, with concentric growth rings; 2 distinct forms in type-species (may represent alternating generations), one discoidal with central inflated area, other slightly elliptical in outline, with 2 eccentric slotlike perforations which pass through test, apparently migrating outward by resorption and regrowth at margins as test enlarges; wall agglutinated, with thick inner layer of loosely cemented large grains, and thin, fine-grained, well-cemented outer layer, imperforate except at peripheral margin where interstitial spaces communicate with labyrinthic interior. *Rec.*, Australia.——FIG. 119, *6-8*. **D. biperforata;* S.Queensl.*(6)*, Great Barrier Reef*(7,8)*; *6a,b,* side, edge views of holotype (perforated form), ×1.8 (*375); *7a,b,* side, edge views

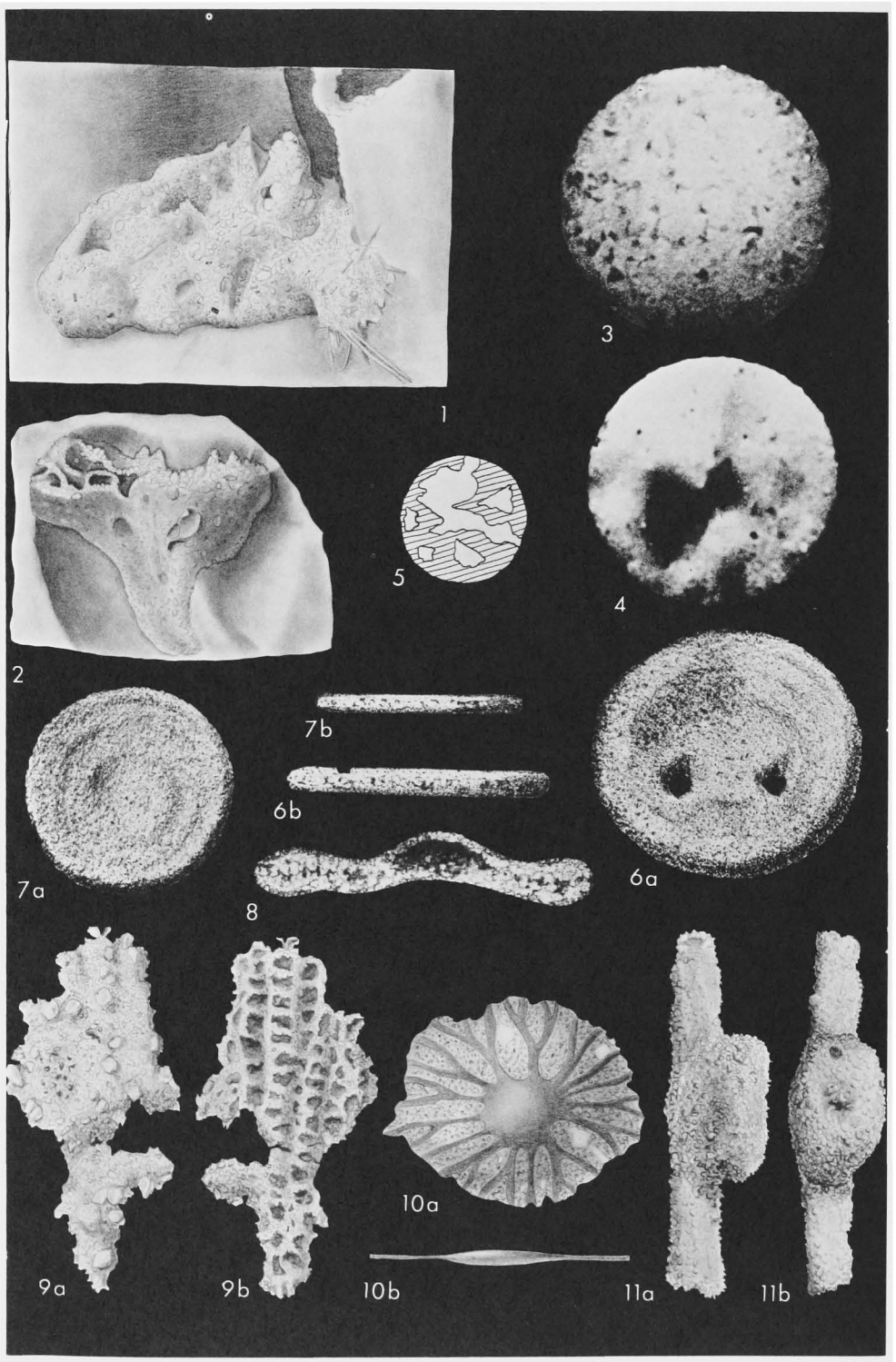

FIG. 119. Saccamminidae (Diffusilininae; *1,2, Diffusilina; 3-5, Weikkoella, 6-8, Discohotellina; 9, Kerionammina; 10, Masonella; 11, Verrucina*) (p. C205-C210).

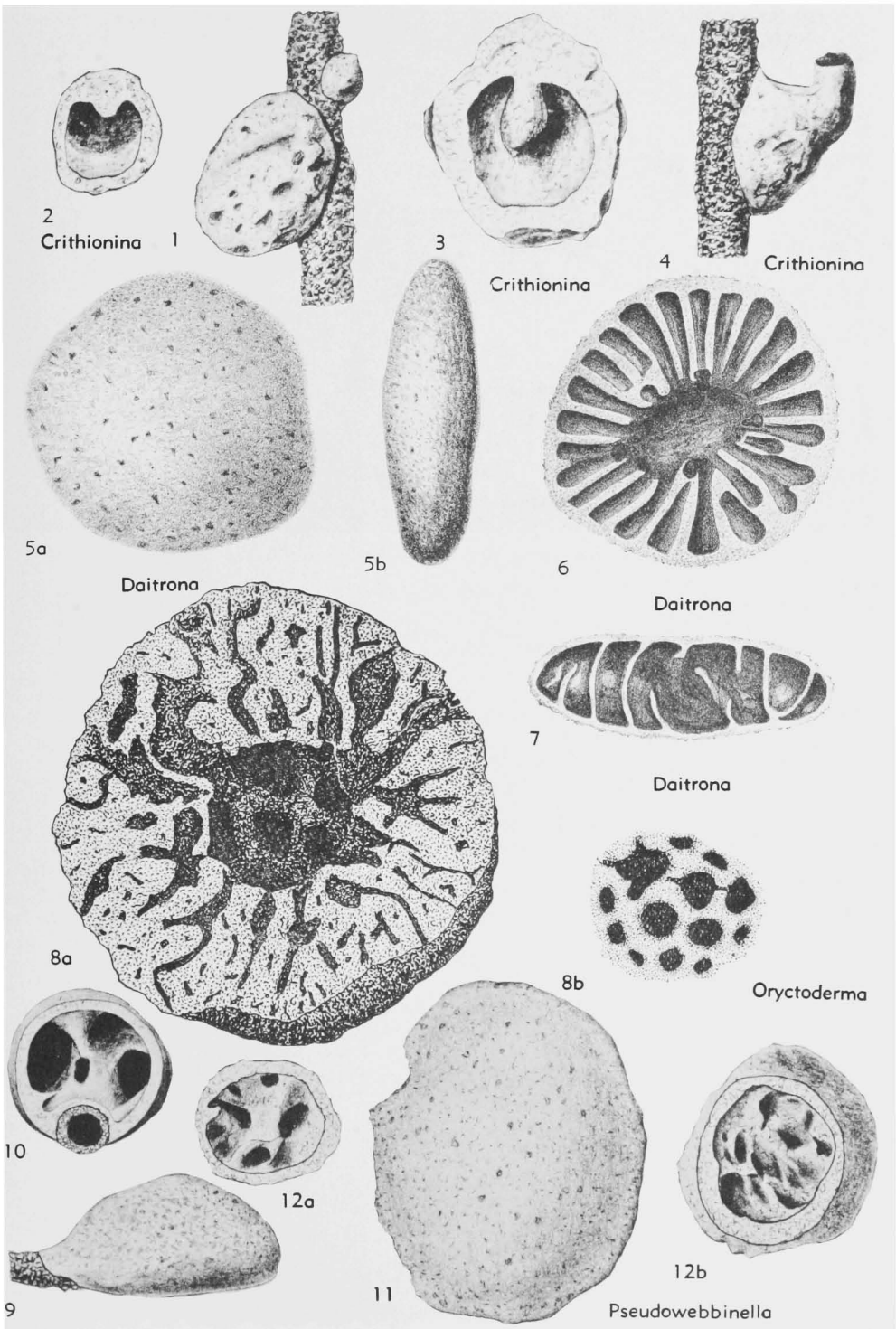

FIG. 120. Saccamminidae (Diffusilininae; *1-4, Crithionina; 5-7, Daitrona; 8, Oryctoderma; 9-12, Pseudowebbinella*) (p. C205, C208).

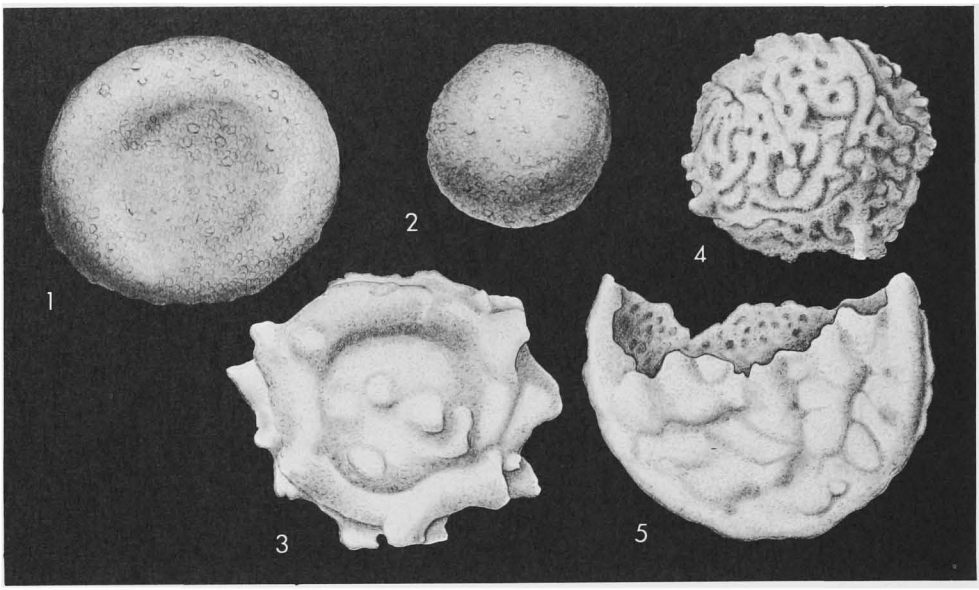

FIG. 121. Saccamminidae (Diffusilininae; *1-5, Thuramminoides*) (p. C208-C210).

of paratype, ×3 (*375); *8,* specimen broken to show internal structure, ×4 (*375).

Kerionammina MOREMAN, 1933, *1310, p. 397 [**K. favus*; OD]. Test attached, irregularly spreading; wall agglutinated, with labyrinthic interior, subdivided into more or less regular chamberlets; apertures rounded, at ends of tubular extensions from peripheral margin. [Originally placed in the family Neusinidae because of its labyrinthic character, later it was removed to the Saccamminidae (*486). *Neusina* is a junior synonym of *Stannophyllum* and belongs to the Xenophyophorida rather than to the Foraminiferida.] *M.Ord.,* N.Am.——FIG. 119,*9*. **K. favus,* Trenton., USA (Okla.); *9a,b,* dorsal and ventral sides, ×26 (*2117).

Masonella BRADY, 1889, *201, p. 295 [**M. planulata;* SD CUSHMAN, 1927, *433, p. 188] [=*Armasonellum* RHUMBLER, 1913, *1572b, p. 345 (obj.) *(nom. van.)*]. Test discoidal, compressed, central cavity with fine, branching tubules extending to periphery; wall finely agglutinated; aperture at open ends of tubules. *Rec.,* Ind.O. ——FIG. 119,*10*. **M. planulata,* Bay of Bengal; *10a,b,* side, edge views, ×7 (*201).

Oryctoderma LOEBLICH & TAPPAN, 1961, *1181, p. 217 [**Crithionina rotundata* CUSHMAN, 1910, *404a, p. 56; OD]. Test free, large, globular, unilocular; central cavity relatively small, simple, spherical; wall agglutinated, very thick and loosely cemented, with numerous ramifying canals leading from central cavity to exterior, margins of canals being relatively firmly cemented; apertures consisting of numerous circular to polygonal openings on surface which lead into these canals. *Perm.-Rec.,* Atl.-Pac.-Australia.——FIG. 120,*8*. **O. rotundata* (CUSHMAN), Rec., Pac.(off San Diego, Calif.); *8a,* int., ×10; *8b,* part of surface, ×25 (*404a).

Pseudowebbinella SHCHEDRINA, 1962, *1726A, p. 54 [**Crithionina goesi* HÖGLUND, 1947, *924, p. 36; OD]. Test attached, consisting of single hemispherical chamber, internally partially subdivided by short radial partitions projecting inward from the peripheral margin; wall agglutinated; no distinct aperture. [*Pseudowebbinella* resembles *Crithionina* externally, but has a more complex internal subdivision. It resembles *Daitrona* in the inner structure but differs in the attached character.] *Rec.,* Eu.(N. Sea)-USSR(White Sea).——FIG. 120,*9-12*. **P. goesi* (HÖGLUND), N. Sea; *9,* ext. of specimen attached to *Rhabdammina*; *10,* sectioned specimen showing internal subdivision; *11,* surface of discoidal specimen; *12a,b,* transversely sectioned specimen, ×17 (*924).

Thuramminoides PLUMMER, 1945, *1468, p. 218 [**T. sphaeroidalis*; OD]. Test free, subglobular to compressed; wall finely agglutinated, interior labyrinthic; no visible aperture, or with openings at ends of short protuberances. *L.Penn.-M.Penn.,* N.Am.; *Mesoz.,* USSR.——FIG. 121,*1-5*. **T. sphaeroidalis,* L.Penn., Tex.*(2),* M.Penn., Tex. *(1,3-5); 1,* holotype; *2,* small globular paratype; *3-5,* paratypes with large protuberances, labyrinthic test, broken specimen showing pitted inner surface; all ×48 (*2117).

[This genus was defined as having a labyrinthic or spongy interior, and in the type-species varying from a smooth surface to a papillate one. Examination of the original types strongly suggests that these include more than one species and possibly more than one genus. The holotype and one paratype have a compressed circular form, with smoothly finished surface; another paratype shows large protuberances bearing small rounded openings.

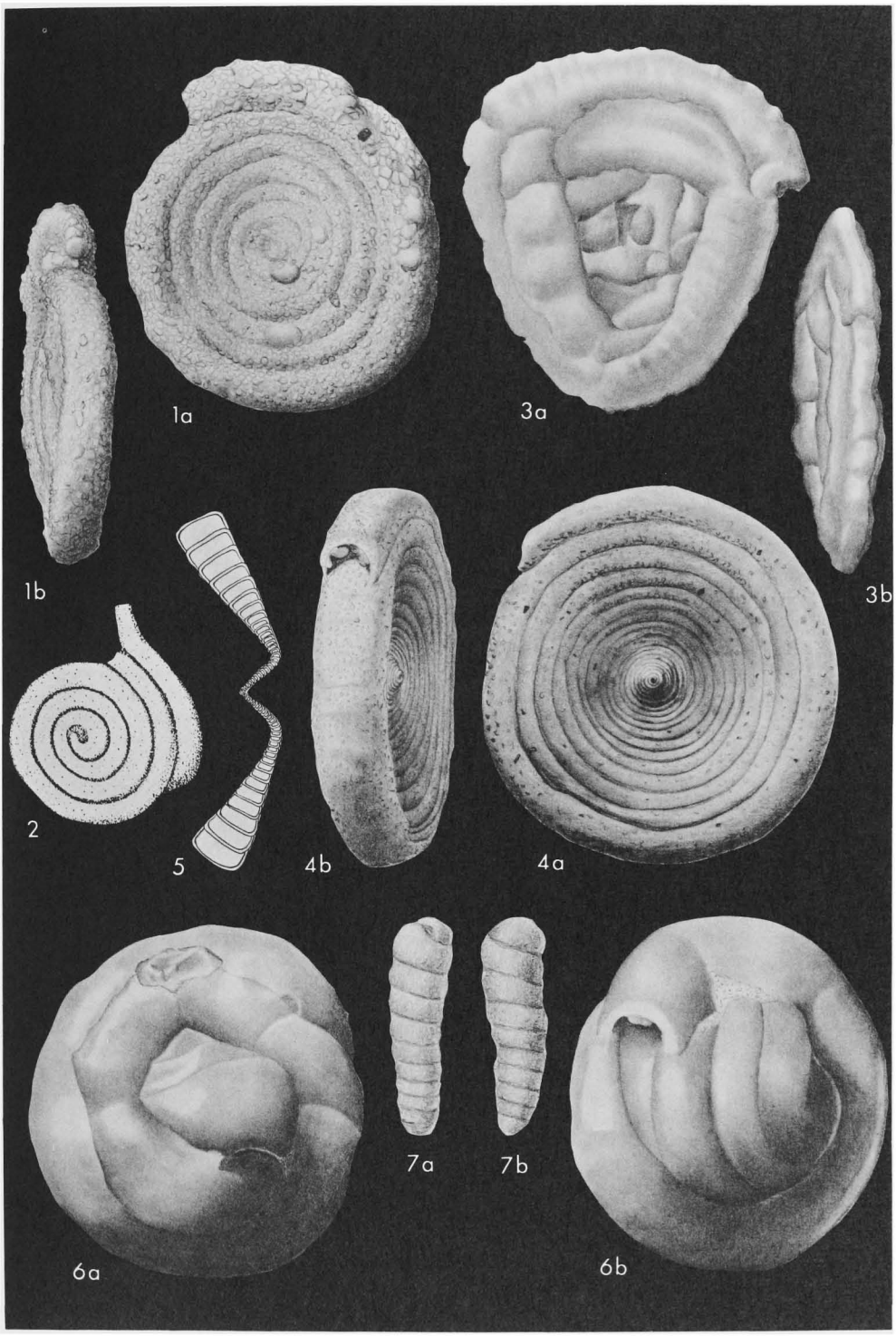

FIG. 122. Ammodiscidae (Ammodiscinae; *1,2, Ammodiscus; 3, Glomospirella; 4,5, Ammodiscoides; 6, Glomospira; 7, Turritellella*) (p. C210, C212).

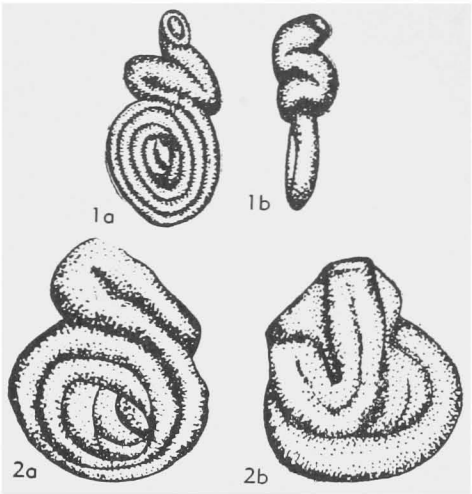

FIG. 123. Ammodiscidae (Ammodiscinae; *1,2, Ammovertellina*) (p. C210).

Other specimens with irregular surfaces show roughened internal walls which suggest a labyrinthic structure. However, the globular paratype PLUMMER figured as an internal cast, showing the spongy interior, we believe to be a complete specimen, as it shows an agglutinated wall and is not a secondarily formed internal cast. It is a globular specimen with exterior labyrinthic wall and seems quite distinct from the smooth-walled, compressed holotype. The interior of a large number of smooth forms must be examined in order to determine if they do represent a single species, and if the genus does include all specimens here included by PLUMMER.]

Verrucina GOËS, 1896, *805, p. 25 [**V. rudis*; OD(M)] [=*Arverrucum* RHUMBLER, 1913, *1572b, p. 346 (obj.) *(nom. van.)*]. Test attached, hemispherical to ovoid; coarsely agglutinated, interior partially subdivided into chamberlets; aperture in depressed area at summit of test. [Similar to *Colonammina* but with complex interior.] *Rec.*, E.Pac.——FIG. 119,*11*. **V. rudis*, off Mex.; *11a,b*, edge and top views, ×7 (*2117).

Weikkoella SUMMERSON, 1958, *1858, p. 548 [**W. sphaerica*; OD]. Test similar to *Thuramminoides*, but without definite central cavity, entire test consisting of labyrinthic agglutinated material with ramifying cavity. *M.Dev.*, USA(Ohio).——FIG. 119,*3-5*. **W. sphaerica*; *3*, ext. of holotype, ×53; *4*, broken specimen showing inter., ×53; *5*, diagram. sec. showing labyrinthine chamber cavity, ×26 (*1858).

Family AMMODISCIDAE Reuss, 1862

[*nom. correct.* RHUMBLER, 1895, p. 83 (*pro* family Ammodiscinea REUSS, 1862, p. 365]——[All names of family rank]——[=Ammodisculinidae RHUMBLER, 1913, p. 339 *(nom. van.)*; =Arammodisclidia RHUMBLER, 1913, p. 341 *(nom. van.)*; =Ammodiscida HAECKEL, 1894, p. 185; =Tolypamminidae LOEBLICH & TAPPAN, 1954, p. 308]

Test free or attached, proloculus followed by nonseptate enrolled tubular second chamber, aperture formed by open end of tube. *Sil.-Rec.*

Subfamily AMMODISCINAE Reuss, 1862

[*nom. transl.* RHUMBLER, 1904, p. 275 (*ex* family Ammodiscinea REUSS, 1862)] [=Arammodiscinia RHUMBLER, 1913, p. 385 *(nom. van.)*; Baissunellinae ARAPOVA, 1961, p. 151]

Test free, planispiral, or irregularly coiled. *Sil.-Rec.*

Ammodiscus REUSS, 1862, *1552, p. 365 [**Ammodiscus infimus* BORNEMANN, 1874, *174, p. 725 (*non Orbis infimus* STRICKLAND, 1846); =*Involutina silicea* TERQUEM, 1862, *1883, p. 450; SD LOEBLICH & TAPPAN, 1954, *1165, p. 306; GERKE, 1960, *781, p. 7; LOEBLICH & TAPPAN, 1961, *1176, p. 191] [=*Arammodiscum* RHUMBLER, 1913, *1572b, p. 387 (obj.) *(nom. van.)*; *Bifurcammina* IRELAND, 1939, *976, p. 201 (type, *B. bifurca*)]. Test free, discoidal, proloculus followed by undivided planispirally enrolled tubular chamber, which may show transverse growth constrictions but no internal partitions; wall agglutinated; aperture at open end of tubular chamber. [GERKE, 1960, *781, p. 7, and LOEBLICH & TAPPAN, 1961, *1176, p. 191, independently arrived at similar conclusions as to the type-species and status of *Ammodiscus*. The occasional double chamber, basis for the genus *Bifurcammina*, is an accidental occurrence in many species, from Paleozoic to Recent, and does not warrant separate generic status.] *Sil.-Rec.*, cosmop.——FIG. 122,*1*. **A. siliceus* (TERQUEM), L.Jur.(Lias.), Fr.: *1a,b*, side and edge views of lectotype, ×44 (*1165). ——FIG. 122,*2*. *A. bifurca* (IRELAND), Sil., USA (Okla.); ×53 (*976).

Ammovertellina SULEYMANOV, 1959, *1854, p. 19 [**A. prima*; OD]. Test free, with tubular chamber streptospirally coiled in early stage, later planispiral, as in *Glomospirella*, but with final stage uncoiled and zigzag growth as in *Ammovertella*; wall agglutinated of angular quartz grains in insoluble cement; aperture simple, at open end of tube. *Paleoc., ?Rec.*, USSR(Uzbek, Kyzylkumov).——FIG. 123,*1,2*. **A. prima: 1a,b*, side and edge views of holotype; *2a,b*, opposite sides of paratype, ×68 (*1854).

Ammodiscoides CUSHMAN, 1909, *402, p. 424 [**A. turbinatus;* OD] [=*Arammodiscodum* RHUMBLER, 1913, *1572b, p. 387 (obj.) *(nom. van.)*]. Early stage regularly trochospiral as in *Arenoturrispirillina*, later planispiral as in *Glomospirella* or *Ammodiscus;* aperture at open end of tubular chamber. *Penn.-Rec.*, Eu.-N.Am.-Atl.-Carib.—— FIG. 122,*4,5*. **A. turbinatus*, Rec., Carib.; *4a,b*, side and edge views, ×16 (*2117); *5*, diagram. sec. showing plan of coiling, ×40 (*402).

Arenoturrispirillina TAIROV, 1956, *1861, p. 115 [**A. aptica* TAIROV & KUZNETSOVA, 1956, *1861, p. 115; OD]. Test conical, similar in plan to *Ammodiscus* but with regular trochospiral coil,

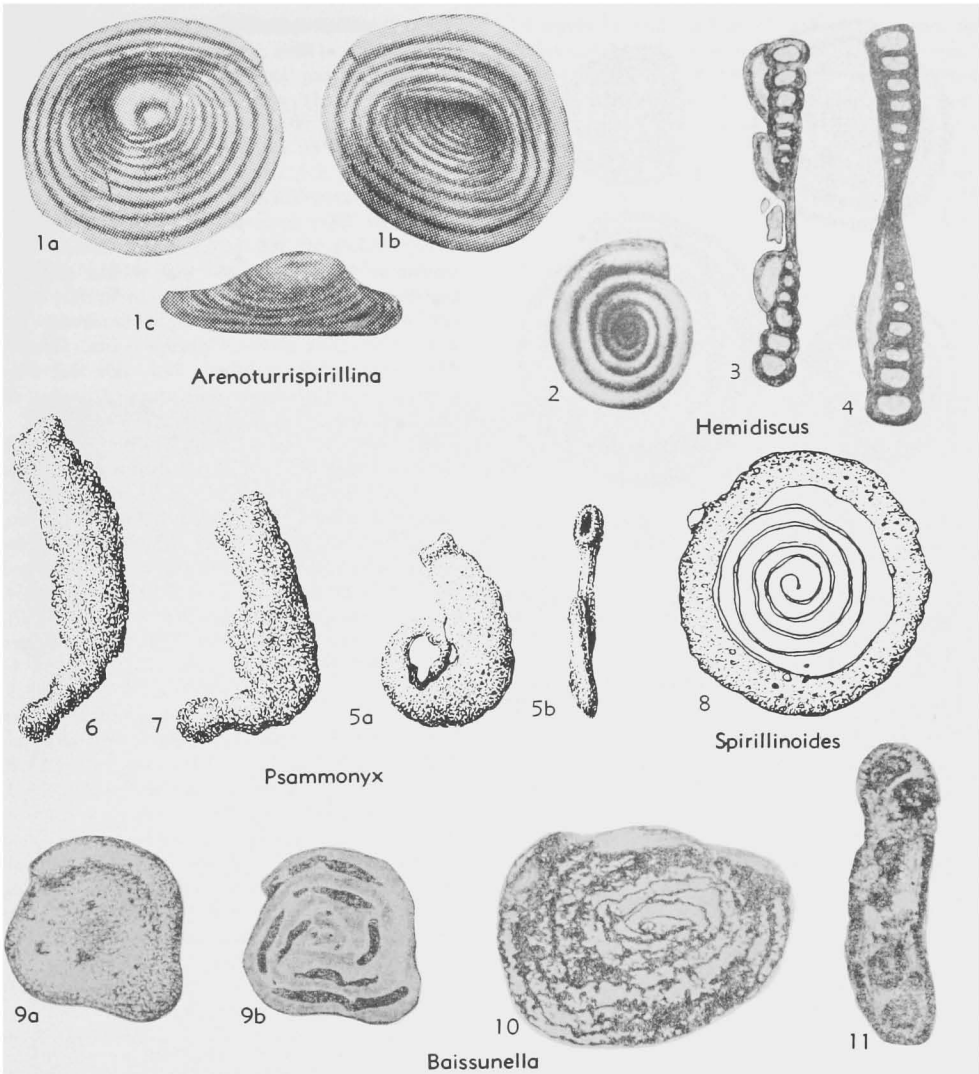

FIG. 124. Ammodiscidae (Ammodiscinae; *1, Arenoturrispirillina; 2-4, Hemidiscus; 5-7, Psammonyx; 8, Spirillinoides; 9-11, Baissunella*) (p. C210-C212).

as in early stage of *Ammodiscoides,* evolute and not close-coiled or high-spired as in *Turritellella,* aperture at open end of tube. *Cret.-Eoc.,* Eu.-N. Am.——FIG. 124,*1.* **A. aptica* TAIROV & KUZNETSOVA, L.Cret., USSR; *1a-c,* approx. ×100 (*1861).

Baissunella ARAPOVA, 1961, *27A, p. 151 [**B. mirkamalovae;* OD]. Test free, large, to 6.0 mm. diam., discoidal, periphery rounded; oval proloculus followed by tubular second chamber, which in section is seen to have slight growth constrictions giving appearance of pseudochambers, plane of coiling may vary slightly with growth; spiral suture obscure; wall of 2 layers, inner one with angular quartz grains in large amount of calcareous cement, exterior layer of microgranular calcite; aperture a rounded areal opening. *U.Cret. (U.Cenom.),* USSR(Uzbek).——FIG. 124,*9-11.* **B. mirkamalovae,* Baisun-Tau, Uzbek SSR; *9a,b,* ext. (paratype) (stated to be lateral views, but one drawing apparently reversed, or that of fig. 9b may be in transmitted light), ×5; *10,* transv. sec. showing growth constrictions in early coil, ×8; *11,* long. sec. showing change in plane of coiling which produces sigmoid appearance, ×9 (*27A).

[This genus was made the monotypic representative of a new subfamily Baissunellinae, because of the "two layered" wall and "pseudochambers." As the proportions of cement and agglutinated matter vary in many Ammodisci-

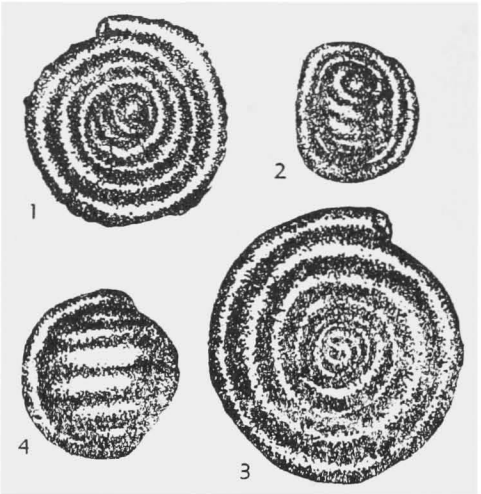

FIG. 125. Ammodiscidae (Ammodiscinae; *1-4, Usbekistania*) (p. C212).

nae, it is here placed in this subfamily. The genus is tentatively recognized, although the large size of the test is unusual for Cretaceous Ammodiscidae; possibly examination may prove it to be a calcareous worm tube. It was described from Upper Cretaceous (lower Turonian) in the *Inoceramus labiatus* zone where it is associated with *Praeglobotruncana stephani*. It is regarded by us as late Cenomanian in age.]

Glomospira RZEHAK, 1885, *1600, p. 126 [**Trochammina squamata* JONES & PARKER, *var. gordialis* JONES & PARKER, 1860, *998, p. 304; OD (M)] [=*Seguenza* O. SILVESTRI, 1889, *1792, p. 57 (type, *Seguenza anomala* SILVESTRI, 1889); *Gordiammina* RHUMBLER, 1895, *1568A, p. 84 (obj.); *Arglomospirum* RHUMBLER, 1913, *1572b, p. 387 (obj.) *(nom. van.)*; *Tolypamminella* MARIE in DELEAU & MARIE, 1961, *580A, p. 83 (type, *T. vermiculare* MARIE, 1961); *Hemigordiellina* MARIE in DELEAU & MARIE, 1961, *580A, p. 76 (type, *Glomospira diversa* CUSHMAN & WATERS, 1930, *539A, p. 42)]. Test similar to *Ammodiscus,* but coiling streptospiral or irregular; aperture at end of tube. *Sil.-Rec.,* cosmop.——FIG. 122,*6*. **G. gordialis* (JONES & PARKER), Rec., Atl.; *6a,b,* opposite sides of test, ×116 (*2117).

Glomospirella PLUMMER, 1945, *1468, p. 233 *(non Glomospirella* REYTLINGER, 1950) [**Glomospira umbilicata* CUSHMAN & WATERS, 1927, *534, p. 148; OD] [=*Brunsiella* REYTLINGER, 1950, *1560, p. 16 (type, *Glomospira ammodiscoidea* RAUZER-CHERNOUSOVA, 1938, *1501, p. 93, 151)]. Test free, discoidal, early stage as in *Glomospira,* later planispiral as in *Ammodiscus;* wall very finely agglutinated, smoothly finished; aperture at open end of tube. *U.Carb.(L.Penn.-M.Penn.)-Cret.,* N.Am.-Eu.——FIG. 122,*3*. **G. umbilicata* (CUSHMAN & WATERS), L.Penn., USA(Tex.); *3a,b,* side and edge views of holotype, ×68 (*2117).

Hemidiscus SCHELLWIEN, 1898, *1644, p. 265 [**Ammodiscus (Hemidiscus) carnicus;* OD] [=*Arhemidiscum* RHUMBLER, 1913, *1572b, p. 387 (obj.) *(nom. van.)*]. Test similar to *Ammodiscus* but later coiling irregular on one side; wall finely agglutinated; aperture at open end of tubular chamber. *U.Carb.-Perm.,* Eu.——FIG. 124,*2-4*. **H. carnicus,* U.Carb., Italy; *2,* side view, ×100; *3,4,* cross secs., ×100 (*1644).

Psammonyx DÖDERLEIN, 1892, *598, p. 145 [**P. vulcanicus;* OD] [=*Arpsammonyxum* RHUMBLER, 1913, *1572b, p. 386 (obj.) *(nom. van.)*]. Test similar to *Ammodiscus,* but with tubular chamber compressed, evolute and tending to uncoil; aperture terminal, may have slight bordering lip. *Dev.,* USA(Okla.); *Rec.,* Japan.——FIG. 124,*5-7*. **P. vulcanicus,* Rec., Japan; *5a,b,* side and edge views of enrolled form; *6,7,* uncoiled forms; all ×1.7 (*1570).

Spirillinoides RHUMBLER, 1938, *1576, p. 174 [**S. circumcinctus;* OD]. Test consisting of a planispiral and evolute to slightly trochospirally coiled undivided tubular chamber; wall pseudochitinous, imperforate, with the outer whorl bordered by an agglutinated layer; aperture at the open end of the tubular chamber. *Rec.,* N.Sea.——FIG. 124, *8*. **S. circumcinctus,* Helgoland, ×200 (*1576).

Turritellella RHUMBLER, 1904, *1569, p. 283 [*pro Turitellopsis* RHUMBLER, 1895, *1568A, p. 84 *(nom. null., fide* RHUMBLER, 1904, *1569, p. 289, corr. *Turritellopsis* RHUMBLER) *(non* SARS, 1878)] [**Trochammina shoneana* SIDDALL, 1878, *1736, p. 46; SD SCHELLWIEN, 1898, *1644, p. 265] [=*Arturritellum* RHUMBLER, 1913, *1572b, p. 387 (obj.) *(nom. van.)*]. Test free, elongate, high-spired; proloculus followed by long undivided close-coiled tubular 2nd chamber; wall finely agglutinated, reddish or yellowish, grading from more deeply colored proloculus to lighter terminal portion; aperture at open end of tube. *Sil.-Rec.,* Eu.-N.Am.-Arctic-Antarctic. —— FIG. 122,*7*. **T. shoneana,* Rec., N.Am.(off Baffin Is); *7a,b,* opposite sides of test, ×100 (*1162).

[RHUMBLER, 1895 (*1568A, p. 84) described *Turitellopsis* as being "turitellaartig," spelling both the new generic name and that of the gastropod genus with one "r." Comparison to the gastropod genus, also misspelled, is regarded as evidence of erroneous spelling in the original publication (Code, Art. 32,a,ii), hence RHUMBLER's name was a homonym of *Turritellopsis* SARS. It was renamed by RHUMBLER, 1904 (*1569, p. 283) as *Turritellella*.]

Usbekistania SULEYMANOV, 1960, *1855, p. 18 [**Glomospirella (Usbekistania) mubarekensis;* OD] [=*Glomospirella (Usbekistania)* SULEYMANOV, 1960, *1855, p. 18 (obj.)]. Test free, consisting of spherical proloculus and undivided tubular 2nd chamber coiled in high spire around vertical axis, with final stage planispirally coiled at axis nearly perpendicular to original axis; wall agglutinated, of minute quartz grains in insoluble, probably siliceous cement; aperture at open end of tube. *Jur.-Rec.,* USSR(Uzbek).——FIG. 125, *1-4*. **U. mubarekensis,* Paleoc., Bukhara *(1-3),* U.Eoc., Amu Darya Basin *(4)*: *1-3,* holotype and paratypes; *4,* paratype; all ×100 (*1855).

Subfamily TOLYPAMMININAE Cushman, 1928

[Tolypammininae CUSHMAN, 1928, p. 103]

Test attached, proloculus followed by tubular second chamber, coiled or irregular. *Sil.-Rec.*

Tolypammina RHUMBLER, 1895, *1568A, p. 83 [**Hyperammina vagans* BRADY, 1879, *196a, p. 33; OD(M)] [=*Serpulella* EIMER & FICKERT, 1899, *692, p. 674 (obj.); *Adhaerentina* PAALZOW, 1935, *1406, p. 28 (type, *Adhaerentina permiana* PAALZOW, 1935)]. Test attached, large globular proloculus followed by long undivided tubular 2nd chamber of smaller diameter which winds irregularly over surface of attachment; wall agglutinated with considerable cement, commonly reddish; aperture at open end of tubular chamber. [Differs from *Lituotuba* in lacking the early streptospiral coil and in having an irregularly winding later stage.] *U.Sil.-Rec.*, Eu.-N.Am.-N.Z.-Australia-Antarctic-Atl.-Pac.——FIG. 126,*1*. **T. vagans* (BRADY), Rec., S.Atl.; ×19 (*2117).——FIG. 126, *2*. *T. permiana* (PAALZOW), Perm.(Zech.), Ger.; ×8 (*1406).

Ammodiscella IRELAND, 1956, *977, p. 845 [**A. virgilensis;* OD]. Similar to *Hemidiscus*, but attached. *U.Penn.(Virgil.)*, USA(Kans.).——FIG. 126,*7*. **A. virgilensis; 7a*, top view; *7b*, attached side; *7c*, cross sec.; all ×53 (*977).

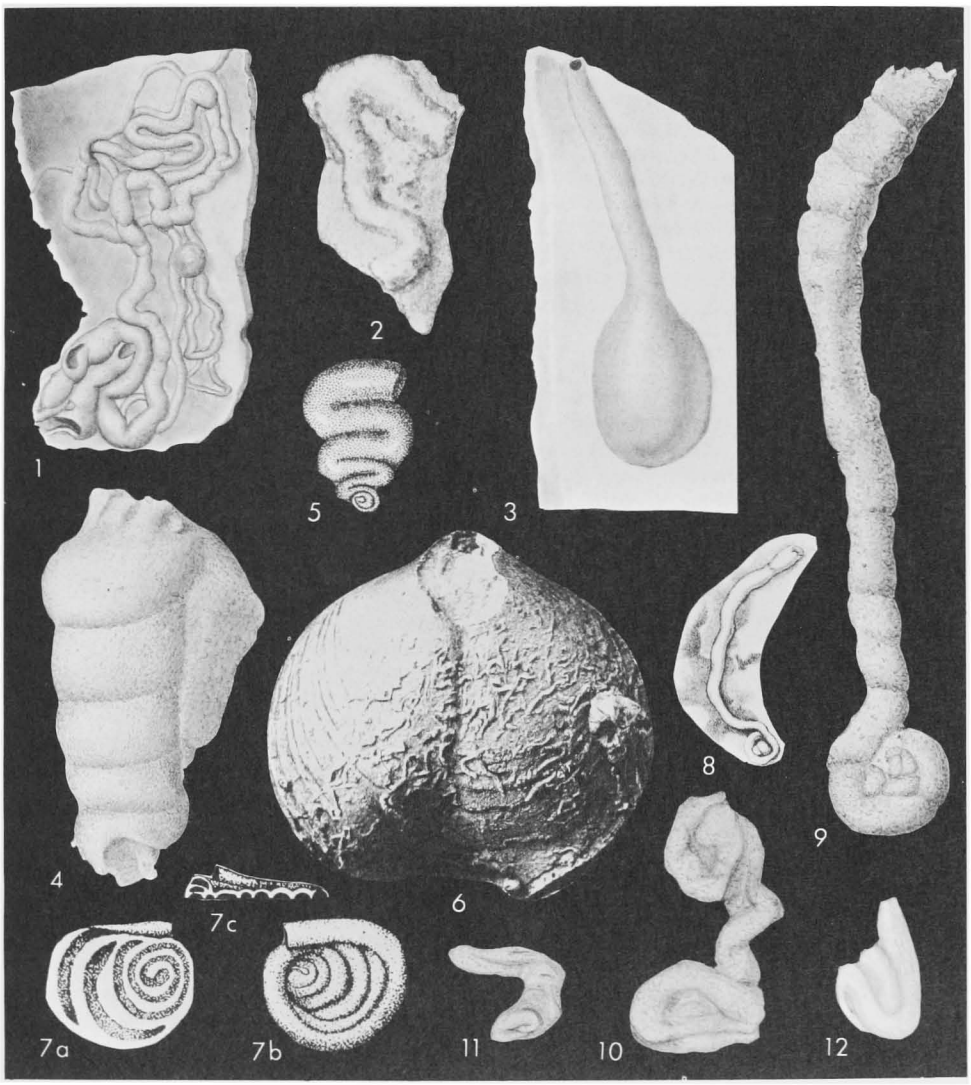

FIG. 126. Ammodiscidae (Tolypammininae; *1,2, Tolypammina; 3, Ammolagena; 4, Trepeilopsis; 5, Ammovertella; 6, Serpulopsis; 7, Ammodiscella; 8-12, Lituotuba*) (p. C213-C214).

Ammolagena EIMER & FICKERT, 1899, *692, p. 673 [**Trochammina irregularis* (D'ORBIGNY) var. *clavata* JONES & PARKER, 1860, *998, p. 304; OD (M)] [=*Arammlagenum* RHUMBLER, 1913, *1572b, p. 346 (obj.) *(nom. van.)*]. Test attached, lagenoid, with elongate tubular neck; wall with pseudochitinous inner layer and finely agglutinated outer layer; aperture terminal, rounded. *Sil.-Rec.,* Ger.-Atl.-Carib.-Medit.——FIG. 126,*3*. **A. clavata* (JONES & PARKER), Rec., Gulf Mex.; ×20 (*2117).

Ammovertella CUSHMAN, 1928, *436, p. 8 [*pro Ammodiscus (Psammophis)* SCHELLWIEN, 1898, *1644, p. 265 (*non Psammophis* FITZINGER, 1826)] [**Ammodiscus (Psammophis) inversus* SCHELLWIEN, 1898, *1644, p. 266; OD] [=*Arpsammophoum* RHUMBLER, 1913, *1572b, p. 387 (obj.) *(nom. van.)*]. Test attached, proloculus followed by elongate undivided tubular 2nd chamber which progresses in zigzag fashion, later bends closely adjacent to earlier ones; wall agglutinated, with considerable cement; aperture at open end of tube. *Penn.-Rec.,* Eu.-N.Am.-Carib. ——FIG. 126,*5*. **A. inversa* (SCHELLWIEN), U. Carb., Eu.(Carnic Alps), enlarged (*1509).

Lituotuba RHUMBLER, 1895, *1568A, p. 83 [**Serpula filum* SCHMID, 1867, *1672, p. 583; SD SCHELLWIEN, 1898, *1644, p. 265] [=*Ammonema* EIMER & FICKERT, 1899, *692, p. 685 (obj.); *Arlituotubum* RHUMBLER, 1913, *1572b, p. 386 (obj.) *(nom. van.)*; *Thalmannina* MAJZON, 1943, *1203, p. 64, 154 (type, *T. nothi*)]. Test free or attached, early stage irregularly coiled undivided tube as in *Glomospira,* later stage uncoiling and becoming rectilinear; aperture at end of tube. [Specimens with irregular early coil are found in many assemblages, and do not warrant generic separation.] *Sil.-Rec.,* cosmop. —— FIG. 126,*8*. **L. filum* (SCHMID), Perm.(Zech.), Ger.; enlarged (*193).——FIG. 126,*9*. *L. lituiformis* (BRADY), Rec., Carib.; ×20 (*2117).——FIG. 126, *10,11*. *L. irregularis* TAPPAN, L.Jur., N.Alaska; *10,* test showing irregular character, ×48 (*1874); *11,* irregular specimen, ×28 (*1874).——FIG. 126,*12*. *L. nothi* (MAJZON), Flysch, Hung.; ×36 (*1203).

Serpulopsis GIRTY, 1911, *790, p. 124 [**Serpula insita* WHITE, 1878, *2054, p. 37; OD] [*(non Serpulopsis* KITTL, 1913)]. Test free or attached, may be somewhat embedded in host; proloculus followed by close-coiled tube of 1 or 2 volutions, then with tube of irregular growth, enlarging slowly; wall agglutinated; aperture at open end of tube. [Originally regarded as an annelid, *Serpulopsis (Treatise* Part W, p. 160) was considered by HENBEST (1960, *898, p. B386) to be a foraminifer.] *Penn.,* USA(Okla.-Ind.).——FIG. 126,*6*. **S. insita* (WHITE), USA(Okla.); attached tubes on surface of brachiopod, ×1.3 (*791).

Trepeilopsis CUSHMAN & WATERS, 1928, *535, p. 38 [**Turritellella grandis* CUSHMAN & WATERS, 1927, *534, p. 149; OD]. Test tubular undivided chamber in high trochospiral coil as in *Turritellella* but attached commonly to spines of *"Productus,"* with final portion of tubular chamber reverting and growing straight across previous whorls; aperture at open end. *U.Dev.-Perm.,* N.Am.-Eu.——FIG. 126,*4*. **T. grandis* (CUSHMAN & WATERS), M. Penn., USA(Tex.); high-spired test and reverted tubular chamber which may have been attached to algae, as central area is open, ×53 (*2117).

Superfamily LITUOLACEA de Blainville, 1825

[*nom. correct.* LOEBLICH & TAPPAN, 1961, p. 277 (*pro* superfamily Lituolidea GLAESSNER, 1945, p. 93, *ex* family Lituacea DE BLAINVILLE, 1825)]——[In synonymic citations superscript numbers refer to taxonomic rank assigned by authors (¹tribu, ²family group, ³superfamily); dagger(†) indicates *partim*]——[=¹Lituolina DELAGE & HÉROUARD, 1896, p. 132; =³Lituolicae BRÖNNIMANN, 1958, p. 176]——[=³Enclinostegia† EIMER & FICKERT, 1899, p. 682; =³Orthoklinostegia† EIMER & FICKERT, 1899, p. 685; =²Textulinidia† RHUMBLER in KÜKENTHAL & KRUMBACH, 1923, p. 88; =²Nodosalidia† RHUMBLER in KÜKENTHAL & KRUMBACH, 1923, p. 86; =²Rotaliaridia† RHUMBLER in KÜKENTHAL & KRUMBACH, 1923, p. 88]

Multilocular, typically coiled spirally or uncoiled or straight, reduction of chambers in each whorl may result in triserial or biserial arrangement; chambers simple or labyrinthic; wall siliceous or agglutinated, with calcareous, siliceous, or ferruginous cement; aperture single or multiple. *Miss.-Rec.*

Family HORMOSINIDAE Haeckel, 1894

[*nom. correct.* LOEBLICH & TAPPAN, herein, *pro* Hormosinida HAECKEL, 1894, p. 185]——[All names of family rank; dagger(†) indicates *partim*]——[=Arenacea BÜTSCHLI in BRONN, 1880, p. 193 *(nom. nud.)*; =Aschemonellidae EIMER & FICKERT, 1899, p. 676; =Nodosamminidae† RHUMBLER, 1913, p. 339 *(nom. nud.)*; =Arnodosammidia† RHUMBLER, 1913, p. 341 *(nom. van.)*; =Reophacidae CUSHMAN, 1927, p. 15; =Silicinidae CUSHMAN, 1927, p. 29; =Reophacida COPELAND, 1956, p. 186 *(nom. van.)*]

Test free, chambers arranged in straight or curved series; wall agglutinated, aperture terminal. *Miss.-Rec.*

Subfamily ASCHEMONELLINAE Eimer & Fickert, 1899

[*nom. transl.* CUSHMAN, 1910, p. 80 (*ex* family Aschemonellidae EIMER & FICKERT, 1899)] [=Araschemonellinia RHUMBLER, 1913, p. 439 *(nom. van.)*]

Irregular chambers in rectilinear arrangement. *Cret.-Rec.*

Aschemonella BRADY, 1879, *196a, p. 44 [**A. scabra:* OD (M)] [=*Araschemonellum* RHUMBLER, 1913, *1572b, p. 440 *(nom. van.)*]. Test free, consisting of tubular or inflated chambers in single or commonly branching series; wall thin, finely to coarsely agglutinated, firmly cemented; apertures several, rounded, at ends of tubular necks. *Cret.-Rec.,* Atl.-Pac.-Eu.——FIG. 127,*1*. **A. scabra,* Rec., N.Pac. (*Challenger* Sta-

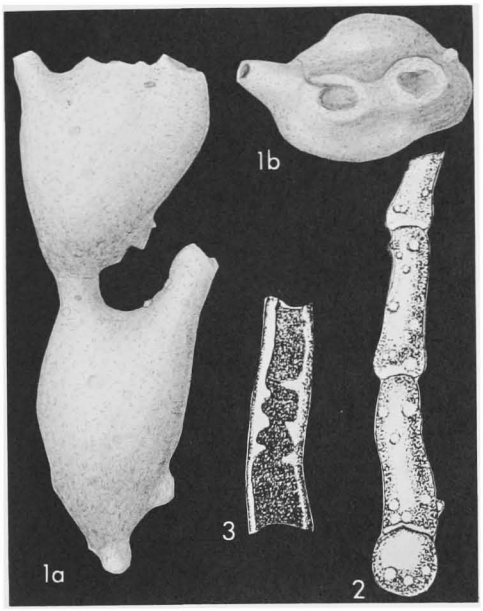

FIG. 127. Hormosinidae (Aschemonellinae; *1, Aschemonella; 2,3, Kalamopsis*) (p. C214-C215).

tion 244, lat. 35°22'N., long. 169°53'E., 2,900 fathoms); *1a,b,* side and top views of lectotype here designated (BMNH-ZF 1102), ×10 (*2117).

[BRADY (1884, *200) considered *A. scabra* to be a synonym of *Astrorhiza catenata* NORMAN, 1876, but the two species are distinct. *Aschemonella catenata* is a much smaller, delicate species, with chambers tending to be bulbous rather than elongate as in *A. scabra*. The name of the type-species thus remains *A. scabra*. *Aschemonella* differs from *Kalamopsis* in its inflated chambers which may branch and in having more than one aperture to each chamber.]

Kalamopsis DE FOLIN, 1883, *725, p. 320 [**K. vaillanti;* OD (M)] [=*Arkalamopsum* RHUMBLER, 1913, *1572b, p. 352 *(nom. van.)*]. Test with globular proloculus and tubular later chambers, which are separated internally by partial septa not always reflected by external sutures. *Rec.,* Atl.-Pac.——FIG. 127,*2,3*. **K. vaillanti,* Gulf Gasc.; *2,3,* side view and long. sec., enlarged (*1569).

Subfamily HORMOSININAE Haeckel, 1894

[*nom. transl.* LOEBLICH & TAPPAN, herein, *ex* family Hormosinida HAECKEL, 1894, p. 185]——[=Reophacinae CUSHMAN, 1910, p. 81; =Arreophaxnia RHUMBLER, 1913, p. 440 *(nom. van.)*; =Reophacidinae SILVESTRI, 1950, p. 44 *(nom. van.)*; =Proteonininae GALLOWAY, 1933, p. 65; =Silicininae CUSHMAN, 1933, p. 143]

Chambers typically in regular rectilinear series; wall agglutinated, interior simple; aperture single or multiple. *Miss.-Rec.*

Hormosina BRADY, 1879, *196a, p. 56 [**H. globulifera;* SD CUSHMAN, 1910, *404a, p. 93] [=*Arhomosum* RHUMBLER, 1913, *1572b, p. 441 *(nom. van.)*]. Test similar to *Reophax* but with very large globular chambers; wall finely arenaceous, with abundant cement and smoothly finished; aperture on produced neck. *Jur.-Rec.,* Atl.-Pac.-Eu.-Carib.-Medit.-Antarctic.——FIG. 128,*4,5*. **H. globulifera,* Rec., Atl.; *4a,* side view of microspheric form; *4b,* top view; *5,* side view of single-chambered specimen; all ×20 (*2117).

Auerinella FRENGUELLI, 1953, *746, p. 46 [**A. fuegiae;* OD]. Test similar to *Reophax,* but very small, about 0.175 mm. long, insoluble in HCl, somewhat roughened surface; aperture elliptical, on subcylindrical neck. *Pleist.,* S.Am.——FIG. 129, *1*. **A. fuegiae; 1a,* photograph of surface; *1b,* median plane; *1c,* outline drawing, all ×600 (*746).

Nodosinum HOFKER, 1930, *928b, p. 121 [**Nodosinella gaussica* RHUMBLER, 1913, *1572b, p. 453, 459, 460, 461; (=*Arnodosinum py-gaussicum* RHUMBLER, 1913, *1572b, p. 452, 453, 459, 460, 461, *nom. van.);* OD]. Similar to *Reophax* but with radiate aperture owing to ribs that protrude inward from apertural opening and extend internally length of neck. *Rec.,* Malay Arch. (Indon.).—— FIG. 129,*3-6*. **N. gaussicum* (RHUMBLER); *3,4,* side views, ×4.5; *5,* apert. view, enlarged; *6,* long. sec. of final chamber, enlarged (*928b).

[The type-species was stated by THALMANN (1961, *1905, p. 232) to be *Arnodosinum py-gassicum* RHUMBLER, 1913 *(sic)*. However, it was named *Nodosinella gaussicum* by RHUMBLER (followed by the added "new nomenclature" he was then proposing). HOFKER stated (*928b, p. 122) that he gave the species the name *Nodosinum gaussicum*; hence the specific name *py-gaussicum* is merely a *nomen vanum* synonym.]

Polychasmina LOEBLICH & TAPPAN, 1946, *1154, p. 242 [**P. pawpawensis*; OD]. Test free, flattened, composed of linear series of chambers; wall thick, coarsely arenaceous; aperture terminal, consisting of single row of elongate slits, paralleling flattened sides of test. *L.Cret.(Alb.),* USA(Tex.).—— FIG. 128,*6,7*. **P. pawpawensis; 6a,b,* side and top views of broad, flattened specimen; *7,* side view of narrower form, ×10 (*2117).

Protoschista EIMER & FICKERT, 1899, *692, p. 605, 677 [**Lituola findens* PARKER, 1870, *565, p. 176; OD (M)]. Test free, consisting of series of chambers which are normally regularly uniserial, commonly branching from proloculus and forming 2 or 3 uniserial series of slightly inflated chambers, nearly equal in size throughout; wall agglutinated, with comparatively little cement, surface rough; aperture circular, at ends of series of chambers. [*Protoschista* differs from *Reophax* in developing a branching habit of growth.] *Rec.,* Atl.-Arctic.——FIG. 130,*4*. **P. findens* (PARKER), Alaska; ×66 (*1162).

Psammolingulina SILVESTRI, 1904, *1760, p. 247 [**Lingulina papillosa* NEUGEBOREN, 1856, *1351, p. 97; OD]. Test elongate, uniserial, similar to *Reophax* with agglutinated wall but with elongate, arcuate terminal aperture. *U.Cret.-Plio.,* Eu.—— FIG. 129,*2*. **P. papillosa* (NEUGEBOREN), Mio.-Plio., Rumania; *2a,b,* side, top views, enlarged (*700).

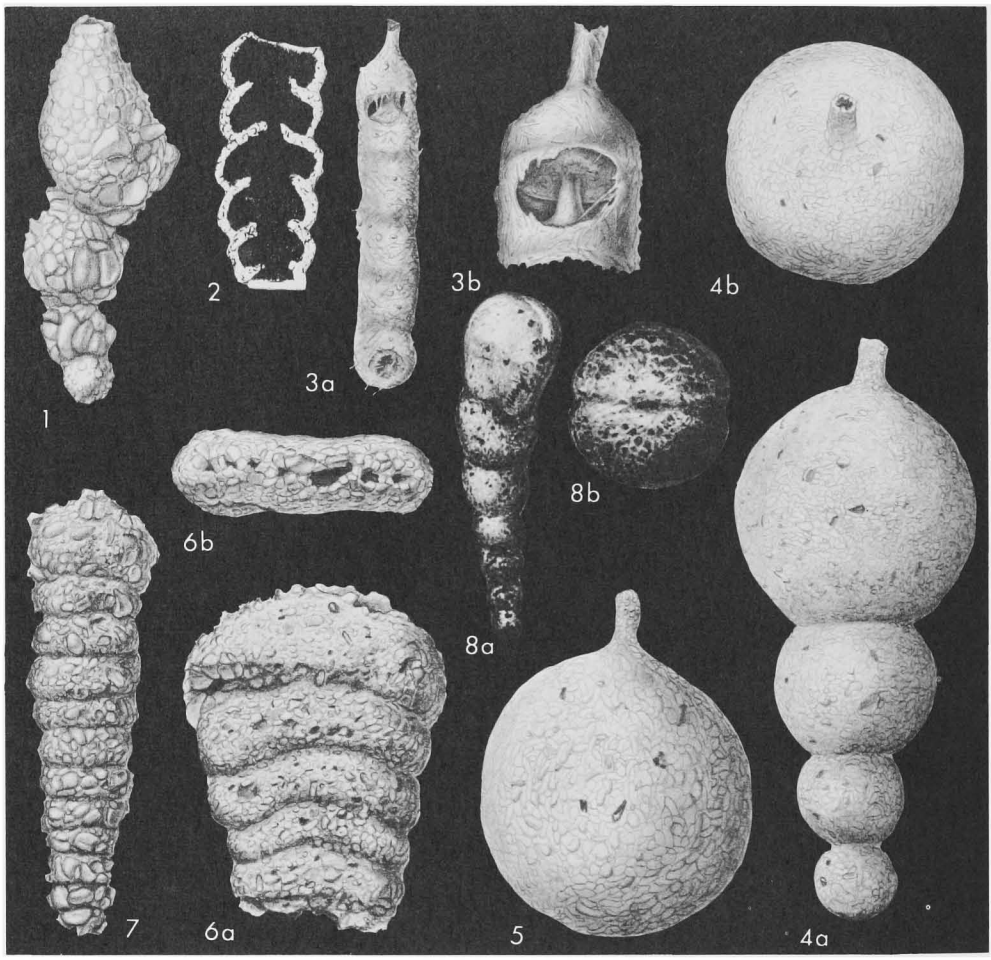

FIG. 128. Hormosinidae (Hormosininae; *1-3, Reophax; 4,5, Hormosina; 6,7, Polychasmina; 8, Sulcophax*) (p. C215-C217).

Reophax MONTFORT, 1808, *1305, p. 331 [**R. scorpiurus;* OD (M)] [=*Reophagus* AGASSIZ, 1844, *5, p. 22 *(nom. van.)*; *Proteonina* WILLIAMSON, 1858, *2065, p. 1 (type, *P. fusiformis*); *Silicina* BORNEMANN, 1874, *174, p. 731 (type, *Involutina polymorpha* TERQUEM, 1864, *1885, p. 432); *Lituolina* GOËS, 1881, *800, p. 33 (obj.); *Reophaxopsis* DE FOLIN, 1887, *129, p. 127 (type, *R. elegans*); *Nodulina* RHUMBLER, 1895, *1568A, p. 82, 85 (type, *Reophax dentaliniformis* BRADY, 1881, *196c, p. 49, SD LOEBLICH & TAPPAN, herein); *Rheophax* EIMER & FICKERT, 1899, *692, p. 603 *(nom. van.)*; *?Ammofrondicularia* SCHUBERT, 1902, *1681, p. 24 (type, *A. angusta*); *Arreophaxum* RHUMBLER, 1913, *1572b, p. 441 *(nom. van.)*; *Arproteonum* RHUMBLER, 1913, *1572b, p. 348 *(nom. van.)*; *Arsilicoum* RHUMBLER, 1913, *1572b, p. 389 *(nom. van.)*; *Ginesina* BERMÚDEZ & KEY, 1952, *129, p. 72 (type, *G. delicatula*)]. Test free, elongate, nearly straight or arcuate; chambers few, increasing in size as added; sutures nearly horizontal, obscure to moderately constricted; wall agglutinated, with comparatively little cement, surface rough; aperture terminal, rounded, at end of distinct tubular neck. *Miss.-Rec.*, cosmop.——FIG. 128,*1*. **R. scorpiurus,* Rec., Gulf Mex.; side view, ×45 (*2117).——FIG. 128, *2*. *R. angusta* (SCHUBERT), L.Oligo., S.Tirol; holotype, sectioned, ×66 (*700).——FIG. 128,*3*. *R. delicatula* (BERMÚDEZ & KEY), Rec., Carib.; *3a,* side view, portion of penultimate chamber wall removed to show interior, ×13; *3b,* terminal portion, ×28 (*2117).

[*Reophax* differs from *Hormosina* in lacking the very distinct apertural neck and globular chambers of the latter. From *Protoschista* it is distinguished by its lack of branching habit of growth. *Proteonina* WILLIAMSON has been shown to be a *Reophax* (*1166, p. 7), as based on the type-species. *Silicina* was shown (*1875, p. 210) to be unrecognizable, as two of the three original specimens of TERQUEM were indeterminate fragments and the last was a fragment of *Reophax*. *Ammofrondicularia* was

based on a fragment in section, and although the base was not present on the type, it apparently also belongs to *Reophax*. *Ginesina* was originally distinguished from *Reophax* by the presence of an internal tube (*129). Restudy of the holotype shows that the "internal tube" merely represents the apertural neck of earlier chambers preserved within succeeding chambers, hence is not a valid basis for separation.]

Sulcophax RHUMBLER in WIESNER, 1931, *2063, p. 93 [**S. claviformis;* OD (M)]. Test similar to *Reophax* but aperture curved slit, which may be in slight depression on terminal face. *Rec.*, Antarctic-N.Am.——FIG. 128,*8*. **S. claviformis; 8a,b,* side and apert. views, ×40, ×70 (*2063).

Thomasinella SCHLUMBERGER in THOMAS, 1893, *1908, p. 5 [**T. punica* SCHLUMBERGER, 1893; SD SCHLUMBERGER in PERON, 1893, *1446, explanation pl. 14] [=*Thomasinella* SCHLUMBERGER, 1889, *1652, p. 425 *(nom. nud.)*; *Bireophax* BOLLI, 1961, *163, p. 494 (type, *B. guaricoensis*)]. Test large, arborescent, branches composed of numerous cylindrical chambers somewhat

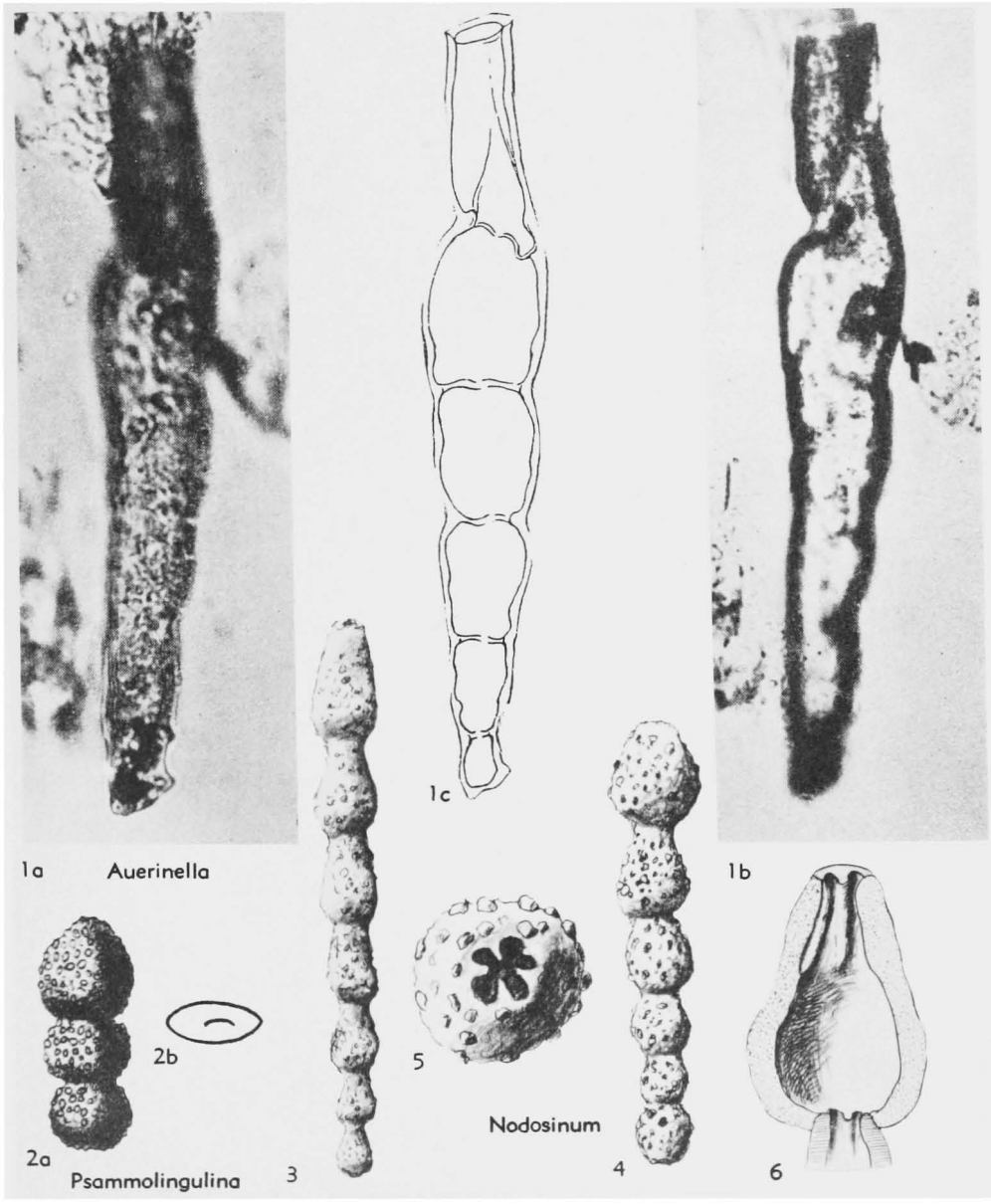

FIG. 129. Hormosinidae (Hormosininae; *1, Auerinella; 2, Psammolingulina; 3-6, Nodosinum*) (p. C215).

broader than high, arranged in single series, but regularly bifurcating so that adult test is composed of numerous dichotomously bifurcating and chambered branches; sutures distinct, horizontal, slightly constricted; wall agglutinated, very thick, traversed by large radially arranged pores which can be seen in broken specimens; apertures terminal on ends of branches, usually single, but

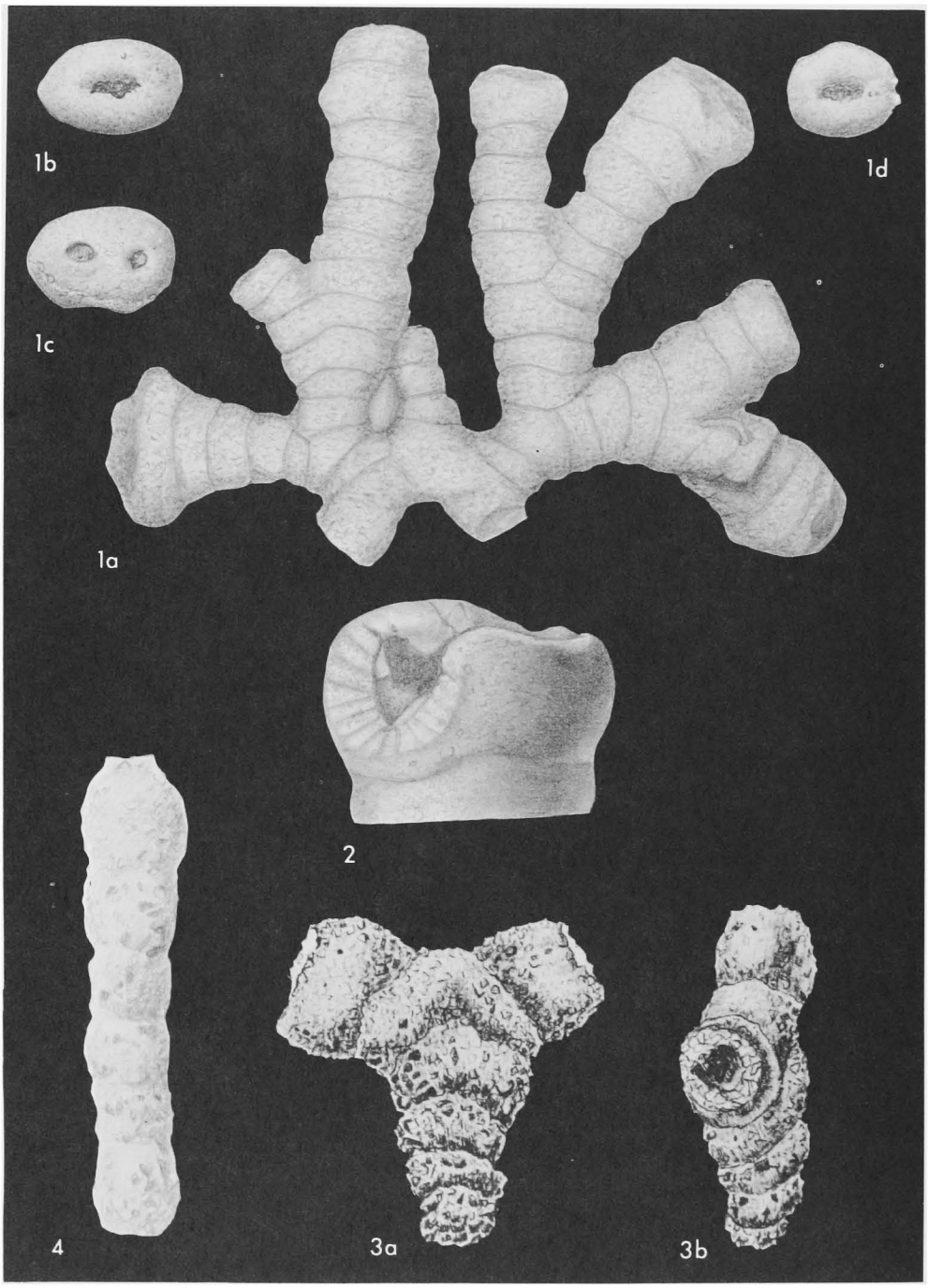

FIG. 130. Hormosinidae (Hormosininae; *1-3, Thomasinella; 4, Protoschista*) (p. C215, C217-C219).

rarely double, probably in later chambers just prior to bifurcation. *U.Cret.(Cenoman.),* Alg.-Tunisia-Egypt-Venez.——FIG. 130,*1,2*. **T. punica,* Tunisia; *1a,* holotype, ×15.5; *1b-d,* apert. views, ×15.5; *2,* enlarged portion of broken specimen, canals perforating wall, ×30 (*2117).——FIG. 130,*3*. *T. guaricoensis* (BOLLI), M.Cret., Venez.; *3a,b,* side and edge views of holotype, ×26 (*163).

[Although well described and figured nearly 70 years ago, this genus was generally overlooked because of the relative inaccessibility of the publications until the figures and description were copied by ELLIS & MESSINA (*700). The first placement of the genus in a specific family was that by SIGAL (1956, *1748, p. 104) who placed it in the "Haplophragmiidae (fam. Lituolidae, sousfamille Haplophragmoidinae pour Maync)," regarding it as related to *Ammobaculites* and *Flabellammina*. Approximately three months later OMARA (*1389, p. 885) independently published a redescription of the genus and placed it in the Reophacidae on the basis of an ontogenetic series he obtained from Egypt.]

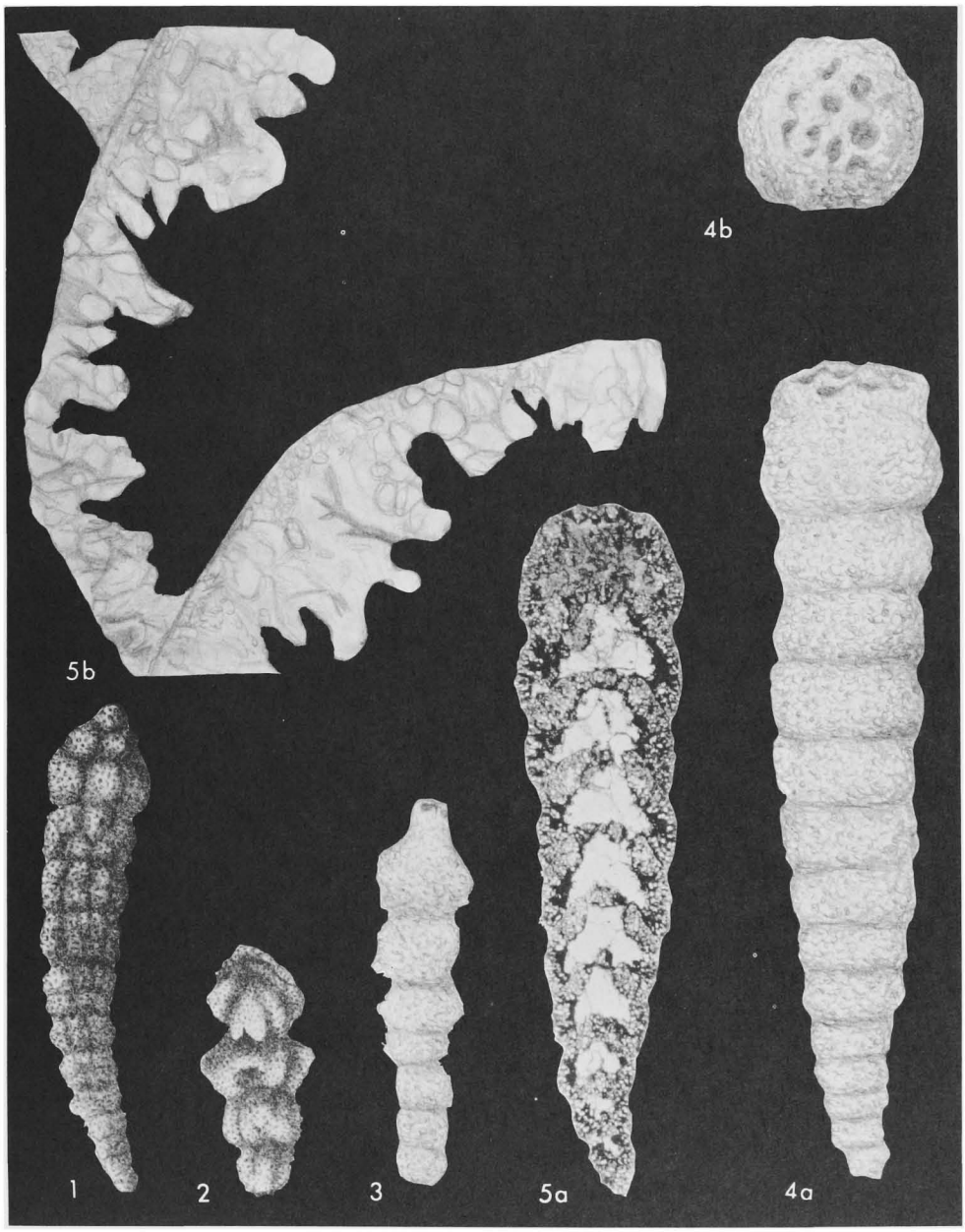

FIG. 131. Hormosinidae (Cribratininae; *1,2, Haplostiche; 3-5, Cribratina*) (p. C220).

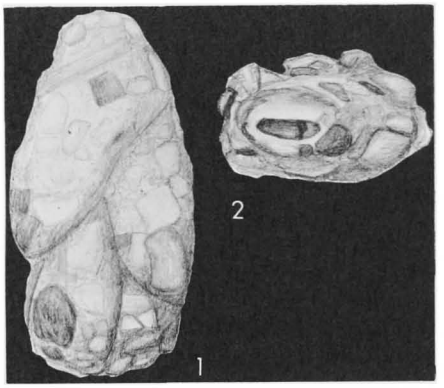

FIG. 132. Nouriidae; *Nouria* (p. C220).

Subfamily CRIBRATININAE Loeblich & Tappan, n. subfam.

Test free, elongate; chambers in a rectilinear series; wall agglutinated; interior labyrinthic; aperture terminal. *Cret.*

Cribratina SAMPLE, 1932, *1624, p. 319 [**Nodosaria texana* CONRAD in EMORY, 1857, *705, p. 159; OD]. Test free, large, to 10 mm. in length, elongate, uniserial and rectilinear, chambers closely appressed, sutures straight, horizontal, constricted; wall agglutinated, medium- to coarse-grained, with calcareous or ferruginous cement, labyrinthic; aperture terminal, cribrate, with numerous irregular, subangular openings on produced portion of terminal face. [Although previously regarded as a synonym of *Haplostiche*, the present genus differs in having a multiple aperture.] *L.Cret.(Alb.)-U.Cret.(Cenom.)*, N.Am. ——FIG. 131,*3-5*. **C. texana* (CONRAD); L.Cret. (Alb.), USA(Tex.); *3*, megalospheric specimen; *4a,b*, side and apert. views of microspheric specimen, ×11.5; *5a*, long. sec., ×12; *5b*, portion of long. sec. enlarged to show labyrinthic interior, ×72 (*2117).

Haplostiche REUSS, 1861, *1549, p. 15 [**Dentalina foedissima* REUSS, 1860, *1548, p. 189; OD] [=*Arhaplostichoum* RHUMBLER, 1913, *1572b, p. 446 (obj.) *(nom. van.)*]. Test free, large, elongate, up to 7 or 8 mm. in length, consisting of numerous, uniserially arranged, gradually enlarging and closely appressed chambers; sutures horizontal, constricted; wall agglutinated, interior labyrinthic; aperture terminal, rounded, somewhat produced. *U.Cret.*, Eu.——FIG. 131,*1,2*. **H. foedissima* (REUSS), Ger.; approx. ×10 (*1549).

[*Haplostiche* is here restricted to include only species with single terminal aperture, as in the type-species. It differs from *Reophax* in its much larger size, labyrinthic interior, and closely appressed chambers. Small species with a single aperture and simple interior belong to *Reophax*, those with slitlike aperture are placed in *Psammolingulina*, and those with a terminal multiple aperture and labyrinthic interior are referred to *Cribratina*.]

Family NOURIIDAE Chapman & Parr, 1936

[*nom. transl.* LOEBLICH & TAPPAN, 1961, p. 279 (*ex* subfamily Nouriinae CHAPMAN & PARR, 1936, p. 149)]

Chambers in loose spiral or biserial, strongly overhanging laterally; aperture terminal. *?Eoc.,Rec.*

Nouria HERON-ALLEN & EARLAND, 1914, *910a, p. 375 [**N. polymorphinoides;* SD CUSHMAN, 1927, *433, p. 189]. Test free, elongate, rounded in section; 2 to 5 elongate chambers which are first arranged in polymorphine spiral, later biserial; sutures obscure, little depressed; wall thin, externally smooth, rough within, of mineral grains, shell fragments, or sponge spicules; aperture terminal, round or oval, some with slight lip. *?Eoc., Rec.*, Eu.-Pac.-Carib.-Kerimba Arch.-N.Sea-Atl.——FIG. 132,*1,2*. **N. polymorphinoides*, Rec., Kerimba Arch.; *1*, side view of lectotype (here designated, BMNH-ZF 3622, *910a, pl. 37, fig. 7); *2*, top view of paratype, ×36 (*2117).

Family RZEHAKINIDAE Cushman, 1933

[*nom. transl.* TAPPAN, 1957, p. 210 (*ex* subfamily Rzehakininae CUSHMAN, 1933, p. 144)]——[=subfamily Silicininae EARLAND, 1933, p. 89 (*non* Silicininae CUSHMAN, 1933); =Silicinidae CUSHMAN, 1927 *(nom. nud.)*; =Paramiliolidae SIGAL in PIVETEAU, 1952, p. 208 *(nom. nud.)*]

Test free, proloculus followed by tubular chambers, about half coil in length and added in various planes, as in calcareous imperforate Miliolidae; wall siliceous or agglutinated, generally insoluble in acid. *L.Cret.-Rec.*

Rzehakina CUSHMAN, 1927, *431, p. 31 [**Silicina epigona* RZEHAK, 1895, *1605, p. 214; OD]. Test ovate in outline, compressed; chambers a half coil in length, planispiral and involute; aperture at open end of chamber, somewhat constricted. *U. Cret.-Paleoc.*, cosmop.——FIG. 133,*1-3*. **R. epigona* (RZEHAK), ?Paleoc., Eu.(Aus.); *1a,b, 2a,b*, side and top views, ×60 (*2117); *3*, long. sec., enlarged (*1605).

Ammoflintina EARLAND, 1934, *653, p. 98 [**A. trihedra;* OD]. Test free, roughly triangular in outline, planispiral, evolute; chambers 3 to whorl, wedge-shaped; aperture large, simple, at end of final chamber. [*Ammoflintina* was originally considered to belong to the Ammodiscinae, close to *Lituotuba*. It differs from *Lituotuba* in being distinctly chambered and coiled throughout.] *Rec.*, Antarctic.——FIG. 133,*7*. **A. trihedra;* lectotype (here designated, *653, pl. 3, fig. 22, BMNH-ZF 400); *7a,b*, opposite sides; *7c*, edge view, ×105 (*2117).

Miliammina HERON-ALLEN & EARLAND, 1930, *914c, p. 41 [**Miliolina oblonga* (MONTAGU) var. *arenacea* CHAPMAN, 1916, *320, p. 59; SD COCKERELL, 1930, *353, p. 975]. Chambers arranged in quinqueloculine plan; wall siliceous, insoluble in

hydrochloric acid; aperture rounded, with infolding of wall to form tooth. *L.Cret.-Rec.*, N.Am.-Antarctic.-Eu.——Fig. 134,*1,2*. *M. earlandi* Loeblich & Tappan, Rec., S.Atl.(S.Georgia Is.); *1a-c*, lectotype; *1a,b*, opposite sides; *1c*, top view; *2*, sectioned specimen to show quinqueloculine plan, ×105 (*1166).

Psamminopelta Tappan, 1957, *1875, p. 211 [*P.*

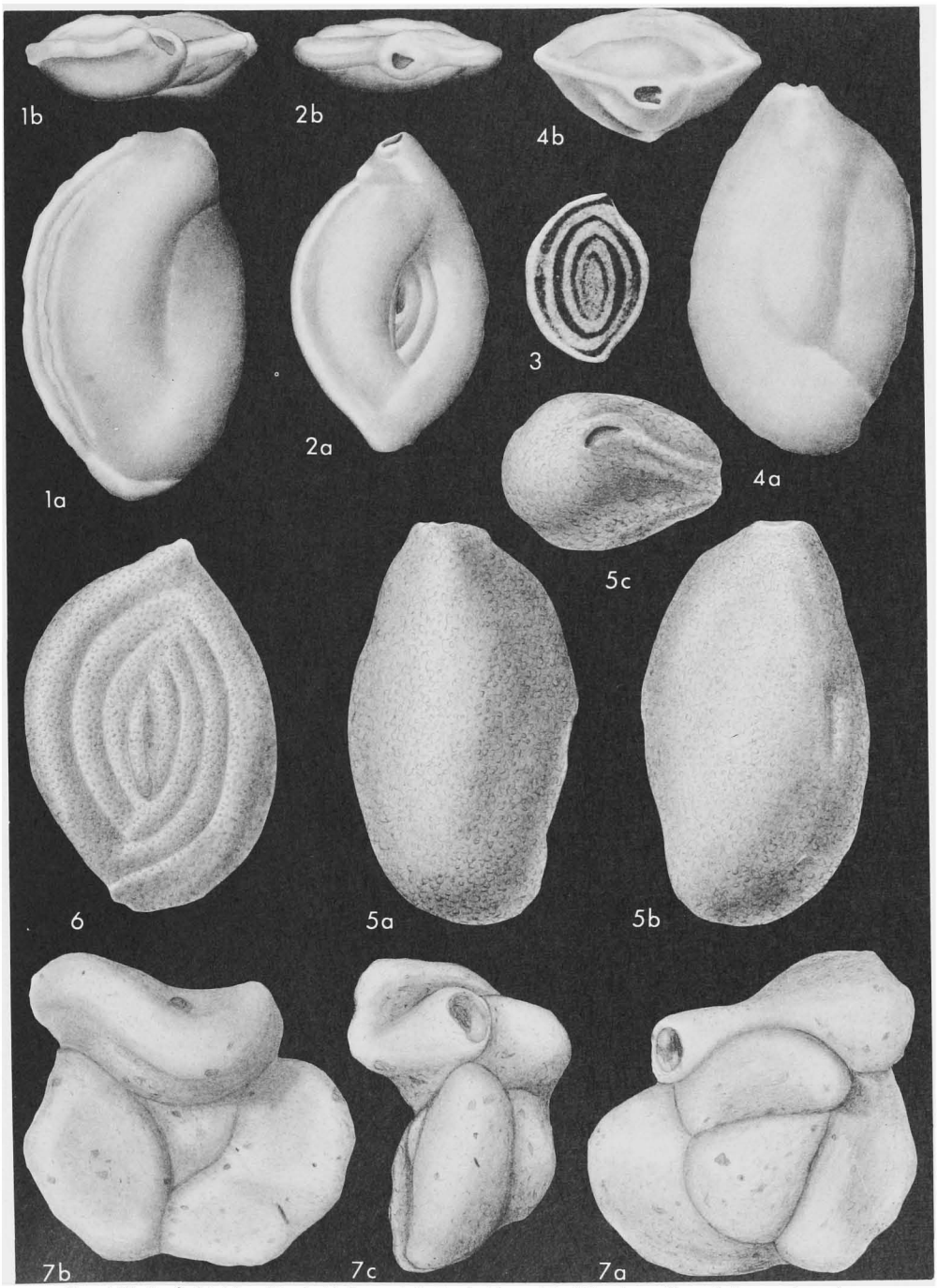

Fig. 133. Rzehakinidae (Rzehakininae; *1-3, Rzehakina; 4,5, Silicosigmoilina; 6, Psamminopelta; 7, Ammoflintina*) (p. C220-C222).

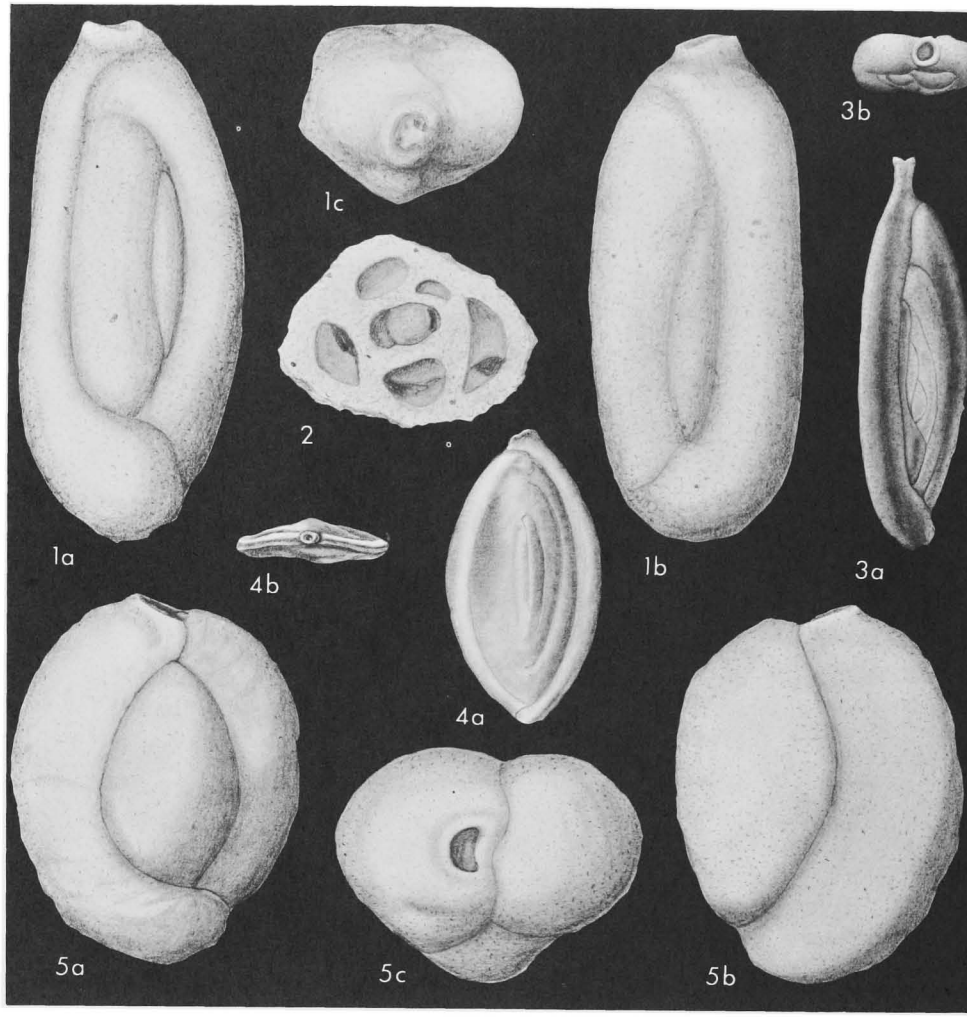

FIG. 134. Rzehakinidae (Rzehakininae; *1,2, Miliammina; 3, Spirolocammina; 4, Spirosigmoilinella; 5, Trilocularena*) (p. C220-C224).

bowsheri; OD]. Similar to *Spirosigmoilinella* but planispiral and evolute throughout and without any sigmoid development; aperture without tooth. [Differs from *Rzehakina* in being evolute and symmetrically planispiral in coiling.] *L.Cret.-U.Cret.*, N.Am.(Alaska).——FIG. 133,*6*. **P. bowsheri*, side view of holotype, ×62 (*2117).

Silicosigmoilina CUSHMAN & CHURCH, 1929, *500, p. 502 [**S. californica;* OD] [=*Silicosigmoilina (Bramletteia)* ISRAELSKY, 1951, *980, p. 10 (type, *S. (B.) perplexa)*]. Test with chambers half coil in length, planispirally arranged in early stages, later sigmoid; aperture described as lacking tooth, but small tooth or infolding of inner margin occurs in young specimens, slight compression of aperture in later stages obscuring its character somewhat. [*Bramletteia* was described as a subgenus for the species with a "toothlike" projection at the aperture. As this is also found in the type-species of *Silicosigmoilina*, the generic definition only requires modification and *Bramletteia* is a synonym.] *U.Cret.-Paleoc.*, N.Am.-S.Am.-Japan-Eu. —— FIG. 133,*4*. **S. californica*, U.Cret., USA(Calif.); *4a,b*, side and top views of paratype showing aperture and short toothlike projection, ×66 (*2117).—— FIG. 133,*5*. *S. perplexa* ISRAELSKY, Paleoc., USA (Calif.); *5a-c*, opposite sides and top view of holotype, ×143 (*2117).

Spirolocammina EARLAND, 1934, *653, p. 109 [**S. tenuis;* OD]. Test minute, elongate; chambers evolute and nearly planispiral, but with slight sigmoid curve of long axis; aperture produced on neck, without tooth. *Rec.*, Antarctic.——FIG. 134, *3*. **S. tenuis; 3a,b*, side and top views, ×102 (*2117).

Spirosigmoilinella MATSUNAGA, 1955, *1237, p. 49

[**S. compressa;* OD]. Early stage sigmoid in development as in *Silicosigmoilina*, later chambers in single plane; aperture rounded, on short neck, and lacking tooth. *L.Mio.-M.Mio.*, Japan.——Fig. 134,4. **S. compressa; 4a,b*, side and top views showing rounded aperture and slightly inflated central portion due to early sigmoid development, ×62 (*2117).

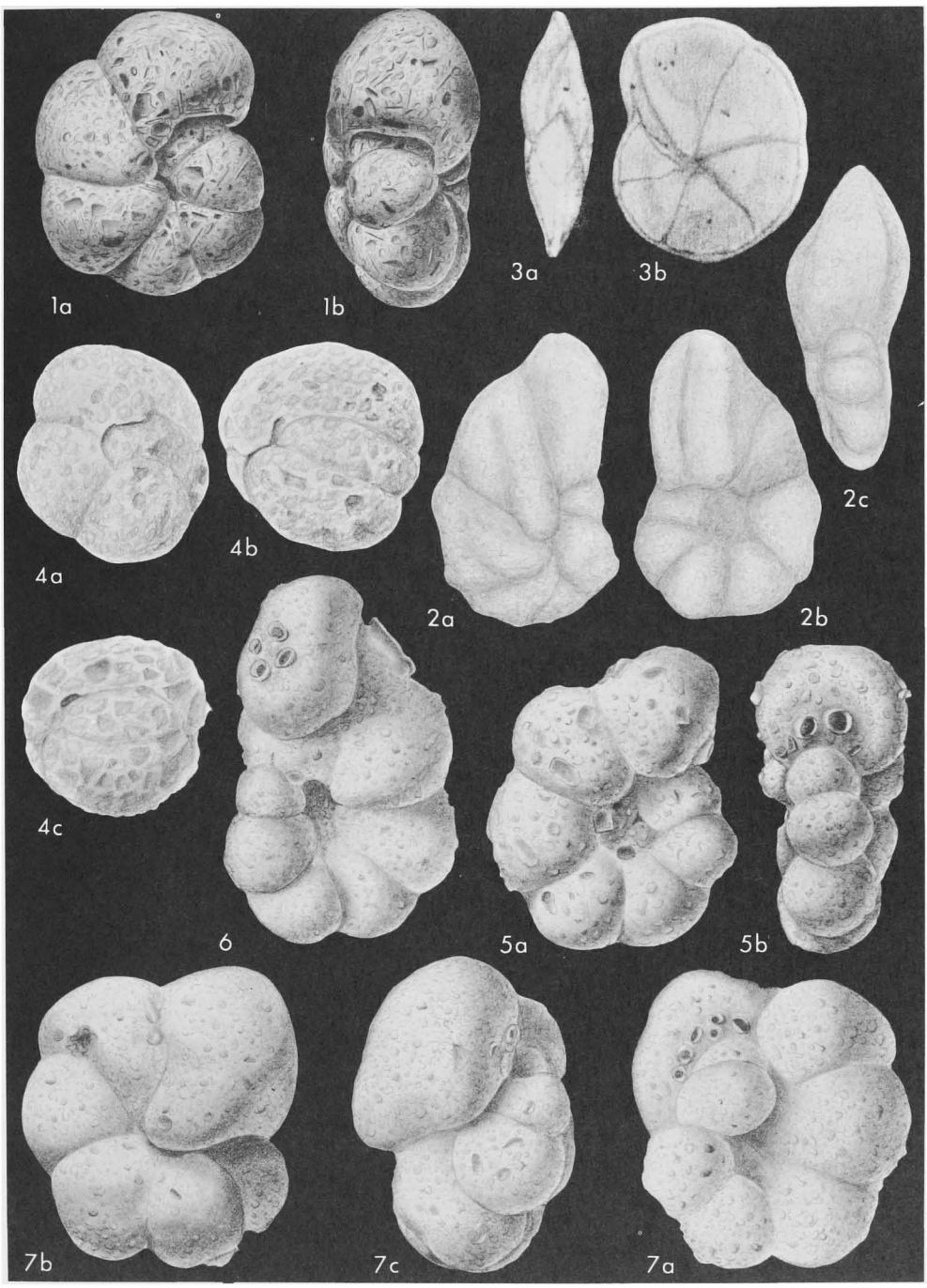

Fig. 135. Lituolidae (Haplophragmoidina *1-3, Haplophragmoides; 4, Adercotryma; 5-7, Trochamminita*) (p. C225-C227).

Trilocularena LOEBLICH & TAPPAN, 1955, *1166, p. 13 [**Miliammina circularis* HERON-ALLEN & EARLAND, 1930, *914c, p. 44; OD]. Chambers in triloculine arrangement; aperture with broad shallow tooth formed by infolding of margin. *Rec.*, Antarctic.——FIG. 134,*5*. **T. circularis*

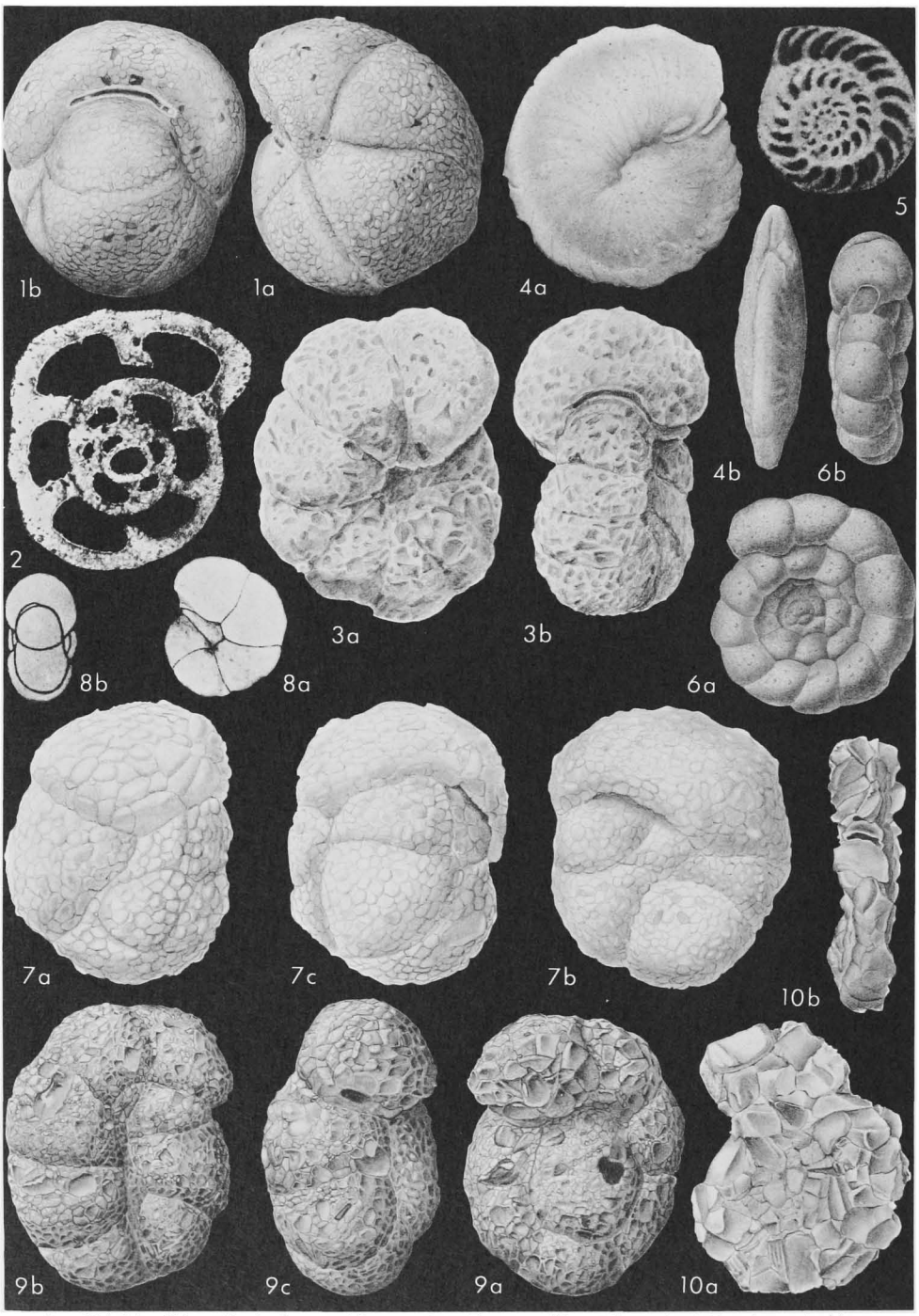

FIG. 136. Lituolidae (Haplophragmoidinae; *1-3, Cribrostomoides; 4,5, Daxia; 6, Trochamminoides; 7,8, Thalmannammina; 9, Recurvoides; 10, Discammina*) (p. C225-C227).

(HERON-ALLEN & EARLAND); *5a,b,* opposite sides; *5c,* top view, ×36 (*1166).

Family LITUOLIDAE de Blainville, 1825

[*nom. correct.* SCHULZE, 1877, p. 28 (*pro* family Lituacea and Lituacés DE BLAINVILLE, 1825, p. 380)]——[All names of family rank; dagger(†) indicates *partim*]——[=Les Lituolacées LAMARCK, 1809, p. 323 (*nom. neg.*); =Lituolata CROUCH, 1827, p. 40; =Lituolitidae BRODERIP, 1839, p. 321; =Lituolacea AGASSIZ, 1844, p. 15; =Lituolidea REUSS, 1862, p. 308; =Lituolida CARPENTER, 1861, p. 470; =Lituolidee SCHWAGER, 1876, p. 482; =Lituolideae GÜMBEL, 1868, p. 22; =Lituolina LANKESTER, 1885, p. 847; =Lituoletta HAECKEL, 1894, p. 164; =Lituolinae DELAGE & HÉROUARD, 1896, p. 132]——[=Polythalamaţ LATREILLE, 1825, p. 161 (*nom. nud.*); =Nautiloidaeţ D'ORBIGNY in DE LA SAGRA, 1839, p. xxxviii, 38 (*nom. nud.*); =Nautiloidaţ SCHULTZE, 1854, p. 53 (*nom. nud.*); =Loftusina LANKESTER, 1885, p. 847; =Loftusiidae LISTER in LANKESTER, 1903, p. 142]——[=Spirocyclinidae MUNIER-CHALMAS, 1887, p. xxxi; =Haplophragmidae EIMER & FICKERT, 1899, p. 693; =Placopsilinidae CUSHMAN, 1927, p. 41; =Polyphragmidae HOFKER, 1930, p. 124; Haplophragmiidae SIGAL in PIVETEAU, 1952, p. 162; =Mesoendothyridae VOLOSHINOVA, 1958, p. 19]

Test free or attached, early stage coiled, later may be uncoiled, irregular or annular; wall agglutinated, with calcareous cement or microgranular calcite, interior simple to labyrinthic, epidermal layer imperforate; aperture single or multiple. *Carb.-Rec.*

Subfamily HAPLOPHRAGMOIDINAE Maync, 1952

[Haplophragmoidinae MAYNC, 1952, p. 43]

Test free, coiled, interior simple, not labyrinthic, no alveolar hypodermis. *Carb.-Rec.*

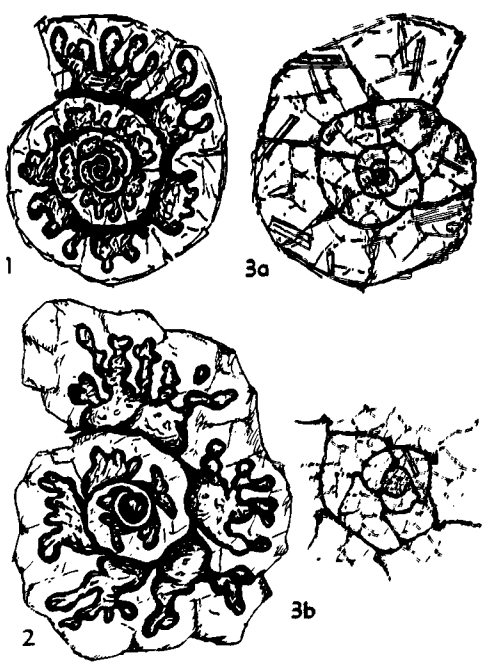

FIG. 137. Lituolidae (Haplophragmoidinae; *1-3, Discammina*) (p. C226).

Haplophragmoides CUSHMAN, 1910, *404a, p. 99 [**Nonionina canariensis* D'ORBIGNY, 1839, *86, p. 128; OD] [=*Robulammina* MONTANARO GALLITELLI, 1947, *1299A, p. 189 (type, *Haplophragmoides? robulus*); *Asanospira* TAKAYANAGI, 1960, *1863, p. 74 (type, *Lenticulina? teshioensis* ASANO, 1950, *51, p. 21)]. Test planispirally coiled, involute; wall agglutinated, aperture an equatorial interiomarginal slit. [*Robulammina* was based on a very small species in flysch sediments of the Apennines where compression of the agglutinated species results in a considerable amount of distortion. *Asanoina* was separated on the basis of its siliceous cement, but as the type-species occurs in Cretaceous mud and siltstones, possibly the cement is a product of replacement in fossilization.] *Carb.-Rec.,* cosmop.——FIG. 135,*1. *H. canariensis* (D'ORBIGNY), Rec., Philip.; *1a,b,* side and edge views, ×44 (*2117).——FIG. 135,*2. *H. robulus* (MONTANARO GALLITELLI), U.Cret., Italy (Apennines); *2a,b,* opposite sides of lectotype (here designated, *1299A, figs. 1(9), 2(5); *2c,* edge view, ×212 (*2117).——FIG. 135,*3. *H. teshioensis* (ASANO), U.Cret., Japan; *3a,b,* edge and side views, ×26 (*1863).

Adercotryma LOEBLICH & TAPPAN, 1952, *1159, p. 141 [**Lituola glomerata* BRADY, 1878, *195, p. 433; OD]. Test free, planispiral, subglobular or ovate, elongate in direction of coiling axis, slightly asymmetrical; aperture interiomarginal, forming low slit or arch near umbilicus on one side, and closer to umbilicus than to periphery, or may be lacking in final chamber. [*Adercotryma* differs from *Haplophragmoides* in being somewhat asymmetrical, completely involute rather than slightly evolute, in having the greatest dimension in the axis of coiling, and in the asymmetrically placed aperture, which is found near the umbilicus on one side rather than in the plane of coiling at the periphery, or it may even be lacking completely in the final chamber.] *Rec.,* Atl.-Pac.——FIG. 135,*4. **A. glomerata* (BRADY), Greenl.; *4a-c,* side and edge views, ×100 (*1159).

Cribrostomoides CUSHMAN, 1910, *404a, p. 108 [**C. bradyi* (=*Lituola subglobosum* G. O. SARS, 1871); OD] [=*Labrospira* HÖGLUND, 1947, *924, p. 141, 145 (type, *Haplophragmium crassimargo* NORMAN, 1892, *1364, p. 17)]. Similar to *Haplophragmoides* but with areal aperture consisting of single elongate slit in young, and dentate slit or row of areal pores in very large individuals. [The original types of both *Cribrostomoides* and *Labrospira,* here regarded as synonymous, have been restudied by us, and a lectotype is here designated for *Haplophragmium crassimargo* NORMAN (BMNH-ZF 3640, from Bog Fjord, East Finmark at 100-110 fathoms). As *Cribrostomoides bradyi* CUSHMAN is a synonym of *Lituola subglobosum* G. O. SARS (*653, p. 89) the type-species should be referred to *Cribrostomoides subglobosum.*] *U. Cret.-Rec.,* Atl.-Pac.-N.Am.-Carib.-Japan-Eu.——FIG. 136,*1,2. **C. subglobosum* (G. O. SARS), Rec.,

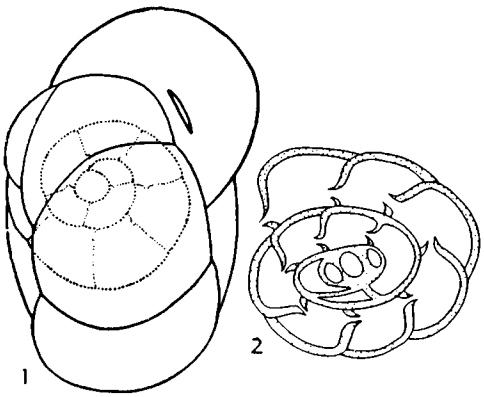

FIG. 138. Lituolidae (Haplophragmoidinae; *1,2, Recurvoides*) (p. C226).

Philip.; *1a,b,* side, edge views, ×26 (*2117); *2,* sagittal sec., ×20 (*894).——FIG. 136,*3. C. crassimargo* (NORMAN), Rec., Arctic; *3a,b,* side, edge views, ×17 (*1162).

Daxia CUVILLIER & SZAKALL, 1949, *544, p. 8 [**D. cenomana;* OD]. Test planispiral and involute as in *Haplophragmoides* but having numerous broad low chambers with simple interior forming compressed lenticular test; wall finely agglutinated with calcareous cement; aperture elongate slit extending somewhat up face of final chamber. [*Daxia* superficially resembles *Cyclammina* but lacks the complex internal structure of that genus.] *U.Cret.(Cenom.),* Fr.——FIG. 136,*4,5. *D. cenomana; 4a,b,* side and edge views of topotype, ×22 (*2117); *5,* sectioned specimen, ×10 (*544).

Discammina LACROIX, 1932, *1076, p. 2 [**D. fallax* LACROIX, 1932 (=*Lituolina irregularis* var. *compressa* GOËS, 1882, *801, p. 141, =*Haplophragmium emaciatum* BRADY, 1884, *200, p. 305); OD (M)]. Test planispiral, slightly evolute, to 1.5 mm. in diam., interior divided by thin straight septa, which may show at surface as sutural constrictions or be obscured by coarse wall texture; wall coarsely agglutinated on pseudochitinous membrane? and may include quartz grains, sponge spicules, or volcanic fragments in ferruginous cement; aperture low interiomarginal equatorial opening. *Rec.,* Medit.-Atl.-Pac.-Carib.——FIG. 136, *10*; 137,*1-3. *D. compressa* (GOËS), Atl. (136, *10*), Fr.(Gulf Gasc.) (137); 136,*10a,b,* side and edge views of specimen identified by LACROIX, ×45 (*2117); 137,*1,2,* microspheric and megalospheric specimens injected with air and viewed in transmitted light, showing pseudolabyrinthic appearance, ×67 (*1077); 137,*3a,* microspheric specimen filled with "essence de girofle," showing distinct septa, ×67 (*1077); 137,*3b,* central area showing slightly elevated apertures in straight, thin septa, ×133 (*1077).

[BRÖNNIMANN (1951, *225, p. 103) considered that *Discammina,* because of its supposedly nonseptate, undivided second chamber, belongs in the Ammodiscidae, as originally placed by LACROIX. BRÖNNIMANN noted that septa seemed to be shown in LACROIX's text-fig. *a,* but later MAYNC (1953, *1242, p. 148) indicated that neither true septa nor semisepta are present in *Discammina;* also, he did not consider it to have a truly labyrinthic wall. Nevertheless, *Discammina* was shown by LACROIX (1935, *1077) to be distinctly septate, the thin septa resembling those of *Ammoscalaria,* as shown by the figures here reproduced. The difference in interpretation of wall structure is due to the different methods used for study. LACROIX illustrated specimens that had been injected with air, colored liquids, or a clarifying liquid (such as "essence de girofle") after treatment in alcohol. These methods produced an appearance completely different from that obtained by thin sectioning. Bubbles introduced by the air-injection method gave specimens a complex appearance. In transmitted light, however, shells identified by LACROIX are nearly transparent because of large clear quartz grains in the walls, which give no indication of truly labyrinthic structure. Hence the genus does not belong with *Cyclammina,* as suggested by LACROIX (1935, *1077) or with *Ammodiscus,* as he concluded earlier (1932, *1076). Although here placed in the Haplophragmoidinae, *Discammina* is regarded as distinct from *Haplophragmoides* in having thin transverse septa (as in *Ammoscalaria*), which do not appear analogous to the apertural face. During the injection treatment LACROIX noted that the test was apparently imperforate, since the glycerin entered only at the aperture. This was regarded as evidence for a pseudochitinous base to the agglutinated test. The type-species was noted by LACROIX (*1077) to be a junior synonym of both *Lituolina irregularis* var. *compressa* GOËS, 1882, and *Haplophragmium emaciatum* BRADY, 1884. Although *Rhaphidohelix elegans* MÖBIUS, 1880, was also regarded as identical, this last appears to be distinct, and is probably a trochospiral rather than planispiral form. The correct name for the type-species thus is *Discammina compressa* (GOËS).]

Recurvoides EARLAND, 1934, *653, p. 91 [**R. contortus;* OD]. Test free, subglobular; coiling streptospiral, with few chambers in each whorl, later whorls in differing planes so that exterior somewhat resembles *Trochammina,* although only earlier periphery and not all earlier whorls are visible from spiral side; wall agglutinated, thin; aperture small, areal, with distinct bordering lip. [Coiling may vary from distinctly streptospiral throughout to nearly planispiral, with an abrupt change of 90° in the plane of coiling during development.] *Mio.-Rec.,* Antarctic-Carib.-Eu.-N. Am.-Atl.-Pac.——FIG. 136,*9. *R. contortus,* Rec., Antarctic; *9a,b,* opposite sides; *9c,* edge view; all ×44 (*2117).——FIG. 138,*1. R. trochamminiforme* HÖGLUND, Rec., Sweden; diagram of progressive change in coiling plan, ×175 (*924). ——FIG. 138,*2. R. laevigatum* HÖGLUND, Rec., Sweden; sectioned specimen showing position of aperture and change in direction of coiling, ×155 (*924).

Thalmannammina POKORNÝ, 1951, *1473, p. 477 [**Haplophragmium subturbinatum* GRZBOWSKI, 1897, *836, p. 280; OD] [=*Recurvoidella* UCHIO, 1960, *1961, p. 53 (type, *R. parkerae*)]. Similar to *Recurvoides,* but with interiomarginal aperture, not areal in position. *Eoc.-Rec.,* Eu.-Atl.-Pac.—— FIG. 136,*7. *T. subturbinata* (GRZBOWSKI), Eoc., Eu.; *7a,b,* opposite sides; *7c,* edge view, ×105 (*2117).——FIG. 136,*8. T. parkerae* (UCHIO), Rec., Calif.; *8a,* side view; *8b,* edge view showing interiomarginal aperture, ×50 (*1961).

Trochamminita CUSHMAN & BRÖNNIMANN, 1948, *498, p. 17 [**T. irregularis;* OD]. Test free, enrolled, early portion planispiral, later portion may develop irregular inflated chambers; sutures radial in planispiral portion; wall agglutinated; apertures

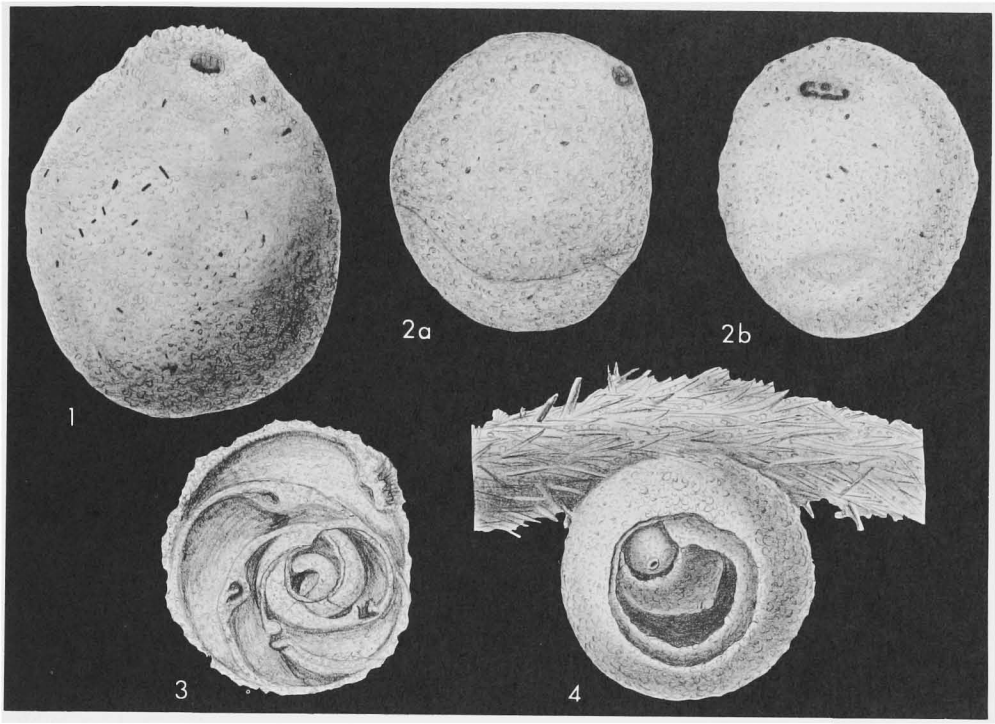

FIG. 139. Lituolidae (Sphaeramminae; *1-3, Sphaerammina; 4, Ammosphaerulina*) (p. C227-C228).

areal, single or multiple in planispiral portion, variable in position on irregular later chambers, surrounded by prominent raised lips. [*Trochamminita* differs from *Trochammina* in being planispiral in the early stage and in having multiple areal apertures in the adult.] *Rec.*, Carib.-USA (La.).——FIG. 135,*5-7*. **T. irregularis*, Trinidad, W. Indies; *5a,b*, side and edge views, ×112; *6*, side view, ×82; *7a-c*, opposite sides and edge view, ×82 (*1631).

Trochamminoides CUSHMAN, 1910, *404a, p. 97 [**Trochammina proteus* KARRER, 1866, *1021, p. 494; OD]. Similar to *Haplophragmoides* but coiling involute, aperture large, interiomarginal, with slightly thickened lip. *Carb.-Rec.*, cosmop. ——FIG. 136,*6*. **T. proteus* (KARRER), Rec., Gulf Mex.; *6a,b*, side, edge views, ×17 (*2117).

Subfamily SPHAERAMMININAE Cushman, 1933

[Sphaeramminae CUSHMAN, 1933, p. 87]

Test planispiral and involute, with later chambers almost completely overlapping and enclosing earlier ones; wall agglutinated; aperture areal, with incurved rim and projecting tooth. *Rec.*

Sphaerammina CUSHMAN, 1910, *403, p. 439 [**S. ovalis*; OD]. Test large, 1-2 mm. in length, consisting of planispiral series of strongly overlapping chambers, with little other than final chamber visible externally; wall finely arenaceous; aperture areal, slitlike to rounded, with simple to elongate tooth. [The generic definition is here emended to delineate planispiral instead of rectilinear development, as evidenced by dissected topotypes of the type-species.] *Rec.*, Philip.——FIG. 139,*1-3*; 140,*1*. **S. ovalis*; 139,*1*, holotype, ×35; 139,*2a,b*, side and edge views of topotype, chambers strongly overlapping, aperture areal, ×28; 139,*3*, horiz. half-section, showing planispiral coiling with approximately 5 chambers to each whorl but strong chamber overlap, so that only 3 are visible externally, apert. margin incurved, distinct apert. tooth seen in 3 chambers, ×28; 140,*1a-d*, apert. variation in specimens of *S. ovalis*, showing tooth and modifications, ×40 (all *2117).

Ammosphaerulina CUSHMAN, 1912, *405, p. 228 [**A. adhaerens*; OD]. Test attached, otherwise

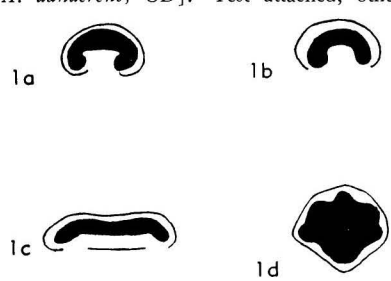

FIG. 140. Lituolidae (Sphaeramminae; *1, Sphaerammina*) (p. C227).

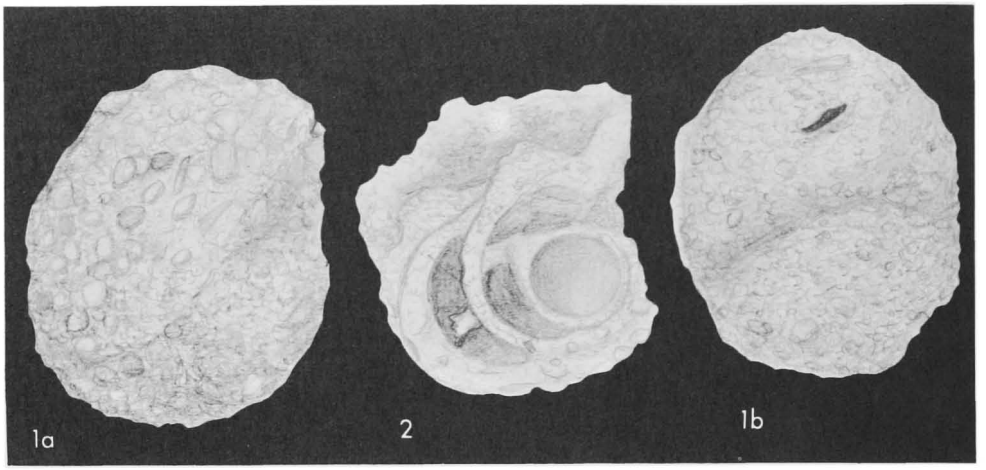

FIG. 141. Lituolidae (Sphaeramminae; *1,2, Canepaia*) (p. C228).

similar to *Sphaerammina,* with completely overlapping chambers, approx. 0.75 mm. in diam. *Rec.,* Malay Arch.(Indon.).——FIG. 139,*4*. **A. adhaerens;* holotype attached to *Saccorhiza,* partially broken to show enveloping spherical chambers, ×44 (*2117).

Canepaia BOLTOVSKOY, 1961, *166, p. 74 [**C. brasiliensis;* OD]. Test free, subspherical, with strongly overlapping chambers, commonly only last 1 or 2 chambers visible externally, chamber arrangement asymmetrical, apparently planispiral as in *Sphaerammina;* wall agglutinated, septa in inner portion of wall very fine-grained, outer wall with some larger grains in fine-grained base; aperture small, rounded to irregularly elongate, with inward projecting lip which in broken specimens may give appearance of interseptal pillar. [*Canepaia* differs from *Sphaerammina* as herein redefined in the simple nondentate aperture. Because of strong similarity to *Sphaerammina* and absence of a rectilinear development, *Canepaia* is here transferred from the Reophacidae, where it was placed originally, to the Sphaeramminidae.] *Rec.,* S.Am.(Brazil).——FIG. 141,*1,2*. **C. brasiliensis; 1a,b,* side and apert. views of topotype with strongly overlapping chambers and elongate aperture; *2,* dissected specimen showing globular proloculus, overlapping later chambers with portions of inner entosolenian apertural necks appearing as interseptal pillars, ×72 (*2117).

Subfamily CYCLAMMININAE Marie, 1941

[Cyclammininae MARIE, 1941, p. 257] [=Choffatellinae MAYNC, 1958, p. 1]

Planispiral to uncoiling; wall with reticulate near-surface meshwork beneath imperforate epidermal coating and commonly with labyrinthic interior; aperture single or multiple. *Jur.-Rec.*

Cyclammina BRADY, 1879, *196a, p. 62 [**C. cancellata;* OD (M)] [=*Cyclammina* BRADY in NORMAN in JEFFREYS, 1876, *987, p. 214 *(nom. nud.)*]. Test planispirally coiled, involute; chambers low, broad, numerous, with complex interior, reticulate hypodermis beneath imperforate outer layer; wall finely agglutinated, both walls and septa strongly labyrinthic, with intricate network of branching and anastomosing passages; aperture consisting of equatorial interiomarginal slit and series of rounded pores with raised margins scattered over face. *Cret.-Rec.,* cosmop.——FIG. 142, *1-4*. **C. cancellata,* Rec., Atl. *(1-3),* Rec., Philip. *(4)*; *1a,b,* side and edge views, ×14 (*2117); *2,3,* equat. and axial secs., ×18 (*1248); *4,* equat. sec., ×20 (*894).

Alveolophragmium SHCHEDRINA, 1936, *1723, p. 312 [**A. orbiculatum;* OD]. Test planispiral, involute, similar to *Haplophragmoides,* but with complex interior; wall with inner alveolar structure below imperforate outer layer; aperture equatorial and areal, with bordering lips. *Rec.,* Arctic-Sea of Japan.——FIG. 143,*1,2*. **A. orbiculatum,* Sea of Japan; *1a,b,* side, edge views, ×12; *2,* sec. showing labyrinthic interior, ×25 (*1509).

Choffatella SCHLUMBERGER, 1905, *1665, p. 763 [**C. decipiens;* OD]. Test planispiral, involute, chambers numerous, broad and low, tending to increase in breadth somewhat in adult so that whorls are higher; wall with imperforate outer layer and alveolar inner layer, regularly spaced partitions; aperture linear series of pores in slight depression extending vertically up apertural face. *L.Cret.,* Medit.-USA-Mex.-Carib.-S. Am.(Venez.)-Afr.-W.Eu.——FIG. 143,*3-6*. **C. decipiens;* Port. *(3),* Venez. *(4,6),* Switz. *(5); 3a,b,* side and edge views of paratype, matrix attached to one side, ×24 (*2117); *4,* tang. sec.; *5,* median sec., microspheric; *6,* equat. sec., megalospheric; *4-6,* ×30 (*1239).

Feurtillia MAYNC, 1958, *1245, p. 1 [**F. frequens;* OD]. Test coiled to uniserial, like *Ammobaculites* but wall complex, with reticulate subepidermal

meshwork; aperture elongate vertical slit in plane of coiling. *Jur.(Purbeck.)-L.Cret.(U.Valang.)*, Eu. (Switz.).——FIG. 144,*1-3*. **F. frequens*, Jur., Switz.; *1a-c*, holotype, opposite sides, and apert. views; *2,3*, median and axial secs. of paratypes showing thick septa, ×64 (*1245).

Hemicyclammina MAYNC, 1953, *1242, p. 148 [**H. sigali*; OD]. Test planispiral, involute, interior

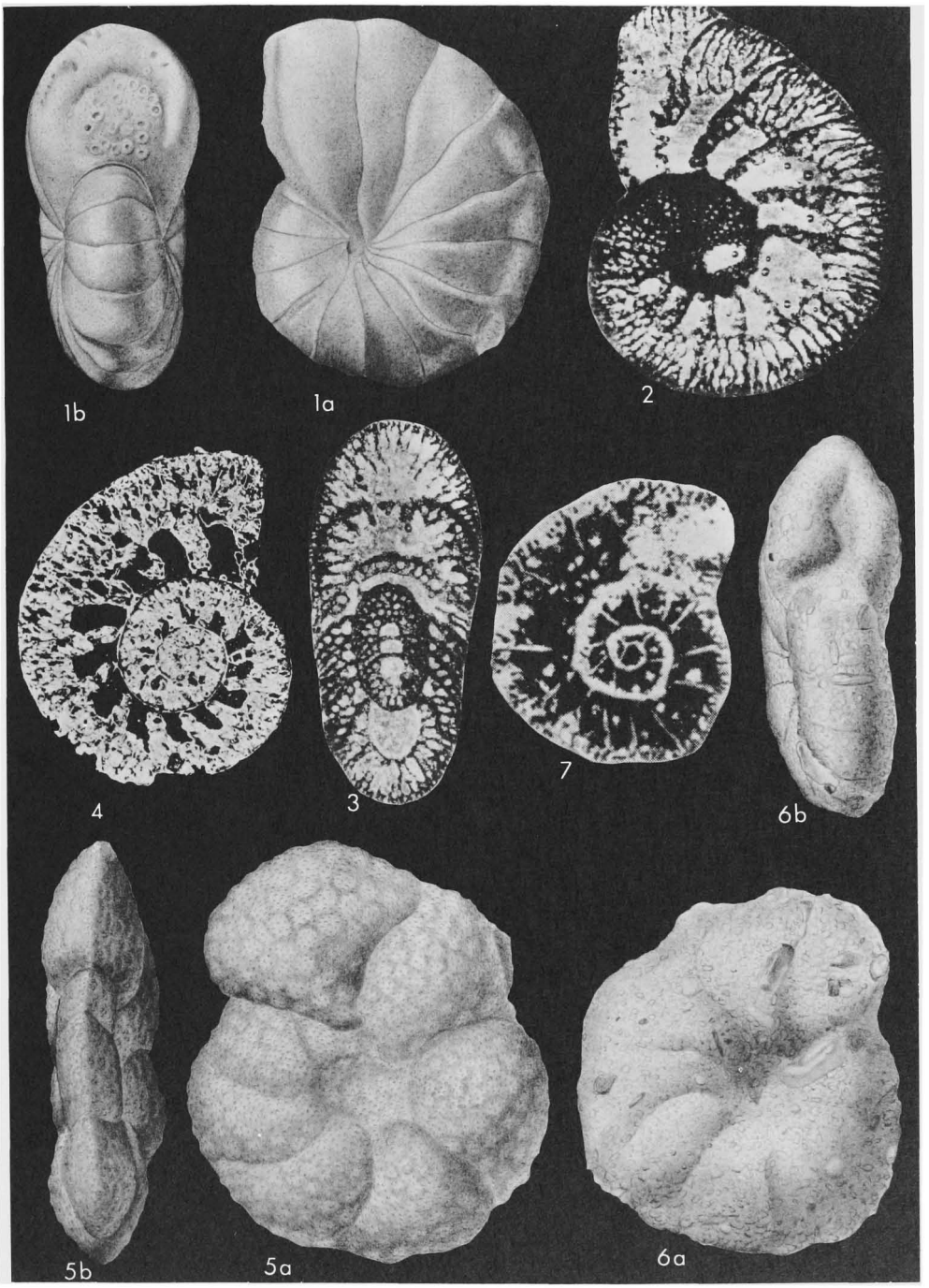

FIG. 142. Lituolidae (Cyclammininae; *1-4, Cyclammina; 5, Reticulophragmium; 6,7, Hemicyclammina*) (p. C228-C231, C233).

incompletely divided by "semisepta," or discontinuous septa projecting 0.5-0.8 distance across chamber cavity; outer wall labyrinthic, septal walls simple; aperture obscure in type-species, but apertural face depressed. *U.Cret.(M.Cenoman.)*, N.Afr. (Alg.).——Fig. 142,*6,7*. **H. sigali; 6a,b*, side

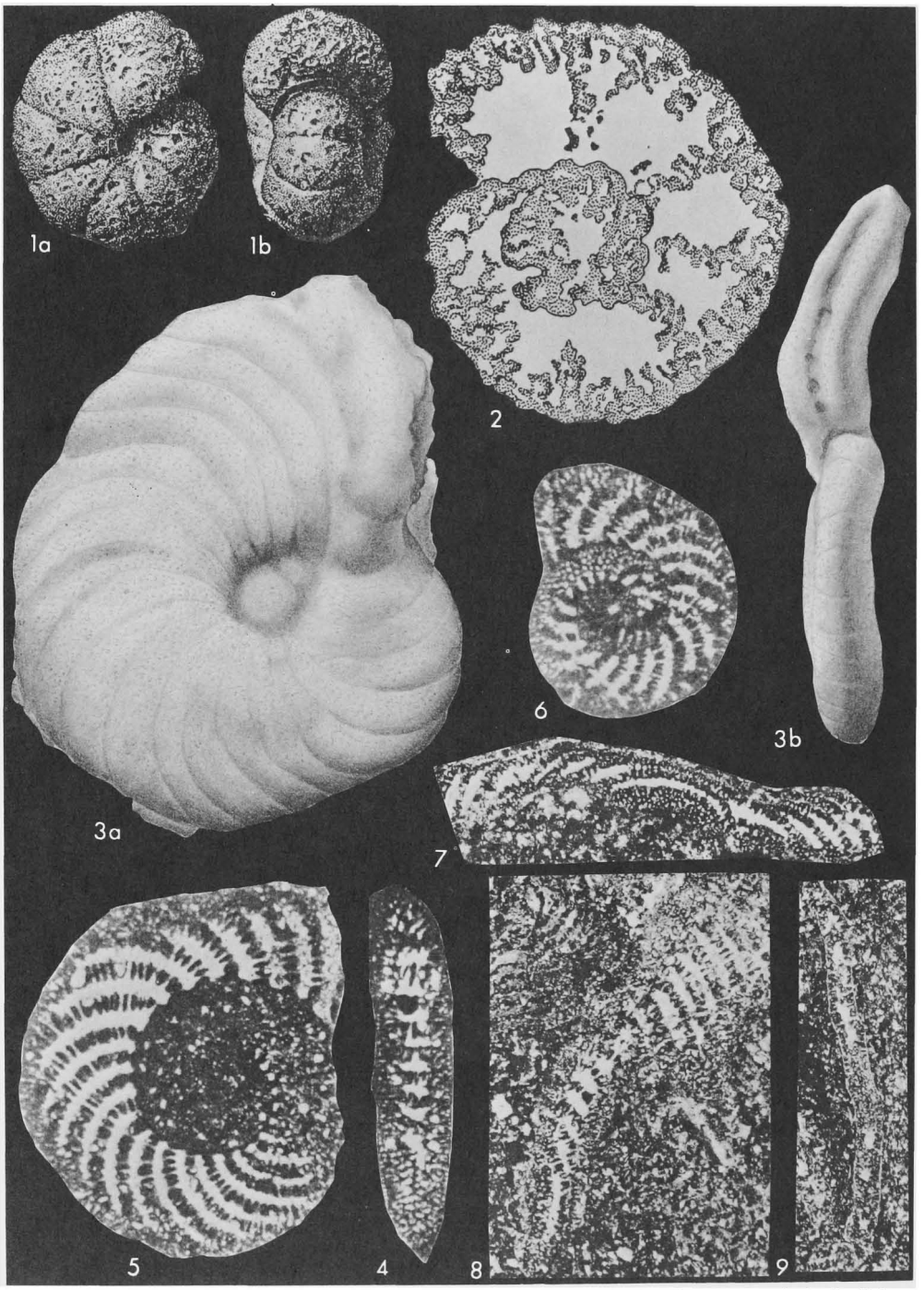

Fig. 143. Lituolidae (Cyclammininae; *1,2, Alveolophragmium; 3-6, Choffatella; 7-9, Pseudochoffatella*) (p. C228, C233).

and edge views of holotype, ×58 (*2117); *7*, sec. showing labyrinthic wall and semisepta, ×35 (*1242).

Martiguesia MAYNC, 1959, *1248, p. 21 [**M. cyclamminiformis;* OD]. Test planispiral in early stage, later tending to uncoil, wall with outer imperforate layer over alveolar subepidermal layer, which forms labyrinthic spongy mass filling cham-

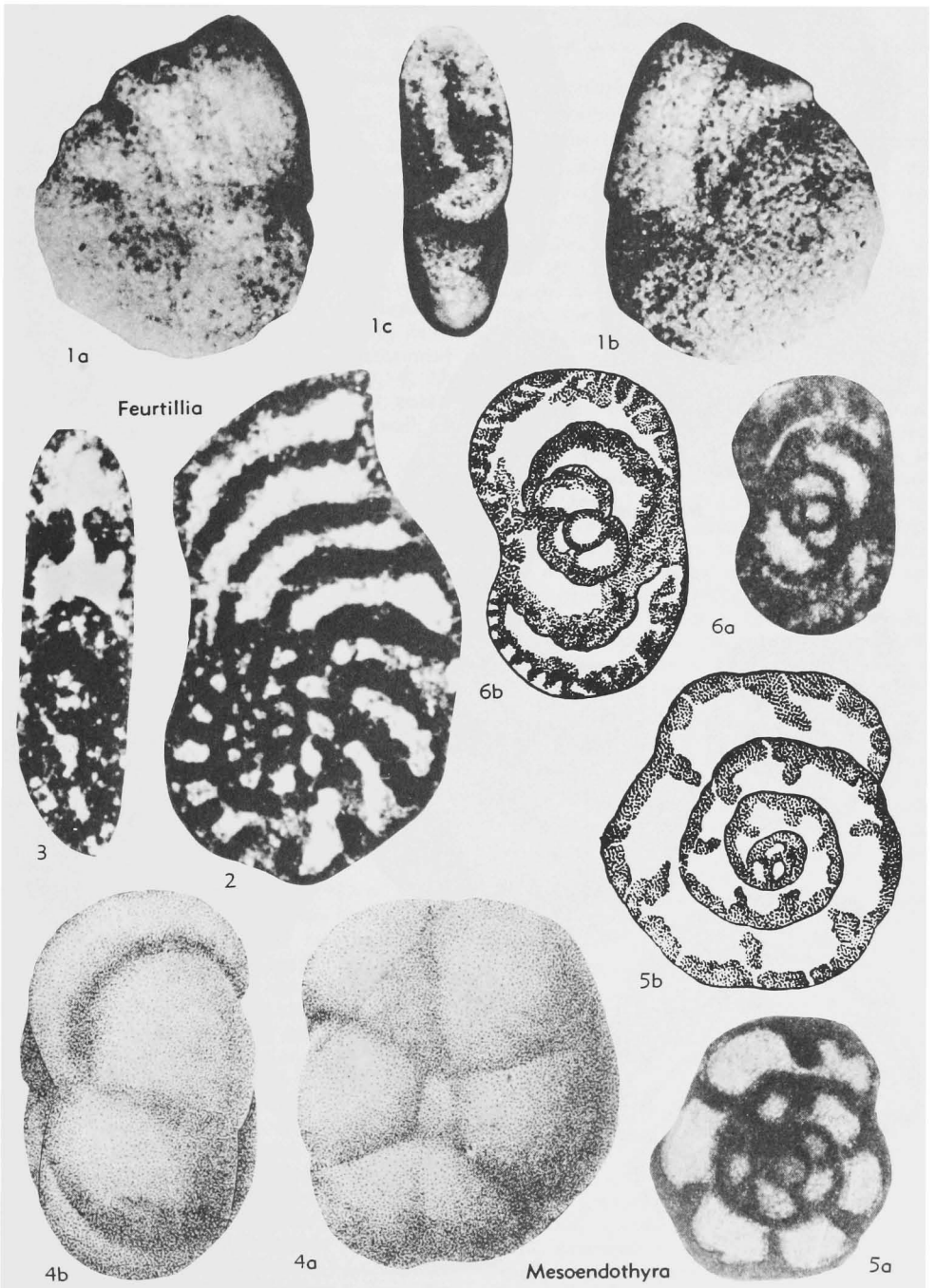

FIG. 144. Lituolidae (Cyclammininae; *1-3, Feurtillia; 4-6, Mesoendothyra*) (p. C228-C229, C232-C233).

ber; aperture terminal, cribrate. *U.Cret.(Santon.)*, Eu.(Fr.).——Fig. 145,*1-3*. **M. cyclamminiformis; 1*, side view of holotype, ×40; *2*, axial sec. megalospheric paratype; *3*, equat. sec. microspheric paratype; *2,3*, ×20 (*1248).

Mesoendothyra Dain, 1958, *265, p. 19 [**M. izu-*

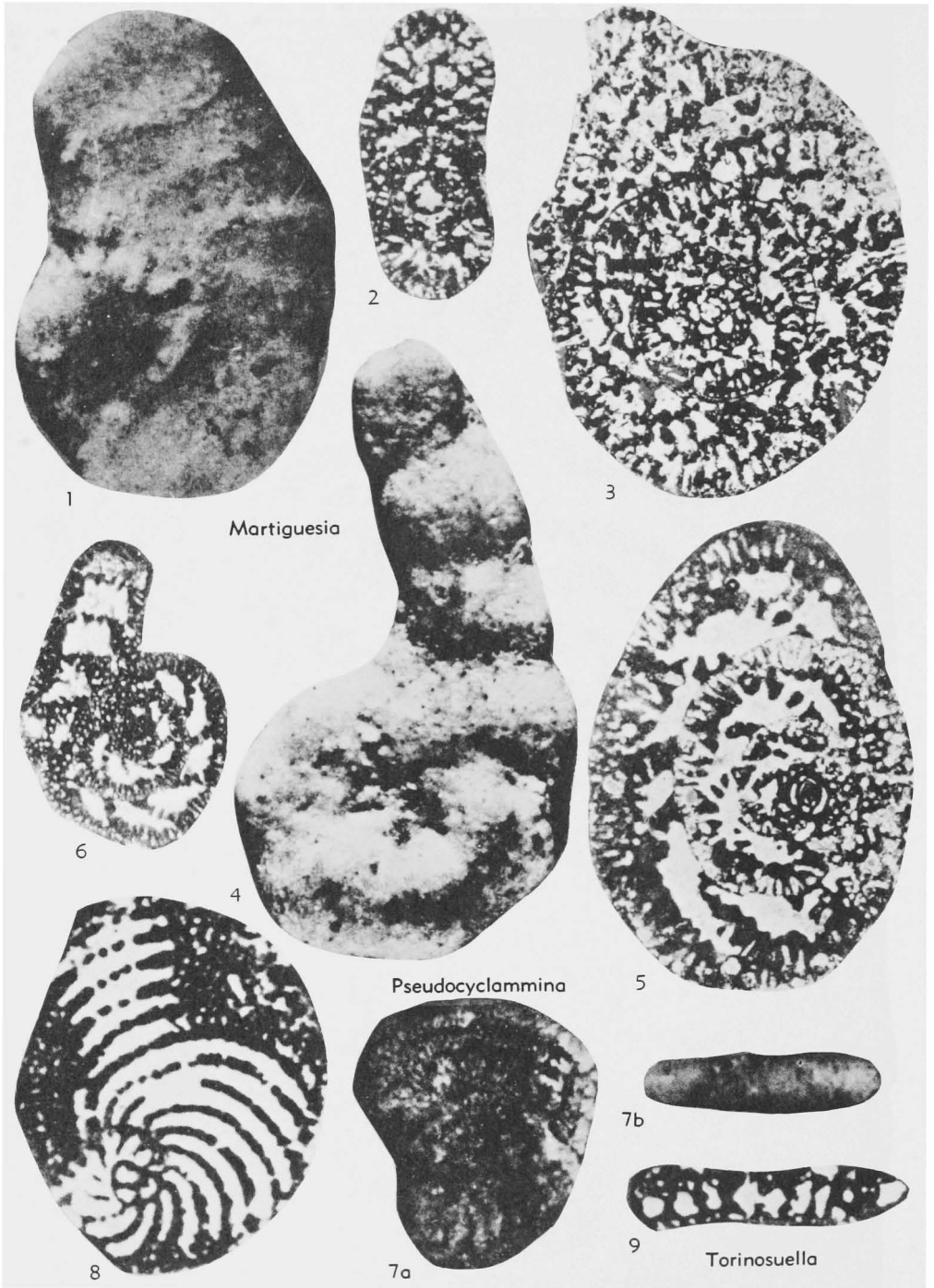

Fig. 145. Lituolidae (Cyclammininae; *1-3, Martiguesia; 4-6, Pseudocyclammina; 7-9, Torinosuella*) (p. C231-C233).

miana; OD]. Test enrolled and involute, early coiling plectogyral; wall agglutinated, outer layer imperforate and interior coarsely alveolar, septa with single imperforate layer; aperture an interiomarginal slit. *U.Jur.(Kimmeridg.),* Eu.(Ukraine). ——FIG. 144,*4-6.* **M. izumiana; 4a,b,* side, edge views of holotype, ×72 (*265); *5a,6a,* median and vert. secs., ×50 (*265); *5b,6b,* median and vert. secs. redrawn, ×68 (*1509).

Pseudochoffatella DELOFFRE, 1961, *582, p. 105 [**P. cuvillieri;* OD] [*non* LEUPOLD & MAYNC, 1935, *1131, p. 132 *(nom. nud.)*]. Test free, large, compressed, 7-12 mm. long, 0.9-1.2 mm. thick, early stage enrolled, later uncoiled; chambers numerous, interior labyrinthic, chambers only partially subdivided; wall agglutinated, with quartz grains embedded in much calcareous cement; aperture undetermined. [*Pseudochoffatella* is known only from nonoriented sections, hence certain important characters are yet unknown.] *L.Cret.(Apt.),* Eu.(Fr.-Sp.).——FIG. 143,*7-9.* **P. cuvillieri,* Fr.; *7,8,* oblique horiz. sec.; *9,* transv. sec. showing large size and labyrinthic wall, all ×17 (*582).

Pseudocyclammina YABE & HANZAWA, 1926, *2091, p. 10 [**Cyclammina lituus* YOKOYAMA, 1890, *2096, p. 26; OD] [=*Pseudochoffatella* LEUPOLD & MAYNC, 1935, *1131, p. 132 *(nom. nud.)* (*non* DELOFFRE, 1961)]. Test enrolled in early stage, later uncoiling as in *Lituola,* but with irregular reticulate outer layer and thick, conspicuous labyrinthic inner layer in both walls and septa; aperture cribrate, of numerous irregularly spaced openings on terminal face. [Differs from *Lituola* in its complex wall, and from *Choffatella* in its cribrate aperture, rather than vertical series of pores.] *U.Jur.-U.Cret.(Santon.),* Japan-Eu.-Carib.-Malay Arch.(Sumatra).——FIG. 145,*4-6.* **P. lituus* (YOKOYAMA), U.Jur.(Kimmeridg.), Japan *(5,6),* U.Jur.(Kimmeridg.-Portland.), Pol. *(4); 4,* side view, ×20; *5,* median sec., ×20; *6,* equat. sec., ×12 (all *1247).

Reticulophragmium MAYNC, 1955, *1244, p. 557 [**Alveolophragmium venezuelanum* MAYNC, 1952, *1241, p. 142; OD]. Similar to *Alveolophragmium,* but with interiomarginal aperture, bordered only by lip at upper margin. *Mio.-Rec.* S. Am.(Venez.)-Malay Arch.(Java).——FIG. 142,*5.* **R. venezuelanum* (MAYNC), Mio., Venez.; *5a,b,* side and edge views, surface meshwork reflecting internal reticulate layer, ×62 (*2117).

Torinosuella MAYNC, 1959, *1250, p. 6 [**Choffatella peneropliformis* YABE & HANZAWA, 1926, *2091, p. 11; OD]. Planispiral, similar to *Choffatella* in early stage but uncoiling and with broad low uniserial chambers in later stage; wall finely arenaceous, with imperforate outer layer and inner alveolar layer forming meshwork; aperture terminal, cribrate. *U.Jur.(Kimmeridg.)-L.Cret.(Hauteriv.),* Japan-Eu.(Port.-Switz.-Yugo.). —— FIG. 145,*7-9.* **T. peneropliformis* (YABE & HANZAWA), U.Jur.(Kimmeridg.), Port. *(7),* U.Jur., Japan *(8,9); 7a,b,* side, top views, ×40 (*1250); *8,9,* median and transv. secs., ×40 (*1250).

Subfamily SPIROCYCLININAE Munier-Chalmas, 1887

[*nom. transl.* MAYNC, 1950, p. 538 (*ex* family Spirocyclinidae MUNIER-CHALMAS, 1887)]

Septa simple, chambers subdivided by secondary radial septula into chamberlets, interior labyrinthic, walls and septa divided by ramifying, anastomosing channels, alveolar-reticulate hypodermis beneath epidermal coating. *Jur.-U.Cret.*

Spirocyclina MUNIER-CHALMAS, 1887, *1325, p. xxxi [**S. choffati;* OD]. Test free, coiled, large, slightly trochospiral, nearly involute; chambers broad, low, increasing rapidly in breadth, subdivided internally by numerous transverse radial partitions beneath alveolar layer, forming secondary chamberlets which show at surface as reticulations when specimen is dampened; wall agglutinated, fine-grained, with much cement; aperture consisting of 2 vertical rows of pores in slight depression at either side of apertural face. *U.Cret.(Senon.),* Eu.(Fr.).——FIG. 146,*1,2.* **S. choffati; 1a-c,* opposite sides and edge of lectotype (designated by MAYNC, *1247), showing double row of apertural pores, ×17 (*2117); *2,* sectioned specimen, ×14 (*1247).

Anchispirocyclina JORDAN & APPLIN, 1952, *1003, p. 3 [**A. henbesti* JORDAN & APPLIN, 1952 (=*Dicyclina lusitanica* EGGER, 1902, *660, p. 585); OD] [=*Trematocyclina* CHOFFAT, 1885, *337B, p. 23 *(nom. nud.); Iberina* MUNIER-CHALMAS, 1902, *1327, p. 350 (type, *Dicyclina lusitanica* EGGER, 1902, *660, p. 585) (*non Iberina* SIMON, 1881)]. Test enrolled, spreading, reniform or discoidal; broad, low chambers planispiral in early stage, increasing in breadth and curvature, especially in microspheric forms, becoming peneropline to reniform in outline, or chambers may become cyclical, resulting in discoidal test; chambers internally subdivided by somewhat irregular interseptal pillars, which project backward from each septum toward previous one, septa with numerous openings (as in *Choffatella*) spaced among interseptal pillars; wall with imperforate outer layer and alveolar subepidermal layer, and may have undivided chamber cavity immediately beneath this layer, with interior intricately divided by numerous interseptal pillars forming distinctly labyrinthic appearance; aperture cribrate. [MAYNC (1959, *1249, p. 39-40) noted the synonymy of *Iberina* and *Anchispirocyclina,* suppressing the latter as junior synonym. As *Iberina* MUNIER-CHALMAS, 1902, is a junior homonym of *Iberina* SIMON, 1881, *Anchispirocyclina* is here re-instated as the valid name of this genus.] *U.Jur.(Kimmeridg.)-L.Cret.(L.Valang.),* S.Eu.-N.Afr.-SE. USA-Carib. (Cuba).——FIG. 147,*1-10.* *A. lusitanica* (EGGER),

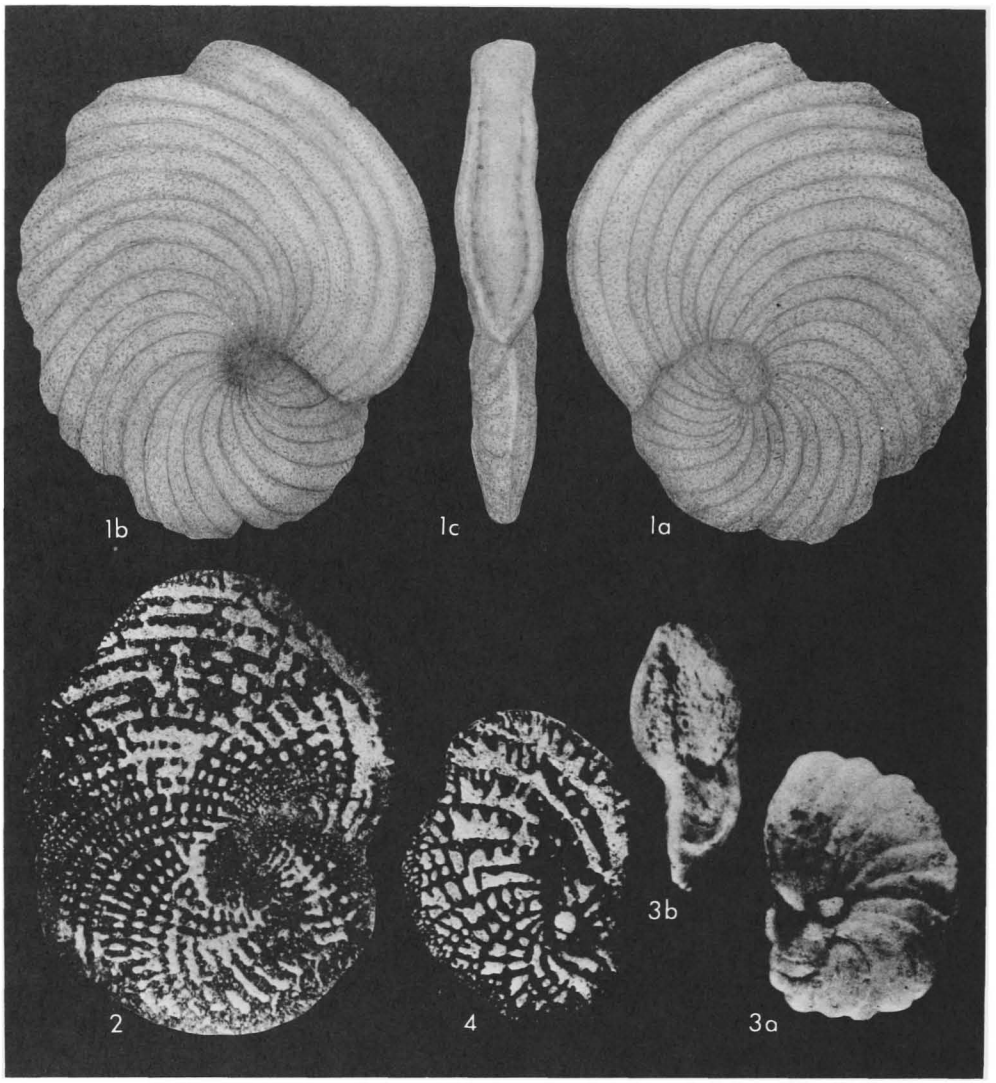

FIG. 146. Lituolidae (Spirocyclininae; *1,2, Spirocyclina; 3,4, Sornayina*) (p. C233, C236).

U.Jur., Port. *(1,3,5,6)*, U.Jur., USA(N.Car.) *(7-10)*, L.Cret.(L.Valang.), Port. *(2,4)*; *1a-c*, opposite sides and edge of neotype, ×3.2; *1d*, edge enlarged to show apertural pores, ×15; *2*, megalospheric form, ×24; *3*, megalospheric section, ×24; *4*, median sec. of microspheric form, ×7; *5*, portion of median sec. of microspheric form, ×14; *6*, trans. sec. of microspheric form, ×8.3; *7*, sec. of microspheric test, holotype of *"A. henbesti,"* ×64; *8*, sec. of megalospheric form, paratype of *"A. henbesti,"* ×20; *9, 10*, oblique equat. sec. and subaxial sec. of microspheric form, ×18 *(1-6,* *1249; *7-10,* *1003).

Orbitammina BERTHELIN, 1893, *135, p. lxxiii [**Orbicula elliptica* D'ARCHIAC, 1843, *36, p. 375; OD]. Test large, compressed, reniform, with lateral borders recurved and overlapping to give discoidal appearance, to 22 mm. in diam., surface with fine concentric striae when slightly abraded, primary chambers broad, low and semiannular, subdivided into secondary chamberlets approx. 0.06 mm. in diam., with one or more perforations connecting successive chamberlets, chamber subdivisions not quite extending to outer lamella, so that opening connects all chamberlets of single chamber adjacent to outer wall, which is granular-calcareous, probably agglutinated with calcareous cement, imperforate. [Differs from *Spirocyclina* in the absence of a subepidermal alveolar layer.] *U.Jur.(Bathon.)*, EU.(Fr.).——FIG. 148, *1-3.* **O. elliptica* (D'ARCHIAC); *1a*, neotype, ×2;

1b, same specimen with early peneropline stage restored, ×1.7; *2*, part of equat. sec., ×20; *3a*, schematic drawing of axial sec. along line AB of *3b*, showing chambers of secondary chamberlets and connecting perforations; *3b*, superficial equat. sec. along line XY of *3a*, ×87 (all *172).

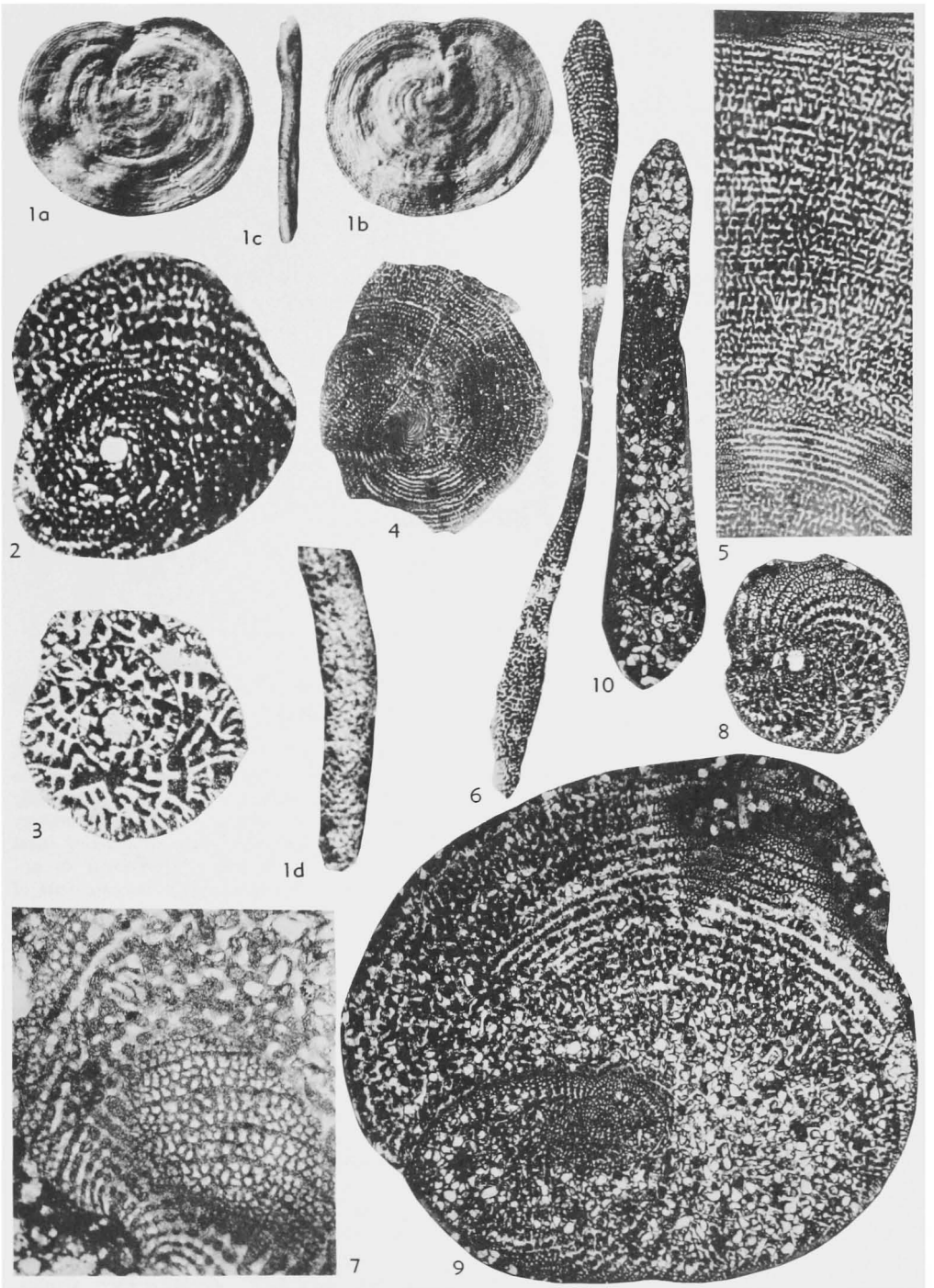

FIG. 147. Lituolidae (Spirocyclininae; *1-10, Anchispirocyclina*) (p. C233-C234).

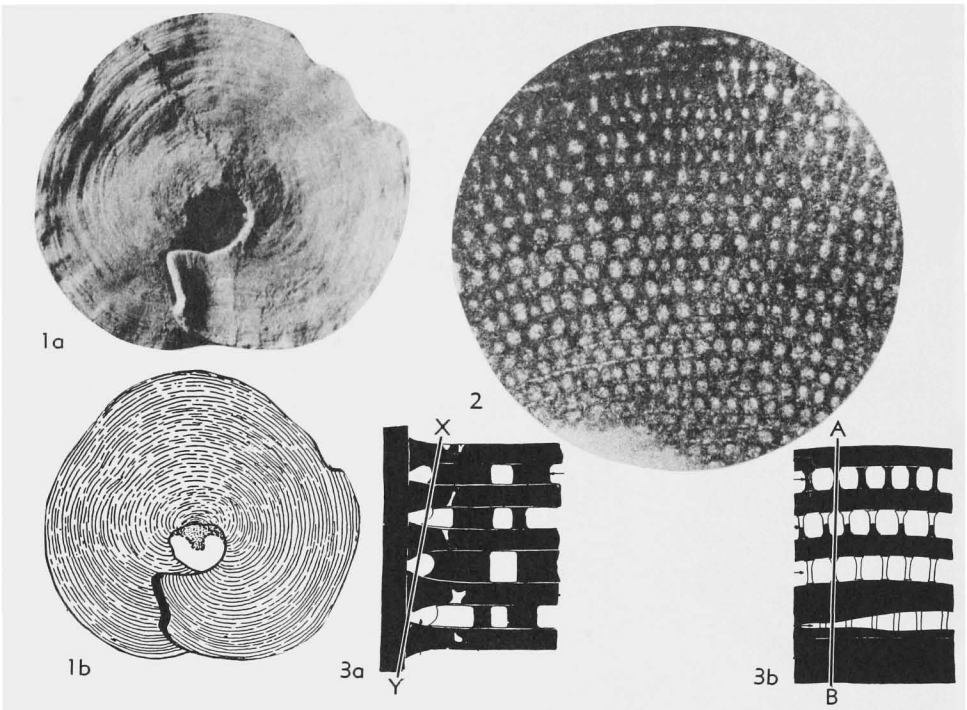

FIG. 148. Lituolidae (Spirocyclininae; *1-3, Orbitammina*) (p. C234-C235).

Sornayina MARIE, 1960, *1224, p. 320 [**S. foissacensis;* OD]. Test free, planispiral to asymmetrical, trochospiral, chambers numerous, low and broad, tending to uncoil slightly in later stages; wall agglutinated with considerable cement, imperforate epidermal layer overlying subepidermal alveolar zone, primary chambers subdivided by somewhat irregular transverse partitions perpendicular to septa below alveolar zone, septula progressively reduced to pillars or knobs farther inward, nearly continuous median partition at center dividing test equally; aperture cribrate, filling most of apertural face. [*Sornayina* differs from *Spirocyclina* in its less regularly spaced secondary septula, smaller number of chambers in each whorl, and in having a cribrate aperture, instead of a double vertical row of pores.] *U.Cret. (Coniac.),* Eu.(Fr.).——FIG. 146,*3,4*. **S. foissacensis; 3a,b,* side and edge of holotype, ×17 (*1224); *4,* median sec. of megalospheric topotype, showing reticulate subepidermal layer and primary chambers partially subdivided by secondary septula, ×18 (*1251).

Subfamily LOFTUSIINAE Brady, 1884

[*nom. correct.* LOEBLICH & TAPPAN, 1961, p. 280 (*pro* subfamily Loftusinae BRADY, 1884, p. 67)]

Test fusiform, planispiral, involute, with numerous low whorls; wall agglutinated, interior labyrinthic; aperture multiple, along base of apertural face. *Jur.-Cret.*

Loftusia BRADY in CARPENTER & BRADY, 1870, *278, p. 739, 751 [**L. persica;* OD (M)]. Test large, to 80.0 mm. in length, free, fusiform, planispirally enrolled, with elongate axis of coiling; primary septa strongly oblique to regularly enrolled spiral lamina, secondary septula perpendicular to primary septa; wall agglutinated, enclosing tests of smaller foraminifers and mineral fragments in calcareous cement, thin spiral lamina largely of calcareous granules closely cemented. *U.Cret. (Maastricht.),* SW.Asia-Eu.(Balkans). —— FIG. 149,*1-4*. **L. persica,* Iran; *1,* ext., ×1; *2,* tang. long. sec. in reflected light, showing alveolar appearance of layer beneath thin epidermis, ×22.5; *3,* transv. sec., part showing separate epidermal layer, alveolar subepidermal layer, and secondary septula, ×33; *4,* transv. sec. in Canada balsam, in transmitted light, ×5 (*278).

Paracyclammina YABE, 1946, *2086, p. 259 [**Loftusia bemmeleni* SILVESTRI, 1932, *1786, p. 89; OD]. Test to 10 mm. in diam., short axis of coiling, numerous low whorls; septa oblique, thick, perforate, no secondary septa; wall agglutinated, with much cement, coarsely alveolar layer near surface. [*Paracyclammina* differs from

Pseudocyclammina in the large number of its closely coiled whorls and strongly oblique septa, like those of *Loftusia*. It differs from *Loftusia* in its short axis of coiling and absence of secondary septa or pillars.] *U.Jur.-L.Cret.*, Malay Arch.(Sumatra).——Fig. 150,*1-3*. **P. bemmeleni*

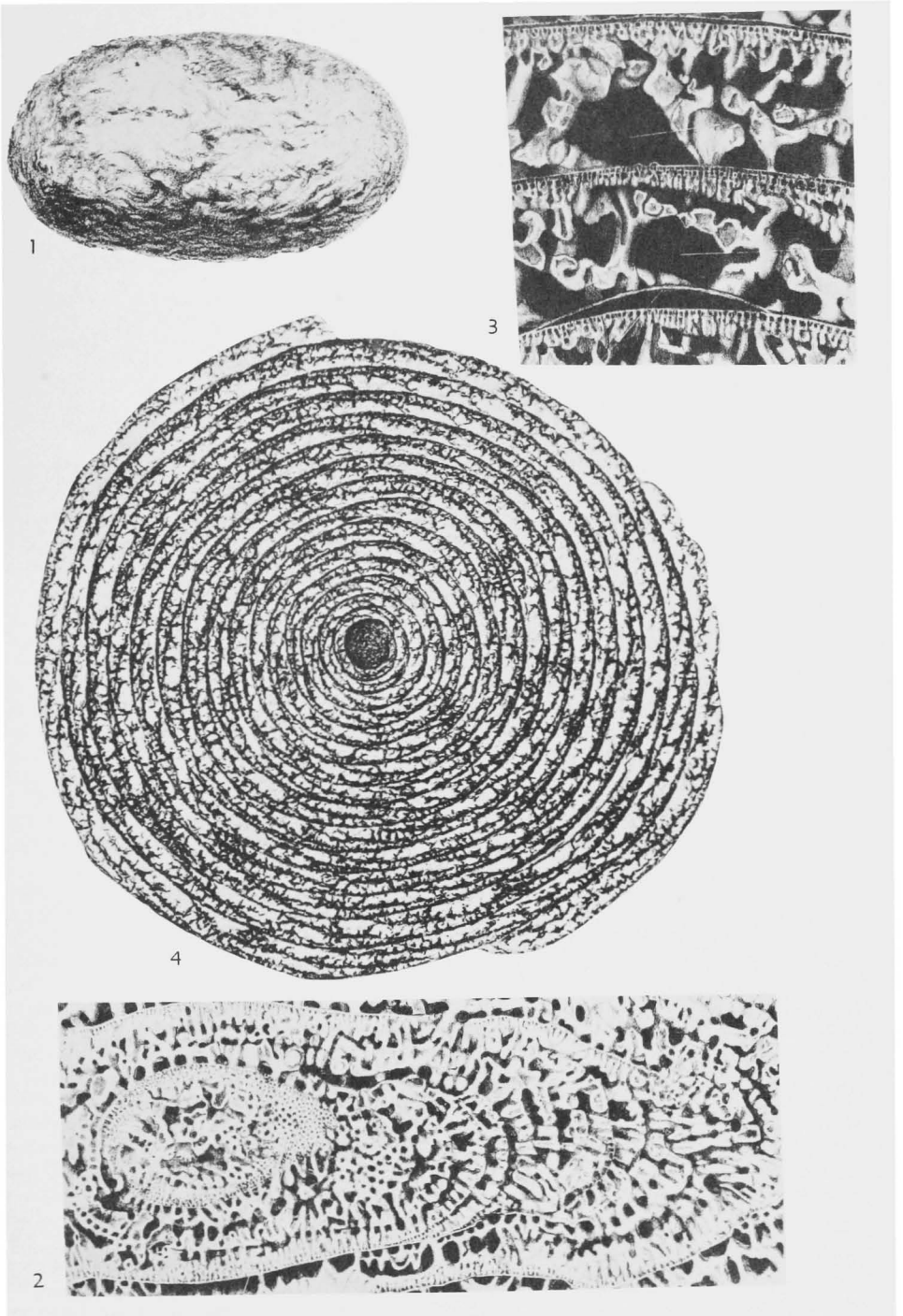

Fig. 149. Lituolidae (Loftusiinae; *1-4, Loftusia*) (p. *C236*).

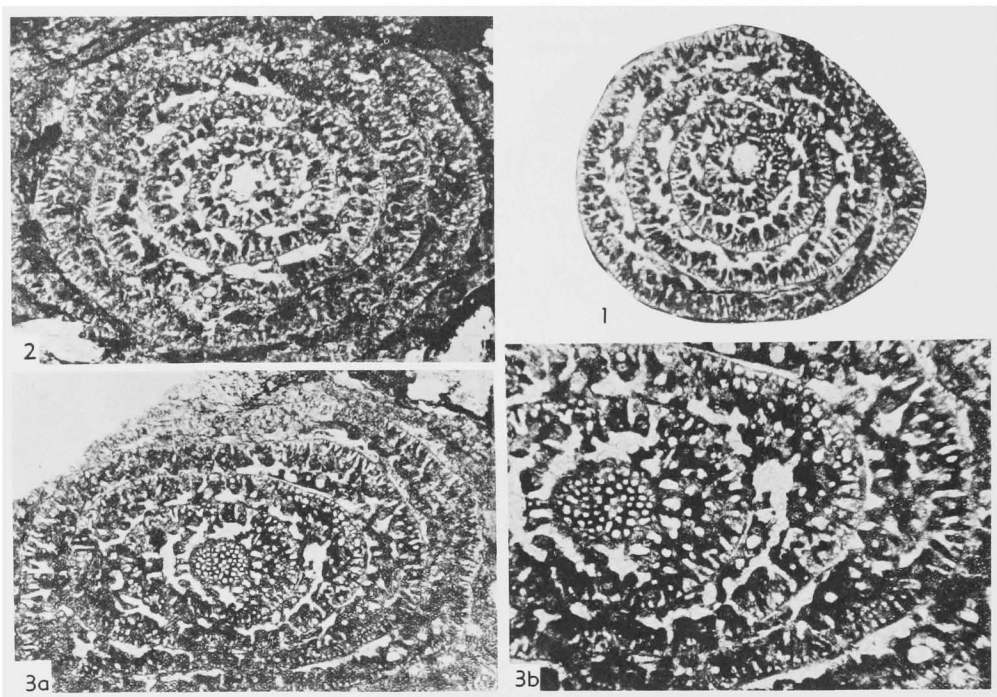

FIG. 150. Lituolidae (Loftusiinae; *1-3, Paracyclammina*) (p. C236-C238).

(SILVESTRI), L.Cret.; *1,* megalospheric juvenile, sec. in plane of symmetry, ×14; *2,* slightly oblique long. sec. of megalospheric adult, ×14; *3a,* long. sec. perpend. to plane of symmetry of megalospheric adult, ×14; *3b,* central part of *3a,* ×24 (all *1786).

Subfamily LITUOLINAE de Blainville, 1825

[*nom. transl.* BRADY, 1884, p. 65 (*ex* family Lituacea DE BLAINVILLE, 1825)] [=Haplophragmiinae CUSHMAN, 1927, p. 19]

Similar to Haplophragmoidinae but spire uncoiling in adult, or cyclical, interior simple. *Carb.-Rec.*

Lituola LAMARCK, 1804, *1085b, p. 242 [**L. nautiloidea* LAMARCK, 1804 (=*Lituolites nautiloidea* LAMARCK, 1804, *1085b, p. 242); SD CUSHMAN, 1920, *411b, p. 69] [=*Lituolites* LAMARCK, 1804, *1085b, p. 242 (obj.); *Stylolina* KARRER, 1877, *1023, p. 371 (type, *S. lapugyensis*); *Cribrospirella* MARIE, 1941, *1215, p. 28 (type, *Lituolites difformis* LAMARCK, 1804, *1085b, p. 243)]. Test large, early portion planispirally coiled, later rectilinear; wall agglutinated, with interior structure of walls and septa simple; aperture terminal, cribrate. [Differs from *Ammobaculites* in having a multiple aperture and from *Haplophragmium* in having an early planispiral, rather than streptospiral, coil. *Stylolina* has been regarded as a synonym of *Haplophragmium* (*762), but because of its multiple aperture, is here classed as a synonym of *Lituola.*] *U.Trias.-Rec.,* cosmop.—— FIG. 151,*1-3.* **L. nautiloidea,* U.Cret.(Campan.), Eu.(Fr.); *1a,b,* side, edge views of neotype, ×16 (*2117); *2a,b,* side, top views of topotype, ×16 (*2117); *3,* median sec., showing simple walls and septa, ×17 (*1240).

Ammoastuta CUSHMAN & BRÖNNIMANN, 1948, *498, p. 17 [**A. salsa;* OD] [=*Praeammoastuta* BURSCH, 1952, *255, p. 915 (type, *P. alberdingi*)]. Ovate to flabelliform, compressed test with low, rapidly broadening chambers in curved, semienrolled series, similar to calcareous isomorph *Astacolus;* wall finely agglutinated on inner pseudochitinous layer, interior simple; aperture transverse areal slit near center of terminal face of final chamber, secondary apertures consisting of cribrate openings at lower end of final chamber (nearest proloculus). *U.Eoc.-Rec.,* N.Am.(USA)-W.Indies(Trinidad)-S. Am.(Venez.-Ecuad.)-C. Am.(Panama). —— FIG. 151,*4.* **A. salsa,* Rec., USA(La.); *4a,b,* side and edge views, ×130 (*2117).——FIG. 151,*5. A. alberdingi* (BURSCH), Oligo., Venez.; *5a,b,* side, edge views, ×174 (*2117).

[MAYNC (*1240, p. 43) stated that the genus lacks an early coiled portion and is therefore "not a lituolid foraminifer." BURSCH (*255, p. 915) placed it in the Reophacinae. As it shows apparent derivation from a coiled form, however, we regard it as closely related to such forms as *Flabellammina* and retain it within this subfamily. It shows no affinity to the uniserial Reophacidae. The presence of cribrate apertures in *Praeammoastuta alberdingi* BURSCH

was noted by SAUNDERS (*1633, p. 84), who therefore classed that genus as a synonym of *Ammoastuta*.]

Ammobaculites CUSHMAN, 1910, *404a, p. 114 [**Spirolina agglutinans* D'ORBIGNY, 1846, *1395, p. 137; OD]. Test free, early portion close coiled, later uncoiled and rectilinear, rounded in section;

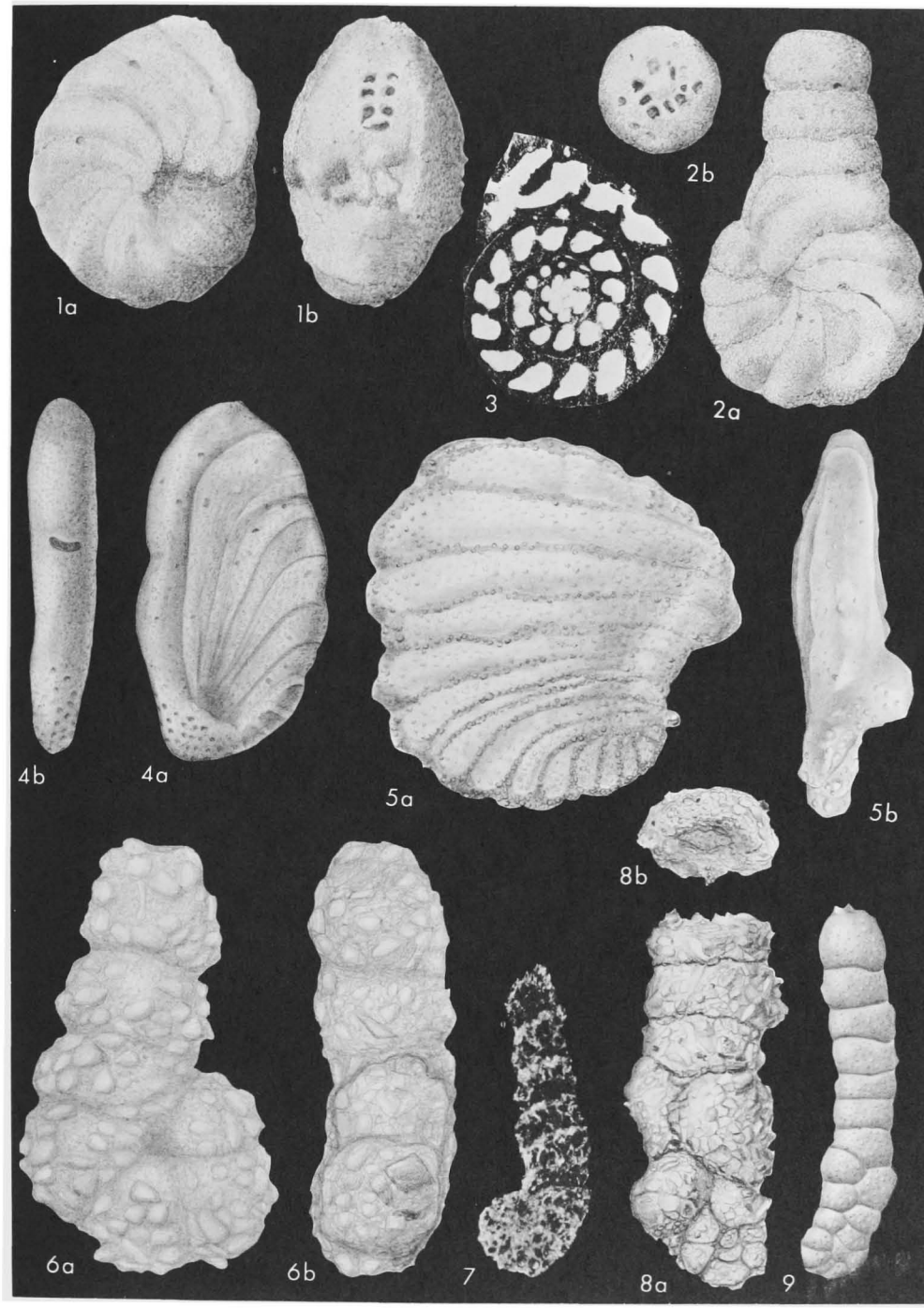

FIG. 151. Lituolidae (Lituolinae; *1-3, Lituola; 4,5, Ammoastuta; 6, Ammobaculites; 7, Ammomarginulina; 8,9, Ammobaculoides*) (p. C238-C241).

wall agglutinated, interior simple; aperture terminal, rounded. [*Ammobaculites* differs from *Haplophragmium* in its early planispiral, rather than streptospiral coil, from *Ammomarginulina* in its straight sutures and centrally placed aperture, and from *Ammoscalaria* in its thicker septa, which

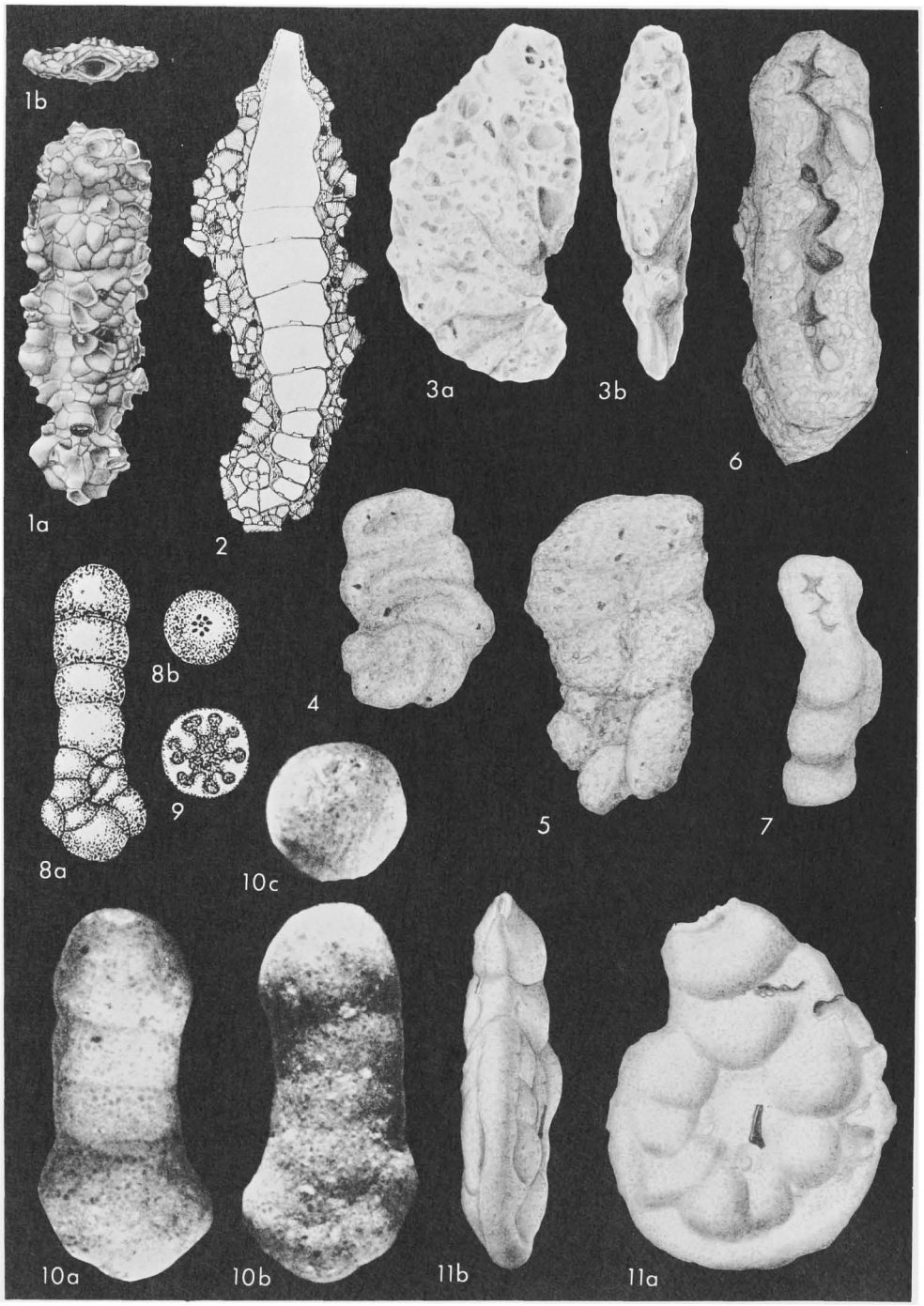

FIG. 152. Lituolidae (Lituolinae; *1,2, Ammoscalaria; 3, Ammotium; 4-7, Buccicrenata; 8-10, Bulbophragmium; 11, Discamminoides*) (p. C241-C244).

represent apertural faces of previous chambers, rather than being pseudochitinous and of secondary origin.] *Carb.-Rec.*, cosmop.——FIG. 151, *6*. **A. agglutinans* (D'ORBIGNY), Mio., Eu.(Aus.); *6a,b*, side, edge views of lectotype, ×48 (*2117).

Ammobaculoides PLUMMER, 1932, *1465, p. 87 [**A. navarroensis;* OD] [=*Spiroplectella* EARLAND, 1934, *653, p. 113 (type, *S. cylindroides)*]. Test free, elongate, ovate to rounded in section; early chambers in planispiral coil, later biserially arranged and finally uniserial; wall agglutinated, insoluble in acid; aperture at base of final chamber of early portion, becoming terminal in adult. *L.Cret.-Rec.*, N.Am.-Eu.-Antarctic.——FIG. 151,*8*. **A. navarroensis*, U.Cret., USA(Tex.); *8a,b*, side, top views, ×80 (*2117).——FIG. 151,*9*. *A. cylindroides* (EARLAND), Rec., Antarctic, side view, ×166 (*2117).

[The type-species of *Spiroplectella* differs from that of *Ammobaculoides* only in being smaller and more regular in size, breadth of the coil being approximately equal to that of the biserial stage and the final uniserial portion. In *A. navarroensis* the biserial stage is widest. These differences are of specific rather than generic importance, however. Since both develop from coiled to biserial to uniserial, having agglutinated tests insoluble in HCl, they are here considered synonymous.]

Ammomarginulina WIESNER, 1931, *2063, p. 97 [**A. ensis;* OD (M)]. Test planispiral in early stage, later rectilinear, strongly compressed; sutures oblique; wall agglutinated, with very little cement; aperture terminal, eccentric, at dorsal angle of test. [MAYNC (*1240) stated that *Ammobaculites compressa* CUSHMAN & WATERS (M. Penn., Mich.) "should be referred to *Ammomarginulina*" and thus would extend the range of the genus to the Pennsylvanian. As *A. compressa* has neither the eccentric aperture at the dorsal angle nor the oblique sutures which characterize *Ammomarginulina*, we regard it as a true *Ammobaculites*.] *Jur.-Rec.*, Antarctic-Afr.-N.Am.-Eu. ——FIG. 151,*7*. **A. ensis*, Rec., Antarctic; holotype, ×66 (*2063).

Ammoscalaria HÖGLUND, 1947, *924, p. 151 [**Haplophragmium tenuimargo* BRADY in TIZARD & MURRAY, 1882, *1936, p. 715; OD]. Test free, elongate, early portion planispiral, later uncoiling and rectilinear, original development as tubular test with secondarily formed septa and resultant chamber development; sutures indistinct at surface, internal septa extremely thin, straight and pseudochitinous; exterior wall coarsely agglutinated, thick; aperture rounded to slightly elongate, may be produced on distinct neck, which is apparently temporary structure resorbed in formation of next succeeding chamber, foramina of secondarily formed septa not correlative with terminal aperture, but consisting of slight tubular projection from center of each pseudochitinous septum. [*Ammoscalaria* differs from *Ammobaculites* in its secondarily formed thin, pseudochitinous septa.] *Rec.*, Atl.-Pac.——FIG. 152,*1,2*. **A. tenuimargo* (BRADY), Atl. *(1)*, N.Sea *(2)*; *1a,b*, side, top view of topotype, ×23 (*2117); *2*, sec. showing nature of septa, ×37 (*924).

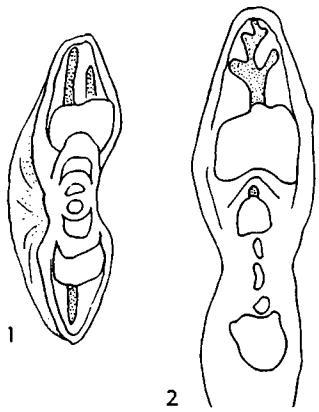

FIG. 153. Lituolidae (Lituolinae; *1,2, Discamminoides*) (p. C242-C244).

Ammotium LOEBLICH & TAPPAN, 1953, *1162, p. 33 [**Lituola cassis* PARKER in DAWSON, 1870, *565, p. 177; OD]. Test free, compressed, ovate in outline, chambers planispirally coiled and evolute, later chambers tending to uncoil but reaching backward toward coil at inner margin; wall agglutinated; aperture simple, rounded, terminal, at dorsal angle of final chamber. [*Ammotium* differs from *Ammobaculites* in becoming only partially uncoiled, the later portion being flattened rather than rounded in section and the chambers reaching far back toward the coil at the inner margin.] *Cret.-Rec.*, Atl.-Pac.——FIG. 152,*3*. **A. cassis* (PARKER), Rec., Alaska; *3a,b*, side, edge views, ×28 (*1162).

Buccicrenata LOEBLICH & TAPPAN, 1949, *1156, p. 252 [**Ammobaculites subgoodlandensis* VANDERPOOL, 1933, *1975, p. 407); OD]. Test free, flattened, early stage planispiral, later portion uncoiled and straight; wall agglutinated, aperture interiomarginal in the early stage, becoming terminal in uncoiled portion, elongate, with series of lateral toothlike projections. [*Buccicrenata* differs from *Ammobaculites* in its elongate, crenulate aperture instead of a simple one.] *L.Cret.(Alb.)*, USA(Tex.-Okla.).——FIG. 152,*4-7*. **B. subgoodlandensis* (VANDERPOOL); *4,5*, side view of lectotype and topotype, ×10; *6,7*, apert. views of topotypes, ×22 (*1156).

Bulbophragmium MAYNC, 1952, *1240, p. 46 [**Haplophragmium aequale* REUSS, 1860, *1548, p. 218, pl. 11, fig. 2a *(non Spirolina aequalis* ROEMER, 1841, *1583, p. 98) (=*Bulbophragmium aequale* MAYNC, 1952, see *1164, p. 33, =*Lituola westfalica* BARTENSTEIN, 1952, *91, p. 323); OD]. Test similar to *Lituola*, but early stage streptospirally coiled rather than planispiral; interior simple; aperture cribrate. *Cret.*, Eu.——FIG. 152, *8-10*. **B. aequale* MAYNC, U.Cret.(Campan.), Ger.; *8a,b*, side and top views; *9*, sec. of specimen; *10a-c*, opposite sides and top view of neotype, ×10 (*91).

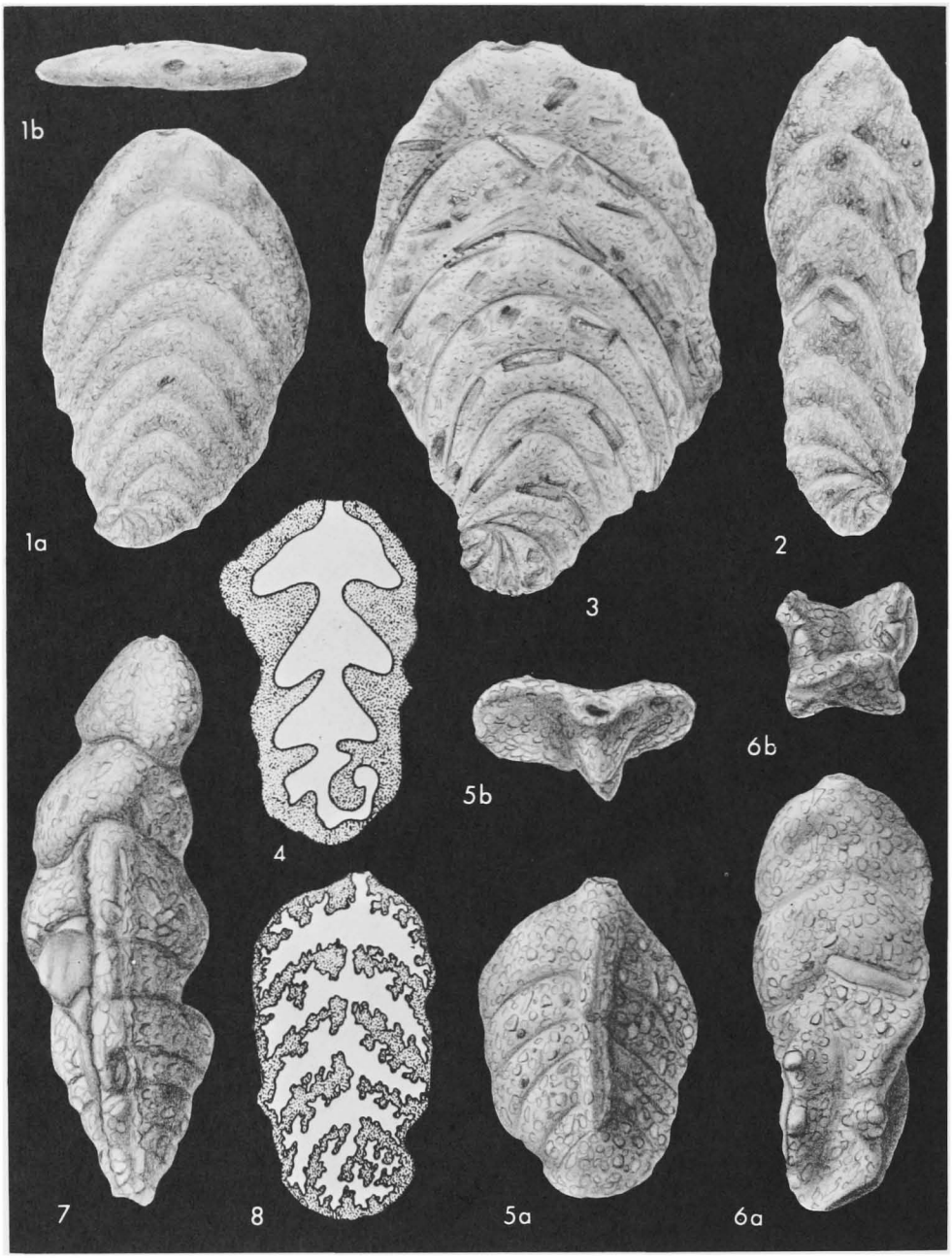

FIG. 154. Lituolidae (Lituolinae; *1-4, Flabellammina; 5-8, Flabellamminopsis*) (p. C244).

[The involved nomenclature of the type-species is discussed by LOEBLICH & TAPPAN (*1164). The type-species was stated originally to be *Haplophragmium aequale* REUSS, 1860 (*non Spirolina aequalis* ROEMER, 1841). As this is a type without a valid specific name, the Rules state that in such cases the old specific name is to be used with the new generic name as a new species, with authorship and date that of the author of the genus, in this instance, *Bulbophragmium aequale* MAYNC. The later-proposed name *Lituola westfalica* BARTENSTEIN is therefore a junior synonym.]

Discamminoides BRÖNNIMANN, 1951, *225, p. 103 [*D. tobleri;* OD]. Planispiral early stage, becoming uniserial in later development; septa thin, curved, nonalveolar; wall agglutinated, peripheral area of chamber cavity with spongy alveolar filling of fine-grained arenaceous material, alveolar openings perpendicular to outer wall but not perforat-

ing it, no true labyrinthic layer developed; aperture interiomarginal in early stage, terminal in later stage (whether single or multiple being unknown). [This genus is only provisionally recognized as distinct, for according to MAYNC (*1240, p. 48) the alveolar structure is not pres-

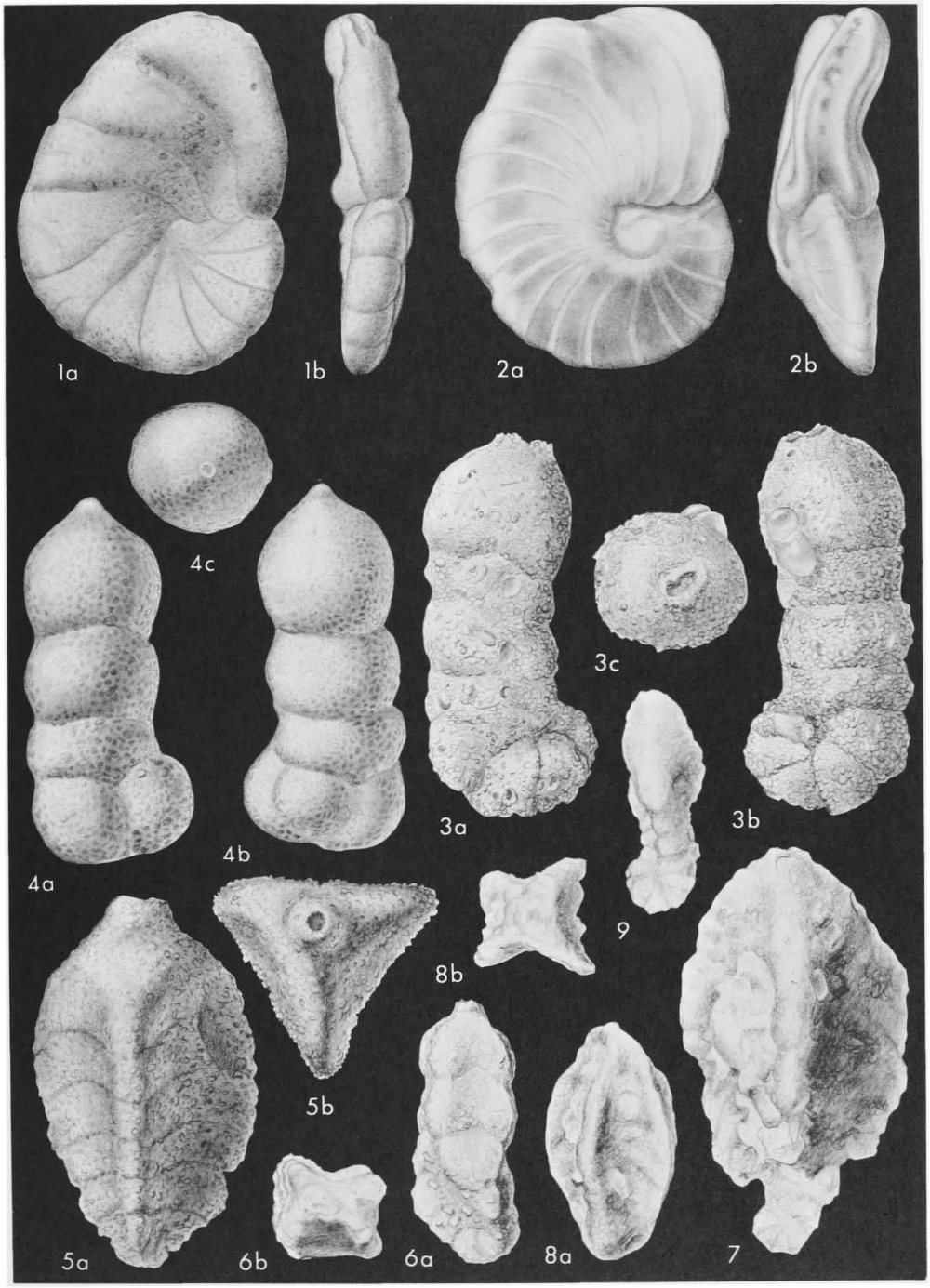

FIG. 155. Lituolidae (Lituolinae; *1, Phenacophragma; 2, Stomatostoecha; 3,4, Haplophragmium; 5-9, Triplasia*) (p. C244-C247).

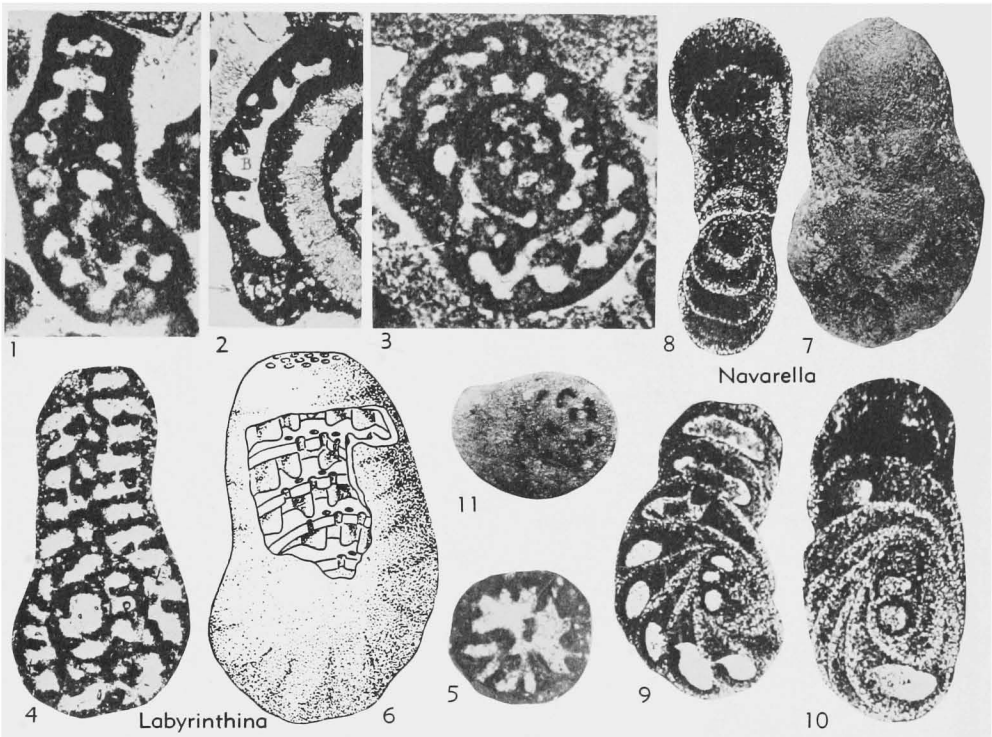

FIG. 156. Lituolidae (Lituolinae; *1-6, Labyrinthina; 7-11, Navarella*) (p. C245).

ent in all specimens. If this is not a constant feature of the genus, *Discamminoides* would appear to be a synonym of *Ammobaculites* or *Lituola,* depending on the presence of a single or multiple aperture, not yet described.] *U.Oligo.-L.Mio.,* W.Indies(Trinidad).——FIG. 152,*11*; 153, *1,2. *D. tobleri,* Mio.; 152,*11a,b,* side, edge views of holotype, ×39 (*2117); 153,*1,2,* megalospheric paratypes, nearly axial sec. *(1),* showing straight alveoles (shaded), and sec. parallel to axis *(2)* showing branching alveole, ×35 (*225).

Flabellammina CUSHMAN, 1928, *436, p. 1 [**F. alexanderi;* OD]. Test elongate, compressed, early stage coiled, later uniserial, with broad, low chevron-shaped chambers; wall coarsely agglutinated, simple walls and septa; aperture terminal, rounded to ovate. [*Flabellammina* differs from *Ammobaculites* in having compressed, equitant uniserial chambers.] *L.Cret.-U.Cret.,* N.Am.-Eu. ——FIG. 154,*1-3. *F. alexanderi,* L.Cret.(Alb.), USA(Tex.); *1a,b,* side, top views of microspheric, finely agglutinated specimen, ×33; *2,3,* side views of coarsely agglutinated microspheric and megalospheric specimens, ×72 (*2117).——FIG. 154,*4. F. rugosa* ALEXANDER & SMITH, L.Cret.(Alb.), USA(Tex.), long. sec. showing simple interior, ×52 (*11).

Flabellamminopsis MALECKI, 1954, *1209, p. 104, 112, 117 [**F. variabilis;* OD]. Test enrolled to uniserial, similar in form to *Triplasia,* with flattened, triangular or quadrate tests, but with pseudolabyrinthic, quite irregular internal structure, although lacking true alveolar layer; aperture terminal, rounded. [This variable form may have flattened, triangular, or quadrate specimens or a succession of these stages in a single specimen.] *M.Jur.,* Eu.(Pol.).——FIG. 154,*5-8. *F. variabilis; 5a,b,* side, top views of triangular specimen; *6a,b,* side, top views of quadrate specimen; *7,* triangular form, rounded in later portion, ×33 (*2117); *8,* sec. showing pseudolabyrinthic structure, enlarged (*1210).

Haplophragmium REUSS, 1860, *1548, p. 217 [**Spirolina aequalis* ROEMER, 1841, *1583, p. 98; SD CUSHMAN, 1920, *411b, p. 67] [=*Bulbobaculites* MAYNC, 1952, *1240, p. 47 (type, *Ammobaculites lueckei* CUSHMAN & HEDBERG, 1941, *507, p. 83)]. Early portion streptospirally coiled, as in *Bulbophragmium,* later rectilinear; interior simple; aperture rounded, single, terminal. [*Haplophragmium* differs from *Ammobaculites* in its early streptospiral coil.] *M.Jur.-U.Cret.,* Eu.-N. Am.-S.Am.——FIG. 155,*3. *H. aequale* (ROEMER), L.Cret.(Hauteriv.), Ger.; *3a-c,* opposite sides and top view of topotype, ×20 (*2117).——FIG. 155,*4. H. lueckei* (CUSHMAN & HEDBERG), U.Cret., S.Am.(Colom.); *4a-c,* opposite sides and top of holotype, ×124 (*2117).

Labyrinthina WEYNSCHENK, 1951, *2051, p. 793 [**L. mirabilis*; OD] [=*Lituosepta* CATI, 1959, *303, p. 2 (type, *L. recoarensis*)]. Test elongate, subcylindrical, enrolled in early stage, later uncoiling, wall agglutinated of calcareous particles in calcareous cement, nonlabyrinthic, as in *Lituola,* but with secondary transverse septa projecting short distance inward from outer wall; aperture terminal, cribrate. *U.Trias.-L.Jur.(Lias.),* Eu.(Aus.)-Italy.——FIG. 156,*1-3*. **L. mirabilis,* U.Trias., Aus.; *1,* long. sec. showing parts of secondary transverse septa in central portion of test; *2,* long. sec. showing supposed attachment; *3,* transv. sec., ×33 (*2051).——FIG. 156,*4-6*. *L. recoarensis* (CATI), L.Jur.(Lias.), Italy; *4,* long. equat. sec. of holotype showing early coil and later rectilinear development, with portions of transv. septa visible where intersected near center of test; *5,* transv. sec. of paratype showing transv. septa, ×40; *6,* reconstr. showing internal and external charatcers, ×55 (*303).

[*Labyrinthina* and its synonym *Lituosepta* were both originally placed in the Lituolidae because of the similarity to *Lituola* and the nature of the embryonal portion, although the secondary septa of *Lituosepta* were regarded as similar to the Meandropsinidae. MAYNC (*1240, p. 51) suggested the placement of *Labyrinthina* with the Placopsilinidae because of some supposedly attached specimens. These were obtained only from thin sections in limestone and the presumed attached nature seems uncertain from the evidence available. The majority of specimens were unquestionably free-living.]

Navarella CIRY & RAT, 1951, *343, p. 85 [**N. joaquini;* OD]. Test large, early stage streptospirally enrolled, later portion uncoiled, in wide spire; septa strongly arched; wall agglutinated, with calcareous cement; aperture in early coil interiomarginal arched slit, later with small circular pores in addition to interiomarginal opening, and in uncoiled stage only scattered circular pores occur on terminal surface. *U.Cret.(Maastricht.),* Eu.(Sp.-Switz.-Fr.).——FIGS. 156,*7-11*. **N. joaquini,* Sp.; *7,* side view of topotype, ×8; *8,9,* axial and equat. secs., ×8; *10,* somewhat oblique sec. showing early spire and arched septa, ×10; *11,* sec. near surface showing cribrate aperture, ×15 (*1243).

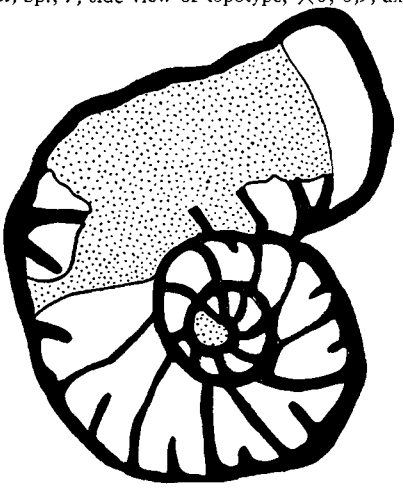

FIG. 157. Lituolidae (Lituolinae; *Phenacophragma*) (p. C245).

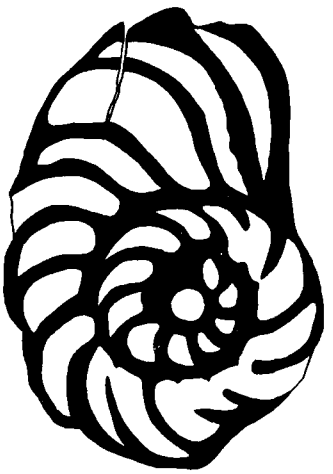

FIG. 158. Lituolidae (Lituolinae; *Stomatostoecha*) (p. C245).

Phenacophragma APPLIN, LOEBLICH & TAPPAN, 1950, *27, p. 78 [**P. assurgens;* OD]. Test free, planispiral, somewhat evolute, with slight tendency to uncoil; chambers numerous; septa of 2 types, complete normal septa alternating with hemisepta which project only slightly into chamber cavities; wall calcareous, imperforate, and microgranular, with some additional material incorporated in epidermal layer, interior simple, not labyrinthic, and with no transverse partitions; aperture slitlike, terminal. *L.Cret.(Alb.),* USA (Tex.).——FIG. 155,*1;* 157. **P. assurgens;* 155, *1a,b,* side, edge views of holotype, ×83 (*2117); 157, sec. of paratype showing true septa and hemisepta, ×95 (*27).

Stomatostoecha APPLIN, LOEBLICH & TAPPAN, 1950, *27, p. 76 [**S. plummerae;* OD]. Test free, planispiral, not completely involute; chambers numerous; wall composed of calcareous detrital material, interior simple, not labyrinthic, and with neither transverse nor parallel partitions; aperture single series of pores in linear depression on apertural face of final chamber. [*Stomatostoecha* differs from *Choffatella* in lacking any transverse or parallel partitions and from *Phenacophragma* in lacking hemisepta and in having a multiple aperture.] *L.Cret.(Alb.),* USA(Tex.).——FIG. 155,*2*; 158. **S. plummerae;* 155,*2a,b,* side, edge views of holotype, ×44 (*2117); 158, sec. of paratype showing simple interior, ×64 (*27).

Triplasia REUSS, 1854, *1543, p. 65 [**T. murchisoni;* OD (M)] [=*Rhabdogonium* REUSS, 1860, *1548, p. 198 (type, *Triplasia murchisoni* REUSS, 1854, SD LOEBLICH & TAPPAN, herein, obj.); *Frankeina*

CUSHMAN & ALEXANDER, 1929, *487, p. 61 (type, *F. goodlandensis*); *Centenarina* MAJZON, 1948, *1204, p. 24 (type, *C. hungarica*); *Tetraplasia* BARTENSTEIN & BRAND, 1949, *94, p. 672 (type, *T. georgsdorfensis*); *Centenaria* THALMANN, 1950, *1897i, p. 743 *(nom. null.)*]. Test free, early

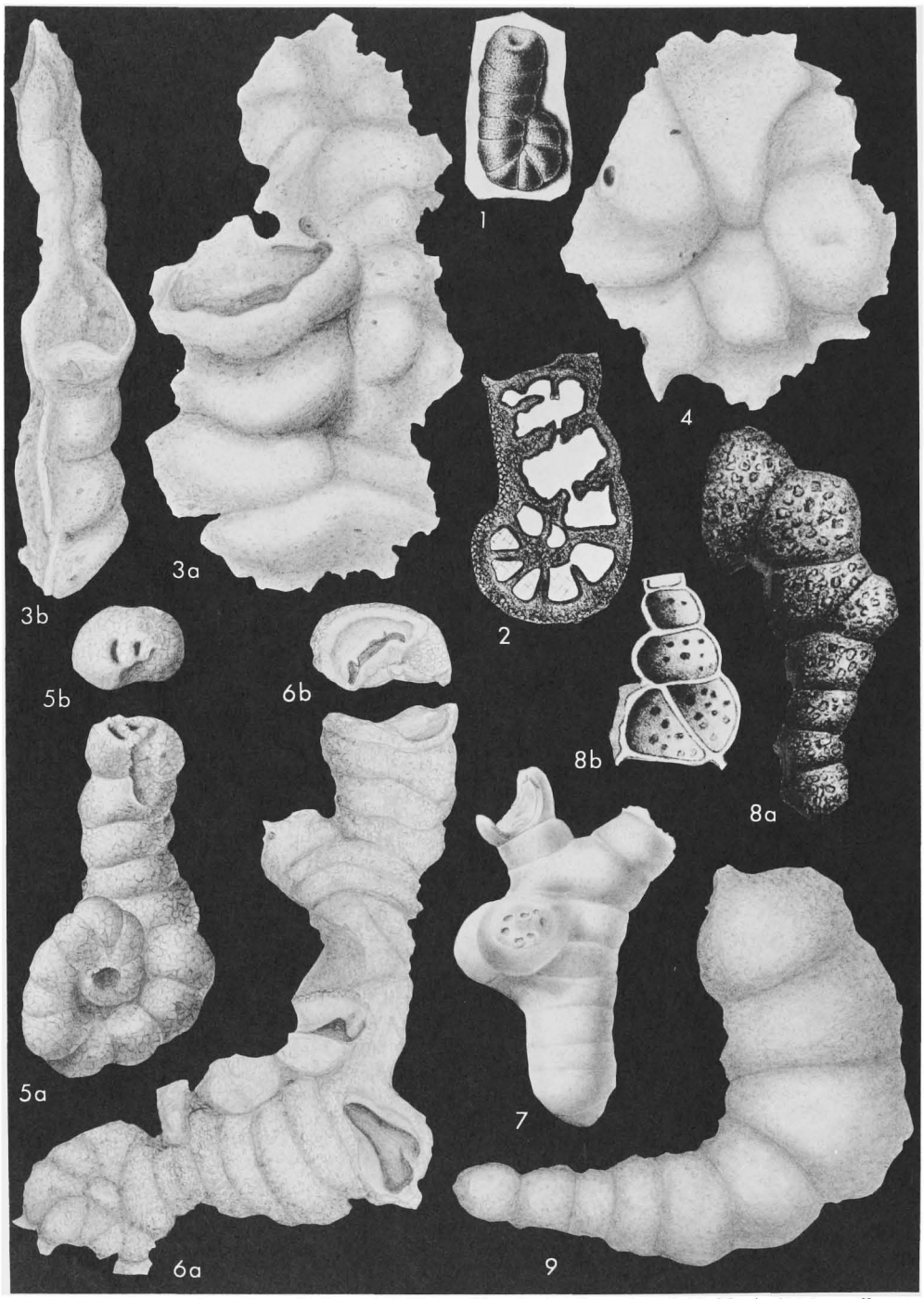

FIG. 159. Lituolidae (Placopsilininae; *1-4, Placopsilina; 5, Acruliammina; 6, Haddonia; 7, Manorella; 8,9, Subbdelloidina*) (p. C247-C248).

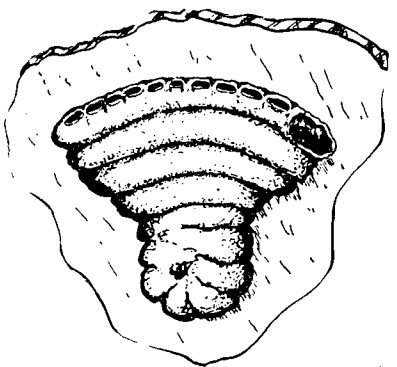

FIG. 160. Lituolidae (Placopsilininae; *Arenonina*) (p. C247).

portion may be planispiral, especially in microspheric forms, later portion uniserial or may be uniserial throughout, uniserial portion rhomboid in section, most commonly triangular, but some quadrate specimens occur in most species; sutures somewhat arched on faces of test, recurved at angles; wall agglutinated, composition and size of fragments extremely variable in same species; aperture terminal, round to elongate, may be produced on short neck. [*Triplasia* differs from *Flabellammina* in being triangular or quadrate in section in the uniserial stage. Most species contain some quadrate specimens; hence, this feature is not regarded as generic in importance in this lineage (*1161).]. *L.Jur.-Rec.,* N.Am.-Eu.-Pac. ——FIG. 155,*5.* **T. murchisoni,* U.Cret.(Coniac.-L.Santon.), Aus.; *5a,b,* side, apert. views of topotype, ×48 (*2117).——FIG. 155,*6. T. georgsdorfensis* (BARTENSTEIN & BRAND), L.Cret.(Valang.), Ger.; *6a,b,* side, top views, ×22 (*1161).——FIG. 155,*7-9. T. goodlandensis* (CUSHMAN & ALEXANDER), L.Cret.(Alb.), USA(Tex.); *7,* side view of triangular microspheric topotype; *8a,b,* side, top views of quadrate topotype; *9,* megalospheric topotype; all ×55 (*1161).

Subfamily PLACOPSILININAE Rhumbler, 1913

[Placopsilininae RHUMBLER, 1913, p. 444] [=Arplacopsinia RHUMBLER, 1913, p. 444 *(nom. van.)*]

Test attached, early chambers may be enrolled, later uncoiling; wall simple. *Miss.-Rec.*

Placopsilina D'ORBIGNY, 1850, *1397a, p. 259 [**P. cenomana;* SD CUSHMAN, 1920, *411b, p. 70] [=*Ammocibicides* EARLAND, 1934, *653, p. 106 (type, *A. proteus*)]. Test attached, early stage planispirally coiled, later uncoiling and rectilinear; wall agglutinated, nonlabyrinthic; aperture terminal, rounded, may have slight lip. *M.Jur.-Rec.,* cosmop.——FIG. 159,*1,2. *P. cenomana,* U.Cret. (Cenoman.), Czech.; *1,* attached specimen, ×10; *2,* sec. of early portion showing nonlabyrinthic walls, ×28 (*1445).——FIG. 159,*3,4. P. proteus* (EARLAND), Rec., S.Am.(Drake Straits); *3,* syntype of EARLAND (*653, pl. 4, fig. 5) here designated as lectotype; *3a,b,* side and edge views showing flattened area where attached, ×48; *4,* small paratype (*653, pl. 4, fig. 1), ×105 (*2117).

[*Ammocibicides* was stated by CUSHMAN (1948, *486, p. 204) to be trochoid in the early stage, "probably attached in the early stages, later becoming free." An examination of the original types in the British Museum (Natural History) (here redrawn), shows this form to be wholly attached, planispiral, and in no way distinguishable from *Placopsilina.* The irregular margin of *A. proteus* was not regarded by EARLAND as of generic importance, as he also described *A. pontoni* from the Eocene of Alabama, which shows as regular an outline as *P. cenomana. Ammocibicides* is here suppressed as a synonym of *Placopsilina.*]

Acruliammina LOEBLICH & TAPPAN, 1946, *1154, p. 252 [**Placopsilina longa* TAPPAN, 1940, *1871, p. 100; OD]. Test attached, at least in early portion; early stage close coiled, later uncoiling, only few chambers of coiled portion may be attached or all of coiled portion and much of uniserial portion may be attached, later portion of test usually growing free from attachment and uniserial part becoming cylindrical; wall agglutinated; aperture terminal, single low slit at attachment in early stages, later divided by median septum and finally cribrate. [*Acruliammina* differs from *Placopsilina* in having a cribrate rather than simple aperture.] *L.Cret.(Alb.)-U.Cret.(Campan.),* USA (Tex.-Okla.).——FIG. 159,*5. *A. longa* (TAPPAN), L.Cret.(Alb.), Tex.; *5a,b,* side, apert. views, ×22 (*2117).

Arenonina BARNARD, 1958, *87, p. 118 [**A. cretacea;* OD]. Test attached, early stage planispirally enrolled, later uncoiled and with broad, low chambers resulting in flabelliform test; wall finely agglutinated, with considerable calcareous cement; aperture terminal slit in early stage, multiple in adult flabelliform portion, with single row of large rounded openings extending across breadth of final chamber, each aperture with distinct lip. [*Arenonina* differs from *Placopsilina* in its spreading chambers and flabelliform test and in having a multiple aperture consisting of a single row of openings.] *U.Cret.(Senon.),* Eng.——FIG. 160. **A. cretacea;* ×30 (*87).

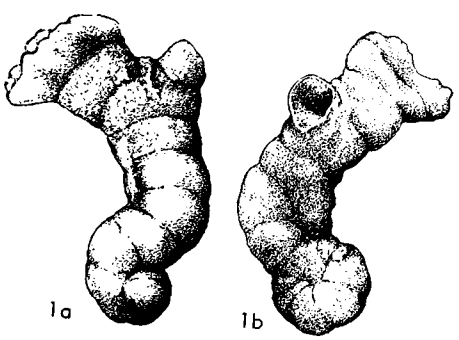

FIG. 161. Lituolidae (Placopsilininae; *1, Manorella*) (p. C248).

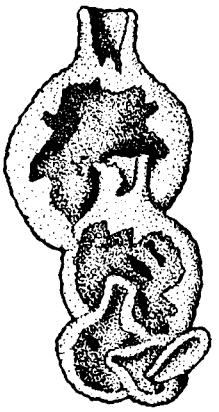

FIG. 161A. Lituolidae (Placopsilininae; *Oxinoxis*) (p. C248).

Haddonia CHAPMAN, 1898, *313, p. 453, 455 [**H. torresiensis;* OD] [=*Arhaddonium* RHUMBLER, 1913, *1572b, p. 448 (obj.) *(nom. van.)*]. Test large, attached, early portion coiled, later uniserial or branching; chambers broad, low, irregular in size and shape; sutures depressed; wall coarsely agglutinated, with much calcareous cement, interior smoothly finished, although pitted and traversed by large canals; aperture terminal, arched and slitlike, with projecting teeth. *Eoc.-Rec.,* Pac.-W.Indies(Cuba).——FIG. 159,*6*. **H. torresiensis,* Rec., N.Australia(Torres Straits); *6a,* side view of lectotype (here designated and redrawn, BMNH Cat. No. 97.11.20.1, specimen figured by CHAPMAN, *313, pl. 28, fig. 2), illustration here published showing more of test than original figures, which did not show complete specimen; *6b,* top view of final chamber showing slitlike aperture and projecting teeth of penultimate chamber, with broken wall of final chamber showing straight transverse canals or pores, ×5.2 (*2117).

[This form was originally described as having a labyrinthic interior, but the inner wall is very smoothly finished as can be seen where branches are broken. Possibly straight pores in the wall were mistaken for a labyrinthic interior. No sections or additional material were available to check this. *Haddonia* differs from *Placopsilina* in its branching character, coarsely perforate wall, and elongate, slitlike aperture, instead of rounded aperture. *Coscinophragma* differs in having a labyrinthic interior and cribrate aperture.]

Manorella GRICE, 1948, *823, p. 223 [**M. proteus;* OD]. Test free, early stage may be trochospirally coiled, later uniserial, with closely appressed chambers, rarely branching; wall agglutinated on pseudochitinous base, with calcareous particles in calcareous cement, coarsely perforate, interior simple; aperture multiple, with few ovate to slitlike openings on slight collar-like projections, paralleling periphery on terminal face. *U.Cret.,* USA (Tex.).——FIG. 159,*7*; 161,*1*. **M. proteus*; 159,*7,* holotype, with multiple apert. and coarse perforations, ×36 (*2117); 161,*1a,b,* opposite sides of paratype showing early coil and later branching, ×30 (*823).

Oxinoxis GUTSCHICK, 1962, *844A, p. 1299 [**O. botrys*; OD]. Test large, up to 1.5 mm. in length, early portion attached and lacking basal wall against attachment, later growing free of attachment, with complete wall; proloculus ovate, followed by loosely coiled series of few subglobular chambers, later chambers uncoiled and rectilinear, each with distinct and tubular neck; wall agglutinated, of quartz and calcareous grains in siliceous cement; aperture rounded and terminal on short thick neck. *L.Miss.(Kinderhook.),* USA(Mont.).——FIG. 161A,*1*. **O. botrys;* attached side of holotype, showing open base of early loosely coiled attached chambers, and free-growing later chambers broken open to show tubular necks, ×33 (*844A).

[Although originally placed in the "family Reophacidae, subfamily Aschemonellinae," *Oxinoxis* is here transferred to the Placopsilininae, because of its early coil and attached nature. It resembles *Subbdelloidina* FRENTZEN in the poorly developed coil, but differs in the distinctly globose chambers and tubular necks, and in the tendency to grow free of the attachment in the later stage.]

Subbdelloidina FRENTZEN, 1944, *747, p. 331 [**S. haeusleri;* OD] [=*Eoplacopsilina* PAYARD, 1947, *1432, p. 63 (type, *E. mariei*)]. Test attached, with bulbous proloculus followed by uniserial, rectilinear, arcuate, or somewhat irregular series of chambers, increasing gradually in size; wall agglutinated; aperture terminal, may be slightly produced. [Differs from *Placopsilina* in lacking an early coiled stage. *Eoplacopsilina* was originally stated (*1432) to have an internal spire within the spherical proloculus, but examination of the holotype (only known specimen) of the type-species shows that this appearance is due to an irregular chamber cavity, not a spiral stage of numerous chambers, as found in *Placopsilina.*] *L. Jur.(U.Lias.)-U.Jur.,* Eu.(Switz.-Ger.-Fr.).——FIG. 159,*8*. **S. haeusleri,* U.Jur., Switz.; *8a,b,* ext. and part of formerly attached side showing simple walls, enlarged (*854).——FIG. 159,*9*. *S. mariei* (PAYARD), L.Jur.(Toarc.), Fr.; holotype (redrawn), ×105 (*2117).

Subfamily COSCINOPHRAGMATINAE Thalmann, 1951

[*nom. correct.* LOEBLICH & TAPPAN, herein (*pro* Coscinophragminae THALMANN, 1951, p. 221) (*nom. subst. pro* Polyphragminae RHUMBLER, 1913, p. 446, *nom. nud.*)] [=Arpolyphragmina RHUMBLER, 1913, p. 446 *(nom. van.)*]

Test attached, wall labyrinthic. *U.Cret.-Rec.*

Coscinophragma THALMANN, 1951, *1899d, p. 221 [*pro Polyphragma* REUSS, 1871, *1556, p. 278 (*non* QUATREFAGES, 1866)] [**Lichenopora cribrosa* REUSS, 1846, *1538, p. 64; OD] [=*Arpolyphragmoum* RHUMBLER, 1913, *1572b, p. 447 (obj.) *(nom. van.)*]. Test attached by base, with cylindrical and bifurcating branches composed of numerous broad low chambers; wall agglutinated,

interior labyrinthic with coarsely agglutinated layer and inner thin perforate homogeneous layer lining alveolar openings; aperture terminal, cribrate, consisting of regularly spaced rounded openings. *U.Cret.(Cenoman.),* Eu.(Czech.).——FIG. 162, *8,7. *C. cribrosa* (REUSS); *6a,b,* side and top views of branched fragment, ×5, ×14; *7a,* sec. showing interior structure, ×22; *7b,* sec. of portion of wall, showing thick, compact arenaceous layer and thin perforate layer, ×400 (*1445).

Adhaerentia PLUMMER, 1938, *1467, p. 242 [**A. midwayensis;* OD]. Test elongate, attached by hemispherical proloculus, commonly to coiled calcareous foraminifers, later growing free, early chambers biserially arranged, later uniserial and cylindrical; sutures slightly depressed to indistinct; wall agglutinated, interior labyrinthic; aperture in biserial stage rounded and subterminal, in later stages becoming irregular in outline and finally terminal and multiple. [*Adhaerentia* was

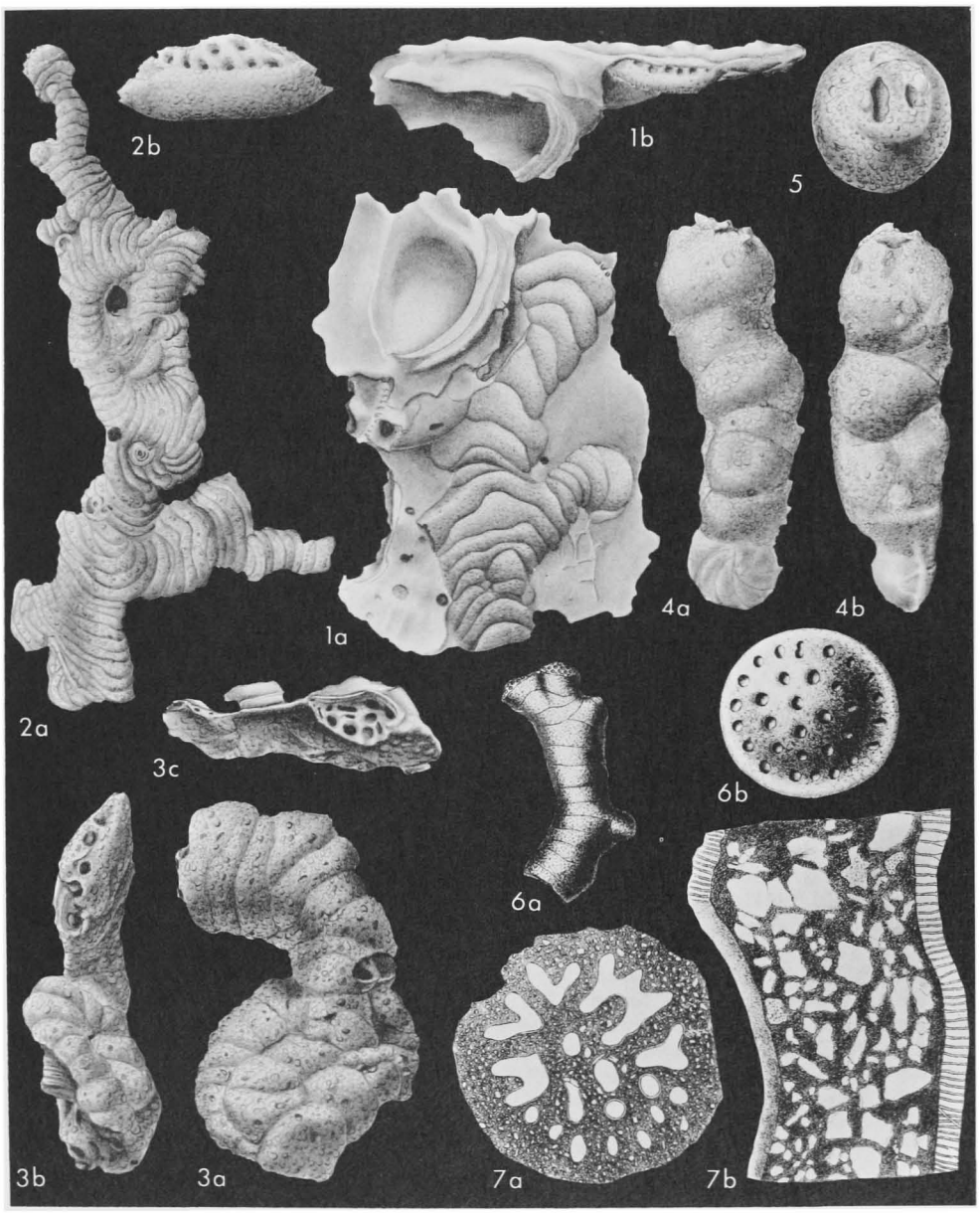

FIG. 162. Lituolidae (Coscinophragminae; *1-3, Bdelloidina; 4,5, Adhaerentia; 6,7, Coscinophragma*) (p. C248-C250).

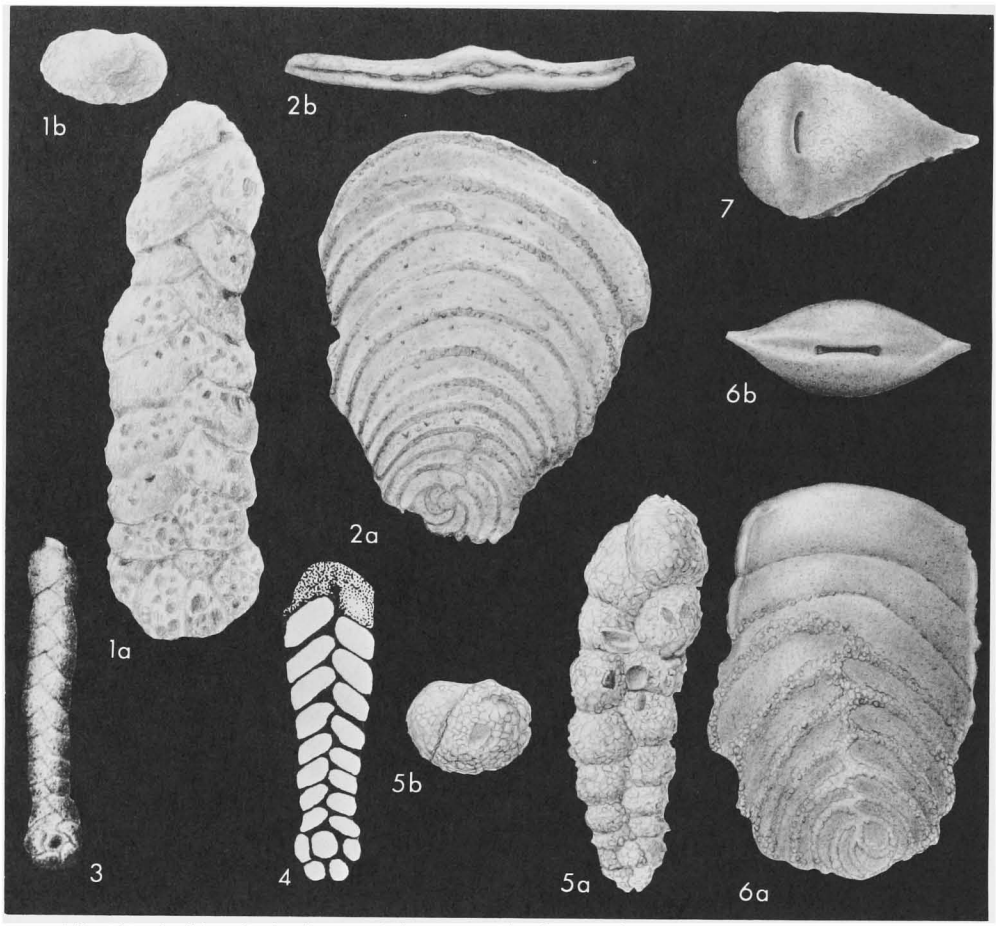

FIG. 163. Textulariidae (Spiroplectammininae; *1, Spiroplectammina; 2, Ammospirata; 3,4, Bolivinopsis; 5, Morulaeplecta; 6,7, Vulvulina*) (p. *C*251-*C*253).

placed in the Placopsilinidae by PLUMMER (1938, *1467), who regarded it as an advanced member of the family because of its reduced attached stage and labyrinthic interior.] *Paleoc.*, USA(Ala.).——FIG. 162,*4,5*. **A. midwayensis; 4a,b,* side, edge views of specimen attached to *Lenticulina; 5,* top view of another specimen showing double aperture; both ×26 (*2117).

Bdelloidina CARTER, 1877, *293, p. 201 [**B. aggregata;* OD] [=*Arbdelloidinum* RHUMBLER, 1913, *1572b, p. 448 (obj.) *(nom. van.)*]. Test attached, with numerous broad, low chambers in uniserial series or spreading and rarely branching; wall agglutinated, rough externally, smooth inside, with interior secondary septa vertically crossing chambers from base to top, numerous internal pores pitting interior and row of communicating pores through septal faces; aperture single or double row of pores against attachment on terminal face of last-formed chamber. *Paleoc. (Landen.)-Rec.*, Pac.-USA(N.J.).——FIG. 162,*1,2*. **B. aggregata,* Rec., Pac.(Bikini Atoll) *(1)*, Ind. O. *(2)*; *1a,b,* side view of attached specimen and top view of branch showing multiple aperture, ×5.5; *2a,b,* side view of much branched specimen and top view of branch showing double row of pores, ×5, ×20 (*1166).——FIG. 162,*3*. *B. vincentownensis* HOFKER, Paleoc.(Landen.), N.J.; *3a,b,* side, edge views showing aperture as a single row of pores; *3c,* broken to show complex interior; all ×14 (*2117).

Family TEXTULARIIDAE Ehrenberg, 1838

[*nom. correct*. CHAPMAN, 1900, p. 9 (*pro* family Textularina EHRENBERG, 1838, p. 200)]——[All names referred to are of family rank; dagger(†) indicates *partim*]——[=Énallostèguest D'ORBIGNY, 1826, p. 260 *(nom. nud)*; =Turbinoidat SCHULTZE, 1854, p. 52 *(nom. nud.)*; =Uvellideat REUSS, 1862, p. 318, 382 *(nom. nud.)*; =Uvellideaet GÜMBEL, 1870, p. 23 *(nom. nud.)*; =Plecanioidea SCHWAGER, 1877, p. 22; =Turbinidat MARRIOTT, 1878, p. 30 *(nom. nud.)*; =Opistho-Dischistidaet EIMER & FICKERT, 1899, p. 677 *(nom. nud.)*; =Dischistidaet EIMER & FICKERT, 1899, p. 678 *(nom. nud.)*]——[=Textularidae D'ORBIGNY in DE LA SAGRA, 1839, p. 140; =Textilarina AGASSIZ, 1844, p. 4; =Textilarideae REUSS, 1860, p. 231; =Textilaridea REUSS, 1862, p. 320; =Textularida SCHMARDA, 1871, p. 164; =Textilarida JONES in GRIFFITH & HENFREY, 1875, p. 320; =Textilariidae JONES,

1895, p. 140; =Textularinae DELAGE & HÉROUARD, 1896, p. 140; =Textulinidae RHUMBLER, 1913, p. 339 (*nom. van.*); =Artextulidia RHUMBLER, 1913, p. 342 (*nom. van.*); =Textuláridos GADEA BUISÁN, 1947, p. 18 (*nom. neg.*)]

Test free or attached, may have early planispiral coil, generally biserial and may become uniserial; wall agglutinated; aperture simple, basal or terminal, single to multiple. *Carb.-Rec.*

Subfamily SPIROPLECTAMMININAE Cushman, 1927

[Spiroplectammininae CUSHMAN, 1927, p. 21]

Early stage planispiral, later biserial. *Carb.-Rec.*

Spiroplectammina CUSHMAN, 1927, *431, p. 23 [**Textularia agglutinans* d'ORBIGNY var. *biformis* PARKER & JONES, 1865, *1418, p. 370; OD]. Test free, elongate, early portion in planispiral coil of few chambers, later chambers biserially arranged; wall agglutinated; aperture low arch at inner margin of final chamber. [*Spiroplectammina* differs from *Textularia* in having a distinct and well-developed initial coil. The lectotype of *Textularia agglutinans* var. *biformis* PARKER & JONES is here designated (BMNH-ZF 3639, *ex* 94.4.3.194, at 60-70 fathoms off Hunde Island, Davis Straits).] *Carb.-Rec.*, cosmop.——FIG. 163, *1. *S. biformis* (PARKER & JONES), Rec., Alaska (Chukchi Sea); *1a,b*, side, top views, ×100 (*1162).

Ammospirata CUSHMAN, 1933, *458, p. 32 [**Pavonina mexicana* CUSHMAN, 1926, *422, p. 22; OD]. Test free, palmate, compressed; globular proloculus followed by few narrow, elongate chambers in planispiral coil of single whorl, chambers with considerable overlap of preceding chambers at periphery, coiled stage followed by short biserial stage of very low, broad chambers, which extend back around coil at each margin of test, followed by well-developed uniserial stage of many broad, low-arched chambers (as many as 14 uniserial chambers present in topotype specimens of type-species); sutures thickened, slightly elevated; wall finely agglutinated, smoothly finished; aperture terminal, consisting of series of small pores in narrow depression extending along entire upper margin of chamber. [*Ammospirata* differs from *Spiroplectammina* in its palmate shape, strongly arched chambers and extremely broad, low chambers, showing considerable overlap of earlier ones at their outer margin in the later uniserial stage, and in the multiple aperture.] *Oligo.*, Mex.——FIG. 163,*2*. **A. mexicana* (CUSHMAN); *2a,b*, side, top views of topotype showing pores in terminal groove, ×42 (*2117).

Bolivinopsis YAKOVLEV, 1891, *2095, p. 349 [**B. capitata*: OD] [=*Spiroplectoides* CUSHMAN, 1927, *428, p. 77 (type, *Spiroplecta rosula* EHRENBERG, 1854, *680, p. xxxii)]. Test with large planispiral coil in early stage and later long, narrow biserial stage, similar in plan to *Spiroplectammina;*

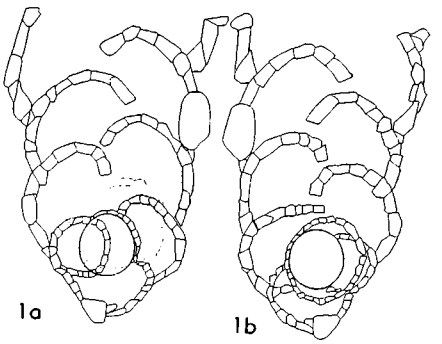

FIG. 164. Textulariidae (Spiroplectammininae; *1, Morulaeplecta*) (p. C251).

wall calcareous, possibly of agglutinated fine-grained calcareous particles. *U.Cret.*, Eu.-N.Am.-S.Am.——FIG. 163,*3*. **B. capitata*, USSR; ×120 (*1197).——FIG. 163,*4*. *B. rosula* (EHRENBERG), USA(Miss.); ×39 (*484).

[The nature of the wall of the type-species is somewhat doubtful. MACFADYEN (1933, *1197) noted that *B. capitata* had originally been included in the perforate calcareous group by YAKOVLEV and on this basis, as well as general form, assumed it to be identical with *Spiroplecta rosula* EHRENBERG. Thus *Spiroplectoides* was regarded as a junior synonym of *Bolivinopsis*. FRIZZELL (1943, *750, p. 338) stated that the synonymy was not positive. As the original description was based on a single specimen mounted in balsam, details of wall characters were uncertain and FRIZZELL stated that it is commonly difficult to distinguish between finely agglutinated tests and secreted calcareous ones. He added that a study of topotypes would be necessary to settle the problem. CUSHMAN (1946, *484, p. 102, 103) regarded *B. rosula* as "calcareous, finely perforate," and *B.? clotho* (GRZYBOWSKI) (=*Spiroplectammina grzybowskii* FRIZZELL) as "entirely siliceous." GLAESSNER (1947, *796, p. 98) stated that *Bolivinopsis* should replace *Spiroplectammina*, as the type-species was said to be arenaceous. SHLYKOVA in RAUZER-CHERNOUSOVA & FURSENKO (1959, *1509, p. 219) recognized both *Spiroplectammina* and *Bolivinopsis*, placing both in the Textulariinae. As we have been unable personally to examine topotype material of *B. capitata*, we follow this latter usage and recognize both genera. SHLYKOVA stated that the wall of *Bolivinopsis* is calcareous but by placement in this family would seem to indicate that it may be of agglutinated calcareous particles.]

Morulaeplecta HÖGLUND, 1947, *924, p. 165 [**M. bulbosa;* OD]. Test streptospirally coiled in initial portion, completely enclosing bulbous proloculus, later portion biserial; proloculus pseudochitinous, remainder of wall agglutinated; aperture interiomarginal arch. [*Morulaeplecta* differs from *Spiroplectammina* in its early streptospiral rather than planispiral coil.] *Rec.*, Sweden.——FIG. 163,*5*; 164,*1*. **M. bulbosa;* 163,*5a,b*, side, top views of paratype, ×123 (*2117); 164,*1,a,b*, optical secs., ×250 (*924).

Vulvulina D'ORBIGNY, 1826, *1391, p. 264 [**V. capreolus;* SD CUSHMAN, 1928, *439, p. 118] [=*Schizophora* REUSS, 1861, *1551, p. 12 (type, *S. neugeboreni*); *Venilina* GÜMBEL, 1870, *840, p. 648 (type, *V. nummulina*); *Trigenerina* SCHUBERT, 1902, *1681, p. 26 (obj.)]. Test free, flaring or elongate, lozenge-shaped or rhomboidal in section, lateral margins acutely angled; chambers increasing rapidly in size, early portion coiled at least in microspheric generation, later cham-

bers biserially arranged, broad and low, somewhat arched over early coil, recurved laterally, final chambers uniserial in best-developed specimens of most species, but some may show only biserial development; sutures distinct, commonly thickened and elevated in early portion, later

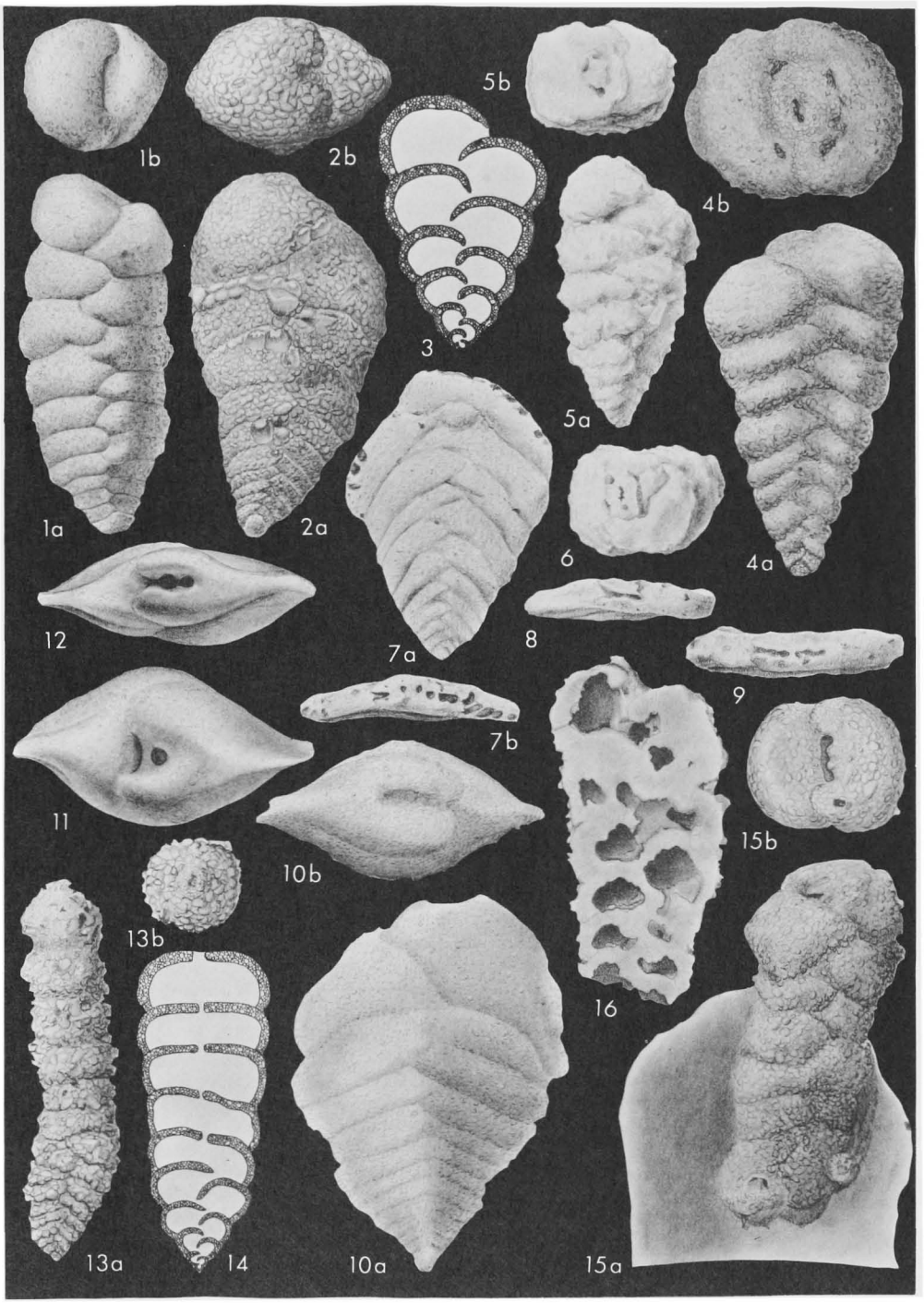

FIG. 165. Textulariidae (Textulariinae; *1-3, Textularia; 4-6, Olssonina; 7-9, Poritextularia; 10-12, Semivulvulina; 13-14, Bigenerina; 15,16, Textularioides*) (p. C253-C255).

moderately depressed; wall agglutinated, but very finely grained and smoothly finished, of calcareous, arenaceous, or other mineral grains; aperture in early stage broad, low interiomarginal arch, in uniserial stage becoming elongate, narrow terminal slit. [*Vulvulina* differs from *Ammospirata* in having a single terminal aperture rather than a row of pores in the uniserial stage and in the uniserial portion being of equal or lesser breadth than the preceding biserial stage, whereas in *Ammospirata* the uniserial portion is broad, resulting in a distinctly palmate test.] *U.Cret. (Campan.)-Rec.*, cosmop.——FIG. 163,*6,7*. *V. pennatula* (BATSCH), Rec., Italy, topotypes; *6a,b*, side, top views of adult test showing early coil, later biserial stage, and final uniserial development with terminal slitlike aperture; *7*, top view showing basal aperture in biserial stage; all ×40 (*2117).

Subfamily TEXTULARIINAE Ehrenberg, 1838

[*nom. correct*. CHAPMAN, 1900, p. 9 (*pro* subfamily Textularinae CARPENTER, PARKER & JONES, 1862, p. 189)]——[All names referred to are of subfamily rank]——[=Textilarida SCHULTZE, 1854, p. 52; =Textilaridae SCHWAGER, 1877, p. 21; =Textilaria MARRIOTT, 1878, p. 30; =Textularidae BÜTSCHLI in BRONN, 1880, p. 203; =Textilariinae JONES, 1895, p. 141]

Test biserial, at least in early stage, may become uniserial. *Penn.-Rec.*

Textularia DEFRANCE in DE BLAINVILLE, 1824, *141a, p. 177 [**T. sagittula;* OD (M)] [=*Textilaria* EHRENBERG, 1839, *667, opposite p. 120 (obj.) *(nom. van.)*; *Plecanium* REUSS, 1862, *1552, p. 383 (type, *Textularia labiata* REUSS, 1862); *Textillaria* SCHWAGER, 1864, *1702, p. 200 *(nom. van.)*; *Pleurostomelloides* MAJZON, 1943, *1203, p. 157 (type, *P. andreasi*)]. Test free, elongate, biserial, generally more or less compressed in plane of biseriality or rarely oval to circular in cross section; chambers numerous, generally closely appressed; wall agglutinated, simple; aperture single low arch at base of last chamber. *Penn.-Rec.*, cosmop.——FIG. 165,*1,2*. **T. sagittula*, Plio.(Piacenz.), Italy (Siena, *1a,b;* Castel-Arquato, *2a,b*); *1a,b*, side, top views of topotype, ×26 (*2117); *2a,b*, side, top views, ×64 (*2117).——FIG. 165,*3*. *T.* sp., long. axial sec. showing simple wall construction, enlarged (*401).

[DEFRANCE (*141a, p. 177) described *Textularia* with *T. sagittula* DEFRANCE as type-species. No localities were cited, for the author stated only that his fossils came from Italy. DEFRANCE's illustrations (1824, *141b, pl. 13, figs. 5, 5a,b) indicate that the species is a very large form (3 mm. in length) and show that it definitely is biserial in the early stages. Later, DEFRANCE (1828, *579f, p. 345) reported the occurrence of this species as "fossile près de Sienne, de Castel-Arquato, et vivant sur les bords de la Mediterranée. d'Orbigny, loc. cit.)." LACROIX (1929, *1074, p. 2) stated that he had examined many thousand examples of *T. sagittula* from dredgings in the Bay of Biscay (Gulf of Gascony), the English Channel, and the Mediterranean, and that a true biserial specimen did not exist. All complete specimens seen by him exhibited an early coiled stage, although in some less perfect specimens this portion was broken or abraded so as to give a pseudobiserial appearance. On the basis of dimorphism and of a statistical study LACROIX believed that a biserial form would be impossible in this species as he observed both "A and B forms" with distinct coils. Following LACROIX's work, some later investigators have considered *Textularia* and *Spiroplectammina* to be synonymous, although LACROIX considered both genera valid, differing only in relative importance of the coiled portion of the test. BANDY (1949, *71) noted that some workers even placed the type-species of *Textularia* in *Spiroplectammina*, which *Textularia* antedated by more than a century.

In order to settle definitely the status of this genus we attempted to re-examine DEFRANCE's types, conducting a prolonged search for them while in France during 1953-54. Since no trace of his collection could be found, the types are presumed to be lost. As noted above, DEFRANCE's original description gave no definite localities, whereas his later publication cited three localities in Italy—near Siena, at Castel-Arquato, and off the Italian coast living in the Mediterranean. The Mediterranean is excluded from consideration as a source of topotype material, as too vague and not qualifying as a producer of "fossil from Italy." Both Castel-Arquato and Siena have excellent exposures of the Piacenzan (Pliocene), and both contain numerous textularians. Specimens closest in appearance to the type description and figures were found at Siena. CUSHMAN (1945, *481) figured two specimens from Castel-Arquato, which he referred to *"Spiroplectammina sagittula"* but, like the majority of specimens at Castel-Arquato, they were only about 1 mm. in length, and thus only one-third the length of DEFRANCE's figured type. Much more typical specimens occur at Siena and for this reason, as well as the fact that the Siena locality was the first cited by DEFRANCE, we consider it to be the type locality.

Specimens of the species from Siena were found to be truly biserial, as described for the genus, and they range from approximately 1.35 to 2.57 mm. in length. It is quite possible that for the species LACROIX described, no completely biserial form exists, but he was not studying DEFRANCE's *Textularia sagittula*. LACROIX's specimens were all obtained from Recent dredgings in areas remote from the type locality of *T. sagittula* in the Pliocene (Piacenzan) of northern Italy. Furthermore, LACROIX's specimens (fig. 2,3) were approximately 1 mm. long, much compressed, and with a rounded base, whereas DEFRANCE's figured type has a length of 3 mm. ("un ligne et demi"), the base is quite pointed, and the original illustration shows considerable inflation of the test. It seems obvious, therefore, that LACROIX was dealing with a completely different species and genus, his form being a true *Spiroplectammina*; hence, it has little or no bearing on understanding of *Textularia*.]

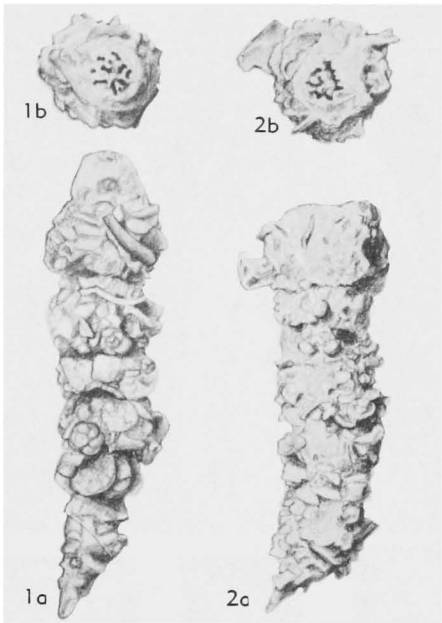

FIG. 166. Textulariidae (Textulariinae; *1,2, Cribrobigenerina*) (p. C254).

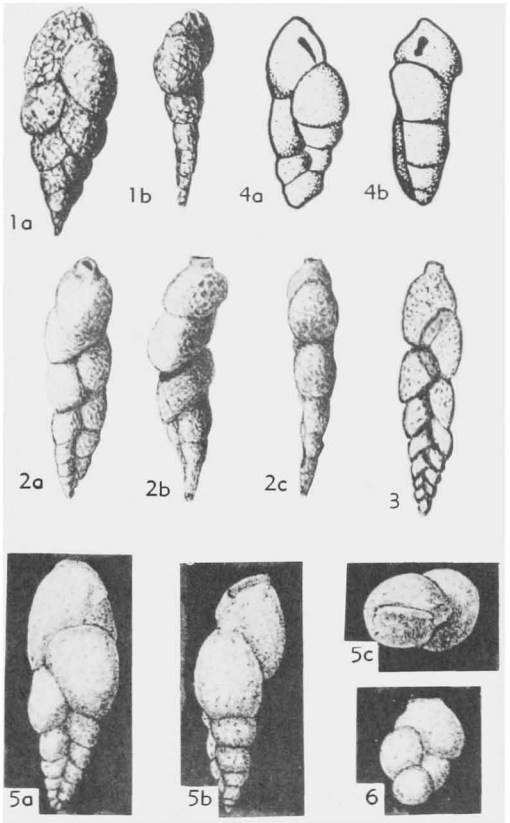

FIG. 167. Textulariidae (Pseudobolivininae; *1-6, Pseudobolivina*) (p. C255).

Bigenerina D'ORBIGNY, 1826, *1391, p. 261 [**B. nodosaria;* SD CUSHMAN, 1911, *404b, p. 27] [=*Bigenerina (Gemmuline)* D'ORBIGNY, 1826, *1391, p. 262 *(nom. neg.); Gemmulina* D'ORBIGNY in DE LA SAGRA, 1839, *1611, p. 141 (type, *Bigenerina (Gemmuline) digitata* D'ORBIGNY, 1826, *1391, p. 262)]. Test free, elongate, early portion biserial with basal aperture as in *Textularia,* later uniserial with terminal and rounded aperture. *Jur.-Rec.,* cosmop.——FIG. 165,*13.* **B. nodosaria,* Rec., Eu.(Fr.); *13a,b,* side, top views, ×35 (*2117).——FIG. 165,*14. B.* sp., long. sec., showing simple agglutinated wall and change in apert. position with growth, enlarged (*401).

Cribrobigenerina ANDERSEN, 1961, *18, p. 26 [**C. parkerae;* OD]. Test large, elongate, early stage biserial, later uniserial; chambers somewhat inflated; sutures indistinct in early stage, slightly constricted in adult; wall coarsely agglutinated with much cement, surface rough; aperture terminal, cribrate, with irregularly shaped openings. *Rec.,* USA(La.).——FIG. 166,*1,2.* **C. parkerae; 1a,b,* side, top views of holotype; *2a,b,* paratype; all ×20 (*18).

Olssonina BERMÚDEZ, 1949, *124, p. 99 [**O. cribrosa;* OD] [=*Cribrotextularia* LOEBLICH & TAPPAN, 1952, *1158, p. 79 (type, *Textularia coryensis* COLE, 1941, *357, p. 21)]. Test free, elongate, flaring, ovate to quadrangular in section; chambers biserially arranged throughout; wall agglutinated, simple, not labyrinthic; aperture in early stages consisting of arch at base of last chamber and in addition symmetrical series of pores, usually in ring, on face of chamber, arched aperture partially closed in later chambers and represented by series of openings at base of final chamber additional to terminal cribrate apertures. *M.Eoc.,* W.Indies(Dominican Republic) - USA (Fla.).——FIG. 165,*4.* **O. cribrosa,* Dominican Republic; *4a,b,* side, top views, ×48 (*2117).——FIG. 165,*5,6. O. coryensis* (COLE), USA(Fla.); *5a,b,* side and top views of hypotype showing terminal cribrate aperture; *6,* top view of specimen with broken final chamber showing part of multiple aperture in addition to basal aperture, ×22 (*1158).

[The synonymy of *Cribrotextularia* and *Olssonina* was noted by LOEBLICH & TAPPAN (1953, *1163). *Olssonina* differs from both *Climacammina* and *Cribrostomum* in being wholly biserial and in lacking any uniserial development, in having a simple and distinctly agglutinated wall, rather than a double-layered fibrous calcareous one, and in lacking any development of pillars supporting the terminal chamber as in *Cribrostomum.*]

Poritextularia LOEBLICH & TAPPAN, 1952, *1160, p. 264 [**P. mexicana;* OD]. Test free, compressed, biserial throughout; wall agglutinated, interior simple; aperture consisting in early stages of elongate slit at base of last chamber, paralleling sides of test, and in adult comprising a linear series of openings across terminal portion of final chamber, formed by development of pillars across original slit. *Rec.,* Pac.(off Mex.).——FIG. 165,*7-9.* **P. mexicana; 7a,b,* side and top views of holotype showing multiple aperture; *8,9,* top views of paratypes showing basal aperture and later development of terminal aperture, ×22 (*1160).

[*Poritextularia* resembles *Textularia* DEFRANCE in its biserial agglutinated test but differs in having a multiple aperture. It resembles *Tawitawia* in the large flattened biserial test with rather extreme overlap of chambers and multiple aperture but differs in having a simple interior, lacking the internal pillars and labyrinthic structure of the latter genus, and in being completely biserial with no tendency to become uniserial. The aperture of *Tawitawia* is completely terminal and does not extend to the base of the final chamber as in *Poritextularia.*]

Semivulvulina FINLAY, 1939, *717a, p. 505 [**Textilaria capitata* STACHE, 1865, *1825, p. 270; OD] [=*Vulvulina (Semivulvulina)* FINLAY, 1939, *717a, p. 505 (obj.)]. Test free, flaring, rhomboidal in section, lateral margins acutely angled; chambers increasing rapidly in size, biserially arranged throughout, relatively low and broad; sutures distinct, depressed, oblique; wall finely agglutinated; aperture in early stages comprising interiomarginal arch, later with additional 1 or 2 areal openings above basal aperture, which in well-developed specimens fuse to form very high, narrow slit with scalloped margins reflecting its

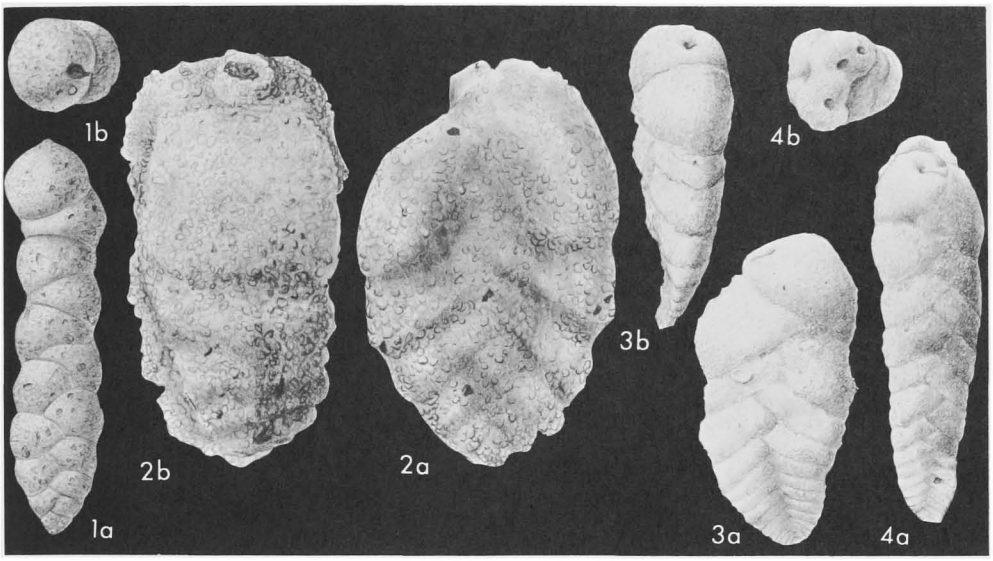

FIG. 168. Textulariidae (Pseudobolivininae; *1, Haeuslerella; 2, Siphotextularia; 3,4, Planctostoma*) (p. C256-C258).

development from separate openings, final elongate slit becoming nearly central in position and occupying nearly 0.3 of distance across terminal surface of test, though remaining open at base of chamber. [*Semivulvulina* differs from *Textularia* DEFRANCE in having a much elongated aperture with scalloped margin, which develops from 2 or more distinct openings, rather than having a single, low interiomarginal arch. *Semivulvulina* differs from *Vulvulina* in the absence of an early coil, in lacking a final uniserial stage, and in its more complex aperture.] *M.Eoc.-L.Mio.*, N.Z.——FIG. 165,*10-12*. **S. capitata* (STACHE), L.Oligo. *(10)*, Tert. *(11,12)*; *10a,b*, side, top views; *11,12*, apert. views showing varying apert. forms; all ×48 (*2117).

Textularioides CUSHMAN, 1911, *404b, p. 26 [**T. inflata;* ODj. Test attached at least in early stages; chambers in biserial textularian arrangement, somewhat flattened against attachment, later portion may grow free of attachment; wall agglutinated, with coarse grains embedded in fine ground mass, numerous tiny pores piercing wall; aperture low arch or slit at base of final chamber. [*Textularioides* differs from *Textularia* in being attached during at least part of its development.] *Rec.*, N.Pac.——FIG. 165,*15,16*. **T. inflata; 15a,b*, side, top views of topotype; *16*, attached side of topotype showing radial perforations of agglutinated wall; all ×33 (*1166).

Subfamily PSEUDOBOLIVININAE Wiesner, 1931

[Pseudobolivininae WIESNER, 1931, p. 98]

Test biserial, aperture comprising elongate terminal slit or may be produced on neck. *M.Jur.-Rec.*

Pseudobolivina WIESNER, 1931, *2063, p. 99 [**P. antarctica* (=*Bolivina punctata* D'ORBIGNY var. *arenacea* HERON-ALLEN & EARLAND, 1922, *911, p. 133) (*non B. variabilis* var. *arenacea* H.-A. & E., 1922; *nec. B. textilarioides* var. *arenacea* H.-A. & E., 1922; *nec B. inflata* var. *arenacea* H.-A. & E., 1922; *nec. B. tortuosa* var. *arenacea* H.-A. & E., 1922); OD (M)] [=*Plectinella* MARIE, 1956, *1221, p. B240 (type, *P. virgulinoides*); *Parvigenerina* VELLA, 1957, *2001, p. 18 (type, *Bifarina porrecta* (BRADY) var. *arenacea* H.-A. & E., 1922, *911, p. 132); *Arenovirgulina* SAID & BARAKAT, 1958, *1616, p. 243 (type, *A. aegyptica*); *Bimonilina* EICHER, 1960, *690, p. 65 (type, *B. variana*)]. Test biserial, tending to become uniserial, axis slightly twisted; aperture high narrow slit, interiomarginal in early biserial stage, becoming nearly terminal in later stage. *M.Jur.(Callov.)-Rec.*, Antarctic-N.Z.-Pac.-Eu.-Atl.-N.Afr.-N.Am.——FIG. 167,*1-3*. **P. antarctica;* Rec., Antarctic *(1)*, N.Z.*(2)*; *1a,b*, side and edge views of type-specimen of *Bolivina punctata* var. *arenacea* H.-A. & E., ×90 (*911); *2a-c*, opposite sides and edge of type-specimen of *Bifarina porrecta* var. *arenacea* H.-A. & E., type-species of *Parvigenerina; 3*, specimen mounted in balsam and viewed in transmitted light; all ×70 (*911).——FIG. 167,*4*. *P. aegyptica* (SAID & BARAKAT), M.Jur.(Callov.), Egypt; *4a,b*, ×80 (*1616).——FIG. 167,*5,6*. *P. variana* (EICHER), L.Cret., USA (Wyo.); *5a-c*, opposite sides and top view of microspheric holotype; *6*, megalospheric paratype, all ×83 (*690).

[The type-species of *Pseudobolivina* and *Parvigenerina* were both described from specimens obtained by the Terra Nova Expedition. They are nearly identical in size and appearance, except that those with the better uniserial develop-

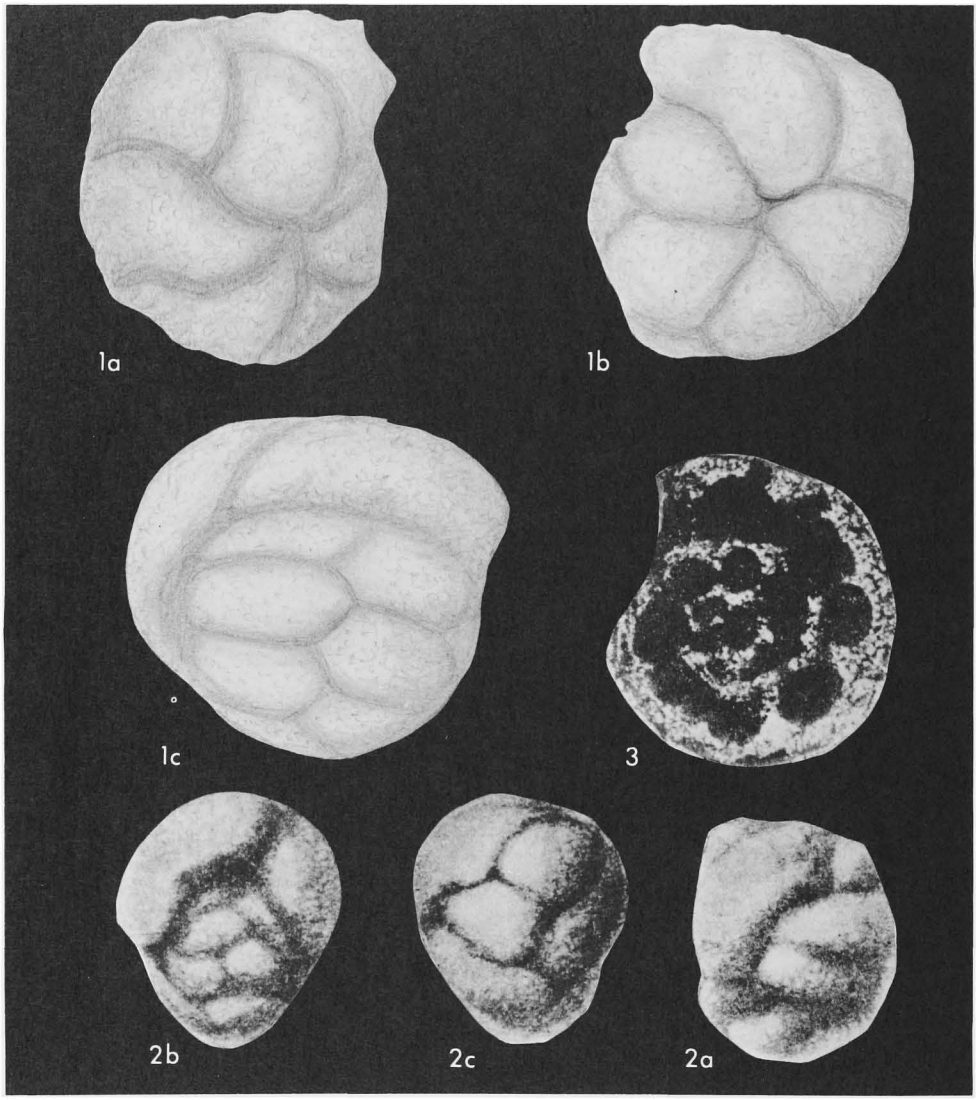

FIG. 169. Textulariidae (Plectorecurvoidinae; *1-3, Plectorecurvoides*) (p. C258).

ment (*"Bifarina"*) were somewhat larger (0.40-0.45 mm.) than the wholly biserial forms (0.35 mm.). They are here regarded as conspecific, as well as congeneric. *Pseudobolivina* differs from *Textularia* in the high slitlike aperture and tendency to become uniserial.]

Haeuslerella PARR, 1935, *1423, p. 82 [**H. pukeuriensis;* OD (M)]. Test free, elongate, chambers numerous, biserial in early portion, later chambers cuneate and alternating in loosely biserial arrangement; sutures distinct, depressed, early ones nearly horizontal, later ones oblique; wall agglutinated, surface smoothly finished; aperture nearly terminal, rounded, slightly eccentric, on upper surface of cuneate chamber. [*Haeuslerella* differs from *Textularia* in possessing the loosely biserial, cuneate-chambered later portion, and terminal aperture. It differs from *Bigenerina* in having an eccentric aperture and in lacking a distinct uniserial development. *Planctostoma* differs in the absence of a loosely biserial stage, and in having a terminal aperture on the typically biserial chambers.] *L.Mio.-L.Plio.,* N.Z.——FIG. 168,*1*. **H. pukeuriensis,* Mio.; *1a,b,* side, top views of topotype, ×42 (*2117).

Planctostoma LOEBLICH & TAPPAN, 1955, *1166, p. 8 [**Textularia luculenta* BRADY, 1884, *200, p. 364; OD]. Test free, elongate, chambers biserially arranged, only very rarely with final uniserial development; wall agglutinated, simple in structure; aperture basal in young stage, later and

typically consisting of rounded opening in terminal face, commonly somewhat eccentric and may become multiple with 2 or 3 rounded openings. *Rec.*, N.Atl.-S.Atl.-Carib.——Fig. 168,*3,4*.

**P. luculenta* (Brady), Carib.; *3a,b*, side, edge views of hypotype; *4a,b*, side and apert. views of hypotype showing multiple aperture; all ×22 (*1166).

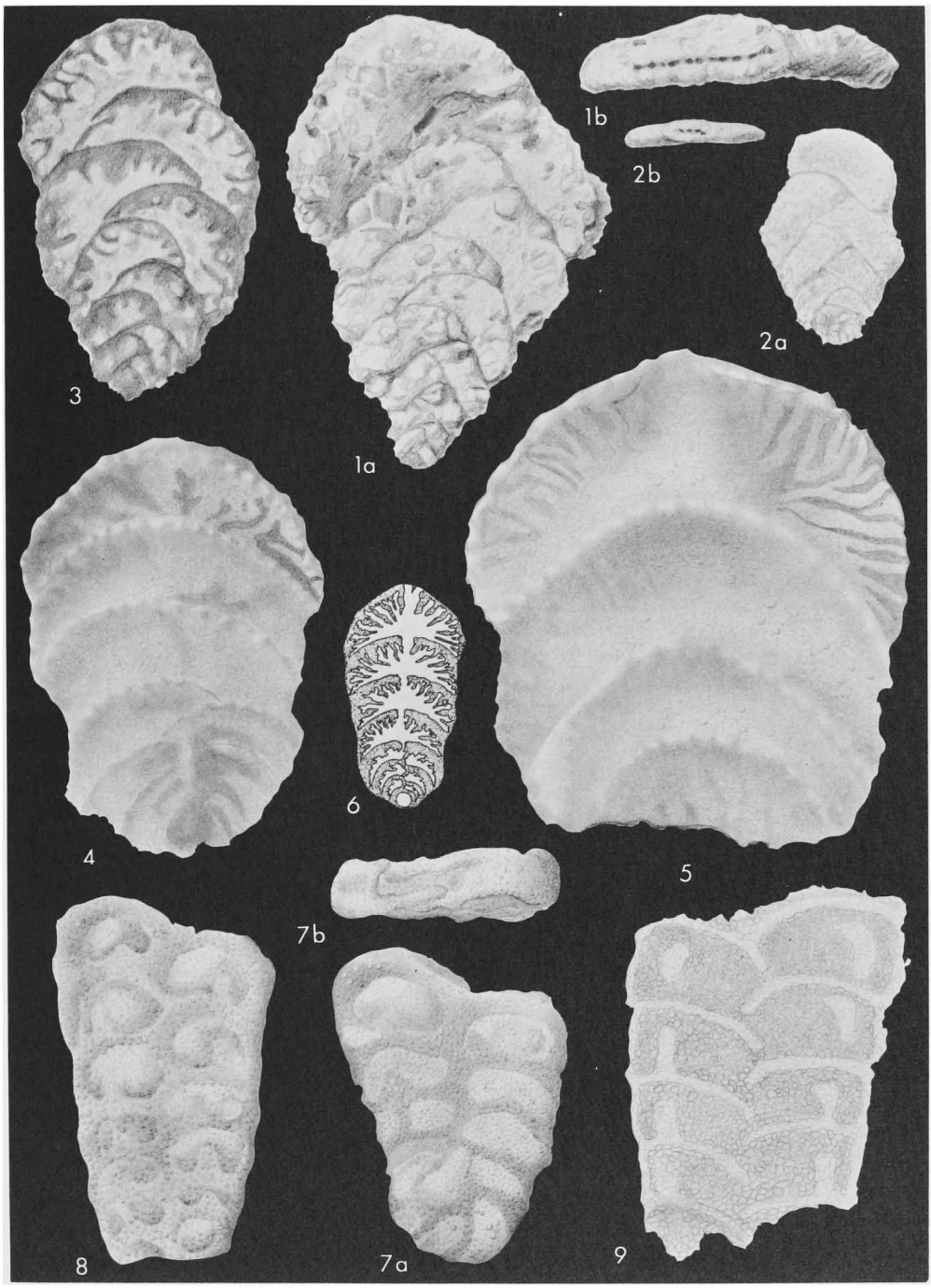

Fig. 170. Textulariidae (Tawitawiinae; *1-3, Tawitawia; 4-6, Phyllopsamia; 7-9, Septigerina*) (p. C258-C259).

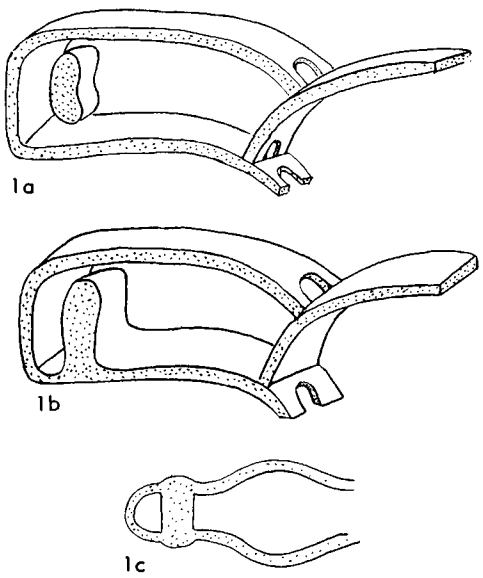

FIG. 171. Textulariidae (Tawitawiinae; *1, Septigerina*) (p. C258-C259).

[*Planctostoma* differs from *Textularia* in having a terminal aperture rather than a basal one. It is differentiated from *Bigenerina* in generally lacking a uniserial stage and in its terminal single or multiple aperture. It lacks the quadrangular outline of *Siphotextularia* and has a rounded aperture, which may be multiple instead of a terminal slitlike aperture with a projecting rim.]

Siphotextularia FINLAY, 1939, *717a, p. 510 [**S. wairoana;* OD]. Test free, quadrangular in section, chambers biserially arranged throughout; aperture nearly terminal, rounded, in face of final chamber and produced on short neck. *Paleoc.-Rec.,* cosmop.——FIG. 168,*2*. **S. wairoana,* L. Plio., N.Z.; *2a,b,* side and edge views showing terminal elevated aperture, ×109 (*2117).

[*Siphotextularia* differs from *Textularia* in having a subterminal slitlike aperture which is areal rather than basal, and in the aperture being produced on a distinct neck. It differs from *Planctostoma* in having a quadrangular section, in having a slitlike rather than a rounded aperture, in having an apertural neck, and in having only a single apertural opening.]

Subfamily PLECTORECURVOIDINAE Loeblich & Tappan, n. subfam.

Test biserial, with biserial axis planispirally enrolled, so that test is isomorph of *Cassidulina* in development. *L.Cret.*

Plectorecurvoides NOTH, 1952, *1365, p. 117 [**P. alternans;* OD]. [=*Globivalvulinella* BUKALOVA, 1957, *252, p. 185 (type, *G. grossheimi*)]. Test planispirally enrolled, biserial; wall agglutinated; aperture not observed but intercameral openings are interiomarginal. *L.Cret.(Alb.),* Eu.(Aus.-Czech.-USSR).——FIG. 169,*1*. **P. alternans,* Aus.; *1a-c,* opposite sides and apert. views, ×158 (*2117).——FIG. 169,*2,3*. *P. grossheimi* (BUKALOVA), USSR; *2a-c,* side, apert., periph. views of holotype, ×70; *3,* sec. of paratype showing interior, ×100 (*252).

Subfamily TAWITAWIINAE Loeblich & Tappan, 1961

[Tawitawiinae LOEBLICH & TAPPAN, 1961, p. 282]

Biserial, with vertical pillars subdividing chambers; aperture multiple, terminal. *Eoc.-Rec.*

Tawitawia LOEBLICH, 1952, *1151, p. 190 [**Textularia immensa* CUSHMAN, 1913, *406, p. 633; OD]. Test large, flattened, biserial; chambers numerous, low, strongly overlapping in line of biseriality; wall coarsely agglutinated, thick, with pillars projecting downward into interior from roof of chambers, resulting in labyrinthine interior; aperture terminal, consisting of elongate series of irregular slits separated completely by pillars across opening or only partially by projections from one side, aperture not extending as far as inner margin of chamber. *Rec.,* N.Pac.O.(Philip.).——FIG. 170,*1-3*. **T. immensa* (CUSHMAN); *1a,b,* side and top views of microspheric hypotype, ×10; *2a,b,* side and top views of megalospheric hypotype, ×10; *3,* long. sec. showing vertical pillars projecting downward from chamber roofs, ×22 (*1151).

[*Tawitawia* differs from *Textularia* in its labyrinthine interior, internal pillars, and terminal multiple aperture. *Septigerina* has vertical internal pillars, but these are much fewer, the test has a coiled base, and the aperture is typically textularian. *Tawitawia* differs from *Olssonina* in having a single row of apertural slits, rather than scattered pores over the apertural surface, and in having a labyrinthic interior.]

Phyllopsamia MAŁECKI, 1954, *1210, p. 503, 507, 511 [**P. adanula;* OD]. Test compressed, palmate; early stage biserial, later uniserial; interior as in *Tawitawia;* wall agglutinated; aperture one or more slits in terminal groove. [Originally placed in the Lituolidae (Lituolinae), this genus is here referred to the Textulariidae because of its biserial early stage. *Phyllopsamia* differs from *Tawitawia* in having a final uniserial stage.] *Mio.,* Eu.(Pol.).——FIG. 170,*4-6*. **P. adanula; 4,5,* ext. views, ×52 (*2117); *6,* sec. showing interior, approx. ×28 (*1210).

Septigerina KEIJZER, 1941, *1028, p. 1006 [**S. dalmatica;* OD]. Test free, elongate, flattened; early portion planispiral, later biserial, with horizontal partition extending through later chambers near their outer margin from one wall to that opposite, projection attached also to preceding septum in earlier biserial chambers, but extending only as horizontal pillar across central part of final chamber; wall agglutinated; aperture comprising arch at base of final chamber. *M.Eoc.,* Eu.(Yugo., Dalmatia).——FIG. 170,*7-9*; 171,*1*. **S. dalmatica;* 170,*7a,b,* side and top views of lectotype showing basal coil; 170,*8,* side view of paratype showing later development of pillars, ×116; 170,*9,* long. sec., ×86 (*2117); 171,*1a,b,*

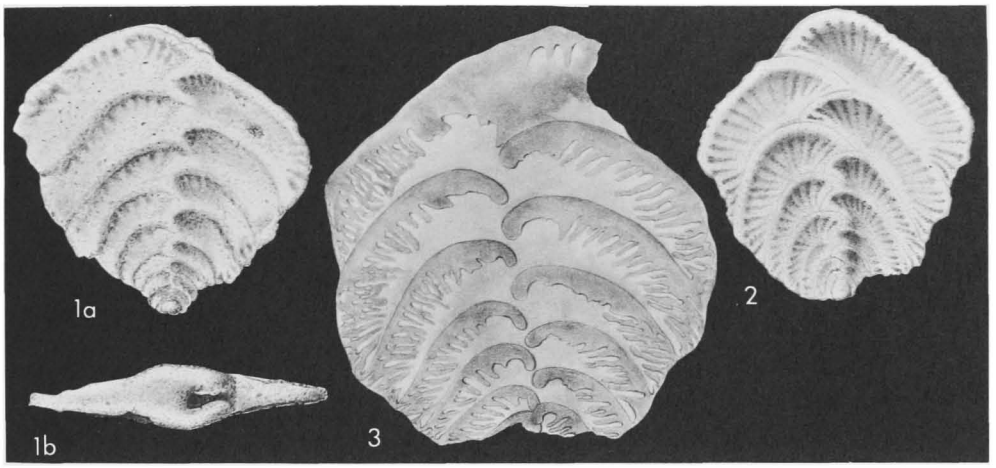

FIG. 172. Textulariidae (Tawitawiinae; *1-3, Zotheculifida*) (p. C259).

diagram of long. sec. showing internal pillar within a chamber; 171,*1c,* diagram of horiz. sec. showing pillar extending across chamber, enlarged (*1028).

[*Septigerina* differs from *Spiroplectammina* in the presence of secondary pillars extending across the outer portions of the biserial chambers. Three of the original syntypes of the type-species (collection of the Rijks Universitiet, Utrecht, Netherlands) were redrawn, the specimens having been generously loaned to us by the Rijks Universitiet. That in Fig. 170,7 is here designated as lectotype.]

Zotheculifida LOEBLICH & TAPPAN, 1957, *1172, p. 224 [**Textularia lirata* CUSHMAN & JARVIS, 1929, *509, p. 6; OD]. Test free, compressed, elongate or palmate, chambers numerous, biserially arranged, with internal incomplete partitions extending obliquely downward from septa, visible externally only when outer surface has either been dampened or somewhat abraded, and in rare specimens secondary partitions visible externally as slightly darker than intervening spaces; wall agglutinated, fine-grained, rather smoothly finished; aperture comprising high narrow arch at base of final chamber. *Mio.,* W.Indies(Trinidad).——FIG. 172,*1-3. *Z. lirata* (CUSHMAN & JARVIS); *1a,2,* side views of hypotypes; *1b,* top view; *3,* long. sec.; all ×34 (*1172).

[*Zotheculifida* differs from *Tawitawia* in its more numerous and regularly arranged internal partitions and in possessing a single textularian aperture, rather than a terminal linear series of pores. The type-species was originally described from the "*Sagrina* beds," Trinidad Point, Oropouche Lagoon, Trinidad, West Indies, which were then thought to be Eocene in age, but are now regarded as Miocene.]

Family TROCHAMMINIDAE Schwager, 1877

[*nom. correct.* LISTER in LANKESTER, 1903, p. 142 (*pro* family Trochamminidea SCHWAGER, 1877, p. 21)]——[In synonymic citations dagger(†) indicates *partim*]——[=Arenacea BÜTSCHLI in BRONN, 1880, p. 193 (*nom. nud.*); =Dischistidae† EIMER & FICKERT, 1899, p. 678 (*nom. nud.*); =Trochammina LANKESTER, 1885, p. 847; =Trochamminae DELAGE & HÉROUARD, 1896, p. 133; =Artrochammidia RHUMBLER, 1913, p. 342 (*nom. van.*); =Trochamminida HAECKEL, 1894, p. 185]

Test free or attached, trochospiral; wall agglutinated; aperture interiomarginal or areal, single or multiple. *Carb.-Rec.*

Subfamily TROCHAMMININAE Schwager, 1877

[*nom. transl.* BRADY, 1884, p. 66 (*ex* family Trochamminidea SCHWAGER, 1877)] [=Ammosphaeroidininae CUSHMAN, 1927, p. 40]

Test free or attached, trochospiral; wall agglutinated, interior simple; aperture interiomarginal or areal. *Carb.-Rec.*

Trochammina PARKER & JONES, 1859, *1417b, p. 347 [**Nautilus inflatus* MONTAGU, 1808, *1299, p. 81; OD (M)] [=*Rhaphidohelix* MÖBIUS, 1880, *1293, p. 76 (type, *R. elegans*); *Raphidohelix* GOËS, 1882, *801, p. 140 *(nom. van.)*; *Trochammina* DEECKE, 1884, *568, p. 21 *(nom. null.)*; *Reussina* GRZYBOWSKI, 1896, *835, p. 278 (*non Reussina* NEVIANI, 1896); *Ammoglobigerina* EIMER & FICKERT, 1899, *692, p. 704 (type, *A. bulloides,* =*Lituola nautiloidea* LAMARCK var. *globigeriniformis* PARKER & JONES, 1865, *1418, p. 407); *?Glomerina* FRANKE, 1928, *740, p. 164 (type, *Lituola globigerinoides* PERNER, 1892, *1445, p. 52)]. Test free, trochospiral; globular to ovate chambers increasing gradually in size; wall agglutinated; aperture low interiomarginal extraumbilical-umbilical arch which may have narrow bordering lip. *Carb.-Rec.,* cosmop.——FIG. 173,*1. *T. inflata* (MONTAGU), Rec., N.Atl.; *1a-c,* spiral and umbilical sides and edge view, ×86 (*2117). ——FIG. 173,*2. T. globigeriniformis* (PARKER & JONES), Rec., N.Atl.; *2a-c,* opposite sides and edge view of lectotype (here designated and refigured) of *Lituola nautiloidea* LAMARCK var. *globigeriniformis* PARKER & JONES (1865, *1418, pl. 17, fig. 96), ×146 (*2117).

Ammosphaeroidina CUSHMAN, 1910, *404a, p. 128 [**Haplophragmium sphaeroidiniformis* BRADY, 1884, *200, p. 313; OD]. Test globose, streptospirally coiled with few embracing chambers,

only 3 of final whorl visible at exterior; wall agglutinated; aperture low interiormarginal arch. *Eoc.-Rec.*, Pac.-Medit.-Antarctic-W.Indies(Cuba).

——Fig. 174,*1*. **A. sphaeroidiniformis* (Brady), Rec., Pac.; *1a-d*, opposite sides, edge view, and oblique view to show aperture, ×33 (*2117).

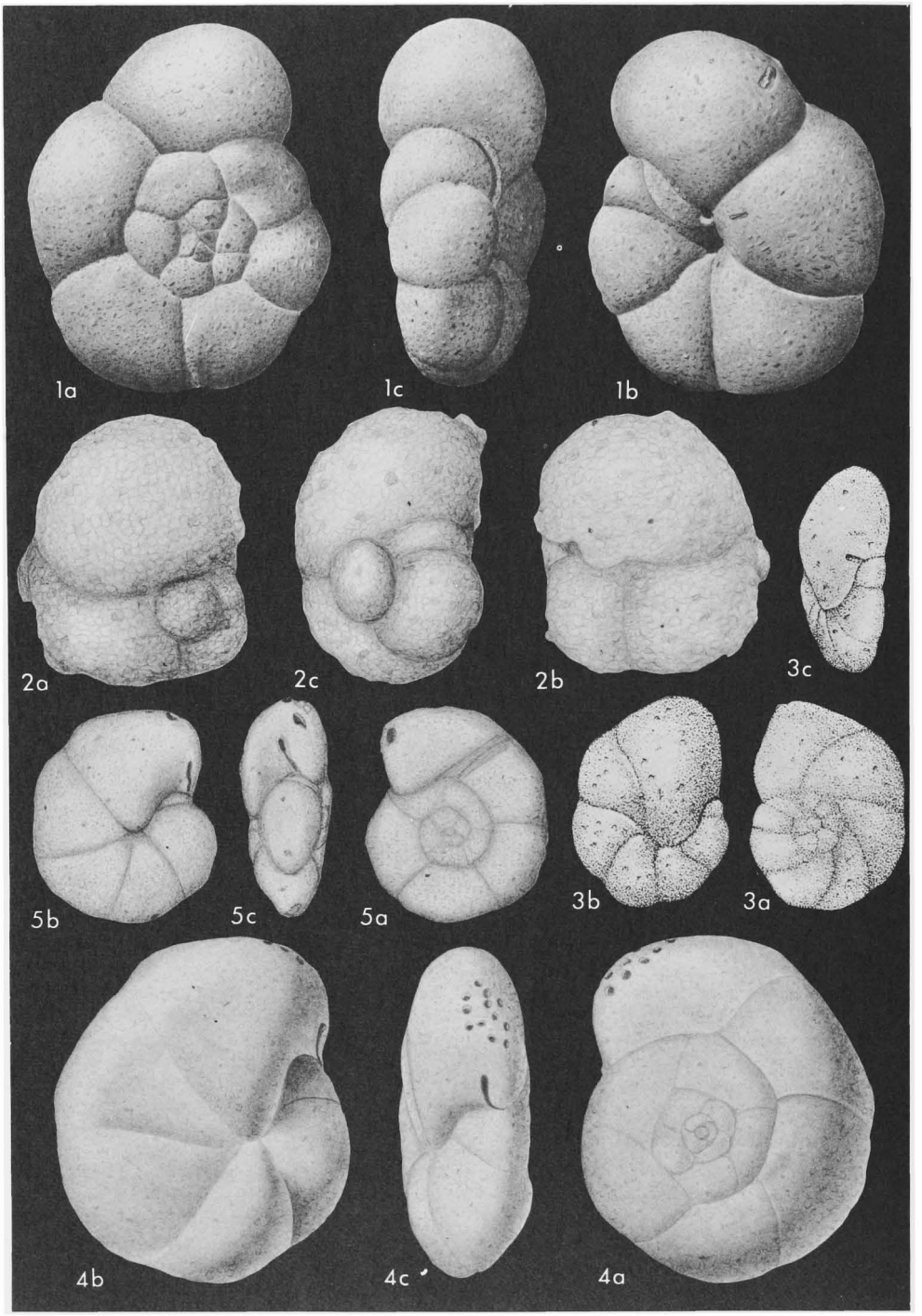

Fig. 173. Trochamminidae (Trochammininae; *1,2, Trochammina; 3, Trochamminula; 4,5, Arenoparrella*) (p. *C259*, *C262*, *C266*).

Arenonionella MARKS, 1951, *1225, p. 377 [**A. voutei*; OD]. Test free, slightly trochospiral; chambers low and broad, all partially visible on spiral side, but with prominent lobe overhanging umbilicus on opposite side; wall thin, somewhat flexible and easily distorted, agglutinated with calcareous cement on pseudochitinous base, interior simple; aperture low interiomarginal, equatorial slit. [*Arenonionella* resembles the calcareous genus *Nonionella* in character of coiling, the overhanging chamber on one side, and equatorial location of the aperture but differs in having an agglutinated

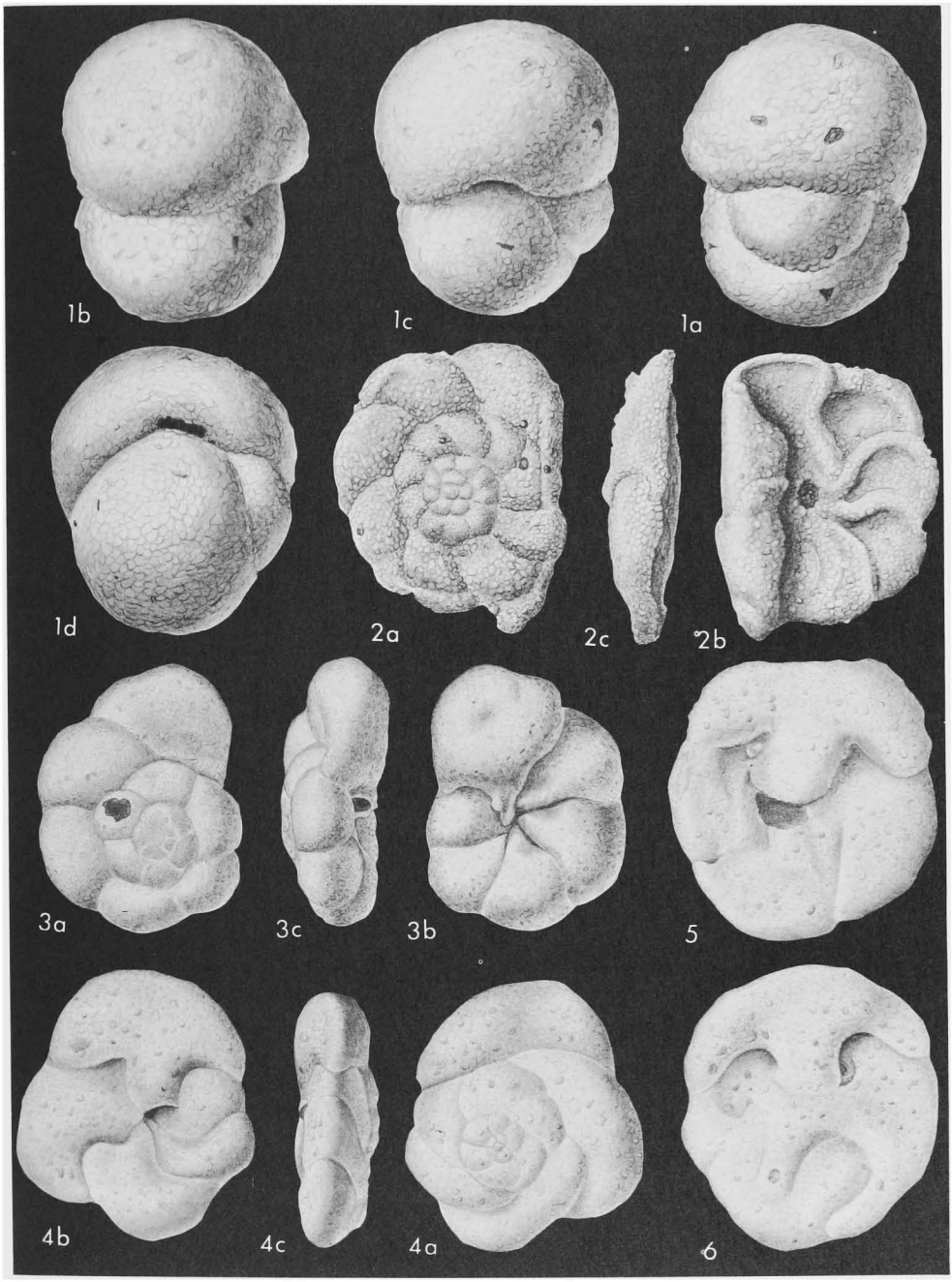

FIG. 174. Trochamminidae (Trochammininae; *1, Ammosphaeroidina; 2, Rotaliammina; 3, Siphotrochammina; 4-6, Tiphotrocha*) (p. C259-C260, C265-C266).

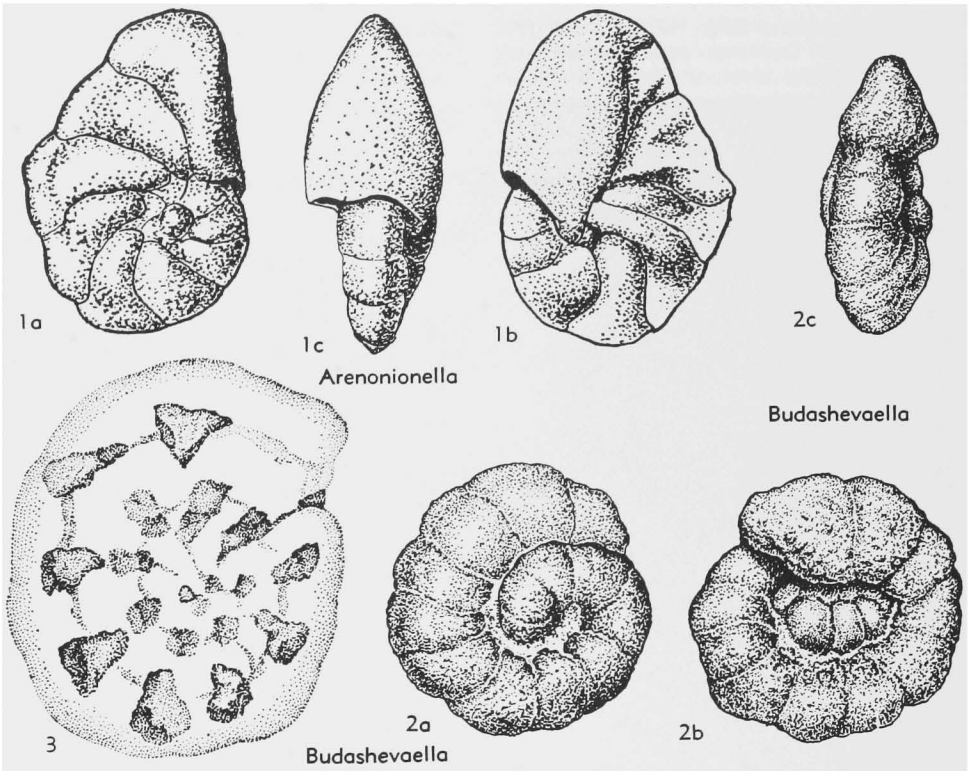

FIG. 175. Trochamminidae (Trochammininae; *1, Arenonionella; 2,3, Budashevaella*) (p. C261-C262).

wall. Because of the trochospiral coiling, it is here removed from the Haplophragmoidinae to the Trochamminidae. A junior synonym f *Arenonionella* is *Mendesia* PETRI, 1962, *1447A, p. 56 (type, *M. minuta) (non Mendesia* DE JOANNIS, 1902).] *U.Cret.(Maastricht.),* S.Am.(Brazil)-*Mio. (Vindob.),* N.Afr.(Algeria).——FIG. 175,*1. *A. voutei; 1a-c,* opposite sides and edge, ×124 (*1225).

Arenoparrella ANDERSEN, 1951, *15, p. 31 [**Trochammina inflata* (MONTAGU) var. *mexicana* KORNFELD, 1931, *1048, p. 86; OD]. Test free, trochospiral, spiral side convex, umbilical side with small closed umbilicus; chambers increasing gradually in size; sutures radial; wall agglutinated; primary aperture elongate slit extending up face of final chamber approximately paralleling plane of coiling, supplementary cribrate aperture consisting of numerous circular openings near apex of final chamber. [*Arenoparrella* differs from *Jadammina* in having a vertical slitlike primary aperture and supplementary cribrate openings at the apex of the chamber, whereas in *Jadammina* the primary aperture is a low interiomarginal equatorial aperture with cribrate openings just above in the face of the chamber.] *Mio.-Rec.,* USA(La.) - W. Indies(Trinidad) - S. Am.(Venez.). ——FIG. 173,*4,5. **A. mexicana* (KORNFELD), Rec., Trinidad *(4),* USA(La.) *(5); 4a-c,* opposite sides and edge view of hypotype showing loop-shaped, nearly vertical slitlike primary aperture, and secondary apertural openings at peripheral angle, ×109 (*1631); *5a-c,* opposite sides and edge of hypotype, ×64 (*16).

Budashevaella LOEBLICH & TAPPAN herein [*nom. nov. pro Circus* VOLOSHINOVA & BUDASHEVA, 1961, *2021, p. 199, *non Circus* DE LACEPÈDE, 1799] [**Circus multicameratus* VOLOSHINOVA & BUDASHEVA, 1961, *2021, p. 201, here designated as type-species]. Test free, enrolled, early chambers streptospiral, later planispiral and partially evolute; chambers numerous; sutures curved to sinuate, radial, depressed; wall agglutinated, simple, non-alveolar, with considerable amount of siliceous cement; aperture interiomarginal. [Differs from *Trochamminoides* in its early streptospiral coil and from *Recurvoides* in its evolute coiling and interiomarginal aperture.] *U.Eoc.-Mio.,* USSR (Sakhalin Is.-Kamchatka).——FIG. 175,*2,3. **B. multicamerata* (VOLOSHINOVA & BUDASHEVA), L. Mio., Sakhalin Is.; *2a-c,* opposite sides and edge view of paratype, ×47; *3,* specimen partially clarified in oil to show chamber arrangement, ×72 (*2021).

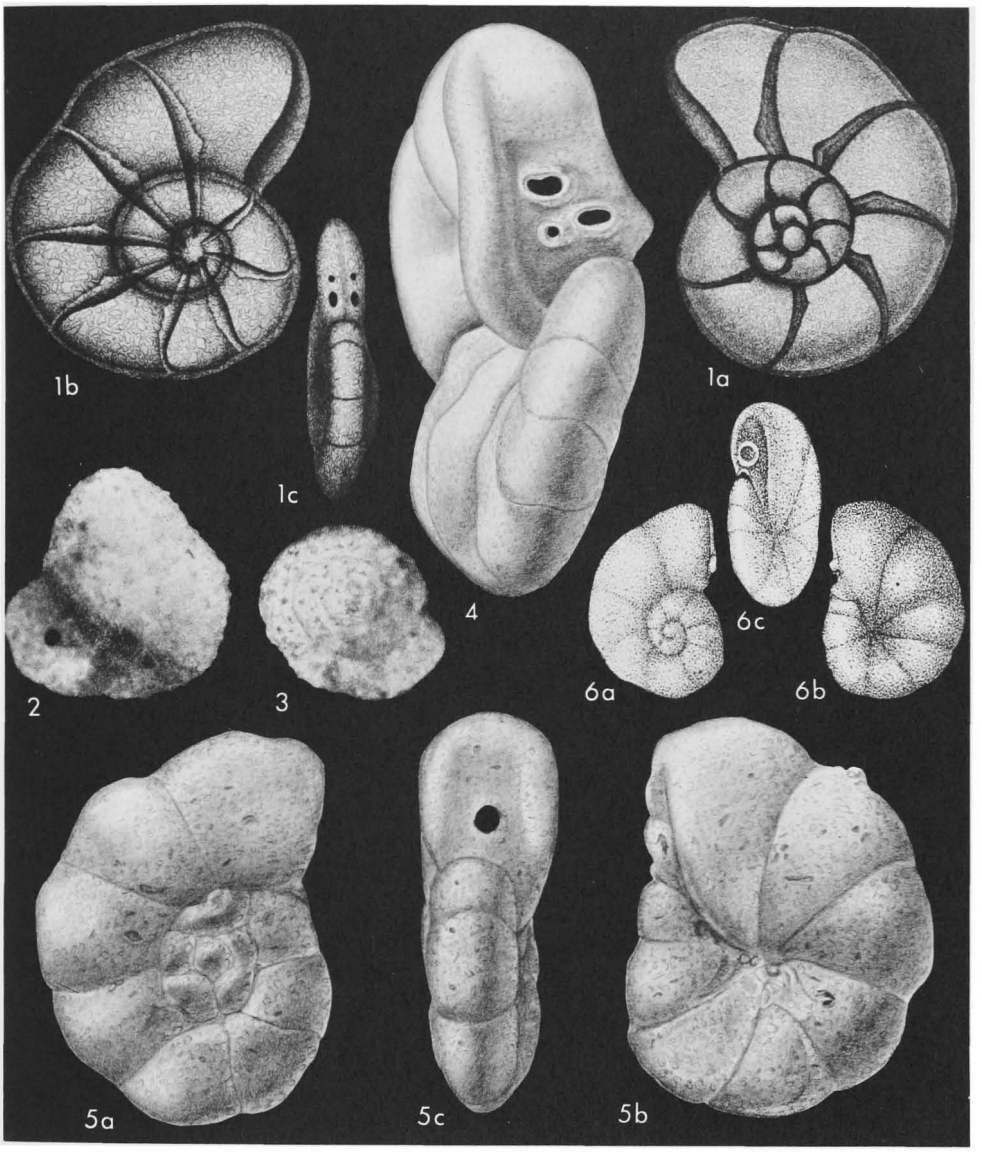

FIG. 176. Trochamminidae (Trochammininae; *1, Entzia; 2,3, Conotrochammina; 4-6, Jadammina*) (p. C263-C265).

Conotrochammina FINLAY, 1940, *717d, p. 448 [**C. whangaia*; OD]. Test with high trochospiral coil, deeply umbilicate, with nonconstricted sutures; aperture small rounded areal opening. [*Conotrochammina* differs from *Trochammina* in having an areal instead of interiomarginal aperture. Originally placed in the Ammodiscidae, it is here regarded as closely related to *Trochammina*, because of its distinctly chambered character and a restricted areal aperture.] *U.Cret.(Campan.)-Paleoc.*, N.Z.——FIG. 176,*2,3*. **C. whangaia*, Campan.; *2*, holotype, edge view showing elevated spire; *3*, spiral view of paratype, ×30 (*717d).

Cystammina NEUMAYR, 1889, *1355, p. 167 [**Trochammina pauciloculata* BRADY, 1879, *196a, p. 58; SD GALLOWAY, 1933, *762, p. 186] [=*Ammochilostoma* EIMER & FICKERT, 1899, *692, p. 692 (type, *Trochammina pauciloculata* BRADY, 1879, SD CUSHMAN, 1910, *404a, p. 126) obj.)]. Test free, trochoid, chambers few, high, inflated; sutures distinct, depressed; wall finely agglutinated with considerable cement; aperture comprising slit in face of final chamber, paralleling

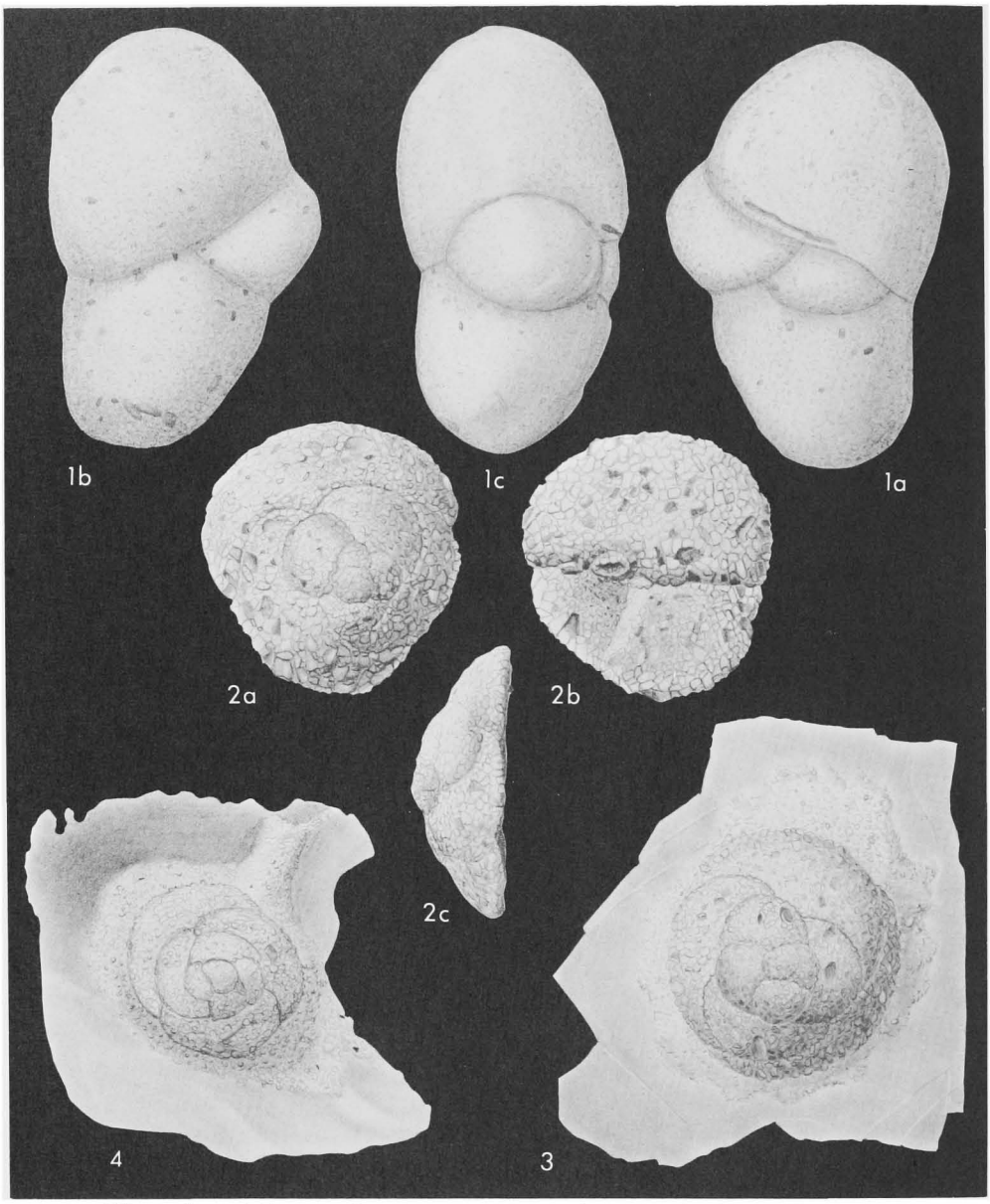

FIG. 177. Trochamminidae (Trochammininae; *1, Cystammina; 2-4, Tritaxis*) (p. C263-C264, C266).

and near basal margin, on ventral side. [*Cystammina* differs from *Trochammina* in having high and inflated chambers and in having a slitlike areal aperture in the ventral face, instead of a basal one.] *Eoc.-Rec.*, Pac.-Atl.-Eu.-Carib.-Antarctic.——FIG. 177,*1*. **C. paucilocculata* (BRADY), Rec., Pac.; *1a-c*, opposite sides and edge view showing areal slitlike aperture of lectotype (BMNH-ZF 2508) (here designated and redrawn), ×105 (*2117).

Entzia DADAY, 1883, *548, p. 209 [**E. tetrastomella*; OD (M)] [*non Entzia* LEBOUR, 1922]. Test in low trochospiral coil; wall pseudochitinous, with small amount of siliceous material; aperture areal, with 2 pair of openings somewhat produced and symmetrically placed in lower half of apertural face, lower pair larger and ovate, upper pair smaller and rounded. [*Entzia* differs from *Jadammina* in lacking an interiomarginal aperture in addition to the areal openings.] *Rec.*, Rumania (salt pools).——FIG. 176,*1*. **E. tetrastomella; 1a-c*, opposite sides and edge view, approx. ×120 (*548).

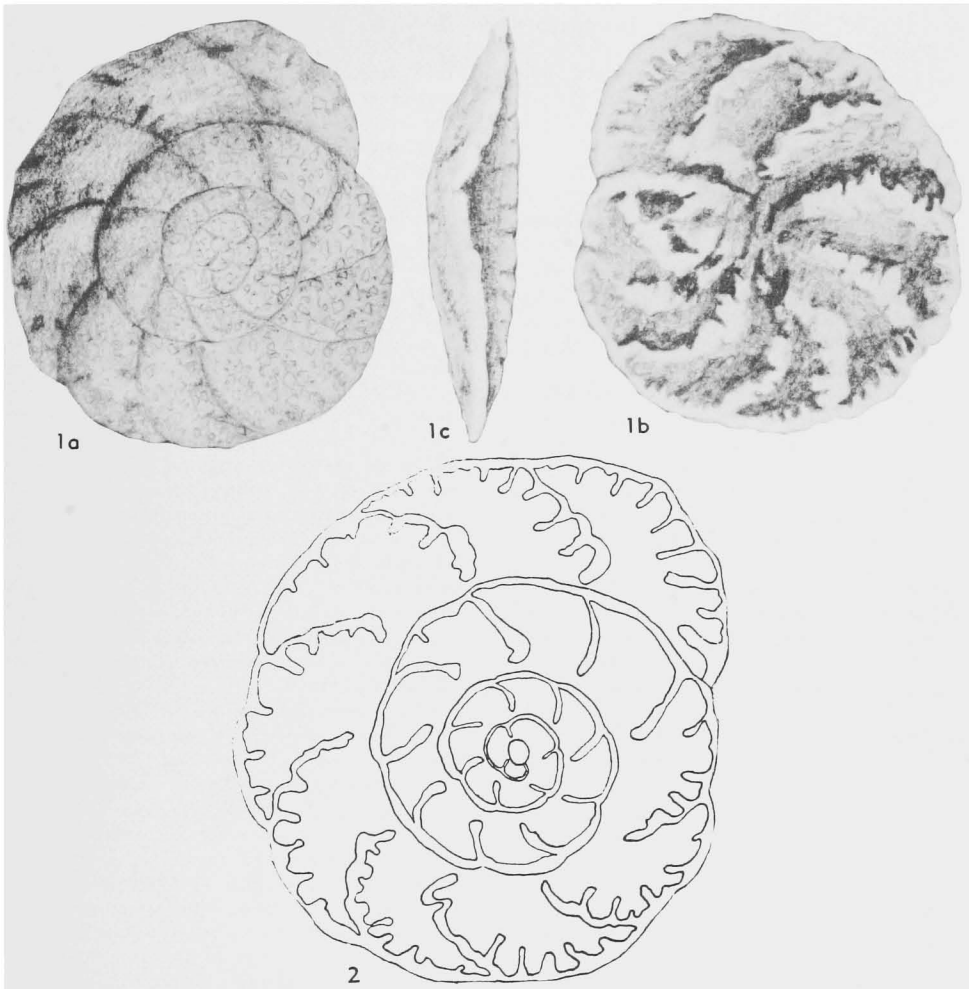

FIG. 178. Trochamminidae (Remaneicinae; *1,2, Remaneica*) (p. *C266-C268*).

Jadammina BARTENSTEIN & BRAND, 1938, *93, p. 381 [**J. polystoma*; OD] [=*Borovina* SHMALGAUSEN, 1950, *1735, p. 869 (type, *B. zernovi*); *Trochamminisca* SHCHEDRINA, 1955, *1726, p. 7 (type, *T. cyclostoma*)]. Test free, trochospiral, lenticular to flattened, sutures radial to slightly curved; wall agglutinated, imperforate, with few grains on pseudochitinous base; primary aperture low interiomarginal, equatorial slit, with supplementary cribrate areal aperture consisting of rounded openings in lower portion of final chamber face, with projecting lips. *Rec.*, Eu.-N.Am.—— FIG. 176,*4,5*. **J. polystoma*, Ger.; *5a-c*, opposite sides and edge of small specimen with single areal aperture; *4*, edge view of larger specimen showing multiple areal aperture; all ×200 (*2117).——FIG. 176,*6*. *J. cyclostoma* (SHCHEDRINA), USSR(White Sea); *6a-c*, opposite sides and oblique edge view to show mode of coiling and 2 apertural forms, ×66 (*1726).

[*Jadammina* differs from *Trochammina* in having an equatorial primary aperture, rather than one on the umbilical side, and in having supplementary cribrate areal openings. *Trochamminisca* was described as having 2 apertures, the primary aperture an arched equatorial slit extending slightly to the ventral side and bordered by a lip, the secondary aperture a single rounded areal opening with a bordering collar. As many specimens of the type-species of *Jadammina* also show only a single areal opening in addition to the equatorial opening, *Trochamminisca* is regarded as a synonym.]

Rotaliammina CUSHMAN, 1924, *418, p. 11 [**R. mayori;* OD]. Test attached, trochoid, all chambers visible on spiral side, only those of final whorl seen from attached umbilical side; wall very thin, flexible, agglutinated, with fine sand held in small amount of cement; aperture indistinct, probably against attachment. [*Rotaliammina* differs from *Trochammina* in its attached character,

thin flexible walls, and obscure aperture, probably against the attachment, rather than a conspicuous arched extraumbilical-umbilical one.] *Rec.,* Pac.——FIG. 174,*2. *R. mayori; 2a-c,* opposite sides and edge view of holotype, ×118 (*1166).

Siphotrochammina SAUNDERS, 1957, *1631, p. 9 [**S. lobata;* OD]. Test free, trochospiral, spiral side convex, umbilical side depressed; chambers ovate, increasing gradually in size; sutures curved on spiral side, radial on umbilical side; wall agglutinated; aperture consisting of forward-directed, rounded opening at end of siphon-like lobe which projects from umbilical margin of final chamber, former aperture of penultimate chamber opening into siphon of final chamber. [*Siphotrochammina* differs from *Trochammina* in having a rounded aperture at the end of a siphon-like extension of the final chamber, rather than a simple interiomarginal slit.] *Rec.,* W.Indies(Trinidad).——FIG. 174, *3. *S. lobata; 3a-c,* opposite sides and edge of paratype showing apertural siphon, ×110 (*1631).

Tiphotrocha SAUNDERS, 1957, *1631, p. 11 [**Trochammina comprimata* CUSHMAN & BRÖNNIMANN, 1948, *498A, p. 41; OD]. Test free, trochospiral, spiral side flat to convex, umbilical side somewhat excavated, with small, open umbilicus; chambers enlarging rapidly as added, resulting in decreasing number in each whorl, later chambers crescentic, with prominent central lobe on umbilical side; sutures depressed, curved on spiral side, strongly and doubly sinuate on umbilical side; wall agglutinated, thin and fragile, with little cement; aperture interiomarginal in young specimens, extraumbilical-umbilical in position, in re-entrant just forward from umbilical lobe of final chamber, and in well-developed adult specimens secondary opening seemingly occurs in posterior re-entrant behind umbilical lobe, its margin free with opening beneath it, or lobe may cross umbilicus and fuse with opposite side, effecting complete closure of opening. [*Tiphotrocha* differs from *Trochammina* in its open umbilical apertures, and umbilical lobe of the final chamber, which may also have a secondary opening. It is similar in apertural features to the calcareous genus *Neoconorbina,* differing in its agglutinated wall character.] *Mio.-Rec.,* W.Indies(Trinidad)-USA(La.).——FIG. 174,*4-6. *T. comprimata* (CUSHMAN & BRÖNNIMANN), Rec., Trinidad; *4a-c,* opposite sides and edge views of hypotype showing crescentic chambers and apertural openings into umbilicus from each chamber of final whorl; *5,* ventral view of hypotype showing large ventral lobe of final chamber partially covering umbilicus; *6,* hypotype showing fused umbilical covering obscuring apertures; all ×71 (*1631).

Tritaxis SCHUBERT, 1921, *1694, p. 180 [**Rotalina fusca* WILLIAMSON, 1858, *2065, p. 55; SD CUSHMAN, 1928, *439, p. 171] [=*Trochamminella* CUSHMAN, 1943, *477, p. 95 (type, *T. siphonifera*)]. Test low trochoid spire, free-living in early stage, later becoming attached by ventral surface with irregular spreading mass surrounding regularly coiled early portion; early chambers subglobular, later increasing rapidly in relative breadth and developing low crescentic outline as seen on spiral side, much overlapping on umbilical side, with final chamber comprising approximately half of test; sutures distinct, slightly depressed; wall agglutinated, comparatively coarse-grained, surface roughened in appearance; aperture on umbilical side, free specimens with ovate opening at base of last-formed chamber near umbilicus, surrounded by distinct lip, not always visible in attached later stages, but may occur as openings on tubular projections at outer margins of attached portion. [*Tritaxis* differs from *Trochammina* in possessing in the free stage an ovate aperture on the umbilical side, rather than an extraumbilical-umbilical aperture, and in having a later attached stage with tubular-like openings at outer margins of the attached portion.] *Rec.,* Brit. I.(Ire.)-Puerto Rico.——FIG. 177,*2,3. *T. fusca* (WILLIAMSON), Ire.; *2a-c,* opposite sides and edge of free specimen; *3,* attached specimen; all ×48 (*1166).——FIG. 177,*4. *T. siphonifera* (CUSHMAN), Puerto Rico; ×44 (*1166).

Trochamminula SHCHEDRINA, 1955, *1726, p. 5 [**T. fissuraperta* = *Trochammina fissuraperta* SHCHEDRINA, 1953 *(nom. nud.),* *1725, p. 15; OD]. Test similar to *Trochammina* but with 2 types of apertures—interiomarginal, extending from periphery nearly to umbilicus on ventral side and elongate aperture extending somewhat obliquely up face of final chamber on periphery; wall finely agglutinated, with ferruginous cement. [*Trochamminula* resembles *Arenoparrella* in having a vertical aperture in the face but has an interiomarginal aperture and lacks secondary pores near the peripheral angle.] *Rec.,* Arctic(Barents Sea-Okhotsk Sea-Bering Sea).——FIG. 173,*3. *T. fissuraperta,* Arctic; *3a-c,* opposite sides and edge to show 2 forms of aperture, ×66 (*1726).

Subfamily REMANEICINAE
Loeblich & Tappan, n. subfam.

Test attached, trochospiral, chambers internally subdivided by infoldings of wall. *Rec.*

Remaneica RHUMBLER, 1938, *1576, p. 194 [**R. helgolandica;* OD] [=*Trochammina (Remaneica)* HÖGLUND, 1947, *924, p. 212 (obj.)]. Test small, attached, low trochospiral coil; chambers with secondary infoldings or plications of wall, which may show at surface as septal slits; wall brown, pseudochitinous, imperforate and flexible, with varying amount of agglutinated matter, exterior surrounded by "buffer zone" of agglutinated matter; aperture not observed. *Rec.,* Ger.(Helgoland)-

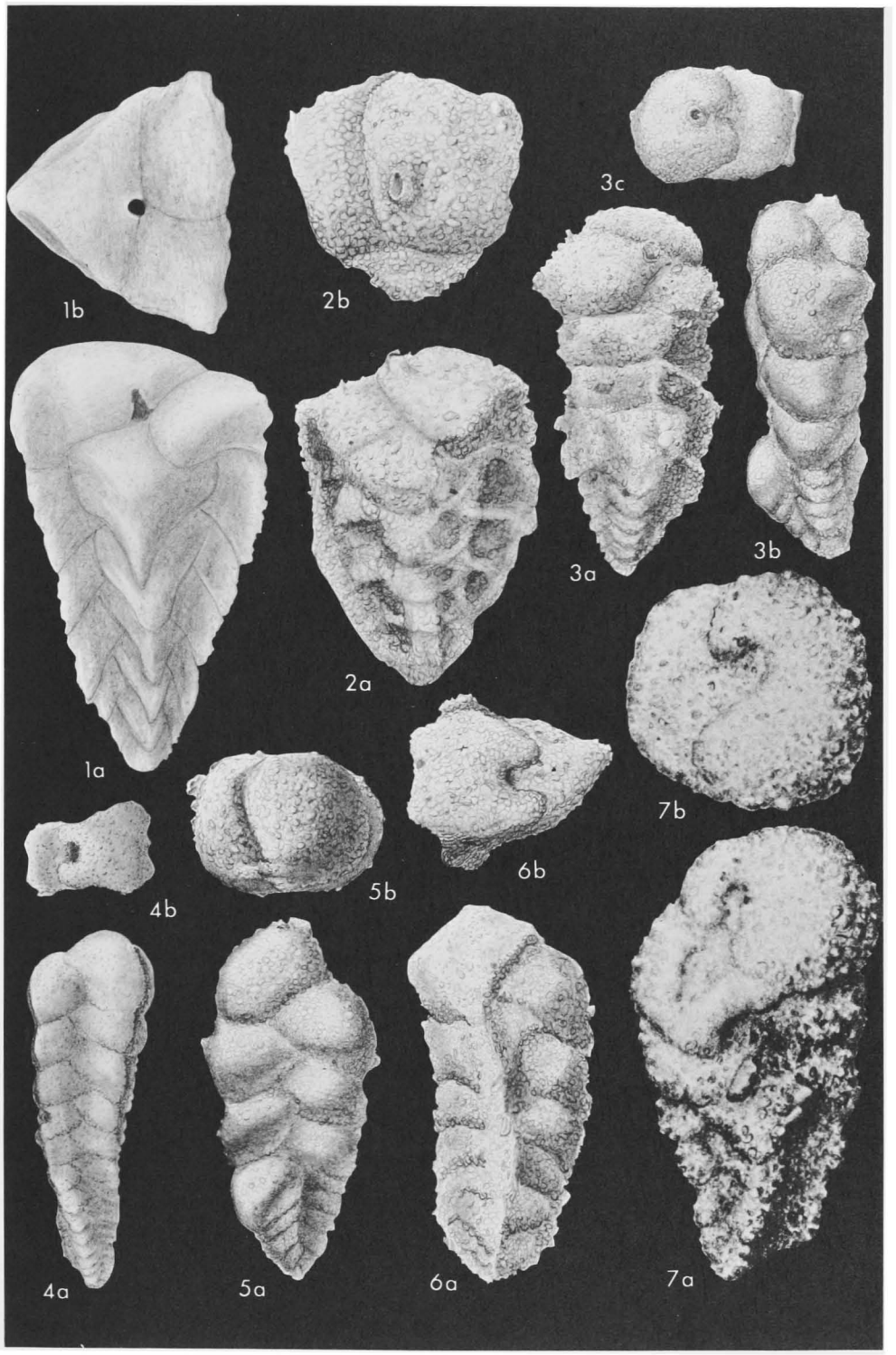

FIG. 179. Ataxophragmiidae (Verneuilininae; *1, Verneuilina; 2, Barbourinella; 3, Bermudezina; 4-7, Gaudryina*) (p. C268-C269).

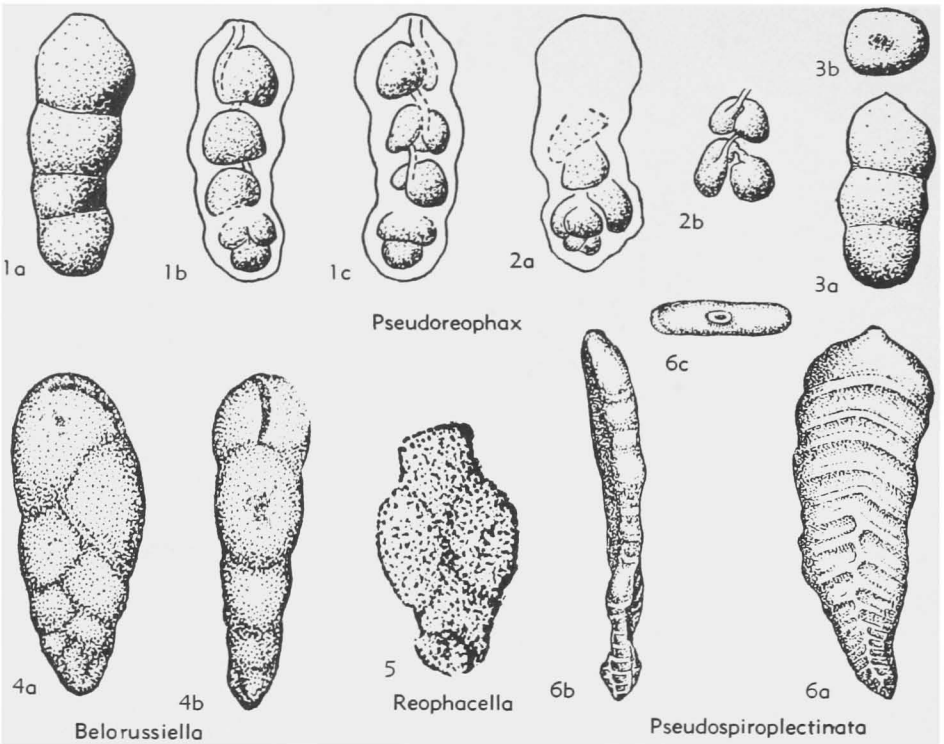

FIG. 180. Ataxophragmiidae (Verneuilininae; *1-3, Pseudoreophax; 4, Belorussiella; 5, Reophacella; 6, Pseudospiroplectinata*) (p. C269-C272).

Fr.-Sweden.——FIG. 178,*1,2*. **R. helgolandica,* Sweden; *1a-c,* opposite sides and edge view, ×210; *2,* optical sec. showing secondary chamber plications, ×230 (*924).

[*Remaneica* differs from *Rotaliammina* in having secondary plications within the chambers. *Remaneica* is regarded as adapted to life on a movable substratum, its scalelike form, protective coating, and chamber plications tending to make it resistant to deformation. Specimens referred to *Remaneica* from the western Atlantic do not appear congeneric, as they lack the characteristic chamber plication.]

Family ATAXOPHRAGMIIDAE Schwager, 1877

[*nom. correct.* GALLOWAY & HEMINWAY, 1941, p. 320 (*pro* family Ataxophragmidea SCHWAGER, 1877, p. 22)]——[All names are of family rank; dagger(†) indicates *partim*]——[=Hélicostègues† D'ORBIGNY, 1826, p. 268 (*nom. nud.*); =Uvellinat EHRENBERG, 1839, table opposite p. 120 (*nom. nud.*); =Turbinoidae† D'ORBIGNY in DE LA SAGRA, 1839, p. xxxviii, 71 (*nom. nud.*); =Turbinoidat SCHULTZE, 1854, p. 52 (*nom. nud.*); =Helicostegiat REUSS, 1860, p. 151, 205 (*nom. nud.*); =Uvellidae† REUSS, 1860, p. 203 (*nom. nud.*); =Uvellideat REUSS, 1862, p. 318, 382 (*nom. nud.*); =Uvellideae† GÜMBEL, 1870, p. 23 (*nom. nud.*); =Turbinidat MARRIOTT, 1878, p. 30 (*nom. nud.*); =Trischistidae EIMER & FICKERT, 1899, p. 680 (*nom. nud.*)];——[=Valvulinidae BERTHELIN, 1880, p .16; =Opistho-Trischistidae EIMER & FICKERT, 1899, p. 680 (*nom. nud.*); =Textulinidae† RHUMBLER, 1913, p. 339 (*nom. van.*); =Verneuilinidae CUSHMAN, 1927, p. 25; =Eggerellidae HOFKER, 1957, p. 35]

Test free, trochospiral, uncoiling or uniserial; wall agglutinated; aperture a basal slit in the early stage, later may become terminal, cribrate or toothed. *Penn.-Rec.*

Subfamily VERNEUILININAE Cushman, 1911

[Verneuilininae CUSHMAN, 1911, p. 52]——[All names of subfamily rank; dagger(†) indicates *partim*]——[=Uvellidat SCHULTZE, 1854, p. 52 (*nom. nud.*); =Spiroplectininae CUSHMAN, 1927, p. 62; =Spiroplectinatinae CUSHMAN, 1928, p. 235]

Triserial in early stage, later biserial or uniserial in some forms; number of chambers to whorl tending to decrease with growth; aperture simple. *U.Trias.-Rec.*

Verneuilina D'ORBIGNY in DE LA SAGRA, 1839, *1611, p. 104 [**V. tricarinata;* SD (SM) D'ORBIGNY, 1840, *1394, p. 39] [=*Verneulina* & *Verneolina* COSTA, 1856, *392, p. 263 *(nom. null.)*]. Test free, elongate, triangular, with angles of test sharp, nearly carinate, chambers triserially arranged throughout; wall agglutinated, with much calcareous cement; aperture a low arch at inner face of final chamber. *Jur.-Rec.,* cosmop.——FIG. 179, *1.* **V. tricarinata,* U.Cret.(Senon.), Eu.(Fr.); *1a,b,* side and top views of lectotype, here designated and redrawn (MNHN), ×80 (*2117).

Barbourinella BERMÚDEZ, 1940, *122, p. 410 [*pro Barbourina* BERMÚDEZ, 1939, *121a, p. 9 (*non* AMARAL, 1924)] [**Barbourina atlantica* BERMÚDEZ, 1939, *121a, p. 9; OD]. Test triserial and triangular throughout as in *Verneuilina,* but with terminal rounded aperture which may be slightly produced. *Mio.-Rec.,* Carib.——FIG. 179,*2*. **B.*

atlantica (BERMÚDEZ), Rec., Carib.; *2a,b,* side, top views of holotype, ×56 (*2117).

Belorussiella AKIMETS, 1958, *9, p. 35 [**B. bolivinaeformis;* OD]. Test elongate, with short, early triserial and triangular stage followed by better-developed biserial stage with more inflated chambers and ovate section; sutures indistinct in triserial portion, depressed and oblique in biserial stage; wall agglutinated, of fine-grained calcareous particles in calcareous cement, surface roughened; aperture elongate loop-shaped slit extending up face of final chamber to its apex. [Differs from *Gaudryina* in its elongate vertical apertural slit.] *U.Cret.(Turon.-U.Santon.),* USSR(Belorusskaya SSR).——FIG. 180,*4.* **B. bolivinaeformis,* U. Santon.; *4a,b,* side, edge views, ×104 (*10).

Bermudezina CUSHMAN, 1937, *470, p. 102 [**Heterostomella* (?) *cubensis* PALMER & BERMÚDEZ, 1936, *1412, p. 244; OD]. Test similar to *Gaudryina* but with terminal circular aperture on short neck. *U.Eoc.-Mio.,* Carib.-Eu.(Bulg.).——FIG. 179,*3.* **B. cubensis* (PALMER & BERMÚDEZ), L.Oligo., Cuba; *3a-c,* side, edge, and top views of lectotype (here designated, USNM-498781), ×94 (*2117).

Flourensina MARIE, 1938, *1214, p. 91 [**F. douvillei;* OD]. Test triserial, with chambers strongly inflated into spinose projections; aperture a loop in face of final chamber, extending upward from basal suture. [*Flourensina* differs from *Verneuilina* in its strongly laterally produced chambers and high narrow aperture.] *L.Cret.(U. Vracon.),* Eu. (Fr.).——FIG. 181,*1.* **F. douvillei;* side, top views of paratype, ×50 (*2117).

Gaudryina D'ORBIGNY in DE LA SAGRA, 1839, *1611, p. 112 [**G. rugosa* D'ORBIGNY, 1840, *1394, p. 44; SD CUSHMAN, 1911, *404b, p. 62] [=*Gaudryna* D'ORBIGNY, 1839, *1611, p. 219 *(nom. null.); Gaudryina (Siphogaudryina)* CUSHMAN, 1935, *466, p. 3 (type, *Gaudryina stephensoni* CUSHMAN, 1928, *438, p. 108); *Gaudryina (Pseudogaudryina)* CUSHMAN, 1936, *468, p. 12 (type, *Textularia atlantica* BAILEY, 1851, *65, p. 12); *Valvoreussella* HOFKER, 1957, *948, p. 87 (type, *Verneuilina bronni* REUSS, 1846, *1538, p. 38)]. Test free, elongate, early stage triserial and commonly triangular, later portion biserial; aperture interiomarginal. *U.Trias.-Rec.,* cosmop.——FIG. 179,*5.* **G. rugosa,* U.Cret., Ger.; *5a,b,* side, top views of hypotype, ×39 (*2117).——FIG. 179,*6.* *G. atlantica* (BAILEY), Mio., W.Indies(Jamaica); *6a,b,* side, top views, ×20 (*2117).——FIG. 179, *4.* *G. stephensoni* CUSHMAN, U.Cret., USA(Tex.); *4a,b,* side, top views of paratype, ×86 (*2117). ——FIG. 179,*7.* *G. bronni* (REUSS), U.Cret. (Plänermergel), Eu.(Boh.); *7a,b,* side, top views of topotype, ×66 (*470).

[The subgenus *Pseudogaudryina* was based on forms with few biserial chambers that had retained the triangular section of the test, but as this angularity commonly becomes less pronounced with increased length of biserial development, it is regarded as a developmental feature and not of taxonomic importance. The subgenus *Siphogaudryina* is based on *Gaudryina stephensoni,* which does not show the fistulose processes described for that subgenus, worn angles of poorly preserved specimens being so mistaken. *Valvoreussella* was stated to have a normally loop-shaped aperture, although some specimens have a terminal aperture in the biserial stage. Many species of *Gaudryina* show a tendency toward *Tritaxia,* by developing a random uniserial chamber and terminal aperture in gerontic specimens (TAPPAN, 1943, *1872, p. 78). The characters shown by the major part of the species population must determine the generic placement, however. All specimens of *Verneuilina bronni* illustrated by REUSS (*1538), CUSHMAN (*470), and others show typical characters of *Gaudryina,* as do all but one of those figured by HOFKER (*948). *Valvoreussella* is therefore regarded as a synonym of *Gaudryina.* BOWEN (1955, *182) regarded *Heterostomella, Plectina, Dorothia, Marssonella, Karreriella, Bermudezina,* and *Migros* as synonyms of *Gaudryina,* recognizing as generic characters neither the number of chambers to a whorl (triserial or multilocular trochospiral) nor the position and character of the aperture. Both features are regarded as of generic value by us. *Bermudezina* and *Heterostomella* are here regarded as valid genera of the Verneuilininae, *Karreriella* and *Dorothia* as valid genera of the Eggerellinae (with *Marssonella* a synonym of *Dorothia*), and *Plectina* as a valid genus in the Valvulininae.]

Gaudryinella PLUMMER, 1931, *1464, p. 341 [**G. delrioensis;* OD]. Test elongate, early stage triserial and triangular in section, later irregularly and loosely biserial; inflated, cuneate chambers progressively more loosely appressed, becoming semiuniserial; wall agglutinated; aperture interiomarginal in early stage, rounded and terminal in adult. *L.Cret.(Alb.)-U.Cret.(Maastricht.),* N.Am.-Eu.——FIG. 181,*5,6.* **G. delrioensis,* U.Cret.(L. Cenoman.), USA(Tex.); topotypes, ×100 (*2117).

[*Gaudryinella* was considered a possible synonym of *Spiroplectinata* by HOFKER (1951, *935, p. 4) but is here recognized as being triserial in the early stage, then loosely biserial to semiuniserial with cuneate chambers. *Spiroplectinata* has a distinct and regular biserial stage following a reduced triserial stage, succeeded by regularly developed uniserial chambers. The Eocene *G. cubana* CUSHMAN & BERMÚDEZ is here regarded as a *Tritaxia.*]

Heterostomella REUSS, 1866, *1555, p. 448 [**Sagrina rugosa* D'ORBIGNY, 1840, *1394, p. 47; OD (M)]. Test free, early stages triserial, roughly triangular in section, later biserial, becoming roughly quadrangular in section, ridges formed by fistulose angles; wall agglutinated, in type-species, coarsely arenaceous with calcareous cement; aperture in adult terminal on short neck. [*Heterostomella* differs from *Gaudryina* in having fistulose angles and a terminal aperture.]. *U.Cret.(Senon.),* Eu.-N.Am.——FIG. 181,*2.* **H. rugosa* (D'ORBIGNY), Senon., Fr.; *2a,b,* side and top views of lectotype, here designated and redrawn (MNHN), ×64 (*2117).

Migros FINLAY, 1939, *717c, p. 312 [**Gaudryina medwayensis* PARR, 1935, *1423; p. 83; OD] [=*Paleogaudryina* SAID & BARAKAT, 1958, *1616, p. 243 (type, *P. magharaensis*)]. Test similar to *Gaudryina* but with high, loop-shaped, instead of low, basal aperture. *M.Jur.-Mio.,* N.Z.-Australia-Eu.-Egypt.——FIG. 181,*3.* **M. medwayensis* (PARR), M.Mio., N.Z.; *3a,b,* side and top views, ×36 (*2117).——FIG. 181,*4.* *M. magharaensis* (SAID & BARAKAT), U.Jur.(Kimmeridg.), Egypt (Sinai); *4a-c,* holotype, ×55 (*1616).

Pseudoreophax GEROCH, 1961, *785, p. 159 [**P*

cisovnicensis; OD]. Test elongate, straight or arcuate, circular to ovate in section, trochospiral in early stage of microspheric forms and later uniserial, megalospheric forms uniserial throughout; chamber internal cavity semicircular in plane perpendicular to axis of test and arched upward

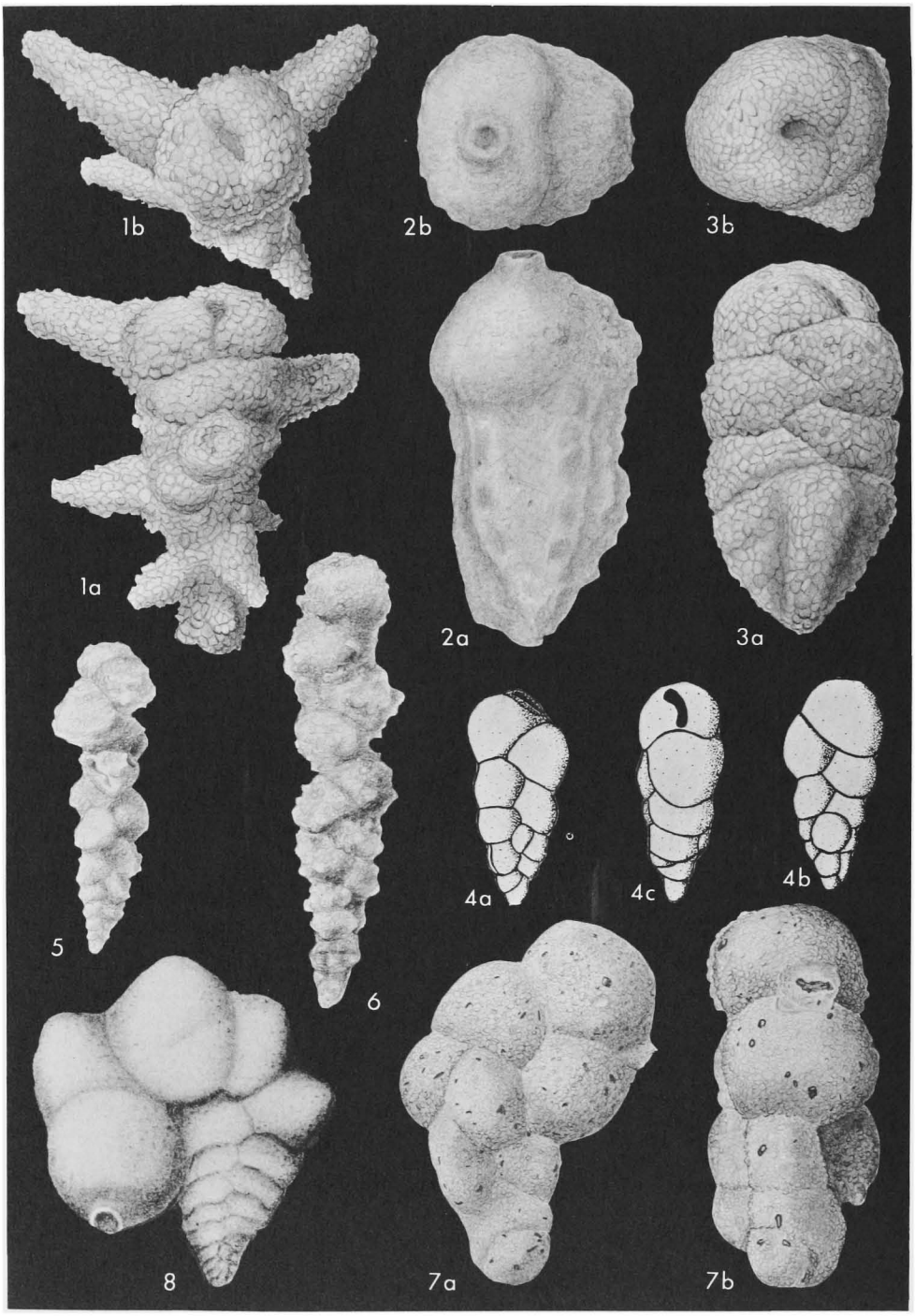

FIG. 181. Ataxophragmiidae (Verneuilininae; *1, Flourensina; 2, Heterostomella; 3,4, Migros; 5,6, Gaudryinella; 7,8, Rudigaudryina*) (p. C269, C272).

from base; sutures depressed; horizontal in uniserial stage; wall very finely agglutinated, surface smoothly finished; aperture terminal, rounded, may be slightly eccentric. *L.Cret.(Valang.-L. Barrem.)*, Carpathians(Pol.).——Fig. 180,*1-3*. **P. cisovnicensis*, Valang.-Hauteriv. *(1,2)*, Barrem.

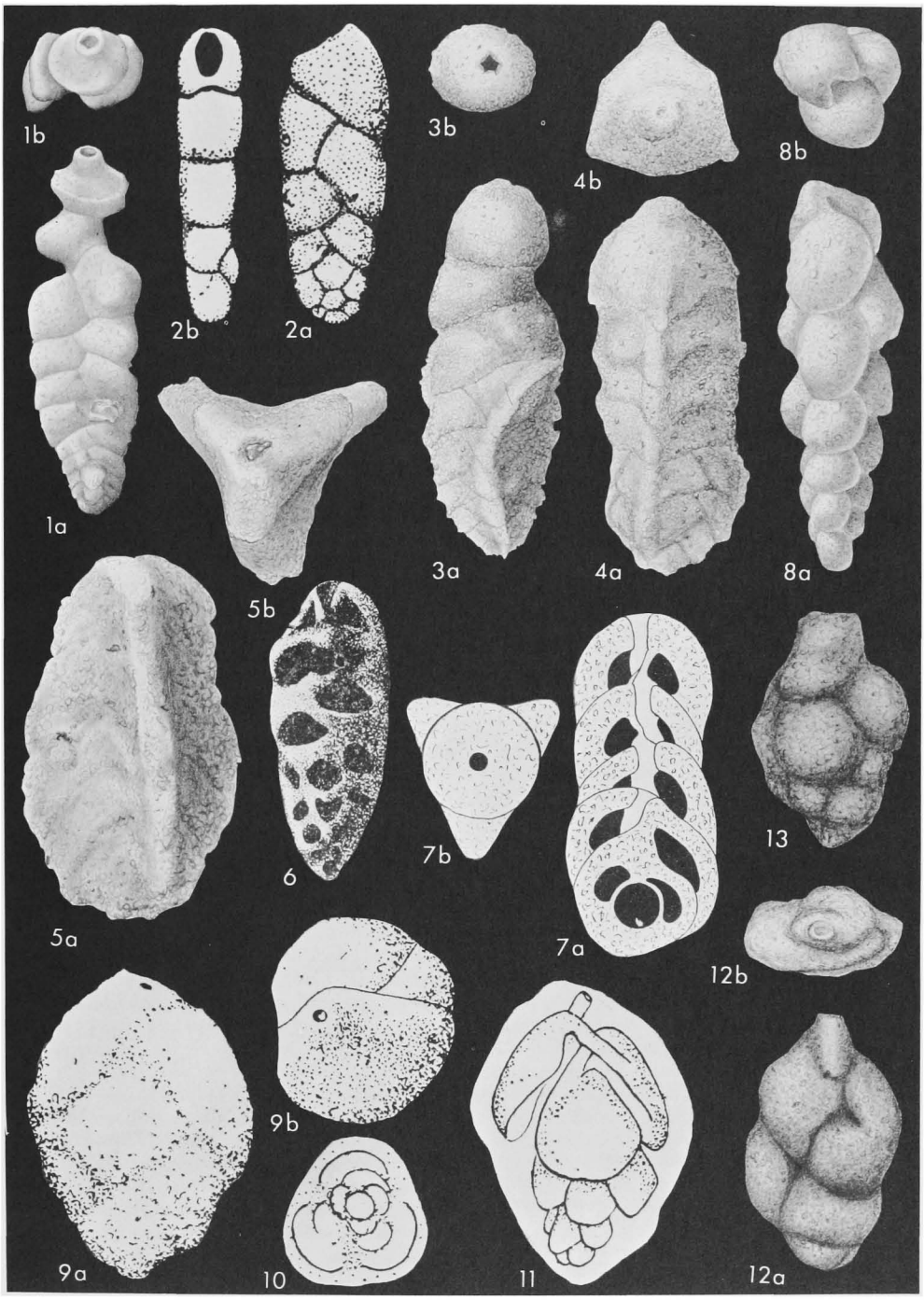

Fig. 182. Ataxophragmiidae (Verneuilininae; *1-2, Spiroplectinata; 3-7, Tritaxia; 8, Verneuilinoides; 9-13, Uvigerinammina*) (p. C272-C273).

(3); *1a-c,* side view and opposite sides of megalospheric holotype viewed in immersion oil to show chamber cavities; *2a,b,* microspheric form viewed in immersion oil to show early trochospiral development and chamber arrangement in transition to uniserial stage; *3a,b,* side, top views of megalospheric paratype, ×65 (*785).

Pseudospiroplectinata GORBENKO, 1957, *808, p. 879 [**P. plana;* OD]. Test elongate, broad and flattened; chambers of early stage triserially arranged, later biserial, and finally uniserial; aperture terminal, rounded, on short neck. [*Pseudospiroplectinata* differs from *Spiroplectinata* in having a broad, flat, and regularly uniserial later stage, rather than cuneate chambers in an irregular, short uniserial stage. The genus and type species were incorrectly described as new in a second publication in 1960 (*808A, p. 71).]. *U. Cret.(U.Cenoman.),* USSR(Donets Basin).——FIG. 180,*6*. **P. plana; 6a-c,* side, edge, and top views, approx. ×40 (*808).

Reophacella KAPTARENKO-CHERNOUSOVA, 1956, *1017, p. 32 [**R. compressa;* OD (M)]. Test free, elongate, somewhat flaring, chamber arrangement indistinct in early portion, later with apparently paired chambers; wall arenaceous; aperture terminal, rounded on broad neck. [Similar to *Uvigerinammina* but lacks the early distinctly triserial development.] *U.Eoc.(Kiev Stage),* USSR (Ukraine).——FIG. 180,*5*. **R. compressa;* side view of holotype, ×70 (*1017).

Rudigaudryina CUSHMAN & MCCULLOCH, 1939, *511, p. 94 [**R. inepta;* OD]. Test triserial in early stage, later portion biserial, as in *Gaudryina,* but with final chambers irregularly spreading; aperture terminal, rounded, with short neck or lip. *Rec.,* Pac.——FIG. 181,*7,8*. **R. inepta; 7a,b,* side, edge views of megalospheric paratype, ×86 (*2117); *8,* microspheric paratype, ×55 (*511).

Spiroplectinata CUSHMAN, 1927, *431, p. 62 [*pro Spiroplectina* CUSHMAN, 1927, *428, p. 78 (non SCHUBERT, 1902)] [**Textularia annectens* PARKER & JONES, 1863, *1417e, p. 92; OD] [=*Paragaudryina* SULEYMANOV, 1958, *1853, p. 19 (type, *P. inornata*)]. Test free, elongate, triserial in early portion, later biserial, and finally uniserial; sutures slightly depressed in early development, more strongly constricted in uniserial portion; wall agglutinated; aperture terminal, rounded. *L.Cret.-U.Cret.,* Brit. I.-Eu.-N.Am.-USSR.——FIG. 182,*1*. **S. annectens* (PARKER & JONES), L.Cret. (Alb.), Eng.; *1a,b,* side, top views of topotype, ×74 (*2117).——FIG. 182,*2*. *S. inornata* (SULEYMANOV), U.Cret.(L.Turon.), USSR(Fergana); *2a,b,* side, edge views of holotype, ×55 (*1857).

[Originally described (1927) as having an early planispiral stage and calcareous wall, *Spiroplectinata* was redescribed (CUSHMAN, *461, p. 114), placed in the Verneuilinidae, and said to have a triserial beginning and arenaceous wall. EARLAND (1934, *653, p. 114) stated that he considered the early development as planispiral, with edges of the spiral toward the face of the test. The original types of PARKER & JONES were examined by us in 1953 and a lectotype from the Gault at Biggleswade, Bedfordshire, England, was chosen; it is here designated (BMNH-P41668). The types and all other specimens seen by us show a very short but distinctly triserial and triangular early stage of about 3 series of chambers. Some species that previously were placed in *Gaudryinella—G. pseudoserrata* CUSHMAN— or *Pseudogaudryinella— P. mollis* (CUSHMAN)—should be placed in *Spiroplectinata*.]

Tritaxia REUSS, 1860, *1548, p. 227 [**Textularia tricarinata* REUSS, 1844, *1537, p. 215 (=*Verneuilina dubia* REUSS, 1851, *1542, p. 40; OD (M)] [=*Tritaxiopsis* RZEHAK, 1895, *1605, p. 217 (type, *Tritaxia pleurostoma* RZEHAK, 1895); *Pseudogaudryinella* CUSHMAN, 1936, *468, p. 23 (type, *Gaudryinella capitosa* CUSHMAN, 1933, *459, p. 52); *Clavulinoides* CUSHMAN, 1936, *468, p. 20 (type, *Clavulina trilatera* CUSHMAN, 1926, *423, p. 588); *?Siphonclavulina* SILVESTRI, 1948, *1790, p. 1 (type, *S. trigona*)]. Test triserial and triangular in section in early stage, later portion uniserial and commonly triangular, more rarely compressed; aperture interiomarginal in triserial stage, terminal in adult, with thick-walled internal tube connecting apertures of last 1 or 2 chambers (*88). [The type-species of *Clavulinoides* is not distinguishable generically from *Tritaxia.* A less typical species, *Clavulina compressa* CUSHMAN, shows a compressed and almost palmate uniserial stage, but rare specimens have a distinct third angle; hence, this species is also regarded as *Tritaxia.*] *L.Cret.-Rec.,* cosmop.——FIG. 182, *5,6*. **T. tricarinata* (REUSS), U.Cret., Eu.(Boh.); *5a,b,* side, top views of topotype, ×58 (*2117); *6,* abraded specimen showing internal tube in final chamber, ×24 (*88).——FIG. 182,*3*. *T. capitosa* (CUSHMAN), U.Cret., USA(Miss.); *3a,b,* side, top views of holotype, ×31 (*2117).——FIG. 182,*4*. *T. trilatera* (CUSHMAN), Paleoc., N.Am.(Mex.); *4a,b,* side, top views of hypotype, ×54 (*2117).——FIG. 182,*7*. *T. trigona* (SILVESTRI), Eoc., Eu.(Italy); *7a,b,* long. sec. and top view, ×40 (*1790).

Uvigerinammina MAJZON, 1943, *1203, p. 68 [**U. jankoi;* OD (M)]. Test in trochoid spire of 3 chambers to whorl and thus triserial throughout, but chambers not in parallel rows, as in *Verneuilina,* chambers increasing rapidly in size; wall agglutinated, thick, chamber cavities saclike with internal necklike connections between adjacent chambers; aperture terminal, may be flush or somewhat produced on external neck. [*Uvigerinammina* is apparently a strongly facies-controlled form, commonly occurring in flysch-type sediments.] *L.Cret.(Alb.)-U.Cret., ?Paleoc.,* USSR (Carpathians)-N.Am.(Can.-Alaska).——FIG. 182, *9-11*. **U. jankoi,* Cret., Carp.; *9a,b,* side and apert. views; *10,* specimen in clove oil showing chamber arrangement in basal view; *11,* specimen viewed from side in clove oil showing internal cavities and stolon-like necks between chamber cavities, ×36 (*784).——FIG. 182,*12,13*. *U. manitobensis* (WICKENDEN), L.Cret.(Alb.), Alaska; *12a,b,* side, top views of hypotype, ×64; *13,* side view of another hypotype, ×47 (*2117).

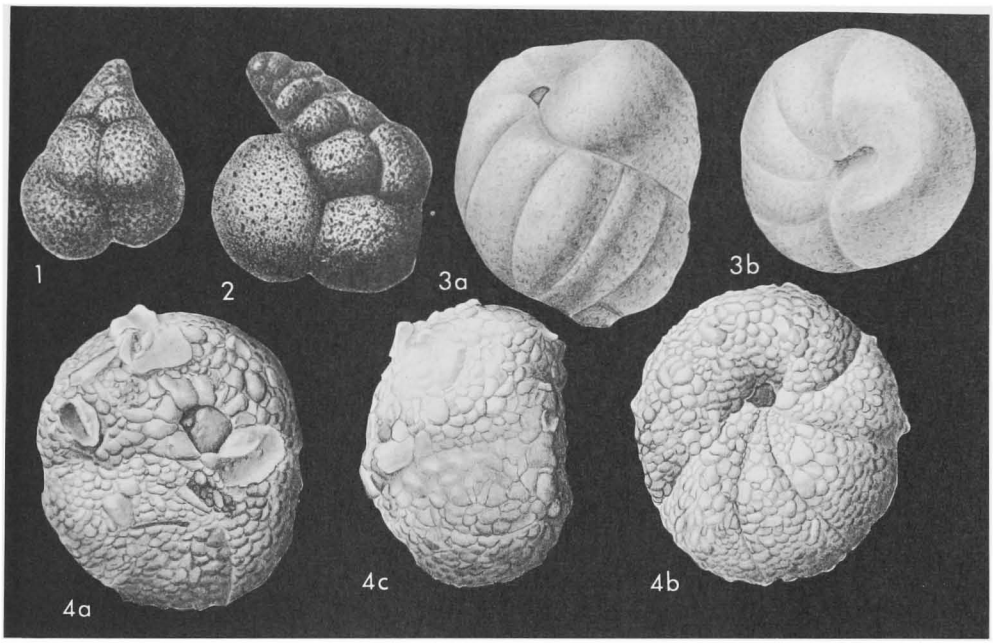

FIG. 183. Ataxophragmiidae (Globotextulariinae; *1,2, Globotextularia; 3,4, Arenobulimina*) (p. C273).

Verneuilinoides LOEBLICH & TAPPAN, 1949, *1155, p. 91 [**Verneuilina schizea* CUSHMAN & ALEXANDER, 1930, *488, p. 9; OD]. Test free, elongate, triserial throughout, with rounded angles; loosely appressed chambers increasing in size toward apertural end; sutures generally distinct and depressed; wall arenaceous, aperture an arch at base of final chamber. [*Verneuilinoides* differs from *Verneuilina* in being rounded in section with loosely appressed chambers rather than triangular in section, and elongate and narrow rather than pyramidal in shape.] *Jur.-Cret.*, N.Am.-Eu.——FIG. 182,*8*. **V. schizea* (CUSHMAN & ALEXANDER), L.Cret.(Alb.), USA(Tex.); *8a,b*, side, top views of holotype, ×100 (*2117).

Subfamily GLOBOTEXTULARIINAE Cushman, 1927

[Globotextulariinae CUSHMAN, 1927, p. 40; Eggerellinae CUSHMAN, 1937, p. 30]

Test trochoid, 3 or more chambers to whorl, number of chambers to whorl tending to decrease with growth to 2 or 1; aperture single interiomarginal opening or cribrate. *Penn.-Rec.*

Globotextularia EIMER & FICKERT, 1899, *692, p. 679 [**Haplophragmium anceps* BRADY, 1884, *200, p. 313; OD]. Test high trochospiral, chambers inflated and subglobular, commonly 4 in final whorl; wall coarsely agglutinated; aperture interiomarginal. *Rec.*, N.Atl.-S.Atl.-S.Pac. [Deep water.]——FIG. 183,*1,2*. **G. anceps* (BRADY), S. Pac. *(1)*, S.Atl. *(2)*; *1*, quadriserial form, here designated lectotype; *2*, aberrant form; both ×10 (*200).

Arenobulimina CUSHMAN, 1927, *428, p. 80 [**Bulimina presli* REUSS, 1846, *1538, p. 38; OD] [=*Hagenowella* CUSHMAN, 1933, *456, p. 21 (type, *Valvulina gibbosa* D'ORBIGNY, 1840, *1394, p. 38); *Ataxophragmoides* BROTZEN, 1948, *241, p. 35 (type, *A. frankei*)]. Test trochospiral, similar to *Valvulammina* in chamber arrangement; wall agglutinated, interior of chambers simple; aperture an interiomarginal arch or loop, without apertural tooth. *L.Cret.(Alb.)-L.Paleoc.*, Eu.-N. Am.——FIG. 183,*3*. **A. presli* (REUSS), U.Cret., Boh.; *3a,b*, side, apert. views of hypotype, ×100 (*2117).——FIG. 183,*4*. *A. frankei* (BROTZEN), L.Paleoc., Sweden; *4a-c*, opposite sides and edge view, ×48 (*2117).

[*Arenobulimina* is similar to *Ataxophragmium*, but does not have internal pillars. *Hagenowella* was described as having internal radial partitions, but was based on misidentified material of the type-species, as was noted by MARIE (1941, *1215, p. 41). As the type-species has a simple interior, *Hagenowella* was suppressed (*1182, p. 242) as a junior synonym of *Arenobulimina*. The specimens erroneously referred to *Hagenowella gibbosa* (D'ORBIGNY) should be referred to *Valvulina quadribullata* VON HAGENOW, the type-species of *Hagenowina* LOEBLICH & TAPPAN, 1961.]

Cribrogoesella CUSHMAN, 1935, *466, p. 4 [**Bigenerina robusta* BRADY, 1881, *196c, p. 53; OD]. Test free, elongate, early trochospiral stage with up to 5 chambers in whorl, reducing rapidly to 3, followed by biserial stage and becoming uniserial in adult; wall agglutinated, thick, fibrous; aperture of biserial stage at base of last-formed chamber, in adult becoming terminal and cribrate. [*Cribrogoesella* differs from *Goesella* in having a

multiple aperture instead of a simple one with tooth.] *Mio.-Rec.,* Carib.-Pac.O.-Atl.O.——FIG. 184,*1-3*. **C. robusta* (BRADY), Rec., Atl.; *1a,b, 2,* side, top views of paratypes; *3,* sectioned specimen showing fibrous wall, paratype (*200, pl. 45, fig. 13) redrawn, ×17 (*2117).

Digitina CRESPIN & PARR, 1940, *396, p. 306 [**D. recurvata;* OD]. Test trochospiral in early stage, later irregularly biserial, similar to *Mooreinella,* but with basal rather than subterminal aperture. [The Cenozoic *Plectotrochammina* differs in having a highly developed trochoid stage and reduced biserial development.] *Perm.,* Australia (New S.Wales).——FIG. 185,*7*. **D. recurvata;*

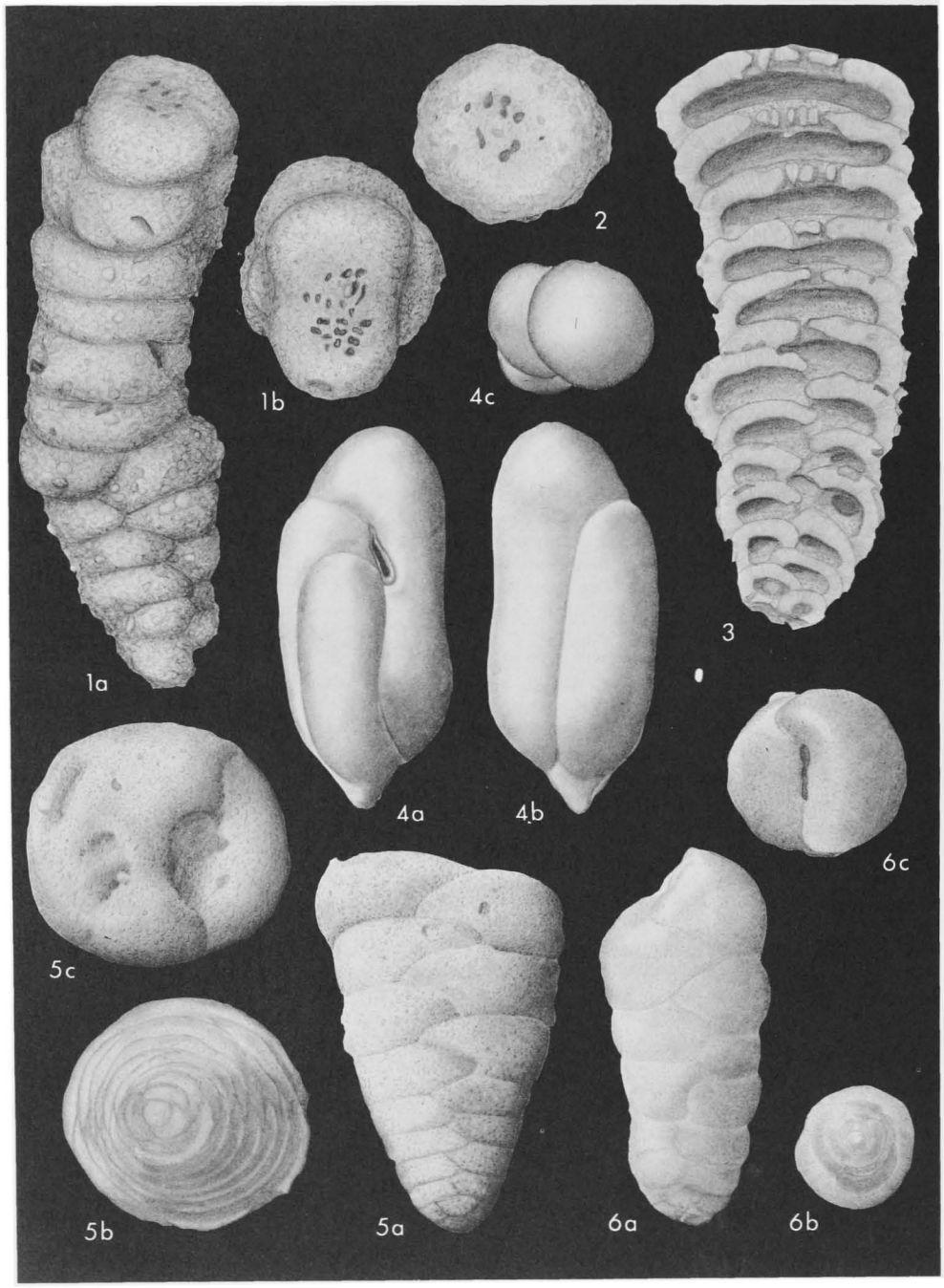

FIG. 184. Ataxophragmiidae (Globotextulariinae; *1-3, Cribrogoesella; 4, Eggerina; 5,6, Dorothia*)
(p. C273-C275).

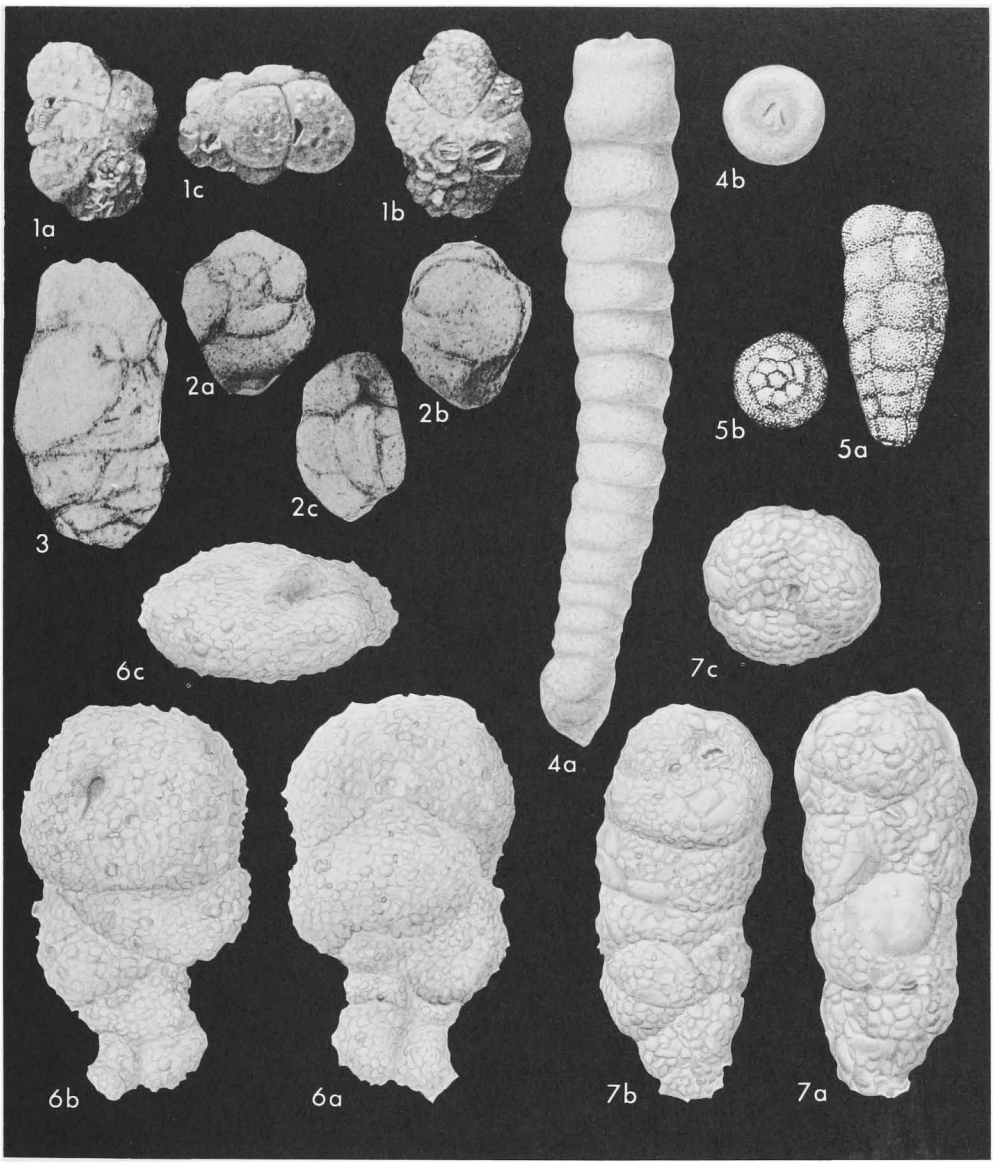

FIG. 185. Ataxophragmiidae (Globotextulariinae; *1-3, Plectotrochammina; 4, Multifidella; 5, Orientalia; 6, Mooreinella; 7, Digitina*) (p. C274, C277-C279).

7a-c, opposite sides and apert. view of topotype, ×52 (*2117).

Dorothia PLUMMER, 1931, *1463, p. 130 [**Gaudryina bulletta* CARSEY, 1926, *282, p. 28; OD] [=*Marssonella* CUSHMAN, 1933, *458, p. 36 (type, *Gaudryina oxycona* REUSS, 1860, *1548, p. 229)]. Early stage trochospiral, with 4 or more chambers to whorl, later stage reduced to biserial; wall agglutinated, may be of calcareous particles on pseudochitinous lining; aperture an interiomarginal slit. [*Marssonella* was placed in the synonymy of *Dorothia* by TRUJILLO (1960, *1954, p. 308) and with this we agree. The congeneric status of *Dorothia, Marssonella,* and *Gaudryina,* as suggested by BOWEN (1955, *182, p. 363) is not upheld by our studies.] *L.Cret.(Alb.)-Rec.,* cosmop.——FIG. 184,*6*. **D. bulletta* (CARSEY), U. Cret., USA(Tex.); *6a-c,* side, basal, and apert. views of topotype, ×68 (*2117).——FIG. 184,*5*. *D. oxycona* (REUSS), U.Cret., Eu.(Ger.); *5a-c,* side, basal, and apert. views, ×62 (*2117).

Eggerella CUSHMAN, 1933, *458, p. 33 [**Verneuilina bradyi* CUSHMAN, 1911, *404b, p. 54; OD]. Test in trochospiral coil, with 5 chambers to whorl in early stage of microspheric form, gradually reduced to 3 to whorl in adult; wall finely agglu-

tinated on pseudochitinous base, may be of calcareous particles in calcareous cement; aperture a low interiomarginal slit. *?U.Cret., Eoc.-Rec.,* cosmop.——Fig. 186,*1*. **E. bradyi* (Cushman), Rec., Pac.O.; *1a,b*, side, top views of holotype, ×65 (*2117).

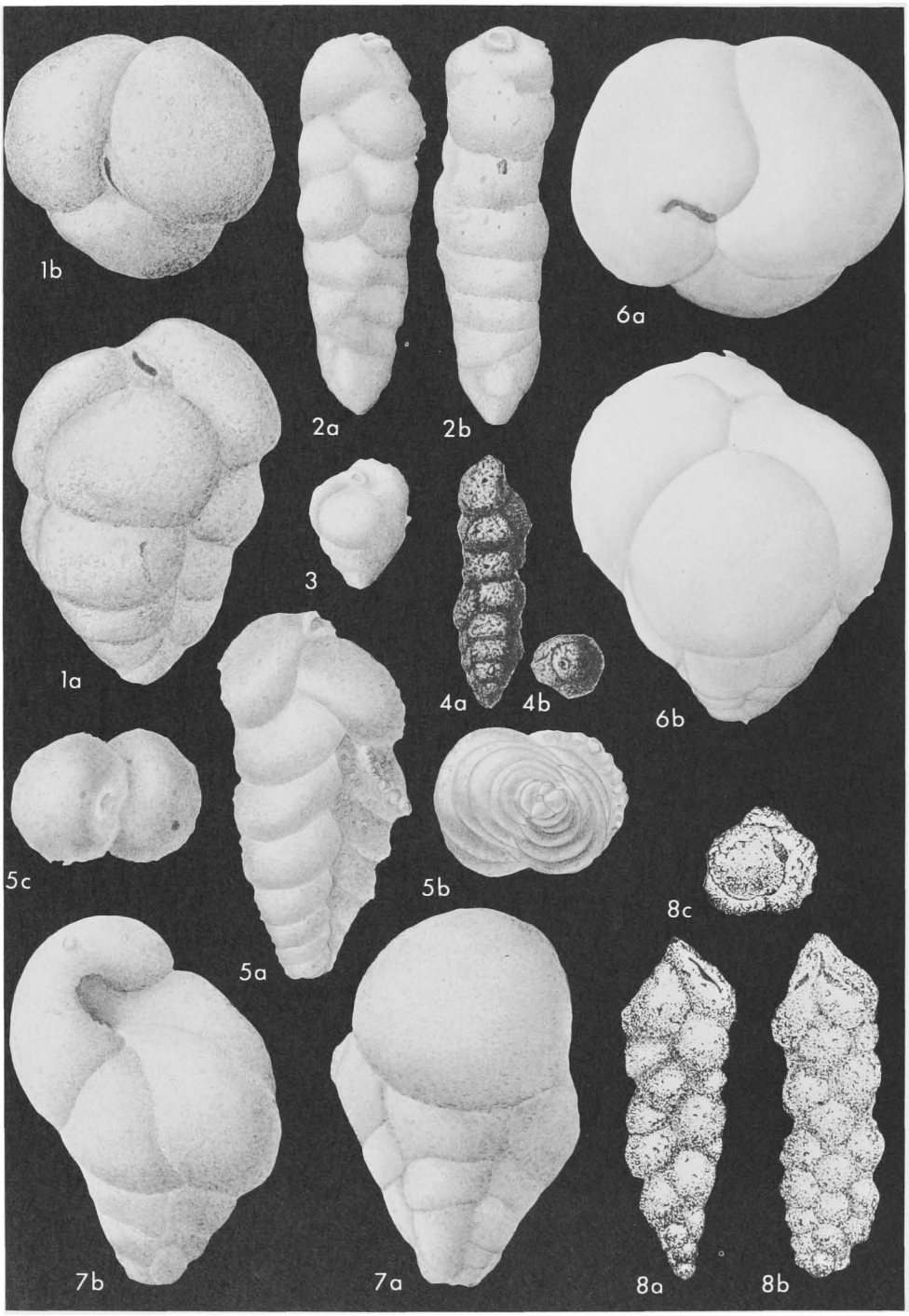

Fig. 186. Ataxophragmiidae (Globotextulariinae; *1, Eggerella; 2-5, Karreriella; 6, Eggerellina; 7,8, Gravellina*) (p. C275-C277).

[*Eggerella* differs from *Dorothia* in being triserial, rather than biserial, in the adult. It is apparently restricted to the Tertiary. The two species referred to *Eggerella* by CUSHMAN (*471) include *Globigerina trochoides* REUSS, 1845, and *Valvulina inflata* FRANKE, 1928. The generic character of REUSS' species is extremely doubtful—in fact, in 1946 CUSHMAN (*484, p. 42) referred it to *Eggerella? trochoides* (REUSS), and in the same publication (p. 145) also referred it to *Allomorphina trochoides* (REUSS), illustrating and describing it under both generic names without comment. A restudy of the original types or topotypes should determine its generic status. *"Valvulina" inflata* FRANKE is probably very similar to *"Globigerina" trochoides. Eggerella columna* FINLAY (1940, *717d), from the uppermost Cretaceous of New Zealand, may possibly belong to the present genus.]

Eggerellina MARIE, 1941, *1215, p. 31 [**Bulimina brevis* D'ORBIGNY, 1840, *1394, p. 41; OD]. Test free, conical or ovoid, triserial, with inflated and embracing chambers; wall agglutinated, of calcareous particles with considerable cement; interior simple; aperture narrow, hook-shaped, interiomarginal and extending short distance up face. *U.Cret.(Senon.)*, Eu.(Fr.).——FIG. 186,*6. E. brevis* (D'ORBIGNY) *conica* MARIE; *6a,b*, top and side views of hypotype, personal collection of P. Marie, no. 6028, Paris (*1215, pl. 7, fig. 70), redrawn, probably microspheric form of *E. brevis* (D'ORBIGNY), ×64 (*2117).

[CUSHMAN (1948, *486, p. 130) regarded D'ORBIGNY's species as a true *Bulimina* with perforate calcareous wall. The wall is agglutinated, but composed of calcareous particles; hence the genera are distinct, and *Eggerellina* is placed with the agglutinated genera. It differs from *Eggerella* in having a high loop- or hook-shaped aperture, instead of a low interiomarginal slit. The aperture thus resembles that of *Hagenowina*, which differs in having secondary septa and a complex interior.]

Eggerina TOULMIN, 1941, *1944, p. 573 [**E. cylindrica*; OD]. Test high trochospiral coil, 3 strongly enveloping chambers to whorl; wall agglutinated, may be of calcareous particles and with much calcareous cement; aperture a low interiomarginal umbilical arch with slight lip. [*Eggerina* differs from *Eggerella* in its elongated chambers along the axis of coiling.] *U.Paleoc.*, USA(Ala.).——FIG. 184,*4. *E. cylindrica; 4a-c*, opposite sides and top view of holotype, redrawn, ×74 (*2117).

Gravellina BRÖNNIMANN, 1953, *229, p. 87 [**G. narivaensis;* OD] [=*Verneuilinella* TAIROV, 1956, *1861, p. 113 (type, *V. azerbaidjanica*)]. Test quadriserial throughout; wall finely agglutinated; aperture an interiomarginal arch. [*Verneuilinella* TAIROV is based on a somewhat more elongate species, but the test shape is not regarded as generic in importance.] *L.Cret.(Apt.)-Mio.*, USSR-W.Indies(Trinidad).——FIG. 186,*7. *G. narivaensis*, Mio., Trinidad; *7a,b*, opposite sides of holotype, redrawn, ×80 (*2117).——FIG. 186,*8. G. azerbaidjanica* (TAIROV), L.Cret., Apt., USSR (Azerbaidzhan); *8a-c*, opposite sides and top view of holotype, ×85 (*1509).

Karreriella CUSHMAN, 1933, *458, p. 34 [**Gaudryina siphonella* REUSS, 1851, *1541, p. 78; OD] [=*Karrerulina* FINLAY, 1940, *717d, p. 450 (type, *Gaudryina apicularis* CUSHMAN, 1911, *404b, p. 69); *Valvotextularia* HOFKER, 1951, *928c, p. 30 (type, *Textularia catenata* CUSHMAN, 1911, *404b, p. 23)]. Test free, elongate, early chambers in trochoid spire of one or more whorls, followed by well-developed biserial stage, which may be slightly twisted about its axis; wall finely agglutinated, smoothly finished; aperture rounded, in terminal face of final chamber, bordered by lip or produced on distinct slender neck. *Paleoc.-Rec.*, cosmop.——FIG. 186,*2,3. *K. siphonella* (REUSS), M.Oligo., Eu.(Ger.); *2a,b*, side and edge views of large microspheric topotype; *3*, side view of megalospheric topotype; all ×40 (*2117).——FIG. 186,*4. K. apicularis* (CUSHMAN), Rec., Pac.O.; *4a,b*, side, top views, ×42 (*200).——FIG. 186, *5. K. catenata* (CUSHMAN), Rec., Pac.O.; *5a-c*, side, base, and top views, ×112 (*2117).

[No generic or subgeneric distinction is recognized for *Karrerulina*, which is here regarded as a synonym of *Karreriella*. FINLAY (1939, *717a, p. 510) placed the type-species of *Valvotextularia, Textularia catenata*, in his genus *Siphotextularia*, stating that it had a typical siphotextularian aperture in the face of the final chamber and produced on a neck. It differs from *Siphotextularia* in having the early trochoid stage of about 4 chambers in the first whorl, hence is here referred to *Karreriella*. *Karreriella* differs from *Dorothia* in having the terminal aperture.]

Mooreinella CUSHMAN & WATERS, 1928, *535, p. 50 [**M. biserialis;* OD]. Test trochospiral in early stage, later irregularly biserial; wall coarsely agglutinated; aperture becoming rounded and terminal in biserial stage. [*Mooreinella* is irregularly biserial in the adult and has a relatively inconspicuous trochospiral development. *Plectotrochammina* differs from it in its highly developed trochospiral stage, and regular but reduced biserial stage, with slitlike areal aperture near the base of the apertural face rather than terminal in position.] *Penn.*, USA(Tex.).——FIG. 185,*6. *M. biserialis; 6a-c*, opposite sides and top view of holotype, ×45 (*2117).

Multifidella LOEBLICH & TAPPAN, 1961, *1181, p. 218 [**Clavulina communis* D'ORBIGNY var. *nodulosa* CUSHMAN, 1922, *411c, p. 85; OD]. Test free, elongate, early portion trochospiral with 4 or 5 chambers to whorl, progressively reducing to triserial, biserial and uniserial, uniserial stage comprising large proportion of adult test; wall finely agglutinated, aperture terminal, cribrate, consisting of variously aligned, elongate slits with bordering lips. [*Multifidella* differs from *Cribrogoesella* in its slender test with elongate uniserial stage and in having a multiple aperture consisting of slits with bordering lips.] *Mio.-Rec.*, Atl.O.-Carib.-W.Indies(Trinidad).——FIG. 185,*4. *M. nodulosa* (CUSHMAN), Rec., Atl.; *4a,b*, side and apert. views of lectotype, × 20 (*2117).

Orientalia N. K. BYKOVA, 1947, *262, p. 229 [**O. exilis;* OD]. Test elongate, early stage trochospiral, with 6 or 7 chambers to whorl, later reduced to quadriserial, with chambers in 4 vertical rows; wall finely agglutinated with large amount of cement; aperture an interiomarginal slit. [*Orientalia* differs from *Dorothia* in its later

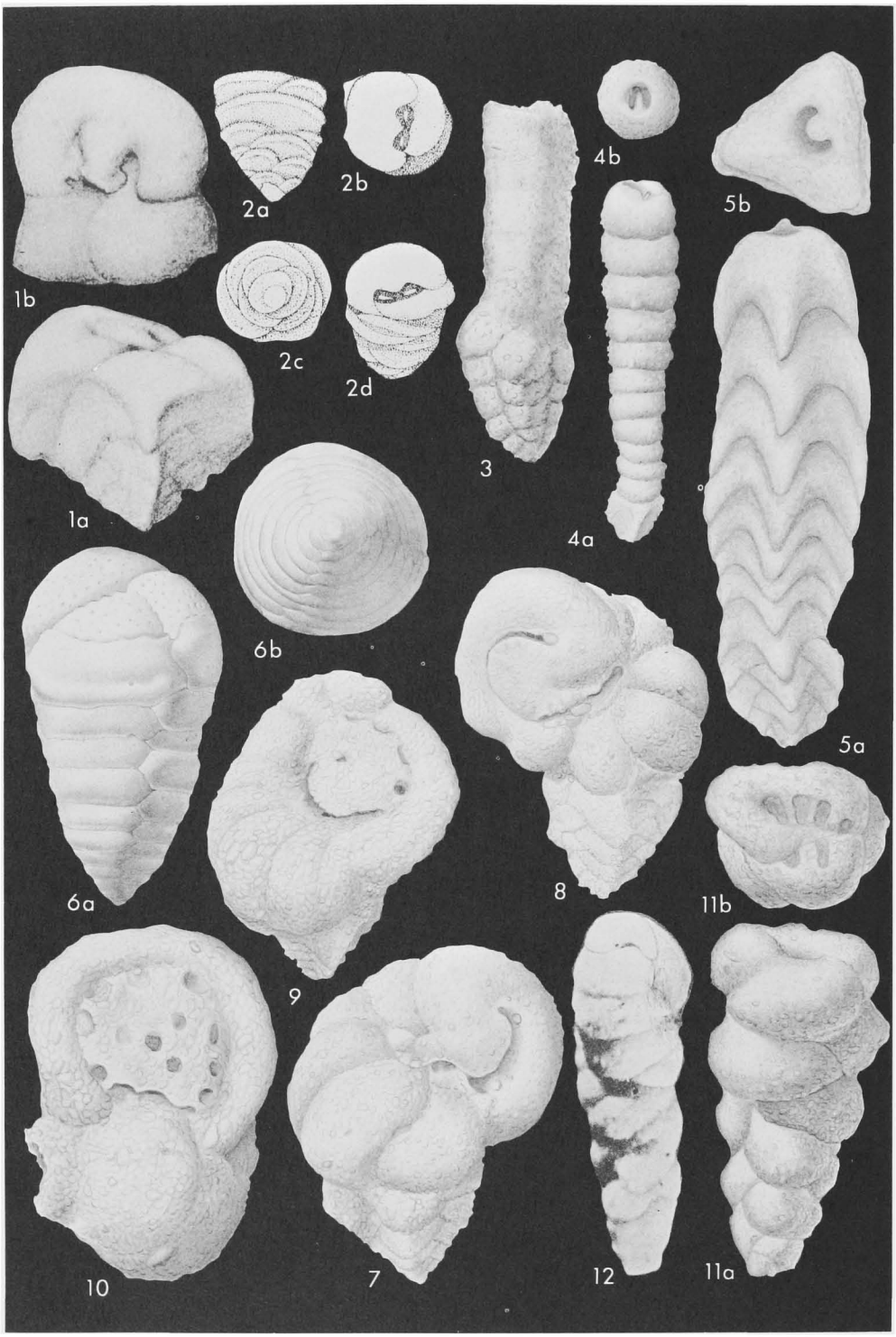

FIG. 187. Ataxophragmiidae (Valvulininae; *1,2, Valvulina; 3-5, Clavulina; 6, Chrysalidina; 7-10, Cribrobulimina; 11,12, Cribroturretoides*) (p. C279-C281).

quadriserial stage, and from *Gravellina* in having an early trochospiral stage of more than 4 chambers in each whorl, rather than being quadriserial throughout.] *U.Cret.(Cenoman.),* USSR (Guzar-Dari, Bukhara).——FIG. 185,*5. *O. exilis; 5a,b,* side and basal views of holotype, ×66 (*262).

Plectotrochammina PARR, 1950, *1429, p. 280 [**P. subglobosa*; OD] [=*Poronaia* UJIIÉ & WATANABE, 1960, *1965, p. 133 (type, *Plectina poronaiensis* ASANO, 1952, *53, p. 33)]. Test free, early chambers in high trochoid spire similar to *Trochammina,* later portion becoming biserial; wall coarsely agglutinated; aperture an arched areal slit, slightly above base of final chamber. [*Poronaia* was also described as trochospiral, as in *Trochammina,* with later biserial stage and was placed in the Eggerellinae. It is here regarded as a junior synonym of *Plectotrochammina* which is transferred to the Globotextulariinae.] *U.Eoc.-Rec.,* Antarctic-Japan. ——FIG. 185,*1. *P. subglobosa,* Rec., Antarctic; *1a,b,* opposite sides showing early trochoid coil followed by pair of biserial chambers; *1c,* view of top of biserial pair of chambers showing aperture, ×25 (*1429).——FIG. 185,*2,3. P. poronaiensis* (ASANO), ?U.Eoc., Japan; *2a-c,* opposite sides and edge showing early trochoid spire; *3,* crushed specimen with well-developed biserial stage; all ×33 (*1965).

Subfamily VALVULININAE Berthelin, 1880

[*nom. transl.* SCHUBERT, 1920, p. 179 (*ex* family Valvulinidae BERTHELIN, 1880)] [=Uvellida SCHULTZE, 1854, p. 52 (*partim*) (*nom. nud.*)]

Three chambers in early whorls, later increasing in number or becoming uniserial; aperture with valvular tooth, interiomarginal at least in early stage, but may become terminal and modified to multiple aperture. *U.Trias.-Rec.*

Valvulina D'ORBIGNY, 1826, *1391, p. 268, 270 [**V. triangularis*; SD PARKER, JONES & BRADY, 1865, *1419, p. 35] [=*Duotaxis* KRISTAN, 1957, *1057, p. 294 (type, *D. metula*)]. Test free, triserial in early stages, may be triangular in section, later may have more than 3 chambers to whorl; wall agglutinated; aperture at base of final chamber, with large valvular tooth. *U.Trias.(Rhaet.)-Rec.,* cosmop.——FIG. 187,*1. *V. triangularis,* Eoc., Eu.(Fr.); *1a,b,* side, top views, ×33 (*471). ——FIG. 187,*2. *V. metula* (KRISTAN), U.Trias. (Rhaet.), Eu.(Aus.); *2a-d,* side, top, base, and oblique views of holotype, ×22 (*1057).

Chrysalidina D'ORBIGNY in DE LA SAGRA, 1839, *1611, p. 109 [**C. gradata*; OD (M)] [=*Pupina* D'ORBIGNY in DE LA SAGRA, 1839, *1611, p. 29 (*non* VIGNARD, 1829)]. Test large, elongate, triserial throughout; wall agglutinated; aperture of numerous pores in terminal face, those of all chambers of last whorl remaining open. [CUSHMAN (1937, *471, p. 54) stated "early stages unknown," and "all of the figures given of the type species are based upon d'Orbigny's originals." The figures here given are of topotype specimens and show the species to be triserial throughout.] *U. Cret.(Cenoman.),* Eu.(Fr.).——FIG. 187,*6. *C. gradata; 6a,b,* side, basal views of topotype, ×12 (*2117).

Clavulina D'ORBIGNY, 1826, *1391, p. 268 [**C. parisiensis*; SD CUSHMAN, 1911, *404b, p. 72] [=*Pseudoclavulina* CUSHMAN, 1936, *468, p. 16 (type, *Clavulina clavata* CUSHMAN, 1926, *423, p. 589)]. Test free, triangular in section, early portion with chambers triserially arranged, later uniserial; chambers numerous, low, broad; wall agglutinated, with much calcareous cement; aperture terminal, rounded, with valvular tooth. [*Clavulina* differs from *Valvulina* in possessing a final uniserial stage and terminal aperture.] *Paleoc.-Rec.,* cosmop.——FIG. 187,*4. *C. parisiensis,* M.Eoc.(Lutet.), Eu.(Fr.); *4a,b,* side, top views, ×35 (*2117).——FIG. 187,*5. *C. angularis* D'ORBIGNY, Rec., Medit.Sea(Corsica); *5a,b,* side, top views of holotype (MNHN, labeled "Tableau Methodique Modèle"), ×48 (*2117).——FIG. 187,*3. *C. clavata* CUSHMAN, Paleoc., Mex.; side view of holotype, ×51 (*2117).

Cribrobulimina CUSHMAN, 1927, *428, p. 80 [**C. mixta* CUSHMAN, 1927 (=*Valvulina mixta* PARKER & JONES, 1865, *1418, p. 438, *nom. nud,* =*Valvulina polystoma* PARKER & JONES, 1865, *1418, p. 437, *nom. nud.,* =*Valvulina* sp. CARPENTER, PARKER & JONES, 1862, *281, p. 146, pl. 11, figs. 19-26); OD]. Test free, early stages triserial and triangular in section, later in loose spiral of 5 or more chambers in each whorl; wall agglutinated, with 2 layers, inner layer distinctly perforated, relatively thick, commonly of calcareous particles embedded in calcareous cement, covered by thin outer layer of quartz sand; aperture in young as in *Valvulina,* in later development platelike tooth attaches to opposite wall and develops series of openings at its margin and others scattered over its surface. *Rec.,* Australia.——FIG. 187, *7-10. *C. mixta; 7,8,* specimens showing valvular tooth with only early indication of pores at its margin; *9,10,* specimens with tooth attached for most of its margin and strong development of pores both at edge and in central area of tooth, ×45 (*2117).

[CARPENTER, PARKER & JONES (1862, *281, p. 146-148) described *Valvulina,* stating (p. 146) that in it all the principal modifications could be referred to "one central type; the *Valvulina triangularis* of d'Orbigny being the form of which the rest may be regarded as varieties." The description of the "varieties" followed, but they gave no name to any of these, other than the generic name of *Valvulina.* In 1865 PARKER & JONES (*1418) used the names *Valvulina polystoma* (table, p. 437) and *Valvulina mixta* (table, p. 438), but without any description. Footnotes referred to the illustrations in CARPENTER, PARKER & JONES (1862, *398, pl. 11, fig. 21, 24 for *V. polystoma* and pl. 11, figs. 19, 20,

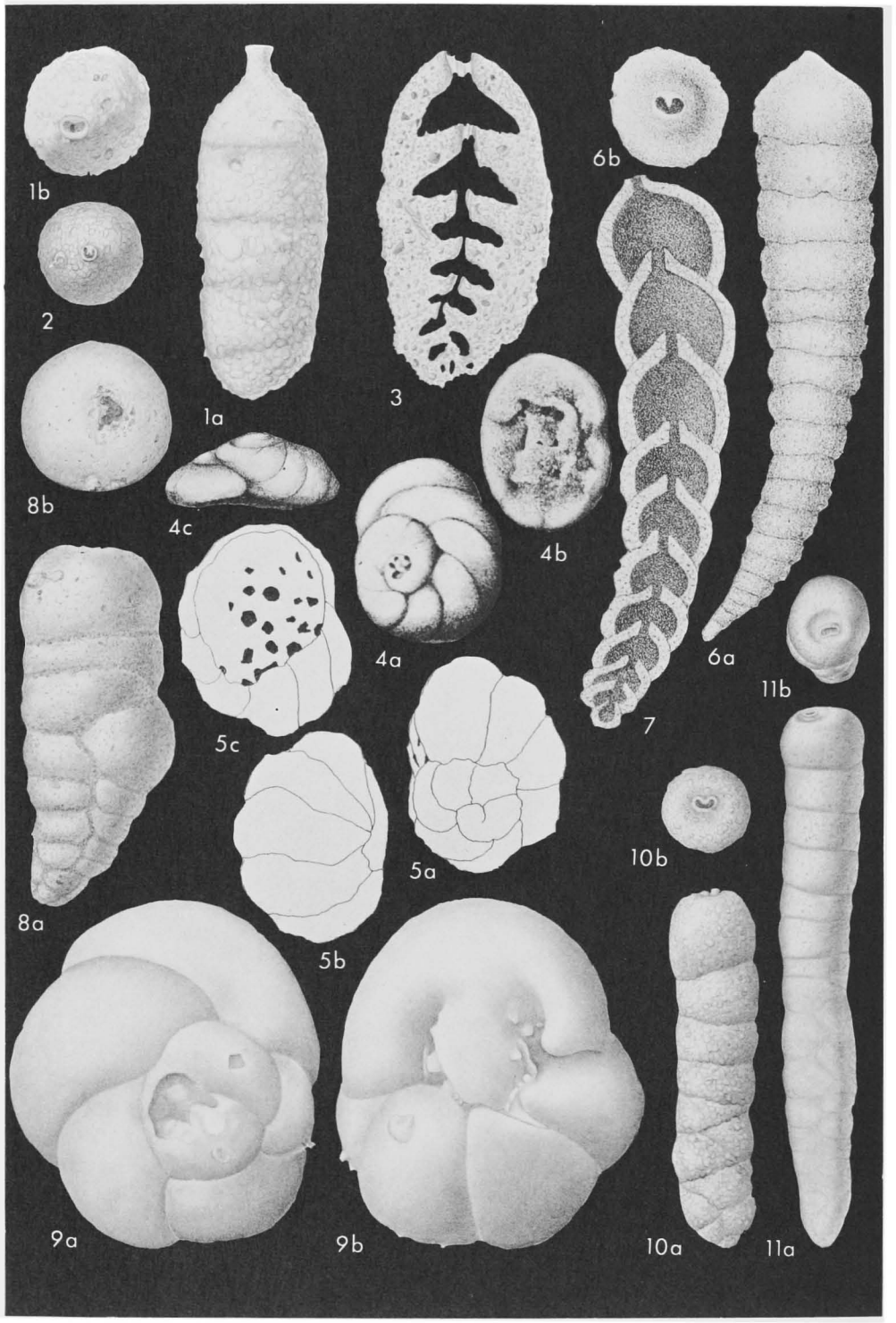

FIG. 188. Ataxophragmiidae (Valvulininae; *1-3, Cylindroclavulina; 4,5, Discorinopsis; 6,7, Dusenburyina; 8, Goesella; 9, Valvulammina; 10,11, Martinottiella*) (p. C281-C283).

25, 26 for *V. mixta*) but did not refer to any description. The descriptions for these species quoted in ELLIS & MESSINA (1940, *700) are from CARPENTER, PARKER & JONES' discussion of unnamed *Valvulina*. Both names were *nomina nuda* in the 1865 publication. The first validated reference to a specific name for this form is apparently that of CUSHMAN (1927, *428), where for the first time a description was given with the specific name. The type-species is therefore correctly cited as *Cribrobulimina mixta* CUSHMAN, 1927. The page priority of *Valvulina polystoma* PARKER & JONES, 1865, over *V. mixta* PARKER & JONES, 1865, accepted by PARR (1932, *1421, p. 6) and CUSHMAN (1937, *471, p. 27) is invalid, as both names were *nomina nuda* in 1865, and *V. polystoma* was not mentioned by CUSHMAN in 1927. A lectotype is here designated for *Cribrobulimina mixta* CUSHMAN (=*Valvulina mixta* PARKER & JONES, 1865, *nom. nud.*) (BMNH-ZF 3591). Paratypes in the British Museum (Natural History) are labeled *Valvulina mixta* PARKER & JONES (BMNH-ZF 3590). A lectotype was also selected and so labeled by us (and is here designated) for *Valvulina polystoma* PARKER & JONES (BMNH-ZF 3593) and paratypes (ZF 3592). All are from Recent shore sands at Melbourne, Australia. The name *Valvulina polystoma* (*nomen nudum*, PARKER & JONES) was validated by PARR (1932, *1421). The two are conspecific. *Cribrobulimina* differs from *Valvulina* in the development of a multiple aperture on the large platelike tooth.]

Cribroturretoides SMITH, 1949, *1799, p. 56 [**C. miocenica;* OD] [=*Neoclavulina* PURI, 1957, *1488, p. 106 (type, *Valvulina intermedia* APPLIN & JORDAN, 1945, *26, p. 134)]. Test free, elongate, triserial, with chambers rounded as in *Verneuilinoides;* wall agglutinated; aperture terminal, cribrate, with few relatively large, irregular openings apparently developed from valvuline tooth. *Eoc.-Mio.,* USA(La.-Fla.).——FIG. 187,*11. *C. miocenica,* Mio., USA(La.); *11a,b,* side, top views of holotype, ×173 (*2117).——FIG. 187, *12. C. intermedia* (APPLIN & JORDAN), M.Eoc., USA(Fla.); side view of holotype, ×30 (*26).

[*Neoclavulina* was stated by PURI to have a terminal rounded or elliptical aperture, "with or without a valvular tooth." The type-species, *Valvulina intermedia,* has a distinct tooth, "which is broadened on mature specimens to form small, rounded, plate-like structure with series of small openings along edge" (*26). As based on the type-species, *Neoclavulina* is thus a junior synonym of *Cribroturretoides.* If other species placed in *Neoclavulina* do not have a valvular tooth, they would not be referrable to the present subfamily, and probably would be assigned to *Verneuilina.*]

Cylindroclavulina BERMÚDEZ & KEY, 1952, *129, p. 76 [**Clavulina bradyi* CUSHMAN, 1911, *404b, p. 73; OD]. Test free, large, robust, cylindrical, earliest portion triserial, then biserial and finally uniserial, with multiserial stage much reduced; wall agglutinated, very thick, leaving much diminished chamber cavity; aperture terminal, produced on distinct neck, with tooth projecting from one margin. [*Cylindroclavulina* differs from *Clavulina* D'ORBIGNY in being cylindrical throughout, rather than triangular in the early triserial stage. Also, *Cylindroclavulina* has a biserial stage between the triserial and uniserial stages.] *Oligo.-Rec.,* Pac.O. - Eu.(Hung.-Italy).——FIG. 188,*1-3. **C. bradyi* (CUSHMAN), Rec., Pac.; *1a,b,* side, top views of holotype, ×24 (*2117); *2,* top view showing well-developed tooth, ×14; *3,* sectioned specimen showing thick wall, ×10 (*200).

Discorinopsis COLE, 1941, *357, p. 36 [**D. gunteri;* OD] [=*Arenagula* BOURDON & LYS, 1955, *177, p. 336 (type, *A. globula*); *Arenaglobula* THALMANN, 1958, *18971, p. 752 (obj.) *(nom. null.)*]. Test low, spiral, early stage with about 5 chambers to each whorl, increasing to as many as 7 chambers in final whorl of microspheric form with early development as in *Valvulammina;* wall agglutinated, of calcareous particles in calcareous cement; aperture umbilical in young, with broad valvular tooth, which in adult becomes attached and perforated throughout with large openings, as in *Cribrobulimina. M.Eoc.-Oligo.,* USA(Fla.)-Eu.(Fr.).——FIG. 188,*4. *D. gunteri,* M.Eoc., USA (Fla.); *4a-c,* opposite sides and edge of holotype showing low multilocular spire and cribrobulimine aperture, ×10 (*357).——FIG. 188,*5. D. globula* (BOURDON & LYS), Oligo.(Stamp.), Fr.; *5a-c,* opposite sides and edge, showing low spire and multiple aperture, ×24 (*177).

[*Discorinopsis* was originally described as calcareous and related to *Discorbis.* Thin sections of the type-species made by us showed it to be agglutinated (*1162, p. 117), and it is here placed with the Valvulininae. The species described as *Valvulina floridana* COLE, 1941, from the same sample as the type-specimens of *D. gunteri,* is probably a young megalospheric form of this species, being smaller, with only 3 chambers in each whorl and with a simple valvular tooth. *Discorinopsis* has an apertural development as in *Cribrobulimina* but differs from that genus in having a low trochospiral coil, whereas *Cribrobulimina* has an early triserial and triangular, high-spired stage and a later stage with many chambers in a whorl. *Arenagula* is identical in all characteristics to *Discorinopsis* as here redefined on the basis of the type-species.]

Dusenburyina BERMÚDEZ & KEY, 1952, *129, p. 73 [**Clavulina procera* GOËS, 1889, *802, p. 9; OD]. Test free, elongate, uniserial, rounded in section; wall agglutinated, of calcareous particles with considerable cement; aperture terminal, rounded to ovate, with projecting tooth that, when relatively broad, may appear semilunate. [*Dusenburyina* differs from *Reophax* in possessing an apertural tooth. It differs from *Clavulina* D'ORBIGNY in lacking an early triserial development and in being uniserial throughout.] *Rec.,* Carib.——FIG. 188,*6,7. **D. procera* (GOËS); *6a,b,* side, apert. views of microspheric specimen; *7,* sectioned megalospheric specimen, ×8 (*801).

Goesella CUSHMAN, 1933, *458, p. 34 [**Clavulina rotundata* CUSHMAN, 1913, *406, p. 635; OD]. Test elongate, early stage with 4 or 5 chambers in whorl, then progressively reduced to triserial, biserial, and finally uniserial; wall thick, agglutinated, of fine sand with considerable cement; aperture terminal, rounded or irregular, with tooth projecting from one side. *U.Cret.(Senon.)-Rec.,* cosmop.——FIG. 188,*8. **G. rotundata* (CUSHMAN), Rec., Philip. Is.; *8a,b,* side and top views of holotype (redrawn), ×20 (*2117).

[*Goesella* differs from *Martinottiella* in having a rounded aperture with a tooth instead of a slitlike or arcuate aperture, with bordering lip or produced neck. The uniserial development is commonly more pronounced in *Martinottiella,* resulting in a narrower, more elongate test. The original description of *Goesella* did not mention the apertural tooth, but this is seen in the holotype of the type-species, as well as in many others. Species such as *G. parri* CUSHMAN should be placed in *Martinottiella,* as they have a slitlike or arcuate aperture, and slender test with pronounced uniserial development.]

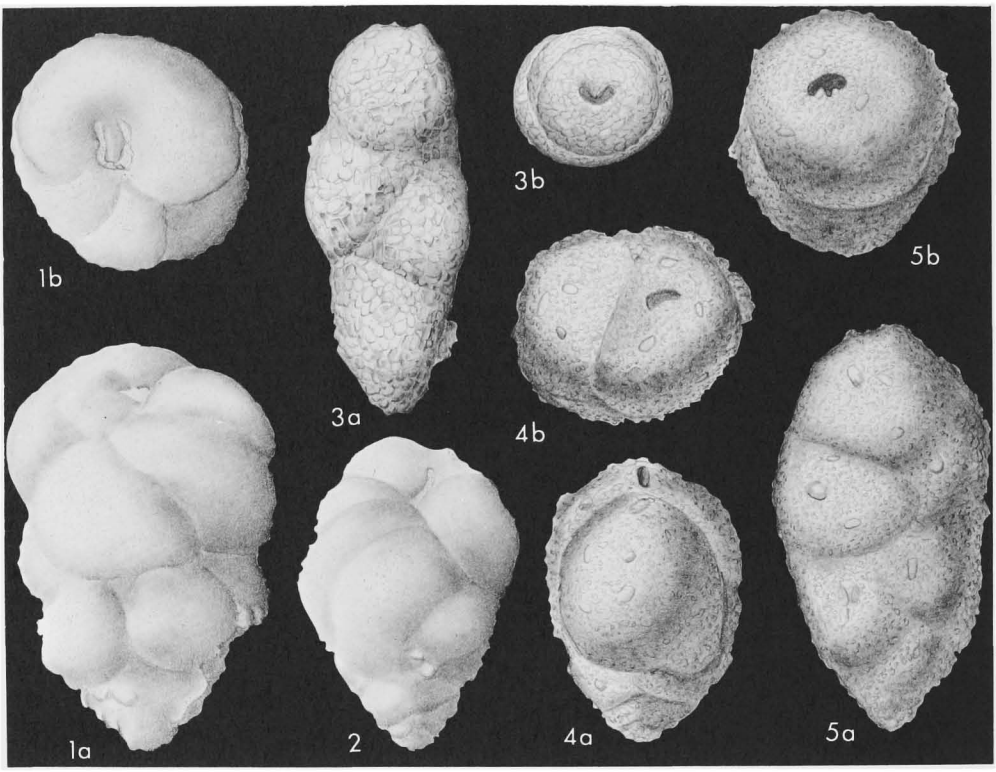

FIG. 189. Ataxophragmiidae (Valvulininae; *1,2, Makarskiana; 3-5, Plectina*) (p. C282-C283).

Makarskiana VAN SOEST, 1942, *1808, p. 27 [**M. trochoidea;* OD]. Similar to *Valvulammina* in having 4 or 5 chambers in early whorls, later with 3 or 4, but differs in having high trochospiral coil; aperture with small narrow valvuline tooth. *Eoc.,* Eu.(Yugo., Dalmatia).——FIG. 189, *1,2. *M. trochoidea; 1a,b,* side, top views of holotype (redrawn); *2,* paratype, all ×32 (*2117).

Martinottiella CUSHMAN, 1933, *458, p. 37 [**Clavulina communis* D'ORBIGNY, 1826, *1391, p. 268; OD] [=*Listerella* CUSHMAN, 1933, *458, p. 36 (type, *Clavulina primaeva* CUSHMAN, 1913, *406, p. 635) (*non Listerella* JAHN, 1906); *Schenckiella* THALMANN, 1942, *1900, p. 458 (type, *Clavulina primaeva* CUSHMAN, 1913, *406, p. 635) (*nom. subst. pro Listerella* CUSHMAN, 1933, *non* JAHN, 1906)]. Test free, elongate, cylindrical, early chambers trochospiral with 4 or 5 to whorl, progressively reduced to triserial, biserial, and uniserial, adult with relatively elongate uniserial development; wall finely agglutinated; aperture terminal, elongate slit, commonly arcuate, with bordering lip. *Paleoc.-Rec.,* cosmop.——FIG. 188,*10. *M. communis* (D'ORBIGNY), Rec., Eu.(Italy); *10a,b,* side, top views of hypotype, ×28 (*2117). ——FIG. 188,*11. M. primaeva* (CUSHMAN), Rec., Pac.O.; *11a,b,* side, top views of holotype, ×28 (*2117).

[*Martinottiella* differs from *Goesella* in its more pronounced uniserial development and resultant elongate test, and in having a slitlike aperture with bordering lip, rather than a depressed rounded aperture with projecting tooth. CUSHMAN (1937, *471, p. 138) placed *Martinottiella* in the synonymy of *Listerella,* stating that their type-species were congeneric. In 1942, THALMANN (*1900) noted that *Listerella* CUSHMAN was a homonym of *Listerella* JAHN and proposed *Schenckiella* as a replacement name. CUSHMAN (1947, *485, p. 48) recognized both *Schenckiella* and *Martinottiella,* using the latter name for "those species, formerly placed under *Listerella,* in which the biserial stage is much reduced or wanting." As the proportionate length of the biserial stage is quite variable in many species, *Martinottiella* is here regarded as the valid name and *Schenckiella* is suppressed as a junior synonym.]

Minouxia MARIE, 1955, *1220, p. 119 [**M. gumbelitrioides;* OD] [=*Bermudezita* SEIGLIE, 1961, *1715, p. 342 (type, *B. borroi*)]. Test triserial throughout; wall agglutinated; primary aperture interiomarginal, umbilical region covered by trematophore (separate plate with numerous perforations). [The original illustrations of this genus appear similar to *Chrysalidina* but the aperture is described as having a distinct trematophore plate; the genus therefore is recognized on that basis until type material can be examined.] *U.Cret. (Dordon.),* Eu.(Fr.)-W.Indies(Cuba). —— FIG. 190,*1. *M. gumbelitrioides,* Fr.; *1a-c,* opposite sides and apert. view, ×85 (*1220).——FIG. 190, *2. M. dordonica* MARIE, Fr.; side view, ×54 (*1220).

Plectina MARSSON, 1878, *1228, p. 160 [**Gaudryina ruthenica* REUSS, 1851, *1542, p. 41; SD CUSHMAN, 1928, *439, p. 127] [=*Arenodosaria* FINLAY, 1939, *717b, p. 95 (type, *Clavulina robusta* STACHE, 1865, *1825, p. 169)]. Test elongate, up to 5 chambers to whorl in early stage, later reducing to loosely biserial; wall agglutinated, with considerable cement; aperture interiomarginal in early stage, later terminal, rounded, with small valvular tooth. [*Arenodosaria* was regarded as being uniserial in final development, but the type-species of *Plectina* and *Arenodosaria* both are loosely biserial to nearly uniserial with cuneate chambers, not truly rectilinear and uniserial. The two generic names are regarded as synonymous.] *U.Cret.(Senon.)-Rec.*, cosmop.——FIG. 189,*3*. **P. ruthenica* (REUSS), U.Cret.(Senon.), Eu.(Ger.); *3a,b*, side, top views of hypotype, ×32 (*2117). ——FIG. 189,*4,5*. *P. robusta* (STACHE), L.Oligo., N.Z.; *4a,b*, *5a,b*, side, top views, ×32 (*2117).

Valvulammina CUSHMAN, 1933, *458, p. 37 [**Valvulina globulosa* D'ORBIGNY, CUSHMAN, 1933 *err. pro Valvulina globularis* D'ORBIGNY, 1826, *1391, p. 270; OD]. Test low trochospiral coil, with more than 3 chambers to whorl, ventral side umbilicate; wall agglutinated, of calcareous fragments in calcareous cement with pseudochitinous lining in at least early portion; aperture umbilical, partially covered by large rounded tooth. [*Valvulammina* differs from *Valvulina* in having more than 3 chambers to a whorl throughout development and in its low trochospiral coil.] *Paleoc., ?Mio.*, N.Am.-Carib.-Eu.(Fr.).——FIG. 188,*9*. **V. globularis* (D'ORBIGNY); Eoc., Fr.; *9a,b*, opposite sides, ×50 (*2117).

Subfamily ATAXOPHRAGMIINAE Schwager, 1877

[*nom. transl.* GALLOWAY, 1933, p. 211 (*ex* family Ataxophragmidea SCHWAGER, 1877)]

Early stage with 3 or more chambers in each whorl but increasing in number with growth or uncoiling and spreading to form low conical test; interior with internal pillars and partitions. *L.Cret.-Rec.*

Ataxophragmium REUSS, 1860, *1546, p. 52 [**Bulimina variabilis* D'ORBIGNY, 1840, *1394, p. 40; SD CUSHMAN, 1928, *439, p. 129] [=*Pernerina* CUSHMAN, 1933, *456, p. 19 (type, *Bulimina depressa* PERNER, 1892, *1445, p. 55); *Ataxogyroidina* MARIE, 1941, *1215, p. 53, 255, 258 (obj.)]. Test free, trochospiral, tending to become streptospiral in coiling; chambers low and broad, with internal partitions; wall agglutinated; aperture interiomarginal slit or loop, umbilical in position. *U.Cret.(Cenom.-Maastricht.)*, Eu.——FIG. 191,*1,2*. **A. variabile* (D'ORBIGNY), Senon., Eng.; *1a,b*, edge, apert. views of hypotype, ×50; *2a-c*, opposite sides and apert. view of hypotype (P. MARIE Coll. 6051), Senon., Fr.; ×39 (*2117).——FIG. 191,*3,4*. *A. depressum* (PERNER), Cenoman., Czech. *(3)*, Turon., Ger. *(4)*; *3a-c*, side, edge, apert. views of topotype, ×45 (*2117); *4*, apert. view of hypotype, abraded to show internal partitions, ×45 (*2117).

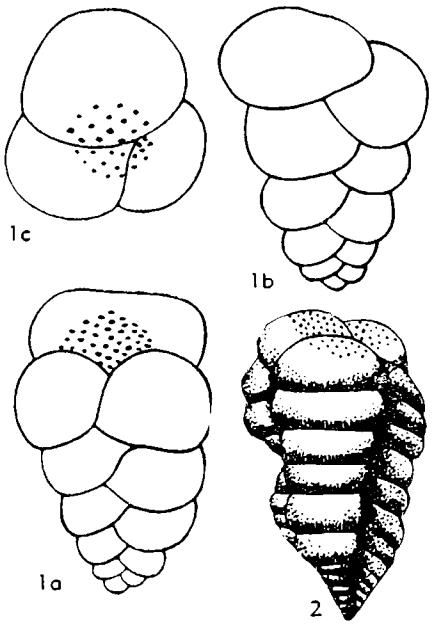

FIG. 190. Ataxophragmiidae (Valvulininae; *1,2*, *Minouxia*) (p. *C*282).

[The nomenclature of this form has been confused in the past, and specimens with simple interior, as well as those with internal partitions, have been variously referred to the type-species, as have both enrolled and uniserial forms. At least 3 revisions have been made which resulted in the description of new generic names for one or another of these forms, but as the type-species was not firmly based, the results were not conclusive. D'ORBIGNY described *Bulimina variabilis* in 1840, stating that it was extremely variable in form, figuring 3 specimens. It was stated to be common at Sens, rare at Meudon and Saint Germain, and in England. Of specimens figured, that shown on his plate 4, fig. 9, 10 (*1394) was stated to be a "regular individual" (figures reproduced by CUSHMAN, 1937, *471, pl. 21, figs. 10a,b), that in fig. 11 regarded as a deformed individual, and that in fig. 12 stated to be an exaggerated form of the type of fig. 11. As the original of figs. 9, 10 was regarded as the normal form, it is here designated as lectotype. The uncoiled specimens, such as D'ORBIGNY's fig. 12, were stated by MARIE (1941, *1215, p. 54) to belong to a different species and genus *(Orbignyna)*, although these dissimilar forms have been repeatedly referred to the same species. Of the specimens illustrated by CUSHMAN (1937, *471, pl. 21) as *Ataxophragmium variabile*, those of figs. 10 and 13 are definitely *A. variabile;* those of figs. 11 and 15 and possibly 14 are *Orbignyna*. Noting that 2 forms were originally included by D'ORBIGNY, and referring the uncoiled specimens to *Orbignyna*, MARIE (1941) proposed *Ataxogyroidina* as a new generic name for the close-coiled specimens but designated *Bulimina variabilis* D'ORBIGNY as type-species. Hence *Ataxogyroidina* is a junior isogenotypic synonym of *Ataxophragmium*. BARNARD in BARNARD & BANNER (1953, *88, p. 177, 206) recognized the generic name *Ataxogyroidina* for specimens without internal partitions and *Arenobulimina* for those with internal partitions, although this is exactly contrary to conditions shown in the type-species and descriptions of the 2 forms. MARIE's original definition of *Ataxogyroidina* (*1215, p. 53) stated (translation) that the chambers were "occupied in their interior by a series of buttresses, more or less developed, localized at the contact of the suture below." Furthermore, *Ataxophragmoides* BROTZEN, 1948, was described for forms without internal partitions but

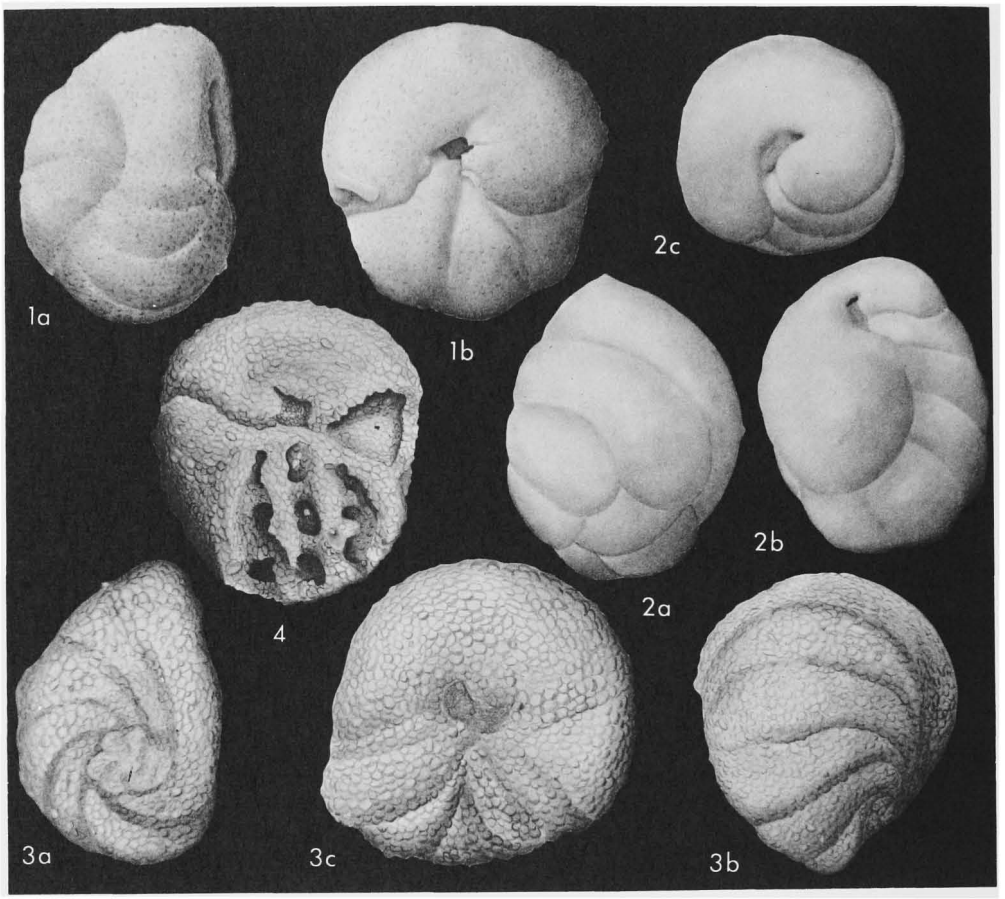

FIG. 191. Ataxophragmiidae (Ataxophragmiinae; *1-4, Ataxophragmium*) (p. C283-C284).

superficially similar to *Ataxophragmium*. VOLOSHINOVA & BALAKHMATOVA in RAUZER-CHERNOUSOVA & FURSENKO (1959, *1509, p. 226-227) recognize *Arenobulimina* and *Ataxophragmium* as having simple chambers, and *Pernerina* and *Orbignyna* with internal partitions, and proposed *Beisselina* (a homonym of *Beisselina* CANU, 1913) for the uncoiled forms with internal partitions. As here redefined on the basis of their type-species, *Ataxophragmium* (with *Pernerina* and *Ataxogyroidina* as synonyms) includes coiled species with internal chamber partitions and interiomarginal aperture; *Arenobulimina* (with *Ataxophragmoides* as a synonym) includes similar forms without internal partitions; *Orbignyna,* partially uncoiled, with partitions and a terminal aperture, and *Voloshinovella* LOEBLICH & TAPPAN (*nom. nov. pro Beisselina* VOLOSHINOVA & BALAKHMATOVA, 1959, *non Beisselina* CANU, 1913) include forms with internal partitions, later completely uncoiled and rectilinear stage and terminal aperture.]

Camagueyia COLE & BERMÚDEZ, 1944, *1370, p. 335 [**C. perplexa;* OD]. Early stage trochospiral, later with fewer chambers to whorl; wall thick, finely agglutinated, with considerable cement, septa not completely extending across test, as vertical pillars fill central area; aperture terminal, in center of truncate apertural face, with inward-projecting teeth, as in *Tritaxilina*. [*Camagueyia* is poorly known from original materials and needs further study. No information is available as to number of chambers in a whorl or changes in development. It was originally placed in the Valvulinidae but is here tentatively transferred to the Ataxophragmiinae because of the presence of vertical pillars.] *M.Eoc.,* W.Indies(Cuba).——FIG. 192,*1,2*. **C. perplexa; 1a-d,* ext. of 4 cotypes, ×10; *2,* axial sec. of "paratype," ×41 (*370).

Coprolithina MARIE, 1941, *1215, p. 37 [**C. subcylindrica*; OD]. Test free, subcylindrical, trochospirally coiled in single whorl in early stage, forming bulbous base, though with little external evidence of coil, later with cylindrical uniserial portion, with diameter nearly equal to that of coil; chambers subdivided internally by 8 to 14 vertical radial partitions, extending inward from wall approximately half the distance to center; sutures in early portion indistinct, later ones slightly depressed and horizontal; wall thick, coarsely agglutinated, with much calcareous cement; aperture in early stage comprising interiomarginal slit, multiple in adult, consisting of 5 or 6 rounded pores in central portion of terminal face. [*Coprolithina* differs from *Orbignyna* in having a multiple aperture instead of a single large, central

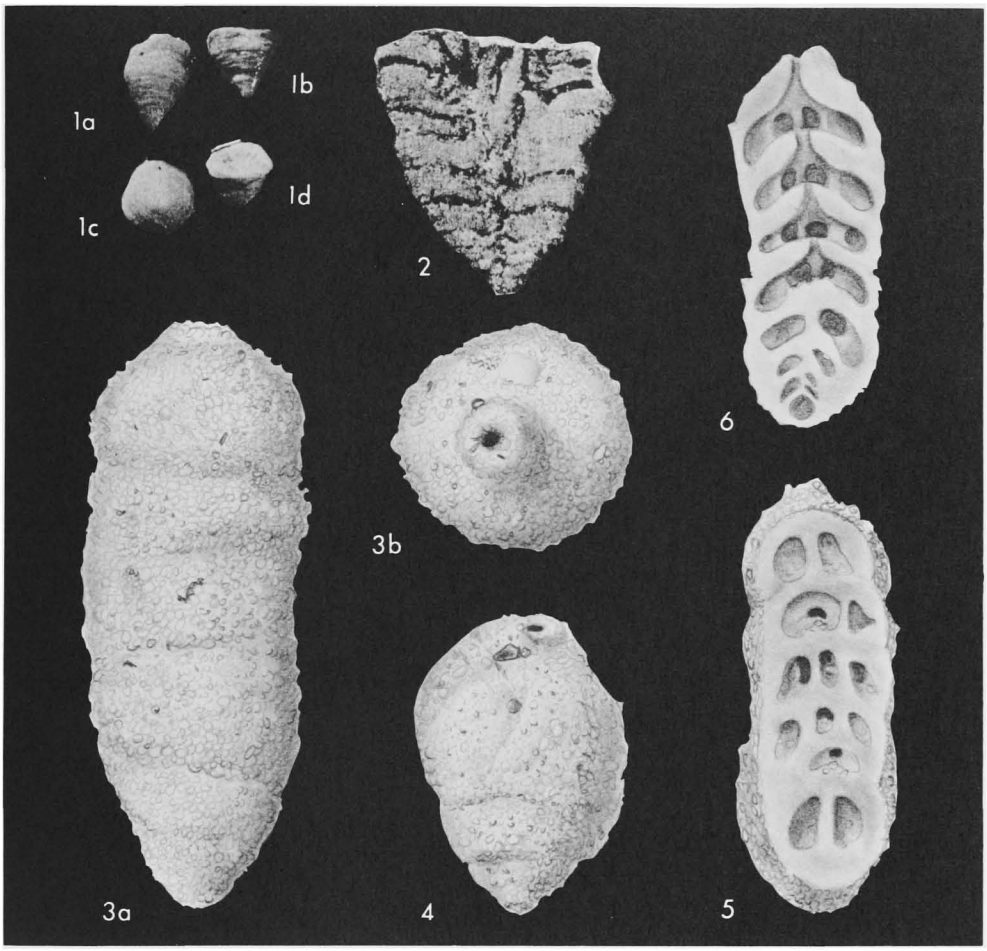

FIG. 192. Ataxophragmiidae (Ataxophragmiinae; *1,2, Camagueyia; 3-6, Cubanina*) (p. C284-C285).

aperture in a terminal depression.] *U.Cret. (Senon.),* Eu.(Fr.-Eng.).——FIG. 193,*3-5*. **C. subcylindrica,* Fr. *(3),* Eng. *(4,5)*; *3a,b,* side, top views of holotype (P. MARIE Coll., Paris), ×20; *4,5,* horiz. and long. sectioned hypotypes, ×22 (*2117).

Cubanina PALMER, 1936, *1409, p. 123 [**C. alavensis;* OD]. Test elongate, early portion triserial, later uniserial, as in *Clavulina,* but with interior of chambers partially subdivided by narrow vertical partitions projecting somewhat inward from agglutinated wall; aperture terminal, rounded, somewhat produced. [*Cubanina* differs from *Matanzia* in the uniserial, rather than biserial, final stage.] *L.Oligo.,* W.Indies(Cuba).——FIG. 192,*3-6*. **C. alavensis; 3a,b,* side, top views of lectotype (here designated, USNM 498772); *4,* side view of juvenile paratype (USNM 498773); *5,6,* tang. and axial long. secs. of paratypes (USNM 498849, 498850) showing internal partitions, ×30 (*2117).

Cuneolina D'ORBIGNY in DE LA SAGRA, 1839, *1611, p. 150 [**C. pavonia* D'ORBIGNY, 1846, *1395, p. 253; SD (SM)] [=*Cuneolinella* CUSHMAN & BERMÚDEZ, 1941, *492, p. 101 (type, *C. lewisi*)]. Test subcylindrical to flabelliform, trochospiral in early stage, later with arcuate biserially arranged chambers, increasing rapidly in size in plane of biseriality; internal structure as in *Dicyclina;* wall agglutinated, with considerable cement and imperforate outer layer; aperture series of rounded interiomarginal openings. *L.Cret.(Alb.)-Mio.,* Eu.-N. Am.-C. Am. - SW. Asia - W. Indies(Dominican Rep.).——FIG. 193,*1*. **C. pavonia,* U.Cret. (Cenoman.), Fr.; *1a,b,* side, edge views of topotype, ×48 (*2117).——FIG. 193,*2*. *C. lewisi* (CUSHMAN & BERMÚDEZ), Mio., Dominican Republic; *2a-c,* side, basal, apert. views of paratype, ×7 (*2117). [See also Fig. 210.]

Dictyopsella MUNIER-CHALMAS in SCHLUMBERGER, 1900, *1660, p. 462 [**D. kiliani;* SD CUSHMAN, 1928, *439, p. 111]. Test trochospiral; chambers

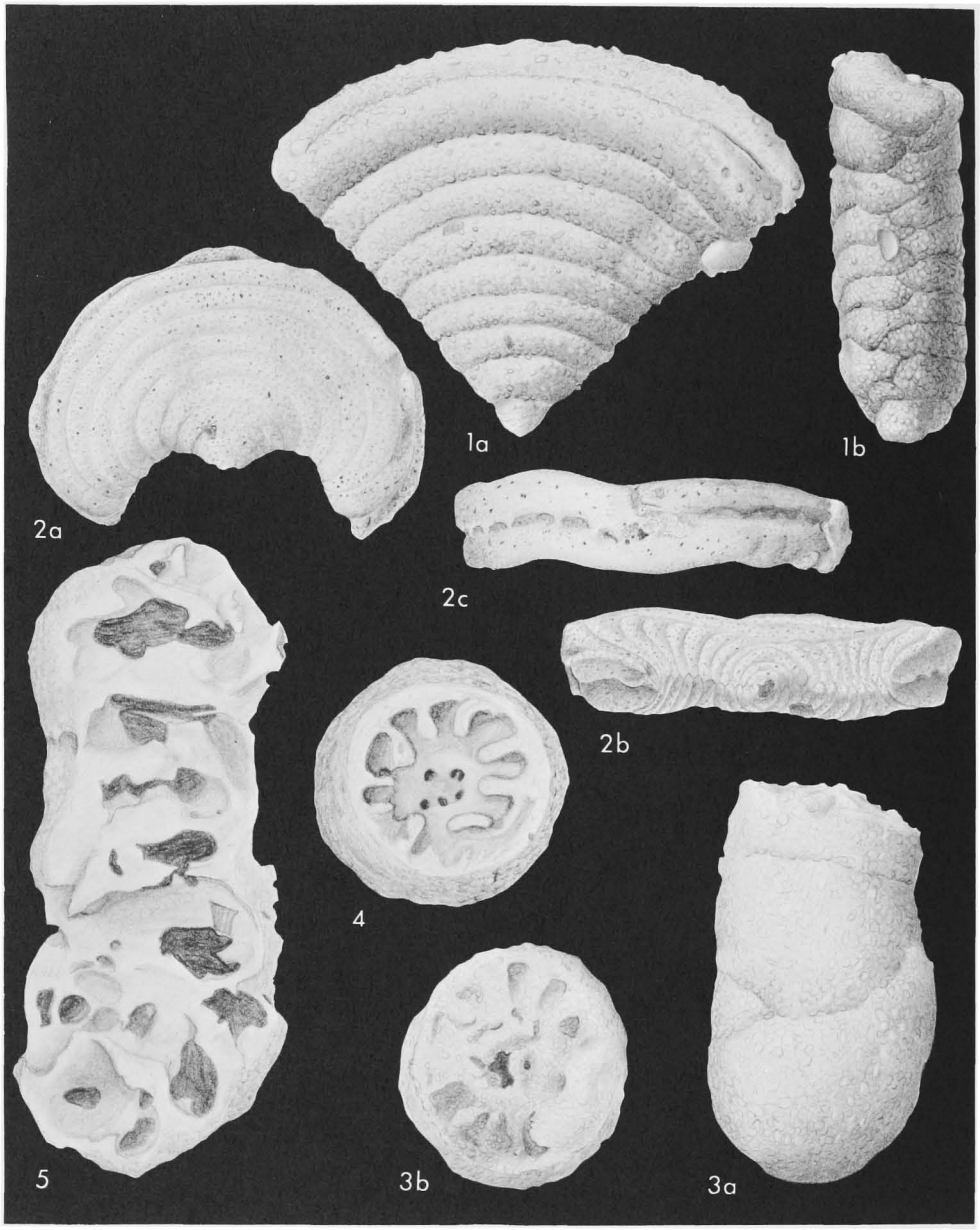

FIG. 193. Ataxophragmiidae (Ataxophragmiinae; *1,2, Cuneolina; 3-5, Coprolithina*) (p. C284-C285).

subdivided by secondary radial partitions between radial septa and partial transverse subepidermal partitions giving superficially cancellate appearance; wall largely of calcareous material, probably agglutinated calcareous particles, with some extraneous material in outer layer; aperture umbilical, interiomarginal. *U.Cret.(Cenoman.-Santon.)*, Eu.(Sp.)-Asia(Arabia).——FIG. 194,*1-3*. **D. kiliani*, Santon., Sp.; *1a-c*, opposite sides and edge of topotype, *1a*, ×33, *1b,c*, ×34 (*2117); *2,3*, long. and transv. secs., ×33 (*1660).

Hagenowina LOEBLICH & TAPPAN, 1961, *1182, p. 242 [**Valvulina quadribullata* VON HAGENOW, 1842, *858, p. 570; OD]. Test trochospiral, 3 or more chambers to whorl as in *Eggerella*, but with interior subdivided by partial radial partitions similar to those of *Ataxophragmoides* and *Orbignyna*; aperture interiomarginal slit, with indistinct tooth. *U.Cret.(U.Senon.)*, Ger.(Rügen).——FIG. 194,*4,5*. **H. quadribullata* (VON HAGENOW), topotypes (USNM, CUSHMAN Coll. 21213) previously illustrated as *Hagenowella gibbosa*, redrawn; *4a,b*,

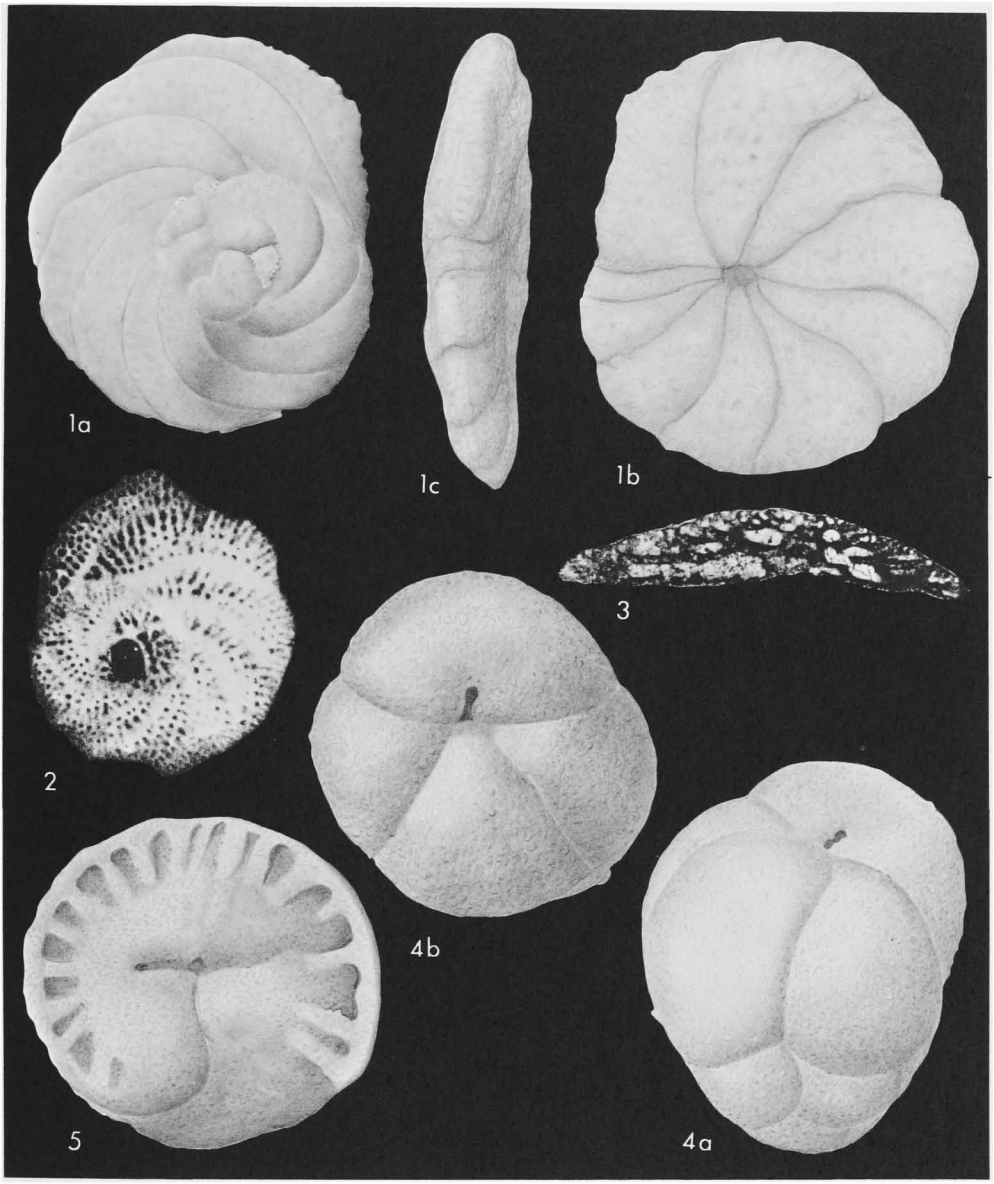

FIG. 194. Ataxophragmiidae (Ataxophragmiinae; *1-3, Dictyopsella; 4,5, Hagenowina*) (p. C285-C287).

side, apert. views; *5,* sectioned specimen showing internal partitions, ×49 (*2117).

[*Hagenowina* includes forms referred to *Hagenowella* that show internal radial partitions. The type-species of *Hagenowella* (*Valvulina gibbosa* D'ORBIGNY, 1840) has a simple interior cavity and thus is referred to *Arenobulimina*. Specimens referred to *Hagenowella gibbosa* from England and France must be checked internally to determine whether they should be placed in species of *Hagenowina* or *Arenobulimina*.]

Jarvisella BRÖNNIMANN, 1953, *229, p. 88 [**J. karamatensis;* OD]. Test trochospirally coiled in early stage, becoming triserial in adult; chambers partially subdivided by vertical infolding of walls at lower edge; wall finely agglutinated, thin; aperture interiomarginal arch with bordering lip. [*Jarvisella* is similar in general appearance to *Remesella* but is triserial rather than biserial in the adult.] *Oligo.-Mio.,* W.Indies(Trinidad).—— FIG. 195,*1,2. *J. karamatensis; 1a-d,* opposite sides, base and top of holotype, ×80 (*2117); *2,* specimen with outer wall removed to show infolding of basal portion of chamber walls, ×24 (*229).

Liebusella CUSHMAN, 1933, *458, p. 36 [**Lituola soldanii* JONES & PARKER, 1860, *998, p. 307; OD]. Test with early trochospiral portion of 4 or 5 chambers to whorl, rapidly reducing to uniserial in adult; interior of chambers subdivided by ra-

dial vertical partitions; wall coarsely agglutinated, commonly of calcareous particles; aperture terminal, slightly produced and may be irregular or multiple. [*Liebusella* differs from *Tritaxilina* in its coarse-textured, homogeneous wall, rather than distinctly perforate wall.] *Eoc.-Rec.*, Eu.-N.Am.-

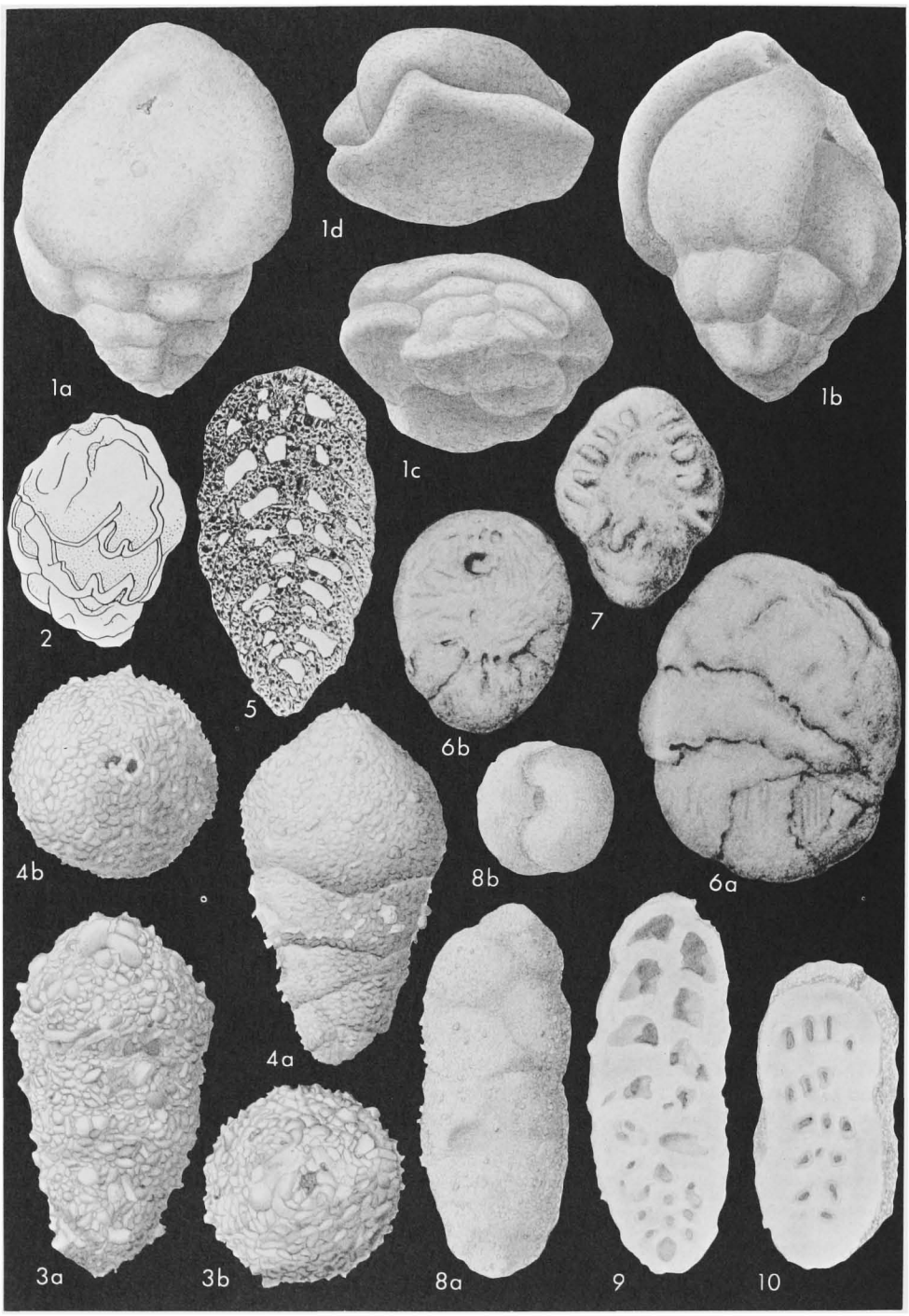

FIG. 195. Ataxophragmiidae (Ataxophragmiinae; *1,2, Jarvisella; 3-5, Liebusella; 6,7, Orbignyna; 8-10, Matanzia*) (p. C287-C290).

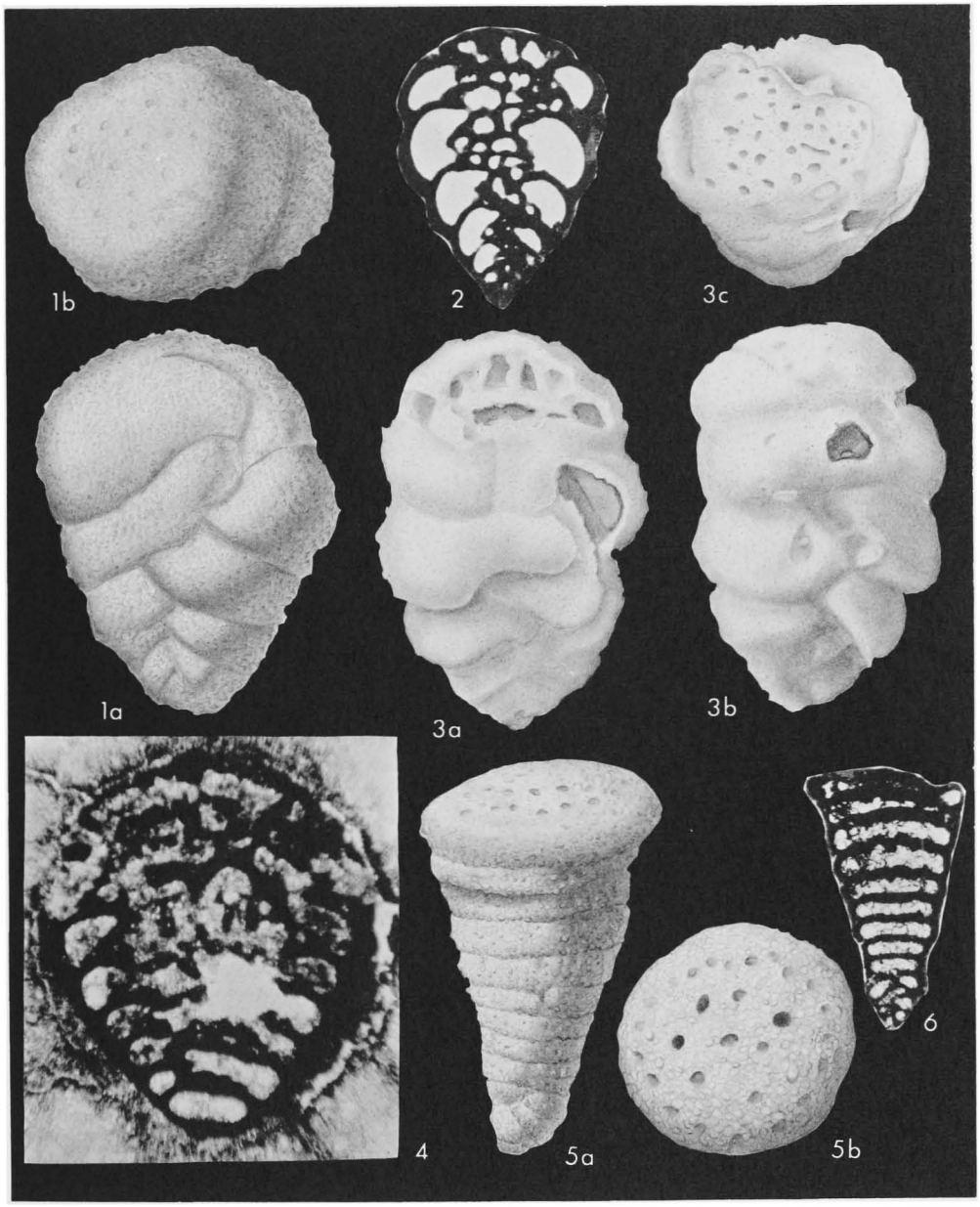

FIG. 196. Ataxophragmiidae (Ataxophragmiinae; *1-4, Pseudochrysalidina; 5,6, Pseudolituonella*) (p. C290).

W.Indies-Pac.O.-N.Z.-Australia. —— FIG. 195,*3-5*. **L. soldanii* (JONES & PARKER), Mio., Jamaica *(3)*, Rec., Cuba *(4)*, Rec., Carib. *(5)*; *3a,b*, side, top views of hypotype, ×23; *4a,b*, side, top views, ×23; *5*, sectioned specimen, ×10 (*2117).

Matanzia PALMER, 1936, *1409, p. 125 [**M. bermudezi;* OD]. Test trochospiral in early stages, later reducing to biserial; chambers partially subdivided internally by vertical partitions projecting inward from outer wall; wall agglutinated, of calcareous particles in considerable cement; aperture interiomarginal. *L.Oligo.-Mio.*, Carib.(Cuba)-?N.Z.——FIG. 195,*8-10*. **M. bermudezi*, L.Oligo., Cuba; *8a,b*, side, top views of lectotype (here designated, USNM 498771, specimen figured by PALMER); *9,10*, sectioned paratypes (USNM 498845, 498847), ×29 (*2117).

Orbignyna VON HAGENOW, 1842, *858, p. 573 [**O. ovata;* OD (M)] [=*Orbignyina* BRONN, 1853, *214a, p. 84 *(nom. van.)*].Early stage planispiral,

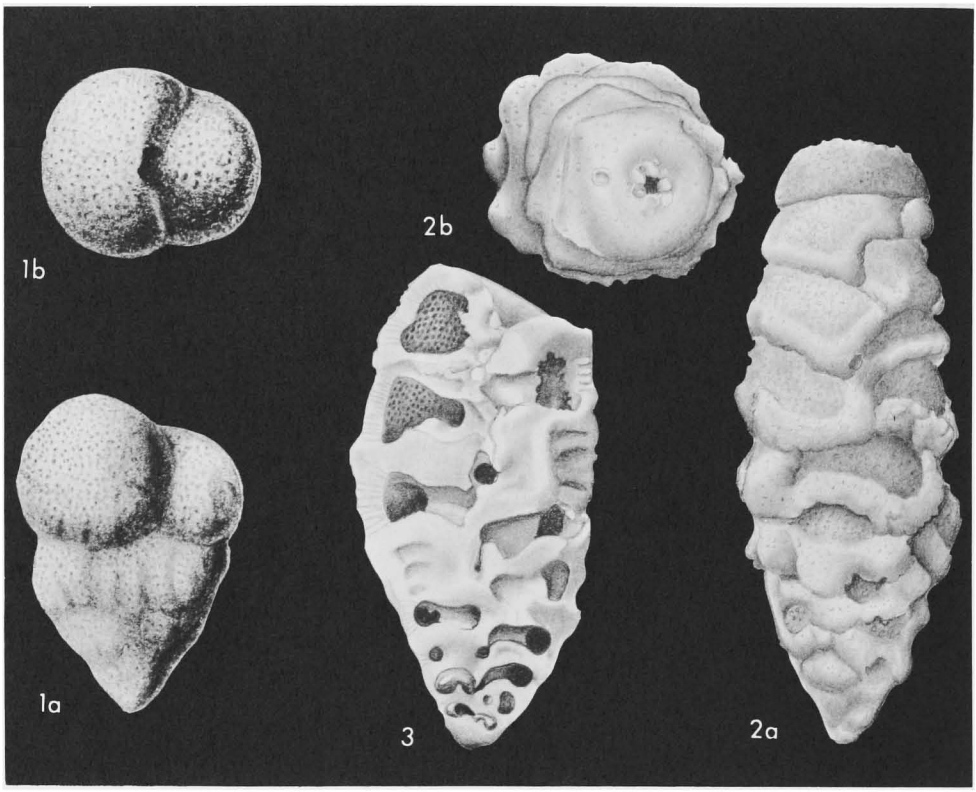

FIG. 197. Ataxophragmiidae (Ataxophragmiinae; *1, Remesella; 2,3, Tritaxilina*) (p. C290-C291).

later somewhat uncoiling, but compressed and not completely uncoiled; interior of chambers subdivided by vertical radial partitions extending inward from outer agglutinated wall, which may include calcareous particles and shell fragments; aperture interiomarginal in earliest coiled stage and rounded or irregular areal opening in adult. *U.Cret.(U.Senon.-Maastricht.),* Eu.——FIG. 195, *6,7. *O. ovata,* Maastricht., Ger.; *6a,b,* side, apert. views; *7,* eroded specimen showing internal divisions; all ×47 (*471).

Pseudochrysalidina COLE, 1941, *357, p. 35 [**P. floridana;* OD] [=*Pseudogoesella* KEIJZER, 1945, *1030, p. 190 (type, *P. cubana*); *Dukhania* HENSON, 1948, *901, p. 609 (type, *D. conica*)]. Test high trochospiral, with gradual reduction in number of chambers to whorl, later portion tending to become biserial; wall agglutinated, may be of calcareous particles; interior with vertical pillars subdividing central area of chambers; aperture interiomarginal in early stage, cribrate over terminal surface in adult. [*Pseudogoesella* was shown by BERMÚDEZ (1949, *124, p. 100) to be a synonym of *Pseudochrysalidina.*] *L.Cret.-Eoc.,* Carib. (Cuba)-USA (Fla.) - W. Indies (Dominican Rep.)-Arabia(Qatar Penin.).——FIG. 196,*1,2. *P. floridana,* M.Eoc., USA(Fla.); *1a,b,* side, top views of paratype, ×33 (*2117); *2,* long. sec. showing internal vertical pillars, ×29 (*357).——FIG. 196, *3. P. cubana,* Eoc., Cuba; *3a-c,* opposite sides and apert. view of holotype (Univ. Utrecht Coll.), ×39 (*2117).——FIG. 196,*4. P. conica* (HENSON), M.Cret., Qatar Penin.; slightly oblique sec., ×28 (*2115).

Pseudolituonella MARIE, 1955, *1220, p. 117 [**P. reicheli;* OD]. Test elongate, conical, early portion trochospiral, later uniserial, with broad low chambers; interior of chambers with sporadic hollow interseptal pillars extending from edge of circular openings at base of chambers toward apertures at opposite end of chamber; wall of agglutinated calcite, single-layered, imperforate; aperture cribrate in center of terminal face with nonperforate marginal area. [*Pseudolituonella* differs from *Lituonella* in the sporadic and rudimentary nature of the interseptal pillars and from *Minouxia* in the later uniserial stage.] *U.Cret.(U.Cenoman.),* Eu.(Fr.)-SW.Asia(Israel).——FIG. 196,*5,6. *P. reicheli,* Fr.; *5a,b,* side, top views of topotype, ×37 (*2117); *6,* axial sec. of topotype showing portions of interseptal pillars, ×29 (*1532).

Remesella VAŠÍČEK, 1947, *1981, p. 246 [**R. mariae;* OD]. Early portion triserial, later biserial as in *Gaudryina* but with incomplete secondary vertical partitions, visible as grooves at test surface; wall agglutinated, with considerable cement, surface rough; aperture interiomarginal. [Originally known only from the type-species, Eocene, *Matan-*

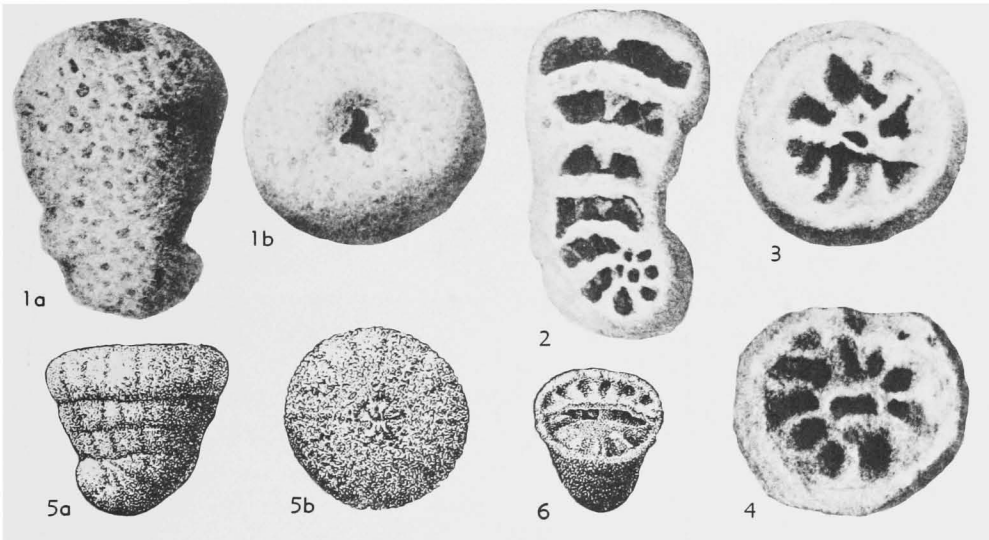

FIG. 198. Ataxophragmiidae (Ataxophragmiinae; *1-6, Voloshinovella*) (p. C291).

zia simulans FINLAY, from the Whangai beds (U. Cret.) of Dannevirke area, Mangaotoro S.D., New Zealand, apparently belongs to *Remesella.*] *U. Cret.-Eoc.*, Eu.-N.Z.——FIG. 197,*1*. **R. mariae*, Eoc., Czech.; *1a,b*, side, top views of holotype, ×47 (*1981).

Tritaxilina CUSHMAN, 1911, *404b, p. 71 [**Clavulina caperata* BRADY, 1881, *196c, p. 54; OD] [=*Clavulinella* SCHUBERT, 1921, *1694, p. 181 (obj.)]. Test free, elongate, in high trochospiral coil, early stage with up to 5 chambers in whorl, successively reduced to 4, 3, and 2 to whorl, and finally rectilinear; chambers internally subdivided; wall agglutinated, thick, with pseudochitinous lining and distinct pores in wall; aperture interiomarginal in early stages, becoming terminal and rounded in adult, with slight lip, and series of projecting teeth which partially close opening. *Eoc.-Rec.*, Pac.O.-Atl.O.-Eu.-N.Am.-C.Am.——FIG. 197,*2,3*. **T. caperata* (BRADY), Rec., Philip. Is.; *2a,b*, side, top views of hypotype; *3*, sec. of hypotype, ×32 (*2117).

Voloshinovella LOEBLICH & TAPPAN, *nom. nov.*, herein [*pro Beisselina* VOLOSHINOVA & BALAKHMATOVA in RAUZER-CHERNOUSOVA & FURSENKO, 1959, *1509, p. 227 (*non* CANU, 1913)] [**Lituola aequisgranensis* BEISSEL, 1891, *106, p. 12; here designated as type-species]. Test similar to *Orbignyna* in early stage, but uncoiling and with rounded section in adult; wall agglutinated, with vertical radial partitions subdividing chambers; aperture terminal, irregular in outline. *U.Cret.(Senon.)*, Eu.——FIG. 198,*1-6*. **V. aequisgranensis* (BEISSEL); U.Senon., Ger. *(1-4)*, USSR *(5,6)*; *1a,b*, side, top views; *2*, long. sec.; *3,4*, horiz. secs. showing internal pillars, ×14 (*106); *5a,b*, side, top views; *6*, oblique view of sectioned specimen, ×23 (*1509).

Family PAVONITINIDAE Loeblich & Tappan, 1961

[*nom. transl.* LOEBLICH & TAPPAN, herein (*ex* Pavonitininae LOEBLICH & TAPPAN, 1961, p. 283)] [=Pfenderinidae SMOUT & SUGDEN, 1962, p. 582]

Test trochospiral, at least in early stage, with 3 to many chambers to whorl, later may be reduced in number of chambers to biserial or uniserial, chambers may be subdivided by pillars or partitions; wall of agglutinated calcareous fragments or microgranular. *U.Jur.-Rec.*

Subfamily PFENDERININAE Smout & Sugden, 1962

[*nom. transl.* LOEBLICH & TAPPAN, herein (*ex* Pfenderinidae SMOUT & SUGDEN, 1962, p. 582)]

Test trochospiral, in later stage may have reduction in number of chambers to whorl, interior subdivided by vertical or horizontal partitions, or both; wall calcareous and microgranular, or of agglutinated calcareous grains. *U.Jur-U.Cret.(Senon.)*.

Pfenderina HENSON, 1948, *901, p. 609 [**Eoruppertia neocomiensis* PFENDER, 1938, *1452, p. 236; OD]. Test trochospiral; chambers numerous, with axial region of thickened shell material which may show irregular, reticulate texture in sections; septa more or less perpendicular to spiral axis and oblique to axis of test; wall calcareous, microgranular, imperforate; aperture consisting of numerous pores in center of apertural face, secondary intercameral foramina about equidistant from ends of chamber spaces, along central columella and appear there as spiral groove. [*Pfenderina* differs from *Kurnubia* in the absence of subepidermal

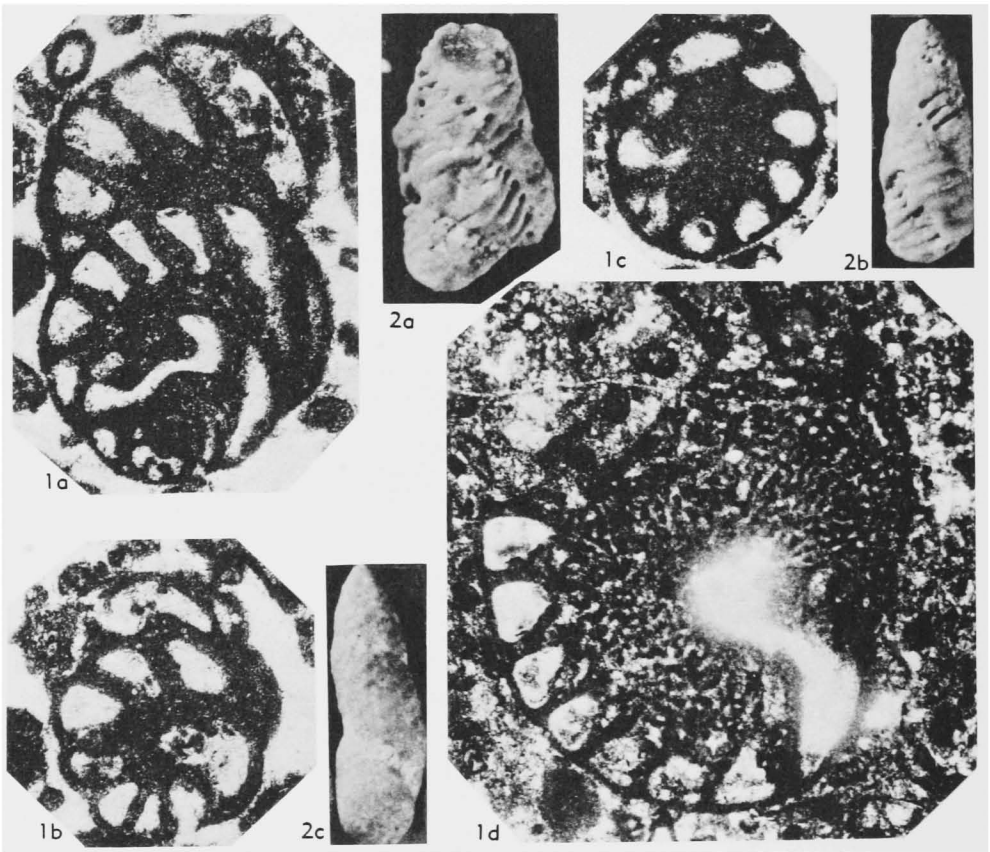

FIG. 199. Pavonitinidae (Pfenderininae; *1,2, Pfenderina*) (p. C291-C292).

partitions.] *U.Jur.-U.Cret.(Cenoman.),* Eu.-SW. Asia.——FIG. 199,*1,2*. **P. neocomiensis* (PFENDER), L.Cret.(Neocom.), Fr. *(1)*; M.Jur.(Bathon.), Arabia *(2)*; *1a,* subaxial sec.; *1b,* sec. through early coil; *1c,* transv. sec. showing central thickened area; *1d,* reticulate appearance of central thickened area, ×40 (*1452); *2a-c,* ext. of isolated specimens, partially decorticated, secondary foramina visible in *2a,b,* entire apert. face shown in *2c,* perforate, but without basal primary aperture, ×20 (*1807).

Accordiella FARINACCI, 1962 (see p. C795).

Hensonia MARIE, 1955, *1220, p. 121 [**H. tricarinata*; OD]. Test triangular and triserial, similar to *Verneuilina* but with internal plates resulting in reticular subepidermal area of chambers; wall agglutinated; aperture multiple, terminal on final chamber. *U.Cret.(Senon.),* Eu.(Fr.).——FIG. 200, *2*. **H. tricarinata;* side view, ×50 (*1220).

Kilianina PFENDER, 1933, *1449, p. 245 [**K. blancheti;* OD] [=*Lituonelloides* HENSON, 1948, *902, p. 26 (type, *L. compressus*)]. Test conical in form, early chambers trochospirally arranged, later uniserial; outer portion of chambers without subepidermal partitions, central area with lamelliform interseptal buttresses, which may coalesce to form irregular partitions; wall of agglutinated calcareous particles, with some sandy material, imperforate; aperture consists of large perforations in oral face of central portion. [*Kilianina* commonly has been placed in the Orbitolinidae, but was deleted from that family by DOUGLASS (*611, p. 260) and regarded by SMOUT & SUGDEN, 1962 (*1807), as belonging to the Tetrataxinae. Chamber arrangement, wall structure and multiple aperture suggest its present placement in the Pfenderininae.] *M.Jur.(Bathon.)-U.Cret.(Maastricht.),* Eu.-SW.Asia.——FIG. 201, *1-4*. **K. blancheti,* M.Jur.(Bathon.), Fr.; *1,* sec. parallel to axis, ×40; *2,* same, ×35; *3,* basal sec., ×35; *4,* oblique sec. through early spiral portion, ×35 (*1449).——FIG. 201,*5*. *K. compressa* HENSON, U.Cret.(Maastricht.), Qatar Penin., Arabia; subaxial sec. of paratype (BMNH P35876), ×39 (*2115).

Kurnubia HENSON, 1948, *901, p. 608 [**K. palasti-*

niensis; OD]. Test elongate, with early stage trochospiral about central column, gradually becoming rectilinear, uniserial stage being more or less prominent in different species; wall probably agglutinated calcareous, outer layer imperforate, reticulate subepidermal layer formed by inter-

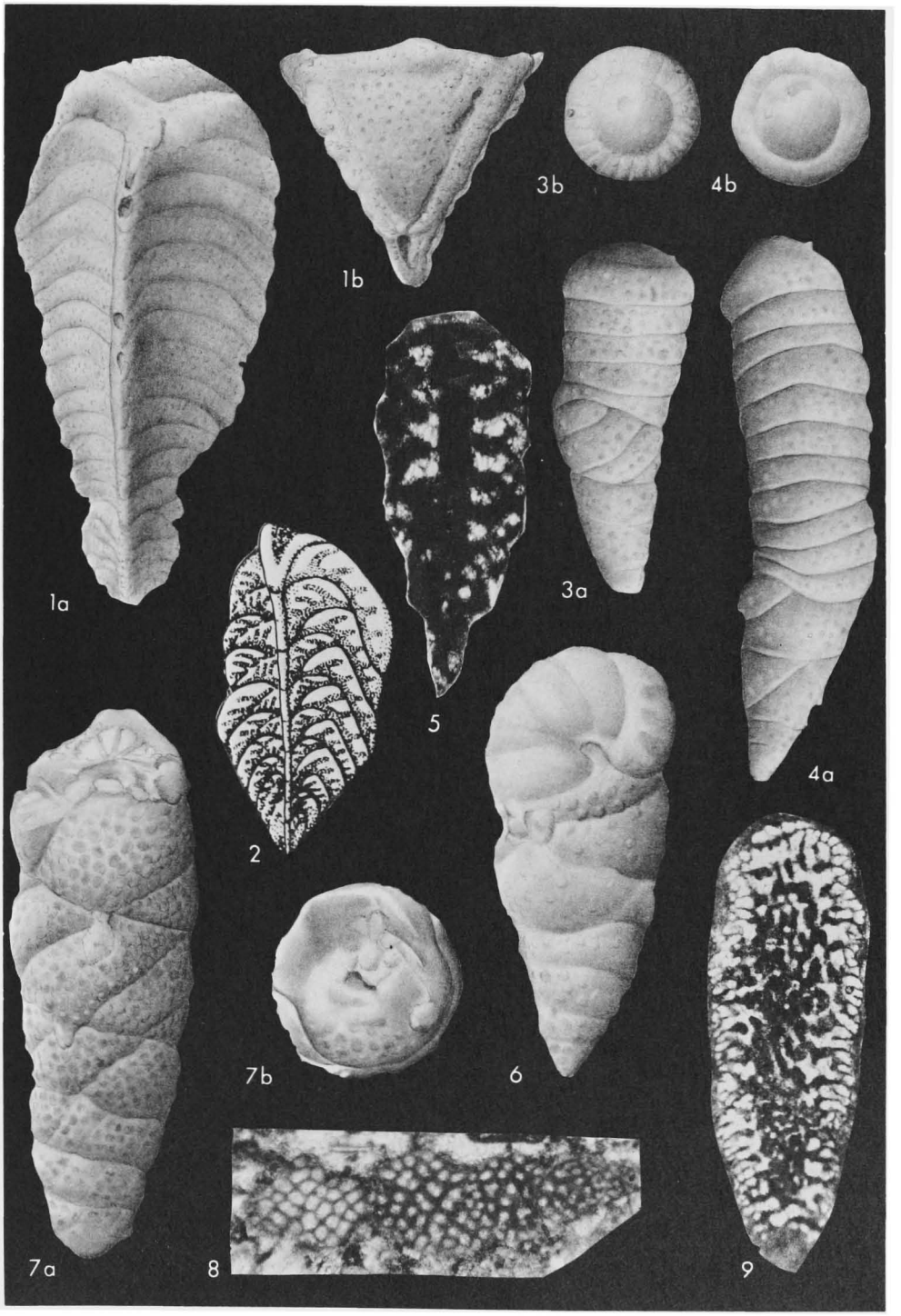

FIG. 200. Pavonitinidae (Pfenderininae; *1, Marieita; 2, Hensonia; 3-9, Kurnubia*) (p. C292-C294).

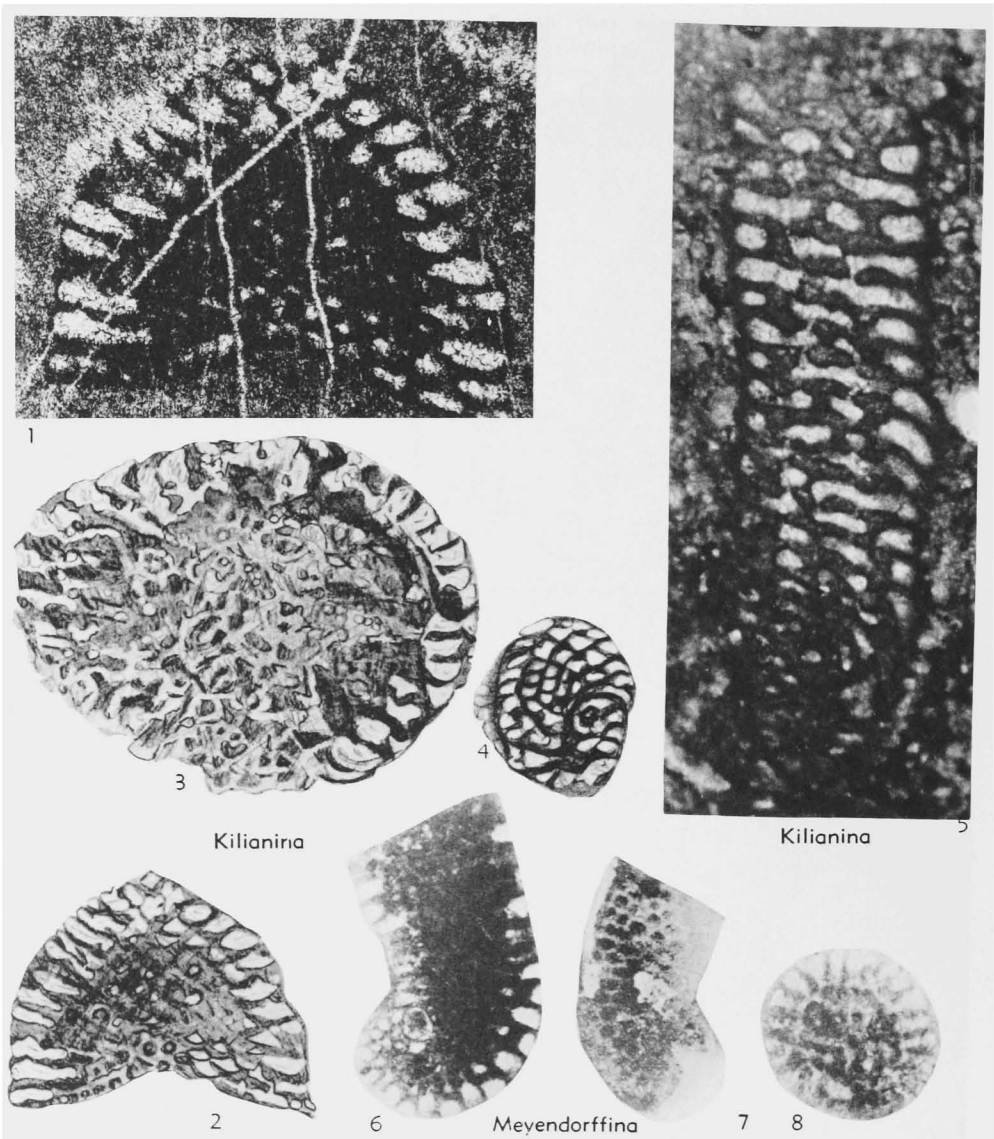

FIG. 201. Pavonitinidae (Pfenderininae; *1-5, Kilianina; 6-8, Meyendorffina*) (p. C292, C295).

secting short partitions projecting inward from outer wall; oral face convex, aperture interiomarginal in early stage, becoming terminal in later stage, probably multiple around central core but not distinct in specimens observed. [*Valvulinella jurassica* HENSON is here regarded as belonging to *Kurnubia*. It occurs with and was said to intergrade with *K. palastiniensis*, although lacking the elongate uniserial development.] *U.Jur.*, SW.Asia.——FIG. 200,*3-5*. **K. palastiniensis*, Palest.; *3a,b*, *4a,b*, side and top views of paratypes, ×52 (*2117); *5*, vert. sec., ×70 (*2115).——FIG. 200,*6-9*. *K. jurassica* (HENSON), U.Jur., Palest.; *6,7a*, side views of paratypes, showing coiling and reticulate subepidermal layer of worn specimen; *7b*, top view, ×60 (*2117); *8,9*, tang. sec. showing subepidermal layer and deeper long. sec. showing internal pillars, ×36 (*2115).

Marieita LOEBLICH & TAPPAN, *nom. nov.*, herein, [*pro Reichelina* MARIE, 1955, *1220, p. 122 (*non* ERK, 1942)] [**Reichelina prismatica* MARIE, 1955, *1220, p. 123; here designated as type-species]. Test elongate, pyramidal, triangular in section, early stage probably triserial, adult with broad,

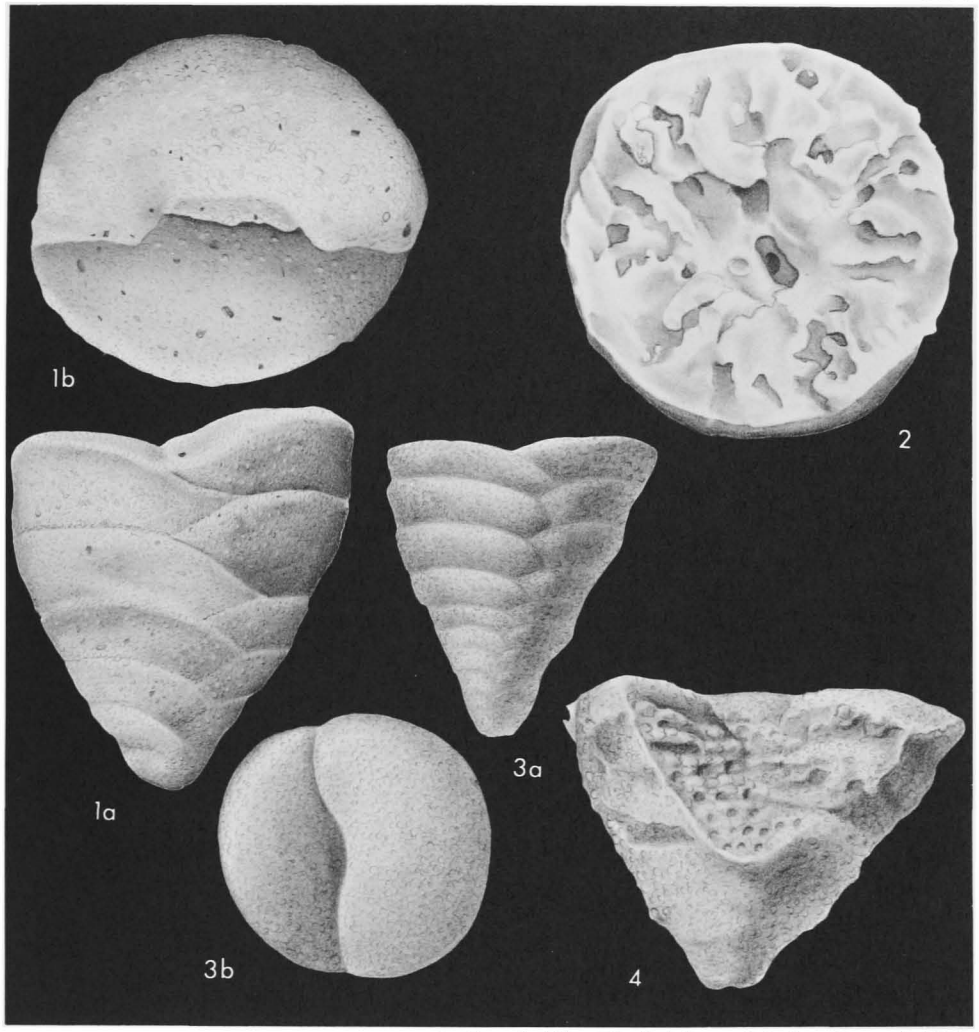

FIG. 202. Pavonitinidae (Pavonitininae; *1,2, Textulariella;* Pfenderininae; *3,4, Pseudotextulariella*) (p. C295, C299-C300).

low, uniserial chambers with labyrinthic interior; sutures slightly depressed, moderately arched at center of flat sides of test; wall agglutinated, with reticulate subepidermal meshwork; aperture cribrate, with small circular openings scattered over flattened terminal face of test. *U.Cret.(Senon.),* Eu.(Fr.).——FIG. 200,*1. *M. prismatica* (MARIE); *1a,b,* side, apert. views, ×53 (*2117).

Meyendorffina AUROUZE & BIZON, 1958, *56, p. 72 [**M. bathonica;* OD]. Test planispiral in early stage, later uncoiling and uniserial, chambers subdivided by vertical radial partitions in peripheral area, and pillars in internal zone; wall of microgranular calcite; aperture multiple, openings lying between peripheral and internal zones where they are irregularly interspersed between pillars. *Jur.(Bathon.),* Eu.(Fr.).——FIG. 201,*6-8. *M. bathonica; 6,* long. sec. of paratype, ×50; *7,* exterior of holotype, ×30; *8,* transv. sec. of paratype, ×40 (*56).

Pseudotextulariella BARNARD in BARNARD & BANNER, 1953, *88, p. 177, 198 [**Textulariella cretosa* CUSHMAN, 1932, *454, p. 97; OD]. Test subconical, early stage triserial, later biserial; interior of chambers with vertical and horizontal partitions forming partial chamberlets; wall agglutinated; aperture interiomarginal. *U.Cret.(Cenoman.),* Eu.——FIG. 202,*3,4. *P. cretosa* (CUSHMAN), Eng.; *3a,b,* side, top views; *4,* specimen with broken exterior to show peripheral chamberlets, all ×47 (*2117).

Subfamily PAVONITININAE Loeblich & Tappan, 1961

[Pavonitininae LOEBLICH & TAPPAN, 1961, p. 283]

Early stage trochospiral, with 3 or more chambers to whorl, later may be biserial or

uniserial, secondary septa or vertical pillars projecting downward from chamber roof. *L.Cret.-Rec.*

Pavonitina SCHUBERT, 1914, *1692, p. 143 [*P. styriaca;* OD] [=*Pseudotriplasia* MAŁECKI, 1954, *1210, p. 499, 509 (type, *P. elongata*)]. Test

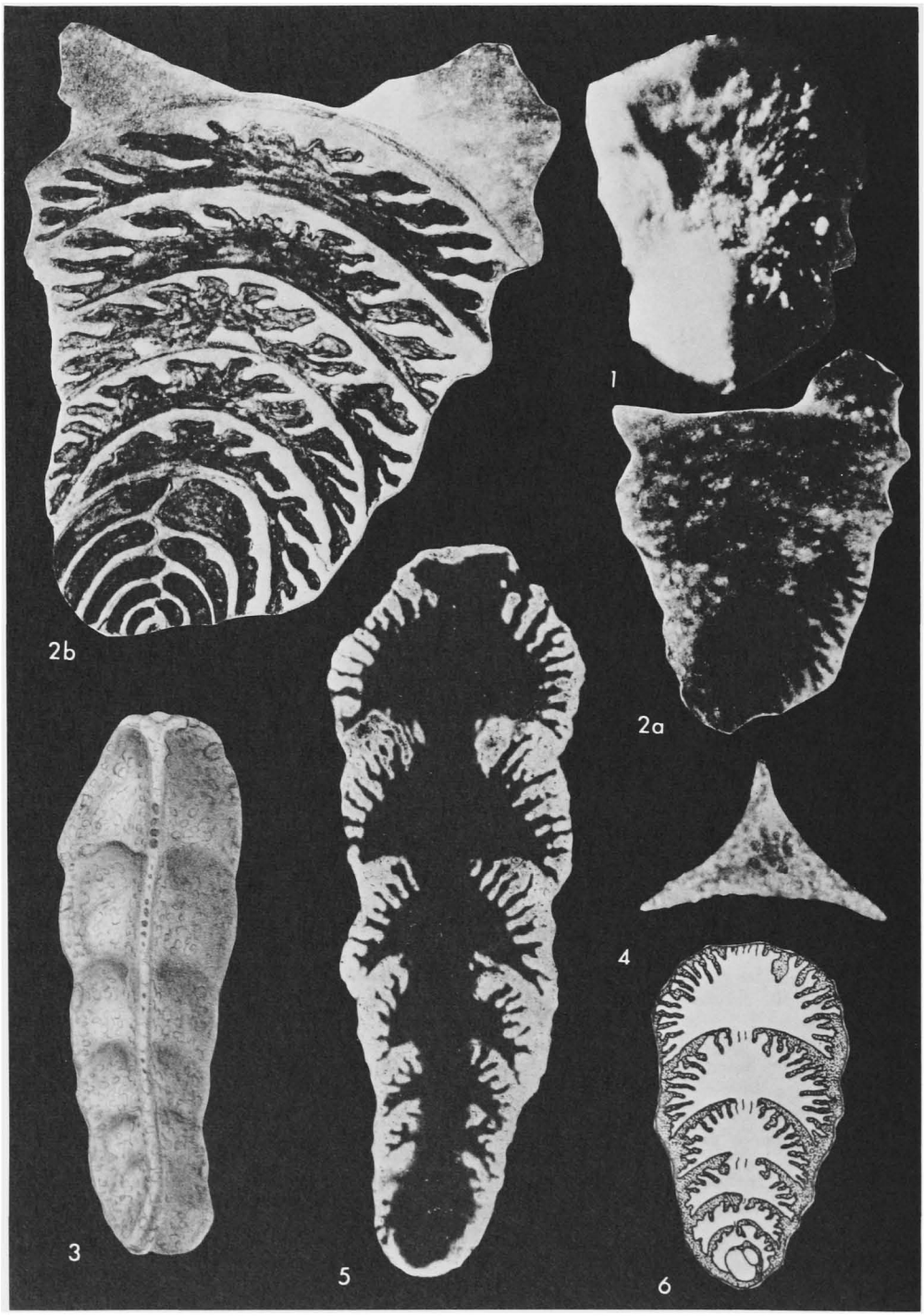

FIG. 203. Pavonitinidae (Pavonitininae; *1-6, Pavonitina*) (p. C296-C298).

elongate, early stage triserial, later uniserial, later stage compressed or may be triangular throughout; interior of chambers with irregular secondary partitions projecting inward and downward from outer agglutinated wall; aperture terminal, cribrate. *Mio.*, Eu.——Fig. 203,*1,2*. **P.*

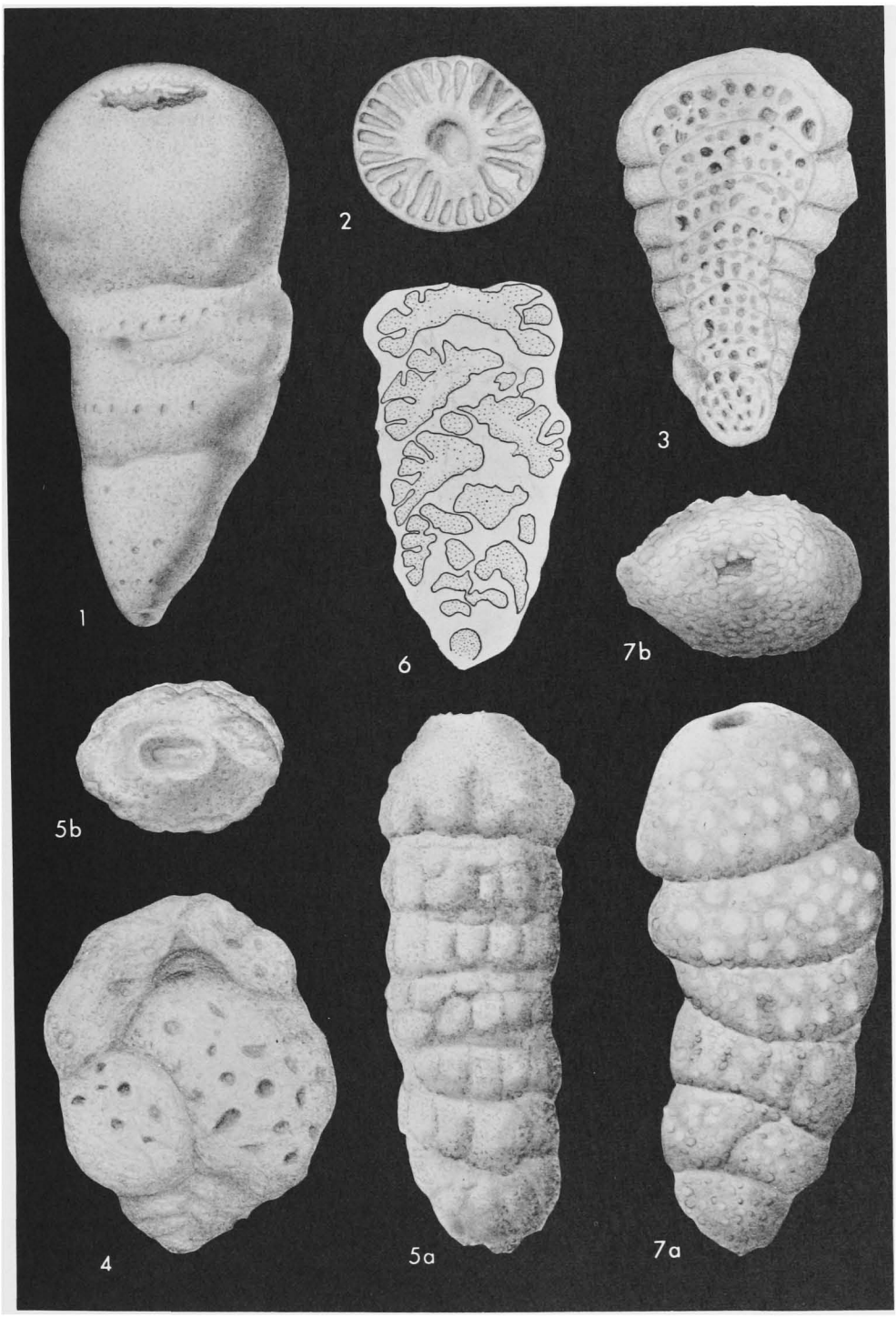

Fig. 204. Pavonitinidae (Pavonitininae; *1-3, Guppyella; 4, Alveovalvulina; 5-7, Alveovalvulinella*) (p. C298).

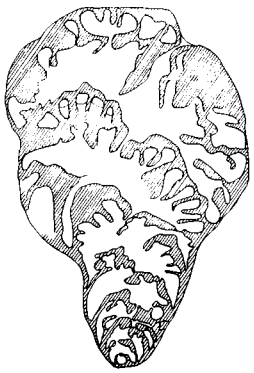

FIG. 205. Pavonitinidae (Pavonitininae; *Alveovalvulina*) (p. C298).

styriaca, Aus.; *1*, exterior, ×60; *2a*, unretouched photograph of specimen mounted in glycerin seen in transmitted light, ×70; *2b*, same specimen retouched to show chamber arrangement, ×100 (*1692).——FIG. 203,*3-6*. *P. elongata* (MAŁECKI), Pol.; *3*, side view, ×40 (*2117); *4*, top view of another specimen; *5*, long. sec. showing partial subdivisions, ×40; *6*, same, diagram. (*1210).

[*Pavonitina* was originally described as having an agglutinated shell but was placed with the perforate calcareous *Pavonina* by GALLOWAY (1933, *762), and not mentioned at all in other texts and treatises on foraminifers. Although SCHUBERT described only 2 rows of chambers in the early stage (determined from specimens mounted in glycerin and seen in transmitted light) his photographic figures clearly show the early triangular stage. No sections were made. The one figure that shows distinct "biseriality" of the base is the only one that was retouched. It seems probable from the illustrations, age, and locality that *Pseudotriplasia plana* or *P. robusta* MAŁECKI, or both, may be junior synonyms of *Pavonitina styriaca* SCHUBERT.]

Alveovalvulina BRÖNNIMANN, 1951, *225, p. 100 [**A. suteri;* OD]. Early stage trochospiral, reducing in number of chambers in whorl to 3 or 4 in adult, chambers overlapping, outer portions subdivided by irregular horizontal and vertical plates projecting inward, resulting in alveolar or reticulate peripheral area; wall agglutinated; aperture interiomarginal. *Mio.*, W.Indies(Trinidad).——FIG. 204,*4*; 205. **A. suteri;* 204,*4*, exterior of holotype showing surface pits which reflect internal alveoli, ×72 (*2117); 205, axial sec., ×44 (*225).

Alveovalvulinella BRÖNNIMANN, 1953, *229, p. 90 [**Liebusella pozonensis* CUSHMAN & RENZ, 1941, *523, p. 9; OD]. Test elongate, early chambers trochospiral, later triserial, biserial, and finally uniserial; interior of chambers peripherally subdivided by transverse and longitudinal plates, forming alveoles, as in *Alveovalvulina;* wall agglutinated; aperture terminal, rounded in adult. [*Alveovalvulinella* differs from *Alveovalvulina* in the later uniserial stage and terminal aperture.] *Oligo-Mio.*, W. Indies(Trinidad)-S. Am.(Venez.)-Costa Rica.——FIG. 204,*5-7*. **A. pozonensis* (CUSHMAN & RENZ), Venez.; *5a,b*, side, top views of paratype, ×88 (*2117); *6*, long. sec., ×40 (*229); *7a,b*, side, top views of holotype, ×62 (*2117).

Coskinolina STACHE, 1875, *1826, p. 337 [**C. liburnica*; OD (M)]. Early portion trochospiral, later conical, with vertical interseptal pillars as in *Lituonella* but marginal zone subdivided by radial partial partitions, terminal face with nonperforate marginal area; wall finely agglutinated; aperture multiple, in central area of terminal face. *L.Cret.-M.Eoc.*, Eu.-N.Am.-S.Am.-Asia.——FIG. 206,*4-6*. **C. liburnica*, M.Eoc., Istria-Dalmatia; *4a,b*, ext. views, ×7; *5*, axial section, ×16 (*1690); *6a*, part of axial sec. of topotype showing spongy or fibrous wall, ×66; *6b*, part of basal sec., ×66 (*611).——FIG. 206,*7*. *C. balsilliei* DAVIES, L.Eoc., Baluch.; *7a*, basal sec. showing interseptal pillars in central area and radial partitions subdividing marginal zone, ×18; *7b*, part of marginal zone, ×48 (*560).

Guppyella BRÖNNIMANN, 1951, *225, p. 98 [**Goesella miocenica* CUSHMAN, 1936, *468, p. 33; OD]. Test elongate, early stage trochospiral, with 4 to 6 chambers in whorl, later reduced to triserial, biserial, and finally uniserial; chambers peripherally subdivided into alveolar cavities formed by vertical and horizontal partitions extending nearly to center of test; wall agglutinated; aperture interiomarginal slit in early stage, becoming terminal and ovate in uniserial stage. *Mio.*, W.Indies(Trinidad).——FIG. 204,*1-3*. **G. miocenica* (CUSHMAN); *1*, holotype, showing exterior and terminal aperture; *2*, transv. sec. of hypotype; *3*, long. tang. sec. showing alveolar appearance, ×35 (*2117).

Lituonella SCHLUMBERGER in SCHLUMBERGER & DOUVILLÉ, 1905, *1667, p. 297, 303 [**L. roberti;* OD]. Test conical, early chambers in asymmetrical spire somewhat to one side of apex of test, later chambers broad, saucer-shaped, nearly circular in plan, with marginal ridge, sutures curved in early portion, nearly straight in uniserial portion and slightly depressed; outer wall compact, imperforate, central portion of basal surface with spongy texture and containing large perforations, each of which is bordered by hemicylindrical, pillar-like interseptal buttresses, those of outer ring of perforations with buttress external to opening, marginal area outside rows of perforations without subdivision. [The depository for types of *Lituonella roberti* was not stated originally; the lectotype and paratypes are in the Sorbonne collections, Paris.] *Eoc.*, Eu.(Fr.)-Asia (India).——FIG. 206,*1,2*. **L. roberti*, M.Eoc. (Lutet.), Fr.; *1a-c*, side, spiral, and apert. views of topotype showing asymmetrical spire and large perforations of terminal face, ×17 (*2117); *2*, axial sec., ×15 (*1780).——FIG. 206,*3*. *L. douvillei* DAVIES, L.Eoc., Baluch.; *3a*, horiz. sec. showing undivided outer marginal zone and interseptal buttresses in central area, ×18; *3b*, marginal portion, ×48 (*560).

Textulariella CUSHMAN, 1927, *431, p. 24 [**Textularia barrettii* JONES & PARKER, 1876, *1001, p. 99 (=*Textularia barrettii* JONES & PARKER, 1863, *1000, p. 80, *nom. nud.*); OD]. Test subconical, early stage trochospiral with 3 or more chambers in whorl, later biserial as in *Dorothia* but interior

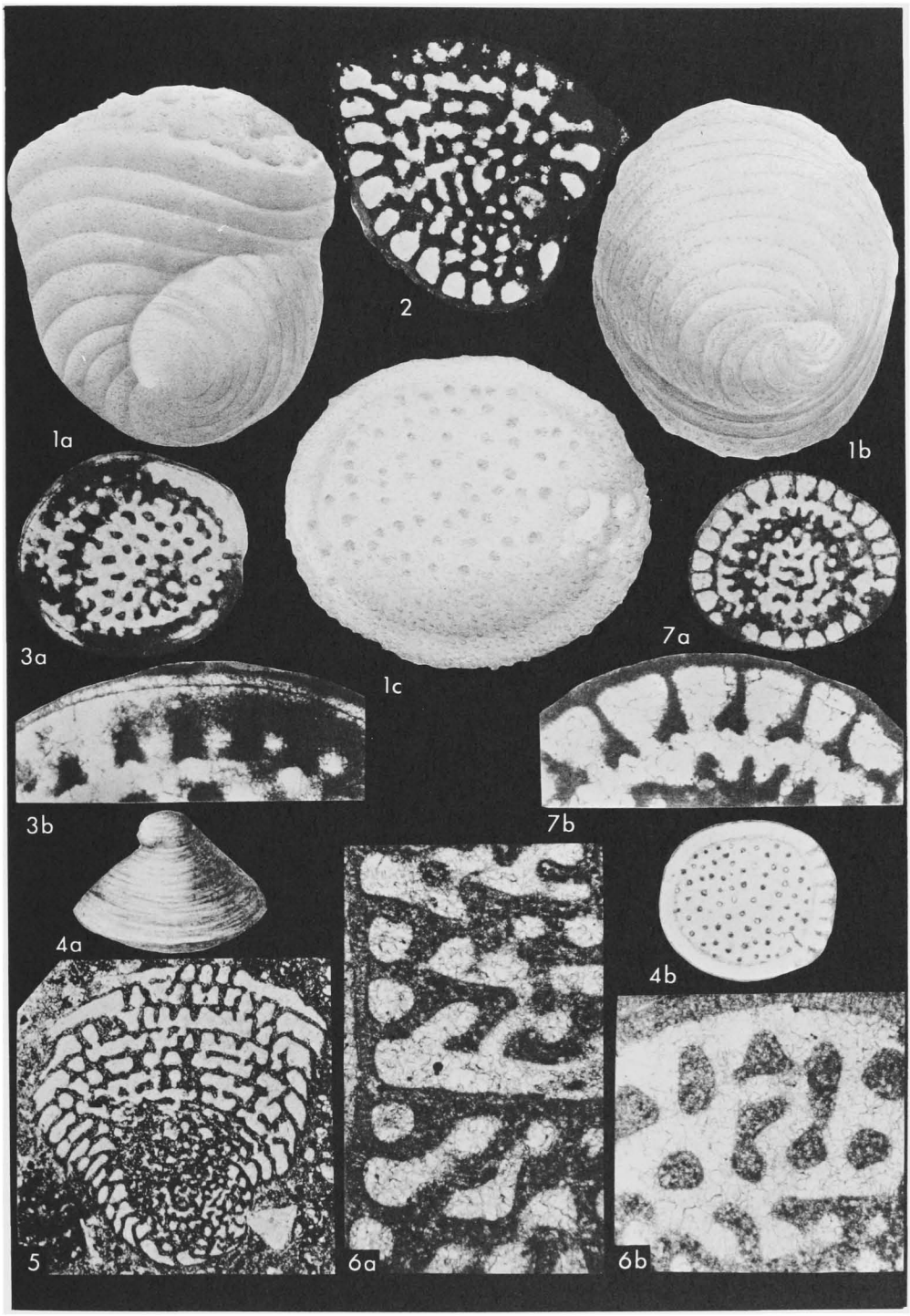

FIG. 206. Pavonitinidae (Pavonitininae; *1-3, Lituonella; 4-7, Coskinolina*) (p. C298).

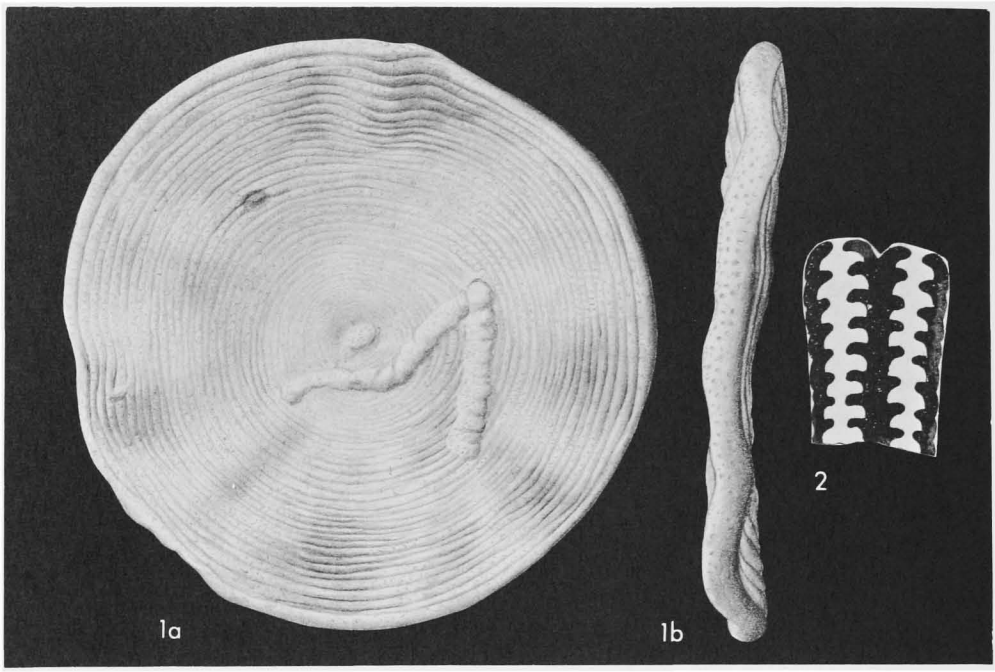

FIG. 207. Dicyclinidae (Cyclolininae; *1, Cyclolina; 2, Cyclopsinella*) (p. C301-C302).

labyrinthic; aperture low interiomarginal arch. [The original types in the British Museum (Natural History) were segregated by us. A lectotype (BMNH-ZF3635) and paratype (BMNH-ZF3636) are here designated from Recent deposits off Jamaica, West Indies, at 100-250 fathoms.] *Paleoc.-Rec.*, Carib.-N.Am.-Afr.-Eu.-Pac.-Atl.—— FIG. 202,*1,2*. **T. barrettii* (JONES & PARKER), Rec., USA(Fla.); *1a,b*, side, top views; *2*, specimen broken to show interior, ×33 (*2117).

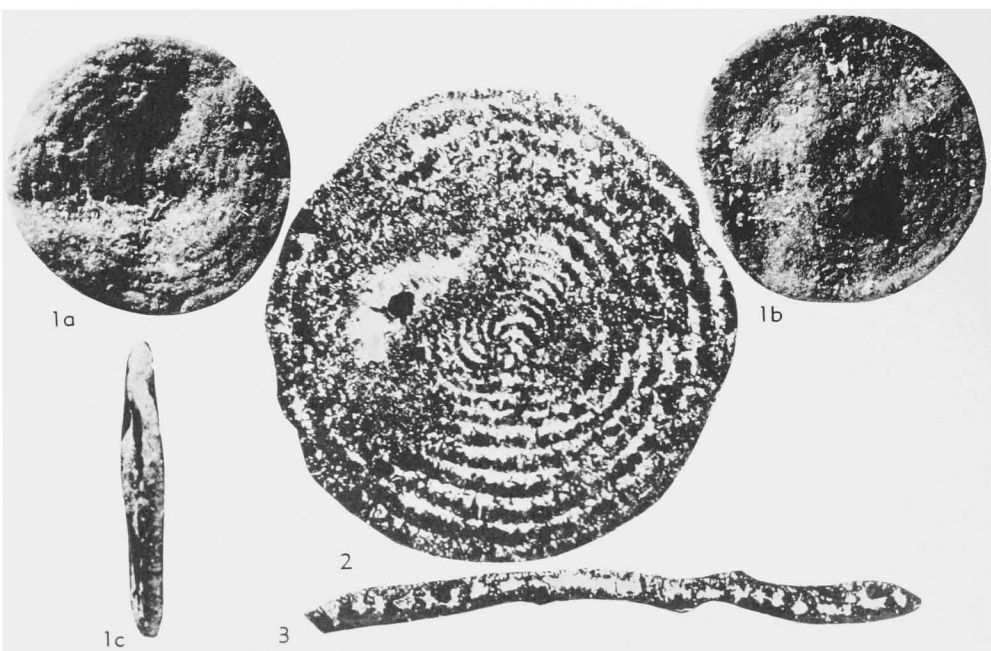

FIG. 208. Dicyclinidae (Cycylolininae; *1–3, Ammocycloloculina*) (p. C302).

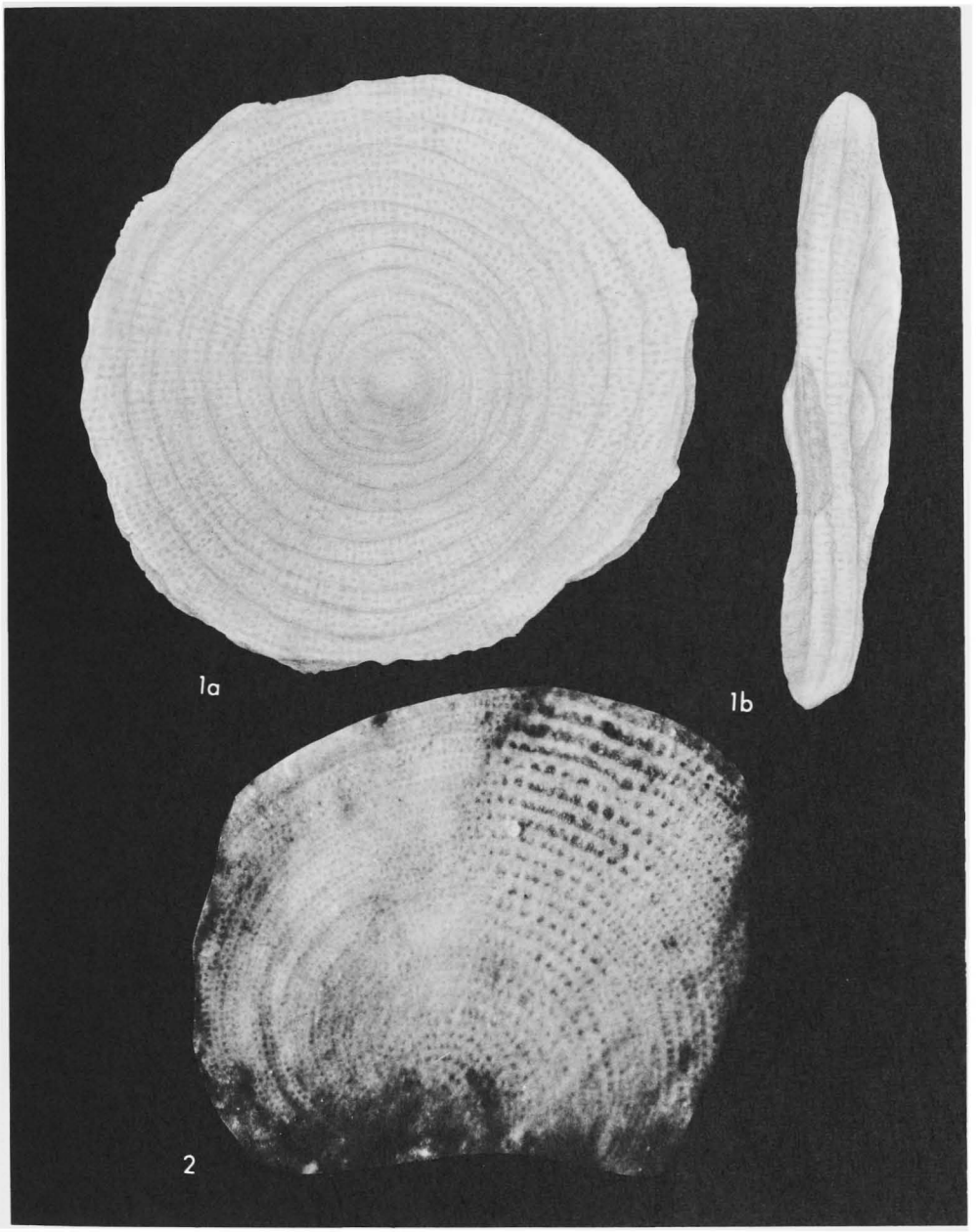

FIG. 209. Dicyclinidae (Dicyclininae; *1, Dicyclina; 2, Broeckinella*) (p. C303-C304).

Family DICYCLINIDAE
Loeblich & Tappan, n. fam.

Test free, discoidal or depressed conical, chambers cyclical; wall of finely agglutinated calcareous particles, with imperforate epidermis; aperture multiple, peripheral. *?U.Trias., Jur.-M.Eoc.*

Subfamily CYCLOLININAE
Loeblich & Tappan, n. subfam.

Cyclical chambers not subdivided by radial partitions. *L.Cret.-U.Cret.*

Cyclolina D'ORBIGNY, 1846, *1395, p. 139 [*C. *cretacea;* OD (M)]. Test free, discoidal, with undivided annular chambers; wall finely agglutin-

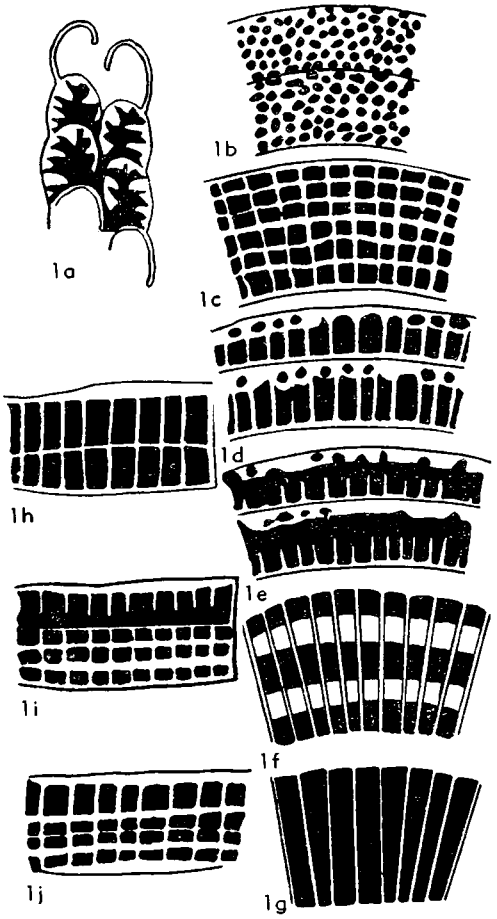

FIG. 210. Dicyclinidae (Dicyclininae; *1, Dicyclina*) (p. C303-C304).

ated; aperture multiple, with numerous pores on periphery. [The lectotype and two paratypes are in MNHN, Paris.] *U.Cret.(Cenoman.-Senon.)*, Eu. ——FIG. 207,*1*. **C. cretacea*, U.Cret.(Cenoman.), Fr.; *1a,b*, side, edge views of topotype, ×17 (*2117).

Ammocycloloculina MAYNC, 1958, *1246, p. 53 [**Spirocyclina erratica* JOUKOWSKY & FAVRE, 1913, *1004, p. 491; OD]. Test discoidal, to 15 mm. diam.; early chambers planispirally arranged in spire of about 6 chambers, later strongly embracing, with flabelliform outline, and finally cyclical; wall thick, coarsely agglutinated, with calcareous cement, thin imperforate outer layer with microgranular texture, thick walls irregularly perforated by tubular openings or interstitial spaces between foreign matter but without development of radially arranged pillars; aperture indistinct, probably consisting of peripheral pores. [Differs from the Cyclammininae and Spirocyclininae in lacking a subepidermal alveolar layer.] *L.Cret. (Infravalangin.)*, Eu.(Fr.).——FIG. 208,*1-3*. **A. erratica* (JOUKOWSKY & FAVRE); *1a-c*, opposite sides and edge of paratype, ×5.5; *2,3*, median and axial secs., ×11 (*1246).

Cyclopsinella GALLOWAY, 1933, *762, p. 138 [**Cyclopsina steinmanni* MUNIER-CHALMAS, 1887, *1325, p. xxx; OD] [=*Cyclopsina* MUNIER-CHALMAS, 1887, *1325, p. xxx (obj.) (*non* MILNE-EDWARDS, 1840); *Cycloclypsinella* THALMANN, 1935, *1897a, p. 734 *(nom. null.)*]. Test discoidal, with 2 layers of annular chambers separated by median partition, with intercameral pores between chambers of single layer but no communication between 2 layers; wall agglutinated. *U.Cret.(Cenoman.)*, Eu.——FIG. 207,*2*. **C. steinmanni* (MUNIER-CHALMAS), diagram. transv. sec. showing 2 layers of chambers, ×40 (*1666).

[*Cyclopsinella* was originally described as similar to 2 superposed *Cyclolina*. The original material, now in the Sorbonne, Paris, was from the Upper Cretaceous (Cenomanian) of Île Madame, France, and included a longitudinal and a transverse section. In addition, a longitudinal section is included from Les Martigues, France. All sections were poor and none have been figured.]

Subfamily DICYCLININAE
Loeblich & Tappan, n. subfam.

Chambers partially subdivided by radial transverse partitions or both into numerous small chamberlets. *?U.Trias., Jur.-M.Eoc.*

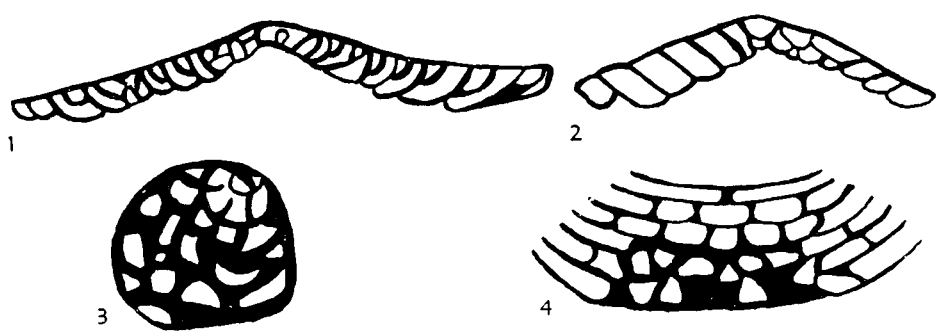

FIG. 211. Dicyclinidae (Dicyclininae; *1-4, Coskinolinella*) (p. C304).

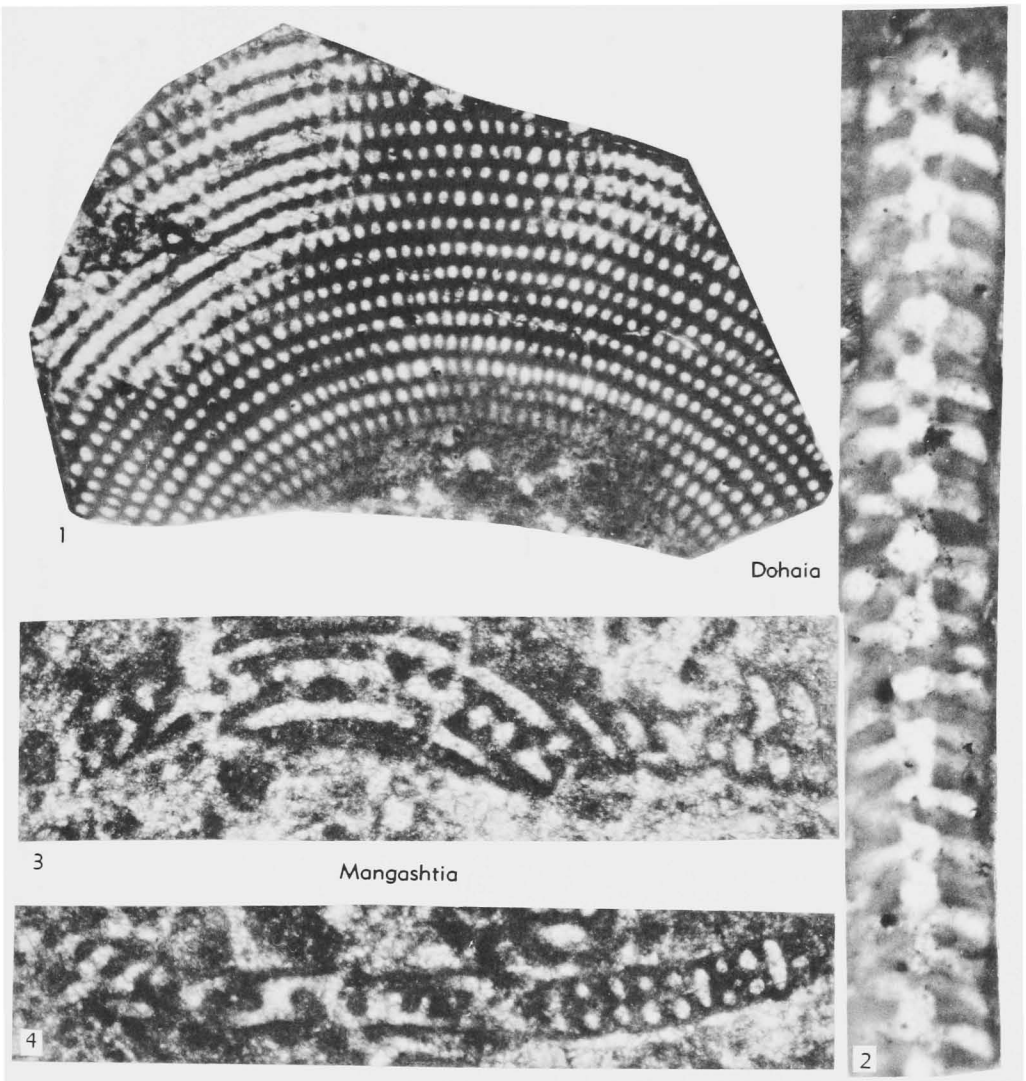

FIG. 212. Dicyclinidae (Dicyclininae; *1,2, Dohaia; 3,4, Mangashtia*) (p. C304-C307).

Dicyclina MUNIER-CHALMAS, 1887, *1325, p. xxx [**D. schlumbergeri*; OD]. Test free, flattened, discoidal, early planispiral chambers in 2 parallel layers forming raised central knob, remainder consisting of 2 layers of annular chambers which are subdivided by radial partitions into chamberlets; wall agglutinated, of calcareous fragments with imperforate epidermis, walls of the primary chambers recurved in section toward center of test, not meeting peripheral wall of preceding chamber or that of opposite layer, leaving median zone between incurved ends of opposing primary chambers; interior subdivided by numerous, thin radial partitions perpendicular to median layer and in alignment from one primary chamber to next, dividing primary chamber into rectangular chamberlets which may be resubdivided by 3 or 4 partial partitions in each chamberlet, those of same cycle communicating by means of large pore through each radial partition; aperture comprising single median row of openings in slight depression at peripheral margin. [The types of *D. schlumbergeri,* from the Cenomanian of Île Madame, France, are in the Sorbonne Collections, Paris. Four specimens on the original slide have about the same size as that refigured here, and 2 fragments would have been approximately twice as large.] *U.Cret.(Cenoman.),* Eu.——FIG. 209,*1*. **D. schlumbergeri,* Île Madame,; *1a,b,* side, edge views of lectotype (here designated, Sorbonne

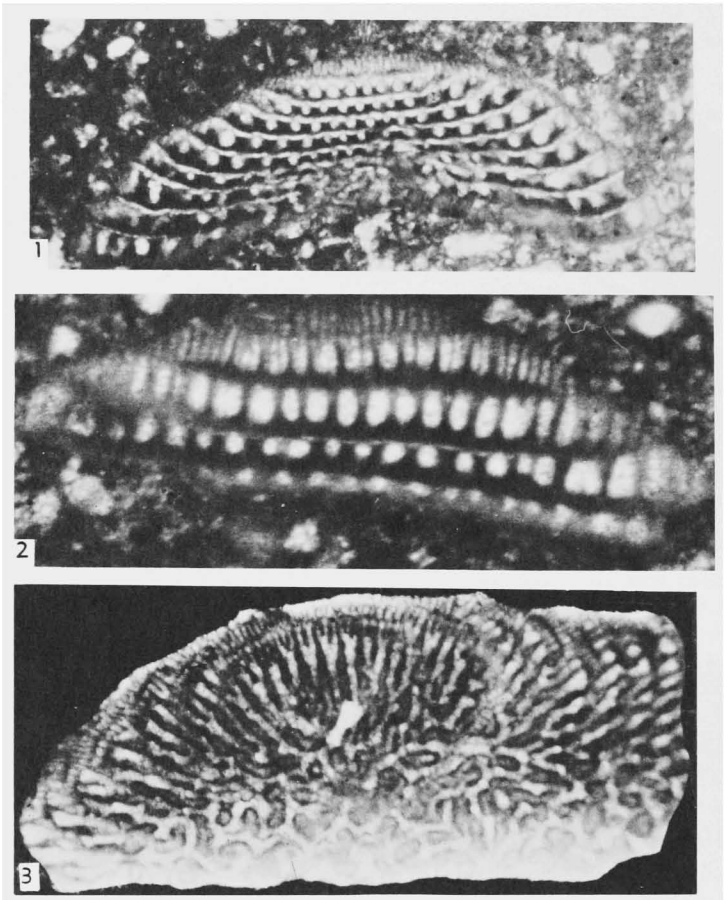

FIG. 213. Dicyclinidae (Dicyclininae; *1-3, Orbitolinella*) (p. C308).

Coll., Paris), ×33 (*2117).——FIG. 210,*1*. Internal structure of *Dicyclina* and *Cuneolina* (diagram.); *1a,* transv. sec. along radius; *1b-g,* secs. parallel to plane of development cut progressively from surface *(1b)* to median layer *(1g); 1h-j,* transv. secs. perpend. to radius (*901).

Broeckinella HENSON, 1948, *902, p. 92 [**B. arabica*; OD]. Test compressed, early stages planispiral, later flabelliform, tending to become cyclical; chambers arcuate, in single layer, undivided in median plane but with subepidermal transverse and parallel partial partitions, giving reticulate subepidermal layer, transverse partitions of succeeding chambers in alignment; successive chambers connected by apertures which appear on oral face as single median row of circular openings. [*Broeckinella* differs from *Broeckina* in having both parallel and transverse subepidermal plates. The genus and type-species are known from a single specimen.] *U.Cret.(Maastricht.),* Asia (Qatar Penin., Arabia).——FIG. 209,*2*. **B. arabica,* exterior of holotype, ×30 (*2115).

Coskinolinella DELMAS & DELOFFRE. '961, *581, p. 167 [**C. daguini*; OD]. Test free, small, low conical, early chambers indistinct, possibly trochospiral, later chambers discoidal, apparently not subdivided; septa not extending entirely to axis but leave unpartitioned open central area; wall finely agglutinated, of calcareous fragments. [The genus is known only from sections and originally was regarded as belonging to the Orbitolinidae. Because of the simple interior, it is here transferred to the Dicyclininae.] *L.Cret.(Alb.),* Eu. (Fr.).——FIG. 211,*1-4*. **C. daguini; 1,* transv. sec., ×42; *2,* transv. sec., ×40; *3,* tang. sec. through apex, ×60; *4,* tang. sec., ×42 (*581).

Dohaia HENSON, 1948, *902, p. 101 [**D. planata*; OD]. Test discoidal, early stage planispiral and evolute, later chambers cyclical; chambers undivided in median plane but outer portions of chambers have transverse subepidermal partitions, forming rectangular subepidermal incomplete chamberlets; wall calcareous, agglutinated; apertures numerous, in 2 rows, one at each side of

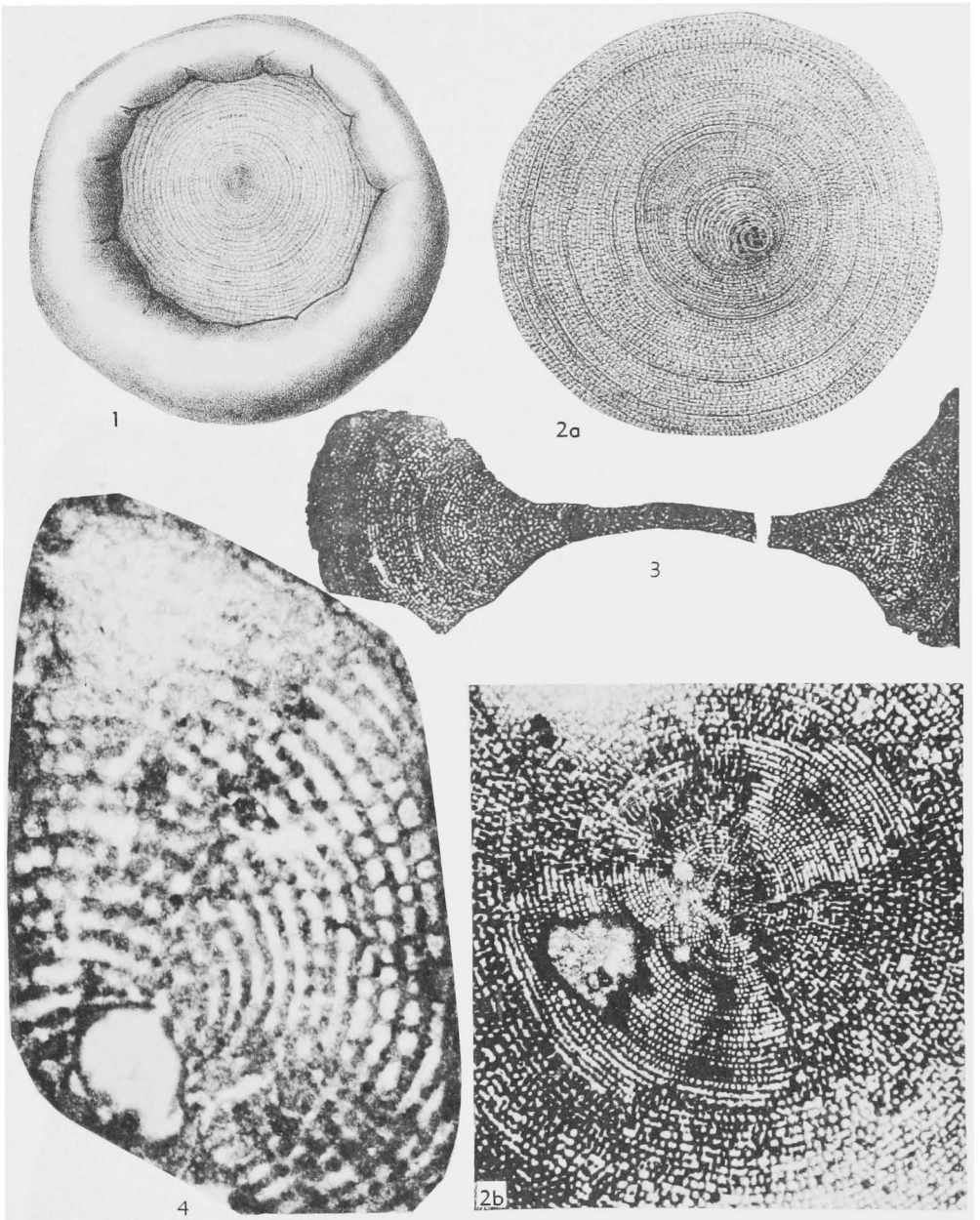

FIG. 214. Dicyclinidae (Dicyclininae; *1-4, Orbitopsella*) (p. C308).

median plane. [Differs from *Qataria* in the chamberlets alternating in position from one annulus to the next, whereas they are in radial alignment in *Qataria*.] *U.Cret.(U.Cenoman.-Turon.)*, SW. Asia.——FIG. 212,*1,2*. **D. planata*, Qatar Penin., Arabia; *1*, slightly oblique subequat. sec., ×30; *2*, axial sec. of paratype, ×58 (*2115).

Mangashtia HENSON, 1948, *902, p. 94 [**M. viennoti*; OD]. Test compressed, operculiform or flabelliform, early chambers spirally arranged; later stages with interseptal pillars perpendicular to septa in median plane of test, and aligned from one chamber to next; wall agglutinated, of calcareous particles in calcareous cement; aperture

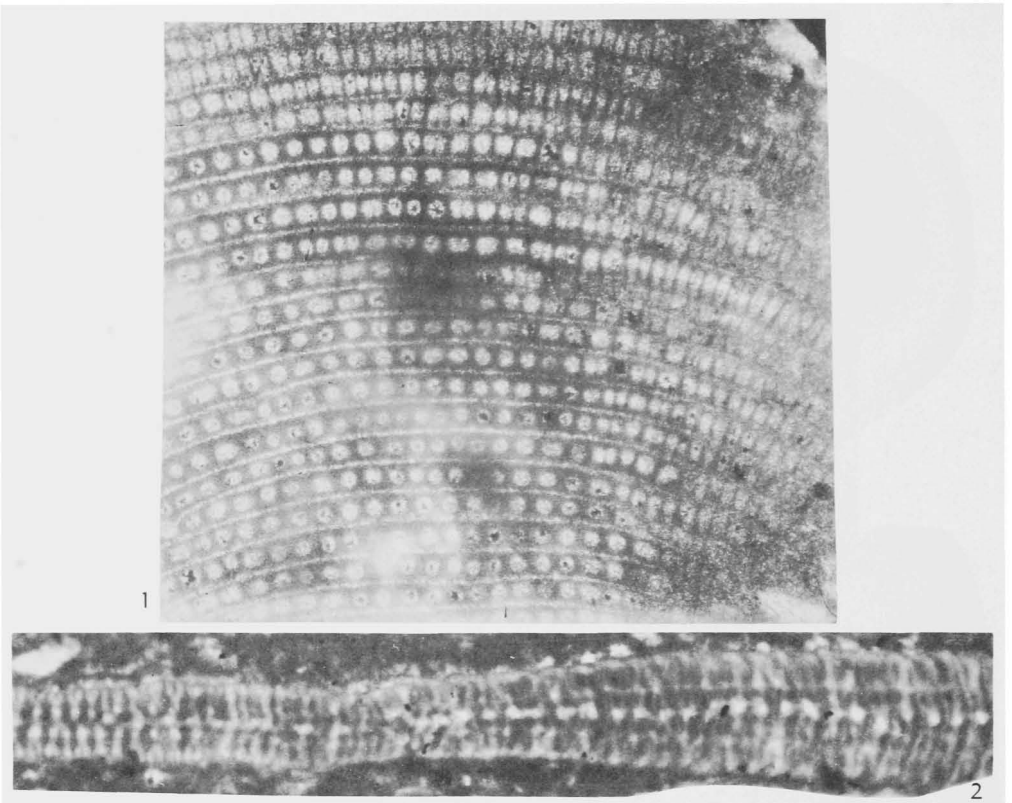

FIG. 215. Dicyclinidae (Dicyclininae; *1,2, Qataria*) (p. C308).

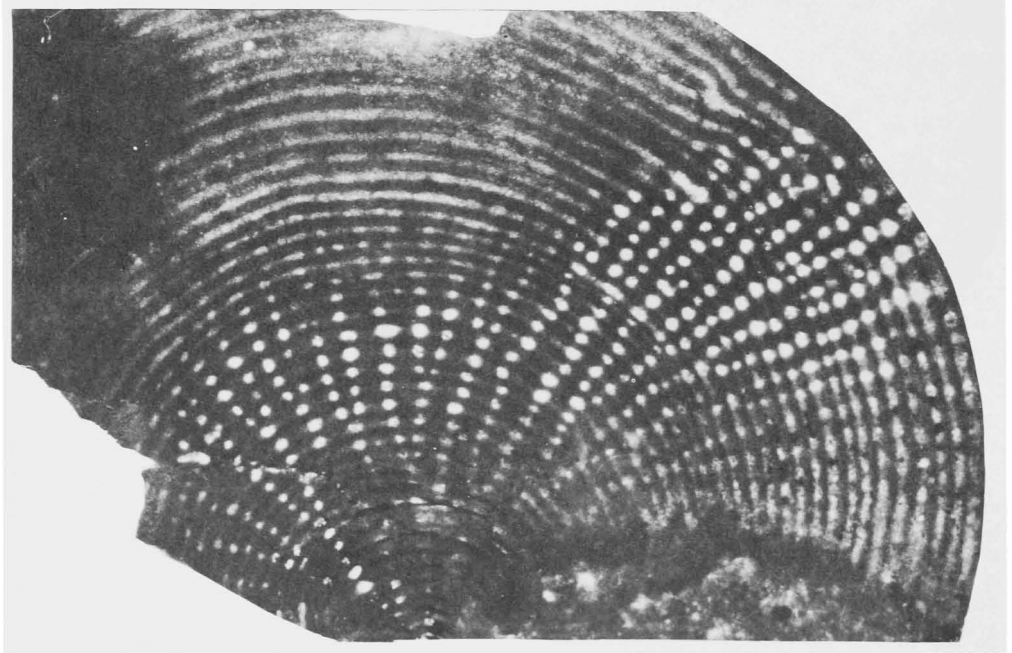

FIG. 216. Dicyclinidae (Dicyclininae; *1, Zekritia*) (p. C308).

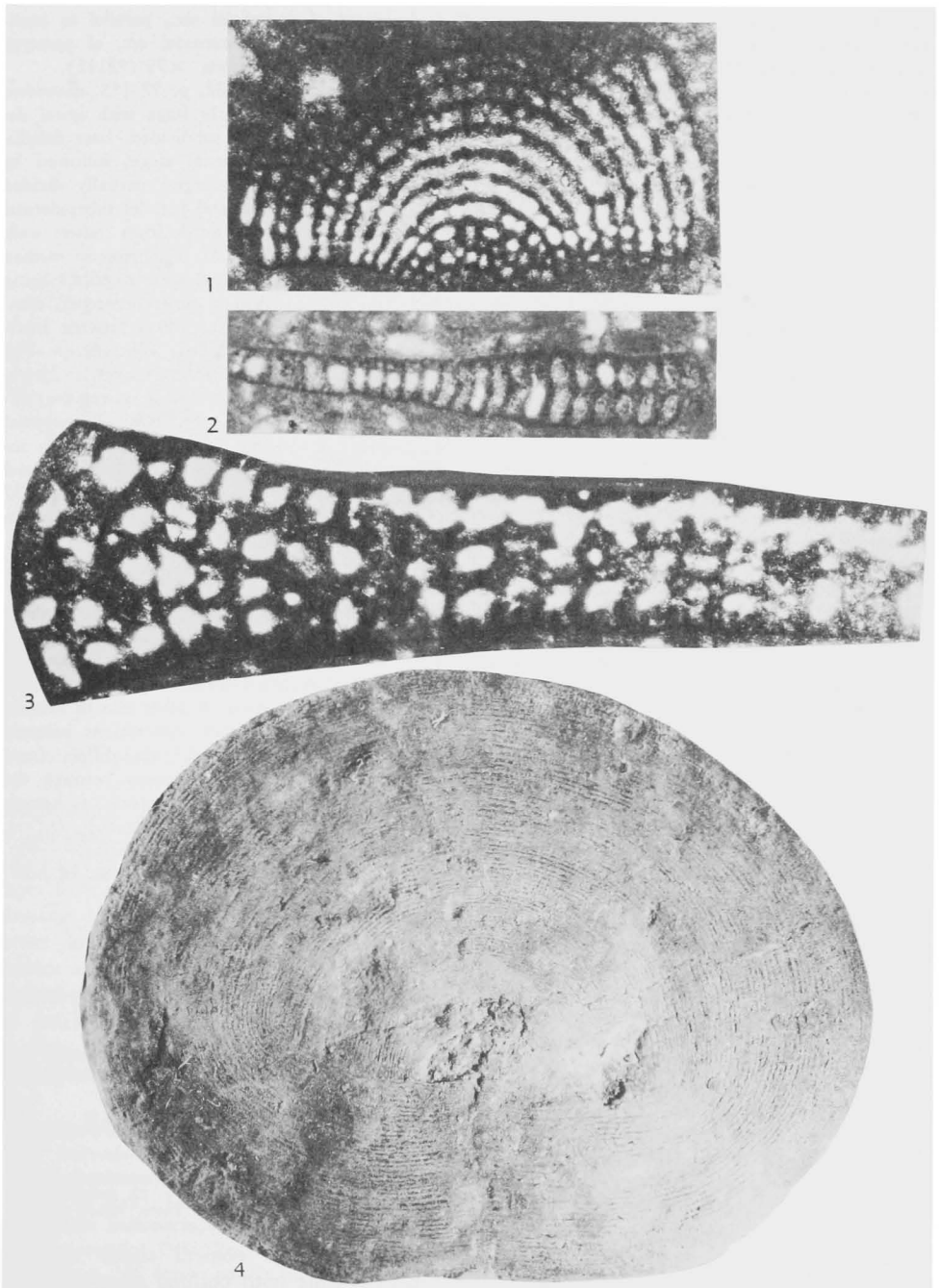

FIG. 217. Dicyclinidae (Dicyclininae; *1-4, Saudia*) (p. *C*308).

multiple, consisting of perforations in septa between interseptal buttresses. [This genus is known only from 12 random sections of the type-species. It differs from *Cyclolina* in the development of interseptal pillars.] *U.Cret.(Cenoman.-Turon.)*, Asia(Iran).——FIG. 212,*3,4*. **M. viennoti*, Kuh-i-Mangasht, Iran, syntypes (BMNH-P35881); *3*, subaxial sec. parallel to septum in center of sec., showing interseptal pillars and transverse to septa at ends of section, ×60; *4*, slightly oblique equat.

sec. showing irregular interseptal buttresses, apertures, and undivided chambers at each side of median plane, ×60 (*2115).

Orbitolinella HENSON, 1948, *902, p. 90 [**O. depressa*; OD]. Test conical, chambers arranged as in *Orbitolina* and subdivided by numerous subepidermal partitions, perpendicular to septa and outer walls and those of succeeding chambers in alignment, partitions becoming irregular toward center of chamber, forming reticulate zone; intercameral communication by means of pores in radial and inner reticulate zones but not in marginal area; wall granular or agglutinated calcareous, with vitreous layer over oral face (possibly originally pseudochitinoid). *U.Cret.(U. Cenoman.* or *Turon.)*, Asia(Qatar Penin., Arabia).——FIG. 213,*1-3*. **O. depressa; 1*, subaxial sec. of syntype, ×38; *2*, oblique tang. sec. showing more numerous partitions in outer layer (at top of figure), ×60; *3*, oblique transv. sec. of syntype intersecting 6 chambers at outer edge and showing reticulate appearance of central part, ×30 (*2115).

Orbitopsella MUNIER-CHALMAS, 1902, *1328, p. 351 [**Orbitulites praecursor* GÜMBEL, 1872, *841, p. 256 (=*Orbitulites circumvulvata* GÜMBEL, 1872, *841, p. 259); OD] [=*Coskinolinopsis* HENSON, 1948, *902, p. 27 (type, *C. primaevus*)]. Test discoidal, to 18 mm. diam., may have thickened margin; early coiled stage reduced, chambers spreading in peneropline form, followed by reniform stage and later by annular chambers, at least in microspheric form; incomplete secondary septa forming chamberlets which are regularly developed and perpendicular to spiral lamella in outer layer, but irregular and in form of pillars in deeper zone of each chamber; no true alveolar structure; circular canals aligned beneath surface may be seen in axial sections as undivided portions of circular chamber occurring between outer reticulate zone and inner regularly pillared zone; aperture consisting of irregularly distributed openings on peripheral margin. *?U.Trias., L.Jur.*, Eu.-SW.Asia.——FIG. 214,*1-3*. **O. praecursor* (GÜMBEL), L.Jur.(Lias.), Roveredo Tyrol Alps; *1*, ext. (as *O. circumvulvata*), ×10 (*841); *2a*, equat. sec., ×10 (*841); *2b*, central portion of equat. sec., ×14 (*788); *3*, axial sec., ×9 (*788).——FIG. 214,*4*. *O. primaeva* (HENSON), U.Trias. or L.Jur., SW.Asia(Oman); probably megalospheric syntype (BMNH P35788), ×60 (*2115).

Qataria HENSON, 1948, *902, p. 98 [**Q. dukhani*; OD]. Test discoidal, early stage planispiral; later chambers cyclical; outer margins of chambers subdivided by numerous parallel and transverse subepidermal partitions; lateral chamberlets in radial rows from center to periphery; aperture multiple; small perforations in outer wall in rows corresponding to opposing pairs of lateral chamberlets. *U.Cret. (U. Cenoman.* or *Turon.)*, Asia(Qatar Penin., Arabia).——FIG. 215,*1,2*. **Q. dukhani; 1*, fragment of superficial sec., parallel to equatorial plane, ×67; *2*, subaxial sec. of paratype showing lateral chamberlets, ×59 (*2115).

Saudia HENSON, 1948, *902, p. 97 [**S. discoidea*; OD]. Test discoidal, early stage with spiral development probably not subdivided, later flabelliform with arcuate uniserial stage, followed by cyclical chambers with margins partially divided by secondary transverse and parallel subepidermal partitions, projecting inward from outer wall, radial interseptal pillars also occurring in median plane in later, thicker parts of test, pillars being aligned from one cycle to next; interseptal communication by means of apertures between interseptal pillars. *Paleoc.-M.Eoc.*, SW.Asia.——FIG. 217,*1-3*. **S. discoidea*, M.Eoc.(Lutet.), Ansab, between Iraq and Saudi Arabia; *1*, young megalospheric flabelliform paratype, ×40; *2*, subaxial sec. through early stage of paratype showing interseptal pillars in outer zone, ×40; *3*, subaxial sec. of paratype showing numerous pillars, ×37 (*2115).——FIG. 217,*4*. *S. labyrinthica* GRIMSDALE, Paleoc., N.Iraq; ext., ×5 (*2115).

Zekritia HENSON, 1948, *902, p. 95 [**Z. langhami*; OD]. Test compressed, flabelliform; chambers of early stages probably evolute planispiral, later uniserial and arcuate, chambers in 2 layers partially subdivided by interseptal partitions and pillars in median plane; wall calcareous, agglutinated; aperture cribrate in rows at either side of median partition, with intercameral connections between chambers of 2 layers. [*Zekritia* differs from *Cyclopsinella* in having connections between the 2 layers of chambers. The type-species is known from a single sectioned specimen.] *U.Cret. (?Turon.)*, Asia(Qatar Penin., Arabia).——FIG. 216. **Z. langhami*, slightly oblique sec. of holotype, ×39 (*2115).

ORBITOLINIDAE

By R. C. Douglass,[1] A. R. Loeblich, Jr.,[2] and Helen Tappan[3]

[[1]United States Geological Survey, [2]California Research Corporation, [3]University of California at Los Angeles]

Family ORBITOLINIDAE Martin, 1890

[Orbitolinidae MARTIN, 1890, p. 226] [=subfamily Orbitolininae CUSHMAN in EASTMAN, 1913, p. 27; =family Arorbitolidia RHUMBLER, 1913, p. 342 (*nom. van.*); =family Orbitolinida COPELAND, 1956, p. 186 (*nom. van.*)]

Relatively large conical shells varying from high cone with pointed apex to broad shield or disc. Test with single series of shallow cuplike chambers that increase in diameter more or less regularly, initial chambers of some tests developed in spiral form at angle to adult portion of test; chambers divided by vertical and, in some genera,

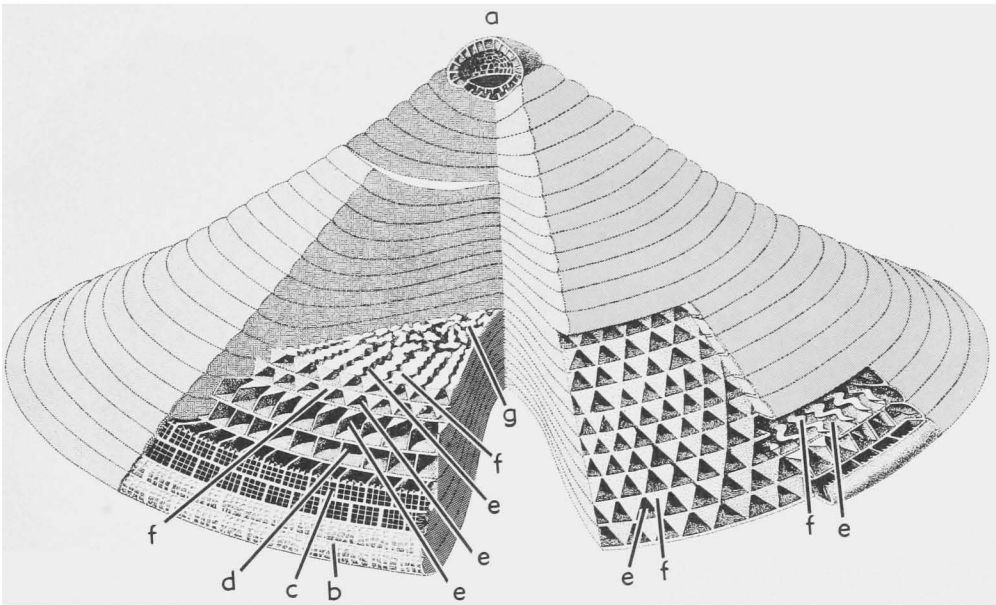

FIG. 218. Orbitolinidae. Reconstruction of *Orbitolina* with parts cut away to show internal structures. [Explanation: *a,* megalospheric embryonic apparatus; *b,* slightly abraded surface showing cellules; *c,* marginal zone beneath cut-away surface; *d,* inframarginal zone exposing chamberlets; *e,* radial passages between chambers; *f,* slightly zigzag main radial partitions showing triangular cross section; *g,* central complex] (*611).

horizontal plates, with central area divided by either vertical partitions or pillars, or combination of both (Fig. 218, 219); communication between chambers by septal or apertural pores. Test wall of 2 parts, outer layer forming dorsal surface of test and continuing as ventral surface of each septum, inner layer continuous with partitions or pillars and plates; inner layer, at least, agglutinate and may contain abundant grains of detrital material. [The family lived in shallow, warm marine waters in a circumglobal northern equatorial belt.] *L.Cret.-Eoc.*

Orbitolina D'ORBIGNY, 1850, *1397b, p. 143 [**Orbulites lenticulata* LAMARCK, 1816, *1088, p. 197 (=*Madreporites lenticularis* BLUMENBACH, 1805, *150b, p. lxxx); OD (M)] [=*Orbitulina* BRONN in BRONN & ROEMER, 1853, *214a, p. 93 (obj.) *(nom. van.)*; *Orbitolinopsis* SILVESTRI, 1932, *1787A, p. 160 *(nom. nud.)*; *Orbitolinopsis* HENSON, 1948, *902, p. 67 (type, *Orbitolina? kiliani* PREVER in SILVESTRI, 1932, *1787A, p. 159); *Orbitolinoides* VAUGHAN, 1945, *1995, p. 22 (type, *senni*); *Birbalina* SAHNI & SASTRI, 1957, *1612, p. 28 (type, *B. pulchra*); *Abrardia* NEUMANN & DAMOTTE, 1960, *1353, p. 60 (type, *Dictyoconus mosae* HOFKER, 1955, *944, p. 115); *Orbitolina (Mesorbitolina)* SCHRÖDER, 1962, *1676A, p. 181 (type, *Orbitulites texanus* ROEMER, 1852, *1580A, p. 86)]. Test to 30 mm. diam.; main partitions zigzag, continuous through marginal and radial zones, thickened in upper portion of chambers; partitional pores prominent in some species, tending to interrupt partitions to form pillar-like structures in central area; marginal zone divided by partitions and one or more series of vertical and horizontal plates. *L.Cret.(Barrem.) - U.Cret. (Maastricht.),* equat. region, cosmop.——FIG. 220, *1-4. *O. lenticularis* (BLUMENBACH), L.Cret. (Apt.), Fr.; *1,2,* dorsal, ventral sides of topotypes,

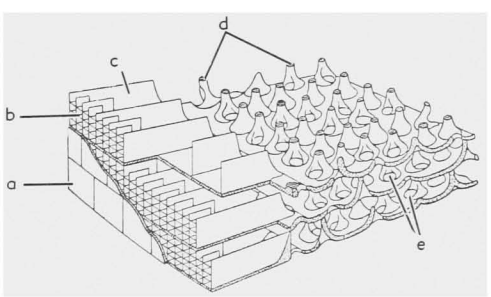

FIG. 219. Orbitolinidae. Reconstruction of a small portion of the test of *Dictyoconus* near its base with parts cut away to show internal structure. [Explanation: *a,* outer surface indicating placement of septa and main partitions; *b,* cellules; *c,* chamberlets; *d,* pillars partially encircling apertural pores; *e,* apertural pores] (*562).

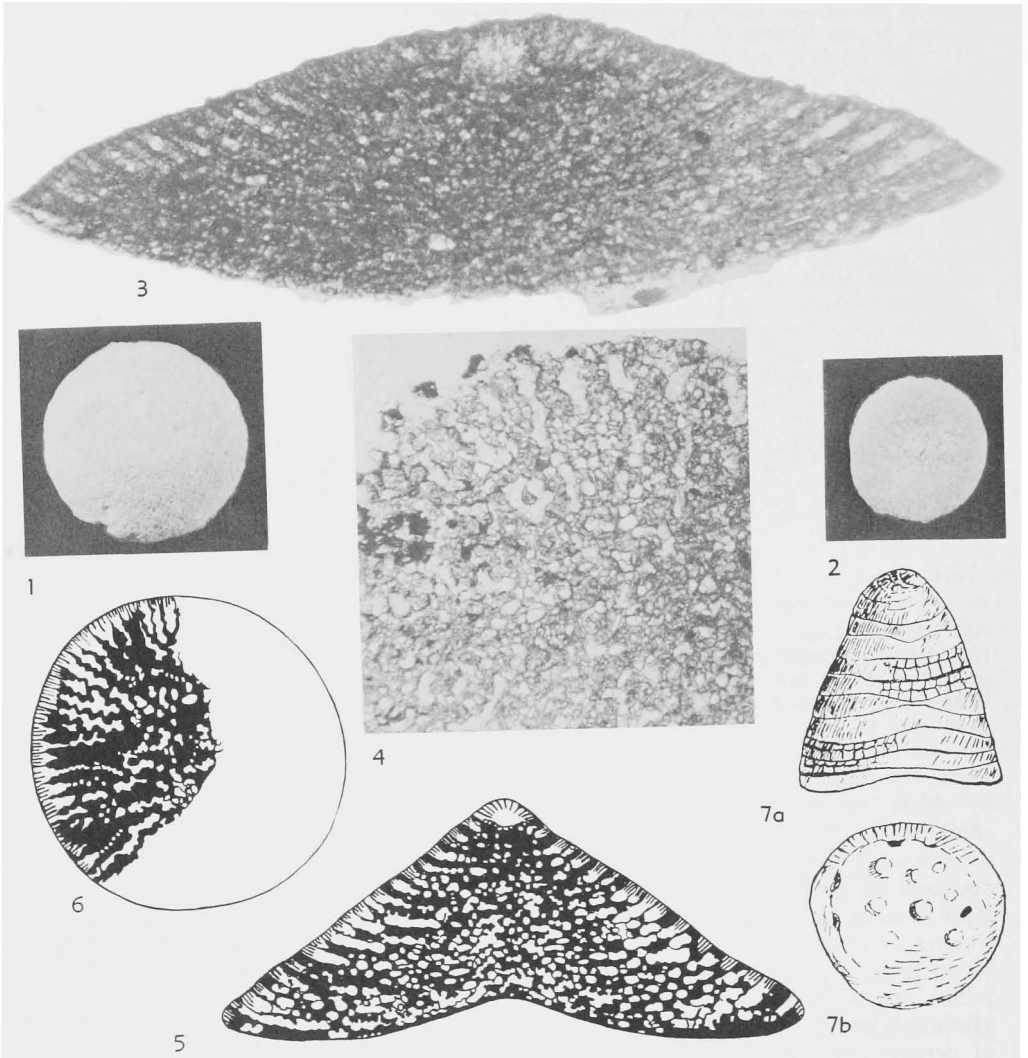

FIG. 220. Orbitolinidae; *1-7, Orbitolina* (p. C309-C310).

×6.6; *3,* slightly oblique axial sec., ×20; *4,* portion of basal sec., ×50 (*2114).——FIG. 220,*5,6. O. texana* (ROEMER), L.Cret.(Alb.), USA(Tex.); ×20 (*611).——FIG. 220,*7. O. mosae* (HOFKER), U.Cret.(Maastricht.), Fr.; *7a,b,* side and basal views, approx. ×33 (*1353).

Coskinolinoides KEIJZER, 1942, *1029, p. 1016 [**C. texanus* (=*Coskinolina adkinsi* BARKER, 1944, *83, p. 206); OD]. Test minute, about 0.5 mm. diam.; main partitions simple planes extending from marginal zone to central area; marginal zone divided by main partitions and 1 or 2 sets of vertical plates only. *L.Cret.,* N.Am.-S.Am.——FIG. 221,*1-3. *C. texanus,* Alb., USA(Tex.); *1,2,* basal and axial secs., ×66 (*2114); *3a,b,* side, basal views of exterior, ×50 (*2117).

Dictyoconus BLANCKENHORN, 1900, *146, p. 432 (*nom. conserv.,* ICZN, Op. 585) [**Patellina egyptiensis* CHAPMAN, 1900, *316, p. 11 (=*P. aegyptiensis* CHAPMAN, 1900, *nom. reject.,* ICZN, Op. 585); SD WOODRING, 1924, *2078, p. 608] [=*Dictyoconos* BLANCKENHORN, 1900, *146, p. 434 (*nom. reject.,* ICZN, Op. 585); *Cushmania* SILVESTRI, 1925, *1780, p. 52 (type, *Conulites americana* CUSHMAN, 1919, *414, p. 43); *Fallotella* MANGIN, 1954, *1212, p. 209 (type, *F. alavensis*)]. Test to about 7 mm. diam.; central area with interseptal pillars, separated slightly from marginal zone by marginal ridge in many species; marginal zone divided by partitions and may have one or more series of vertical and horizontal plates. *L.Cret.-U.Eoc.,* cosmop.——FIG. 221,*4. *D.*

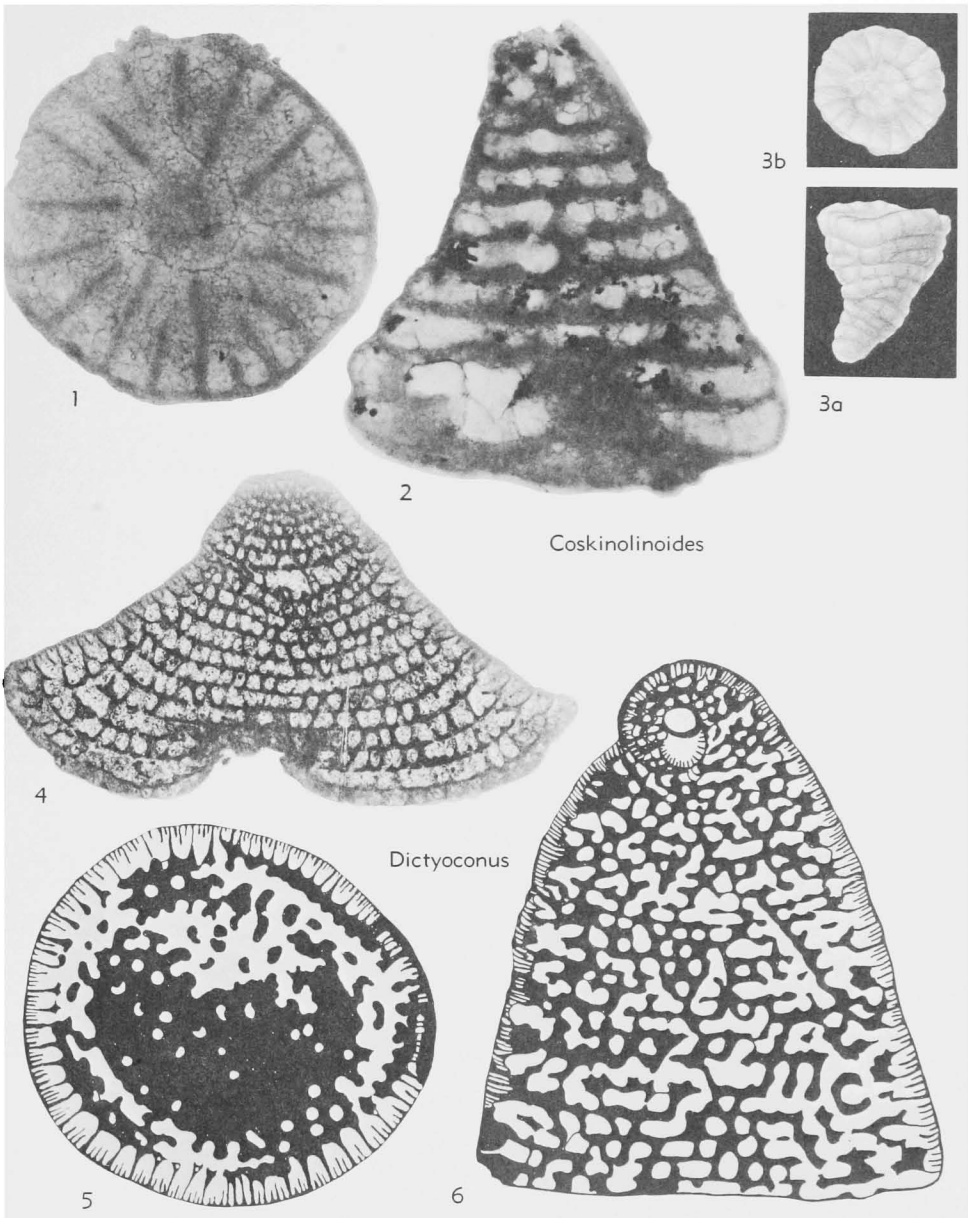

FIG. 221. Orbitolinidae; *1-3, Coskinolinoides; 4-6, Dictyoconus* (p. C310-C311).

egyptiensis (CHAPMAN), Eoc.(Lutet.), SW.Asia (Egypt); axial sec., ×10 (*1781).——FIG. 221, *5,6. D. indicus* DAVIES, L.Eoc., Baluch.; basal and axial secs., ×20 (*611).

Iraqia HENSON, 1948, *902, p. 69 [**I. simplex*; OD] [=*Dictyoconella* HENSON, 1948, *902, p. 24 (type, *D. complanata*)]. Test less than 2 mm. diam.: main partitions reticulate in central area; marginal zone divided by main partitions and may have one or more series of vertical and horizontal plates. *L.Cret.(Apt.-Alb.)-U.Cret. (Cenoman.-Maastricht.)*, Eu.-SC.Asia.——FIG. 222, *1-3. *I. simplex*, L.Cret.(Apt.), Iraq; *1a,b*, side and basal views, ×40 (*2117); *2*, axial sec.; *3*, horiz. sec., ×33 (*2115).——FIG. 222,*4-7. *I. complanata* (HENSON), U.Cret.(Maastricht.), Arabia; *4*, side view of holotype, ×22 (*2117); *5*, oblique sec. of paratype nearly paralleling plane

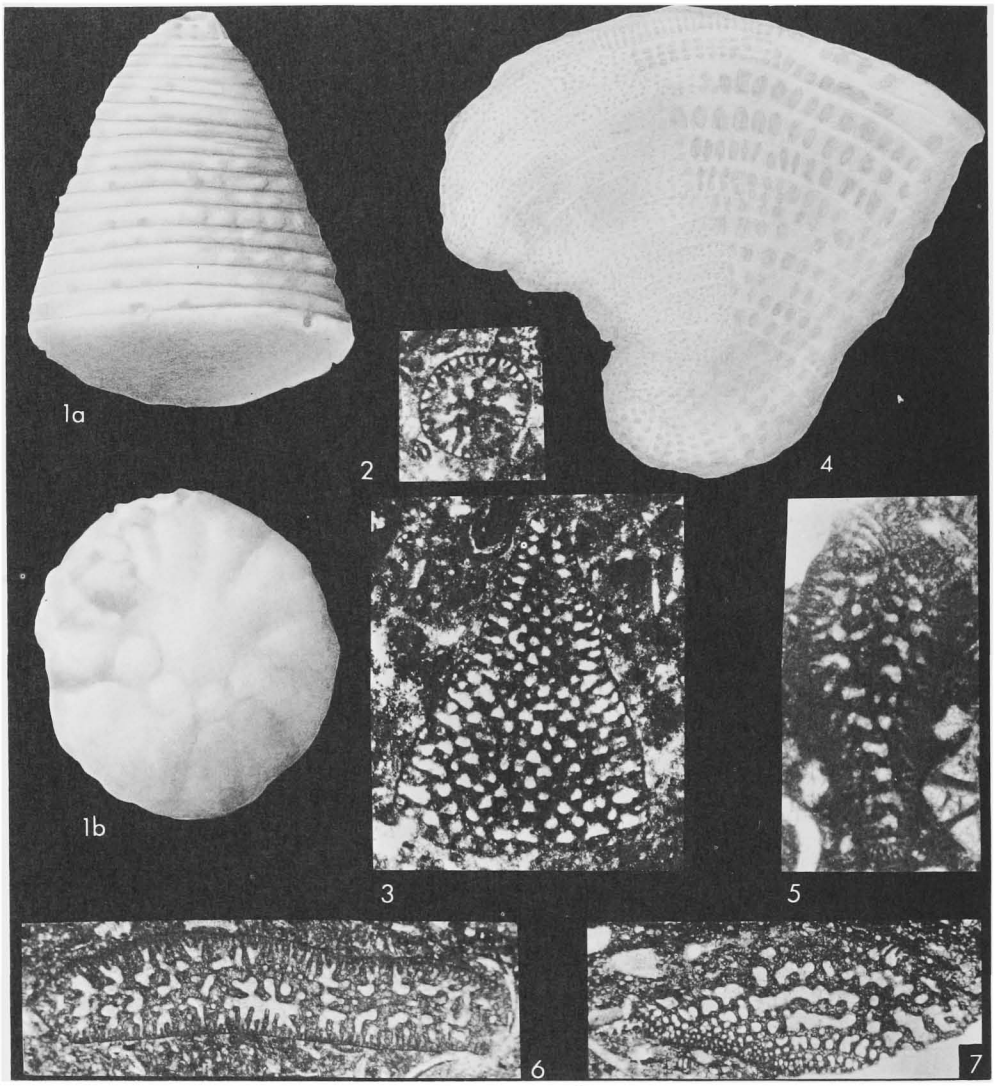

FIG. 222. Orbitolinidae; *1-7, Iraqia* (p. C311-C312).

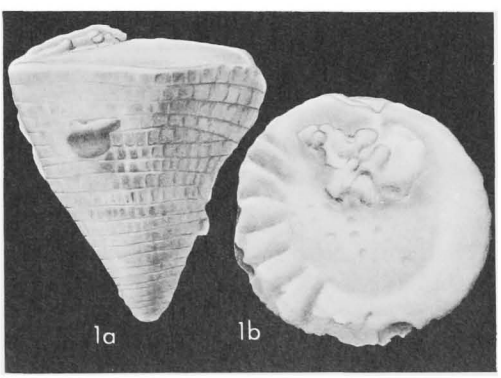

FIG. 223. Orbitolinidae; *1, Simplorbitolina* (p. C312-C313).

of compression, ×23; *6,* paratype, sec. perpend. to axis, ×20; *7,* oblique sec. showing subepidermal layer, left, and central zone, right, ×20 (*2115).

Simplorbitolina CIRY & RAT, 1953, *344, p. 85 [*S. *manasi*; OD]. Test small, generally less than 3 mm. diam.; includes forms intermediate between *Orbitolina* and *Dictyoconus,* with main partitions extending from marginal zone into central area in zigzag manner as in *Orbitolina* but with lower part of each partition discontinuous in form of pillars as in *Dictyoconus;* marginal zone divided by main partitions and one or more series of plates. *L.Cret.,* Eu.(Spain)-Asia(Arabia).——FIG. 223,*1*; 224,*1-3*. **S. manasi,* Spain; 223,*1a,b,* side and basal views of exterior of topotype, ×35 (*2117); 224,*1a,b,* basal and axial sec., ×30

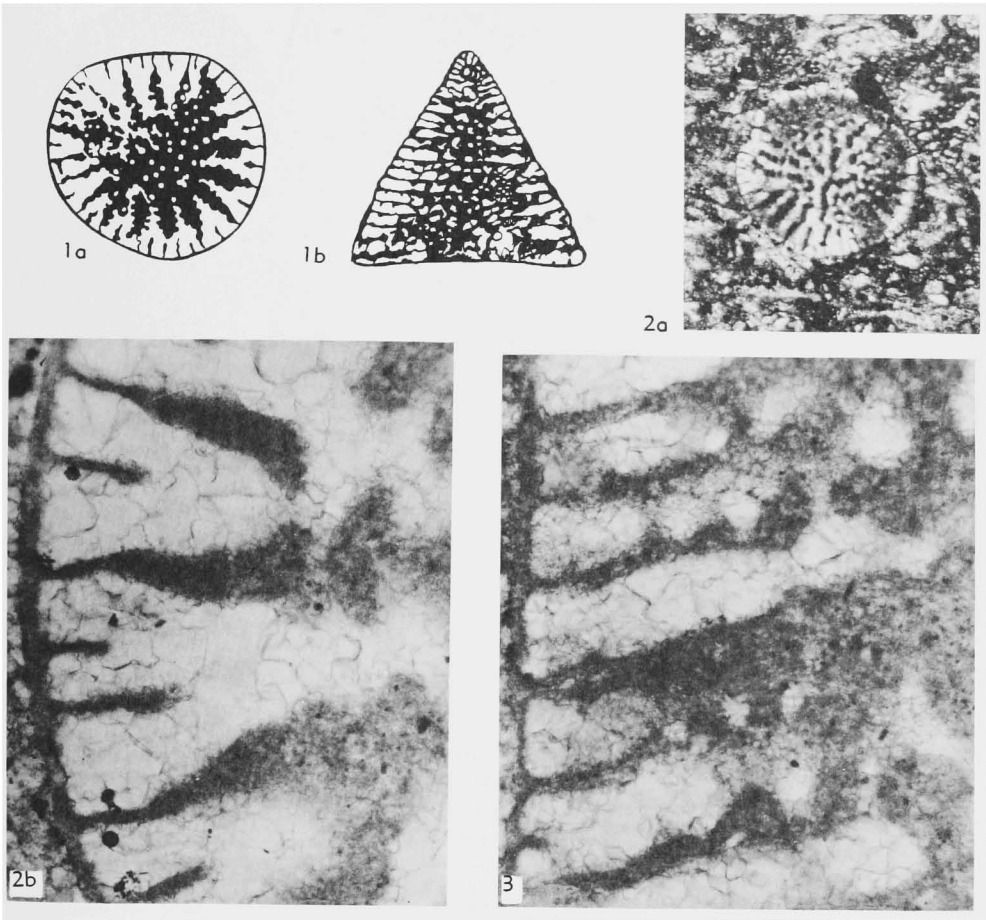

FIG. 224. Orbitolinidae; *1-3, Simplorbitolina* (p. C312-C313).

(*611); 224,*2a,* basal sec., ×20; 224,*2b,* portion of basal sec., ×100; 224,*3,* portion of axial sec., ×100 (*2114).

Suborder FUSULININA Wedekind, 1937

[*nom. correct.* LOEBLICH & TAPPAN, 1961, p. 219 (*pro* suborder Fusulinacea WEDEKIND, 1937, p. 79)]——[In synonymic citations superscript numbers indicate taxonomic rank assigned by authors (¹order, ²suborder); dagger(†) indicates *partim*] —— [=²Imperforina† CALKINS, 1901, p. 106; =²Tinoporinae† CALKINS, 1901, p. 109; =¹Nodosaridia† KÜHN, 1926, p. 134; =¹Rotaliaridia† KÜHN, 1926, p. 152; =¹Textulinida† CALKINS, 1926, p. 356; =¹Nodosalidia† CALKINS, 1926, p. 355; =Sektion *Palaeohellenoidea* WEDEKIND, 1937, p. 72, 79; =¹*Hellenoidea*† WEDEKIND, 1937, p. 79; =²*Cribrostomacea* WEDEKIND, 1937, p. 79; =²Cribrospiracea WEDEKIND, 1937, p. 79; =²Plurilocul inidea† SIGAL in PIVETEAU, 1952, p. 160; =¹Endothyrida FURSENKO, 1958, p. 23; =¹Fusulinida FURSENKO, 1958, p. 23]

Primitively of microgranular calcite, advanced forms with 2 or more differentiated layers in wall. *Ord.-Trias.*

Superfamily PARATHURAMMINACEA E. V. Bykova, 1955

[*nom. correct.* LOEBLICH & TAPPAN, 1961, p. 283 (*pro* superfamily Parathuramminidea FURSENKO in RAUZER-CHERNOUSOVA & FURSENKO, 1959, p. 174)]

Single globular or tubular chamber or cluster of such chambers; wall simple, consisting of calcareous granules in calcareous cement; aperture simple. *Ord.-Carb.*

Family PARATHURAMMINIDAE E. V. Bykova, 1955

[Parathuramminidae E. V. BYKOVA in E. V. BYKOVA & POLENOVA, 1955, p. 15] [=Archaesphaeridae MALACHOVA, 1956, p. 87]

Globular chamber or cluster of chambers; aperture absent or multiple, at ends of tubular projections. *Dev.-L.Carb.*