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Part L
MOLLUSCA 4
CEPHALOPODA
AMMONOIDEA

BY W. J. ARKELL, W. M. FURNISH, BERNHARD KUMMEL, A. K. MILLER, R. C. MOORE, O. H. SCHINDEWOLF, P. C. SYLVESTER-BRADLEY, AND C. W. WRIGHT

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INTRODUCTION TO AMMONOIDEA

By A. K. Miller and W. M. Furnish

The clymenias, goniatites, ceratites, and ammonites, which together constitute the order Ammonoidea, have long been extinct, but their fossilized shells are common in all continents and many oceanic islands. Numerous specimens are remarkably well preserved, even spectacular, and their exceptional value as a basis for stratigraphic correlations has been recognized for well over a century. Accordingly, they have attracted the attention of both layman and scientist for generations, and the literature in regard to them is voluminous. Almost all our knowledge of these creatures comes from studies of the shells and the enclosing matrices, but a few opercula are also preserved. The shells are comparable to that of modern *Nautilus,* a presumed relative of the group.

The nautiloids and ammonoids, which together constitute the subclass Tetrabranchiata, were widespread and abundant in the past but are now almost extinct, being represented by only a few species of the single genus, *Nautilus.* All members of the entire group are characterized by the possession of

hook, aperture facing inward; ribs fine, concave and prorsiradiate; umbilical tubercles may occur on shaft and hook, with ventrolateral tubercles also in some. *U.Alb.*, SE.Afr.-Madag.-Queensl.

L. (Labeceras). No ventrolateral tubercles. Occurrence as for genus.——FIG. 257,*1*. *L. (L.) plasticum* SPATH, Port.E.Afr.; *1a*, ×1; *1b*, ×1.5; *1c*, ×4 (713*).

L. (Appurdiceras) WHITEHOUSE, 1926 [**Ancyloceras corcycepoides* ETHERIDGE, JR., 1905]. Whorl section subquadrate; strong ventrolateral tubercles. *U.Alb.*, Queensl.

Myloceras SPATH, 1925 [**Crioceras ammonoides* ETHERIDGE, JR., 1909] [*Aleteceras, Flindersites* WHITEHOUSE, 1926]. Larger than *Labeceras*, with spire more closely coiled after initial few open whorls and aperture not facing inward to same extent; whorl section generally compressed, with flat venter; strong, distant ventrolateral spines may be present. *Low.U.Alb.*, Port.E.Afr.-Madag.-Queensl.-?N.Z.——FIG. 257,*2*. *M. serotinum* SPATH, Port.E.Afr.; ×0.5 (713*).

Ellipsoceras COLLIGNON, 1950 [**E. expansum*] [*Abadieceras* COLLIGNON, 1950]. Coiling of later part less regular than in *Myloceras*, whorl section more compressed and much higher; fine, well-spaced, slightly sinuous ribs are sharpened on ventrolateral edges but tubercles are lacking. *Low. U.Alb.*, Madag.——FIG. 257,*3*. **E. expansum*; ×0.5 (601*).

?Hamitoides SPATH, 1925 [**Hamites studerianus* PICTET, 1847]. Nature of coiling uncertain, since only fragments are known; whorl section circular to oval; ribs branch irregularly at umbilical edge or on sides, in many shells forming tubercle at point of branching. Suture not adequately known, with bifid saddles and trifid lobes. *Up.M.Alb.-Low. U.Alb.*, Fr.-Switz.-Pol.-Port.E.Afr.-Madag.-Pak. ——FIG. 257,*4*. **H. studerianus* (PICTET), U.Alb., Fr.; ×1 (346*).

Suborder AMMONITINA Hyatt, 1889

[*nom. correct.* ARKELL, 1950 (*ex* "suborder Ammonitinae of the Trias, Jura, and Cretaceous")]

Normally coiled derivatives of Phylloceratina and Lytoceratina, in which thick test and strong ornament are characteristic, though by no means universal. Sutures only very rarely with bifid lobes or phylloid saddle endings (200). *L.Jur.-U.Cret.*, world-wide.

In this suborder are grouped all post-Triassic Ammonoidea except the 2 fundamental stocks, Phylloceratina and Lytoceratina, and their immediate and uncoiled descendants or offshoots. It is not yet possible to determine for some families whether they originated from Phylloceratina or Lytoceratina and it is therefore best, at the present stage of knowledge, to keep them all in one polyphyletic suborder. This arrangement also best brings out the fundamental distinction between the 2 persistent stocks and all other Jurassic and Cretaceous ammonites.

Superfamily PSILOCERATACEAE Hyatt, 1867

[*nom. transl.* WEDEKIND, 1917 (as Psiloceratoidea, *ex* Psiloceratidae HYATT, 1867, *nom. correct.* ARKELL, herein (as Psiloceratateae)] [=Ammonitacea BUCKMAN, 1905; Psiloceratacea BUCK., 1919; Arietitaceae ARKELL, 1950]

Derivatives of Phylloceratina. The earliest Jurassic Ammonitina (Psiloceratidae) are probably direct descendants of *Eopsiloceras* (Rhaet.) and so of *Mojsvarites* (Carn.-Nor.) of the Ussuritidae (=Monophyllitidae). *L. Jur.*(mainly *Hett., Sinem.*, 2 genera only lingering into *L.Pliensb.*), world-wide.

Family PSILOCERATIDAE Hyatt, 1867

[=Caloceratidae BUCKMAN, 1906]

Evolute, smooth or with blunt primary ribbing, venter rounded and smooth to nearly smooth or feebly keeled in some. Sutures simple, with retracted suspensive lobe, saddle endings phylloid in some. Aptychus single-valved, with concentrically striated shiny surface (Anaptychus) (found *in situ* in *Psiloceras*) (65, 123, 250, 251, 253, 464, 550). *L.Jur.*(*Hett.-Sinem.*, mainly *Hett.*), world-wide.

Subfamily PSILOCERATINAE Hyatt, 1867

[*nom. transl.* LANGE, 1941 (*ex* Psiloceratidae HYATT, 1867)]

Venter unkeeled. *L.Jur.*(*Hett.*).

Psiloceras HYATT, 1867 [**Am. planorbis* SOWERBY, 1824; SD SPATH, 1924 (ICZN Opinion 324)] [=*Psilonoticeras* QUENSTEDT, 1883 (obj.)]. Small, compressed planulates, smooth, unribbed or with sporadic blunt rib. Eu.-Indon.-N.Z.-Can.-Nev.-Peru.——FIG. 258,*10*. **P. (P.) planorbis* (Sow.), Eng.; *10a*, holotype, ×0.7 (18*); *10b,c*, drawings, ×1 (737*).

Caloceras HYATT, 1870 [**Am. torus* D'ORBIGNY, 1844; SD BUCKMAN, 1912]. Blunt primary ribbing on all whorls; many-whorled. Subgen. of *Psiloceras*. Eu.-Peru.——FIG. 258,*1*. **P. (C.) torus* (ORB.), Fr.; *1a-c*, ×0.5 (330*).

Franziceras BUCKMAN, 1923 [**F. ruidum*]. Differs from *Caloceras* in having normal planulate coiling and sutures with longer lobes. Subgen. of *Psiloceras*. Eng.——FIG. 258,*7*. **P. (F.) ruidum* (BUCK.); *7a,b*, ×0.5 (65*).

Discamphiceras SPATH, 1923 [**Aegoceras kammerkahrense* GÜMBEL, 1861 (fig'd. WAEHNER, 1884)].

Involute, high-whorled, with rounded venter and feeble primary ribbing. Sutures complex. Eu.——FIG. 258,9. **D. kammerkahrense* (GÜMBEL), Aus.; *9a,b,* ×0.25 (550*).

Kammerkaroceras LANGE, 1941 [**Aegoceras emmrichi* GÜMBEL, 1861 (CANAVARI, 1882)]. Involute, discoidal, with sigmoid ribs which branch on whorl sides and pass over rounded venter. Eu.——FIG. 258,2. **K. emmrichi* (GÜMBEL), Aus.; *2a,b,* ×1 (597*).

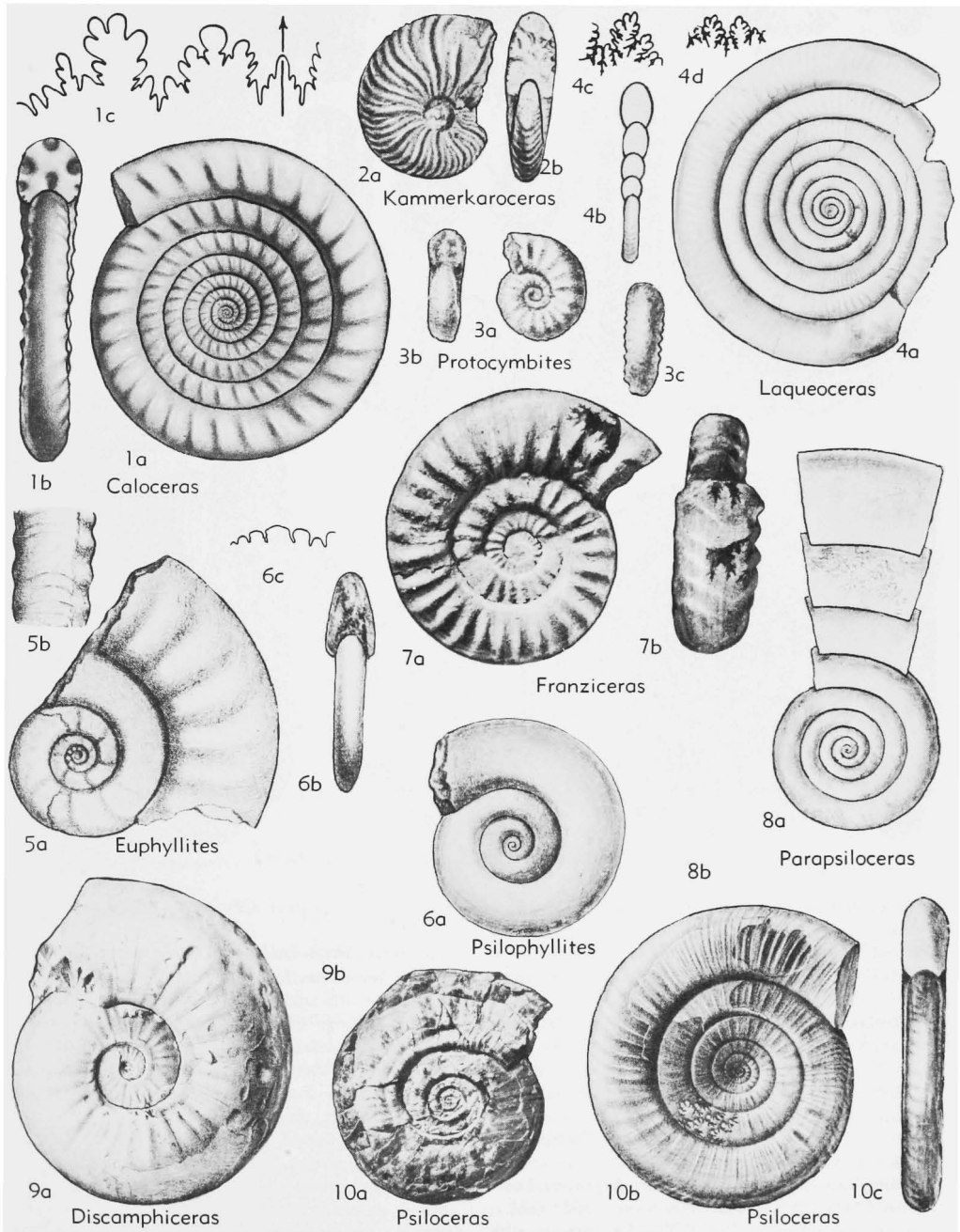


FIG. 258. Psiloceratidae (Psiloceratinae) (p. L232-L234).

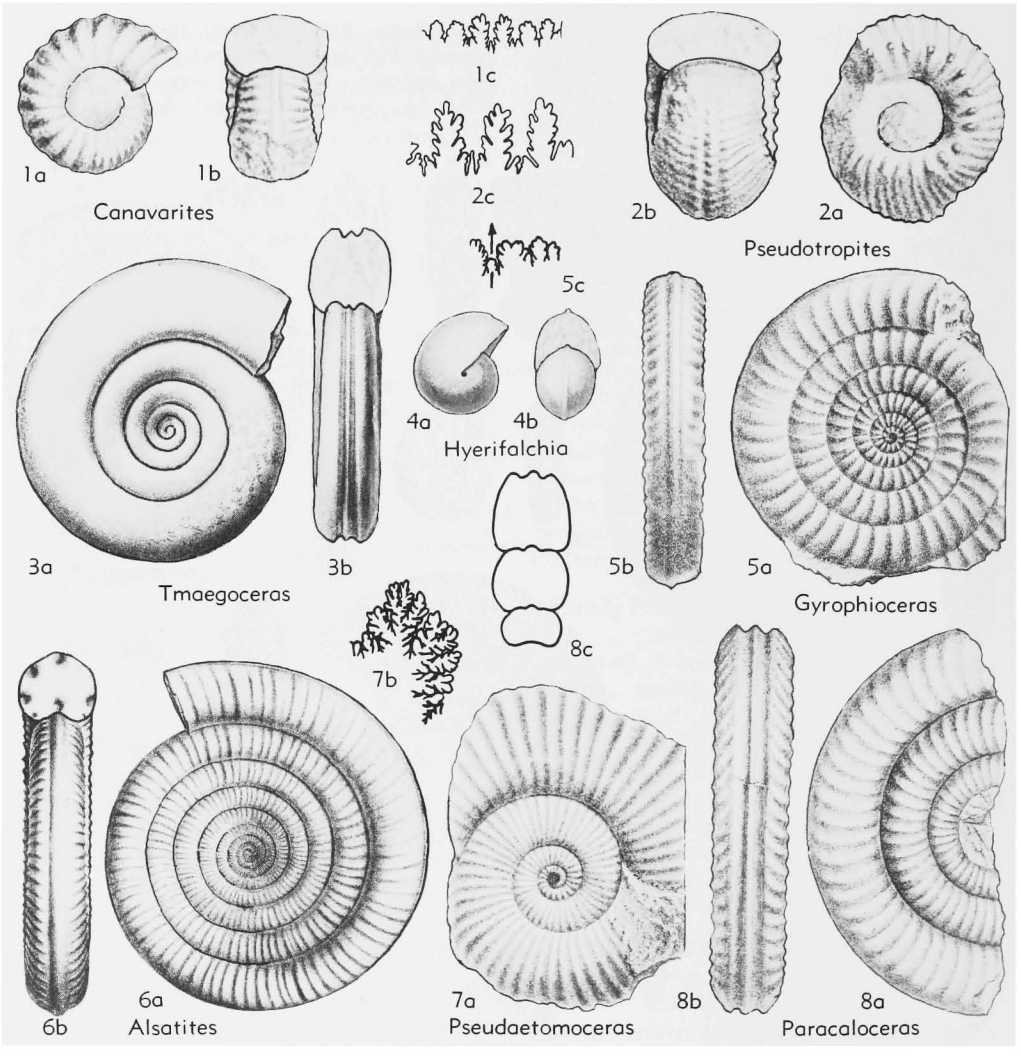


FIG. 259. Psiloceratidae (Alsatitinae) (p. L235-L236).

Laqueoceras LANGE, 1925 [**Aegoceras sublaqueus* WAEHNER, 1886]. Evolute, many-whorled, inner whorls fine-ribbed, outer whorls smooth. Eu.-N. Caled.——FIG. 258,*4*. **L. sublaqueus* (WAEHNER), Ger.; *4a-d*, ×0.25 (550*).

Parapsiloceras HYATT, 1900 [**Psiloceras polycyclum* WAEHNER, 1886] [=*Paraphylloceras* SALFELD, 1919]. Evolute, many-whorled, section elliptical, inner whorls with faint ribbing, growth halts and spiral lineation, middle and outer whorls smooth. Eu.——FIG. 258,*8*. **P. polycyclum* (WAEHNER), Aus.; *8a,b*, ×0.5 (550*).

Psilophyllites SPATH, 1914 [**Am. hagenowi* DUNKER, 1847] [=*Hagenowiceras* LANGE, 1921 (obj.); *Neophyllites* LANGE, 1941]. Evolute, smooth, with ?degenerate pseudoceratitic sutures. Eu.——FIG. 258,*6*. **P. hagenowi* (DUNKER), Ger.; *6a-c*, ×1 (615*).

Euphyllites WAEHNER, 1898 [**Aegoceras? struckmanni* NEUMAYR, 1879]. Inner whorls constricted, middle whorls smooth, outer whorl feebly ribbed. Saddle endings of sutures phylloid. Intermediate between Psiloceratidae and Phylloceratina, of which it may be an independent offshoot. Eu.-Himalaya-?N.Z.-Nev.——FIG. 258,*5*. **E. struckmanni* (NEUM.), Aus.; *5a,b*, ×0.75 (550*).

Protocymbites SPATH, 1923 [**P. waehneri*]. Dwarfs with rather strong primary ribs and slightly contracted body chamber. Resembles *Cymbites* but believed to be an unrelated psiloceratid derivative. *Sinem.(bucklandi-rotiformis beds)*, Eu.——FIG. 258,*3*. **P. waehneri*, Aus.; *3a-c*, ×1 (550*).

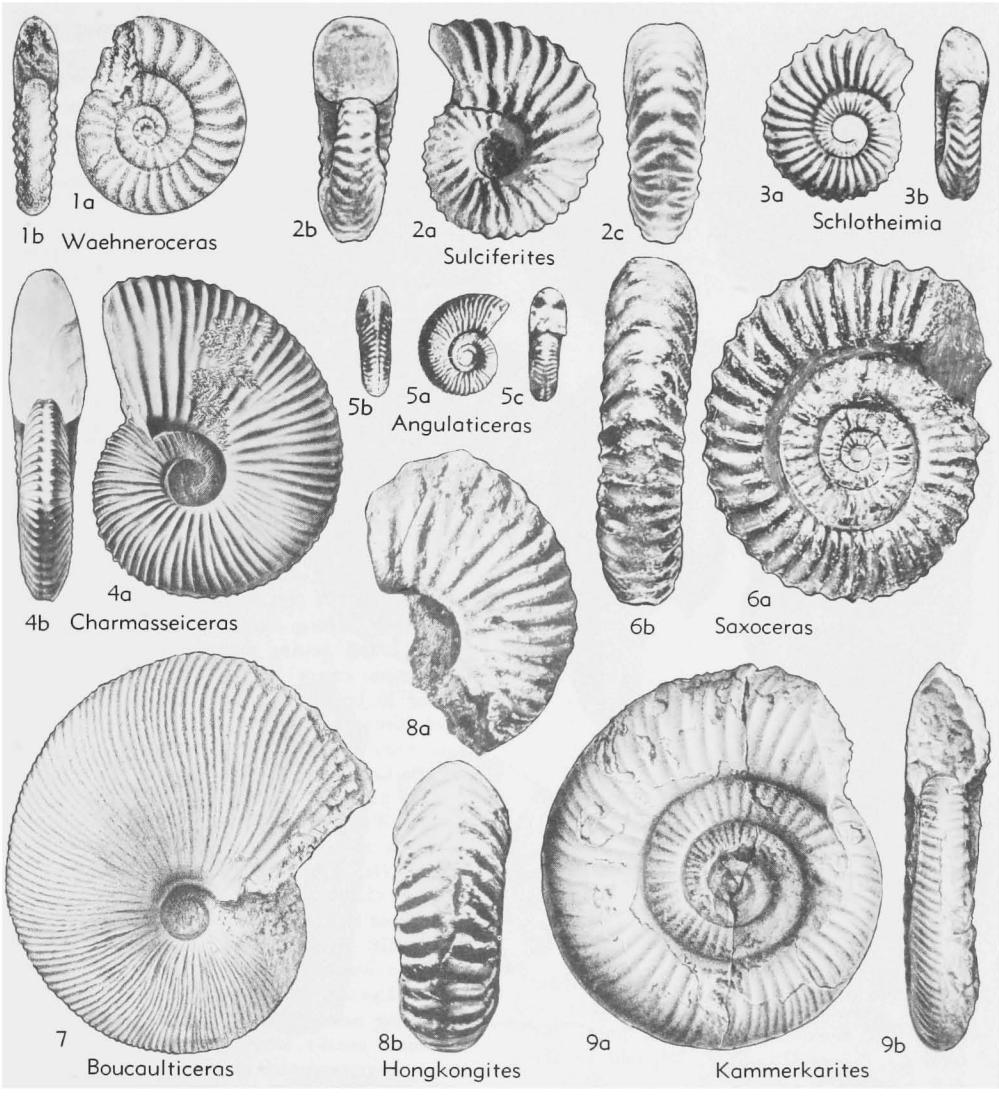


FIG. 260. Schlotheimiidae (p. L236-L237).

Subfamily ALSATITINAE Spath, 1924

[*nom. transl.* LANGE, 1941 (*ex* Alsatitidae SPATH, 1924)] [=Proarietitinae LANGE, 1941]

Derivatives of Psiloceratinae which develop a keeled and in some a bisulcate venter (123, 251, 461). *L.Jur.(Hett.-Sinem.)*, Eu.-Pac.

Alsatites HAUG, 1894 [**Am. liasicus* D'ORBIGNY, 1844] [=*Proarietites* LANGE, 1922; *Gonioptychoceras* LANGE, 1941]. Extremely evolute, many-whorled; keel broad and blunt; primary ribbing close and persistent. *Hett.*, Eu.-?Japan.——FIG. 259,6. **A. liasicus* (ORB.), Fr.; *6a,b*, ×0.25 (330*).

Tmaegoceras HYATT, 1889 [**Am. latesulcatus* HAUER, 1856; SD POMPECKJ, 1901]. Evolute, compressed, smooth, resembling *Psiloceras* in side view, but with deeply bisulcate carinate venter. *Sinem.*, Eu.-Nev.——FIG. 259,*3*. **T. latesulcatum* (HAUER), Aus.; *3a,b*, ×0.5 (633*).

Canavarites HYATT, 1900 [**Am. discretus* SOWERBY in DELABECHE, 1831 (fig'd. CANAVARI, 1882, as *Arietites*)]. Involute, discoidal, whorls depressed, rounded; venter with blunt keel; ribbing simple, on the whorl sides only, curved gently forward. *Sinem.*, Eu.——FIG. 259,*1*. **C. discretus* (Sow.), Italy; *1a-c*, ×1 (597*).

Pseudotropites WAEHNER, 1894 [**Tropites ultra-*

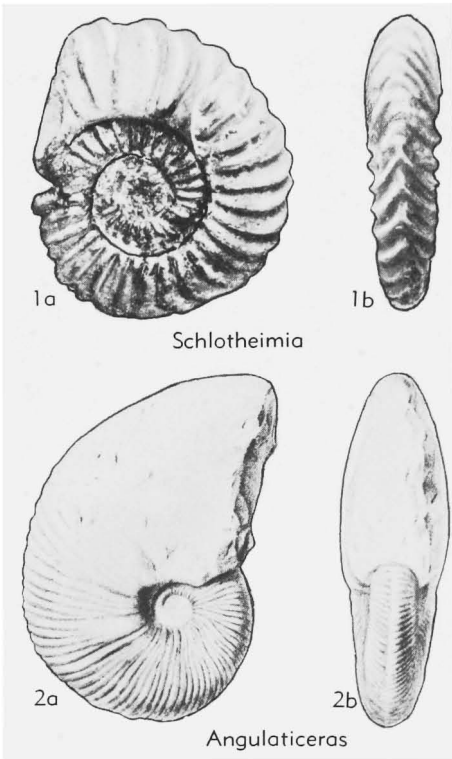


FIG. 261. Schlotheimiidae (p. L236).

triasicus CANAVARI, 1882]. Involute, cadicone; keeled and incipiently bisulcate; ribbing bifurcating from tubercles on sharp edge of crater-like umbilicus. *Sinem.(bucklandi z.)*, Eu.——FIG. 259, *2*. **P. ultratriasicus* (CANAV.), Italy; *2a,b*, ×1; *2c*, ×0.5 (597*).

Hyerifalchia FUCINI, 1907 [**H. solitaria*]. Small, smooth, globular, with occluded umbilicus and simple keel; resembling *Paroniceras*. *Sinem.(bucklandi z.)*, Eu.——FIG. 259,*4*. **H. solitaria*, Italy; *4a,b*, ×1 (624*).

Paracaloceras SPATH, 1923 [**Am. coregonensis* J. DEC.SOWERBY in DELABECHE, 1831 (fig'd. WAEHNER, 1888, as *Arietites*)] [=*Alpinoceras* LANGE, 1941]. Inner whorls depressed, with broad, blunt venter; outer whorls become rounded and develop carinate-bisulcate venter; ribbing as in *Caloceras*. *Hett.*, Eu.——FIG. 259,*8*. **P. coregonense* (Sow.), Aus.; *8a-c*, ×0.5 (550*).

Pseudaetomoceras SPATH, 1923 [**Arietites abnormilobatus* WAEHNER, 1886]. Whorls high, compressed, with sharp carinate venter, simple falcate ribs and complex sutures. *Hett.*, Eu.——FIG. 259,*7*. **P. abnormilobatum* (WAEHNER), Aus.; *7a,b*, ×0.7 (550*).

Gyrophioceras SPATH, 1924 [**Arietites praespiratissimus* WAEHNER, 1886]. Venter as in *Alsatites*, keel strong and blunt, but ribbing stronger and more distant, more as in *Caloceras*. *Sinem.*, Eu.——FIG. 259,*5*. **G. praespiratissimum* (WAEHNER), Aus.; *5a-c*, ×0.75 (550*).

Family SCHLOTHEIMIIDAE Spath, 1923

[=Angulatidae HYATT, 1874 (invalid because not formed on a nominal genus); Schlothemiidés H.DOUVILLÉ, 1916 (invalid vernacular name)]

Compressed, strongly ribbed ammonites, usually with ventral groove or smooth band, which first appears on inner whorls of certain *Waehneroceras* and only in later *Schlotheimia* spreads on to outer whorls (SPATH, 1923, 1924); ornament commonly weakens or dies out on later whorls. Sutures simple, with retracted suspensive lobe (123, 252, 253, 506). *L.Jur.(Hett.-Sinem.)*, worldwide.

Waehneroceras HYATT, 1889 [**Aegoceras tenerum* NEUMAYR, 1879; SD SPATH, 1924] [=*Storthoceras, Megastomoceras* LANGE, 1941; *Teneroceras, Tenoceras* LANGE, 1951 (obj.)]. Evolute, many-whorled, compressed; ribbing simple, projected at the ventral edge and passing across the venter without interruption except in the young; outer whorl tending to be smooth. *Hett.*, Eu.-?IndoChina-N. Caled.-Nev.——FIG. 260,*1*. **W. tenerum* (NEUM.), Aus.; *1a,b*, ×1 (667*).

Saxoceras LANGE, 1924 [**Psiloceras costatum* LANGE, 1921] [=*Macrogrammites* BUCKMAN, 1928]. Resembles *Waehneroceras*, with strong simple ribbing, but more evolute and with strigate outer whorls. *Hett.*, Eu.-N.Caled.——FIG. 260,*6*. **S. costatum* (LANGE), Ger.; *6a,b*, ×1 (251*).

Schlotheimia BAYLE, 1878 [**Am. angulatus* SCHLOTHEIM, 1820 (*non* SOWERBY, 1815, ICZN Opinion 323)] [=*Scamnoceras* LANGE, 1924 (obj.); *Anguliferites* LANGE, 1951]. Ribbing strong, simple or bifurcating near umbilical edge, projected at ventral edge, usually interrupted by ventral groove but in some specimens or parts of specimens ribs cross the venter. *Hett.*, Eu.-Himalaya-Japan-N. Caled.-Can.-Nev.-Peru.——FIG. 260,*3*. **S. angulata* (SCHLOTH.), Ger.; *3a,b*, lectotype, ×1 (252*).——FIG. 261,*1*. *S. gonyphora* LANGE (type of *Anguliferites*); *1a,b*, holotype, ×0.7 (251*).

Angulaticeras QUENSTEDT, 1883 [**Am. lacunatus* J. BUCKMAN, 1844; SD LANGE, 1924 (ICZN Opinion 324)] [=*Pseudoschlotheimia* SPATH, 1924]. Involute, whorls heightening rapidly; ribs numerous, somewhat irregular, fading on adult. *Sinem.*, Eu.——FIG. 260,*5*. **A. lacunatus* (J.BUCK.), Eng.; *5a-c*, ×1 (675*).——FIG. 261,*2*. *A. densilobata* (POMPECKJ) (type of *Pseudoschlotheimia*); *2a,b*, ×0.5 (682*).

Boucaulticeras SPATH, 1924 [**Am. boucaultianus* D'ORBIGNY, 1844]. Involute, compressed, whorls high, covered with fine dense ribs which end in

incipient ventral tubercles. *Sinem.*, Eu.——Fig. 260,7. **B. boucaultianum* (Orb.), Fr.; ×0.3 (737*).

Charmasseiceras Spath, 1924 [**Am. charmassei* d'Orbigny, 1844]. Involute; whorls high, elliptical, enlarging rapidly; ribs strong, sharp on inner whorls, persistent, bifurcating near umbilical edge. *L.Sinem.*, Eu.——Fig. 260,*4*. **C. charmassei* (Orb.), Fr.; *4a,b*, ×0.25 (737*).

Kammerkarites Spath, 1924 [**Aegoceras diploptychum* Waehner, 1882]. Specialized offshoot of *Waehneroceras*, with secondary ribbing. *Hett.*, Eu.——Fig. 260,*9*. **K. diploptychum* (Waehner), Aus.; *9a,b*, ×0.3 (550*).

Sulciferites Spath, 1922 [**Am. sulcatus* J.Buckman, 1844 (*non* Simpson) (=**Schlotheimia sulcifera* S.Buckman, 1911)]. Small, with subquadrate whorl section and coarse, strong, biplicate ribbing. *Sinem.*, Eu.——Fig. 260,*2*. **S. sulciferus* (S. Buck.), Eng.; *2a-c*, ×1 (675*).

Hongkongites Grabau, 1928 [**H. hongkongensis*; SD Arkell, herein]. Coarsely ribbed, tumid. Per-

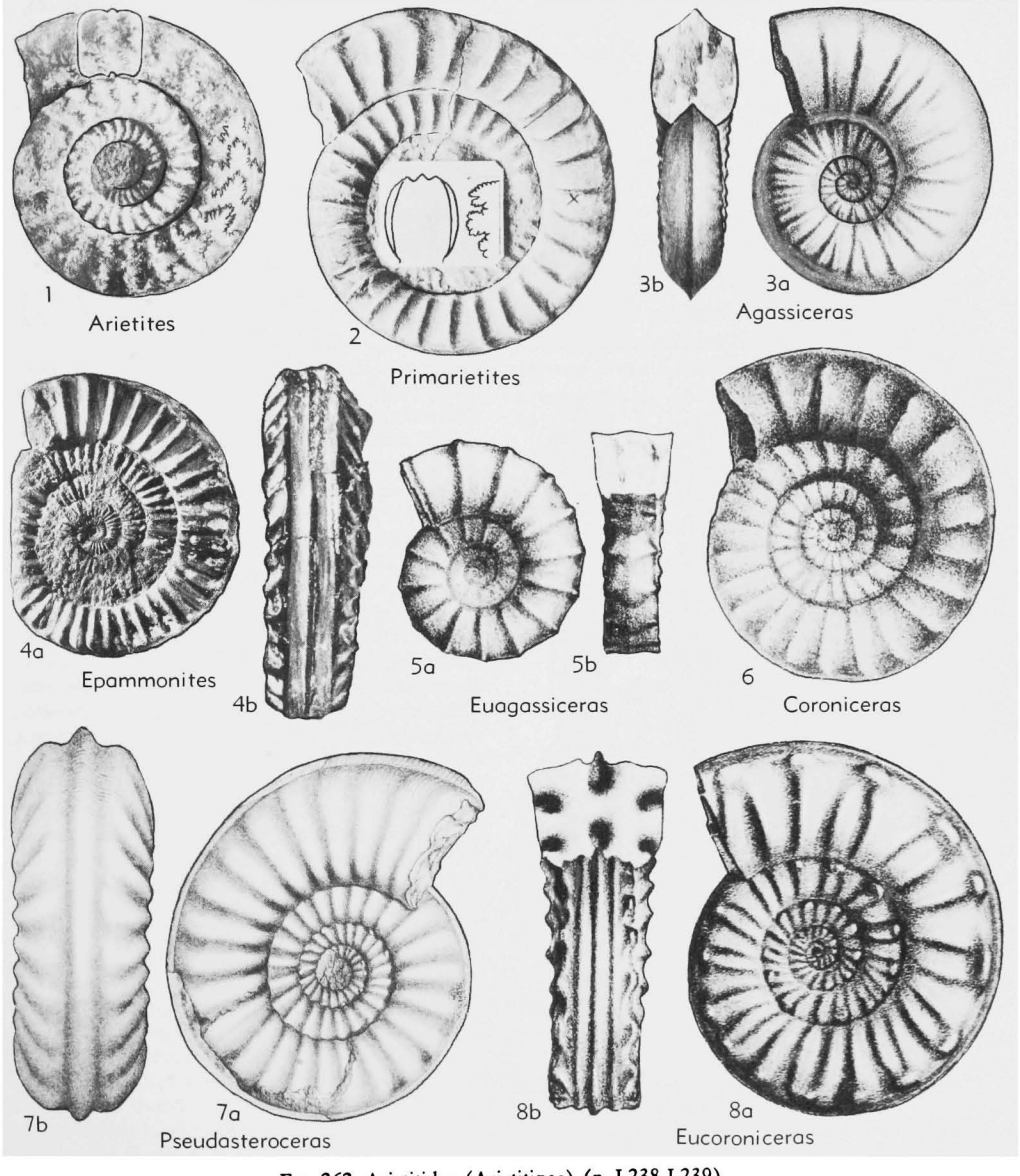


Fig. 262. Arietitidae (Arietitinae) (p. L238-L239).

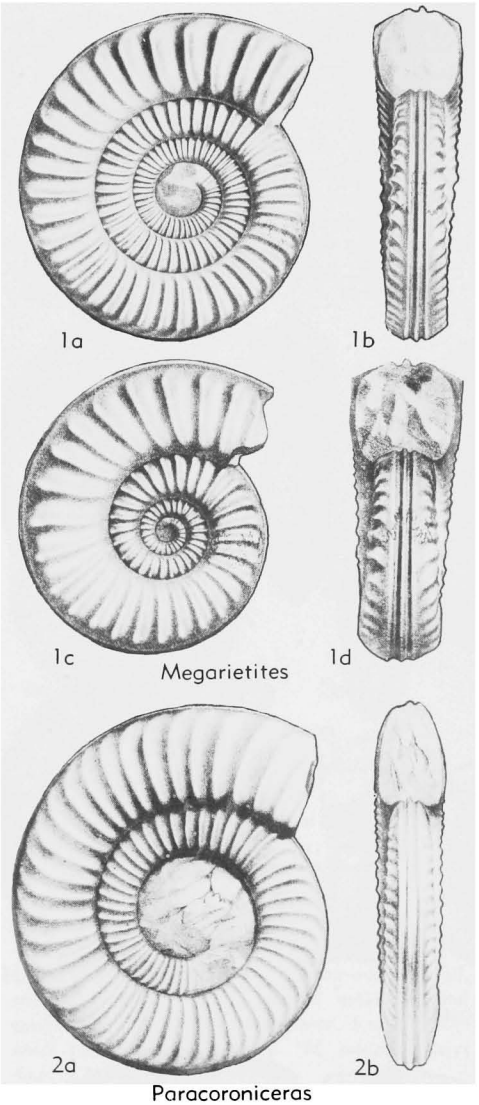


FIG. 263. Arietitidae (Arietitinae) (p. L238).

haps a *Sulciferites*. *L.Sinem.*, HongKong.——FIG. 260,*8*. **H. hongkongensis; 8a,b,* ×0.7 (629*).

Family ARIETITIDAE Hyatt, 1874

[*nom. correct.* HAUG, 1885 (*pro* Arietidae HYATT, 1874), *nom. conserv.*, proposed ARKELL, 1955 (ICZN pend.)] [=Discoceratidae HYATT, 1867 (invalid, based on junior homonym); Ammonitidae BUCKMAN, 1919 (*non* OWEN, 1836), ICZN Opinion 305]

Large or gigantic to medium-sized ammonites, strongly ribbed in general, some tuberculate, with carinate or carinate-bisulcate venter and well-differentiated sutures. Aptychus single-valved with concentrically striated shiny surface (Anaptychus). Believed to have common origin with Schlotheimiidae in the Psiloceratidae and thence the Phylloceratinae (12, 123, 126, 145, 200, 461). *L.Jur.(Sinem.-L.Pliensb.)*, constituting dominant ammonites of Sinem., world-wide.

Subfamily ARIETITINAE Hyatt, 1874

[*nom. transl.* ARKELL, 1950 (*ex* Arietitidae HYATT, 1874] [=Ammonitidae SPATH, 1924 (*non* OWEN, 1836; *nec* MEEK, 1876), incl. Agassiceratinae SPATH, 1924]

Large or giant, strongly ribbed planulates, generally with carinate-bisulcate or tricarinate venter. *L.Jur.(Sinem.-L.Pliensb.)*, world-wide.

Arietites WAAGEN, 1869 [**Am. bucklandi* J.SOWERBY, 1816 (ICZN Opinion 305)] [=*Arieticeras* QUENSTEDT, 1883 (obj.) (*non Arieticeras* SEGUENZA, 1885, ICZN Opinion 337); *Arietitites* SPATH, 1924]. Giant, massive, evolute planulates with subquadrate whorls and tricarinate-bisulcate venter. *L.Sinem.*, Eu.-Anatolia-Himalaya-?Japan.-?Philip.-Indon.-N.Alaska-Nev.-Mex.-Chile-Peru-Arg. —— FIG. 262,*1*. **A. bucklandi* (Sow.), Eng.; ×0.7 (4*).

Coroniceras HYATT, 1867 [**Am. kridion* ZIETEN, 1830; SD BONARELLI, 1900 (ICZN Opinion 324)] [=*Arnioceratoides* SPATH, 1922 (obj.)]. Venter arched, with single tall keel, no sulci; ribs few and strong, with slight ventrolateral bullae. *Sinem.*, Eu.-S.Alaska-Can.——FIG. 262,*6*. **C. kridion* (ZIETEN), Ger.; ×1 (389*).

Megarietites SPATH, 1922 [**Am. meridionalis* REYNÈS, 1879] [*Pararnioceras* SPATH, 1922]. Like *Arietites*, with massive quadrate whorls, keel and tubercles reduced; some ribs tending to be looped. *Sinem.*, Eu.-Nev.——FIG. 263,*1*. **M. meridionalis* (REYNÈS), Fr.; *1a-d*, ×0.25 (376*).

Epammonites SPATH, 1922 [**Am. latisulcatus* QUENSTEDT, 1883]. Like a close-ribbed *Arietites* but some tending to resemble *Arnioceras*. *Sinem.*, Eu.——FIG. 262,*4*. **E. latisulcatus* (QUENST.), Ger.; *4a*, ×0.25; *4b*, ×0.75 (702*).

Vermiceras HYATT, 1889 [**Am. spiratissimus* QUENSTEDT, 1852; SD SPATH, 1924]. Like *Arietites* but many-whorled; ventral grooves obsolete or obsolescent. *Sinem.*, Eu.-N.Afr.-Persia-Can.-?Mex.-Chile-Peru.——FIG. 264,*1*. **V. spiratissimum* (QUENST.), Ger.; *1a,b*, ×1 (684*).

Paracoroniceras SPATH, 1922 [**Am. gmündensis* OPPEL, 1856; SD LANGE, 1925]. Like *Primarietites*, but whorl sides becoming convergent and ventral features degenerating on middle and outer whorls. *Sinem.*, Eu.——FIG. 263,*2*. **P. gmündense* (OPPEL) (=*P. charlesi* DONOVAN, 1955); *2a,b*, ×0.25 (376*).

Eucoroniceras SPATH, 1922 [**Am. sinemuriensis* D'ORBIGNY, 1844]. Massive, with whorl sides parallel or divergent; venter tricarinate; ribs looped at

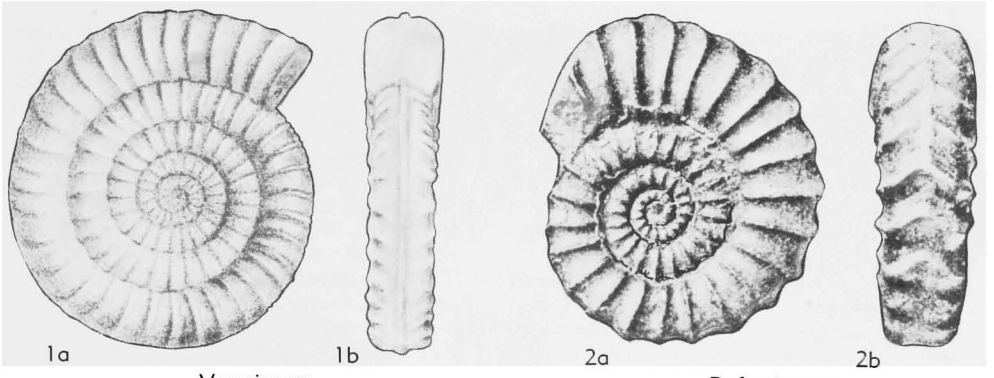


FIG. 264. Arietitidae (Arietitinae) (p. L238-L239).

clavi. *Sinem.*, Eu.——FIG. 262,*8*. **E. sinemuriense* (ORB.), Fr.; *8a,b*, ×1 (330*).

Pseudasteroceras SPATH, 1922 [**Am. stellaeformis* GÜMBEL in WAEHNER, 1888]. Massive, with whorl sides parellel or divergent, whorls enlarging rapidly; venter carinate-bisulcate, with keel large and tall; ribs strong, rursiradiate, many tuberculate. *Sinem.*, Eu.——FIG. 262,*7*. **P. stellaeformis* (GÜMB.); *7a,b*, ×0.3 (550*).

Metophioceras SPATH, 1924 [**Am. conybeari* J. SOWERBY, 1816] [=*Discoceras* HYATT, 1867 (obj.); SD ARKELL, herein (*non* BARRANDE, 1867); *Diplosellites* BUCKMAN, 1925; *Keynshamites* BUCK., 1926]. Compressed, with high keel persisting to a large diameter and deep ventral grooves; ribs ventrally prominent but not tuberculate. *Sinem.*, Eu.-Nev.-Chile-Peru.——FIG. 265,*1*. **M. conybeari* (Sow.), Eng.; holotype, ×0.7 (608n).

Primarietites BUCKMAN, 1926 [**P. primitivus* (=*Agassiceras reynesi* SPATH, 1923]. Like *Metophioceras* but shoulders tuberculate and ribs more distant. *Sinem.*, Eu.——FIG. 262,*2*. **P. reynesi* (SPATH); ×0.2 (65*).

Agassiceras HYATT, 1875 [**Am. scipionianus* D'ORBIGNY, 1844; SD BUCKMAN, 1894 (ICZN Opinion 324)] [=*Agassiziceras* FISCHER, 1879 (obj.); *Agassizoceras* BUCK., 1904 (obj.); *Aetomoceras* HYATT, 1900 (obj.)]. Compressed, with sharp fastigate venter and feeble straight ribs, some of which may bifurcate from near umbilical edge. *Sinem.*, Eu.——FIG. 262,*3*. **A. scipionianum* (ORB.), Fr.; *3a,b*, ×0.75 (330*).

Euagassiceras SPATH, 1924 [**Am. sauzeanus* D'ORBIGNY, 1844] [=*Paracoronites* BUCKMAN, 1927]. Whorls quadrate; venter flat with feeble keel; ribs straight, strong, blunt, tuberculate. *Sinem.*, Eu.-Mex.——FIG. 262,*5*. **E. sauzeanum* (ORB.), Fr.; *5a,b*, ×1 (330*).

Defossiceras BUCKMAN, 1913 [**Am. defossus* SIMPSON, 1843]. Like *Euagassiceras* but with ribs continued in chevrons over venter to keel instead of ending in tubercles. *?Sinem.*, *?L.Pliensb.*, Eu.—— FIG. 264,*2*. **D. defossum* (SIMP.), Eng.; *2a,b*, ×1 (65*).

Subfamily ARNIOCERATINAE Spath, 1924

[*nom. transl.* ARKELL (*ex* Arnioceratidae SPATH, 1924)]

Arietitidae with carinate but not sulcate venter and relatively simple lateral lobes with few but distinct indentations. Probably derived from Arietitinae and especially from *Epammonites* (SPATH, 1924, p. 205) (12, 461, 528). *L.Jur.(Sinem.)*, world-wide.

Arnioceras HYATT, 1867 [**A. cuneiforme* (ICZN Opinion 307)] [=*Amioceras* SPATH, 1919 (error); *Eparnioceras* SPATH, 1924]. Evolute, whorl sides slightly divergent; nucleus smooth to variable age,

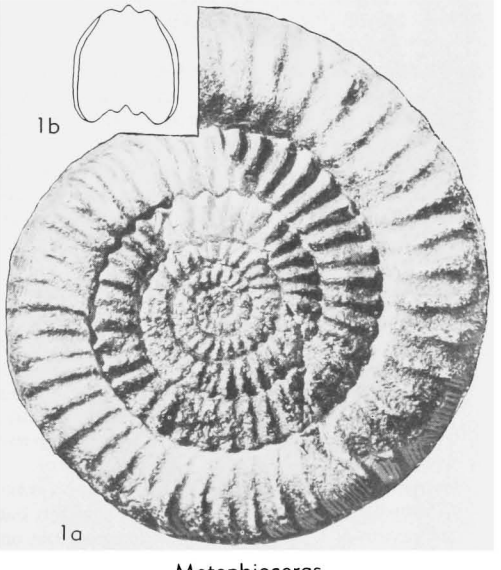


FIG. 265. *Metophioceras conybeari* (SOWERBY), L. Jur.(Sinem.), Eng.; ×0.7 (608n) (p. L239).

ribs strong, sharp, straight until they near ventrolateral edge, where they swing forward, then fade on venter. *Sinem.*, Eu.-N.Afr.-Indon.-N.Caled.-S. Alaska-Can.-?Nev.-Mex.-Colombia-Ecuador - Peru-Chile.——Fig. 266,*2*. **A. cuneiforme*, Fr.; *2a,b*, ×1 (200*).

Metarnioceras Spath, 1925 [**M. sheppardi*]. Externally resembles *Agassiceras*, but sutures as in *Arnioceras*. *Sinem.*, Eng.——Fig. 266,*1*. **M. sheppardi; 1a,b*, ×1 (464*).

Arniotites Whiteaves, 1889 [**A. vancouverensis*] [=*?Melanhippites* Crickmay, 1928]. Nucleus smooth to variable age, middle and outer whorls with blunt primary ribs ending abruptly or with ventrolateral tubercle; venter keeled. Sutures simple, as in *Arnioceras*. *Sinem.*, Can.——Fig. 266,*5*. **A. vancouverensis*, B.C.; ×1 (732*).

Subfamily ASTEROCERATINAE Spath, 1946

[*nom. transl.* Arkell, 1950 (*ex* Asteroceratidae Spath, 1946)]

Ribbing strong but smooth, venter carinate, some bisculate, sutures simple, with wide undivided saddles. Comprises groups of *Am. turneri* Sowerby and *Am. stellaris* Sow., probably originating in Arnioceratinae (125, 464; Spath, 1924). *L.Jur.(Sinem.)*, world-wide.

Asteroceras Hyatt, 1867 [**Am. stellaris* J.Sowerby, 1815; SD Buckman, 1911 (ICZN Opinion 324)]. Whorls high, enlarging rapidly, sides converging above the middle; keel large, prominent, flanked by 2 deep, wide sulci which in many are lost on outer whorl; ribs strong but smooth, curved forward. *Sinem.*, Eu.-N.Afr.-Japan-Indon.-Can.——Fig. 266,*12*. **A. stellare* (Sow.), Eng.; *12a,b*, ×0.7 (737*).

Aegasteroceras Spath, 1925 [**A. simile*]. Venter degenerated, without distinct keel or sulci. *Sinem.*, Eng.——Fig. 266,*7*. **A. simile; 7a,b*, ×0.75 (737*).

Eparietites Spath, 1924 [**A. tenellus* Simpson in Buckman, 1912]. Involute, compressed, with convergent sides and tall keel; ribs becoming irregular and fading on outer whorl. *Sinem.*, Eng.——Fig. 266,*10*. **E. tenellus* (Simp.); ×0.5 (65*).

Ptycharietites Spath, 1925 [**Asteroceras ptychogenos* Pompeckj, 1897]. Inner whorls almost smooth, middle and outer whorls with large swollen, blunt, straight ribs; venter carinate but not sulcate; whorl section compressed, becoming oval. Probably close to *Eparietites* (*teste* Spath). *Sinem.*, Eng.——Fig. 266,*9*. **P. ptychogenos* (Pomp.), Sinem., Port.; *9a-d*, ×0.5 (682*).

Pompeckioceras Spath, 1925 [**Arietites oncocephalus* Pompeckj, 1897]. Evolute, mostly smooth but for growth lines and a few vague, irregular ribs on outer whorls; section quadrate, sides slightly convergent. Probably close to *Eparietites* (*teste* Spath). *Sinem.*, Eu.——Fig. 266,*8*. **P. oncocephalus* (Pomp.), Sinem., Port.; *8a-c*, ×0.7 (682*).

Euasteroceras Donovan, 1953 [**Am. turneri* J.deC. Sowerby, 1824] [=*?Caenisites* Buckman, 1925 (based on a monstrosity)]. Whorl section oval; ribbing strong, rather dense, straight, radial on the whorl sides, gently projected on shoulders; venter strongly keeled, bisulcate. *Sinem.*, Eu.——Fig. 266,*4*. **E. turneri* (Sow.), Eng. (737*).

Hypasteroceras Spath, 1923 [**Asteroceras? ceratiticum* Fucini, 1903]. Evolute, compressed, smooth, with ceratitic sutures. *Sinem.*, Italy.——Fig. 266,*11*. **H. ceratiticum* (Fucini); *11a-c*, ×1 (162*).

Epophioceras Spath, 1924 [**Am. landrioti* d'Orbigny, 1850 (*nom. dub.*), clarified Thevenin, 1907]. Very evolute, serpenticone; whorls subcircular, enlarging slowly at all stages; venter keeled, becoming rounded and almost smooth; ribs simple and smooth. Resembles *Alsatites* externally but sutures are those of Asteroceratinae. *Sinem.*, Eu.——Fig. 266,*13*. **E. landrioti* (Orb.), Fr.; *13a,b*, ×0.3 (673*).

Subfamily CYMBITINAE Buckman, 1919

Small, smooth, inflated, featureless forms which Buckman (1894) believed to be the primitive radicle of all Lower Lias ammonites. Pompeckj (1895) refuted this view, and Spath (1924) considered the Sinemurian forms simplified and degenerated developments of some arietitid stock, perhaps *Eparnioceras*. *Protocymbites* (Sinem.) is believed to be a psiloceratid and *Metacymbites* (Pliensb.) a liparoceratid (62, 65). *L.Jur.(Sinem.-Pliensb.)*, Eu.

Cymbites Neumayr, 1878 [**Am. globosus* Zieten, 1832; SD Buckman, 1894]. Subspherical smooth dwarf with deep narrow umbilicus and contracted body chamber, which causes excentric coiling of last half whorl. Sutures inclined to be ceratitic. *Sinem. (semicostatum z.).*——Fig. 266,*3*. **C. (C.) globosus* (Ziet.), Ger.; *3a-c*, ×1 (742*).

Paracymbites Trueman & Williams, 1927 [**P. obsoletus*]. Small, globose, with feeble ornament and slightly excentric outer whorl. Subgen. of *Cymbites*. *?Sinem.*——Fig. 266,*6*. **C. (P.) obsoletus* (True.-W.), Eng.; *6a,b*, ×1.7 (524*).

Family OXYNOTICERATIDAE Hyatt, 1875

[*nom. correct.* Spath, 1926 (*pro* Oxynotidae Hyatt, 1874), validation proposed Arkell, 1955 (ICZN pend.)]

A family of oxycones probably derived from various arietitid stocks, mainly Asteroceratinae (cf. *Eparietites*) (65,125,464). *L. Jur.(U.Sinem.-L.Pliensb.)*, world-wide.

Oxynoticeras Hyatt, 1875 [**Am. oxynotus* Quenstedt, 1845; SD Buckman, 1909]. Venter sharp, umbilicus moderately open, umbilical slope gentle; ribbing fades on middle of whorl sides. Sutures

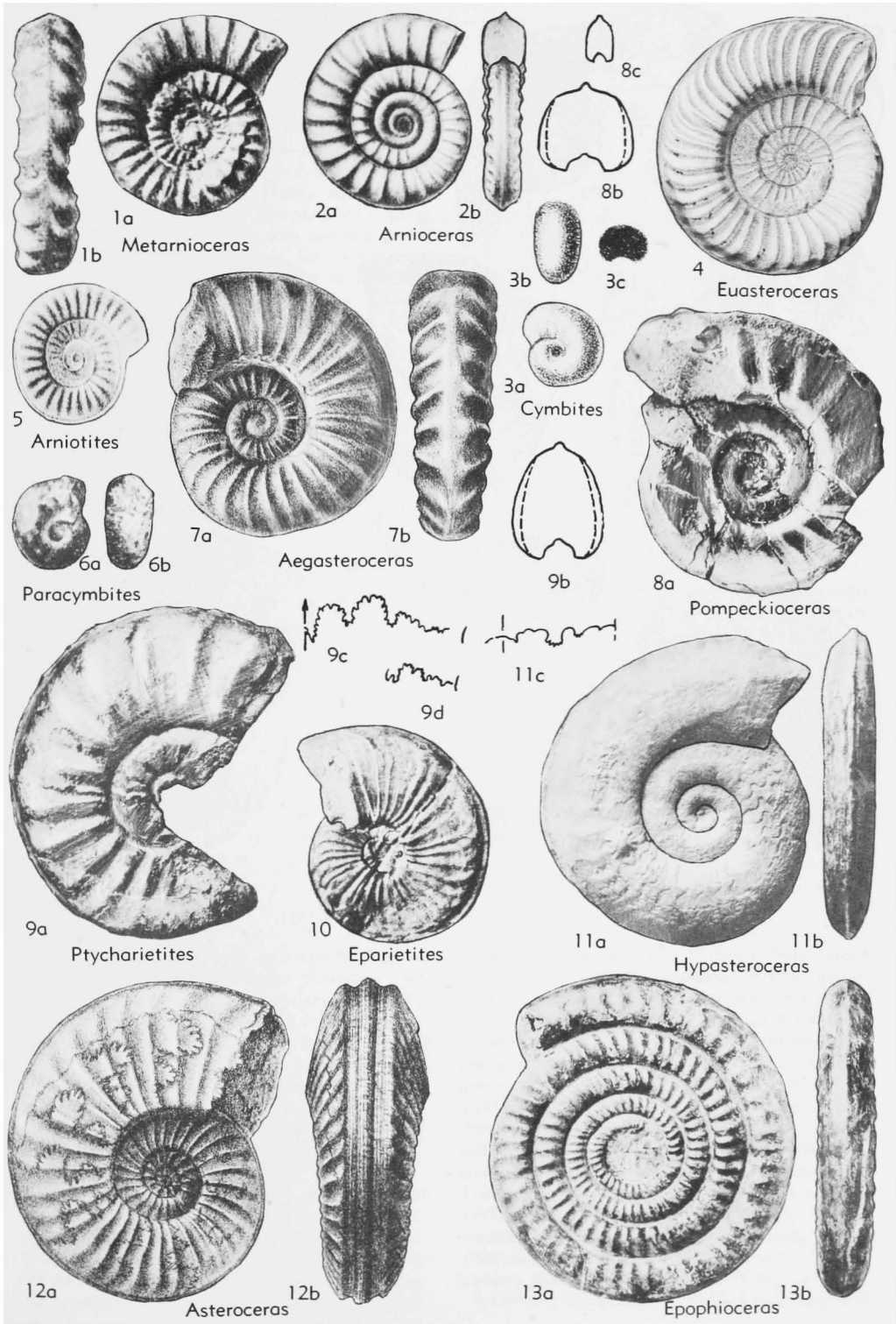


FIG. 266. Arietitidae (Arnioceratinae, Asteroceratinae, Cymbitinae) (p. L239-L240).

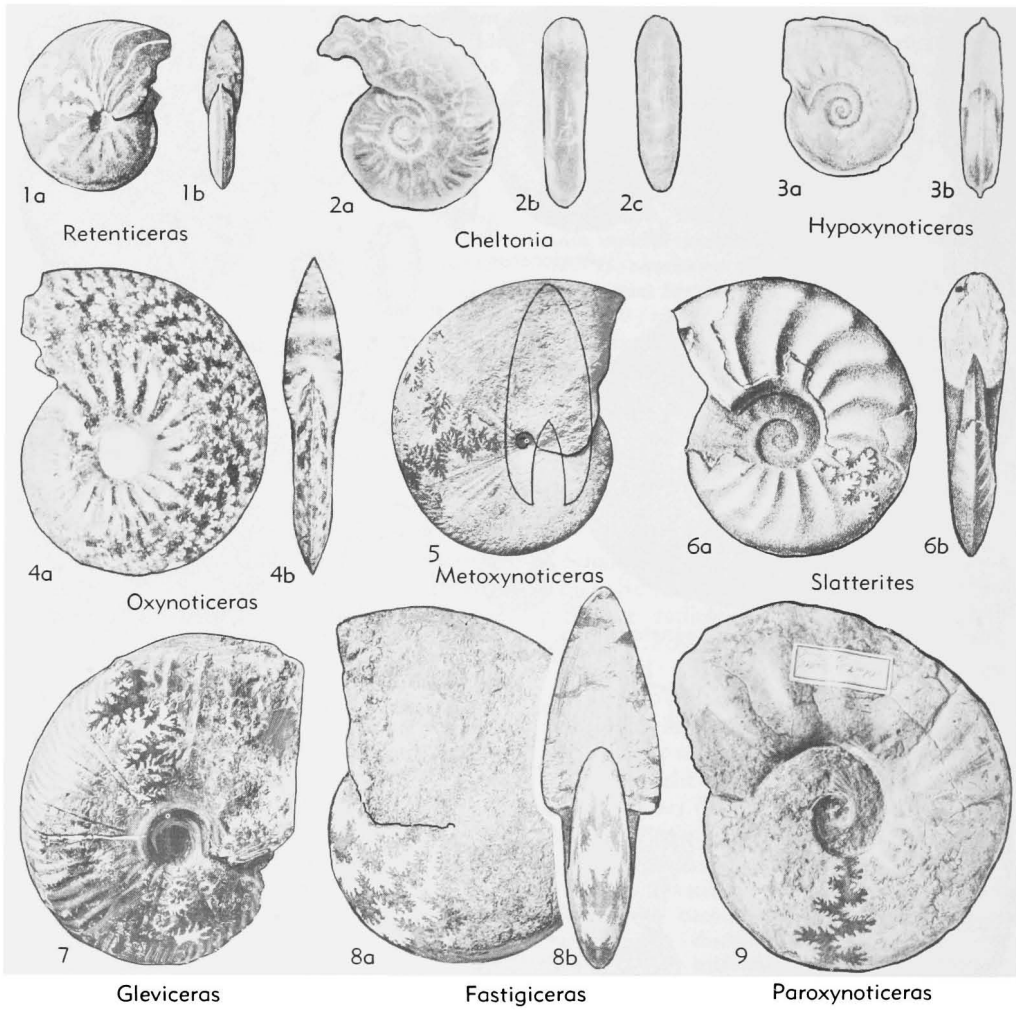


FIG. 267. Oxynoticeratidae (p. L240-L243).

with long ventral lobe, 2 laterals, and 4 or 5 much smaller auxiliaries. *Sinem.*, Eu.-N.Afr.-S. Persia-Japan-Indon.-S.Am.——FIG. 267,*4*. **O. oxynotum* (QUENST.), Ger.; *4a,b*, ×0.7 (65*).

Gleviceras BUCKMAN, 1918 [**G. glevense* (=**Oxynoticeras subguibalianum* PIA, 1914, *nom. nov. pro Amaltheus guibalianus* WRIGHT, 1881, *non* D'ORBIGNY, 1844)] [=*Guibaliceras, Victoriceras* BUCK., 1918; *Tutchericeras* BUCK., 1919; *Glevumites* BUCK, 1924 (obj.)]. Less compressed than *Oxynoticeras*, with blunter venter but sharp keel and more abrupt umbilical slope. *Sinem.*, Eu.-S. Am.——FIG. 267,*7*. **G. subguibalianum* (PIA), Eng.; ×0.3 (65*).——FIG. 268,*1*. *G. guibalianus* (ORB.) (type of *Guibaliceras*); suture, ×1 (330*). ——FIG. 268,*2*. *G. victoris* (DUMORTIER) (type of *Victoriceras*); *2a-c*, ×0.4 (614*).

Fastigiceras BUCKMAN, 1919 [**F. clausum*]. Umbilicus occluded, venter rounded. Forerunner of *Metoxynoticeras*. *Sinem.*, Eu.——FIG. 267,*8*. **F. clausum*, Eng.; *8a,b*, ×0.3 (65*).

Radstockiceras BUCKMAN, 1918 [**R. complicatum*]. Differs from *Oxynoticeras* by smaller umbilicus and more complex suture line; 1st lateral lobe of suture long and narrow, 2nd lateral resembling the 1st lateral in *Oxynoticeras*. *?L.Pliensb.*, Eu.—— FIG. 269,*1*. **R. complicatum*, Eng.; *1a,b*, ×0.25 (595*).

Metoxynoticeras SPATH, 1922 [**Am. oppeli* SCHLOENBACH, 1865] [=*Phylloxynotites* BUCKMAN, 1924; *Homoxynoticeras, Kleistoxynoticeras* BUCK., 1925; *Carixiceras* SPATH, 1925]. Umbilicus nearly or quite occluded, venter blunt or rounded. Possibly same as *Radstockiceras*. *L.Pliensb.*, Eu.

——Fig. 267,*5*. **M. oppeli* (Schloen.), Ger.; ×0.25 (65*).

Hypoxynoticeras Spath, 1925 [**Am. sphenonotus* Monke, 1888 (figs. 14, 14a, lectotype; SD Arkell, herein)]. Venter with square shoulders and smooth keel; sides with soft falcoid ribbing and longitudinal lirae. *L.Pliensb.*, Eu.——Fig. 267,*3*. **H. sphenonotum* (Monke), Ger.; *3a,b*, ×1 (665*).

Paraoxynoticeras Pia, 1914 [**Am. salisburgensis* Hauer in Pia, 1914; SD Spath, 1924]. Inner whorls compressed, elliptical, with rounded venter, outer whorls becoming oxycone, but venter never sharp. Ribs on inner whorls consist of short primaries confined to umbilical edge. *Sinem.*, Eu.——Fig. 267,*9*. *P. salisburgense* (Hauer), Aus.; ×0.5 (344*).

Slatterites Spath, 1923 [**Aegoceras slatteri* Wright, 1882]. Venter at first sharp, as in *Oxynoticeras*, then becoming broad and blunt. *Sinem.*, Eu.——Fig. 267,*6*. **S. slatteri*, Eng.; *6a,b*, ×0.7 (737*).

Retenticeras Buckman, 1920 [**Am. retentus* Simpson in Buck., 1920]. Small, with tall keel, shouldered venter and ceratitic sutures, at least in young. *?Sinem.*, Eu.——Fig. 267,*1*. **R. retentum* (Simp.), Eng.; *1a,b*, ×1 (65*).

Cheltonia Buckman, 1904 [**Am. accipitris* J.Buckman, 1844]. Dwarf platycone with open umbilicus and rounded, almost keel-less venter, which develops crenations on end of body chamber; aperture rostrate. Sutures simple. *Sinem.*, Eu.——Fig. 267, *2*. **C. acciptris* (J.Buck.), Eng.; *2a-c*, ×1 (675*).

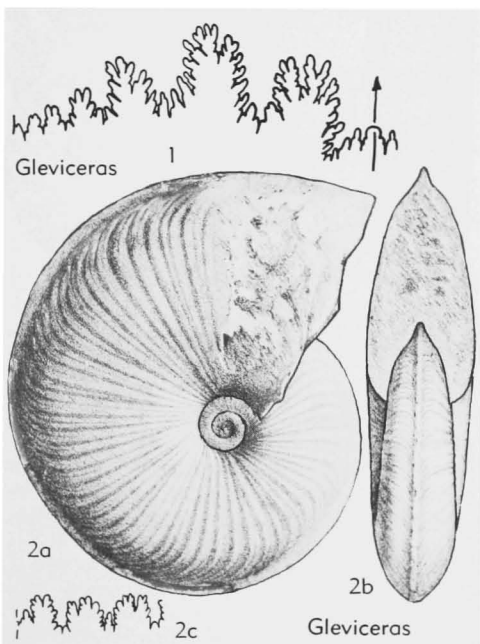
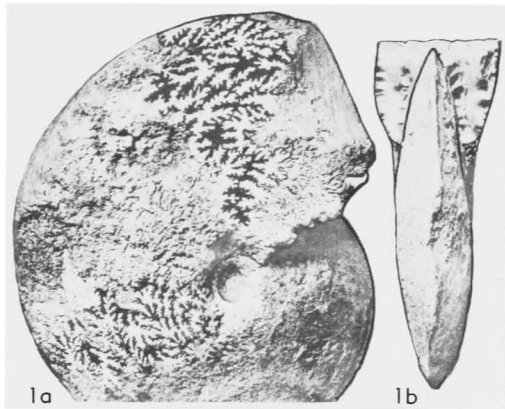


Fig. 268. Oxynoticeratidae (p. L242).



Radstockiceras

Fig. 269. *Radstockiceras complicatum* Buckman, L. Jur.(?L.Pliensb.), Eng.; *1a,b*, ×0.25 (595*) (p. L242).

Family ECHIOCERATIDAE Buckman, 1913

Evolute, many-whorled, keeled. Inner whorls typically smooth-ventered or unicarinate, finely ribbed; outer whorls strongly ribbed. Origin and affinities uncertain, probably derived from Alsatitinae such as *Canavarites* and *Paracaloceras* (65, 125, 524; Spath, 1926) or possibly from Arietitidae (Donovan). *L.Jur.(U.Sinem.)*, probably world-wide.

Gagaticeras Buckman, 1913 [**Am. gagateus* Young & Bird, 1828] [*Parechioceras* Buck., 1914]. Inner whorls with stout, beadlike ribs; outer whorls with strong, distant simple ribs which pass straight over venter or run gently forward to a vestigial keel (which may be absent). *U.Sinem.(oxynotum z.)*, Eu.——Fig. 270,*7*. **G. gagateum* (Young-B.), Eng.; *7a,b*, ×1 (65*).——Fig. 271,*2*. *G. finitimum* (Blake) (type of *Parechioceras*); ×1 (65*).

Palaeoechioceras Spath, 1929 [**Protechioceras spirale* Trueman & Williams, 1927] [=*Protechioceras* True.-W., 1927 (obj.), (*non* Spath, 1925)]. Small; stout beadlike ribbing on inner whorls gives place on outer whorls to uniform fine ribbing which fades on unicarinate venter. *U.Sinem.(?raricostatum z.)*, Eu.——Fig. 270,*2*. **P. spirale* (True.-W.), Eng.; *2a-c*, 2 specimens, ×1.5 (524*).

Echioceras Bayle, 1878 [**Am. raricostatus* Zieten, 1831 (ICZN Opinion 324)] [=*Ophioceras* Hyatt, 1867 (*non* Barrande, 1865); *Pleurechioceras, Echioceratoides* Trueman & Williams, 1925; *Homechioceras* Buckman, 1925]. Venter unicarinate; ribs fine on inner whorls, becoming strong, straight and usually distant, fading on venter of outer whorls. *U.Sinem.(raricostatum z.)*, Eu.-Anatolia-Indon.-Calif.-Mex.-S.Am.——Fig. 270,*1*.

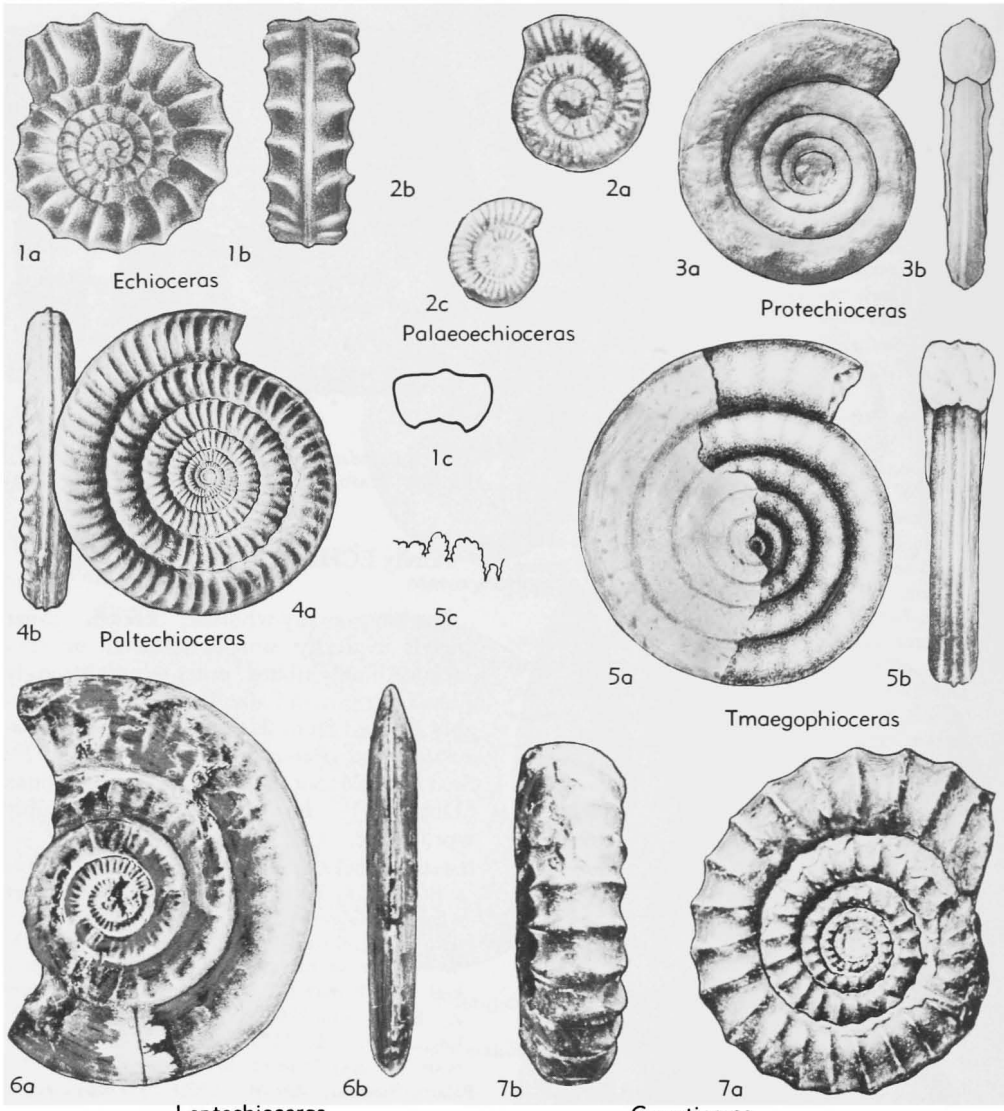


FIG. 270. Echioceratidae (p. L243-L245).

**E. raricostatum* (ZIETEN), Ger.; *1a-c*, ×1 (742*).——FIG. 271,*3*. *E. regulare* (TRUE.-W.) (type of *Echioceratoides*); ×0.7 (524*).

Paltechioceras BUCKMAN, 1924 [**P. elicitum*] [*Metechioceras, Plesechioceras, Orthechioceras, Euechioceras, Kamptechioceras, Vobstericeras* TRUEMAN & WILLIAMS, 1925; *Stenechioceras* BUCK., 1927]. Very evolute, many-whorled, with tricarinate-bisulcate venter, typically developed from an early stage. Ribs usually more numerous than in *Echioceras* and prorsiradiate. Transitions (*"Plesechioceras," "Orthechioceras"*) occur. *U.Sinem.(raricostatum z.)*, Eu.-Calif.-Ore.——FIG. 270,*4*. **P. elicitum*, Eng.; *4a,b*, ×0.25 (65*).——FIG. 271,*1*. *P. delicatum* BUCK. (type of *Plesechioceras*); ×0.7 (65*).

Leptechioceras BUCKMAN, 1923 [**Am. macdonnelli* PORTLOCK, 1843]. Whorls compressed, with sharp unicarinate venter; ribbing feeble, tending to fade. *U.Sinem.(raricostatum z.)*, Eu.——FIG. 270,*6*. **L. macdonnelli* (PORTL.), N.Ire.; *6a,b*, ×1 (65*).

Protechioceras SPATH, 1925 [**Vermiceras formosum* FUCINI, 1902]. Very evolute, compressed, with blunt keel; smooth except for median lateral row of large distant nodes. *Sinem.*, Italy.——FIG. 270, *3*. **P. formosum* (FUCINI); *3a,b*, ×0.7 (162*).

Tmaegophioceras SPATH, 1925 [**Arietites laevis*

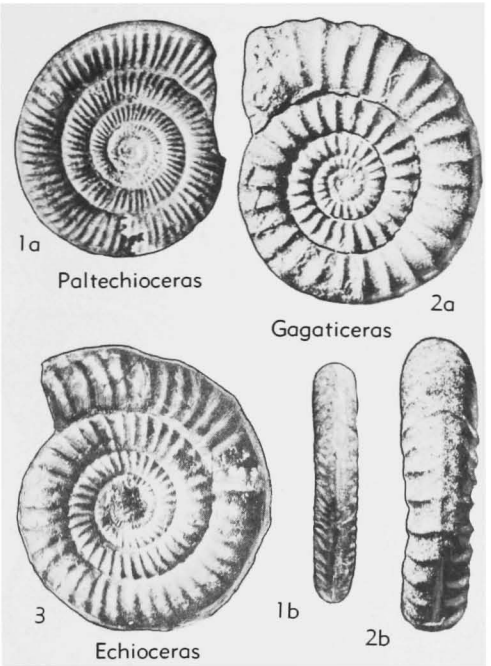


FIG. 271. Echioceratidae (p. L243-L244).

GEYER, 1886]. Very evolute, many-whorled, whorl section rounded-quadrate, venter tricarinate-bisulcate; ribs are distant feeble undulations. *Sinem.*, Aus.——FIG. 270,5. **T. laeve* (GEYER); *5a-c*, ×1 (628*).

Superfamily EODEROCERATACEAE Spath, 1929

[*nom. transl.* ARKELL, 1950 (*ex* Eoderoceratidae SPATH, 1929)] [=Deroceratacea+Liparoceratacea+Amalthacea BUCKMAN, 1919; Deroceratida SPATH, 1926, +Xipheroceratida SPATH, 1929]

Ribbed, tuberculate and spinous derivatives of Lytoceratina, perhaps of Ectocentritidae (SPATH, 1938). *L.Jur.(Sinem.-Toarc.)*, world-wide.

Family EODEROCERATIDAE Spath, 1929

[*nom. nov.* SPATH, 1929 (*pro* Deroceratidae HYATT, 1867, invalid name based on junior homonym)]

Evolute, loosely coiled forms with little overlap of whorls, which are usually round or quadrate in section but may be somewhat compressed; whorl sides typically bituberculate, tubercles being joined commonly by radial ribs, inner row of tubercles absent in some. Sutures highly complex, retaining some of the mosslike quality of those in Lytoceratina (12, 65, 464). *L.Jur.(Sinem.-Pliensb.)*.

Subfamily XIPHEROCERATINAE Spath, 1925

[*nom. transl.* ARKELL, 1950 (*ex* Xipheroceratidae SPATH, 1925)]

Earliest eoderoceratids, characterized by early maximum development of spines on inner whorls and their dying out later so as to leave crude ribbing only. *L.Jur.(U.Sinem.-L.Pliensb.)*.

Xipheroceras BUCKMAN, 1911 [**Am. ziphus* ZIETEN, 1830 (ICZN pend.)] [=*Praederoceras* DIETZ, 1923 (obj.); *Postderoceras* SCHINDEWOLF, 1923 (obj.). Inner and middle whorls with strong ribs and large distant outer spines, outer whorls with closer simple ribs. *U.Sinem.(obtusum z.)*, Eu.-

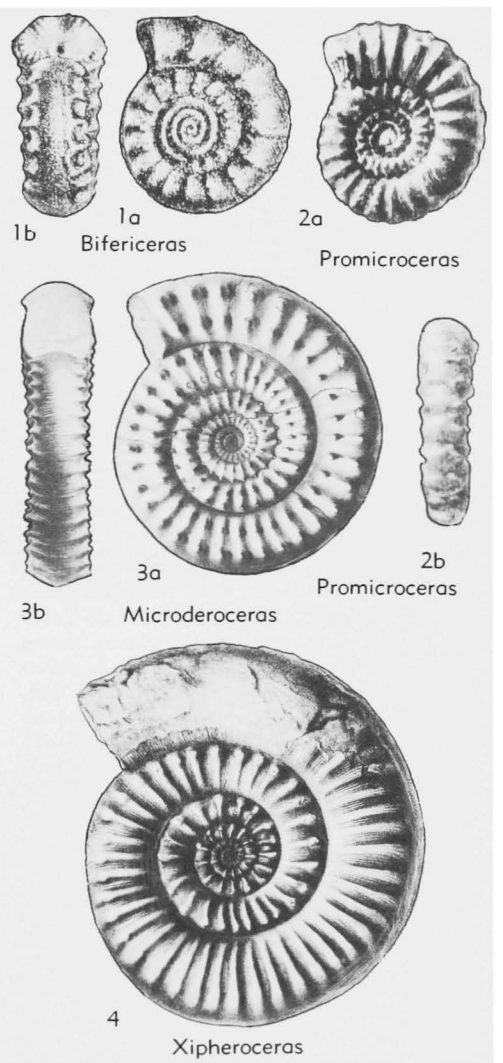


FIG. 272. Eoderoceratidae (Xipheroceratinae) (p. L245-L247).

?Borneo.——Fig. 272,*4*. **X. ziphus* (Zieten), Ger.; ×0.25 (737*).

Microderoceras Hyatt, 1871 [**Am. birchi* J.Sowerby, 1820; SD Spath, 1926]. Very evolute, almost serpenticone, with 2 persistent rows of lateral spines (tubercles on internal mold). *Sinem.(turneri z.)-L.Pliensb.(jamesoni z.)*, Eu.-Anatolia-Mex.-Peru.——Fig. 272,*3*. **M.* sp. aff. *M. birchi* (J. Sow.), Eng.; *3a,b*, ×0.25 (737*).

Bifericeras Buckman, 1913 [**Am. bifer* Quenstedt,

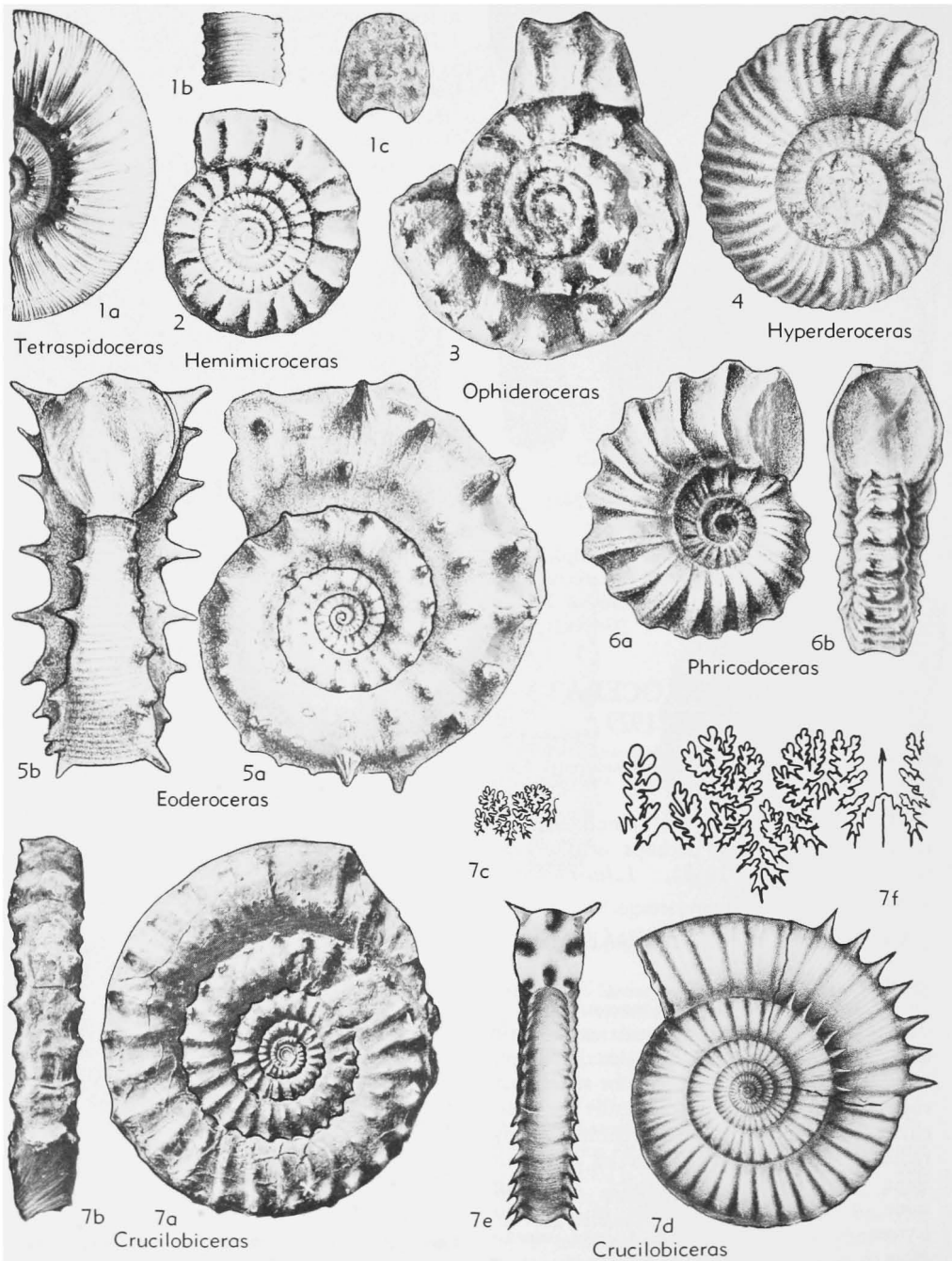


Fig. 273. Eoderoceratidae (Eoderoceratinae, Phricodoceratinae) (p. L247).

1845]. Whorls strongly depressed but evolute; early smooth stage prolonged, followed by distant, rounded, straight, bituberculate ribs. *U.Sinem. (oxynotum z.)*, Eu.——FIG. 272,*1*. **B. bifer* (QUENST.), Ger.; *1a,b*, ×1 (358*).

Promicroceras SPATH, 1925 [**Am. planicosta* J. SOWERBY, 1814]. Small capricorns without distinct tubercles; ribs flattened on venter. *U.Sinem.(obtusum z.)*, Eu.——FIG. 272,*2*. **P. planicosta* (Sow.), Eng.; *2a,b*, ×1 (713*).

Subfamily EODEROCERATINAE Spath, 1929

[*nom. transl.* ARKELL, 1950 (*ex* Eoderoceratidae SPATH, 1929)] [Includes Microceratidae SPATH, 1926 (=Hemimicroceratinae SPATH, 1929)]

Evolute, round-whorled bituberculate forms, which do not change essentially during growth, but some lose inner row of tubercles. *L.Jur.(U.Sinem.-L.Pliensb.)*.

Eoderoceras SPATH, 1925 [**Deroceras bispinigerum* BUCKMAN, 1918] [=*Deroceras* HYATT, 1867 (*non* RAFINESQUE, 1820)]. With outer row of large, distant spines and in some an inner row of tubercles; only inner whorls ribbed. *U.Sinem.(raricostatum z.)*, Eu.-N.Afr.-Anatolia-Persia-Ore.-Nev.-S. Am.——FIG. 273,*5*. **E. bispinigerum* (BUCK.), Eng.; *5a,b*, ×1 (595*).

Hyperderoceras SPATH, 1926 [**Am. armatus ruga* QUENSTEDT, 1884]. Whorls rounded, covered with coarse but not distant rounded simple ribs, which pass over rounded venter without interruption; every 3rd or 4th rib flared, with outer lateral tubercle which later becomes almost median lateral; ornament fading on body chamber. ?Subgen. of *Eoderoceras*. *L.Pliensb.*, Eu.——FIG. 273,*4*. **E? (H.) rugum* (QUENST.), Ger.; ×0.5 (360*).

Crucilobiceras BUCKMAN, 1920 [**C. crucilobatum*] [=*Metaderoceras* SPATH, 1925 (obj.)]. Ribbing persistent, and persistently either bituberculate or with only outer row of tubercles; whorls becoming compressed. *U.Sinem.(raricostatum z.)*, Eu.——FIG. 273,*7*. **C. crucilobatum*, Eng.; *7a-c*, ×0.7 (65*); *7d,e*, ×0.5; *7f*, ×2 (330*).

Hemimicroceras SPATH, 1925 [**H. thompsoni*] [=*Microceras* HYATT, 1867 (*non* HALL, 1845)]. Small forms with strong, feebly bituberculate ribs which cross venter with some flattening and projection; inner whorls capricorn, resembling *Gagaticeras*. *U.Sinem.(raricostatum z.)*, Eu.——FIG. 273,*2*. **H. thompsoni*, Eng.; ×1 (376*).

Ophideroceras SPATH, 1925 [**O. ziphoides*]. Whorls quadrate, enlarging very slowly, serpenticone, with heavy outer spines and inner nodes, connected by thick distant ribs. *U.Sinem.(raricostatum z.)*, Eu.——FIG. 273,*3*. **O. ziphoides*, Eng.; ×0.7 (464*).

Tetraspidoceras SPATH, 1926 [**Am. quadrarmatus* DUMORTIER, 1869]. Evolute planulates with 2 distant rows of lateral spines and numerous fine ribs between, which cross venter, producing a liparoceratid appearance. *L.Pliensb.(jamesoni z.)*, Eu.——FIG. 273,*1*. **T. quadrarmatum* (DUM.), Fr.; *1a-c*, ×0.25 (614*).

Subfamily PHRICODOCERATINAE Spath, 1938

[*nom. transl.* ARKELL, 1950 (*ex* Phricodoceratidae SPATH, 1938)]

Aberrant dimorphs; with stoutly ribbed, spinous, round-whorled early stage followed by high-whorled later stage in which ribbing is modified and spines are lost. *L.Jur. (L.Pliensb.)*.

Phricodoceras HYATT, 1900 [**Am. taylori* J.DEC. SOWERBY, 1826]. Early stage depressed or rounded, with very strong distant ribs and enormous median lateral and ventral spines, latter being directed ventrally so as to form concave venter; outer whorls high, compressed with ribs becoming approximated and feebler, lateral spines usually dying out. Sutures complex. Size large. *L.Pliensb.(jamesoni z.)*, Eu.-Anatolia-Indon.——FIG. 273,*6*. **P. taylori* (Sow.), Eng.; *6a,b*, ×0.75 (737*).

?Epideroceras SPATH, 1923 [**Am. roberti* HAUER, 1854]. Inner whorls tuberculate, not spinous; coiling more evolute; middle and outer whorls becoming high, elliptical, compressed, almost smooth, with loss of all but feeble straight primary ribbing. Sutures complex. Size large. *L.Pliensb.(jamesoni z.)*, Eu.-Anatolia.——FIG. 274,*6*. **E. roberti* (HAUER), Aus.; *6a-c*, ×0.5 (633*).

Subfamily COELOCERATINAE Haug, 1910

[*nom. transl.* ARKELL, herein (*ex* Coeloceratidae HAUG, 1910)]

Stephanoceras-like forms with ribbing differentiated into primaries and secondaries, branching from an outer lateral tubercle. *L. Jur.(U.Sinem.-U.Pliensb.)*.

Coeloceras HYATT, 1867 [**Am. pettos* QUENSTEDT, 1846; SD BUCKMAN, 1898]. Whorls very depressed, coronate; with strong, sharp primary ribs ending at a conspicuous tubercle on edge of the crater umbilicus and branching into relatively indistinct secondaries on venter. *L.Pliensb.*, Eu.-N. Afr.-Anatolia-Ore.——FIG. 274,*3*. **C. pettos* (QUENST.), Ger.; *3a-c*, ×1 (358*).

Coeloderoceras SPATH, 1923 [**Coeloceras ponticum* PIA, 1913]. Evolute, whorls depressed or rounded; inner whorls strongly ribbed, bituberculate, middle whorls losing inner tubercles and becoming *Stephanoceras*-like, with biplicate and triplicate ribbing. *L.Pliensb.(jamesoni z.)*, Eu.-Anatolia-Indon.——FIG. 274,*4*. **C. ponticum* (PIA), Anatolia; *4a,b*, ×1 (344*).

Apoderoceras BUCKMAN, 1921 [**A. lobulatum*]. Inner whorls as in *Coeloceras*. The type species becomes almost smooth and *Lytoceras*-like, with divergent whorl sides and flatly rounded venter; others are more distinctly ribbed and develop an outer row of lateral spines. Size large. *U.Sinem.*

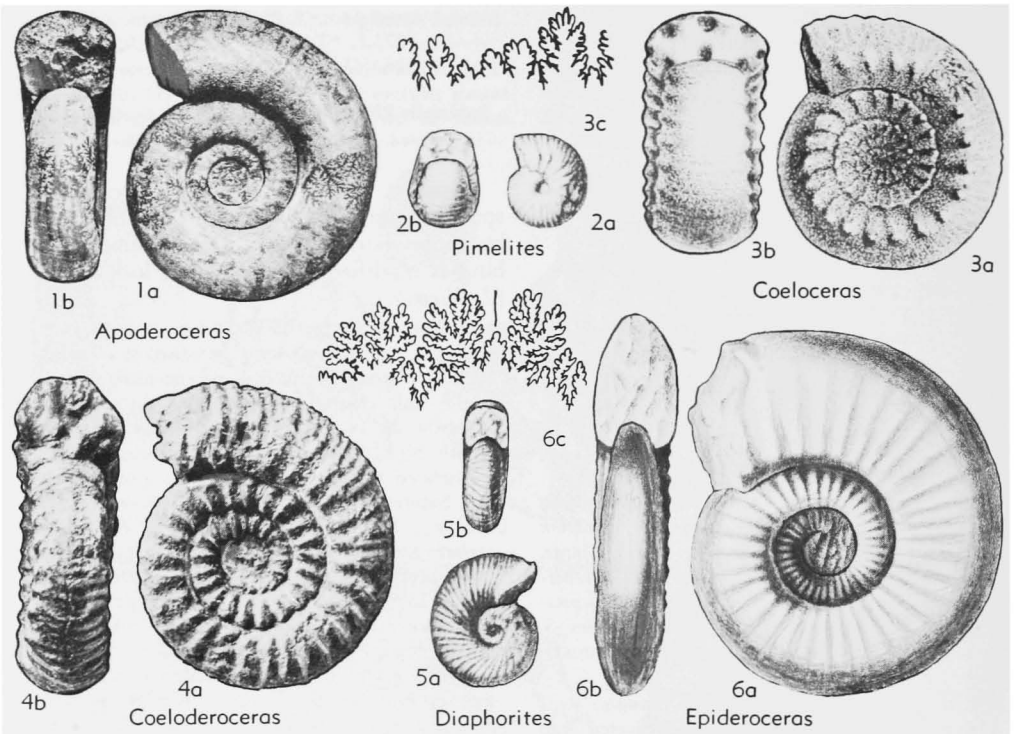


FIG. 274. Eoderoceratidae (Phricodoceratinae, Coeloceratinae) (p. L247-L248).

(raricostatum z.), Eu.——FIG. 274,*1*. **A. lobulatum*, Eng.; *1a,b*, ×0.2 (65*).

?**Pimelites** FUCINI, 1896 [**P. populonius*; SD ROMAN, 1938]. Dwarf inflated form with excentric contracted body chamber and restricted aperture; ribbing with tendency to branch from lateral tubercles. *U.Pliensb.*, Italy.——FIG. 274,*2*. **P. populonius*; *2a,b*, ×1 (624*).

?**Diaphorites** FUCINI, 1896 [**D. vetulonius*] [=*Praesphaeroceras* LEVI, 1896]. Close to *Pimelites* but more compressed; body chamber less contracted and showing a sinuous lipped aperture. ?Subgen. of *Pimelites*. *U.Pliensb.*, Italy.——FIG. 274,*5*. **D. vetulonius*; *5a,b*, ×1 (624*).

Family POLYMORPHITIDAE Haug, 1887

[*nom. correct.* ARKELL, 1950 (*pro* Polymorphidae HAUG, 1887), validation proposed ARKELL, ICZN pend.]

Evolute, more or less compressed, simply ribbed or smooth, with a wide variety of venters. Sutures usually complex, but may be simple in young forms. Probably derivatives of Eoderoceratidae (12, 65, 528; SPATH, 1938). *L.Jur.*(mainly *L.Pliensb.*)., worldwide.

Subfamily POLYMORPHITINAE Haug, 1887

[*nom. transl.* ARKELL, 1950 (*ex* Polymorphitidae HAUG, 1887]

Venter smooth or ribbed, or with median row of beading or serrations. *L.Jur. (Pliensb.)*.

Polymorphites HAUG, 1887 [**Am. polymorphus* QUENSTEDT, 1845; SD BUCKMAN, 1892 (lectotype, QUENST., 1845, pl. 4, fig. 9; SD ROMAN, 1938)]. Small shells with quadrate whorl section and distant sharp ribs which bear small sharp tubercle on ventrolateral margin, then run forward across venter to form chevrons. Sutures simple in young, complex in adult. *L.Pliensb.(jamesoni z.)*, Eu.-N.Afr.-Anatolia-Mex.——FIG. 275,*2*. **P. polymorphus* (QUENST.), Ger.; *2a,b*, ×1 (358*).

Platypleuroceras HYATT, 1867 [**Am. brevispina* J. DEC.SOWERBY, 1827]. Whorl section quadrate or compressed; ribs strong, bituberculate on the whorl sides, passing strongly across tabulate venter; outer row of tubercles appearing before inner, and both rows fading on last whorl. Sutures simple for family. *L.Pliensb.(jamesoni z.)*, Eu.-N.Afr.-Can. ——FIG. 275,*6*. **P. brevispina* (Sow.), Eng.; *6a,b*, ×0.5 (737*).

Uptonia BUCKMAN, 1898 [**Am. jamesoni* J.DEC. SOWERBY, 1827]. Large, compressed, with strong

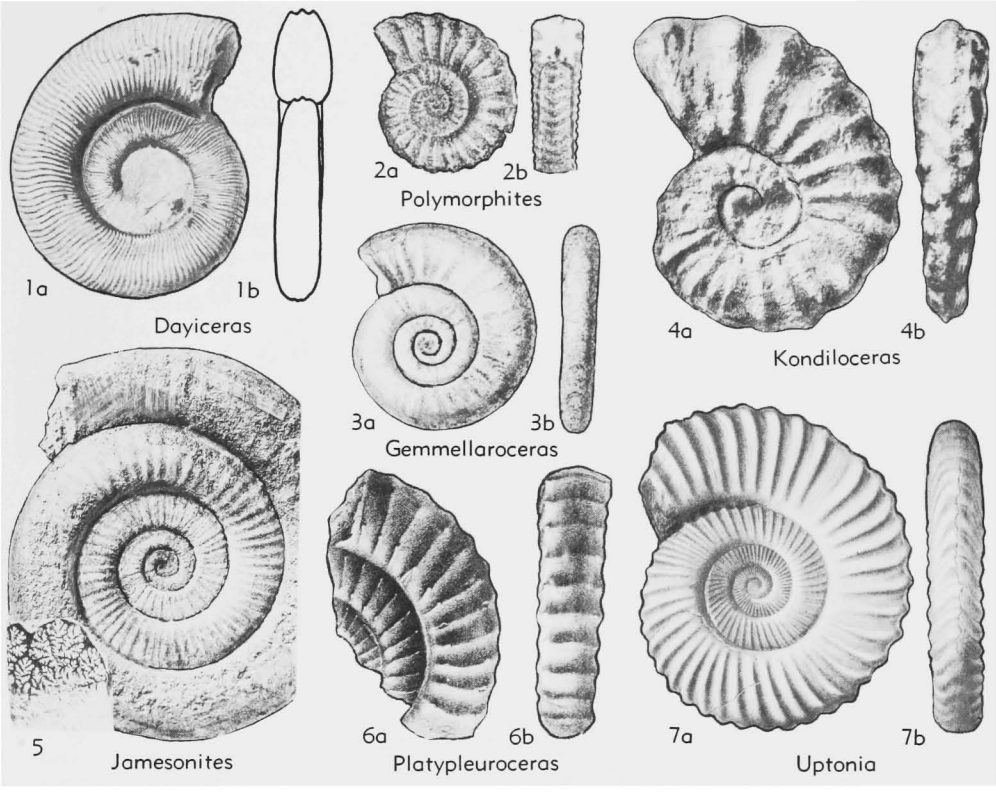


FIG. 275. Polymorphitidae (Polymorphitinae) (p. L248-L249).

rounded simple ribs and strong chevrons on venter but no tubercles. Sutures complex, with large lateral lobes. *L.Pliensb.(jamesoni z.)*, Eu.-Anatolia-Indochina-Indon.-Transbaikal-Greenl.-?Ore.-Mex.-Arg.——FIG. 275,*7*. **U. (U.) jamesoni* (Sow.), Eng.; *7a,b*, ×0.25 (737*).

Jamesonites BUCKMAN, 1923 [**J. reticulatus*]. Giant, compressed, more feebly ribbed than *Uptonia;* feebly tuberculate; outer whorl almost or quite smooth. Sutures complex. Subgen. of *Uptonia. L. Pliensb.(jamesoni z.)*, Eng.——FIG. 275,*5*. **U. (J.) reticulata* (BUCK.); ×0.2 (65*).

Dayiceras SPATH, 1920 [**D. polymorphoides*]. Form and sutures as in *Uptonia;* ribbing fine; with median row of small tubercles on venter. *L.Pliensb. (ibex z.)*, Eng.-Port.——FIG. 275,*1*. **D. polymorphoides*, Eng.; *1a,b*, ×0.5 (713*).

Peripleuroceras TUTCHER & TRUEMAN, 1925 [*P. rotundicosta*]. Small, with high rounded whorls which enlarge more rapidly than usual for the family; inner whorls smooth or striate; outer whorls striated and gradually acquiring feeble ribs which strengthen as they aproach venter, on which they curve gently forward. Sutures complex with very large 1st lateral lobe. *L.Pliensb.(jamesoni z.)*, Eng.——FIG. 276,*2*. **P. rotundicosta; 2a,b*, ×1 (528*).

Gemmellaroceras HYATT, 1900 [**Aegoceras aenigmaticum* GEMMELLARO, 1884] [=*Tubellites* BUCKMAN, 1924; *Leptonotoceras* SPATH, 1925]. Small, compressed, with oval whorl section, smooth or feebly and irregularly ribbed. *L.Pliensb.(raricostatum z.-jamesoni z.)*, Eu.——FIG. 275,*3*. **G. aenigmaticum* (GEMM.), Italy; *3a,b*, ×1 (627*).

Kondiloceras FUCINI, 1901 [**K. manciatii*]. Compressed, whorls enlarging rapidly; with straight ribs ending in ventrolateral tubercles or clavi, median row of clavi on venter simulating a serrated keel (cf. beaded venter of *Dayiceras*). *?U. Pliensb.*, Italy.——FIG. 275,*4*. **K. manciattii; 4a,b*, ×1 (162*).

Subfamily ACANTHOPLEUROCERATINAE Arkell, 1950

[*nom. nov.* ARKELL, 1950 (*pro* Cycloceratidae HYATT, 1867, based on junior synonym)] [=Tropidoceratidae HYATT, 1900]

Venter keeled (12, 201). *L.Jur.(L. Pliensb.)*.

Acanthopleuroceras HYATT, 1900 [**Am. natrix* SCHLOTHEIM in ZIETEN, 1830] [=*Cycloceras* HYATT, 1867 (*non* M'COY, 1844)]. Whorl section quadrate; ribs strong on the whorl sides, ending with ventrolateral tubercles; keel broad and blunt. Sutures simple for family. *L.Pliensb.(jamesoni z.)*,

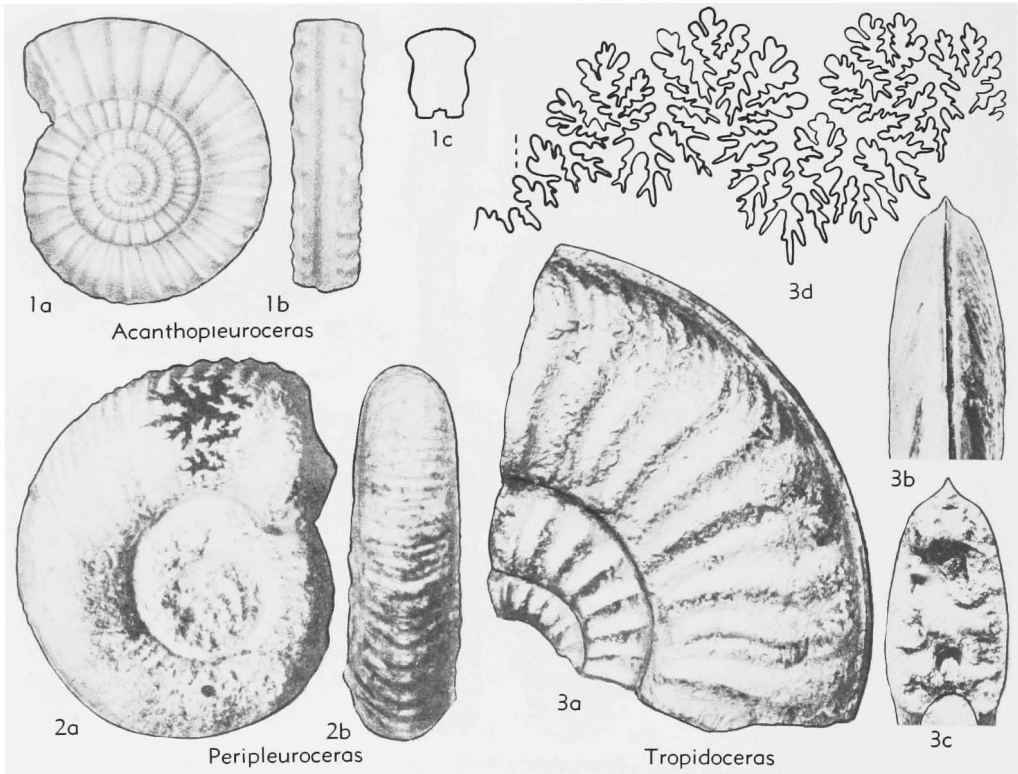


FIG. 276. Polymorphitidae (Polymorphitinae, Acanthopleuroceratinae) (p. L249-L250).

Eu.——FIG. 276,*1*. **A. natrix* (ZIETEN), Ger.; *1a-c*, ×1 (742*).

Tropidoceras HYATT, 1867 [**Am. masseanus* D'ORBIGNY, 1844; SD HAUG, 1885]. Compressed, *Harpoceras*-like, with strong keel and smooth ribbing which may show differentiation into primaries and secondaries. Sutures varying widely in degree of complexity. Probably transitional from Polymorphitidae to *Arieticeras* (SPATH, 1928). *L. Pliensb.(jamesoni z.)*, Eu.-N.Afr.-Anatolia-Indon. ——FIG. 276,*3*. **T. masseanum* (ORB.), Fr.; *3a-d*, ×1 (675*).

Family LIPAROCERATIDAE Hyatt, 1867

[=Aegoceratidae NEUMAYR, 1875]

A highly polymorphic family, comprising sphaerocones, capricorns, and dimorphs, which change from one type to another during ontogeny. Sutures less complex than in Eoderoceratidae. Derivation believed to be in common with Polymorphitidae from evolute Eoderoceratidae such as *Tetraspidoceras* (481; SPATH, 1938). Aptychus single-valved (Anaptychus). *L.Jur.(Pliensb.)*, world-wide.

Liparoceras HYATT, 1867 [**L. bronni* SPATH, 1938 (ICZN Opinion 308)]. Whorls increase rapidly in height; umbilicus deep; ribbing fine to coarse, continuous across broadly arched venter; whorl sides bituberculate, in many lirate. Sutures with large 1st lateral lobe and prominent external saddle. *L.Pliensb.(jamesoni z.)-U.Pliensb.(margaritatus z.)*, Eu.-N.Afr.-Indon.——FIG. 278,*3*. **L. (L.) bronni; 3a,b*, ×1 (481*).

Becheiceras TRUEMAN, 1918 [**Am. bechei* J.SOWERBY, 1821] [=*Anisoloboceras* TRUEMAN, 1918; *Becheoceras* DACQUÉ, 1934]. Involute, with delicate ornament; ribs less prominent between the 2 rows of tubercles than on venter. Subgen. of *Liparoceras* with same range.——FIG. 277,*2*. **L. (B.) bechei* (Sow.), Eng.; *2a,b*, ×0.3 (737*).

Parinodiceras TRUEMAN, 1918 [**Am. striatus parinodus* QUENSTEDT, 1884]. Ornament fine, ribs recessive and whorl sides flattened between 2 distant rows of lateral nodes. Subgen. of *Liparoceras*. *L. Pliensb.(jamesoni* or *ibex z.)*, Eu.——FIG. 277,*1*. **L. (P.) parinodus* (QUENST.), Ger.; *1a,b*, ×0.5 (360*).

Vicininodiceras TRUEMAN, 1918 [**V. simplicostata*]. With rounded, sphaerocone whorls; inner row of tubercles placed high up on whorl sides, close to outer row. Subgen. of *Liparoceras*. *L.Pliensb.*

(jamesoni or *ibex z.)*, Eu.——Fig. 278,*5*. **L. (V.) simplicostatum*, Eng.; *5a,b*, ×0.5 (481*).

Platynoticeras Spath, 1938 [**Am. alter* Oppel, 1862]. Like *Liparoceras (Parinodiceras)* but more evolute and with ribbed polymorph inner whorls and narrow, flat venter bearing irregular zigzag ribs. *L.Pliensb.(jamesoni z.)*, Eu.——Fig. 278,*2*. **P. alterum* (Oppel), Ger.; *2a,b*, ×0.5 (481*).

Metacymbites Spath, 1923 [**Am. centriglobus* Oppel, 1862]. Dwarf, subspherical, smooth or with ventral ribbing in young only; body chamber contracted, occupying half a whorl, with constricted aperture and small lappets. Sutures reduced. *L. Pliensb.-U.Pliensb.*, Eu.——Fig. 278,*1*. **M. centriglobus* (Oppel), Ger.; ×1 (358*).

Beaniceras Buckman, 1913 [**Am. luridus* Simpson in Buck., 1913]. Small forms with cadicone inner whorls, feebly ornamented or spinous, and middle whorls which become serpenticone and have tendency to capricorn ribbing; body chamber may lose ornament to some extent. Sutures as in *Liparoceras*. *L.Pliensb.(ibex z., ?davoei z.)*, Eu.-Transbaikal-Greenl.——Fig. 279,*2*. **B. luridum* (Simp.), *ibex* z., Eng.; *2a,b*, ×1 (65*).

Androgynoceras Hyatt, 1867 [**Am. hybrida* d'Orbigny, 1844; SD Buckman, 1911] [=*Aegoceras* Waagen, 1869; *Amblycoceras* Hyatt, 1900]. Somewhat evolute dimorphs. Capricorn early stage usually prolonged, in some followed by fine-ribbed *Liparoceras* stage with differentiated bituberculate ribbing. Sutures become more complicated in latter stage. *L.Pliensb.(ibex-davoei z.)*, Eu.——Fig. 278, *4*. **A. hybridum* (Orb.), Fr.; *4a,b*, ×0.5 (330*).

Oistoceras Buckman, 1911 [**Am. figulinus* Simpson in Buck., 1911]. Serpenticone capricorns, like immature *Androgynoceras*, ribs forming pronounced chevrons on venter; usually tubercles at some stage. *L.Pliensb.(davoei z.), ?U.Pliensb.(margaritatus z.)*, Eu.——Fig. 279,*1*. **O. figulinum* (Simp.), *davoei* z., Eng.; *1a,b*, ×1 (65*).

Family AMALTHEIDAE Hyatt, 1867

[*nom. correct.* Fischer, 1882 (*pro* Amaltheoidae Hyatt, 1867), validation proposed Arkell, 1955 (ICZN pend.)] [=Paltopleuroceratidae Spath, 1926]

Discoidal oxycones evolving into strongly ribbed and spinous planulates with quadrate whorls, typically with crenulated keel. Sutures with short external lobe, large and long 1st lateral, small 2nd lateral grading with a few small retracted auxiliaries. Aptychus single-valved with concentrically striated shiny surface (Anaptychus). Derivation possibly from various Liparoceratidae (Spath, 1938), though derivation of some forms from Phylloceratina by way of *Galaticeras* has been suggested (159, 198a, 297; Frebold, 1922). *L.Jur.(U.Pliensb.)*, world-wide.

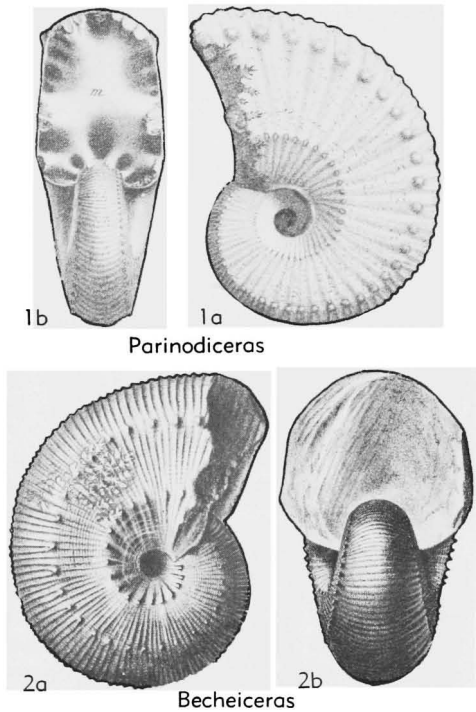


Fig. 277. Liparoceratidae (p. L250).

Amaltheus de Montfort, 1808 [**A. margaritatus*] [=*Proamaltheus* Lange, 1932 (nuclei)]. Oxycones with moderately open umbilicus, serrated keel, and smooth, gently sigmoid ribbing, in many strigate, some with lateral tubercles; aperture rostrate, no lappets. *Margaritatus z.*, Eu.-N.Afr.-Cauc.-Sib.-Bureya Basin-N.Alaska-Can.-Ore.-?Hond.——Fig. 280,*1*. **A. (A.) margaritatus; 1a,b*, ×0.25 (737*).

Pseudoamaltheus Frebold, 1922 [**Am. engelhardti* d'Orbigny, 1844; SD Frentzen, 1937]. Differs from *Amaltheus*, of which it is a late derivative, by early loss of keel and ribbing and extreme development of strigation. Subgen. of *Amaltheus*. Eu.——Fig. 281,*1*. **A. (P.) engelhardti* (Orb.), Fr.(Alsace); *1a,b*, ×0.3 (583n).

Amauroceras Buckman, 1913 [**Am. ferrugineus* Simpson in Buck., 1919]. Small, smooth, without ribs or strigation, compressed, keel reduced. Eu.-Ore.——Fig. 282,*1*. **A. ferrugineum* (Simp.), Eng.; ×2 (65*).

Pleuroceras Hyatt, 1867 [**Am. spinatus* Bruguière, 1789; SD Fischer, 1882 (ICZN Opinion 324)] [=*Paltopleuroceras* Buck., 1898 (obj.)]. Planulate, with quadrate whorl section; ribs strong, radial, ending in ventrolateral tubercles; venter tabulate, with strong serrated keel. *Spinatum z.*, Eu.-N.Afr.——Fig. 282,*2*. **P. spinatum* (Brug.); *2a,b*, ×0.75 (4*).

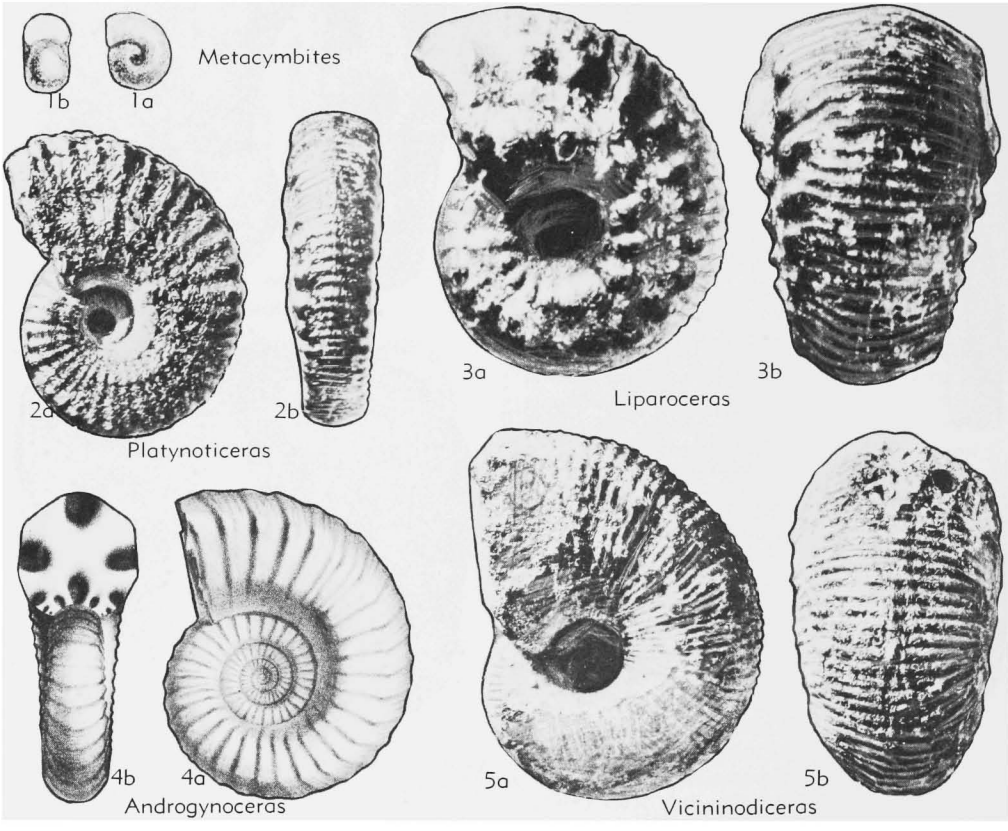


FIG. 278. Liparoceratidae (p. L250-L251).

Family DACTYLIOCERATIDAE Hyatt, 1867

[*nom. correct.* J.P.SMITH, 1913 (as Dactylioceratinae) (*pro* Dactyloidae HYATT, 1867), validation proposed ARKELL, 1955, and SYLVESTER-BRADLEY, 1955, ICZN pend.)]

Evolute or involute (serpenticone or coronate), ribbed and commonly tuberculate ammonites, which prefigure Bajocian stephanoceratids and Oxfordian perisphinctids and are sometimes hard to separate from their later homeomorphs. Derived by way of *Prodactylioceras* in the *davoei z.* from Lytoceratina (150) but some other genera perhaps from Eoderoceratidae (65, 125, 298, 299, 478). *L.Jur.(L.Pliensb.-Toarc.)*, worldwide.

Prodactylioceras SPATH, 1923 [**Am. davoei* J.SOWERBY, 1822] [=*Paralytoceras* FREBOLD, 1922 (*non* FRECH, 1902); *Praedactyloceras* FRENTZEN, 1937]. Evolute, ribs fine, mainly simple, with sporadic ventrolateral tubercles. Sutures somewhat complex, with large ramifying 1st lateral lobe. *L.Pliensb. (davoei z.)*, Eu.-Can.-Chile.——FIG. 283,*1*. **P. davoei* (Sow.), Eng.; *1a,b*, ×0.3 (737*).

Reynesoceras SPATH, 1936 [**Am. ragazzonii* HAUER, 1861]. A race or derivative of *Prodactylioceras*, tending to loose and irregular coiling; ribs simple, sigmoid, not tuberculate. *U.Pliensb.*, Italy-?Can.——FIG. 284,*2*. **R. ragazzonii* (HAUER), Alps; *2a,b*, ×1 (633*).

Dactylioceras HYATT, 1867 [**Am. communis* J.SOWERBY, 1815; SD ICZN pend.] [*Kryptodactylites, Tenuidactylites, Xeinodactylites, Vermidactylites, Toxodactylites, Athlodactylites, Koinodactylites, Nomodactylites, Curvidactylites, Microdactylites, ?Leptodactylites, Orthodactylites, Anguidactylites, Peridactylites* BUCK., 1926-27]. Evolute *Perisphinctes*-like planulates, with bifurcating and in part simple ribs, which pass across venter straight or with gentle forward inclination. *L.Toarc.*, Eu.-N. Afr. - Persia - Baluch. - Japan-Indon.-N.Z.-Spitz.-NE.Sib.Transbaikal-Greenl.-N.Alaska - Can. - Chile - Arg.——FIG. 284,*5*. **D. (D.) commune* (Sow.), Eng.; *5a,b*, lectotype, ×0.7 (18*).——FIG. 285,*2*. *D. (D.) directum* (BUCK.) (type species of *Orthodactylites*); *2a,b*, ×0.7 (65*).

Zugodactylites BUCKMAN, 1926 [**Am. braunianus* D'ORBIGNY, 1845] [*?Arcidactylites* BUCK., 1926, *?Parvidactylites* BUCK., 1927]. Like some *Dactylio-*

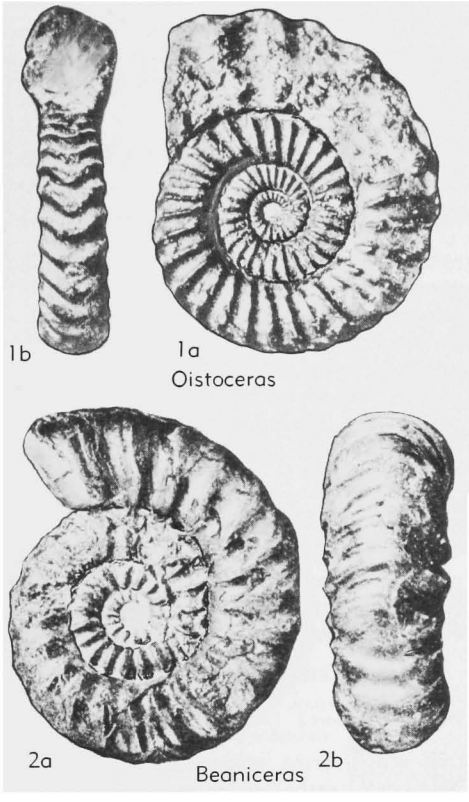


FIG. 279. Liparoceratidae (p. L251).

ceras but develops ventrolateral tubercles. Subgen. of *Dactylioceras*. *L.Toarc.*, Eu.——FIG. 283,*2*. **D. (Z.) braunianum* (ORB.), Fr.; *2a,b*, ×0.75 (65*). ——FIG. 285,*1*. *D. (Z.) parvus* (SOWERBY) (type of *Parvidactylites*); *1a,b*, ×0.5 (65*).

Peronoceras HYATT, 1867 [**Am. fibulatus* J.DEC. SOWERBY, 1823; SD BUCKMAN, 1911] [*Porpoceras*

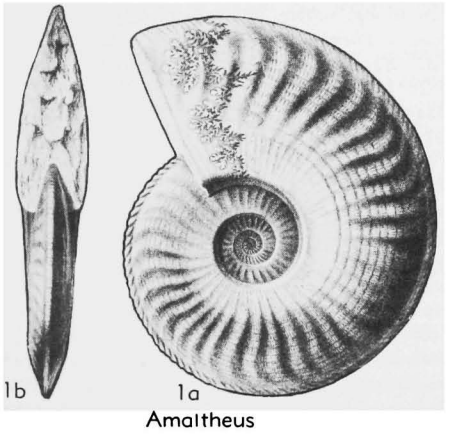


FIG. 280. *Amaltheus (Amaltheus) margaritatus* (DE MONTFORT), L.Jur.(U.Pliensb.), Eu.; *1a,b*, ×0.25 (737*) (p. L251).

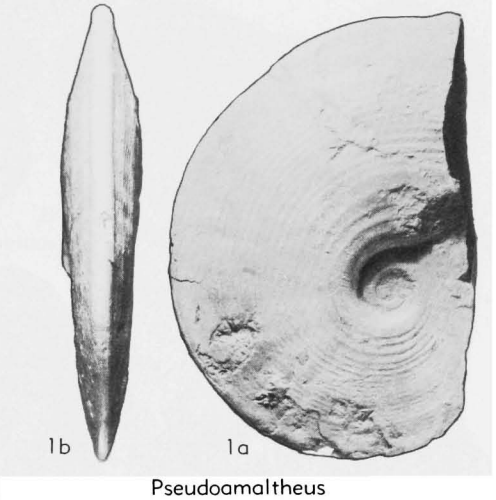


FIG. 281. *Amaltheus (Pseudoamaltheus) engelhardti* (D'ORBIGNY), L.Jur.(U.Pliensb.), Fr.(Alsace); *1a,b*, ×0.3 (583n) (p. L251).

BUCK., 1911]. Like *Dactylioceras* but with variable proportion of ribs looped in pairs to a ventrolateral tubercle or spine. *L.Toarc.*, Eu.-N.Afr.-Cauc.-Baluch.-Japan-NE.Sib.-Transbaikal-N.Alaska-Can.——FIG. 286,*2*. **P. fibulatum* (Sow.), Eng.; *2a,b*, ×0.7 (65*).

Subcollina SPATH, 1925 [**S. yeovilensis*]. Large,

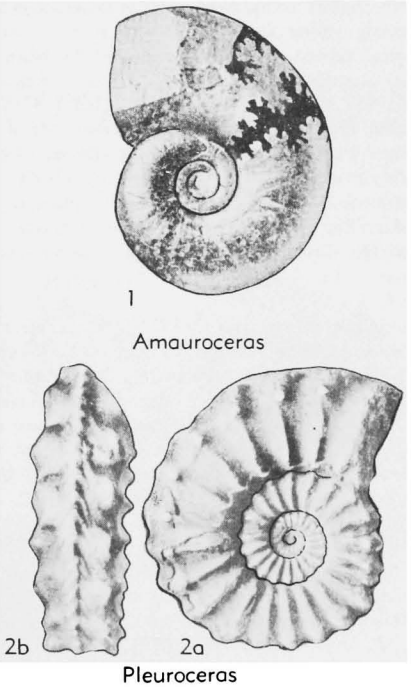


FIG. 282. Amaltheidae (p. L251).

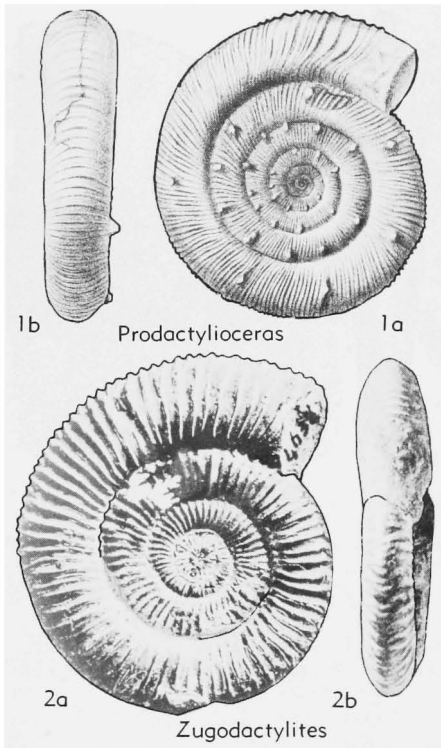


FIG. 283. Dactylioceratidae (p. L252-L253).

with slightly compressed angular quadrate whorls bearing strong simple ribs with row of ventrolateral tubercles placed very high and bounding flat to slightly concave venter. *Toarc.*, Eng.——FIG. 284,*3*. **S. yeovilensis; 3a,b,* ×0.3 (737*).

Collina BONARELLI, 1893 [**C. gemma;* SD BUCKMAN, 1927] [=*Mucrodactylites* BUCK., 1927]. Whorls angular, quadrate, enlarging slowly; primary ribs strong, straight, distant, bifurcating or trifurcating at a high ventrolateral tubercle; secondaries sharp and uninterrupted across venter. *Toarc.*, Eu.——FIG. 284,*1*. **C. gemma,* Italy; *1a,b,* ×1 (591*).

Catacoeloceras BUCKMAN, 1923 [**C. confectum*] [*Crassicoeloceras, Nodicoeloceras, Spinicoeloceras, Multicoeloceras, ?Lobodactylites, ?Simplidactylites* BUCK., 1926-27]. Whorls depressed, coronate at least in early stage; ribs biplicate and in some simple; ventrolateral tubercles absent or present to a variable extent. *L.Toarc.*, Eu.-N.Afr.-Crimea-Indon.-Spitz.-Greenl.-Bol.——FIG. 284,*4*. **C. confectum,* Eng.; *4a-c,* ×0.7 (*4a,b,* 65*; *4c,* 65*).

?Preperonoceras MAUBEUGE, 1949 [**P. brancoi*]. Whorls depressed, rounded, with vague fine fasciculate ribbing; distant lateral swellings, probably parabolic, no tubercles. *L.Toarc.*, Fr.——FIG. 284, *6*. **P. brancoi; 6a-d,* ×1 (47*).

Sphaerocoeloceras JAWORSKI, 1926 [**S. brochii-forme*]. Involute. Ribbing blunt, distant, biplicate; appearance resembles *Emileia* but sutures as in *Catacoeloceras*. *Toarc.*, Arg.——FIG. 286,*1*. **S. brochiiforme; 1a,b,* ×1 (218*).

Superfamily HILDOCERATACEAE Hyatt, 1867

[*nom. transl.* ARKELL, herein (*ex* Hildoceratidae HYATT, 1867) [=Harpoceratacea WEDEKIND, 1917]

Compressed or planulate, tending in many genera to oxycone shape, generally with falcate or falcoid ribbing. Aptychus (found *in situ* in *Hildoceras, Grammoceras, ?Dumortieria* and *Leioceras*) double-valved with plicated shiny surface (Cornaptychus) or smooth (Laevicornaptychus) (161, 162, 163, 164, 299). *L.Jur.(U.Pliensb.)-M.Jur.(Bath.),* world-wide.

Family HILDOCERATIDAE Hyatt, 1867

Typical Hildoceratacea apparently derived from Acanthopleuroceratinae, especially *Tropidoceras* (L.Pliensb.). *L.Jur.(U. Pliensb.-Toarc.).*

Subfamily ARIETICERATINAE Howarth, 1955

[*nom. nov.* HOWARTH, 1955 (*pro* Seguenziceratidae SPATH, 1924), ICZN pend.] [=Seguenziceraten ROSENBERG, 1909 (invalid vernacular name)]

Evolute forms with mainly unicarinate venter and rather straight stout ribbing. *L. Jur.(U.Pliensb.),* especially Tethys but rarely Eng. and Japan.

Arieticeras SEGUENZA, 1885 [*non* QUENSTEDT, 1883 (ICZN Opinion 337)] [**Am. algovianus* OPPEL, 1862] [=*Seguenziceras* LEVI, 1896 (obj.) (ICZN Opinion 337); *Meneghinia* FUCINI, 1931 (*non* SILVESTRI, 1889); *Emaciaticeras* FUCINI, 1931]. Whorl section quadrate to compressed, venter unicarinate with or without sulci; ribs strong, simple, distant, straight to gently falcoid. *U.Pliensb.*, Eu.-N.Afr.-Cauc.——FIG. 287,*1*. **A. algovianum* (OPPEL), Alps; *1a,b,* ×0.7 (628*).

Canavaria GEMMELLARO, 1886 [**Harpoceras (Dumortieria) haugi* GEMM., 1885, SD HOWARTH, 1955] [*Di-Stefania* FUCINI, 1931 (*non* CHECCHIA-RISPOLI, 1917); *Naxensiceras, ?Seguentia, ?Tauromenia, ?Trinacrioceras* FUCINI, 1931 (last 2 invalid under Art. 25)]. Resembles *Seguenziceras* but ribs commonly twinned at umbilical margin and may be uni- or bituberculate. *U.Pliensb.*, Eu.-Japan.——FIG. 288,*1*. **C. haugi* (GEMM.), Sicily; holotype, ×0.7 (164*).

Fontanelliceras FUCINI, 1931 [**Harpoceras fontanellense* GEMM., 1885; SD VECCHIA, 1949]. Evolute, whorls enlarging very slowly; venter tricarinate-bisulcate; ribs simple, straight, robust, distant. Resembling *Echioceras*. *U.Pliensb.*, Italy-

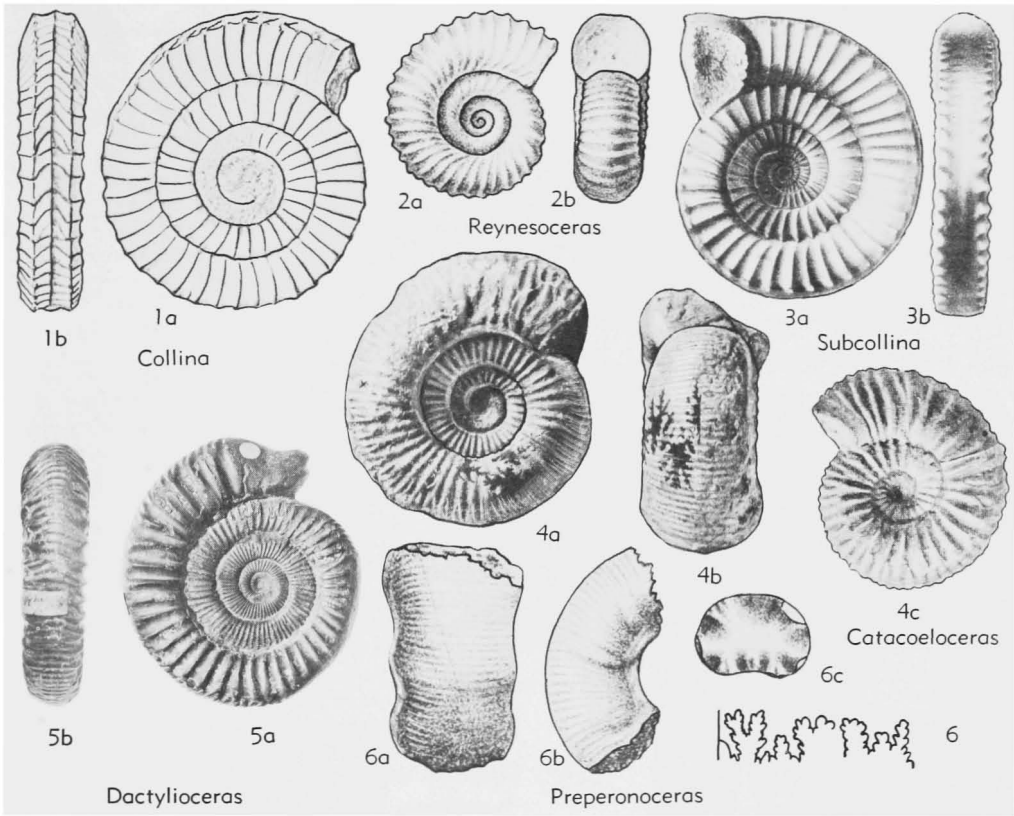


FIG. 284. Dactylioceratidae (p. L252-L254).

Japan.——FIG. 288,*3*. **F. fontanellense* (GEMM.), Italy; ×1 (164*).

Leptaleoceras BUCKMAN, 1918 [**L. leptum*]. Evolute, compressed; venter strongly unicarinate, not sulcate; ribbing obscure, only gently flexuous. *U. Pliensb.*, Eng.——FIG. 288,*4*. **L. leptum; 4a,b,* ×1 (595*).

Asaphoceras SPATH, 1924 [**Amphiceras apenninicum* FUCINI, 1911]. Small, discoidal; whorl section compressed elliptical; umbilical slope gradual; smooth but for gently falcoid growth lines; sutures simplified, ceratitic, but with 3 auxiliary lobes. *U.Pliensb.*, Italy.——FIG. 288,*2*. **A. apenninicum* (FUCINI); *2a-c*, ×1 (163*).

Subfamily HARPOCERATINAE Neumayr, 1875

[*nom. correct.* FISCHER, 1882 (*pro* Harpoceratinen NEUMAYR, 1875, invalid vernacular name, validation proposed ARKELL, ICZN 1955]

Comprises true Falciferi of VON BUCH. There are intimate connections with both Arieticeratinae and Hildoceratinae but, in general, the Harpoceratinae are more compressed, with flatter whorl sides and finer, less prominent ribbing, which is invariably more or less falcoid or falcate (162, 163, 164, 577). *L.Jur.(U.Pliensb.-Toarc.)*, world-wide.

Harpoceras WAAGEN, 1869 [**Am. falcifer* J.SOWERBY, 1820; SD ARKELL, 1951 (validated ICZN Opinion 363, 1954)] [=*Falciferites* BREISTROFFER, 1947 (obj.); *Tardarpoceras* BUCKMAN, 1927; *Phaularpites* BUCK., 1928]. Sides flat, umbilical edge

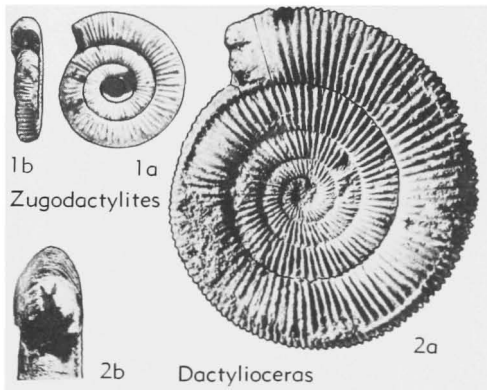


FIG. 285. Dactylioceratidae (p. L252-L253).

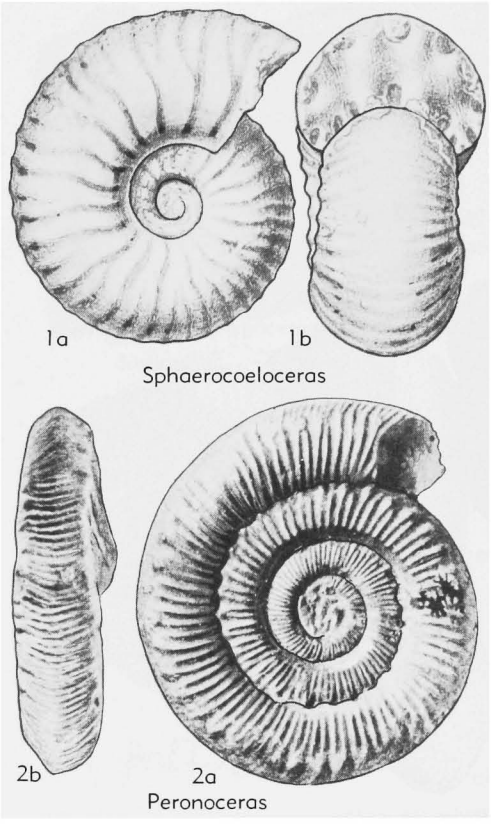


FIG. 286. Dactylioceratidae (p. L253-L254).

sharp, venter unicarinate, ribbing falcate, stronger on outer half on whorl sides than on inner. *L. Toarc.*, Eu.-N.Afr.-Cauc.-Japan-Indon.-Can.-Ore.-Nev.-Chile-Arg.——FIG. 289,*1*. **H. (H.) falcifer* (Sow.), Eng.; *1a,b*, holotype, ×0.7 (65*).

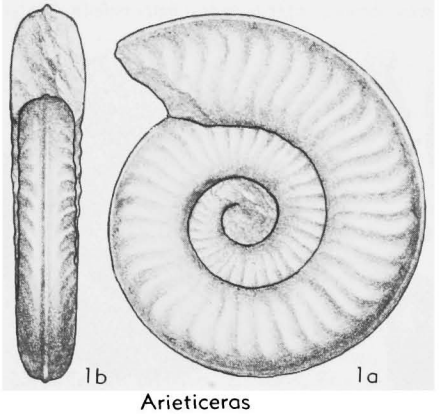


FIG. 287. *Arieticeras algovianum* (OPPEL), L.Jur. (U.Pliensb.), Alps; *1a,b*, ×0.7 (628*) (p. L254).

Eleganticeras BUCKMAN, 1913 [**E. pseudo-elegans*] [*?Elegantuliceras* BUCK., 1913, based on inner whorls]. Differs from *Harpoceras* by being almost smooth from an early stage. ?Subgen. of *Harpoceras*. *L.Toarc.*, Eng.——FIG. 289,*3*. **H.? (E.) pseudoelegans; 3a-c*, ×0.5 (65*).

Harpoceratoides BUCKMAN, 1909 [**Am. alternatus* SIMPSON in BUCK., 1909] [*Glyptarpites* BUCK., 1927]. Differs from *Harpoceras* in being more evolute and having the ribbing more fasciculate, more clearly differentiated into primaries and secondaries. Subgen. of *Harpoceras*. *L.Toarc.*, Eu. ——FIG. 289,*4*. **H. (H.) alternatus* (SIMP.), Eng.; *4a,b*, ×0.5 (65*).

Ovaticeras BUCKMAN, 1918 [**Am. ovatus* YOUNG & BIRD, 1822]. Differs from *Harpoceratoides* chiefly in having a gentler umbilical slope; ribbing feeble, fading on outer whorls. Subgen. of *Harpoceras*. *L.Toarc.*, Eu.——FIG. 289,*9*. **H. (O.) ovatum* (YOUNG-B.); *9a,b*, ×0.5 (65*).

Paltarpites BUCKMAN, 1922 [**P. paltus*] [*Argutarpites* BUCK., 1923; *Platyharpites* BUCK., 1927; *Nagatoceras* MATSUMOTO, 1947]. Ribbing more gently falcoid than in *Harpoceras*, and of a peculiar flat-topped style, so that in denser-ribbed species whorls appear to be striate rather than ribbed. *U.Pliensb.*, Eu.-Japan-Ore.——FIG. 289,*5*. **P. paltus*, Eng.; *5a,b*, ×0.3 (65*).

Lioceratoides SPATH, 1919 [**Lioceras? grecoi* FUCINI, 1900] [=*Praelioceras* FUCINI, 1929]. Umbilical slope gentle; ribs blunt, distant, falcate,

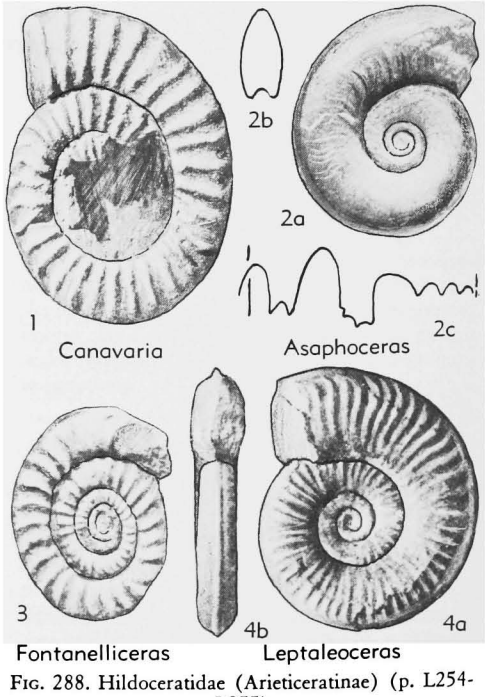


FIG. 288. Hildoceratidae (Arieticeratinae) (p. L254-L255).

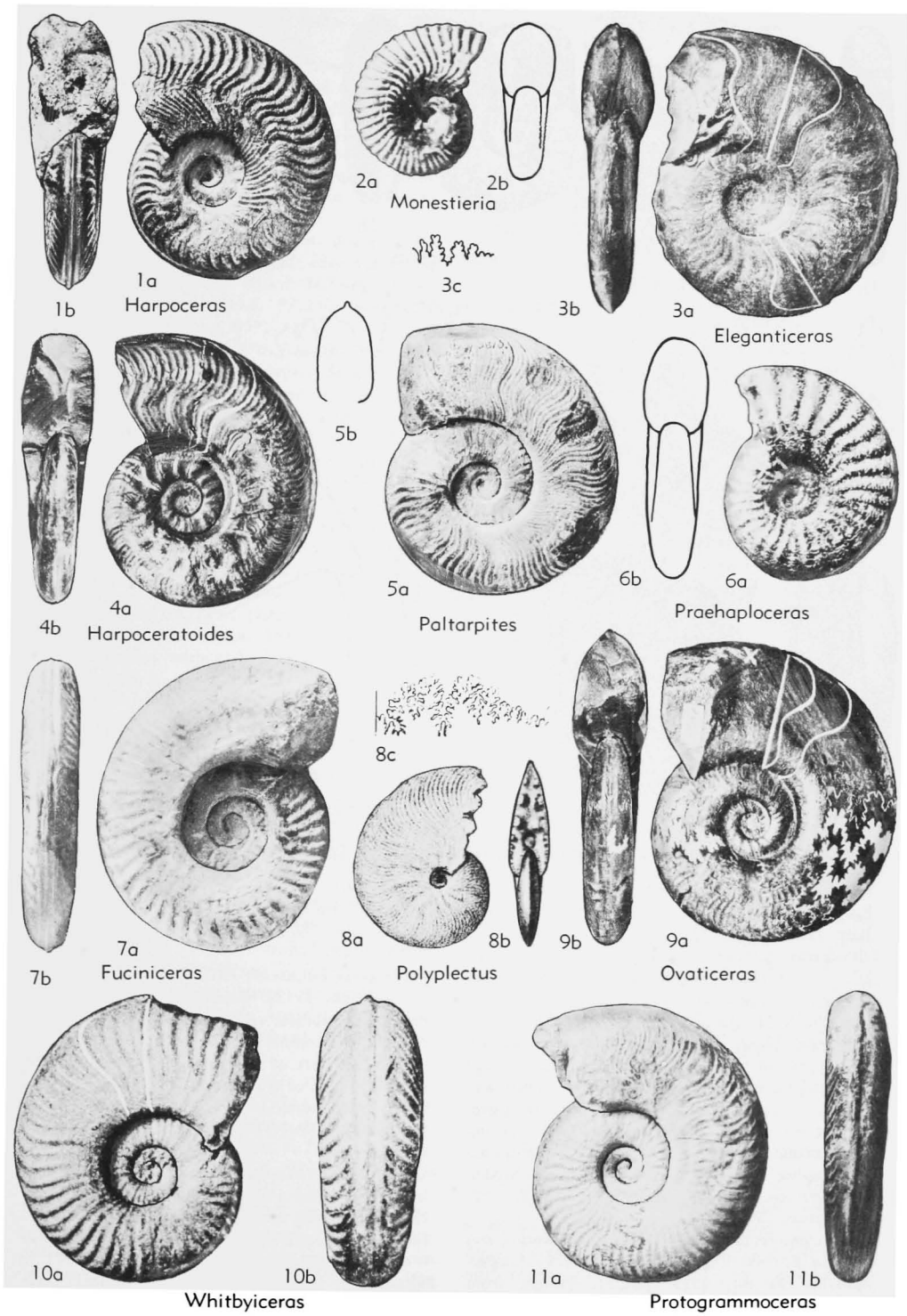


FIG. 289. Hildoceratidae (Harpoceratinae) (p. L255-L259).

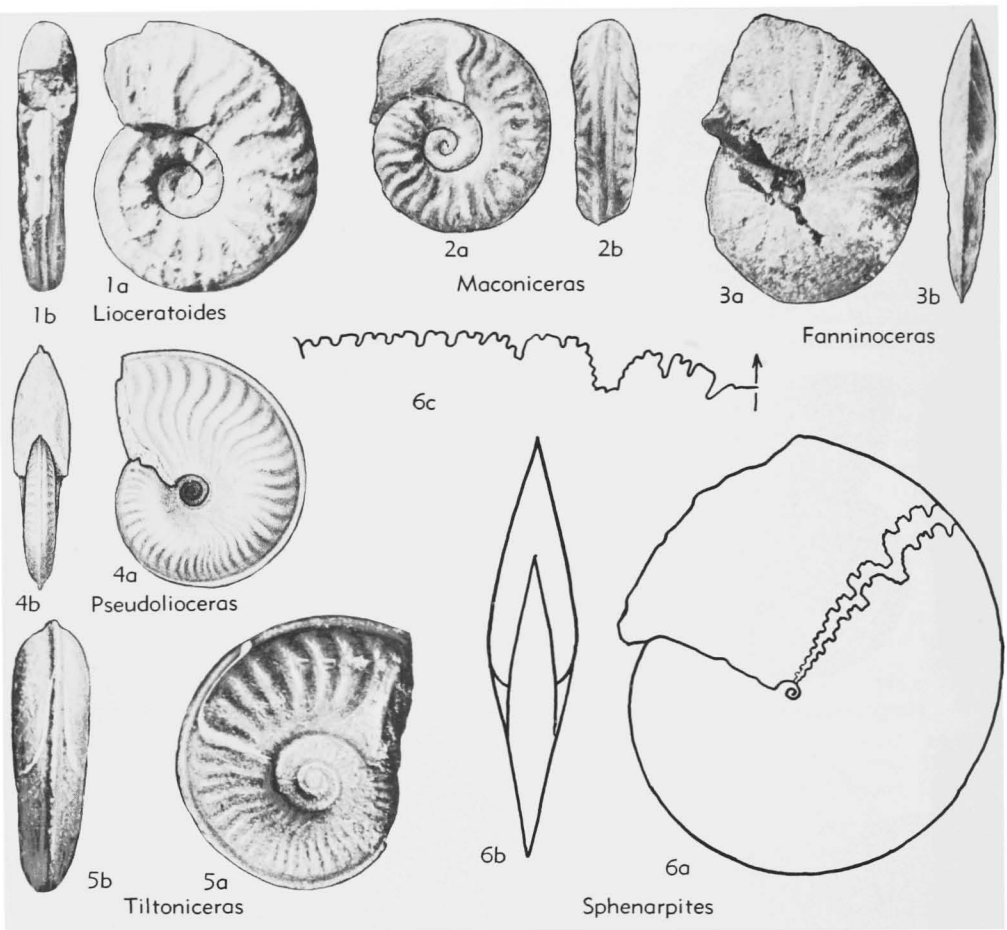


FIG. 290. Hildoceratidae (Harpoceratinae) (p. L256-L259).

rather coarse, fading on body chamber. *U.Pliensb.*, Eu.-Japan.——FIG. 290,*1*. **L. grecoi* (FUCINI), Italy; *1a,b*, ×1 (161*).

Tiltoniceras BUCKMAN, 1913 [**T. costatum*]. Umbilical edge sharp, ribbing gently falcate, blunt, strongly projected on venter. *L.Toarc.*, Eng.——FIG. 290,*5*. **T. costatum*; *5a,b*, ×1 (65*).

Fuciniceras HAAS, 1913 [**Harpoceras lavinianum* MENEGHINI in FUCINI, 1900]. Planulate, with flat sides and venter ranging from acute or unicarinate-tabulate to carinate-bisulcate, and in many species passing from one to other and back again during development; ribbing gently falcoid, not projected at periphery. *U.Pliensb., ?L.Toarc.*, Eu.-N.Afr.-Cauc.-Baluch.-Japan-Indon.——FIG. 289,*7*. **F. lavinianum* (MEN.); *7a,b*, ×1 (162*).

Protogrammoceras SPATH, 1913 [**Grammoceras bassanii* FUCINI, 1900; SD SPATH, 1919] [=*Bassaniceras* FUCINI, 1929 (obj.)]. Differs from *Fuciniceras* (which is prior to it in date) only in its more falcate ribbing, which is more projected at periphery. ?Subgen. of *Fuciniceras*. *U.Pliensb., L.Toarc.*, Eu.-N.Afr.-Madag.-C.Arabia-Baluch.-Japan.——FIG. 289,*11*. **P. bassanii* (FUCINI); *11a,b*, ×0.5 (161*).

Whitbyiceras BUCKMAN, 1913 [**Am. pinguis* SIMPSON in BUCK., 1913]. Whorls stout, venter carinate-bisulcate, umbilical wall abrupt with sharp edge; ribs simple, commonly twinned but unbranched, with inner part of primaries becoming faint on last half-whorl of type (believed to be body chamber). *L.Toarc.(falcifer z.)*, Eng.——FIG. 289,*10*. **W. pingue* (SIMP.), Jet Rock, Yorks.; *10a,b*, ×1 (65*).

Maconiceras BUCKMAN, 1926 [**M. vigoense*]. Venter becoming carinate-bisulcate and ending in long rostrum; ribbing similar to that of *Lioceratoides*, fading on gentle umbilical slope. *L.Toarc.*, Eu.——FIG. 290,*2*. **M. vigoense*; *2a,b*, ×1 (65*).

Fanninoceras MCLEARN, 1930 [**F. fannini*]. Oxycone with undercut umbilical wall, feeble flexuous ribs which fade on outer whorl. Sutures as in

some Oxynoticeratidae. *Toarc.*, B.C.——Fig. 290, *3*. **E. fannini*; *3a,b*, ×1 (270*).

Pseudoliocerас Buckman, 1889 [**Am. compactilis* Simpson in Buck., 1889]. Supposed to be homeomorph of *Leioceras*, from which it differs by having a hollow instead of solid keel and smoother aptychus (Laevicornaptychus). *U.Toarc.*, Eu.-N. Afr.-Anatolia - Cauc. - Transbaikal - Bureya Basin - Japan-Spitz.-Greenl.-N.Alaska.——Fig. 290,*4*. **P. compactile*, Eng.; *4a,b*, ×0.5 (60*).

Polyplectus Buckman, 1890 [**Am. discoides* Zieten, 1830]. Oxycone with knife-edge venter. Sutures modified but well frilled. *U.Toarc.*, Eu.-N. Afr.-Baluch.——Fig. 289,*8*. **P. discoides* (Zieten), Ger.; *8a-c*, ×1 (595*).

Sphenarpites Spath, 1936 [**S. hawkinsi*]. Aberrant oxycone with knife-edge venter. Sutures much modified, with elements reduced in size, simplified, and increased in numbers. *Toarc.*, Baluch. ——Fig. 290,*6*. **S. hawkinsi; 6a,b*, ×1 (477*).

?Monestieria Cossmann, 1922 [*pro Lapparentia* Monestier, 1921 (*non* Berthelin, 1885)] [**Lapparentia ressouchei* Monestier, 1921; SD Arkell, herein]. Venter rounded, without keel or sulcus; ribs sharp, wiry, falcoid, fading toward umbilicus, strengthening toward venter and on it. Sutures simple. *U.Toarc.*, Eu.——Fig. 289,*2*. **M. ressouchei* (Monestier), Fr.; *2a,b*, ×1 (296*).

?Praehaploceras Monestier, 1931 [**P. zwieseli*]. Venter rounded, without keel or sulcus; ribs faint, falcoid. Sutures complex. *M.Toarc.*, Fr.——Fig. 289,*6*. **P. zwieseli; 6a,b*, ×1 (298*).

Subfamily HILDOCERATINAE Hyatt, 1867

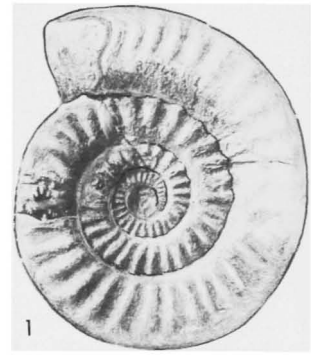
Evolute planulates with quadrate whorl section, tricarinate-bisulcate venter, and falcate ribs which may be interrupted by longitudinal groove on whorl sides (65, 288). *L. Jur.(L.Toarc.)*, world-wide.

Hildoceras Hyatt, 1867 [**Am. bifrons* Bruguière, 1789; SD Buckman, 1889] [*?Goniohildoceras* Seguenza, 1886]. Usually strong median lateral groove, inside which ribbing is faded or absent, but on outside strong, steeply rursiradiate and falcate. *L.Toarc.*, Eu.-N.Afr.-Anatolia-Cauc.-Persia-Japan.——Fig. 291,*2*. **H. bifrons* (Brug.), Eng.; *2a,b*, ×0.7 (65*).

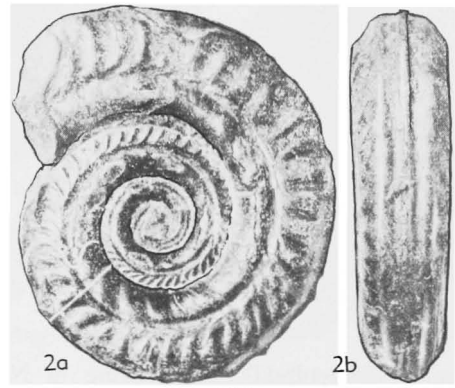
Hildaites Buckman, 1921 [**H. subserpentinum*] [=*Hildoceratoides* Buck., 1921]. Lacks lateral groove of *Hildoceras*, and ventral sulci are shallower. ?Subgen. of *Hildoceras*. *L.Toarc.*, Eu.-Anatolia-C.Arabia.——Fig. 292,*2*. **H.? (H.) subserpentinum*, Eng.; *2a*, ×0.5; *2b*, ×1 (65*).

Orthildaites Buckman, 1923 [**O. orthus*]. Link between *Hildoceras* and *Arieticeras*. Venter tricarinate-bisulcate, sulci fading on last whorl; ribs strong, simple, straight. *L.Toarc.*, Eng.——Fig. 291,*1*. **O. orthus*; ×0.3 (65*).

Mercaticeras Buckman, 1913 [**Am. mercati* Hauer, 1856] [=*Murleyiceras* Buck., 1921]. Inner whorls tricarinate-bisulcate, sulci fading on outer whorl, which is unicarinate; ribs strong, gently falcate. *L.Toarc.*, Eu.-N.Afr.——Fig. 292,*3*. **M. mercati* (Hauer), Alps; *3a,b*, lectotype (SD Buck., 1913), ×1 (633*).



Orthildaites



Hildoceras

Fig. 291. Hildoceratidae (Hildoceratinae) (p. L259).

Renziceras Arkell, 1953 [**Hildoceras nausikaae* Renz, 1912]. Inner whorls coronate, sides divergent, with strong, distant simple ribs which end in coarse ventrolateral tubercle; ribbing changes on last whorl suddenly to gently falcoid, tubercles disappear, and whorl shape becomes quadrate, with coiling evolute, planulate; venter unicarinate. Sutures normal hildoceratid. *L.Toarc.*, Greece.——Fig. 292,*6*. **R. nausikaae* (Renz); *6a,b*, ×1 (687*).

Subfamily BOULEICERATINAE Arkell, 1950

Aberrant Hildoceratidae with reduced and simplified sutures, in some ceratitic, with wide range of whorl shapes and ribbing styles. Probably convergent offshoots or end forms of several different genera, but impossible to identify their parent stocks (12,15,368,369,370,504). *L.Jur.(L.Toarc.)*,

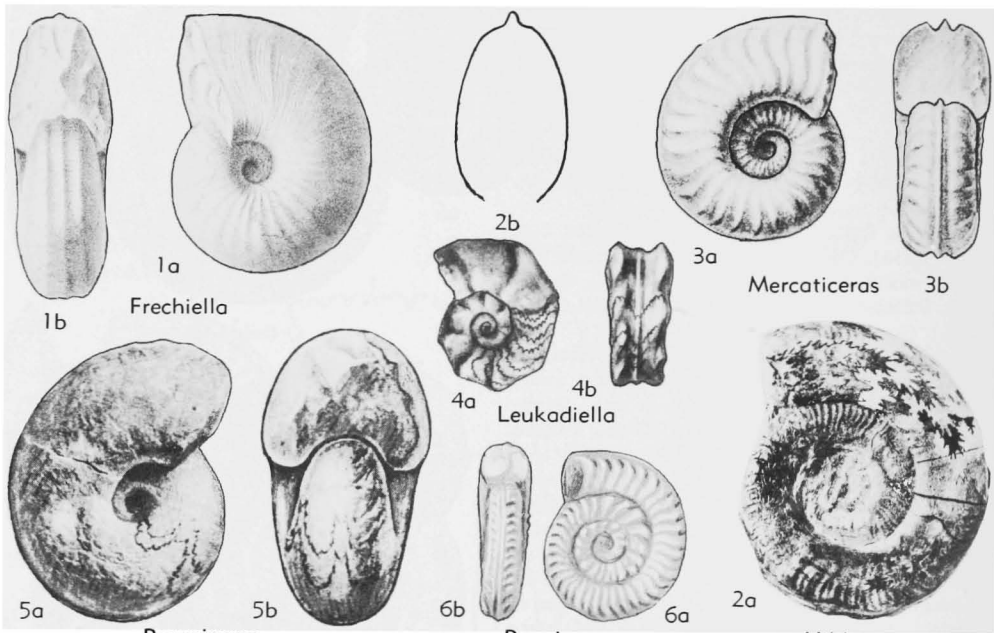


FIG. 292. Hildoceratidae (Hildoceratinae, Bouleiceratinae) (p. L259-L260).

mainly Tethys-Ind.O. but ranging to N. Eng.

Bouleiceras THEVENIN, 1906 [**B. nitescens*]. Nucleus smooth, then a tuberculate stage, followed by strong rursiradiate ribbing somewhat as in *Mercaticeras* but bifurcating from umbilical edge, and finally a flat-sided smooth stage; all stages with strong keel. Sutures ceratitic, with wide entire lateral saddle and long, smooth-sided 1st lateral lobe toothed at extremity. *L.Toarc.*, Port.-C. Arabia-Baluch.-Somali.-NE. Kenya-Madag.——FIG. 293,*1*. **B. nitescens* (THEV.), Madag.; *1a,b*, ×1 (504*).

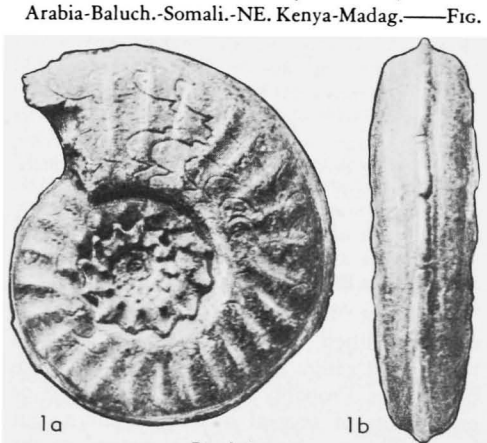


FIG. 293. *Bouleiceras nitescens* (THEVENIN), L.Jur. (Toarc.), Madag. (p. L260).

Paroniceras BONARELLI, 1893 [**Am. sternalis* VON BUCH, 1832] [=*Jacobella* JEANNET, 1908]. Sutures ceratitic as in *Bouleiceras*. External form variable, venter broadly rounded or sharp or even carinate, all species more involute than *Bouleiceras;* either ribbed or smooth. *L.Toarc.*, chiefly E.Medit. but ranging to Sp.-N.Afr.——FIG. 292,*5*. **P. sternale* (BUCH); *5a,b*, ×1 (687*).

Frechiella PRINZ, 1904 [**Am. subcarinatus* YOUNG & BIRD, 1822] [=*Achilleia* RENZ, 1913]. Form swollen, involute to moderately evolute, venter broad, tricarinate-bisulcate; shell smooth or with low distant primary ribs which fade halfway up sides or break into sheaves of obscure secondaries. Sutures hildoceratid but simplified, lobes tending to digitate detail, or in some becoming ceratitic, as in *Paroniceras*. *L.Toarc.*, Eu.——FIG. 292,*1*. **F. subcarinata* (YOUNG-B.), Eng.; *1a,b*, ×0.3 (737*).

Leukadiella RENZ, 1913 [**L. helenae*]. Evolute, with coarse distant simple ribs (8 per whorl in type), ending in heavy clavi, which overtop median keel sunk in concave venter. Sutures extremely degenerated. *L.Toarc.*, Greece-Alg.——FIG. 292,*4*. **L. helenae*, Greece; *4a,b*, ×1 (687*).

Subfamily GRAMMOCERATINAE Buckman, 1904

[Includes "Dumortieriae" and "Hudlestoniae" MAUBEUGE, 1950]

Last subfamily of Hildoceratidae, in which ribbing has almost lost its falcoid

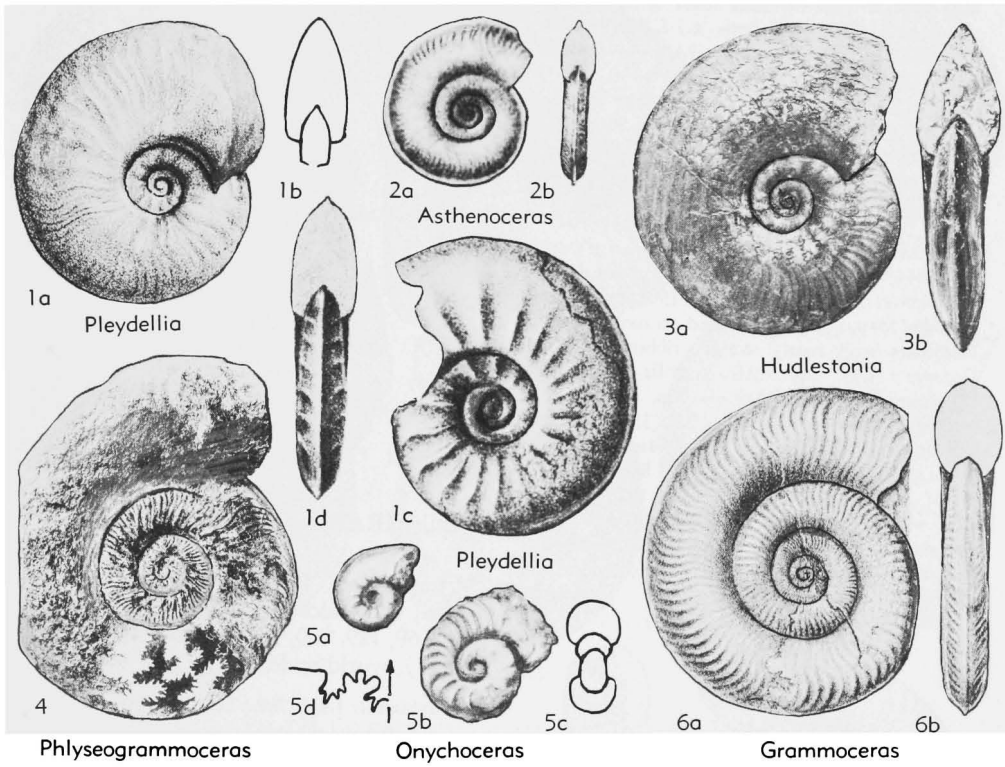


FIG. 294. Hildoceratidae (Grammoceratinae) (p. L261-L262).

style. Forms range from sharply ribbed planulates *(Dumortieria)* to smooth oxycones *(Hudlestonia)* (60, 433). *L.Jur.(U. Toarc.)-M.Jur.(L.Baj.),* world-wide.

Grammoceras HYATT, 1867 [**Am. striatulus* SOWERBY, 1823; SD BUCKMAN, 1890] [*Pseudogrammoceras* BUCK., 1901 (ICZN Opinion 324); *Costigrammoceras* BUCK., 1926; *?Pseudowalkericeras* MAUBEUGE, 1949]. Evolute; umbilical slope gentle; ribbing simple and gently sigmoid. *U.Toarc. (jurense z.),* Eu.-N.Afr.-Cauc.-N.Persia-Indon.-?Borneo-Spitz.-Can.——FIG. 294,6. **G. (G.) striatulum* (Sow.), Eng.; holotype, *6a,b,* ×0.7 (595*).

Asthenoceras BUCKMAN, 1899 [**Grammoceras nannodes* BUCK., 1890]. Dwarf *Grammoceras.* Subgen. of *Grammoceras. L.Baj.(murchisonae z.),* Eng. ——FIG. 294,2. **G. (A.) nannodes; 2a,b,* ×1 (595*).

Phlyseogrammoceras BUCKMAN, 1901 [**Am. dispansus* LYCETT, 1860 (ICZN Opinion 324)]. Umbilical margin sharp, tuberculate; ribbing fasciculate. *U. Toarc.(jurense z.),* Eu.——FIG. 294,4. **P. dispansum* (LYCETT), Eng.; ×0.3 (65*).

Pleydellia BUCKMAN, 1899 [**P. comata*] [*Cotteswoldia* BUCK., 1902 (=*Gotteswaldia* THEOBALD, 1950); *Canavaria* BUCK., 1902 (*non* GEMMELLARO, 1886) (=*Canavarina* BUCK., 1904); *Walkeria* BUCK., 1902 (*non* FLEMING, 1823) (=*Walkericeras* BUCK., 1904)]. Involute to evolute, moderately compressed, tending to oxycone form; umbilical margin abrupt or moderately rounded; rib-

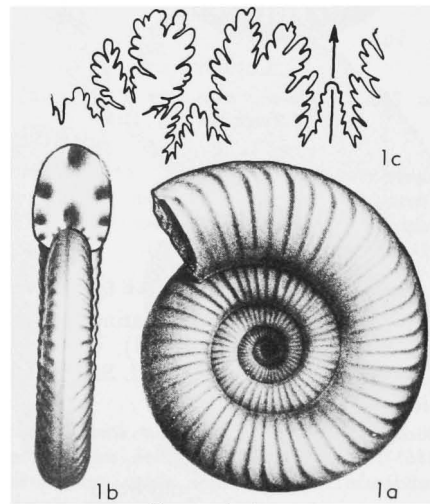


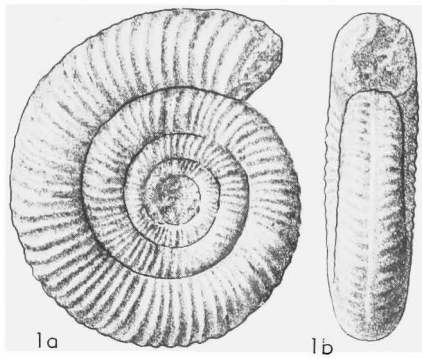
FIG. 295. *Dumortieria levesquei* (D'ORBIGNY), L.Jur. (U.Toarc.), Fr. (p. L262).

bing tends to fade on either inner or outer half of whorl side. *U.Toarc.(jurense z.)-L.Baj.(opalinum z.)*, Eu.-N.Afr.-Anatolia-Persia-?Arg.——FIG. 294, *1*. **P. comata*, Eng.; *1a-d*, ×1 (60*).

Hudlestonia BUCKMAN, 1890 [**Am. affinis* SEEBACH, 1864]. Large oxycones with degraded suture lines comparable with those of *Staufenia* and *Clydoniceras;* probably derived from *Phlyseogrammoceras. L.Baj.(opalinum z.)*, Eu.——FIG. 294,*3*. **H. affinis* (SEEBACH), Ger.; *3a,b*, ×0.3 (141*).

Dumortieria HAUG, 1885 [**Am. levesquei* D'ORBIGNY, 1844; SD BUCKMAN, 1890] [=*Phenakoceras* MAUBEUGE, 1949 (*non* FRECH, 1902) (=*Phenakocerites* MAUBEUGE, 1950, based on monstrosity)]. Planulates with nearly straight ribbing. *U.Toarc.(jurense z.)*, Eu.-N.Afr.-Anatolia-Cauc.-Persia-Indochina-Borneo-Can.-Arg.——FIG. 295,*1*. **D. levesquei* (ORB.), Fr.; *1a-c*, ×0.5 (330*).

Catulloceras GEMMELLARO, 1886 [**Am. dumortieri* THIOLLIÈRE in DUMORTIER, 1874; SD BUCKMAN, 1892] [=*Dactylogammites* BUCK., 1925]. Planulates with subquadrate whorl section and strong straight ribbing, tending to resemble *Tmetoceras* but still possessing a keel. *U.Toarc.(jurense z.)*, Eu.-N.Afr.——FIG. 296,*1*. **C. dumortieri* (THIOLL.), Fr.; *1a,b*, ×0.75 (614*).



Catulloceras

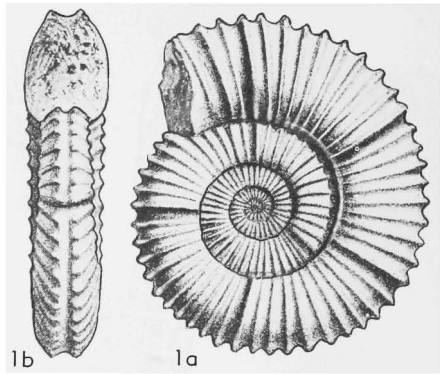
FIG. 296. *Catulloceras dumortieri* (THIOLLIER), L. Jur.(U.Toarc.), Fr. (p. L262).

Onychoceras WUNSTORF, 1907 [**O. differens*]. Dwarf *Cymbites*-like form from the *dispansum* subz. *U.Toarc.(jurense z.)*, Ger.——FIG. 294,*5*. **O. differens; 5a-d*, ×1 (738*).

Subfamily TMETOCERATINAE Spath, 1936

Derivatives of Grammoceratinae, especially *Dumortieria* (HAUG, 1888), which have lost keel (406, 477). *M.Jur.(L.Baj.)*, world-wide.

Tmetoceras BUCKMAN, 1892 [**Am. scissus* BENECKE, 1865]. Planulate, whorl section subquadrate to subcircular; ribbing simple, sharp, wiry, straight, interrupted on venter by deep median groove. *L. Baj.*, Eu.-N.Afr.-Japan-?Alaska-Can.-Ore.-Arg.——



Tmetoceras

FIG. 297. *Tmetoceras scissum* (BENECKE), M.Jur. (L.Baj.), Alps; *1a,b*, ×0.7 (587*) (p. L262).

FIG. 297,*1*. **T. scissum* (BEN.), Alps; *1a,b*, ×0.7 (587*).

Family GRAPHOCERATIDAE Buckman, 1905

Compressed, mainly rather involute, keeled, with falcate, falcoid, or sigmoid ribbing (60, 129, 190, 433, 477). *M.Jur.(L.Baj.-M.Baj.)*, world-wide.

Subfamily LEIOCERATINAE Spath, 1936

[Includes "Staufeniae" MAUBEUGE, 1950]

Very involute, keel less distinct than in Graphoceratinae (141, 190, 433, 477). *M. Jur.(L.Baj.)*.

Leioceras HYATT, 1867 [**Nautilus opalinus* REINECKE, 1818; SD BUCKMAN, 1887] [*Lioceras* BAYLE, 1878 (obj.); *Cypholioceras, ?Ancolioceras* BUCK., 1899]. Smooth or finely ribbed, with lappets. *L. Baj.*, Eu.-N.Afr.-Anatolia-Cauc.-Persia-Transbaikal. ——FIG. 298,*4*. **L. opalinum* (REIN.); ×1 (358*).

Costileioceras MAUBEUGE, 1950 [**Ludwigia sinon* BAYLE, 1878]. Somewhat more coarsely ribbed than *Leioceras*, but becoming smooth; sutures specialized, degenerated. *L.Baj.*, Eu.——FIG. 298,*6*. **C. sinon* (BAYLE), Fr.; ×0.5 (586*).

Cyclicoceras BUCKMAN, 1899 [**C. undatum*]. Thick, oval whorl section and coarse biplicate ribbing. *L.Baj.(opalinum z.)*, Eng.——FIG. 298,*2*. **C. undatum; 2a,b*, ×0.7 (595*).

Canavarella BUCKMAN, 1904 [**C. belophora*]. Resembles *Cyclicoceras* but more compressed, dwarfed. ?Subgen. of *Cyclicoceras. L.Baj.(scissum z.)*, Eng.——FIG. 298,*3*. **C.? (C.) belophorum; 3a,b*, ×0.7 (595*).

Staufenia POMPECKJ, 1906 [**Am. staufensis* OPPEL, 1856]. Inner whorls well ribbed, outer smooth. Sutures strongly modified, like those of *Hudlestonia* and *Clydoniceras. L.Baj., Eu.*——FIG. 298,*5*. **S. staufensis* (OPPEL), Ger.; ×0.5 (190*).

?Vacekia BUCKMAN, 1899 *(nom. dub.)* [**V.*

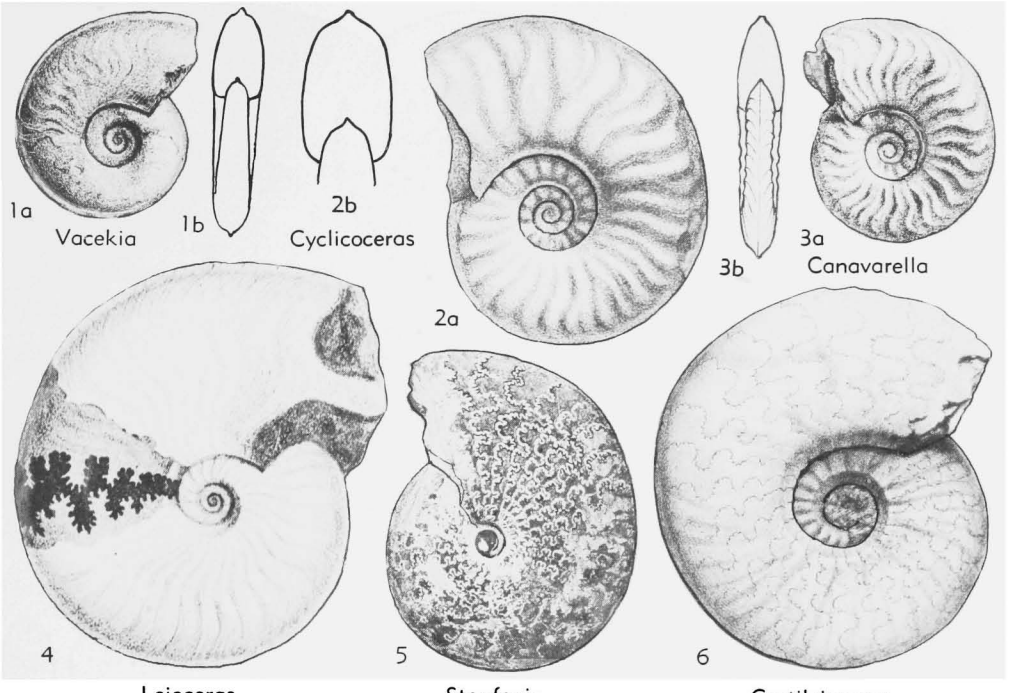


FIG. 298. Graphceratidae (Leioceratinae) (p. L262-L263).

stephensi]. Growth lines strongly projected on venter. *L.Baj.(murchisonae z.)*, Eng.——FIG. 298, *1*. **V. stephensi; 1a,b*, ×1 (595*).

Subfamily GRAPHOCERATINAE Buckman, 1905

[Includes Hyatteinae, Darelleinae, Lucyinae BUCK., 1905; Ludwigellidae SPATH, 1925; Ludwiginae GÉRARD & BICHELONNE, 1940]

Planulates to oxycones, of harpoceratid appearance, more or less strongly keeled; venter varies from square-shouldered to acute; ribbing strong throughout or fading on body chamber or earlier, epecially in later genera of *sowerbyi* z. (60, 190, 477). *M.Jur.(L.Baj.-M.Baj.)*, world-wide.

Ludwigia BAYLE, 1878 [**Am. murchisonae* J.DEC. SOWERBY, 1827; SD H.DOUVILLÉ, 1879] [*Murchisonia* ENGEL, 1896 (obj.) (*non* DE VERNEUIL, 1841); includes *Ludwigina, Cosmogyria, Welschia, Kiliania, Hyattia, Hyattina, Strophogyria, Crickia, Rhaeboceras* (*non* MEEK, 1876) BUCKMAN, 1899]. Stout-whorled and predominantly evolute, with broad, strongly keeled venter; ribbing strong but fades on body chamber. *L.Baj.*, Eu.-N.Afr.-Cauc.-Persia-Sib.-Bureya Basin-?S.Am.——FIG. 299,*1*. **L. murchisonae* (Sow.), Scot.; *1a,b*, holotype, ×0.3 (595*).

Brasilia BUCKMAN, 1898 [**Lioceras bradfordense* BUCK., 1887] [*Brasilina, Wiltshireia, Apedogyria, Paquieria, Manselia* BUCK., 1899; *Paineia* BUCK., 1904; *Planifastigites* BUCK., 1925]. More compressed, more involute, more finely ribbed than *Ludwigia*. *L.Baj.(murchisonae z.)*, Eu.-N.Afr.-Persia.——FIG. 300,*7*. **B. bradfordensis* (BUCK.), Eng.; *7a,b*, ×0.3 (595*).

Pseudographoceras BUCKMAN, 1899 [**P. literatum*].

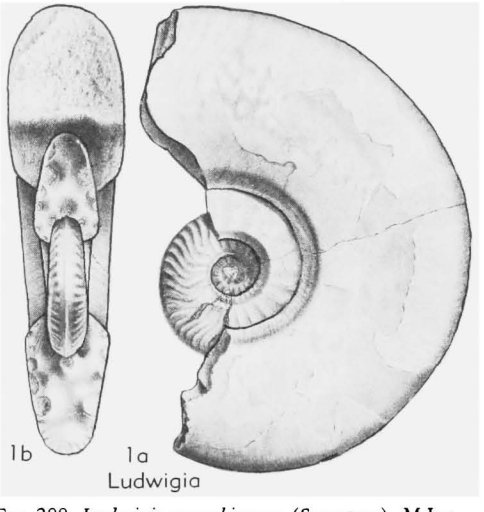


FIG. 299. *Ludwigia murchisonae* (SOWERBY), M.Jur. (L.Baj.), Scot.; *1a,b*, ×0.3 (595*) (p. L263).

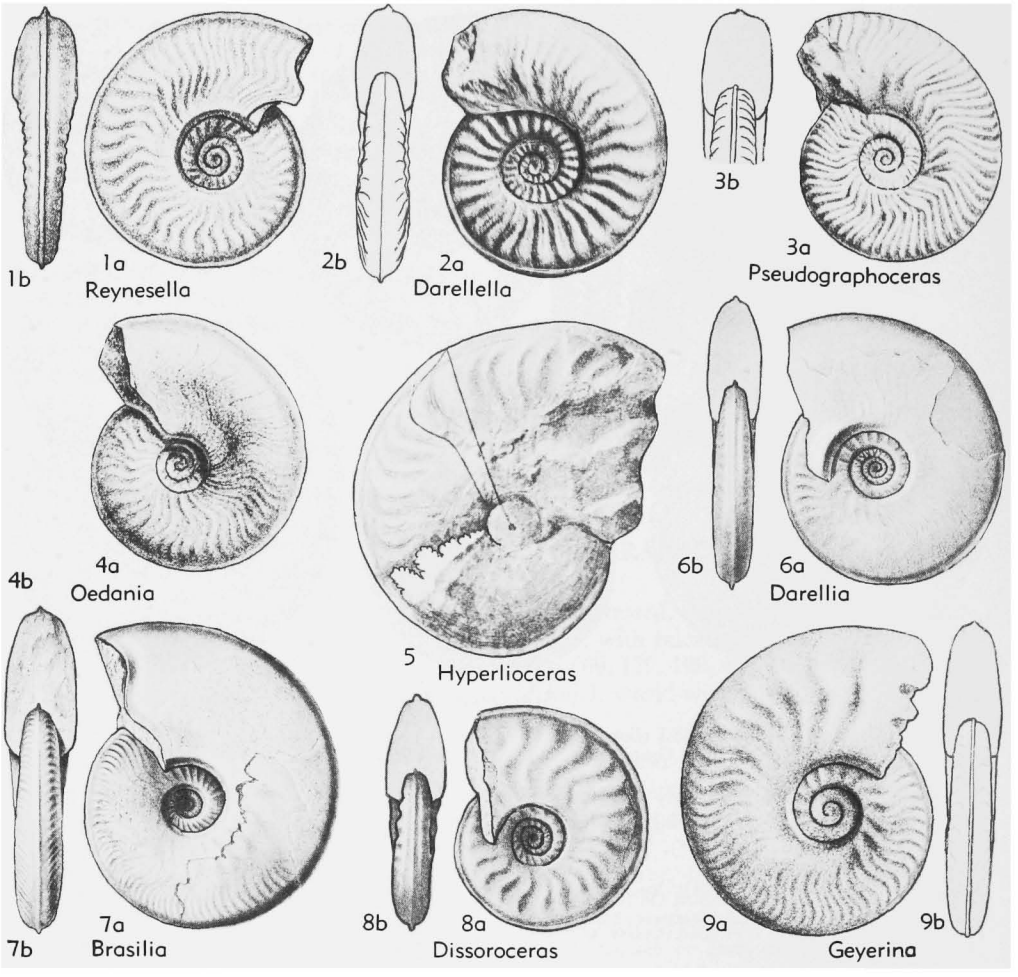


FIG. 300. Graphoceratidae (Graphoceratinae) (p. L263-L265).

Combines form of *Ludwigia* with sharply rursiradiate secondary ribbing of *Graphoceras*. *L.Baj.(murchisonae z.)*, Eng.——FIG. 300,*3*. **P. literatum*; *3a,b*, ×0.7 (595*)

Graphoceras BUCKMAN, 1898 [**Lioceras concavum* var. *v.-scriptum* BUCK., 1888] [*Ludwigella* BUCK., 1901; *Braunsina, Depaoceras, Lucya, Platygraphoceras* BUCK., 1902]. Involute, compressed, with raised umbilical edge; secondary ribbing strongly rursiradiate. *L.Baj.-M.Baj.(discites subz.)*, Eu.-N. Afr.-Persia.——FIG. 301,*1a,b*. **G. v-scriptum* (BUCK.), *concavum* z., Eng.; ×0.35 (595*).——FIG. 301,*1c,d*. *G. concavum* (SOW.) (type of *Ludwigella*); ×0.7 (595*).

Geyerina BUCKMAN, 1913 [**Geyeria fasciata* BUCK., 1899] [=*Geyeria* BUCK., 1899 (obj.) (*non* BUCHECKER, 1880)]. Transitional from Leioceratinae. *L.Baj.(murchisonae z.)*, Eng.——FIG. 300,*9*. **G. fasciata* (BUCK.); *9a,b*, ×0.7 (595*).

Darellia BUCKMAN, 1898 [**D. semicostata*] [*Reynesia, Braunsia* (*non* KRIECHBAUMER, 1894) BUCK., 1902; *Darellina, Braunsella, Hugia* BUCK., 1904]. Medium-sized, body chamber smooth. *M.Baj. (sowerbyi z.)*, Eng.——FIG. 300,*6*. **D. semicostata*; *6a,b*, ×0.5 (595*).

Reynesella BUCKMAN, 1902 [**R. piodes*]. Dwarf, body chamber ribbed and with lappets. *M.Baj. (sowerbyi z.)*, Eu.-N.Afr.——FIG. 300,*1*. **R. piodes*, Eng.; *1a,b*, ×1 (595*).

Darellella BUCKMAN, 1904 [**D. recticostata*]. Dwarf, with lappets and nearly straight ribs. *M.Baj. (sowerbyi z.)*, Eng.——FIG. 300,*2*. **D. recticostata*; *2a,b*, ×1 (595*).

Hyperlioceras BUCKMAN, 1889 [**Am. discites* WAAGEN, 1867] [*Toxolioceras, Deltoidoceras, Deltoceras* (*non* HYATT, 1894) BUCK., 1902; *Deltotoceras, Lopadoceras, Stokeia* BUCK., 1904]. Very compressed and involute, with tall persistent keel

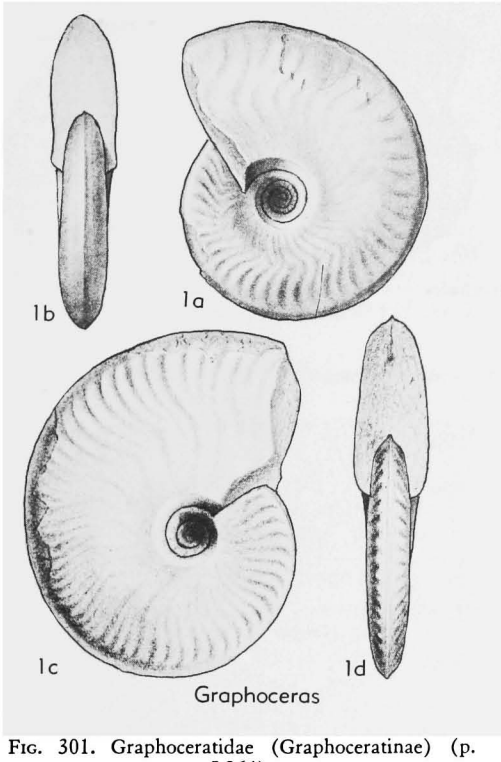


FIG. 301. Graphoceratidae (Graphoceratinae) (p. L264).

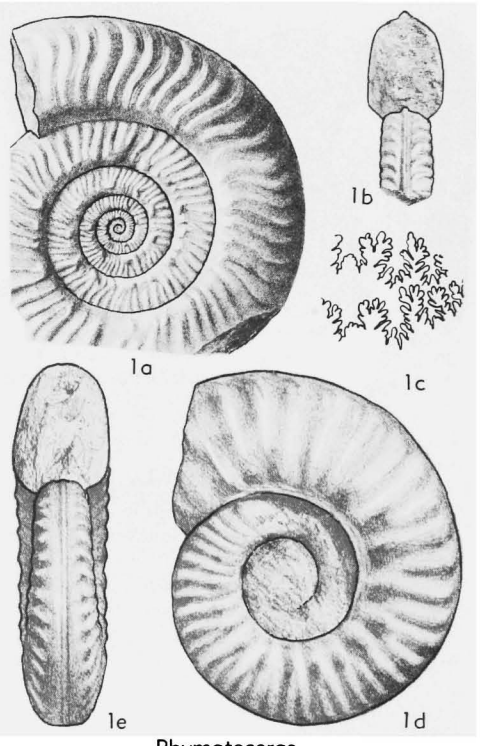


FIG. 302. Hammatoceratidae (Phymatoceratinae) (p. 265).

and flat sides, on which ribbing fades early. *M. Baj.(sowerbyi z.)*, Eu.-N.Afr.——FIG. 300,*5*. **H. discites* (WAAGEN), Ger.; ×0.7 (595*).

Dissoroceras BUCKMAN, 1902 [**D. tabulatum*]. Ribbing coarse and reminiscent of *Ludwigia*, but confined to middle of whorl sides and fading early. *M.Baj.(sowerbyi z.)*, Eng.——FIG. 300,*8*. **D. tabulatum; 8a,b*, ×0.5 (595*).

Oedania BUCKMAN, 1904 [**O. falcigera*]. Body chamber inflated and tending to lose keel. *M.Baj. (sowerbyi z.)*, Eng.——FIG. 300,*4*. **O. falcigera; 4ab*, ×1 (595*).

Family HAMMATOCERATIDAE Buckman, 1887

Planulate to involute, keeled, usually strongly ribbed, with long secondaries, and many with lateral tubercles (60, 129, 288, 357). *L. Jur.(U. Toarc.) - M.Jur. (M. Baj.)*, world-wide.

Subfamily PHYMATOCERATINAE Hyatt, 1900

[*nom. correct.* SPATH, 1936 (*pro* Phymatoidae HYATT, 1900), validation proposed ARKELL, 1955 (ICZN pend.)] [=Haugiinae BUCKMAN, 1905]

Probably derivatives of various Hildoceratidae, from which some are transitional (201, 288). *L.Jur.(U.Toarc.)*.

Phymatoceras HYATT, 1867 [**P. robustum* HYATT, (young of *Am. tirolensis* DUMORTIER, 1874, *non* HAUER)] [*Lillia* BAYLE, 1878 (*non* BOIE, 1844), =*Loryella* BREISTROFFER, 1947; *Chartronia, Denckmannia* BUCKMAN, 1898]. Evolute planulates with flat to carinate-bisulcate venter and more or less sigmoid ribs, many twinned or triploid from tubercles on umbilical edge. *U.Toarc.*, Eu.-N.Afr.-Anatolia - Japan. - S.Alaska-Chile.——FIG. 302,*1a-c*. **P. robustum* HYATT, Fr.; ×0.3 (614).——FIG.

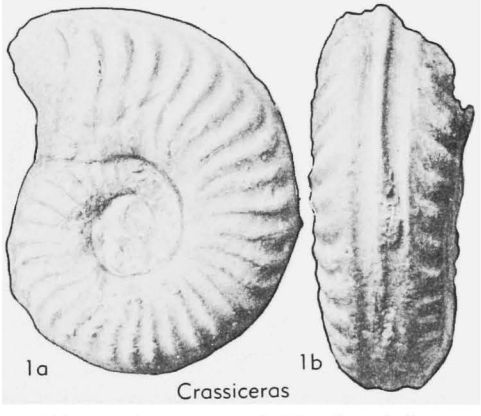


FIG. 303. *Pseudomercaticeras? (Crassiceras) latum* (MERLA), L.Jur.(U.Toarc.), Italy (p. L266).

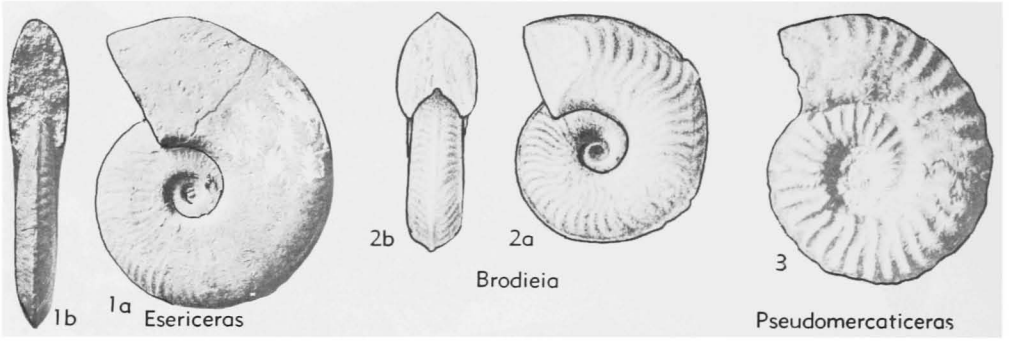


FIG. 304. Hammatoceratidae (Phymatoceratinae) (p. L266).

302,*1d,e*. *P. binodata* (BUCK.) (type of *Chartronia*); ×0.7 (595*).

Pseudomercaticeras MERLA, 1933 [**P. parvilobum*; SD ARKELL, herein]. Evolute, whorl section subquadrate, venter tricarinate-bisulcate; no tubercles; ribs fade on inner half of outer whorls. *U.Toarc.*, Italy.——FIG. 304,*3*. **P. parvilobum*; ×1 (288*).

Crassiceras MERLA, 1933 [**C. latum*; SD ARKELL, herein]. Like *Pseudomercaticeras* but with thicker whorls, and robust ribs which do not fade. ?Subgen. of *Pseudomercaticeras*. *U.Toarc.*, Italy.——FIG. 303,*1*. **P.? (C.) latum* (MERLA); *1a,b*, ×1 (288*).

Brodieia BUCKMAN, 1898 [**B. curva*] [=*Brodiceras* BUCK., 1899 (obj.)] [?*Pseudolillia* MAUBEUGE, 1949]. Involute, not tuberculate, otherwise resembling *Phymatoceras* and *Pseudomercaticeras*. *U. Toarc.*, Eu.-Chile.——FIG. 304,*2*. **B. curva*, Eng.; *2a,b*, ×1 (595*).

Pelecoceras HYATT, 1867 [**P. attenuatum*]. Evolute, compressed, discoidal with single tall keel and irregular ribbing which fades on last half-whorl; some ribs flared; some tubercles of irregular size. *U.Toarc.*, Eu. (No figure.)

Haugia BUCKMAN, 1888 [**Am. variabilis* D'ORBIGNY, 1845]. Compressed, discoidal, with single tall and massive keel; ribbing strong, regular, twinned or triploid from regular row of tubercles, fading on last half whorl. *U.Toarc.*, Eu.-N.Afr.-Japan-Can.-Chile.——FIG. 305,*1*. **H. variabilis* (ORB.), Fr.; *1a,b*, ×0.25 (330*).

Esericeras BUCKMAN, 1920 [**Haugia inaequa* BUCK., 1898]. Like *Haugia* but more involute, ribbing feebler, umbilical edge unribbed and untuberculated. *U.Toarc.*, Eu.-Indon.——FIG. 304,*1*. **E. inaequum* (BUCK.), Eng.; *1a,b*, ×0.25 (595*).

?Nejdia ARKELL, 1952 [**N. bramkampi*]. Involute, smooth; whorl section lanceolate, with steep or undercut umbilical wall but rounded umbilical edge; sutures subceratitic, highly variable. *Toarc.*, C.Arabia-Madag.——FIG. 306,*1*. **N. bramkampi*, C.Arabia; *1a,b*, ×0.7 (583*).

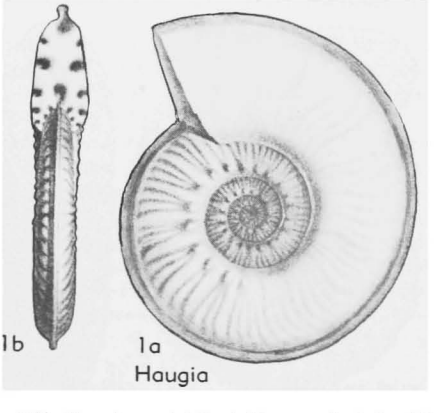


FIG. 305. *Haugia variabilis* (D'ORBIGNY), L.Jur.(U. Toarc.), Fr. (p. L266).

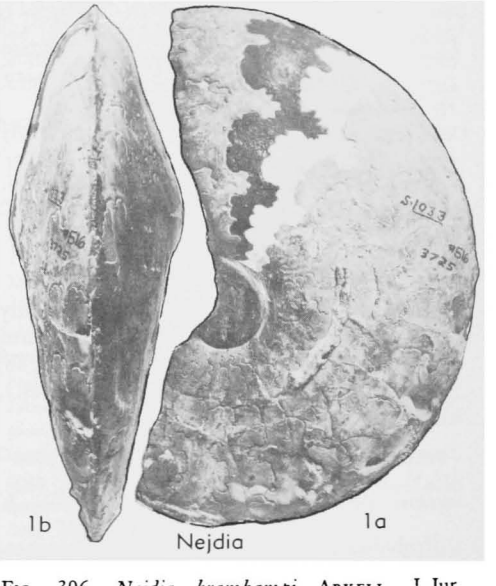


FIG. 306. *Nejdia bramkampi* ARKELL, L.Jur. (Toarc.), C.Arabia; *1a,b*, ×0.7 (583*) (p. L266).

Subfamily HAMMATOCERATINAE Buckman, 1887

[Includes Erycitidae Spath, 1928]

Descendants of Phymatoceratinae, differing from them chiefly in ribbing, which branches higher up on whorl sides and is differentiated into primaries and secondaries; and in sutures, which tend to be more elaborated, with umbilical lobe retracted and bearing well-developed auxiliaries (60, 129, 288, 357). *L.Jur.(U.Toarc.)-M.Jur.(M.Baj.)*, world-wide except boreal.

Hammatoceras Hyatt, 1867 [**Am. insignis* Zieten, 1831; SD Buckman, 1887] [=*Ammatoceras* Hyatt, 1867 (obj.); *Pachammatoceras* Buck., 1921]. Coiling moderately involute or evolute, whorl section subtriangular, primary ribs short, secondary ribs long, branching from near umbilical margin, usually from a tubercle; outer whorl becoming smooth. *U.Toarc.(jurense z.)*, Eu.-N. Afr.-Bureya Basin-Indon.-Can.-S.Am.——Fig. 307, *1a,b. H. pachu* (Buck.) (type of *Pachammatoceras*); ×0.25 (595*).——Fig. 307,*1c-e.* **H. insigne* (Zieten), Ger.; ×0.7 (742*).

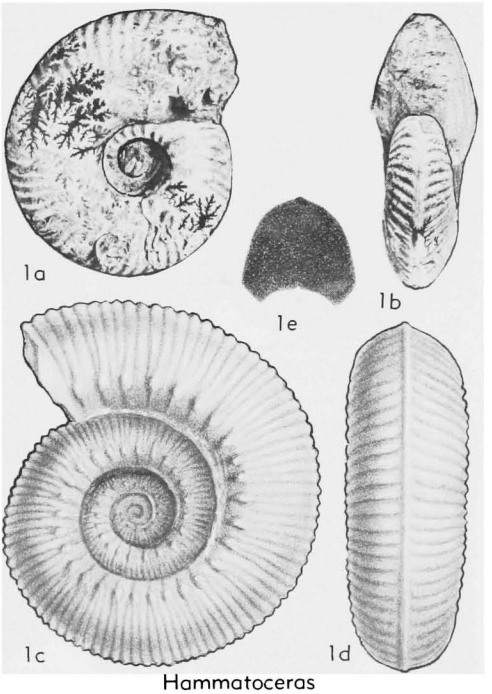
Planammatoceras Buckman, 1922 [**P. planiforme*] [*Parammatoceras* Buck., 1925]. Ribbing with distinct lengthened primaries, some flared on inner whorls, but no tubercles; ribbing fades toward aperture, which is sigmoid. *L.Baj.(murchisonae z.)*, Eu.-Tangan.-?Persia-Japan-S.Am.——Fig. 308, *2a. *P. planiforme*, Eng.; ×0.3 (595*).——Fig. 308,*2b. P. obtectum* (Buck.) (type of *Parammatoceras*); ×0.3 (595*).

Eudmetoceras Buckman, 1920 [**E. eudmetum*] [*Euaptetoceras* Buck., 1922]. Inner whorls with long primary ribs, outer whorls becoming smooth; involute coiling in some species goes as usual with a nonretracted umbilical lobe. *M.Baj.(sowerbyi z.)*, Eu.-Persia-Arg.——Fig. 308,*1a,b.* **E. eudmetum*, Eng.; ×0.4 (595*).——Fig. 308,*1c. E. euapeptum* (Buck.) (type of *Euaptetoceras*); ×0.3 (595*).

Bredyia Buckman, 1910 [*pro Burtonia* Buck., 1910 (*non* Bonaparte, 1850)] [**Burtonia crassornata*]. Massive forms; ribbing very coarse on inner whorls, fading on outer whorl; sutures with well-retracted umbilical lobe. *L.Baj.(opalinum z.)*, Eu.——Fig. 308,*4.* **B. crassornata* (Buck.), Eng.; *4a,b*, ×0.2 (66*).

Erycites Gemmellaro, 1886 [**E. fallifax* Arkell (*pro Am. fallax* Benecke, 1865, *non* Guéranger, 1865); SD Loczy, 1915]. Keel almost or quite lost; transitional to Stephanoceratacea. *L.Baj.*, Eu.-N.Afr.-Anatolia-Cauc.-N.Alaska-Arg.——Fig. 308, *3. **E. (E.) fallifax* Arkell, Italy; *3a,b*, holotype, ×0.7 (587*).

Abbasites Buckman, 1921 [**A. abbas*] [*Ambersites* Buck., 1921]. Small, tumid; keel lost but its place still marked by interruption and alternation of ribbing. Subgen. of *Erycites*. *L.Baj.(murchisonae z.)*, Eu.——Fig. 309,*1.* **E. (A.) abbas* (Buck.), Eng.; *1a,b*, ×1 (65*).



Hammatoceras

Fig. 307. Hammatoceratidae (Hammatoceratinae) (p. L267).

Family SONNINIIDAE Buckman, 1892

[Includes Poecilomorphidae and Zurcherinae Hyatt, 1900]

A great variety of forms, ranging from stout planulates to oxycones, mostly well ribbed, many tuberculate or spinous, nearly all with hollow keel, which tends to die out in later whorls or body chamber. Sutures simple to complex, umbilical lobe short, never much retracted. Aptychus shiny with coarse folds (Cornaptychus) (20, 60, 64, 129, 188). *M.Jur.(Baj.-L.Bath.)*, mainly *M. Baj.*, world-wide except boreal.

Sonninia Bayle, 1879 [*pro Waagenia* Bayle, 1878 (*non* Kriechbaumer, 1874)] [**Waagenia propinquans* Bayle, 1878] [*Stiphromorphites, Sherbornites* Buckman, 1923; *Sonnites* Buck., 1925]. Single-keeled planulates with strong irregular ribbing bearing median row of lateral tubercles at least on early to middle whorls; body chamber becoming more or less smooth. *L.Baj.(concavum z.*, rare)-*M.Baj.(sowerbyi z.-sauzei z.)*, Eu.-N.Afr.-Madag.-Cauc.-Azerbaijan-Persia-Tibet-W. Austral.-S.Alaska-Can.-Ore.-Calif.-S.Am.——Fig. 310,*1.* **S. (S.) propinquans* (Bayle), Fr.; *1a,b*, ×1 (586*).

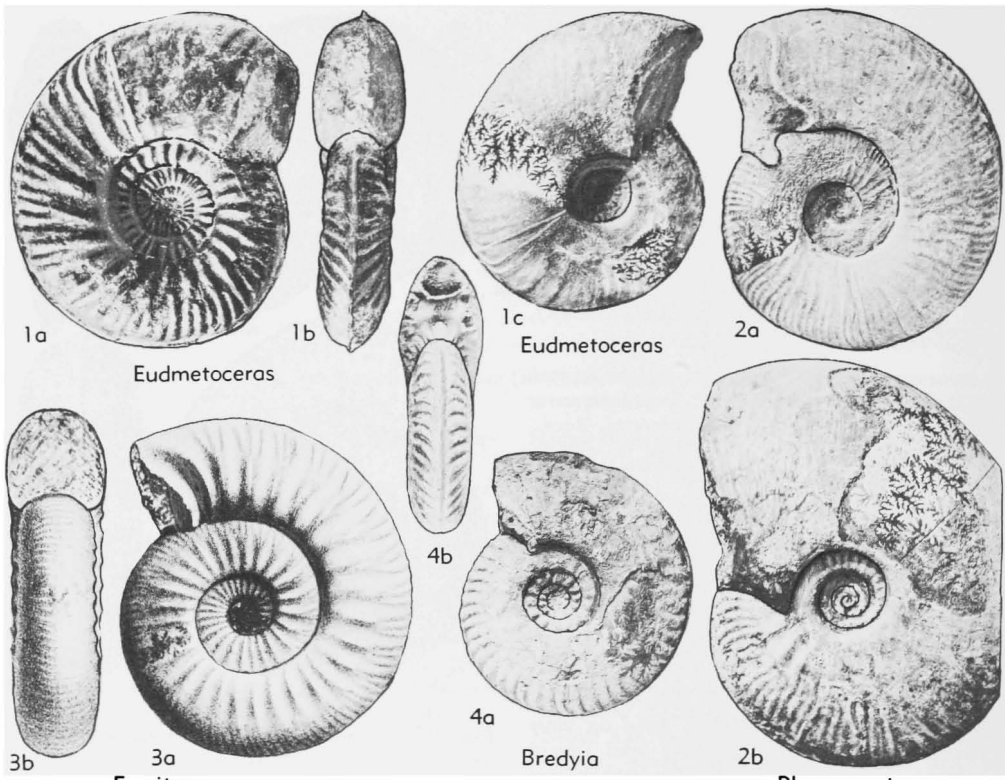


FIG. 308. Hammatoceratidae (Hammatoceratinae) (p. L267).

Papilliceras BUCKMAN, 1920 [**P. papillatum*] [=*Prepapillites* BUCK., 1927]. With row of median lateral tubercles persisting over all septate whorls and in some also on body chamber; may be strigate. Subgen. of *Sonninia. M.Baj.*, Eu.-Ore.——FIG. 311, *5*. **S. (P.) papillata* (BUCK.), Eng.; ×0.2 (595*).

Euhoploceras BUCKMAN, 1913 [**Sonninia acanthodes* BUCK., 1889]. Similar to *Sonninia* but tubercles die out earlier and rursiradiate ribbing and tall keel persist over body chamber. Subgen. of *Sonninia. L.Baj.(concavum z.)-M.Baj.*, Eu.-Ore.——FIG. 311,*11*. **S. (E.) acanthodes*, Eng.; ×0.25 (595*).

Shirbuirnia BUCKMAN, 1910 [**S. trigonalis* BUCK.; SD ARKELL, 1954]. Large, smooth, more or less involute; nucleus as in *Sonninia;* venter becomes

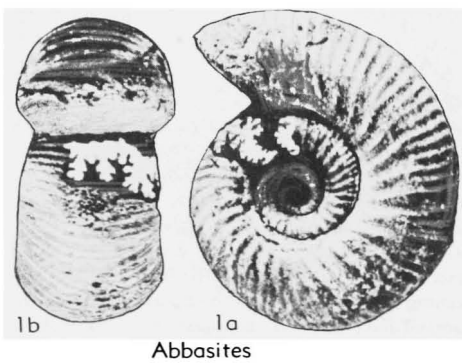


FIG. 309. *Erycites (Abbasites) abbas* (BUCKMAN), M.Jur.(L.Baj.), Eng. (p. L267).

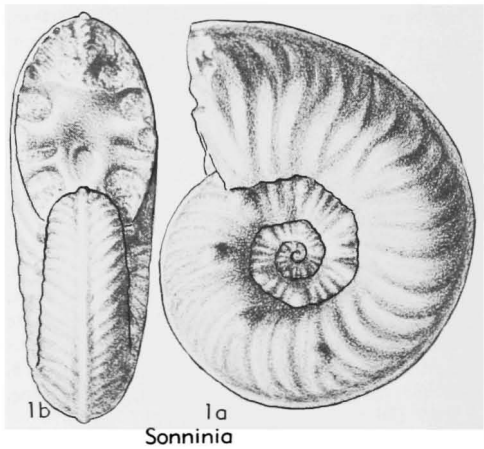


FIG. 310. *Sonninia (Sonninia) propinquans* (BAYLE), M.Jur.(M.Baj.), Fr. (p. L267).

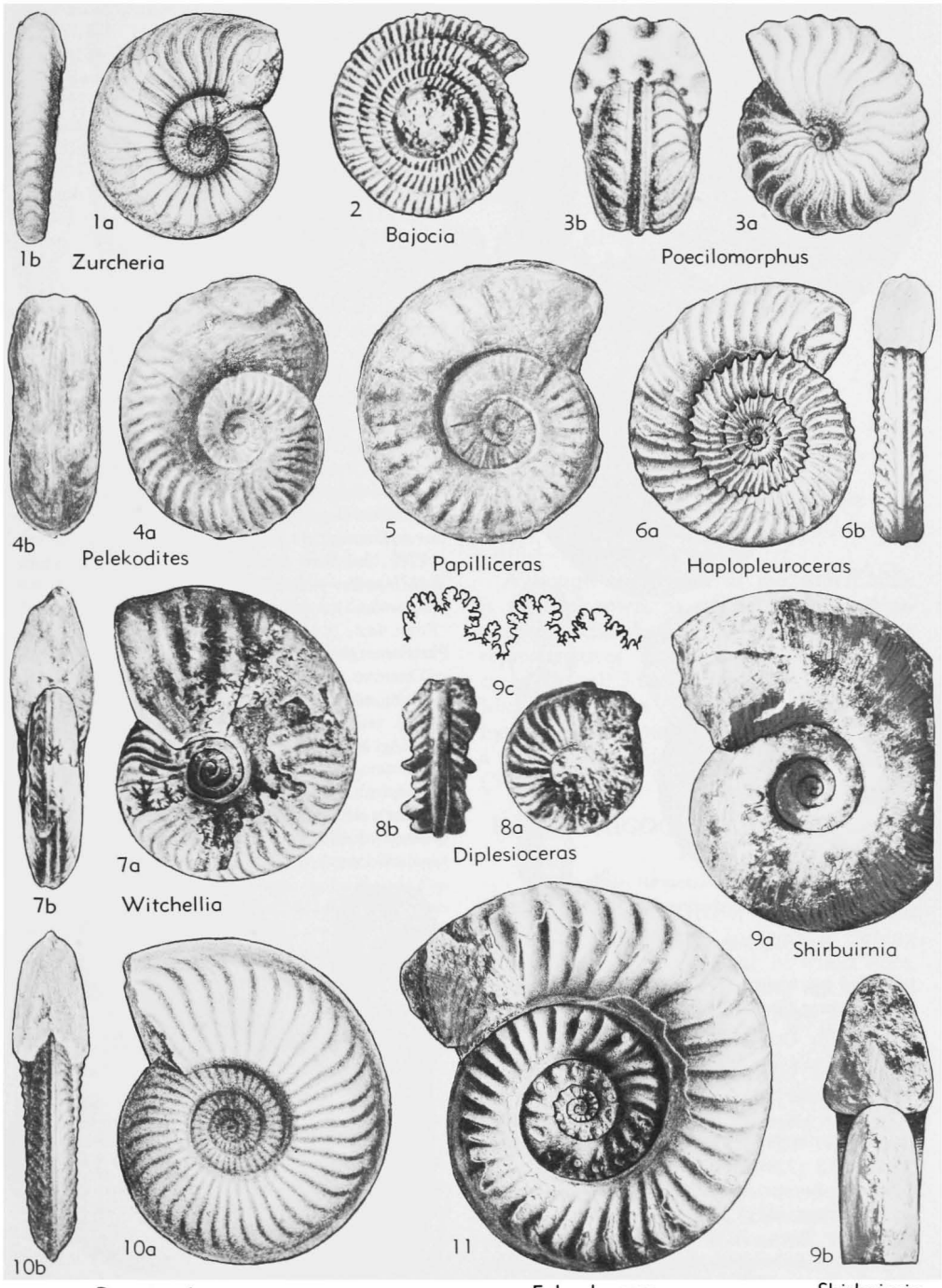


FIG. 311. Sonniniidae (p. L268-L270).

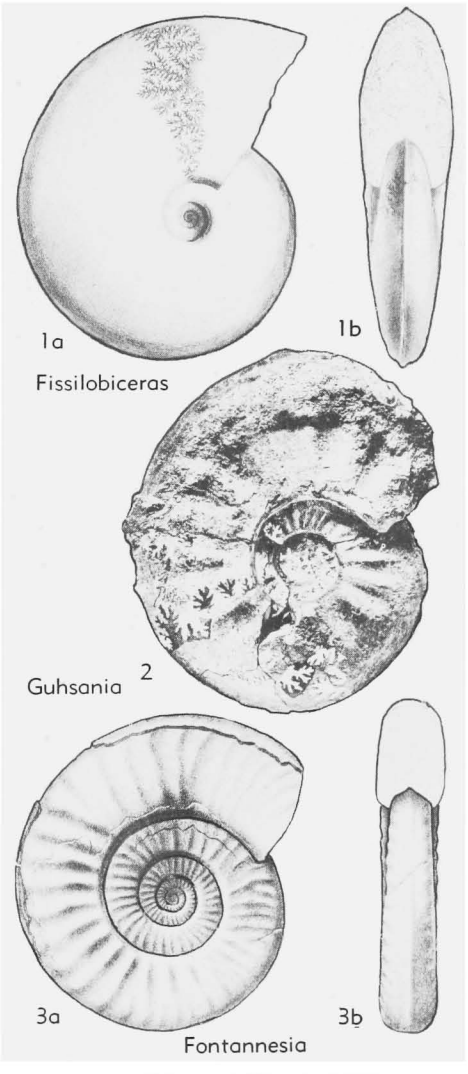


FIG. 312. Sonniniidae (p. L270).

rounded on body chamber with degeneration of keel. Sutures simple. *M.Baj.(sowerbyi z.)*, Eu.—FIG. 311,9. **S. trigonalis*, Eng.; *9a,b*, ×0.15; *9c*, ×0.3 (595*).

Fissilobiceras BUCKMAN, 1919 [**Am. fissilobatus* WAAGEN, 1867]. Similar to *Shirbuirnia* but sutures complex. ?Subgen of *Shirbuirnia*. *M.Baj.*, Eu.—FIG. 312,*1*. **S.? (F.) fissilobata* (WAAGEN), Ger.; *1a,b*, ×0.2 (729*).

Witchellia BUCKMAN, 1889 [**Am. laeviusculus* J. DEC.SOWERBY, 1824] [=*Zugophorites* BUCK., 1922; *Sonninites* BUCK., 1923; *Gelasinites* BUCK., 1925; *Dundryites, Rubrileiites, Anolkoleiites* BUCK., 1926; *Zugella* BUCK., 1927]. Inclined to be involute and compressed, whorls heightening and smoothing early, long before septation ceases; venter narrow, tabulate and carinate, commonly bisulcate, even tricarinate, or becoming fastigate; nucleus as in *Sonninia*. *M.Baj.*, Eu.-N.Afr.-Cauc.-Persia-Tibet-W.Austral.-Can.-Ore.-S.Am.—FIG. 311,*7*. **W. laeviuscula* (Sow.), Eng.; *7a,b*, ×0.7 (65*).

Dorsetensia BUCKMAN, 1892 [**Am. edouardianus* D'ORBIGNY, 1846] [*Hyalinites* BUCK., 1924]. Nucleus ribbed or smooth, outer whorls smooth, compressed, with narrow sharp-keeled venter; umbilical edge sharp, sometimes undercut. *M.Baj.*, Eu.-N. Afr.-Kenya-Madag.-C. Arabia - Pamirs - Tibet.—FIG. 311,*10*. **D. edouardiana* (ORB.), Fr.; *10a,b*, ×1 (330*).

Guhsania MCLEARN, 1926 [**G. bella*]. Outer whorl oxycone, ribbed to end; umbilical edge sharp. *M. Baj.*, Can.—FIG. 312,*2*. **G. bella*; ×0.3 (657*).

Fontannesia BUCKMAN, 1902 [**Dumortieria grammoceroides* HAUG, 1887] [=*?Nannina* BUCK., 1927]. Small to medium-sized planulates with tabulate to fastigate unicarinate venter, wide blunt keel, gradual and smooth umbilical slope; ribbing falcoid, no tubercles. *M.Baj.(sowerbyi z.)*, Eu.-W. Austral.-Can.-Arg.—FIG. 312,*3*. **F. grammoceroides* (HAUG), Eng.; *3a,b*, ×0.3 (595*).

Pelekodites BUCKMAN, 1923 [**P. pelekus*] [*Nannoceras* BUCK., 1923; *Maceratites, Spatulites* BUCK., 1928]. Small to dwarf, evolute, with large spatulate lappets; ribbing rursiradiate in many. *M.Baj. (sowerbyi z.)*, Eu.—FIG. 311,*4*. **P. pelekus*, Eng.; *4a,b*, ×1 (595*).

Poecilomorphus BUCKMAN, 1889 [**Am. cycloides* D'ORBIGNY, 1846; SD BUCK., 1927]. Small to dwarf, stouter and more involute than *Pelekodites*, with tabulate carinate-bisulcate venter, falcate ribbing and small lappets. *M.Baj.(sauzei z.-humphriesianum z.)*, Eu.-N.Afr.—FIG. 311,*3*. **P. cycloides* (ORB.), Fr.; *3a,b*, ×1 (330*).

Zurcheria H.DOUVILLÉ, 1885 [**Z. ubaldi*]. Dwarf, without keel; ribs are simple plications, strongly projected on venter, which is rounded; some with

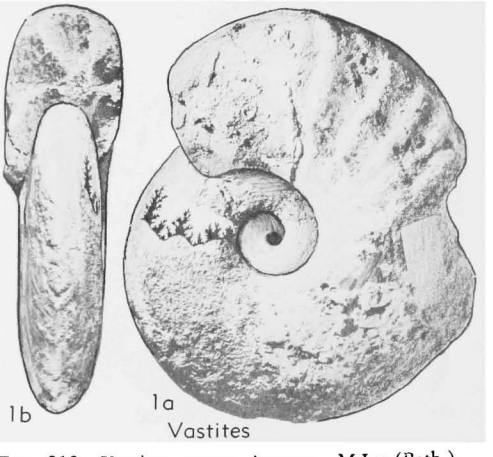


FIG. 313. *Vastites vastus* ARKELL, M.Jur.(Bath.), Eng.; *1a,b*, ×0.2 (14*) (p. L271).

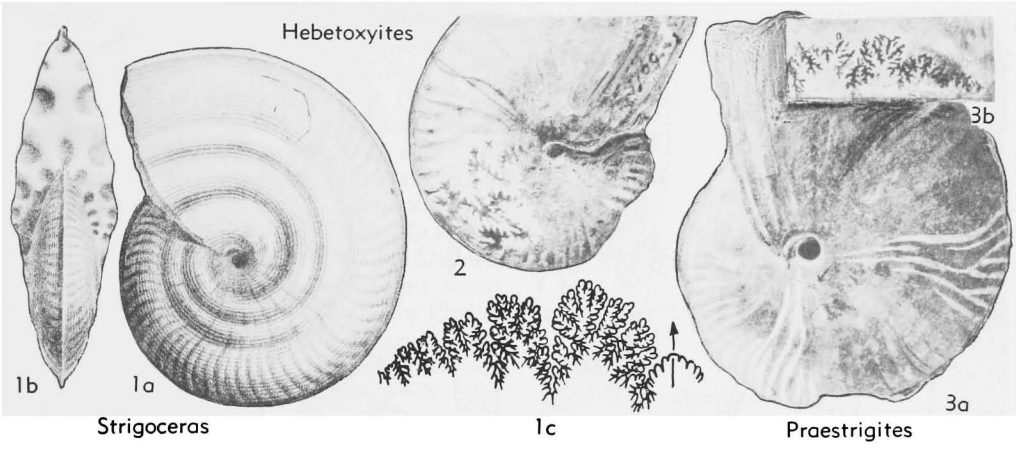


FIG. 314. Strigoceratidae (p. L271-L272).

outer row of lateral tubercles. *M.Baj.(sowerbyi z.)*, Eu.-N.Afr.——FIG. 311,*1*. **Z. ubaldi*, Fr.; *1a,b*, ×0.7 (612*).

Haplopleuroceras BUCKMAN, 1892 [**Amaltheus subspinatus* BUCK., 1881]. Nucleus as in *Sonninia*, but thereafter shell becomes homeomorph of *Pleuroceras*(U.Pliensb.), except that keel is not serrated. *L.Baj.-M.Baj.*, Eu.-N.Afr.——FIG. 311,*6*. **H. subspinatum* (BUCK.), Eng.; *6a,b*, ×0.5 (595*).

Bajocia BRASIL, 1895 [**B. farcyi*]. Small, extremely evolute, serpenticone, with fastigate venter, no keel; ribs numerous, simple, strong, straight. An aberrant relative of *Haplopleuroceras*. *M.Baj. (humphriesianum z.)*, Fr.——FIG. 311,*2*. **B. farcyi*; ×1 (389*).

?**Diplesioceras** BUCKMAN, 1920 [**D. diplesium*]. Founded on a strongly carinate nucleus recalling *Poecilomorphus*, with some flared ribs suggesting nuclei of some *Sonninia* and *Zurcheria*. Thought by BUCKMAN to be "an acmic oppelid." *U.Baj. (garantiana z.)*, Eng.——FIG. 311,*8*. **D. diplesium; 8a,b*, ×1.3 (595*).

?**Vastites** ARKELL, 1951 [**V. vastus*]. Large, smooth, involute, similar to *Shirbuirnia*. *L.Bath.*, Eng.——FIG. 313,*1*. **V. vastus; 1a,b*, ×0.2 (14*).

Superfamily HAPLOCERATACEAE Zittel, 1884

[*nom. transl.* ARKELL, herein (*ex* Haploceratidae ZITTEL, 1884)] [=Oppelacea BUCKMAN, 1919 (superfam.); Oppeliaceae ARKELL, 1950 (superfam.)]

Keeled or unkeeled, typically compressed, discoidal, tending to oxycones, with smooth, usually falcoid or falcate ribbing. Aptychi double-valved, differing in families, commonest form (found *in situ* in *Oppelia subradiata*) having surface covered with oblique ridges (Lamellaptychus); some are similar but smoother (Laevilamellaptychus, found *in situ* in *Pseudolissoceras*); others have ridges or folds overlapping like tiles, and punctate furrows (Punctaptychus). Cornaptychus and Laevicornaptychus are also recorded doubtfully. *M.Jur.(L.Baj.)-L.Cret. (Alb.)*, world-wide.

Although the origin of the superfamily is still unknown, as when R.DOUVILLÉ attempted a classification in 1913, much earlier representatives have been found, which carry back all 3 families, to beginning of the Middle Bajocian (*sowerbyi* z.) and the hypothesis here put forward is that they had a common origin in Hammatoceratidae (544, 577).

Family STRIGOCERATIDAE Buckman, 1924

[Includes Hebetoxyitidae BUCK., 1924]

Compressed to oxycone, with or without keel, umbilicus narrow to minute; ribbing almost confined to outer half of whorl sides, simple or irregularly branched, not parallel to growth lines (which invariably are more projected than the ribs), whorl sides tending to be ridged or fluted spirally and strigate. Sutures moderately simple to complex, with long umbilical lobe, not retracted, bearing a graded series of auxiliaries (65, 409). *M.Jur.(L.Baj.-U.Baj.)*.

Praestrigites BUCKMAN, 1924 [**P. praenuntius*] [*Deltostrigites* BUCK., 1924]. Discoidal, with hollow floored keel and characteristic irregularly branched ribbing but smooth and featureless, without fluting or strigation. *L.Baj.(concavum z.; teste* BUCK.)-*M.Baj.(sowerbyi z.)*, Eng.-Ore.——FIG. 314,*3*. **P. praenuntius*, Eng.; *3a,b*, ×0.7 (595*).

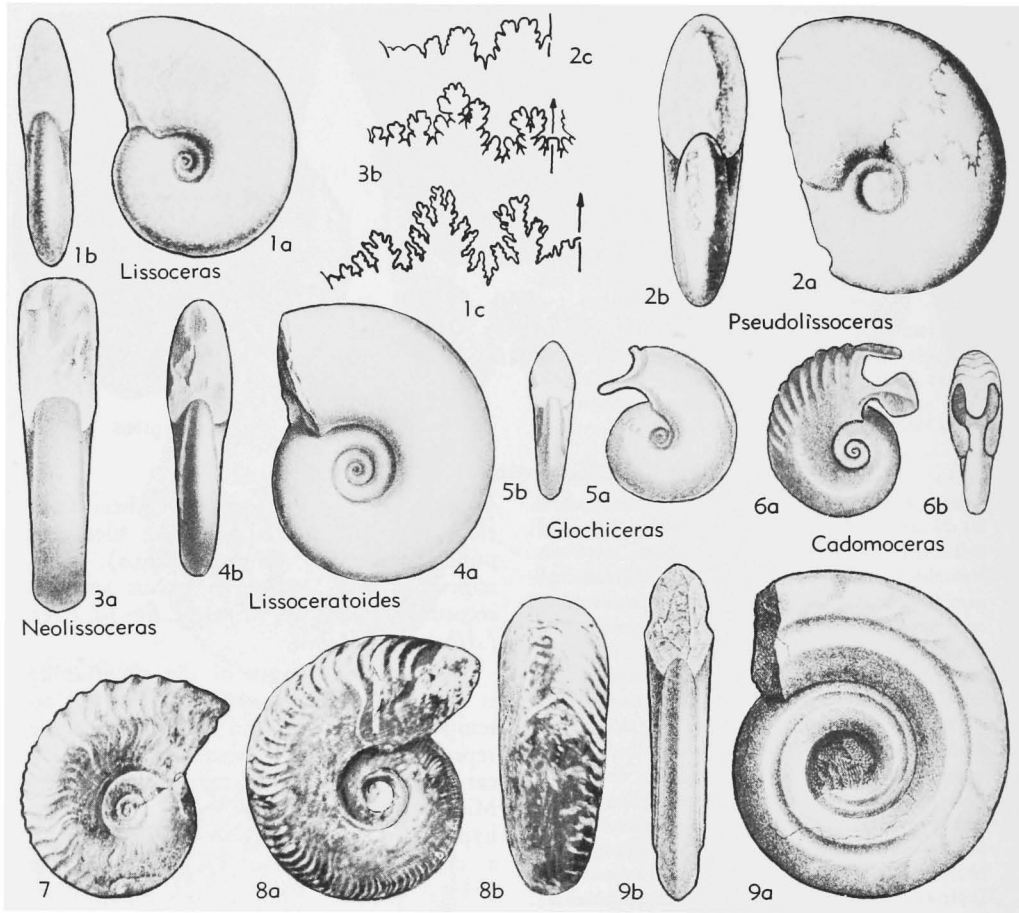


FIG. 315. Haploceratidae (p. L273-L274).

Strigoceras QUENSTEDT, 1886 [**Am. truellei* D'ORBIGNY, 1845] [=*Stringoceras* H.DOUVILLÉ, 1916 (obj.); *?Kleistoxyites* BUCKMAN, 1922; *Strigites, Leptostrigites, Plectostrigites, Varistrigites* BUCK., 1924]. Discoidal to somewhat inflated, rather coarsely ribbed, many but not all spirally fluted; strigate; with tall hollow floored keel and complex sutures. *M.Baj.(sowerbyi z.)-U.Baj.(parkinsoni z.)*, Eu.-N.Afr.-Azerbaijan.——FIG. 314, *1*. **S. truellei* (ORB.), Fr.; *1a,b*, ×0.3; *1c*, ×0.5 (330*).

Hebetoxyites BUCKMAN, 1924 [**H. hebes*]. Oxycones wtih minute umbilicus and median lateral spiral ridge but neither keeled nor strigate. In different species ribbing resembles that of *Strigoceras, Oppelia,* or *Oxycerites*. *M.Baj.(sowerbyi z.-sauzei z.)*, Eu.-Ore.——FIG. 314,*2*. **H. hebes*, Eng.; ×0.7 (595*).

Family HAPLOCERATIDAE Zittel, 1884

[=Lissoceratinae H.DOUVILLÉ, 1885; Glochiceratidae HYATT, 1900]

Typically small, smooth, somewhat featureless ammonites, typically unkeeled and unribbed, with moderately differentiated and featureless sutures. *M.Jur.(M.Baj.)-L.Cret.(Hauteriv.)*, world-wide.

ZITTEL (1884), BUCKMAN (1924), and many others believed this assemblage to be degenerate oppeliids, but this is now known to be stratigraphically impossible. According to the theory of Iterative Evolution of SALFELD (1924), as advocated by SPATH (1925, 1928), they are not a persistent stock but a series of intermediate grades between Phylloceratina and Oppeliidae, repeated at suc-

cessive geological periods. The earliest form now known (*Lissoceras semicostulatum* BUCK., M.Baj., *sowerbyi* z.) has sutures exactly like Upper Jurassic forms (with the deep 2nd lateral saddle emphasized by R. DOUVILLÉ, 1913, who thought it a late development) and with no suggestion of phylloid folioles. It could therefore be a degenerate hammatoceratid (e.g., *Eudmetoceras*) which has lost its keel, like *Erycites*. Some Kimmeridgian and Tithonian forms may be derived independently from Phylloceratina by way of *Sowerbyceras,* as suggested by SPATH (1923), but until there are better grounds than conjecture for a complete reclassification, the only practical course is to retain the traditional morphological family (575, 576, 577).

Lissoceras BAYLE, 1879 [**Am. psilodiscus* SCHLOENBACH, 1865]. Involute, smooth, or with growth lines or fine ventrolateral ribbing, and unkeeled blunt venter. *M.Jur.(M.Baj., sowerbyi z.-L.Bath.),* Eu.-Sinai-Cauc.-Azerbaijan-Persia-Pamir-Indon.-S. Alaska.——FIG. 315,*1*. **L. (L.) psilodiscus* (SCHLOEN.), L.Bath., Ger.; *1a,b,* ×1; *1c,* ×2 (701*).

Lissoceratoides SPATH, 1923 [**Am. erato* D'ORBIGNY, 1850]. Indistinguishable morphologically from *Lissoceras* but separated from it by a wide stratigraphical gap. Subgen. of *Lissoceras. M.Jur.(U. Callov.)-U.Jur.(U.Oxf.),* Eu.-N.Afr.-Syria-Cutch. ——FIG. 315,*4*. **L. (L.) erato* (ORB.), Oxf., Fr.; *4a,b,* ×0.5 (330*).

Toxamblyites BUCKMAN, 1924 [**T. arcifer*]. Differs from inflated Bajocian species of *Lissoceras,* such as common *L. oolithicum* (D'ORBIGNY), only in having outer half of whorl sides covered with regular, dense, falcoid ribbing which is parallel to growth lines and projected to pass as blunt chevrons over the rounded, nearly smooth venter. *M.Jur.(M.Baj., sauzei z.),* Eng.——FIG. 315,*8*. **T. arcifer; 8a,b,* ×1 (595*).

Protoecotraustes SPATH, 1928 [**P. dundriensis*]. Inner whorls smooth, like *Lissoceras,* with rounded venter; outer whorl develops sigmoid ribbing which ends at ventrolateral clavi, and a somewhat tabulate venter, commonly with an incipient keel; aperture with lappets. *M.Jur.(M.Baj., sauzei z.),* Eng.——FIG. 315,*7*. **P. dundriensis;* ×1 (466*).

Cadomoceras MUNIER-CHALMAS, 1892 [**Am. cadomensis* DEFRANCE in DEBLAINVILLE, 1840]. Inner whorls smooth, involute; outer whorl coiled elliptically and developing coarse ventral plications. Sutures straight and simple with small distant lobes. Aperture with large rostrum and spatulate lappets. *M.Jur.(M.Baj., sauzei z.-U.Baj., subfurcatum z.),* Eu.——FIG. 315,*6*. **C. cadomense* (BLAINV.), Fr.; *6a,b,* ×1 (675*).

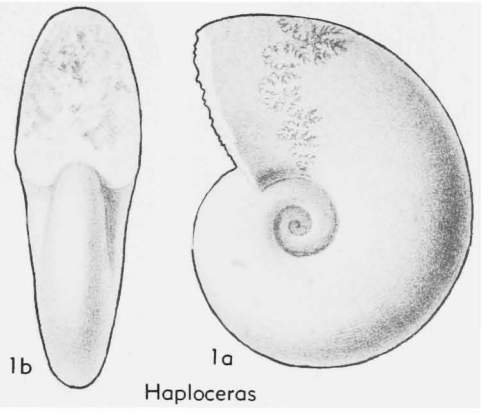


FIG. 316. *Haploceras elimatum* (OPPEL), U.Jur. (Tithon.), Eu. (p. L273).

Haploceras ZITTEL, 1870 [**Am. elimatus* OPPEL in ZITTEL, 1868; SD SPATH, 1923] [=*Hypolissoceras* BREISTROFFER, 1947]. Similar to *Lissoceras* but with more rectangular whorl section and small blunt lappets and blunt rostrum; some species have feeble ventral folds on body chamber. *U.Jur. (Kimm.-Tithon.)* Eu.-N.Afr.-Tangan.-Madag.-Kurdistan-Cutch-Mex.-Tex.-Cuba.——FIG. 316,*1*. **H. elimatum* (OPPEL), Tithon., Eu.; *1a,b,* ×0.7 (576*).

Pseudolissoceras SPATH, 1925 [**Neumayria zitteli* BURCKHARDT, 1903; SD ROMAN, 1938]. Whorl section elliptical, surface smooth, sutures simple, with small distant lobes. *U.Jur.(U.Tithon.),* Arg.-Chile-Mex.-Cuba-Kurdistan.——FIG. 315,*2*. **P. zitteli* (BURCK.), Arg.; *2a-c,* ×1 (68*).

Neolissoceras SPATH, 1923 [**Am. grasianus* D'ORBIGNY, 1841]. Compressed, flat-sided, smooth, with flatly rounded venter and distinct umbilical margin; small lappets. Sutures well frilled, typically haploceratid. *U.Jur.(U.Tithon.)-L.Cret.(Hauteriv.),* S.Eu.-Madag.-Punjab.——FIG. 315,*3*; 317,*1*. **N. grasianum* (ORB.), Fr.; all ×0.5 (329*).

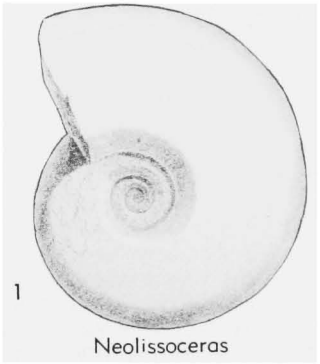
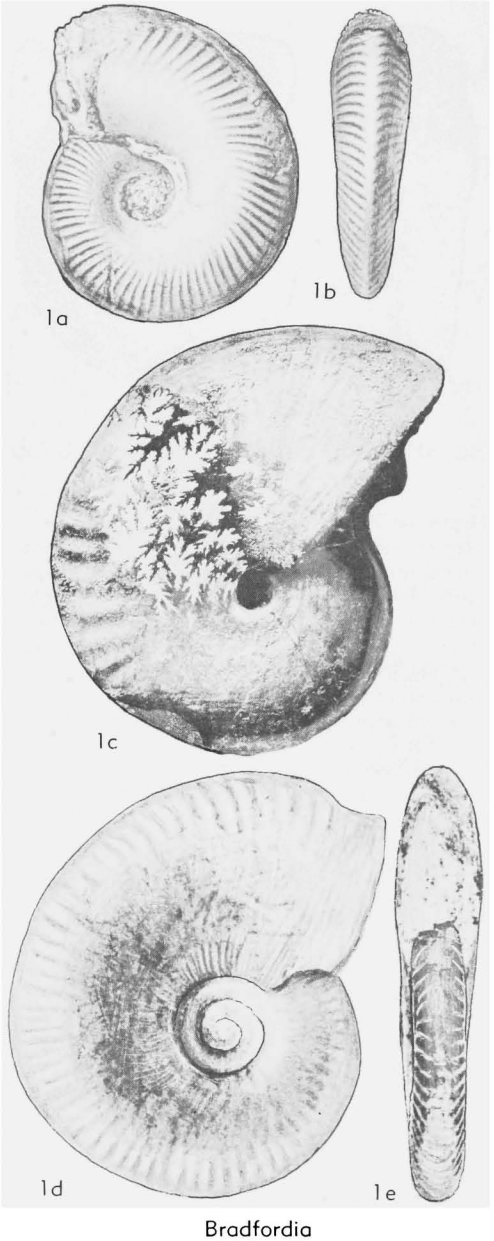


FIG. 317. *Neolissoceras grasianum* (D'ORBIGNY), U. Jur.(U.Tithon.), Fr.; ×0.5 (329*) (p. L273).



Bradfordia

FIG. 318. Oppeliidae (Oppeliinae) (p. L275).

Glochiceras HYATT, 1900 [**Am. nimbatus* OPPEL, 1863]. Small, evolute, compressed, smooth, with median lateral groove and big lappets. *U.Jur.(Oxf.-Kimm.)*, Eu.-Russia-Arabia-Somali.-Tangan.-Kurdistan-Cutch-Japan-Mex.-Cuba-Arg.——FIG. 315,5. **G. nimbatum* (OPPEL), L.Kimm., Ger.; *5a,b*, ×1 (327*).

Hildoglochiceras SPATH, 1924 [**Hecticoceras latistrigatum* UHLIG, 1903]. Very evolute, compressed, flat-sided, with deep median lateral groove and lappets; outer ribs steeply rursiradiate, as in *Paroecotraustes*. *U.Jur.(U.Kimm.-L.Tithon.)*, Himalaya-Cutch-Tangan.-Madag. - Mex. - Cuba. —— FIG. 315,9. **H. latistrigatum* (UHLIG), Spiti sh., Himalaya; *9a,b*, ×0.7 (533*).

Family OPPELIIDAE Bonarelli, 1894

[*nom. correct.* ARKELL, 1951 (*pro* Oppelidae BONARELLI, 1894)]

Compressed to oxycone, either unkeeled, unicarinate, bicarinate, or tricarinate, with or without lappets and rostrum, with sculpture and sutures in almost infinite variety, but ribbing usually more or less falcoid or falcate (14, 66, 135, 544). *M.Jur.(M.Baj.)-L.Cret.(Alb.)*, *?U.Cret.(Cenom.)*, world-wide except boreal.

Subfamily OPPELIINAE Bonarelli, 1894

[*nom. correct.* ARKELL, 1951 (*pro* Oppelinae BONARELLI, 1894)]

Mainly oxycones when adult; inner whorls usually keeled, outer whorls with acute or blunt periphery; ribbing usually falcoid or falcate, smooth, failing on outer whorl; whorl sides commonly with median lateral spiral groove, smooth band, or fillet. Sutures complex, consisting of a long series of evenly graded lobes and saddles with finely frilled endings. *M.Jur.(M.Baj.-M.Callov.)*, world-wide except boreal.

The earliest known genus, *Bradfordia* (M. Baj., *sowerbyi* z.-*sauzei* z.), is contemporary with and shows strong resemblance to the earliest known haploceratid, *Lissoceras semicostulatum* BUCKMAN. Both are unkeeled and have the same style of fine ribbing, which is not projected at the periphery.

FIG. 319. *Oppelia (Oppelia) subradiata* (SOWERBY), M.Jur.(M.Baj.), Eng. (p. L275).

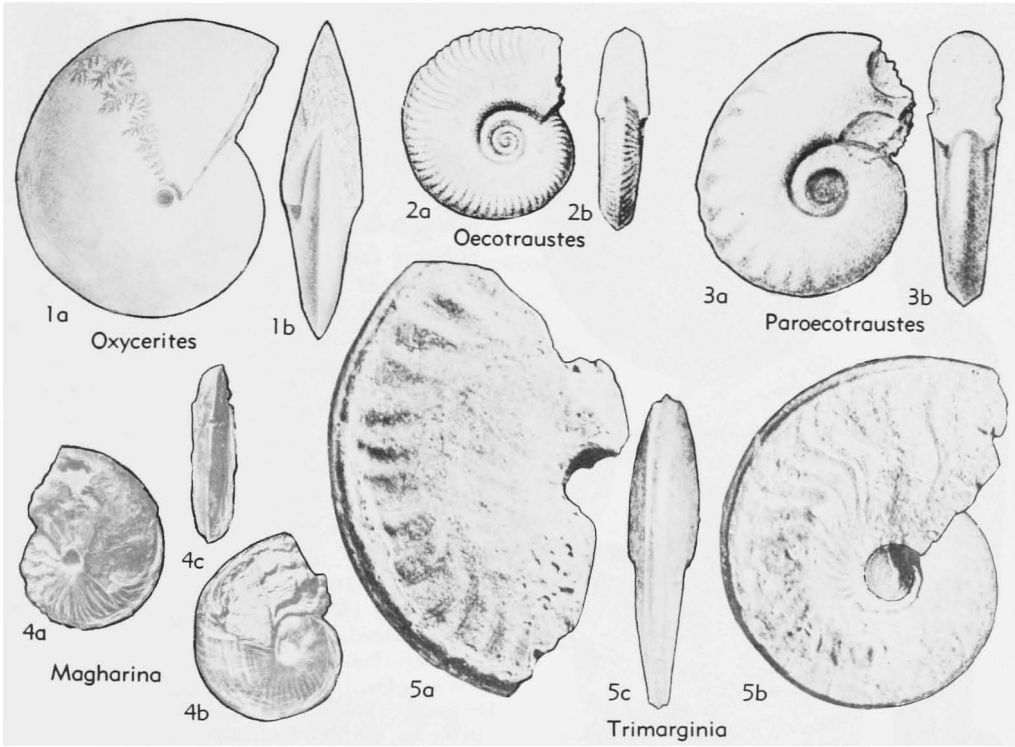


FIG. 320. Oppeliidae (Oppeliinae) (p. L275-L276).

Bradfordia differs by being more compressed and may have a sharp or raised umbilical edge, but the 2 probably are closely allied and could be derived from a hammatoceratid like *Eudmetoceras* by loss of the keel.

Bradfordia BUCKMAN, 1910 [**B. liomphala*] [*?Amblyoxyites* BUCK., 1922; *Iokastelia* RENZ, 1925]. Comprises "group of *Oppelia praeradiata* H. DOUV." Moderately involute to involute, unkeeled; venter rounded, smooth; umbilical wall steep, umbilical edge sharp or raised; outer half of whorl sides with fine, somewhat rursiradiate ribbing, which is not projected at shoulders. Sutures simple for the family. *M.Jur.(M.Baj., sowerbyi z.-sauzei z.)*, Eu.-N.Afr.-Arg.——FIG. 318,*1a,b*. *B. helenae* (RENZ) (type of *Iokastelia*); ×0.75 (367*).——FIG. 318,*1c*. *B. amblys* (BUCK.) (type of *Amblyoxyites*); ×0.5 (595*).——FIG. 318,*1d,e*. **B. liomphala*, Eng.; ×1 (66*).

Oppelia WAAGEN, 1869 [**Am. subradiatus* J.DEC. SOWERBY, 1823; SD DOUVILLÉ, 1884 (ICZN Opinion 324)] [*Pleuroxyites, Flexoxyites, Harpoxyites, Gonoxyites* BUCKMAN, 1924]. Compressed, involute, feebly keeled; with distant falcoid primary ribbing and close fine secondaries on ventrolateral edge. *M.Jur.(M.Baj., sauzei z.-U.Baj., parkinsoni z.)*, Eu.-N.Afr.-Kenya-Sinai-Cauc.-Azerbaijan-Persia-Pamir-S.Alaska.——FIG 319,*1*. **O. (O.) subradiata* (Sow.), *sauzei* z., Eng.; *1a,b*, holotype, ×1 (14*).

Oxycerites ROLLIER, 1909 [**Am. aspidoides* OPPEL, 1857]. Differs from *Oppelia* in having sharper venter and in lacking secondary ribbing except in young of some species. Subgen. of *Oppelia. M.Jur. (U.Baj.-Callov.)*, Eu.-N.Afr.-Crimea-Cauc.-Persia-Pamir-Himalaya-Indon.-S.Alaska-Can.-S. Am.——FIG. 320,*1*. **O. (O.) aspidoides* (OPPEL), U.Bath., Switz.; *1a,b*, ×0.3 (327*).

Paralcidia SPATH, 1928 [*pro Alcidia* ROLLIER, 1913 (*non* WESTWOOD, 1879)] [**P. khengari*] [*Paroxycerites* BREISTROFFER, 1947]. Smooth, or with weak distant primary ribs, some with secondaries also; umbilical slope gentle; venter fastigate or incipiently tricarinate, becoming rounded on body chamber. *M.Jur.(M.Bath.-M.Callov.)*, Eu.-N.Afr.-Madag.-Persia-Cutch.——FIG. 321,*1*. **P. khengari*, L.Callov., Cutch; *1a,b*, ×0.7 (466*).

Strungia ARKELL, 1952 [**Oppelia redlichi* POPOVICI-HATZEG, 1905]. Venter fastigate, becoming rounded in adult; ribbing feeble, fasciculate; surface strigate. *M.Jur.(Bath.)*, SE.Eu.-C.Arabia.——FIG. 322,*1*. **S. redlichi* (POP.-HATZEG), Rumania; *1a,b*, ×0.7 (354*).

Trimarginia ARKELL, 1952 [**T. sinaitica*]. Discoidal, tricarinate; ribbing as in *Oxycerites*. *M.Jur. (U.Baj.)*, Sinai.——FIG. 320,*5*. **T. sinaitica; 5a-c*, ×1 (132*).

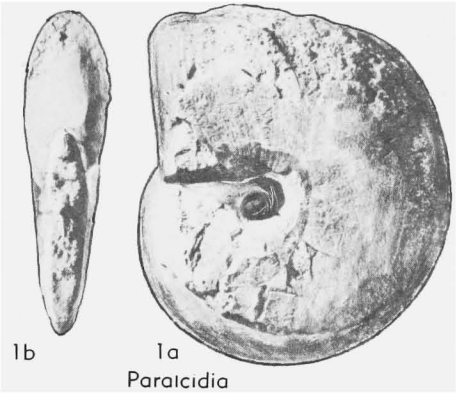


FIG. 321. *Paralcidia khengari* SPATH, M.Jur. (Callov.), Cutch; *1a,b,* ×0.7 (p. L275).

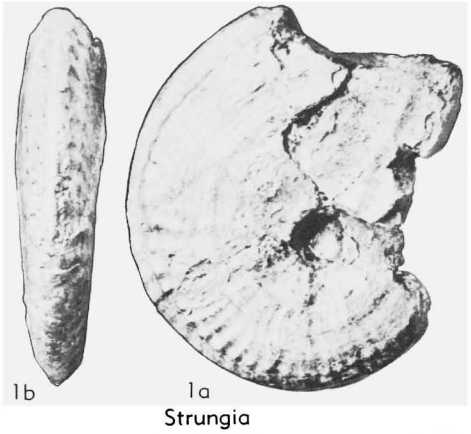


FIG. 322. *Strungia redlichi* (POPOVICI-HATZEG), M. Jur.(Bath.), Rumania (p. L275).

?Magharina ARKELL, 1952 [**M. magharensis*]. Small, smooth, unicarinate, with extremely simple sutures. Possibly a modified sonniniid. *M. Jur.(U.Baj.),* Sinai.——FIG. 320,*4*. **M. magharensis; 4a-c,* ×0.7 (15*).

Oecotraustes WAAGEN, 1869 [**O. genicularis;* SD MUNIER-CHALMAS, 1892 (ICZN Opinion 324)] [=*Oekotraustes* WAAGEN, 1869 (obj.); *Oppelina* BUCKMAN, 1926]. Inner whorls like *Oppelia;* outer whorl commonly slightly elliptical; aperture with spatulate lappets; ribs strongly falcate, outer part markedly rursiradiate and in some ending at ventrolateral nodes. *U.Baj.(subfurcatum z.)-M.Callov.,* Eu.-N.Afr.-?Kenya-Persia.——FIG. 320,*2*. **O. (O.) genicularis* (WAAG.), U.Baj., Fr.; *2a,b,* ×1 (729*).

Stegoxyites BUCKMAN, 1924 [**S. parcicarinatus*]. Differs from *Oecotraustes* in having 2 feeble sulci on whorl sides separated by a blunt spiral ridge; with raised umbilical edge and incipient ventral keel. ?Subgen. of *Oecotraustes. M.Baj.(humphriesianum z.),* Eng.——FIG. 323,*1*. **O.? (S.) parcicarinatus* (BUCK.); *1a,b,* ×1 (65*).

Paroecotraustes SPATH, 1928 [**Oecotraustes serrigerus* WAAGEN, 1869]. Similar to *Oecotraustes* but with median-lateral groove and more distant ribbing; coiling elliptical in some species, not in others. Subgen. of *Oecotraustes. M.Bath.-Callov.,* Eu.-N.Afr.-Cutch.——FIG. 320,*3*. **O. (P.) serrigerus,* Pol.; *3a,b,* ×1 (729*).

Subfamily HECTICOCERATINAE Spath, 1925

Ribbing falcoid or falcate (except on nuclei), usually rather strong and covering inner as well as outer parts of whorl sides, tuberculate in some; venter usually keeled, may be tricarinate. Some forms closely resemble various *Oecotraustes* and *Paroecotraustes*. In U.Bath. passage forms from *Oxycerites* into *Prohecticoceras* (type species of which has untypically stout whorls and strong ribbing) are found (258, 466, 526). *M. Jur.(U. Bath.) - U. Jur.(L. Oxf.),* worldwide.

Prohecticoceras SPATH, 1928 [**Am. retrocostatus* DE GROSSOUVRE, 1888]. Venter flat, unicarinate; ribs regular, falcoid, weak to strong. *M.Jur.(U.Bath.),* Eu.-N.Afr.-Pamir.——FIG. 324,*1*. **P. retrocostatum* (GROSS.), Fr.; *1a,b,* ×1 (693*).

Hecticoceras BONARELLI, 1893 [**Nautilus hecticus* REINECKE, 1818]. Evolute, unicarinate; ribbing strong, paired, arising at umbilicate edge and ending in row of ventrolateral submarginal tubercles. *M.Jur.(L.Callov.),* Eu.-N.Afr.-Somali.-Madag.-?Anatolia-Persia-Cutch-?Japan.——FIG. 324,*2*. **H. (H.) hecticum* (REIN.), Ger.; *2a,b,* ×1 (688*).

Hecticoceratoides SPATH, 1924 [**H. suborientalis*]. Resembles *Hecticoceras* but keel-less. Subgen. of *Hecticoceras. M.Jur.(L.Callov.),* Cutch-Madag.——FIG. 324,*7*. **H. (H.) suborientalis,* Cutch; ×0.5 (466*).

Lunuloceras BONARELLI, 1893 [**Nautilus lunula* REINECKE, 1818]. Inner whorls smooth, outer whorls with falcoid ribbing but no tubercles. Sub-

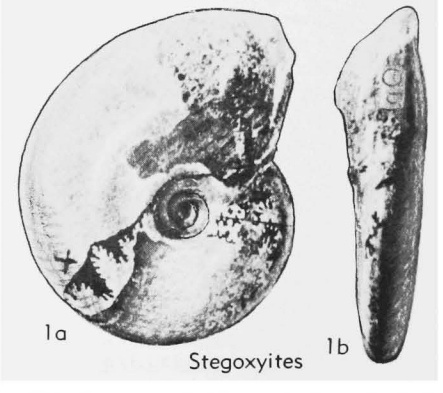


FIG. 323. *Oecotraustes? (Stegoxyites) parcicarinatus* (BUCKMAN), M.Jur.(M.Baj.), Eng. (p. L276).

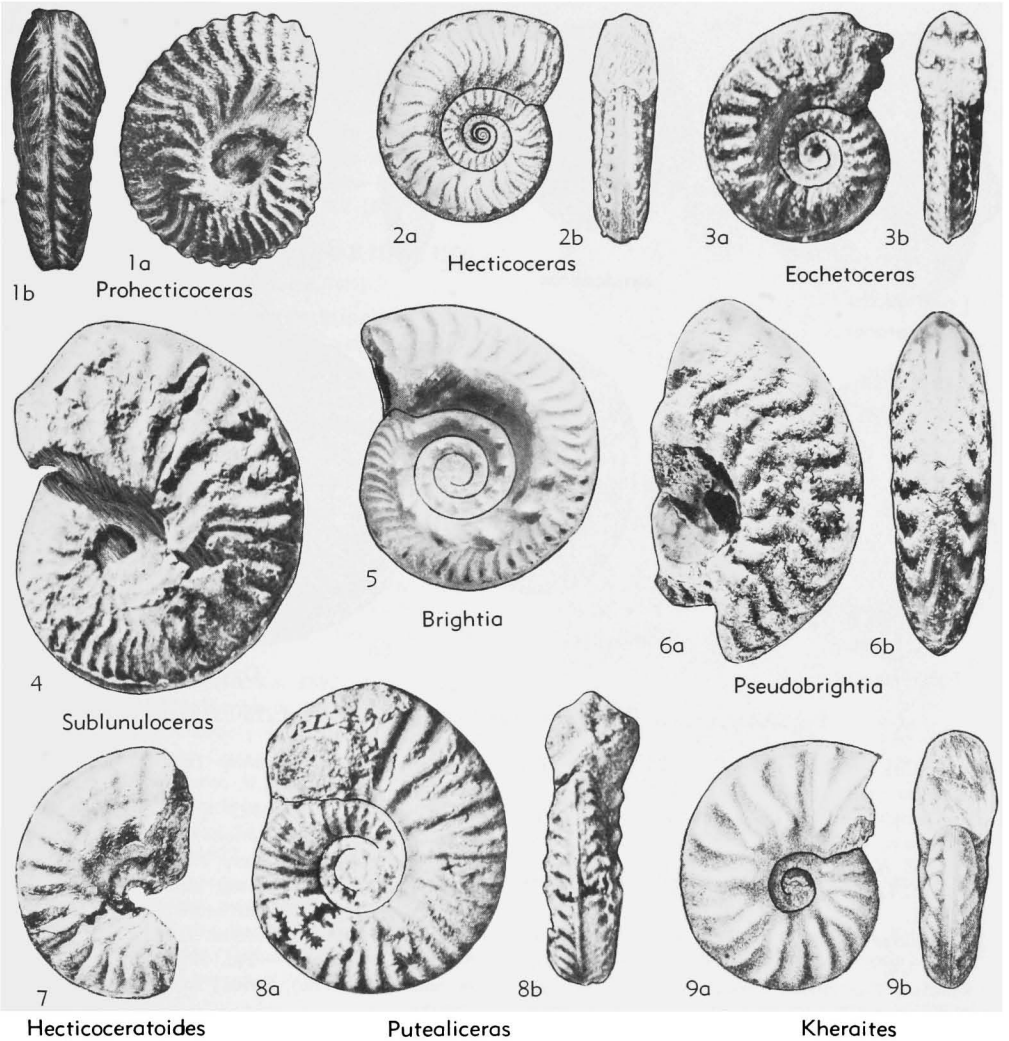


FIG. 324. Oppeliidae (Hecticoceratinae) (p. L276-L278).

gen. of *Hecticoceras. M.Jur.(L.Callov.)*, Eu.-N.Afr.-Syria-Cutch.——FIG. 325,*2*. **H. (L.) lunula* (REIN.), Ger.; ×1 (389*).

Sublunuloceras SPATH, 1928[**Harpoceras lairense* WAAGEN, 1875] [=*Orbignyiceras* GÉRARD & CONTAUT, 1936]. Large, discoidal, unicarinate, involute, with gentle falcoid ribbing. Subgen. of *Hecticoceras. M.Jur.(M.Callov.)-U.Jur.(L.Oxf.)*, Eu.-Russia-Syria-N. Afr.-Madag.-Crimea-TransCaspia-Persia-Cutch-Pamir-Indon.——FIG. 324,*4*. **H. (S.) lairense* (WAAGEN), Cutch; ×1 (466*).

Putealiceras BUCKMAN, 1922 [**Am. putealis* LECKENBY, 1859] [=*Rossiensiceras* GÉRARD & CONTAUT, 1936]. Differs from *Sublunuloceras* in being stouter and more strongly ribbed; resembles *Ludwigia*. Subgen. of *Hecticoceras M.Jur.(U.Callov.)*, Eu.-Russia-Syria-Madag.-Crimea-Cauc. - Persia - Cutch-Pamir-Himalaya-Indon.——FIG. 324,*8*. **H. (P.) puteale* (LECK.), Eng.; *8a,b*, ×1 (65*).

Kheraites SPATH, 1925 [**Harpoceras crassefalcatum* WAAGEN, 1875]. Strongly ribbed; close to *Putealiceras*. Subgen. of *Hecticoceras. M.Jur.(M.Callov.)*, Cutch-Madag.——FIG. 324,*9*. **H. (K.) crassefalcatum* (WAAGEN), Cutch; *9a,b*, ×0.5 (546*).

Brightia ROLLIER, 1922 [**Hecticoceras nodosum* BONARELLI, 1893]. Evolute, compressed, unicarinate, resembling *Paroecotraustes;* inner half of whorl sides with distant bullate ribs or submesial nodes only; outer half with fine rursiradiate ribs. Subgen. of *Hecticoceras. M.Jur.(U.Callov.)-U.Jur.(L.Oxf.)*, Eu.-Russia-N.Afr.-Syria-Crimea-Cauc.-

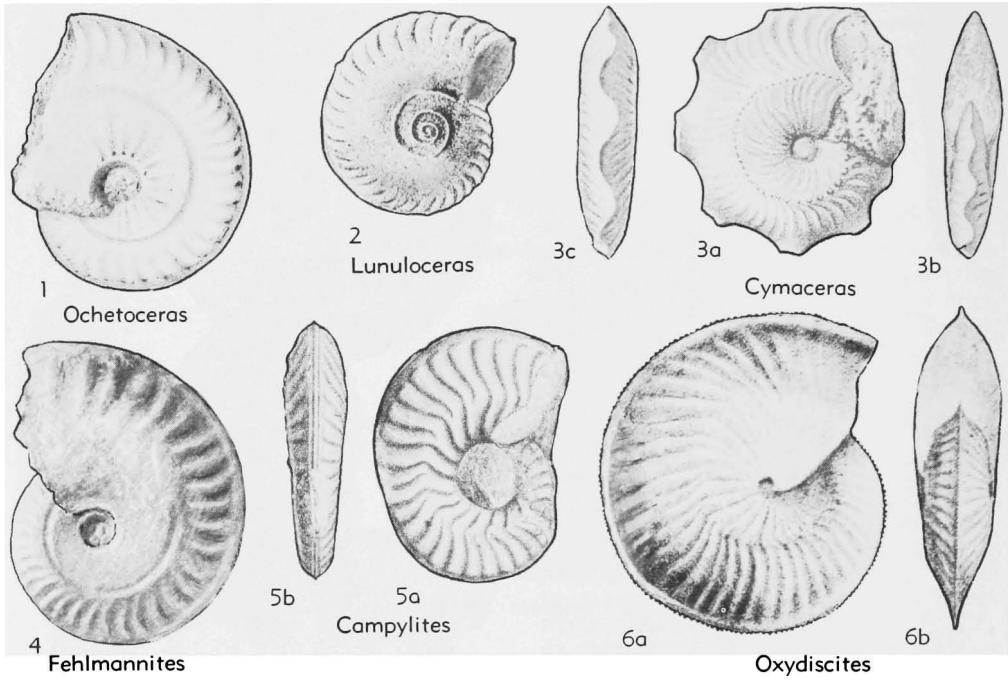


FIG. 325. Oppeliidae (Hecticoceratinae, Ochetoceratinae) (p. L276-L279).

Persia-Cutch-Himalaya.——FIG. 324,*5*. **H. (B.) nodosum* (BON.), Eu.; ×0.75 (526*).

Pseudobrightia SPATH, 1928 [**P. dhosaensis*]. Large, tricarinate, with sculpture as in *Putealiceras*. Subgen. of *Hecticoceras U.Jur.(L.Oxf.)*, Cutch.——FIG. 324,*6*. **H. (P.) dhosaense; 6a,b*, ×0.5 (466*).

Eochetoceras SPATH, 1928 [**Am. hersilia* D'ORBIGNY, 1850 (fig'd. 1927); SD ROMAN, 1938]. Stout-whorled, unicarinate, strongly ribbed; doubtfully distinct from *Putealiceras*. Subgen. of *Hecticoceras. U.Jur.(L.Oxf.)*, Eu.——FIG. 324,*3*. **H. (E.) hersilia* (ORB.), Fr.; *3a,b*, ×1 (673*).

Subfamily OCHETOCERATINAE Spath, 1928

Harpoceras-like oxycones with falcoid ribbing divided by median lateral groove or fillet; venter tricarinate, median keel tallest and commonly minutely serrated. Probably polyphyletic derivatives of Hecticoceratinae and Oppeliinae (70, 466; SPATH, 1928, p. 103, 128). *U.Jur.(L.Oxf.-L.Kimm.)*, worldwide.

Ochetoceras HAUG, 1885 [**Am. canaliculatus* VON BUCH, 1832; SD MUNIER-CHALMAS, 1892] [*Canaliculites* JEANNET, 1951]. Venter rounded, only median keel well developed, minutely serrated; division in whorl sides may be either incised (groove) or raised (fillet). *L.Oxf.-L.Kimm.*, Eu.-N. Afr.-C.Russia-Persia-Mex.-Cuba-Chile.——FIG. 325, *1*. **O. (O.) canaliculatum* (BUCH), Oxf., Ger.; holotype, ×0.7 (327*).

Campylites ROLLIER, 1922 [**Am. delmontanus* OPPEL, 1863] [=*Neoprionoceras* SPATH, 1928; *Pseudocampylites* JEANNET, 1951]. Differs from *Ochetoceras* in its narrower and more definitely tricarinate venter, and in more distinct primary ribs. Subgen. of *Ochetoceras. L.Oxf.-U.Oxf.*, Eu.-Syria-Cutch-Madag.——FIG. 325,*5*. **O. (C.) delmontanum* (OPPEL), Switz.; *5a,b*, holotype, ×0.7 (266*).

Fehlmannites JEANNET, 1951 [**F. jurensis*]. Outer whorl resembling *Oxycerites*. Subgen. of *Ochetoceras. L.Oxf.*, Switz.——FIG. 325,*4*. **O. (F.) jurense* (JEANNET); ×0.7 (220*).

Trimarginites ROLLIER, 1909 [**Am. arolicus* OPPEL, 1863; SD ARKELL, 1943]. Very involute and discoidal, strongly tricarinate; inner whorls smooth. *U.Oxf.*, Eu.-N.Afr.-?Cutch-Chile.——FIG. 326,*1*. **T. arolicus* (OPPEL), Switz.; *1a,b*, ×0.7 (327*).

Cubaochetoceras SANCHEZ-ROIG, 1951 [**Ochetoceras imlayi;* SD ARKELL, herein]. Large *Cardioceras*-like forms with indistinct ribbing. *U.Oxf.*, Cuba.——FIG. 326,*2*. **C. imlayi; 2a,b*, ×0.5 (404*).

Cymaceras QUENSTEDT, 1887 [**Am. guembeli* OPPEL, 1863]. Inner whorls like a tuberculate *Ochetoceras;* venter becoming sharpened and coarsely crenulated on middle and outer whorls with alternate crenulations bent toward opposite sides; secondary ribs rursiradiate, arising from median row of minute tubercles. *L.Kimm.*, Ger.-

Switz.——Fig. 325,3. **C. guembeli* (Oppel), Ger.; *3a-c*, ×1 (327*).

Oxydiscites Dacqué, 1933 [*ex* Rollier, 1909 *(nom. nud.)*] [**Am. laffoni* Moesch, 1867]. Ribbing falcoid, similar to that of *Cymaceras* but no tubercles; venter sharp, with tall, finely toothed keel; umbilicus minute. *L.Kimm.*, Switz.——Fig. 325, 6. **O. laffoni* (Moesch); *6a,b*, ×1 (663*).

Subfamily DISTICHOCERATINAE Hyatt, 1900

[=Bonarellidae Spath, 1925]

Derivatives of Hecticoceratinae in which keel is feeble or obsolete and venter tends to be flat or concave and bordered by clavi formed at ends of ribs (7, 201, 466). *M.Jur. (Callov.)-U.Jur.(Oxf.)*, world-wide.

Distichoceras Munier-Chalmas, 1892 [**Am. bipartitus* Zieten, 1831] [=*Bonarellia* Cossmann, 1898 (obj.)]. Inner ribs obsolete or feeble, outer ribs ending in, or looped to, tall clavi, which overtop the median keel; inner whorls have clavi but no ribs. *M.Jur.(U.Callov.)-U.Jur.(L.Oxf.)*, Eu.-Alg.-Madag.-Cutch-Pamir-Himalaya.——Fig. 327, *1*. **D. bipartitum* (Zieten), Ger.; *1a,b*, ×1 (742*).

Horioceras Munier-Chalmas, 1892 [**Am. baugieri* d'Orbigny, 1847]. Unribbed, unkeeled, venter with channel between large pointed distant clavi. Supposed by Munier-Chalmas and Rollier to be male of *Distichoceras*. *M.Jur.(U.Callov.)-U.Jur.(L. Oxf.)*, Eu.-Alg.-Cutch-Japan.——Fig. 327,*3*. **H. baugieri* (Orb.), Fr.; *3a,b*, ×1 (330*).

Chanasia Rollier, 1922 [**Hecticoceras chanasiense* Parona & Bonarelli, 1897]. Intermediate between *Hecticoceras* and *Distichoceras*, separated from former only by presence of rudimentary clavi at rib ends. *M.Jur.(Callov.)*, Eu.-Cutch.——Fig. 327,*9*, **C. chanasiensis* (Parona-B.), Fr.; ×1 (258*).

Petitclercia Rollier, 1909 [**Am. mirabilis* de Grossouvre, 1891; SD Rollier, 1913]. Very compressed, involute, with sharp umbilical angle and sharp fastigate venter; perhaps "an involute development of *Chanasia*" (Spath, 1928, p. 93). *M. Jur.(Callov.)*, Fr.——Fig. 327,*7*. **P. mirabilis* (Gross.); *7a,b*, ×1 (631*).

Sindeites Spath, 1925 [**S. madagascariensis*]. Ribbing sharp and ending in small tubercles. *M.Jur. (M.Callov.)*, Cutch-Kenya-Tangan.-Madag.——Fig. 327,*8*. **S. madagascariensis*, Madag.; *8a*, ×1.5; *8b*, ×2 (464*).

Subbonarellia Spath, 1928 [**S. decipiens*]. Ribbing coarse and distant, continuous from inner to outer parts of whorl side. *M.Jur.(Callov.)*, Cutch.——Fig. 327,*2*. **S. decipiens;* ×1 (466*).

?Styracoceras Hyatt, 1903 [**Am. balduri* Keyserling, 1846]. Inner whorls involute, smooth or with faint falcoid ribs or small lateral tubercles; venter narrow and deeply grooved but later with groove filled up and then becoming a keel; outer whorls with tabulate unicarinate venter bordered by large outwardly flattened clavi; sides slightly convergent, with distant bullae. Sutures extremely degenerated, with short frilly lobes. *M.Jur.(M. Callov.)*, N.Russia.——Fig. 328,*1*. **S. balduri* (Keys.); *1a,b*, ×0.5; *1c,d*, ×1; *1e*, ×0.7 (645*).

?Concavites Jeannet, 1951 [**Nautilus parallelus* Reinecke, 1818]. Small, evolute, smooth; venter narrow, concave, owing to deep groove, which dies out toward aperture; resembles nucleus of *Styracoceras*. *U.Jur.(L.Oxf.)*, Eu.——Fig. 327,*6*. **C. parallelus* (Rein.), Switz.; *6a*, ×1; *6b*, ×2 (220*).

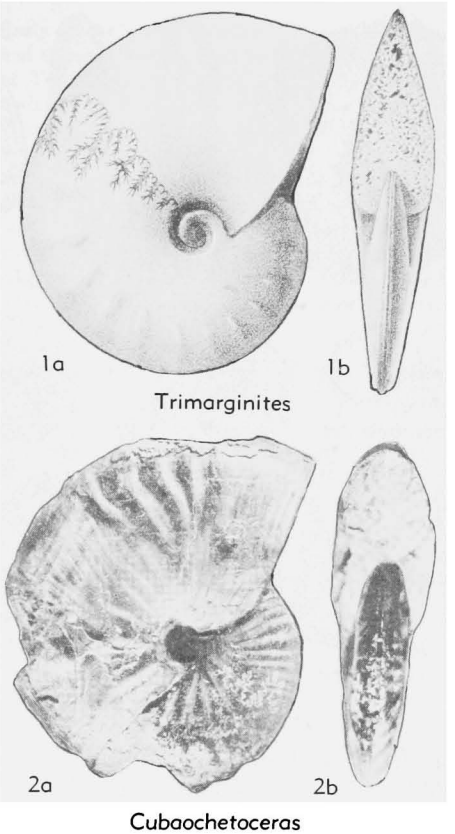


Fig. 326. Oppeliidae (Ochetoceratinae) (p. L278).

Subfamily TARAMELLICERATINAE Spath, 1928

[=Neumayriceratidae Spath, 1925]

Ornate oppeliids without median lateral groove or fillet, with ribbing that crosses whole whorl sides, and various developments of serrated or smooth keels or lateral clavi bordering venter; also some simpler and dwarfed forms believed to be specialized

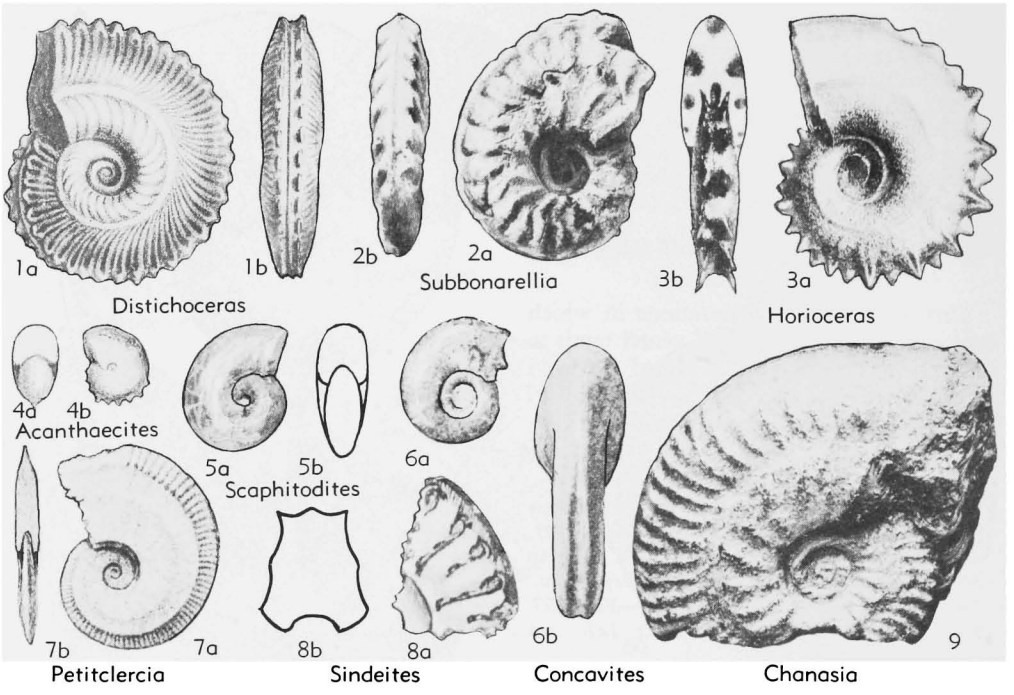


FIG. 327. Oppeliidae (Distichoceratinae, Taramelliceratinae) (p. L279-L282).

or degenerated offshoots (197, 265, 266, 466). *M. Jur. (Callov.) - U. Jur. (Tithon.)*, world-wide.

Taramelliceras DEL CAMPANA, 1904 [*pro Taramellia* DEL CAMPANA, 1903 [*non* SEGUENZA, 1903); *pro Neumayria* BAYLE, 1878 (*non* DE STEFANI, 1877)] [**Am. trachinotus* OPPEL, 1863; SD H. DOUVILLÉ, 1879] [*Neumayriceras* ROLLIER, 1909 obj., lectotype *Am. trachinotus* OPPEL; SD ARKELL, herein); *Rollieria* JEANNET, 1951 (*non* COSSMANN, 1920)]. Involute, robust, with blunt to broad venter; usually well ribbed, commonly with ventrolateral clavi and row of median ventral serrations; ribs looped at clavi in many. *U.Jur.(Oxf.-Kimm.)*, Eu.-N. Afr.-Kenya-Tangan.-Madag.-Persia-Cutch-Himalaya-Japan-Indon.-Mex.——FIG. 329,*1*. **T. (T.) trachinotum* (OPPEL), L.Kimm., Ger.; *1a,b*, ×0.5 (327*).

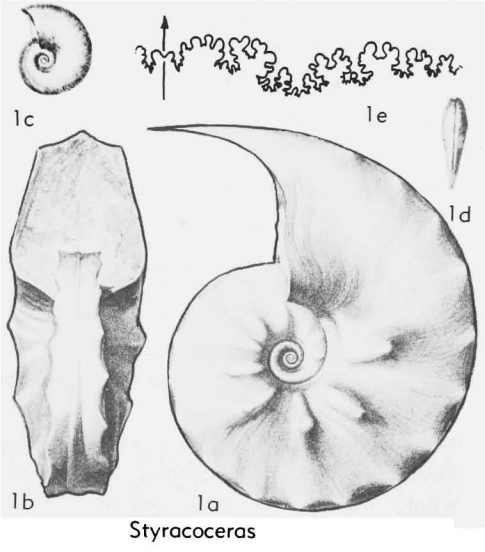


FIG. 328. *Styracoceras balduri* (KEYSERLING), M.Jur. (M.Callov.), N.Russ. (p. L279).

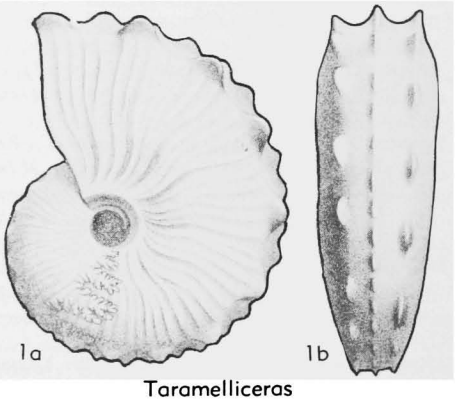


FIG. 329. *Taramelliceras (Taramelliceras) trachinotum* (OPPEL), U.Jur.(L.Kimm.), Ger. (p. L280).

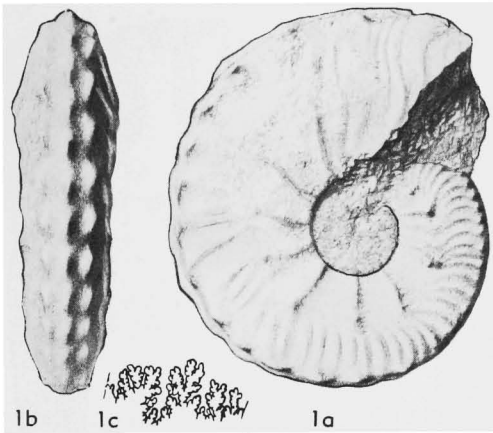


FIG. 330. *Taramelliceras (Fontannesiella) valentina* (FONTANNES), U.Jur.(Kimm.), Fr. (p. L281).

Proscaphites ROLLIER, 1909 [**Am. anar* OPPEL, 1863] [=*Richeiceras* JEANNET, 1951]. Involute, fine-ribbed, developing beaded keel or median row of serrations or ventrolateral serrations or clavi on outer whorl. Probably rootstock of *Taramelliceras* and other genera of subfamily. Subgen. of *Taramelliceras. U.Jur.(L.Oxf.-U.Oxf.)*, Eu.-C. Russia-Cauc.-Syria-Cutch.——FIG. 334,*7*. **T. (P.) anar* (OPPEL), U.Oxf., Switz.; *7a,b*, ×1 (327*).

Fontannesiella SPATH, 1925 [**Oppelia valentina* FONTANNES, 1879]. Differs from *Taramelliceras* in having distinctly differentiated primary ribs which end at a median lateral tubercle. Subgen. of *Taramelliceras. U.Jur.(Kimm.)*, Fr.——FIG. 330,*1*. **T. (F.) valentina* (FONT.); *1a-c*, ×0.5 (160*).

Strebliticeras HÖLDER, 1955 [**Am. pictus tegulatus* QUENSTEDT, 1887]. Differs from *Taramelliceras* in having weak median lateral ridge and little or no ventrolateral tuberculation, and venter which is finely serrate on phragmocone, becoming grooved and then concave on adult body chamber. Subgen. of *Taramelliceras. U.Jur.(U.Oxf.-L.Kimm.)*, Ger.-Switz.——FIG. 331,*1*. **S. pictus tegulatus* (QUENST.), U.Oxf., Ger.; *1a,b*, ×0.7 (583n).

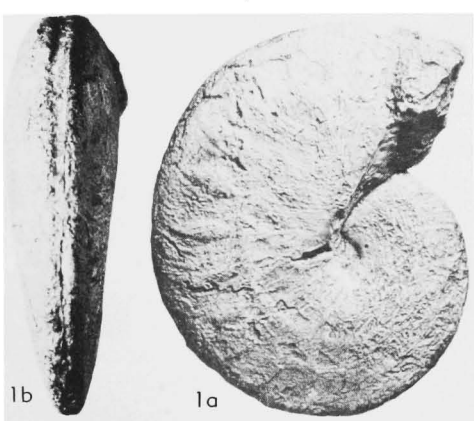


FIG. 331. *Taramelliceras (Strebliticeras) pictus tegulatus* (QUENSTEDT), U.Jur.(L.Kimm.), Ger. (p. L281).

Metahaploceras SPATH, 1925 [**M. affine* SPATH (=*Am. lingulatus nudus* QUENST.)]. A development of *Proscaphites*, finely ribbed, with few distant ventrolateral bullae on outer whorl and smooth rounded venter. Subgen. of *Taramelliceras. U.Jur. (Kimm.)*, Eu.-Madag.-Cutch-Mex.-Cuba.——FIG. 332,*1*. **T. (M.) affine* (SPATH) (from QUENST.), Ger.; *1a-c*, ×0.75 (360*).

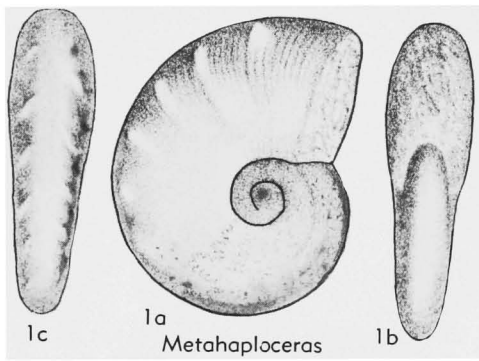


FIG. 332. *Taramelliceras (Metahaploceras) affine* (SPATH), U.Jur.(Kimm.), Ger. (p. L281).

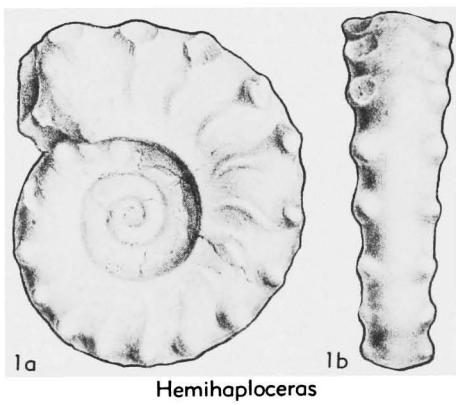


FIG. 333. *Hemihaploceras nobilis* (NEUMAYR), U. Jur.(Kimm.), Rumania (p. L281).

Hemihaploceras SPATH, 1925 [**Oppelia nobilis* NEUMAYR, 1873]. Evolute, *Peltoceras*-like; inner whorls smooth, outer whorls developing distant simple ribs which end in large round ventrolateral tubercles; venter smooth, flatly rounded. *U.Jur.(Kimm.)*, SE.Eu.-Cutch.——FIG. 333,*1*. **H. nobilis* (NEUM.), Rumania; *1a,b*, ×0.5 (309*).

Loriloceras SPATH, 1928 [**Neumayriceras kormosi* LOCZY, 1915; SD ROMAN, 1938]. Involute, resembles *Proscaphites* but differs by lacking clavi and developing smooth body chamber. *M.Jur.*

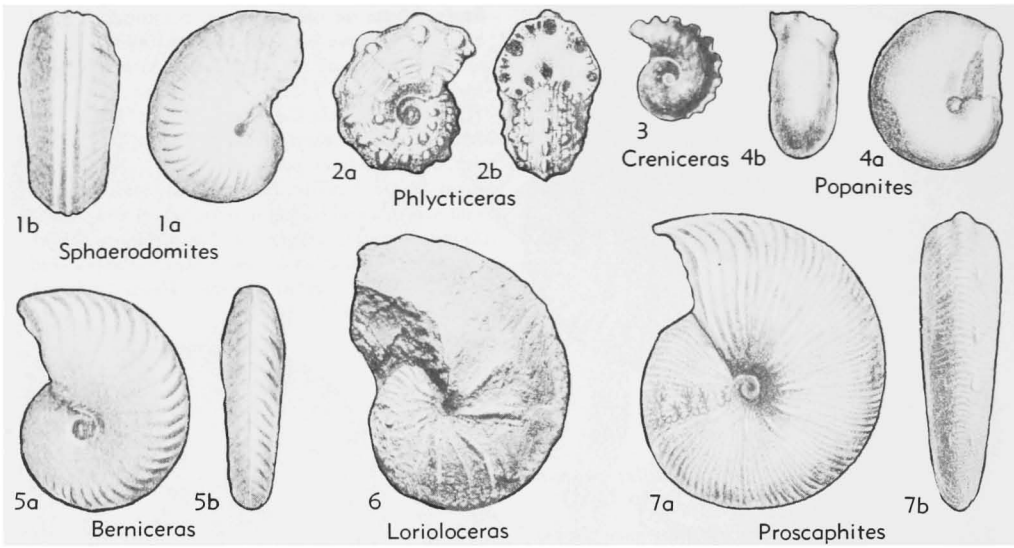


FIG. 334. Oppeliidae (Taramelliceratinae, Phlycticeratinae) (p. L281-L283).

(Callov.), SE.Eu.-Cutch.——FIG. 334,*6*. **L. kormosi* (LOCZY), Hung.; ×0.7 (263*).

Berniceras JEANNET, 1951 [**Oppelia inconspicua* DE LORIOL, 1898]. Involute, resembles *Proscaphites* but differs by lack of clavi, simple unbeaded keel, and fading of ribs on inner half of whorl sides. *U.Jur.(L.Oxf.)*, Eu.——FIG. 334,*5*. **B. inconspicuum* (LORIOL), Switz.; *5a,b*, ×2 (265*).

Acanthaecites ROLLIER, 1909 [**Am. velox* OPPEL, 1862]. Small globose derivative of *Proscaphites*, smooth except for median ventral row of sharp, distant serrations, which die out on body chamber. *M.Jur.(U.Callov.)*, Ger.——FIG. 327,*4*. **A. velox* (OPPEL); *4a,b*, ×1 (327*).

Creniceras MUNIER-CHALMAS, 1892 [**Am. renggeri* OPPEL, 1863] [=*Bukowskites* JEANNET, 1951 (*non* DIENER, 1905)]. Small, compressed, smooth, except for median row of blunt coxcomb serrations on body chamber, which coils excentrically; may have some outer ribbing; with lappets. *U.Jur. (Oxf.)*, Eu.-Syria.——FIG. 334,*3*. **C. renggeri* (OPPEL), Eng.; ×1 (7*).

Scaphitodites BUCKMAN, 1924 [**S. navicula*]. Small, moderately compressed to globose, completely smooth, body chamber coiling excentrically. *U.Jur. (L.Oxf.)*, Eu.-Syria.——FIG. 327,*5*. **S. navicula*, Eng.; *5a,b*, ×1 (65*).

Popanites ROLLIER, 1909 [**Am. paturattensis* GREPPIN, 1870]. Small, involute, smooth, with minute umbilicus to end; body chamber not excentrically coiled but ends with constriction and trumpet-shaped lateral expansion. *U.Jur.(Oxf.)*, Switz.-Pol. ——FIG. 334,*4*. **P. paturattensis* (GREPPIN), Switz.; *4a,b*, ×1 (266*).

Sphaerodomites ROLLIER, 1909 [**Am. calcaratus* COQUAND, 1853]. Small globular development of *Proscaphites*, with tabulate tricarinate-bisulcate venter as in *Frechiella* and *Poecilomorphus*. *U.Jur. (L.Oxf.)*, Fr.-Switz.——FIG. 334,*1*. **S. calcaratus* (COQ.); *1a,b*, ×1 (265*).

Subfamily PHLYCTICERATINAE Spath, 1928

For *Phlycticeras*, a highly specialized cryptogenic genus strongly resembling the Bajocian *Strigoceras*, and in some features recalling the Bathonian *Micromphalites*. QUENSTEDT (1887, p. 752), ROLLIER (1909, p. 617), and others did not doubt direct descent from *Strigoceras*, but main resemblance lies in the strigation, which occurs in some other families including Sonniniidae, favored by SCHEURLEN (1928, p. 37) as ancestors. The striking resemblance, especially of inner whorls, to some Oxfordian *Cardio-*

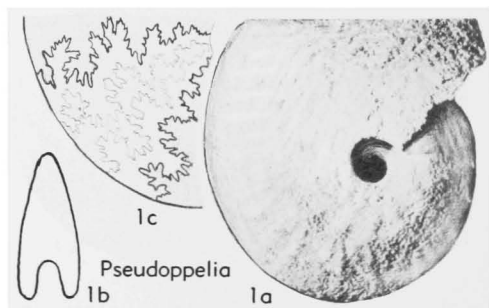


FIG. 335. *Streblites (Pseudoppelia) oxynotus* (LEANZA), U.Jur.(L.Kimm.), Arg. (p. L284).

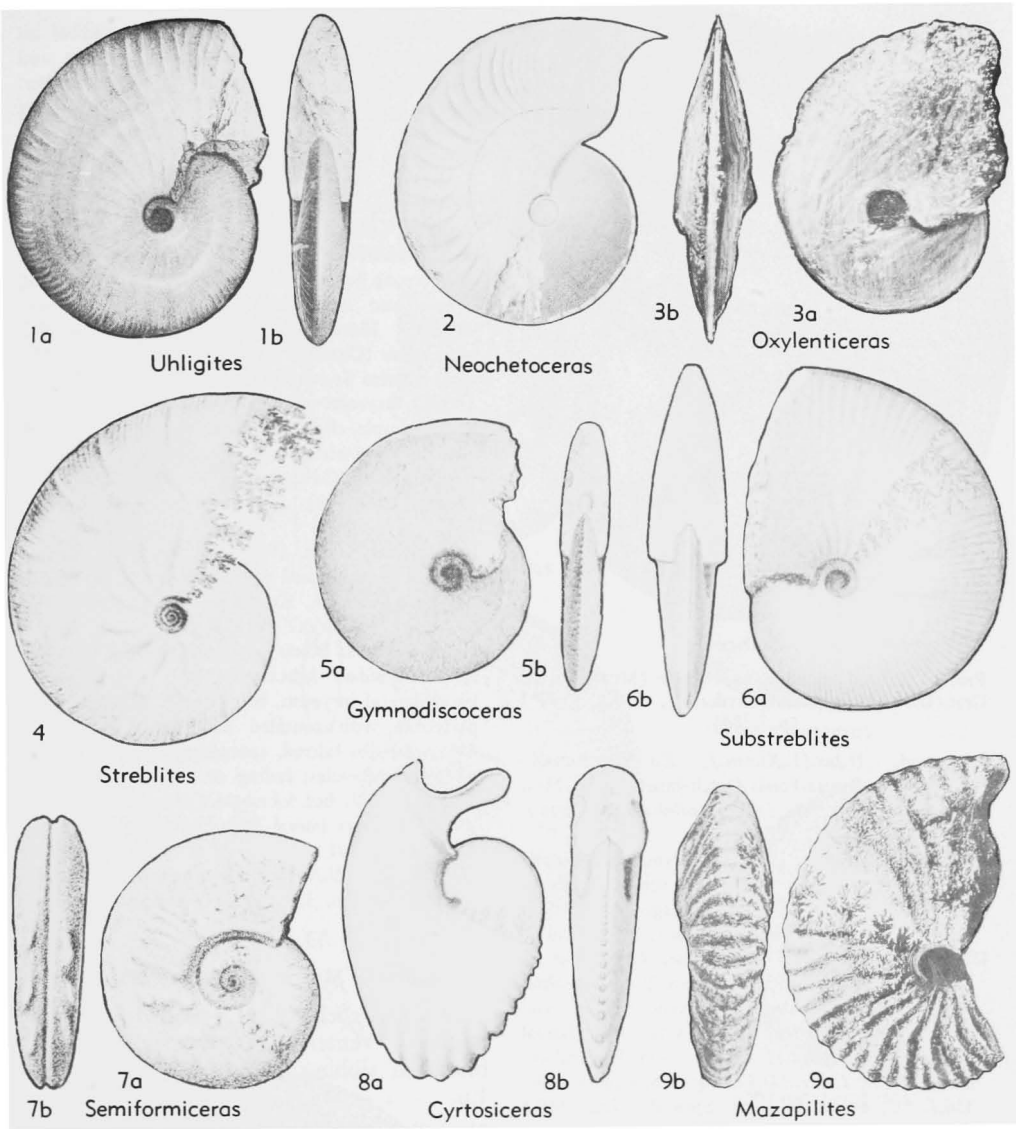


FIG. 336. Oppeliidae (Streblitinae, Mazapilitinae) (p. L283-L284).

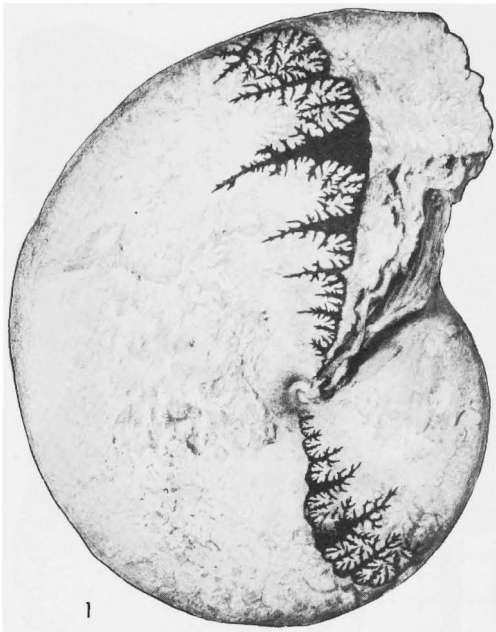
ceras (pointed out by LOCZY, 1915, p. 313) might be taken to point to affinity with Stephanoceratacea, alongside *Chamoussetia;* and BUCKMAN (1914, pl. 98) even figured a *Chamoussetia* as *Phlycticeras*. But the true derivation is more likely to be from some Bathonian Oppeliinae, perhaps via *Strungia* (409, 466). *M.Jur.(Callov.)*.

Phlycticeras HYATT, 1900 [*pro Lophoceras* PARONA & BONARELLI, 1895 (*non* HYATT, 1893)] [**Nautilus pustulatus* REINECKE, 1818]. Involute, feebly but coarsely ribbed, bituberculate, strongly strigate, with serrated keel and moderately complex sutures. *L.Callov.-U.Callov.*, Eu.-Alg.-Cutch.——FIG. 334, 2. **P. pustulatum* (REIN.), Ger.; 2*a,b*, ×1 (688*).

Subfamily STREBLITINAE Spath, 1925

Involute, compressed, typically more or less oxycone, with complex sutures (70, 466, 533). *U.Jur.(Kimm.)-L.Cret.(Hauteriv.)*, world-wide.

Streblites HYATT, 1900 [**Am. tenuilobatus* OPPEL, 1862]. Oxycone with falcoid primary and ventral secondary ribbing, resembling *Oppelia subradiata* (Baj.). Sutures highly complex, lobes thin-



Bornhardticeras

FIG. 337. *Bornhardticeras discoidale* (MÜLLER), L. Cret.(U.Neocom.), Tanganyika; *1*, ×0.3 (590*) (p. L284).

stemmed. *U.Jur.(L.Kimm.)*, Eu.-Alg.-Somali.-Tangan.-S. Russia-Persia-Cutch-Japan-Philip.-Mex. ——FIG. 336,*4*. **S. (S.) tenuilobatus* (OPPEL), Ger.; holotype, ×1 (358*).

Pseudoppelia LEANZA, 1946 [**P. oxynota*]. Externally resembles *Streblites* but sutures simpler. Subgen. of *Streblites*. *U.Jur.(L.Kimm.)*, Arg.——FIG. 335, *1*. **S. (P.) oxynotus* (LEANZA); *1a-c*, ×0.7 (256*).

Uhligites KILIAN, 1907 [**Streblites kraffti* UHLIG, 1903; SD ROMAN, 1938]. Differs from *Streblites* by its rounded venter, obsolescent ribbing, and very elaborate sutures with enormous 1st lateral lobe. *U.Jur.(Tithon.)*, Himalaya-Madag.-Indon.-N.Am.-Mex.; *L.Cret.(U.Valang.)*, Madag.——FIG. 336,*1*. **U. kraffti* (UHLIG), Spiti sh.; *1a,b*, ×0.3 (533*).

Gymnodiscoceras SPATH, 1925 [**Oppelia acucincta* BLANFORD in UHLIG, 1903]. Oxycone with finely serrated keel. Sutures simpler than for subfamily. *Spiti sh.*, Himalaya; *?Tithon.*, Moravia.——FIG. 336,*5*. **G. acucincta* (BLAND.), Spiti sh.; *5a,b*, ×0.7 (533*).

Substreblites SPATH, 1925 [**Am. zonarius* OPPEL in ZITTEL, 1868]. Like *Streblites* but venter with narrow, raised flat fillet, and sutures having more numerous and narrower lobes. *U.Jur.(Tithon.)*, Moravia-Crimea; *L.Cret.(Valang.)*, Fr.-Aus.-SaltR. ——FIG. 336,*6*. **S. zonarius* (OPPEL), Stramberg; *6a,b*, ×1 (575*).

Semiformiceras SPATH, 1925 [**Am. fallauxi* OPPEL in ZITTEL, 1870]. Evolute; venter with minute median serrations which give place to groove on last whorl; some irregular lateral tubercles and elongate, oblique lateral bullae on body chamber. *Tithon.*, Moravia.——FIG. 336,*7*. **S. fallauxi* (OPPEL), Stramberg; *7a,b*, ×1 (576*).

Cyrtosiceras HYATT, 1900 [**Am. macrotelus* OPPEL in ZITTEL, 1868]. Compressed, very involute, venter minutely serrated, sutures complex, with thin-stemmed lobes; body chamber coiled excentrically, at half-whorl before end developing an elbow bend with strong beaded ventral folds, finally becoming simple and contracted, with spatulate lappets. *Tithon.*, Moravia-Crimea.——FIG. 336,*8*. **C. macrotelus* (OPPEL), Stramberg; *8a,b*, ×1 (575*).

Neochetoceras SPATH, 1925 [**Am. steraspis* OPPEL, 1863]. Oxycone strongly resembling *Oxycerites;* venter simple, sharp; some falcate ribbing on outer half of outer whorl; aperture sinuous, rostrate. *M. Kimm.*, S.Eu.-C.Eu.-Somali.——FIG. 336,*2*. **N. steraspis* (OPPEL), Solnhofen sl., Ger.; ×0.5 (327*).

Oxylenticeras SPATH, 1950 [**O. lepidum*]. Smooth oxycone with closed umbilicus and very acute periphery. *Tithon.*, Kurdistan.——FIG. 336,*3*. **O. lepidum; 3a,b*, ×0.7 (713*).

?Bornhardticeras BÖHM & RIEDEL, 1933 [**Placenticeras discoidale* MÜLLER, 1900]. Whorl section quadrilateral in youth, heightening with age; adult platycone with rounded keel-less venter, as in *Uhligites;* ribs falcoid, sporadically bearing 2 rows of lateral tubercles; fading on adult. Sutures as in *Oppelia (s.s.)*, but lobes thick-based, long, tapering, with short lateral branches, as in Aconeceratinae; 1st lateral saddle divided by large accessory (69, 71, 466). *U.Neocom.(Trigonia schwarzi bed)*, Tangan.——FIG. 337,*1*. **B. discoidale* (MÜLLER); ×0.3 (590*).

Subfamily MAZAPILITINAE Spath, 1928

Involute shells with rounded or gently tabulate venter and coarse, foldlike, branched ribbing. *U.Jur.(Kimm.)*, Mex.-S. Eu.

Mazapilites BURCKHARDT, 1919 [**M. symonensis;* SD ROMAN, 1938]. Ribbing strong, irregularly biplicate, fading on last whorl except on ventral half, as in *Morrisiceras* and *Pachyceras*. Sutures complex, most resembling *Streblites*. *M.Kimm.-U.Kimm.*, Mex.——FIG. 336,*9*. **M. symonensis; 9a,b*, ×0.7 (71*).

Eurynoticeras CANAVARI, 1897 [**E. paparellii;* SD ROMAN, 1938]. Similar to *Mazapilites* but ribbing weaker and branching more indefinitely. Sutures differ only by having lobes somewhat less deeply divided. ZITTEL (1896) considered genus transitional "from the Oppeliidae to the Haploceratidae"; SPATH (1928) put it in Taramelliceratinae. *L. Kimm.-M.Kimm.(acanthicus beds)*, Italy.——FIG. 338,*4*. **E. paparellii; 4a,b*, ×0.7 (597*).

Subfamily ACONECERATINAE Spath, 1923
[as Aconeceratidae]

Fairly small, involute and compressed, with flat or slightly convex sides and usually a keeled venter. Aperture with weak to strong rostrum and lappets. Shell smooth or with flexuous to falcate striae or ribs which follow line of sutures, 2nd lateral saddle of which tends to project well beyond 1st. This feature distinguishes the family from any similar Desmoceratidae. The subfamily is probably a compact group derived in the Valanginian or Lower Hauterivian from Streblitinae, from which, indeed, it is hard to differentiate Aconeceratinae satisfactorily (76). *L.Cret.(L.Hauteriv.-U.Alb.)*.

Protaconeceras Casey, 1954 [**Oppelia patagoniensis* Favre, 1908]. Sides relatively convex, keel coarse-

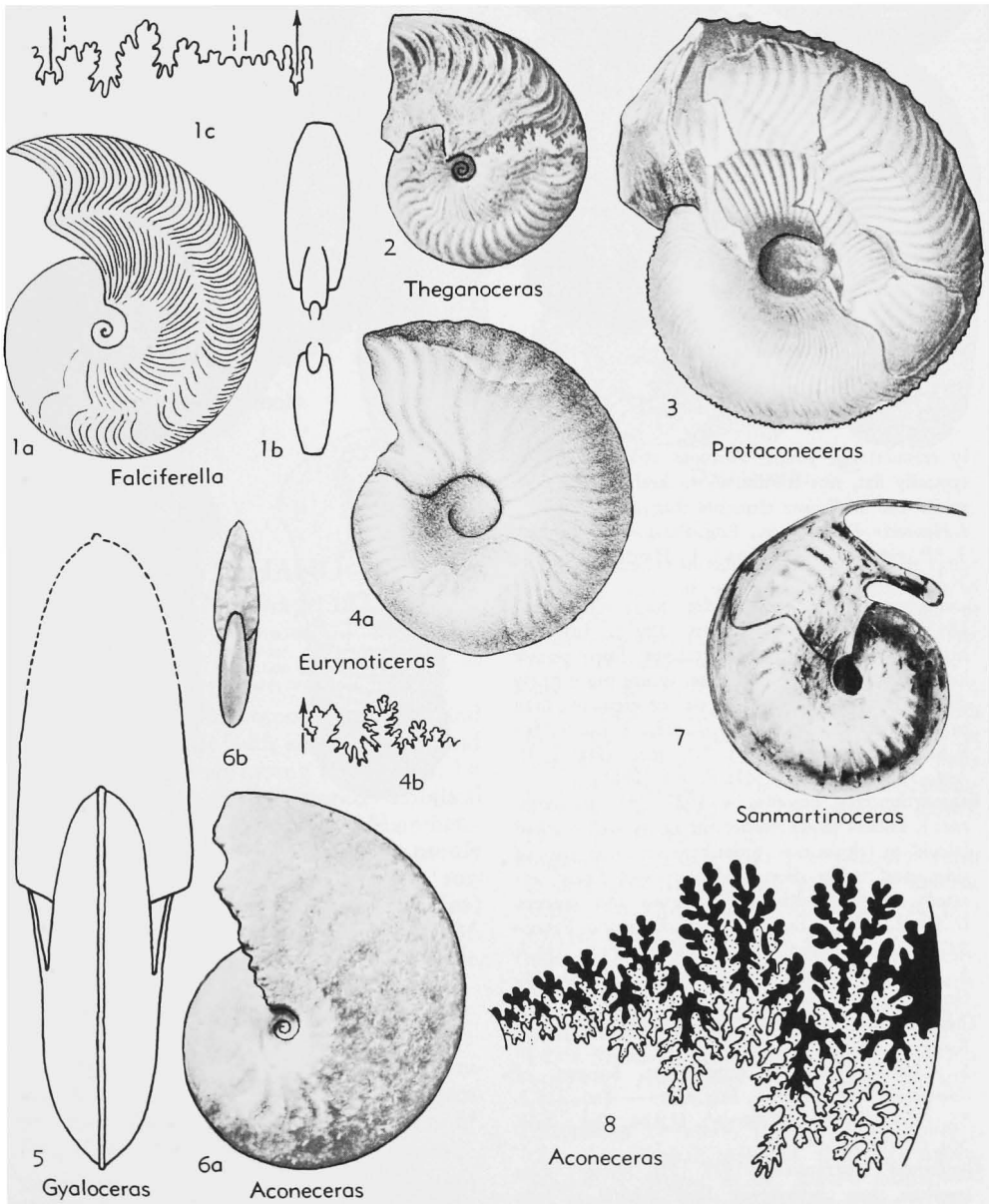


Fig. 338. Oppeliidae (Mazapilitinae, Aconeceratinae) (p. L284-L286).

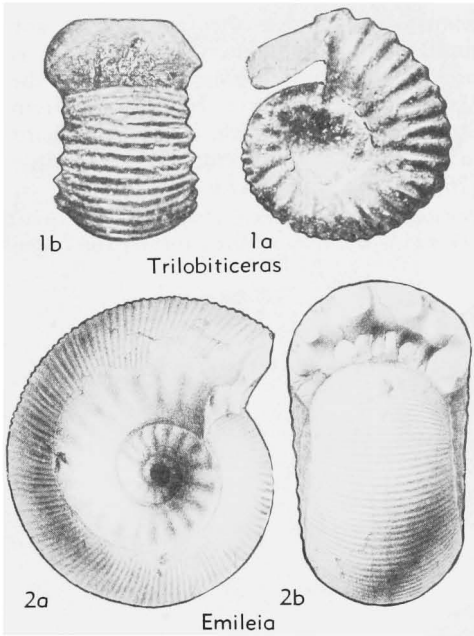


FIG. 339. Otoitidae (p. L287).

ly crenulate in youth. Flexuous striae or feeble, typically flat, ribs continuous to keel. Suture with wider and shallower elements than in *Aconeceras*. *L.Hauteriv.-U.Hauteriv.*, Eng.-Patag.——FIG. 338, *3*. **P. patagoniense* (FAVRE), L. Hauteriv., Patag.; ×2 (619*).

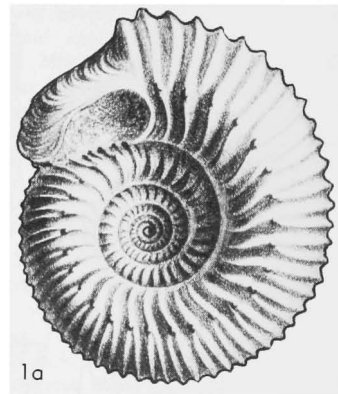
Aconeceras HYATT, 1903 [**Am. nisus* D'ORBIGNY, 1841] [=*Adolphia* STOLLEY, 1907]. Involute, high-whorled with flat sides and very finely serrate keel. Radial line more angulate, suture more finely divided and with narrower, deeper elements than in *Protaconeceras*. *U.Barrem.-L.Alb.*, W.Eu.-S.Afr.-E.Austral.——FIG. 338,*6,8*. **A. nisus* (ORB.), U. Apt., Fr.; *6a,b*, ×1.5, ×1; *8*, ×4 (696*).

Sanmartinoceras BONARELLI, 1921 [**S. patagonicum*]. Differs from *Aconeceras* in its well-marked falcoid to falcate ribs, prominent on outer part of sides, and in its shorter folioles; keel finely serrated; aperture with long rostrum and lappets. *U.Apt.-L.Alb.*, W.Eu.-W.Austral.-E.Austral.-Patag.-S.Georgia-AlexanderLand-Greenl. —— FIG. 338,*7*. *S. (S.) groenlandicum* ROSENKRANTZ, U.Apt., Greenl.; ×1 (694a*).

Theganoceras WHITEHOUSE, 1927 [**Oppelia scalata* KOENEN, 1902]. Ribs more acutely falcate than in *S. (Sanmartinoceras)*, dense, flat. Subgen. of *Sanmartinoceras*. U.Apt., Eng.-Ger.——FIG. 338,*2*. **S. (T.) scalatum* (KOENEN), U.Apt., Ger.; *2a,b*, ×1 (237*).

Gyaloceras WHITEHOUSE, 1927 [**G. smithi*]. Less involute than *Aconeceras;* later whorls at least more inflated, sides flat or convex; venter successively fastigate, subcarinate, and broadly rounded. Shell smooth. *U.Apt.-U.Alb.*, Eng.-Nigeria-Queensl.——FIG. 338,*5*. **G. smithi*, U.Apt., Queensl.; ×0.75 (567*).

Falciferella CASEY, 1954 [**F. millbournei*]. Flat-sided with rounded, then feebly carinate, then flat venter; with irregular fine, dense, falcate riblets or striae. Suture simpler than in *Aconeceras*, with reduced auxiliaries. *M.Alb.*, Eng.——FIG. 338,*1*. **F. millbournei; 1a,b*, ×2; *1c*, ×4 (76*).



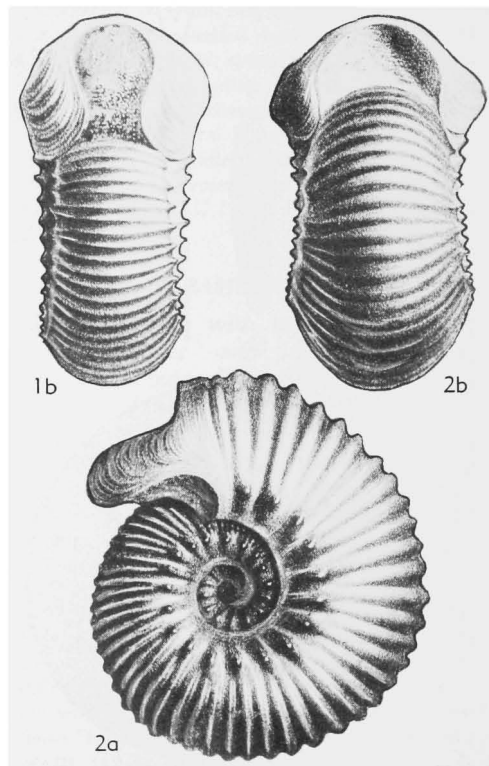


FIG. 340. Otoitidae (p. L287-L289).

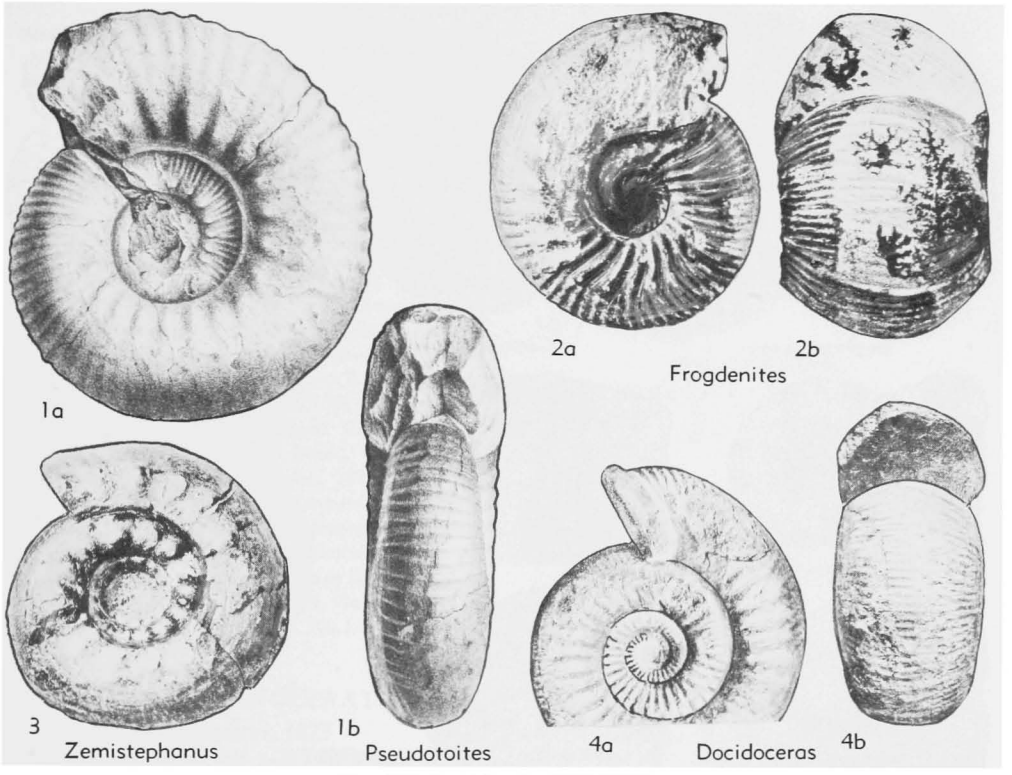


FIG. 341. Otoitidae (p. L287-L289).

Superfamily STEPHANOCERATACEAE Neumayr, 1875

[*nom. transl.* J.P.SMITH in ZITTEL-EASTMAN, 1913 (*ex* Stephanoceratidae FISCHER, 1882, *nom. correct. pro* Stephanoceratinen NEUMAYR, 1875) validation proposed ARKELL, ICZN 1955] [=Stepheoceratacea BUCKMAN, 1919]

Planulates, sphaerocones, cadicones and oxycones, generally with sharp ribbing and complex suture lines having a dominant 1st lateral lobe and well-developed umbilical lobe. Believed to be derivatives of Hammatoceratidae. Aptychi believed to be mostly granulated (Granulaptychus) or with surface ribbed concentrically (Praestriaptychus) (15, 20, 64, 65, 269, 270, 428, 552, 557). *M. Jur.(M.Baj.)-U.Jur.(L.Kimm.)*, world-wide.

Family OTOITIDAE Mascke, 1907

[Includes Normannitinae WESTERMANN, 1954]

Coiling at first cadicone, becoming planulate, with reduced and excentric body chamber. Derivatives of *Erycites* (20, 561). *M. Jur.(M.Baj.)*.

Docidoceras BUCKMAN, 1919 [**D. cylindroides*]. Differs from the ancestral *Erycites* and *Abbasites* only by complete loss of keel and all signs of ventral discontinuity in ribbing. Includes a wide range of forms, some of which probably gave rise to Otoitidae, some to Stephanoceratidae, some to Sphaeroceratidae. *M.Baj.*, Eu.-N.Afr.-Ore.——FIG. 341,*4*. **D. cylindroides*, Eng.; *4a,b*, ×0.3 (65*).

Emileia BUCKMAN, 1898 [**Am. brocchii* J.SOWERBY, 1818] [*Emileites* BUCK., 1927]. Large forms with fine ribbing and many secondaries; cadicone at first, with excentric, more or less smooth body chamber. *M.Baj.*, Eu.-N.Afr.-Cauc.-Pamir-S.Alaska-S.Am.——FIG. 339,*2*. **E. (E.) brocchii* (SOW.), Eng.; *2a,b*, holotype, ×0.3 (595*).

Frogdenites BUCKMAN, 1921 [**F. spiniger*]. Small *Emileia* with lateral spines. Subgen. of *Emileia*. *M.Baj.*, Eu.-Tibet-Can.——FIG. 341,*2*. **E. (F.) spiniger* (BUCK.), Eng.; *2a,b*, ×1 (65*).

Otoites MASCKE, 1907 [**Am. sauzei* D'ORBIGNY, 1846]. Inner whorls cadicone, last whorl contracted; ribs coarse, with long secondaries springing from low lateral tubercles; large lappets. *M.Baj.*, Eu.-N. Afr.-Cauc.-Persia-W.Austral.-S.Am.——FIG. 340,*2*. **O. (O.) sauzei* (ORB.), Fr.; *2a,b*, ×0.7 (330*).

Trilobiticeras BUCKMAN, 1919 [**T. trilobitoides*]. Coarse-ribbed small cadicones with large lappets. Subgen. of *Otoites*. *M.Baj.*, Eu.-?W.Austral.——FIG. 339,*1*. **O. (T.) trilobitoides* (BUCK.), Eng.; *1a,b*, ×1 (65*).

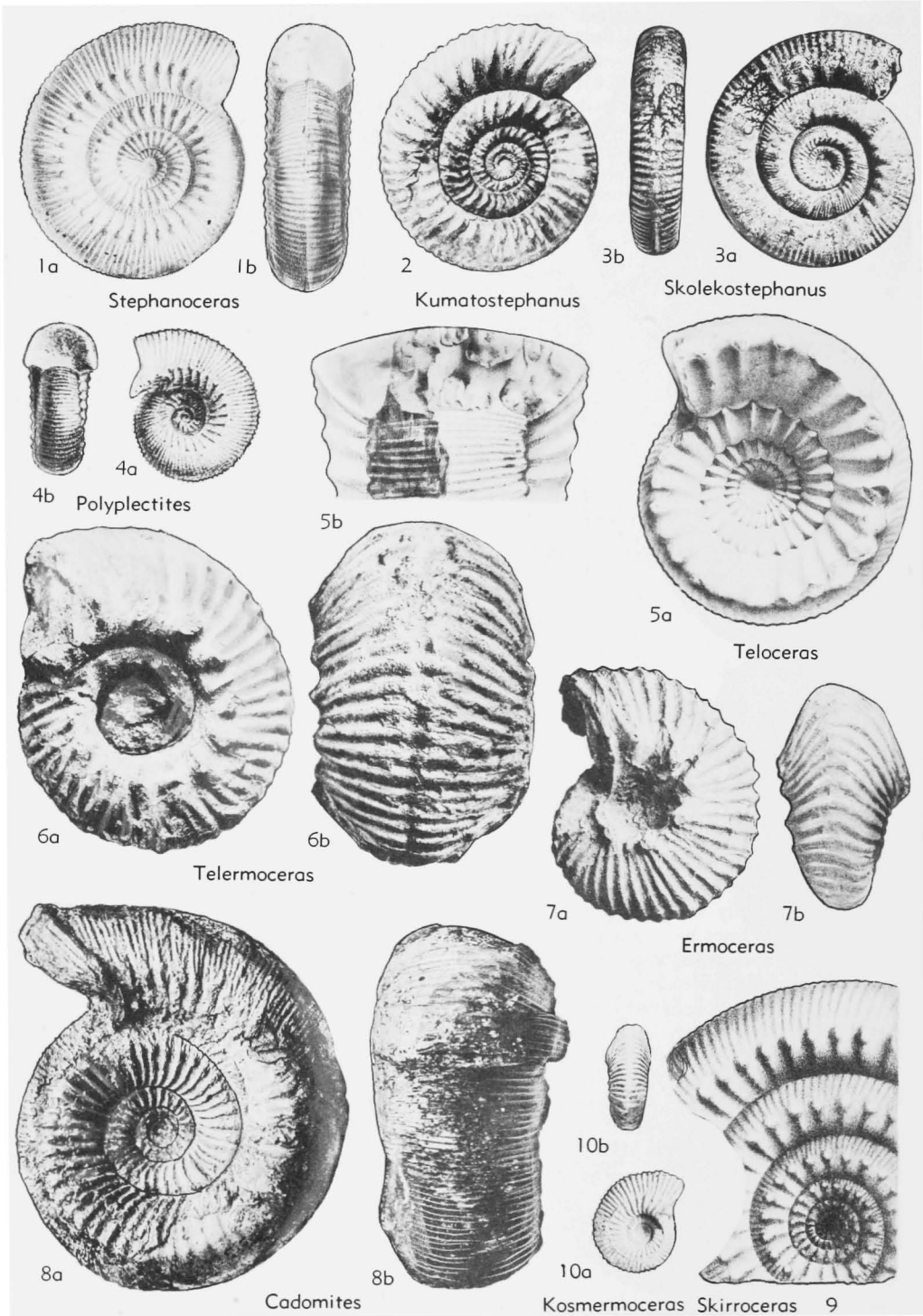


FIG. 342. Stephanoceratidae (p. L289-L290).

Pseudotoites SPATH, 1939 [**Stephanoceras leicharti* NEUMAYR, 1885]. Similar to *Emileia* but differs by possessing shorter primary ribs with tubercles or bullae on umbilical edge, as in *Otoites*, and retaining its long secondary ribbing to end. Aperture gently collared and lipped. *M.Baj.*, W.Austral.-Indon.-S.Alaska-Can.-Arg. —— FIG. 341,*1*. **P. leicharti* (NEUMAYR), W.Austral.; *1a,b*, ×1 (667*).

Zemistephanus MCLEARN, 1927 [**Am. richardsoni* WHITEAVES, 1876]. Coronate forms allied to *Emileia* and *Pseudotoites* but retaining coronate form to end. Aperture collared and lipped. *M.Baj.*, Can.-S.Alaska-N.USA-W.Austral.——FIG. 341,*3*. **Z. richardsoni* (WHIT.), Can.; ×0.3 (269*).

Normannites MUNIER-CHALMAS, 1892 [**N. orbignyi* BUCKMAN, 1908, ICZN Opinion 309] [*Epalxites* MASCKE, 1907; *Masckeites* BUCK., 1920; *Kanastephanus, Itinsaites* MCLEARN, 1927; *Parallites, Platystomites, Gerzenites, Germanites* WESTERMANN, 1954]. Evolute developments of *Otoites*, with lengthened primary ribs, shorter secondaries, and reduced 2nd lateral lobe. Large lappets. *M.Baj.*, Eu.-N. Afr.-Sinai-Cauc.-Persia-N. Guinea-S.Alaska-Can.-Ore.-Calif.-Mex.——FIG. 340,*1*. **N. orbignyi*, Fr.; *1a,b*, ×0.7 (330*).

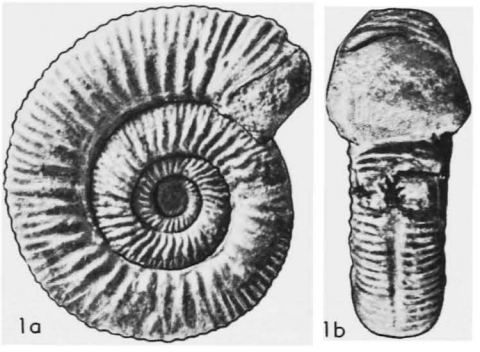
Family STEPHANOCERATIDAE Neumayr, 1875

[*nom. correct.* FISCHER, 1882 (*pro* Stephanoceratinen NEUMAYR, 1875, invalid vernacular name) validation proposed ARKELL, 1955, ICZN 1955] [=Stepheoceratidae BUCKMAN, 1898; Stemmatoceratidae MASCKE, 1907]

Planulates and coronates with sharp ribbing, in many tuberculate at point of furcation. *M.Jur.(M.Baj.-Bath.), ?M.Jur.(Callov.).*

Stephanoceras WAAGEN, 1869 [**Am. humphriesianus* J.DEC.SOWERBY, 1825; SD BUCKMAN, 1898 (ICZN Opinion 324)] [*Stepheoceras* BUCK., 1898 (obj.); *Stephoceras* ROLLIER, 1911 (obj.); *Grahamites* KILIAN & REBOUL, 1909; *Kallistephanus, Rhytostephanus* BUCK., 1921; *Mollistephanus* BUCK., 1922; *Kreterostephanus* BUCK., 1927; *Brodiaeia* ROCHÉ, 1939 (*non* BUCK., 1898)]. Moderately stout tuberculate planulates; ribbing sharp, entire on the venter; aperture collared and lipped. *M.Baj.*, Eu.-N.Afr.-Sinai-C.Arabia-Kenya-Cauc.-Azerbaijan-Persia-N.Guinea-Indon.-S.Alaska-Can.-S.Am. —— FIG. 342,*1*. **S. (S.) humphriesianum* (Sow.), Eng.; *1a,b*, holotype, ×0.3 (595*).

Skirroceras MASCKE, 1907 [**Am. humphriesianus macer* QUENSTEDT, 1886] [*Oecostephanus* BUCKMAN, 1921; *Bayleia, Dolichoecus, Freycinetia* ROCHÉ, 1939]. Many-whorled, serpenticone *Stephanoceras;* at least some species with trumpet-like expansion of peristome. Subgen. of *Stephanoceras. M.Baj.*, Eu.-N.Afr.-Cauc.-Ore.——FIG. 342, *9*. **S. (S.) macrum* (QUENST.), Ger.; ×0.3 (360*).



Phaulostephanus

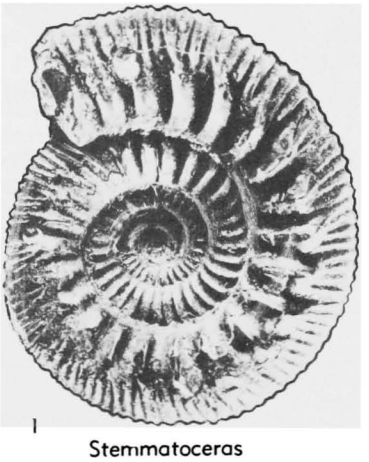
FIG. 343. *Stephanoceras (Phaulostephanus) paululum* (BUCKMAN), M.Jur.(M.Baj.), Eng.; *1a,b*, ×1 (65*) (p. L289).

Phaulostephanus BUCKMAN, 1927 [**P. paululus*] [*Romania* ROCHÉ, 1939 (obj.)]. Small, without tubercles. Subgen. of *Stephanoceras. M.Baj.*, Eu. ——FIG. 343,*1*. **S. (P.) paululum* (BUCK.), Eng.; *1a,b*, ×1 (65*).

Skolekostephanus BUCKMAN, 1921 [**S. skolex*]. With short primary and long secondary ribs which branch from umbilical nodes. Subgen. of *Stephanoceras. M.Baj.*, Eu.——FIG. 342,*3*. **S. (S.) skolex* (BUCK.), Eng.; *3a,b*, ×0.3 (65*).

Stemmatoceras MASCKE, 1907 [**Am. humphriesianus coronatus* QUENSTEDT, 1886 (=*S. frechi* RENZ, 1913)]. Similar to *Stephanoceras* but stouter, more involute, transitional to *Teloceras*. Aperture simple. *M.Baj.*, Eu.-Cauc.-W.Austral.-S.Alaska-Can.-Wyo.-Idaho.——FIG. 344,*1*. **S. frechi* RENZ, Ger.; holotype, ×0.7 (730*).

Teloceras MASCKE, 1907 [**Am. blagdeni* J.SOWERBY, 1818] [*Blagdenia* ROCHÉ, 1939 (obj.)]. Close to *Stemmatoceras* but with cadicone coronate stage



Stemmatoceras

FIG. 344. *Stephanoceras (Stemmatoceras) frechi* RENZ, M.Jur.(M.Baj.), Ger.; *1*, ×0.7 (730*) (p. L289).

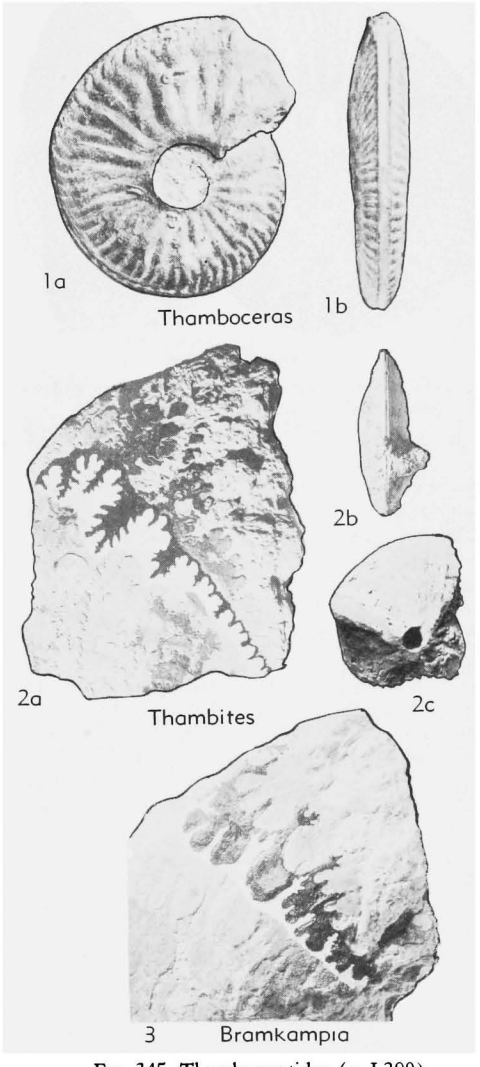


FIG. 345. Thamboceratidae (p. L290).

persisting to end; aperture simple. *M.Baj.-U.Baj.*, Eu.-Indon.-S. Alaska-Can.-Mont.-S. Am. —— FIG. 342,*5*. **T. blagdeni* (Sow.), Eng.; *5a,b*, holotype, ×0.3 (595*).

Kumatostephanus BUCKMAN, 1922 [**K. kumaterus*] [*Gibbistephanus* BUCK., 1928]. Early nontuberculate forms of perisphinctoid appearance. *M.Baj. (sowerbyi z.)*, Eu.——FIG. 342,*2*. **K. kumaterus*, Eng.; ×0.2 (65*).

Cadomites MUNIER-CHALMAS, 1892 [**Am. deslongchampsi* DEFRANCE in D'ORBIGNY, 1846 (ICZN Opinion 324)] [*Polystephanus* BUCKMAN, 1922 (*non* BRANDT, 1835); *Stegeostephanus* BUCK., 1922; *Deslongchampsia* ROCHÉ, 1939 (*non* MORRIS & LYCETT, 1851)]. Direct derivatives of *Stephanoceras*, with similar collared and lipped peristome but denser, finer, sharper ribbing. *U.Baj.-Bath, ?L. Callov.*, Eu.-N.Afr.-Kenya-Madag.-Azerbaijan-Persia-Cutch-Indon.-N.Guinea.——FIG. 342,*8*. **C. deslongchampsi* (ORB.), U.Baj., Fr.; *8a,b*, lectotype, ×0.7 (675*).

Polyplectites MASCKE, 1907 [**Am. linguiferus* D'ORBIGNY, 1846]. Resembles *Cadomites* but smaller and with lappets; ribbing though fine and dense is less sharp. *?U.Baj., Bath.*, Eu.-N.Afr.-S.Alaska. ——FIG. 342,*4*. **P. linguiferus* (ORB.), M.Bath., Fr.; *4a,b*, ×1 (330*).

Ermoceras H.DOUVILLÉ, 1916 [**E. mogharense*]. Strong primary and secondary ribs, with single row of lateral tubercles more or less emphasized and deep ventral groove. *U.Baj.*, C.Arabia-Sinai-Alg.——FIG. 342,*7*. **E. (E.) mogharense*, Sinai; *7a,b*, ×0.7 (132*).

Telermoceras ARKELL, 1952 [**Coeloceras coronatoides* H.DOUVILLÉ, 1916]. Coronate *Ermoceras* with depressed whorls, coarse secondary ribs, and deep umbilicus surrounded by large tubercles or spines. Subgen. of *Ermoceras*. *U.Baj.*, Sinai-C. Arabia.——FIG. 342,*6*. **E. (T.) coronatoides*, Sinai; *6a,b*, ×0.5 (132*).

Kosmermoceras ARKELL, 1952 [**Ermoceras runcinatum*]. With high, compressed whorls, fine sharp to coarse ribbing, and tabulate venter. Subgen. of *Ermoceras*. *U.Baj.*, C.Arabia-Sinai-Alg.——FIG. 342,*10*. **E. (K.) runcinatum*, C.Arabia; *10a,b*, ×0.7 (15*).

Family THAMBOCERATIDAE Arkell, 1952

Bicarinate oxycones with ribbing of clydoniceratid style or obsolete, and highly variable degenerated sutures resembling those of Oxynoticeratidae and Clydoniceratidae. Believed to be derived from *Ermoceras* (15). *M.Jur.(U.Baj.-L.Bath.)*, Middle East.

Thamboceras H.DOUVILLÉ, 1916 [**T. mirum*]. Primary and secondary ribbing of clydoniceratid style; venter concave, smooth; umbilicus moderately small. *U.Baj.*, Sinai-C.Arabia.——FIG. 345, *1*. **T. mirum*, Sinai; *1a*, ×0.75; *1b*, ×1 (132*).

Thambites ARKELL, 1952 [**T. planus*]. Ribbing obsolete; umbilicus minute; concave venter a mere groove between keels. Sutures highly variable, with tendency to form an adventitious lobe. *L.Bath.*, C.Arabia.——FIG. 342,*2*. **T. planus; 2a*, ×2.8; *2b,c*, ×0.7 (15*).

Bramkampia ARKELL, 1952 [**B. steinekei*]. Ribbing obsolete. Sutures extremely degenerated, with nearly smooth saddles and numerous short, irregular, bud- or candelabra-shaped lobes, as in Cretaceous genera like *Engonoceras, Knemiceras, Lybicoceras*. *L.Bath.*, C.Arabia.——FIG. 345,*3*. **B. steinekei*; ×0.7 (15*).

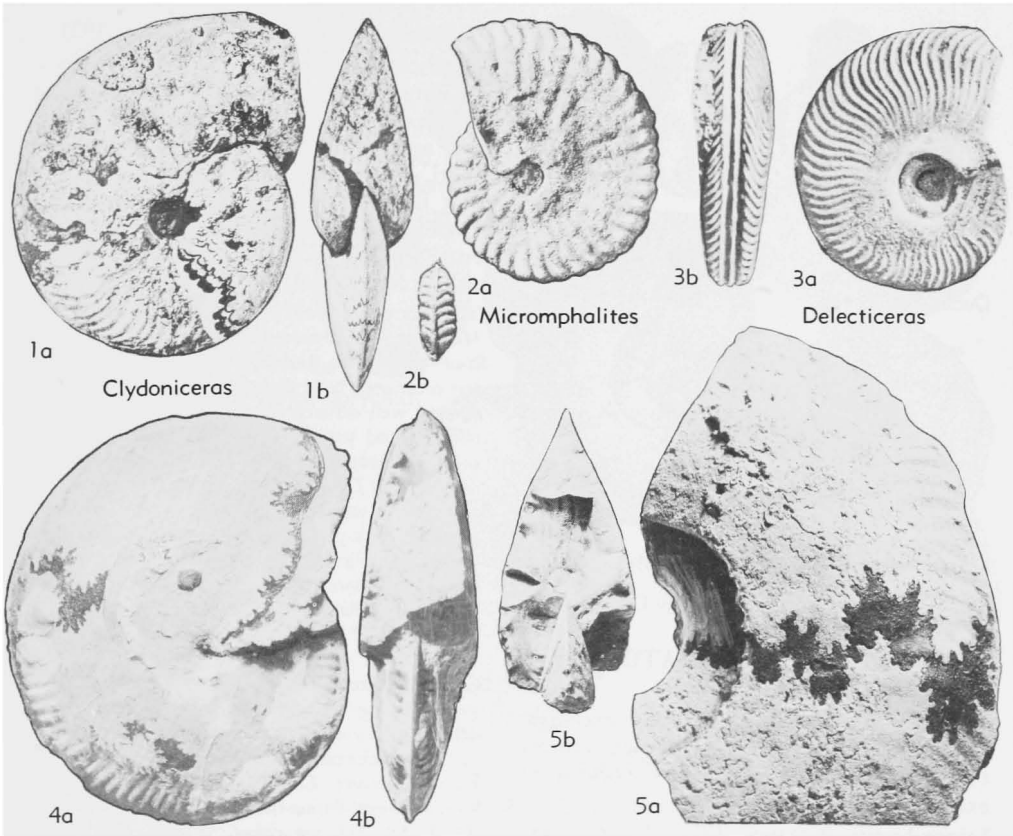


FIG. 346. Clydoniceratidae (p. L291).

Family CLYDONICERATIDAE Buckman, 1924

Oxycones, believed to be derived from Thambitidae by closing of ventral groove and fusion of the 2 keels. Sutures highly variable and degenerated, some resembling those of specialized hildoceratid offshoots (Bouleiceratinae) (14, 15). *M.Jur.(Bath.),* Eu.-N.Afr.-Middle East-Madag.

Clydoniceras BLAKE, 1905 [**Am. discus* J.SOWERBY, 1813] [=*Harpoceratidarum* POMPECKJ, 1906; *Benedictites* BUCKMAN, 1924]. Smooth or with gently falcoid ribs; tall keel on early whorls, lost later, when venter becomes acute; umbilicus minute or occluded, except in last whorl. Accessory lobes of sutures tend to be digitate. *M.Bath.-U.Bath.*, Eu.-N.Afr.-Sinai-C.Arabia - Baluch. - Madag. —— FIG. 346,*1*. **C. discus* (Sow.), Eng.; *1a,b,* holotype, ×0.5 (14*).

Delecticeras ARKELL, 1951 [**D. delectum*]. Venter tricarinate-bisulcate, at least on middle and outer whorls; ribbing as in *Clydoniceras,* but umbilicus wider. *U.Bath.*, Eu.——FIG. 346,*3*. **D. delectum*, Eng.; *3a,b,* ×1 (14*).

Micromphalites BUCKMAN, 1923 [**Am. micromphalus* PHILLIPS, 1871] [=*Neactinoceras* SPATH, 1924 (obj.)]. Cross section fusiform, owing to circumumbilical bulge; venter square-shouldered, with persistent tall keel; ribs coarse, usually with more or less incipient inner or outer tubercles or both; umbilicus narrow, deep, cylindrical, suddenly opening out on last whorl. *L.Bath.-M.Bath.*, Eu.-Alg.-Sinai-C.Arabia-Madag.——FIG. 346,*2*. **M. (M.) micromphalus* (PHILL.), Eng.; *2a,b,* lectotype, *2a,* ×0.5; *2b,* ×0.2 (14*).

Clydomphalites ARKELL, 1952 [**Micromphalites clydocromphalus*]. Discoidal without circumumbilical bulge or nodes. Subgen. of *Micromphalites. M.Bath.*, C.Arabia-Alg.——FIG. 346,*4*. **M. (C.) clydocromphalus,* C.Arabia; *4a,b,* ×0.7 (15*).

Dhrumaites ARKELL, 1952 [**D. cardioceratoides*]. Giant oxycones with faint or obsolete ribbing and degenerated *Micromphalites*-like sutures. *U.Bath.*, C.Arabia.——FIG. 346,*5*. **D. cardioceratoides; 5a,* ×0.3; *5b,* ×0.7 (15*).

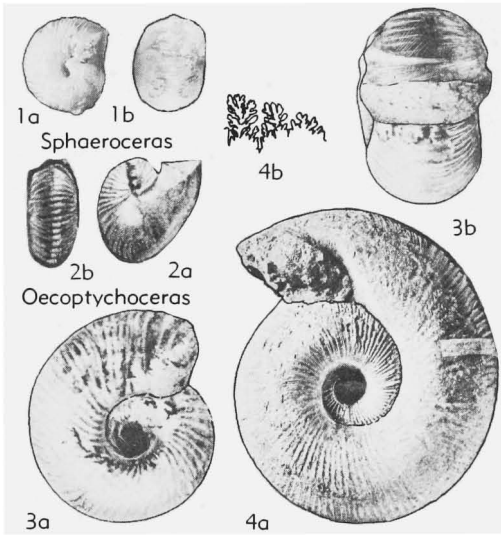


FIG. 347. Sphaeroceratidae (p. L292).

Family SPHAEROCERATIDAE Buckman, 1920

Sphaerocones with markedly excentric coiling, fine ribbing, and complex sutures (14, 65). *M.Jur.(M.Baj.-U.Baj.)*, world-wide except boreal.

Labyrinthoceras BUCKMAN, 1919 [**L. perexpansum*]. Large, round-whorled, with open umbilicus; body chamber smooth, contracted, with terminal contraction. *M.Baj.(sauzei z.)*, Eu.——FIG. 347,*4*. **L. perexpansum*, Eng.; *4a,b*, ×0.3 (595*).

Chondroceras MASCKE, 1907 [**Am. gervillii* J. SOWERBY, 1817] [*Defonticeras, Saxitoniceras* MCLEARN, 1927]. Similar to *Labyrinthoceras* in young, but body chamber retains ribbing to the end and has terminal constrictions and collar with conspicuous ventral flare. Wide bifid 2nd lateral lobe. *M.Baj.(humphriesianum z.)*, Eu.-N.Afr.-Cauc.-N. Guinea-Indon.-S. Alaska-Can.-Wyo.-Idaho-Calif.-S. Am.——FIG. 347,*3*. **C. gervillii* (Sow.); *3a,b*, ×1 (65*).

Sphaeroceras BAYLE, 1878 [*non* HOPE, 1840 (ICZN Opinion 300)] [**Am. brongniarti* J.SOWERBY, 1817; SD H.DOUVILLÉ, 1879]. Tightly coiled, umbilicus occluded; end of body chamber suddenly contracting and ending with flared collar; ribbing very sharp, in many superficial, leaving no impression on internal mold. *M.Baj.-U.Baj.*, Eu.-N. Afr.-Persia-S.Alaska.——FIG. 347,*1*. **S. brongniarti* (Sow.), Fr.; *1a,b*, holotype, ×0.7 (583*).

Oecoptychoceras BUCKMAN, 1920 [**O. subrefractum*]. Dwarf, elliptically coiled, with lappets. *U.Baj.*, Eu.——FIG. 347,*2*. **O. subrefractum*, Eng.; *2a,b*, ×1.3 (65*).

Family TULITIDAE Buckman, 1921

Cadicone and sphaerocone derivatives of Sphaeroceratidae, displaying various excentricities of coiling and contracted body chambers, and tending to lose ribbing on outer whorl. Sutures simplified compared with most Bajocian forms; all with broad, bifid or multifid 2nd lateral lobe, as in *Chondroceras* (14, 65). *M.Jur.(Bath.-Callov.)*, world-wide except boreal.

Tulites BUCKMAN, 1921 [**T. tula*] [*Tulophorites, Madarites, Sphaeromorphites* BUCK., 1921]. Cadicones with open umbilicus and smooth, more or less contracted body chamber, and simple aperture; ribbing well differentiated into primaries and secondaries and tending to incipient tuberculation on umbilical edge. *M.Bath.*, Eu.-C.Arabia.——FIG. 349,6. **T. (T.) tula*, Eng.; *6a,b*, ×0.5 (65*).

Rugiferites BUCKMAN, 1921 [**R. rugifer*] [=*Pleurophorites* BUCK., 1921]. Differs from *Tulites* in its vaguer umbilical edge and more persistent and somewhat more irregular ribbing. Subgen. of *Tulites*. *M.Bath.*, Eu.-N.Guinea-Indon.——FIG. 348,*1*. **T. (R.) rugifer* (BUCK.), Eng.; *1a-c*, ×0.5 (65*).

Bullatimorphites BUCKMAN, 1921 [**B. bullatimorphus*]. Group of *Am. bullatus* D'ORBIGNY. Inner whorls sphaerocone, outer whorl markedly elliptical; body chamber contracted, with simple contracted aperture. *L.Bath.-L.Callov.*, Eu.-Alg.-Azerbaijan-Baluch.-Pamir-Indon.-N.Guinea. —— FIG. 349,*5*. **B. bullatimorphus*, U.Bath., Eng.; ×0.2 (65*).

Kheraiceras SPATH, 1924 [**Sphaeroceras cosmopolita* PARONA & BONARELLI, 1897]. Whorls spindle-shaped, whorl section very depressed, umbilicus minute; last quarter whorl contracted suddenly as in *Sphaeroceras*, so that umbilical seam becomes radial, then bends forward again at right angle near aperture, which is simple and contracted. *L.*

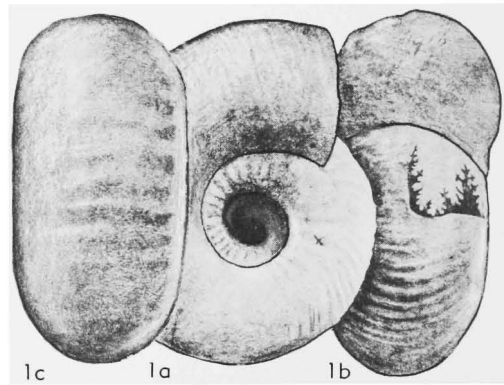


FIG. 348. *Tulites (Rugiferites) rugifer* (BUCKMAN), M.Jur.(M.Bath.), Eng.; *1a-c*, ×0.5 (65*) (p. L292).

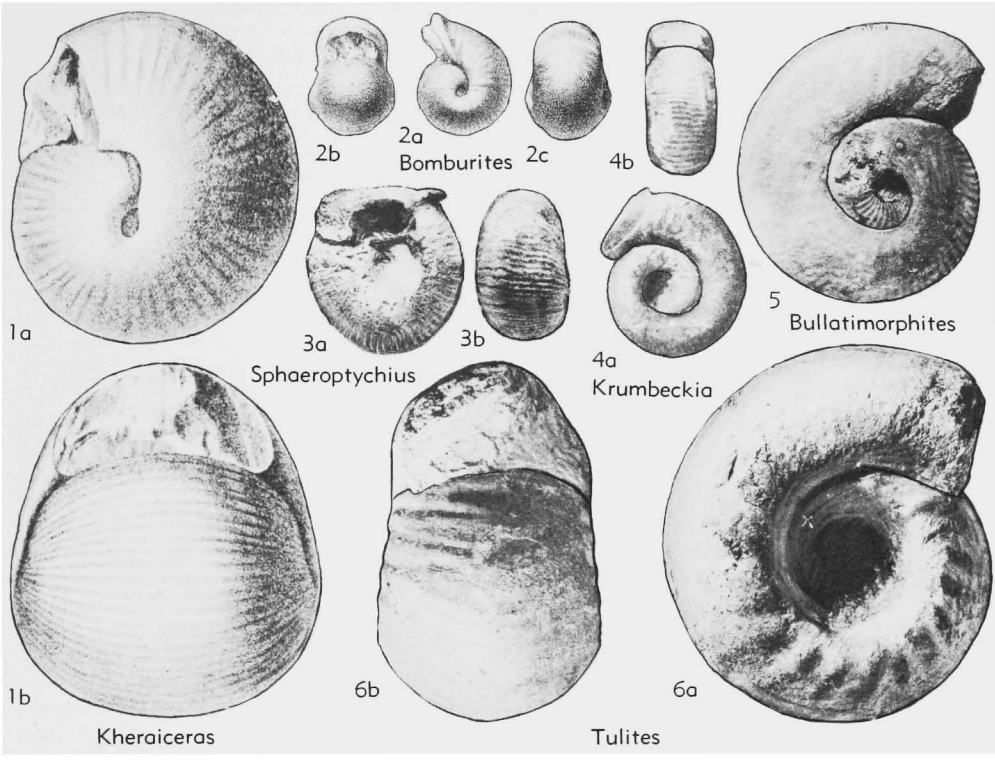


FIG. 349. Tulitidae (p. L292-L293).

Callov., Eu.-Tangan.-?Madag.-Cutch-S.Alaska-Mex. ——FIG. 349,*1*. **K. cosmopolitum* (PARONA-B.), Cutch; *1a,b*, holotype, ×0.7 (546*).

Krumbeckia ARKELL, 1951 [**K. reuteri*]. Coiling evolute for family, whorl section depressed, becoming circular; aperture with collar, ventral flare and long lappets. *M.Bath.*, Eu.——FIG. 349,*4*. **K. reuteri*, Ger.; *4a,b*, ×1 (13*).

Schwandorfia ARKELL, 1951 [**S. marginata*]. Differs from *Bullatimorphites* in having sharp umbilical edge and collared aperture, with large ventral bulla and blunt lappets. *M.Bath.*, Eu.——FIG. 352,*6*. *S. lucasi* (DE GROSSOUVRE), Fr.; *6a,b*, ×0.7 (13*).

Bomburites ARKELL, 1952 [**Am. devauxi* DE GROSSOUVRE, 1891]. Dwarf forms with spindle-shaped inner whorls, as in *Kheraiceras*, and excentric outer whorl, as in *Bullatimorphites*, but differing from both in aperture, which has flared collar and lip as in *Stephanoceras*. *Callov.*, Eu.——FIG. 349,*2*. **B. devauxi* (GROSS.), Fr.; *2a-c*, ×0.7 (14*).

Sphaeroptychius LISSAJOUS, 1923 [**S. buckmani*]. Specialized development from *Schwandorfia*, with strongly elliptical coiling of last whorl and enormous spatulate lappets. *M.Bath.*, Eu.——FIG. 349, *3*. **S. buckmani*, Fr.; *3a,b*, ×1 (262*).

Family MACROCEPHALITIDAE Buckman, 1922

[Macrocephalinae SALFELD, 1921; includes Eucycloceratidae SPATH, 1928]

Involute, globular, sharply ribbed, with moderately complex sutures, which typically differ from those of Tulitidae in having slender, pointed 2nd lateral lobe with single central main stem (transition from bifid type of 2nd lateral lobe being seen in *Morrisiceras*, M.Bath.). Body chamber smooth in many genera but seldom markedly contracted or excentric; peristome never collared, flared, or constricted (30, 74, 466). *M. Jur.(M.Bath.-M.Callov.)*, mainly *L.Callov.*, world-wide but rare in boreal realm.

Morrisiceras BUCKMAN, 1920 [**M. sphaera*] [=*Morrisites* BUCK., 1921; *Pionoceras* LISSAJOUS, 1923]. Ribbing feebler than in most later genera; inner half of whorl sides smooth. *M.Bath.*, Eu.——FIG. 352,*10*. **M. sphaera*, Eng.; *10a,b*, ×0.5 (65*).

Lycetticeras ARKELL, 1953 [**L. lycetti*]. Resembles *Morrisiceras*, but outer whorl excentrically coiled and contracted, eventually becoming smooth. *M.*

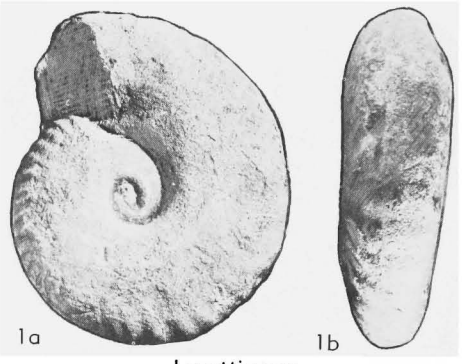


FIG. 350. *Lycetticeras lycetti* ARKELL, M.Jur.(M. Bath.), Eng.; *1a,b*, ×0.7 (16*) (p. L293).

Bath., Eu.——FIG. 350,*1*. **L. lycetti*, Eng.; *1a,b*, ×0.7 (16*).

Macrocephalites ZITTEL, 1884 [**Am. macrocephalus* SCHLOTHEIM, 1813 (as interpreted by ZITTEL, 1884; ICZN pend.)] [=*Tmetokephalites, ?Macrocephaliceras* BUCKMAN, 1922]. Large to giant species, inner whorls moderately compressed, ribbed, outer whorl gradually becoming smooth; body chamber smooth and in many somewhat contracted. *L.Callov.*, Eu.-N.Afr.-Somali.-Kenya-?Tangan.-Madag.-Cauc.-Russia-Baluch.-Cutch-Indon.-N.Guinea-?Philip.-?N.Z.-N.Am.-S.Am.——FIG. 351,*1*. **M. (M.) macrocephalus* (SCHLOTH.), Ger.; *1a,b*, ×0.5 (65*).

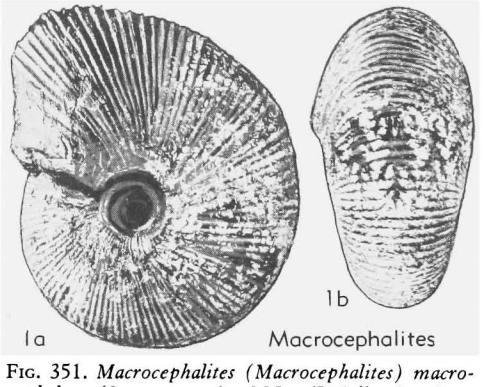


FIG. 351. *Macrocephalites (Macrocephalites) macrocephalus* (SCHLOTHEIM), M.Jur.(L.Callov.), Ger.; *1a,b*, ×0.5 (65*) (p. L294).

Dolikephalites BUCKMAN, 1923 [**D. dolius* BUCK., 1922 (=**Macrocephalites typicus* BLAKE, 1905)]. Finely ribbed to end of adult, never large. Subgen. of *Macrocephalites*. *L.Callov.-M.Callov.*, Eu.-N.Afr.-Kenya-Madag.-Cauc.-Cutch-Baluch.-Indon.-N.Guinea.——FIG. 352,*2*. **M. (D.) typicus* BLAKE, Eng.; ×0.5 (65*).

Kamptokephalites BUCKMAN, 1922 [**K. kamptus*]. Coarse, wiry, biplicate ribs to end of adult. Subgen. of *Macrocephalites*. *L.Callov.*, Eu.-Russia-N.Afr.-Somali.-Kenya-Madag.-Cauc.-TransCaspia-Cutch-Indon.-N.Guinea.——FIG. 352,*3*. **M. (K.) kamptus*, Eng.; *3a,b*, ×0.3 (65*).

Pleurocephalites BUCKMAN, 1922 [**P. lophopleurus*] [=*Platystomaceras* CORROY, 1932]. Depressed to cadicone, sharply ribbed to end of adult, umbilical edge rounded, ribbing rursiradiate on umbilical wall. Subgen. of *Macrocephalites*. *L.Callov.*, Eu.-Russia-?N.Afr.-Kenya-Madag.-Cauc.-Cutch-Baluch-Greenl.——FIG. 352,*9*. **M. (P.) lophopleurus*, Eng.; ×0.3 (65*).

Indocephalites SPATH, 1928 [**I. kheraensis*]. Inner whorls cadicone, strongly ribbed; outer whorls becoming more compressed, smooth, *macrocephalus*-like. ?Subgen. of *Macrocephalites*. *L.Callov.*, occurrence as for *Macrocephalites*.——FIG. 352,*4*. **M.? (I.) kheraensis*, Cutch; *4a-d*, ×0.3 (466*).

Eurycephalites SPATH, 1928 [**Macrocephalites vergarensis* BURCKHARDT, 1903]. Ribbing semiobsolescent, reminiscent of *Morrisiceras*. *L.Callov.*, Arg.-Mex.-USA-Can.-Greenl.——FIG. 354,*1*. **E. vergarensis* (BURCK.), Arg.; *1a-c*, ×0.7 (68*).

Xenocephalites SPATH, 1928 [**Macrocephalites neuquenensis* STEHN, 1924]. Ribbing very coarse, biplicate with widely splayed secondaries. *Callov.*, S.Am.-Mex.-S.Alaska-Greenl.——FIG. 352,*13*. **X. neuquenensis* (STEHN), Arg.; ×1 (492*).

Lilloetia CRICKMAY, 1930 [**L. lilloetensis*] [=*?Buckmaniceras* CRICKMAY, 1930]. Inner whorls finely ribbed, but ribbing soon becomes obtuse and fades; at moderate size whole outer whorl is smooth; peristome swollen, simple. *L. Callov.*, Can.-S.Alaska-Ore.——FIG. 352,*7*. **L. lilloetensis*, Can.; *7a,b*, ×1 (603*).

Eucycloceras SPATH, 1924 [**Stephanoceras eucyclum* WAAGEN, 1875]. Involute, compressed, with ribbing fine and dense on inner whorls, becoming distant and feeble on outer whorls, especially on venter. Sutures simple. *L.Callov.*, N.Afr.-Cutch-Indon.-Madag.——FIG. 352,*12*. **E. eucyclum* (WAAGEN), Cutch; ×0.3 (466*).

Nothocephalites SPATH, 1928 [**N. asaphus*]. Compressed, discoidal; ribbing dense, fading early on inner half of whorl sides. *L.Callov.*, Eu.-N.Afr.-Kenya-Madag.-Cutch-Indon.——FIG. 352,*1*. **N. asaphus*, Cutch; *1a,b*, ×0.3 (466*).

Idiocycloceras SPATH, 1928 [**I. perisphinctoides*]. Evolute, with coarse *Kamptokephalites*-like ribbing and simple sutures. *M.Callov.(anceps z.)*, Cutch-Indon.-Madag.——FIG. 352,*11*. **I. perisphinctoides*, Cutch; *11a,b*, ×0.5 (466*).

Subkossmatia SPATH, 1924 [**Am. opis* J.DEC.SOWERBY, 1840]. Evolute, with fine to coarse biplicate ribbing, projected on venter, which has tendency to become tabulate. Sutures simple. *M.Callov. (anceps z.)*, Cutch-Indon.-N.Guinea-Madag.——FIG. 355,*1*. **S. opis* (Sow.), Cutch; *1a,b*, ×0.5 (466*).

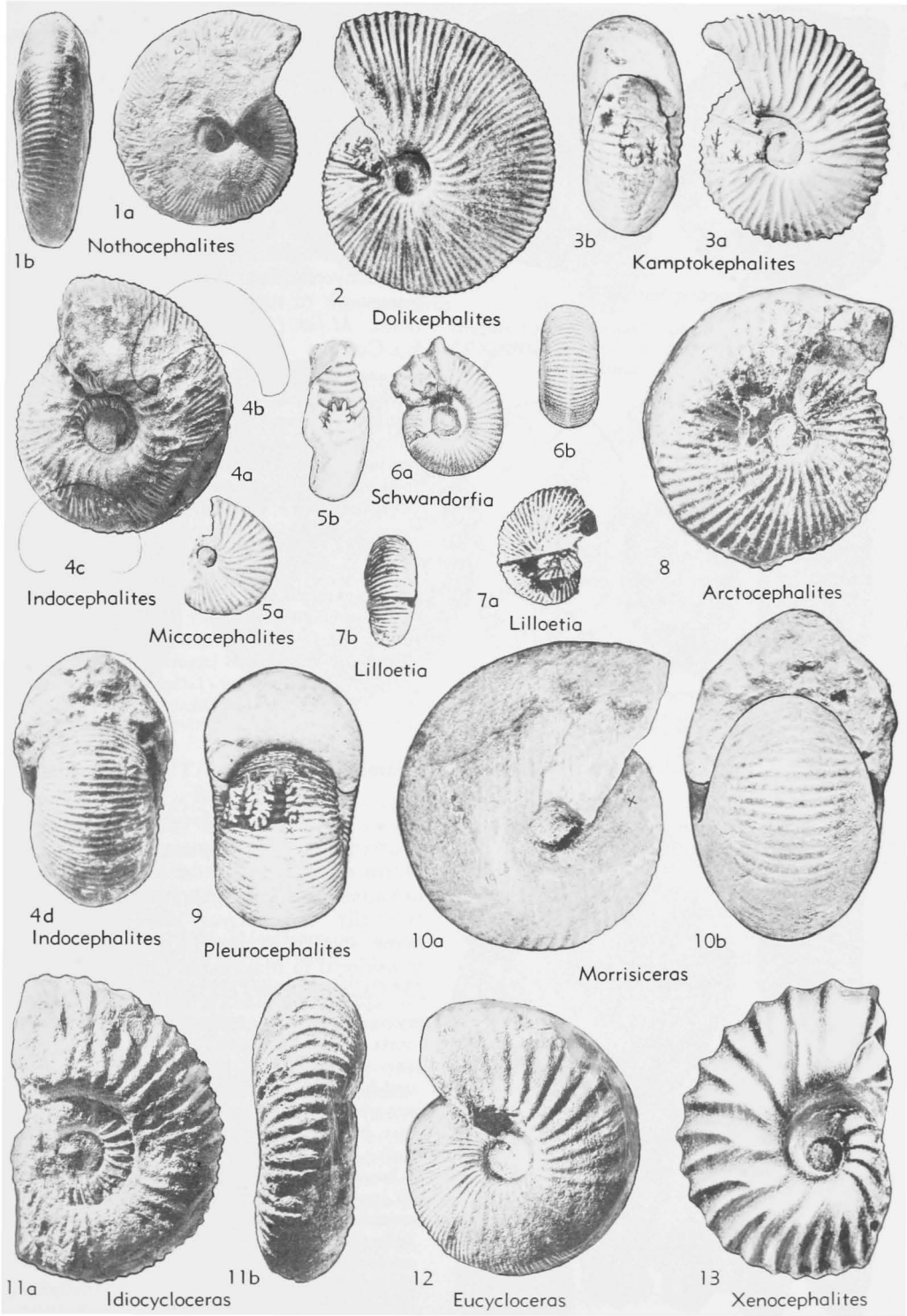


FIG. 352. Tulitidae, Macrocephalitidae (p. L293-L294, L301-L302).

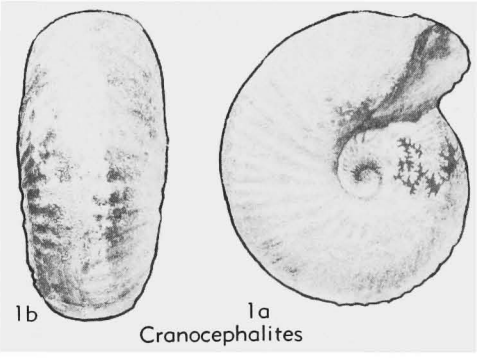


FIG. 353. *Arctocephalites (Cranocephalites) vulgaris* (SPATH), M.Jur.(L.Callov.), Greenl.; *1a,b*, ×0.5 (469*) (p. L301).

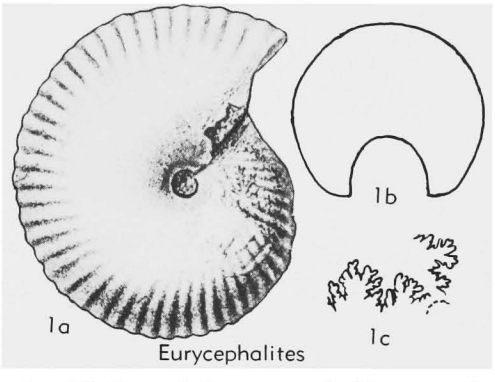


FIG. 354. *Eurycephalites vergarensis* (BURCKHARDT), M.Jur.(L.Callov.), Arg.; *1a-c*, ×0.7 (68*) (p. L294).

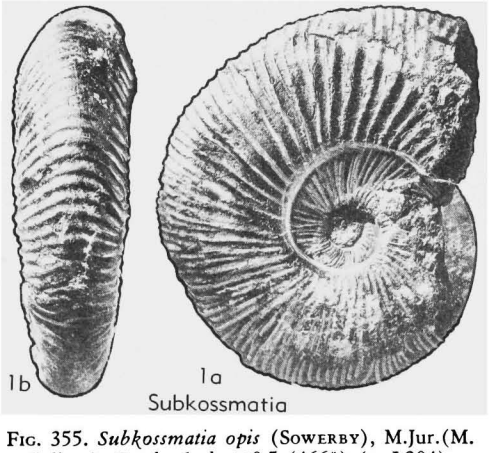


FIG. 355. *Subkossmatia opis* (SOWERBY), M.Jur.(M. Callov.), Cutch; *1a,b*, ×0.5 (466*) (p. L294).

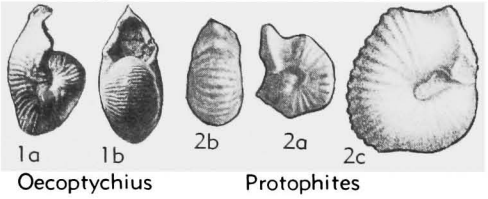


FIG. 356. Oecoptychiidae (p. L296).

Family OECOPTYCHIIDAE Arkell, nov.

Specialized cryptogenic dwarfs with acutely excentric coiling and bizarre modified apertures. They have been assigned to Stephanoceratidae by NEUMAYR (1878) and others, to Reineckeiidae by HYATT (1900), to Morphoceratidae by BUCKMAN (1920), to Macrocephalitidae by SPATH (1928), and to Cadoceratidae by WETZEL (1937). SPATH (1919) thought *Protophites* might belong to Pachyceratidae. There is nothing but guesswork to support any of these suggestions. *M.Jur. (M.Callov.) - U.Jur. (L.Oxf.)*, Eu.-Cutch.

Oecoptychius NEUMAYR, 1878 [**Nautilus refractus* REINECKE, 1818; SD MUNIER-CHALMAS, 1892]. Inner whorls smooth, sphaerocone, outer whorls with fine biplicate ribbing, ventral groove, and acute elbow bend at half whorl before aperture; peristome constricted, with large outwardly directed spatulate lappets, and ventral rostrum elevated in tea-cozy form. Sutures simple. *M.Jur.(M.Callov.)*, Eu.-Cutch.——FIG. 356,*1*. **O. refractus* (REIN.), Ger.; *1a,b*, ×0.7 (86*).

Protophites EBRAY, 1860 [**P. oxfordianus*] [=*Christolia* ROLLIER, 1909 (*non* BRULLÉ, 1846)]. Coiling scaphitoid; aperture with reflected peristome and rostrum, no lappets. Perhaps unrelated to *Oecoptychius*. *U.Jur.(L.Oxf.)*, Fr.-Switz.—— FIG. 356,*2*. *P. christoli* (BEAUDOUIN); *2a,b*, ×0.7 (220*).

Family PACHYCERATIDAE Buckman, 1918

[=Erymnoceratidae BREISTROFFER, 1947]

Inner whorls coronate, cadicone, or *Macrocephalites*-like, outer whorls reverting to various earlier Stephanoceratacean types, especially *Morrisiceras* and *Lycetticeras*. Some species in the L.Oxf. seem to be transitional to Mayaitidae (65, 220). *M.Jur. (M.Callov.)-U.Jur.(U.Oxf.)*, world-wide.

Erymnoceras HYATT, 1900 [**Am. coronatus* BRUGUIÈRE in D'ORBIGNY, 1848] [*Doliolumites* BREISTROFFER, 1947]. Coronate, with tuberculate umbilical edge and strong ribbing; resembling inner whorls of *Teloceras* and *Tulites*. Outer whorl may become smooth and contracted. *M.Jur.(M. Callov.)*, Eu.-N.Afr.-Syria-C.Arabia-Crimea-Cauc.-C.Russia-Persia-Cutch-Mex.——FIG. 357,*2*. **E. (E.) coronatum* (BRUG.), Fr.; ×0.12 (330*).

Erymnocerites JEANNET, 1951 [**E. argoviensis*]. Differs from *Erymnoceras* by having more numerous secondary ribs. Subgen. of *Erymnoceras*. *M.Jur. (M.Callov.)*, Eu.——FIG. 357,*1*. **E. (E.) argoviense*, Switz.; ×0.3 (220*).

Pachyerymnoceras BREISTROFFER, 1947 [**Pachyceras*

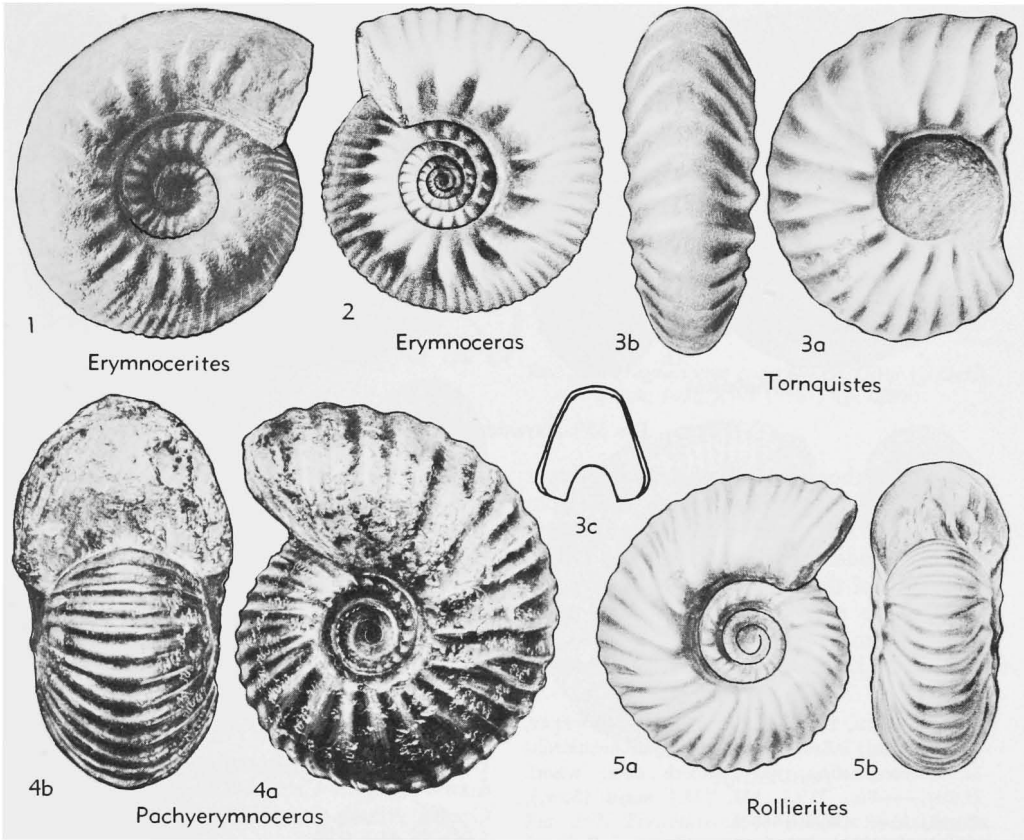


FIG. 357. Pachyceratidae (p. L296-L297).

jarryi R.DOUVILLÉ, 1912]. Involute, with last whorl becoming compressed and somewhat *Pachyceras*-like, but without fading of primary ribs. Subgen. of *Erymnoceras*. *M.Jur.(U.Callov.)*, Eu.-C.Arabia. ——FIG. 357,*4*. **E. (P.) jarryi* (R.DOUV.), Fr.; *4a,b*, ×0.7 (134*).

Rollierites JEANNET, 1951 [**Stephanoceras renardi* NIKITIN, 1882]. Evolute, more or less planulate in form; ribs coarse and branching from tubercles at umbilical edge. *M.Jur.(M.Callov.)*, Eu.-Russia.—— FIG. 357,*5*. **R. renardi* (NIKITIN), Russia; *5a,b*, ×0.3 (319*).

Pachyceras BAYLE, 1878 [*non* RATZEBURG, 1844 (ICZN pend.)] [**Am. lalandeanus* D'ORBIGNY, 1848] [=*Lalandeites* BREISTROFFER, 1947 (obj.)]. Umbilical edge rounded, not tuberculate, ribs fading on inner half of whorl sides as in *Morrisiceras;* last whorl commonly smooth or with ventral folds only. *M.Jur.(U.Callov.)-U.Jur.(L.Oxf.)*, Eu.-N. Afr.-Somali-Sinai-C.Arabia - Persia - Cutch - ?Wyo. ——FIG. 358,*1*. **P. (P.) lalandeanum* (ORB.), Fr.; *1a,b*, ×0.5 (330*).

Tornquistes LEMOINE, 1910 [**Macrocephalites helvetiae* TORNQUIST, 1894]. Differs from *Pachyceras (s.s.)* by coarsening ribs on last whorl and developing excentric coiling. Subgen. of *Pachyceras*. *U.Jur.(L.Oxf.-U.Oxf., plicatilis z.)*, Eu.-Tunisia. ——FIG. 357,*3*. **P. (T.) helvetiae* (TORNQ.), Switz.; *3a-c*, ×0.3 (507*).

Family MAYAITIDAE Spath, 1928

[ICZN pend.] [=?Grayiceratidae SPATH, 1925 *(nom. dub.)*]

Some genera indistinguishable from Callovian Macrocephalitidae, but all are sep-

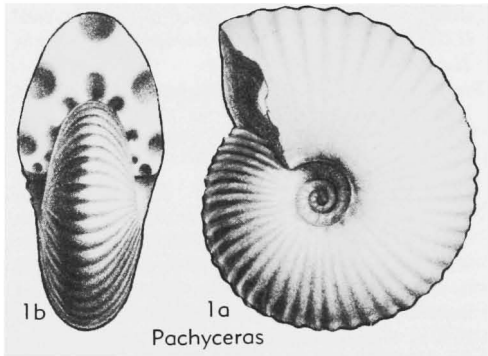


FIG. 358. *Pachyceras (Pachyceras) lalandeanum* (D'ORBIGNY), U.Jur., Fr.; *1a,b*, ×0.5 (330*) (p. L297).

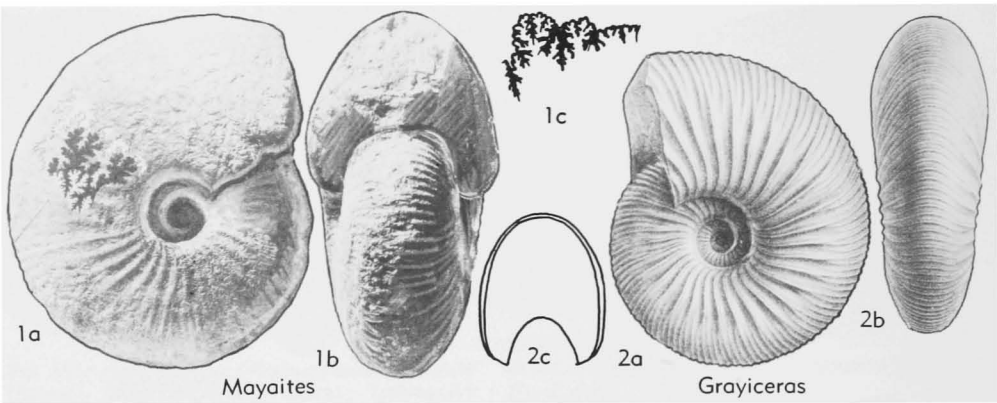


FIG. 359. Mayaitidae (p. L298).

arated from them stratigraphically by Upper Callovian and Lower Oxfordian beds from which no "macrocephalitids" are known. The Mayaitidae are confined to the Upper Oxfordian of the Indian Ocean province of the Tethyan realm and are believed to be derived from Pachyceratidae (30, 466). *U. Jur.(U.Oxf.),* E.Afr.-Madag.-Cutch-Attock-Indon.

Mayaites SPATH, 1924 [**Am. maya* J.DEC.SOWERBY, 1840]. Giant, inflated, coarse-ribbed homeomorphs of *Macrocephalites,* with smooth outer whorl. *U.Oxf.*——FIG. 359,*1*. **M. (M.) maya* (Sow.), Cutch; *1a-c,* ×0.25 (466*).

Epimayaites SPATH, 1928 [**Stephanoceras transiens* WAAGEN, 1875]. Ribbing projected on venter, sutures simpler than in *Mayaites (s.s.);* some species appear to be transitional from *Pachyceras.* Subgen. of *Mayaites. U.Oxf.*——FIG. 360,*1*. **M. (E.) transiens* (WAAGEN), Cutch; *1a,b,* ×0.3 (546*).

Paryphoceras SPATH, 1928 [**P. badiense*]. Whorls somewhat quadrate, ribbed to end of adult; resembling *Subkossmatia. U.Oxf.*——FIG. 360,*2*. **P. badiense,* Cutch; *2a,b,* ×0.5 (466*).

Dhosaites SPATH, 1924 [**D. elephantoides* SPATH, 1924; SD SPATH, 1925]. Evolute, with coarse, sharp, rectiradiate ribbing which persists to end. *U.Oxf.*——FIG. 360,*3*. **D. elephantoides,* Cutch; *3a,b,* ×0.7 (466*).

Prograyiceras SPATH, 1928 [**P. grayi*]. Inner whorls like *Mayaites,* outer more like *Dhosaites. U.Oxf.* ——FIG. 361,*1*. **P. grayi,* Cutch; *1a,b,* ×0.3 (546*).

?Grayiceras SPATH, 1923 [**G. blanfordi* SPATH, 1923; SD SPATH, 1924]. A macrocephalitoid form of uncertain affinities and age, thought by WAAGEN and UHLIG to be Oxfordian (*Mayaites* beds) and by SPATH (1924, p. 11) to be Tithonian; but later included by SPATH (1928, p. 224) in Mayaitidae (1928) although already chosen as type genus of his "family" Grayiceratidae (1925). *U.Oxf.*—— FIG. 359,*2*. **G. blanfordi; 2a-c,* ×0.3 (533*).

Family KOSMOCERATIDAE Haug, 1887

[="Runcinati" SEEBACH, 1864; includes Gowericeratidae, Gulielmiceratidae BUCKMAN, 1926]

Derivatives of Macrocephalitidae? with more or less tabulate ("runcinate") venter and many developing either lateral or ventrolateral tubercles, or both. Aptychus double-valved with surface concentrically ribbed (Praestriaptychus) found *in situ* in *Kepplerites* and perhaps *Kosmoceras* (7, 65, 74, 138, 273). *M.Jur.(Callov.),* N.Hemis. (characteristically boreal)-N.Eu.-E.Eu.-Rumania-Anatolia-Crimea-Cauc.-TransCaspia-Greenl.-Alaska-Can.-USA. Single records from E.Alg.-Peru.

Kepplerites NEUMAYR & UHLIG, 1892 [**Am. keppleri* OPPEL, 1862] [*Gowericeras* BUCKMAN, 1921; *Galilaeiceras, Galileanus, Galilaeites, Cerericeras, Torricelliceras* BUCK., 1922]. Moderately evolute; inner whorls finely ribbed with tabulate or grooved venter, outer whorl with rounded venter, ribs becoming fasciculate and tending to smooth; aperture simple. *L.Callov.*——FIG. 364,*6*. **K. keppleri* (OPPEL), Ger.; *6a,b,* ×0.3 (65*).

Gulielmina BUCKMAN, 1925 [**G. quinqueplicata*]. Differs from *Kepplerites (s.s.)* in having short lappets. Subgen. of *Kepplerites. L.Callov.,* Eng. (no figure).

Seymourites KILIAN & REBOUL, 1909 [**Am. loganianus* WHITEAVES, 1876] [=*Yakounites, Yakounoceras* MCLEARN, 1927]. Large, evolute, *Stephanoceras*-like. Subgen. of *Kepplerites. L.Callov.,* Can.-Mont.-Calif.-Greenl.-?Spitz.-Japan.——FIG. 364,*8*. **K. (S.) loganianus* (WHIT.), Can.(B.C.); *8a,b,* ×0.3 (269*).

Toricellites BUCKMAN, 1922 [**T. approximatus*]. Small, with lappets; inner whorls have strong, biplicate, rectiradiate ribbing. *L.Callov.,* Eu.—— FIG. 362,*1*. **T. approximatus,* Eng.; *1a,b,* ×1 (65*).

Sigaloceras HYATT, 1900 [**Am. calloviensis* J.SOWERBY, 1815 (ICZN Opinion 324)]. Involute, com-

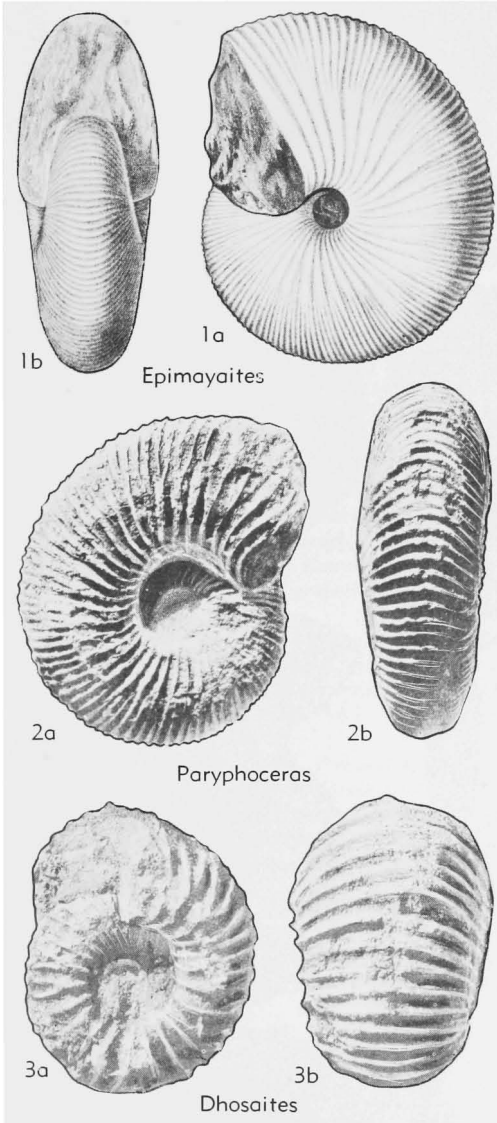


FIG. 360. Mayaitidae (p. L298).

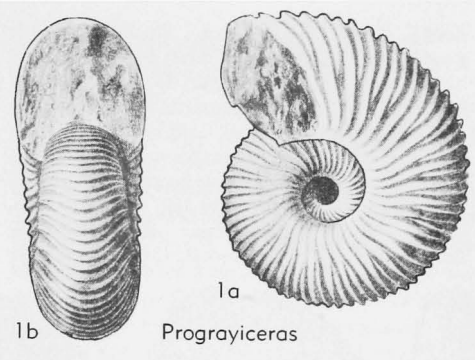


FIG. 361. *Prograyiceras grayi* SPATH, U.Jur.(U.Oxf.), Cutch; *1a,b,* ×0.3 (546*) (p. L298).

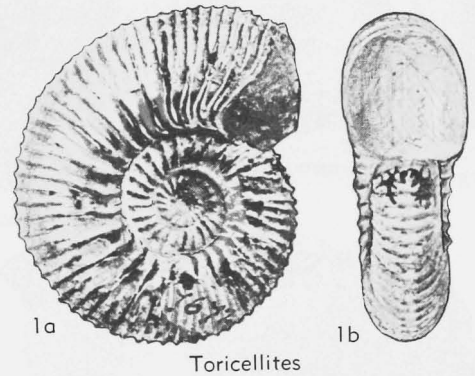


FIG. 362. *Toricellites approximatus* BUCKMAN, M. Jur.(L.Callov.), Eng.; *1a,b,* ×1 (65*) (p. L298).

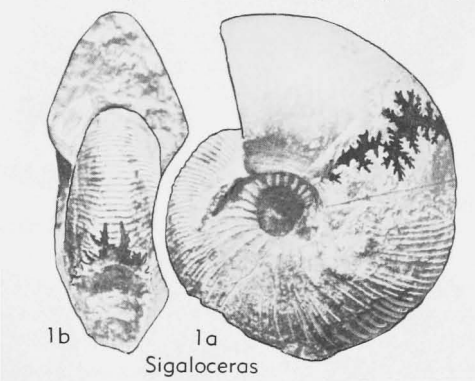


FIG. 363. *Sigaloceras (Sigaloceras) calloviense* (SOWERBY), M.Jur.(L.Callov.), Eng.; *1a,b,* ×0.5 (*4) (p. L299).

pressed, venter markedly tabulate and remaining so to the end of adult. Aperture simple. Ribbing fine, fading on body chamber. *L.Callov.*, Eu.—— FIG. 363,*1*. **S. (S.) calloviense* (Sow.), Eng.; *1a,b,* holotype, ×0.5 (4*).

Catasigaloceras BUCKMAN, 1923 [**C. planicerclus*]. Small, differing from *Sigaloceras (s.s.)* by having less sharply tabulate venter, which becomes smoothly rounded on body chamber. Subgen. of *Sigaloceras*. *L.Callov.*, Eu.-TransCaspia-Can.——FIG. 364,*3*. **S. (C.) planicerclus; 3a,b,* topotype (same quarry and bed), ×0.7 (583n).

Kosmoceras WAAGEN, 1869 [**Am. spinosus* J.DEC. SOWERBY, 1826 (ICZN Opinion 303)] [=*Cosmoceras* NEUMAYR, 1869, altered spelling]. Restricted subgenus moderately evolute, with simple aperture; ribbing irregular, interrupted by irregular row of lateral tubercles; strong ventral tubercles separated by smooth ventral sulcus. *U.Callov.*—— FIG. 364,*5*. **K. (K.) spinosum* (Sow.), Eng.; *5a,b,* topotype, ×0.7 (7*).——FIG. 365,*1*. *K. (K.) ornatum rotundum* (QUENST.); *1a,b,* ×1 (358*).

Gulielmites BUCKMAN, 1923 [**G. conlaxatum*, =fine-ribbed variety of *Kosmoceras jason* (REIN-

ECKE), 1818]. Compressed, fine-ribbed, with smooth body chamber; aperture simple; ribs not looped. Subgen. of *Kosmoceras*. *M.Callov*.——FIG. 364,9. **K. (G.) jason* (REIN.); ×0.7 (65*).

Lobokosmokeras BUCKMAN, 1923 [**Kosmoceras proniae* TEISSEYRE, 1884 [=*Bikosmokeras* BUCK., 1926]. Two rows of incipient lateral tubercles and well-developed ventral tubercles, to which secondary ribs are looped; venter smooth; aperture simple. Subgen. of *Kosmoceras*. *U.Callov*.——FIG. 364,*1*. **K. (L.) proniae* (TEISS.), Russia; *1a,b*, ×1 (724*).

Gulielmiceras BUCKMAN, 1920 [**Am. gulielmi* J. SOWERBY, 1821] [=*Anakosmokeras* BUCK, 1924]. Sharply ribbed and trituberculate on inner and middle whorls; body chamber with fasciculate ribs and no tubercles; aperture simple. Subgen. of *Kosmoceras*. *L. Callov.-M.Callov*.——FIG. 366,*1*. **K. (G.) gulielmi* (Sow.), Eng.; *1a,b*, ×1 (65*).

Zugokosmokeras BUCKMAN, 1923 [**Z. zugium*

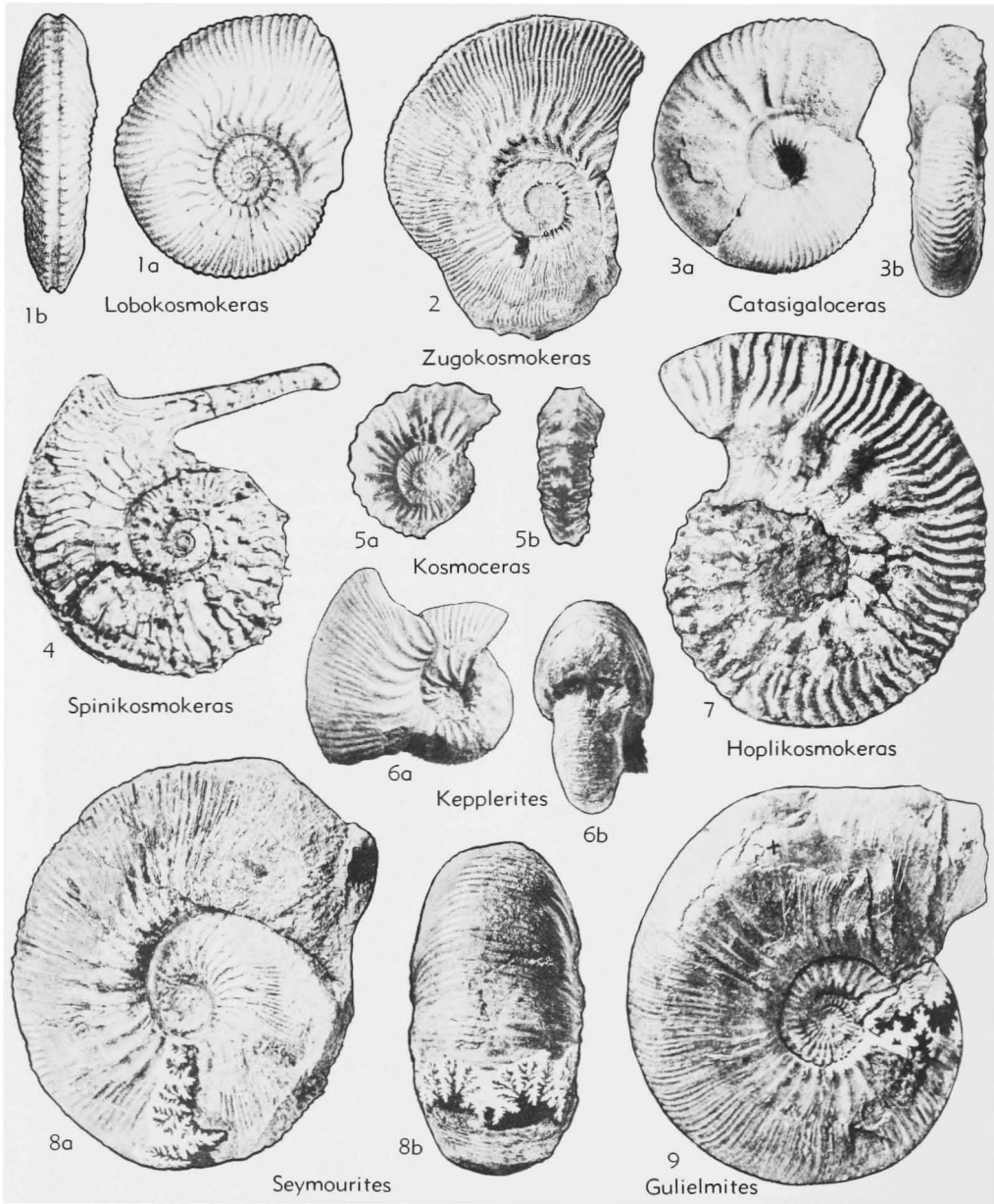


FIG. 364. Kosmoceratidae (p. L298-L301).

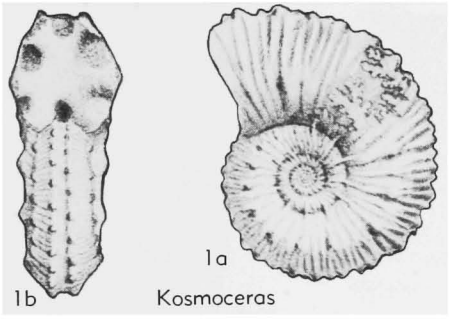


FIG. 365. *Kosmoceras (Kosmoceras) ornatum rotundum* (QUENSTEDT), M.Jur.(U.Callov.), Ger.; *1a,b,* ×0.7 (358*) (p. L299).

(=**K. grossouvrei* R.DOUVILLÉ, 1915)] [=*Kuklokosmokeras* BUCK., 1926; *?Katakosmokeras* BUCK., 1925 *(nom. dub.)*]. Large, evolute, planulate, finely ribbed, without tubercles, venter ribbed; aperture simple. Subgen. of *Kosmoceras*. *U.Callov.* ——FIG. 364,*2*. **K. (Z.) grossouvrei* (R.DOUV.), Eng.; ×0.3 (65*).

Spinikosmokeras BUCKMAN, 1924 [**S. acutistriatum*]. Coarsely ribbed, spinous, with greatly elongated lappets. Subgen. of *Kosmoceras*. *M.Callov.-U. Callov.*——FIG. 364,*4*. **K. (S.) acutistriatum*, Eng.; ×0.7 (65*).

Epicosmoceras MODEL, 1938 [**Aspidoceras fuchsi* NEUMAYR, 1871]. Parallel to *Spinikosmokeras* but without lappets; having coarse bullate ribs and clavate ventrolateral tubercles bounding smooth, concave venter. *Callov.* (zone uncertain, probably *M.Callov.*), Pol.-C.Russia.——FIG. 367,*1*. **E. fuchsi* (NEUM.), Pol.; *1a,b,* ×0.7 (667*).

?Hoplikosmokeras BUCKMAN, 1924 *(nom. dub.)* [**H. hoplistes*]. Horizon unknown, probably *M. Callov.*, Eng.——FIG. 364,*7*. **H. hoplistes;* ×0.5 (65*).

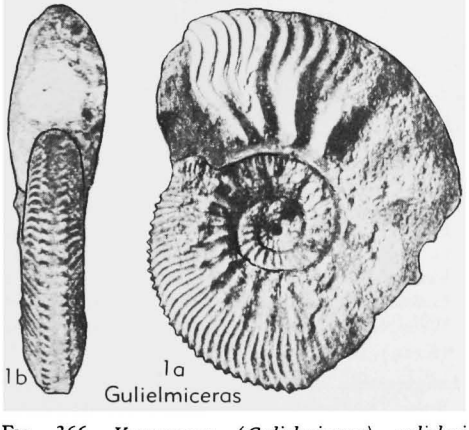


FIG. 366. *Kosmoceras (Gulielmiceras) gulielmi* (SOWERBY), M.Jur.(M.Callov.), Eng.; *1a,b,* ×1 (65*) (p. L300).

Family CARDIOCERATIDAE Siemiradzki, 1891

From its first appearance in the Lower Callovian this last Stephanoceratacean family displays all the form range of the Bajocian and Bathonian families, from coronates and sphaerocones to oxycones. This diversity (contrasting with contemporary Macrocephalitidae and Kosmoceratidae) continues into the Upper Oxfordian, above which only compressed forms, especially oxycones, persist to their disappearance at the top of the Lower Kimmeridgian (6, 134, 272, 361). *M. Jur.(L.Callov.)-U.Jur.(L.Kimm.),* boreal and essentially northern, with a few stragglers to S.Eu.(Port.-N.Italy).

Subfamily CADOCERATINAE Hyatt, 1900

Inner whorls compressed and involute in some, sharply ribbed, cadicone from the start in others; outer whorls lose ribbing and become oxycones, extreme cadicones, or intermediate forms (134, 212, 452, 469). *M.Jur. (Callov.).*

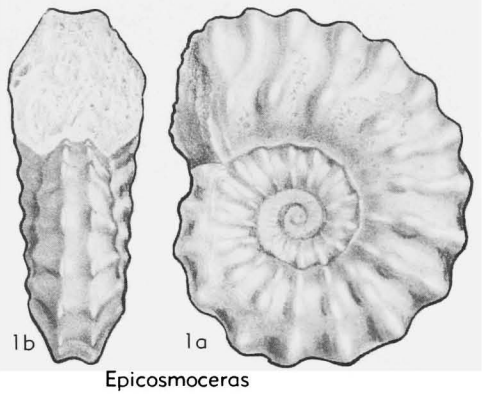


FIG. 367. *Epicosmoceras fuchsi* (NEUMAYR), M.Jur. (Callov.), Pol.; *1a,b,* ×0.7 (667*) (p. L301).

Arctocephalites SPATH, 1928 [**Am. ishmae* var. *arcticus* NEWTON, 1897] [=*Metacephalites, ?Paracephalites* BUCKMAN, 1929]. Inner whorls sharply ribbed, outer smooth, with change abrupt and early. Sutures complex. *L.Callov.*, FranzJoseph Land - NovayaZemlya - K.CharlesI. - N.Sib. - E.Sib.-Greenl.-Mont.——FIG. 352,*8*. **A. (A.) arcticus* (NEWTON), ×0.7 (469*).

Cranocephalites SPATH, 1932 [**C. vulgaris*]. Body chamber contracted, excentric, with terminal constriction. Subgen. of *Arctocephalites*. *L.Callov.*, Greenl.-N. Alaska-S. Alaska-Novaya Zemlya-E. Sib.

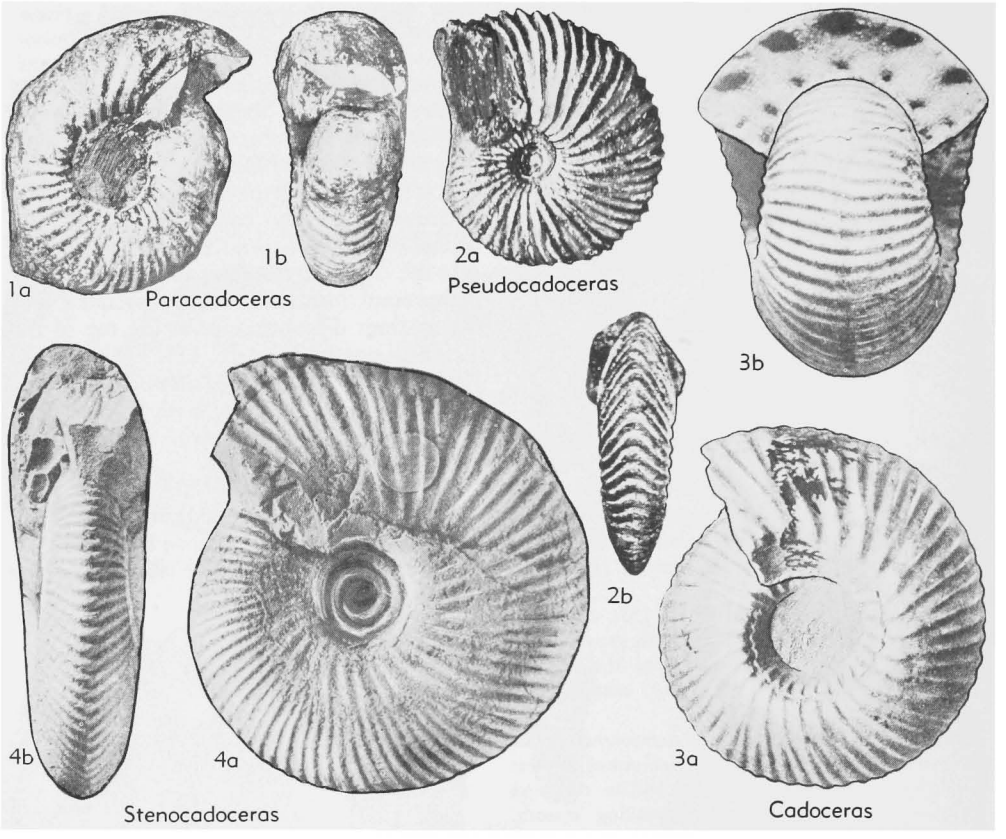


FIG. 368. Cardioceratidae (p. L302).

——FIG. 353,*1*. **A. (C.) vulgaris* (SPATH), Greenl.; *1a,b*, ×0.5 (469*).

Miccocephalites BUCKMAN, 1929 [**M. miccus*]. Uncertain; said by WARREN (1947) to be a close relative of *Cranocephalites*. ?Subgen. of *Arctocephalites*. *L.Callov.*, Alba.——FIG. 352,*5*. **A.? (M.) miccus; 5a,b*, ×1 (65*).

Cadoceras FISCHER, 1882 [**Am. sublaevis* J.SOWERBY, 1814; SD SPATH, 1932 (ICZN Opinion 324)]. [=*Catacephalites* BUCKMAN, 1922]. Whorls cadicone at all stages; inner and middle whorls well ribbed, some with umbilical tubercles, outer whorl or body chamber smooth. *L.Callov.-M.Callov.*, N. Eu.-C.Eu.-Russia-Cauc.-NovayaZemlya-FranzJoseph Land.-Spitz.-N. Sib.-New Sib.I.-S.Alaska-Can.-USA. ——FIG. 368,*3*. **C. (C.) sublaeve* (Sow.), Eng.; *3a,b*, ×0.75 (65*).

Paracadoceras CRICKMAY, 1930 [**P. harveyi*]. Evolute, compressed in young, becoming stouter in adult but remaining more or less planulate; body chamber smooth. Subgen. of *Cadoceras*. *L.Callov.*, Eng.-Russia-Greenl.-S.Alaska-Can.——FIG. 368,*1*. **C. (P.) harveyi* (CRICKMAY), Can.(B.C.); *1a,b*, ×0.7 (603*).

Stenocadoceras IMLAY, 1953 [**Cadoceras multicostatum*]. Involute, compressed, with umbilical edge rounded on the inner whorls, abrupt on outer; body chamber smooth. Subgen. of *Cadoceras*. *L. Callov.*, Russia-Greenl.-S.Alaska.——FIG. 368,*4*. **C. (S.) multicostatum*, S.Alaska; *4a,b*, ×1 (212*).

Pseudocadoceras BUCKMAN, 1918 [**P. boreale*]. Small, compressed at all stages, sharply ribbed to end, with rostrate aperture. *L.Callov.-M.Callov.*, N.Eu.-FranzJosephLand - N.Alaska - Can. —— FIG. 368,*2*. **P. boreale*, Eng.; *2a,b*, ×1 (65*).

Arcticoceras SPATH, 1924 [**Am. ishmae* KEYSERLING, 1846]. Involute, inner whorls sharply ribbed, outer whorl becoming smooth and *Macrocephalites*-like. Perhaps derived from *Arctocephalites*. *L. Callov.*, N.Russia-C.Russia-Greenl.-N.Alaska-Can.-Wyo.-N.Dak.-Utah.——FIG. 369,*1*. **A. ishmae* (KEYS.), Russia; *1a,b*, ×0.5 (469*).

Longaeviceras BUCKMAN, 1918 [**Am. longaevus* BUCK. (*ex* LECKENBY & BEAN, MS)]. Inner whorls compressed, with irregularly branched prorsiradiate ribs and resembling some *Lamberticeras*, but with venter like *Arcticoceras;* outer whorls smooth, cadicone, as in *Cadoceras*. *M.Callov.-U.Callov.*, N.

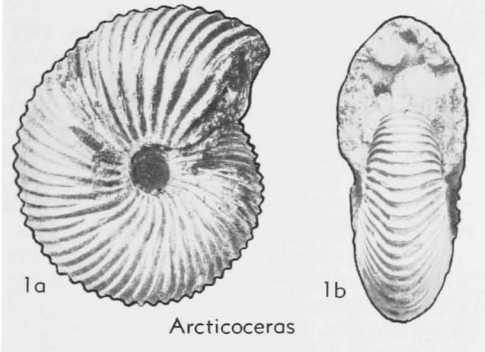
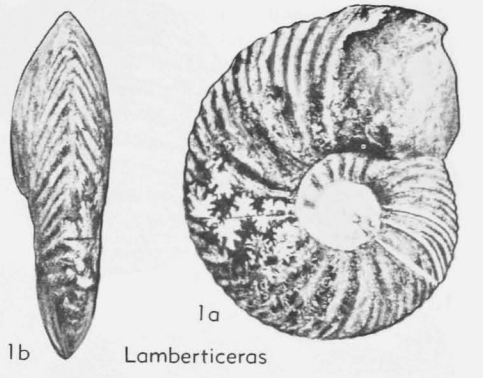


FIG. 369. *Arcticoceras ishmae* (KEYSERLING), M.Jur. (L.Callov.), Russ.; *1a,b,* ×0.5 (469*) (p. L302).



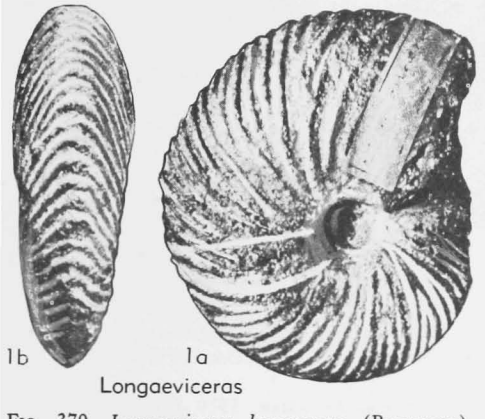
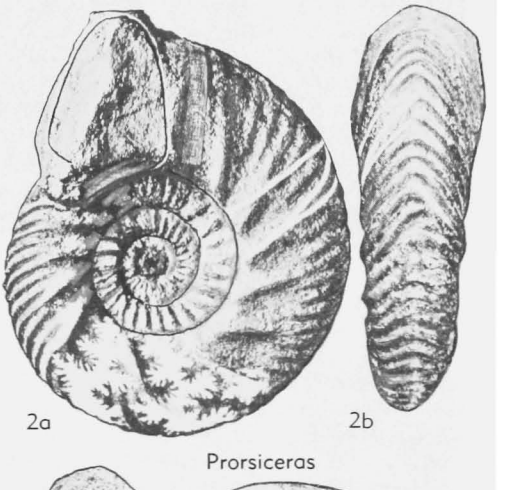


FIG. 370. *Longaeviceras longaevum* (BUCKMAN), M.Jur.(Callov.), Eng.; *1a,b,* ×1 (65*) (p. L302).



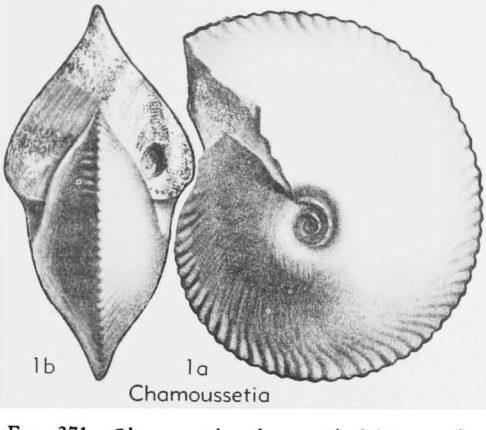


FIG. 371. *Chamousettia chamusetti* (D'ORBIGNY), M.Jur.(Callov.), Fr.; *1a,b,* ×0.5 (330*) (p. L303).

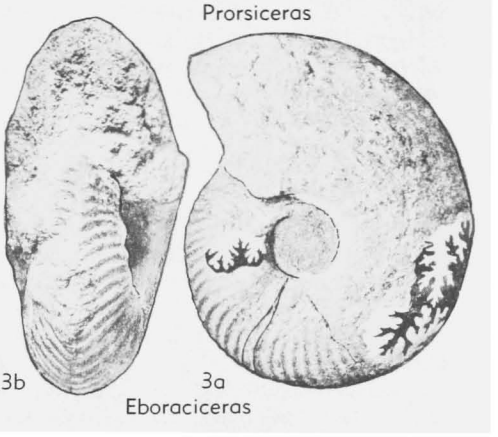


FIG. 372. Cardioceratidae (Cardioceratinae) (p. L304).

Eu.-Russia-NovayaZemlya-Spitz. —— FIG. 370,*1*. **L. longaevum* (BUCK.), Eng.; *1a,b,* ×1 (65*).

Chamoussetia R.DOUVILLÉ, 1912 [**Am. chamusseti* D'ORBIGNY, 1847]. Inner whorls involute, compressed, as in *Longaeviceras* or *Pseudocadoceras;* outer whorls become trigonal or cordate in section, with loss of ribbing except on periphery, which is acute and serrated. *L.Callov.-M.Callov.,* N.Eu.-C. Eu.-Russia-Cauc.——FIG. 371,*1*. **C. chamusseti* (ORB.), Fr.; *1a,b,* ×0.5 (330*).

Subfamily CARDIOCERATINAE Siemiradzki, 1891

Comprises 4 important genera *(Quenstedtoceras, Goliathiceras, Cardioceras,*

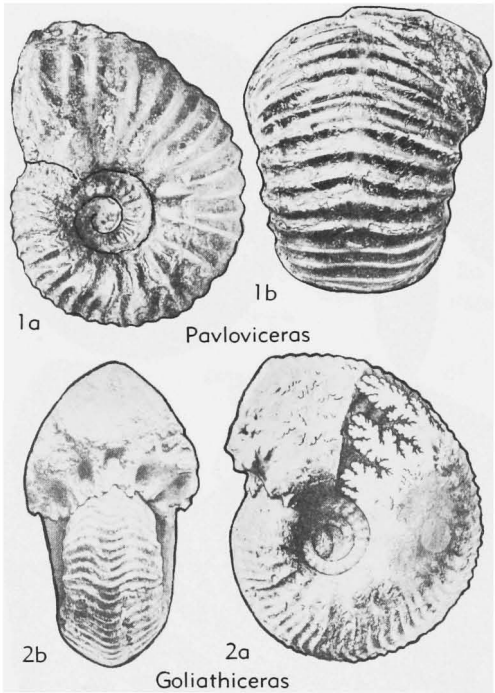


FIG. 373. Cardioceratidae (Cardioceratinae) (p. L304).

Amoeboceras) of which numerous subdivisions have been named by BUCKMAN and SPATH between 1920 and 1935. These genera and subgenera succeed one another stratigraphically with little overlap except between *Goliathiceras* and *Cardioceras*. *Quenstedtoceras* and *Goliathiceras* range in form from oxycones to cadicones and sphaerocones but are unkeeled or only incipiently keeled. *Cardioceras* and *Amoeboceras* are keeled and mainly oxycones or planulates. The subgenera of *Quenstedtoceras* probably arose from different Cadoceratinae. Classification of the subfamily is necessarily "horizontal" (6, 7, 134, 272, 322, 361, 397; ARKELL, 1941, p. lxxiii). *M.Jur.(U.Callov.)-U.Jur.(L.Kimm.).*

Quenstedtoceras HYATT, 1877 [*pro Quenstedioceras* HYATT, 1877 (misspelling; ICZN Opinion 324)] [**Am. leachi* J.SOWERBY, 1819] [=*Quenstedticeras* TEISSEYRE, 1889 (obj.); *Vertumniceras* BUCKMAN, 1918]. The restricted subgenus comprises planulates with coarse sigmoid ribbing which forms chevrons on an obtusely fastigate venter. *M.Jur.(U.Callov.)*, Eu.-C.Russia-Donetz-Cauc.-?Anatolia-TransCaspia-FranzJosephLand-Spitz.——FIG. 375, *1. *Q. (Q.) leachi* (Sow.), Eng.; *1a,b*, topotype, ×1 (7*).

Lamberticeras BUCKMAN, 1920 [*non* KILIAN, 1910 *(nom. nud.)*, ICZN Opinion 324] [**Am. lamberti* J.SOWERBY, 1819] [=*Bourkelamberticeras* BUCK., 1920 (obj.)]. Compressed, fine-ribbed, with acute periphery. Subgen. of *Quenstedtoceras*. *M.Jur.(U. Callov.)*, Eu.-Russia-Donetz-?Mont.——FIG. 372, *1. **Q. (L.) lamberti* (Sow.), Eng.; *1a,b*, ×0.7 (595*).

Prorsiceras BUCKMAN, 1918 [**Am. gregarius* LECKENBY, 1859]. Close to *Lamberticeras* but more evolute, planulate, with fasciculate prorsiradiate ribs, which form chevrons on venter. Subgen. of *Quenstedtoceras*. *M.Jur.(U.Callov.)*, Eng.-C.Russia. ——FIG. 372,*2*. **Q. (P.) gregarium* (LECK.), Eng.; *2a,b*, ×0.7 (65*).

Eboraciceras BUCKMAN, 1918 [**Am. dissimilis* BROWN, 1849] [=*Weissermeliceras* BUCK., 1920; *Sutherlandiceras* BUCK., 1922]. Inner whorls resemble inflated *Lamberticeras* with blunt periphery; outer whorls become smooth sphaerocones, hard to separate from *Cadoceras*. Subgen. of *Quenstedtoceras*. *M.Jur.(U.Callov.)*, Eu.-Russia.-Wyo.——FIG. 372,*3*. **Q. (E.) dissimile* (BROWN), Eng.; *3a,b*, ×0.7 (65*).

Pavloviceras BUCKMAN, 1920 [**Quenstedtoceras pavlowi* R.DOUVILLÉ, 1912] [=*Eichwaldiceras* BUCK., 1920]. Inflated at all stages, with strong wiry ribbing to end. Grades into *Goliathiceras* and *Scarburgiceras*. Subgen. of *Quenstedtoceras*. *U.Jur. (L.Oxf.)*, Eu.-Russia-Donetz-Wyo.——FIG. 373,*1*. **Q. (P.) pavlowi* (R.DOUV.), Fr.; *1a,b*, ×0.5 (134*).

Goliathiceras BUCKMAN, 1919 [**Am. ammonoides* YOUNG & BIRD, 1828] [=*Hortoniceras* BUCK., 1922]. Intermediate between *Eboraciceras* and *Cardioceras (s.s.)*. Inflated, commonly giants, with smooth sphaeroconic outer whorls; keel feeble. Lobes of suture long. *U.Jur.(L.Oxf.-U.Oxf.)*, Eu.-C.Russia-TransCaspia-Wyo.——FIG. 373,*2*. **G.*

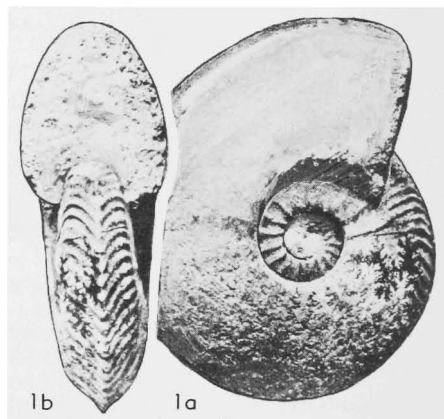


FIG. 374. *Goliathiceras (Pachycardioceras) robustum* (BUCKMAN) U.Jur.(U.Oxf.), Eng.; *1a,b*, ×0.5 (6*) (p. L305).

(G.) ammonoides (YOUNG-B.), Eng.; *2a,b*, ×0.5 (6*).

Goliathites ARKELL, 1943 [**Am. goliathus* D'ORBIGNY, 1849]. Differs from *Goliathiceras* by having short lobes. Subgen. of *Goliathiceras*. *U.Jur.(L. Oxf.-U.Oxf.)*, Eu.——FIG. 375,*4*. **G. (G.) goliathus* (ORB.), Fr.; *4a,b*, ×0.5 (6*).

Herznachites JEANNET, 1951 [**H. helveticus*]. Somewhat compressed, keel-less; doubtfully separable from *Goliathites*. ?Subgen. of *Goliathiceras*. *U.Jur. (L.Oxf., cordatum z.)*, Eu.——FIG. 379,*3*. **G.? (H.) helveticum*, Switz.; ×0.3 (220*).

Pachycardioceras BUCKMAN, 1926 [**P. robustum*]. Intermediate between *Goliathiceras* and *Cardioceras (s.s.)*. Subgen. of *Goliathiceras*. *U.Jur.(L. Oxf.-U.Oxf.)*, Eu.-C.Russia-N.Sib.-Wyo.——FIG. 374,*1*. **G. (P.) robustum* (BUCK.), Eng.; *1a,b*, ×0.5 (6*).

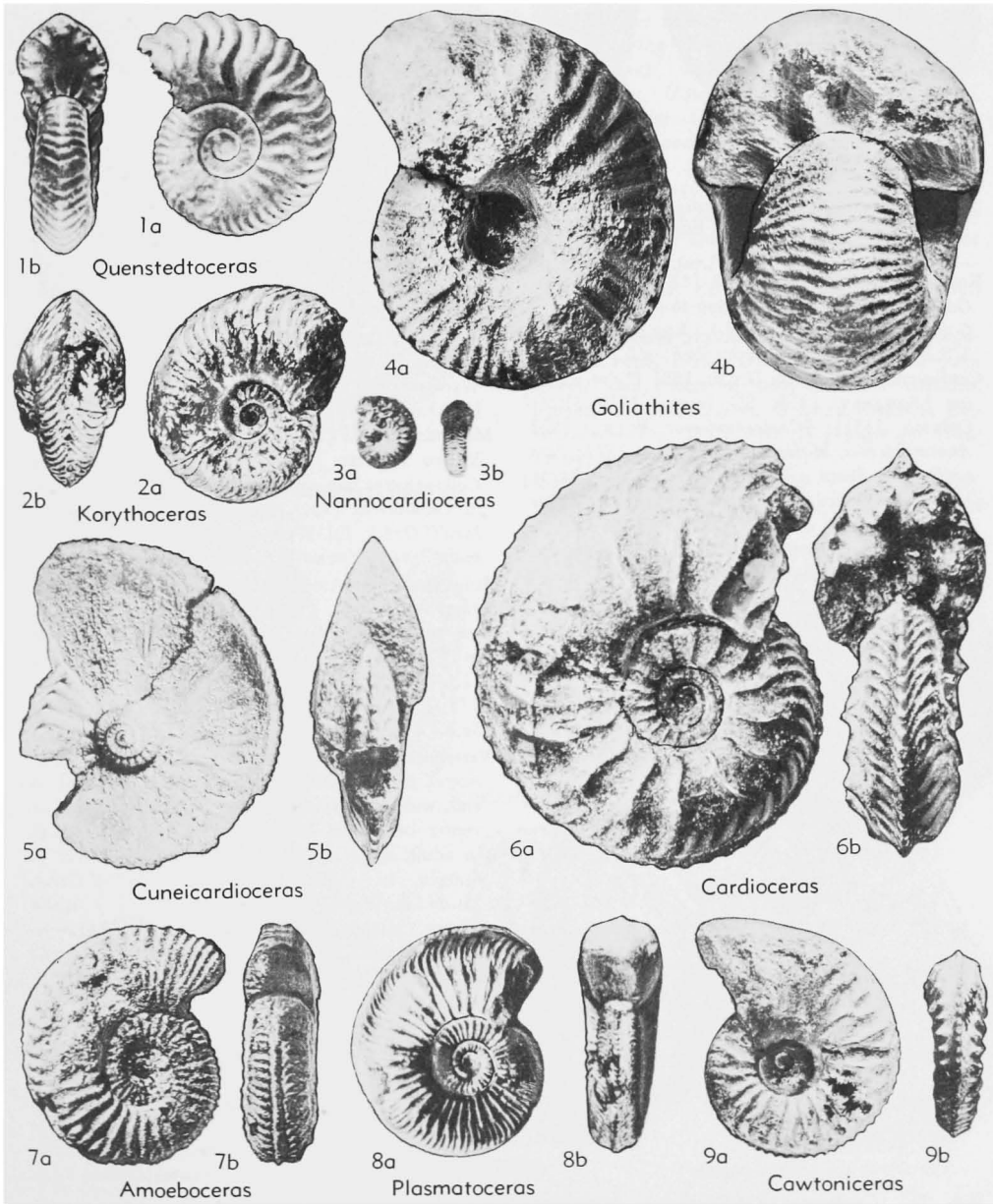


FIG. 375. Cardioceratidae (Cardioceratinae) (p. L304-L307).

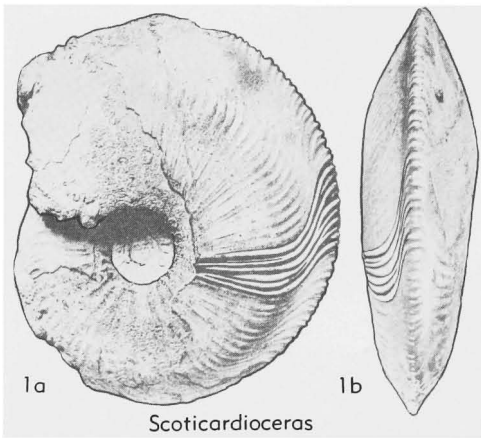


FIG. 376. *Cardioceras (Scoticardioceras) excavatum* (SOWERBY), U.Jur.(Oxf.), Eng. (p. L306).

Korythoceras BUCKMAN, 1920 [**K. korys*]. Small *Goliathiceras* with wiry ribbing to end. Subgen. of *Goliathiceras. U.Jur.(L.Oxf.)*, Eng.-Scot.——FIG. 375,*2*. **G. (K.) korys*, Scot.; *2a,b*, ×0.7 (65*).

Cardioceras NEUMAYR & UHLIG, 1881 [**Am. cordatus* J.SOWERBY, 1813; SD BUCK., 1920 (ICZN Opinion 235)] [*Chalcedoniceras* BUCK., 1922; *Anacardioceras, Miticardioceras* BUCK., 1923; *Paracardioceras* BUCK., 1925; *Galecardioceras* BUCK., 1926]. Restricted subgenus is moderately compressed, strongly keeled, with ribs well differentiated and secondaries strongly projected on venter; outer whorl large, becoming smooth. *U.Jur. (L.Oxf.-U.Oxf.)*, Eu.-Russia-N.Sib.-S.Alaska-Can.-Wyo.-Utah.——FIG. 375,*6*. **C. (C.) cordatum* (Sow.), Eng.; *6a,b*, lectotype (desig. Opinion 235), ×1 (6*).

Scarburgiceras BUCKMAN, 1924 [**Am. scarburgensis* YOUNG & BIRD, 1828]. Ancestral *Cardioceras* with less distinct keel, secondary ribs less differentiated and less projected on venter than in *Cardioceras*

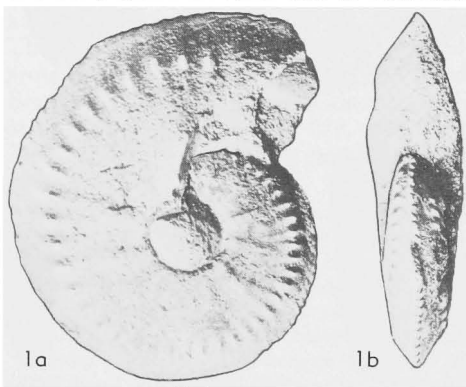


FIG. 377. *Cardioceras (Maltoniceras) maltonense* (YOUNG & BIRD), U.Jur.(U.Oxf.), Eng.

(s.s.). Subgen. of *Cardioceras. U.Jur.(L.Oxf.)*, Eu.-Donetz-S.Alaska-Can.-Wyo.——FIG. 379,*2*. **C. (S.) scarburgense* (YOUNG-B.), Eng.; *2a,b*, holotype, ×1 (7*).

Plasmatoceras BUCKMAN, 1925 [**P. plastum*]. Finely ribbed, inner whorls like some *Cardioceras (s.s.)*, but believed not to have smooth outer whorl. Subgen. of *Cardioceras. U.Jur.(L.Oxf.-U.Oxf.)*, Eu.-Donetz.——FIG. 375,*8*. **C. (P.) plastum* (BUCK.), Eng.; *8a,b*, ×1 (65*).

Scoticardioceras BUCKMAN, 1925 [**S. scoticum* BUCK. (=var. of *C. excavatum* J.SOWERBY)]. Compressed, involute, oxycone, with sigmoid aperture. Subgen. of *Cardioceras. U.Jur.(L.Oxf.-U.Oxf.)*, Eu.-N.Sib.-Wyo.——FIG. 376,*1*. **C. (S.) excavatum* (Sow.), Eng.; *1a,b*, ×0.5 (6*).

Cuneicardioceras ARKELL, 1941 [**C. (C.) cuneiforme*]. Close to *Scoticardioceras* but with specialized cuneiform ribbing. Subgen. of *Cardioceras. U.Jur.(U.Oxf.)*, Eng.——FIG. 375,*5*. **C. (C.) cuneiforme; 5a,b*, ×0.5 (6*).

Cawtoniceras BUCKMAN, 1923 [**Am. cawtonensis* BLAKE & HUDLESTON, 1877]. Keel minutely serrated; ribs strong and bifurcated, persisting to end. Subgen. of *Cardioceras. U.Jur.(U.Oxf.)*, Eu.-Can.-Wyo.——FIG. 375,*9*. **C. (C.) cawtonense* (BLAKE-H.), Eng.; *9a,b*, holotype, ×0.5 (6*).

Maltoniceras ARKELL, 1941 [**Am. maltonensis* YOUNG & BIRD, 1822]. Inner whorls resemble *Cawtoniceras* but outer whorl large and smooth as in *Cardioceras (s.s.)*. Subgen. of *Cardioceras. U. Jur.(U.Oxf.)*, Eu.-Wyo.——FIG. 377,*1*. **C. (M.) maltonense* (YOUNG-B.), Eng.; *1a,b*, ×0.5 (6*).

Subvertebriceras ARKELL, 1941 [**Cardioceras densiplicatum* BODEN, 1911]. Resembles *Cawtoniceras* except that keel has coarse distant serrations, as in *Vertebriceras*. Subgen. of *Cardioceras. U.Jur. (L.Oxf.-U.Oxf.)*, Eu.-N.Sib.-Can.-Wyo.——FIG. 379,*5*. **C. (S.) densiplicatum* (BODEN), Lithuania; *5a,b*, ×1 (39*).

Vertebriceras BUCKMAN, 1920 [**V. dorsale*] [*Sagitticeras* BUCK., 1920]. Inflated, strongly ribbed to end, with coarsely serrated keel and broad tabulate venter on which ribbing forms strong chevrons in adult, some with loss of keel (*"Sagitticeras"*). Subgen. of *Cardioceras. U.Jur.(L.Oxf.-U.Oxf.)*, Eu.-N.Sib.-Wyo.——FIG. 378,*1a,b*. *C. (V.) sagitta* (BUCK.) (type of *Sagitticeras*); ×0.5 (583).——FIG. 378,*1c,d*. **C. (V.) dorsale* (BUCK.), Eng.; ×0.5 (6*).

Amoeboceras HYATT, 1900 [**Am. alternans* VON BUCH, 1832] [=*Plasmatites* BUCKMAN, 1925]. Restricted subgenus is small, finely ribbed to end, with tabulate venter and minutely serrated keel, flanked by smooth bands or shallow sulci. *U.Jur. (U.Oxf., bimammatum z.)*, Eu.-Russia-Donetz-Cauc.-AndoeI.-Spitz.-NovayaZemlya-W.Sib.-Greenl. ——FIG. 375,*7*. **A. (A.) alternans* (BUCH); *7a,b*, ×1 (397*).

Amoebites BUCKMAN, 1925 [**A. akanthophorus*

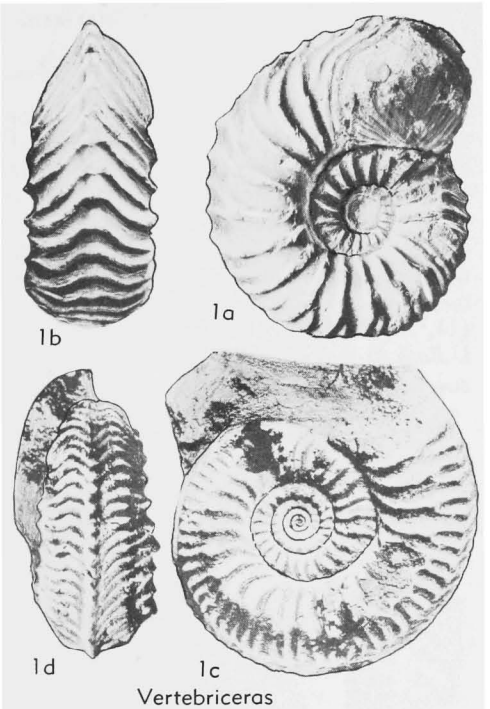


FIG. 378. Cardioceratidae (Cardioceratinae) (p. L306).

(=*Cardioceras kitchini* SALFELD, 1915)]. *Vertebriceras*-like offshoot differing from *Amoeboceras (s.s.)* by its minutely serrated, stouter, depressed keel, and coarser ribs which on outer whorl become still coarser, looped and spinous in some. Subgen. of *Amoeboceras. U.Jur.(L.Kimm.)*, Eu.-Russia-Greenl.-Calif.——FIG. 379,*4*. **A. (A.) kitchini* (SALFELD), Eng.; ×0.7 (65*).

Prionodoceras BUCKMAN, 1920 [**P. prionodes*] [=*Prionoceras* BUCK., 1920 (obj.) (*non* HYATT, 1883)]. Inner whorls like *Amoeboceras (s.s.)*, but soon becoming more compressed; outer whorls large, smooth, with acute venter. Subgen. of *Amoeboceras. U.Jur.(U.Oxf., bimammatum z.)*, Eu.-Russia-Spitz.-Greenl.-Alaska.——FIG. 379,*1*. **A. (P.) prionodes* (BUCK.), Eng.; *1a,b*, ×0.3 (65*).

Euprionoceras SPATH, 1935 [**E. kochi*]. Inner whorls like those of *Prionodoceras*, but adult remaining evolute and ribbed to end. Subgen. of *Amoeboceras. U.Jur.(L.Kimm.)*, Greenl.-Spitz.——FIG. 379,*6*. **A. (E.) kochi* (SPATH), Greenl.; ×0.3 (474*).

Nannocardioceras SPATH, 1935 [**Cardioceras anglicum* SALFELD, 1915]. Dwarfs with smooth outer whorl, and venter of body chamber rounded. Subgen. of *Amoeboceras. U.Jur.(L.Kimm.)*, Eu.-Greenl.——FIG. 375,*3*. **A. (N.) anglicum* (SALFELD), Eng.; *3a,b*, ×1 (397*).

Hoplocardioceras SPATH, 1935 [**H. decipiens*]. Evolute, resembling *Aspidoceras*, with 3 rows of

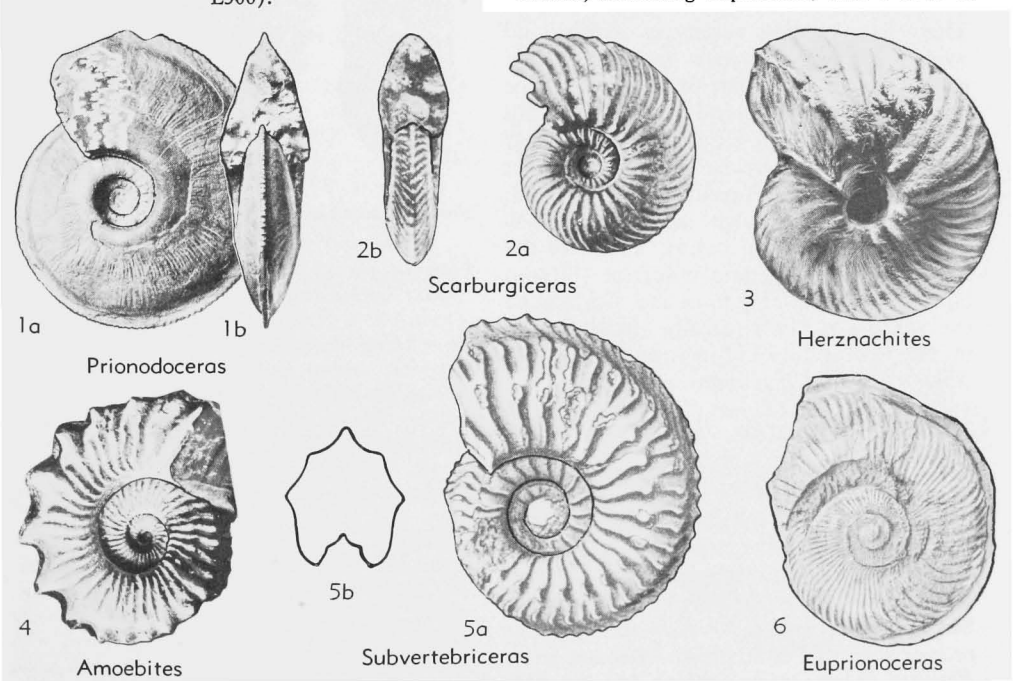


FIG. 379. Cardioceratidae (Cardioceratinae) (p. L305-L307).

FIG. 380. *Hoplocardioceras decipiens* SPATH, U.Jur. (L.Kimm.), Greenl.; *1*, ×0.3 (474*).

spines. *U.Jur.(L.Kimm.)*, Greenl.——FIG. 380,*1*. **H. decipiens* SPATH; ×0.3 (474*).

Superfamily PERISPHINCTACEAE Steinmann, 1890

[as Perisphinctinae; section Perisphinctoidea WEDEKIND, 1917]

Typically evolute planulates, with sharp-branched ribbing and complex differentiated sutures with dominant 1st lateral lobe and more or less retracted suspensive lobe. There is an endless variety of ribbing and whorl shape. The platycone trend frequently recurs but is never carried to the oxycone grade. The cadicone trend is much rarer but does occur *(Gravesia)*. Sphaerocones appear only in Morphoceratidae and the aberrant *Neomorphoceras*. Aptychus double-valved; only a few are known *in situ* and they differ from family to family. Those of the main stock have a granular surface (Granulaptychus); in *Parkinsonia* and *Garantiana* the surface is concentrically ribbed, as in the Kosmoceratidae (Praestriaptychus); in *Aspidoceras* and *Hybonoticeras* it is punctate (Laevaptychus). *M. Jur. (M. Baj.) - L. Cret. (Valang.)*, world-wide.

In Europe, the earliest known Perisphinctaceae appear suddenly in quantity at the base of the Upper Bajocian. In southern Alaska and South America there are isolated records in the Middle Bajocian. Derivation unknown, but may have been from Stephanoceratidae such as *Kumatostephanus* or independently of Stephanocerateceae from *Erycites* (Hammatoceratidae) (6, 14, 443, 466).

Family PARKINSONIIDAE Buckman, 1920

[*nom. correct.* ARKELL, herein (*pro* Parkinsonidae BUCK., 1920)] [=Garantianidae WETZEL, 1937]

Early Perisphinctaceae with sharp ribbing which is interrupted on venter by smooth band or groove; tubercles commonly develop at points of bifurcation of ribs and at ventral edge or on venter. Sutures relatively simple, with suspensive lobe not much retracted. Granulaptychus occurs in *Garantiana* and Praestriaptychus in *Parkinsonia* (14, 33, 34, 127, 316, 427). *M.Jur.(U.Baj.-U.Bath.)*, world-wide.

Strenoceras HYATT, 1900 [**Am. niortensis* D'ORBIGNY, 1846 (=**Am. bajocensis* DEFRANCE, 1830)]. Ribs very strong, sharp, straight, mostly simple, with lateral and ventral tubercles; aperture with lappets. *U.Baj.*, Eu.-N.Afr.-Cauc.——FIG. 381,*1*. **S. bajocense* (DEFR.), Fr.; *1a,b*, holotype, ×1 (675*).

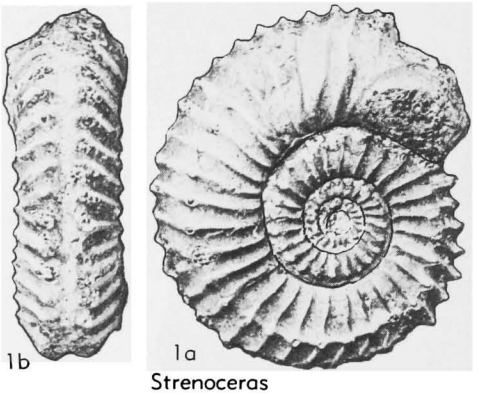


FIG. 381. *Strenoceras bajocense* (DEFRANCE), M.Jur. (U.Baj.), Fr.; *1a,b*, ×1 (675*) (p. L308).

Epistrenoceras BENTZ, 1928 (Nov.) [**Am. contrarius* D'ORBIGNY, 1846] [=*Pseudostrenoceras* SPATH, 1928 (Dec.)]. Like *Strenoceras*, but ribs bent forward to form chevrons on whorl sides and tubercles obsolete or fading. *U.Baj.-U.Bath.*, Eu.-Donetz-Madag.-Mex.——FIG. 384,*11*. **E. contrarium* (ORB.), Fr.; *11a,b*, ×0.7 (330*).

Pseudogarantiana BENTZ, 1928 [**P. dichotoma*]. Small, evolute; ribs sharp, simple and bifid; with lappets. *U.Baj.*, Eu.——FIG. 384,*1*. **P. dichotoma*, Ger.; *1a,b*, ×1 (34*).

Garantiana MASCKE, 1907 [**Am. garantianus* D'ORBIGNY, 1846 (ICZN Opinion 324)] [=*Garantia* ROLLIER, 1911 (obj.); *Baculatoceras* MASCKE, 1907; *Odontolkites* BUCKMAN, 1925]. Ribbing sharp, simple to triplicate, mainly biplicate, with or without lateral tubercles, invariably with small ventral tubercles; no lappets. *U.Baj.-M.Bath.*, Eu.-N.Afr.-Donetz-Cauc.-Transbaikal.——FIG. 382,*1*.

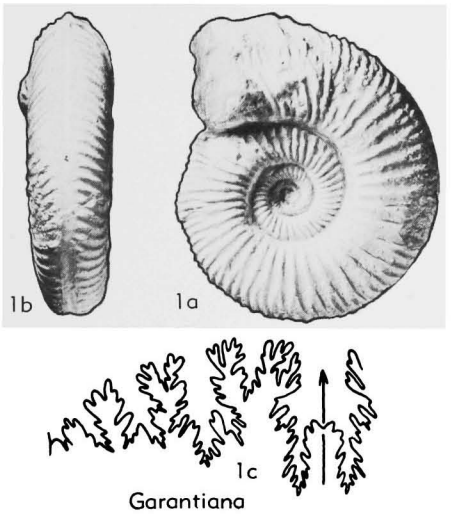


FIG. 382. *Garantiana (Garantiana) garantiana* (D'ORBIGNY), M.Jur., Fr. (p. L308).

Hlawiceras* BUCKMAN, 1921 [H. platyrrymum*] [=*Subgarantiana* BENTZ, 1928]. Ribs coarser, more distant than in *Garantiana (s.s.)*, secondaries projected; no lappets. Subgen. of *Garantiana. U. Baj.*, Eu.——FIG. 384,*3*. **G. (H.) platyrrymum* (BUCK.), Eng.; *3a,b*, ×0.7 (65*).

Orthogarantiana* BENTZ, 1928 [Garantiana schroederi* BENTZ, 1924]. Early forms with rectiradiate ribs (not projected), lateral but not ventral tubercles, and ventral sulcus very narrow or even absent. Subgen. of *Garantiana. U.Baj.*, Eu.——FIG. 384,*13*. **G. (O.) schroederi* (BENTZ), Ger.; *13a,b*, ×0.5 (588*).

Hemigarantia* SPATH, 1928 [Am. julii* D'ORBIGNY, 1846]. Like *Garantiana (s.s.)* but trituberculate. ?Subgen. of *Garantiana. U.Baj.*, Fr.-Alg.——FIG. 384,*2*. **G.? (H.) julii* (ORB.), Fr.; *2a,b*, ×1 (330*).

Praeparkinsonia* SCHMIDTILL & KRUMBECK, 1931 [P. garantiformis;* SD ROMAN, 1938]. Like *Garantiana*, but ribs alternate on venter, as in many *Parkinsonia*. Basal *U.Baj.*, Ger.——FIG. 384,*4*. **P. garantiformis; 4a,b*, ×0.6 (427*).

Parkinsonia* BAYLE, 1878 [Am. parkinsoni* J.SOWERBY, 1821; SD H.DOUVILLÉ, 1879]. Compressed, with strong, sharp, biplicate ribbing, which persists to end, with or without lateral tubercles; ?no lappets. *U.Baj.-L.Bath.*, Eu.-N.Afr.-Donetz-Crimea-Cauc.-Azerbaijan-Persia.——FIG. 384,*6*. **P. (P.) parkinsoni* (Sow.), U.Baj., Eng.; *6a,b*, holotype, ×0.3 (595*).

Durotrigensia* BUCKMAN, 1928 [Am. dorsetensis* T. WRIGHT, 1856]. Large to giant forms with sharply and finely ribbed inner and middle whorls, smooth outer whorl; no tubercles, no lappets. Subgen. of *Parkinsonia. U.Baj.*, Eu.——FIG. 384,*5*. **P. (D.) dorsetensis* (WRIGHT), Eng.; ×0.9 (65*).

Gonolkites* BUCKMAN, 1925 [G. convergens*]. Inner whorls with blunt ribbing, secondaries long; middle and outer whorls smooth, unribbed; no tubercles, no lappets. Subgen. of *Parkinsonia. L. Bath.*, Eu.——FIG. 384,*7*. **P. (G.) convergens* (BUCK.), Eng.; ×0.3 (65*).

Oraniceras* FLAMAND, 1911 [O. hamyanense*]. Compressed, involute, inner and middle whorls well ribbed, with ribbing in some inclined to be fasciculate, outer whorl large, smooth, becoming discoidal. In some specimens, a keel-like raised fillet takes place of ventral smooth band and may appear on either test or cast. No tubercles, no lappets. Comprises *wurttembergica* group. Subgen. of *Parkinsonia. L.Bath.*, Eu.-N.Afr.-Donetz.——FIG. 384,*12*; 385,*1*. **P. (O.) hamyanensis* (FLAMAND), Alg.; ×1 (386*).

Okribites* KAKHADZÉ, 1937 [O. okribensis;* SD SALISBURY, 1939 (Zool. Record)]. Differs from *Oraniceras* by being rather less involute and not developing smooth discoidal outer whorl; fine ribbing persists to end and becomes crowded toward the adult aperture. A fine-ribbed, involute, nontuberculate development of *Parkinsonia (s.s.)*. Subgen. of *Parkinsonia. U.Baj.-L.Bath.*, Eu.-N.Afr.-Cauc.——FIG. 384,*10*. **P. (O.) okribensis* (KAK.), Georgia; ×0.7 (223*).

Caumontisphinctes* BUCKMAN, 1920 [C. polygyralis*]. Evolute, *Perisphinctes*-like, but with parkinsoniid venter, ribbing, and suture. *Low.U.Baj.(subfurcatum z.)*, Eu.——FIG. 384,*9*. **C. polygyralis*, Eng.; ×0.5 (65*).

Pseudocosmoceras* MOURACHKINE, 1930 [Cosmoceras michalskii* BORISSJAK, 1908]. Inner whorls rounded; middle whorls evolute, compressed, with tabulate smooth venter bordered by small tubercles

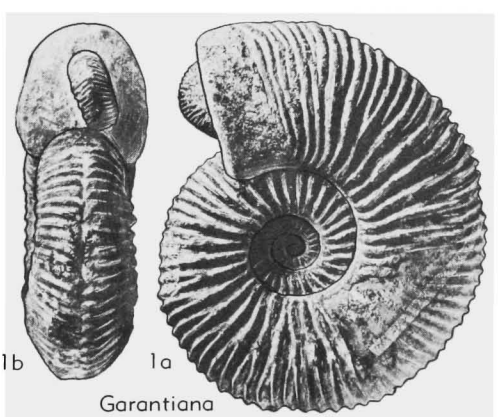


FIG. 383. *Garantiana (Garantiana) parkinsoni longidens* (QUENSTEDT), M.Jur., Ger.; *1a,b*, ×0.5.

at ends of secondary ribs; primary ribs obsolete; outer whorl evolute, smooth, oval, with rounded venter, *Psiloceras*-like. Sutures parkinsoniid, with small, short, 1st lateral lobe. *L.Bath.*, Donetz.—— Fig. 348,*8*. **P. michalskii* (Bor.); ×1 (44*).

[?**Subparkinsonia** Mascke, 1907 *(nom. nud.)*].

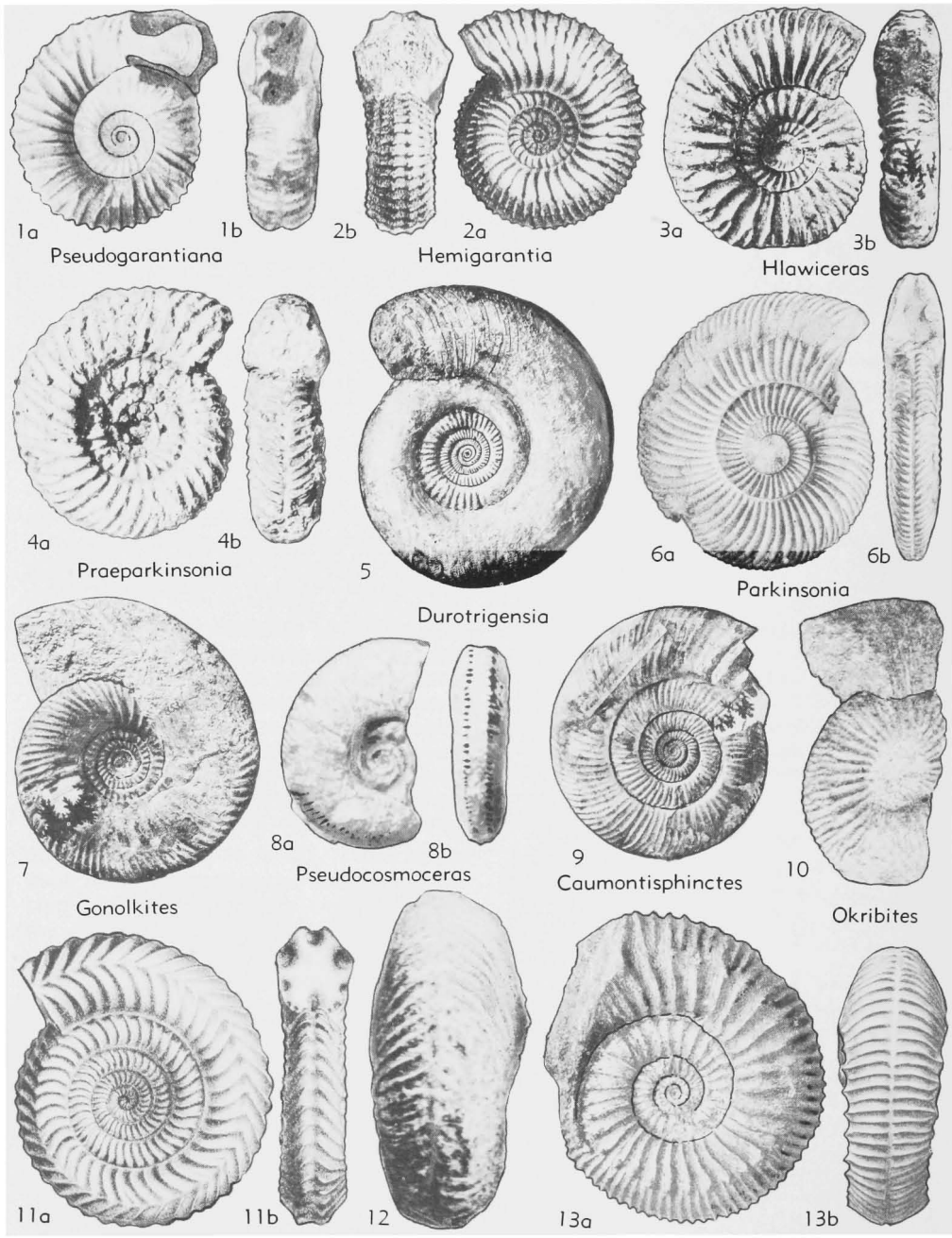


Fig. 384. Parkinsoniidae (p. L308-L309).

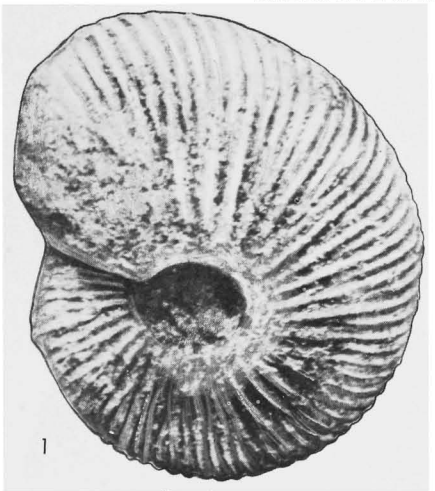


FIG. 385. *Parkinsonia (Oraniceras) hamyanensis* (FLAMAND), M.Jur.(Bath.), Alg.; *1*, ×1 (p. L309).

Family MORPHOCERATIDAE Hyatt, 1900

Planulates and sphaerocones, and combinations of both, with mixture of stephanoceratacean and perisphinctacean characters. All show peculiar aberrant bundling or furcation of the ribs, generally truncated very obliquely by constrictions, and most have a ventral smooth band or sulcus. Sutures relatively simple, with suspensive lobe not retracted. Believed to have been derived from early perisphinctids in the Middle or early Late Bajocian and to be reverting to perisphinctid characters in the Early Bathonian (14). *M.Jur.(U.Baj.-L.Bath.)*, Eu.-W. Tethys.

Morphoceras H.DOUVILLÉ, 1880 [**Am. polymorphus* D'ORBIGNY, 1846 (*non* QUENSTEDT, 1845) (=*M. multiforme* ARKELL, 1951)] [*Patemorphoceras* BUCKMAN, 1922; *?Asphinctites* BUCK., 1924]. Inner whorls sphaerocone, outer whorls becoming planulate; ventral smooth band and typically but not invariably with numerous deep oblique constrictions which transect ribbing; aperture simple. *L.Bath.*, Eu.-N.Afr.-Persia.——FIG. 386,*3*. **M. multiforme* ARKELL, Fr.; lectotype, ×1 (330*).

Dimorphinites BUCKMAN, 1923 [**Am. dimorphus* D'ORBIGNY, 1846]. Differs from *Morphoceras* by tighter coiling of inner whorls, with occluded umbilicus, and by absence of ventral smooth band. ?Subgen. of *Morphoceras*. *U.Baj.(parkinsoni z.)*, Eu.-N.Afr.-Azerbaijan-Persia.——FIG. 386,*1*. **M.? (D.) dimorphum* (ORB.); *1a-c*, ×0.7 (65*).

Ebrayiceras BUCKMAN, 1920 [**E. ocellatum* BUCK. (=**Am. pseudoanceps* EBRAY, 1864)]. Planulates, evolute, flat-sided, with long secondary ribs, deep ventral groove, and elaborate lappets which may join and almost close the aperture. *L.Bath.-M.Bath.*, Eu.-N.Afr.-Persia.——FIG. 386,*2*. **E. pseudoanceps* (EBRAY); *2a,b*, ×1 (65*).

Polysphinctites BUCKMAN, 1922 [**P. polysphinctus*]. Dwarf evolute planulates, with feeble ribbing, many deep constrictions, and compressed, smooth outer whorls; large spatulate lappets. *L.Bath.*, Eu. ——FIG. 387,*1*. **P. polysphinctus*, Eng.; ×1 (65*).

?Sulcohamites WETZEL, 1937 [**S. eimensis*]. Uncoiled ammonoid differing from Spiroceratidae by possessing old mouth borders and concave impressed area (dorsum) bounded by ridges, which seem to be relics of coiling. WETZEL considered it an uncoiled offshoot of *Ebrayiceras*. *L.Bath.*, Ger. ——FIG. 387,*2*. **S. eimensis; 2a,b*, ×2.5 (563*).

Family REINECKEIIDAE Hyatt, 1900

[*nom. correct.* ARKELL, herein (*pro* Reineckidae, *sic*, HYATT, 1900)]

Mainly planulates, commonly with coronate innermost whorls, strong ribbing, many with lateral tubercles or spines, and invariably bearing ventral smooth band or sulcus. Some forms strongly resemble *Ebrayiceras* and suggest derivation from Morphoceratidae, but the spinous coronate nucleus of others suggest Parkinsoniidae as likely an-

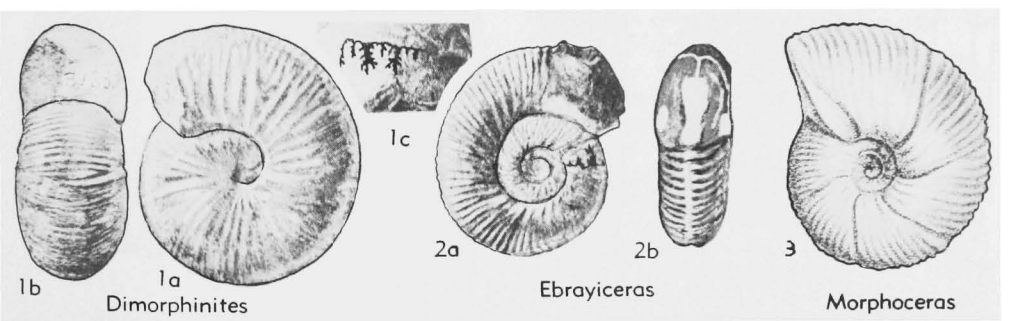


FIG. 386. Morphoceratidae (p. L311).

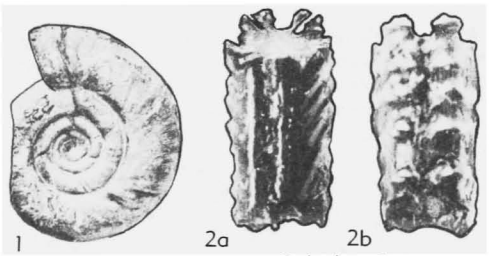


FIG. 387. Morphoceratidae (p. L311).

cestors. No connecting links with either family are known in the Upper Bathonian except the improbable *Epistrenoceras,* and the nearest known *Ebrayiceras* is Middle Bathonian (72, 201, 220, 466, 505). *M.Jur. (Callov.),* world-wide except boreal.

Epimorphoceras SPATH, 1928 [**Perisphinctes decorus* WAAGEN, 1875]. Nucleus coronate, tuberculate; remainder planulate, becoming compressed, with fine, close, fasciculate, nontuberculate ribbing. Perhaps transitional from Morphoceratidae. *L.Callov.(macrocephalus z.),* Cutch.——FIG. 388, *1.* **E. decorum* (WAAGEN); *1a-c,* ×0.5 (546*).

Reineckeia BAYLE, 1878 [**Nautilus anceps* REINECKE, 1818]. Inner whorls coronate, tuberculate; later whorls become stout planulate, with large distant primary ribs, commonly bullate, and a single row of median lateral tubercles at furcation of ribs. *M.Callov.(anceps z.),* Eu.-N.Afr.-Madag.-Anatolia-Cauc.-Trans Caspia-Persia-Cutch-Pamir-Himalaya-S.Alaska-Mex.-S.Am.——FIG. 389,*1.* **R. (R.) anceps* (REIN.), Ger.; ×0.3 (586*).

Reineckeites BUCKMAN, 1924 [**R. duplex* (*?=Reineckeia stuebeli* STEINMANN, 1881]. Differs from *Reineckeia (s.s.)* in lacking tubercles and in its normally biplicate ribbing and having lappets. Subgen. of *Reineckeia. U.Callov.,* Eu.-N.Afr.-Cutch-Himalaya-Mex.-Calif.——FIG. 390,*1.* **R. (R.) duplex* (BUCK.), Eng.; *1a,b,* ×0.7 (65*).

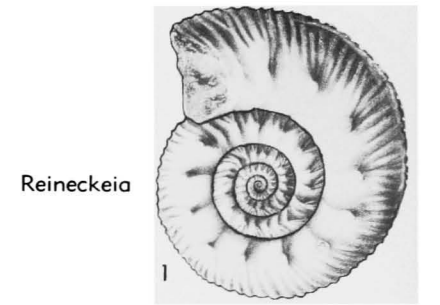


FIG. 389. Reineckeiidae (p. L312).

Kellawaysites BUCKMAN, 1925 [**Reineckeia multicostata* PETITCLERC, 1915]. Inner whorls finely ribbed, not coronate, primary ribs long, tubercles feeble or absent; outer whorls large, ribbing becoming gradually more distant. Subgen. of *Reineckeia. U.Callov.,* Eu.-Persia-Cutch-Mex.——FIG. 391,*1.* **R. (K.) multicostata* (PETITCL.), Fr.; ×0.5 (680*).

Collotia DE GROSSOUVRE, 1917 [**Am. fraasi* OPPEL, 1857] [*Collotites* JEANNET, 1951]. Giant, evolute, constricted, trituberculate. In some species tuberculation is strongest on inner whorls and feebler

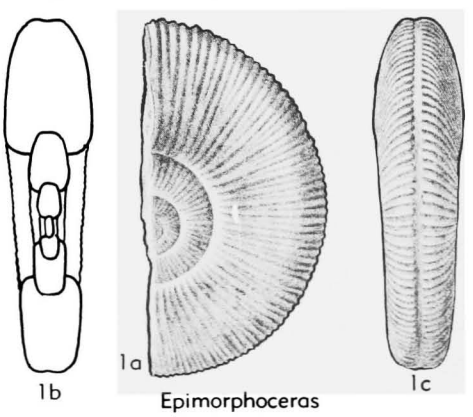


FIG. 388. *Epimorphoceras decorum* (WAAGEN), M. Jur.(L.Callov.), Cutch; *1a-c,* ×0.5 (546*).

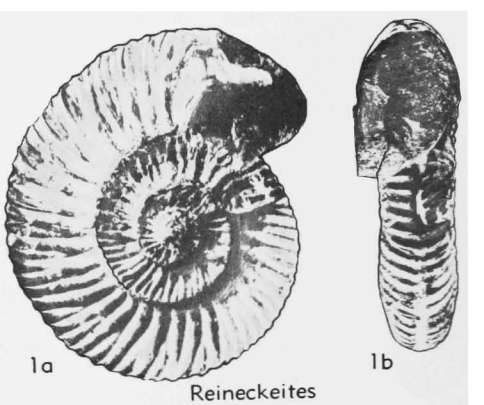
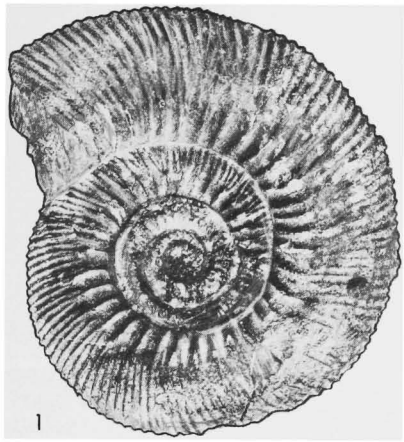


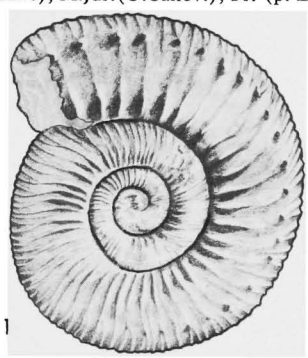
FIG. 390. *Reineckeia (Reineckeites) duplex* (BUCKMAN), M.Jur.(U.Callov.), Eng.; 1a,b, ×0.7.

later, in others (*"Collotites"*) it is feeble or absent on inner whorls but stronger later. *U.Callov.*, Eu.-Cutch.——Fig. 389,*2*. **C. fraasi* (Oppel), Ger.;



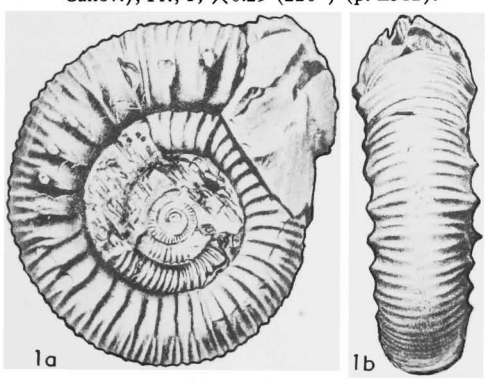
Kellawaysites

Fig. 391. *Reineckeia (Kellawaysites) multicostata* (Petitclerc), M.Jur.(U.Callov.), Fr. (p. L312).



Collotia

Fig. 392. *Collotia petitclerci* Jeannet, M.Jur.(U. Callov.), Fr.; *1*, ×0.25 (220*) (p. L312).



Nequeniceras

Fig. 393. *Nequeniceras steinmanni* (Stehn), M.Jur. Callov.), Arg.; *1*, ×0.5 (492*) (p. L313).

2a,b, ×1 (672).——Fig. 392,*1*. *C. petitclerci* Jeannet (type of *Collotites*); ×0.25 (220*).

Nequeniceras Stehn, 1924 [**Perisphinctes steinmanni* Stehn] [*Frickites* Jeannet, 1951]. Evolute to serpenticone, perisphinctoid, inner whorls nontuberculate, outer whorls suddenly becoming unituberculate after a constriction. *Callov.*, Arg.-?Eu. ——Fig. 393,*1*. **N. steinmanni* (Stehn), Arg.; ×0.5 (492*).

Family PERISPHINCTIDAE Steinmann, 1890

[as Perisphinctinae]

Typically planulates with biplicate, simple, or triplicate ribbing. As with many Stephanoceratacеae, there are 2 main groups: (1) large forms with simple aperture and commonly a smooth or distantly ribbed body chamber, and (2) small forms with lappets, and body chamber ribbed to the end. Lateral offshoots show trends toward smooth venters, or general smoothing with platycone shape, or (in a few) cadicones. The sutures of all are differentiated stephanoceratacean, with suspensive lobe more or less retracted. The family, as now comprehended, corresponds roughly with the genus *Perisphinctes* as monographed by Siemiradzki in 1898-99, representing the main trunk or stem of the perisphinctacean tree after lopping off the families Parkinsoniidae, Morphoceratidae, Reineckeiidae, Aspidoceratidae and the terminal branches Berriasellidae and Craspeditidae (6, 14, 70, 78, 443, 466). *M.Jur.-U.Jur.*, world-wide, but mainly Tethyan and Pacific at most horizons.

Subfamily LEPTOSPHINCTINAE Arkell, 1950

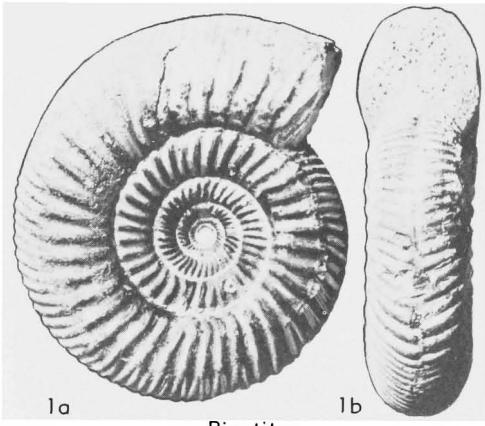
The first assemblage of typical Perisphinctidae, from which branched off at least some of the Parkinsoniidae and Morphoceratidae, and which gave rise directly to the Zigzagiceratinae and thence the whole of the subsequent perisphinctacean stock (12, 14, 65, 317). *M.Jur.(M.Baj.-U.Baj.)*.

?Praebigotites Wetzel, 1936 [**P. westfalicus*]. Small forms doubtfully characterized. No lappets. *U.Baj.(subfurcatum z.)* or highest *M.Baj.*, Ger. (no figure).

Bigotites Nicolesco, 1918 [*pro Bigotella* Nic., 1917 (*non* Cossmann, 1914)] [**Bigotella petri* Nic., 1917; SD Nic., 1931 (ICZN Opinion 324)] [*Pseudobigotella* Lemoine, 1918 (obj.); *Haselburgites* Buckman, 1920; *Bajocisphinctes* Buck., 1927]. Round-whorled, strongly ribbed, with smooth band on venter, constricted and enlarging "segmentally"

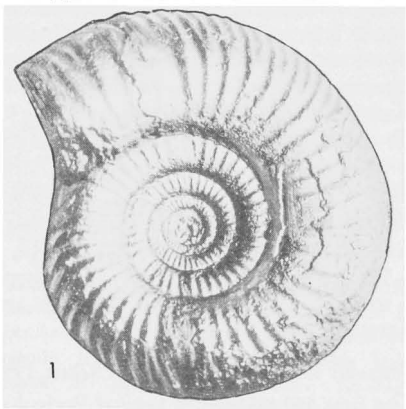
after the constrictions. Suspensive lobe not strongly retracted. *U.Baj.*, Eu.-N.Afr.——Fig. 394,*1*. **B. petri* (Nic.), Fr.; *1a,b*, ×0.5 (669*).

Leptosphinctes Buckman, 1920 [**L. leptus*]. Compressed, evolute, constricted, finely ribbed; venter smooth on body chamber; peristome with simple oblique terminal constriction. *M.Baj.*, N.Am.-S. Am.; *U.Baj.(subfurcatum z.)*, Eu.-N.Afr.-Sinai-S. Alaska-Arg.——Fig. 396,*1*. **L. (L.) leptus*, Eng.; *1a,b*, ×0.4 (595*).



Bigotites

Fig. 394. *Bigotites petri* (Nicolesco), M.Jur.(U. Baj.), Fr.; *1a,b*, ×0.5 (669*) (p. L313).



Prorsisphinctes

Fig. 395. *Leptosphinctes (Prorsisphinctes) pseudomartinsi* (Siemiradzki), M.Jur.(U.Baj.), Fr.

Prorsisphinctes Buckman, 1921 [**Perisphinctes pseudomartinsi* Siemiradzki, 1899] [*Stomphosphinctes, ?Phanerosphinctes* Buck., 1921; *?Glyphosphinctes* Buck., 1925]. Like *Leptosphinctes* and with simple or slightly trumpet-shaped peristome, but whorls stouter and nucleus not tuberculate. Subgen. of *Leptosphinctes*. *U.Baj.*, Eu.—— Fig. 395,*1*. **L. (P.) pseudomartinsi* (Siem.), Fr.; ×0.7 (443*).

Vermisphinctes Buckman, 1920 [**V. vermiformis*] [=*Spathia* Schindewolf, 1925]. Group of *Perisphinctes martinsi* (d'Orbigny). Resembling *Leptosphinctes (s.s.)* and *Prorsisphinctes* and deeply constricted, but with large asymmetric lappets. Subgen. of *Leptosphinctes*. *U.Baj.*, Eu.-N.Afr.-Azerbaijan.——Fig. 396,*3*. **L. (V.) vermiformis*, Eng.; *3a,b*, ×0.4 (65*).

Cleistosphinctes Arkell, 1953 [**Leptosphinctes cleistus* Buckman, 1920]. Small, compressed, evolute, with long secondary ribs and very large asymmetric spatulate lappets which embrace sides of preceding whorl. *U.Baj.(subfurcatum z.)*, Eu.-N. Afr.- Cauc.——Fig. 396,*2*. **C. cleistus* (Buck.), Eng.; ×0.7 (65*).

Subfamily ZIGZAGICERATINAE Buckman, 1920

Small to giant derivatives of Leptosphinctinae, especially characteristic of the Bathonian. Nuclei or early whorls typically pseudocoronate, with parabolic nodes simulating stephanoceratid tubercles. Sutures elaborate, suspensive lobe well retracted (14, 65). *M. Jur.(U.Baj.-Bath.), ?M.Jur.(L.Callov.).*

Lobosphinctes Buckman, 1923 [**L. intersertus*]. Evolute, with wiry ribs and long lobes. If correctly placed stratigraphically by Buckman (basal *parkinsoni z.*) may be ancestor of *Procerites*, or else earliest known *Procerites*. *M.Jur.(?parkinsoni*

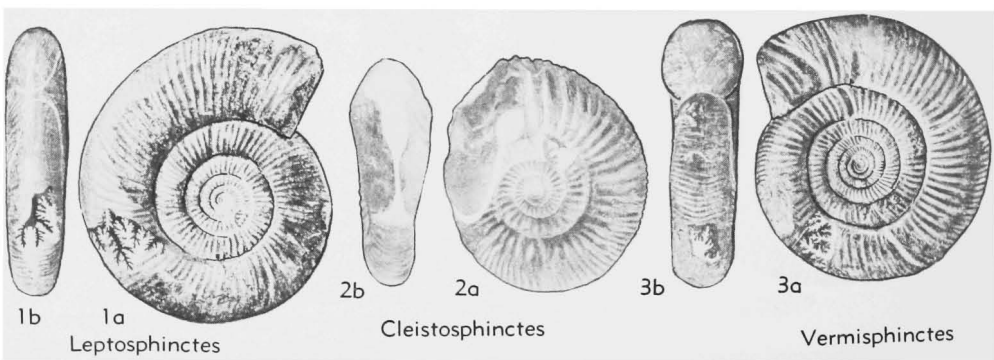


Fig. 396. Perisphinctidae (Leptosphinctinae) (p. L314).

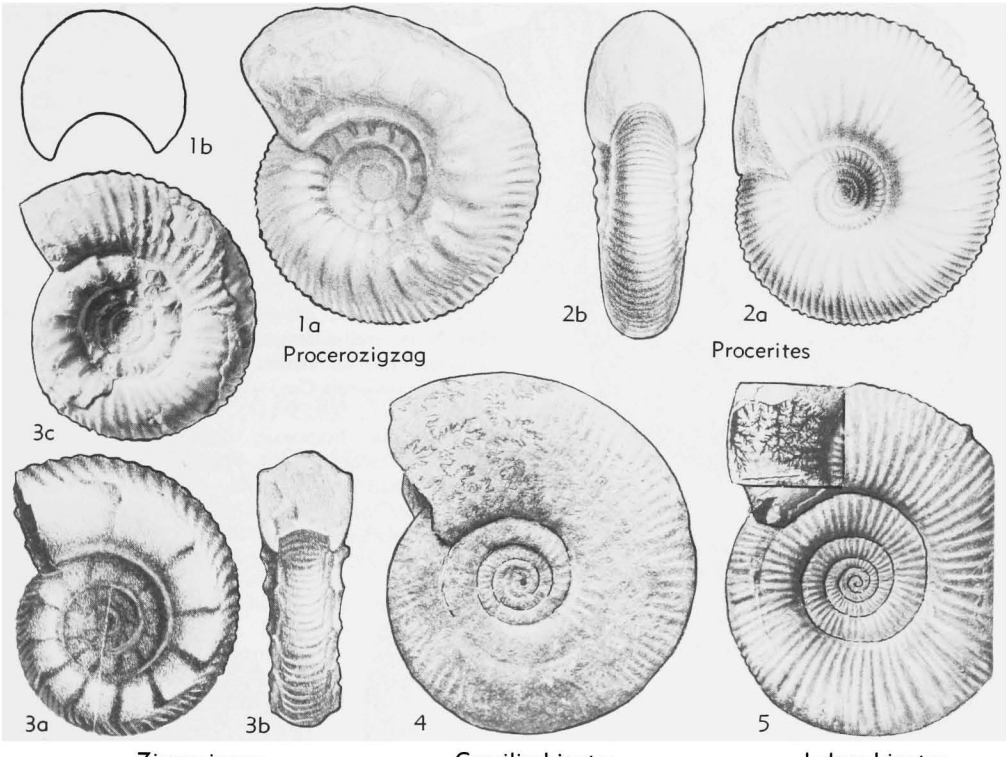


FIG. 397. Perisphinctidae (Zigzagiceratinae) (p. L314-L316).

z.).——FIG. 397,*5*. **L. intersertus*, Eng.; ×0.3 (65*).

Procerites SIEMIRADZKI, 1898 [**P. procerus* SCHLOENBACH, 1865 (*non* VON SEEBACH, 1864) (=**P. schloenbachi* DE GROSSOUVRE, 1907; SD BUCKMAN, 1914 (ICZN Opinion 301)] [*Parkinsonites* BUCK., 1922; *Euprocerites* WETZEL, 1950 (obj.)]. Large planulates, rather finely ribbed, not constricted, only the nucleus (up to a few mm. in diameter) pseudocoronate; peristome simple, body chamber smooth. *L.Bath.-M.Bath., ?L.Callov.*, Eu.-Cauc.-Persia.——FIG. 397,*2*. **P. (P.) schloenbachi* GROSS., Ger.; *2a,b*, holotype, ×0.3 (701*).

Phaulozigzag BUCKMAN, 1926 [**P. phaulomorphus*]. Small, fine-ribbed, with lappets. Subgen. of *Procerites*. *L.Bath.*, Eu.——FIG. 398,*1*. **P. (P.) phaulomorphus* (BUCK.), Eng.; ×1 (65*).

Zigzagiceras BUCKMAN, 1902 [**Am. zigzag* D'ORBIGNY, 1846]. Small, with large lappets. Only last whorl or half whorl is perisphinctoid, all the rest coronate, with large distant noded ribs and tabulate venter. *L.Bath.*, Eu.——FIG. 397,*3*. **Z. (Z.) zigzag* (ORB.); *3a,b*, holotype, Fr., ×1 (330); *3c*, adult, Eng., ×0.5 (583n).

Procerozigzag ARKELL, 1953 [**Zigzagiceras crassizigzag* BUCKMAN, 1892]. Large, stout-whorled, body chamber becoming smooth, peristome simple. Outer whorls resemble *Procerites* though stouter; middle and inner whorls pseudocoronate like those of *Zigzagiceras (s.s.)*. Subgen. of *Zigzagiceras*. *L. Bath.*, Eu.-Mex.——FIG. 397,*1*. **Z. (P.) crassizigzag* (BUCK.), Eng.; *1a,b*, ×0.3 (595*).

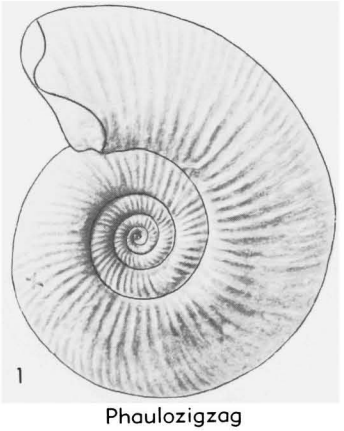


FIG. 398. *Procerites (Phaulozigzag) phaulomorphus* (BUCKMAN), M.Jur.(L.Bath.), Eng. (p. L315).

FIG. 399. *Wagnericeras wagneri* (OPPEL), M.Jur. (Bath.), Fr.; *1*, ×0.7 (583n) (p. L316).

Gracilisphinctes BUCKMAN, 1920 [**Am. gracilis* J. BUCKMAN, 1844 (*non* ZIETEN, 1830) (=**Procerites progracilis* COX & ARKELL, 1950)]. Superficially very similar to *Procerites*, but inner whorls differ by being more evolute, more quadrate in section, and strongly constricted, and outer whorls are more compressed. *M.Bath., ?U.Bath.*, Eu.-Madag.-?Cauc.——FIG. 397,*4*. **G. progracilis* (COX & ARKELL), Eng.; holotype, ×0.3 (65*).

Wagnericeras BUCKMAN, 1920 [**Am. wagneri* OPPEL, 1857] [*Zigzagites, Suspensites* BUCK., 1922]. Ribbing coarse, flexuous, somewhat *Rasenia*-like, whorl section rounded to compressed; outer whorls become smooth and are indistinguishable from those of *Procerites* and *Gracilisphinctes*. *M.Bath.-U.Bath.*, Eu.——FIG. 399,*1*. **W. wagneri* (OPPEL), Fr.; lectotype, ×0.7 (583n).

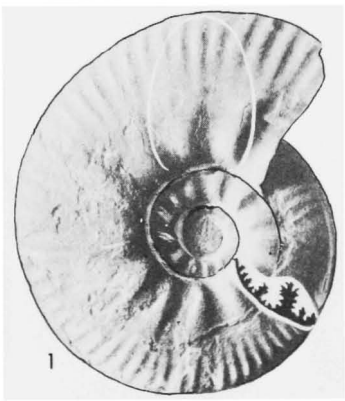


FIG. 400. *Proplanulites koenigi* (SOWERBY), M.Jur. (L.Callov.), Eng. (p. L316).

Subfamily PROPLANULITINAE Buckman, 1921

[as Proplanulitidae]

Expressions of the trend towards high, compressed, involute whorls with smooth venter, and simplified sutures with reduced lobes but long and little-retracted suspensive lobe. Perhaps derived partly from *Wagnericeras* and partly from *Choffatia* (65, 466). *M.Jur.(Callov.)*.

Proplanulites TEISSEYRE, 1887 [**Am. koenigi* J. SOWERBY, 1820] [*Crassiplanulites* BUCKMAN, 1921]. Involute, compressed, with fairly coarse but blunt, well-differentiated ribs, interrupted by smooth band on venter. *L.Callov.*, Eu.-C.Russia-Cauc.-TransCaspia-Can.——FIG. 400,*1*. **P. koenigi* (Sow.), Eng.; ×0.75 (4*).

Kinkeliniceras BUCKMAN, 1921 [**Proplanulites kinkelini* DACQUÉ, 1910]. Primary ribs less differentiated than in *Proplanulites*, and secondaries not interrupted on venter. *L.Callov.-M.Callov.*, Fr.-Tangan.-Madag.-Cutch.——FIG. 401,*1*. **K. kinkelini* (DACQUÉ), M.Callov., Tangan.; *1a,b*, ×0.5 (95*).

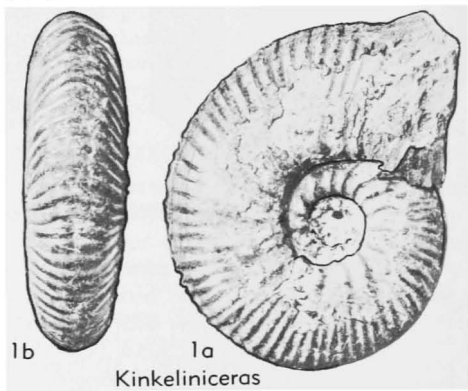


FIG. 401. *Kinkeliniceras kinkelini* (DACQUÉ), M.Jur. (M.Callov.), Tanganyika (p. L316).

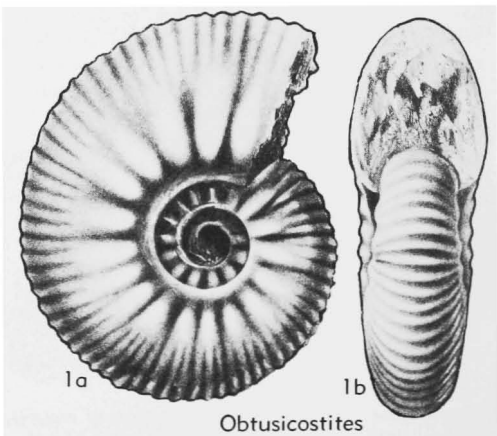


FIG. 402. *Obtusicostites obtusicosta* (WAAGEN), M. Jur.(M.Callov.), Cutch (p. L317).

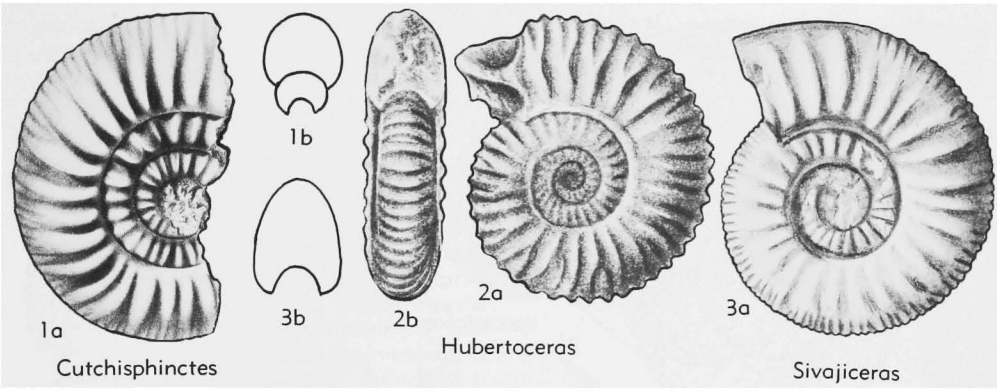


FIG. 403. Perisphinctidae (Proplanulitinae) (p. L317).

Obtusicostites BUCKMAN, 1921 [**Perisphinctes obtusicosta* WAAGEN, 1875]. Ribbing coarse and strong, passing straight over obtuse venter. Not always separable from *Kinkeliniceras*. *M.Callov.*, Fr.-Tangan.-Madag.-Cutch.——FIG. 402,*1*. **O. obtusicosta* (WAAGEN), Cutch; *1a,b*, ×0.3 (546*).

Hubertoceras SPATH, 1930 [**Perisphinctes omphalodes* WAAGEN, 1875]. Ribbing strong, biplicate, decidedly evolute; commonly compressed; venter loses ribbing in a few; no lappets. *M.Callov.-U.Callov.*, Tangan.-Madag.-Cutch.——FIG. 403,*2*. **H. omphalodes* (WAAGEN), U.Callov., Cutch; *2a,b*, ×0.75 (546*).

Sivajiceras SPATH, 1928 [**Perisphinctes congenor* WAAGEN, 1875; SD ROMAN, 1938]. Resembles *Obtusicostites*, but ribs (especially primaries) fade on outer whorl. *M.Callov.*, Somali.-Kenya-Tangan.-Cutch.——FIG. 403,*3*. **S. congenor* (WAAGEN), Cutch; *3a,b*, ×0.25 (546*).

?**Cutchisphinctes** SPATH, 1931 [**Perisphinctes altiplicatus* WAAGEN, 1875]. Round-whorled, evolute, strongly ribbed. Perhaps descended from evolute *Wagnericeras*. *L.Callov.*, Cutch.——FIG. 403,*1*. **C. altiplicatus* (WAAGEN); *1a,b*, ×0.25 (546*).

Subfamily PSEUDOPERISPHINCTINAE Schindewolf, 1925

[as Pseudoperisphinctidae; =Grossouvrinae SPATH, 1930]

Various descendants of Zigzagiceratinae, if not of Leptosphinctinae, which they resemble. *M.Jur.(L.Bath.)-U.Jur.(L.Oxf.)*, world-wide.

Planisphinctes BUCKMAN, 1922 [**P. planilobus*]. Evolute, ribbed to end of body chamber, which has lappets; ribbing regular, not grossouvriid, with rather widely splayed secondaries and many simple ribs (14, 262, 263, 342, 466, 505). *M.Jur.(L.Bath.)*, Eu.-Persia-Mex.——FIG. 404,*1*. **P. planilobus*, Eng.; *1a,b*, ×0.7 (595*).

Choffatia SIEMIRADZKI, 1898 [**Perisphinctes cobra* WAAGEN, 1875; SD BUCKMAN, 1920] [*Anaplanulites* BUCK., 1922; *Loboplanulites* BUCK., 1925]. Medium-sized to large shells with regular, well-differentiated primary and secondary ribbing, which gradually fades on venter and becomes distant and faint on outer whorl; peristome simple. *M.Jur.(U.Bath.-M.Callov.)*, Eu.-N.Afr.-Somali-Kenya-Tangan.-Madag.-Cauc.-TransCaspia - Persia - Cutch-Baluch.-Pamir-Himalaya-S. Alaska-USA-Chile.——FIG. 405,*1*. **C. (C.) cobra* (WAAGEN), Callov., Cutch; *1a,b*, ×0.3 (546*).

Homoeoplanulites BUCKMAN, 1922 [**H. homoeomorphus*]. Like *Choffatia* but small to medium-sized, with lappets, and ribs not modified on body chamber. Subgen. of *Choffatia*. *M.Jur.(U.Bath.-L.Callov.)*, Eu.——FIG. 405,*9*. **C. (H.) homoeomorpha* (BUCK.), Eng.; ×0.3 (65*).

Pseudoperisphinctes SCHINDEWOLF, 1923 [**Perisphinctes rotundatus* ROEMER, 1911 (ICZN Opinion 324)]. Inner whorls as in *Siemiradzkia* but outer whorls like *Choffatia*. *M.Jur.(M.Bath.-U.Bath.)*, Eu.——FIG. 405,*10*. **P. rotundatus* (ROEMER); lectotype (SD ARKELL, 1950), ×0.5 (691*).

Siemiradzkia HYATT, 1900 [**Am. aurigerus* OPPEL, 1857 (ICZN Opinion 301)]. Small, with fine, sharp, irregular ribbing which becomes modified on venter of body chamber; aperture with large

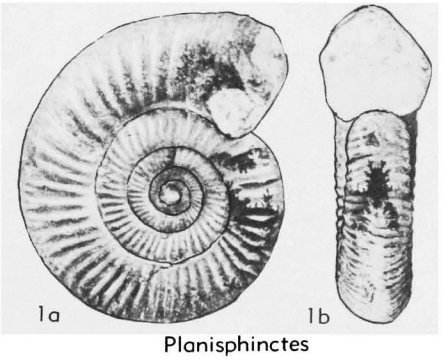


FIG. 404. *Planisphinctes planilobus* BUCKMAN, M. Jur.(L.Bath.), Eng. (p. L317).

lappets. Parabolae, no constrictions. *M.Jur.(Bath.)*, Eu.-N. Afr.-Madag.-Persia-Pamirs-Mex. —— Fig. 405,*13*. **S. aurigera* (Oppel), Fr.; ×0.7 (330*).

Berbericeras Roman, 1933 [**B. sekikense*] [=*Praesutneria* Schmidtill & Krumbeck, 1931 *(nom. nud.)*]. Dwarfs with inner whorls circular, outer

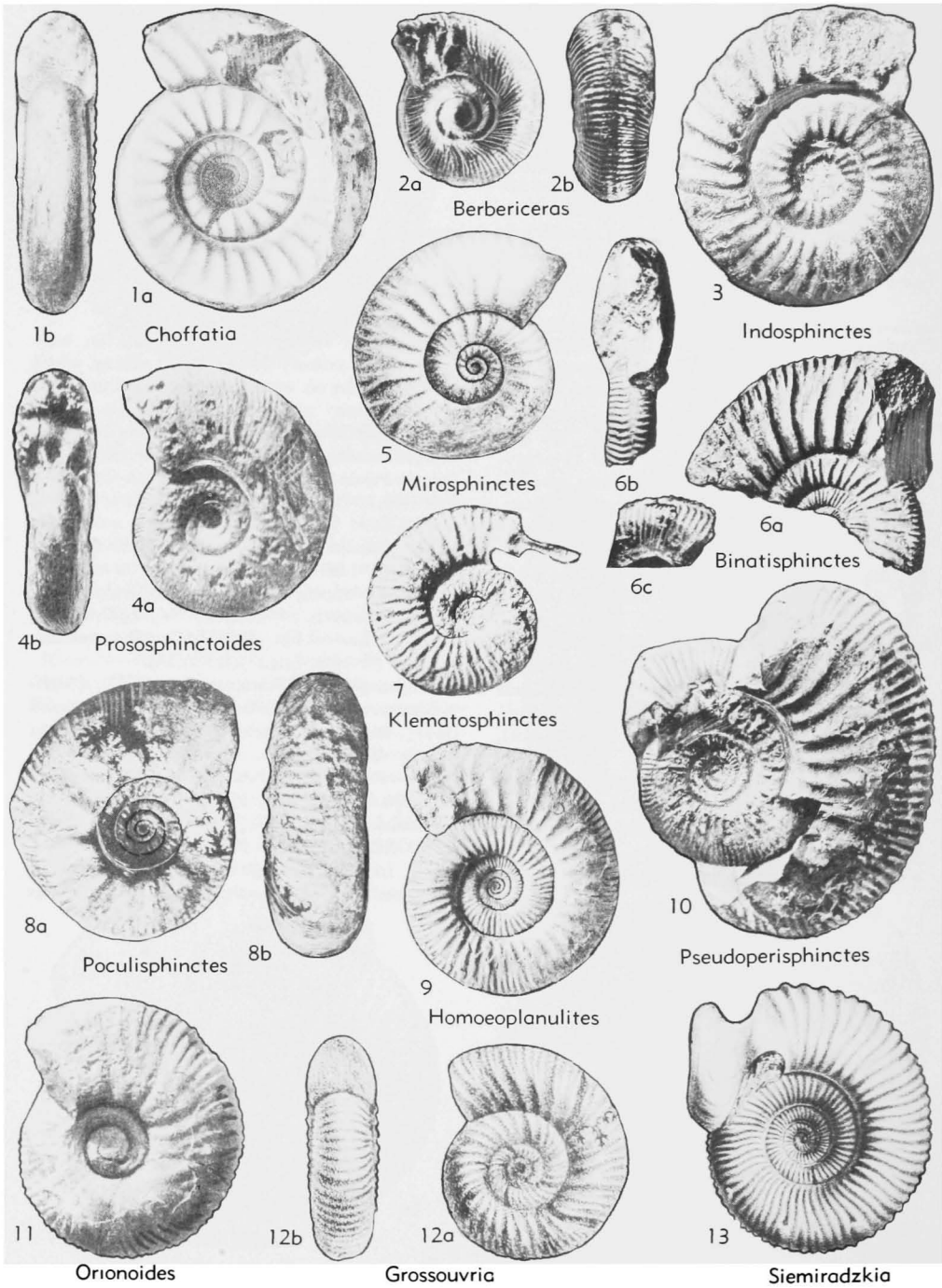


Fig. 405. Perisphinctidae (Proplanulitinae) (p. L317-L319).

whorls becoming slightly compressed; ribbing fine, dense, irregularly branched, prorsiradiate, coarsening ventrally on body chamber; with lappets; no constrictions. *M.Jur.(Bath.),* Eng.-Ger.-Alg.——Fig. 405,*2*. **B. sekikene,* L.Bath., Alg.; *2a,b,* ×2 (692*).

Grossouvria Siemiradzki, 1898 [**Perisphinctes subtilis* Neumayr, 1870; SD Buckman, 1920 (=**Am. sulciferus* Oppel, 1857, obj.) (=*Perisphinctes artisulcus* Teisseyre, 1889, obj.)]. Possible descendants of *Seimiradzkia,* from which they are hardly distinguishable, unless (usually) by more irregular ribbing, more interruptions by parabolae, more conspicuous parabolic nodes, and less coarsening of ribbing on body chamber. *M.Jur.(Callov.),* Eu.-N. Afr. - Somali - Kenya - Tangan.-Madag.-Syria-S. Russia - TransCaspia-Persia-Cutch-Pamir-Himalaya-S.Alaska-USA-S.Am.——Fig. 405,*12*. **G. (G.) sulcifera* (Oppel); *12a,b,* holotype, ×1 (358*).

Klematosphinctes Buckman, 1922 [**Am. vernoni* Young & Bird, 1828]. Miniature descendant of *Grossouvria* with biplicate ribs and long, straight, narrow lappets. Subgen. of *Grossouvria. U.Jur. (L.Oxf.),* Eng.-Cutch.——Fig. 405,*7*. **G. (K.) vernoni* (Young-B.), Eng.; ×0.7 (65*).

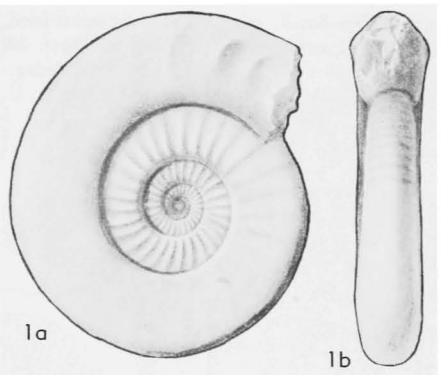
Mirosphinctes Schindewolf, 1926 [**Perisphinctes mirus* Bukowski, 1887]. Miniature forms with rursiradiate secondary ribbing, many parabolic nodes on inner whorls; peristome constricted, flanged, with lappets. ?Subgen. of *Grossouvria. U.Jur.(L.Oxf.),* Eu.-Tangan.-Syria-Japan.——Fig. 405,*5*. **G.? (M.) mirus* (Bukowski), Pol.; ×1 (596*).

Binatisphinctes Buckman, 1921 [**Am. binatus* Leckenby, 1859] [*Hamulisphinctes* Buck., 1921; *?Parapeltoceras* Schindewolf, 1925]. Inner whorls round, with sharp biplicate and simple ribs, *Peltoceras*-like; on outer whorls ribs gradually become distant; usually with ventral smooth band. *M.Jur. (M.Callov.-U.Callov.),* Eu.-N.Afr.-Kenya-Tangan.-Cutch.——Fig. 405,*6*. **B. binatus* (Leck.), Eng.; *6a-c,* ×0.5 (65*).

Poculisphinctes Buckman, 1920 [**Am. poculum* Leckenby, 1859] [*Trinisphinctes* Buck., 1922]. Involute, with stout whorls and blunt, fasciculate ribbing. *M.Jur.(U.Callov.),* Eu.-Cutch-Himalaya-Japan.——Fig. 405,*8*. **P. poculum* (Leck.), Eng.; *8a,b,* ×0.7 (65*).

Indosphinctes Spath, 1930 [**Am. calvus* J.deC. Sowerby, 1840; SD Roman, 1938]. Large, *Choffatia*-like, characterized by low branching of ribs from near umbilical margin. *M.Jur.(Callov.),* Eu.-Kenya-Tangan. - Madag. - Anatolia - Cauc. - Persia-Cutch-Baluch.-Himalaya-Japan.——Fig. 405,*3*. **I. calvus* (Sow.), Cutch; ×0.25 (466*).

Subgrossouvria Spath, 1924 [**Perisphinctes aberrans* Waagen, 1875]. Inner whorls as in *Grossouvria,* but fine ribbing gives places on outer whorls to coarse and distant primaries which in the type species fade altogether. *M.Jur.(Callov.),* Eu.-Somali-Kenya-Tangan.-Madag. - Persia - Cutch - Mex.——Fig. 406,*1*. **S. aberrans* (Waagen), Cutch; *1a,b,* ×0.2 (546*).



Subgrossouvria

Fig. 406. *Subgrossouvria aberrans* (Waagen), M.Jur. (Callov.), Cutch (p. L319).

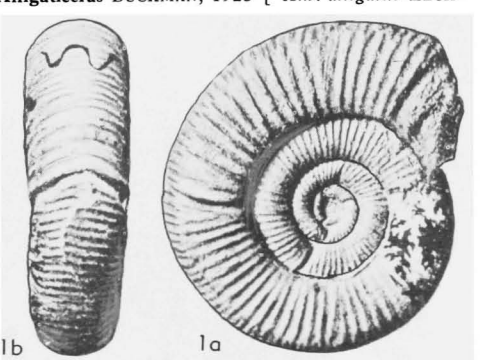
Orionoides Spath, 1931 [**Perisphinctes pseudorion* Waagen, 1875]. Early whorls like *Indosphinctes,* outer whorls becoming like *Pseudopeltoceras,* but not tuberculate. *M.Jur.(U.Callov.),* Eu.-Cutch.——Fig. 405,*11*. **O. pseudorion* (Waagen), Cutch; ×0.75 (466*).

Prososphinctoides Spath, 1928 [**P. manialensis*]. A *Prososphinctes*-like offshoot of *Grossouvria M.Jur. (U.Callov.),* Cutch.——Fig. 405,*4*. **P. manialensis; 4a,b,* ×1 (466*).

Subfamily PERISPHINCTINAE Steinmann, 1890

In the restricted subfamily remain the genera grouped most closely around the restricted genus *Perisphinctes* (see definition of family). Most can be considered subgenera of *Perisphinctes* (6, 8, 377, 390, 404, 444). *M.Jur.(U.Callov.)-U.Jur.(L.Kimm.),* world-wide except boreal.

Alligaticeras Buckman, 1923 [**Am. alligatus* Leck-



Alligaticeras

Fig. 407. *Alligaticeras alligatum* (Leckenby), M. Jur.(U.Callov.), Eng.; *1a,b,* ×1 (65*) (p. L319).

ENBY, 1859]. Small, whorls quadrate, constricted, finely ribbed, not modified on body chamber. *M. Jur.(U.Callov.)-U.Jur.(L.Oxf.)*, Eu.-Syria-Madag.-Cutch.——FIG. 407,*1*. **A. alligatum* (LECK.), U. Callov., Eng.; *1a,b*, ×1 (65*).

Properisphinctes SPATH, 1931 [**Perisphinctes bernensis* DELORIOL, 1898]. Small, whorls round or depressed, constricted, ribbing not modified on body chamber. Doubtfully distinct from *Alligaticeras*. *M.Jur.(U.Callov.)-U.Jur.(L.Oxf.)*, Eu.-

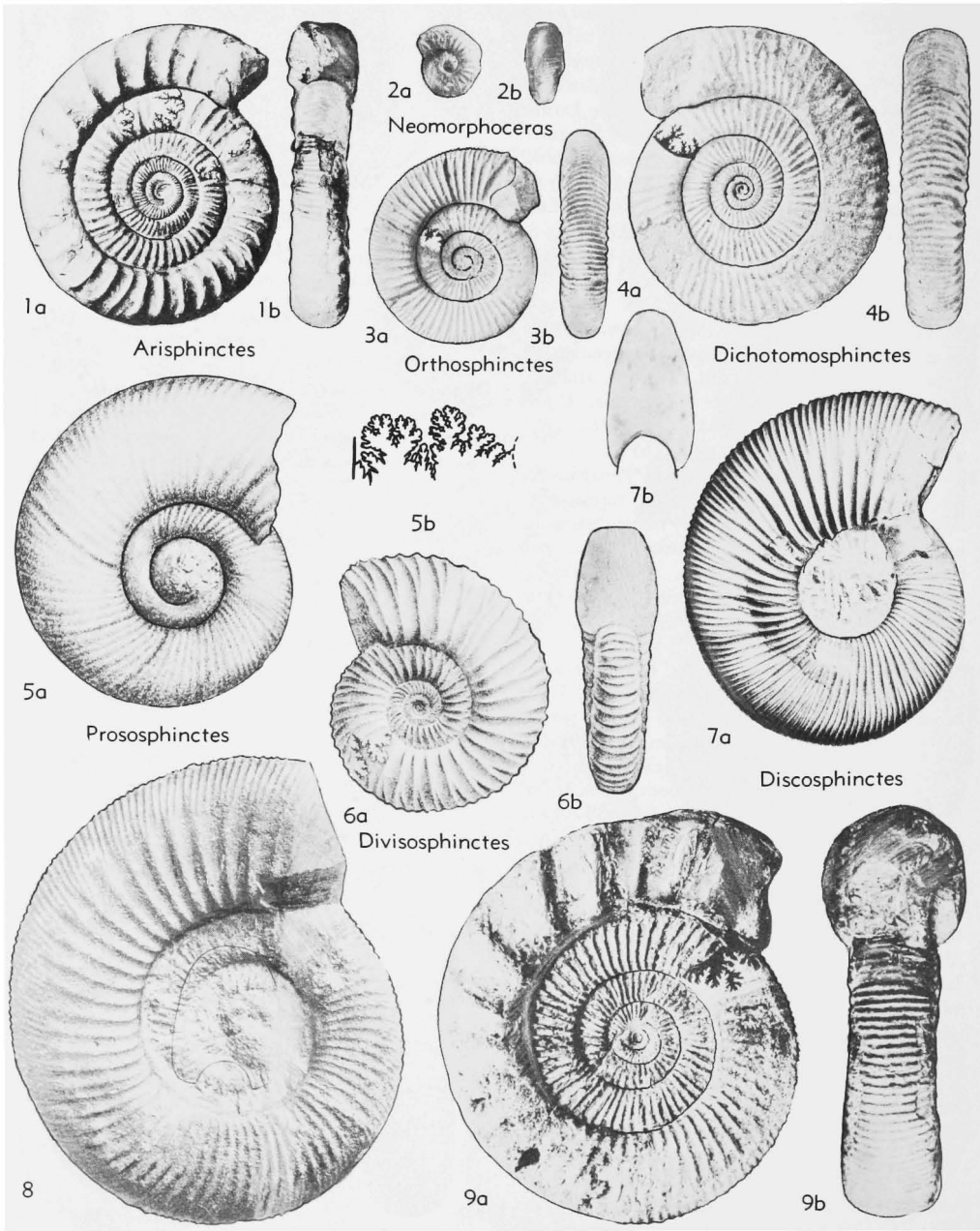


FIG. 408. Perisphinctidae (Perisphinctinae) (p. L321-L322).

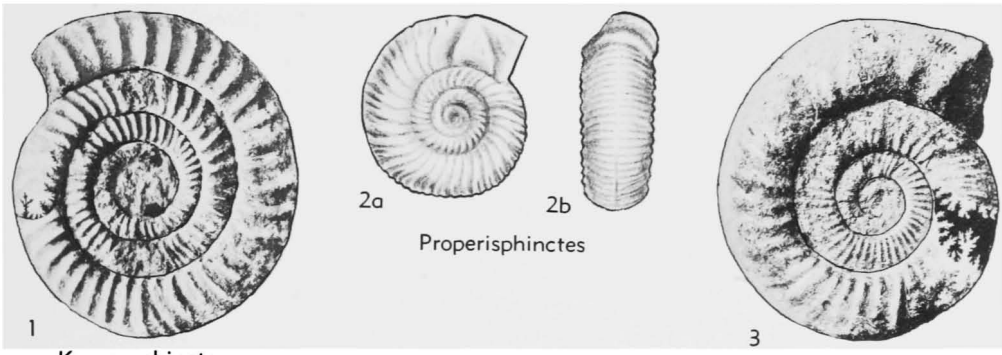


FIG. 409. Perisphinctidae (Perisphinctinae) (p. L321-L322).

Madag.-Syria-Cauc.-Cutch-Japan.——FIG. 409,*2*. **P. bernensis* (LORIOL), L.Oxf., Switz.; *2a,b*, ×1 (265*).

Prososphinctes SCHINDEWOLF, 1925 [**Perisphinctes mazuricus* BUKOWSKI, 1887]. Whorls compressed, ovoid, finely and smoothly ribbed, with smooth body chamber. *U.Jur.(L.Oxf.)*, Fr.-Pol.-Madag.-Cauc.-Cutch.——FIG. 408,*5*. **P. mazuricus* (BUKOWSKI), Pol.; *5a,b*, ×1 (596*).

Neomorphoceras ARKELL, 1953 [**Am. chapuisi* OPPEL, 1857]. Dwarf, constricted, ribbed, *Morphoceras*-like; inner whorls are involute, sphaerocone, outer whorl gradually becoming evolute, contracted; peristome simple. *U.Jur.(U.Oxf.)*, Ger.-Fr.——FIG. 408,*2*. **N. chapuisi* (OPPEL), Fr.; *2a,b*, ×1 (377*).

Perisphinctes WAAGEN, 1869 [**Am. variocostatus* BUCKLAND, 1836; SD proposed ARKELL, 1951, accepted ICZN 1954 (Opinion 303)] [*Martelliceras* SCHINDEWOLF, 1925]. Large to gigantic, whorls quadrate; inner and middle whorls sharply ribbed, with sudden change at outer whorl to strong, coarse, distant, ridge- or wedge-shaped primaries; peristome simple, no constrictions. *U.Jur.(U.Oxf.)*, Eu. - N. Afr.-Sinai-Abys.-Kenya-Tangan.-Anatolia-Donetz-C. Russia-?Persia-Attock-Cutch-Japan-Cuba.——FIG. 408,*9*. **P. (P.) variocostatus* (BUCKLAND), Eng.; *9a,b*, holotype, ×0.25 (6*).

Kranaosphinctes BUCKMAN, 1921 [**K. kranaus*] [*Cymatosphinctes* BUCK., 1923; *Pachyplanulites* SPATH, 1930; *Germanosphinctes* ARKELL, 1935]. Large to gigantic, whorls round to depressed; ribbing gradually changes from normal to modified and venter becomes smooth before end of septation; peristome simple; deep constrictions. Suspensive lobe of suture steeply retracted. Subgen. of *Perisphinctes*. *U.Jur.(U.Oxf.)*, Eu.-N.Afr.-Somali-Kenya-Tangan. - C. Russia-Attock-Cutch-Japan-Indon.-N.Guinea.——FIG. 409,*1*. **P. (K.) kranaus* (BUCK.), Eng.; ×0.15 (6*).

Arisphinctes BUCKMAN, 1924 [**A. ariprepes* (=**P. cotovui* SIMIONESCU, 1907 (ICZN Opinion 306)] [*?Toxosphinctes* BUCK., 1923 (based on incomplete type)]. Large to gigantic, whorl shape quadrate or rounded-quadrate, ribbing changing gradually as in *Kranaosphinctes*, with venter becoming rounded and smooth before septation ceases; constricted; peristome simple. Differs from *Kranaosphinctes* in having less rounded whorls, shallower constrictions, less elongated suspensive lobe. Subgen. of *Perisphinctes*. *U.Jur.(U.Oxf.)*, Eu.-Abys.-Kenya-Tangan. - Sinai - Syria - Donetz-Cauc.-Attock-Cutch-Japan-Cuba-Chile.——FIG. 408,*1*. **P. (A.) cotovui* SIMION.; *1a,b*, ×0.7 (6*).

Pseudarisphinctes ARKELL, 1935 [**P. (P.) shortlakensis*]. Differs from *Arisphinctes* in having simpler suture with less retracted and shorter suspensive lobe, and inner whorls rounded and ribbed as in *Orthosphinctes*. Later in date. Subgen. of *Perisphinctes*. *U.Jur.(U.Oxf.)*, Eng.-Cuba.——FIG. 410,*1*. **P. (P.) shortlakensis*, Eng.; ×0.15 (6*).

Progeronia ARKELL, 1953 [*pro Ammonia* ILOVAISKY & FLORENSKY, 1941 (*non* BRÜNNICH, 1772; *nec* KOCH, 1842)] [**Perisphinctes progeron* VON AMMON, 1875]. Large evolute derivatives of *Arisphinctes*, with biplicate and triplicate ribbing which modifies gradually as in *Arisphinctes*, but on outer whorl becomes irregular and "ataxioceratid," with

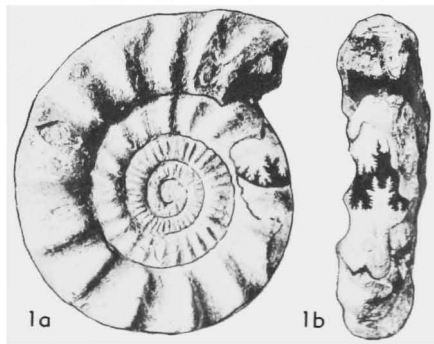


FIG. 410. *Perisphinctes (Pseudarisphinctes) shortlakensis* ARKELL, U.Jur.(U.Oxf.), Eng. (p. L321).

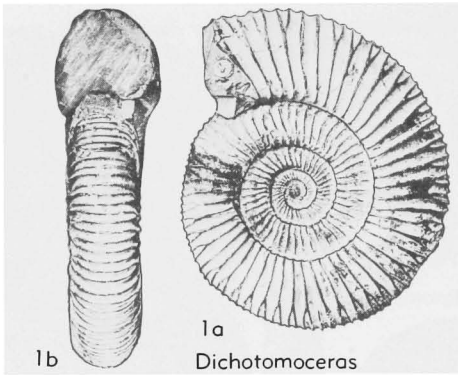


FIG. 411. *Perisphinctes (Dichotomoceras) dichotomus* (BUCKMAN), U.Jur.(U.Oxf.), Eng. (p. L322).

lengthened secondaries. Subgen. of *Perisphinctes. U.Jur.(L.Kimm.),* Eu.-S.Russia-C.Arabia.——FIG. 408,*8*. **P. (P.) progeron* VON AMMON, Ger.; ×0.4 (429*).

Liosphinctes BUCKMAN, 1925 [**L. apolipon*]. Intermediate between *Arisphinctes* and *Dichotomosphinctes;* constricted; ribs remaining close and fine but fading on outer whorl; peristome simple. Subgen. of *Perisphinctes. U.Jur.(U.Oxf.),* Eng.-Ger.——FIG. 409,*3*. **P. (L.) apolipon* (BUCK.), Eng.; ×0.3 (6*).

Dichotomosphinctes BUCKMAN, 1926 [**Perisphinctes antecedens* SALFELD, 1914] [*Otosphinctes* BUCK., 1926]. Typically medium-sized to small, evolute, whorl rounded or quadrate to depressed, finely ribbed to end, constricted, with lappets. Subgen. of *Perisphinctes. U.Jur.(L.Oxf.-U.Oxf.),* Eu.-N.Afr.-Abys. - Kenya - Tangan. - Madag. - Attock - Cutch-Indon.-Mex.-Cuba-Chile.——FIG. 408,*4*. **P. (D.) antecedens* SALFELD, Ger.; *4a,b,* ×0.25 (6*).

Discosphinctes DACQUÉ, 1914 [**Perisphinctes arussiorum* DACQUÉ; SD SPATH, 1931]. Later development of *Dichotomosphinctes,* tending to be more involute, with more triplicate ribbing and some virgatotome ribs on body chamber; aperture unknown. Subgen. of *Perisphinctes. U.Jur.(U.Oxf.), ?L.Kimm.,* Eu.-Kenya-Cutch-Japan-?Indon.-Mex.-Cuba.——FIG. 408,*7*. **P. (D.) arussiorum,* Kenya; *7a,b,* ×0.3 (604*).

Orthosphinctes SCHINDEWOLF, 1925 [**Am. tiziani* OPPEL, 1863] [=*Biplices* SIEMIRADZKI, 1891 (obj., invalid under ICZN Rule 8)]. Later development of *Dichotomosphinctes,* from which it differs by having simpler sutures and smaller lappets. Subgen. of *Perisphinctes. U.Jur.(U.Oxf.),* Eu.-Kenya-Anatolia-Cuba.——FIG. 408,*3*. **P. (O.) tiziani* (OPPEL), Ger.; *3a,b,* ×0.25 (6*).

Dichotomoceras BUCKMAN, 1919 [**D. dichotomum*]. Doubtfully distinct from *Orthosphinctes;* ribs sharper, more distant, no constrictions. Subgen. of *Perisphinctes. U.Jur.(U.Oxf.), ?L.Kimm.,* Eu.-S. Russia-Abys.-Kenya-Cutch-Japan.——FIG. 411,*1*. **P. (D.) dichotomus* (BUCK.), Eng.; *1a,b,* ×0.3 (6*).

Divisosphinctes BEURLEN, 1925 [**Am. biplex bifurcatus* QUENSTEDT, 1847; SD SPATH, 1931] [=*Divisoceras* VON BUBNOFF, 1935 (obj.)]. Small, compressed, evolute, with sharp, wiry, biplicate ribs; aperture unknown. Subgen. of *Perisphinctes. U.Jur. (U.Oxf.), ?L.Kimm.,* Eu.-N.Afr.-Anatolia.——FIG. 408,*6*. **P. (D.) bifurcatus* (QUENST.), Ger.; *6a,b,* ×0.7 (358*).

Ampthillia ARKELL, 1947 [**P. (A.) ampthillensis*]. Inner whorls as in *Dichotomoceras,* followed by sudden change to gerontic simple ribs. Subgen. of *Perisphinctes. U.Jur.(U.Oxf.),* Eng.——FIG. 412,*1*. **P. (A.) ampthillensis; 1a,b,* ×0.25 (6*).

Subfamily ATAXIOCERATINAE Buckman, 1921

[Incl. Idoceratidae SPATH, 1924, and Paraboliceratinae SPATH, 1928]

A polyphyletic subfamily characterized mainly by dense, fine, many-branched ribbing, which may or may not develop the peculiar double furcation of *Ataxioceras,* but typically is not truly virgatotome. *Lithacoceras* is difficult to separate from *Discosphinctes* and might almost as well be classed in Perisphinctinae, but the type species (M.Kimm.) is much later in date and its outer whorl is quite peculiar, with many more secondaries per primary than in any Oxfordian genus and with a tendency to become virgatotome. In *Idoceras,* ribbing is interrupted on the venter, but this is a recurrent phenomenon in ammonites which seems not to have subfamily importance; also, many species, especially in the Pacific realm, have the special double furcation of *Ataxioceras* and these obviously are closely allied to contemporary *Ataxioceras*

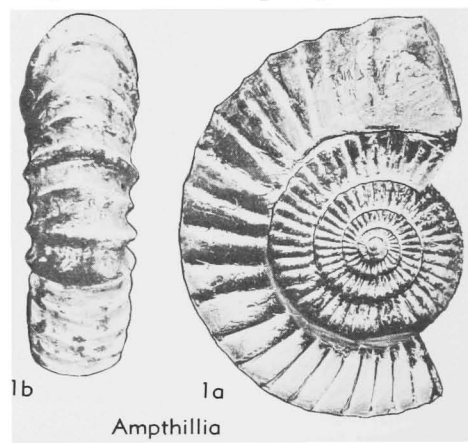


FIG. 412. *Perisphinctes (Ampthillia) ampthillensis* ARKELL, U.Jur.(U.Oxf.), Eng. (p. L322).

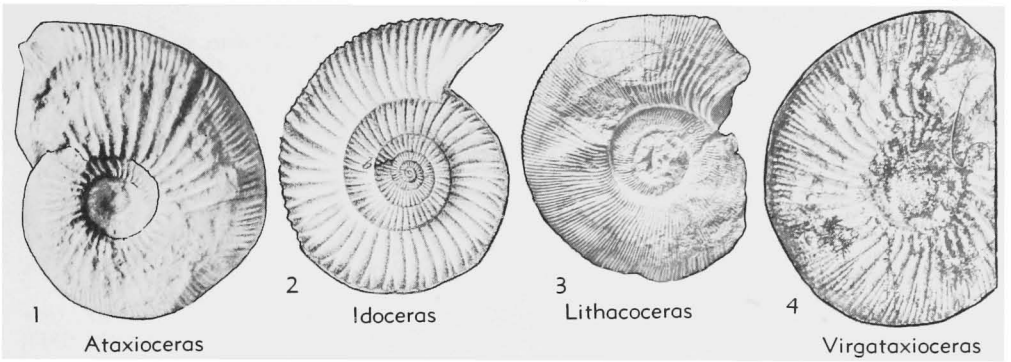


FIG. 413. Perisphinctidae (Ataxioceratinae) (p. L323).

in the same and other realms (5, 69, 70, 432). *U.Jur.(L.Kimm.-M.Kimm.),* world-wide.

Lithacoceras HYATT, 1900 [**Am. ulmensis* OPPEL, 1858]. Large, involute, compressed, constricted, densely covered with fine, sharp ribbing, which is biplicate and triplicate on inner and middle whorls, as in *Discosphinctes,* but becomes distant and fasciculate on outer whorl, with up to 8 secondaries per primary and a tendency to become virgatotome. *L. Kimm.-M. Kimm.,* Eu. - Kenya - Madag. - Cauc.-Cutch-Japan-?Spitz.-?Arg.——FIG. 413,*3*. **L. ulmense* (OPPEL), Solnhofen sl., Ger.; neotype, ×0.25 (429*).

Ataxioceras FONTANNES, 1879 [**Perisphinctes(Ataxioceras) hypselocyclus*] [*Parataxioceras* SCHINDEWOLF, 1925]. Compressed, more or less involute, with large irregular constrictions and many secondary ribs; ribbing typically may be bifurcate twice, near middle of the whorl sides, secondaries then branching near shoulders. *L.Kimm.,* Eu.-Somali.-Cauc.-Persia-Cutch - ?Japan - ?Indon. - ?Spitz. ——FIG. 413,*1*. **A. hypselocyclus* (FONT.), Fr.; holotype, ×0.5 (5*).

Virgataxioceras ARKELL, 1953 [**Virgatosphinctes setatus* SCHNEID, 1914]. Innermost whorls biplicate and indistinguishable from those of *Lithacoceras,* but from early stage ribbing becomes ataxioceratid with some double furcation, and then rapidly becomes fasciculate and virgatotome; ribbing fine and sharp; no constrictions, aperture unknown. *M.Kimm.(beckeri z.),* Ger.-Somali-S.Russia-Mex. ——FIG. 413,*4*. **V. setatum* (SCHNEID), Ger.; ×0.6 (429*).

Idoceras BURCKHARDT, 1906 [**Am. planula* ZIETEN, 1830; SD ROMAN, 1938] [=*Subnebrodites* SPATH, 1925 (obj.)]. Ribbing projected on shoulders and interrupted on venter, but many species show the special double furcation of *Ataxioceras.* Sutures usually simpler than in *Ataxioceras. U.Oxf.-L. Kimm,.* Eu.-N.Afr.-Eritrea-Somali.-Abys.-Tangan.-Cauc.-Japan-Indon.-N. Caled.-N. Z. -Mex.-Tex.-Arg. ——FIG. 413,*2*. **I. planula* (ZIETEN), Ger.; ×0.5 (360*).

Kossmatia UHLIG, 1907 [**Am. tenuistriatus* GRAY, 1832;[1] SD ROMAN, 1938]. Ribbing fine, dense, projected, in some interrupted on venter, which may be rounded or more or less grooved or concave. *Kimm.-U.Tithon.,*[2] Eu.-N.Afr.-Syria-Cauc.-Himalaya-Indon.-N. Guinea-N. Z.- NW. Austral.-Calif.-Tex.-Mex.-S.Am.——FIG. 462,*3*. **K. tenuistriata* (GRAY); *3a,b,* ×0.5 (533*).

Paraboliceras UHLIG, 1910 [**Am. jubar* BLANFORD, 1865; SD ROMAN, 1938]. Like *Berriasella,* with narrow smooth band on venter, but ribbing made irregular by many sinuous parabolic ribs, and shoulders bearing numerous parabolic nodes. *Kimm.-U.Tithon.,*[2] Himalaya-Indon.-N.Z.——FIG. 459,*7*. **P. jubar* (BLANFORD), Spiti sh.; *7a,b,* ×0.5 (533*).

Paraboliceratoides SPATH, 1925 [**Am. mutilis* OPPEL, 1865]. Like *Paraboliceras* at first, but later ribbing becomes bundled in thick, blunt sheaves, each bounded by a parabola. *Kimm.-U.Tithon.,*[2] Himalaya.——FIG. 464,*1*. **P. mutilis* (OPPEL) Spiti sh.; *1a,b,* ×0.5 (672*).

Procraspedites SPATH, 1930 [**Craspedites praecursor* BURCKHARDT, 1906]. Compressed, involute, ribs not interrupted on venter but otherwise similar to Mexican *Idoceras,* fading on outer whorl, and primaries also fading in some on middle whorls. *M.Kimm.,* Mex.——FIG. 414,*1*. **P. praecursor* (BURCK.); *1a,b,* ×0.5 (69*).

Subfamily PICTONIINAE Spath, 1924

[as Pictonidae]

Large ammonites tending to develop smooth middle and outer whorls, or coarse blunt primaries on outer whorls, with inner-

[1] Date of publication of *Am. tenuistriatus* in GRAY's work (1830-32) has not been determined.

[2] The age of this genus in the type area of the Spiti shales is unknown. When the figures were being prepared, it was supposed that they were Tithonian and they were grouped with the Berriasellidae, but work on recent collections of the Geological Survey of New Zealand from the shore of Kawhia Harbor has led to transfer of *Kossmatia, Paraboliceras* and *Paraboliceratoides* to the Kimmeridgian family Ataxioceratidae.—ARKELL.

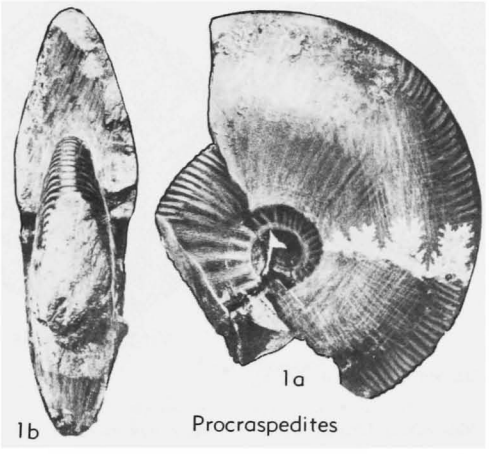


FIG. 414. *Procraspedites praecursor* (BURCKHARDT), U.Jur.(L.Kimm.), Mex. (p. L323).

most whorls of perisphinctoid or olcostephanoid type (5, 120, 431, 474). *U.Jur.*

Decipia ARKELL, 1937 [**Am. decipiens* J.SOWERBY, 1821]. Evolute, whorl section ovate or rounded, ribbing fine, fasciculate, gradually modifying to distant swollen primaries on outer whorl. *U.Oxf.*, Eu.-Donetz-?Japan.——FIG. 415,*1*. **D. (D.) decipiens* (Sow.), Eng.; *1a,b*, holotype, ×0.5 (6*).

Pomerania ARKELL, 1937 [**P. dohmi*]. Inner whorls like those of *Decipia*, middle whorls smooth, outer whorl with large swollen primaries as in *Decipia*. Subgen. of *Decipia*. *U.Oxf.*, Eng.-Ger.——FIG. 416, *5*. **D. (P.) dohmi* (ARKELL), Ger.; holotype, ×0.75 (120*).

Vinalesphinctes SPATH, 1931 [**V. roigi*]. Differs from *Decipia* in having shorter lobes, coarser ribbing, and smooth or weakly ribbed body chamber. *U.Oxf.*, Cuba.——FIG. 416,*6*. **V. roigi; 6a,b*, ×0.7 (219*).

Ringsteadia SALFELD, 1913 [**Am. pseudocordatus* BLAKE & HUDLESTON, 1877] [*Vineta* DOHM, 1925].

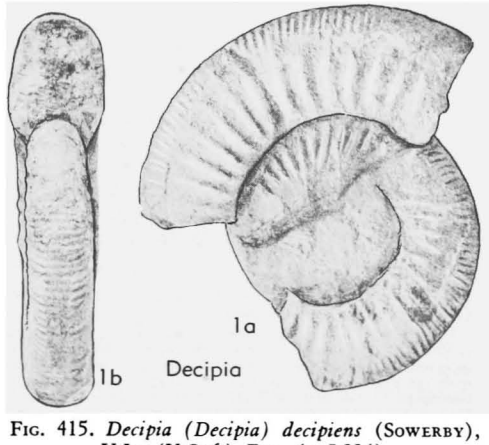


FIG. 415. *Decipia (Decipia) decipiens* (SOWERBY), U.Jur.(U.Oxf.), Eng. (p. L324).

Large, evolute, discoidal; outer whorls smooth and in some inner whorls also. *U.Oxf.*, Eng.-Fr.-Ger.-S.Russia-Abys.——FIG. 416,*2*. **R. (R.) pseudocordata* (BLAKE-H.), Eng.; *2a,b*, holotype, ×0.2 (65*).

Balticeras DOHM, 1925 [**B. pommerania*; SD ARKELL, herein] [=*Baltia* DOHM, 1925 (obj.)]. Involute, discoidal *Ringsteadia* tending to become oxycone. Subgen. of *Ringsteadia*. *U.Oxf.*, Eng.-Ger.-Switz.——FIG. 416,*1*. **R. (B.) pommerania*, Ger.; *1a,b*, ×0.2 (120*).

Pictonia BAYLE, 1878 [**Am. cymodoce* (*non* D'ORBIGNY) (=*Pictonia baylei* SALFELD, 1913; SD SALFELD, 1917 (validation proposed ARKELL, 1951, ICZN pend.)]. More evolute, planulate than *Ringsteadia*, but some species transitional. Distinguished chiefly by periodical flared primary ribs on middle whorls. *L.Kimm.*, Eu.——FIG. 417,*1*. **P. baylei* SALFELD, N.Fr.; ×0.5 (586*).

Triozites BUCKMAN, 1924 [**T. seminudatus*]. Group of *"Rasenia cymodoce"* AUCTT. (*non* D'ORBIGNY). Planulates having inner whorls with coarsely triplicate rectiradiate ribs, outer whorls smooth from half a whorl before body chamber. *L.Kimm.*, Eu.-Greenl.——FIG. 416,*3*. **T. seminudatus*, Eng.; ×0.2 (65*).

Pachypictonia SCHNEID, 1940 [**Pictonia indicatoria*]. Inner whorls like those of *Triozites*, outer whorls massive, with coarse, wedge-shaped, blunt primary ribs only. *U.Oxf.-L.Kimm.*, Eng.-Ger.——FIG. 416, *4*. **P. indicatoria*, Ger.; ×0.2 (704*).

[**Megapictonia** SCHNEID, 1940 (*nom. nud.*)].

Subfamily AULACOSTEPHANINAE Spath, 1924
[=Raseniinae SCHINDEWOLF, 1925]

True "raseniids" and their derivatives, shown by SCHINDEWOLF (1926) to have arisen via *Prorasenia* (and *Microbiplices*) from *Orthosphinctes* or *Divisosphinctes* or both (5, 431, 474). *U.Jur.(Oxf.-Kimm.).*

Microbiplices ARKELL, 1936 [**Am. microbiplex* QUENSTEDT, 1887]. Small, evolute, round-whorled, with coarse biplicate ribs. *U.Oxf.*, Eu.——FIG. 419, *4*. **M. microbiplex* (QUENST.), Ger.; *4a-c*, ×1 (360*).

Prorasenia SCHINDEWOLF, 1925 [**P. quenstedti*] [*Desmosphinctes* SCHIND., 1925]. Like *Microbiplices*, but inner whorls have triplicate *Rasenia*-like ribbing; on outer whorl ribbing becomes sharper and biplicate; aperture with lappets. *L. Kimm.*, Eu.-Russia.——FIG. 419,*5*. **P. quenstedti*, Ger.; ×1.3 (700*).

Rasenia SALFELD, 1913 [**R. involuta* SALFELD in SPATH, 1935 (ICZN pend.)]. Olcostephanoid with sharp, strongly differentiated ribbing, primaries being prorsiradiate, curved, raised, and tending to be tuberculate; ribbing persists on body chamber. *L.Kimm.*, Eu.-Russia-Spitz.-W.Sib.-Greenl.——FIG. 419,*3*. **R. involuta; 3a,b*, ×1 (713*).

Involuticeras SALFELD, 1913 [**Am. involutus*

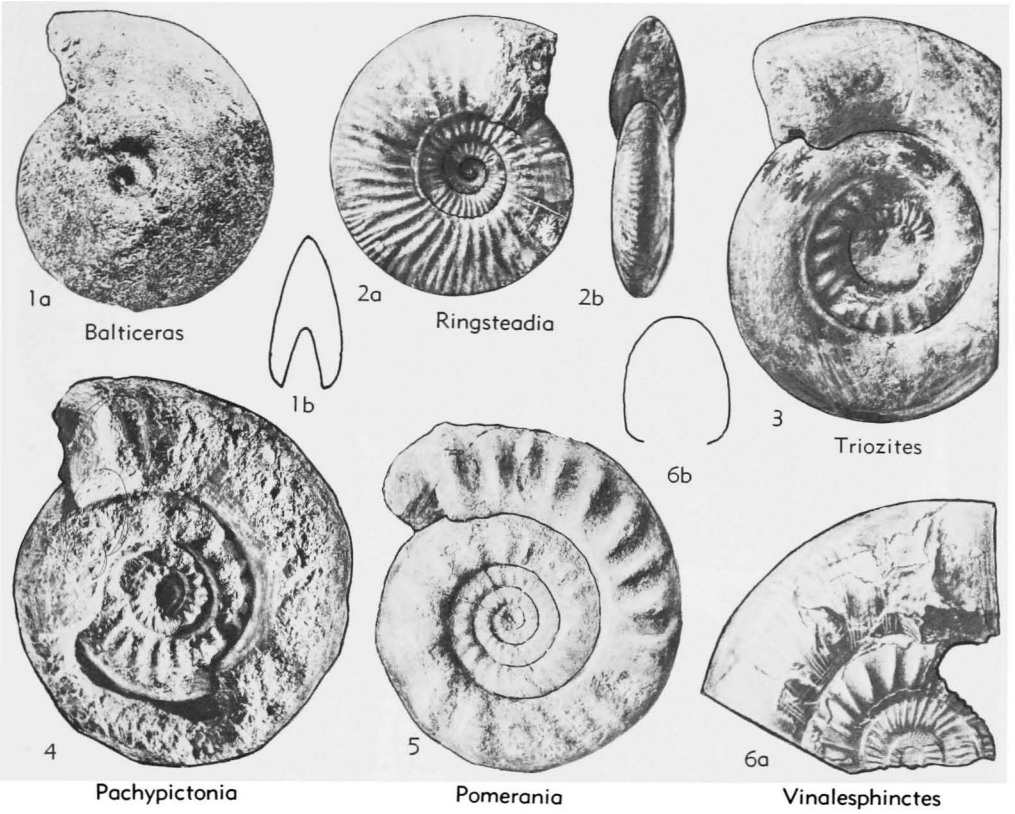


FIG. 416. Perisphinctidae (Pictoniinae) (p. L324).

QUENSTEDT, 1846; SD SPATH, 1931]. Involute, moderately compressed, ribs continuous across rounded venter but in some (as in type species) fading in middle of whorl sides. *L.Kimm.*, Eu.-?Mex.——FIG. 418,*1*. **I. involutum* (QUENST.), Ger.; *1a,b*, ×0.7 (358*).

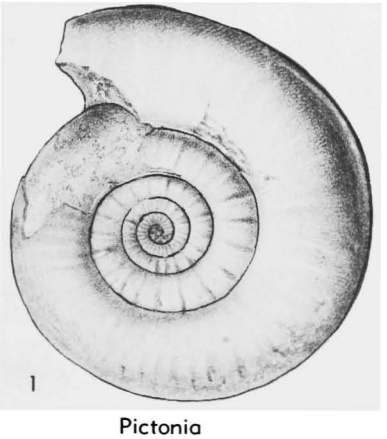


FIG. 417. *Pictonia baylei* SALFELD, U.Jur.(L.Kimm.), N.Fr.; *1*, ×0.5 (586*) (p. L324).

Rasenioides SCHINDEWOLF, 1925 [**Nautilus striolaris* REINECKE, 1818] [*Prorasenioides* SCHIND., 1925]. Like *Involuticeras* but more evolute, with lappets, and tending to develop smooth band on venter. *L.Kimm.*, Eu.——FIG. 419,*6*. **R. striolaris* (REIN.), Ger.; *6a,b*, ×1 (360*).

Aulacostephanus TORNQUIST, 1896 [**Am. pseudomutabilis* DE LORIOL, 1874; SD proposed ARKELL, 1935, accepted ICZN Opinion 302] [=*Odonto-*

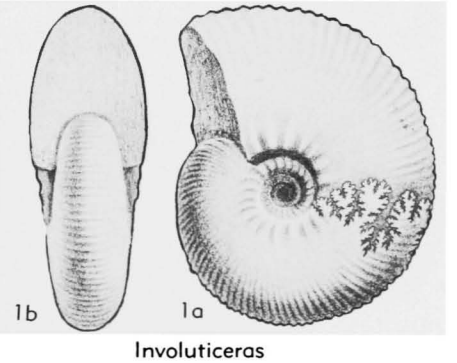


FIG. 418. *Involuticeras involutum* (QUENSTEDT), U. Jur.(L.Kimm.), Ger. (p. L324).

ceras STEUER, 1897; *Steueroceras* COSSMAN, 1899 (obj. syn. of *Odontoceras*); *Sarygulia* KHUDYAEV, 1932 (invalid)]. Close derivatives of *Rasenioides*, in which ribbing has strengthened and become fasciculate, with longer secondaries, and ventral smooth band has become more pronounced; aperture with lappets. *L.Kimm.*, Eu.-N.Russia-S.Russia-Sib.-Kurdistan.——FIG. 419,*1*. **A. pseudomutabilis* (LORIOL), Fr.; *1a,b*, lectotype (SD DURAND, 1932), ×1 (330*).

Pararasenia SPATH, 1925 [**Aulacostephanus zacatecanus* BURCKHARDT, 1906] [*?Aulacostephanoides* SCHINDEWOLF, 1925]. Differs from *Aulacostephanus* by its lengthened primary ribs, short secondaries, and less pronounced ventral smooth band, which is as in *Rasenioides;* no lappets

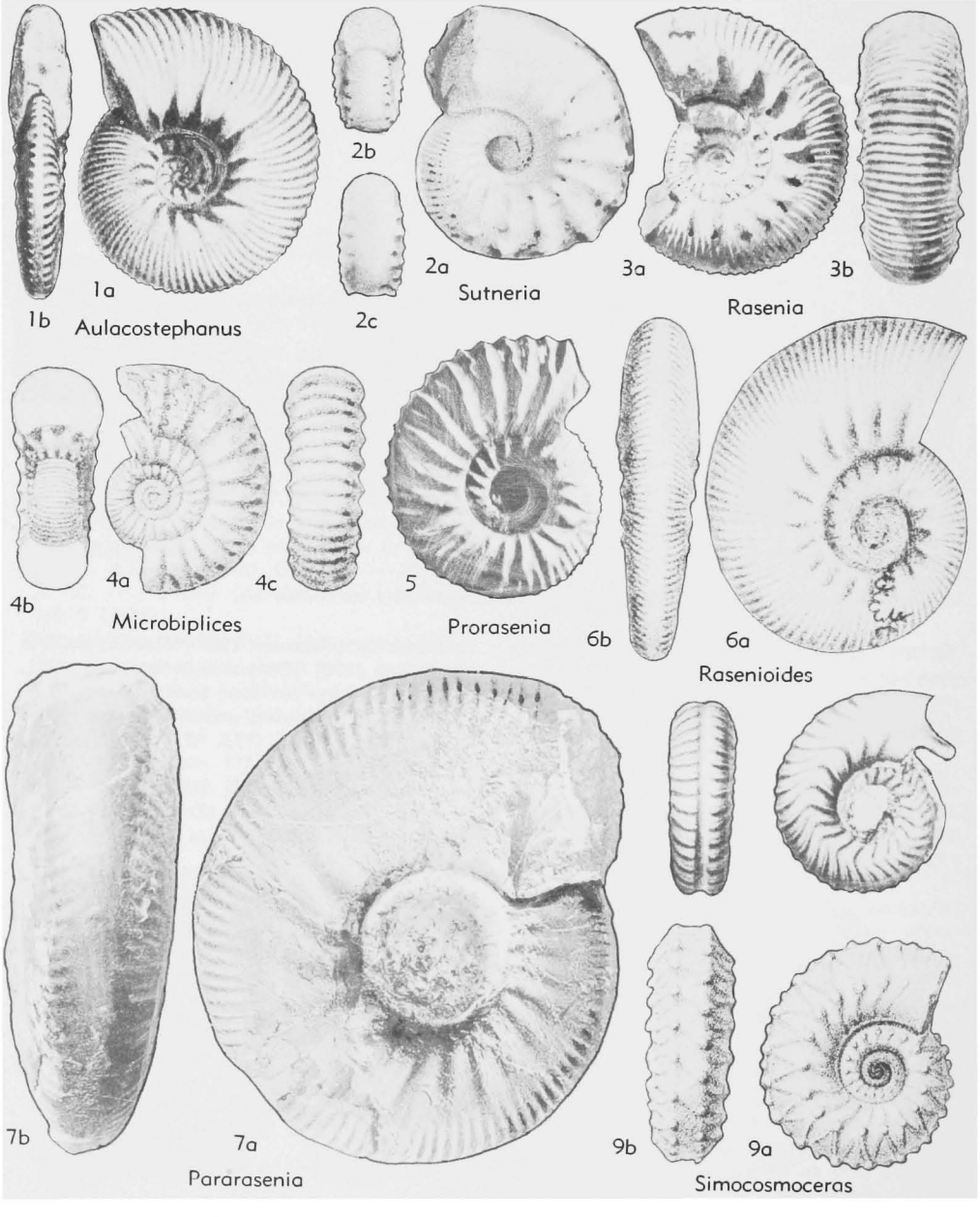


FIG. 419. Perisphinctidae (Aulacostephaninae) (p. L324-L327).

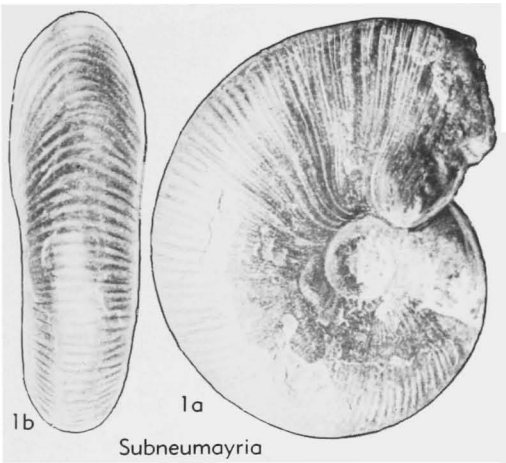


FIG. 420. *Subneumayria ordonezi* (BURCKHARDT), U.Jur.(L.Kimm.), Mex. (p. L327).

known. *L.Kimm.*, Mex.-?Eu.——FIG. 419,7. **P. zacatecana* (BURCK.), Mex.; *7a,b*, ×0.7 (69*).

Epicephalites SPATH, 1928 [**Macrocephalites epigonus* BURCKHARDT, 1906]. Involute, inflated, ribbed only on venter and outer half of whorl sides; inner half smooth. A homeomorph of Bathonian *Morrisiceras;* related to *Involuticeras. L. Kimm.(Idoceras* beds), Mex.-N.Z.——FIG. 421,*1*. **E. epigonus* (BURCK.), Mex.; *1a,b*, ×1 (69*).

Subneumayria SPATH, 1924 [**Neumayria ordonezi* BURCKHARDT, 1906]. Closely related to *Epicephalites* but more compressed, with simpler sutures, and feebler ribbing on venter only, elsewhere only growth lines. *L.Kimm.(Idoceras* beds), Mex.——FIG. 420,*1*. **S. ordonezi* (BURCK.); ×1 (69*).

Gravesia SALFELD, 1913 [**Am. gravesianus* D'ORBIGNY, 1850; SD ROMAN, 1938]. Inflated, with depressed to coronate whorls, coarse biplicate ribbing which tends to fade on body chamber. Sutures with broad 2nd lateral saddle. *M.Kimm.*, Eu.——FIG. 421,*2*. **G. gravesiana* (ORB.), Fr.; *2a,b*, lectotype (SD PAVLOW, 1892), ×0.7 (675*).

Sutneria ZITTEL, 1884 [**Nautilus platynotus* REINECKE, 1818; SD MUNIER-CHALMAS, 1892]. Dwarf, with involute depressed whorls coiled excentrically, and small lappets; ribbing as in *Rasenioides* but on body chamber of type species it is suddenly replaced by strong, distant rectiradiate primaries which end in ventrolateral tubercles. Probably comparable with *Cymbites, Metacymbites, Pimelites,* etc. *L.Kimm.*, Eu.-Somali-Persia-Mex.——FIG. 419, *2*. **S. platynota* (REIN.), Switz.; *2a-c*, ×1 (656*).

Enosphinctes SCHINDEWOLF, 1925 [**Sutneria subeumela* SCHNEID, 1914]. Dwarf, planulate, compressed, with acutely falcoid strong ribbing, secondaries strongly rursiradiate, and narrow, pointed lappets. Venter grooved in some through breaking away of siphuncle. *L.Kimm.-M.Kimm.*, Eng.-Fr.-Ger.——FIG. 419,*8*. **E. subeumelus* (SCHNEID), *steraspis z.*, Ger.; *8a,b*, ×1 (429*).

?Simocosmoceras SPATH, 1925 [**Cosmoceras adversum* OPPEL in ZITTEL, 1870]. Small, with median lateral and ventrolateral tubercles, tabulate or concave venter, and lappets. In type species, secondary

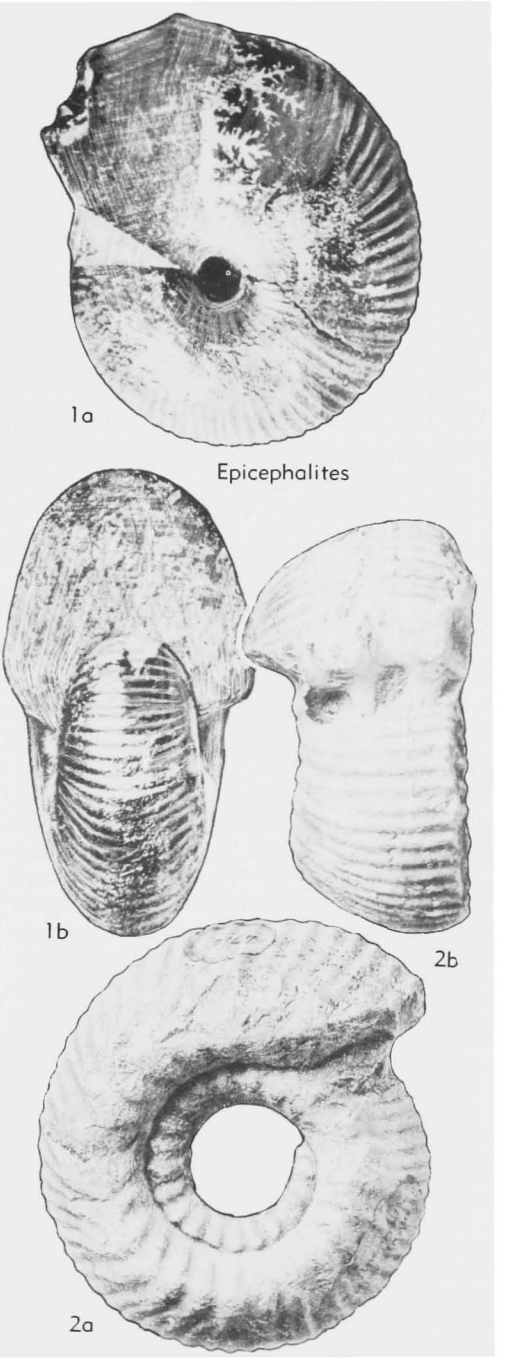


FIG. 421. Perisphinctidae (Aulacostephaninae) (p. L327).

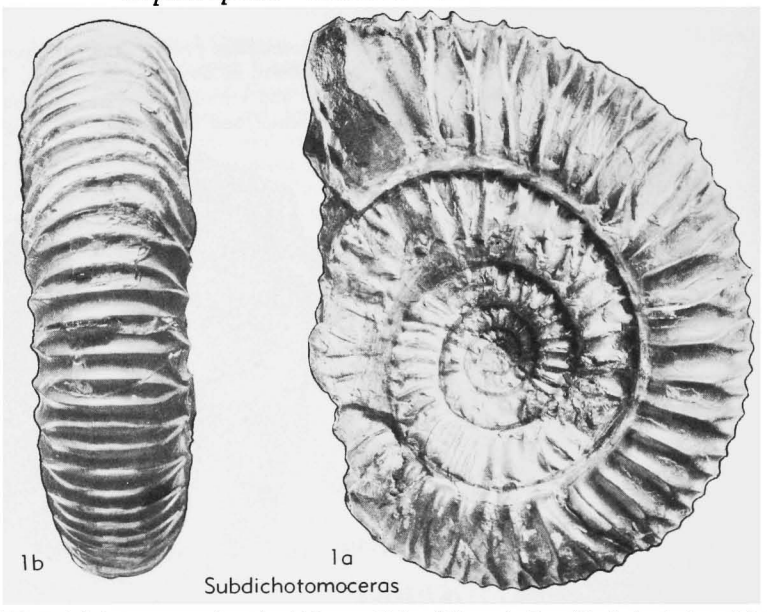


FIG. 422. *Subdichotomoceras lamplughi* SPATH, U.Jur.(Kimm.), Eng.(Yorks.); *1a,b,* ×0.7 (583n) (p. L328).

ribs are looped so as to form zigzag on venter. Perhaps derivative of *Sutneria. M.Kimm.(beckeri z.)-Tithon.,* Eu.——FIG. 419,9. **S. adversum* (OPPEL), Tithon.; *9a,b,* ×1 (576*).

Subfamily VIRGATOSPHINCTINAE Spath, 1923

[Incl. Pseudovirgatitinae SPATH, 1931]

Complex of perisphinctids which carried on main stock through Kimmeridgian[1] and Tithonian; comprises many forms so interconnected that it is impossible to disentangle lineages, making more than usually arbitrary the separation of them from Perisphinctinae and Ataxioceratinae, on the one hand, and from Dorsoplanitinae and Berriasellidae, on the other. To sustain the taxonomic scale adopted by SPATH a number of new genera will require naming. The genera exhibit various peculiarities of ribbing habit, the most frequent and characteristic being virgatotome branching. Granulaptychus and Praestriaptychus both probably occur (206, 213, 306, 429, 430, 463, 466, 486, 533). *U.Jur. (Kimm.-Tithon.),* world-wide.

Subdichotomoceras SPATH, 1925 (before Dec.) [**S. lamplughi*] [*?Sphinctoceras* NEAVERSON, 1925 (Dec.)]. Evolute, planulate; whorls quadrate or depressed; ribbing strong, sharp, regularly biplicate, unchanged to aperture, which is simple or trumpet-shaped, without lappets; constrictions deep, bordered by strong, sharp, oblique simple ribs. Middle and outer whorls in type and some other species indistinguishable from *Pavlovia,* but inner whorls have stronger and more distant ribbing. *L.Kimm.-M.Kimm., ?U.Kimm.,* Eu.-Somali.-Kenya-Tangan.-Madag.-Cutch-Himalaya-?Greenl.-?Mex. —— FIG. 422,*1*. **S. lamplughi,* Kimm. clay, Yorks.; *1a,b,* holotype, ×0.7 (583n*).

Pachysphinctes DIETRICH, 1925 [**P. africogermanus;* SD SPATH, 1930]. Stout, with strongly depressed inner whorls; ribs regularly biplicate but with virgatotome triplicate rib here and there on outer whorl; aperture unknown. *L.Kimm.,* Kenya-Tangan.-Madag.-Cutch.——FIG. 423,*1*. **P. africogermanus,* Tangan.; *1a,b,* ×0.7 (117*).

Metagravesia SPATH, 1931 [**M. decipiens*]. Stout, involute; inner whorls like *Pachysphinctes,* outer whorls acquire blunt primaries. Sutures complex.

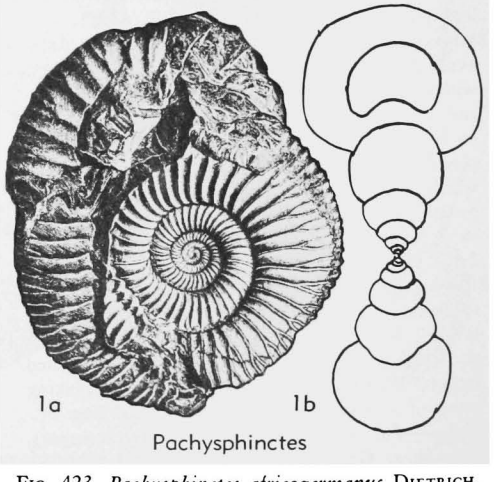


FIG. 423. *Pachysphinctes africogermanus* DIETRICH, U.Jur.(L.Kimm.), Tanganyika (p. L328).

[1] Spelling of Kimmeridgian with 2 *m*'s does not imply agreement of author.

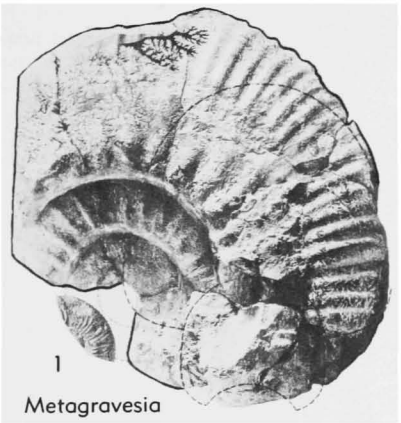


FIG 424. *Metagravesia decipiens* SPATH, U.Jur.(M. Kimm.), Cutch; *1*, ×0.2 (466*) (p. L328).

M.Kimm., Cutch.——FIG. 424,*1*. **M. decipiens*; ×0.2 (466*).

Katroliceras SPATH, 1924 [**Am. pottingeri* J.DEC. SOWERBY, 1840]. Evolute, with depressed whorls and coarse, sharp, distant ribbing, which becomes extremely coarse and triplicate on body chamber. *M.Kimm.*, *?U.Kimm.*, Eu.-Somali.-Kenya-Madag.-Cutch-Japan.——FIG. 425,*1*. **K. pottingeri* (Sow.), Kenya; *1a,b*, ×0.5 (466*).

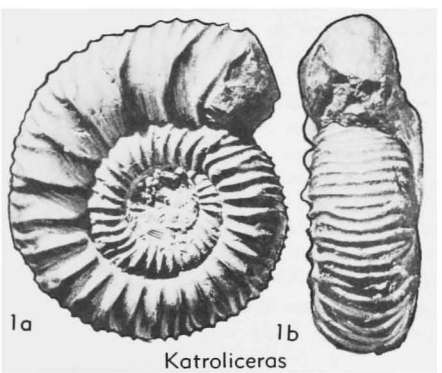


FIG. 425. *Katroliceras pottingeri* (SOWERBY), U.Jur. (Kimm.), Kenya (p. L329).

Torquatisphinctes SPATH, 1924 [**Am. torquatus* J. DEC.SOWERBY, 1840]. Evolute, whorls rounded quadrate, with sharp biplicate and simple ribbing which does not modify on body chamber; lappets presumably present. Hardly distinguishable from typical *Dichotomosphinctes* except by numerous simple ribs. *L.Kimm.-M.Kimm.*, *?U.Kimm.*, Somali.-Kenya-Madag.-Cutch-S.Russia-Mex.-Arg.——FIG. 431,*10*. **T. torquatus* (Sow.), Cutch; *10a,b*, ×0.7 (466*).

Aulacosphinctoides SPATH, 1923 [**Aulacosphinctes infundibulus* UHLIG, 1910]. Closely resembles and passes into *Torquatisphinctes* but typically differs by having more rounded or depressed whorls and more sigmoid and frequently triplicate ribbing; lappets present. *U.Kimm.-L.Tithon.*, Somali.-Cutch-Himalaya-Japan-N. Z. - Mex.-Arg. —— FIG. 426,*1*. **A. infundibulus* (UHLIG), M.Spiti sh., Himalaya; *1a,b*, ×0.5 (533*).

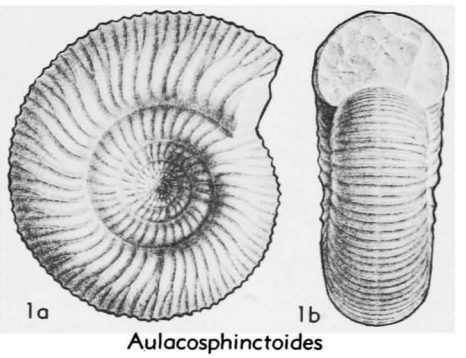


FIG. 426. *Aulacosphinctoides infundibulus* (UHLIG), U.Jur.(Spiti sh.), Himalaya (p. L329).

Parapallasiceras SPATH, 1925 [**Berriasella praecox* SCHNEID, 1915]. Small, *Pavlovia*-like, constricted, with lappets and transitory ventral groove; ribbing biplicate and simple, not modified on body chamber. *L.Tithon.*, Ger.-?Somali.——FIG. 431,*2*. **P. praecox* (SCHNEID), Neuburg beds, Ger.; *2a-d*, ×0.5 (430*).

Subplanites SPATH, 1925 [**Virgatosphinctes reisi* SCHNEID, 1914] [*Virgatosphinctoides, Allovirgatites* NEAVERSON, 1925; *?Pectiniformites* BUCKMAN, 1925; *Sokolovia* ILOVAISKY, 1934 (*non* J.BÖHM, 1933) (=*Ilowaiskya* VIALOV, 1940)]. Evolute, constricted, whorls more or less quadrate; ribbing on inner whorls sharp and biplicate, indistinguishable from *Lithacoceras*, becoming on outer whorls triplicate or quadruplicate and virgatotome. *M. Kimm.-L.Tithon.*, Eu. - S.Russia - Somali. - Abys.-Cutch-Borneo-Mex.-?Greenl.——FIG. 431,*5*. **S. reisi* (SCHNEID), Ger.; ×0.25 (429*).

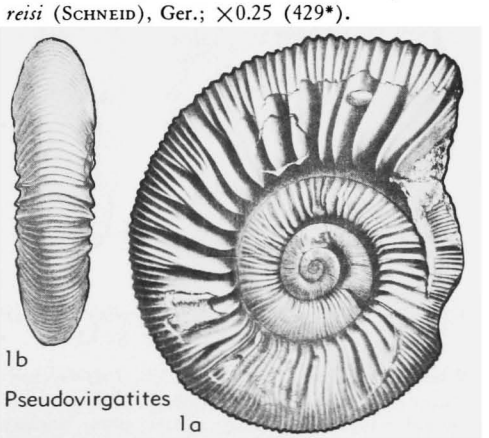


FIG. 427. *Pseudovirgatites scruposus* (OPPEL), U.Jur. (Tithon.), Ger. (p. L330).

Anavirgatites SPATH, 1925 [**A. divisiformis*]. Like *Subplanites* but ribbing becomes more distant, prominent and strongly virgatotome. *M.Kimm.-L. Tithon.*, Eu.-Somali.-?Eritrea-?Chile.——FIG. 431, *4c*. **A. divisiformis*, Somali; ×0.3 (463*).——FIG. 431,*4a,b*. *A. palmatus* (SCHNEID), Ger.; ×0.3 (429*).

Pseudovirgatites VETTERS, 1905 [**Am. scruposus* OPPEL in ZITTEL, 1868]. Giant, inner whorls fine-ribbed, outer whorls with gradually coarsening, very sharp, irregularly branched and simple ribbing, much disturbed by constrictions and parabolae. *Tithon.*, Moravia-Ger.-?Somali.——FIG. 427, *1*. **P. scruposus* (OPPEL); *1a*, ×0.15; *1b*, ×0.12 (728*).

Djurjuriceras ROMAN, 1936 [**D. djurjurense*]. Inner and middle whorls with fine biplicate ribbing, as in *Subplanites;* outer whorl with ribs degenerated to form distant double varices reminiscent of some simoceratids, but also found to a lesser degree in some English *Subplanites*. *L.Tithon.*, Alg.——FIG. 431,*1*. **D. djurjurense;* ×0.2 (388*).

Pectinatites BUCKMAN, 1922 [**Am. pectinatus* PHILLIPS, 1871] [*Keratinites* BUCK., 1925]. Resembling inner and early-middle whorls of *Pseudovirgatites* but ribbing less irregular, only rarely virgatotome, and lacking giant distantly ribbed stage; aperture sinuous, with rostrum, which may be long and upturned like a horn. *U.Kimm.*, Eu.-S.Russia-Greenl.-?Mex.-?Arg.——FIG. 431,*9*. **P. (P.) pectinatus* (PHILLIPS), Eng.; ×0.3 (65*).

Paraberriasella DONZE, 1948 [**P. blondeti*]. Doubtfully distinct from *Pectinatites;* aperture unknown. ?Subgen. of *Pectinatites*. *L.Tithon.*, SE.Fr.——FIG. 428,*1*. **P.? (P.) blondeti* (DONZE); *1a,b*, ×0.7 (609*).

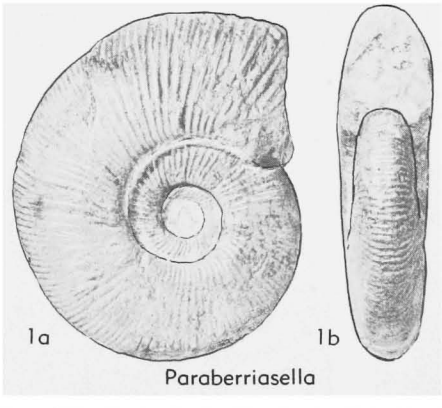


FIG. 428. *Pectinatites? (Paraberriasella) blondeti* (DONZE), U.Jur.(L.Tithon.), Fr. (p. L330).

Wheatleyites BUCKMAN, 1923 [**W. tricostulatus*]. Inner and middle whorls like *Pectinatites,* outer whorl with large, coarse, distant, blunt primary ribs and obsolescent secondaries; aperture simple. ?Subgen. of *Pectinatites*. *U.Kimm.*, Eng.-S.Russia-?Mex.——FIG. 431,*8*. **P.? (W.) tricostulatus* (BUCK.), Eng.; ×0.2 (65*).

Sublithacoceras SPATH, 1925 [**Perisphinctes penicillatus* SCHNEID, 1915] [*Paraulacosphinctes* SCHINDEWOLF, 1925]. Compressed; inner whorls finely, densely and regularly ribbed, with long secondaries; outer whorl smooth. *L.Tithon.*, Ger.-SE.Fr.-Alg.-Somali.——FIG. 431,*7*. **S. penicillatus* (SCHNEID), Ger.; ×0.25 (430*).

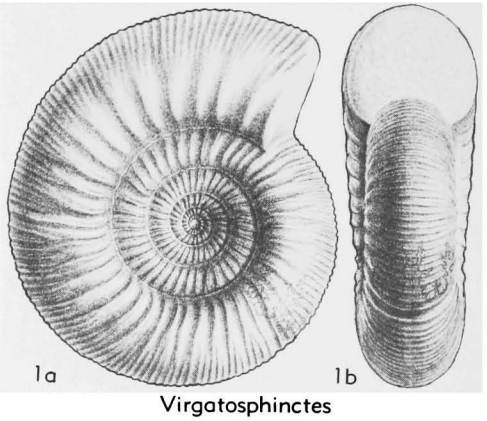


FIG. 429. *Virgatosphinctes broilii* (Uhlig), U.Jur. (Tithon.), M.Spiti sh., Himalaya (p. L330).

Virgatosphinctes UHLIG, 1910 [**V. broilii;* SD R. DOUVILLÉ, 1912]. Large, moderately evolute; whorls rounded to slightly compressed; ribs biplicate, gradually becoming triplicate, virgatotome, then fasciculate, and gradually enlarging and becoming more distant; at all stages ribbing is smoother than in *Pseudovirgatites* or *Subplanites,* more like that of *Wheatleyites;* aperture sinuous, simple. *L.Tithon.-U.Tithon.*, Eu.-N.Afr.-Somali.-?Abys. - Tangan. - Madag. - Cauc. - Persia - Cutch-Baluch.-Himalaya-NW. Austral.-Mex.-Cuba-Trinidad-Arg.——FIG. 429,*1*. **V. broilii* (UHLIG), M. Spiti sh.; *1a,b*, ×0.5 (533*).

Pseudoinvoluticeras SPATH, 1925 [**P. somalicum*]. Involute, very finely ribbed, becoming smooth.

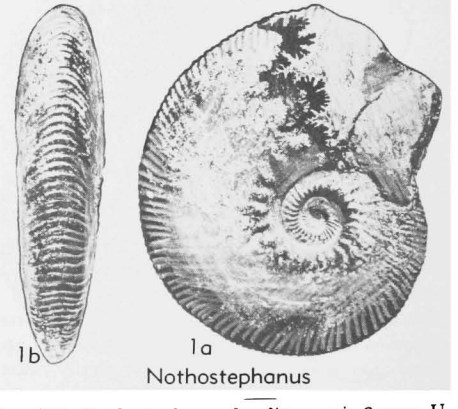


FIG. 430. *Nothostephanus kurdistanensis* SPATH, U. Jur.(Tithon.), Kurdistan (p. L332).

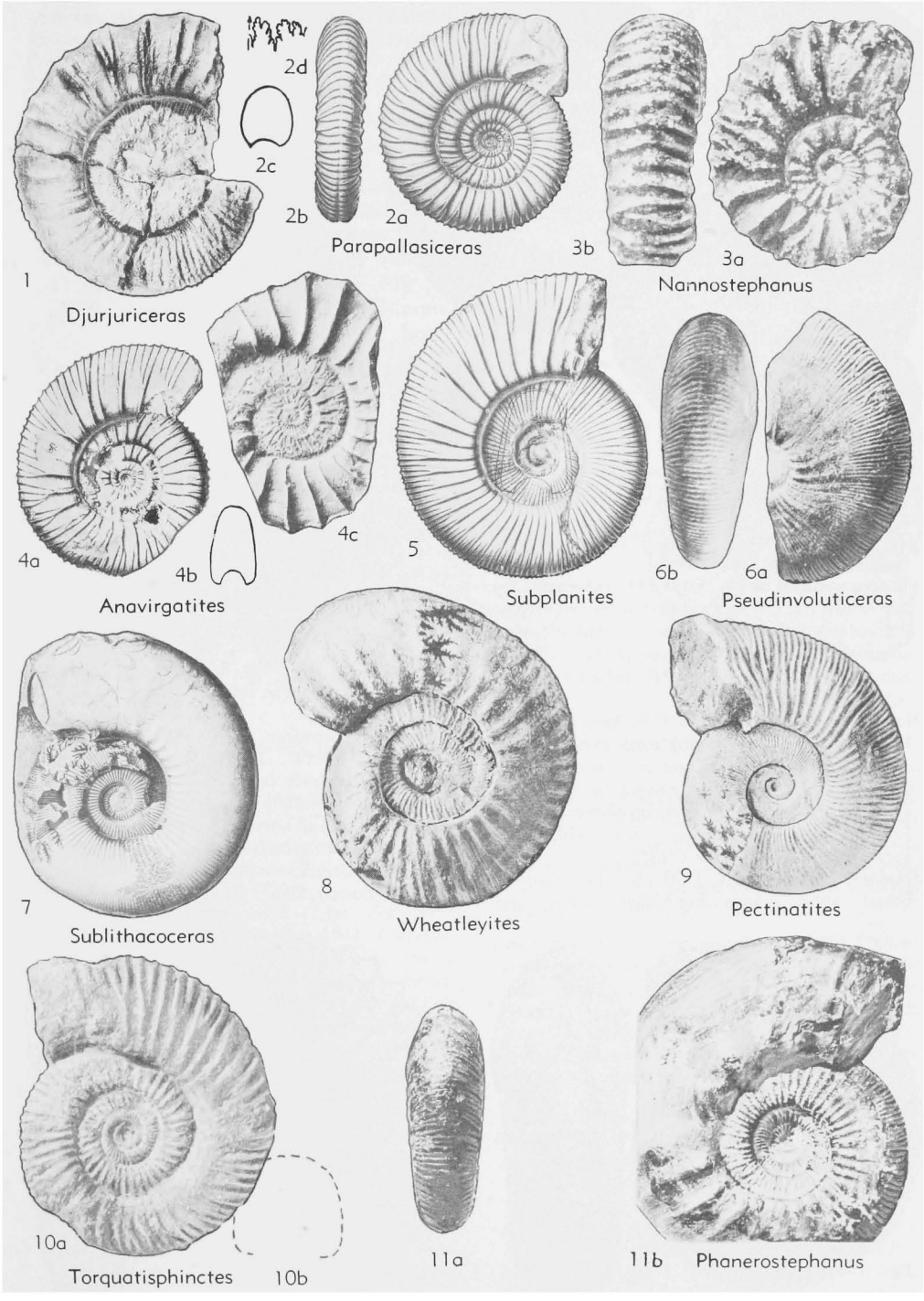


FIG. 431. Perisphinctidae (Virgatosphinctinae) (p. L329-L332).

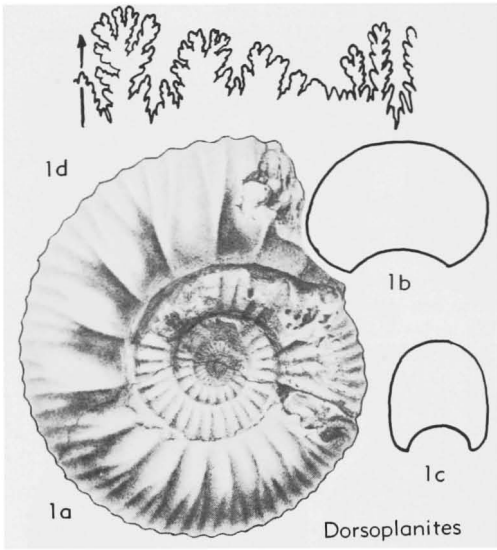


FIG. 432. *Dorsoplanites dorsoplanus* (VISCHNIAKOFF), U.Jur.(L.Volg.), Russ. (p. L333).

Tithon., Somali.-Arg.——FIG. 431,*6*. **P. somalicum; 6a,b,* ×0.5 (463*).

Phanerostephanus SPATH, 1950 [**P. subsenex*]. Inner whorls like *Virgatosphinctes*, outer whorls losing ribbing, which gives place to umbilical bullae; constrictions and ventral lappet present. *Tithon.*, Kurdistan.——FIG. 431,*11*. **P. subsenex; 11a,b,* ×0.5 (713*).

Nothostephanus SPATH, 1950 [**N. kurdistanensis*]. Involute, compressed; ribbing dense except on the innermost whorls, which are also more evolute. Connected with *Phanerostephanus* by transitions and probably closest to *Pseudinvoluticeras* (*teste* SPATH). *Tithon.*, Kurdistan.——FIG. 430,*1*. **N. kurdistanensis; 1a,b,* ×0.5 (713*).

?Nannostephanus SPATH, 1950 [**N. subcornutus*]. Dwarf; inner whorls fine-ribbed, middle and outer whorls with coarse distant ribs which bifurcate at tubercle high on ventrolateral edge and pass strongly across broad, flat to concave venter. *Tithon.*, Kurdistan.——FIG. 431,*3*. **N. subcornutus; 3a,b,* ×2 (713*).

Subfamily DORSOPLANITINAE Arkell, 1950

[*ex* Polytosphinctinae SCHINDEWOLF, 1925; Pavlovidae SPATH, 1931]

Evolute, round-whorled, with strong mainly biplicate ribbing, simple sutures and simple aperture; many attaining giant size. Probably derived from *Subdichotomoceras* (65, 205, 289, 306, 479, 543). *U.Jur.(U. Kimm.-Portl.), L.Volg.*, mainly N.Eu.-Boreal.

The giant ammonites of the Portlandian, of which a selection was figured by BUCKMAN (1922-26) under numerous new generic names, have yet to be systematically studied. The following attempt to sort out the names is provisional.

Pavlovia ILOVAISKY, 1917 [**P. iatriensis* var. *primaria*; SD SPATH, 1931] [*Lydistratites* BUCKMAN, 1922; *Pallasiceras* SPATH, 1923; *Holcosphinctes, Aposphinctoceras, Episphinctoceras* NEAVERSON, 1925; *Pavlovella* ILOVAISKY & FLORENSKY, 1941 (obj.)]. Ribbing sharp, strongly biplicate, in some simple. *U.Kimm.-L.Portl.*, Eng.-N.Fr.-Russia-W. Sib.-Greenl.-?Arg.——FIG. 435,*4*. **P. (P.) latriensis primaria; 4a,b,* type figure of ILOVAISKY, ×0.7 (389*).

Paravirgatites BUCKMAN, 1922 [**P. paravirgatus*] [*Shotoverites* BUCK., 1925]. Inner and middle whorls like *Pavlovia (s.s.)* but outer whorl gradually becoming coarsely ribbed, with ribbing somewhat irregular and varying from simple to triplicate. Subgen. of *Pavlovia. U.Kimm.(pectinatus z.)*, Eng.-N.Fr.-?Greenl.——FIG. 435,*3*. **P. (P.) paravirgatus* (BUCK.), Eng.; ×0.25 (65*).

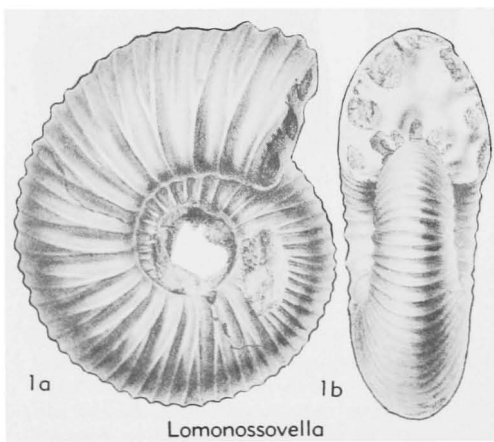


FIG. 433. *Lomonossovella lomonossovi* (VISCHNIAKOFF), U.Jur.(L.Volg.), Russ. (p. L333).

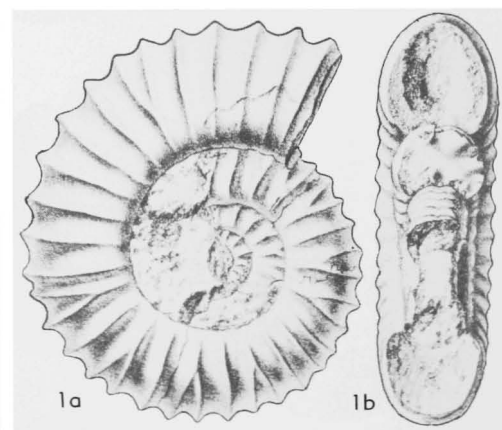


FIG. 434. *Acuticostites acuticostatus* (MICHALSKI), U.Jur.(L.Volg.), Russ. (p. L333).

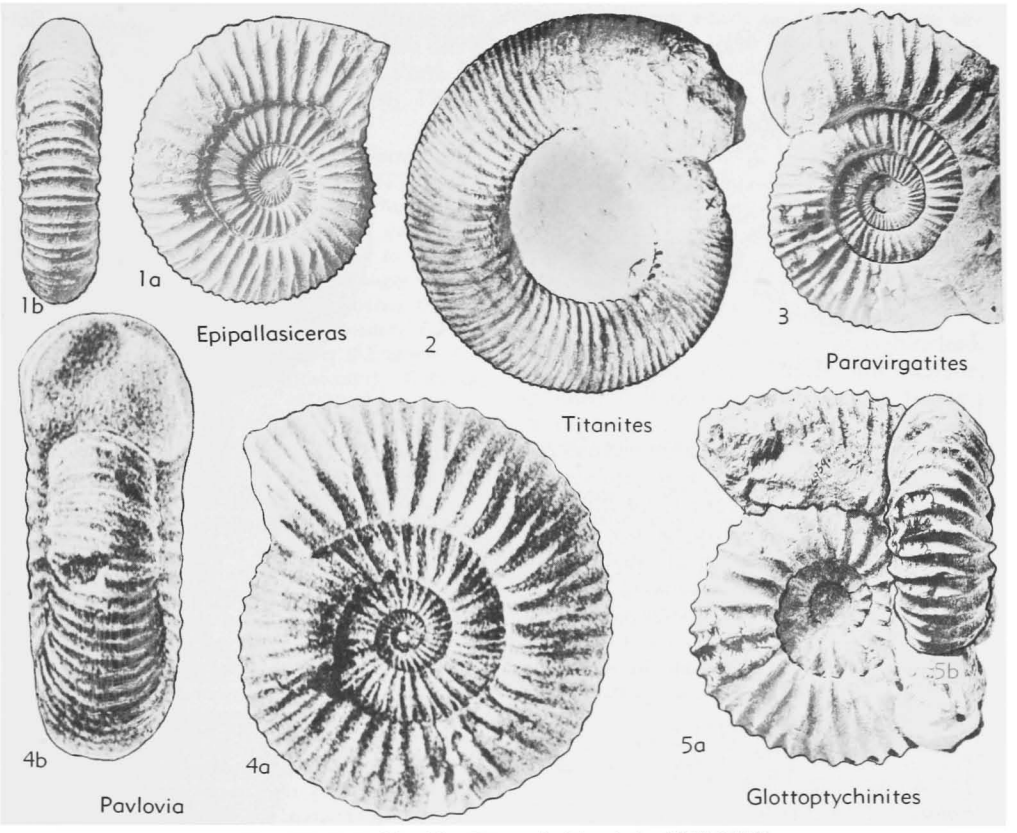


FIG. 435. Perisphinctidae (Dorsoplanitinae) (p. L332-L334).

Epipallasiceras SPATH, 1936 [**Pavlovia (E.) pseudaperta*]. Differs from *Pavlovia (s.s.)* by finer ribbing retained longer and by flatter whorl sides. Subgen. of *Pavlovia. Portl.*, Greenl.——FIG. 435,*1*. **P. (E.) pseudaperta; 1a,b,* ×0.3 (479*).

Dorsoplanites SEMENOV, 1898 [**Am. dorsoplanus* VISCHNIAKOFF, 1882; SD ROMAN, 1938] [=*Polytosphinctes* SCHINDEWOLF, 1925 (obj.)]. Ribbing blunter than in *Pavlovia* and tending to become swollen, with smoothing venter in adult.*L.Volg. (dorsoplanus z.)*, Russia-Spitz.-W.Sib.-Greenl.; *U. Kimm.*, Cauc.-?Cutch-?Eng.——FIG. 432,*1*. **D. dorsoplanus* (VISCH.), Russia; *1a-d,* ×0.5 (289*).

Laugeites SPATH, 1936 [**Kochina groenlandica* SPATH, 1936] [*pro Kochina* SPATH, 1936 (*non* RESSER, 1935)] [*Stschurovskya* ILOVAISKY & FLORENSKY, 1941; =*Prokachpurites* BREISTROFFER, 1947]. Differs from *Dorsoplanites* in being more finely and feebly ribbed and becoming entirely smooth on outer whorl. Perhaps leads to *Craspedites (Kachpurites). L.Volg.*, Russia-W.Sib.; *Portl.*, Greenl.——FIG. 436,*3*. **S. groenlandicus* (SPATH); ×0.3 (479*).

Epivirgatites SPATH, 1923 [**Perisphinctes nikitini* MICHALSKI, 1890; SD SPATH, 1924]. [=*Nikitinella* ILOVAISKY & FLORENSKY, 1941 (obj.)]. Evolute, constricted, closely resembling some English *Glaucolithites* or *"Crendonites"*; ribs prorsiradiate, somewhat irregular. *L.Volg.(blakei z.)*, Russia. ——FIG. 436,*1*. **E. nikitini* (MICHALSKI); lectotype (SD ARKELL, 1956), ×0.7 (289*).

Lomonossovella ILOVAISKY in ZONOV, 1937 [**Olcostephanus lomonossovi* VISCHNIAKOFF, 1882]. Ribbing strong, triplicate, never virgatotome; constrictions absent. Closely resembles some English *Titanites (Kerberites)* and may be Russian equivalent of them. *L.Volg.(blakei z.)*, Russia.——FIG. 433,*1*. **L. lomonossovi* (VISCH.); *1a,b,* ×0.7 (289*).

Acuticostites SEMENOV, 1898 [**Olcostephanus acuticostatus* MICHALSKI, 1890] [*Holcostephanoides* SPATH, 1924 (obj.); *Paravirgatites* ILOVAISKY, 1924 (obj.) (*non* BUCKMAN, 1922); *Oxypleurites* ILOVAISKY & FLORENSKY, 1941 (obj.) (*non* NALEPA 1891)]. Like *Pavlovia* but primary and secondary ribs extremely sharp and distant, and with many simple ribs. *L.Volg.(virgatus z.)*, Russia.——FIG. 434,*1*. **A. acutiscostatus* (MICHALSKI); *1a,b,* ×0.7 (289*).

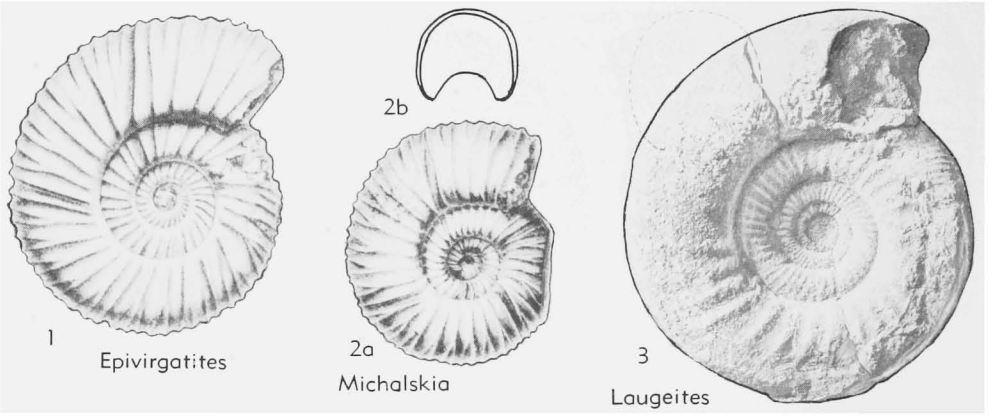


FIG. 436. Perisphinctidae (Dorsoplanitinae, Virgatitinae) (p. L333-L335).

Glaucolithites BUCKMAN, 1922 [**G. glaucolithus*] [*Leucopetrites* BUCK., 1922; *Crendonites* BUCK., 1923; *Aquistratites* BUCK., 1924; *Polymegalites, Gyromegalites, Crendonina* BUCK., 1925; *Hydrostratites* BUCK., 1926]. Giant, evolute, serpenticone, round-whorled or compressed, ribbing biplicate; little changed from some ancestral *Pavlovia*. *L. Portl.-Low.U.Portl.*, Eng.-N.Fr.-Greenl.——FIG. 437,*1*. **G. glaucolithus, gorei* z., Portland stone, Eng.; *1a,b*, ×0.15 (595*).

Titanites BUCKMAN, 1921 [**T. titan*] [*Gigantites, Briareites* BUCK., 1921; *Behemoth, Galbanites, Trophonites* BUCK., 1922; *Pleuromegalites, Hippostratites* BUCK., 1924]. Comprises "gigantids" proper. Inner whorls mainly biplicate and similar to *Glaucolithites* but more involute; outer whorls developing crowded ribbing with long secondaries and body chamber finally becoming nearly smooth. *U.Portl.*, Eng.-N.Fr.-?Greenl.-?Can.-?Russia.——FIG. 435,*2*. **T. titan, giganteus* z., Portland stone, Eng.; ×0.08 (65*).

Kerberites BUCKMAN, 1924 [**K. kerberus*] [*?Vaumegalites* BUCK., 1924]. Massive "gigantids" which start with coarse triplicate ribs on inner whorls. ?Subgen. of *Titanites*. *U.Portl.*, Eng.-N.Fr.-?Russia.——FIG. 438,*1*. **T.? (K.) kerberus* (BUCK.), *giganteus* z., Portland stone, Eng.; *1a,b*, ×0.5 (65*).

Glottoptychinites BUCKMAN, 1923 [**G. glottodes*]. Very strongly and sharply ribbed, *Pavlovia*-like, with biplicate and many simple ribs, which simplify and degenerate at end of body chamber, showing that adult is relatively small. *U.Portl.*, Eng.——FIG. 435,*5*. **G. glottodes*, Portland stone (top), *giganteus* z.; *5a,b*, ×0.25 (65*).

?Simotoichites BUCKMAN, 1923 [**S. simus*]. Peculiar flat-sided form with tabulate venter and short biplicate secondary ribs. Insufficiently known from single badly preserved specimen. *U.Portl.(giganteus z.)* (no figure).

Subfamily VIRGATITINAE Spath, 1923

Extreme developments of either Virgatosphinctinae or Dorsoplanitinae, or both, in which ribbing reaches limit of virgatotome trend, with up to 6 or 7 secondaries taking

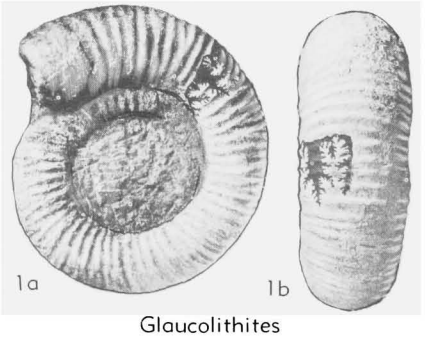


FIG. 437. *Glaucolithites glaucolithus* BUCKMAN, U. Jur.(Portl.), Eng. (p. L334).

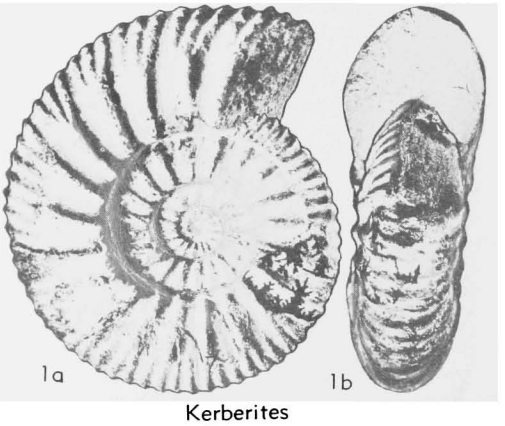


FIG. 438. *Titanites? (Kerberites) kerberus* (BUCKMAN), U.Jur.(U.Portl.), Eng. (p. L334).

off successively from front of a single primary rib; apertures simple (206, 261, 289). *U.Jur.(L.Volg.)* (believed to be L.Portl. by ARKELL but post-Portl. by SPATH, 1950); boreal.

Zaraiskites SEMENOV, 1898 [**Perisphinctes zarajskensis* MICHALSKI, 1890; SD BASSE, 1952] [=*Provirgatites* LEWINSKI, 1923 (obj.); *?Progalbanites* SPATH, 1936]. Comprises "scythicus group," in which inner whorls have normal bifid to triplicate ribbing and outer whorls develop strongly virgatotome ribbing, but with longer primaries than in *Virgatites*, of which it is an ancestor. *L.Volg.(scythicus z.)*, Russia-Pol.-N.Ger.-S.Eng.——FIG. 439,*2*. **Z. zarajskensis* (MICHALSKI), C.Russia; *2a,b*, ×0.5 (289*).

Virgatites PAVLOW, 1892 [**Am. virgatus* VON BUCH, 1832; SD R.DOUVILLÉ, 1910]. [=*Euvirgatites* LEWINSKI, 1923 (obj.)]. Compressed, involute; displays virgatotome ribbing in its most extreme form, beginning with nucleus, reverting to biplicate and simple ribbing near end of adult body chamber. *L.Volg.(virgatus z.)*, C.Russia.——FIG. 439,*1*. **V. virgatus* (BUCH); *1a,b*, type, ×0.45 (583*).

Michalskia ILOVAISKY & FLORENSKY, 1941 [**Perisphinctes miatschkoviensis* MICHALSKI, 1890]. Inner whorls with strong biplicate ribs as in *Pavlovia*, constricted; outer whorls developing triplicate virgatotome ribbing. *L.Volg.(virgatus z.)*, Russia.——FIG. 436,*2*. **M. miatschkoviensis* (MICHALSKI); *2a,b*, ×0.7 (289*).

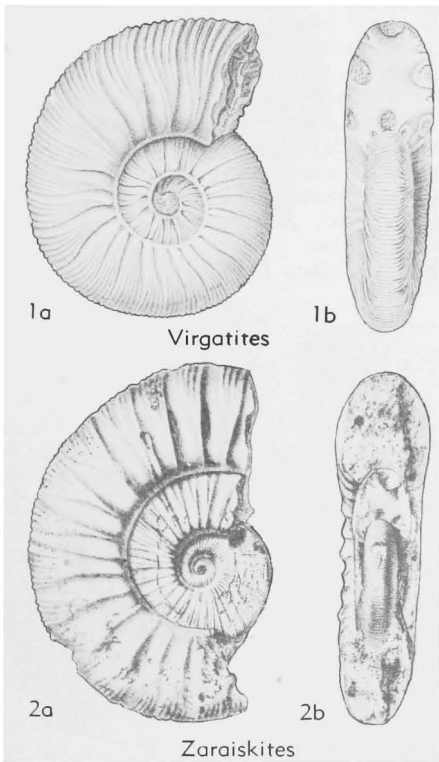


FIG. 439. Perisphinctidae (Virgatitinae) (p. L335).

Family ASPIDOCERATIDAE Zittel, 1895

A series of offshoots from Perisphinctidae at successive levels in the Upper Jurassic, tending to bituberculation (6, 266, 462). *M. Jur.-U.Jur.*

Subfamily PELTOCERATINAE Spath, 1924

Inner whorls typically perisphinctoid, sharply ribbed; outer whorls bituberculate, spinous, or with coarse simple ribs, tending to capricorns. As in Perisphinctidae and Stephanoceratidae, there are giants (usually tuberculate) with simple peristome, side by side with small species in which ribbing remains nontuberculate and the peristome carries lappets. In Aspidoceratinae and Simoceratinae no forms with lappets are known. *M.Jur.(U.Callov.)-U.Jur.(U.Oxf.)*, worldwide.

Origin of the Peltoceratinae from Zigzagiceratinae and Reineckeiidae has been postulated (ROLLIER, 1909, 1911), but WAAGEN (1875), SPATH (1931), PRIESER (1937), and others are almost certainly right in inferring derivation from various Pseudoperisphinctinae. Thus, *Binatisphinctes* and *Hamulisphinctes* probably gave rise to *Rursiceras* and *Peltoceratoides*, either *Binatisphinctes* or *Indosphinctes* to *Metapeltoceras*, and *Subgrossouvria* probably to *Pseudopeltoceras*. Aptychi have not been found *in situ* in Peltoceratinae, although they are common in certain Aspidoceratinae and Simoceratinae (6, 220, 356, 466).

Pseudopeltoceras SPATH, 1928 [**Am. chauvinianus* D'ORBIGNY, 1847]. Morphologically intermediate between large Pseudoperisphinctinae *(Subgrossouvria)* and *Peltoceras*. Strong perisphinctoid ribbing persists on the large outer whorls but develops outer lateral tubercles. *M.Jur.(U.Callov.)*, Eu.-TransCaspia-Cutch-Japan.——FIG. 440,*1*. **P. chauvinianum* (ORB.), Fr.; *1a,b*, ×0.3; *1c*, ×1 (330*).

Peltoceras WAAGEN, 1871 [**Am. athleta* PHILLIPS, 1829; SD SCHINDEWOLF, 1925]. Evolute, whorls hardly overlapping; ribs strong, bifurcating and trifurcating on ventral margin, venter nearly flat; outer whorls with 2 rows of massive lateral tubercles, outer row developing first. *M.Jur.(U.Callov.)*, Eu.-Madag.-Anatolia-Crimea-Donetz-Cauc. - Cutch - ?Philip.-Mex.-S.Am.——FIG. 442,*7*. **P. (P.) ath-*

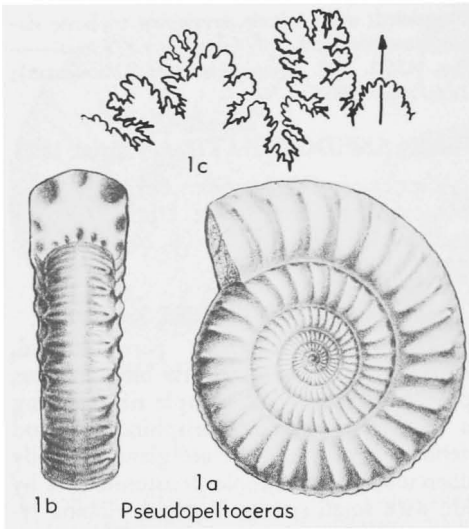


FIG. 440. *Pseudopeltoceras chauvinianum* (D'ORBIGNY), M.Jur.(U.Callov.), Fr. (p. L335).

leta (PHILLIPS), Eng.; *7a,b,* neotype, ×0.75 (466*).

Unipeltoceras JEANNET, 1951 [**Am. athleta unispinosus* QUENSTEDT, 1847]. Differs from *Peltoceras (s.s.)* in developing only outer row of lateral tubercles. Subgen. of *Peltoceras. M.Jur.(U.Callov.),* Eu.——FIG. 442,*8.* **P. (U.) unispinosum* (QUENST.), Ger.; ×1 (358*).

Metapeltoceras SPATH, 1931 [**Am. armiger* J.DEC. SOWERBY, 1840]. Differs from *Peltoceras (s.s.)* in developing inner lateral tubercles before outer. Subgen. of *Peltoceras. M.Jur.(U.Callov.),* Madag.-Cutch.——FIG. 442,*9.* **P. (M.) armiger* (SOW.), Cutch; *9a,b,* ×0.25 (466*).

Peltoceratoides SPATH, 1924 [**Peltoceras semirugosum* WAAGEN, 1875] [*Wedekindia* SCHINDEWOLF, 1925]. On inner whorls ribbing bifurcates from near umbilical edge; giant outer whorls gradually become bituberculate. *U.Jur.(L.Oxf.),* Eu.-C.Russia - S. Russia-Syria-Kenya-Tangan.-Madag.-Cutch-Indon.-N.Guinea.——FIG. 441,*1.* **P. semirugosus* (WAAGEN), Cutch; *1a,b,* ×0.3 (546*).

Peltomorphites BUCKMAN, 1925 [**P. hoplophorus*] [*Raspailites, Peltoraspailites* JEANNET, 1951]. Inner whorls as in *Peltoceratoides;* outer whorls become trituberculate and spinous, with ventral as well as lateral tubercles. Comprises "*eugenii* group." *U.Jur. (L.Oxf.),* Eu.-Madag.——FIG. 442,*6.* **P. hoplophorus,* Eng.; ×0.2 (6*).

Rursiceras BUCKMAN, 1919 [**Am. reversus* LECKENBY, 1859]. Ribbing strongly rursiradiate, biplicate and simple to end, without tubercles, branching from middle of whorl sides; aperture with lappets. *M.Jur.(U.Callov.),* Eu.(incl. ?Donetz).——FIG. 442,*3.* *R. reversum* (LECK.), Eng.; *3a,b,* holotype, ×1 (65*).

?Parapeltoceras SCHINDEWOLF, 1925 [**Nautilus annularis* REINECKE, 1818]. Small, evolute, round-whorled, depressed, with rursiradiate secondary ribs bifurcating from above middle of whorl sides (type too small for determination without further elucidation). Perhaps a *Binatisphinctes* or *Hamulisphinctes* but possibly a *Rursiceras. M.Jur.(M. Callov., ?jason z.),* Ger.——FIG. 442,*4.* **P. annulare* (REIN.); ×1 (610*).

Parawedekindia SCHINDEWOLF, 1925 [**Am. arduennensis* D'ORBIGNY, 1848] [*Prieserites* JEANNET, 1951]. Resembles inner whorls of *Peltoceratoides;* ribs bifurcating at umbilical margin, or may be simple rursiradiate, in some species tending to be interrupted on venter, without tubercles; ribbed to aperture, which has lappets. *U.Jur.(L.Oxf.-U.Oxf.),* Eu. - Morocco - Kenya - Madag. - Anatolia - Donetz - Syria-Cutch.——FIG. 443,*1.* **P. arduennensis* (ORB.), L.Oxf., Fr.; *1a,b,* ×0.5 (330*).

Gregoryceras SPATH, 1924 [**Am. transversarius* QUENSTEDT, 1847]. Small, with coarse, blunt, rursiradiate simple and biplicate ribs, which persist to end; aperture with lappets. Inner whorls more involute and irregularly ribbed than in *Rursiceras. U.Jur.(U.Oxf., transversarium z.),* Eu.-N.Afr.-Donetz.——FIG. 442,*2.* **G. transversarium* (QUENST.), Ger.; *2a-c,* holotype, ×1 (695*).

Pseudogregoryceras JEANNET, 1951 [**P. iteni*]. Differs from *Gregoryceras* in having inner half of inner whorls smooth. *U.Jur.(L.Oxf.),* Switz.——FIG. 442,*5.* **P. iteni;* ×0.7 (220*).

Epipeltoceras SPATH, 1924 [**Am. bimammatus* QUENSTEDT, 1858] [=*Aulapeltoceras* SCHINDEWOLF, 1925 (obj.)]. Small, with strong, distant, mainly simple, straight ribs which end at ventral tubercles; venter smooth, concave; long lappets. *U.Jur.(U.Oxf., bimammatum z.),* Eu.-N.Afr.-Persia.——FIG. 442,*1.* **E. bimammatum* (QUENST.), Ger.; *1a-c,* ×0.75 (360*).

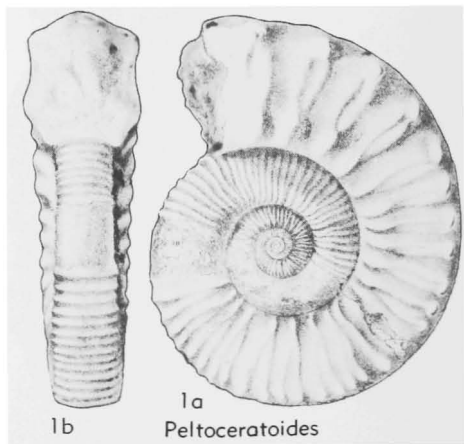


FIG. 441. *Peltoceratoides semirugosus* (WAAGEN), U. Jur.(L.Oxf.), Cutch (p. L336).

Subfamily ASPIDOCERATINAE Zittel, 1895

[=Physodoceratidae Schindewolf, 1925; includes Euaspidoceratinae Spath, 1931]

Differs from Peltoceratinae in lacking early perisphinctoid stage with biplicate ribbing, or in having it reduced to the nucleus only, but its sutures usually depart less from typical perisphinctoid pattern. No forms with lappets are known. Aptychus bivalved, with unribbed punctate outer surface (Laevaptychus); they are very durable and in the Lower Kimmeridgian form Aptychus beds, containing few or no ammonites (6,

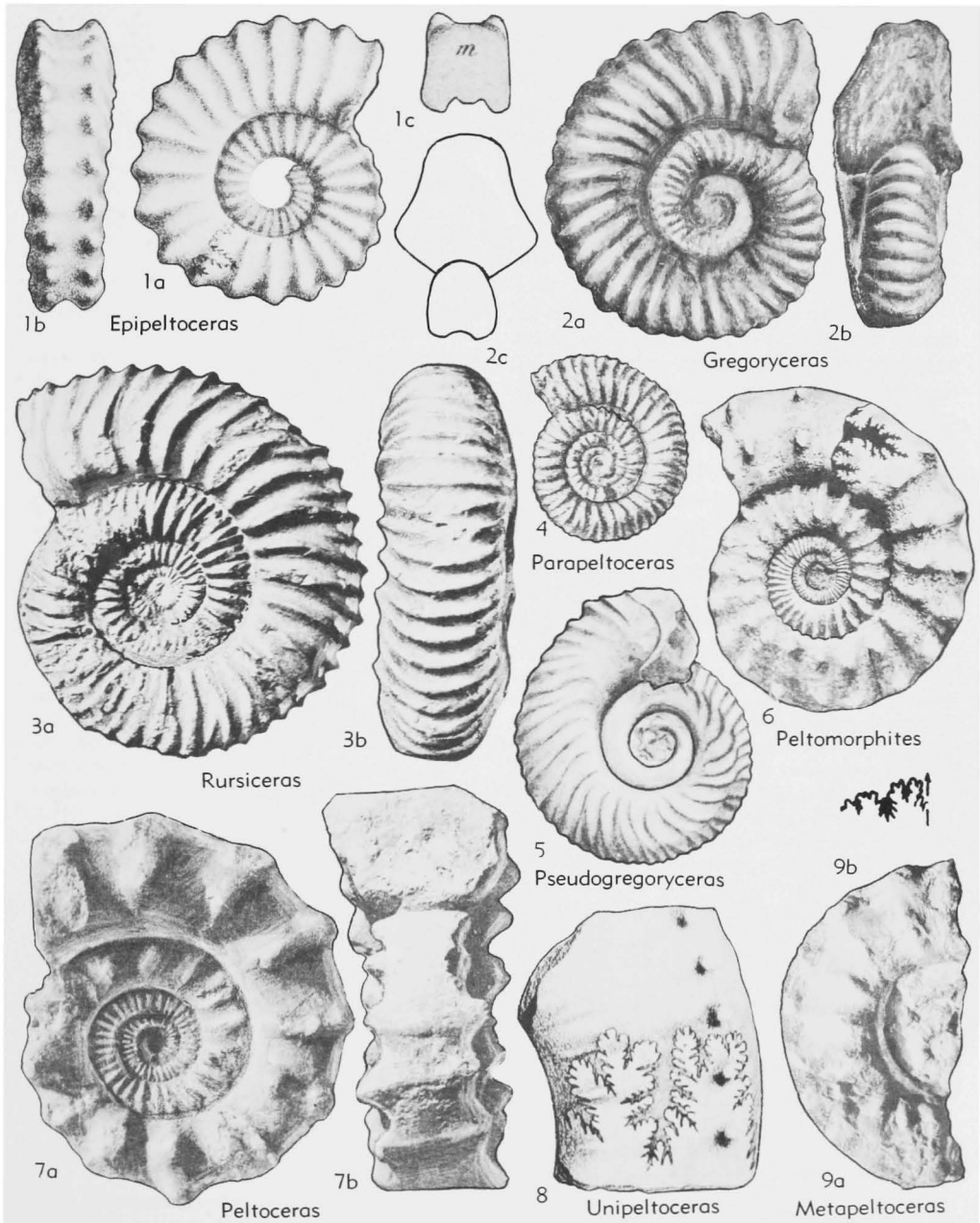


Fig. 442. Aspidoceratidae (Peltoceratinae) (p. L335-L336).

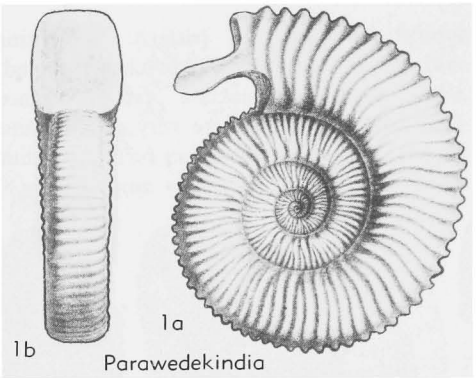


FIG. 443. *Parawedekindia arduennensis* (D'ORBIGNY), U.Jur.(L.Oxf.), Fr. (p. L336).

70, 220, 438, 466). *M.Jur.(U.Callov.)-U.Jur. (Tithon.)*, world-wide.

The earliest species of *Euaspidoceras* occur in the *athleta* z. with the first Peltoceratinae, but other species appear to originate independently in higher zones, apparently from late *Pseudoperisphinctinae* such as *Mirosphinctes* in the Lower Oxfordian. *Perisphinctes perisphinctoides* SINZOW may be intermediate (ARKELL, 1945, p. 275). Some Kimmeridgian genera may likewise connect with later Perisphinctidae of other subfamilies, but no proof has yet been obtained.

Euaspidoceras SPATH, 1931 [**Am. perarmatus* J. SOWERBY, 1822] [*Neaspidoceras* SPATH, 1931; *Arcaspidoceras* JEANNET, 1951]. Evolute, strongly ribbed, bispinous, inner tubercles on early whorls commonly falcoid; whorl shape typically quadrate but varying from depressed (*E. babeanum* D'ORBIGNY) to compressed (*"Neaspidoceras" lusitanicum* CHOFFAT). *M.Jur.(U.Callov.)-U.Jur.(U.Oxf.)*, Eu.-N. Afr.-Kenya-Tangan.-Madag.-Sinai-Syria-Donetz-Cauc.-Persia-Cutch-Indon.-Mex.-Cuba-Chile.——FIG. 444,*1*. **E. (E.) perarmatum* (SOW.), Eng.; ×0.25 (6*).

Paraspidoceras SPATH, 1925 [**Am. meriani* OPPEL, 1863] [*Extranodites* JEANNET, 1951]. Whorls very depressed, coronate and spinous from early stage, outer row of spines more or less clavate, inner row recessive or absent. Subgen. of *Euaspidoceras*. *U. Jur.(U.Oxf.)*, Eu.-Cutch.——FIG. 445,*4*. **E. (P.) meriani* (OPPEL); *4a,b*, ×0.7 (720*).

Epaspidoceras SPATH, 1931 [**Aspidoceras subdistractum* WAAGEN, 1875]. Differs from *Euaspidoceras (s.s.)* only in tending to develop a concave venter and in greater prolongation of its outer lateral spines. Subgen. of *Euaspidoceras*. *U.Jur.(?L. Kimm.)*, Fr.-Madag.-Cutch.——FIG. 445,*5*. **E. (E.) subdistractum* (WAAGEN), Cutch; *5a,b*, ×0.5 (546*).

Intranodites JEANNET, 1951 [**I. muehlbergi*]. Whorls depressed; ribs simple and biplicate from an inner row of lateral tubercles, crossing venter; outer whorls unknown. *U.Jur.(L.Oxf.)*, Switz.——FIG. 444,*3*. **I. muehlbergi; 3a,b*, ×1 (220*).

Clambites ROLLIER, 1922 [**Am. clambus* OPPEL, 1863; SD ROMAN, 1938]. Inner whorls resemble feebly ribbed *Euaspidoceras*, outer whorl smooth. *U.Jur.(U.Oxf., bimammatum z.)*, Eu.——FIG. 445, *1*. **C. clambus* (OPPEL), Ger.; *1a,b*, ×0.5 (327*).

Aspidoceras ZITTEL, 1868 [**Am. rogoznicensis* ZEUSCHNER, 1846] [*Acanthosphaerites* ROLLIER, 1922]. Whorls rounded, rounded-quadrate or depressed, with 2 rows of lateral tubercles, outer row placed near middle of whorl sides and soon fading in many species. Some species also ribbed (group of *A. rafaeli* OPPEL). *U.Jur.(L.Kimm.-U. Kimm.)*, *?Tithon.*, Eu.-N. Afr.-Abys.-Kenya-Tangan.-Madag.-Crimea-Russia-Cutch-Japan-N. Z.-Mex.-Tex.-Cuba-Arg.——FIG. 444,*2*. **A. (A.) rogoznicense* (ZEUSCHNER), L.Tithon., Galician Carpathians; *2a,b*, ×1 (575*).

Pseudowaagenia SPATH, 1931 [**Am. haynaldi* NEUMAYR, 1873]. Evolute, compressed, smooth, with rounded venter and abrupt umbilical margin on which is row of small close inner tubercles. Subgen. of *Aspidoceras*. *U.Jur.(L.Kimm.)*, Eu.-Madag.-Cutch.——FIG. 445,*3*. **A. (P.) haynaldi* (NEUMAYR), Rumania; *3a,b*, ×0.75 (309*).

Orthaspidoceras SPATH, 1925 [**Am. orthocera* D'ORBIGNY, 1850]. Whorls depressed, inflated, with single row of median lateral spines directed normal to surface. Some species also ribbed (*O. uhlandi* OPPEL). *U.Jur.(Kimm.)*, Eu.-Somali.-Madag.——FIG. 444,*6*. **O. orthocera* (ORB.), Fr.; *6a,b*, ×0.3 (330*).

Physodoceras HYATT, 1900 [**Am. circumspinosus* QUENSTEDT, 1858]. Involute, globular, smooth but for inner row of lateral spines which are on umbilical edge and directed inward over umbilicus. *U.Jur.(Kimm.)*, Eu.-Russia-Abys.-Kenya-Madag.-?Cutch-Himalaya-Mex.-Tex.-Cuba.——FIG. 444,*5*. **P. circumspinosum* (QUENST.), Ger.; ×1 (359*).

Glabrophysodoceras SCOTT, 1943 [**G. abyssineanum*]. Inner whorls smooth, *Haploceras*-like, outer whorls smooth but for inner row of feeble, blunt lateral tubercles on umbilical edge, and weak distant ribs. ?Subgen. of *Physodoceras*. *U.Jur.(U.Oxf.* or *L.Kimm.)*, Abys.——FIG. 445,*2*. **P.? (G.) abyssinianum; 2a,b*, ×0.5 (438*).

Simaspidoceras SPATH, 1925 [**Aspidoceras argobbae* DACQUÉ, 1905]. Whorls stout; coarse feeble ribbing branches from blunt tubercles on umbilical edge. Sutures complex. ?Subgen. of *Physodoceras*. *U.Jur.(L.Kimm.)*, Somali.-Abys.-Kenya.——FIG. 444,*4*. **P.? (S.) argobbae* (DACQUÉ), Somali.; *4a-c*, ×0.3 (604*).

?Pseudhimalayites SPATH, 1925 [**Aspidoceras steinmanni* HAUPT, 1907]. Tumid, involute, whorls depressed; outer lateral tubercles stronger than inner

and developed before them; vague ribbing rises to transverse bullae on venter, interrupted by median ventral groove. Possibly a himalayitid. *U.Jur. (?Kimm.)*, Arg.——Fig. 444,7. **P. steinmanni* (Haupt); *7a-c*, ×1 (187*).

Subfamily SIMOCERATINAE Spath, 1924

This subfamily is probably even more polyphyletic than the Aspidoceratinae or Peltoceratinae. Although it is seldom pos-

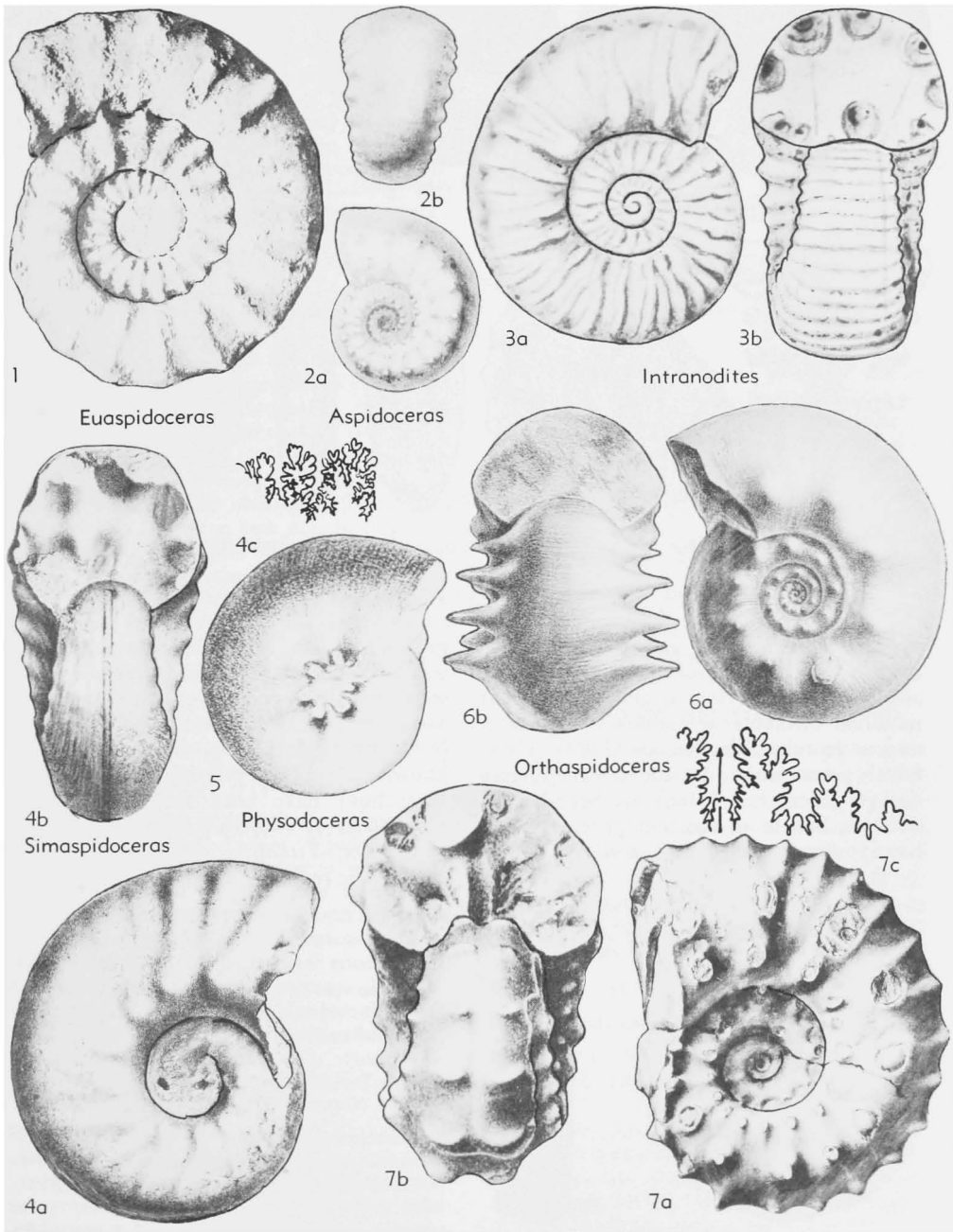


Fig. 444. Aspidoceratidae (Aspidoceratinae) (p. L338).

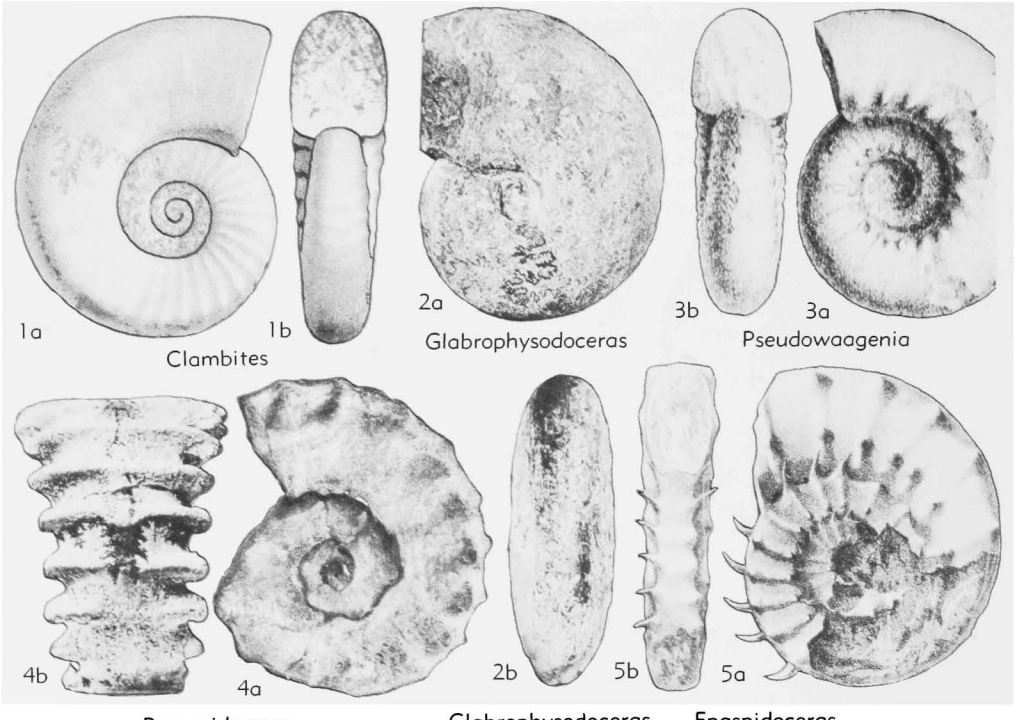


FIG. 445. Aspidoceratidae (Aspidoceratinae) (p. L338).

sible to suggest with any confidence the likely ancestors of various genera, it is probable that they represent largely independent modified offshoots of various Perisphinctidae, as postulated by KILIAN (1889). Those which retain most likeness to Perisphinctidae (6 genera first listed) are heavily constricted. The more aberrant genera (last 5 listed) are unconstricted and develop a grooved or concave venter and tend to resemble generalized aspidoceratid types; some may be derivatives of Aspidoceratidae. *Simoceras (s.s.)* has features more commonly met with in the Oppeliidae. No lappets known. Unribbed, punctate aptychi (Laevaptychus) have been found *in situ* in *Hybonoticeras* (70, 167, 309, 462, 463). *U. Jur.(U.Oxf.-Tithon.),* essentially Tethyan and Pacific realms.

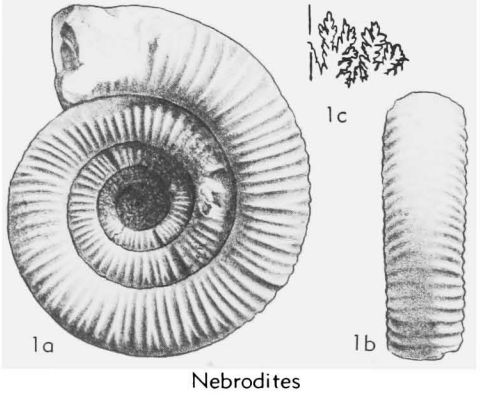


FIG. 446. *Nebrodites agrigentinus* (GEMMELLARO), U.Jur., Sicily; *1a-c,* ×0.5 (167*) (p. L340).

Nebrodites BURCKHARDT, 1910 [**Simoceras agrigentinum* GEMMELLARO, 1872; SD SPATH, 1925] [=*Neobrites* ALBRITTON, 1937]. Evolute, many-whorled, constricted, ribbed as in perisphinctids but with predominant simple ribs; venter tabulate, with median smooth band on outer whorl. *U.Oxf.-L.Kimm.,* S.Eu.-N.Afr.-Tangan.-Madag.-Cauc.-?Cutch-Tex.-Mex.-Arg.——FIG. 446,*1*. **N. agrigentinus* (GEMM.), Sicily; *1a-c,* ×0.5 (167*).

Benacoceras SPATH, 1925 [**Simoceras heteroplocum* GEMMELLARO, 1877]. Evolute, constricted, perisphinctid-like, strong narrow ribs mainly biplicate, with very short projected secondaries; venter smooth, at least on outer whorl. *L.Kimm.,* S.Eu. ——FIG. 448,*3*. **B. heteroplocum* (GEMM.), Sicily; ×0.2 (167*).

Pseudosimoceras SPATH, 1925 [**Olcostephanus stenonis* GEMMELLARO, 1877]. Somewhat more involute, stout-whorled, constricted, with blunt primary ribs becoming distant ridges; venter and shoulders smooth on outer whorl. *L.Kimm.*, S.Eu. ——FIG. 448,*2*. **P. stenonis* (GEMM.), Sicily; ×0.3 (167*).

Virgatosimoceras SPATH, 1925 [**Simoceras rothpletzi* SCHNEID, 1915]. Evolute, perisphinctid-like, with prominent, distant, biplicate and triplicate ribs; constrictions bordered adorally by a conspicuous collar; venter with median groove, becoming smooth and ungrooved on outer whorl. *M.Kimm.*, Ger.-Somali.-Persia-Cuba.——FIG. 447, *1*. **V. rothpletzi* (SCHNEID), *palmatus* z., Ger.; *1a-c*, ×0.7 (430*).

Mesosimoceras SPATH, 1925 [**Simoceras cavouri* GEMMELLARO, 1872]. Evolute, many-whorled, with quadrate whorl section; many close simple ribs ending in ventral tubercles; venter tabulate and smooth; ribs fading on last half whorl; constrictions numerous, deep, bordered both sides by flared collars. *L.Kimm.*, S.Eu.-Alg.——FIG. 448,*4*. **M. cavouri* (GEMM.), Sicily; *4a-c*, ×0.3 (167*).

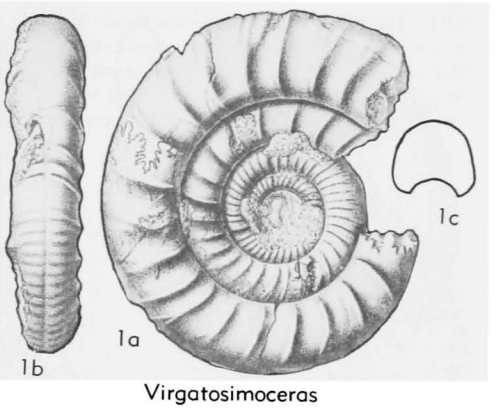
?Lytogyroceras SPATH, 1925 [**Am. fasciatus* QUENSTEDT, 1848]. Evolute, many-whorled, compressed, *Lytoceras*-like, smooth except for deep constrictions bordered on both sides by flared collars. Possibly a derivative of Lytocerataceae but sutures simple; derivation from *Mesosimoceras* more likely. *Kimm.-Tithon.*, S.Eu.——FIG. 448,*1*. **L. fasciatum* (QUENST.), Tithon.(Diphya-Kalk), S.Alps; *1a,b*, ×0.7 (358*).

Hemisimoceras SPATH, 1925 [**H. hemistriatum*]. Inner whorls rounded, finely ribbed; outer whorl changing suddenly to smooth with few distant primary ribs which tend to develop outer lateral tubercles. *M.Kimm.*, Madag.——FIG. 448,*5*. **H. hemistriatum; 5a,b*, ×1 (713*).

Pseudoclambites SPATH, 1925 [**P. aenigmaticus*]. Only body chamber known. Whorl rounded-quadrate, venter broadly tabulate to shallow-concave; ribs dense at first, becoming more distant and fading on shoulders and venter. *?Tithon.*, Somali.——FIG. 448,*7*. **P. aenigmaticus; 7a,b*, ×0.5 (463*).

Aulasimoceras SPATH, 1931 [**Waagenia auberti* PERVINQUIÈRE, 1907]. Evolute, strongly ribbed, with coarse ventrolateral tubercles on outer whorl and deep, sharp ventral groove. *Tithon.*, Tunisia-Alg.; *Kimm.*, Ger.——FIG. 448,*6*. **A. auberti* (PERV.), Tunisia; *6a,b*, ×0.7 (339*).

Hybonoticeras BREISTROFFER, 1947 [**Am. hybonotus* OPPEL, 1863] [=*Waagenia* NEUMAYR, 1878 (obj.) (*non* KRIECHBAUMER, 1874)]. Evolute, compressed; ribs either simple and distant, or bifurcating or trifurcating from umbilical tubercles, some ending at or looped to ventrolateral tubercles or spines; venter deeply concave, smooth, bicarinate, with keels either beaded or smooth. Suture has asymmetrical ventral lobe. *M.Kimm.-L.Tithon.*, S. Eu. - N. Afr.-Somali.-Abys.-Kenya-Madag.-Cutch-Mex.——FIG. 448,*8*. *H.* aff. *hybonotum* (OPPEL), S.Alps; *8a-c*, ×0.3 (587*).



Virgatosimoceras

FIG. 447. *Virgatosimoceras rothpletzi* (SCHNEID), U. Jur.(M.Kimm.), Ger. (p. L341).

Simoceras ZITTEL, 1870 [**Am. biruncinatus* QUENSTEDT, 1847; SD FISCHER, 1882]. Evolute, compressed; whorl sides flat or concave, smooth or with feeble distant simple ribs; with irregular row of umbilical tubercles or bullae, and concave venter bordered by heavy distant clavi. *Tithon.*, S.Eu.-N.Afr.-?Somali. - Cauc.-Persia - Cuba - Arg.——FIG. 448,*9*. **S. biruncinatum* (QUENST.), S.Alps; ×0.7 (358*).

Family CRASPEDITIDAE Spath, 1924

Typically involute planulates, platycones and oxycones, tending to high whorls with loss of ribbing; final expression of a trend previously seen in earlier branches of the Perisphinctaceae, especially *Gracilisphinctes* (Bath.), *Proplanulites* (Callov.) and *Ringsteadia* (Oxf.). Believed to be derived from Dorsoplanitinae (318, 320, 462). *U.Jur.(U. Volg.)-L.Cret.(Infravalang.-Valang.)*, Boreal realm.

Subfamily CRASPEDITINAE Spath, 1924

Venters rounded, perisphinctoid aspect retained. *U. Jur. (U. Volg.) - L. Cret. (Infravalang.)*.

Craspedites PAVLOW, 1892 [**Am. okensis* D'ORBIGNY, 1845; SD R.DOUVILLÉ, 1911]. Compressed, involute, with fine ribbing on inner whorls, smooth outer whorls. *U.Volg.*, Russia-Greenl.——FIG. 449, *1*. **C. (C.) okensis* (ORB.), *1a-c*, ×1 (675*).

Kachpurites SPATH, 1923 [**Am. fulgens* TRAUTSCHOLD, 1861; SD SPATH, 1924]. Evolute, still re-

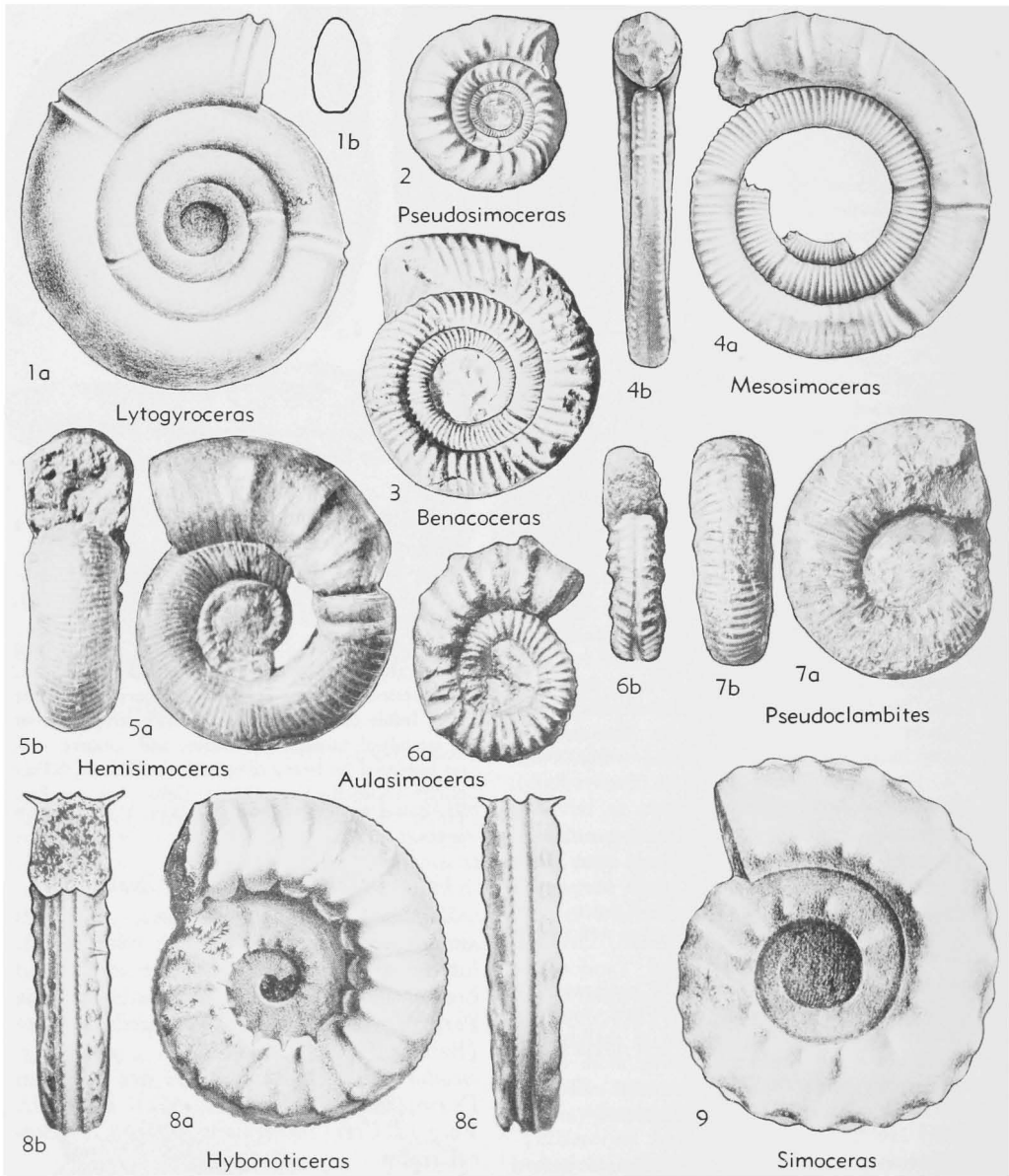


FIG. 448. Aspidoceratidae (Simoceratinae) (p. L340-L341).

taining considerable resemblance to the supposedly ancestral *Dorsoplanites* and *Laugeites;* distant primary ribs and numerous independent smooth secondaries. Subgen. of *Craspedites. U.Volg.,* Russia.——FIG. 449,*4*. **K. fulgens* (TRAUT.); ×0.7 (318*).

Subcraspedites SPATH, 1924 [**Am. plicomphalus* J.SOWERBY, 1822]. Inner whorls finely ribbed, outer develop coarse short primaries. Subgen. of *Craspedites. Infravalang.,* Eng.-Russia-Spitz.-Greenl.——FIG. 449,*2*. **C. (S.) plicomphalus* (Sow.), Spilsby ss., Eng.; *2a,b,* ×0.3 (712*).

Paracraspedites SWINNERTON, 1935 [**P. stenomphaloides*]. Differs from *Subcraspedites* in developing strong, distant primary ribs from early stage, in retaining strong secondaries, and in lacking intercalatories. Subgen. of *Craspedites. Infravalang.,* Eng.-Russia-W.Sib.-Greenl.——FIG. 449,*5*. **C. (P.) stenomphaloides* (SWIN.), Spilsby ss., Eng.; ×0.5 (721*).

Subfamily GARNIERICERATINAE Spath, 1952

Compressed, tending to oxycones. *U.Jur. (U.Volg.)-L.Cret.(Valang.).*

Garniericeras Spath, 1923 [**Am. catenulatus* Fischer de Waldheim, 1837; SD Spath, 1924 (cited by Spath as *"Oxynoticeras" catenulatum* Trautschold in Nikitin, 1884)]. Oxycones with sharp to fastigate or keeled venter and degenerated sutures (458; Spath, 1952). *U.Volg.*, Russia.

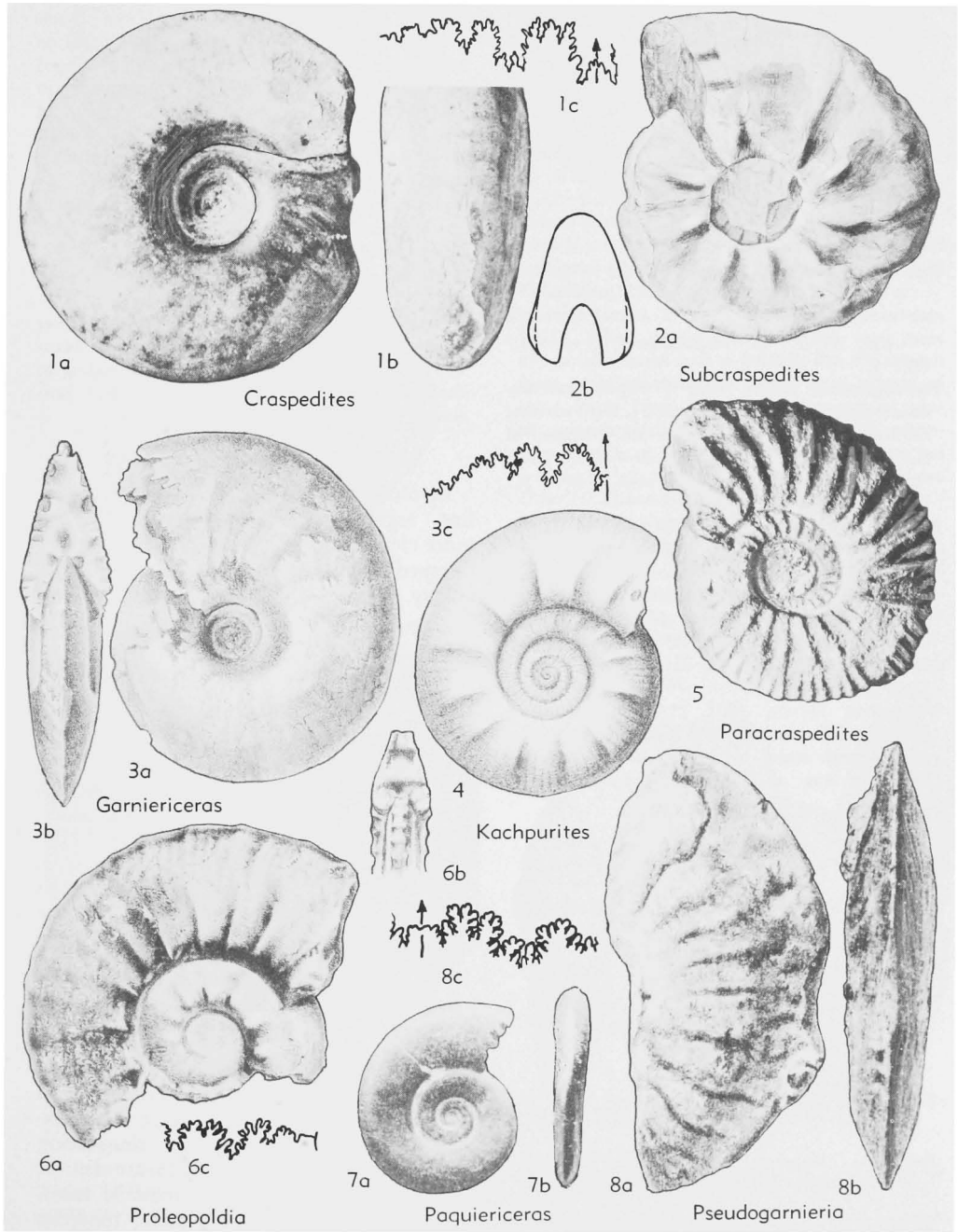


Fig. 449. Craspeditidae (Craspeditinae) (p. L341-L344).

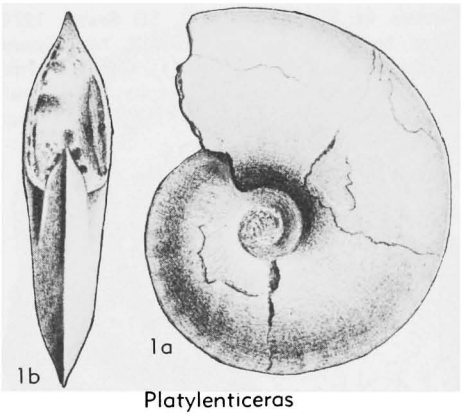


FIG. 450. *Platylenticeras heteropleurum* (NEUMAYR & UHLIG), L.Cret.(Valang.), Ger. (p. L344).

——FIG. 449,*3*. **G. catenulatum; 3a-c,* ×0.7 (320*).

Pseudogarnieria SPATH, 1923 [**Oxynoticeras undulato-plicatile* STCHIROWSKY, 1893]. Derivatives of *Garnericeras* with distinctive suture. ?Subgen. of *Garnericeras*. *Infravalang.*, Russia.——FIG. 449,*8*. **G.? (P.) undulatoplicatile* (STCHIR.); *8a-c*, ×1 (715*).

Platylenticeras HYATT, 1900 [**Oxynoticeras heteropleurum* NEUMAYR & UHLIG, 1881] [=*Garnieria* SAYN, 1901 (*non* BOURGUIGNAT, 1877)]. Differs from *Garnericeras* in having asymmetric siphuncle and asymmetric sutures with ceratitic saddle endings. *Valang.*, Ger.-Fr.——FIG. 450,*1*. **P. heteropleurum* (NEUM.-U.), Hils clay, Ger.; *1a,b*, ×0.7 (312*).

Tolypeceras HYATT, 1903 [**Am. marcousianus* PICTET & CAMPICHE, 1860[1]]. Moderately compressed, with acutely rounded venter; smooth but for inner row of large blunt lateral tubercles, which are represented on inner whorls by radial bullae. *Valang.*, Fr.——FIG. 451,*1*. **T. marcousianum* (PICTET-C.); *1a,b*, ×0.5 (345*).

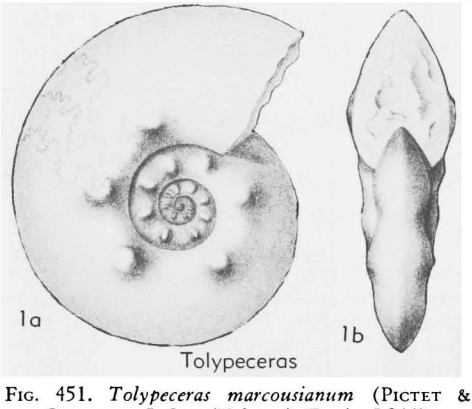


FIG. 451. *Tolypeceras marcousianum* (PICTET & CAMPICHE, L.Cret.(Valang.), Fr. (p. L344).

[1] Date doubtful. Title-page of relevant volume bears date of 1858 but text includes reference to an 1859 publication; probable date, 1860.

?Proleopoldia SPATH, 1923 [**Hoplites kurmyschensis* STCHIROWSKY, 1893]. Evolute, moderately compressed, with triangular whorl section, narrow tabulate venter; inner whorls with large distant umbilical bullae and small ventrolateral clavi; on outer whorl bullae become narrow and prolonged into primary ribs, which branch obscurely in middle of whorl sides, and clavi are reduced to small distant bullae. *L.Cret.(L.Neocom.)*, Russia.——FIG. 449,*6*. **P. kurmyschensis* (STCHIR.), Simbirsk; *6a-c*, ×0.5 (715*).

?Paquiericeras SAYN, 1901 [**P. paradoxum*]. Small, evolute, compressed, with narrow rounded to fastigate venter, completely smooth. Sutures specialized, with club-shaped lateral lobes. *Valang.*, Fr.——FIG. 449,*7*. **P. paradoxum; 7a,b*, ×1 (407*).

?Temnoptychites PAVLOW, 1913 [**Olcostephanus hoplitoides* NIKITIN, 1888] [=*Nikitinoceras* SOKOLOW, 1913]. Derivatives of *Craspedites* tending to depressed whorl shape. *L.Cret.(L.Neocom.)*, Russia-Sib. (no figure).

Subfamily TOLLIINAE Spath, 1952

Involute, compressed; ribbing typically fine, regular, well differentiated. Perhaps more closely related to Berriasellidae than to Craspeditinae (337; 487a). *L.Cret.(Infravalang.)*.

Tollia PAVLOW, 1913 [**T. tolli;* SD ARKELL, herein]. Like *Craspedites*, with regular primary and secondary ribbing which fades before septation ceases; with many constrictions. Sutures with many graded auxiliaries. *Infravalang.*, Sib.-Novaya Zemlya-Greenl.——FIG. 452,*3*. **T. tolli*, Sib.; *3a,b*, ×0.5 (337*).

Praetollia SPATH, 1952 [**P. maynci*]. *Berriasella*-like, with fine, sharp, regular ribbing. *Infravalang.*, Greenl.——FIG. 452,*2*. **P. maynci;* ×0.7 (713*).

Hectoroceras SPATH, 1947 [**H. kochi*]. Compressed, involute, discoidal, with blunt venter and persistent fine ribbing which is less sharp than in *Praetollia* and tends to lose primaries. *Infravalang.*, Greenl.——FIG. 452,*1*. **H. kochi; 1a,b*, ×0.7 (485*).

Family OLCOSTEPHANIDAE Haug, 1910

Perisphinctid derivatives with umbilical tubercles and bundled ribs, normally with strong constrictions at some stage. Many inflated and involute forms occur, some being sphaerocones or cadicones. Ribs are distinct and usually dense. Besides umbilical tubercles, lateral or even ventrolateral tubercles may be present. The earliest subfamily,

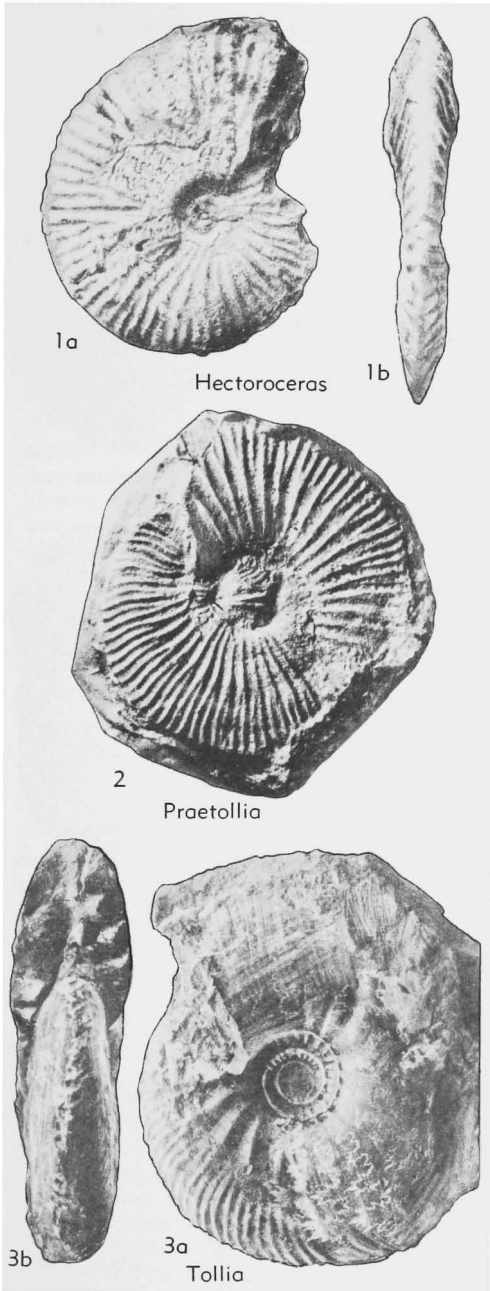


FIG. 452. Craspeditidae (Tolliinae) (p. L344).

Spiticeratinae, ranges from Tithonian to Valanginian. Olcostephaninae and Polyptychitinae are probably derived separately from different members of Spiticeratinae (482). *U. Jur. (L. Tithon.) - L. Cret. (L. Barrem.).*

Subfamily SPITICERATINAE Spath, 1924

Planulate shells of perisphinctoid appearance but with characteristic umbilical tubercles, bundled ribs and strong constrictions; lateral tubercles may occur, especially on inner whorls; outer whorls may lose all ornament (118, 533). *U.Jur.(L.Tithon.)-L.Cret. (Valang.).*

Proniceras BURCKHARDT, 1919 [**Am. pronus* OPPEL in ZITTEL, 1868; SD ROMAN, 1938] [*Prospiticeras* DJANELIDZÉ, 1922]. Inner whorls perisphinctoid from the start, with ribs simple or bifurcating high up on sides and no tubercles. *Tithon.*, S.Eu.-C.Eu.-N.Afr.-Kurdistan-Persia-Punjab-Mex.

Umiates SPATH, 1931 [**U. rajnathi*]. Akin to *Proniceras* but tends to reduce perisphinctoid stage and to develop more or less smooth outer whorls as in *Craspedites. Tithon.*, Cutch.

Spiticeras UHLIG, 1903 [**Am. spitiensis* BLANFORD, 1863]. Whorl section inflated at first, later more or less compressed oval to inflated; fine ribs branch from umbilical tubercles or in early whorls of some forms from lateral tubercles; curved constrictions generally present; aperture with prominent lappets, at least in many forms. Suture has a more or less strongly developed suspensive lobe. *U.Jur.(U.Tithon.)-L.Cret.(Berrias.)*, S.Eu.-C.Eu.-N.Afr.-Madag.-Pak.-India-Mex.-Cuba-Arg.

S. (Spiticeras) UHLIG, 1903. Inner whorls coronate, ribs branching from median lateral tubercles, which later disappear and ribs branch from umbilical tubercles; outer whorl may be high with narrowly rounded venter. Occurrence as for genus. ——FIG. 453,*1*. **S. (S.) spitiensis* (BLANFORD), Berrias., Himalaya; *1a,b*, ×0.5 (533*).

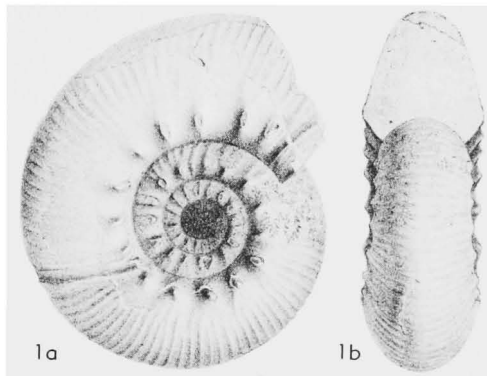


FIG. 453. *Spiticeras (Spiticeras) spitiense* (BLANFORD), L.Cret.(Berrias.), Himalaya (p. L345).

S. (Kilianiceras) DJANELIDZÉ, 1922 [**Stephanoceras damesi* STEUER, 1897; SD ROMAN, 1938]. Ornament coarser and bituberculate stage more persistent than in *S. (Spiticeras)*. *U.Jur.(U.*

Tithon.)-L.Cret.(Berrias.), Fr.-Arg.——Fig. 454, *3. *S. (K.) damesi* (Steuer), Berrias., Arg.; *3a,b*, ×0.7 (498*).

S. (Negreliceras) Djanelidzé, 1922 [**Am. negreli* Matheron, 1880; SD Roman, 1938]. Compressed from early stage, without lateral tubercles and

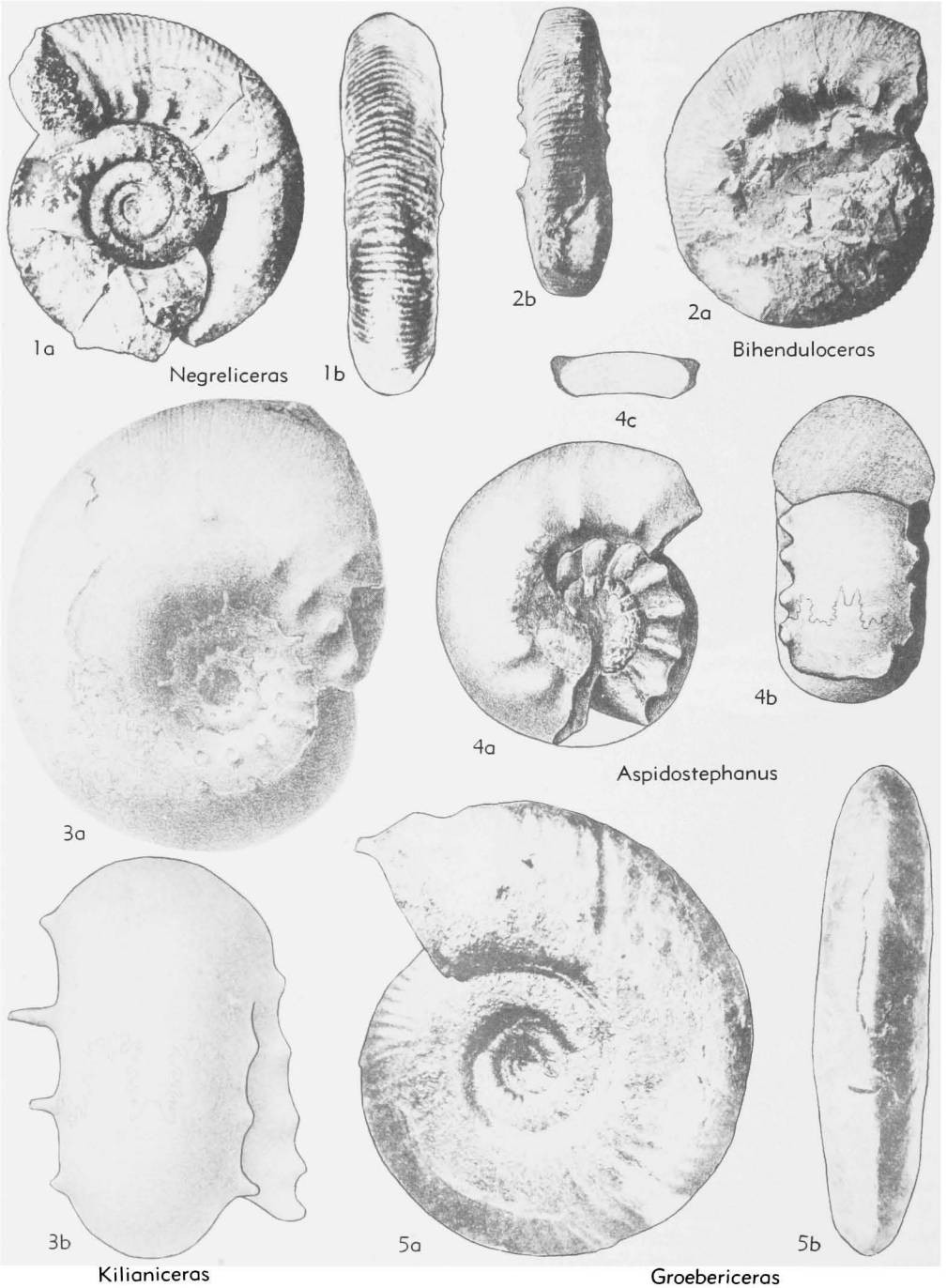


Fig. 454. Olcostephanidae (Spiticeratinae) (p. L345-L347).

tending to become smooth. Suspensive lobe of suture strongly retracted. *L.Cret.(Berrias.)*, S.Eu.-C.Eu.-Tunis-Pak.-Mex.-Arg.——FIG. 454,*1*. **S. (N.) negreli* (MATHERON), L.Cret.(Berrias.), Fr.; *1a,b*, ×0.75 (118*).

Groebericeras LEANZA, 1945 [**G. bifrons*]. Like *Negreliceras* but smoother from an early stage and losing tubercles very early or having none. *L.Cret. (Berrias.)*, Kurdistan-Arg.——FIG. 454,*5*. **G. bifrons*, Berrias., Arg.; *5a,b*, ×0.75 (255*).

?Bihenduloceras SPATH, 1925 [**B. gregoryi*]. Whorl section subquadrate, venter flat; fine ribs spring in bundles from large spinate umbilical tubercles and may be interrupted on venter by transient, narrow groove. *?U.Jur.(Tithon.)*, Somali.-——FIG. 454,*2*. **B. gregoryi; 2a,b*, ×0.5 (463*).

?Aspidostephanus SPATH, 1925 [**Holcostephanus depressus* STEUER, 1897]. Inflated and depressed to coronate with broad smooth venter; early whorls have strong distant ribs with umbilical and lateral tubercles but later whorls are smooth except for umbilical tubercles and whorl height increases. *?U.Jur.(Tithon.)*, *L.Cret.(Berrias.)*, Fr.-Balearics-N.Afr.-Arg.——FIG. 454,*4*. **A. depressus* (STEUER), Berrias., Arg.; *4a-c*, ×0.7 (498*).

Subfamily OLCOSTEPHANINAE Haug, 1910

Moderately involute, compressed to globular, including sphaerocone and cadicone members; primary ribs on umbilical wall split at an umbilical spine or bulla into a sheaf of fine or coarse, straight or slightly curved secondaries, typically prorsiradiate and passing uninterruptedly over venter; strong constrictions normally present at some stage of growth at least; aperture constricted with blunt rostrum and in some forms long lateral lappets (31, 36, 460, 482). *L.Cret.(Valang.-L.Hauteriv.)*.

Olcostephanus NEUMAYR, 1875 [**Am. astierianus* D'ORBIGNY, 1840; SD LEMOINE, 1906] [*Holcostephanus* SAYN, 1889; *Astieria* PAVLOW, 1892; *?Capeloites* LISSON, 1937 (malformation)]. Rather compressed to inflated, with well-rounded venter; 3 or more straight or slightly curved, radial, prorsi- or rursiradiate secondaries spring from umbilical bullae or spines, extra secondaries intercalated or rarely branched; marked constrictions oblique to ribs. *?L.Valang., U.Valang.*, Eu.-S.Afr.-Madag.-Pak.-Mex.-Peru.

O. (Olcostephanus) NEUMAYR, 1875. Ribs sharp and dense, umbilical edge rounded. Occurrence as for genus.——FIG. 455,*1*. **O. (O.) astierianus* (ORB.), U.Valang., Fr.; ×0.75 (329*).

O. (Rogersites) SPATH, 1924 [**Holcostephanus modderensis* KITCHIN, 1908]. Generally large and inflated; ribs on outer whorls coarser and less dense and umbilical edge more angular than in *O. (Olcostephanus)*. *U.Valang.*, Eng.-Natal-Madag.-Pak.-Mex.

Subastieria SPATH, 1923 [**Olcostephanus sulcosus* PAVLOW, 1892]. Whorl section highly coronate, at least in early whorls; fine ribs spring from prominent umbilical spines; constrictions strong and oblique. Very like the inner whorls of some *O. (Rogersites)*. *L.Hauteriv.*, Eng.-Tangan.-Calif.——FIG. 456,*4*. **S. sulcosus* (PAVLOW), L.Hauteriv., Eng.; *4a,b*, ×1 (679*).

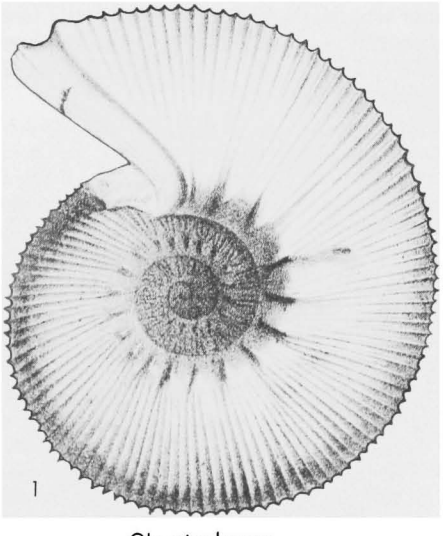
Parastieria SPATH, 1923 [**Acantoceras? peltoceroide* PAVLOW, 1892]. Small, with inner whorls as in *Subastieria*, from which it was derived, but outer whorl high, compressed, with slightly sinuous broad flat ribs and no tubercles. *L.Hauteriv.*, Eng. ——FIG. 456,*1*. **P. peltoceroides* (PAVLOW); *1a,b*, ×1 (679*).

Saynoceras MUNIER-CHALMAS & DE LAPPARENT, 1893 [**Am. verrucosus* D'ORBIGNY, 1840]. Small, inflated, with trapezoidal whorl section; variable sharp lateral tubercles give rise to 1 or 2 faint ribs leading to ventrolateral tubercles, opposite or alternate on venter; ribs normally subordinate to tubercles on outer whorl but may be sharp at some stage. Suture has wide short elements. Probably an offshoot of *Olcostephanus* despite close resemblance to some inflated Berriasellidae. *U.Valang.*, Fr.-Sp.-Balearics-Ger.——FIG. 456,*2*. **S. verrucosum* (ORB.), U.Valang., Fr.; *2a,b*, ×1 (143*).

Subfamily POLYPTYCHITINAE Spath, 1924

[*nom. transl.* SPATH, 1931 (*ex* Polyptychitidae SPATH, 1924)]

Moderately compressed to very depressed, including sphaerocones and cadicones; rounded, low to fairly high, prorsiradiate



Olcostephanus

FIG. 455. *Olcostephanus (Olcostephanus) astierianus* (D'ORBIGNY), L.Cret.(U.Valang.), Fr.; *1*, ×0.75 (329*) (p. L347).

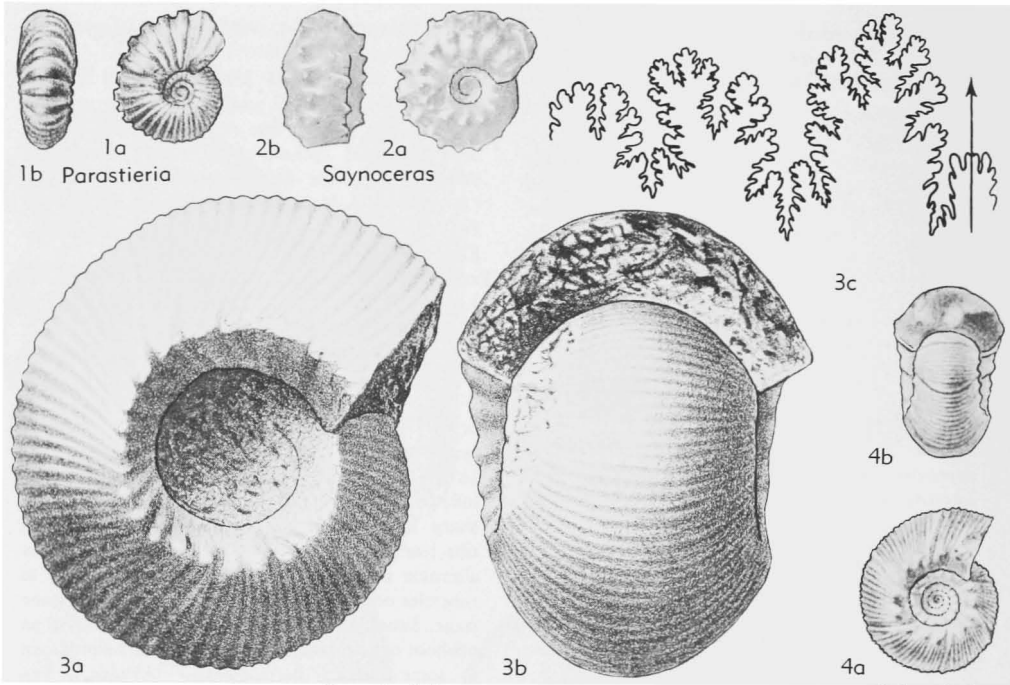


FIG. 456. Olcostephanidae (Olcostephaninae, Polyptychitinae) (p. L347-L348).

ribs spring generally from distinct umbilical bullae and branch 2 or 3 times; inner whorls smooth and constricted to a diameter of as much as 15 mm. but no constrictions on outer whorls. Probably derived directly from Spiticeratinae and not through Olcostephaninae (237, 312, 336, 460, 482). *L.Cret.(L. Valang.-L.Hauteriv.).*

Polyptychites PAVLOW, 1892 [**Am. polyptychus* KEYSERLING, 1846; SD ROMAN, 1938]. Moderately involute to very evolute; whorl section depressed and coronate to high, with flat sides; prominent, normally oblique umbilical bullae each give rise to 2 or more ribs which branch once or twice again; inner whorls of some late species have distant ribs which are sharp and high, branching only at umbilical tubercles. *L.Valang.-U.Valang.*, N. Eurasia-Fr.-Mex.-Calif.

P. (Polyptychites). Whorl section globular to rather compressed. Occurrence as for genus.——FIG. 457,*2*. **P. (P.) polyptychus* (KEYSERLING), U. Valang., Eng.; *2a,b*, ×0.75; *2c*, enlarged (679*).

P. (Euryptychites) PAVLOW, 1913 [**Am. latissimus* NEUMAYR & UHLIG, 1881; SD WRIGHT, herein]. Whorl section coronate. Homeomorph of *Gravesia*. *U.Valang.* Occurrence as for genus.——FIG. 456,*3*. **P. (E.) latissimus* (NEUMAYR & UHLIG), U.Valang., Ger.; *3a,b*, ×0.5 (312*).

Valanginites KILIAN, 1910 [**Am. nucleus* ROEMER, 1840; SD SPATH, 1939] [*Rotundites* STOLLEY, 1937 *(nom. nud.)*]. Differs from *P. (Polyptychites)* in greater involution and absence of umbilical tubercles. *U.Valang.*, Fr.-Ger.-Mex.

Dichotomites KOENEN, 1909 [**Am. bidichotomus* LEYMERIE in D'ORBIGNY, 1841]. Differs from compressed *P. (Polyptychites)* in its flatter sides and finer, feebler, prorsiradiate ribs, tending to weaken on middle of sides. *U.Valang.-L.Hauteriv.*, Eu.-Calif.-Mex.-Greenl.——FIG. 458,*2*. **D. bidichotomus* (ORB.), U.Valang., Eng.; ×0.75 (679*).

Neocraspedites SPATH, 1924 [**Am. semilaevis* KOENEN, 1902]. Differs from *Dichotomites* in greater compression, with consequent narrowly arched venter, and even weaker ribbing on sides, though ribs are prominent on venter; may be very large. *U.Valang.-L.Hauteriv.*, Eu.-Calif.-Greenl.——FIG. 457,*4*. **N. semilaevis* (KOENEN), L.Hauteriv., Ger.; *4a,b*, ×1 (237*).

Californiceras SHIMIZU, 1931 [**Am. traski* GABB, 1869 (holotype destroyed)]. Is probably a synonym of some member of this subfamily.

Subfamily SIMBIRSKITINAE Spath, 1924

[*nom. transl.* SPATH, 1931 (*ex* Simbirskitidae SPATH, 1924)]

Repeats most characters of various Polyptychitidae and to some extent Olcostephaninae, but with definite, though subtle, difference of aspect, including normally lesser de-

gree of involution. Mainly large, compressed, lenticular to globular or coronate; primary ribs give rise to more or less spinate or bullate tubercles on umbilical shoulders or higher up on sides, from which spring 2 (in earlier forms) and up to 4 (in later forms) sharp or rounded, coarse or fine, typically sinuous ribs with forward bend on periph-

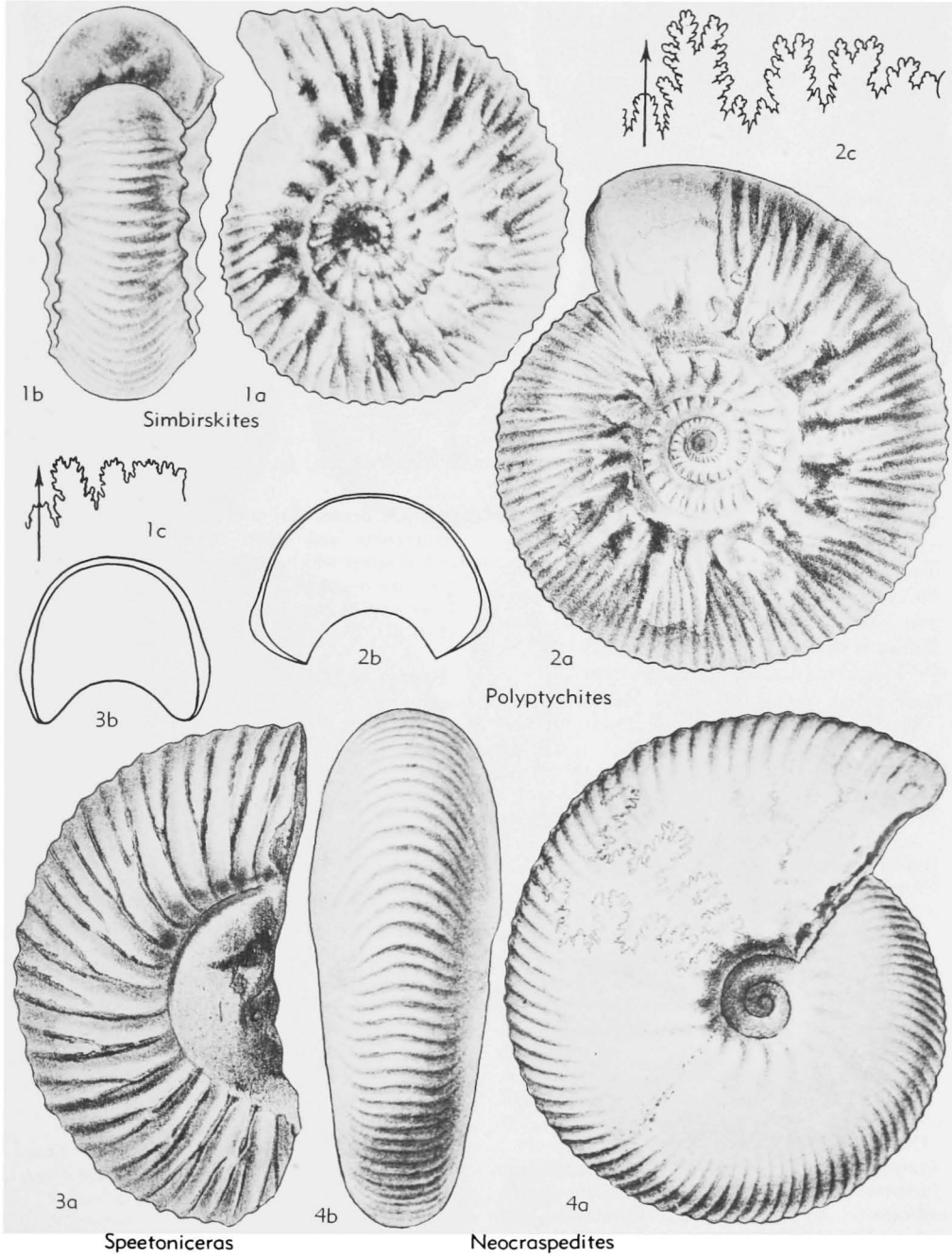


FIG. 457. Olcostephanidae (Polyptychitinae, Simbirskitinae) (p. L348-L350).

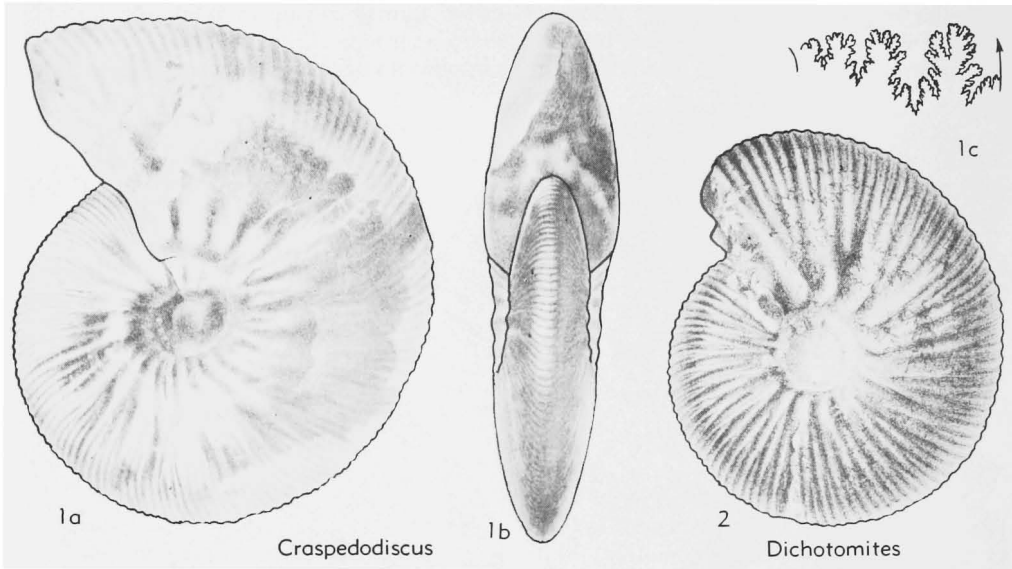


FIG. 458. Olcostephanidae (Polyptychitinae, Simbirskitinae) (p. L348-L350).

ery; ribs tend to weaken or disappear on outer whorl of compressed forms. Resemblance between inner whorls of some late *Polyptychites* and early *Simbirskites* suggests, despite the time gap, that the subfamily is derived from Polyptychitinae (336, 460). *L.Cret.(L.Hauteriv.-L.Barrem.).*

Speetoniceras SPATH, 1924 [**S. subbipliciforme*]. Outer whorls like a slightly depressed *Pavlovia,* evolute, with sharp umbilical bullae giving rise to 2 or 3 sharp, high, well-spaced ribs which cross venter with a marked forward bend; inner whorls more finely and densely ribbed, foreshadowing *Simbirskites. L.Hauteriv.,* N.Eu.——FIG. 457,*3. S. subinversum* (M.PAVLOW), L.Hauteriv., Eng.; *3a,b,* ×0.75 (679*).

Simbirskites PAVLOW, 1892 [**Am. decheni* ROEMER, 1840; SD ROMAN, 1938] [*Thysanotoceras, Stoicoceras* WHITEHOUSE, 1927]. Rather involute to evolute; whorl section compressed, round or coronate; in later forms more or less prominent umbilical bullae tend to move up to middle of sides, each giving rise to 2 to 4 ribs, fine on inner whorls but coarse, low and rounded on outer whorls. *L. Hauteriv., ?L.Barrem.,* N.Eurasia-Queensl.-Calif. ——FIG. 457,*1. *S. decheni* (ROEMER), U. Hauteriv., Sib.; *1a-c,* ×1 (336*).

Craspedodiscus SPATH, 1924 [**Am. discofalcatus* LAHUSEN, 1874; SD WRIGHT, herein (the originally designated type species, *Am. clypeiformis* JUDD, *non* D'ORBIGNY, lacks nomenclatorial standing, being merely a misidentification in a list)]. Inner whorls as in compressed *Simbirskites* but with finer and denser ribs; outer whorls with increasing compression and whorl height, with narrowly arched venter which becomes sharp in some species; ribs may disappear on outer whorls. *U.Hauteriv.-L.Barrem.,* N.Eu.——FIG. 458,*1. *C. discofalcatus* (LAH.), U.Hauteriv., Sib.; *1a-c,* ×0.5 (336*).

Family BERRIASELLIDAE Spath, 1922

[=Palaeohoplitidae ROMAN, 1938 *(partim)* (invalid because no type genus)]

Typically planulates of perisphinctoid appearance, with or without tabulate, smooth, or grooved venter; some, especially in Neocomitinae, tending toward a hoplitid aspect. In the Himalayitinae, whorls tend to be rounded or inflated and ornamented with nodes or spines. As usual, there are small forms ribbed to the aperture, which has lappets, and larger forms with simple aperture and tending to become smooth on the body chamber. Sutures variable, generally more or less perisphinctoid (21, 255, 283, 482, 533). *U.Jur.(Tithon.)-L.Cret.(Neocom.),* Tethyan and Pacific realms.

Subfamily BERRIASELLINAE Spath, 1922

Typical planulate or compressed perisphinctoid genera. *U.Jur.(Tithon.)-L.Cret. (Berrias.).*

Berriasella UHLIG, 1905 [**Am. privasensis* PICTET, 1867; SD ROMAN, 1938] [*Stenoceras* UHLIG, 1911 (*non* D'ORBIGNY, 1849]. Compressed Perisphinc-

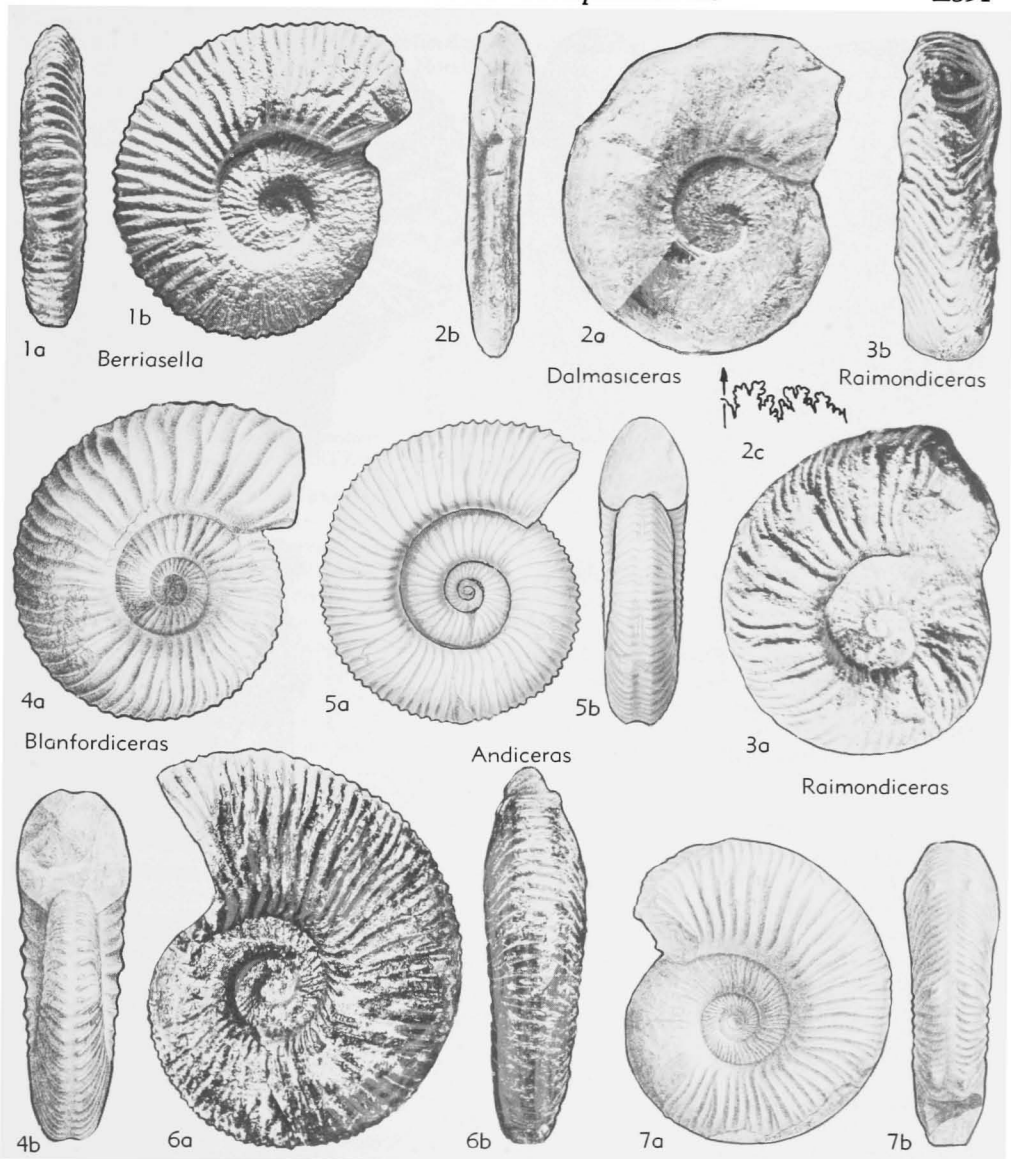
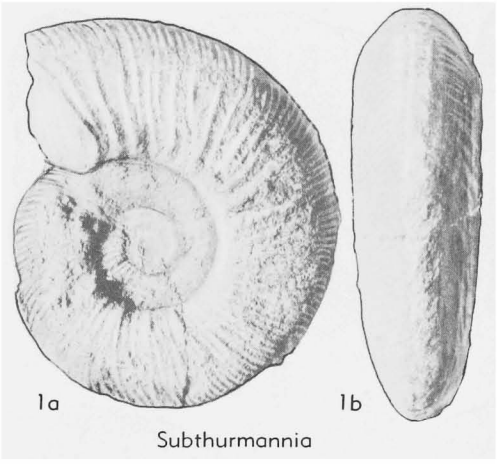


FIG. 459. Berriasellidae (Berriasellinae) (p. L323, L350-L354).

taceae with distinct sharp ribbing, biplicate or simple, which does not modify until close to aperture; venter usually with narrow smooth band or groove; lappets present (21, 118, 283, 374, 498, 533). *Tithon.-Berrias.*, Eu. - N.Afr. - Madag. - Anatolia - Crimea-Cauc. - Persia - Himalaya - N.Caled. - N.Z.-Calif.-Mex.-Cuba-Arg.-Patag.——FIG. 459,*1*. **B. privasensis* (PICTET); U.Tithon., Fr.; *1a,b*, lectotype, ×0.75 (283*).

Dalmasiceras DJANELIDZÉ, 1922 [**Am. dalmasi* PICTET, 1867; SD ROMAN, 1938]. Compressed, tending to lose ribbing, but with persistent small umbilical tubercles; venter becomes smooth and round and may lose groove; lappets present. *U. Tithon.*, Eu.-Tunis.——FIG. 459,*2*. **D. dalmasi* (PICTET), Fr.; *2a-c*, neotype, ×1 (283*).

Subthurmannia SPATH, 1931 [**S. fermori*]. Large, finely ribbed; early whorls compressed, with gently flexuous biplicate ribs and tabulate venter, like *Thurmanniceras;* outer whorls have more or less degenerated ribbing and rounded venter, with or without siphonal smooth band or shallow groove.



Subthurmannia

FIG. 460. *Subthurmannia fermori* SPATH, L.Cret. (Neocom.), SaltR. (p. L351).

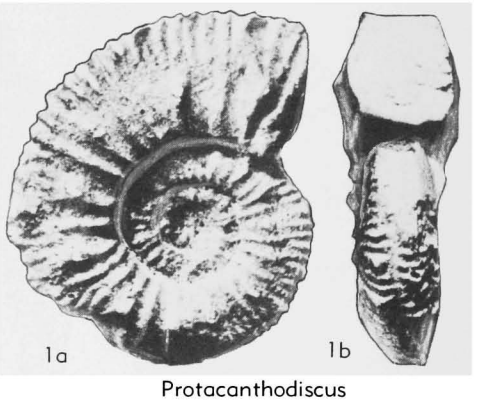
Sutures complex. *L.Neocom.*, S.Eu.-SaltR.-Peru. ——FIG. 460,*1*. **S. fermori*, SaltR.; *1a,b*, ×0.3 (482*).

Substeueroceras SPATH, 1923 [**Odontoceras koeneni* STEUER, 1897]. Ribbing fine and dense, more irregular and with longer secondaries than in *Kossmatia*, less projected but not interrupted on venter, which is tabulate. Allied to *Subthurmannia*. *U.Tithon.*, ?Somali.-Persia-Kurdistan-Calif.-Mex.-Peru-Arg.——FIG. 462,*1*. **S. koeneni* (STEUER), Arg.; *1a-c*, ×0.3 (498*).

Protacanthodiscus SPATH, 1923 [**Hoplites andreae* KILIAN, 1889]. Inner whorls like *Berriasella*, but lateral tubercles may occur on some ribs; middle and outer whorls with some distant bituberculate primary ribs, irregularly branched from outer lateral tubercle, and many intercalatories and non-tuberculate primaries; venter with median smooth band, in some bordered by incipient small bullae and in others by parabolic nodes; aperture simple. Much larger than *Berriasella*. *Tithon.*, S.Eu.-N. Afr.-Crimea-?SaltR.-Himalaya - Calif. - Mex. - Peru - Arg.——FIG. 461,*1*. **P. andreae* (KILIAN), Sp.; *1a,b*, holotype, ×0.7 (283*).

Subalpinites MAZENOT, 1939 [**S. fauriensis*]. Evolute, planulate, with tabulate and grooved venter; ribs coarse, branching rather irregularly near middle of whorl sides and only obscurely interrupted on venter. *Berrias.*, S.Eu.——FIG. 462,*2*. **S. fauriensis*, SE.Fr.; *2a-c*, ×0.5 (283*).

Lytohoplites SPATH, 1925 [**Hoplites burckhardti* MAYER-EYMAR in BURCKHARDT, 1900]. Evolute; whorl section subquadrate to polygonal; with distant, high, thin main ribs which may be twinned, simple or obscurely biplicate, and feeble intermediate ribs which are looped, ending in thin oblique ventral clavi on each side of median ventral furrow. *Tithon.*, Arg.-Cuba-Alg.——FIG. 463, *1*. **L. burckhardti* (MAYER-E.), Arg.; *1a-d*, ×1 (68*).



Protacanthodiscus

FIG. 461. *Protacanthodiscus andreae* (KILIAN), U. Jur.(Tithon.), Sp. (p. L352).

Raimondiceras SPATH, 1924 [**Hoplites raimondi* GABB in LISSON, 1907] [*Pflückeria* LISSON, 1924]. Every 3rd or 4th rib flared and bituberculate; secondaries acutely projected on venter. Probably allied to *Subthurmannia*. *?Tithon.*, Peru.——FIG. 459,*3*. **R. raimondi; 3a,b*, ×0.5 (655*).

Andiceras KRANTZ, 1926 [**A. trigonostomum*; SD ARKELL, herein]. Evolute, with wiry simple and widely biplicate ribs, not projected, persisting unchanged almost to aperture; venter narrow, deeply grooved. The style of ribbing suggests derivation from *Pavlovia*. *Tithon.*, Paraguay.——FIG. 459,*5*. **A. trigonostomum; 5a,b*, ×0.5 (241*).

Riasanites SPATH, 1923 [**Am. rjasanensis* LAHUSEN, 1883]. Ribs strong, coarsely biplicate, reminiscent of some *Pavlovia*, but venter has smooth band or groove. *U.Volg.(uppermost)*, Russia-?Anatolia; *U. Tithon.*, ?Mex.-?Arg.——FIG. 462,*5*. **R. rjasanensis* (LAH.); *5a,b*, ×0.7 (321*).

Blanfordiceras COSSMANN, 1907 [**Am. wallichi* GRAY, 1832[1]] [=*Blanfordia* UHLIG, 1905 (obj.) (*non* ADAMS, 1863); *Blanfordiceras* SPATH, 1923 (obj.); *Pseudoblanfordia* SPATH, 1925]. Resembles *Berriasella* in form and ribbing but differs by being less compressed, by greater projection of ribbing on shoulders and venter where rib endings are minutely tuberculate, by a stronger and more persistent ventral groove, and by enlargement and wider spacing of ribs on body chamber. *?U.Tithon.*, SaltR. - Attock - Himalaya - Indon. - N. Guinea-Arg.-Patag.——FIG. 459,*4*. **B. wallichi* (GRAY), Spiti sh.; *4a,b*, ×0.3 (533*).

Pseudargentiniceras SPATH, 1925 [**Am. abscissus* OPPEL in ZITTEL, 1868]. Evolute, compressed; venter rounded with persistent smooth band or groove; ribbing fine, dense at first, very gradually becoming more distant, with coincident dropping of furcation points and development of umbilical

[1] Date of publication of *Am. wallichi* in GRAY's work (1830-32) has not been determined.

tubercles. *U.Tithon.-Berrias.*, Eu.-N.Afr.-?Himalaya. ——Fig. 465,*1*. **P. abscissum* (Oppel), Moravia; *1a,b*, lectotype, ×0.5 (575*).

Protothurmannia Crickmay, 1932 [**P. rezanoffiana*]. Similar to *Pseudargentiniceras* in coiling, ribbing, and umbilical tubercles; differs by loss in maturity of ventral smooth band and perhaps by more complex sutures, especially longer 2nd lateral lobe. ?Subgen. of *Pseudargentiniceras*. *Tithon.*, Calif. (no figure).

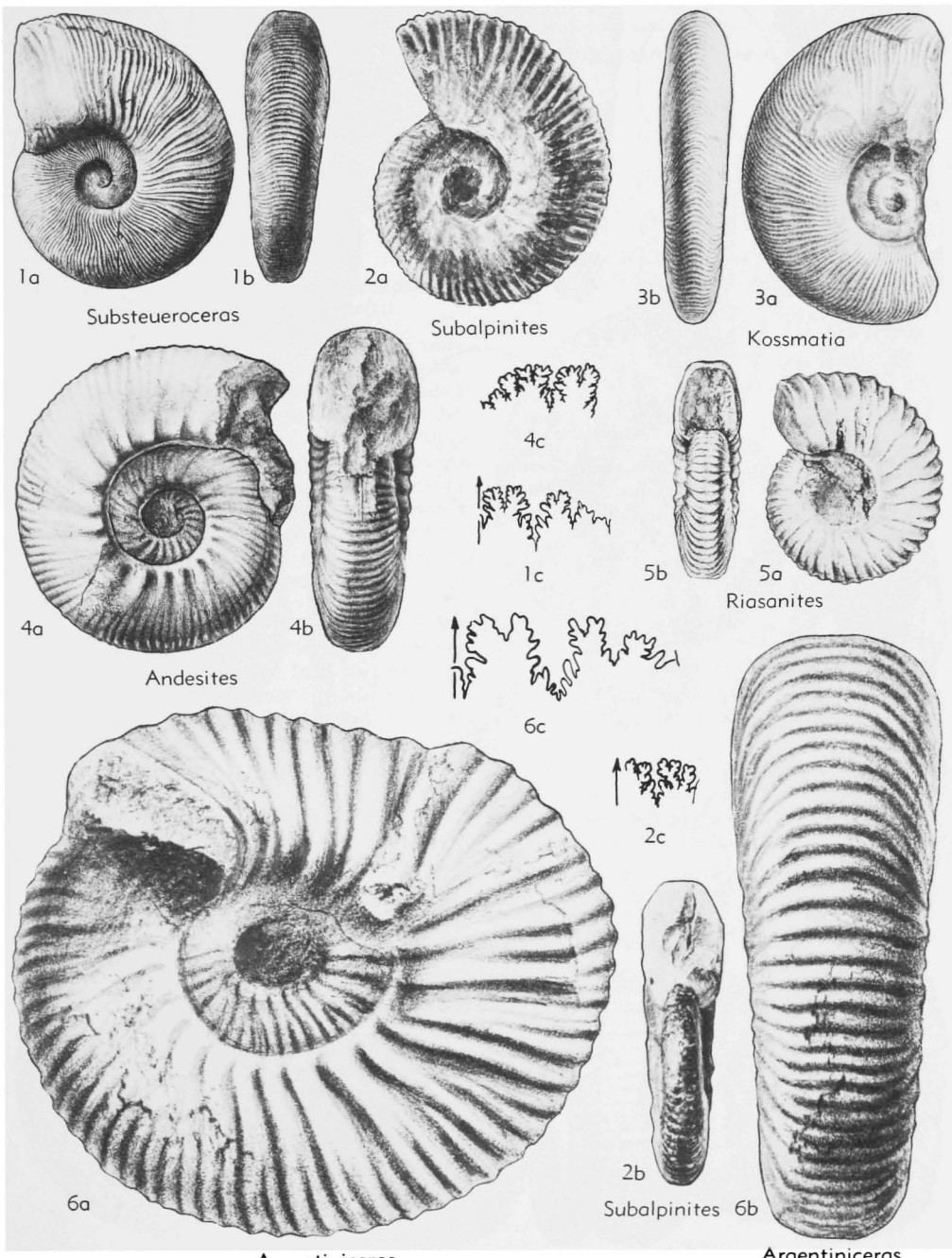


Fig. 462. Berriasellidae (Berriasellinae) (p. L323, L352-L354).

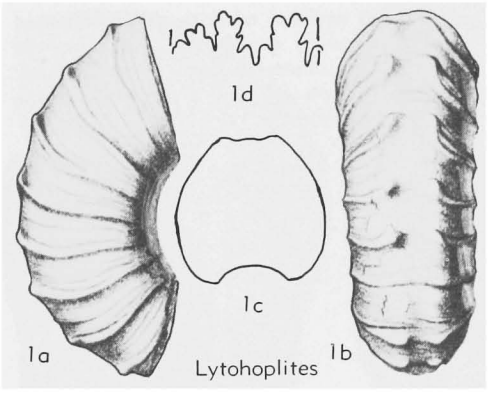


FIG. 463. *Lytohoplites burckhardti* (MAYER-EYMAR), U.Jur.(Tithon.), Arg. (p. L352).

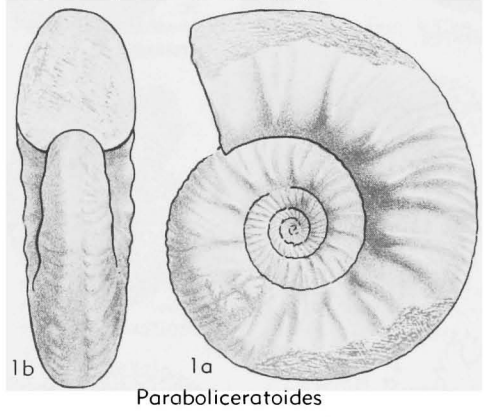


FIG. 464. *Paraboliceratoides mutilis* (OPPEL), U.Jur. (?Tithon.), Himalaya (p. L323).

Parodontoceras SPATH, 1923 [**Hoplites callistoides* BEHRENDSEN, 1891]. Inner whorls finely ribbed, resembling *Substeueroceras* but with marked ventral groove, and secondaries less projected; on outer whorl ribs become more regular and distant, and some are triplicate. *U.Tithon.*, Arg.-Peru-Mex.-Cuba-?Calif.-Kurdistan-?Somali. —— FIG. 459,*6*. **P. callistoides* (BEHR.), Arg.; *6a,b*, holotype, ×0.7 (283*).

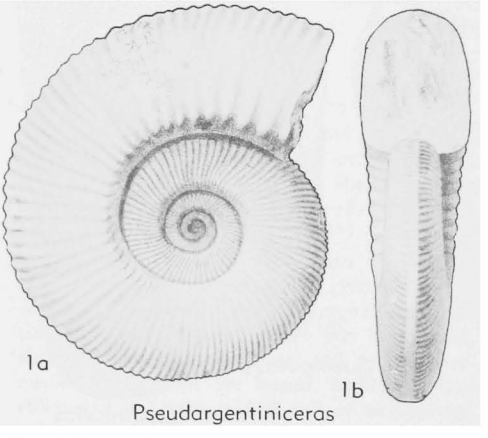


FIG. 465. *Pseudargenticeras abscissum* (OPPEL), *U.* Jur., Ger.; *1a,b*, ×0.5 (575*) (p. L352).

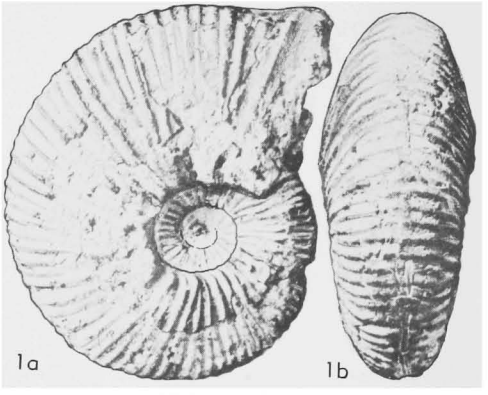


FIG. 466. *Holcoptychites neuquensis* (R. DOUVILLÉ), L.Cret.(?Berrias.), Arg. (p. L371).

Argentiniceras SPATH, 1924 [**Odontoceras malarguense* STEUER, 1897]. Whorls quadrate; ribs coarse, branching irregularly, their umbilical ends tending to form incipient tubercles, not interrupted on venter. Sutures simple. *Berrias.*, Arg.——FIG. 462,*6*. **A. malarguense* (STEUER); *6a-c*, ×0.75 (498*).

Andesites GERTH, 1925 [**Perisphinctes loncochensis* STEUER, 1897]. Ribbing bundled in sheaves of 3 or 4 from umbilical tubercles or bullae, not interrupted on venter. Strongly resembles *Indosphinctes* (Callov.). Could be transitional from *Argentiniceras* to Spiciceratinae. *Berrias.*, Arg.-Patag.—— FIG. 462,*4*. **A. loncochensis* (STEUER); *4a-c*, ×0.3 (498*).

?Somaliceras SPATH, 1925 [**S. isariforme*]. Ribbing triplicate, bundled, tending to fade. Incompletely known; appears to be allied to *Andesites*. *?Tithon.*, Somali. (no figure).

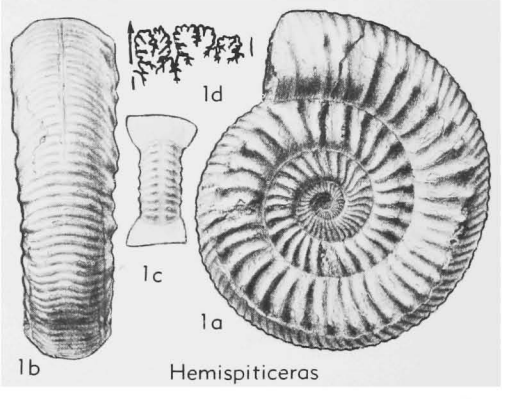


FIG. 467. *Hemispiticeras steinmanni* (STEUER), U. Jur.(U.Tithon.), Arg. (p. L355).

Subfamily HIMALAYITINAE Spath, 1925

Genera typically with rounded or inflated whorls and sharp ribbing in high relief, generally with row of lateral tubercles or spines; venter usually but not invariably with groove or smooth band (40, 70, 209, 255, 463, 533). *U.Jur.(Tithon.).*

Hemispiticeras Spath, 1925 [**Reineckeia steinmanni* Steuer, 1897]. Evolute, ribs evenly differentiated into primary and secondary, with single row of high lateral tubercles at points of furcation, as in *Stephanoceras;* ribbing gently projected but not interrupted on mature venter, which has median flattening or concavity, lost later. *U.Tithon.*(upper-

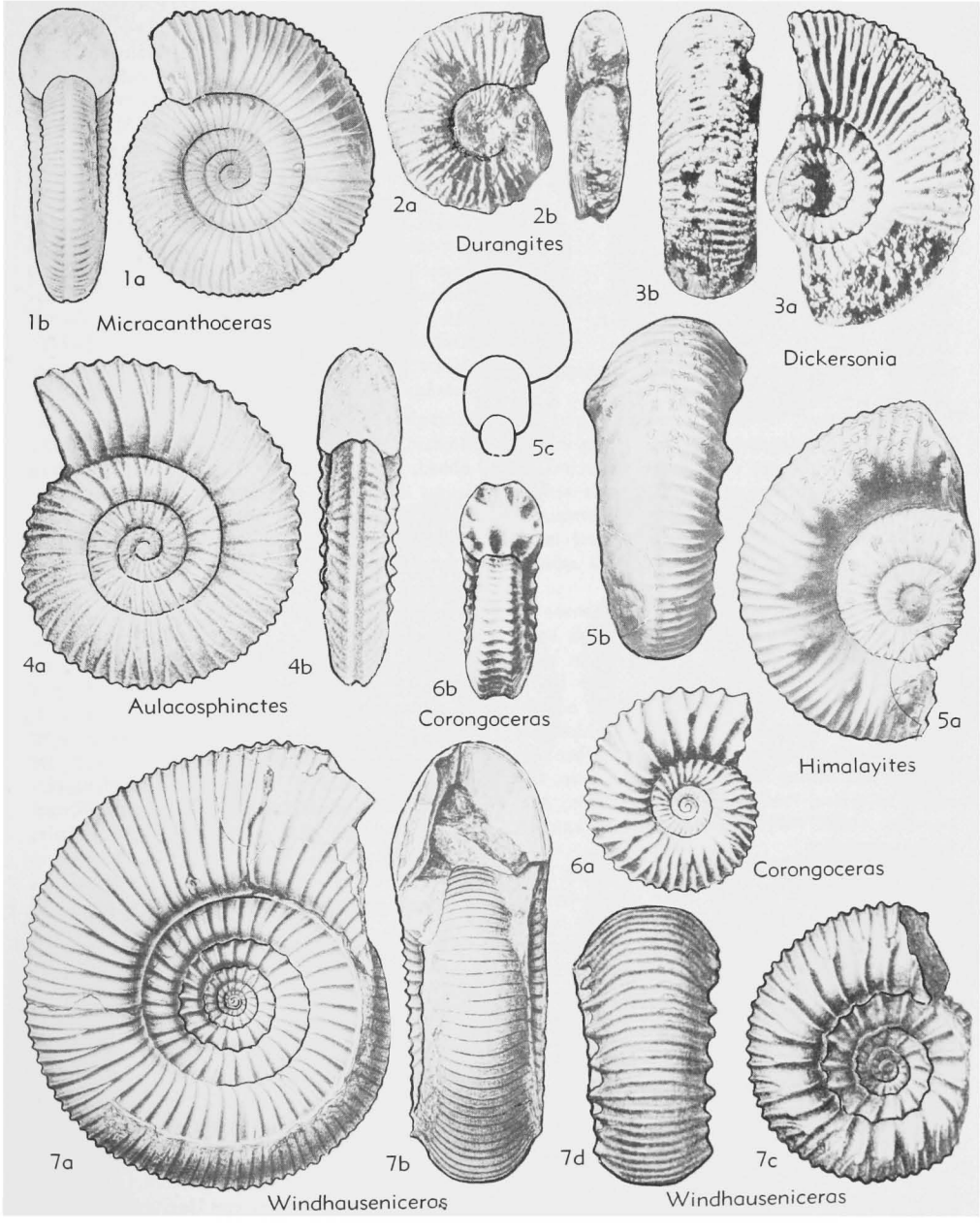


Fig. 468. Berriasellidae (Himalayitinae) (p. L356).

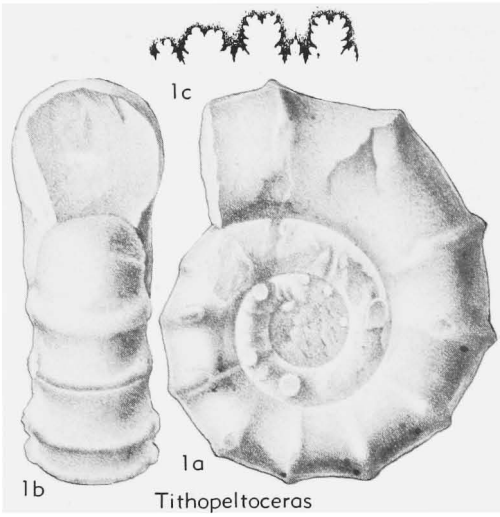


FIG. 469. *Tithopeltoceras moriconii* (MENEGHINI), U.Jur.(Tithon.), Italy (p. L356).

most), Arg.——FIG. 467,*1*. **H. steinmanni* (STEUER); *1a-d*, ×0.3 (498*).

Dickersonia IMLAY, 1942 [**D. sabanillensis;* SD ARKELL, herein]. Inner whorls have strong distant primary ribs with high outer lateral tubercles and ventral tubercles bordering smooth concave venter; outer whorls revert to close biplicate *Berriasella*-style ribbing, without tubercles or ventral interruption. *Tithon.*, Cuba.——FIG. 468,*3*. **D. sabanillensis; 3a,b*, ×1 (209*).

Windhauseniceras LEANZA, 1945 [**Perisphinctes internispinosus* KRANTZ, 1928]. Inner whorls coronate, *Stephanoceras*-like, with strong, distant biplicate and triplicate ribs and row of outer lateral tubercles at points of furcation; ribbing not interrupted or tuberculate on venter, which has median flattening; on outer whorls venter becomes rounded and ribbing loses tubercles, closes up, and reverts to typical *Perisphinctes* style. *Tithon.*, Arg.——FIG. 468,*7*. **W. internispinosum* (KRANTZ); *7a-d*, ×1 (242*).

Corongoceras SPATH, 1925 [**C. lotenoense; pro Hoplites köllikeri* HAUPT, 1907 (*non* OPPEL, 1863)]. Inner whorls like *Dickersonia;* outer whorls continue to have strong, distant bituberculate ribs, with lateral and ventral tubercle to every rib and some secondaries looped or zigzag between them; ventral tubercles may be spinous. *Tithon.*, Arg.-Patag.-Cuba-Mex.-Alg.——FIG. 468,*6*. **C. lotenoense* SPATH; *6a,b*, holotype, ×1 (187*).

?Aulacosphinctes UHLIG, 1910 [**Am. mörikeanus* OPPEL, 1863; SD SPATH, 1924]. Compressed; ribs strong, distant, widely biplicate, some simple; no tubercles, ventral groove deep and persistent; rather long lappets. Could be placed in Berriasellinae but from style of ribbing probably belongs to Himalayitinae. *Tithon.*, Alg. - Somali. - ?Abys.-Madag.-Cutch-Attock-Himalaya-?Calif. - Peru - Arg.——FIG. 468,*4*. **A. moerikeanus* (OPPEL), Spiti sh.; *4a,b*, ×1 (672*).

Himalayites UHLIG in BOEHM, 1904 [**H. treubi;* SD R.DOUVILLÉ, 1912]. Evolute, inner whorls slightly compressed, outer whorls becoming rounded, then rapidly depressed; ribbing of inner whorls widely biplicate and simple, as in *Aulacosphinctes;* on middle and outer whorls are sporadic median lateral tubercles (spines on test), from which branch 2 to 4 secondaries; primary spine-bearing ribs are flared, but intermediate ribs remain simple; venter with median groove or smooth band, which may fade on last whorl. *Tithon.*, S.Eu.-N.Afr.-Madag.-Salt R. - Himalaya - Indon. - Mex.-Peru-Arg.——FIG. 468,*5*. **H. (H.) treubi,* Indon.; *5a-c*, ×0.5 (40*).

Micracanthoceras SPATH, 1925 [**Am. microcanthus* OPPEL in ZITTEL, 1868]. Evolute; like *Himalayites* but whorls mainly rounded, tubercles small and more numerous, tuberculate ribs not flared, and secondaries ending in small ventral tubercles beside smooth band. Subgen. of *Himalayites. Tithon.*, S.Eu.-Alg.-Tangan.-Madag.-Cutch-Tex.-Mex.-Cuba-Arg.——FIG. 468,*1*. **H. (M.) microcanthus* (OPPEL), Stramberg; *1a,b*, ×0.5 (575*).

Durangites BURCKHARDT, 1912 [**D. acanthicus;* SD ROMAN, 1938]. Small, round-whorled, finely ribbed; inner whorls like *Micracanthoceras,* median lateral and ventral tubercles sporadic, small or incipient; venter with persistent smooth sulcus; on outer whorls tubercles die out and ribbing becomes fine, dense, flexuous, irregularly biplicate. *Tithon.*, Mex.-Cuba-Calif.——FIG. 468,*2*. **D. acanthicus,* Mex.; *2a,b*, ×1 (70*).

Tithopeltoceras ARKELL, 1953 [**Aspidoceras moriconii* MENEGHINI, 1885]. Inner and middle whorls depressed, coronate, with irregular ribs bearing a single row of median to ventrolateral tubercles; venter more or less smooth; outer whorl with swollen, distant, simple ribs bearing lateral bullae and passing strongly over venter, resembling certain peltoceratids. *Tithon.*, Italy-Majorca-?Greece.——FIG. 469,*1*. **T. moriconii* (MEN.), Italy; *1a-c*, ×0.7 (660*).

Subfamily NEOCOMITINAE Spath, 1924

Derivatives of Berriasellinae, usually with flat or grooved venter and angular shoulders. The compressed, high-whorled forms with tabulate venters are probably the central stock that gave rise, as did the Berriasellinae, to a succession of branches which were either more evolute and had subquadrate or polygonal whorls and distant, strongly tuberculate ribs, or were involute, high-whorled and smooth. Some of the genera (e.g., *Kilianella*), however, were not derived from the same Berriasellinae as the compressed Neo-

comitinae. Stratigraphical occurrence is still too little known to make the relationships of all genera certain. Although many contemporary genera of different whorl section and coiling appear more closely related to each other than to their forerunners of similar shape, some may be similar grades evolving on parallel lines. The presumed central, compressed genera are described first, followed by their successive "nontypical" derivatives (255, 482, 533). *L.Cret.(Berrias.-L.Hauteriv.).*

Thurmanniceras COSSMANN, 1901 [*pro Thurmannia* HYATT, 1900 (*non* HEER, 1852)] [**Am. thurmanni* PICTET & CAMPICHE, 1858-60] [=*Thurmannites* KILIAN & REBOUL, 1914 (obj.)]. Compressed, rather evolute; venter flat in early and rounded in later whorls; ribs feeble to strong, gently flexuous, irregularly branched near middle of whorl sides or simple with intercalatories, giv-

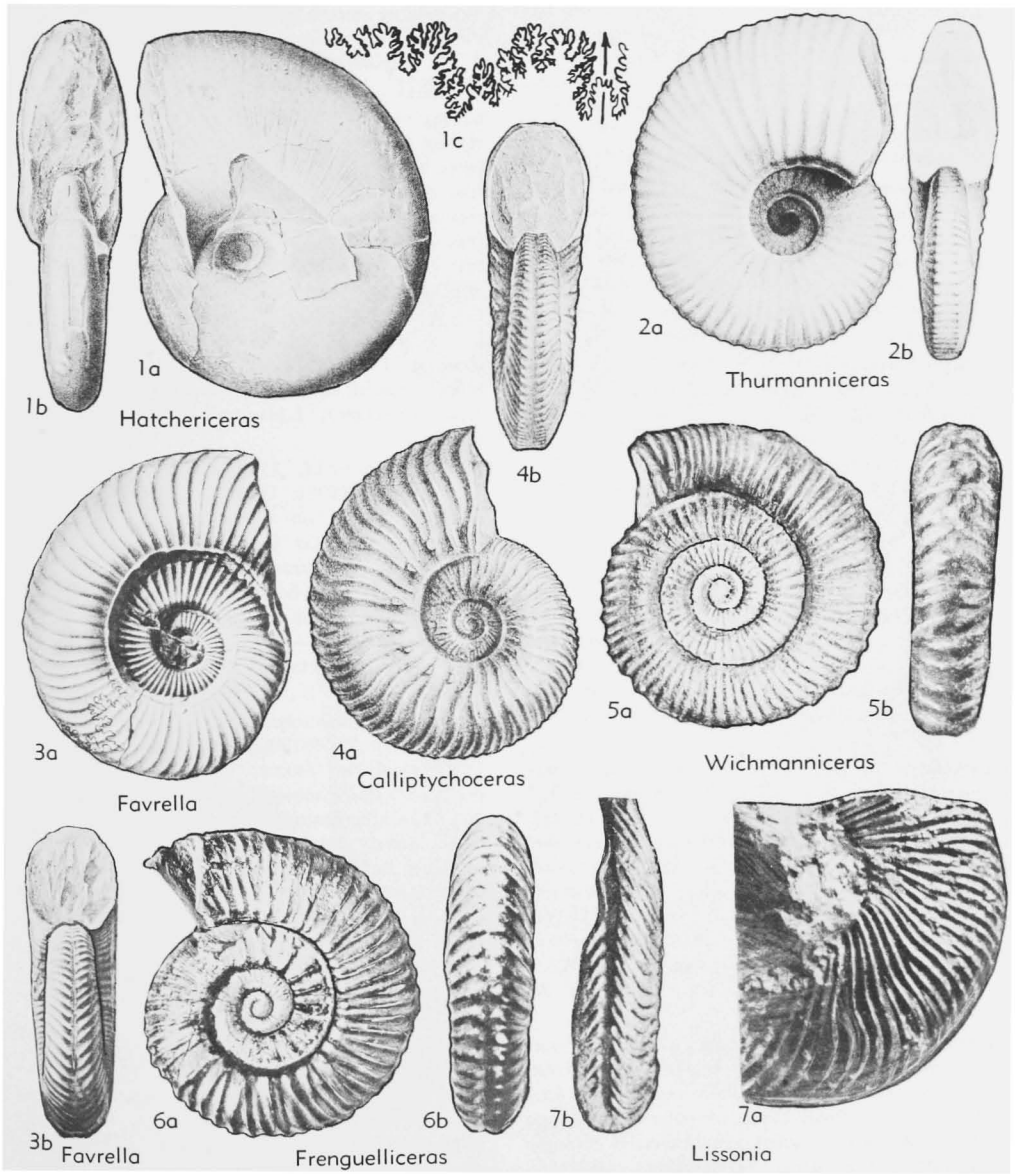


FIG. 470. Berriasellidae (Neocomitinae) (p. L357-L361).

ing rise to small transverse ventrolateral bullae and crossing or interrupted on venter; many with fairly strong constrictions. *Berrias.-L.Valang.*, S.Eu.-C.Eu.-Moroc.-Madag.-Punjab-Himalaya-Sumatra-Mex.-Peru-Arg.-Patag.——Fig. 470,*2*. **T. thurmanni* (Pictet-C.), Fr.; *2a,b*, ×0.7 (345*).

Neocomites Uhlig, 1905 [**Am. necomiensis* d'Orbigny, 1841; SD Roman, 1938]. Involute, compressed, with flat sides; ribs flexuous, prorsiradiate, branching in small sheaves from slight umbilical tubercles and in many branching again or intercalated higher up on whorl, ending in small slightly oblique bullae on either side of smooth flat venter; on later whorls ribs may cross venter more or less transversely. Sutures with large high 1st lateral lobe. *Berrias.-Valang.*, S.Eu.-C.Eu.-N.Afr.-Madag.-SaltR. Himalaya-Borneo-Sumatra-Tex.-Mex.-Peru-Arg.-Patag.——Fig. 471,*7*. **N. (N.) neocomiensis* (Orb.), Fr.; *7a,b*, ×1 (329*).

Odontodiscoceras Spath, 1924 [**Neocomites odontodiscus* Uhlig, 1910]. Fairly compressed, with convex sides; ribs branch fairly regularly at mid-sides ending in row of small rounded clavi beside smooth venter. Subgen. of *Neocomites*. *Valang.*, Himalaya.——Fig. 471,*8*. **N. (O.) odontodiscus* (Uhlig), Spiti sh.; *8a,b*, ×0.5 (533*).

Calliptychoceras Spath, 1924 [**Neocomites calliptychus* Uhlig, 1910]. More evolute and inflated than *Neocomites (s.s.)* with rather distant, sinuous ribs branching from distinct umbilical tubercles, commonly branching again at mid-sides, forming slight, sharp, oblique ventrolateral tubercles. Subgen. of *Neocomites*. *Valang.*, Himalaya.——Fig. 470,*4*. **N. (C.) calliptychus* (Uhlig), Spiti sh.; *4a,b*, ×0.7 (533*).

Lissonia Gerth, 1925 [**Hoplites riveroi* Lisson, 1907]. Compressed, involute; ribbing fine, sharp, simple and bifurcating at middle of whorl sides, projected on rounded shoulders and ventral edges; no tubercles; venter with deep groove. *?Berrias.*, Peru.——Fig. 470,*7*. **L. riveroi* (Lisson); *7a,b*, ×1 (655*).

Cuyaniceras Leanza, 1945 [**Odontoceras transgrediens* Steuer, 1897; SD Arkell, 1952] [=*Steueroceras* auctt. (*non* Cossmann, 1899)]. Moderately compressed; inner whorls involute, resembling *Neocomites* but ribs branching somewhat higher; outer whorl evolute, with most ribs simple and ending with small rounded or clavate tubercle. Homeomorph of *Aulacostephanus* (L. Kimm.). *Berrias.*, Mex.-Arg.-Patag.——Fig. 472,*5*. **C. transgrediens* (Steuer), Arg.; *5a,b*, ×0.5; *5c*, ×0.25 (498*).

Limaites Lisson, 1924 [**Hoplites leopoldinus* var. *peruanum* Lisson, 1907]. Involute, very compressed, with narrow tabulate venter; ribs fine, fasciculate, gradually fading on outer whorl except near venter; some median lateral tubercles. Strongly resembles *Kosmoceras (Gulielmites)* (Callov.), *Berrias.* or *L.Valang.*, Peru.——Fig. 472,*2*. **L. peruanus* (Lisson); *2a-e*, ×1 (655*).

Parandiceras Spath, 1939 [**P. rota*]. Evolute, compressed; ribs fine, simple or bifurcating near middle of whorl sides and ending in small ventral tubercles; venter narrow, with narrow median groove; shallow constrictions occur. *Valang.*, SaltR.-Arg.——Fig. 472,*1*. **P. rota*, SaltR.; *1a,b*, ×0.5 (482*).

Frenguelliceras Leanza, 1945 [**F. magister*]. Evolute planulates with coarse, simple or widely splayed ribs dividing from umbilical edge; venter with diminishing smooth groove bordered by incipiently tuberculate rib endings. *Valang.*, Arg.——Fig. 470,*6*. **F. magister; 6a,b*, ×0.5 (255*).

Lyticoceras Hyatt, 1900 [**Am. cryptoceras* d'Orbigny, 1840]. Rather evolute to moderately involute, moderately to very compressed; ribbing more or less dense, sharp, sinuous to falcoid, some ribs branching at umbilical shoulder and more regularly near middle of whorl sides; primaries may be raised and sharpened at umbilical edge; ribs cross flat venter in distinct, sharp chevrons, after forming slight but usually distinct ventrolateral clavi; some weak on mid-line, some almost joining to form a raised line. Derived from *Neocomites*. *Valang.-L.Hauteriv.*, Eu.-Moroc.-Persia-Himalaya-SaltR.-Calif.-Mex.——Fig. 471,*9*. *L. regale* (Pavlow), L.Hauteriv., Eng.; *9a,b*, ×1 (679*).

Favrella R.Douvillé, 1909 [**Neocomites americanus* Favre, 1908]. Evolute. Sides at first are flat and parallel on inner half, then converge to flat and grooved venter; whorl section later rounded; regular strong ribs, at first simple or biplicate high on whorl sides, later becoming all simple, projected on shoulders and venter. *?L. Hauteriv.*, Patag.——Fig. 470,*3*. **F. americana* (Favre); *3a,b*, lectotype (SD Arkell, herein), ×0.3 (619*).

Neocosmoceras Blanchet, 1922 [**Hoplites sayni* Simionescu, 1899-1900; SD Roman, 1938] [=*Octagoniceras* Spath, 1924]. Whorl section polygonal; ribs trituberculate, very coarse and distant, branching obscurely from outer row of prominent lateral tubercles or spines; inner lateral tubercles bullate and recessive; venter concave, smooth, bordered by large clavi which on body chamber are produced into enormous recurved spines; aperture with lappets. *Berrias.*, S.Eu.-N.Afr.-Crimea-SaltR.-Himalaya-Peru-Arg.——Fig. 471,*2*. **N. sayni* (Sim.), Fr.; *2a,b*, lectotype, ×0.5 (283*).

Kilianella Uhlig, 1905 [**Hoplites pexiptychus* Uhlig, 1881; SD Roman, 1938]. Evolute, with more or less inflated whorl section; venter slightly grooved; ribs strong, gently flexuous, simple or bifurcating at mid-sides or in some at umbilical edge; tubercles may accompany thickening of ribs

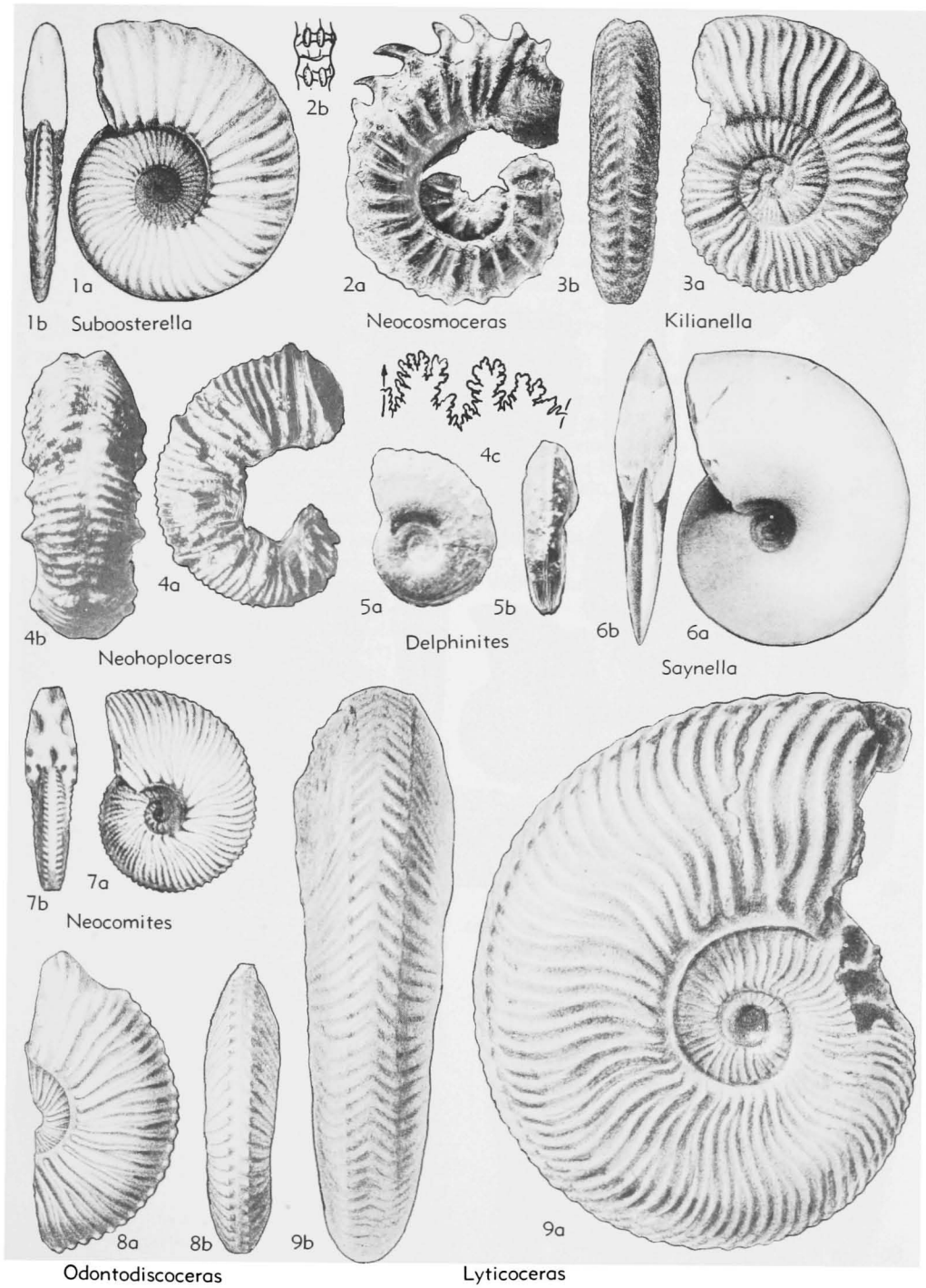


FIG. 471. Berriasellidae (Neocomitinae) (p. L358-L362).

at shoulder, umbilical edge, or mid-sides; constrictions generally present. Probably derived from Berriasellinae independently of the *Thurmanniceras-Neocomites* stock. *Berrias.-U.Valang., ?L.Hauteriv.*, Eu.-Madag.-Pak.-Himlaya-Sumatra-Mex.——FIG. 471,*3*. **K. pexiptycha* (UHLIG), Valang., Fr.; *3a,b*, ×1 (646*).

Sarasinella UHLIG, 1905 [**Hoplites ambiguus* UHLIG, 1902; SD LEMOINE, 1906]. Moderately compressed to moderately inflated; inner whorls with some or all ribs bearing strong umbilical and mediolateral tubercles, at which ribs bifurcate, and slight sharp, radial or oblique ventrolateral bullae; on outer whorl umbilical tubercles become dominant and most ribs branch from them, median lateral tubercles dying out, although some 2nd branching of ribs occurs; venter deeply grooved to flat. *L.Valang.*, Fr.-Crimea-Moroc.-Madag.-SaltR.-

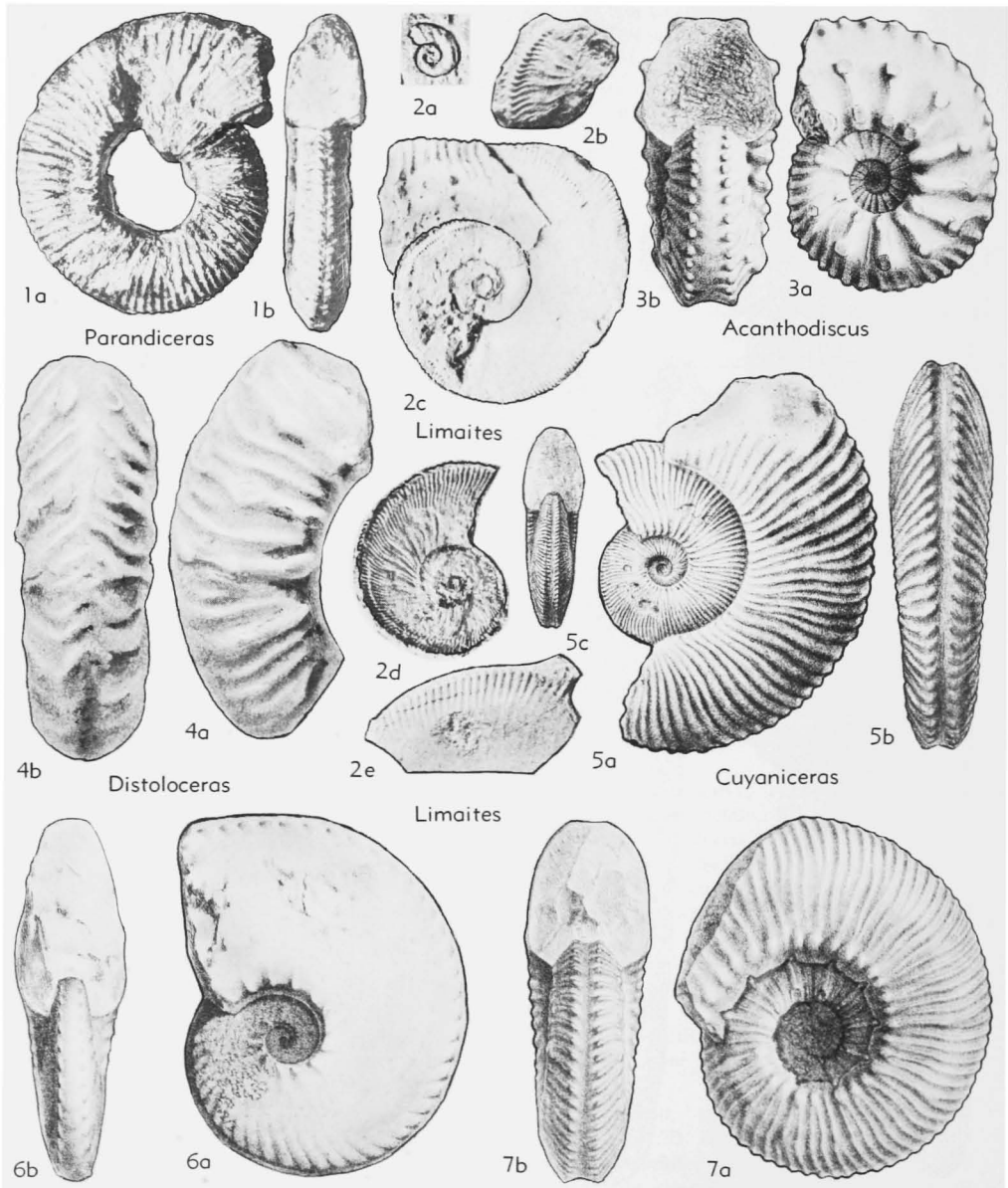


FIG. 472. Berriasellidae (Neocomitinae) (p. L358-L361).

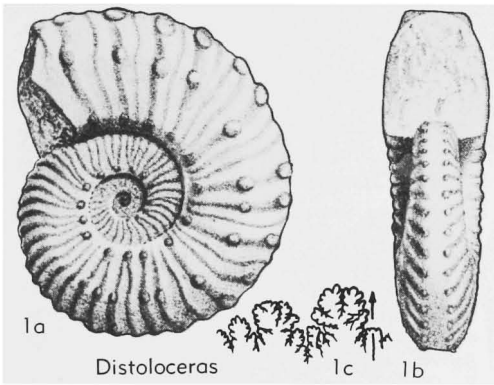


FIG. 473. *Distoloceras hystrix* (PHILLIPS), L.Cret., Eng. (p. L361).

Himalaya.——FIG. 472,*7*. *S. varians,* Spiti sh.; *7a,b,* ×0.5 (533*).

Neohoploceras SPATH, 1939 [*pro Arnoldia* STOLLEY, 1937 (*non* MAYER, 1887)] [**Am. submartini* MALLADA, 1882]. Derivative of *Sarasinella* or *Kilianella* with inflated shell; some ribs branching irregularly from both umbilical and median lateral tubercles, some simple; deep constrictions bordered adapically by collars flared on sides of venter, which has narrow groove, concave or rounded, latter introducing homeomorphy with Himalayitinae. *Valang.,* Fr.-Sp.-Madag.-SaltR.——FIG. 471,*4*. **N. submartini* (MALLADA), SaltR.; *4a,b,* ×0.75; *4c,* ×1 (482*).

Wichmanniceras LEANZA, 1945 [**W. mirum*]. Evolute planulates with regular strong simple ribbing which is frequently looped at blunt ventrolateral tubercles; venter with diminishing groove. *Valang.,* Arg.——FIG. 470,*5*. **W. mirum; 5a,b,* ×0.5 (255*).

Distoloceras HYATT, 1900 [**Ammonites hystrix* PHILLIPS, 1829]. Polygonal-whorled, tuberculate; ribs strongly projected on shoulders, periodic strong ones with large ventrolateral, usually median lateral and in some umbilical spines. Some species uncoil. Probably includes derivatives of both *Neocomites* and *Lyticoceras*. *U.Valang.-L.Hauteriv.,* Eu.-E.Afr.-S.Afr.-SaltR.-Himalaya-Mex.——FIG. 472,*4*. *D. pavlovi* SPATH, Eng.; *4a,b,* ×0.75 (679*).——FIG. 473,*1*. **D. hystrix* (PHILL.), Ger.; *1a-c,* ×0.75 (312*).

Acanthodiscus UHLIG, 1905 [**Am. radiatus* BRUGUIÈRE, 1789; SD SPATH, 1924]. Whorls stout to compressed, with smooth flat to concave venter; strong, straight primary ribs rise from moderate umbilical tubercles, simple, or bi- or trifurcating irregularly at large median lateral tubercles, ending at small ventrolateral tubercles. Perhaps derived from *Distoloceras,* though resembling late *Neocosmoceras*. *L.Hauteriv.,* Eu.-Moroc.-Madag.-Mex.——FIG. 472,*3*. **A. radiatus* (BRUG.), Ger.; *3a,b,* ×0.3 (312*).

Leopoldia MAYER-EYMAR, 1887 [**Am. leopoldinus* D'ORBIGNY, 1840; SD ROMAN, 1938] [=*Hoplitides* VON KOENEN, 1902 (obj.); =*Solgeria* UHLIG, 1905 (obj.)]. Like coarsely ribbed *Neocomites* at first but ribs may fade early on middle of whorl sides and end in blunt clavi beside venter; outer whorls smooth, with rounded to acute periphery. *U.Valang.-L.Hauteriv.,* Eu.-Moroc.-Madag.-Peru-Patag.——FIG. 472,*6*. **L. leopoldina* (ORB.), Fr.; *6a,b,* ×0.5 (329*).

Saynella KILIAN, 1910 [**Am. clypeiformis* D'ORBIGNY, 1841; SD SPATH, 1924]. Smooth, ribless, oxycone. An extreme development of *Leopoldia,* from which there are transitions. *L.Hauteriv.,* S.Eu.——FIG. 471,*6*. **S. clypeiformis* (ORB.), Fr.; *6a,b,* ×0.12 (329*).

Hatchericeras STANTON, 1901 [**H. patagonense*]. Large, involute, compressed; ribs on early whorls blunt, branching from umbilical margin, interrupted on flat venter; outer whorls smooth with rounded venter. Sutures simple, lobes wide. Probably derived from *Leopoldia*. *?L.Hauteriv.,* Patag.——FIG. 470,*1*. **H. patagonense; 1a-c,* ×0.2 (714*).

Suboosterella SPATH, 1924 [**Am. heliacus* D'ORBIGNY, 1840]. Compressed, discoidal, evolute, with smooth, narrow, rounded venter; ribs on early and

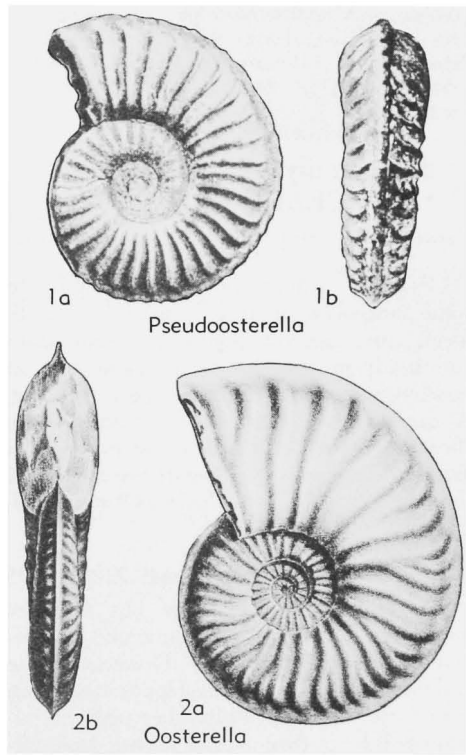


FIG. 474. Oosterellidae (p. L362).

middle whorls branching widely near middle of whorl sides, becoming simple on outer whorl with blunt ends. Probably derived from *Lyticoceras*. *?L. Hauteriv.*, Eu.——Fig. 471,*1*. **S. heliacus* (Orb.); *1a,b*, ×0.7 (329*).

?Delphinites Sayn, 1901 [**D. ritteri*]. Small, moderately involute, smooth, with narrow concave venter. Single known specimen has decomposed. *Valang.*, Fr.——Fig. 471,*5*. **D. ritteri*, SE.Fr.; *5a,b*, ×1 (407*).

Family OOSTERELLIDAE Breistroffer, 1940

[as Oosterellinae]

Keeled, rather compressed ammonites, derived via *Suboosterella* from Neocomitinae. *L.Cret.(U.Valang.-Hauteriv.)*.

Oosterella Kilian, 1911 [*pro Nicklesia* Kilian, 1910 (*non* Hyatt, 1903)] [**Am. cultratus* d'Orbigny, 1841; SD Roman, 1938]. Involute, compressed, discoidal, with high, entire keel; ribs strong, blunt, irregularly simple and biplicate, points of furcation rising with growth, some forming prominent mid-lateral tubercles. *U.Valang.-Hauteriv.*, Sp.-Fr.-Switz.——Fig. 474,*2*. **O. cultrata* (Orb.), Fr.; *2a,b*, ×0.5 (329*).

Pseudoosterella Spath, 1924 [**Mortoniceras fischeri* Nicklès, 1892; SD Roman, 1938]. Compressed, evolute, with stout serrated keel; ribs strong, simple, rectiradiate, sharply projected on shoulders. Homeomorph of *Amoebites* (L.Kimm.). *U.Valang.*, Sp.——Fig. 474,*1*. **P. fischeri* (Nicklès); *1a,b*, ×3 (668*).

Superfamily DESMOCERATACEAE Zittel, 1895

[*nom. transl.* Wright & Wright, 1951 (*ex* Desmoceratidae Zittel, 1895)]

Generally round or oval-whorled but some lanceolate or keeled; smooth or with weak ribs, rarely tuberculate; constrictions commonly present. Suture on same plan as in Phylloceratacеae but folioles not phylloid. A monophyletic superfamily derived from Phylloceratidae, probably *Sowerbyceras*, in earliest Cretaceous and persisting to end of the Cretaceous (570). *L.Cret.(Valang.)-U. Cret.(Maastr.)*.

Family DESMOCERATIDAE Zittel, 1895

Characters of superfamily but excludes several more strongly ornamented assemblages which lie between Desmoceratidae and various families of the Hoplitaceae. The boundaries between subfamilies probably always will be in dispute, the scheme here followed being based on detailed phylogeny (276, 570). *L. Cret. (Valang.) - U. Cret. (Maastr.)*.

Subfamily EODESMOCERATINAE Wright, 1955

Whorl sections various; ornament, if present, weak. Suture relatively simple (570). *L.Cret.(Valang.-Barrem.)*.

Eodesmoceras Spath, 1924 [**Am. celestini* Pictet & Campiche, 1858]. Moderately evolute, with squarish to oval whorl section; feeble sinuous constrictions and in some shells very weak folds or riblets between. Suture with rather simple asymmetrically bifid saddles and trifid lobes. *Valang.-Barrem.*, Eu.-S.Afr.

E. (Eodesmoceras). Small, whorl section hardly higher than wide, constrictions distinct, test smooth or with weak ribs. *Valang.-L.Hauteriv.*, Eu.-S.Afr.——Fig. 475,*1*. **E. (E.) celestini* (Pictet-C.), Valang., Switz.; *1a*, ×1; *1b*, enlarged (345*).

E. (Miodesmoceras) Wright, 1955 [**Haploceras lechicum* Uhlig, 1883]. Whorls distinctly higher than wide, oval in section or widest at umbilical edge and narrowing to rounded or slightly flattened venter; surface smooth, without trace of constrictions on outer whorl. *Barrem.*, Fr.-C.Eu. ——Fig. 475,*3*. **E. (M.) lechicum* (Uhlig), Barrem., Fr.; *3a,b*, ×1; *3c*, ×2.5 (230*).

Barremites Kilian, 1913 [**Am. difficilis* d'Orbigny, 1841]. Moderately to very involute, fairly inflated to very compressed; sinuous to falcate constrictions on cast (showing as collars on the shell), and intermediate feeble striae to moderately distinct ribs. *L.Hauteriv.-U.Barrem.*, Eu. - N.Afr. - Japan - Mex.-Colombia.

B. (Raspailiceras) Wright, 1956 [*pro Raspailites* Wright, 1955 (*non* Jeannet, 1951)] [**Am. cassida* Raspail, 1831]. Moderately involute with well-rounded, more or less inflated whorl section and a sloping umbilical wall, with no angular shoulder. *Hauteriv.-Barrem.*, Fr.-Aus.——Fig. 475,*5*. **B. (R.) cassida* (Raspail), Barrem., Fr.; *5a,b*, ×0.75 (329*).

B. (Barremites). Very involute, compressed, high-whorled, with steep umbilical wall, bounded by a sharp edge. Radial line sinuous to falcate. Occurrence as for genus.——Fig. 475,*4*. **B. (B.) difficilis* (Orb.), Barrem., Fr.; *4a,b*, ×0.75 (329*).

Subsaynella Spath, 1923 [**Am. sayni* Paquier, 1900]. Rather involute, compressed with slightly convex sides, section tending to become lanceolate; venter broadly or narrowly rounded in early forms but may be acute in later species; dense fine ribs weak on mid-sides but become stronger and branch and curve forward on outer part; constrictions shallow. *U.Hauteriv.-Barrem.*, Eng.-Fr.-N.Afr.-Madag.——Fig. 475,*2*. **S. sayni* (Paquier), U.Hauteriv., Fr.; *2a,b*, ×1; *2c*, enlarged (229*).

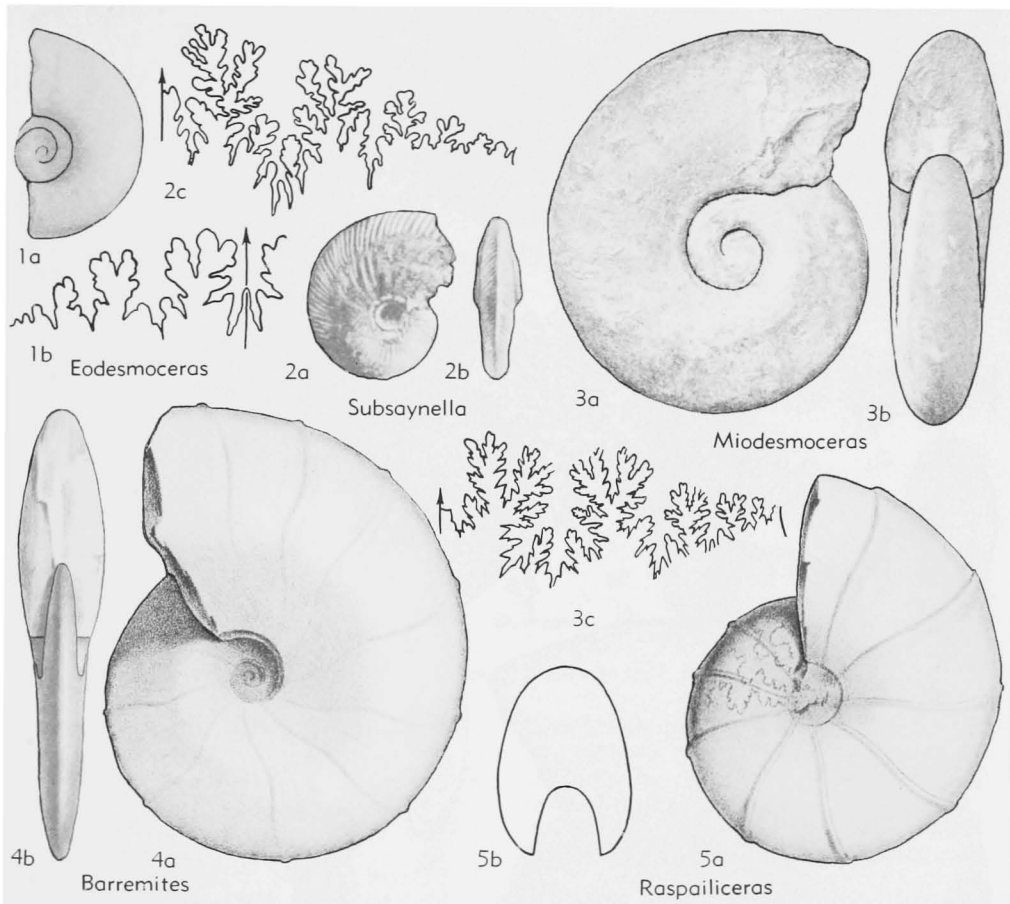


FIG. 475. Desmoceratidae (Eodesmoceratinae) (p. L362).

Subfamily PUZOSIINAE Spath, 1922

[Incl. Silestoidinae BREISTROFFER, 1953]

Evolute, round or oval-whorled, with strong constrictions and intermediate ribs at least on outer part of sides, though some smooth forms occur. In typical later genera suture is complicated and has a retracted suspensive lobe. This subfamily might be interpreted to begin with the typical Albian *Puzosia* but the similar (though more primitive) Neocomian and Aptian genera, derived from Eodesmoceratinae, are here included (277, 459, 570). *L.Cret.(Hauteriv.)-U.Cret.(Maastr.).*

Valdedorsella BREISTROFFER, 1947 [**Desmoceras akuschaense* ANTHULA, 1899]. Inflated, with broad rounded venter; whorl section oval to coronate; with more or less straight radial constrictions which have a prominent rounded rib behind; normally rather fine riblets or ribs occur between the constrictions. The genus is here defined in a very wide sense to cover a variety of Neocomian species. *L.Hauteriv.-U.Apt.,* S.Eu.-Cauc.-N.Afr.-Madag.-Colombia.——FIG. 476,*1*. **V. akuschaensis* (ANTHULA), U.Apt., Cauc.; *1a-c,* ×1 (581*).

Pseudohaploceras HYATT, 1900 [**Am. liptoviensis* ZEUSCHNER, 1856] [*Pleurohaploceras* RIEDEL, 1928 (misprint)]. Moderately involute, slightly to moderately compressed, with convex sides; with regular straight or sinuous constrictions (collared in some), between which are fairly fine, distinct, sharp or rounded, branching ribs extending from umbilical edge and crossing venter. An offshoot of early *Valdedorsella. Barrem.-Apt.,* Eu.-Sinai-Japan-Mex.-Colombia.——FIG. 476,*3*. **P. liptoviense* (ZEUSCHNER), Barrem., Aus.; *3a,* ×0.5; *3b,* enlarged (530*).

Callizoniceras SPATH, 1923 [**Am. hoyeri* KOENEN, 1902]. Small, rather evolute forms with more or less round whorl section, which may heighten on outer whorls; there are typically strong rounded branching ribs and deep steep-sided collared con-

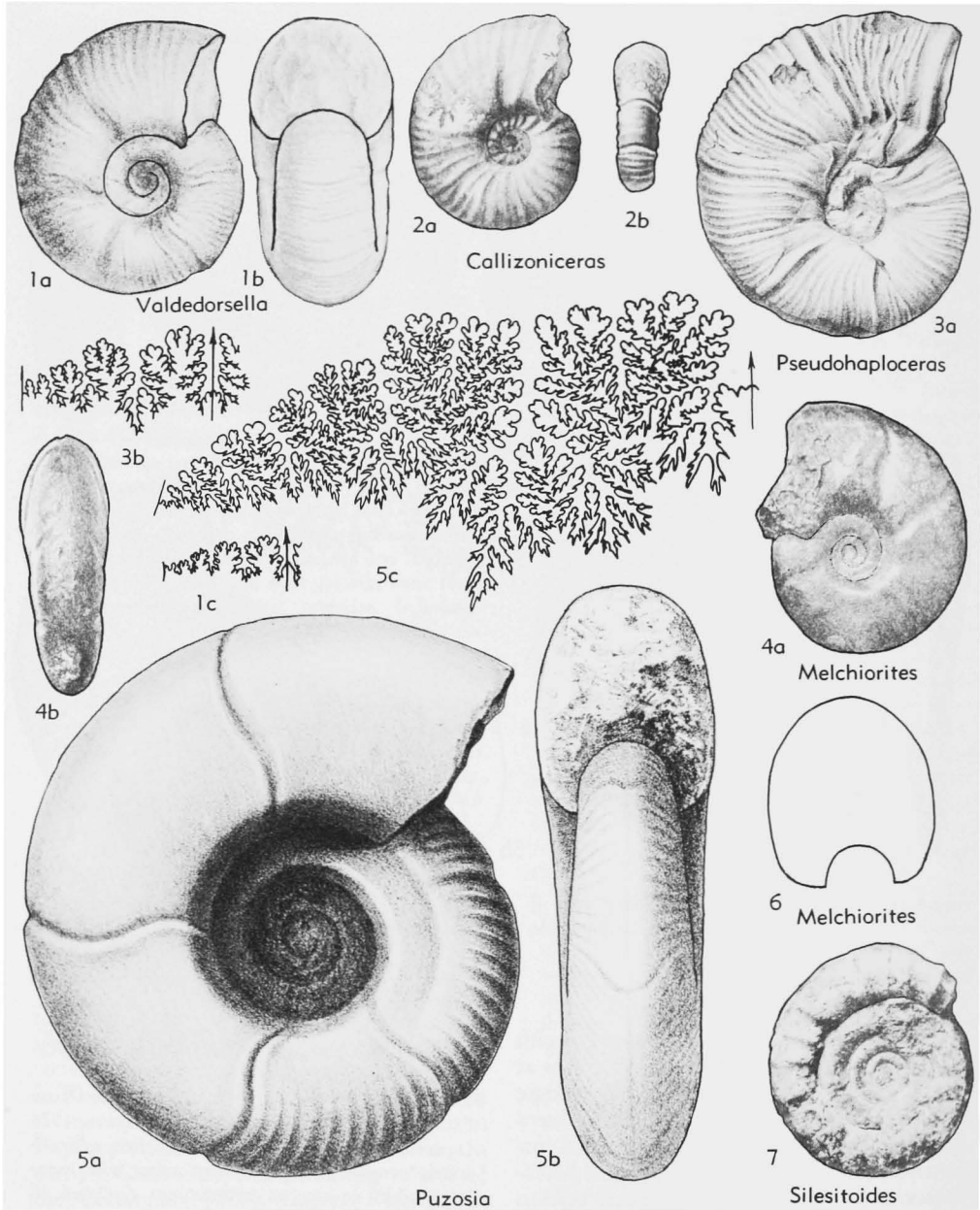


FIG. 476. Desmoceratidae (Puzosiinae) (p. L363-L365).

strictions. Suture rather simple. *U.Barrem.-L.Alb.*, NW.Eu.-Greenl.

C. (Callizoniceras). Ribs regular, ribs and constrictions slightly sinuous. *U.Barrem.-Apt.*, Eng.-Ger.-Greenl.——FIG. 476,*2*. **C. (C.) hoyeri* (KOENEN), U.Barrem., N.Ger.; *2a,b*, ×1 (237*).

C. (Wollemanniceras) BREISTROFFER, 1947 [**Desmoceras keilhacki* WOLLEMANN, 1904]. Falcoid constrictions project on venter; with irregular ribs and striae, main ribs being thick on inner part, then splitting into riblets and fading on venter. *L.Alb.*, Ger.

Melchiorites SPATH, 1923 [**Am. melchioris* TIETZE, 1872]. Whorl section round, subquadrate or compressed, with convex or flattened sides; early whorls with sinuous, radial or oblique constrictions, projected on venter, but without ribs, later ones with rather feeble intermediate ribs on outer part of

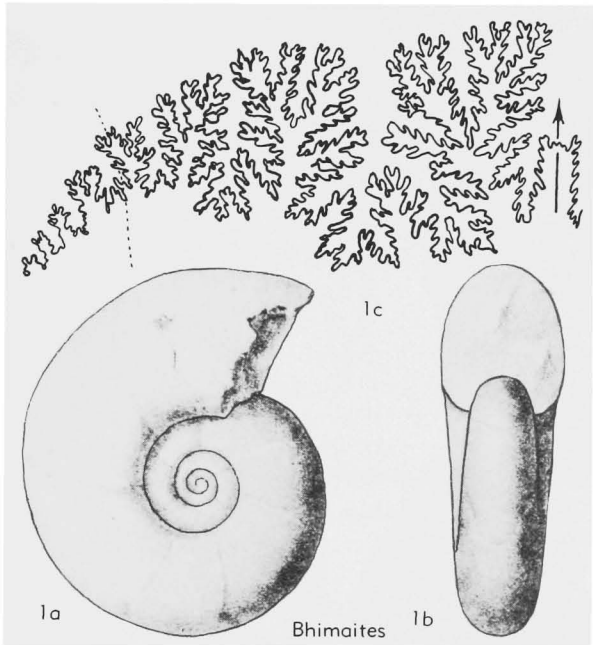


FIG. 477. *Bhimaites bhima* (STOLICZKA), L. Cret.(U.Alb.), S.India (p. L365).

sides and venter. Suture with auxiliaries in straight line or slightly retracted. *L.Apt., ?L.Alb.,* Eu.-N. Afr.-Calif.——FIG. 476,*4*. **M. melchioris* (TIETZE), U.Apt., Fr.; *4a,b,* ×1 (618*).——FIG. 476,*6*. *M. emerici* (RASPAIL), U.Apt., Fr.; ×1 (618*).

Puzosia BAYLE, 1878 [**P. planulata* BAYLE, 1878 (*non* J.DEC.SOWERBY, 1827) =**Am. subplanulatus* SCHLÜTER, 1871; SD H.DOUVILLÉ, 1879 (ICZN pend.)] [*Pleuropachydiscus* HYATT, 1900; includes *Pseudosilesitoides* BREISTROFFER, 1952 *(nom. nud.)*]. In general more evolute, with more linguiform projection of constrictions on venter and more retracted suspensive lobe than in *Melchiorites*. May reach large size. *L.Alb.-U.Turon.,* world-wide.

P. (Puzosia). Whorl section tending to be compressed and flat-sided, with ribs distinct only on outer part; ornament does not modify with age, apart from general weakening. *U.Alb.-U.Turon.,* world-wide.——FIG. 476,*5*. **P. (P.) subplanulata* (SCHLÜTER), Cenom., Ger.; *5a,b,* ×0.75; *5c,* ×0.5 (422*).

P. (Anapuzosia) MATSUMOTO, 1954 (1938, *nom. nud.*) [**Puzosia buenaventura* ANDERSON, 1938]. Generally but not in all specimens with round whorl section and ribs fairly distinct from umbilical edge; ornament modifies on outer whorl and strong periodic ribs occur, which may project into large horns. *L.Alb.-Cenom.,* world-wide.——FIG. 479,*3*. **P. (A.) buenaventura* ANDERSON, (?M.)Alb., Calif.; *3a,b,* ×0.5 (2*).

?Bhimaites MATSUMOTO, 1954 [**Am. bhima* STOLICZKA, 1865]. High-whorled, with convex or flat sides, frequent constrictions projected on venter and hardly any ribs. Sutures intermediate between those of *Puzosia* and *Desmoceras*. *U.Alb.-Cenom.,* ?N.Afr.-Angola-Zululand-S.India.——FIG. 477,*1*. **B. bhima* (STOLICZKA), U.Alb., S.India; ×1 (718*).

Lytodiscoides SPATH, 1922 [**Pachydiscus conduciensis* CHOFFAT, 1903] [*Achilleoceras* VAN HOEPEN, 1951]. Very large; whorl section round; ribs comprise rather strong, slightly curved main ones and intercalated long and short ones; on distal part of body chamber every other main rib bears a vast ventrolateral and large umbilical spine. A siphonal crest also may occur. *U.Alb.,* Fr.-Mozambique-Zululand.——FIG. 478,*3*. **L. conduciensis* (CHOFFAT), U.Alb., Mozambique; *3a,b,* ×0.125 (599*).

Pachydesmoceras SPATH, 1922 [**Am. denisonianus* STOLICZKA, 1865]. Commonly very large, moderately involute; inner whorls with oval section and frequent shallow sigmoid constrictions with a raised rib in front and fine dense striae between; outer whorls with more inflated section and coarse, alternately long and short well-spaced ribs, more or less projected on outer 3rd of side. Suture as in *Puzosia*. *U.Alb.-U.Turon.,* Eng.-Fr.-Rumania-Yugoslavia-W. Afr.-Persia-S. India-Japan-N. Z.——FIG. 478,*4*. **P. denisonianum* (STOLICZKA), Cenom., S.India; ×1 (238*).

Silesitoides SPATH, 1925 [**Silesites escragnollensis* JACOB, 1908] [*Jacobella* PASSENDORFER, 1930 (obj.) (*non* JEANNET, 1908)]. Small, evolute, with round

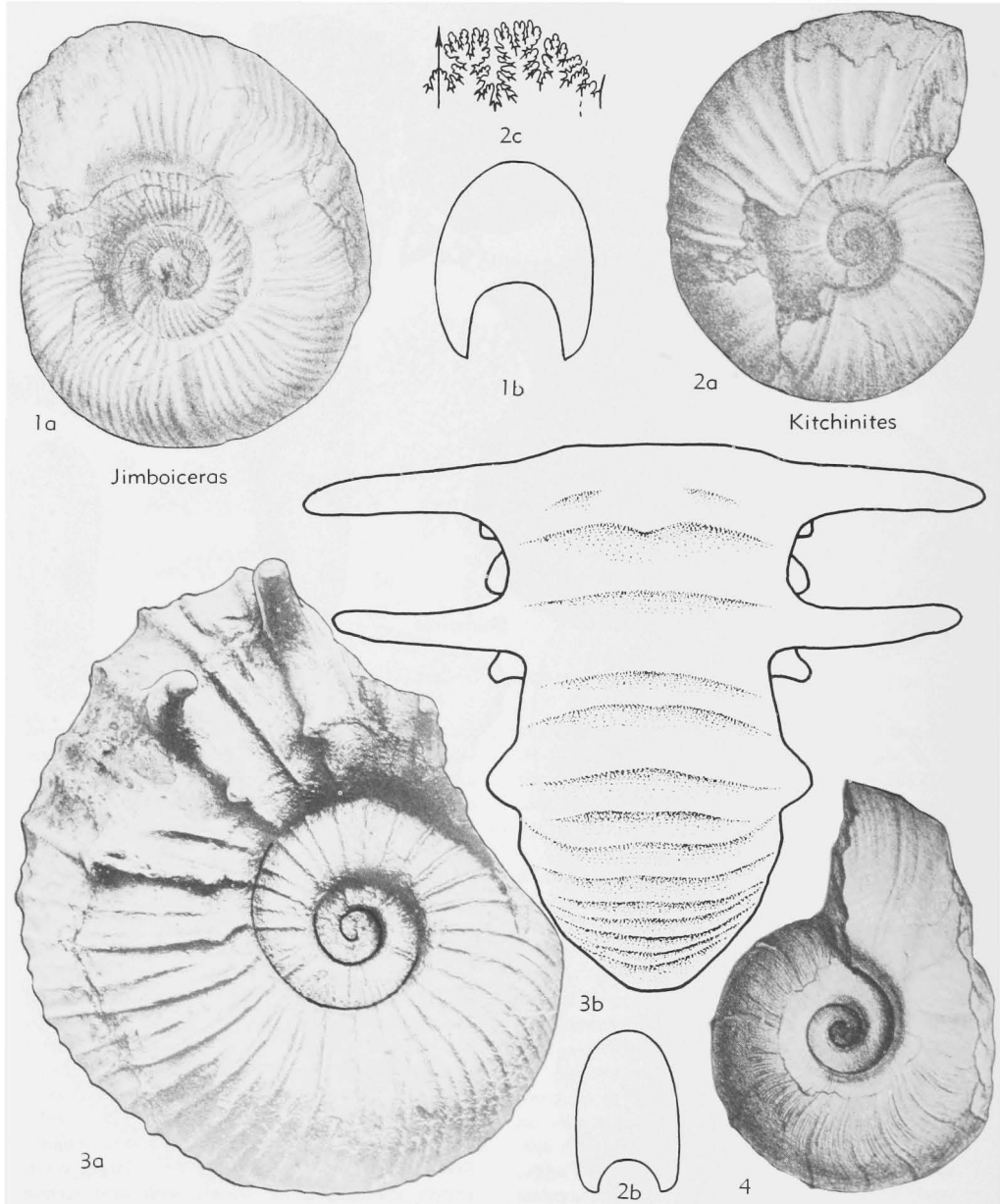


FIG. 478. Desmoceratidae (Puzosiinae) (p. L365-L368).

or oval whorl section, smooth at first, later with strong distant ribs between constrictions; ribs may branch on outer 3rd. *L.Alb.-M.Alb.*, Fr.-Balearics. ——FIG. 476,7. **S. escragnollensis* (JACOB), *L.* Alb., Fr.; ×1 (214*).

Jimboiceras MATSUMOTO, 1954 [**Desmoceras planulatiforme* JIMBO, 1894] [=*Jimboiceras* SHIMIZU, 1935 *(nom. nud.)*]. Early whorls like early whorls of *Anapuzosia* but with stronger ribs; later whorls with strong rectiradiate periodic ribs. *Turon.-L. Santon.*, Japan.——FIG. 478,*1*. **J. planulatiforme* (JIMBO), Turon., Japan; *1a,b,* ×0.5 (642*).

Parapuzosia NOWAK, 1913 [**Sonneratia daubréei* DE GROSSOUVRE, 1894; SD SPATH, 1922]. Commonly large, moderately involute, high-whorled, sides flat or convex; ribs differentiated into distant strong main ones and short intercalatories on outer 3rd of whorl. *U.Cenom.-Camp.*, Eu.-N.Afr.-S.Afr.-USA.

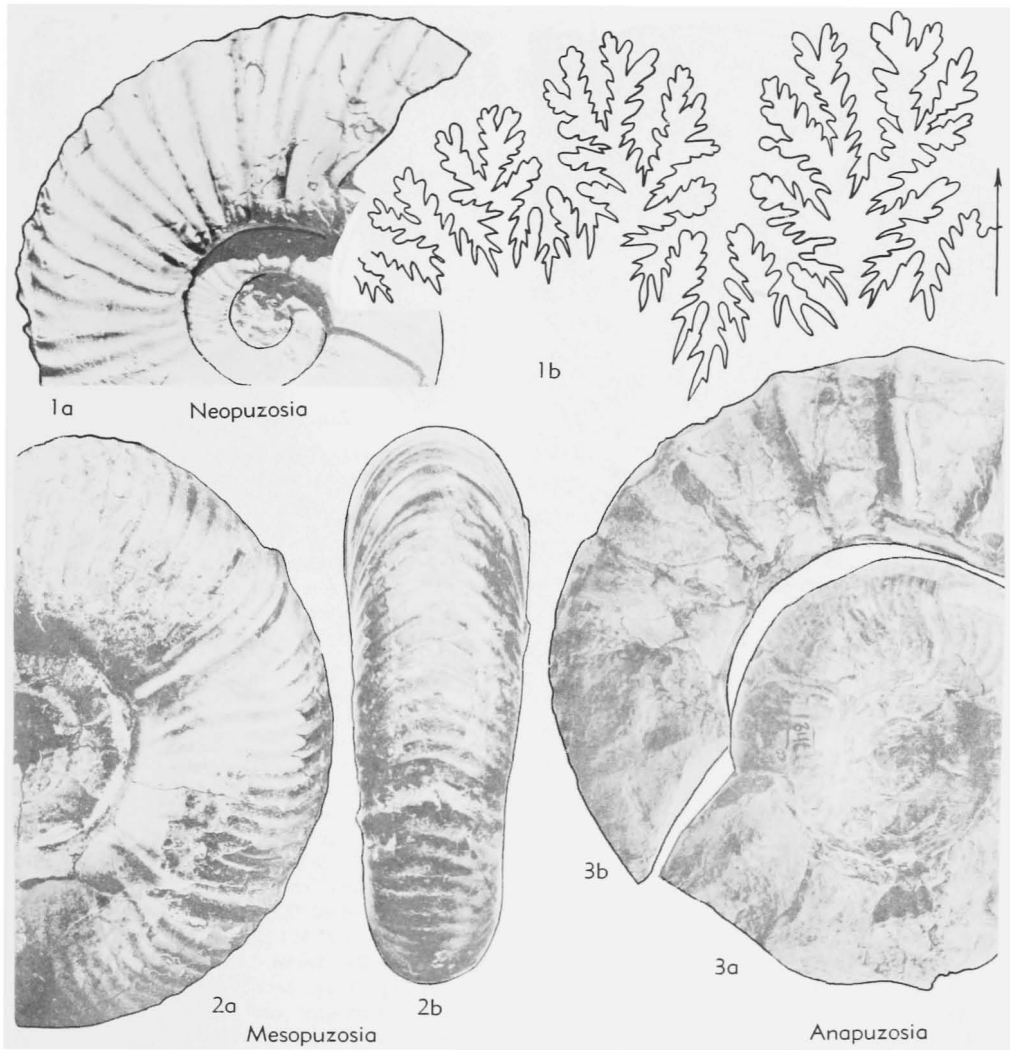


FIG. 479. Desmoceratidae (Puzosiinae) (p. L365-L367).

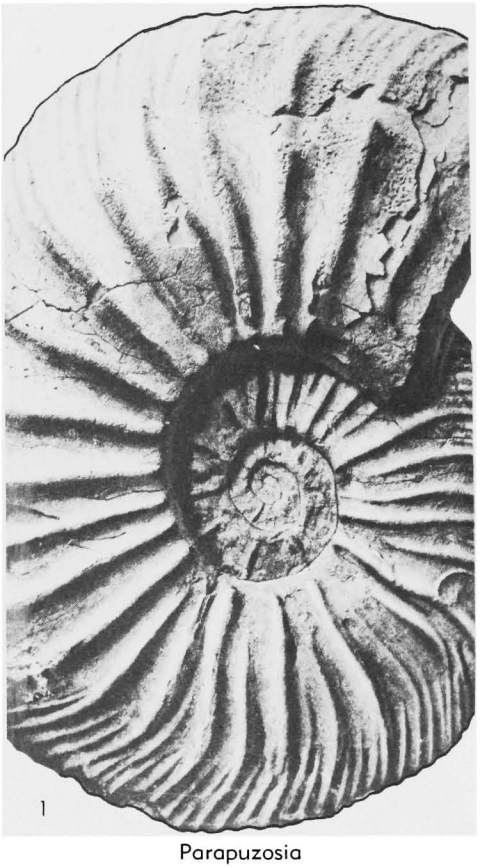
P. (Austiniceras) SPATH, 1922 [**Am. austeni* SHARPE, 1855]. Sides flat or convex, converging to narrowly rounded venter; primary ribs sigmoid or concave; constrictions rather shallow where present. *U.Cenom.-(?U.)Turon.*, Eu.

P. (Parapuzosia). Whorl section more oval than in *P. (Austiniceras)* and ribs stronger, main ones straight till outer 3rd where with intercalatories they are strongly projected; outer whorls smooth. *?Coni., Santon.-Camp.*, distribution as for genus. ——FIG. 480,*1*. **P. (P.) daubréei* (GROSS.), L. Santon., Fr.; ×0.5 (179*).

Mesopuzosia MATSUMOTO, 1954 (1938, *nom. nud.*) [**M. pacifica*]. Similar in form to *P. (Puzosia)* but with dense ribs starting from umbilicus, not so markedly differentiated as in *Parapuzosia* and more or less regular; last whorl smooth. *Turon.-Coni., ?Santon.*, S.India-Japan.——FIG. 479,*2*. **M. pacifica*, Turon., Japan; *2a,b*, ×0.75 (277*).

Kitchinites SPATH, 1922 [**Holcodiscus pondicherryanus* KOSSMAT, 1897]. Compressed, fairly high-whorled with distant, deep constrictions which may slightly truncate ribs; at first smooth between constrictions, then with fine close ribs; finally strong distant rounded ribs appear suddenly on body chamber. *Santon.-Camp.*, S.India-Japan-W. Austral.-N.Z.-Chile.

K. (Neopuzosia) MATSUMOTO, 1954 (Oct.) (March, 1954, *nom. nud.*) [**Kitchinites japonicus* SPATH, 1922]. Sides convex, ribs sigmoid, strongly projected on periphery. *Santon.-L.Camp.*, S.India-Japan.——FIG. 479,*1*. **K. (N.) japonica* (SPATH),



Parapuzosia

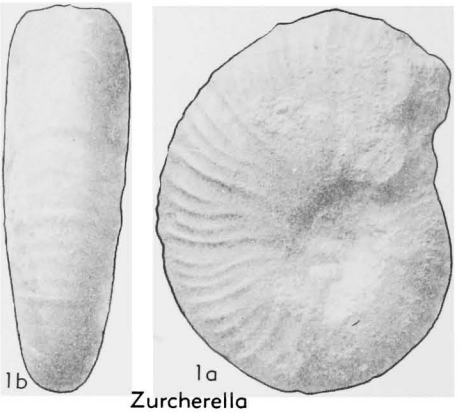
FIG. 480. *Parapuzosia (Parapuzosia) daubreei* (DE GROSSOUVRE), U.Cret.(L.Santon.), Fr. (p. L367).

Santon., S.Sakhalin; *1a,* ×0.75; *1b,* enlarged (277*).

K. (Kitchinites). Sides flat, ribs more or less straight, rectiradiate or prorsiradiate. *Camp.*, S. India-W.Austral.-N.Z.-Chile.——FIG. 478,*2*. **K. (K.) pondicherryanus* (KOSSMAT), Camp., S. India; *2a-c,* ×1 (238*).

Subfamily BEUDANTICERATINAE Breistroffer, 1953

Mainly compressed, high-whorled and rather involute, with narrow venter, smooth or with distinct ribs, which in forms leading to Hoplitidae tend to be raised into umbilical swellings; with or without constrictions. Analogous to earlier *Barremites* but in most cases, readily separable; the smooth forms probably represent a succession of secondarily smooth derivatives of more ornamented genera (50, 75, 570). *L. Cret. (U.Barrem.-U.Alb.).*



Zurcherella

FIG. 481. *Zurcherella zurcheri* (JACOB), L.Cret.(U. Apt.), Switz. (p. L368).

Zurcherella CASEY, 1954 [**Desmoceras zurcheri* JACOB, 1906]. Differs from its descendant, *Uhligella,* in having fine sinuous ribs which arise some distance above umbilical edge. *U.Barrem.-U.Apt.*, Eu.-N.Afr.-E.Afr.-Mex.——FIG. 481,*1*. **Z. zurcheri* (JACOB), U.Apt., Switz.; *1a,b,* ×1 (640*).

Uhligella JACOB, 1907 [**Desmoceras clansayense* JACOB, 1905; SD KILIAN, 1907]. High-whorled, with broadly or narrowly rounded venter, sides slightly convex to flat, section typically broadest near umbilical edge; with irregular shallow constrictions; early whorls have strong or weak sinuous rounded main ribs, distinctly raised on umbilical edge, with several intercalated ribs between; outer whorls smooth. *U.Apt.-M.Alb.*, W.Eu.-C.Eu.-N. Afr.-Mex.——FIG. 482,*1*. **U. clansayensis* (JACOB), L.Alb., Fr.; *1a,b,* ×1 (639*).

?Pseudosaynella SPATH, 1923 [**Am. bicurvatus* MICHELIN, 1838]. Small oxycones with shallow falcate constrictions and feeble ribs. Possibly an offshoot of *Zurcherella*. *L.Apt.-L.Alb.*, W.Eu.-?Japan.-Tex.

Beudanticeras HITZEL, 1905 [**Am. beudanti* BRONGNIART, 1822] [incl. *Pseudorbulites* BREISTROFFER, 1953 *(nom. nud.); ?Boliteceras* WHITEHOUSE, 1928]. Rather to very compressed, moderately involute, sides convex to flat, venter more or less narrowly arched but not acute; with or without shallow but distinct sinuous constrictions; smooth or with weak ribs; no tubercles. Probably includes several distinct offshoots of species of *Uhligella*. *L.Alb.-U.Alb.*, Eu.-Sinai-Queensl.-Japan-Tex.-Patag.-Greenl.——FIG. 482,*2*. **B. beudanti* (BRONGN.), U.Alb., Fr.; *2a-c,* ×0.5 (329*).

Beudantiella BREISTROFFER, 1947 [*pro Cophinoceras* WHITEHOUSE, 1928 (*non* HYATT, 1900)] [**Cophinoceras ogilviei* WHITEHOUSE, 1828]. Like species of *Beudanticeras* with oval whorl section but with sparse, nearly straight main ribs and short intermediate ribs. *U.Alb.*, Queensl.

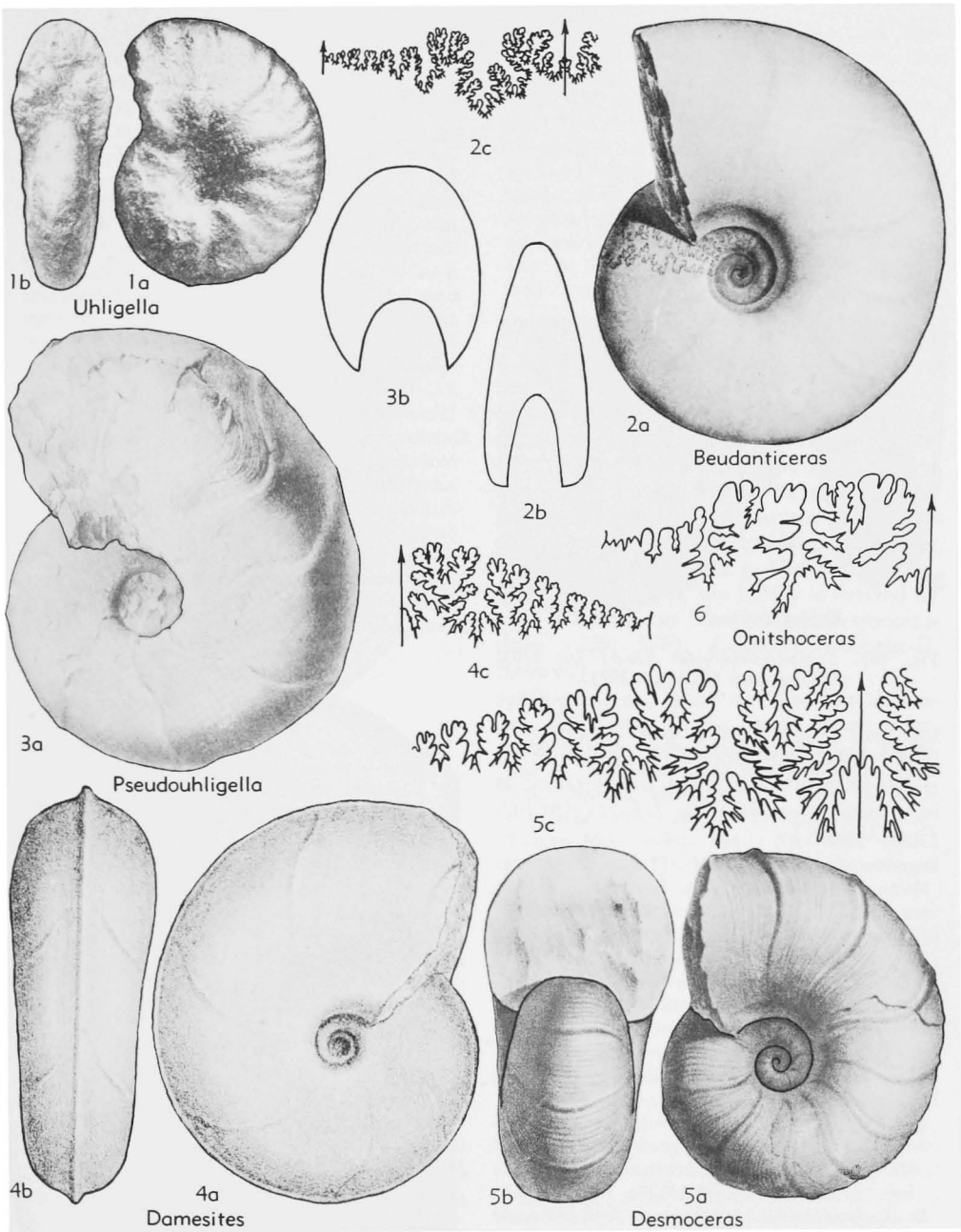


FIG. 482. Desmoceratidae (Beudanticeratinae, Desmoceratinae) (p. L368-L370).

Brewericeras CASEY, 1954 [**Am. breweri* GABB, 1869]. Like *Beudanticeras* but with flat subparallel sides, sharp umbilical edge, and no constrictions on peripheral ridges; ribs, if any, are on outer part of sides, being sharper and more regular than in *Beudanticeras* but weakening on venter. *L.Alb.*(or *M.Alb.*), Calif.-Alaska.

Subfamily DESMOCERATINAE Zittel, 1895

[*nom. transl.* MATSUMOTO, 1938 (*ex* Desmoceratidae ZITTEL, 1895)]

Involute, with little or no ornament except for collared constrictions and in some forms weak intermediate ribs on outer part of whorl; in one group venter tends to nar-

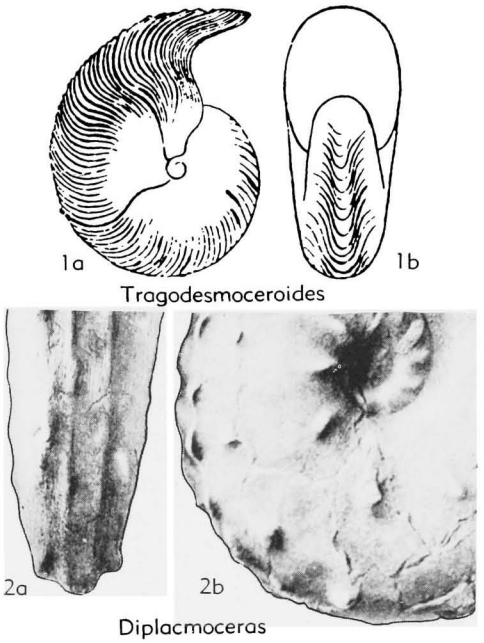


FIG. 483. *Tragodesmoceroides (1a,b)* (p. 370); *Diplacmoceras (2a,b)* (p. 392).

row and finally form a keel. Suture with finely frilled elements and auxiliaries in regularly descending series, not retracted as in Puzosiinae (276,570). *L.Cret.(Apt.)-U. Cret.(Maastr.).*

Desmoceras ZITTEL, 1884 [**Am. latidorsatus* MICHELIN, 1836; SD BOULE, LEMOINE & THEVENIN, 1906] [*Latidorsella* JACOB, 1908 (obj.); *Phyllodesmoceras* SPATH, 1925]. Moderately to very involute, inflated with depressed rounded subquadrate or oval whorl section; sigmoid constrictions form strong rounded ribs on outside of test, with dense striae or weak rounded ribs between them on outer part of side and venter. *U.Apt.-Cenom.,* Eu.-Afr.-Madag.-S.India-Japan-Queensl.-Calif.-Tex.

D. (Desmoceras). Whorl section round to subquadrate. Occurrence as for genus.——FIG. 482,*5*. **D. (D.) latidorsatum* (MICHELIN), M.Alb., Fr.; *5a,b,* ×0.75; *5c,* enlarged (329*).

D. (Lunatodorsella) BREISTROFFER, 1947 [**Puzosia chirichensis* PERVINQUIÈRE, 1907]. Cadicone. *U. Alb.,* Tunis.

D. (Pseudouhligella) MATSUMOTO, 1942 (1938, *nom. nud.*) [**Desmoceras whiteavesi* var. *japonica* YABE, 1902]. Only moderately involute, whorl section oval; with biconcave constrictions and striae. *U.Alb.-Turon.,* Nigeria-Japan.——FIG. 482, *3*. **D. (P.) japonicum* (YABE), ?Cenom., Japan; *3a,b,* ×0.5 (739*).

Tragodesmoceroides MATSUMOTO, 1942 [**T. subcostatus*]. Very involute, moderately inflated; falcoid constrictions and sharp, dense falcoid ribs or striae on outer part of side, and strongly projected on venter, mid-line of which tends to be raised. *Turon.,* USA-Japan.——FIG. 483,*1*. **T. subcostatus,* Turon., Japan; *1a,b,* ×1 (659*).

Damesites MATSUMOTO, 1942 [**Desmoceras damesi* JIMBO, 1894] [=*Kotoceras* YABE, 1927 (obj.) (*non* KOBAYASHI, 1934) (ICZN pend.]. Very involute, more or less compressed, with flat sides and distinct keel; falcoid sinuous or concave constrictions and in some cases fine ribs. Derived probably from *Pseudouhligella* by raising of mid-line of venter. *Cenom.-Camp.,* Madag.-S.India-W.Austral.-Japan-B.C.-USA.——FIG. 482,*4*. *Damesites sugata* (FORBES), ?Santon., S.India; *4a-c,* ×1 (238*).

Onitshoceras REYMENT, 1954 [**O. matsumotoi*]. Moderately involute and inflated, whorl section subquadrate; with numerous thin irregular ribs that rise near umbilicus and strengthen on venter. Suture with very narrow lobes and one or more saddles projecting beyond line of suture. *Coni.,* ?Fr.-Nigeria.——FIG. 482,*6*. **O. matsumotoi,* Coni., Nigeria; ×2 (689*).

Desmophyllites SPATH, 1929 [*pro Schluteria* DE

FIG. 484. *Desmophyllites larteti* (SEUNES), U.Cret. (Maastr.), Fr.; *1a,b,* ×1 (706*) (p. L370).

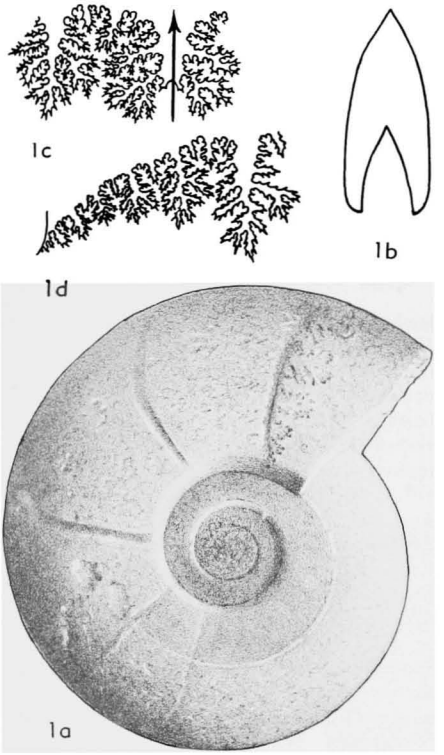


FIG. 485. *Hauericeras pseudogardeni* (SCHLÜTER), U. Cret.(L.Camp.), Ger. (p. L371).

GROSSOUVRE, 1894 (*non* FRITSCH & KAFFKA, 1887)] [**Desmoceras larteti* SEUNES, 1891; SD SPATH, 1921 (*pro Schluteria*)] [=*Schlutericeras* COLLIGNON, 1938 (obj.) (*non* HYATT, 1903)]. Very involute, inflated to compressed, with rounded venter; with sinuous falcoid or biconcave constrictions strongly projected and slightly collared on venter; shell smooth or finely striate. *Santon.-Camp.*, Ire.-Fr.-N.Afr.-SE.Afr.-Madag.-S.India-Japan-B.C.-Calif.——FIG. 484,*1*. **D. larteti* (SEUNES), Maastr.; *1a,b*, ×1 (706*).

Subfamily HAUERICERATINAE Matsumoto, 1938

Rather evolute to rather involute; whorl section high with flat sides; venter rounded (at least initially), then typically fastigate and later with sharp high septicarinate keel. Smooth or with weak tubercles on shoulders. Suture with suspensive lobe retracted or not. Origin doubtful but probably in Desmoceratinae close to point of origin of Muniericeratidae. *U.Cret.(Coni.-Maastr.)*.

Hauericeras DE GROSSOUVRE, 1894 [**Am. pseudogardeni* SCHLÜTER, 1872] [*Schluteria* ROLLIER, 1922 (obj.) (*non* FRITSCH & KAFFKA, 1887); *Pseudogardenia* TOMLIN, 1930 (obj.); incl. *Gardeniceras* MATSUMOTO, 1955]. *Coni.-Maastr.*, Eu.-S.Afr.-Madag.-S.India-Japan-W. Austral.——FIG. 485,*1*. **H. pseudogardeni* (SCHLÜTER), L.Camp., Ger.; *1a-d*, ×0.5 (422*).

?**Oiophyllites** SPATH, 1953 [**O. decipiens*]. Rather involute, very compressed, with narrowly rounded venter and almost flat sides; umbilical edge rounded; surface smooth except for sinuous striae. Suture simple and tending to have phylloid folioles. May be related to *Hauericeras*. *Camp.*, Graham-land-?Angola.

Family HOLCODISCIDAE Spath, 1924

Moderately involute, with rounded, rectangular, or depressed whorl section; straight or sinuous fine dense ribs typically continue over venter and are truncated by oblique constrictions or enlarged rounded or thin and high ribs, which may have lateral and paired ventral tubercles. Suture rather simple. Despite close resemblance of inner whorls to some species to Olcostephaninae, such as *Subastieria*, the family is derived by way of *Spitidiscus* from early Eodesmoceratinae (229, 570). *L.Cret.(L.Hauteriv.-U. Barrem.)*.

Spitidiscus KILIAN, 1910 [**Am. rotula* J.DEC.SOWERBY, 1845]. More or less circular whorl section, rather evolute; with frequent straight or slightly sinuous, moderately deep but wide constrictions which truncate close fine low single or rarely branching ribs. *Hauteriv.*, *?L.Barrem.*, Eu.-Tangan.-Mex.——FIG. 486,*1*. **S. rotula* (J.DEC. Sow.), Hauteriv., Eng.; *1a,b*, ×1; *1c*, enlarged (679*).

?**Holcoptychites** GERTH, 1921 [**Polyptychites neuquensis* R.DOUVILLÉ, 1910]. Large, with inflated whorl section; rather numerous straight constrictions bordered by prominent rounded ribs and with prominent branching ribs (like those of *Polyptychites*) that spring from umbilical bullae. Probably a strongly ribbed holcodiscid rather than constricted polyptychitid. *L.Hauteriv.*, Arg.——FIG. 466,*1*. **H. neuquenensis* (R.DOUV.); *1a,b*, ×0.7 (133*).

Plesiospitidiscus BREISTROFFER, 1947 [**Am. ligatus* D'ORBIGNY, 1841]. Compressed, with flat sides; with straight radial raised ribs and constrictions on cast which do not truncate fine minor ribs occurring on outer half of sides. *U.Hauteriv.*, Fr.-Mex. ——FIG. 486,*2*. **P. ligatus* (ORB.), U.Hauteriv., Fr.; *2a,b*, ×1 (329*).

Holcodiscus UHLIG, 1882 [**Am. cailleaudianus* D'ORBIGNY, 1850]. Circular to rectangular whorl section; with fine low, straight or flexuous, simple or branching ribs truncated by frequent thin high ribs bearing lateral and ventral tubercles; inner whorls tend to have depressed whorl section and

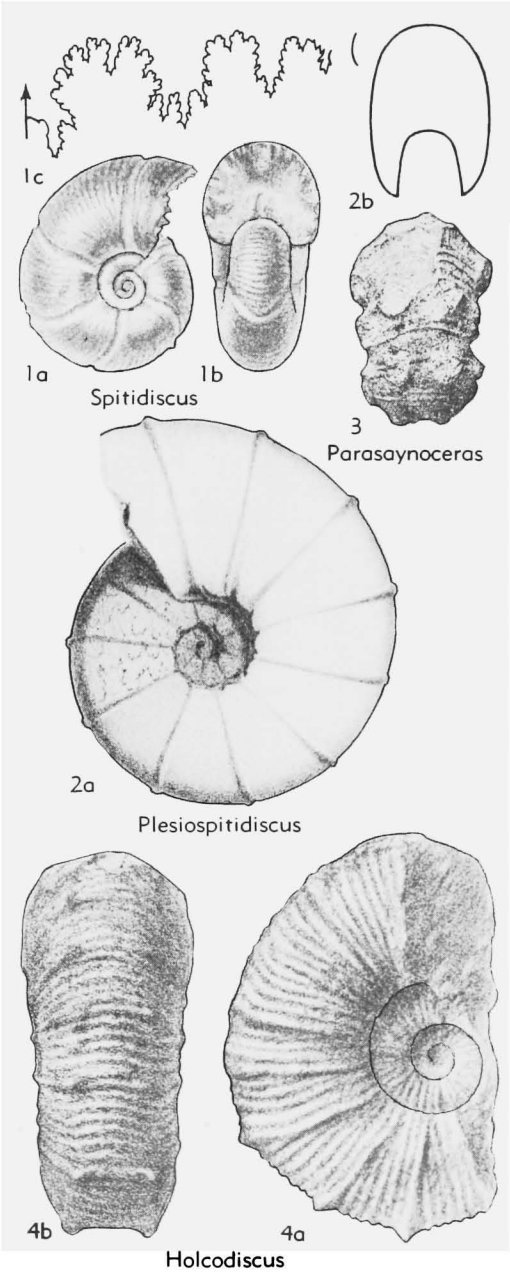


FIG. 486. Holcodiscidae (p. L371-L372).

resemble *Subastieria*. *Barrem.*, C.Eu.-S.Eu.-Calif.-Mex.——FIG. 486,*4*. **H. cailleaudianus* (ORB.), Barrem., Fr.; *4a,b*, ×1 (646*).

Parasaynoceras BREISTROFFER, 1947 [**Am. horridus* D'ORBIGNY, 1850]. Depressed offshoot of *Holcodiscus* with a few very large umbilical or lateral and ventrolateral tubercles, each covering several fine sharp ribs. *Barrem.*, Fr.-Mex.——FIG. 486,*3*. **P. horridum* (ORB.), Barrem., Fr.; ×1.

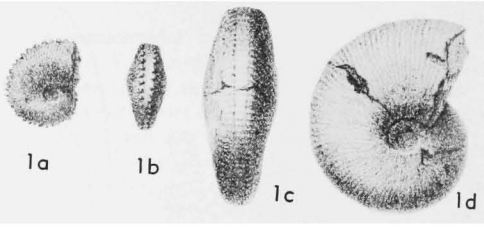


FIG. 487. *Metahoplites henoni* (COQUAND), L.Cret. (Barrem.), Tunisia (p. L372).

Metahoplites SPATH, 1924 [**Am. henoni* COQUAND, 1880]. Involute (evolute forms probably are generically distinct), compressed, rather high-whorled; dense fine ribs unite in 2's or 3's in small ventrolateral clavi; flat venter smooth at first but later ventrolateral clavi weaken and ribs cross venter transversely. *Barrem.*, Fr.-Balearics-N.Afr.——FIG. 487,*1*. **M. henoni* (COQUAND), Barrem., Tunisia; *1a-d*, ×1 (697*).

Astieridiscus KILIAN, 1910 [**Holcodiscus morleti* KILIAN, 1888; SD ROMAN, 1935]. Sides slightly flattened, venter rounded; with dense sharp slightly flexuous simple or branching ribs but no umbilical or other tubercles except on innermost whorls. Superficially resembles *O. (Olcostephanus)*. *Barrem.*, Fr.-Sp.-Balearics.——FIG. 488,*1*. **A. morleti* (KILIAN), Barrem., Fr.; *1a,b*, ×1 (646*).

?**Gymnoplites** SPATH, 1933 [**G. simplex*]. Ill known. Outer whorl smooth. Possibly related to *Astieridiscus*. *?Barrem.*, W.India.

Family SILESITIDAE Hyatt, 1900

Evolute, with oval or compressed whorl section, whorl height increasing slowly; inner whorls smooth, with constrictions; middle and later whorls with distant broad ribs or dense fine ribs. Suture distinctly concave, with auxiliaries tending to curve forward in advance of 1st lateral saddle. Probably derived from early *Barremites* (230, 530). *L. Cret.(Barrem.-L.Alb.)*.

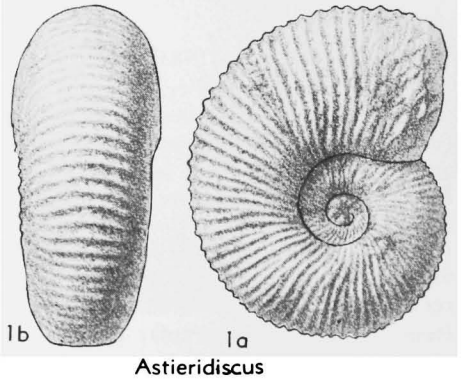


FIG. 488. *Astieridiscus morleti* (KILIAN), L.Cret. (Barrem.), Fr.; *1a,b*, ×1 (646*) (p. L372).

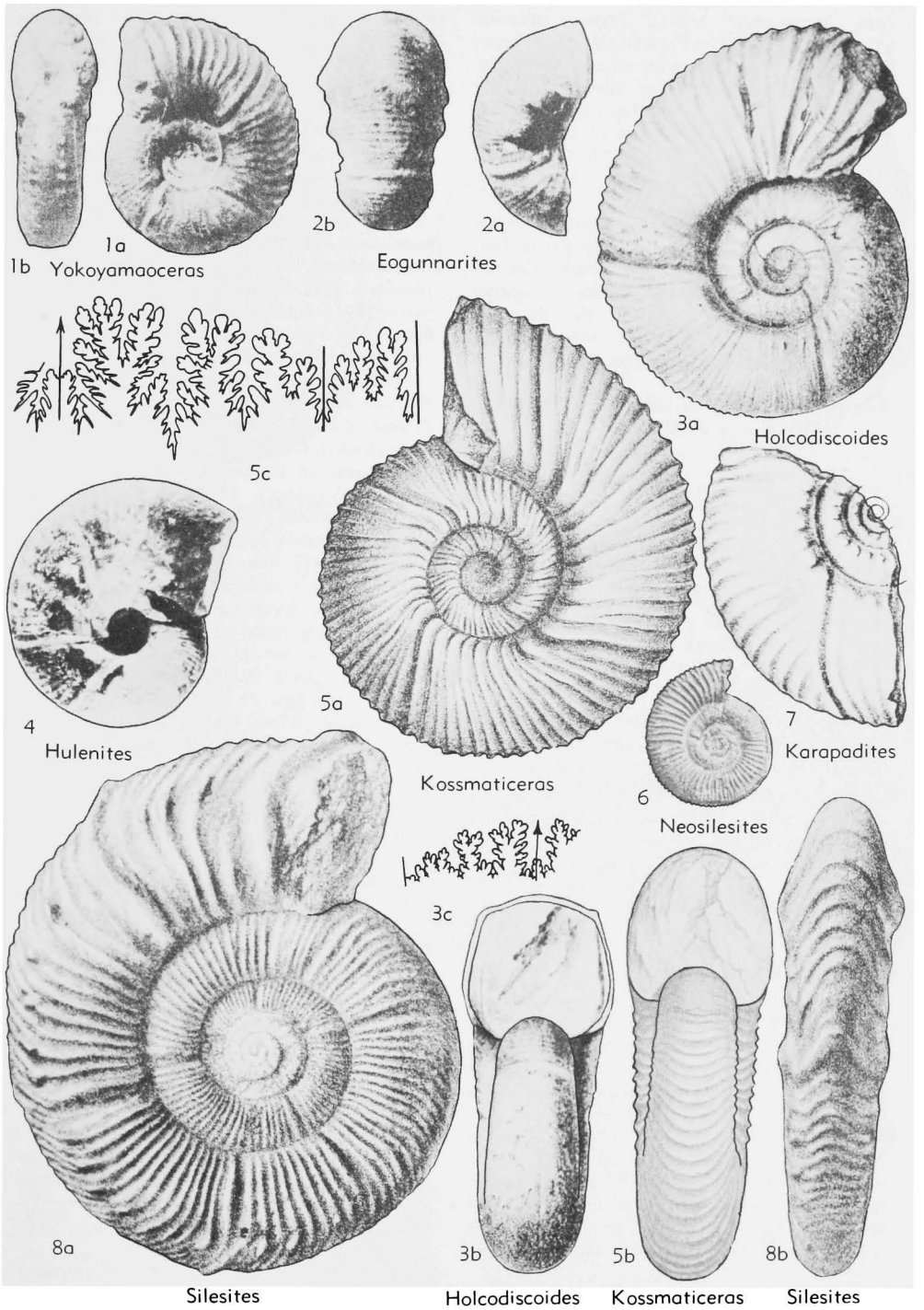


FIG. 489. Silesitidae, Kossmaticeratidae (p. L374).

Silesites UHLIG, 1883 [*pro Beneckeia* UHLIG, 1882 (*non* MOJSISOVICS, 1882)] [**Am. seranonis* D'ORBIGNY, 1841]. Whorl section oval; with regular moderately deep constrictions and ribs radial and straight on inner part of sides but strongly projected on outer, forming chevrons on venter; a small tubercle may occur where rib bends below shoulder. *Barrem.*, S.Eu.-C.Eu.-N.Afr.-Calif.-Patag. ——FIG. 489,*8*. **S. seranonis* (ORB.), Barrem., Fr.; *8a,b*, ×1 (646*).

Neosilesites BREISTROFFER, 1952 [**Silesites seranonis* var. *balearensis* FALLOT, 1920]. Sides flat or convex, venter rounded; with dense sharp primaries split on outer part of sides into fine secondaries which pass over venter. *U.Apt.-L.Alb.*, Balearics-Tunisia-Sinai.——FIG. 489,*6*. *N. nepos* (H.DOUVILLÉ), L.Alb., Madag.-Sinai; ×1 (132*).

Family KOSSMATICERATIDAE Spath, 1922

[*nom. transl.* SPATH, 1923 (*ex* Kossmaticeratinae SPATH, 1955)] [Incl. Marshallitinae MATSUMOTO, 1955]

Compressed to inflated, rather involute to evolute, with fine or coarse, radial or prorsiradiate ribs, usually uninterrupted on venter; tubercles may be present; ribs typically truncated by still more oblique constrictions. An Albian to Coniacian group of genera is derived from the Lower Albian Puzosiinae; a later, Turonian to Maastrichtian group may be derived from the first or from Turonian Puzosiinae, but there is little morphological difference (85, 274, 278, 489). *L.Cret.(U. Alb.)-U.Cret.(Maastr.)*.

Hulenites MATSUMOTO, 1955 [**Puzosia reesidei* ANDERSON, 1938]. Like compressed *Puzosia* but more compressed and involute, with more distinct flexuous ribs and prorsiradiate constrictions; cast may show a spiral depression; venter tends to flatten and ribs to weaken on it. *?U.Alb.*, Calif. ——FIG. 489,*4*. **H. reesidei* (ANDERSON); ×1 (2*).

Marshallites MATSUMOTO, 1955 (1954, *nom. nud.*) [**M. compressus*]. Compressed, high-whorled and involute, with fine flexuous ribs springing in bundles from weak umbilical bullae and truncated by frequent prorsiradiate constrictions. Very like *Maorites* (Senon.) but umbilical tubercles are feebler. *Cenom.-L.Turon.*, S.India-Japan.

Holcodiscoides SPATH, 1922 [**Am. cliveanus* STOLICZKA, 1865]. Less involute and densely ribbed than *Marshallites* and with subquadrate whorl section, flat sides and venter bordered by rather sparse ventrolateral tubercles. *Turon.*, S.India.—— FIG. 489,*3*. **H. cliveanus* (STOLICZKA); *3a-c*, ×1 (718*).

Eogunnarites WRIGHT & MATSUMOTO, 1954 (MATSUMOTO, 1942, *nom. nud.*) [**Olcostephanus unicus* YABE, 1904]. Rather involute, depressed, with deep umbilicus having angular edge; fine slightly curved ribs spring in 3's and 4's from prominent umbilical tubercles; additional ribs intercalated; regular constrictions each truncate 3 or 4 ribs. *U.Alb.-Cenom.*, Japan.——FIG. 489,*2*. **E. unicus* (YABE); *2a,b*, ×1 (571*).

Eomadrasites MATSUMOTO, 1955 [**E. nipponicus*]. Less depressed and inflated than *Eogunnarites* and with inner lateral, ventrolateral and siphonal, irregular, large tubercles and rather irregular ribs. *Cenom.*, Japan.

[**Jacobitoides** MATSUMOTO, 1954 *(nom. nud.)*].

Yokoyamaoceras WRIGHT & MATSUMOTO, 1954 (SHIMIZU, 1935, *nom. nud.*) [**Holcodiscus kotoi* JIMBO, 1894]. Small, evolute and compressed, with flat venter; in mid-growth, fine flexuous ribs end at small ventrolateral tubercles and do not cross venter but on body chamber they do so. Resembles *Holcodiscoides* but has no umbilical tubercles. *?Turon., Coni.*, ?S.India-Japan.——FIG. 489,*1*. **Y. kotoi* (JIMBO), Coni., Japan; *1a,b*, ×1 (571*).

Kossmaticeras DE GROSSOUVRE, 1901 [**Am. theobaldianus* STOLICZKA, 1865; SD DIENER, 1925] [*Pseudoholcodiscus, Madrasites* KILIAN & REBOUL, 1909]. Moderately evolute, whorl section oval to compressed; with more or less dense fairly strong simple branched or intercalated ribs rising from very weak to strong umbilical tubercles and in most cases coarsening on body chamber. Suture moderately indented. *U.Turon.-Camp.*, IndoPac.

K. (Kossmaticeras). Umbilical tubercles very weak; whorl section generally oval. *U.Turon.-Santon.*, S. Afr.-Madag.-S.India-Japan-N.Z.——FIG. 489,*5*. **K. (K.) theobaldianum* (STOLICZKA), Santon., S. India; *5a-c*, ×1 (238*).

K. (Natalites) COLLIGNON, 1954 [**Madrasites natalensis* SPATH, 1922]. Whorl section round to compressed; umbilical tubercles distinct to prominent. *?U.Santon., Camp.*, S.Afr.-S.India-W. Austral.-Japan-N.Z.-GrahamLand.——FIG. 490,*1*. **K. (N.) natalense* (SPATH), Camp., Pondoland; ×0.75 (457*).

K. (Karapadites) COLLIGNON, 1954 [**Holcodiscus karapadensis* KOSSMAT, 1896]. Sides flat; ribs absent or weak on mid-sides, at any rate in early and mid-growth but distinct umbilical tubercles invariably present. *U.Camp.*, Madag.-S.India.—— FIG. 489,*7*. **K. (Karapadites) karapadense* (KOSSMAT), U.Camp., S.India; ×1 (238*).

Grossouvreites KILIAN & REBOUL, 1909 [**Am. gemmatus* HUPPÉ, 1854]. Ribs very fine and dense in young, springing in bundles from umbilical tubercles, later coarse. Perhaps subgenus of *Kossmaticeras*. *Camp.*, N.Z.-Chile-GrahamLand.——FIG. 490,*2*. **G. gemmatus* (HUPPÉ), Camp., Chile; *2a,b*, ×0.75 (717*).

Gunnarites KILIAN & REBOUL, 1909 [**Olcostephanus antarcticus* WELLER, 1903]. Like *Kossmaticeras (Natalites)* but with stronger, more regular ribs invariably crenulate; compressed, with fine ribs,

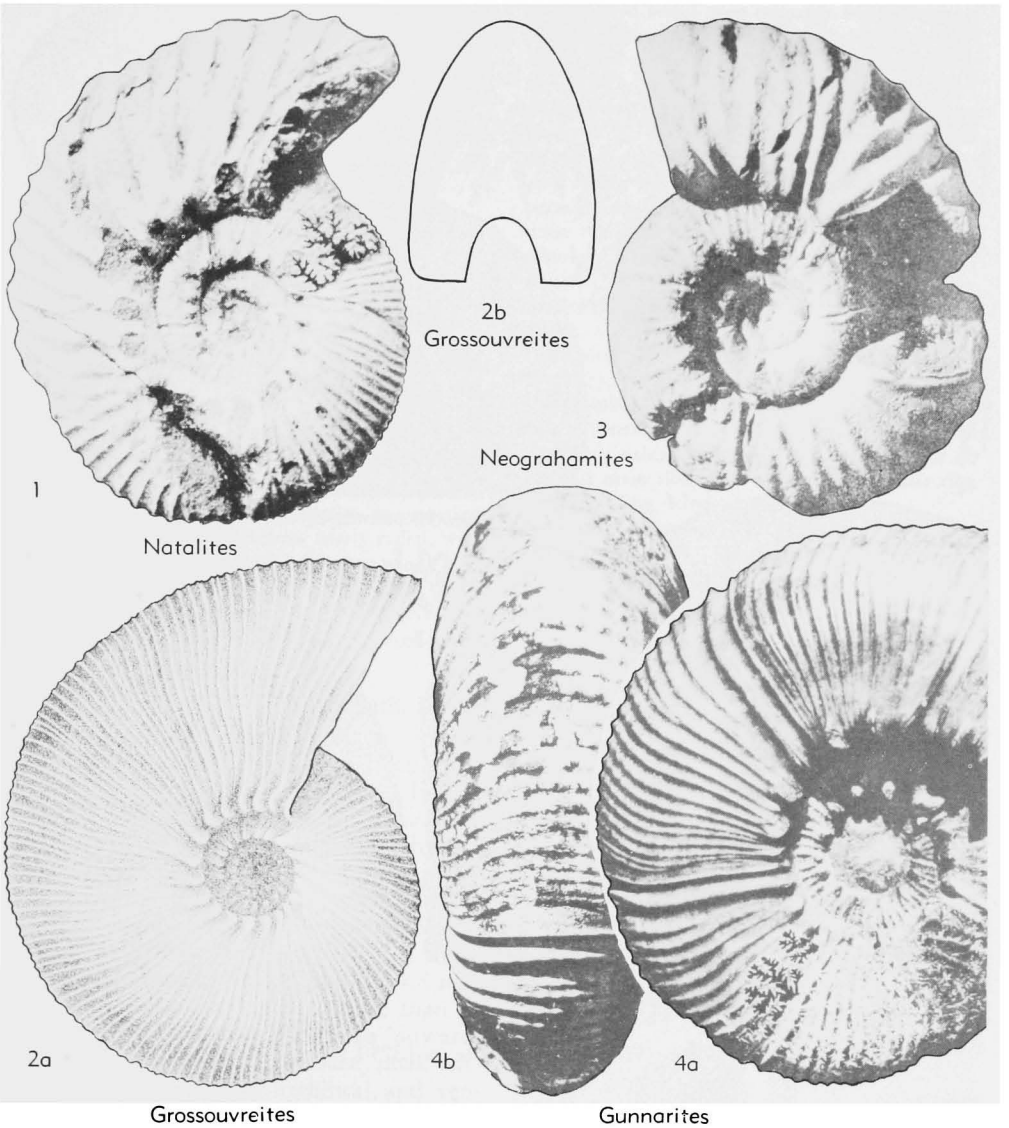


FIG. 490. Kossmaticeratidae (p. L374-L375).

to round-whorled, with coarse ribs. *Camp.*, S.India-N.Z.-GrahamLand.——FIG. 490,*4*. **G. antarcticus* (WELLER), *Camp.*, GrahamLand; *4a,b*, ×0.7 (489*).

Maorites MARSHALL, 1926 [**M. tenuicostatus*]. Involute, compressed, high-whorled, with flat sides; with very dense fine flexuous ribs; distinct umbilical tubercles at any rate in early stages. Suture very finely divided. *Camp.*, Zululand-Madag.-S.India-N.Z.-GrahamLand.——FIG. 491,*3*. **M. tenuicostatus*, Camp., N.Z.; *3a*, ×0.7; *3b*, ×1.5 (274*).

Pseudokossmaticeras SPATH, 1922 [**Am. pacificus* STOLICZKA, 1865]. Round-whorled, with rectiradiate single ribs in adult; subdued umbilical tubercles persist. *?U.Camp., Maastr.*, C.Eu.-Turkey-Madag.-S.India-Patag.——FIG. 491,*2*. **P. pacificum* (STOLICZKA), Maastr., S.India; *2a-c*, ×1 (718*).

Neograhamites SPATH, 1953 [**N. kiliani*]. Small; at first with fine, later with coarse, straight ribs, branching from umbilical tubercles. *Camp.*, Pondoland-N.Z.-Patag.-GrahamLand.——FIG. 490,*3*. **N. kiliani*, Camp., GrahamLand; ×1 (489*).

Jacobites KILIAN & REBOUL, 1909 [**J. anderssoni*]. Inner whorls as in *Kossmaticeras* but more inflated, in some forms coronate, with large lateral spines;

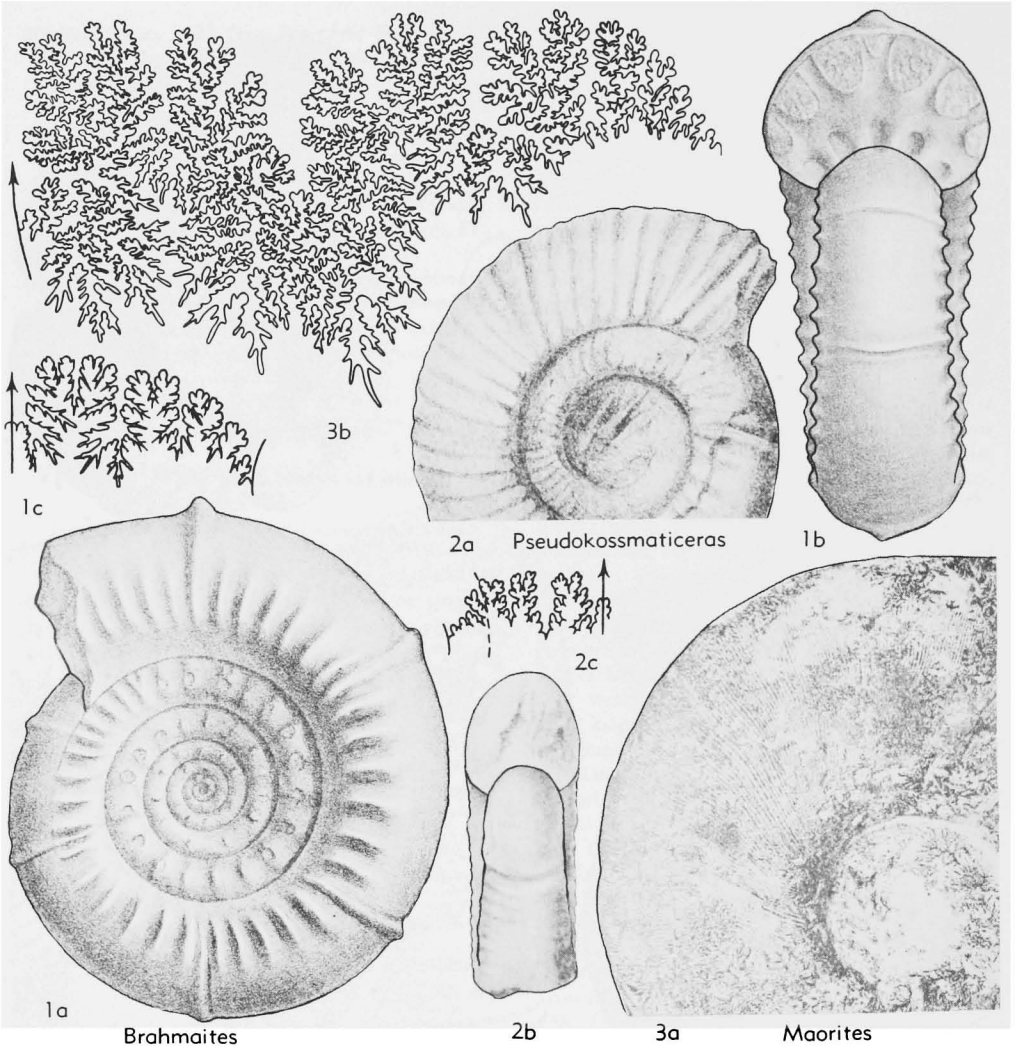


FIG. 491. Kossmaticeratidae (p. L375-L376).

outer whorls with more or less flat parallel sides and broad fastigate venter and with regular or irregular flared or tuberculate ribs. *Camp.*, N.Z.-GrahamLand.

J. (Jacobites). Inner whorls inflated but in some rather depressed; ribs fine, branching in bundles from strong umbilical tubercles and all angulate or tuberculate on shoulder, some also on siphonal line; ribs coarsen suddenly on body chamber. Occurrence as for genus.——FIG. 492,*1*. **J. (J.) anderssoni*, Camp., GrahamLand; side, ×1 (647*).

J. (Neomadrasites) MARSHALL, 1926 [**N. nodulosus*] [=*Aucklandites* MARSHALL, 1927]. Inner whorls with broad, nearly flat venter bordered by sparse long sharp lateral spines; ribs feeble on venter but constrictions and collars strong; whorl section then becomes higher than wide, with flat sides and flat or fastigate venter, with dense and in some looped ribs, periodically with umbilical, ventrolateral and siphonal tubercles, intermediate ribs nontuberculate. *Camp.*, N.Z.

J. (Tainuia) MARSHALL, 1926 [**T. aucklandica*]. Outer whorls with coarse ribs, most with umbilical and all with 3 lateral, ventrolateral, and siphonal tubercles. *Camp.*, N.Z.

Brahmaites KOSSMAT, 1897 [**Am. brahma* FORBES, 1846] [=*Anabrahmaites, Subbrahmaites* YABE & SHIMIZU, 1924]. Evolute; inner whorl depressed, coronate as in some *Jacobites*, with fine ribs and umbilical tubercles; later whorl sections become round and ribs weaken, becoming reduced in some

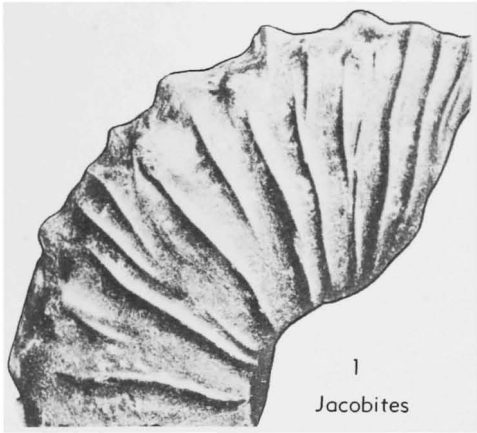


FIG. 492. *Jacobites (Jacobites) anderssoni* KILIAN & REBOUL, U.Cret.(Camp.), Grahamland (p. L376).

cases to elongated umbilical tubercles, rejuvenating on body chamber; constrictions nearly radial, with strong collar behind, which on outer whorl may be interrupted or raised into sharp siphonal tubercles. *Maastr.*, Fr.-Sp.-Madag.-S.India.-Sakhalin.—— FIG. 491,*1*. **B. brahma* (FORBES), Maastr., S.India; *1a,b*, ×0.75; *1c*, ×1 (238*).

Family PACHYDISCIDAE Spath, 1922

Moderate-sized to large, rather involute to evolute, whorl section inflated and depressed to compressed and high-whorled. Distinguished primarily from Desmoceratidae by strong ribbing at some stage of growth, normally crossing venter without interruption, and showing tendency to strong tuberculation at least on umbilical shoulder. Suture much as in Desmoceratinae and with smaller, less asymmetric 1st lateral lobe and narrower, less retracted umbilical lobe than in Puzosiinae. From the Turonian onward, several genera tend to produce small offshoots with prominent umbilical and ventrolateral tubercles on body chamber. The family arose in the Upper Albian, apparently from the Desmoceratinae (84, 179, 276, 279, 457,570). *L.Cret.(U.Alb.)-U.Cret.(Maastr.)*.

Eopachydiscus WRIGHT, 1955 [**Pachydiscus laevicaniculatus* ROEMER in LASSWITZ, 1904]. Large, rather inflated to compressed, moderately involute; venter more or less narrowly rounded; inner whorls with frequent strong but shallow constrictions, both edges raised, and several strong, low intermediate ribs, with ribs and constrictions becoming increasingly projected on shoulders with age; innermost whorls may have slight umbilical tubercles; on outer whorls only distant barlike ribs appear on inner part of sides or none at all. Sutures have broad open minutely frilled elements and auxiliaries in regularly descending series. *U. Alb.*, Tex.——FIG. 493,*1*. **E. laevicaniculatus* (LASSWITZ), ×0.75 (653*).

Lewesiceras SPATH, 1939 [**Am. peramplus* MANTELL, 1822]. Early whorls with constrictions and ribs much as in early whorls of *Eopachydiscus* but with strong umbilical tubercles, more sinuous and persisting to a later stage; later whorls tend to become smooth, more compressed and higher-whorled; later species may have dense fine very sinuous ribs. Suture with simple and massive elements, rather less finely frilled than in *Eopachydiscus*. *U.Cenom.-Coni.*, Eu.-N.Afr.-Madag.-S. India-Mont.——FIG. 494,*1*. *L. mantelli* (WRIGHT & WRIGHT), U.Turon., Eng.; *1a,b*, ×1 (707*).

Pseudojacobites SPATH, 1922 [**P. farmeryi*] [*Rotalinites* SHIMIZU, 1935]. Offshoot of *Lewesiceras* with umbilical, ventrolateral and siphonal tubercles on periodic main ribs, with weaker intermediate ribs. *U.Turon.*, Eng.-S.India-Japan.

Pachydiscoides SPATH, 1922 [**Sonneratia janeti* DE GROSSOUVRE, 1894]. Moderately involute; whorl section nearly circular to high and oval; prominent umbilical bullae give rise to pairs of very strong,

FIG. 493. *Eopachydiscus laevicanaliculatus* (LASSWITZ), L.Cret.(U.Alb.), Tex. (p. L377).

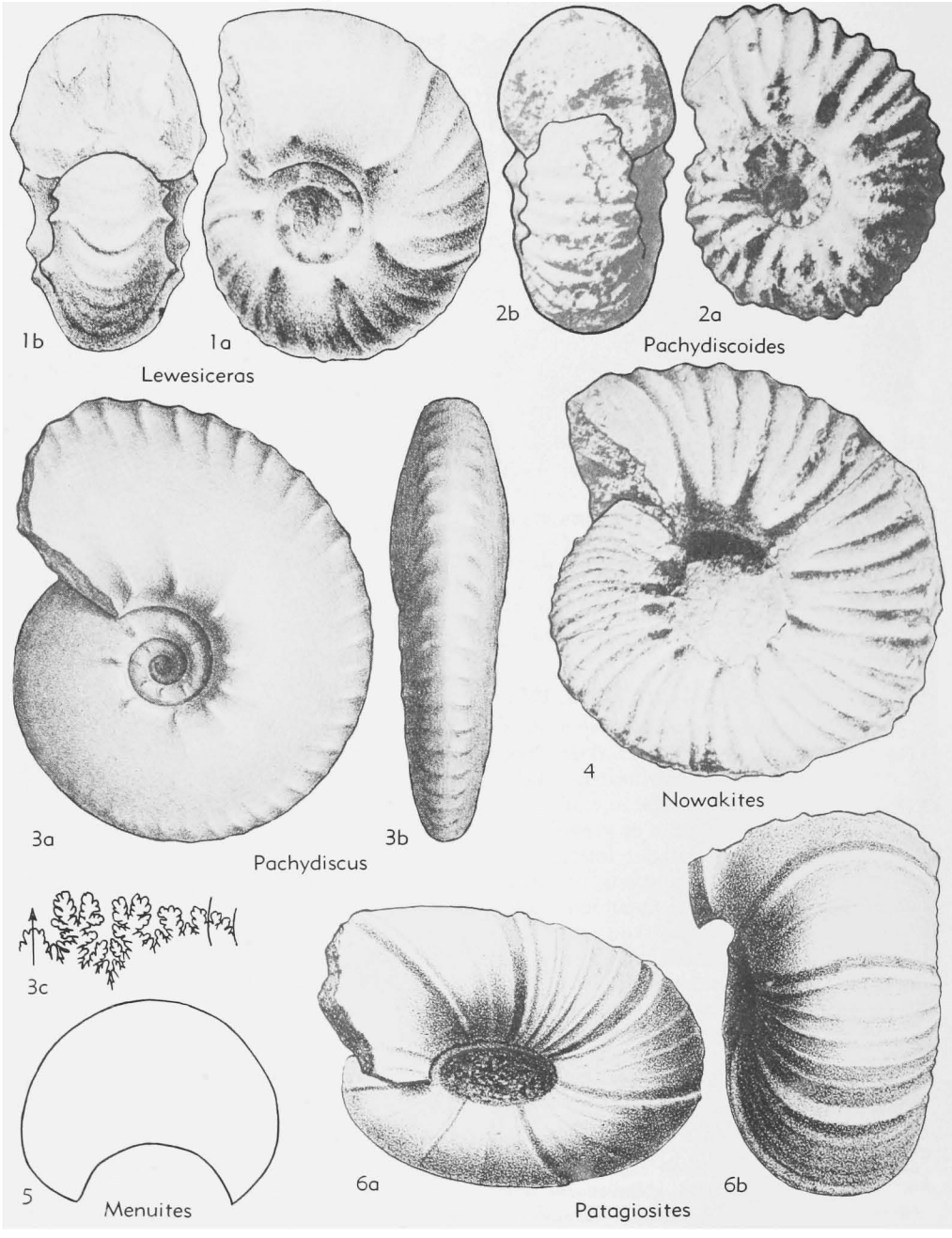


FIG. 494. Pachydiscidae (p. L377-L380).

coarse, straight ribs; a few intercalated ribs present. A direct offshoot of *Lewesiceras*. *Coni.-Santon.*, Fr.-N.Afr.-Madag.——FIG. 494,2. **P. janeti* (GROSS.), Coni., Fr.; *2a,b*, ×1 (179*).

Pseudopuzosia SPATH, 1926 [**Desmoceras marlowense* NOBLE, 1911]. Inflated offshoot probably of *Lewesiceras* with reduced ornament consisting of feeble slightly curved constrictions, weak umbilical bullae and a few faint ribs. *U.Turon., ?Coni.*, Eng.-?Fr.-?N.Afr.

Nowakites SPATH, 1922 [**Pachydiscus carezi* DE GROSSOUVRE, 1894]. Moderately involute, whorl section circular to oval; prominent sharp main ribs spring in pairs from weak umbilical bullae and

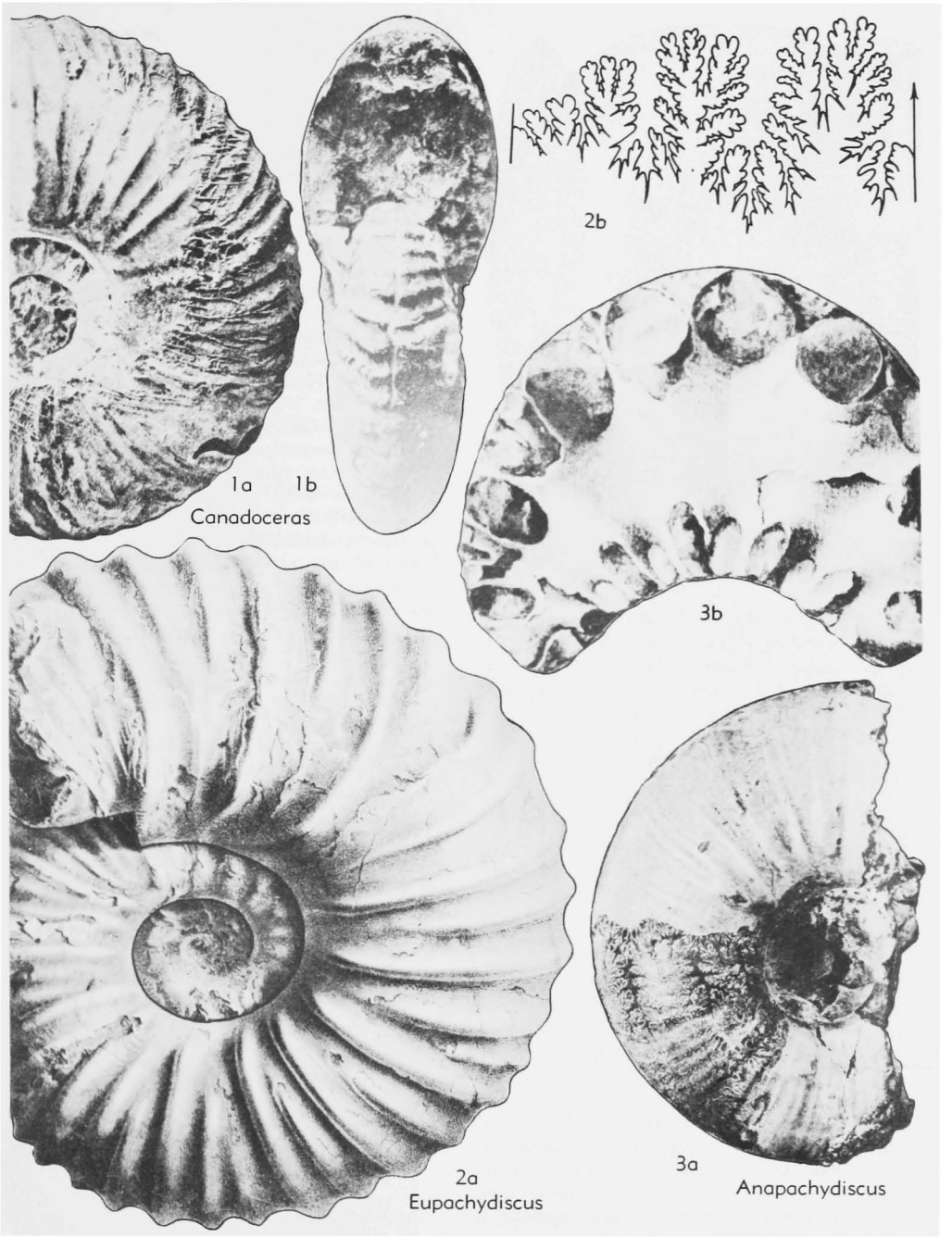


FIG. 495. Pachydiscidae (p. L379-L380).

curve forward to venter with several intercalatories of unequal length between each pair; broad shallow constrictions on inner whorls only. Suture with massive lobes. Perhaps derived from *Pseudopuzosia*. *Coni.-Santon.*, Fr.-Ger.-Aus.-S.India.——FIG. 494,*4*. **N. carezi* (GROSS.), Coni., Fr.; ×1 (179*).

Canadoceras SPATH, 1922 [**Am. newberryanus* MEEK, 1876] [*Pseudopachydiscus* YABE & SHIMIZU, 1926]. Rather evolute, more or less compressed

FIG. 496. *Menuites menu* (FORBES), U.Cret.(Camp.), S.India; *1*, ×1 (718*) (p. L380).

derivative, probably, of *Nowakites*. Strong, equal, sharp, branching or intercalated ribs begin a little above umbilical shoulder; distinct rather oblique constrictions, accompanied by collared ribs with umbilical tubercles, persist to a late stage; ornament weakens on umbilical part of outer whorl. *U.Santon.-Camp.*, Pondoland-Madag.-Japan-B.C.-Calif.-Brazil.——FIG. 495,*1*; 554,*2*. **C. newberryanum* (MEEK), Camp., B.C.; 495,*1a,b*, ×0.5 (457*); 554,*2*, ×0.75 (535*).

Patagiosites SPATH, 1954 [**Am. patagiosus* SCHLÜTER, 1862]. Distinct constrictions persist till a fairly late stage; without definite umbilical tubercles and, at least after early whorls, ribs are weak and irregular or absent. Probably a reduced derivative of *Canadoceras*. *U.Camp.-Maastr.*, NW.Eu.-Patag. ——FIG. 494,*6*. **P. patagiosus* (SCHLÜTER), Camp., Ger.; *6a,b*, distorted, ×1 (422*).

Teshioites MATSUMOTO, 1955 [**T. ryugasensis*]. Small offshoot of *Canadoceras* with ventrolateral tubercles on body chamber. *U.Camp.*, ?Fr.-Japan-Sakhalin.

Anapachydiscus YABE & SHIMIZU, 1926 [**Parapachydiscus fascicostatus* YABE, 1921] [*Neopachydiscus* YABE & SHIMIZU, 1926; *Hoepenites* COLLIGNON, 1952]. Very inflated to moderately compressed, rather involute; smooth and constricted at first, then with umbilical bullae and fine, straight or slightly curved, radial ribs; finally, ornament may disappear. In some species ribs become coarse and distant on outer whorl, which thus resembles *Eupachydiscus*. *Coni.-Maastr.*, Eu.-W.Afr.-Zululand-Madag.-S.India-Japan-N.Z.-Calif.-Mex.-Patag.-GrahamLand.——FIG. 495,*3*. **A. fascicostatus* (YABE-S.), U.Santon., Japan; *3a,b*, ×0.75 (740*).

Pachydiscus ZITTEL, 1884 [**Am. neubergicus* HAUER, 1858; SD DE GROSSOUVRE, 1894] [*Parapachydiscus* HYATT, 1900; *Epipachydiscus* YABE & SHIMIZU, 1926 *(nom. nud.)*]. Compressed and high-whorled, with oval or flat-sided section; ribs tend to differentiate into short umbilical and separate ventrolateral ribs, latter tending to be interrupted on venter; in one subgenus ribs are even more reduced. *Camp.-Maastr.*, world-wide.

P. (Pachydiscus) ZITTEL, 1884. Ribs persist. Occurrence as for genus.——FIG. 494,*3*. *P. (P.) gollevillensis* (ORB.), Camp., S.India; *3a-c*, ×0.75 (238*).

P. (Neodesmoceras) MATSUMOTO, 1947 [**P. (N.) japonicus*]. Ribs disappear early, leaving shell almost smooth. *Maastr.*, Madag.-Japan-Calif.

Menuites SPATH, 1922 [**Am. menu* FORBES, 1845] [=*Besireites* COLLIGNON, 1931]. Rather small offshoot of *Anapachydiscus*, with ornament similar to that of inner whorls of this genus until body chamber, on which are prominent rounded umbilical tubercles and (later) ventrolateral tubercles on rather irregular distant rounded ribs; aperture constricted and associated ribs lacking tubercles. *U.Santon.-Camp.*, Eu.-N.Afr.-Angola-S.India-Japan-Sakhalin.——FIG. 494,*5*; 496,*1*. **M. menu* (FORBES), Camp., S.India; ×1 (718*).

Pseudomenuites MATSUMOTO, 1955 [**Pachydiscus ambiguus* DE GROSSOUVRE, 1894]. Small offshoot of *Pachydiscus*; like *Menuites* but compressed. *Camp.*, Fr.-Ger.-S.India.

Eupachydiscus SPATH, 1922 [**Am. isculensis* REDTENBACHER, 1873] [*Mesopachydiscus* YABE & SHIMIZU, 1926]. Whorl section inflated and depressed, almost round in later whorls; early whorls have rather fine, distant, narrow but prominent ribs springing in pairs from umbilical tubercles; in mid-growth, coarse distant ribs appear which, with their umbilical tubercles, may become even stronger on last whorl. *Coni.-Camp.*, Eu.-Madag.-Japan-B.C.——FIG. 495,*2*. **E. isculensis* (REDTENBACHER), Coni., Aus.; *2a*, ×0.5; *2b*, ×0.75 (685*).

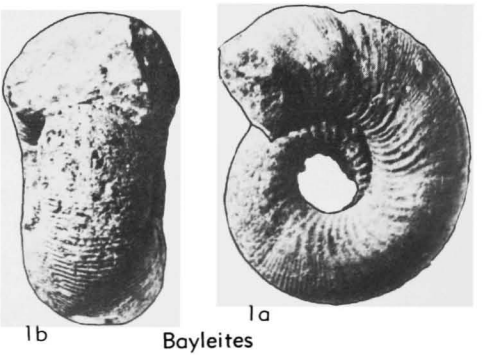


FIG. 497. *Bayleites baylei* (COLLIGNON), U.Cret. (Camp.), Fr. (p. L381).

Urakawites MATSUMOTO, 1955 [**Pachydiscus rotalinoides* YABE, 1915]. Less depressed and more strongly ribbed than *Menuites* and probably a corresponding offshoot of *Eupachydiscus*. *Camp.*, Japan-Sakhalin-B.C.-?Ger.-?Angola.

?Bayleites COLLIGNON, 1952 [**B. baylei*]. Whorl section depressed and inflated, evolute; with very fine dense prorsiradiate secondary ribs springing in bundles from fine close primaries which extend halfway up side and may form distinct bullae. Deep curved constrictions occur but they do not cut across ribs, as in Kossmaticeratidae, to which otherwise the genus might be referred. Sutures with fewer elements than is usual in Pachydiscidae. *Santon.-L.Camp.*, Fr.-S.India-Japan.——FIG. 497,*1*. **B. baylei*, Camp., Fr.; *1a,b*, ×0.45 (84*).

Family MUNIERICERATIDAE Wright, 1952

Moderately involute, with more or less fastigate whorl section and strong sinuous ribs which tend to be tuberculate at umbilical edge and on shoulders. Suture with rather shallow and coarsely denticulate elements. *Tragodesmoceras* is derived from some member of the Desmoceratinae, either *Tragodesmoceroides* or *Pseudouhligella* (179, 570). *U.Cret.(L.Turon.-Coni.)*.

Tragodesmoceras SPATH, 1922 [**Desmoceras clypealoide* LEONHARDT, 1897]. Involute, with convex or flat sides and very narrowly rounded venter; strong slightly sinuous ribs arise at umbilical edge but are not tuberculate and they cross venter; periodic enlarged ribs may be present. *L.Turon.-Coni.*, W.Eu.-Kans.——FIG. 498,*2*. **T. clypealoide* (LEONHARDT), U.Turon., Ger.; *2a,b*, ×1 (654*).

Muniericeras DE GROSSOUVRE, 1894 [**M. lapparenti*]. More evolute than *Tragodesmoceras* and without periodic enlarged ribs; ribs sharper, more distant and more strongly projected on shoulders; there are umbilical and in some cases ventrolateral tubercles; ribs may branch both at umbilicus and on shoulders; venter sharp and crenulate. *Coni.*, Fr.-Ger.-Aus.——FIG. 498,*1*. **M. lapparenti*, Coni., Fr.; *1a,b*, ×1 (179*).

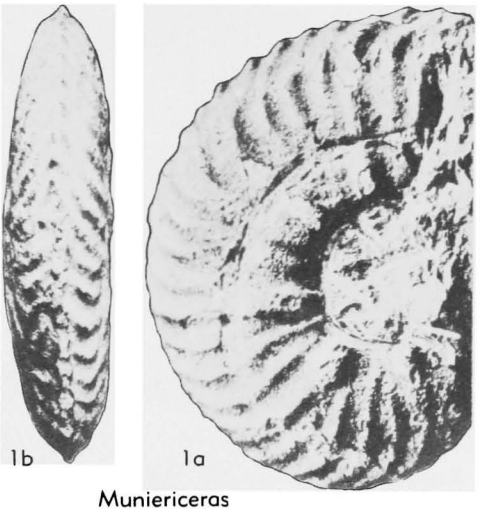


FIG. 498. Muniericeratidae (p. L381).

Superfamily HOPLITACEAE H.Douvillé, 1890

[*nom. correct.* WRIGHT & WRIGHT, 1951 (*pro* Hoplitida SPATH, 1922, *ex* Hoplitidés H.Douv., 1890, ICZN Opinion 353, 1955)]

Includes series of primary and secondary derivatives of Desmoceratidae which take on strong ornament, typically comprising branched ribs springing from umbilical tubercles. Many members are compressed, with flat or grooved venters, and most families include some such forms, but there are numerous genera with rounded venters. Sutures generally are similar throughout the superfamily, being simplified forms of desmoceratid type but a few families specialize in sutures with many adventive and auxiliary elements; some genera have entire saddles and, rarely, entire saddles and lobes (459, 570). *L.Cret.(Hauteriv.)-U.Cret.(Camp.)*.

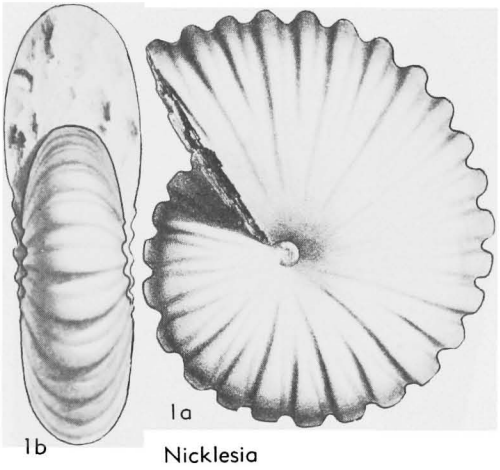


FIG. 499. *Nicklesia dumasiana* (D'ORBIGNY), L.Cret. (Barrem.), Colom. (p. L382).

Family PULCHELLIIDAE Hyatt, 1903

[=Heinziidae HYATT, 1903]

A compact group of small to moderate-sized forms, usually very involute and compressed, smooth or with broad flat ribs; venter may be rounded, flat, concave or keeled; strongly ribbed and less compressed forms may have double ventrolateral tubercles and some lateral tubercles. Suture with wide shallow feebly denticulate elements, in some ceratitic; usually with several auxiliaries. Origin doubtful but probably derived from *Barremites* of the Desmoceratidae, which may have peripheral ribbing similar to that of less extreme species of *Nicklesia* (202, 230, 378, 391). *L.Cret.(Hauteriv.-Apt.).*

Nicklesia HYATT, 1903 [**Am. dumasianus* D'ORBIGNY, 1842]. Very involute; smooth at first, later with broad flat ribs and narrower interspaces crossing the rounded or slightly flattened venter without interruption. *Barrem.*, SW.Eu.-N.Afr.-Colombia.——FIG. 499,*1*. **N. dumasiana* (ORB.), Barrem., Colombia; *1a,b*, ×0.5 (673*).

Pulchellia UHLIG, 1883 [**Am. galeatus* VON BUCH, 1839; SD GIGNOUX, 1921] [*Heinzia* SAYN, 1890; *Gerhardtia* HYATT, 1903]. Compressed, flat-sided and involute, with flat or concave venter, bordered by ventrolateral clavi formed by broad flat ribs. The type and associated species have double ventrolateral tubercles during early or middle stages, lower tubercle persisting in some to beginning of last whorl (=*Heinzia sensu* AUCTT.). Another group lacks a lower ventrolateral tubercle at any stage and its ribs are normally visible only on outer half of sides. *?U.Hauteriv., U.Barrem.*, SW.Eu.-C.Eu.-N. Afr.-?Japan-Calif.-Colombia-Chile.——FIG. 500,*5*. **P. galeata* (BUCH), Barrem., Colombia; *5a-c*, ×0.75 (673*).

Carstenia HYATT, 1903 [**Am. lindigi* KARSTEN, 1858] [*Karstenia* SAYN, 1904]. Relatively evolute and whorl section inflated at all stages; from a very small diameter there are strong ribs with prominent ventrolateral clavate and large lateral tubercles; on last part of outer whorl ribs are broader and only outermost tubercle remains. *Barrem.*, Colombia.——FIG. 500,*3*. **C. lindigi* (KARSTEN); *3a*, ×1; *3b*, ×0.75 (600*).

Coronites HYATT, 1903 [**Heinzia coronatoides* SAYN, 1890]. Only very small nuclei known. Evolute, coronate whorl section, with dense strong single and branching ribs, with or without large umbilical tubercles, and narrow groove on venter. *Barrem.*, Alg.

Subpulchellia HYATT, 1903 [**S. castellanensis*] [Incl. *Mogharaeceras* BREISTROFFER, 1940]. Very involute, compressed and flat-sided, with narrow concave venter bordered by continuous sharp ridges; surface smooth apart from irregular weak folds and striae. Suture simplifies in some species *(Mogharaeceras). Barrem.-Apt.*, Sp.-Fr.-Sinai.——FIG. 500,*1*. *S. oehlerti* (NICKLÈS), Barrem., Sp.; *1a,b*, ×2 (668*).

Psilotissotia HYATT, 1900 [**Pulchellia chalmasi* NICKLÈS, 1890]. Involute, compressed and keeled, smooth or with broad, shallow folds. *U.Hauteriv.-Barrem.*, Sp.-Fr.-Switz.-Alg.-Colombia.——FIG. 500,*2*. **P. chalmasi* (NICKLÈS), Barrem., Sp.; *2a*, ×2; *2b*, ×1.5; *2c*, ×5 (668*).

Lopholobites HYATT, 1903 [**Neolobites? cotteaui* NICKLÈS, 1894]. Differs from *Psilotissotia* in its rounded and not keeled venter and in having almost entire saddles and lobes. *Barrem.*, Sp.——FIG. 500,*4*. **L. cotteaui* (NICKLÈS); ×2 (668*).

[**Psilopulchellia** HYATT, 1903 *(nom. nud.)* was mentioned by its author as the primitive member of the family but no species were mentioned. The species selected by ROMAN, 1938, as "type" is a *Pulchellia*.]

Family TROCHLEICERATIDAE Breistroffer, 1953

Small, smooth, compressed, with grooved venter and very simple suture. As with other dwarf forms having almost goniatitic sutures, origin is obscure. The shape suggests that this family may be derived from Pulchelliidae, which includes a genus, *Lopholobites*, with similar sutures. The stratigraphical occurrence is not against this suggestion. *L.Cret.(U.Apt.-L.Alb.).*

Trochleiceras FALLOT & TERMIER, 1923 [**Waagenia (?) balearensis* FALLOT, 1920] [=*Magneticeras* COLLIGNON, 1950]. Moderately evolute, compressed, with slightly convex sides; venter narrow, flat,

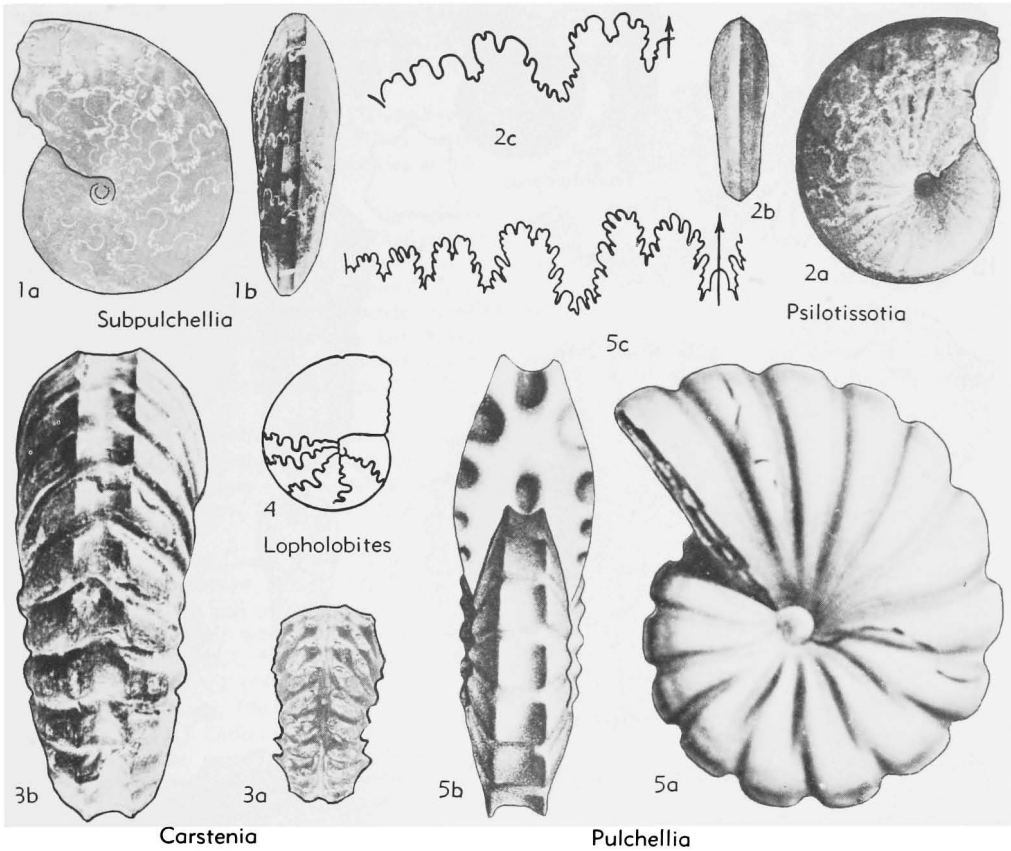


FIG. 500. Pulchelliidae (p. L382).

with rather deep groove; no ornament. Suture with shallow and very feebly indented elements. *U.Apt.-L.Alb.*, Balearics-Madag.——FIG. 501,*2*. *T. magneti* (COLLIGNON), L.Alb., Madag.; *2a,b*, ×2 (601*).

Family DOUVILLEICERATIDAE Parona & Bonarelli, 1897

Evolute, strongly ribbed forms, originally round-whorled, but developing both polygonal-whorled and compressed, high-whorled forms; umbilical, lateral or ventrolateral tubercles may arise in different stocks. The family is derived, by way of *Paraspiticeras* of the Cheloniceratinae, from *Barremites (Raspailiceras)* (459). *L.Cret.(Barrem.-M.Alb.)*.

Subfamily CHELONICERATINAE Spath, 1923

[*nom. transl.* WRIGHT, herein (*ex* Cheloniceratidae SPATH, 1923)]

More or less evolute, with whorl section from more or less oval to circular or depressed, or angular with flat or even concave venter; strong well-rounded ribs, with or without umbilical, lateral or ventrolateral bullate or spinate tubercles, are characteristic. Suture simpler than that of the presumed desmoceratid ancestors, with which the family is linked by *Paraspiticeras*. The limited resemblance of some of this subfamily to *Cicatrites*, of the Lytoceratacea, is not regarded as significant (75, 459). *L.Cret.(Barrem.-U.Apt.)*.

Paraspiticeras KILIAN, 1910 [**Am. percevali* UHLIG, 1883; SD SPATH, 1921]. Evolute, with round or depressed, rapidly enlarging whorls; strong rounded ribs crossing venter with slight forward bend have more or less prominent lateral tubercles and in some forms umbilical tubercles on inner whorls and tend to weaken on the outer. *Barrem.*, Fr.-Aus.——FIG. 504,*3*. **P. percevali* (UHLIG), Aus.; *3a,b*, ×0.5 (530*).

Procheloniceras SPATH, 1923 [**Am. stobieckt* D'ORBIGNY, 1850]. Rather evolute, oval to round

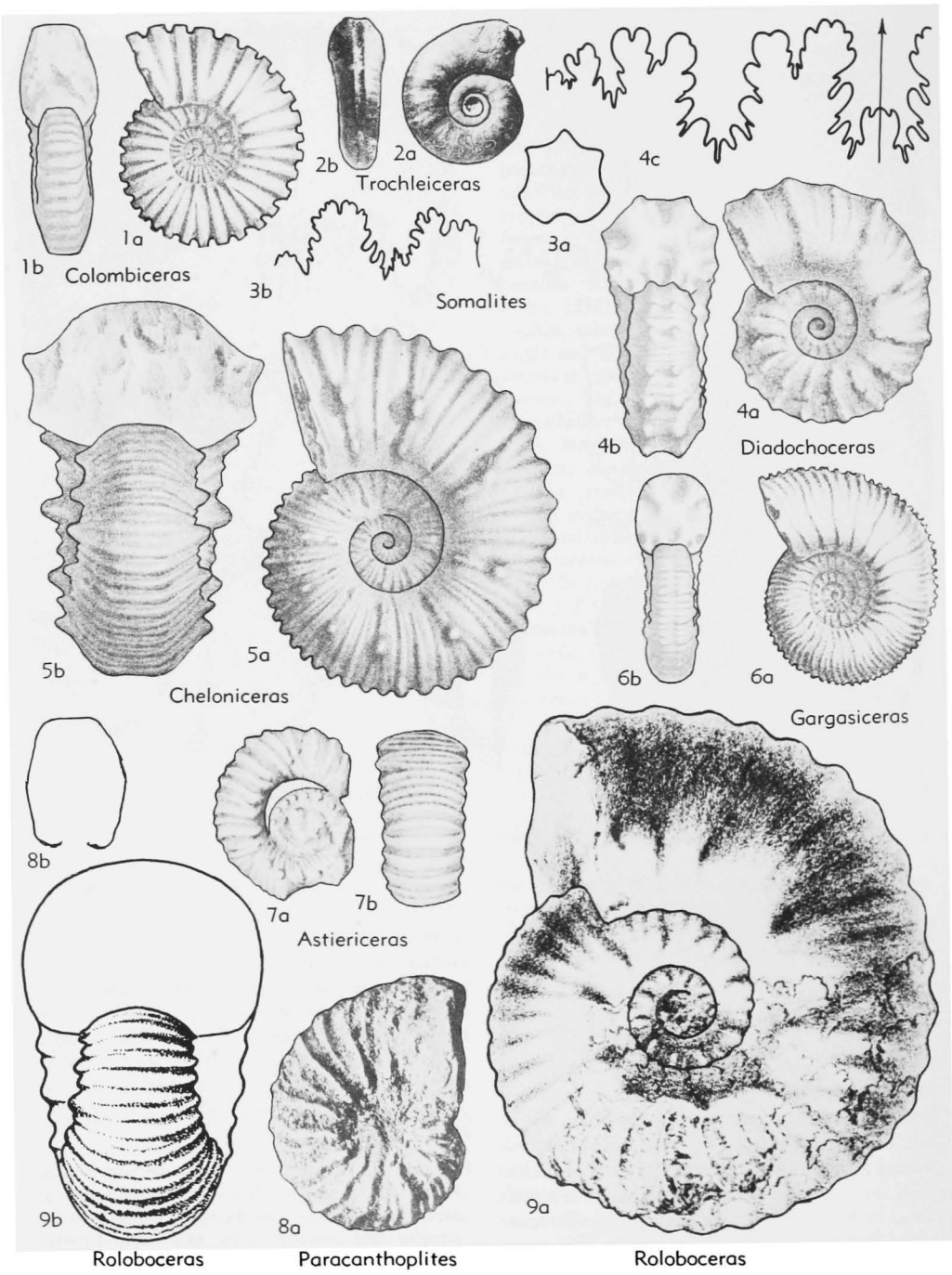


FIG. 501. Trochleiceratidae, Douvilleiceratidae (p. L382-L387).

whorl section, enlarging less rapidly than *Paraspiticeras;* with fairly equal ribs which branch either at umbilical or lateral tubercles that later disappear. *L.Apt.-U.Apt.,* W.Eu.-C.Eu.-?Tex.——

FIG. 502,*1. P. albrechtiaustriae* (UHLIG *ex* HOHENEGGER MS), L.Apt., Fr.; ×0.3 (229*).

Roloboceras CASEY, 1954 [**Am. hambrovi* FORBES, 1845]. Whorl section semicircular; thick blunt

ribs tend to form large bulges where they branch at umbilical edge. *L.Apt.*, NW.Eu.——Fig. 501,*9*. **R. hambrovi* (Forbes), L.Apt., Eng.; *9a,b*, ×0.7 (620*).

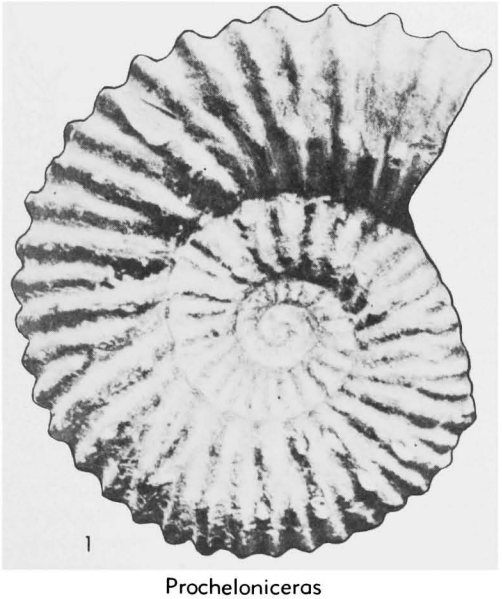
Megatyloceras Humphrey, 1949 [**Douvilleiceras coronatum* Rouchadzé, 1933]. Whorl section coronate, with single very large tubercles at mid-side. *U.Apt.*, Fr.-Georgia.

Cheloniceras Hyatt, 1903 [**Am. cornuelianus* d'Orbigny, 1841 (ICZN pend.)]. Whorl section slightly compressed to depressed; venter flat or concave with angular shoulders; umbilical, lateral and in some forms ventrolateral tubercles present from an early stage on major ribs; later whorls normally with all ribs equal and nontuberculate. *U.Apt.*, Eu.-E.Afr.-S.Afr.-Sinai-Persia-Calif.-Tex.-Mex.-S.Am.

C. (Cheloniceras). Umbilical and lateral tubercles only; shoulders angulate but not tuberculate. Occurrence as for genus.——Fig. 501,*5*. **C. (C.) cornuelianum* (Orb.), U.Apt., Fr.; *5a,b*, ×0.75 (329*).

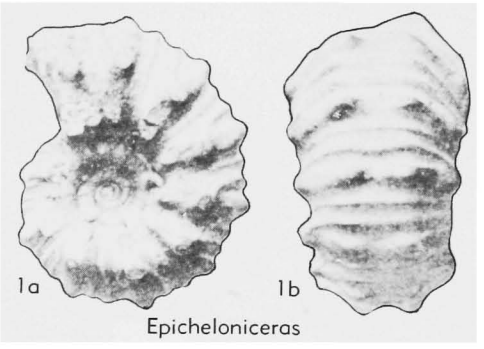
C. (Epicheloniceras) Casey, 1954 [**Douvilleiceras tschernyschewi* Sinzow, 1906]. Major ribs depressed on siphon and with distinct ventrolateral tubercles until later whorls. Occurrence as for genus.——Fig. 503,*1*. **C. (E.) tschernyschewi* (Sinzow); *1a,b*, ×1 (447*).

Diadochoceras Hyatt, 1900 [**Am. nodosocostatus* d'Orbigny, 1841]. Differs from *Epicheloniceras* by greater evolution, round intercostal whorl section and dominance of tubercles over ribs. *U.Apt.*, W. Eu.-Tangan.-Japan-Mex.——Fig. 501,*4*. **D. nodosocostatum* (Orb.), U.Apt., Fr.; *4a,b*, ×1; *4c*, enlarged (329*).



Procheloniceras

Fig. 502. *Procheloniceras albrechtiaustriae* (Uhlig), L.Cret.(L.Apt.), Fr. (p. L383).



Epicheloniceras

Fig. 503. *Cheloniceras (Epicheloniceras) tschernyschewi* (Sinzow), L.Cret.(U.Apt.), Eu. (p. L385).

?Somalites Tavani, 1949 [**S. vertebralis*]. Evolute; slightly flexuous plain ribs at first, later some tuberculate, finally all with large umbilical, ventrolateral and siphonal tubercles. Possibly a parallel development to *Diadochoceras*. *U.Apt.*, Somali.——Fig. 501,*3*. **S. vertebralis; 3a*, ×1; *3b*, ×2 (723*).

Subfamily PARAHOPLITINAE Spath, 1922

[*nom. transl.* Roman, 1938 (*ex* Parahoplitidae Spath, 1922)]

Moderately evolute, with oval or rectangular whorl section; strong, more or less straight ribs, uninterrupted over venter, alternately long and short or in some forms branching at faint umbilical swellings; no distinct tubercles. Suture with asymmetric 1st lateral lobe (3, 500). *L.Cret.(U.Apt.).*

Parahoplites Anthula, 1899 [**P. melchioris*]. Whorl section oval to subquadrate, widest near umbilicus; ribs slightly sinuous throughout, bending distinctly forward on venter; ornament may weaken or disappear on body chamber. *U.Apt.*, Eu.-TransCaspia-Persia.——Fig. 504,*1*. **P. melchioris*, U.Apt., Cauc.; *1a-c*, ×1 (581*).

Kazanskyella Stoyanow, 1949 [**K. arizonica*] [?=*Sinzowiella* Stoyanow, 1949]. Differs from *Parahoplites* in its more rigid ribbing and wide, very asymmetric 1st lateral lobe of suture. *U.Apt.*, Cauc.-Japan-Ariz.

Subfamily ACANTHOHOPLITINAE Stoyanow, 1949

Whorl section may be coronate or depressed at early stages but later is as in Parahoplitinae; early whorls with strong umbilical or lateral tubercles, primary ribs typically branching at latter; later whorls without tubercles or with umbilical tubercles only; ribs generally straight on early whorls and sinuous later. Suture with more or less symmetrical 1st lateral lobe (75, 437, 500). *L.Cret.(U.Apt.-L.Alb.).*

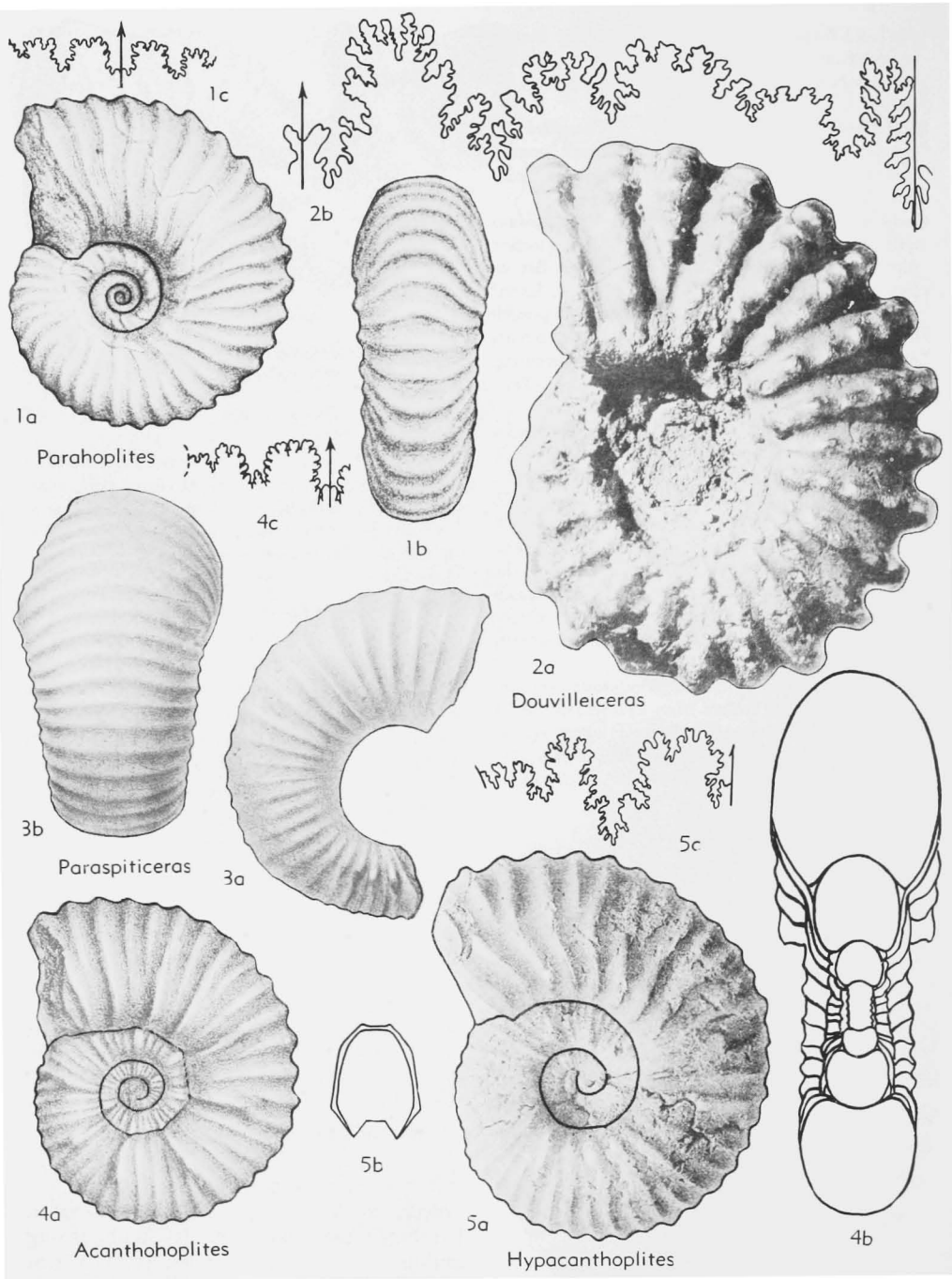


FIG. 504. Douvilleiceratidae (p. L383-L387).

Acanthohoplites SINZOW, 1907 [**Parahoplites aschiltaensis* ANTHULA, 1900; SD SPATH, 1921]. Early whorls coronate and as in *Cheloniceras*, later round, then oval in section; primary ribs with or without umbilical bullae, at first branching at prominent lateral tubercles which later disappear, ribs then branching at umbilical edge alone or at mid-flank also. *U.Apt.-L.Alb.*, Eu.-TransCaspia-E.Afr.-Japan-

Calif.-Ariz.-Mex.——Fig. 504,*4*. **A. aschiltaensis* (Anthula), U.Apt., Cauc.; *4a-c*, ×1; *4b*, ×0.5 (581*).

Paracanthoplites Stoyanow, 1949 [**P. meridionalis*]. Early whorls round, not coronate, later polygonal, with strong single primary ribs angulate at umbilical and ventrolateral shoulders and with strong lateral tubercles; 1 to 3 intercalatories. *L.Alb.*, Tex.——Fig. 501,*8*. **P. meridionalis*; *8a,b*, ×1 (500*).

Hypacanthoplites Spath, 1923 [**Am. milletianus* var. *plesiotypicus* Fritel, 1906] [*?Immunitoceras* Stoyanow, 1949]. Outer whorls compressed, high, with flat sides and venter, normally with long and short, fine to coarse but not flattened, straight or slightly sinuous ribs; strong or weak umbilical, ventrolateral and rarely later, bullate or spinate tubercles. *L.Alb.*, Eu.-Ariz.-Mex.——Fig. 504,*5*. **H. plesiotypicus* (Fritel), L.Alb., Ger.; *5a,b*, ×1; *5c*, ×2 (600*).

Rhytidohoplites Scott, 1939 [**R. robertsi*]. Outer whorls with distant sinuous primary ribs separated by 2 or 3 intercalatories on outer 3rd only of side. *L.Alb.*, Tex.

Quitmannites Scott, 1939 [**Q. ceratitosus*]. Very evolute; whorl section round. First lateral lobe of suture very wide and rounded with 6 finger-like folioles. *L.Alb.*, Tex.

[**Cuchillites** Scott, 1939 [**C. evolutus*]. Unrecognizable. *L.Alb.*, Tex.]

Gargasiceras Casey, 1954 [**Am. gargasensis* d'Orbigny, 1841]. Rather evolute; sides and venter flat, umbilical margins and shoulders rounded; ribs thin on sides, tending to be flattened on venter; on inner whorls major ribs raised into thin flange, above which ribs branch at a minute tubercle; ribs depressed on siphon; later ribs more uniform and venter rounded. *U.Apt.*, Fr.-Mex.-Peru-Colombia.——Fig. 501,*6*. **G. gargasense* (Orb.), U.Apt., Fr.; *6a,b*, ×1 (329*).

Colombiceras Spath, 1923 [**Am. crassicostatus* d'Orbigny, 1841]. Early whorls with sharp lateral tubercles and flat ribs angulate at shoulders; later whorls compressed, with flat sides and venter; ribs single or branching, with flat tops and steep sides and narrow interspaces. *U.Apt.*, Fr.——Fig. 501,*1*. **C. crassicostatum* (Orb.); *1a,b*, ×1 (329*).

Subfamily DOUVILLEICERATINAE Parona & Bonarelli, 1897

[*nom. transl.* Wright, 1955 (*ex* Douvilleiceratidae Parona-B., 1897)] [?Incl. Astiericeratidae Breistroffer, 1953]

Evolute or even uncoiling, with round, depressed or polygonal whorl section; ribs at early stage tuberculate, as in *Epicheloniceras* from which the subfamily is derived, then typically multituberculate, tubercles in some cases very large but sooner or later disappearing so as to leave ribs on outer whorls of some Parahoplitinae. *Astiericeras* is here regarded as an aberrant offshoot of *Douvilleiceras*, although it is peculiar and has been given family rank (459). *L.Cret. (L.Alb.-M.Alb.)*.

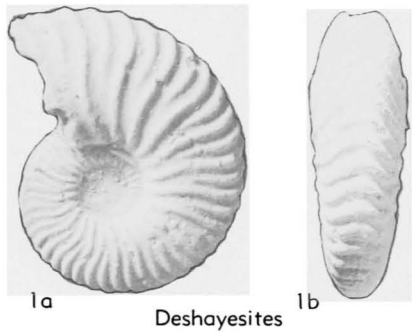


Fig. 505. *Deshayesites deshayesi* (d'Orbigny), L. Cret.(L.Apt.), Fr.; *1a,b*, ×1 (598a) p. L388).

Douvilleiceras de Grossouvre, 1894 [**Am. mammillatus* Schlotheim, 1813 (ICZN pend.)] [*Trinitoceras* Scott, 1940]. Round, polygonal or depressed whorl section; ribs at first with strong umbilical and ventrolateral tubercles, then with numerous tubercles of equal or varying strength, which are later lost. *L.Alb.-M.Alb.*, Eu.-Sinai-Madag.-India-USA-Peru-Colombia.——Fig. 504,*2a*. **D. mammillatum* (Schloth.), L.Alb., Eng.; ×1 (459*).——Fig. 504,*2b*. *D. monile* (J.Sow.), L. Alb., Eng.; ×3.5 (459*).

Astiericeras Parona & Bonarelli, 1896 [**Scaphites astierianus* d'Orbigny, 1850]. At first with umbilical and ventrolateral tubercles; then, after nontuberculate stage, large round lateral tubercles appear, emphasizing the coronate section; these suddenly cease and the shell ends in a hook, transversely oval in section, with strong, nearly straight, slightly rursiradiate ribs, simple or branching from umbilical tubercles. Suture with all elements of about equal size. *Low.M.Alb.*, Fr.——Fig. 501,*7*. **A. astierianum* (Orb.); *7a,b*, ×1 (334*).

Family DESHAYESITIDAE Stoyanow, 1949

[*nom. transl.* Wright, 1955 (*ex* Deshayesitinae Stoyanow, 1949)]

Typically compressed, with whorl section much higher than wide; strong branching or long and short ribs cross venter, or in later forms with flat venter these may be interrupted; tubercles rarely present. Suture tending to simplify, with shallow rounded elements. The family probably is derived in late Barremian from *Callizoniceras* in which the whorl section has heightened and the strong ribs become more regular (500, 570). *L.Cret.(L.Apt.-U.Apt.)*.

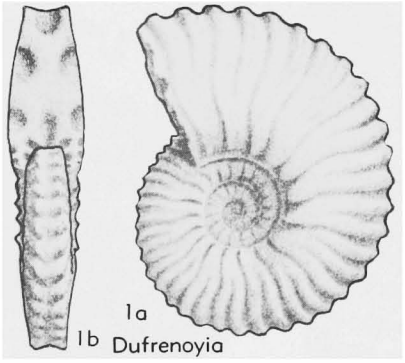


FIG. 506. *Dufrenoyia dufrenoyi* (D'ORBIGNY), L. Cret.(U.Apt.), Fr. (p. L388).

Deshayesites KAZANSKY, 1914 [**Am. deshayesi* LEYMERIE in D'ORBIGNY, 1841] [*Parahoplitoides* SPATH, 1922 (obj.)]. Rather evolute, compressed, more or less oval or subrectangular; ribs may be raised at umbilical edge but are nontuberculate. *L.Apt.-U.Apt.*, Eu.-Queensl.-Calif.-Mex.-Greenl.——FIG. 505,*1*. **D. deshayesi* (ORB.), L.Apt., Fr.; *1a,b*, ×1 (598a).

Dufrenoyia BURCKHARDT in KILIAN, 1915 [**Am. furcatus* J.DEC.SOWERBY, 1831] [=*Dufrenoya* KILIAN, 1915; *Stenhoplites* SPATH, 1922]. Compressed, with flat sides and venter; ribs more or less sinuous, fine or coarse, commonly broad and flat, branching or long and short, interrupted on venter or not but raised at least in some growth stage into more or less distinct clavi on shoulder. Derived directly from *Deshayesites*. *U.Apt.*, Eu.-Tex.-Mex.——FIG. 506,*1*. *D. dufrenoyi* (ORB.), U.Apt., Fr.; *1a,b*, ×1 (329*).

Burckhardtites HUMPHREY, 1949 [**Neocomites nazasensis* BURCKHARDT, 1925]. Differs from *Dufrenoyia* in more rapid increase of whorl height and fine irregular biconcave ribs. *U.Apt.*, Mex.

Cloioceras WHITEHOUSE, 1927 [**Hoplites ruspolii* MAYER-EYMAR, 1893]. Differs from more strongly ribbed species of *Deshayesites* by its sharper and thinner simple ribs, which are raised into slight upper and lower ventrolateral tubercles. *U.Apt.*, Somali.

Family ENGONOCERATIDAE Hyatt, 1900

[Incl. Knemiceratidae HYATT, 1903]

Typically compressed, more or less flat-sided and involute, with venter flat at least in some stage; single or branching irregular ribs may occur and umbilical, lateral or ventrolateral tubercles. Suture with numerous auxiliary and adventive elements, saddles tending to simplify, being characteristically entire; more strongly ornamented forms give rise to a succession of very compressed smooth forms with narrow bicarinate venters. Not all smooth offshoots have been described and they are difficult to distinguish morphologically. Some genera show great resemblance to Pulchelliidae, but there is probably no direct connection, the Engonoceratidae being derived from Deshayesitidae perhaps (202, 233, 339, 459). *L.Cret.(L. Alb.)-U.Cret.(L.Turon.)*.

Knemiceras BÖHM, 1898 [**Am. syriacus* VON BUCH, 1848] [*Cnemioceras* (obj.), *Cnemidoceras* (obj.) HAUG, 1900; includes *Glottoceras* HYATT, 1875 (*non Glossoceras* BARRANDE, 1865) ICZN pend.]. Compressed to moderately inflated, sides flat and parallel or converging to narrow venter, which is flat or slightly concave; ribs moderately to very strong, rather sparse, rounded or flat, springing in 1's or 2's from prominent umbilical tubercles; ribs may branch again at mediolateral tubercles and end in ventrolateral clavi or cross venter. Suture commonly irregular with frilled lobes and slightly frilled saddles, rarely with some entire. *?L.Alb., M.Alb.-U.Alb.*, SW.Eu.-N.Afr.-Syria-Arabia-Persia-Ecuador-Colombia-Peru.——FIG. 507,*1*. **K. syriacum* (BUCH), U.Alb., Syria; *1a,b*, ×1 (585*).

Parengonoceras SPATH, 1924 [**Am. ebrayi* DELORIOL, 1882]. Usually with convex sides and rounded venter from an early stage; distinct but irregular sharp ribs have 3 or 4 rows of tubercles. Suture with many deep and narrow frilled and commonly bifid saddles. *L.Alb.-M.Alb.*, Eng.-Fr.-Venez.-Colombia-Peru.——FIG. 501,*1*; 554,*4*. **P. ebrayi* (LORIOL), M.Alb., Fr.; 508,*1a,b*, ×0.25; 554,*4*, ×1 (656*).

Engonoceras NEUMAYR & UHLIG, 1887 [**Am. pierdenalis* VON BUCH, 1849] [*?Engonhoplitoides* BASSE, 1940]. Involute; inner whorls very compressed with narrow flat or sulcate venter; later flexuous striae are normally replaced by weak flat flexuous or straight ribs which end in small ventrolateral clavi placed alternately and in some shells joined across venter by zigzagging ribs; umbilical and lateral tubercles may be present and venter of last whorl may be rounded. Suture has more elements than *Knemiceras* and saddles normally are all entire; external lobe normally has strongly divergent branches. *M.Alb.-Cenom.*, Eng.-Fr.-N.Afr.-Syria-USA-Mex.-Colombia.——FIG. 507,*2*. *E. serpentinum* (CRAGIN), U.Alb., Tex.; *2a-c*, ×1 (202*).

Protengonoceras HYATT, 1903 [**Engonoceras gabbi* BÖHM, 1898]. Like *Engonoceras* but lacking tubercles at any stage and having ribs only on body chamber. *M.Alb.*, Tex.——FIG. 509,*1*. **P. gabbi* (BÖHM); *1a,b*, ×0.75 (202*).

Metengonoceras HYATT, 1903 [**M. inscriptum* HYATT, 1903; SD ROMAN, 1938]. Only very weak ribs and ventrolateral tubercles rarely present; ven-

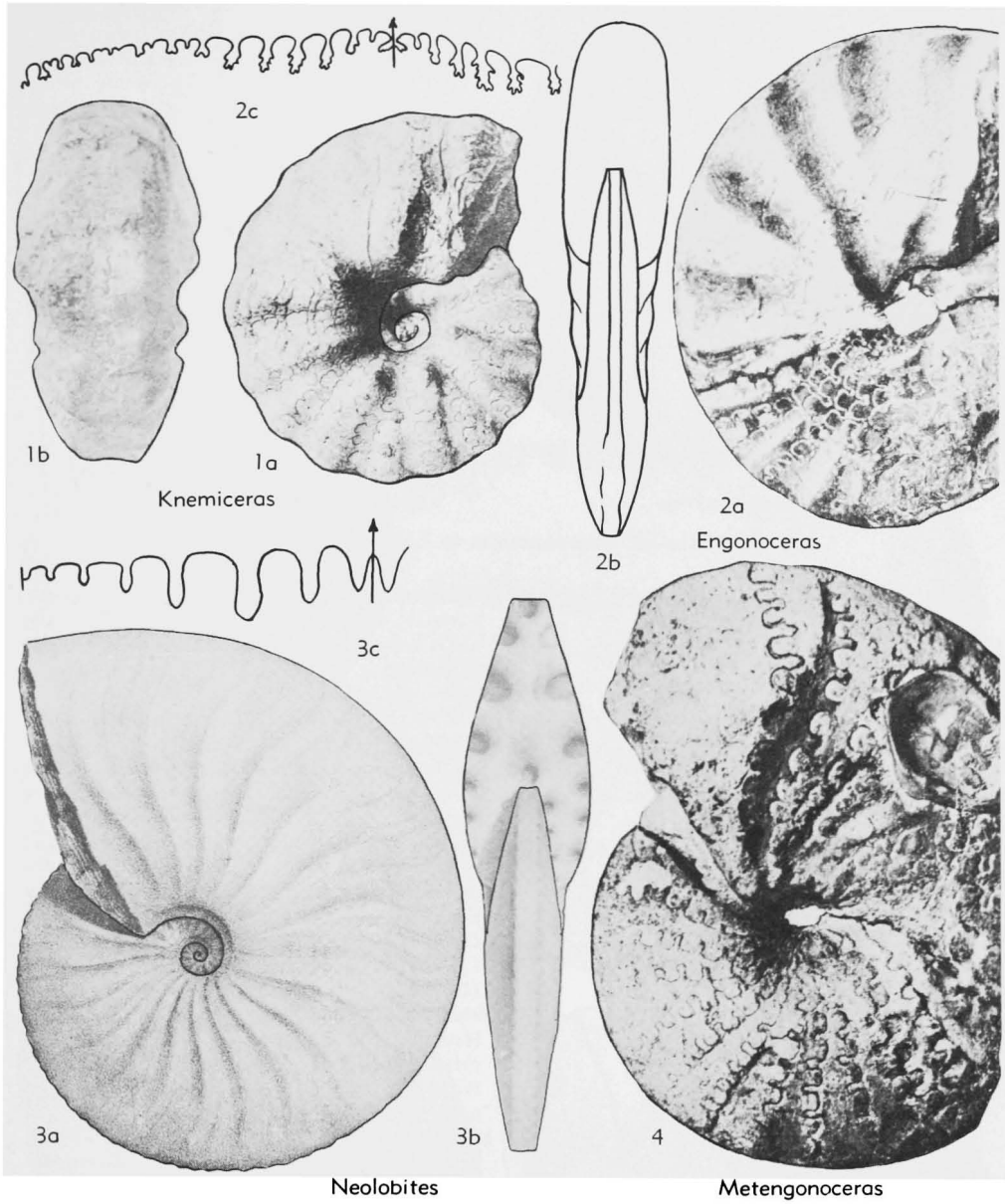


FIG. 507. Engonoceratidae (p. L388-L389).

ter fairly broad at first but soon narrowing until it is acute on cast, though still with very narrow flat or concave area on shell; venter finally becomes rounded. *U.Alb.*, Tex.——FIG. 507,*4*. **M. inscriptum* (HYATT), ×1 (202*).

Epengonoceras SPATH, 1924 [**Sphenodiscus dumbli* CRAGIN, 1893]. Doubtfully distinct from *Metengonoceras*, but with greater involution and compression. *Cenom.-L.Turon.*, Fr.-W.Afr.-Tex.——FIG. 508,*2*. **E. dumbli* (CRAGIN), Cenom., Tex.; *2a,b*, ×1 (202*).

Neolobites FISCHER, 1882 [**Am. vibrayeanus* D'ORBIGNY, 1841]. Has shape of *Engonoceras* but may be much less involute. Suture has fewer elements and entire saddles and lobes. *Cenom.*, Fr.-N.Afr.-Syria-Arabia-Peru.——FIG. 507,*3*. **N. vibrayeanus* (ORB.), Cenom., Fr.; *3a,b*, ×0.75; *3c*, enlarged (329*).

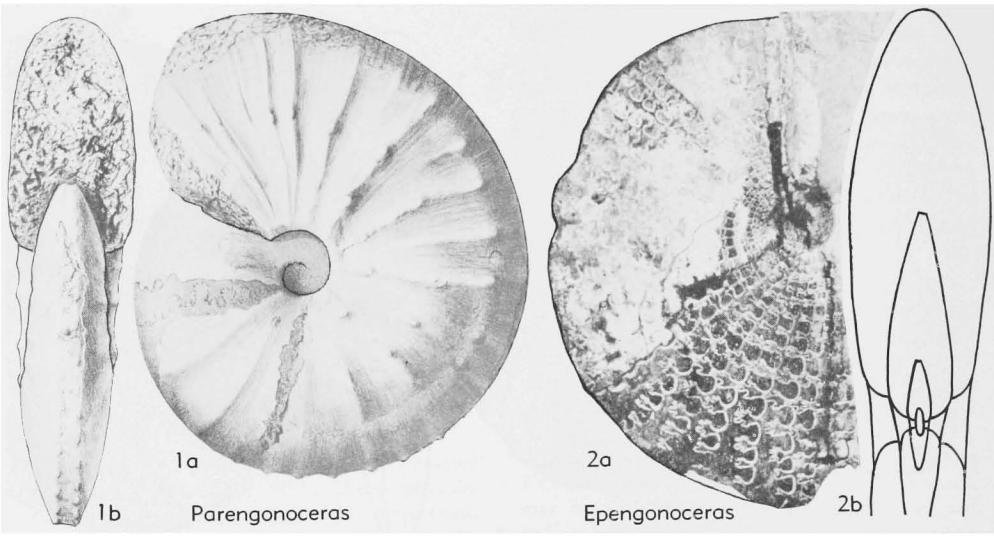


FIG. 508. Engonoceratidae (p. L388-L389).

Family PLACENTICERATIDAE Hyatt, 1900

Moderate-sized to large, compressed, rather involute forms with narrow flat or grooved venters at least on early whorls; ornament absent or weak except in a few rather evolute forms which develop strong tuberculation on outer whorls. Suture with adventive and auxiliary elements, saddles and lobes being typically deep, narrow-necked and much-frilled. The earliest genus, *Hypengonoceras,* is very close to *Knemiceras* and *Parengonoceras* of the Engonoceratidae, from which it is derived (202, 363, 465). *L. Cret.(U.Alb.)-U.Cret.(Maastr.).*

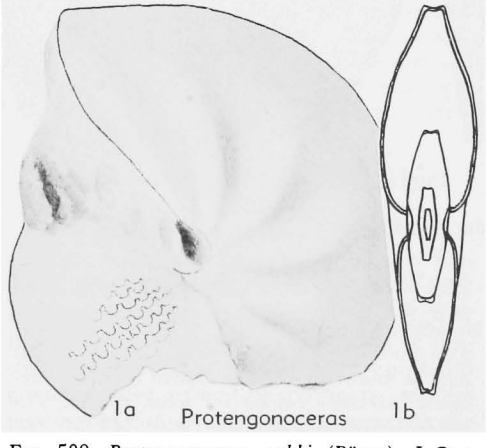


FIG. 509. *Protengonoceras gabbi* (BÖHM), L.Cret. (M.Alb.), Tex. (p. L388).

Hypengonoceras SPATH, 1822 [**Placenticeras warthi* KOSSMAT, 1895]. Involute, with sloping flat sides and narrow flat venter; sparse low falcoid ribs end in alternating ventrolateral clavi. Suture has large, pincer-like bifid folioles. *U.Alb.,* Madag.-S.India. ——FIG. 510,*2*. **H. warthi* (KOSSMAT), U.Alb., S.India; ×0.75 (238*).

Proplacenticeras SPATH, 1926 [**Placenticeras fritschi* DEGROSSOUVRE, 1894]. Compressed, with flat or slightly convex sides and narrow flat venter; nearly smooth, with or without slight conical umbilical tubercles and ventrolateral clavi and crescentic ribs on outer part of sides. Suture with fewer auxiliary elements than in the later *Placenticeras. Cenom.-Coni.,* Fr.-C.Eu.-Turkestan-Mex.-Tex.——FIG. 510, *1*. **P. fritschi* (GROSS.), Coni., Fr.; *1a-c,* ×1 (179*).

Pseudoplacenticeras SPATH, 1926 [**Am. milleri* HAUER, 1866]. Moderately evolute, with sinuous striae and distant ventrolateral clavi. Differs from *Proplacenticeras* mainly in having no umbilical tubercles or outer crescentic ribs. *Coni.,* Aus.

Metaplacenticeras SPATH, 1926 [**Placenticeras pacificum* J.P.SMITH, 1900] [Incl. *Paraplacenticeras* MATSUMOTO, 1953]. Compressed and flat-sided; with rather strong falcoid or falcate ribs; venter distinctly tricarinate, at least in middle growth. Line of suture follows that of the ribs. *?Santon., Camp.,* Japan-Calif.——FIG. 510,*3*. **M. pacificum* (J.P.SMITH), Calif.; *3a,b,* ×0.75; *3c,* ×1 (686*).

Placenticeras MEEK, 1870 [**Am. placenta* DEKAY, 1828]. Very involute, with slightly convex sides and very narrow venter; smooth or with faint falcoid ribs; umbilical tubercles of early whorls move up to mid-sides on later whorls; normally with lower and fine upper ventrolateral clavi; ornament weakens in adult and last whorl may be

smooth and with narrowly rounded venter. Suture with many auxiliaries. *U.Santon.-L.Camp.*, Fr.-Ger.-Pol.-Madag.-S.India-USA-Mex.——Fig. 510, *6*. **P. placenta* (DeKay), N.J.; *6a,b*, ×1 (202*).

Stantonoceras Johnston, 1903 [**S. pseudocostatum*]. Inner whorls as in *Placenticeras* but outer whorls evolute, square in section, with broad venter and very prominent lateral and ventrolateral spinose tubercles, with peripheral rows disappearing in some on last whorl. *U.Santon.-L.Camp.*, Fr.-Ger.-USA-Mex.——Fig. 510,*4*; 511,*1*. *S. guadeloupae* (Roemer), Camp., Tex.; all ×0.5 (691*).

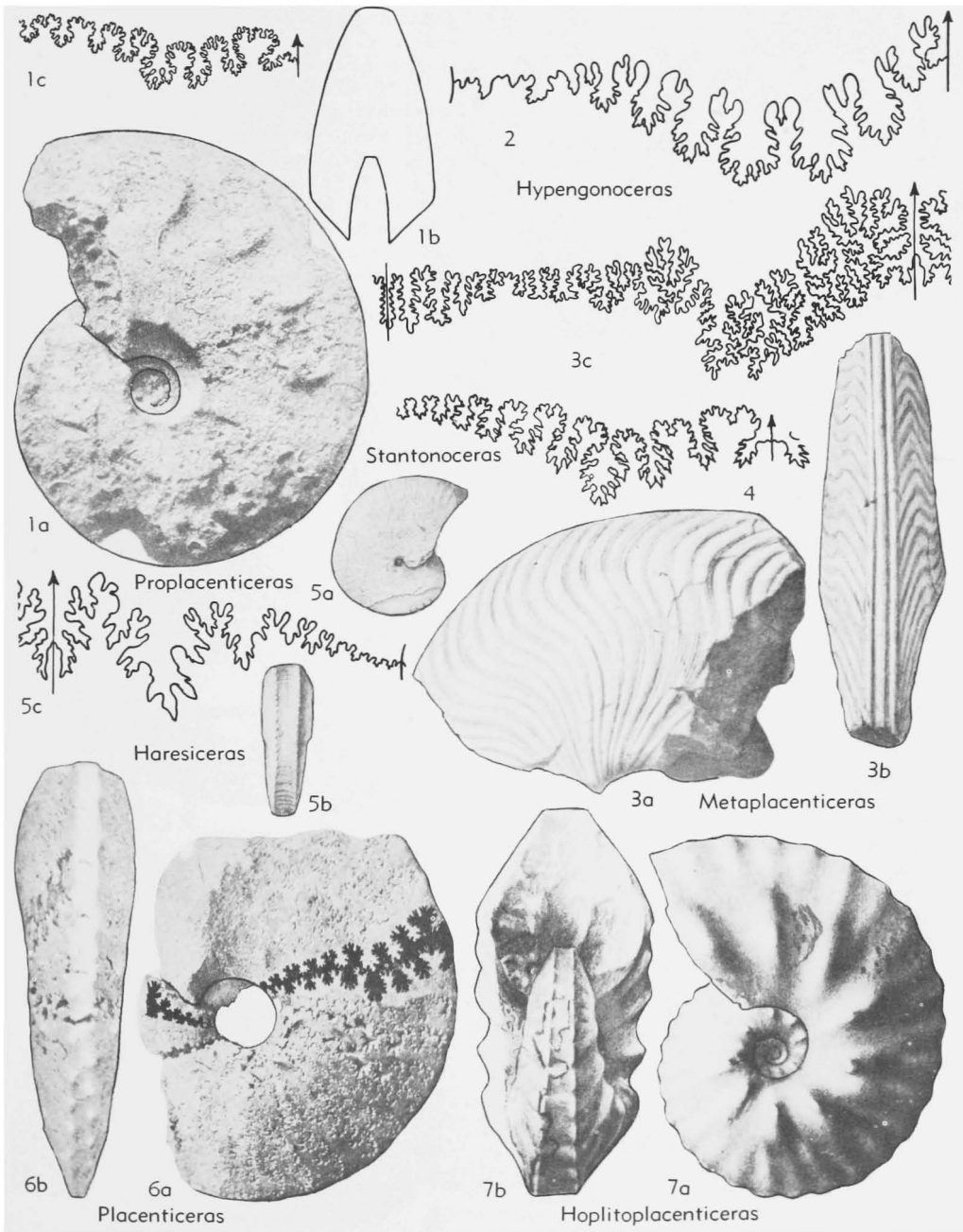


Fig. 510. Placenticeratidae (p. L390-L392).

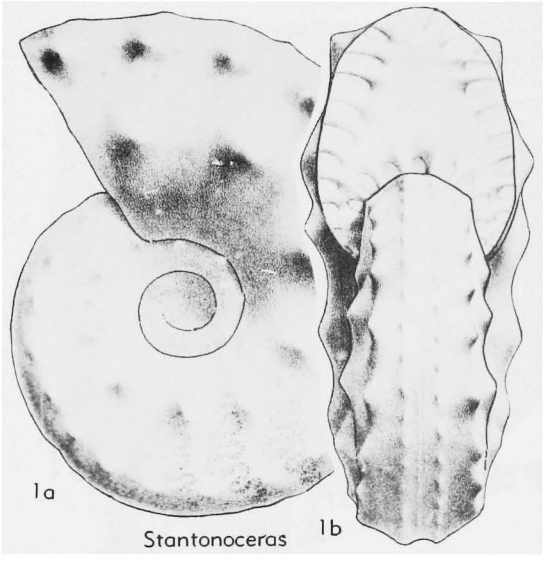


FIG. 511. *Stantonoceras guadeloupae* (ROEMER), U. Cret.(Camp.), Tex.; *1a,b,* ×0.5 (691*) (p. L391).

Diplacmoceras HYATT, 1900 [**Am. bidorsatus* ROEMER, 1841]. Venter very narrow and grooved; nearly smooth until last whorl on which are sparse ventrolateral tubercles, conical at first, later large, ear-shaped and moving up till they are level with venter. *L.Camp.,* Fr.-Ger.——FIG. 483,*2*. **D. bidorsatum,* Ger.; *2a,b,* ×0.75 (MULLER & WOLLEMANN).

Haresiceras REESIDE, 1927 [**H. placentiforme*]. Small, very involute, with high rectangular whorls, sides flat and parallel, converging slightly in their outer part toward the flat or concave venter, bordered by rows of fine rounded nodes; ribs more or less fine, slightly sinuous, crossing venter transversely. Suture with deep asymmetrical 1st lateral lobe. *U.Santon.,* Wyo.——FIG. 510,*5*. **H. placentiforme; 5a,b,* ×1; *5c,* ×2 (363*).

Hoplitoplacenticeras SPATH, 1922 (*ex* PAULCKE, 1906) [**H. plasticus* (ICZN pend.)] [*Dechenoceras* KAYSER, 1924]. Rather evolute for family; whorl section compressed to trapezoidal, venter flat; with prominent variable coarse rounded or dense fine ribs, nearly straight, bearing 2 rows of ventrolateral tubercles, of which outer row may be large and clavate; ribs cross venter transversely and may have trace of a siphonal tubercle. Genus is probably too widely drawn. *L.Camp.-Maastr.,* Fr.-Ger.-W. Afr.-Egypt-Madag.-B.C.-Tex.-Patag.——FIG. 510,*7*. **H. plasticus,* Camp., Patag.; *7a,b,* ×0.75 (677*).

Family LEYMERIELLIDAE Breistroffer, 1951

[*nom. transl.* WRIGHT, 1955 (*ex* Leymeriellinae BREISTR. 1951)]

Rather small, mainly compressed forms distinguished from Hoplitidae by their flattened and grooved ribs and virtual absence of umbilical tubercles. Derived from the desmoceratid *Callizoniceras* (50, 57, 214, 459). *L.Cret.(L.Alb.-Low.M.Alb.).*

Proleymeriella BREISTROFFER, 1947 [**Parahoplites schrammeni* JACOB, 1907]. Oval whorl section; simple strong ribs pass over narrowly rounded or even acute venter forming chevrons on it; constrictions present throughout. *L.Alb.,* Ger.——FIG. 512,*1*. **P. schrammeni* (JACOB); *1a,b,* ×1 (214*).

Leymeriella JACOB, 1907 [**Am. regularis* BRUGUIÈRE, 1780]. Evolute; venter flat or sulcate; ribs single but grooved on outer part. *L.Alb.-M.Alb.,* Eu.——FIG. 512,*3*. **L. regularis* (BRUG.), L.Alb., Fr.; *3a,b,* ×0.75; *3c,* enlarged (329*).

Epileymeriella BREISTROFFER, 1947 [**Leymeriella hitzeli* JACOB, 1907]. Differs from *Leymeriella* in that its ribs branch from weak umbilical bullae. *L.Alb.,* ?Eng.-Fr.——FIG. 512,*2*. **E. hitzeli* (JACOB), L.Alb., Fr.; *2a,b,* ×1 (214*).

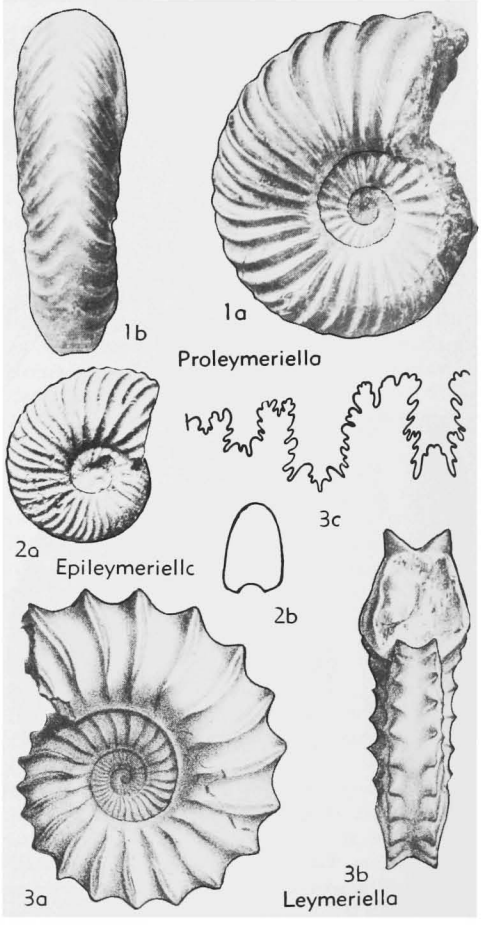


FIG. 512. Leymeriellidae (p. L392).

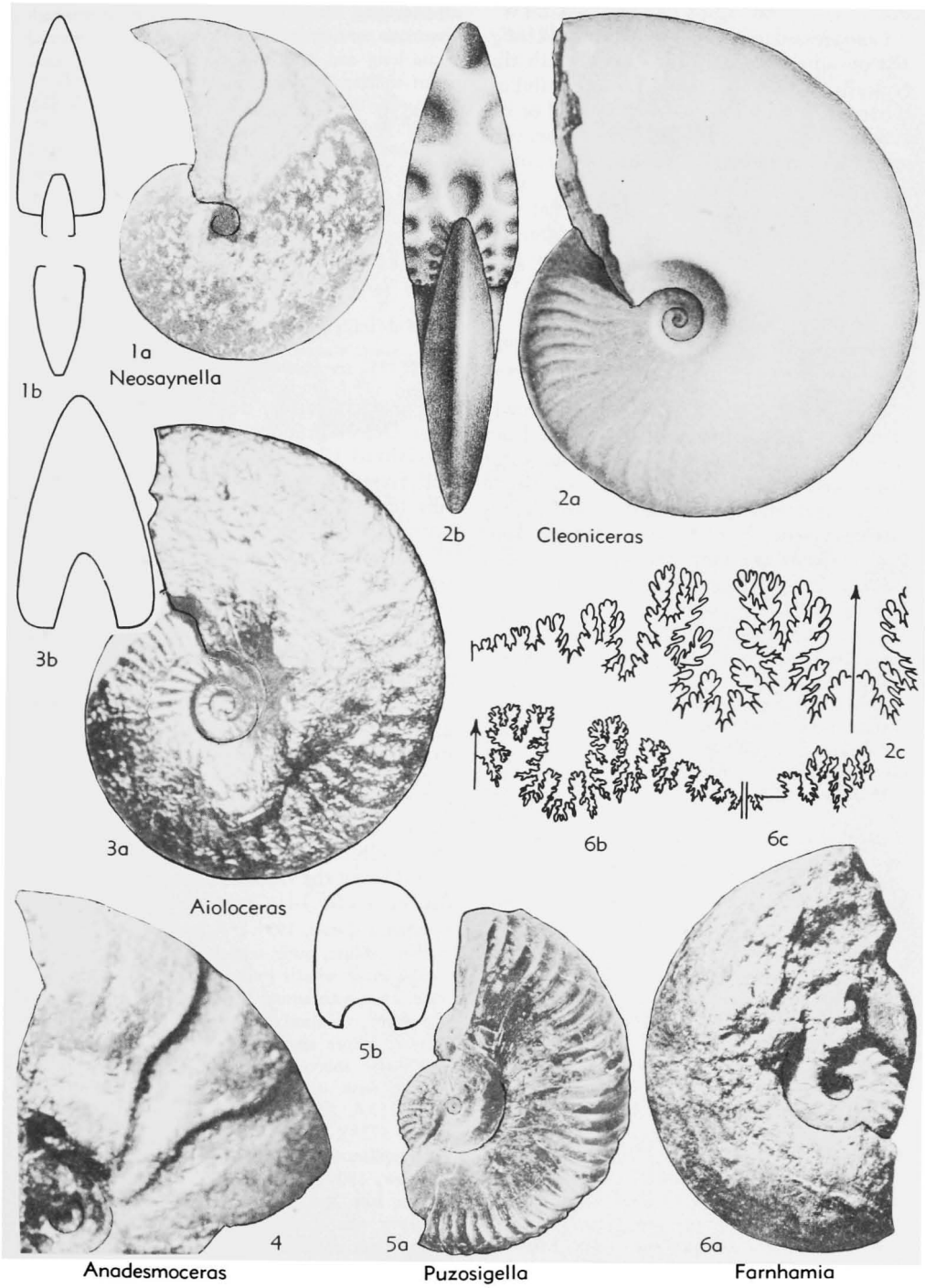


FIG. 513. Hoplitidae (Cleoniceratinae, Hoplitinae) (p. L394).

Family HOPLITIDAE H.Douvillé, 1890

[*nom. correct.* HYATT, 1900 (*pro* Hoplitidés H.Douv., 1890), ICZN Opinion 353, 1955]

Compressed to inflated derivatives of *Uhligella* or allied desmoceratid genera with ribs typically springing from distinct umbilical tubercles, and interrupted on rounded or flat venter. One subfamily, Cleoniceratinae, contains hardly any forms with flat venter; other subfamilies include early forms with rounded venter and later ones with flat venter. The family is particularly characteristic of the northern Middle Albian and few genera extend south of the equator (50, 75, 459, 570). *L.Cret.(L.Alb.)-U.Cret.(Cenom.).*

Subfamily CLEONICERATINAE Whitehouse, 1926

[*nom. transl.* WRIGHT, 1952 (*ex* Cleoniceratidae WHITEHOUSE, 1926)]

Compressed, high-whorled, with narrowly arched to acute venter; sigmoid to falcoid ribs at least on inner whorls and in some cases strong umbilical bullae, but some forms secondarily smooth; constrictions rarely present. Derived from *Uhligella* or similar forms and may include 2 or 3 stocks (2, 75, 459). *?L.Cret.(U.Apt.), L.Cret.(L.Alb.-M.Alb.).*

Aioloceras WHITEHOUSE, 1926 [**Cleoniceras argentinum* BONARELLI, 1921]. Venter narrowly arched; sharp falcoid ribs on inner whorls, later smooth; no umbilical tubercles. *?U.Apt., L.Alb.,* Madag.-Patag.-?Queensl.——FIG. 513,*3*. **A. argentinum* (BONARELLI), L.Alb., Patag.; *3a,b,* ×1 (592*).

Cleoniceras PARONA & BONARELLI, 1896 [**Am. cleon* D'ORBIGNY, 1850]. Rather involute; venter arched to acute, rarely flattened; typically with strong falcoid ribs at some growth stage, springing in pairs from distinct umbilical bullae, tending to disappear on outer whorls and commonly weak on venter. *L.Alb.-basalM.Alb.,* W.Eu.-TransCaspia-?B.C.

C. (Cleoniceras). Umbilical tubercles present at some stage; venter never tabulate. Occurrence as for genus.——FIG. 513,*2*. **C. (C.) cleon* (ORB.), L.Alb., Fr.; *2a-c,* ×0.75 (329*).

C. (Neosaynella) CASEY, 1954 [**C. (N.) inornatum*]. No ornament except obscure crescents on outer part of sides; venter tabulate in early stages. *Up.L.Alb.,* Eng.-TransCaspia.——FIG. 513,*1*. **C. (N.) inornatum,* L.Alb., Eng.; *1a,b,* ×1 (75*).

Anadesmoceras CASEY, 1954 [**A. strangulatum*]. Shape as in compressed *Cleoniceras* but traces of ornament appear on inner whorls only; test with bundled growth striae; aperture preceded by several wide sinuous constrictions. *L.Alb.,* Eng.——FIG. 513,*4*. **A. strangulatum;* ×1 (75*).

?Puzosigella CASEY, 1954 [**Pachydiscus sacramenticus* ANDERSON, 1902]. Rather evolute, with flat parallel sides, broadly rounded venter and distinct umbilical edge; on early whorls blunt umbilical bullae give rise to bundles of sinuous ribs which weaken on venter, later ribs being differentiated into long and short and persisting only on outer part of sides; narrow constrictions on inner whorls. Suture as in *Puzosia. Up.L.Alb.,* Calif.——FIG. 513, *5*. **P. sacramentica* (ANDERSON); *5a,b,* ×0.5 (2*).

?Leconteites CASEY, 1954 [BREISTROFFER, 1952 *(nom. nud.)*] [**Desmoceras lecontei* ANDERSON, 1902]. More involute, compressed, finely ribbed and with weaker umbilical tubercles than *Puzosigella;* periodic prominent ridges across venter; ribs sharper than in *Cleoniceras* and venter never acute. *L.Alb.,* Calif.

Subfamily HOPLITINAE H.Douvillé, 1890

[*nom. transl.* WRIGHT, 1952 (*ex* Hoplitidae, *nom. correct.* HYATT, 1900, *pro* Hoplitidés H.Douv., 1890, ICZN Opinion 353, 1955]

The early forms, derived from basal Albian Desmoceratidae and still close to unspecialized Cleoniceratinae, have blunt ribs and rounded venters. In 2 separate stocks ribs tend to become sharper, tubercles appear, first at the umbilicus, then at the shoulder, and the venter flattens. As ribs become interrupted on the venter, their peripheral ends become alternate, whereas in Gastroplitinae they are opposite, even if interrupted. One of the 2 stocks produces forms mainly with branched ribs only, the other gives rise to forms with looped and zigzag ribs. A 3rd stock appears from the first of these in the early Middle Albian with a steep-sided narrow groove within the ventral sulcus, while the 2nd of the 2 main stocks tends to produce smooth raised venters, culminating in the keeled Schloenbachiidae of the Cenomanian (50, 459, 570). *L.Cret.(L.Alb.)-U.Cret.(L.Cenom.).*

Farnhamia CASEY, 1954 [**F. farnhamensis*]. Large, rather evolute; outer whorl smooth or with weak folds; inner whorls rounded at first but subquadrate later, with strong blunt ribs rising in 2's and 3's from umbilical bullae and bent forward on venter; before smooth stage is reached, alternate long and short nontuberculate ribs may occur. Suture with many auxiliaries. *L.Alb.,* Eng.——FIG. 513,*6*. **F. farnhamensis; 6a,* ×0.25; *6b,c,* ×0.5 (75*).

Tetrahoplites CASEY, 1952 [**Sonneratia subquadrata* SINZOW, 1907]. Subquadrate, with flat sides and venter like 2nd stage of *Farnhamia;* sigmoid or concave ribs throughout, rising mostly in pairs from blunt umbilical bullae, bent forward but not thickened on venter. *L.Alb.,* Fr.-TransCaspia.——FIG. 514,*1*. **T. subquadratus* (SINZOW), TransCaspia; *1a,b,* ×0.75 (448*).

Pseudosonneratia SPATH, 1925 [**P. typica*]. Rather compressed, fairly high-whorled, with slight flattening of sides and narrow venter. Sinuous ribs branch from umbilical bullae or are alternately long and short, crossing venter without interruption and with strong forward sweep. *L.Alb.-M.Alb.*, W.Eu.-Peru.——FIG. 514,2. **P. typica*, L.Alb., Fr.; *2a,b*, ×0.75 (214*).

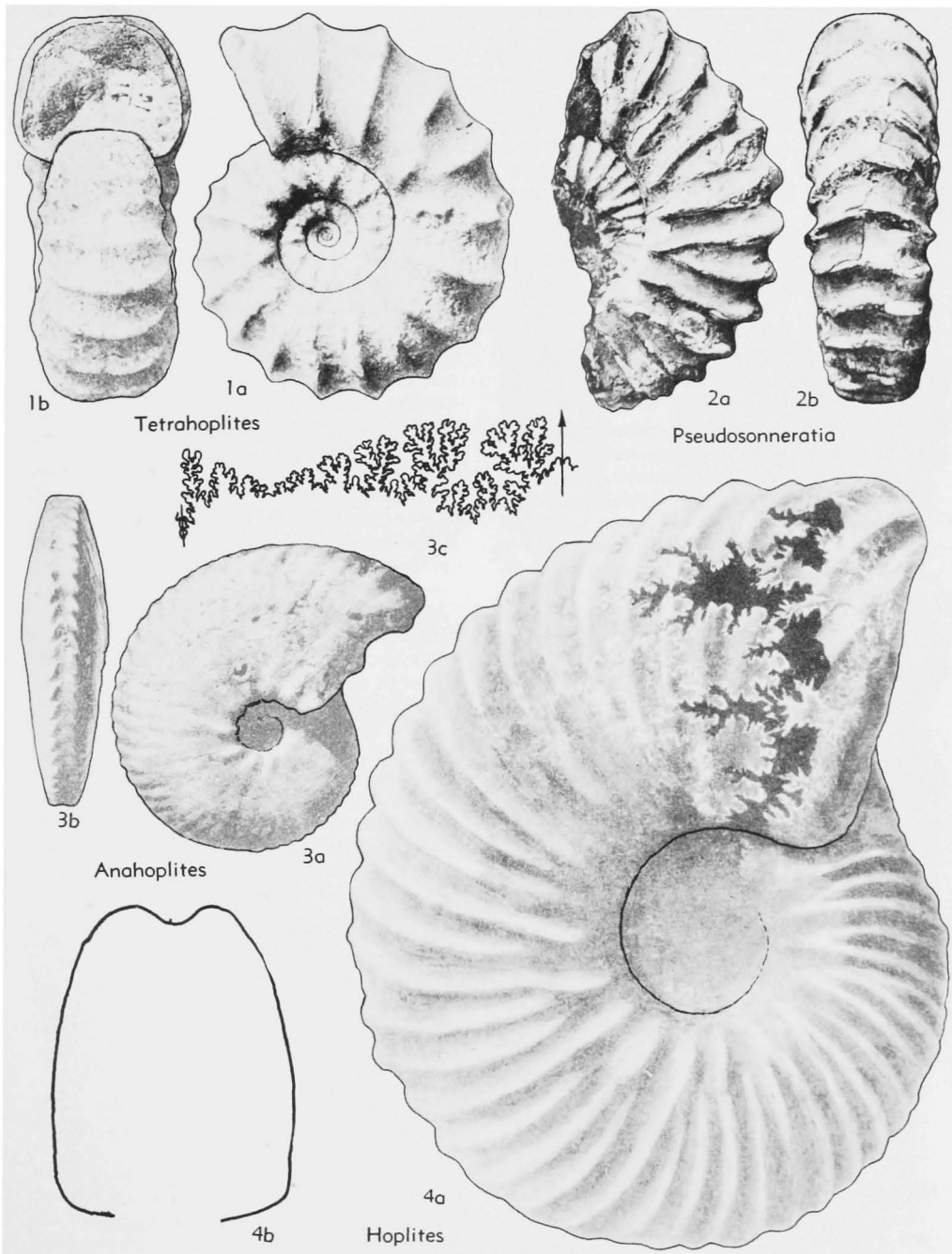


FIG. 514. Hoplitidae (Hoplitinae) (p. L394-L396).

Hoplites NEUMAYR, 1875 [**Am. dentatus* J.SOWERBY, 1821 (genus and type species validated ICZN, 1955)] [=*Odonthoplites* BREISTROFFER, 1947 (ICZN, 1955)]. Compressed, with rectangular to depressed trapezoidal whorl section; prominent branching or zigzag ribs spring from strong umbilical bullae and are interrupted on the venter, ends being opposite in early and alternate in later forms; ribs are normally thickened or raised into ventrolateral tubercles, in most cases oblique clavi. Genus probably includes some species derived from *Otohoplites* but these cannot yet be separated certainly. *M.Alb.*, Eu.-TransCaspia-Mex. (*fide* BURCKHARDT).

H. (Isohoplites) CASEY, 1954 [**Parahoplites steinmanni* JACOB, 1907]. Ribs merely depressed on venter, rib ends never alternate. *M.Alb.*, Eng.-Fr.-Switz.

H. (Hoplites). Ribs distinctly interrupted on the venter, rib ends tpyically prominent and alternate. Occurrence as for genus.——FIG. 514,*4*. **H. (H.) dentatus* (J.Sow.), Eng.; *4a,b*, ×1 (459*).

Anahoplites HYATT, 1900 [**Am. splendens* J.SOWERBY, 1815]. Rather involute, compressed, with flat sides; venter flat or sulcate; flexuous ribs or striae normally ending in fine dense ventrolateral nodes; umbilical tubercles weak. Suture with short and wide elements. Siphuncle typically asymmetrical in later stages. Derived cenogenetically from *Pseudosonneratia*. *M.Alb.-U.Alb.*, Eu.-TransCaspia.——FIG. 514,*3*. *A. planus* (MANTELL), M.Alb., Eng.; *3a,b*, ×1; *3c*, ×1.5 (459*).

Epihoplites SPATH, 1925 [**Am. denarius* J.SOWERBY, 1826]. Compressed to rather inflated; strong rounded ribs branch in 2's or 3's from sharp umbilical tubercles and end rather inconspicuously on shoulders; venter flat or slightly concave. *M.Alb.-U.Alb.*, Eu.-TransCaspia.——FIG. 515,*3*. *E. trifidus* SPATH, U.Alb., Fr.; *3a,b*, ×1 (329*).

Euhoplites SPATH, 1925 [**E. truncatus*]. More or less evolute, compressed to inflated, with flat or concave venter, typically with deep groove above siphuncle and with strong ribs zigzagging between umbilical tubercles and prominent parallel ventrolateral clavi, but ribs or tubercles or both may be absent. *M.Alb.-U.Alb.*, Eu.-Greenl.——FIG. 515,*1*. **E. truncatus* SPATH, M.Alb., Fr.; *1a,b*, ×1 (329*).

Discohoplites SPATH, 1925 [**Am. coelonotus* SEELEY, 1865]. Compressed to moderately inflated, involute to evolute; venter grooved but not flat; typically with falcoid ribs and umbilical but no ventrolateral tubercles. *U.Alb.*, W.Eu.-TransCaspia.——FIG. 515,*2*. *D. subfalcatus* (SEMENOW), U.Alb.; *2a,d*, Eng.; *2b,c*, Transcaspia; all ×1 (459*).

Hyphoplites SPATH, 1922 [**Am. falcatus* MANTELL, 1822]. Differs from *Discohoplites* in having flat and grooved venter, falcate ribs and in most species 1 or 2 rows of ventrolateral tubercles. *U.Alb.-L. Cenom.*, Eu.-TransCaspia.——FIG. 516,*1*. **H. falcatus* (MANTELL), L.Cenom., Eng.; *1a,b*, ×1 (440*).

Sonneratia BAYLE, 1878 [**Am. dutempleanus* D'ORBIGNY, 1850]. More or less involute and inflated with arched venter; strong rounded ribs, long and short or branching at umbilical swellings, continue across venter without thickening on shoulders. Suture rather simple. *Up.L.Alb.-Low.M.Alb.*, Eu.-TransCaspia.——FIG. 515,*6*. **S. dutempleana* (ORB.), L.Alb., Fr.; *6a-c*, ×0.75 (329*).

Tetrahoplitoides CASEY, 1954 [*pro Coloboceras* CRICKMAY, 1927 (*non* TROUESSART, 1889)] [**Sonneratia stantoni* ANDERSON, 1902]. Like compressed *Tetrahoplites* but with more angular venter and tendency of ribs to weaken on mid-sides and venter. *L.Alb.*, Calif.——FIG. 515,*4*. **T. stantoni* (ANDERSON); *4a*, ×1; *4b*, ×2 (580*).

Protohoplites SPATH, 1923 [**Am. archiacianus* D'ORBIGNY, 1841]. More or less evolute, with angular whorl section; coarse ribs with strong umbilical tubercles and distinct ventrolateral thickening of tubercles. *Up.L.Alb.-Low.M.Alb.*, Eu.

P. (Hemisonneratia) CASEY, 1952 (BREISTROFFER, 1952, *nom. nud.*) [**Am. puzosianus* D'ORBIGNY, 1841]. Ribs merely thickened on shoulders. Occurrence as for genus.——FIG. 516,*3*. **P. (H.) puzosianus* (ORB.), M.Alb., Fr.; *3a-c*, ×0.75 (329*).

P. (Protohoplites). Ribs raised into distinct strong ventrolateral tubercles. Occurrence as for genus. ——FIG. 515,*7*. **P. (P.) archiacianus* (ORB.), M. Alb., Fr.; *7a*, ×0.75; *7b*, enlarged (329*).

Otohoplites STEINMANN, 1925 [**Am. raulinianus* D'ORBIGNY, 1841]. Slightly compressed, with looped or zigzagged ribs and clavate ventrolateral tubercles. *Up.L.Alb.-Low.M.Alb.*, Eu.——FIG. 516, *2*. **O. raulinianus* (ORB.), M.Alb., Fr.; *2a,b*, ×0.75 (329*).

Dimorphoplites SPATH, 1925 [**Am. biplicatus* MANTELL, 1822]. Rather compressed, with flat to slightly sulcate venter; strong ribs, usually looped, persist to end; ventrolateral clavi more or less parallel to siphuncle. *M.Alb.-U.Alb.*, Eu.-TransCaspia-Greenl.——FIG. 516,*4*. **D. biplicatus* (MANTELL), M.Alb., Eng.; *4a,b*, ×1 (459*).

Callihoplites SPATH, 1925 [**Am. catillus* J.DEC. SOWERBY, 1827]. Compressed or square whorl section; inner whorls with umbilical bullae and ventrolateral clavi, with or without looped ribs between; body chamber smooth, with rounded venter. *U.Alb.*, Eu.——FIG. 517,*1*. *C.* sp. aff. *C. patella* SPATH, U.Alb., Eng.; *1a-c*, ×1 (459*).

Lepthoplites SPATH, 1925 [**L. falcoides*]. Compressed and involute, with more or less tabulate venter on which incipient keel tends to occur on inner whorls; typically with fine falcoid striae or ribs but some with coarse ribs; fine ventrolateral nodes. Analogous to *Anahoplites*. *U.Alb.*, W.Eu. ——FIG. 515,*5*. *L. cantabrigensis* SPATH, Eng.; ×1 (459*).

Pleurohoplites SPATH, 1921 [**Am. renauxianus*

D'ORBIGNY, 1840]. Less involute than *Lepthoplites;* whorl section compressed to very inflated; venter rounded to subcarinate; with umbilical tubercles from which branch strong ribs, not looped, ending in ventrolateral nodes or swellings or continuous to siphonal line. *U.Alb.-L.Cenom.*, Eu.

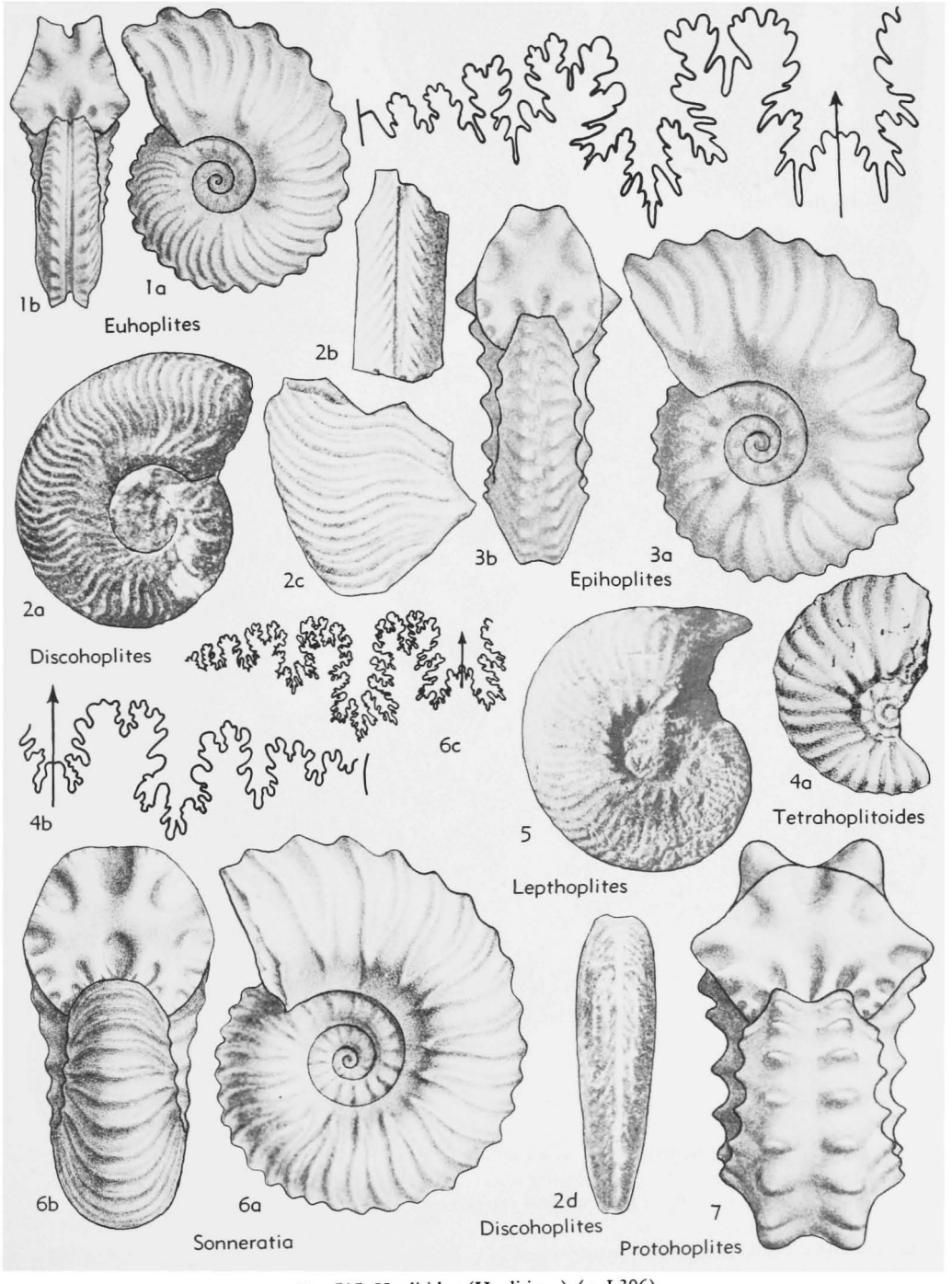


FIG. 515. Hoplitidae (Hoplitinae) (p. L396).

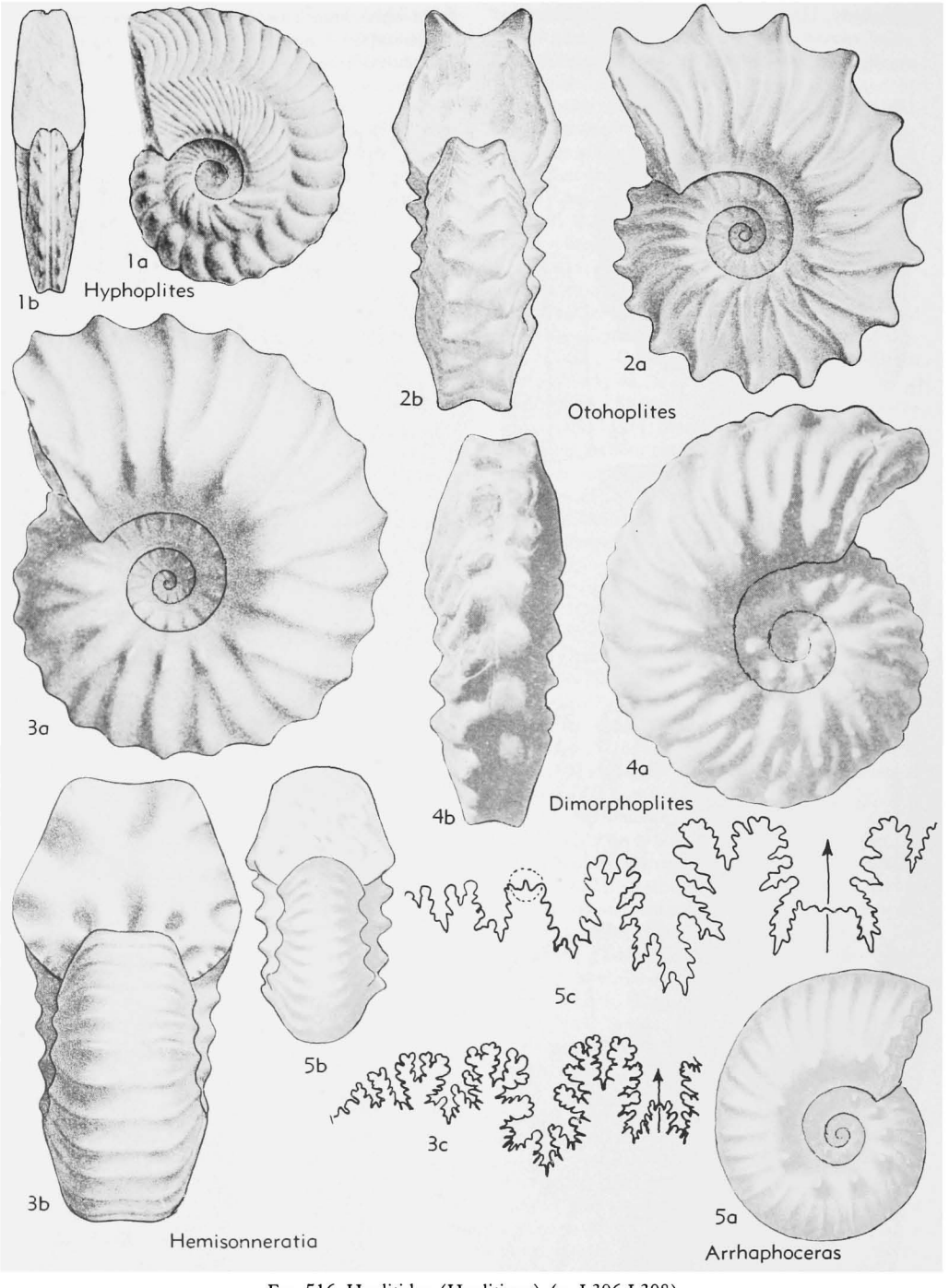


FIG. 516. Hoplitidae (Hoplitinae) (p. L396-L398).

P. (Pleurohoplites). Compressed, venter subcarinate, sides more or less flat. Occurrence as for genus.——FIG. 517,*4*. **P. (P.) renauxianus* (ORB.), U.Alb., Fr.; *4a,b*, ×0.5 (329*).

P. (Arrhaphoceras) WHITEHOUSE, 1927 [**Am. woodwardi* SEELEY, 1865]. Inflated, with rounded venter across which ribs are hardly interrupted; prominent umbilical tubercles. *U.Alb.*——FIG.

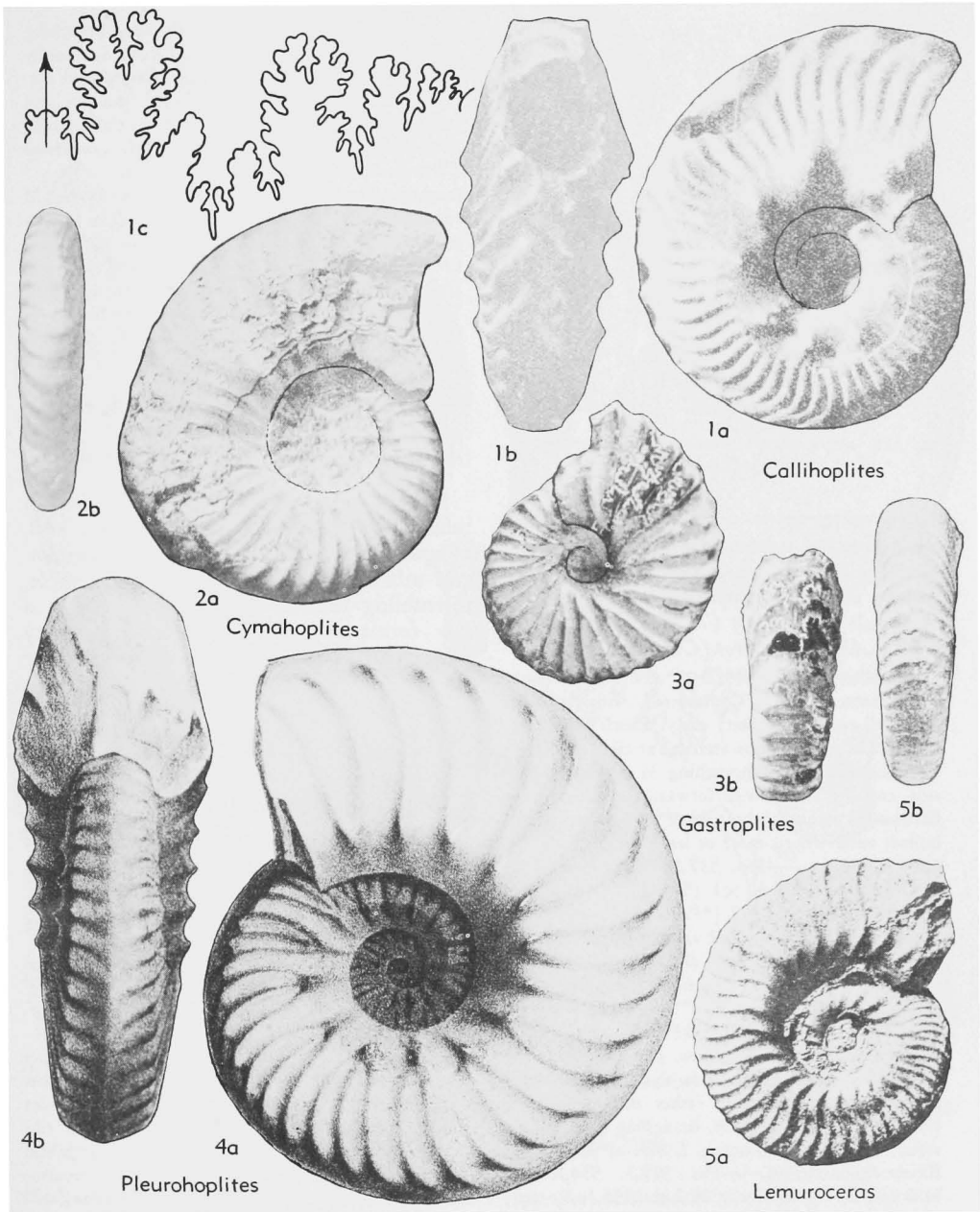


FIG. 517. Hoplitidae (Hoplitinae) (p. L396-L400).

516,5. *P. (A.) studeri* (PICTET & CAMPICHE), U. Alb., Switz.; *5a,b*, ×1; *5c*, enlarged (345*).

Subfamily GASTROPLITINAE Wright, 1952

A distinct offshoot of Desmoceratidae, probably near to *Uhligella*, confined to boreal regions, apart from *Lemuroceras* whose exact affinities are doubtful. Early members are more or less compressed, with concave sinuous or biconcave ribs, mostly branching in pairs from thin umbilical bullae; outer whorls normally smooth; in later forms

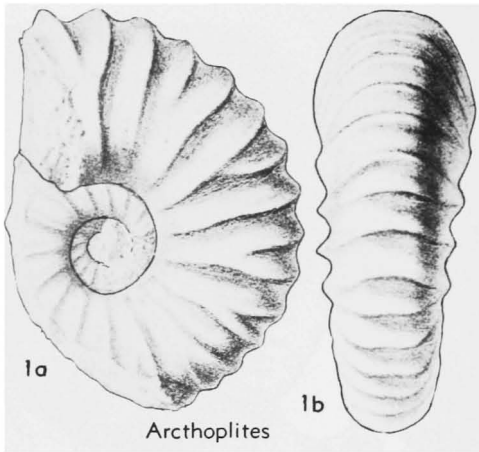


FIG. 518. *Arcthoplites jachromensis* (NIKITIN), L. Cret.(M.Alb.), C.Russ. (p. L400).

arched venter tends to flatten and whorl section to become subquadrate; strong ribs and tubercles may appear; ventrolateral tubercles are invariably opposite each other. Suture tends to simplify (75, 83, 459, 570). *L. Cret.(L.Alb.), ?U.Cret.(Cenom.).*

Cymahoplites SPATH, 1922 [**Am. kerenskianus* BOGOSLOWSKY, 1902]. Compressed, with flat sides and well-rounded venter; early whorls with fine, fairly close sinuous ribs starting at right angles to umbilical edge, some branching ⅓ of the way up side, crossing venter with forward bend and slight flattening; points of branching raised into slight bullae; outer whorls more or less smooth. *L.Alb.* or *M.Alb.*, Russia.——FIG. 517,*2*. **C. kerenskianus* (BOGOSLOWSKY); *2a,b*, ×1 (589*).

Lemuroceras SPATH, 1942 [**Pseudohaploceras aburense* SPATH, 1933]. Ribs of varying strength, finer-ribbed species being very close to *Cymahoplites* but differing in obliquity of ribs at umbilical edge. *L.Alb.*, Madag.-Pak.——FIG. 517,*5*. **L. aburense* (SPATH), Pak.; *5a,b*, ×1 (713*).

Arcthoplites SPATH, 1925 [**Am. jachromensis* NIKITIN, 1888]. Inner whorls as in *Cymahoplites*, outer with strong though thin, rather distant biplicate ribs and a few single ribs, branching high up on sides, sigmoid or biconcave. *L.Alb.* or *M.Alb.*, C. Russia.-Spitz.-Greenl.——FIG. 518,*1*; 554,*7*. **A. jachromensis* (NITIKIN), Russia; 518,*1a,b*, ×1; 554,*7*, enlarged (321*).

Subarcthoplites CASEY, 1954 [**Lemuroceras belli* MCLEARN, 1945]. Differs from *Arcthoplites* in its more rounded venter and nature of ribs, which are not biconcave, branching near umbilicus. *L.Alb.* or *M.Alb.*, Alba.

Gastroplites MCLEARN, 1930 [**Hoplites canadensis* WHITEAVES, 1892]. Rather involute to rather evolute, compressed, with flat sides and venter, shoulders sharp; with more or less prominent coarse ribs that strengthen with age, branching above umbilical border, slightly curved, usually crossing venter with slight forward bend and distinct flattening. Suture with broad shallow and rather simple saddles. *M.Alb.*, Eng.-Calif.-Sask.-Alba.-Mont.-Wyo.——FIG. 517,*3*. **G. canadensis* (WHITEAVES), Sask.; *3a,b*, ×1 (657*).

Neogastroplites MCLEARN, 1930 [**Buchiceras(?) cornutum* WHITEAVES, 1885]. Differs from *Gastroplites* in having bullae at branching of ribs above umbilical edge and distinct ventrolateral clavi and ribs raised on venter in row of siphonal nodes. Varies from compressed with weak ornament to inflated with strong ornament. *U.Alb., ?Cenom.*, Sask.-Mont.-Utah.

Family SCHLOENBACHIIDAE Parona & Bonarelli, 1897

[*nom. correct.* WRIGHT & WRIGHT, 1951 (*pro* Schloenbachidae PARONA-B., 1897)]

Evolute to rather involute, compressed to inflated forms, usually with distinct keel, irregular ribs and umbilical and ventrolateral tubercles at least. Suture rather simple, resembling that in Hoplitidae except in a few forms that develop several auxiliary elements. The family is derived from one or more species of *Pleurohoplites* or perhaps even of *Lepthoplites* (440, 459, 570, 572). *L. Cret.(Up.U.Alb.)-U.Cret.(Cenom.), ?U. Cret.(Turon.).*

Schloenbachia NEUMAYR, 1875 [**Am. varians* J. SOWERBY, 1817; SD H.DOUVILLÉ, 1890] [=*Hystrichoceras* HYATT, 1900]. Involute and compressed to evolute and inflated; keel strong to very weak; some compressed forms almost smooth except for feeble ventrolateral clavi but there are generally distinct, well-spaced ribs with umbilical and ventrolateral tubercles and in many forms lateral tubercles also. *Up.U.Alb.-U.Cenom.*, Eu.-Trans-Caspia-Greenl.——FIG. 519,*3*. **S. varians* (J.Sow.), L.Cenom., Eng.; *3a-c*, ×1 (440*).

Euhystrichoceras SPATH, 1933 [**Am. nicaisei* COQUAND, 1862]. Small, rather evolute, somewhat compressed to inflated, with flat or convex sides and strong keel; with fairly strong irregular ribs springing in 2's and 3's from sharp umbilical tubercles and curving forward on venter; ventrolateral tubercles rarely present and if so, not clavate. *L.Cenom.*, Eng.-N.Afr.-Nigeria-Mex.——FIG. 519,*4*. **E. nicaisei* (COQUAND), Tunis; *4a,b*, ×1 (339*).

Prionocycloides SPATH, 1925 [**Am. proratus* COQUAND, 1854]. Small, compressed and rather evolute, with fairly prominent keel and rather fine ribs curved forward on shoulder. Conceivably an acanthoceratid but known only in pyritic nuclei. *Cenom.*, N.Afr.-Madag.——FIG. 519,*5*. **P. proratum* (COQUAND), Tunisia; *5a,b*, ×1 (339*).

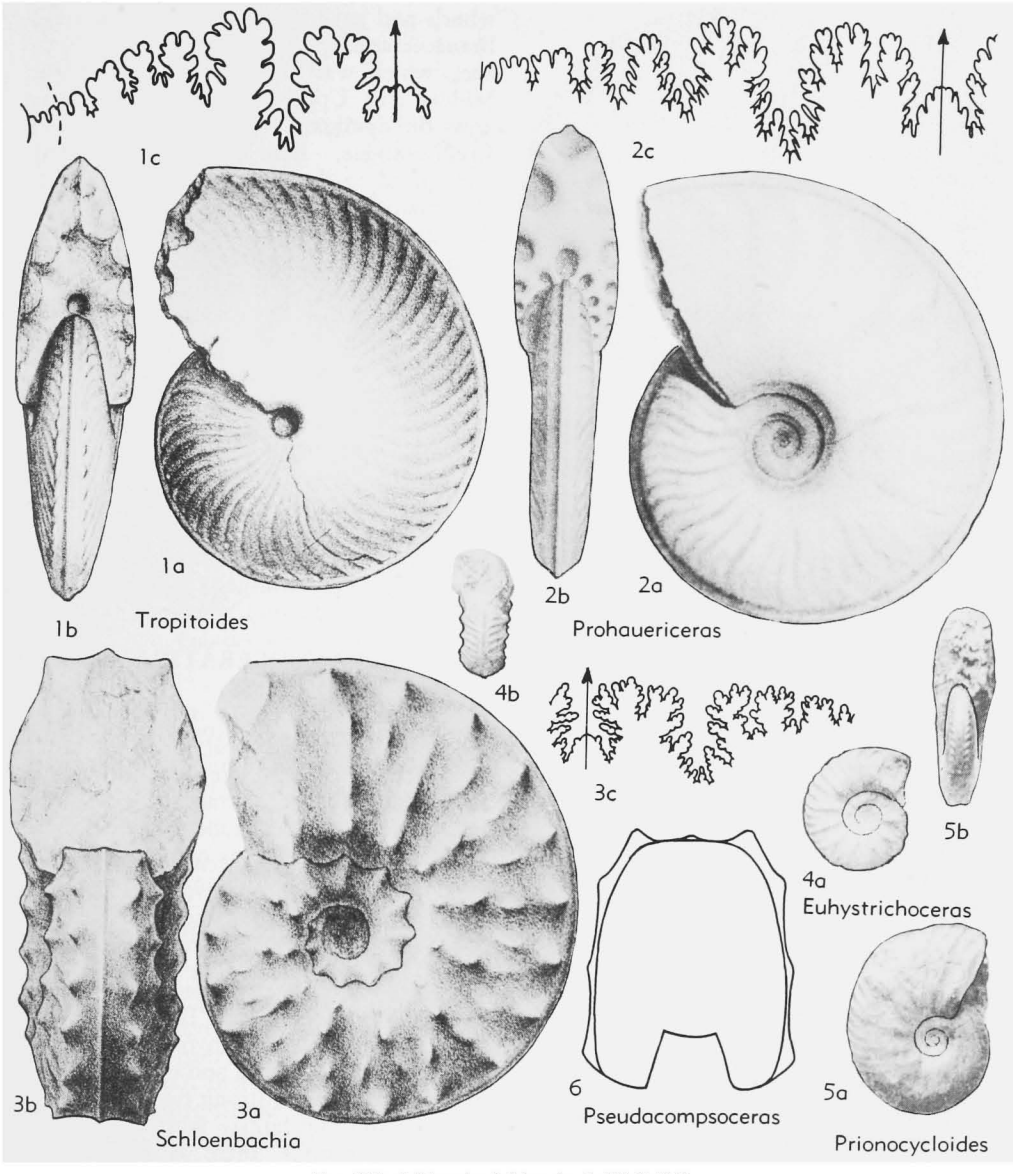


FIG. 519. Schloenbachiidae (p. L400-L401).

Pseudacompsoceras SPATH, 1925 [**P. vectense*]. Like moderately compressed *Schloenbachia* but with broad flat venter, low keel and regular umbilical, ventrolateral and 2 rows of lateral tubercles. *L. Cenom.*, Eng.——FIG. 519,*6*. **P. vectense;* ×1 (707*).

Tropitoides SPATH, 1925 [**Am. obesus* STOLICZKA, 1865]. Involute, high-whorled, with convex sides sloping toward rather narrow venter bearing prominent but rounded keel; close, rather flat, sinuous ribs. Suture with several auxiliaries. *Cenom.*, Palestine-Cauc.-Madag.-S.India.——FIG. 519,*1*. **T. obesus* (STOLICZKA), S.India; *1a,b*, ×0.75; *1c*, ×1 (238*).

?**Prohauericeras** NOWAK, 1913 [**Am. goupilianus* D'ORBIGNY, 1841]. More compressed and involute than *Tropitoides;* keel rounded; weak sinuous branching or short and long ribs but no tubercles. Position and extension of genus uncertain. *Turon.*, Fr.——FIG. 519,*2*. **P. goupilianum* (ORB.); *2a,b*, ×0.75; *2c*, enlarged (329*).

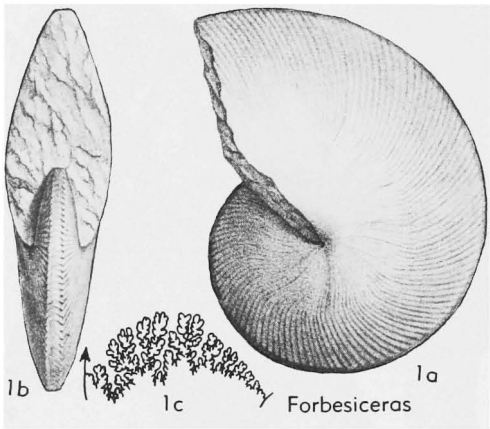


FIG. 520. *Forbesiceras largilliertianum* (D'ORBIGNY), U.Cret.(Cenom.), S.India (p. L402).

Family FORBESICERATIDAE Wright, 1952

[*nom. transl.* WRIGHT, 1955 (*ex* Forbesiceratinae WRIGHT, 1952)]

Very involute, compressed and high-whorled, with flat or slightly convex sides; venter narrow and flat or with 1 or 3 very feeble keels; ribs fine and dense, generally sigmoid or falcate, forming minute ventrolateral nodes and generally crossing venter transversely; midlateral tubercles may be present. Suture with more elements and more finely divided than in Schloenbachiidae, folioles tending to be phylloid. The family is derived from *Schloenbachia* of which specimens with a forbesiceratoid venter and ribs are known (238, 568, 570). *U. Cret.(Cenom.)*.

Forbesiceras KOSSMAT, 1897 [*pro Discoceras* KOSSMAT, 1895 (*non* BARRANDE, 1867)] [**Am. largilliertianus* D'ORBIGNY, 1841; SD DIENER, 1925] [=*Cenomanites* HAUG, 1898 (obj.)]. *Cenom.*, Eu.-Afr.-Madag.-S.India-Tex.——FIG. 520,*1*. **F. largilliertianum* (ORB.), S.India; *1a-c*, ×0.5 (238*).

Superfamily ACANTHOCERATACEAE Hyatt, 1900

[*nom. correct.* WRIGHT & WRIGHT, 1951 (*pro* Acanthoceratida HYATT, 1900, *nom. transl. ex* Acanthoceratidae HYATT, 1900)]

Typically strongly ribbed forms with a tendency to develop prominent tubercles, but a wide variety of other types, including many smooth oxycones, is placed here. The superfamily is derived from an offshoot apparently of Desmoceratidae with simple rounded ribs, appearing at the top of the Lower Albian. It has very variable inner whorls and gave rise to 2 main stocks: (1) Brancoceratidae, characterized by a strong keel, which was virtually confined to the Middle and Upper Albian and in many areas the dominant stock in them; and (2) Lyelliceratidae, little important though widespread in the Albian, but in the early Cenomanian producing the Acanthoceratidae, one of the main components of ammonite faunas of large parts of the world. By the beginning of the Turonian 3 important new families (Vascoceratidae, Tissotiidae, Collignoniceratidae) and 2 lesser ones (Coilopoceratidae, Binneyitidae) had appeared. Most of these had tubercles at some stage but tended to have simplified sutures. By early Coniacian time the Collignoniceratidae had produced 4 important subfamilies which provided most of the ornamented ammonites of the Senonian. From one of these was derived the Sphenodiscidae, last of the ammonite families (568). *L.Cret.(L. Alb.)-U.Cret.(Maastr.)*.

Family BRANCOCERATIDAE Spath, 1933

[*nom. conserv.* proposed WRIGHT, 1956, ICZN pend. (*pro* Hystatoceratidae HYATT, 1900)] [For other synonyms see subfamilies]

Typically rather evolute, with round, oval or quadrate whorls, ventral keel, strong ribs, and at least umbilical tubercles. Many genera have spiral striations or notches on the ribs. The primitive subfamily, Brancoceratinae, usually has no keel in the adult but it may appear cenogenetically. The Mojsisovicziinae are specialized in having a prominent keel and strong, commonly flared ribs, usually without tubercles. The Mortoniceratinae include both more involute compressed forms without tubercles and evolute, square-whorled forms with strong tubercles. Except in some Brancoceratinae with almost pseudoceratitic sutures, there is little sutural variation in the family that does not depend on whorl shape. Since a very large number of species is included in the family, there is a tendency to split it up unduly, but the range of morphological difference is comparatively small and the species are mostly short-lived. The family arises from Desmoceratacae, perhaps from *Silesitoides* or a closely allied genus, in the Lower Albian, reaches its zenith in the upper part of the Middle Albian and in the Upper Albian, where it is world-wide in distribution and

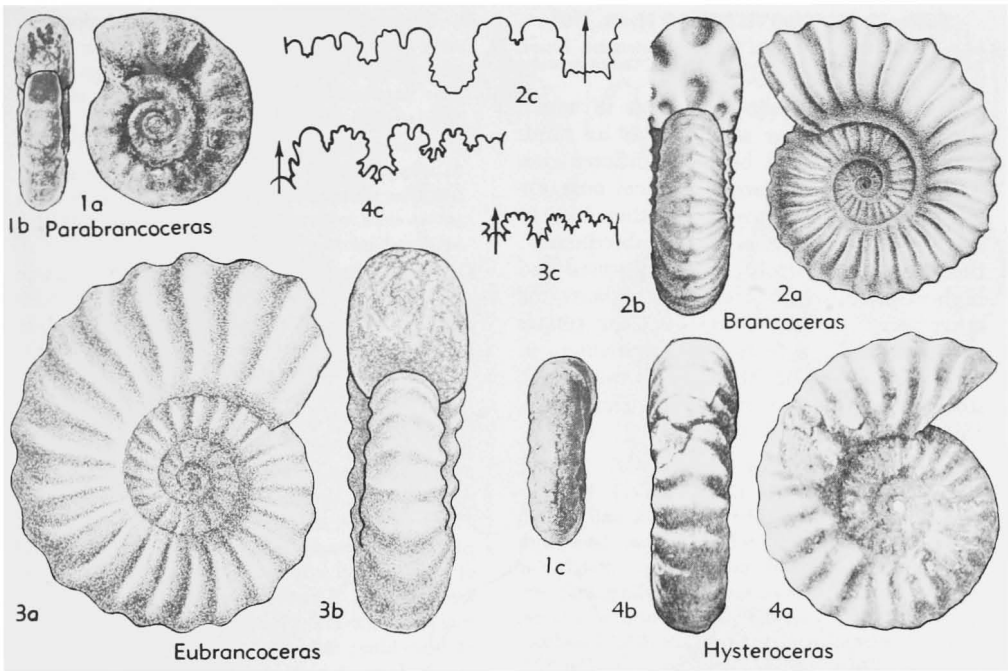


FIG. 521. Brancoceratidae (Brancoceratinae) (p. L403).

the dominant ammonite family, and has only a very few Cenomanian representatives (189, 459). *L.Cret.(L.Alb.)-U.Cret.(Cenom.).*

Subfamily BRANCOCERATINAE Spath, 1933

[*nom. transl.* SPATH, 1934 (*ex* Brancoceratidae SPATH, 1933)]

Generally small, evolute, with round, oval, square, or rectangular whorl section; venter may be sharp on early whorls but only exceptionally remains so on outer ones; usually with strong, rounded ribs, commonly continuous over venter; in later genera tubercles appear, first at umbilicus, later at shoulders. Suture simple, pseudoceratitic in some. The exact relations of the upper Lower Albian forms to each other and to the Mojsisovicziinae are still doubtful; a period of very rapid evolution in the stock occurs (83, 189, 459). *L.Alb.-U.Alb.*

Eubrancoceras BREISTROFFER, 1952 [**Brancoceras aegoceratoides* STEINMANN, 1881]. Early whorls smooth but not acute; ribs appear at varying diameters, rising gently from umbilical edge, thickening toward shoulders and then passing over venter; constrictions may occur. Suture very simple. *Up.L.Alb.-Low.M.Alb.,* Madag.-India-Peru-Colombia.

E. (Parabrancoceras) BREISTROFFER, 1952 [**Brancoceras besairei* COLLIGNON, 1949]. Very evolute, with distant broad low ribs at least until body chamber and wide shallow constrictions. *L.Alb.,* Madag.——FIG. 521,*1*. **B. (P.) besairei* COLLIGNON; *1a,b,* ×1 (601*).

E. (Eubrancoceras). Ribs more or less sharp. No constrictions. Occurrence as for genus.——FIG. 521,*3*. **E. (E.) aegoceratoides* (STEINMANN), L. Alb., Peru; *3a-c,* ×1 (717*).

Brancoceras STEINMANN, 1881 [**Am. senequieri* D'ORBIGNY, 1841; SD HYATT, 1900] [=*Hystatoceras* HYATT, 1900 (obj.)] Like *Eubrancoceras* but smooth stage may last longer and inner whorls are acute, and outer ones may be distinctly fastigate; ribs acutely chevroned on venter in some forms. *Up.L.Alb.-M.Alb.,* Eng.-Fr.-India.——FIG. 521,*2*. **B. senequieri* (ORB.), L.Alb., Fr.; *2a,b,* ×0.75; *2c,* enlarged (329*).

Hysteroceras HYATT, 1900 [**Am. varicosus* J.DEC. SOWERBY, 1824] [*?Askoloboceras, Komeceras, Petinoceras, Terasceras* VANHOEPEN, 1944]. Differs from *Brancoceras* in that keel more commonly persists to the ribbed stage, ribs branching or are unbranched long and short, with umbilical tubercles and in some forms blunt ventrolateral tubercles; ribbing varies from sharp and high to broad and flat but subdivision on this basis is hardly justified. *Up.M.Alb.-Low.U.Alb.,* Eu.-Afr.-Madag.-Persia-Pak.-Mex.-Greenl.——FIG. 521,*4*. **H. varicosum* (J.DEC.SOW.), U.Alb., Eng.; *4a,b,* ×1; *4c,* ×2.5 (459*). [=*Podagrosiceras* MAUBEUGE, 1955 (subj.)].

Subfamily MOJSISOVICZIINAE Hyatt, 1903

[*nom. transl.* Wright, 1952 (*ex* Mojsisovicziidae Hyatt, 1903)] [=Dipoloceratidae Spath, 1921; incl. Cechenoceratidae van Hoepen, 1941]

Derivatives of Hystatoceratinae in which the keel has become stabilized as an adult feature and the ribs begin to differentiate. However, in some forms the keel only appears early in ontogeny and is then lost, in others it only appears late. Subsequently, there are 2 main stocks, one compressed and high-whorled, which left no descendants, the other more evolute, with round or square whorl section, which by acquisition of tubercles led to the Mortoniceratinae; both stocks are derived from *Mojsisoviczia* (36, 189, 459). *L.Cret.(M.Alb.-U.Alb.).*

Mojsisoviczia Steinmann, 1881 [**M. durfeldi* (=**Am. ventanillensis* Gabb, 1869)] [*Dipoloceroides* Breistroffer, 1947]. Evolute and smooth in young, with round whorl section; later with prominent sharp keel and strong, straight or slightly curved, unbranched ribs, which may expand in breadth toward venter or form very large, irregular ventrolateral tubercles. *M.Alb.*, Eu.-Zululand-Pak.-Tex.-Colombia-Peru-Greenl.——Fig. 522, *4. *M. ventanillensis* (Gabb); *4a-c*, ×1 (611*).

Falloticeras Parona & Bonarelli, 1897 [**Am. proteus* d'Orbigny, 1850]. With diameter up to 10 mm.; like young *Dipoloceras*, with ribs and keel but first ribs and then keel disappearing; venter rounded but finally depressed and concave. *M.Alb.*, Eng.-Fr.

Venezoliceras Spath, 1925 [**Oxytropidoceras venezolense* Stieler, 1920]. Differs from *Mojsisoviczia* mainly in being high-whorled and more compressed; thin and high or broad, straight or slightly sinuous ribs raised into lateral tubercles ending in bullate or slightly clavate ones. *Up.M.Alb.*, Madag.-Tex.-Venez.-Peru-Braz.——Fig. 522,*3*. **V. venezolense* (Stieler), Peru; ×1 (698*).

Oxytropidoceras Stieler, 1920 [**Am. roissyanus* d'Orbigny, 1841] [*Pseudophacoceras* Spath, 1921 (obj.); *Lophoceras* vanHoepen, 1931 (*non* Hyatt, 1893)]. Differs from *Mojsisoviczia* in being compressed and high-whorled and from *Mojsisoviczia* and *Venezoliceras* in being nontuberculate or having umbilical or ventrolateral but not mediolateral tubercles and typically with flat ribs; 1st 5 or 6 whorls may be smooth, keel appearing before ribs (at this stage shell being very like that of *Aconeceras*). Suture with distinctly oblique outer slope to 1st lateral saddle. *Up.L.Alb.-M.Alb.*, Eu.-W.Afr.-E.Afr.-Madag.-Pak.-N.Am.-S.Am.

O. (Oxytropidoceras). Very compressed and rather involute; ribs fine, close, more or less flat; no tubercles. Occurrence as for genus.——Fig. 522, *1. **O. (O.) roissyanum* (Orb.), M.Alb., Fr.; *1a,b*, ×0.75; *1c*, enlarged (329*).

O. (Manuaniceras) Spath, 1925 [**Pseudophacoceras manuanense* Spath, 1921]. Fine or coarse ribs, branching once or twice, tending to disappear on outer whorl; innermost whorls involute and inflated. *M.Alb.*, Zululand-Madag.

O. (Androiavites) Collignon, 1936 [**O. (A.) besairei*]. Rather distant ribs spring from strong, irregular umbilical tubercles, which tend to move up on sides with age and then disappear. *M.Alb.*, Madag.-Nigeria.

O. (Adkinsites) Spath, 1931 [**Am. belknapi* Marcou, 1858]. Coarse, rather distant, straight ribs, flat, with steep slope on forward edge, may or may not bend forward on shoulders; inner whorls with strong umbilical and weak ventrolateral tubercles. *M.Alb.*, Eu.-Madag.-Tex.

Dipoloceras Hyatt, 1900 [**Am. cristatus* Deluc in Brongniart, 1822] [*Rhytidoceras* vanHoepen, 1931; *Cechenoceras* vanHoepen, 1941; *Ricnoceras* vanHoepen, 1942; *Euspectroceras* vanHoepen, 1946]. Rather evolute, typically inflated or depressed; prominent keel is commonly below level of ventrolateral ends of ribs, which are dense to fairly distant, rounded to sharp, typically a mixture of single and branched, latter flared at point of branching; tubercles normally absent except in certain forms which lead to Mortoniceratinae. Sutures with plump, broad, finely indented saddles. *Up.M.Alb.-Low.U.Alb.*, Eu.-Zululand-Madag.-Tex.

D. (Dipoloceras). Whorl section more or less round; tubercles, if present, insignificant. Occurrence as for genus.——Fig. 522,*2*. **D. (D.) cristatum* (Deluc), M.Alb., Fr.; *2a,b*, ×1; *2c*, ×2 (329*).

D. (Diplasioceras) vanHoepen, 1946 [**Diplasioceras fallax*]. Inner whorls more or less flat-sided, with umbilical and weak ventrolateral tubercles; outer whorl oval in section, with distant sharp high slightly curved ribs. Occurrence as for genus.

Subfamily MORTONICERATINAE Spath, 1925

[*nom. transl.* Spath, 1934 (*ex* Mortoniceratidae Spath, 1925)] [Inflaticeratidae Spath, 1925; Pervinquieridae Spath, 1925; Drepanoceratidae vanHoepen, 1941; Arestoceratidae, Cainoceratidae vanHoepen, 1942; Eriolceratidae vanHoepen, 1955]

Moderately involute to very evolute, whorl section more or less rounded, square or compressed, with low to high keel; ribs branch, at any rate at first, but may be single on body chamber or even earlier, being low and rounded or flat to high and rounded but never high and sharp; at least umbilical tubercles occur, normally also ventrolateral, in some forms as many as 5 in all on a rib; spiral striation or notching of ribs common; aperture with rostrum directed forward, upward, or backward. Suture generally with squarish, symmetrical, deeply and sharply

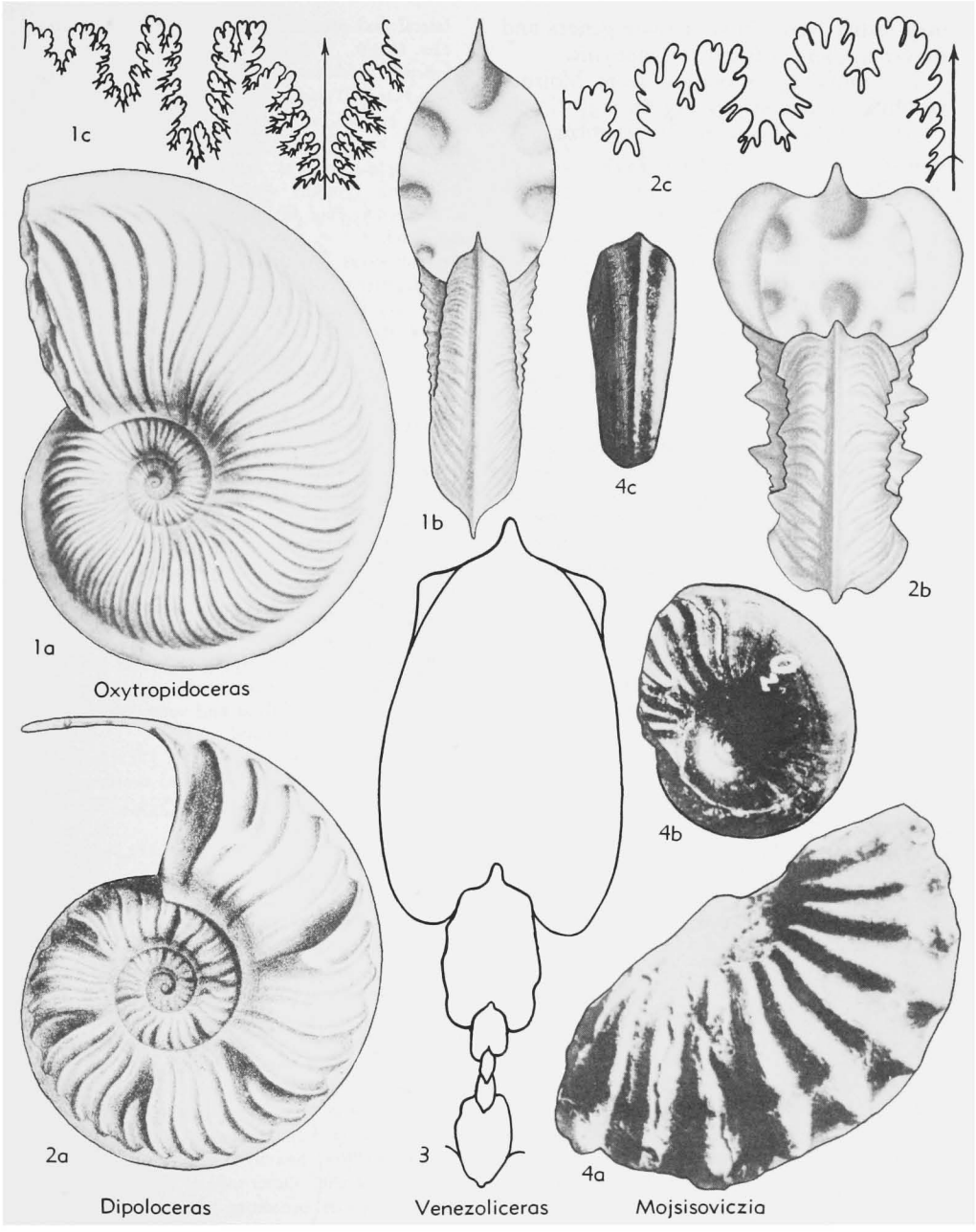


FIG. 522. Brancoceratidae (Mojsisovicziinae) (p. L404).

indented saddles (189, 459, 568). *L.Cret. (Up.M.Alb.)-U.Cret.(L.Cenom.)*.

As the synonymies of the subfamily and its genera show, both the nomenclature and scale of classification of the group have been in doubt. A large number of species with much the same basic characters vary in the combination of nature of whorl section, number and shape of tubercles, and strength and direction of ribs. An attempt is here made to classify them in accord with the scale accepted for allied groups, but time

may justify recognition of some genera and subgenera here reduced to synonyms.

The subfamily is derived from Mojsisovicziinae, apparently along several closely related lines and remains very uniform.

Mortoniceras MEEK, 1876 [**Am. vespertinus* MORTON, 1834 (despite many authors, a valid species)] [For synonyms see subgenera]. More or less evolute, with square, rectangular, or trapezoidal whorl section; ribs normally strong but may become weaker or stronger on body chamber; with prominent umbilical and normally ventrolateral tubercles at least and there may also be 1 or 2 lateral tubercles and upper ventrolateral one as well; keel high or low. *Up.M.Alb.-UppermostU. Alb.*, Eu.-Afr.-India-N.Am.-S.Am.

M. (Deiradoceras) VANHOEPEN, 1931 [**Inflaticeras prerostratum* SPATH, 1921]. Whorl section depressed, subquadrate with sharp keel. Very strong umbilical and ventrolateral tubercles with costal section concave between; early whorls tend to have a rounded venter, as in *Dipoloceras;* compressed species referred to this subgenus are probably distinct. *Low.U.Alb.*, W.Eu.-W.Afr.-E. Afr.——FIG. 523,*4*. **M. (D.) prerostratum* (SPATH), Zululand; ×0.75 (713*).

M. (Mortoniceras) MEEK, 1876 [*Pervinquieria* BOEHM, 1910; *Inflaticeras* STIELER, 1920; *Subschloenbachia* SPATH, 1922; *Drepanoceras* VAN HOEPEN, 1931; *Leonites* SPATH, 1932; *?Ameleceras, Ophryoceras* VANHOEPEN, 1942; *Mimeloceras* VANHOEPEN, 1944 (=*Mimoceras* VANHOEPEN, 1941, *non* HYATT, 1884); *Rusoceras* VAN HOEPEN, 1946; *?Pagoceras, Collignonia, Omocrateceras, Styphloceras* VANHOEPEN, 1951]. Ribs moderately fine to very coarse, branching at umbilical tubercles on early whorls, later single; with umbilical, mediolateral and ventrolateral tubercles, mediolaterals typically weak but all may be strong. Occurrence as for genus.——FIG. 523, *3a,b*. *M. (M.) inflatum* (J.Sow.), U.Alb., Eng.; *3a*, ×0.7; *3b*, ×1 (459*).——FIG. 523,*3*. Same, U.Alb., Fr.; ×1 (329*).

M. (Durnovarites) SPATH, 1932 [**Subschloenbachia perinflata* SPATH, 1921]. Whorl section square or trapezoidal; at least 4 equally spaced tubercles on each rib, outer one as prominent as others and may be clavate. *Up.U.Alb.*, Eu.-Afr. Tex.——FIG. 523,*1*. *M. (D.) subquadratum* SPATH, U.Alb., Eng.; *1a,b*, ×1 (459*).

M. (Cantabrigites) SPATH, 1932 [**M. (C.) cantabrigense*]. Small, generally with single, almost nontuberculate ribs and much simplified suture. *Up.U.Alb.*, Eng.-Fr.——FIG. 524,*1*. **M. (C.) cantabrigense*, U.Alb., Eng.; *1a,b*, ×1; *1c*, ×2 (459*).

M. (Angolaites) SPATH, 1932 [**Pervinquieria gregoryi* SPATH, 1922]. Rather compressed, with single ribs at all stages; with umbilical, slight lateral and prominent double ventrolateral tubercles. *U.Alb.*, W.Afr.

Erioliceras VANHOEPEN, 1955 [**E. tenuis*] [*?Omocyrtoceras, ?Tetragonoceras* VANHOEPEN, 1955]. Small, evolute, with square or rectangular whorl section; keel weakens in later growth and disappears before end of last whorl; ribs single or branching, typically sinuous, thickened on shoulders and tending to overhang backward. *U.Alb.*, Zululand.

Neokentroceras SPATH, 1921 [**N. curvicornu*]. Small, outer whorls as in *M. (Mortoniceras)*, inner with very strong umbilical tubercles, weak or no lateral ones and large, clavate, normally irregular, ventrolateral tubercles; ribs weak or absent. *Low. U.Alb.*, W.Afr.-?Braz.——FIG. 524,*2*. **N. curvicornu*, U.Alb., Angola; *2a,b*, ×1 (713*).

Arestoceras VANHOEPEN, 1942 [**A. collinum*] [*?Tetagmenoceras* VANHOEPEN, 1942; *Aidoceras* VANHOEPEN, 1946]. Early whorls as in early, less tuberculate species of *M. (Mortoniceras)* but ornament tending to disappear, whorl increasing in height and venter becoming fastigate rather than keeled. *Low.U.Alb.*, Zululand.——FIG. 523,*6*. **A. collinum;* ×0.75 (189*).

Cainoceras VANHOEPEN, 1942 [**C. liberum*]. Rather involute, whorl section compressed, with flat, parallel or slightly converging sides and flat, fairly broad venter with sharp keel; early whorls at least have sharp umbilical and ventrolateral tubercles. *Low.U.Alb.*, Zululand.

C. (Cainoceras) VANHOEPEN, 1942 [*?Lethargeceras* VANHOEPEN, 1942]. Sides flat and nearly parallel, ribs flat and sinuous.——FIG. 524,*3*. **C. (C.) liberum; 3a,b*, ×1 (189*).

C. (Letheceras) VANHOEPEN, 1942 [**L. complanatum*]. Sides convergent, slightly convex; ribs and tubercles tend to disappear on outer whorls.

C. (Poikiloceras) VANHOEPEN, 1951 [**P. firmum*]. Keel higher, whorl section squarer and ornament of inner whorls coarser than in other subgenera.

Prohysteroceras SPATH, 1921 [**P. wordiei*]. More or less evolute, compressed and with high keel, though whorl section may be subquadrate in young; ribs rather weak, fine, close, sinuous and branching; umbilical and ventrolateral tubercles present but may be subdued in adult. *Low.U.Alb.*, Eu.-Afr.-Madag.-S.India-Queensl.

P. (Goodhallites) SPATH, 1932 [**Am. goodhalli* J. SOWERBY, 1820]. Outer whorls with strong ornament, tubercles becoming more prominent with age. Occurrence as for genus.——FIG. 525,*1*. **P. (G.) goodhalli* (J.Sow.), Eng.; ×1 (459*).

P. (Prohysteroceras). The ornament does not strengthen and the tubercles may weaken on the outer whorls. *Low.U.Alb.*, Eng.-Angola.——FIG. 523,*2*. **P. (P.) wordiei*, Angola; *2a*, ×0.7; *2b*, ×1; *2c*, ×2.5 (713*).

Neoharpoceras SPATH, 1921 [**Am. hugardianus* D'ORBIGNY, 1841]. Compressed, more involute

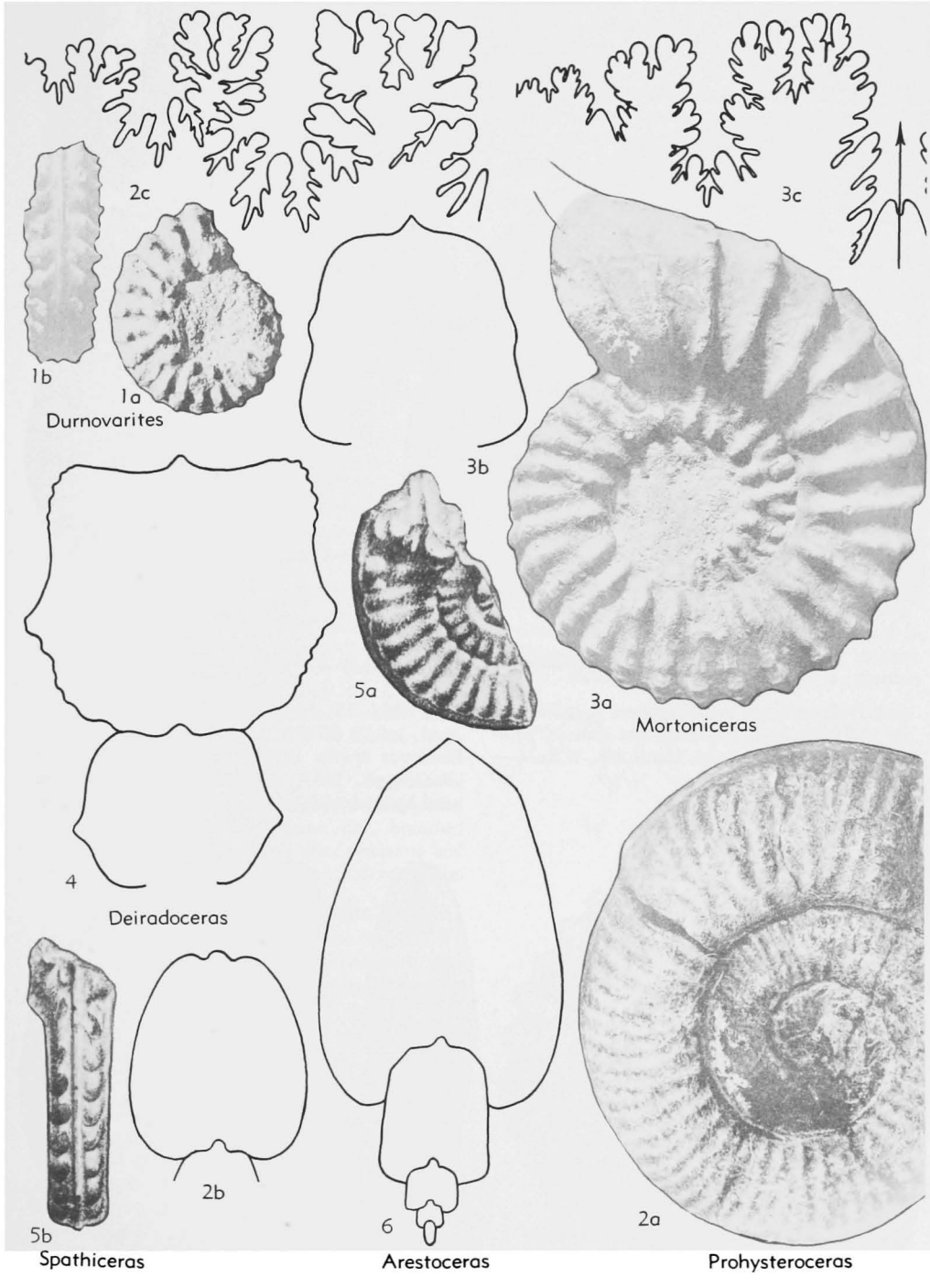


FIG. 523. Brancoceratidae (Mortoniceratinae) (p. L406-L409).

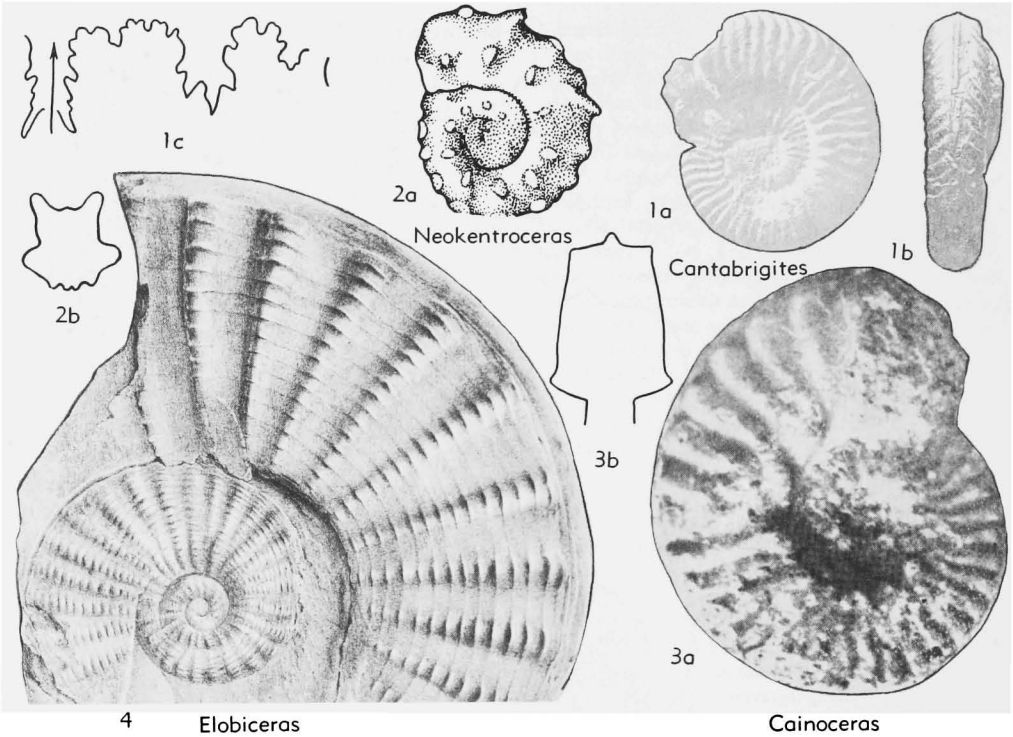


FIG. 524. Brancoceratidae (Mortoniceratinae) (p. L406-L408).

than *Prohysteroceras* and with more rounded venter and lower keel; ribs dense and sinuous, without tubercles. Suture florid. *Mid.U.Alb.*, W.Eu.——

FIG. 526,*1*. **N. hugardianum* (ORB.), U.Alb., Fr.; *1a,b*, ×0.75 (329*).

Elobiceras SPATH, 1922 [**Schloenbachia elobiensis* SZAJNOCHA, 1885]. Rather involute, compressed and high-whorled, with flat or slightly convex sides

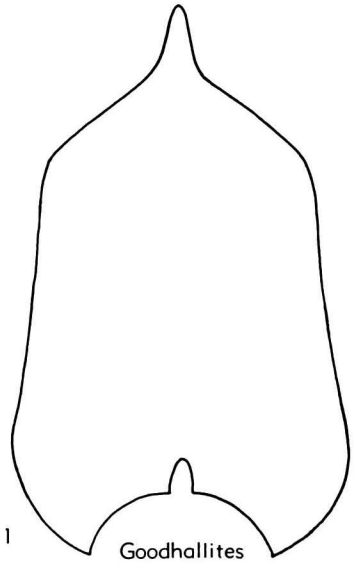


FIG. 525. *Prohysteroceras (Goodhallites) goodhalli* (J. SOWERBY), L.Cret.(U.Alb.), Eng. (p. L406).

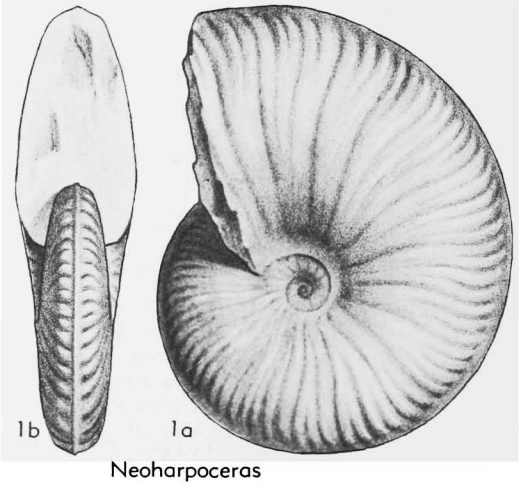


FIG. 526. *Neoharpoceras hugardianum* (D'ORBIGNY), L.Cret.(U.Alb.), Fr. (p. L406).

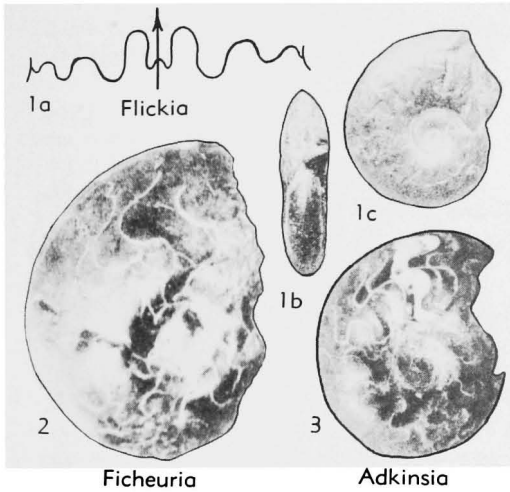


FIG. 527. Flickiidae (p. L409).

and high, thin keel; simple ribs expand into flat bulges on shoulders and have very distinct spiral notching. *Up.U.Alb.*, Angola-Nigeria.——FIG. 524, *4*. **E. elobiense* (SZAJNOCHA), Angola; ×0.5 (722*).

Spathiceras WHITEHOUSE, 1927 [**Hystrichoceras antipodeum* ETHERIDGE, JR., 1902]. Very evolute, rather compressed, with moderately high keel; simple and branching ribs rise from distinct, rounded umbilical tubercles. *TopU.Alb.-L.Cenom.*, N.Afr.-Pak.-S.India-N.Austral.-Tex.——FIG. 523,*5*. **S. antipodeum* (ETH.), U.Alb., N.Austral.; *5a,b*, ×1.5 (617*).

Algericeras SPATH, 1925 [**Am. bogharіensis* COQUAND, 1879]. Small, compressed, with rounded shoulders, high keel and dense, fine, branched ribs sharper than in *Neoharpoceras;* similar to and perhaps derived from *Cantabrigites*. *L.Cenom.*, Alg.

Family FLICKIIDAE Adkins, 1928

[*nom. correct.* WRIGHT, herein (*pro* Flickidae ADKINS, 1928)]

Dwarf(?) forms with little ornament and very simple sutures; only small pyritic specimens known, but some species may have reached larger size in different environment. Origin of the family is obscure but, on analogy with the early smooth whorls of *Mojsisoviczia* or *Falloticeras*, it is placed provisionally in this superfamily (45, 339). *L.Cret.(U.Alb.)-U.Cret.(Cenom.)*.

Flickia PERVINQUIÈRE, 1907 [**F. simplex*]. Moderately evolute, rather compressed, with narrowly arched venter; surface smooth. *U.Alb.-L.Cenom.*, N.Afr.-Madag.-Tex.——FIG. 527,*1*. **F. simplex*, U.Alb., Tunis; *1a,b*, ×2; *1c*, ×4 (339*).

Ficheuria PERVINQUIÈRE, 1907 [**F. kiliani*]. Very involute, globular, umbilical shoulder tending to be angular. *U.Alb.-L.Cenom.*, N.Afr.——FIG. 527, *2*. *F. pernoni* DUBOURDIEU, U.Alb., Alg.; ×2 (613*).——FIG. 554,*3*. **F. kiliani*, U.Alb., N.Afr.; *3a,b*, ×1; *3c*, ×4 (339*).

Adkinsia BÖSE, 1928 [**A. adkinsi*]. Rather more involute and inflated than *Flickia* but less than *Ficheuria;* has distinct umbilical tubercles and in some shells fairly strong ribs. *L.Cenom.*, Tex.——FIG. 527,*3*. *A. tuberculata* BÖSE; ×2 (593*).

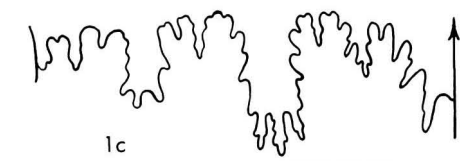
Family LYELLICERATIDAE Spath, 1921

[Incl. Stoliczkainae BREISTROFFER, 1953]

Small to moderate in size, moderately compressed, fairly evolute, with straight or slightly curved ribs crossing venter or breaking down into ventrolateral and siphonal tubercles. Suture moderately indented, not particularly characteristic. The earliest genus, *Prolyelliceras*, is derived directly from *Hystatoceras* (50, 459). *L.Cret.(L.Alb.)-U.Cret.(Cenom.)*.

Prolyelliceras SPATH, 1920 [**P. peruvianum*]. Slightly compressed, high-whorled, with straight ribs continuous across venter but flattened on it; with 1 or 2 rows of ventrolateral clavi and row of siphonal clavi subordinate to ribs. *L.Alb.*, Tunisia-Colom.-Peru.——FIG. 528,*1*. *P. prorsocurvatum* (GEBHARDT), Peru; *1a,b*, ×0.75; *1c*, ×2 (626*).

Lyelliceras SPATH, 1921 [**Am. lyelli* LEYMERIE in D'ORBIGNY, 1841]. Moderately to very evolute; whorl section slightly compressed to circular;



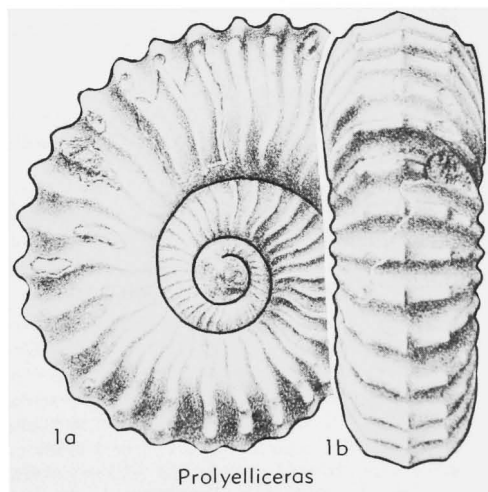


FIG. 528. *Prolyelliceras prorsocurvatum* (GEBHARDT), L.Cret.(L.Alb.), Peru (p. L409).

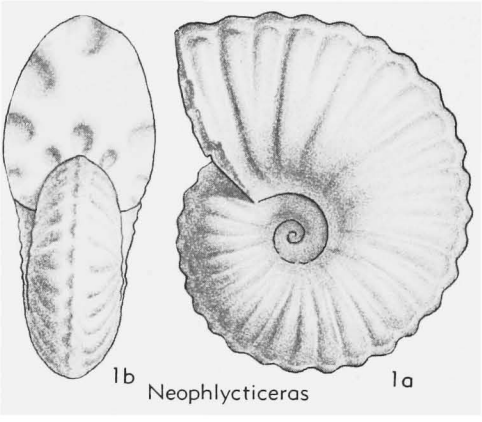


FIG. 529. *Neophlycticeras (Neophlycticeras) brottianum* (D'ORBIGNY), L.Cret.(M.Alb.), Fr.

straight radial ribs with 2 or 3 rows of lateral clavi and row of siphonal clavi, latter effaced in some forms; tubercles usually dominant over the ribs, which continue over venter or zigzag irregularly there. *L.Alb.-M.Alb.*, W.Eu.-Pak.-Mex.-Colombia-Peru.——FIG. 530,*1*. **L. lyelli* (ORB.), M.Alb., Fr.; *1a,b*, ×0.75; *1c*, enlarged (329*).

Tegoceras HYATT, 1900 [**Am. mosensis* D'ORBIGNY, 1841 (=*Rauliniceras gladiator* BAYLE, 1878)] [=*Rauliniceras* H.DOUVILLÉ, 1912]. Rather involute; sides and venter flat, though median line may be slightly raised and indistinctly tuberculate; venter rounded on body chamber; ribs straight and narrow up to mid-side where there is a bulla, then weaker, ending in ventrolateral clavus. Includes as subgenus *Seunesiceras* BREISTROFFER, 1953 (*nom. nud.*). *L.Alb.-M.Alb.*, W.Eu.-Pak.——FIG. 530,*4*. *T. camatteanum* (ORB.), M.Alb., Fr.; *4a,b*, ×1 (329*).

Neophlycticeras SPATH, 1921 [**Am. brottianus* D'ORBIGNY, 1841]. Rather involute, compressed, with flat or convex sides and flat or broadly rounded ribs. Venter sharp and crenulate or rounded and tuberculate. *M.Alb.-U.Alb.*, W.Eu.-Madag.-Colombia-Peru. [=*Protissotia* COLLIGNON, 1932 (subj.)].——FIG. 529,*1*; 530,*3*. **N. brottianum* (ORB.), M.Alb., Fr.; 529,*1a,b*, ×1; 530,*3*, enlarged (329*).

Stoliczkaia NEUMAYR, 1875 [**Am. dispar* D'ORBIGNY, 1841; SD DIENER, 1925]. Rather involute, umbilicus tending to widen in adult; straight or slightly curved rounded main ribs with numerous intercalatories; venter broad or narrow, in young flat, fastigate or rounded, with 1, 2 or 3 tubercles, while later ribs tend to cross and thicken on venter; tubercles weaken first and later ribs, in some leaving outer whorl smooth. Suture with well-rounded folioles, tending to simplify. *U.Alb.-L. Cenom.*, Eu.-N.Afr.-W.Afr.-Madag.-S.India-Tex.-Ariz.

S. (Faraudiella) BREISTROFFER, 1947 [**Am. blancheti* PICTET & CAMPICHE, 1859]. Venter subangular throughout and row of rounded peripheral tubercles persist to body chamber. *U.Alb.*, Eng.-Fr.-Switz.

S. (Stoliczkaia). Except in young the venter is slightly flattened or rounded and the juvenile peripheral tubercles do not persist. Occurrence as for genus.——FIG. 530,*5*. **S. (S.) dispar* (ORB.), U.Alb., Fr.; ×0.5 (586*).

Budaiceras BÖSE, 1927 [**B. mexicanum*]. Rather compressed, with straight to flexuous strong ribs, forming more or less prominent ventrolateral and siphonal clavi, latter increasing in number on outer whorl where they are twice as numerous as ribs. *L.Cenom.*, Tex.-Mex.——FIG. 530,*6*; 554,*5*. *B. texanum* (SHATTUCK), Tex.; 530,*6a,b*, ×1 (653*); 554,*5*, whorl sec.

Salaziceras BREISTROFFER, 1936 [**Am. salazacensis* HÉBERT & MUNIER-CHALMAS, 1875] [*Salazaciceras* BREIST., 1940 (obj.)]. Small, moderately involute, inflated; more or less straight coarse rounded ribs from prominent umbilical bullae. Suture with simplified saddles. *U.Alb.*, Fr.——FIG. 530,*2*. **S. salazacense* (HÉBERT & MUNIER-CHALMAS); ×1 (634*).

Family ACANTHOCERATIDAE Hyatt, 1900

Strong tuberculation, at least umbilical and ventrolateral, is the main characteristic of most genera of the family. However in some the ribs are dominant, while in others the ornament may be weak or absent on outer whorls. Most genera are evolute, compressed to very depressed in section. The suture has few special characteristics or variations, though in some later genera there is a tendency to simplification of sutural detail, as in the successor families. The family represents a burst of radiation during the Cenomanian from the rather limited Lyelliceratidae. There are few survivors after this stage but 4 families are derived directly from the Acanthoceratidae by early Turonian time. Of the subfamilies, Mantelliceratinae is the most primitive, being close to the ancestral *Stoliczkaia*. From it spring the Acanthoceratinae, which in turn give rise to Metoiceratinae and Mammitinae (480, 572). *U. Cret.(L.Cenom.-U.Turon.)*.

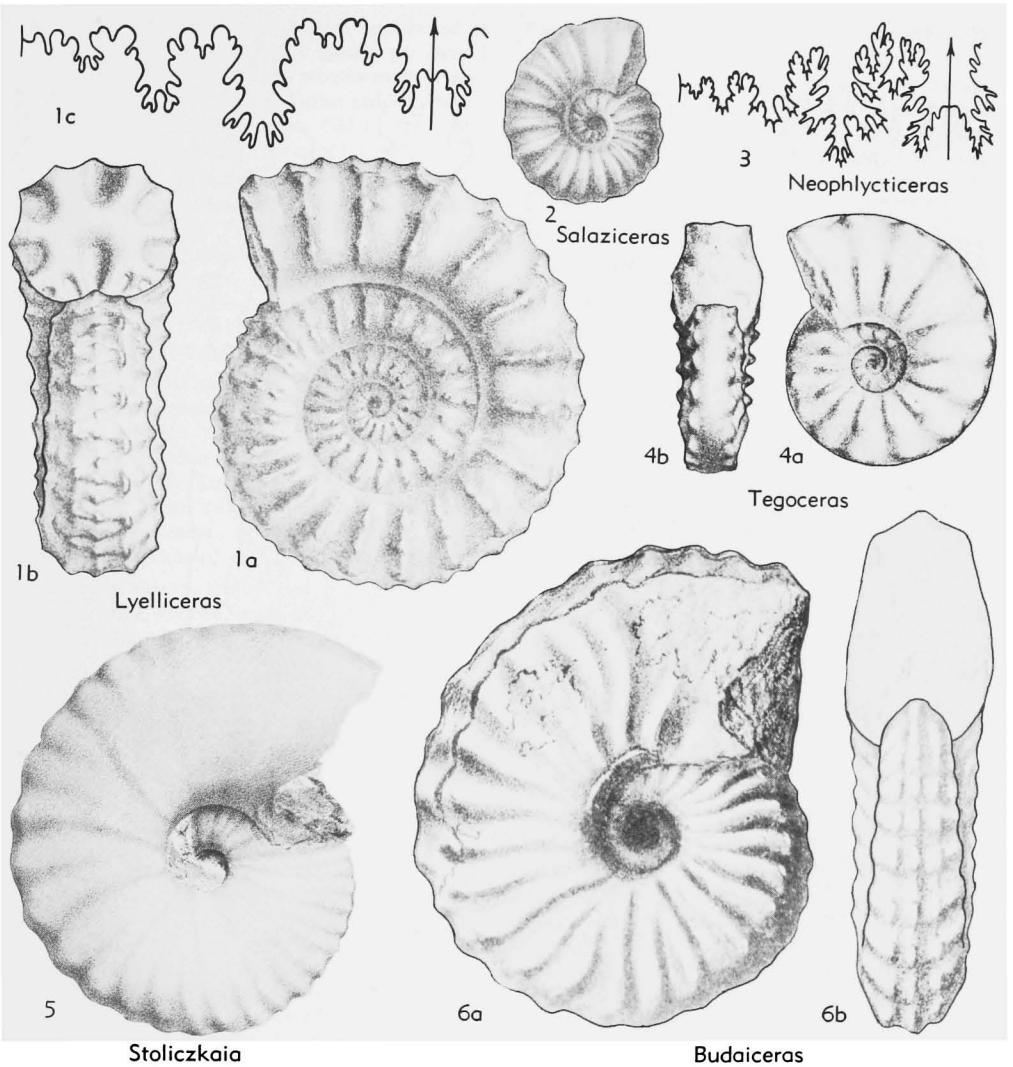


FIG. 530. Lyelliceratidae (p. L410).

Subfamily MANTELLICERATINAE Hyatt, 1903

[*nom. transl.* WRIGHT & WRIGHT, 1951 (*ex* Mantelliceratidae HYATT, 1903)]

Involute to rather evolute, round-whorled or compressed, rarely depressed; usually with prominent ribs, dominant over tubercles where these occur. Typical *Calycoceras* with trituberculate venter is derived from inflated *Mantelliceras* with bituberculate venter, but an unnamed group (usually assigned to *Calycoceras*) is probably derived directly from a species of *Stoliczkaia* different from that which gave rise to *Mantelliceras*. The more strongly ornamented *Calycoceras* (M. Cenom.) gave rise to the Acanthoceratinae (480). *U.Cret.(L.Cenom.-basal Turon.).*

Mantelliceras HYATT, 1903 [**Am. mantelli* J.SOWERBY, 1814] [=*Submantelliceras* SPATH, 1923]. Involute to rather evolute, compressed to inflated; ribs strong, only slightly sinuous; venter usually flat or concave and bituberculate, in some rounded on outer whorls, ribs passing over venter or interrupted; usually distinct umbilical and ventrolateral tubercles and commonly 1 or 2 rows of lateral tubercles. *Submantelliceras* includes merely inner whorls of compressed species of this and other genera. *L.Cenom.*, Eu.-N.Afr.-SE.Afr.-Madag.-S. India-Tex.-Braz.

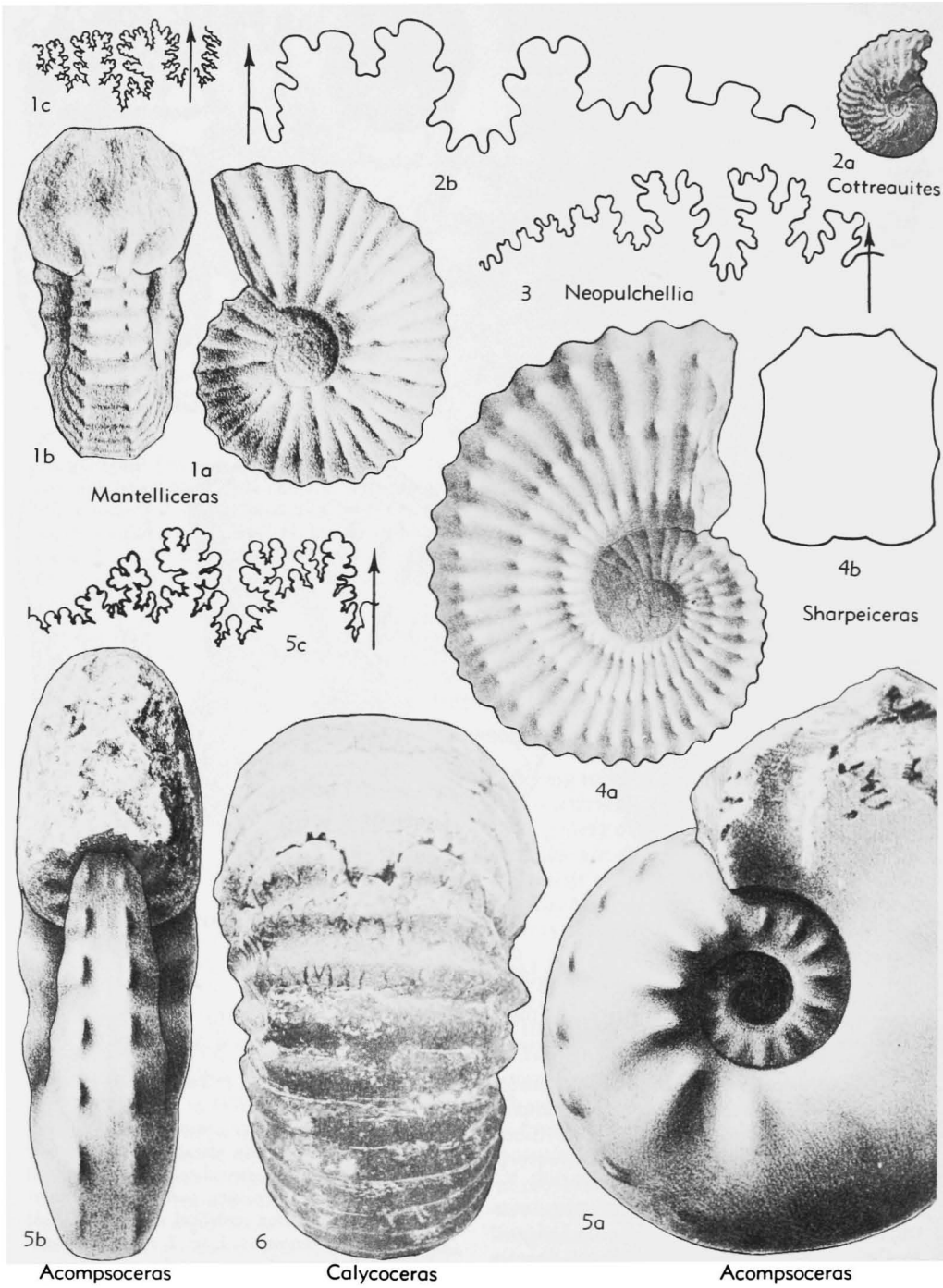


FIG. 531. Acanthoceratidae (Mantelliceratinae) (p. L413).

M. (Mantelliceras). Rather evolute, compressed to inflated; in multituberculate species one lateral tubercle is invariably more prominent than umbilical. Suture with only 4 distinct saddles. Occurrence as for genus.——FIG. 531,*1*. **M. (M.) mantelli* (J.Sow.), Eng.; *1a-c*, ×1 (440*).

M. (Cottreauites) COLLIGNON, 1929 [**Acanthoceras (Prionotropis) subvicinale* BOULE, LEMOINE & THEVENIN, 1906]. Pyritic nuclei alone known, with distinct ventrolateral tubercles but inflated to subcarinate venter. Involute, compressed. Suture with 5 or 6 distinct saddles. *?L.Cenom.*, Alg.-Madag.——FIG. 531,*2*. **M. (C.) subvicinale* (BOULE-L.-T.); *2a*, ×1; *2b*, ×8 (46*).

Neopulchellia COLLIGNON, 1929 [**Pulchellia (Neopulchellia) gignouxi* COLLIGNON, 1929; SD WRIGHT, herein]. Very involute and compressed; ribs fine and dense or absent (on pyritic nuclei which alone are known). Suture with 6 or 7 saddles, 1st lateral saddle divided by large adventive lobe. *?L.Cenom.*, Madag.——FIG. 531,*3*. **N. gignouxi* COLLIGNON; enlarged (601*).

Sharpeiceras HYATT, 1903 [**Am. laticlavius* SHARPE, 1855]. High-whorled, moderately evolute, rather compressed; ribs coarse, typically but not uniformly single, with umbilical tubercle and up to 3 lateral and ventrolateral tubercle on every one; venter concave; adult body chamber may be smooth and fastigate or quadrate with large ventrolateral tubercles. *Cenom.*, W.Eu.-N.Afr.-E.Afr.-Madag.-Syria-Persia-S.India-Tex.——FIG. 531,*4*. **S. laticlavium* (SHARPE), L.Cenom., Eng.; *4a,b*, ×0.5 (440*).

Acompsoceras HYATT, 1903 [**Am. bochumensis* SCHLÜTER, 1871]. Moderately evolute, compressed, with flat venter or with nascent keel, rounded on outer whorl; ribs moderate to strong in young, distant, typically branching at umbilical edge; later broad and flat with rounded or clavate ventrolateral tubercles; body chamber smooth. Folioles of suture well rounded, in some phylloid. *L. Cenom.*, W.Eu.-N.Afr.-Syria-USA.——FIG. 531,*5*. **A. bochumensis* (SCHLÜTER), Ger.; *5a,b*, ×0.375; *5c*, ×0.5 (422*).

Calycoceras HYATT, 1900 [**Am. navicularis* MANTELL, 1822] [*Metacalycoceras* SPATH, 1926]. Rather evolute, with depressed round, oval or quadrate whorl section; strong, generally straight ribs continuous over rounded or flat but not concave venter; umbilical, ventrolateral and siphonal tubercles and in most cases mediolateral tubercles at least on early whorls; in multituberculate forms, umbilical tubercle is more prominent than lateral; tubercles may disappear with age and then rejuvenate on last part of shell. *Cenom.-L.Turon.*, Eu.-Afr.-Madag.-Syria-Persia-S. India-Papua-Japan. ——FIG. 531,*6*; 532,*1*. **C. naviculare* (MANTELL), U.Cenom., Angola; 531,*6*, ×0.75; 532,*1*, ×0.75 (612*).

Tunesites PERVINQUIÈRE, 1907 [**T. salammbo*; SD ROMAN, 1938] [*?Hourcquiceras* COLLIGNON, 1939]. The syntypes, known only from minute nuclei, differ from *Calycoceras* in having marked constrictions with raised rib behind. *Hourcquiceras*, with similar constrictions but known only from large specimens, is probably synonymous. *L. Cenom.*, N.Afr.-?Madag.

Paracalycoceras SPATH, 1925 [**Am. wiesti* SHARPE, 1857]. Inner whorls rather compressed, with weakly trituberculate periphery; body chamber with broad widely separated flexuous ribs bent backward on outer part of sides, as in some *Stoliczkaia. Cenom.*, Eng.-Tex.——FIG. 533,*1*. **P. wiesti* (SHARPE), L.Cenom., Eng.; *1a,b*, ×0.75 (440*).

Eucalycoceras SPATH, 1923 [**Acanthoceras pentagonum* JUKES-BROWNE, 1896]. High-whorled, rather compressed; venter flat at first, later arched; ribs usually dense, in some flat and rather distant, with umbilical, lower and upper ventrolateral and siphonal tubercles, though innermost whorls may have narrow flat bituberculate periphery, as in *Mantelliceras;* tubercles may disappear on body chamber and ribs become flat and steep behind. *U.Cenom.-basal Turon.*, Eng.-N.Afr.-Angola-Madag.-S.India-Tex.——FIG. 533,*2*. **E. pentagonum* (JUKES-BROWNE), U.Cenom., Eng.; *2a,b*, ×0.5 (644*).

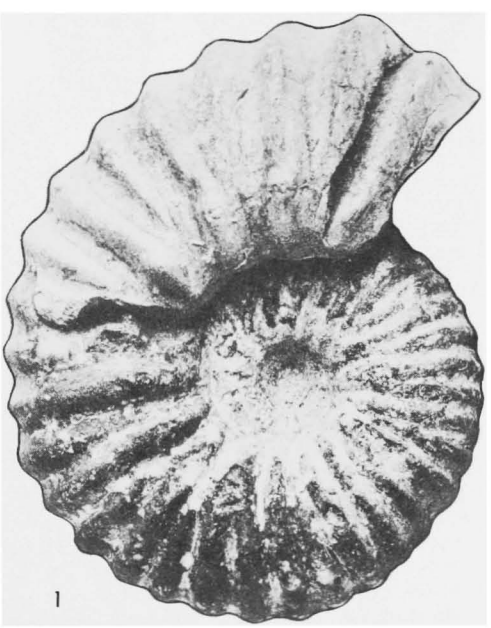


FIG. 532. *Calycoceras naviculare* MANTELL), U.Cret. (U.Cenom.), Angola (p. L413).

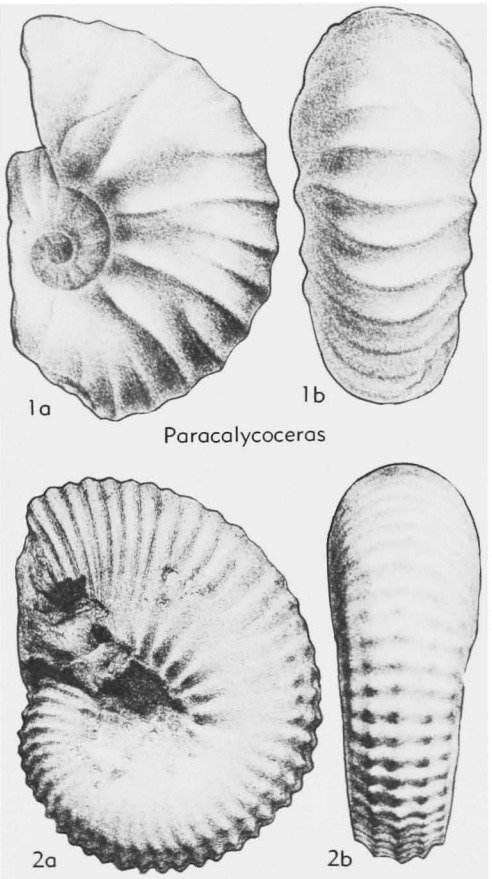


FIG. 533. Acanthoceratidae (Mantelliceratinae) (p. L413).

Subfamily ACANTHOCERATINAE Hyatt, 1900

[*nom. transl.* WRIGHT & WRIGHT, 1951 (*ex* Acanthoceratidae HYATT, 1900)]

Tubercles typically dominant over ribs and very large in some forms but the subfamily includes some small compressed genera with finely tuberculate venters. A number of distinct groups still need generic names (572). *U.Cret.(Up.L.Cenom.-U. Turon.).*

Acanthoceras NEUMAYR, 1875 [**Am. rhotomagensis* DEFRANCE in BRONGNIART, 1822; SD DEGROSSOUVRE, 1894] [=*Metacanthoplites* HYATT, 1900 (obj.)]. Middle stages generally with round or squarish whorl section and umbilical, lower and upper ventrolateral and siphonal tubercles, with or without distinct ribs; later in large adults, 2 clavate ventrolateral tubercles may fuse to produce large horn, while siphonal tubercles disappear, leaving a broad flat venter. *Up.L.Cenom.-U.Cenom.,* Eu.-Afr.-Persia-S.India-USA.——FIG. 534,*7*. **A. rhotomagense* (DEFRANCE), U.Cenom., Fr.; *7a,b,* ×0.75 (586*).

Neosaynoceras BREISTROFFER, 1947 [**Saynoceras gazellae* PERVINQUIÈRE, 1907]. Dwarf, globular and involute, with sharp umbilical, ventrolateral and siphonal tubercles. Approximate homeomorph of *Saynoceras. L.Cenom.,* Tunisia-Madag.——FIG. 534,*1*. **N. gazellae* (PERV.), Tunisia; *1a,b,* ×1 (339*).

Euomphaloceras SPATH, 1923 [**Am. euomphalus* SHARPE, 1855] [=*Cunningtoniceras* COLLIGNON, 1937]. Very evolute, rather depressed; prominent umbilical and ventrolateral tubercles on some or all main ribs; venter broad and flat, with 3 rows of small tubercles or ribs, more numerous than ventrolateral tubercles; with shallow ventral constrictions. Derived from evolute *Acanthoceras. U. Cenom.,* W.Eu.-N.Afr.-Madag.-Syria-S.India-Tex. ——FIG. 534,*2*. **E. euomphalus* (SHARPE), Eng.; *2a-c,* ×1 (602*).

Kanabiceras REESIDE & WEYMOUTH, 1931 [**Acanthoceras(?) kanabense* STANTON, 1893 (=**Scaphites(?) septemseriatus* CRAGIN, 1893)]. Differs from *Euomphaloceras* in that paired tubercles on venter are oblique, not transverse, and siphonal tubercles now form a nodose keel. *U.Cenom.-L.Turon.,* W. Eu.-USA.——FIG. 534,*5*. **K. septemseriatum* (CRAGIN), L.Turon., Tex.; *5a,b,* ×0.5 (666*).

Romaniceras SPATH, 1923 [**Am. deverianum* D'ORBIGNY, 1841] [=*Kossmatia* YABE, 1927 (*non* UHLIG, 1910)]. Rather evolute, circular or oval whorl section; differs from *Acanthoceras* in having 9 or 11 rows of more or less equal tubercles, equidistant or not; ventrolateral tubercles may be clavate. *U.Cenom.-U.Turon.,* W.Eu.-N.Afr.-W.Afr.-Madag.-Syria-Japan.——FIG. 534,*3*. **R. deverianum* (ORB.), L.Turon., Fr.; *3a,b,* ×0.5 (585*).

Protacanthoceras SPATH, 1923 [**Am. bunburianus* SHARPE, 1853]. Typically small, rather involute to evolute, compressed to moderately inflated; with more or less prominent umbilical and lower ventrolateral tubercles, upper ventrolateral and siphonal tubercles forming 3 close rows of clavi on narrow venter, which may amalgamate on last part of body chamber to form chevron-like ribs. Suture with plump, round, moderately indented saddles. *U.Cenom.,* Eng.-Madag.-Syria-S.India-Wyo.——FIG. 534,*4*. *P. compressum* (JUKES-BROWNE), Eng.; *4a,b,* ×1 (644*).

Neocardioceras SPATH, 1926 [**Am. juddi* BARROIS & GUERNE, 1878]. Evolute, compressed, with sharp umbilical and double ventrolateral tubercles; row of close round siphonal tubercles tend to form nodose keel; tubercles may disappear on outer whorls, leaving fine sharp ribs. Differs from *Protacanthoceras* in sharper ribs, more fastigate venter, and much closer siphonal tubercles. *Basal Turon.,* Eng.-Fr.-Mont.

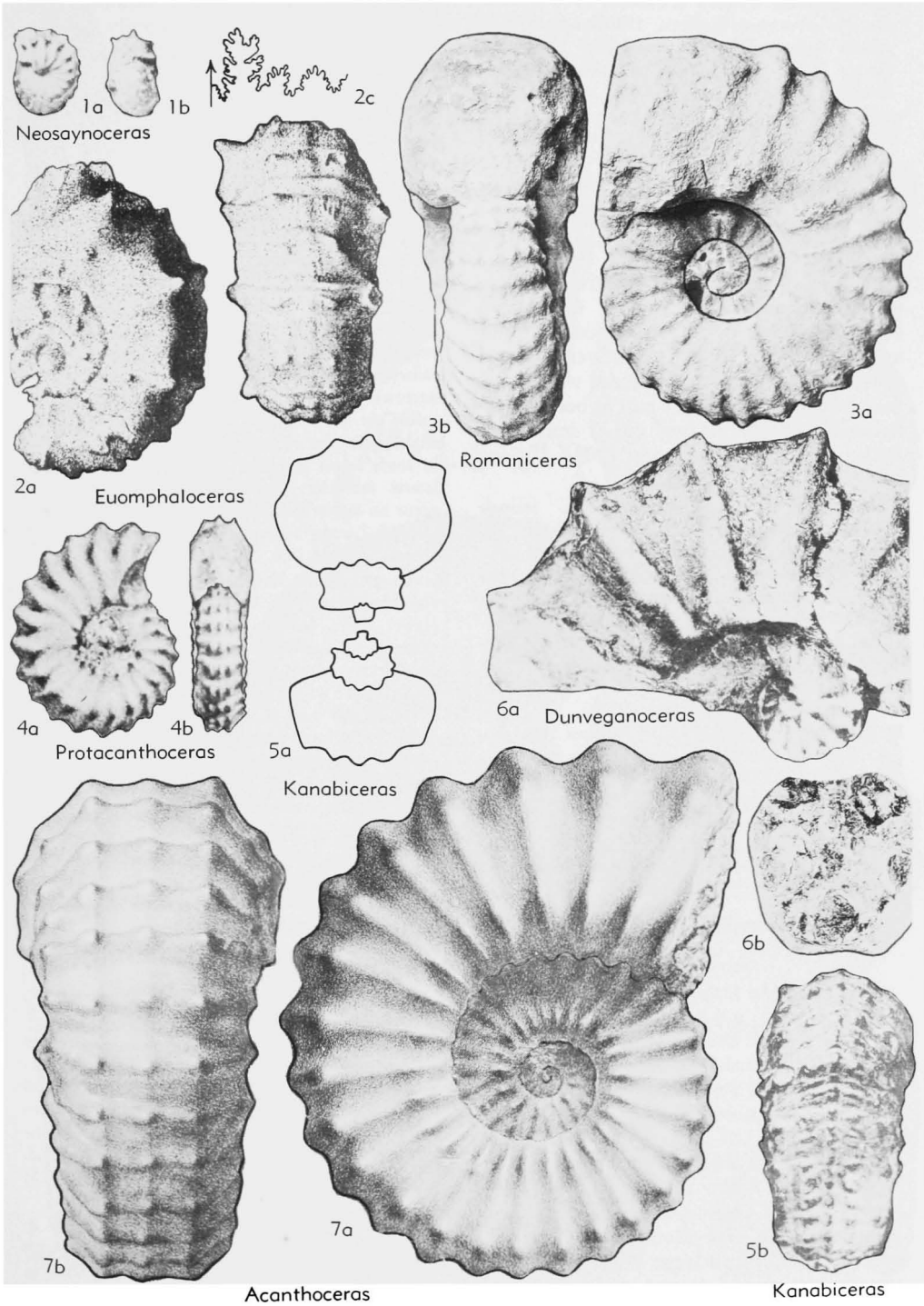


FIG. 534. Acanthoceratidae (Acanthoceratinae) (p. L414-L416).

Dunveganoceras WARREN & STELCK, 1940 [**Acanthoceras albertense* WARREN, 1930]. Large; early whorls with umbilical bullae, conical lower and clavate upper ventrolateral tubercles; sides flat, shoulders converging, venter flat or concave; outer whorls with dominant rounded ribs and rounded, flat or fastigate venter, with ventrolateral horns or bulges. *U.Cenom.*, Can.-USA.——FIG. 534,*6*. *D. pondi* HAAS, Wyo.; *6a,b*, ×0.25 (632*).

Subfamily METOICOCERATINAE Hyatt, 1903

[*nom. transl.* WRIGHT & WRIGHT, 1951 (*ex* Metoiceratidae HYATT, 1903)]

Still more compressed derivatives of compressed *Acanthoceras*, tending to develop concave bituberculate venter, broad flat ribs and simplified suture; inner ventrolateral tubercle usually present on inner whorls but may disappear later; later part of body chamber may be rounded and either smooth or with ribs passing over venter (202). *U.Cret. (U.Cenom.-L.Turon.)*.

Utaturiceras WRIGHT, 1956 [**Am. vicinale* STOLICZKA, 1865]. Typically compressed, with flat ribs; early whorls with distinct umbilical, inner and outer ventrolateral and siphonal tubercles but inner ventrolateral and the siphonal ones may weaken on outer whorls; includes some more inflated and coarsely ornamented species with prominent, not flattened ribs. *U.Cenom.*, Eng.-?Sp.-S. India.——FIG. 535,*2*. **U. vicinale* (STOLICZKA), S.India; *2a*, ×0.75; *2b,c*, ×1 (718*).

Metoicoceras HYATT, 1903 [**Am. swallovi* SHUMARD, 1859]. Differs from *Utaturiceras* mainly in its simpler suture and absence of any row of siphonal tubercles; includes smooth or ribbed, compressed, involute forms and more evolute, more strongly ornamented ones. *L.Turon.*, Eu.-USA.——FIG. 535,*1*. **M. swallovi* (SHUMARD), Tex.; *1a*, ×0.75; *1b*, ×0.5 (202*).

Subfamily MAMMITINAE Hyatt, 1900

[*nom. transl.* WRIGHT & WRIGHT, 1951 (*ex* Mammitidae HYATT, 1903)]

Moderately to very evolute, typically with rectangular to square whorl section and blunt umbilical and prominent inner and outer ventrolateral tubercles on sparse ribs, but ribs may be strong and rounded, sharp and narrow or absent; siphonal line may be slightly raised, but there is no keel or row of siphonal tubercles. Suture is a little simpler than in most Acanthoceratinae. Although a few Cenomanian species have been recorded, they are doubtful; *Mammites* seems to be merely a large *Watinoceras* with squarer section and coarser ornament; stratigraphical relations support this. *Watinoceras* seems to be derived from *Neocardioceras*, a derivative of *Protacanthoceras*. Other members of the subfamily are derived from *Mammites* or *Watinoceras* directly (202, 375). *U.Cret.(L.Turon.)*.

Watinoceras WARREN, 1930 [**W. reesidei*]. Early whorls compressed, finely ribbed, with inner and outer ventrolateral and siphonal tubercles as in *Neocardioceras*, but siphonal row soon lost; later, venter may be concave between rows of ventrolateral clavi or rounded, with ribs passing over in chevrons; ornament usually coarsens with age. *L.Turon.*, Eng.-Nigeria-Turkestan-Alba.-USA.——FIG. 535,*5*. *W. amudariense* (ARKANGELSKY), Turkestan; *5a,b*, one specimen, ×1; *5c*, another specimen, ×1 (582*).

Benueites REYMENT, 1954 [**B. benueensis*]. Small, rather evolute, compressed, with flat sides; venter narrowly arched, commonly with deep narrow sulcus on early whorls, later with shallow sulcus, slightly concave or flat; very fine sigmoid ribs and in some forms irregular lower and upper ventrolateral tubercles; coarser ribs and tubercles may occur on last whorl which then resembles *Watinoceras*. *L.Turon.*, Nigeria.——FIG. 536,*1*; 537,*1*. **B. benueensis*; 536,*1a,b*, ×1; 537,*1*, ×2 (689*).

Mammites LAUBE & BRUDER, 1886 [**Am. nodosoides* SCHLOTHEIM in VON BUCH, 1829] [*Schlutericeras* HYATT, 1903 (obj.)]. Whorl section rectangular, square, or trapezoidal, venter flat or slightly concave; inner whorls rather like ribless *Mantelliceras* but on outer whorl tubercles are sparser and much larger, inner and outer ventrolaterals fusing in some into a large horn. *Turon.*, Eu.-Turkestan-N. Afr. - Nigeria - Madag. - S. India - Tex.-Peru.——FIG. 535,*4*. **M. nodosoides* (SCHLOTH.), L.Turon., Ger.; *4a,b*, ×0.5; *4c*, ×0.25 (422*).

?Kamerunoceras REYMENT, 1954 [**Acanthoceras eschii* SOLGER, 1904]. Rectangular whorl section, very evolute; umbilical tubercles only in middle growth; rather weak inner and strong, spinose outer ventrolateral tubercles; irregular siphonal tubercles; ribs irregular, straight at first, becoming denser and sigmoid on outer whorl. *L.Turon.*, Nigeria.——FIG. 537,*2*. **K. eschii* (SOLGER); ×0.75 (689*).

Pseudaspidoceras HYATT, 1903 [**Am. footeanus* STOLICZKA, 1865]. Whorl section high and rectangular; ribs almost absent, tubercles distant and less prominent than in *Mammites* and not enlarging on outer whorl. *L.Turon.*; Eu.-Cameroons-Egypt-Madag.-S.India-USA-Braz.——FIG. 535,*3*. **P. footeanum* (STOLICZKA), S.India; *3a,b*, ×0.25; *3c*, ×1; *3d*, enlarged (718*).

Metasigaloceras HYATT, 1903 [**Am. rusticus* J. SOWERBY, 1817]. Whorl section trapezoidal; with very large blunt lateral tubercles giving rise to pairs of broad flat ribs, each ending in low ventrolateral tubercle; venter flat and smooth. *L. Turon.*, Eng.-Turkestan.——FIG. 537,*3*. *M. rusti-*

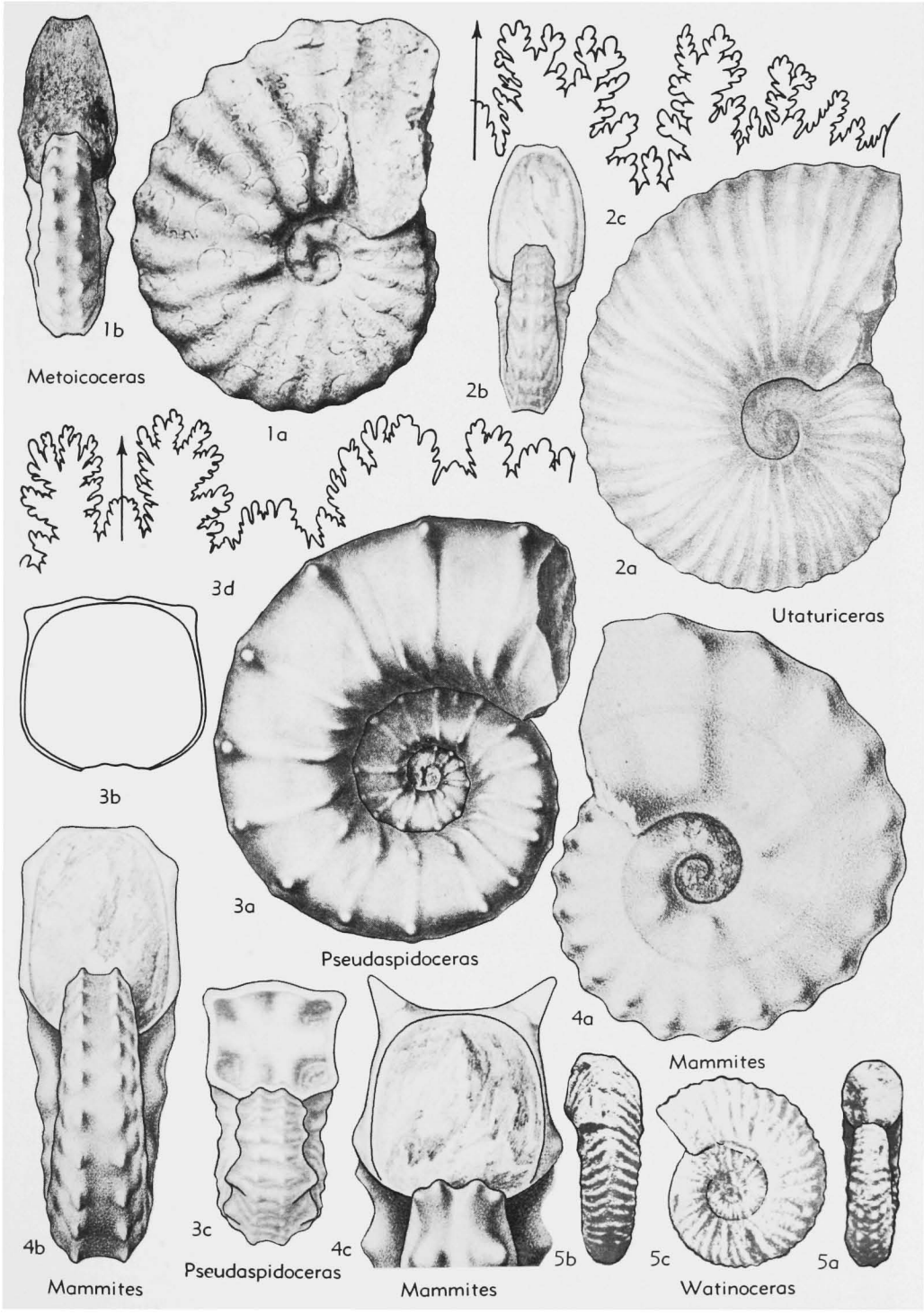


FIG. 535. Acanthoceratidae (Metoicoceratinae, Mammitinae) (p. L416).

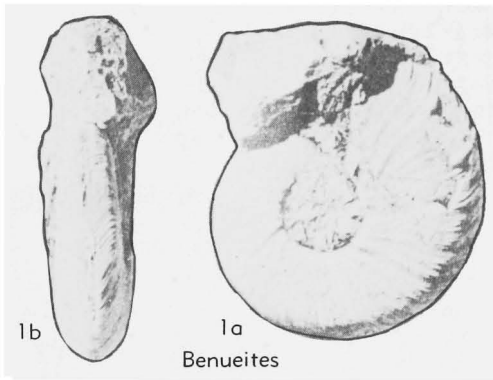


FIG. 536. *Benueites benueensis* REYMENT, U.Cret. (L.Turon.), Nigeria (p. L416).

cum amudariense (ARKANGELSKY), L.Turon., Turkestan; *3a,b*, ×0.7 (582*).

Family BINNEYITIDAE Reeside, 1927

Rather small, compressed and flat-sided forms with little ornament and peculiar suture tending to have deep, narrow, simple or even entire elements with parallel sides. The early species retain traces of ventrolateral ornament which indicate derivation from a compressed acanthoceratid, probably *Protacanthoceras* (363). *U.Cret.(U. Cenom.-Coni.)*.

Borissjakoceras ARKANGELSKY, 1916 [**B. mirabilis*]. Moderately evolute to rather involute, venter bluntly trapezoidal to rounded; surface smooth except for traces of oblique ribs on shoulders. Suture simple, with deep narrow parallel-sided bifid 1st lateral lobe and broad saddles, 1st lateral bifid or entire and the 2nd trifid. *U.Cenom.-L. Turon.*, Turkestan-Kans.-Mont.——FIG. 538,*1*. **B. mirabilis*, L.Turon., Turkestan; *1a,b*, ×1; *1c*, ×3 (582*).

Binneyites REESIDE, 1927 [**B. parkensis*]. Very involute, venter flat, shoulders sharper and ventrolateral ornament stronger than in *Borissjakoceras*. Suture with very narrow, entire and finger-like 1st lateral saddle, broad 1st lateral lobe and with more auxiliary elements than in *Borissjakoceras*. *Coni.*, Wyo.——FIG. 538,*2*. **B. parkensis; 2a,b*, ×2; *2c*, ×4 (363*).

Family VASCOCERATIDAE Spath, 1925

Derivatives of Acanthoceratinae which rapidly lose ribbing and tuberculation of that subfamily and are either smooth or bluntly tuberculate or have sparse coarse ribs. Suture may comprise shallow, irregular and slightly indented or deep and much-indented elements. The whorl section and degree of involution is variable, even within species. Typically Tethyan in occurrence (339, 375). *U.Cret.(L.Turon.)*.

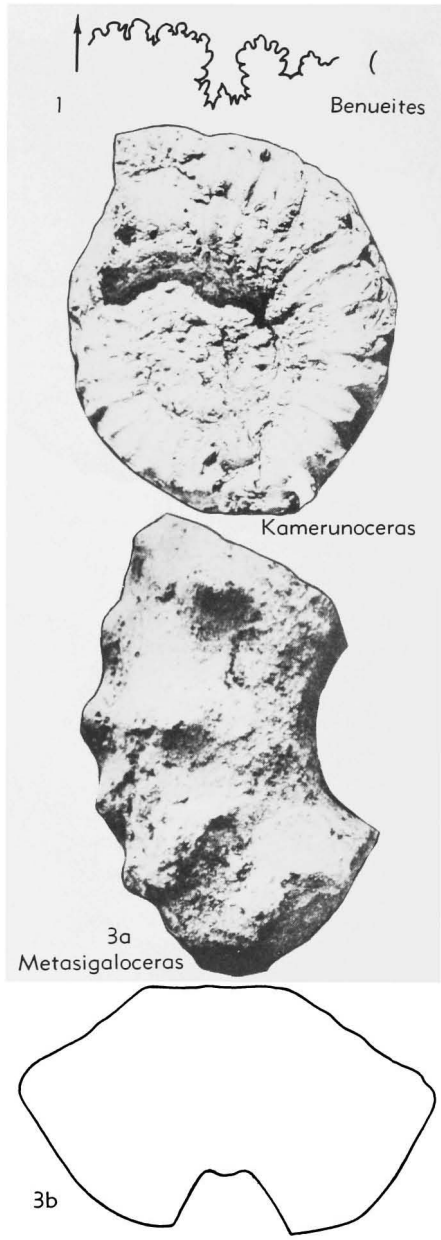


FIG. 537. Acanthoceratidae (Mammitinae) (p. L416).

Nigericeras SCHNEEGANS, 1943 [**N. gignouxi*]. Acanthoceratine ornament of ribs and umbilical, double ventrolateral, and siphonal tubercles persist to diameters as great as 40 mm.; thereafter, shell is smooth except for strong or weak folds;

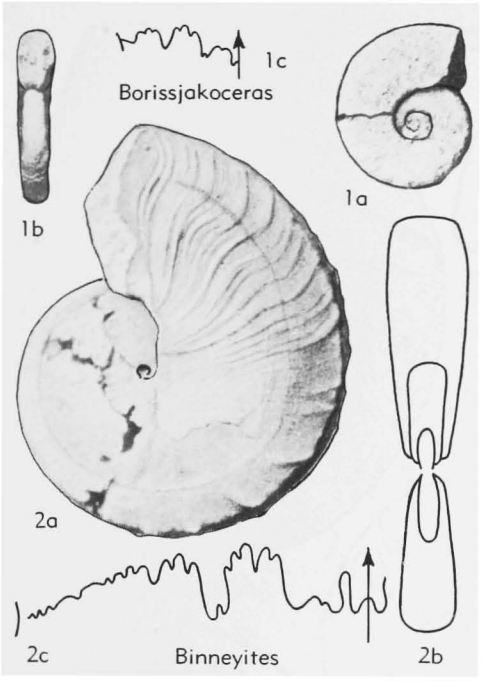


FIG. 538. Binneyitidae (p. L418).

whorl section oval, round, or squarish. Suture much as in *Vascoceras* but a little less simplified. *L.Turon.*, Fr.W.Afr.-Nigeria-Turkestan.——FIG. 540,*1*. **N. gignouxi*, Fr.W.Afr.; *1a*, ×1; *1b*, ×0.5 (703*).

Spathites KUMMEL & DECKER, 1954 [**S. chispaensis*]. More involute than *Nigericeras* and lacking siphonal tubercle at any stage; adult whorl section typically square, with angular shoulders. *L.Turon.*, Tex.——FIG. 539,*1*. **S. chispaensis*; ×1 (651*).

Gombeoceras REYMENT, 1954 [**Vascoceras gongilense* WOODS, 1911]. Moderately evolute, whorl section subquadrate to rounded; inner whorls with strong low ribs ending in ventrolateral tubercles and faint keel which later becomes crenulate, then breaks into discrete siphonal tubercles; ornament weakens on latter part of last whorl. Suture as in *Vascoceras* but elements a little deeper and narrower in adult. *L.Turon.*, Nigeria-Turkestan.——FIG. 540,*3*. **G. gongilense* (WOODS), Nigeria; *3a*, ×1; *3b*, ×0.5 (689*).

Ezilloella REYMENT, 1954 [**E. ezilloensis*]. More evolute than *Gomboeceras* and with more compressed inner whorls, with narrowly arched to subcarinate venter; with broad bulges on sides and only feeble ventrolateral and siphonal tubercles on outer whorl. *L.Turon.*, Nigeria.

Paravascoceras FURON, 1935 [**Vascoceras cauvini* CHUDEAU, 1909] [*Paracanthoceras* FURON, 1935]. Early whorls involute, compressed, with weak ribs on outer part; later whorls evolute, moderately compressed to inflated and smooth; finally, ventrolateral bulges appear and strengthen into strong prorsiradiate ribs on outer part of side; no umbilical tubercles. *L.Turon.*, Fr.W.Afr.-Nigeria.——FIG. 540,*4*. *P. chevalieri* (FURON), Fr.W.Afr.; ×0.5 (625*).

Pachyvascoceras FURON, 1935 [**P. crassum* FURON, 1935; SD REYMENT, 1954]. Globular or cadicone with weak but persistent ribs and either no tubercles or in a few species umbilical tubercles on early whorls only. *L.Turon.*, Port.-W.Afr.-Mex.-Peru-Braz.——FIG. 540,*7*. **P. crassum* (FURON), Fr.W. Afr.; ×0.75 (625).

Vascoceras CHOFFAT, 1898 [**V. gamai*]. More or less evolute, whorl section oval, triangular or round; early whorls with coarse ribs and umbilical tubercles, ribs soon disappearing so as to leave large blunt umbilical tubercles which may or may not persist. Suture irregular, with wide, very shallow, feebly indented elements. *L.Turon.*, Port.-Sp.-Fr.-N.Afr.-W.Afr.-Mex.——FIG. 540,*2*. **V. gamai;* Port.; *2a-c*, ×0.5 (599*).

Paramammites FURON, 1935 [**Vascoceras polymorphum* PERVINQUIÈRE, 1907; SD REYMENT, 1954]. Variable, more or less evolute; prominent coarse ribs bear strong and blunt umbilical, ventrolateral and one or more lateral tubercles. *L. Turon.*, Port.-Tunisia-Mex.——FIG. 541,*3*. **P. polymorphum* (PERV.), Tunisia; *3a-c*, ×1 (339*).

Plesiovascoceras SPATH, 1925 [**Am. catinus* MANTELL, 1822]. Evolute, with very depressed whorl section; early whorls with coarse ribs in pairs, interrupted on venter; later whorls almost smooth apart from very large, blunt umbilical or lateral tubercles. Suture as in *Vascoceras*. *L.Turon.*, Eng.-

FIG. 539. *Spathites chispaensis* KUMMEL & DECKER, U.Cret.(L.Turon.), Tex. (p. L419).

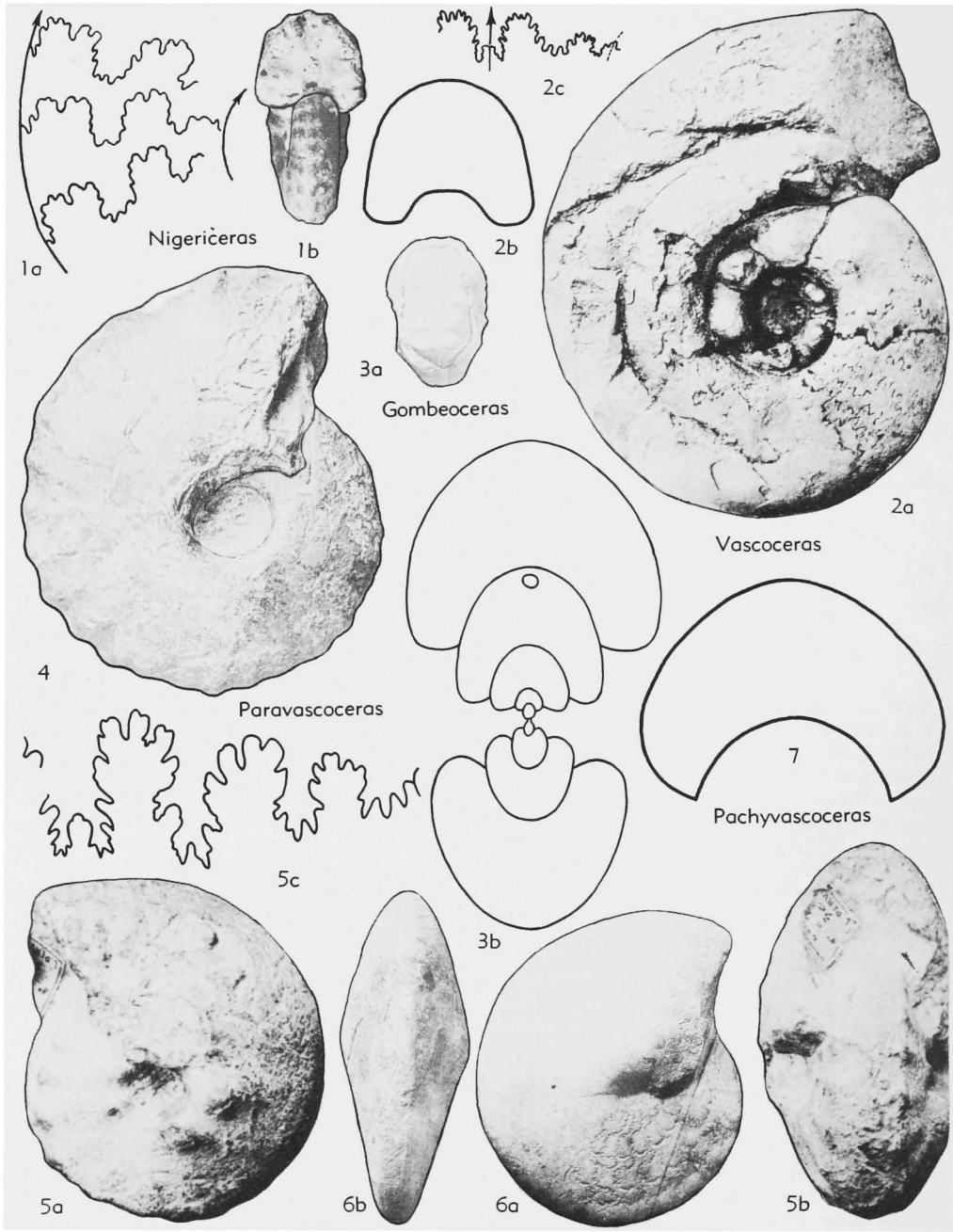


FIG. 540. Vascoceratidae (p. L418-L421).

Port.-Mex.-Mont.——FIG. 541,*1*. *P. stantoni* (REESIDE), Mont.; *1a*, ×0.5; *1b*, ×1 (686*).

Fagesia PERVINQUIÈRE, 1907 [**Olcostephanus superstes* KOSSMAT, 1897]. Typically cadicones with strong blunt umbilical tubercles from which spring 2 or 3 strong rounded ribs which persist to a late stage, but in some species tubercles and ribs are lost at early stage. Suture regular, with deep narrow much-indented elements. *L.Turon.*, Fr.-N.Afr.-Nigeria-Madag.-S.India-Japan.——FIG. 544,2. **F. superstes* (KOSSMAT), S.India; *2a-c*, ×0.5 (238*).

Thomasites PERVINQUIÈRE, 1907 [**Pachydiscus rol-*

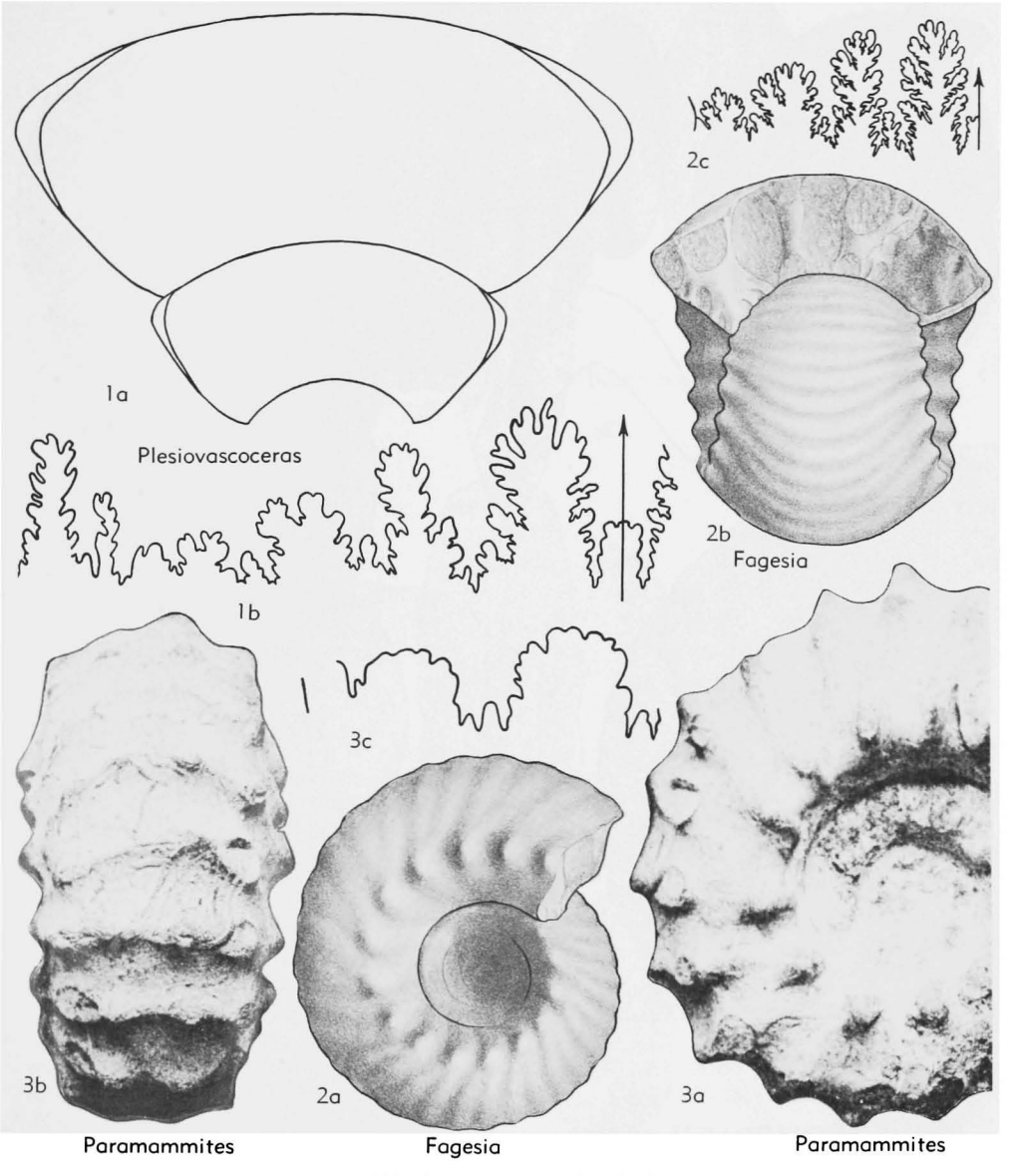


FIG. 541. Vascoceratidae (p. L419-L420).

landi THOMAS & PERON, 1889]. Involute and globose when young; late whorl section becomes triangular with 4 or 5 umbilical tubercles to a whorl, each giving rise to 2 or 3 faint broad ribs which end in slight, blunt ventrolateral tubercles; with row of blunt siphonal tubercles also; finally all ornament disappears; mouth constricted. Suture less regular than in *Fagesia* but otherwise similar. *L.Turon.*, N.Afr.-Syria-Tex.——FIG. 540,*5*. **T. rollandi* (THOMAS & PERON), Tunisia; *5a,b*, ×1; *5c*, enlarged (339*).

Neoptychites KOSSMAT, 1895 [**Am. telinga* STOLICZKA, 1865 (**Am. cephalotus* COURTILLER, 1860)]. Very involute, high-whorled with minute umbilicus; whorl section widest at rounded umbilical edge; venter narrowly rounded; inner whorls much as in *Thomasites* but constricted and nontuberculate; broad low ribs present in many shells at first disappear, leaving outer whorl smooth and compressed, with constricted aperture. Suture as in *Vascoceras*. *L.Turon.*, Fr.-N.Afr.-Madag.-S.

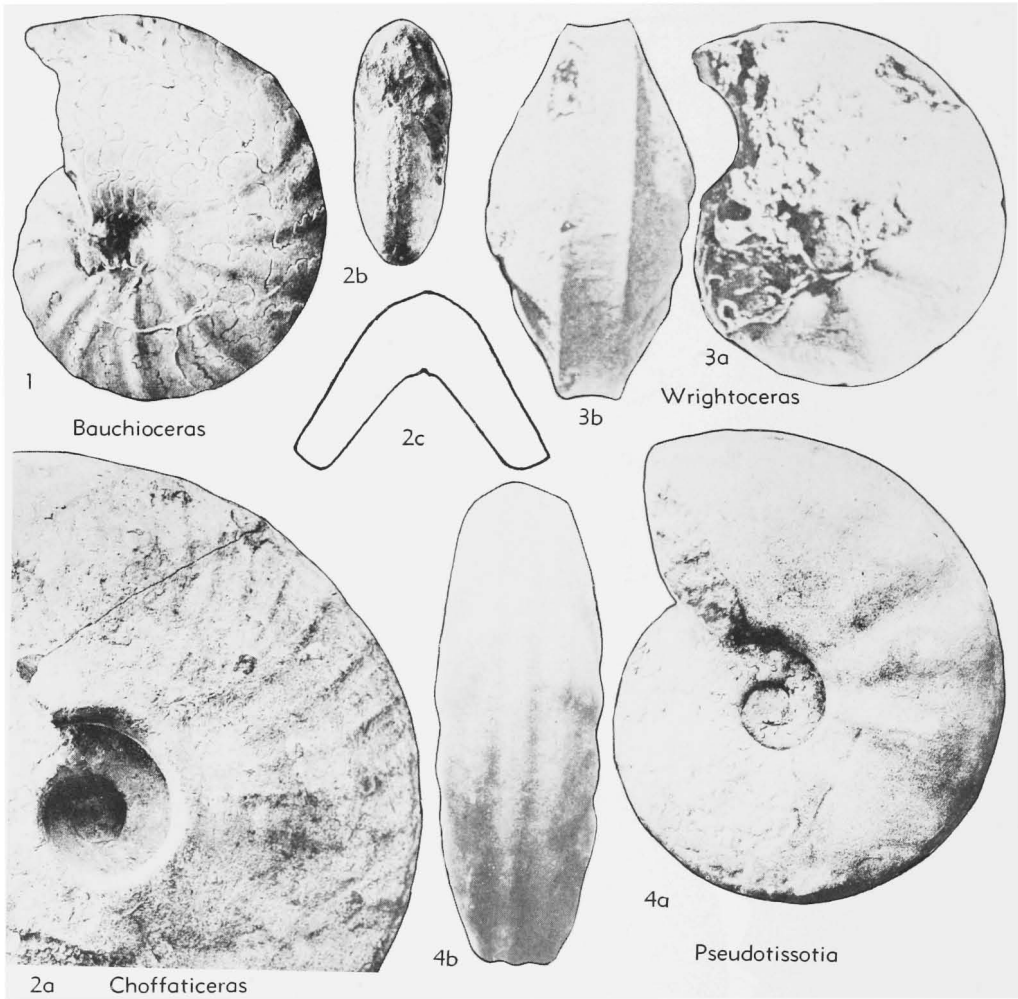


FIG. 542. Tissotiidae (Pseudotissotiinae) (p. L422-L424).

India-Tex.-Mex.——FIG. 540,6. **N. cephalotus* (COURT.), Tunisia; *6a,b*, ×0.25 (339*).

Family TISSOTIIDAE Hyatt, 1900

Derivatives of Vascoceratidae tending to smoothness, with entire keels, great involution and multiplication and simplification of sutural elements. Classification is difficult because of convergence between some of the family and Coniacian derivatives of the Collignoniceratidae (202, 338, 339, 375). *U. Cret.(L.Turon.-L.Santon.)*.

Subfamily PSEUDOTISSOTIINAE Hyatt, 1903

[*nom. transl.* WRIGHT, 1952 (*ex* Pseudotissotiidae HYATT, 1903)]

Involute, with flat, fastigate or sharp venter; ribs broad and sparse or absent. Differs from Tissotiinae only in suture and then slightly. *Pseudotissotia* is closely related to early Vascoceratidae (131, 202, 338, 339, 375). *U.Cret.(L.Turon.-Coni.)*.

Pseudotissotia PERON, 1897 [**Am. gallienei* D'ORBIGNY, 1847]. Whorl section more or less rectangular or trapezoidal with flat venter, bearing 2 or 3 fairly persistent keels. Suture with 4 saddles, usually feebly denticulate but inner ones tending to be entire. *L.Turon.*, Fr.-Sp.-N.Afr.-W. Afr.-Syria-Tex.-Mex.-C.Am.

P. (Bauchioceras) REYMENT, 1954 [**Hoplitoides nigeriensis* WOODS, 1911]. Inflated to compressed, whorl sides convex or flat, venter flat with 3 bluntly crenulate or entire keels, more or less equal, but siphonal one in some weaker than others; sparse broad ribs on inner whorls only. *L.Turon.*, N.Afr. - W.Afr. - Syria - C.Am.——FIG.

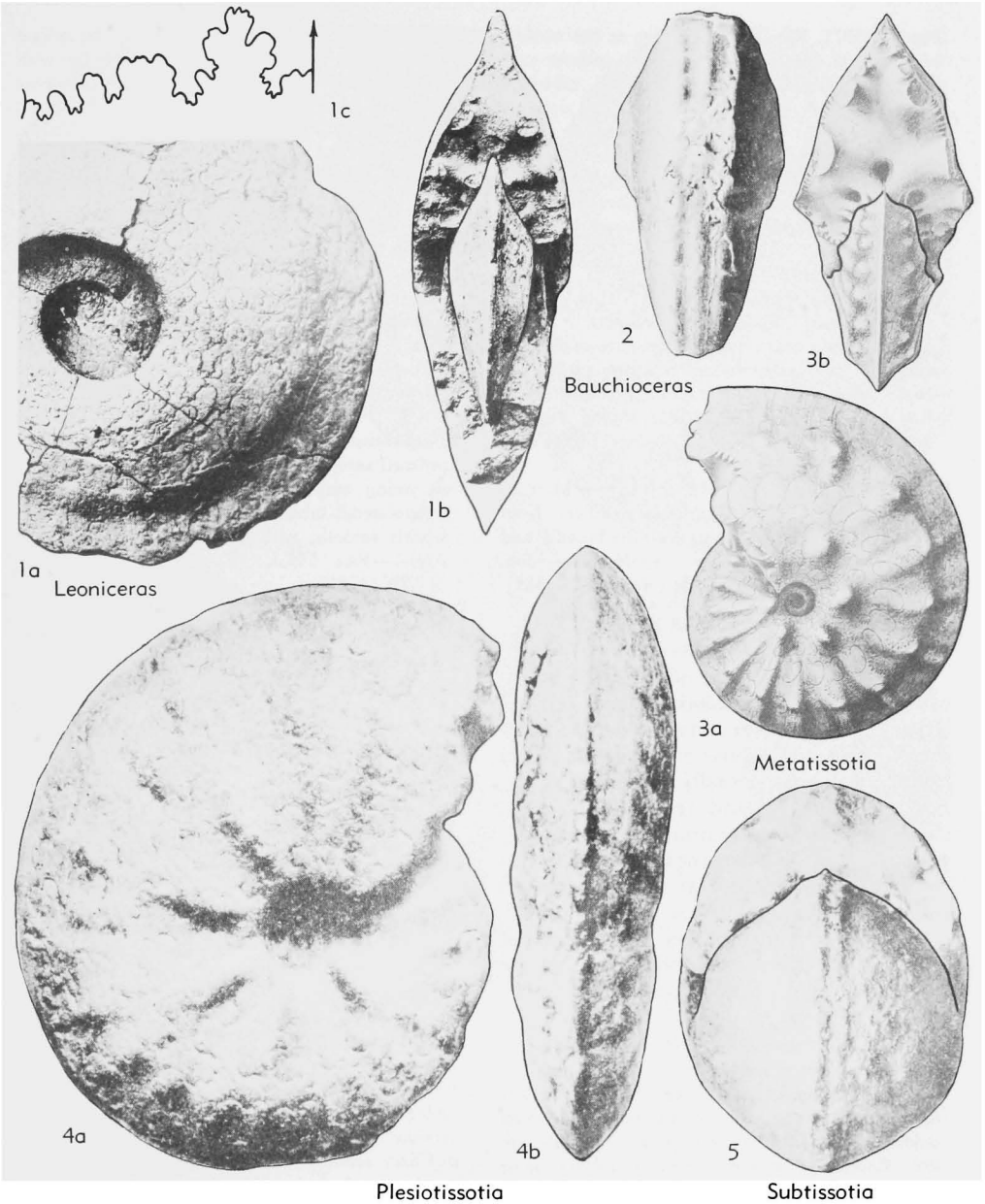


FIG. 543. Tissotiidae (Pseudotissotiinae, Tissotiinae) (p. L422-L424).

542,*1;* 543,*2.* **P. (B.) nigeriense* (WOODS), Nigeria; both, ×0.75 (734*).

P. (Pseudotissotia). Distinguished from *P. (Bauchioceras)* only by higher and more rectangular whorl section and the persistent wedge-shaped, flat ribs. *L.Turon.,* Fr.-N.Afr.-Egypt-Fr.Congo. ——FIG. 542,*4.* **P. (P.) gallienei* (ORB.); *4a,b,* ×0.5 (338*).

P. (Wrightoceras) REYMENT, 1954 [**Bauchioceras (Wrightoceras) wallsi*]. Similar at first to *P. (Bauchioceras)* but later whorls compressed, with sides flat or concave on outer part and venter flat or concave, with no siphonal keel; ribs sparser but stronger than in *P.(Bauchioceras);* umbilical area may be inflated. *L.Turon.,* Sp.-Tunisia-Nigeria-Mex.——FIG. 542,*3.* **P. (W.) wallsi* (REYMENT); Nigeria; *3a,b,* ×1 (689*).

Choffaticeras HYATT, 1903 [**Pseudotissotia meslei*

PERON, 1897]. Whorl section more or less cordate or lanceolate. Venter sharp, with or without subdued ventrolateral keels or rows of tubercles. Derived from *Pseudotissotia* by raising of siphonal keel. *Turon.*, Fr.-N.Afr.-W.Afr.-Madag.

C. (Choffaticeras). Inflated with nearly cordate whorl section; distinct ventrolateral keels or rows of tubercles on early whorls. *L.Turon.*, N.Afr.-W.Afr. Occurrence as for genus.——FIG. 542,*2*. **C. (C.) meslei* (PERON), Alg.; *2a*, ×0.5; *2b*, ×0.25; *2c*, ×0.5 (338*).

C. (Leoniceras) H.DOUVILLÉ, 1912 [**Pseudotissotia (Choffaticeras) luciae* PERVINQUIÈRE, 1907]. Whorl section more or less lanceolate, sides concave on outer part; without perceptible tubercles. Inner whorls may have rounded shoulders and fine dense ribs. *Turon.*, Fr.-N.Afr.-Madag.——FIG. 543,*1*. **C. (L.) luciae* (PERV.), Tunis; *1a-c*, ×0.5 (339*).

Plesiotissotia PERON, 1897 [**P. michaleti*]. More or less lanceolate whorl section but differs from *Leoniceras* in having 1st lateral saddle broadly and asymmetrically bifid. *Coni.*, Sp.-N.Afr.——FIG. 543,*4*. **P. michaleti*, Coni., Alg.; *4a,b*, ×1 (338*).

Subfamily TISSOTIINAE Hyatt, 1900

[*nom. transl.* WRIGHT, 1952 (*ex* Tissotiidae HYATT, 1900)]

May comprise several offshoots of different members of Pseudotissotiinae, but relationships are not yet certain. Involute, compressed with rectangular or lanceolate whorl section or globular; usually with fairly strong ribs and umbilical and ventrolateral tubercles, latter forming continuous keel in some young forms but ornament may disappear at varying stages. Suture with some or all saddles entire; 1st lateral saddle usually divided by adventitious lobe into 2 more or less equal parts but all details of sutures are irregular (202, 233, 338). *U.Cret.(U. Turon.-L.Santon.)*.

Heterotissotia PERON, 1897 [**H. neoceratites*]. Involute, sides flat or inflated, venter flat or concave, with angular or keeled shoulders; strong but low rounded branching ribs. Suture with 1st lateral saddle deeply bifid, 3 other saddles usually entire. Except in suture closely resembles some *Pseudotissotia*. *U.Turon.-Coni.*, N.Afr.-Somali.-Peru.——FIG. 544,*2*. **H. neoceratites*, Coni., Alg.; *2a,b*, ×1 (338*).

Tissotia H.DOUVILLÉ, 1878 [**Buchiceras tissoti* BAYLE, 1878]. Very involute, more or less inflated; in early stages with low, branching ribs, siphonal keel and ventrolateral keels or rows of tubercles, which may disappear. Suture with 1st lateral saddle divided into 2 equal saddles, one or both of which may have a few indentations, but they and other saddles are usually entire. *Coni.-L.Santon.*, Fr.-C.Eu.-N.Afr.-W.Afr.-Borneo.

T. (Tissotia). Retains more or less subquadrate whorl section throughout growth; venter flat with 3 feeble keels separated by sulci which disappear on outer whorls. *Coni.*, Fr.-N.Afr.——FIG. 544, *3a,b*. **T. (T.) tissoti* (BAYLE), Coni., Fr.; *3a*, ×0.75; *3b*, ×1 (586*).

T. (Metatissotia) HYATT, 1903 [**Buchiceras fourneli* BAYLE, 1878; SD ROMAN, 1938]. Venter more or less flat in early stages with sharp keel and rows of ventrolateral clavi formed by ends of fairly strong ribs; later, siphonal keel rises, forming angular venter, ribs disappear and umbilical and ventrolateral tubercles persist. *Coni., ?L.Santon.*, Fr.-N.Afr.-W.Afr.-Borneo-Peru.——FIG. 543,*3*; 544,*3c*. **T. (M.) fourneli* (BAYLE), Coni., 543,*3a,b*, (Peru), ×0.5 (233*); 544,*3c* (Fr.), ×1 (586*).

T. (Subtissotia) HYATT, 1903 [**T. tissoti* var. *inflata* PERON, 1897; SD ROMAN, 1938]. Globular in young with low siphonal keel and rows of ventrolateral tubercles very close to keel; later whorls smooth, with rounded venter. *Coni.*, N. Afr.——FIG. 543,*5*. **T. (S.) inflata* PERON; ×0.75 (338*).

Paratissotia HYATT, 1903 [**P. regularis*]. Omits or passes very quickly through stage of flat or fastigate venter with keel and rows of ventrolateral tubercles which characterizes *Tissotia*, and quickly becomes compressed with acute venter, without tubercles but with rather weak ribs. *Coni.*, Fr.-N. Afr.-W.Afr.-Peru.——FIG. 544,*4*. **P. regularis*, Peru; ×0.75 (202*).

Hemitissotia PERON, 1897 [**H. cazini*]. Compressed to moderately inflated, with sharp venter; sparse, rounded branching ribs may be present on early whorls. Suture with 5 saddles, 2 outer ones frilled, others entire. *Coni.*, N.Afr.——FIG. 544,*5*. **H. cazini*, Alg.; ×1 (338*).

[**Heterammonites** COQUAND, 1880 (*nom. dub.*), ?Synonym of *Hemitissotia*.]

Buchiceras HYATT, 1875 [**B. bilobatum*] [=*Roemeroceras* HYATT, 1903]. Whorl section squarish, venter broad and flat with low keel; low bulging ribs branch from umbilical tubercles and end in blunt or sharp ventrolateral tubercles. Suture variable, with broad simple feebly indented saddles tending to be entire; with 3 main and up to 3 auxiliary saddles. *Coni.*, Peru.——FIG. 544,*1*. **B. bilobatum; 1a,b*, ×1 (594*).

Family COILOPOCERATIDAE Hyatt, 1903

[=Hoplitoidinae WRIGHT, 1952]

Moderately to very involute, more or less compressed forms, either flat-sided with flat venter that becomes narrowly rounded in adult or cordate or lanceolate in section with sharp venter; at some stage broad low rounded ribs spring in pairs from low um-

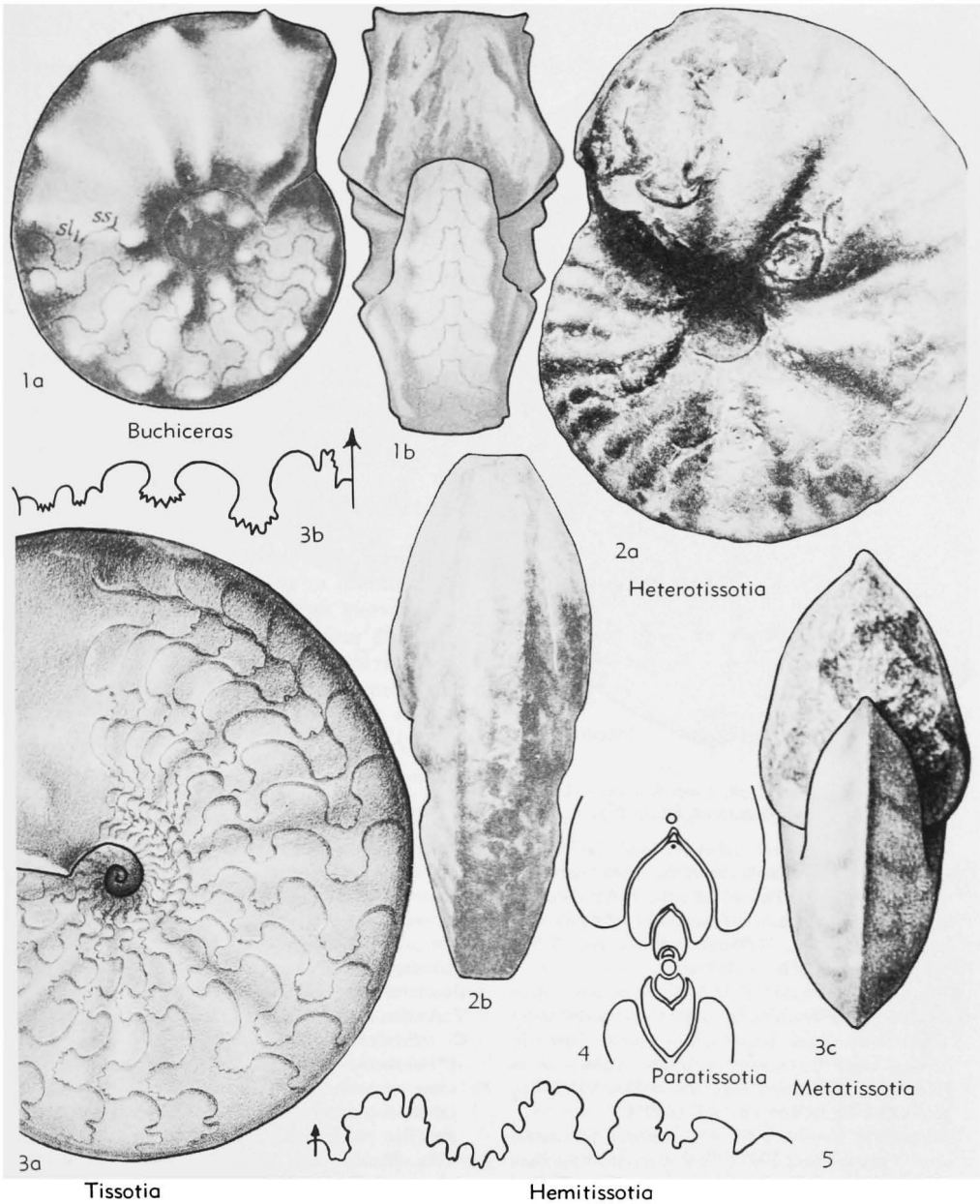


FIG. 544. Tissotiidae (Tissotiinae) (p. L424).

bilical tubercles or bulges. Suture characterized by very broad, shallow 1st lateral lobe divided by one or more accessory saddles. *Hoplitoides* has considerable resemblance to early Pseudotissotiinae, e.g., *P. (Bauchioceras)*, from which it is probably derived. Typical *Coilopoceras* seems to be derived from *Hoplitoides* or *Glebosoceras*, but this can hardly be so if, as has been reported, *Coilopoceras* really occurs in the Upper Cenomanian (59, 202, 375). *U.Cret. (L.Turon.-Coni.)*.

Hoplitoides VONKOENEN, 1898 [**H. latesellatus* KOENEN, 1898 (=**Neoptychites? ingens* KOENEN, 1897)]. Early whorls with sulcate, then flat venter and variable rather sparse ribs branching from

FIG. 545. *Hoplitoides ingens* (VON KOENEN), U.Cret. (L.Turon.), Kamerun (p. L425).

insignificant umbilical tubercles and fading on shoulders; later whorls smooth, with narrowly rounded venter. *L.Turon.-L.Coni.*, N.Afr.-W.Afr.-Syria-Colombia-Peru.——FIG. 545,*1*; 546,*3*. **H. ingens* (KOENEN), L.Turon., Kamerun; 545,*1*, ×0.4; 546,*3a,b*, ×0.4 (648*).

Glebosoceras REYMENT, 1954 [**G. glebosum*]. More involute than *Hoplitoides* and with fairly sharp venter at all stages; broad lumpy prorsiradiate ribs become more prominent with age. Suture as in *Hoplitoides*. *L.Turon.*, Nigeria.——FIG. 546,*2*. **G. glebosum*; *2a*, ×0.5; *2b*, ×1 (689*).

Coilopoceras HYATT, 1903 [**C. colleti*] [*Namadoceras* VREDENBERG, 1907]. Still more involute than *Glebosoceras* and with sharper venter and less prominent ornament. Suture more regular than in this genus and *Hoplitoides*, with accessory saddle approaching or even exceeding in size the 2nd lateral saddle. *L.Turon.-Coni.*, Fr.-N.Afr.-W.Afr.-Syria-Baluch-Colo.-Tex.-N.Mex.——FIG. 546,*1*. **C. colleti*, Coni., N.Mex.; *1a-d*, ×1 (202*).

Family COLLIGNONICERATIDAE Wright & Wright, 1951

[*nom. subst. pro* Prionotropidae ZITTEL, 1895 (*ex Prionotropis* MEEK, 1876, *non* FIEBER, 1853; =*Collignoniceras* BREISTROFFER, 1947)] [=Prionocyclidae BREISTR., 1947 (*ex Prionocyclus* MEEK, 1876, ineligible as family type)]

Typically more or less evolute, compressed, oval or square-whorled forms with serrate or entire keel and dense ribs with from 1 to 5 tubercles, although one subfamily includes smooth oxycones. The nominate subfamily was derived from *Neocardioceras* or perhaps one of its immediate ancestors; late in the Turonian various species of *Subprionocyclus* gave rise in a short time to 4 other subfamilies, 2 of which persisted to the Campanian. These subfamilies might be treated as families but they are closely related and, for example, the obliquely trifid 1st lateral saddle which characterizes Lenticeratinae appears also in Collignoniceratinae and in Barroisiceratinae (285, 422). *U.Cret. (L.Turon.-M.Camp.)*.

Subfamily COLLIGNONICERATINAE Wright & Wright, 1951

[*nom. transl.* WRIGHT herein (*ex* Collignoniceratidae)]

Compressed or square-whorled, with finely or coarsely serrate keel and more or less prominent umbilical and double ventrolateral tubercles; latter may fuse in adult into large horns; in some forms all ornament weakens with age. *U.Cret.(L.Turon.-U. Turon.), ?U.Cret.(L.Coni.)*.

Collignoniceras BREISTROFFER, 1947 [*non* VANHOEPEN, 1955] [*pro Prionotropis* MEEK, 1876 (*non* FIEBER, 1853)] [**Am. woollgari* MANTELL, 1822]. Compressed in early stages, with rounded or high and clavate siphonal tubercles tending to form serrate keel; with straight or slightly sinuous ribs and weak umbilical and strong ventrolateral tubercles; later whorls tend to be squarer in section with exaggerated ventrolateral tubercle which may absorb even the umbilical tubercle. *Turon.*, Eu.-Turkestan-Can.-USA-Colombia.

C. (Selwynoceras) WARREN & STELCK, 1940 [**Prionotropis borealis* WARREN, 1930]. With some secondary or intercalated ribs; siphonal tubercles almost separate on early whorls at least and not yet forming continuous keel. *L.Turon.*, C.Eu.-Can.——FIG. 547,*1*. *C. (C.) schlueterianum* (LAUBE & BRUDER), S.Ger.; *1a-c*, ×0.5 (680a*).

C. (Collignoniceras). Without secondary or intercalated ribs; siphonal tubercles forming thin high serrated keel. *Turon.*, Eu.-Turkestan-USA-Colombia.——FIG. 547,*3*. **C. (C.) woollgari* (MANTELL), Eng.; *3a,b*, ×0.5 (440*).

Prionocyclus MEEK, 1876 [**Am. serratocarinatus* MEEK, 1872 (*non* STOLICZKA, 1865), =**P. wyomingensis* MEEK, 1876]. Differs from *Collignoniceras* in its denser and finer ribs, irregular in size and length on outer whorl and dominant over tubercles at least at some stages; venter rather broad, with ribs joining keel; no extreme development of ventrolateral tubercles on outer whorl.

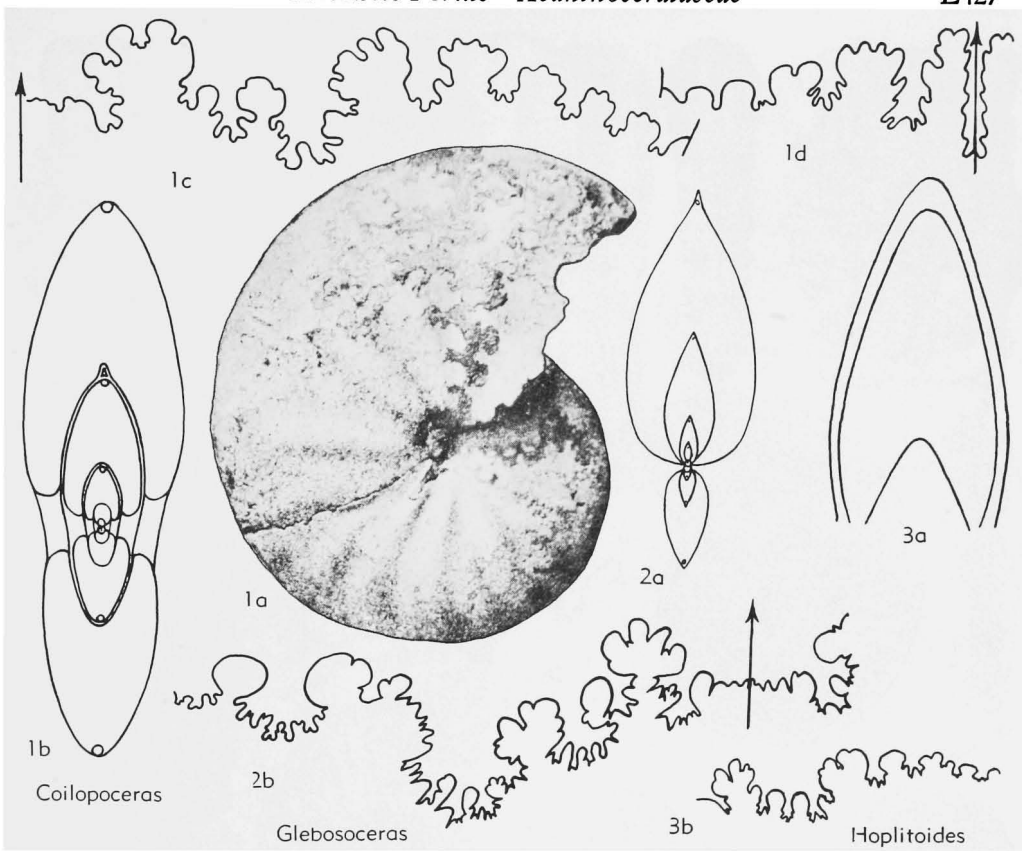


FIG. 546. Coilopoceratidae (p. L425-L426).

Turon., Japan-USA.——FIG. 547,6. **P. wyomingensis*, Wyo.; *6a,b*, ×0.75 (731*).

Subprionocyclus SHIMIZU, 1932 [**Prionocyclus hitchinensis* BILLINGHURST, 1927] [*Oregoniceras* ANDERSON, 1940 *(nom. nud.)*]. Compressed to square-whorled, involute to rather evolute; prominent keel finely or coarsely serrate; ribs fine to coarse, sharp at first but may be flat on outer whorls, springing in pairs from weak umbilical tubercles; double ventrolateral clavi on all ribs but lower one may weaken on outer whorl. *U. Turon.*, W.Eu.-Japan-Calif.——FIG. 547,5. *S. neptuni* (GEINITZ), Eng.; *5a*, ×1; *5b*, enlarged (734*).

Germariceras BREISTROFFER, 1947 [**Am. germari* REUSS, 1845]. Differs from square-whorled species of *Subprionocyclus* in having very fine thin prominent ribs, each with sharp umbilical, ventrolateral and ventral tubercles and keel with more serrations than number of ribs. *U.Turon.*, C.Eu.——FIG. 547, 2. **G. germari* (REUSS), Czech.; *2a*, ×1; *2b,c*, ×2 (623*).

Reesidites WRIGHT & MATSUMOTO, 1954 [*ex* MATSUMOTO, 1942 *(nom. nud.)*] [**Barroisiceras minimum* HAYASAKA & FUKADA, 1951 (*ex* YABE, 1925, *nom. nud.*)]. Involute, compressed, flat-sided with fastigate venter; sinuous ribs branch in 2's and 3's from small umbilical bullae and form ventrolateral clavi and chevrons on venter, bending sharply forward below ventrolateral tubercle; ribs broaden and flatten with age. *U.Turon.* (or *L.Coni.*), Japan.

Niceforoceras BASSE, 1948 [**N. colombianum*]. Involute, compressed, with flat or moderately inflated sides, venter fastigate or rounded, with subdued crenulate keel; umbilical wall vertical; more or less distinct umbilical tubercles give rise to fine sinuous ribs or striae ending in single or double ventrolateral clavi. *Coni.*, Colombia.——FIG. 547, *4. N. umbulaziforme* BASSE; *4a,b*, ×1 (585*).

Subprionotropis BASSE, 1950 [**S. columbianus*]. Moderately to very involute, sides flat and parallel or widest at shoulders; rather strong distant ribs branch in pairs from sharp umbilical tubercles and join sharp ventrolateral tubercles to distant siphonal clavi in chevrons across fastigate venter; feeble tubercles may appear between ventrolateral and siphonal tubercles. *Coni.*, Pondoland-Colombia. ——FIG. 547,7. **S. columbianus*, L.Coni., Colombia; *7a,b*, ×1 (585*).

?Pseudobarroisiceras SHIMIZU, 1932 [**P. nagaoi*].

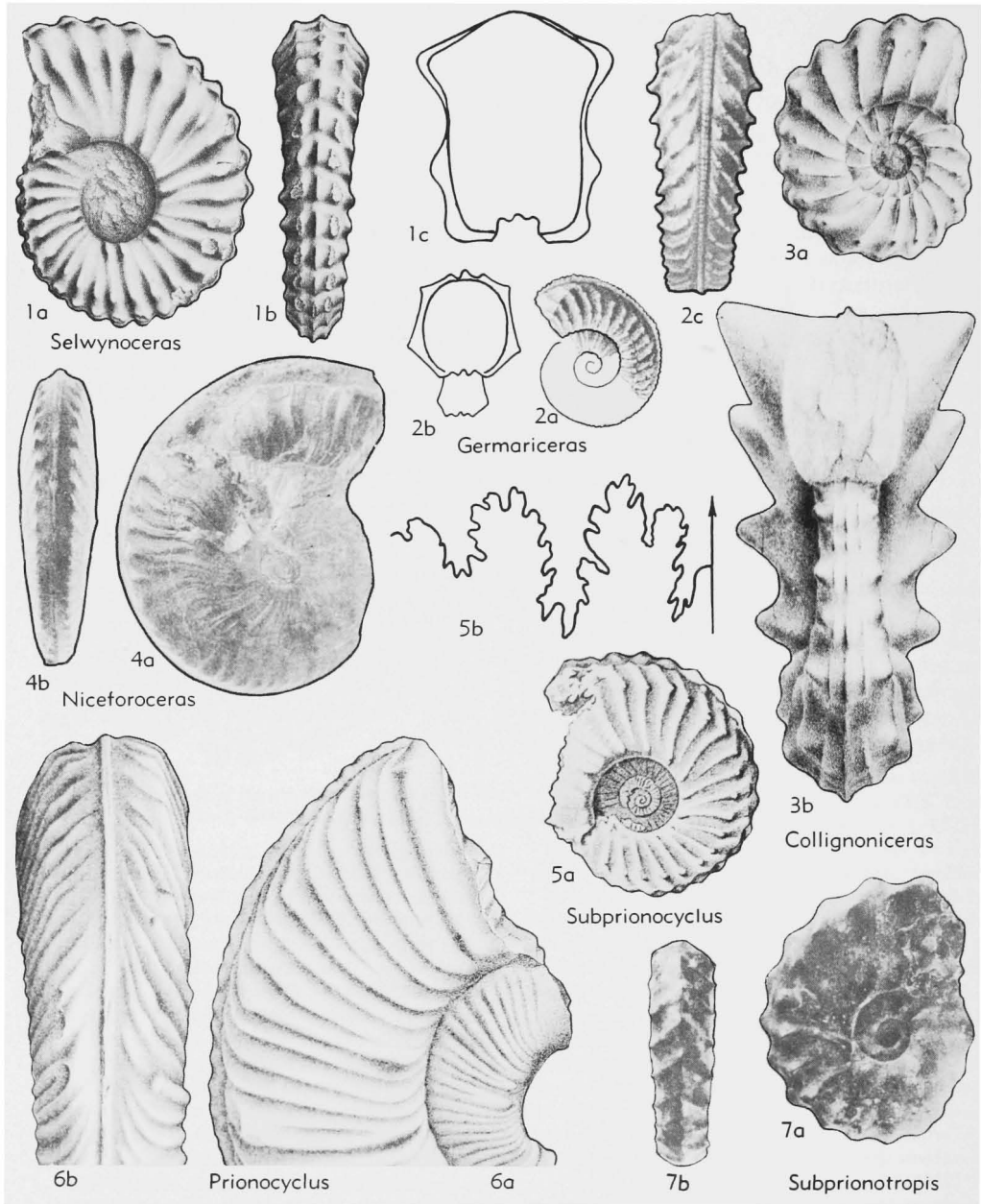


FIG. 547. Collignoniceratidae (Collignoniceratinae) (p. L426-L427).

Rather involute and compressed, with flat sides and entire keel; falcoid ribs arise singly or in pairs from feeble umbilical tubercles and may branch, with or without small tubercle, at mid-side. *Coni.*, Fr.-Japan.

[**Spathinella** SHIMIZU, 1935 *(nom. nud.)*].

Subfamily PERONICERATINAE Hyatt, 1900

[*nom. transl.* WRIGHT, herein (*ex* Peroniceratidae HYATT, 1900)] [=Gauthiericeratidae VANHOEPEN, 1955]

Evolute, with trapezoidal, square, or rectangular whorl section; keel loses its close relation with ribbing and is either nodate or entire; lateral keels tend to develop leading to tricarinate venter; typically with only umbilical and ventrolateral tubercles, joined by strong or weak ribs (173, 179, 422). *?U. Cret.(U.Turon.), U.Cret.(Coni.).*

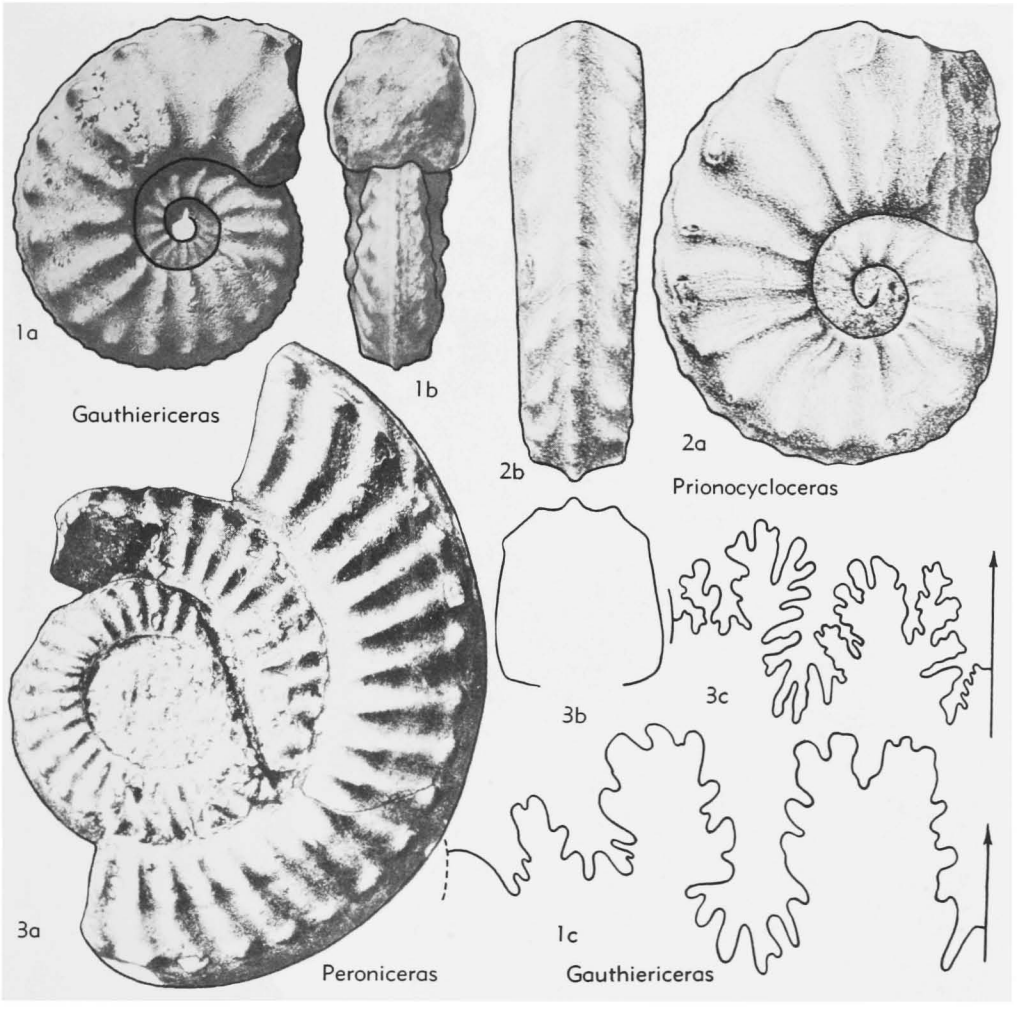


FIG. 548. Collignoniceratidae (Peroniceratinae) (p. L429).

Prionocycloceras SPATH, 1926 [**Am. guayabanus* STEINMANN, 1881] [*Donjuaniceras* BASSE, 1950]. Differs from square-whorled *Subprionocyclus* by loss of lower ventrolateral tubercles and by having nodate keel; ventrolateral tubercles may develop into long spines. *Coni.*, N.Afr.-Madag.-Colombia. ——FIG. 548,*2*. **P. guayabanum* (STEINMANN), Colombia; *2a,b*, ×1 (173*).

Gauthiericeras DEGROSSOUVRE, 1894 [**Am. margae* SCHLÜTER, 1867]. Rather evolute; whorl section trapezoidal to subquadrate; with entire or feebly crenulate high keel bearing a distinct groove on either side; strong ribs spring at first in pairs, later usually singly, from single or double umbilical tubercles and end in strong ventrolateral tubercles. *?U.Turon., Coni.*, Fr.-C.Eu.-SE.Afr.-Madag.-Mex.-Peru.——FIG. 548, *1*. **G. margae* (SCHLÜTER), Coni., Fr.; *1a,b*, ×0.5; *1c*, ×2 (179*).

Peroniceras DEGROSSOUVRE, 1894 [**P. moureti*]. Very evolute, with oval, trapezoidal or square whorl section; venter with 3 entire keels, middle one as high as others or higher; regular rounded or conical umbilical tubercles are joined to slightly larger number of similar ventrolateral ones by short straight rounded ribs; also, lateral tubercles may occur. *Coni.*, Eu.-SE.Afr.-Madag.-S.India-Mex.-Colombia.——FIG. 548,*3*. **P. moureti*, Fr.; *3a,b*, ×0.75; *3c*, ×1 (179*).

Yabeiceras TOKUNAGA & SHIMIZU, 1926 (**Y. orientale*]. Venter narrower and more rounded and keel weaker than in *Peroniceras;* at first ribs join weak umbilical to strong lateral tubercles, bending sharply forward on outer part of sides; later umbilical tubercles and outer part of ribs disappear and finally all ornament is lost. *Coni.*, Japan.

Subfamily TEXANITINAE Collignon, 1948

[*nom. transl.* WRIGHT, herein (*ex* Texanitidae COLLIGNON, 1948)]

Evolute to moderately involute, with in-

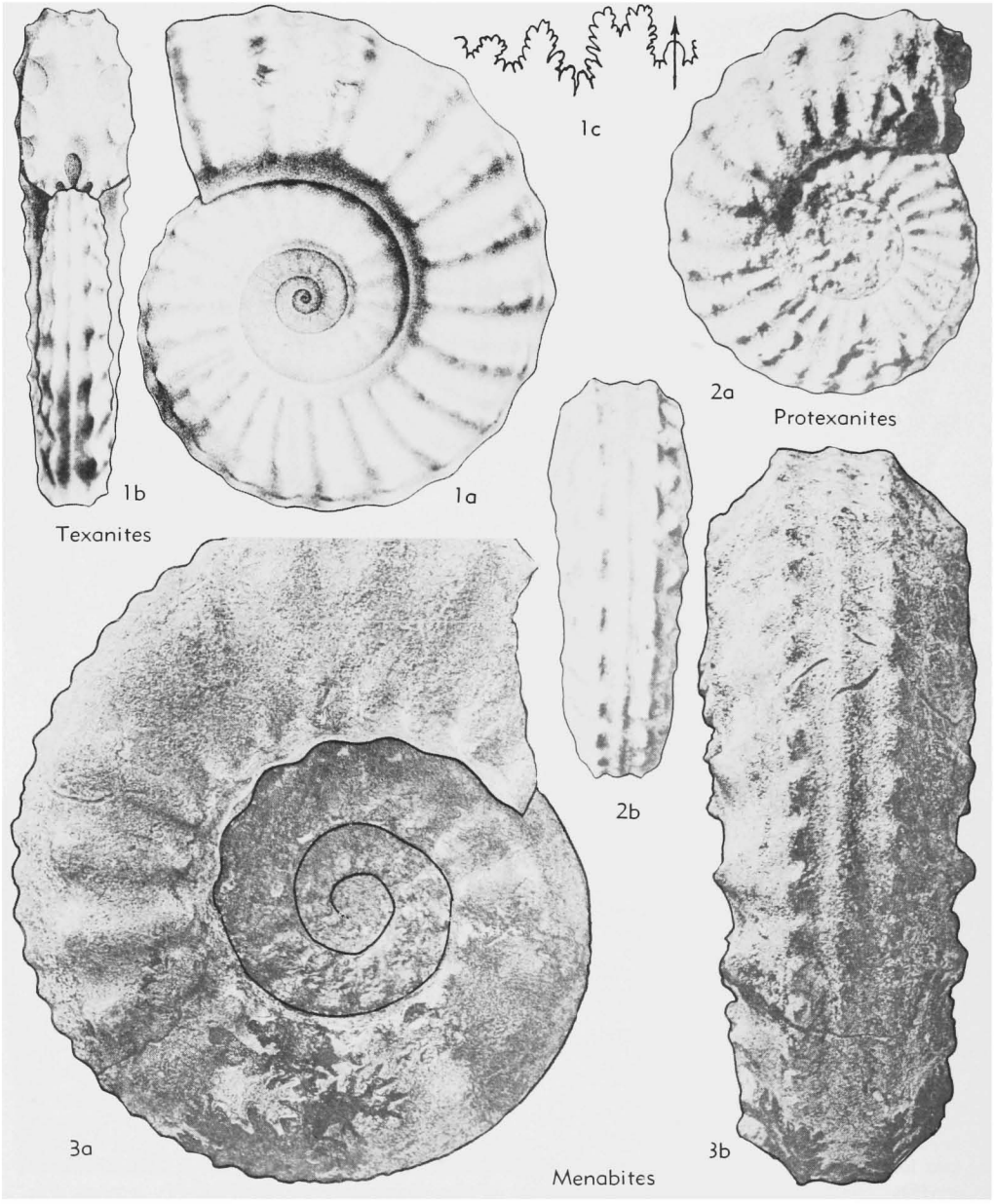


FIG. 549. Collignoniceratidae (Texanitinae) (p. L430-L432).

flated to compressed whorl section; typically with strong ribs bearing 3 to 5 strong tubercles and rather subdued entire keel, but all ornament may weaken on outer whorls. There is no direct evidence that spinaptychi belong to species of *Texanites,* as has been suggested. Confusion has arisen from close homeomorphy with Albian Mortoniceratinae. The subfamily is derived from 1 or 2 species of *Subprionocyclus* and has 2 main branches, both ranging to the Campanian (82). *U.Cret.(L.Coni.-M.Camp.).*

Protexanites MATSUMOTO, 1955 [**Mortoniceras bourgeoisi* DEGROSSOUVRE, 1894 (*ex* D'ORBIGNY, 1850)]. Evolute, with more or less square whorl section; ribs simple or branched or long and short, with umbilical, ventrolateral and clavate ventral tubercles, rarely with 4th (lateral) tubercle on outer

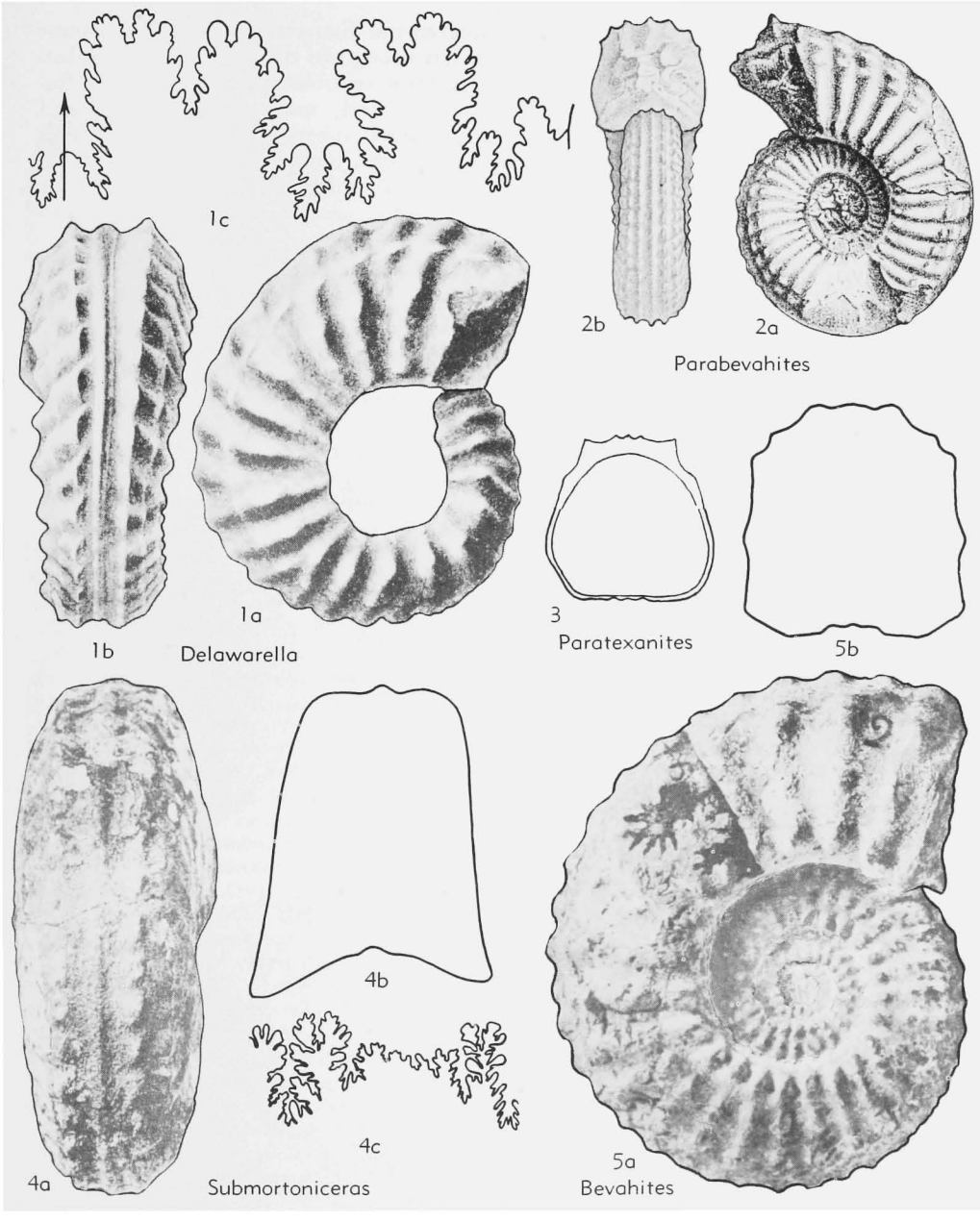


FIG. 550. Collignoniceratidae (Texanitinae) (p. L432).

whorls. *L.Coni.-L.Santon.,* Fr.-Italy-Japan-Wyo.-Peru.——FIG. 549,*2*. **P. bourgeoisi* (GROSS.), Coni., Fr.; *2a,b,* ×1 (179*).

Texanites SPATH, 1932 [**Am. texanus* ROEMER, 1852]. Generally compressed and high-whorled, with sides flat on inner part, then converging to narrow venter with entire keel; dense strong straight simple ribs have 3 more or less equally spaced tubercles, 2 lateral ones being added to those present in *Protexanites;* intercalated ribs rare. *U.Coni.-L.Camp.,* Eu.-N.Afr.-W.Afr.-E.Afr.-Madag.-S.India-Japan-USA.——FIG. 549,*1*. **T. texanus* (ROEMER), Santon., Tex.; *1a-c,* ×0.5 (691*).

Paratexanites COLLIGNON, 1948 [**Mortoniceras zeilleri* DEGROSSOUVRE, 1894]. Whorl section subquad-

rate; strong umbilical, upper and lower ventrolateral and ventral tubercles; ribs simple. *L.Coni. L.Santon.*, Fr.-Ger.-Aus.-Zululand-Japan.

P. (Paratexanites). Lower and upper ventrolateral and ventral tubercles equidistant. *Coni.*, occurrence as for genus.——FIG. 550,*3*. **P. (P.) zeilleri* (GROSS.), L.Coni., Fr.; ×0.5 (179*).

P. (Parabevahites) COLLIGNON, 1948 [**Am. serratomarginatus* REDTENBACHER, 1873]. Two ventrolateral tubercles tend to approximate. *U.Coni.-L.Santon.*, Fr.-Ger.-Aus.-Zululand.——FIG. 550,*2*. **P. (P.) serratomarginatus* (REDT.), Coni., Aus.; *2a,b*, ×1 (685*).

Bevahites COLLIGNON, 1948 [**B. quadratus*]. Whorl section squarish to compressed, with 2 ventrolateral tubercles close together while ventral tubercle moves near keel; lateral tubercles and many intercalated ribs occur also, making many more outer tubercles than umbilical. *U.Santon.-M.Camp.*, Zululand-Madag.——FIG. 550,*5*. **B. quadratus*, ?U.Santon., Madag.; *5a,b*, ×0.75 (82*).

Submortoniceras SPATH, 1921 [**S. woodsi*]. Sparse or dense ribs similar to those of *Bevahites*, but weakening; typically all ornament except umbilical tubercles is lost on outer whorls. *Camp.*, Zululand-Madag.-Japan-Del.-N.J.——FIG. 550,*4*. **S. woodsi*, Zululand; *4a-c*, ×0.75 (713*).

Menabites COLLIGNON, 1948 [**M. menabensis*]. Differs from *Bevahites* by persistence of early trituberculate stage to a diameter of up to 100 mm.; lateral and outer ventrolateral tubercles when present uniformly weak. *U.Santon.-M.Camp.*, Fr.-Tunis.-Zululand-Madag.-Tex.-Del.-N.J.

M. (Menabites). Rather compressed, with strong fairly dense ribs; trituberculate at first but becomes pentatuberculate rather quickly. *Santon.-M.Camp.*, Madag.-Tex.-Mex.——FIG. 549,*3*. **M. (M.) menabensis*, Camp., Madag.; *3a,b*, ×1 (82*).

M. (Bererella) COLLIGNON, 1948 [**M. (B.) bererensis*]. Rather compressed, with sparse weak ribs but strong stout tubercles. *M.Camp.*, Zululand-Madag.-Tex.

M. (Australiella) COLLIGNON, 1948 [**Mortoniceras australe* BESAIRIE, 1930]. Inflated, with broad rounded venter and seldom more than 3 rows of tubercles; middle whorl with large coarse inner ventrolateral tubercles. *M.Camp.*, Zululand-Madag.

M. (Delawarella) COLLIGNON, 1948 [**Am. delawarensis* MORTON, 1830]. Rather involute; ribs fine and dense; all ornament weakens with age and whorl section then becomes rounded. *M. Camp.*, Fr.-Tunisia-Madag.-N.J.——FIG. 550,*1*. **M. (D.) delawarensis* (MORTON), Camp., N.J.; *1a-c*, ×1 (733*).

Subfamily BARROISICERATINAE Basse, 1947

Moderately involute, typically compressed forms with crenulate keel, which may weaken and disappear on outer whorls; more or less strong ribs rise from umbilical tubercles, form ventrolateral clavi and bend forward to keel; some forms with distinct mediolateral tubercles, others smooth after early whorls. Suture with variable number of saddles, which are fairly short and only moderately incised (27, 364). *U.Cret. (Coni.)*.

Most of the subfamily resemble late Collignoniceratinae but are distinguished by breadth and sparseness of the ribs and absence of a 2nd ventrolateral tubercle at any stage of growth. The subfamily is derived from compressed *Subprionocyclus* and has no direct connection with Tissotiidae, despite close homeomorphy in some cases. In view of the great variability of populations several superficially very distinct groups are here treated as subgenera.

Barroisiceras DEGROSSOUVRE, 1894 [*pro Barroisia* GROSS., 1894 (*non* MUNIER-CHALMAS, 1882)] [**Am. haberfellneri* HAUER, 1866; SD SOLGER, 1904]. Rather involute, compressed to inflated, high-whorled; strong crenulate keel normally persists to outer whorl; sparse umbilical tubercles give rise to pairs of strong or weak, commonly flat ribs, which, with intercalatories, form ventrolateral clavi, then turn sharply forward to keel. *Coni.*, Fr.-Sp.-Ger.-Aus.-N.Afr.-W.Afr.-Madag.-Tex.-Peru.

B. (Barroisiceras). Moderately involute, suture rather simple. Occurrence as for genus.——FIG. 551,*5*. **B. (B.) haberfellneri* (HAUER), Aus.; *5a,b*, ×1 (685*).

B. (Texasia) REESIDE, 1932 [**Am. dentatocarinatus* ROEMER, 1849]. Umbilicus distinctly excentric; more evolute and suture less simple than in *B. (Barroisiceras). Coni.*, ?Sp.-Tex.

Solgerites REESIDE, 1932 [**Barroisiceras brancoi* SOLGER, 1904] [*Piveteauoceras* BASSE, 1947]. Ribs fine and dense at first, with umbilical, ventrolateral and weak mediolateral tubercles, but later all ornament disappears or is reduced to exaggerated ventrolateral tubercles; even when keel is lost and venter broadens, it remains convex. *Coni.*, ?Fr.-N.Afr.-W.Afr.-Fr.Congo-Madag.——FIG. 551,*1*. **S. brancoi* (SOLGER), Kamerun; *1a,b*, ×0.5 (710*).

Forresteria REESIDE, 1932 [**Barroisiceras (Forresteria) forresteri* REESIDE, 1932]. Whorl section and ornament variable but readily distinguished from *Barroisiceras* by presence on inner whorls of mediolateral tubercle, which later disappears or fuses with umbilical or ventrolateral tubercles. *Coni.*, Fr.-Madag.-W.Afr.-Utah-Wyo.-Peru.

F. (Forresteria). Mediolateral tubercle fuses with ventrolateral; whorl section moderately to very inflated. *Coni.*, Madag.-Utah-Wyo.-Peru.——FIG.

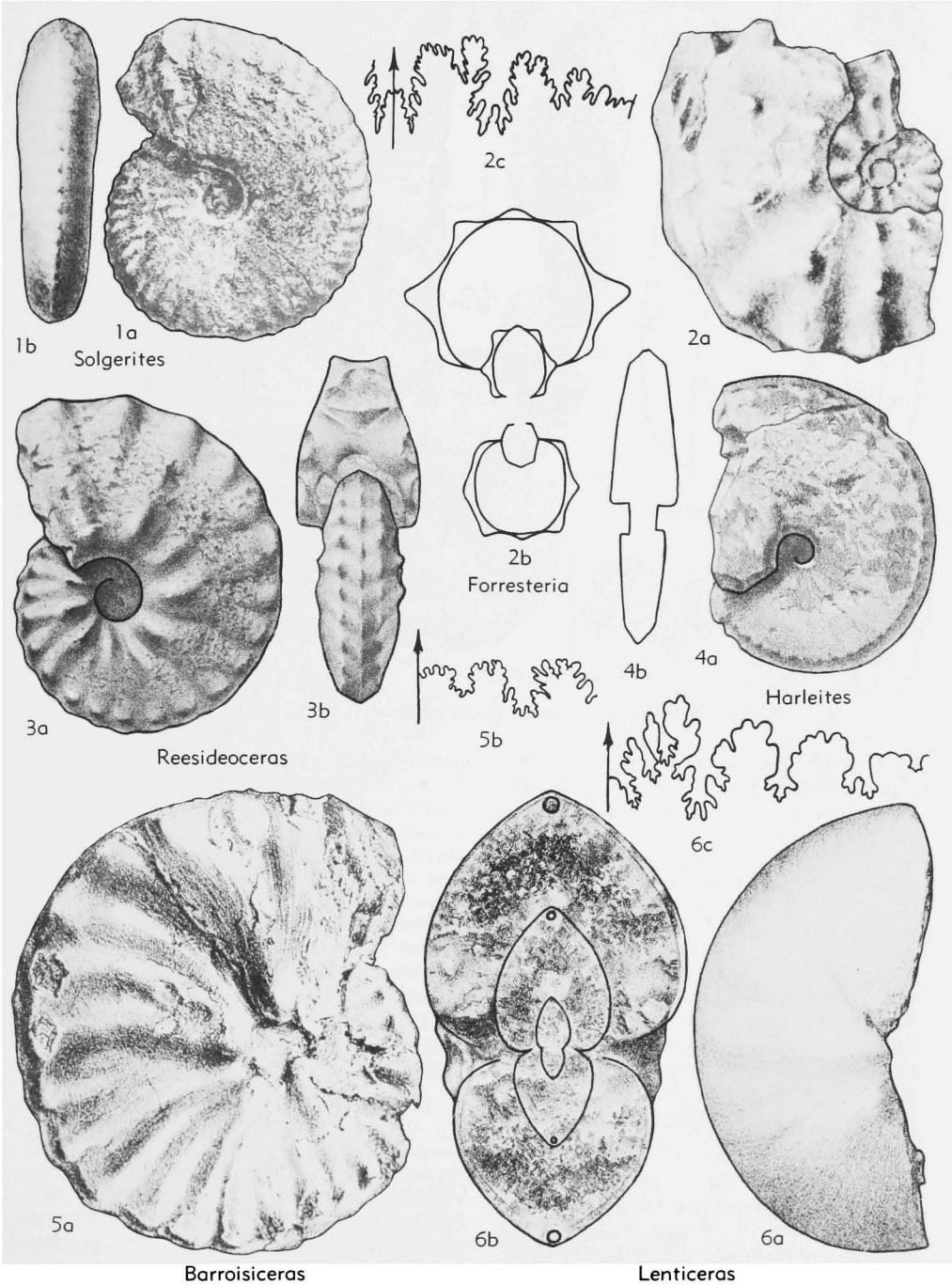


FIG. 551. Collignoniceratidae (Barroisiceratinae, Lenticeratinae) (p. L432-L435).

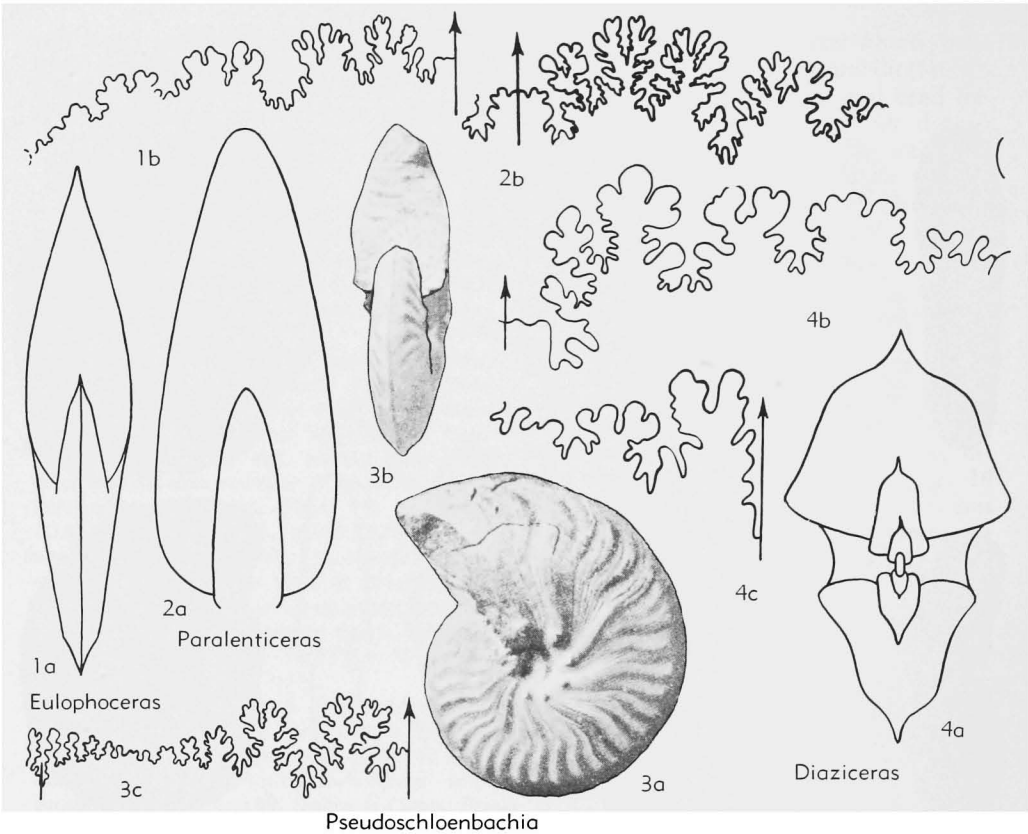


FIG. 552. Collignoniceratidae (Lenticeratinae) (p. L435-L437).

551,2. **F. (F.) forresteri,* Utah; *2a-c,* ×1 (364*).

F. (Reesideoceras) BASSE, 1947 [**R. gallicum*]. Less inflated than *F.(Forresteria)* and mediolateral tubercle fuses with umbilical tubercle; keel disappears on outer whorl leaving venter flat or concave, bordered by ventrolateral clavi. *Coni.,* Fr.-Kamerun-Madag.——FIG. 551,*3*. **F. (R.) gallicum,* Fr.; *3a,b,* ×0.75 (179*).

F. (Harleites) REESIDE, 1932 [**Barroisia haberfellneri* var. *harlei* DEGROSSOUVRE, 1894] [*Alstadenites* REESIDE, 1932]. Compressed, with sharp high keel and steep umbilical wall; early whorls with weak umbilical, strong mediolateral and fine, feeble ventrolateral tubercles, joined by fine, flat ribs; later all ornament except keel and fine ventrolateral clavi disappears. *Coni.,* Fr.-Ger.-Kamerun-Utah-Peru.——FIG. 551,*4*. **F. (H.) harlei* (GROSS.), Fr.; *4a,b,* ×1 (179*).

F. (Zumpangoceras) BASSE, 1947 [**Z. burckhardti*]. Doubtful because no uncrushed specimen known; mediolateral tubercle strengthens with age; fine flexuous striae or ribs form ventrolateral clavi and cross venter without interruption, being raised on mid-line to form crenulate keel. Suture rather deeply indented. *Coni.,* Mex.

Subbarroisiceras BASSE, 1947 [**S. mahafalense*]. Very involute, rather inflated; strong umbilical and ventrolateral tubercles approximate on last whorl; coarsely crenulate keel persists to end. Suture more deeply indented than in others of subfamily except *F.(Zumpangoceras). Coni.,* Madag.

?Eboroceras BASSE, 1946 [**E. magnumbilicatum*]. Very evolute; body chamber occupies more than a whorl; initially whorl section is fastigate, with ribs branching from mediolateral tubercles, thickening on shoulders and forming crenulate keel; lateral ornament is lost except moderate umbilical tubercles joined to strong mediolateral tubercles; body chamber smooth. *Coni.,* Madag.

Subfamily LENTICERATINAE Hyatt, 1900

[*nom. transl.* WRIGHT, 1952 (*ex* Lenticeratidae HYATT, 1900)] [Includes Eulophoceratidae HYATT, 1903; ?Diaziceratinae BASSE, 1947]

Generally involute, with sharpened or narrowly rounded venter and whorl section varying from lanceolate to stoutly cordate but including more evolute fastigate forms; surface smooth or with broad flat ribs or with prominent umbilical and ventrolateral

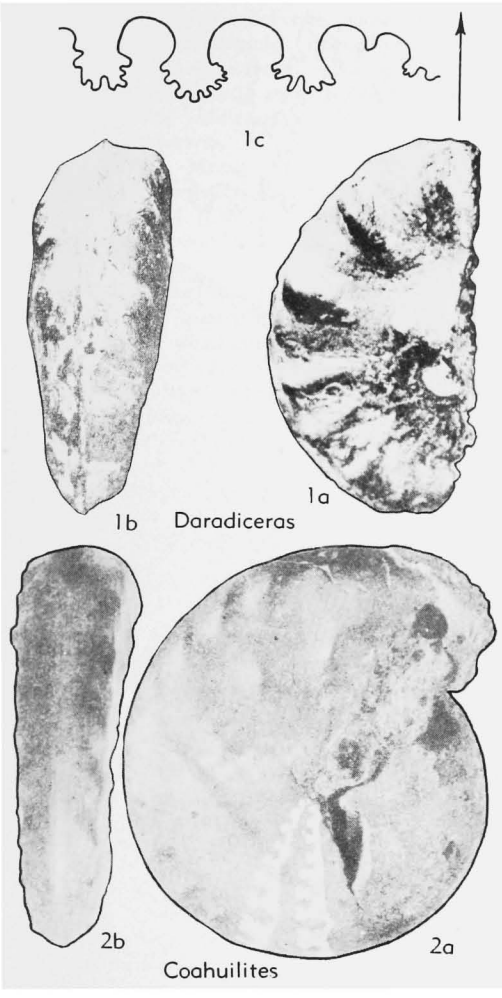


FIG. 553. Sphenodiscidae (p. L437).

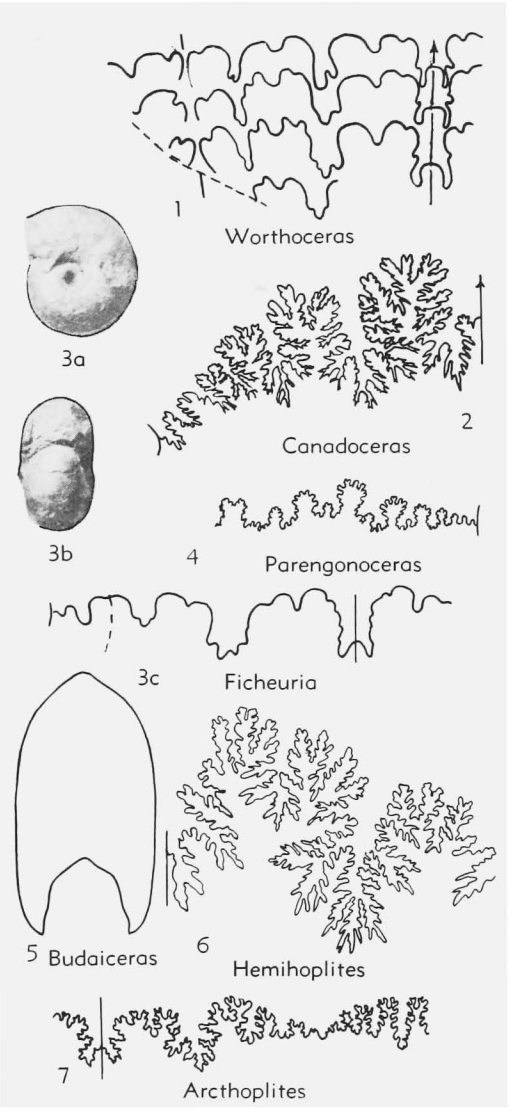


FIG. 554. Various families (p. L212, L231, L379, L388, L400, L409, L410).

tubercles. Suture may have a varying number of auxiliary saddles, 1st lateral saddle being very wide, usually trifid and outer part may be markedly oblique to siphonal line, a feature foreshadowed in some *Subprionocyclus*. *Paralenticeras* is derived from compressed involute Collignoniceratinae, referred at present to *Niceforoceras; Pseudoschloenbachia* and *Diaziceras* might be either secondarily fastigate derivatives of one of the lanceolate genera or morphologically primitive members of the subfamily derived from Collignoniceratinae by way of unknown Lower Santonian forms (27, 198, 202). *U.Cret.(Coni.-L.Camp.)*.

Lenticeras GERHARDT, 1897 [**Am. andii* GABB, 1877]. Very involute, with more or less cordate whorl section; low rounded ribs branch in pairs from umbilical bulges and disappear below venter. External saddle of suture very broad, markedly oblique. *Coni.-L.Santon.*, Sp.-Peru.——FIG. 551, *6. *L. andii* (GABB), Coni., Peru; *6a,b*, ×0.75; *6c*, ×1 (626*).

Paralenticeras HYATT, 1900 [**Amaltheus sieversi* GERHARDT, 1897]. Suture much as in *Lenticeras* but elements deeper and saddles more finely divided; whorl section compressed; ribs present on inner part of sides; rest of shell smooth but for dense striae, recurved on high thin keel. *U.Coni.-L.Santon.*, Colombia-Peru-Venez.-Haiti.——FIG.

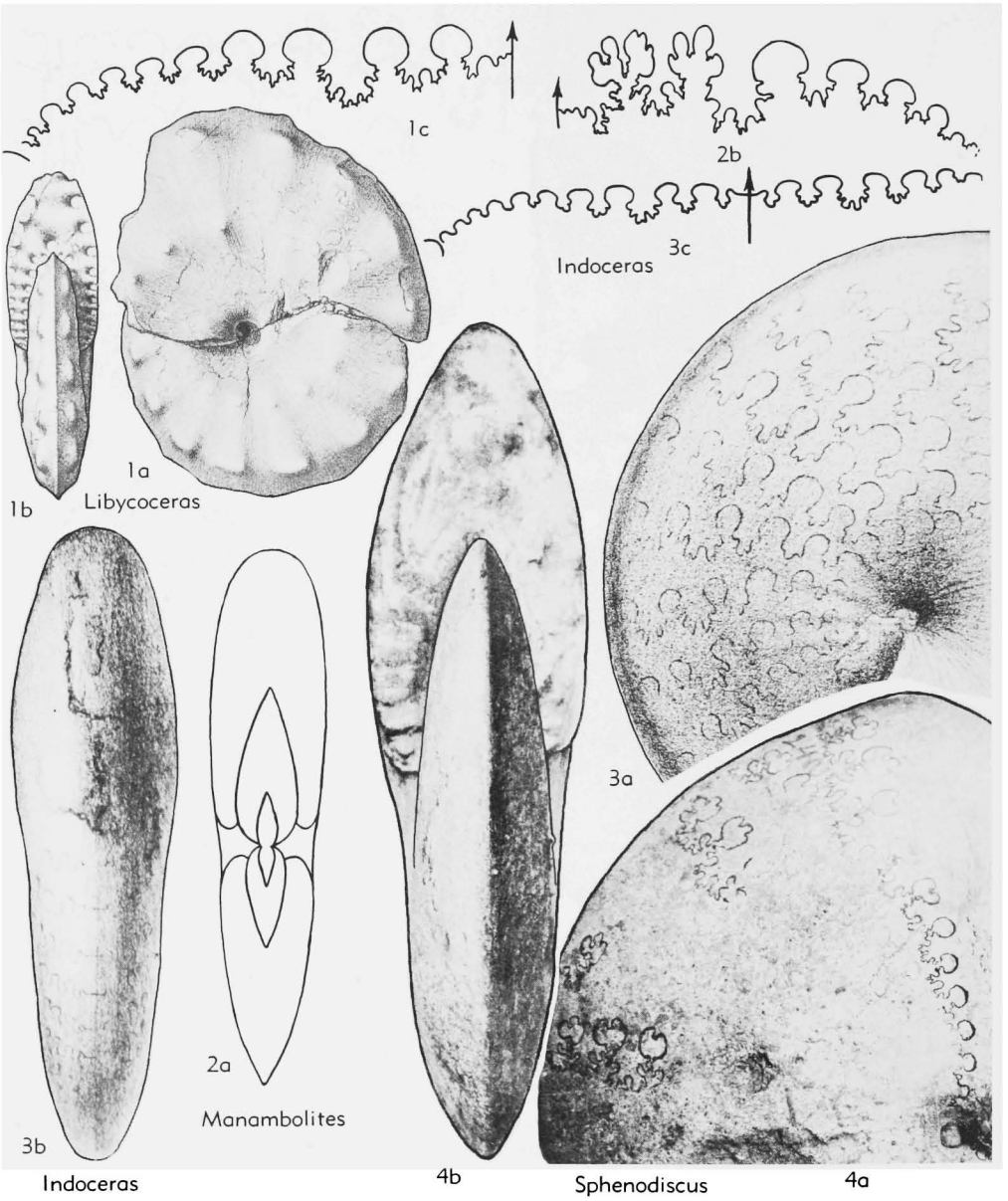


FIG. 555. Sphenodiscidae (p. L437).

552,2. **P. sieversi* (GERHARDT), L.Santon., Haiti; *2a,b*, ×1 (686*).

Eulophoceras HYATT, 1903 [**E. natalense*] [*Praelybicoceras* H.DOUVILLÉ, 1911; *Pelecodiscus* VAN HOEPEN, 1921; *Spheniscoceras* SPATH, 1921 (*ex* CRICK MS)]. Form much as in *Paralenticeras* but some with fine convex ribs and some with low rounded ones. Suture irregular, with several auxiliary saddles and tendency to increase complexity of external saddle, outer part being obliquely trifid; folioles commonly finger-like. *U.Coni.-L. Camp.*, Alg.-Nigeria-SE.Afr.-Madag.-Peru.——FIG. 552,*1*. *E. jacobi* HOURCQ, U.Santon., Madag.; *1a,b*, ×1 (198*).

?**Pseudoschloenbachia** SPATH, 1921 [**Am. umbulazi* BAILY, 1855]. Compressed, more or less evolute, with fastigate venter and high keel; typically with prominent umbilical tubercles from which spring

2 or more low rounded ribs, ending in blunt, low ventrolateral tubercles; frequent constrictions may be present. Some species, while retaining fastigate venter, are nearly smooth. Suture with narrower external saddle and more rounded folioles than *Eulophoceras*. *U.Santon.-L.Camp.*, Egypt-Syria - SE. Afr. - Madag. - S.India-B.C.-Tex.——Fig. 552,*3a,b*. **P. umbulazi* (Baily), ?L.Camp., Pondoland; *3a,b*, ×1 (636*).——Fig. 552,*3c*. *P. griesbachi* (vanHoepen); L.Camp., Pondoland; ×3 (636*).

?Diaziceras Spath, 1921 [**D. tissotiaeforme*]. Rather inflated, with fastigate venter and high crenulate keel; sparse prominent umbilical tubercles give rise to pairs of weak ribs which end in weak or strong ventrolateral tubercles. Suture with shallow, plump elements, only slightly indented, 1st lateral saddle oblique on outer side. *U.Santon.*, Zululand-Madag.——Fig. 552,*4*. **D. tissotiaeforme*, U. Santon., Zululand; *4a*, ×1; *4b,c*, ×2 (713*).

Family SPHENODISCIDAE Hyatt, 1900

Involute, compressed and generally with weak lateral and ventrolateral tubercles or smooth sharp or rounded venter. Sutures with narrow-necked entire or frilled and in some phylloid saddles; 1st lateral saddle divided by 1 or 2 adventitious lobes; many auxiliary elements. Generic distinction has usually been made on details of the suture but this can be misleading. Origin of the family probably lies in the Lenticeratidae (198, 202). *U.Cret.(U.Camp.-Maastr.)*.

Manambolites Hourcq, 1949 [**M. piveteaui*]. Smooth, whorl section lanceolate but on body chamber flat-sided with rounded venter. First lateral saddle of suture with large adventitious lobe, outer or both parts of saddle indented, indentation on outer part tending to become a 2nd adventitous lobe. *?U.Camp.-Maastr.*, Angola-Madag.-Palestine-Iran-Baluch.——Fig. 555,*2*. **M. piveteaui*, Maastr., Madag.; *2a,b*, ×1 (198*).

Coahuilites Böse, 1927 [**C. sheltoni*]. Sides flat and parallel, venter at first fastigate or rounded, then broad and flat; rather prominent ribs branch from pointed tubercles above umbilical edge and end in ventrolateral clavi. First lateral saddle of suture as in *Manambolites*. *?U.Camp.-Maastr.*, Tunisia-Mex.-Peru-Colombia-Venez.——Fig. 553, *2*. *C. cavinsi* Böse, L.Maastr., Mex.; *2a,b*, ×0.7 (45*).

Daradiceras Sornay & Tessier, 1949 [**D. gignouxi*]. Sharp venter becomes broad and flat with age; bulging falcoid ribs join 8 umbilical to 16 ventrolateral tubercles; large bulge at base of outer whorl envelopes umbilicus. Suture as in *Coahuilites*, of which it is an extreme development, if not distinguishable as subgenus. *Maastr.*, Senegal.——Fig. 553,*1*. **D. gignouxi* (Sornay & Tessier); *1a,b*, ×0.5; *1c*, enlarged (711*).

Sphenodiscus Meek, 1871 [**Am. lenticularis* Owen, 1852 (*non* Phillips, 1825) =**Am. lobata* Tuomey, 1856] [Incl. *Austrosphenodiscus* Olsson, 1944]. Generally smooth involute oxycones, but some species have weak lateral and ventrolateral tubercles as early whorls. First lateral saddle with 2 adventitious lobes as big as 1st lateral lobe but primitive forms have outer one smaller; folioles generally but not uniformly with long narrow necks and kidney-shaped ends. *Maastr.*, Holl.-Fr.-Palestine-Arabia-Madag. - S.India-USA-Mex.-Venez. ——Fig. 555,*4*. **S. lobatus* (Tuomey), Miss.; *4a,b*, ×0.4 (202*).

Libycoceras Hyatt, 1900 [**Engonoceras ismaeli* Zittel, 1895 (*Am. (Buchiceras) ismaelis* Zittel, 1883, *nom. nud.*)] [Incl. *Paciceras* Olsson, 1944]. Venter fastigate, at any rate in early stages, becoming lanceolate with growth; smooth or with faint broad ribs and some with feeble lateral and ventrolateral tubercles, fading on outer whorl. First lateral saddle of suture with one adventitious lobe, usually as deep as 1st lateral lobe; all saddles usually entire but outer ones may be feebly indented. *Maastr.*, Libya-Fr.Sudan-Nigeria-Egypt-Palestine-Arabia-Peru.——Fig. 555,*1*. **L. ismaeli* (Zittel), Libya; *1a*, ×0.5; *1b*, ×0.4; *1c*, ×0.75 (683*).

Indoceras Noetling, 1897 [**I. baluchistanense*]. Like *Libycoceras* but smooth and venter becoming rounded on outer whorls. *Maastr.*, Iran-Baluch.——Fig. 555,*3*. **I. baluchistanense*, Baluch.; *3a-c*, ×1 (670*).

APTYCHI

By W. J. Arkell

General accounts of the aptychi have been given in the introductory chapters on Paleozoic and Mesozoic ammonoids. The present section is devoted to technical descriptive terms, nomenclature, and a catalogue of the form genera recognized, with their principal characters and range, and the ammonite genera with which they are associated.

DESCRIPTIVE TERMS

A number of German descriptive terms for bivalved aptychi have been standardized by Trauth (1927-38). English equivalents of some of them were introduced by Cox (1926), in collaboration with Trauth, and others are now proposed in Fig. 556. Anaptychi have a more striking range of

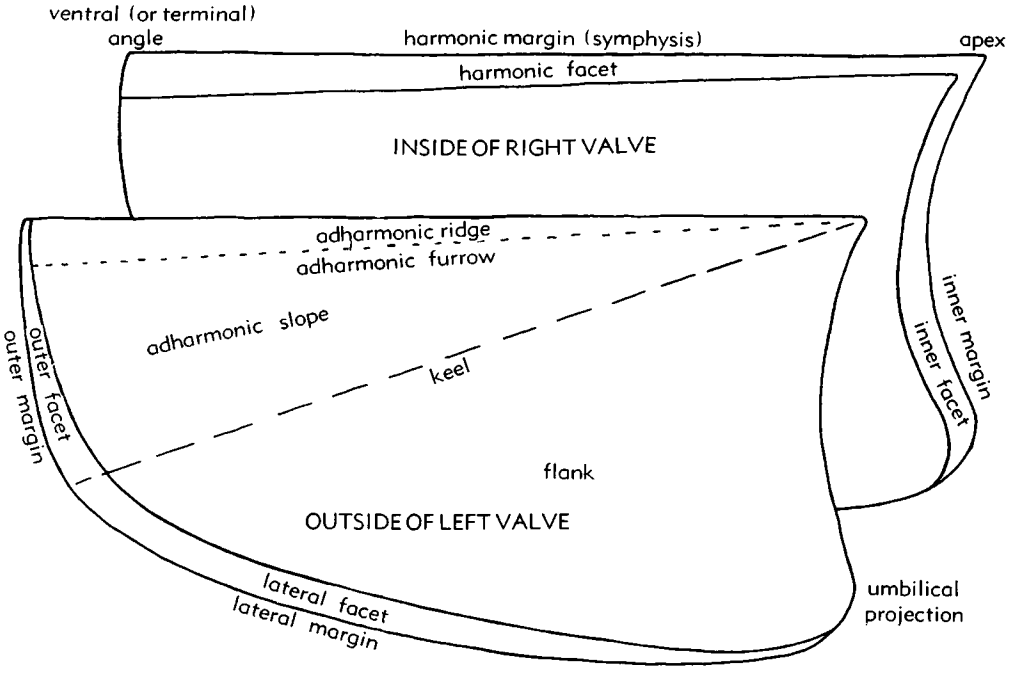


FIG. 556. Morphological features of aptychi.

shapes and by no means always fit the aperture (Fig. 146).

NOMENCLATURE

The bivalved aptychi bear a superficial resemblance to pelecypods, for which they were first mistaken, and in consequence they were given generic names such as *Trigonellites* (PARKINSON, 1811), *Solennites* (SCHLOTHEIM, 1813) and others. TRAUTH (1927-38) has elaborated an independent binominal nomenclature for aptychi, brushing aside these and other earlier generic names and using a standardized set having the suffix *-aptychus,* the first element of the names being descriptive. At first (1929) TRAUTH made it clear that his names, although used in generic form, were not intended to be Linnaean genera and should not be counted for priority or homonymy, or for any other purpose, as part of the Linnaean system of nomenclature. Later on, however, he modified his views, and he and other authors commonly printed the names in italics and used them in every way as if they were nomenclaturally valid and correct.

Article 27, subsection (a), of the International Rules of Zoological Nomenclature lays down that "the oldest available name is retained when any part of an animal is named before the animal itself." Under this rule, generic and specific names first applied to loose aptychi take priority over names applied to ammonites if the ammonites were named at a later date, and consequently every time a previously named aptychus is found in place in an ammonite there will be a disturbance to ammonite nomenclature. Already it has long been clear that *Trigonellites* probably ought to displace the well-known generic name *Aspidoceras,* and likewise some of TRAUTH's names are junior synonyms of the early "generic" and "specific" names.

In order to avoid such unnecessary disturbance to ammonite nomenclature an application has been made to the International Commission on Zoological Nomenclature, recommending that the Commission render a Declaration to amend Article 27 of the Rules "in such a way as to deprive of availability in zoological nomenclature any name based solely upon the aptychus of an ammonite."[1] In anticipation that this applica-

[1] W. J. ARKELL, Bull. Zool. Nomencl., 1954, vol. 9, part 9, p. 266.

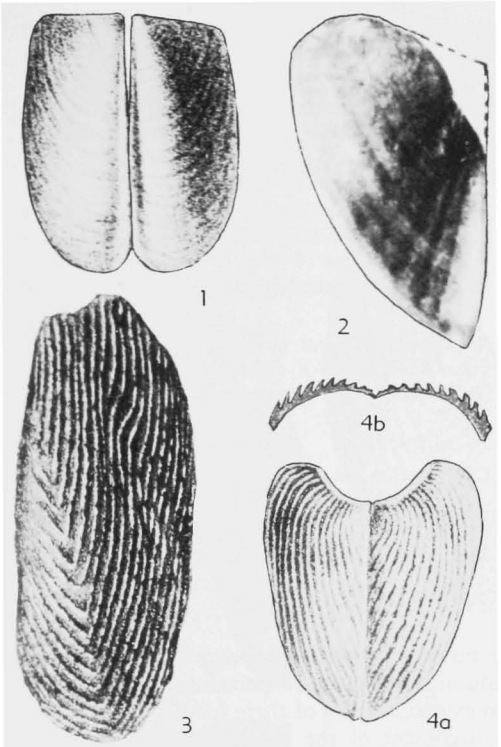


FIG. 557. Aptychi. *1, Pseudostriaptychus,* U.Cret., ×1 (707). *2, Laevicornaptychus,* L.Jur., ×2.7 (725a). *3, Rugaptychus,* U.Cret., ×1 (725a). *4, Lamellaptychus,* M.Jur.-L.Cret.; *4a,b,* exterior and transv. sec., ×1 (725a).

tion will be successful, names based upon aptychi have been ignored in the *Treatise* for nomenclatural purposes. In the present section devoted to the descriptive systematics of aptychi, TRAUTH's form genera are used. None of these names is here regarded as part of the Linnaean system of nomenclature and accordingly in systematic descriptions of Mesozoic ammonites given in foregoing pages of the *Treatise* they are not printed in italics.

In addition to the names listed below, Palaptychus was proposed by TRAUTH (1927) for supposed bivalved aptychi of the Paleozoic, but later this was abandoned (TRAUTH, 1935a, p. 70) when investigation showed it to be unlikely that any of the recorded objects were in fact aptychi. Similarly Palanaptychus (TRAUTH, 1927) was subsequently found to be a synonym of Anaptychus (OPPEL, 1856) but MOORE and SYLVESTER-BRADLEY consider that Anaptychus is invalid, as also Synaptychus FISCHER, 1882.

The best available series of figures of bivalved aptychi in position in ammonites is given by OPPEL (1863, plates 68-74). Some of the originals have been refigured photographically by TRAUTH (1938). The most illuminating paper on Anaptychi is by MARTIN SCHMIDT (1929); see also TRAUTH (1935b, 1935c, 1935f).

SINGLE-VALVED TYPES (ANAPTYCHI)

Anaptychus OPPEL, 1856 (p. 74) [=Palanaptychus TRAUTH, 1927; Neoanaptychus NAGAO, 1931 (*non* 1932)]. Surface shiny, striate concentrically or radially, or with concentric folds and striae. Test carbonaceous, probably in life chitinous and elastic; rarely with thin outer calcareous layer. *U.Dev.-Cret.* [*Paleoz., Manticoceras,* etc.; *Trias., Arcestes, Trachyceras, Monophyllites; Lias.,* Psiloceratidae, Arietitidae, Liparoceratidae, Amaltheidae; *Cret.,* Lytoceratina, ?Desmocerataceae].——FIG. 558,*1,* Anaptychus, Senon.; *1a,* Japan (Neoanaptychus), reconstr., ×2 (after NAGAO, from TRAUTH); *1b,* Ger., ×1 (GIEBEL).

BIVALVED TYPES (APTYCHI PROPER)

Cornaptychus. Surface shiny, black, with coarse folds. *L.Jur.-M.Jur.* [*Lias., Hildoceras, Harpoceras, Grammoceras, ?Acanthopleuroceras, ?Dumortieria; M.Jur., Leioceras, Sonninia, Hecticoceras*].——FIG. 558,*3.* Cornaptychus, L.Jur., Ger.; ×1 (TRAUTH).

Laevicornaptychus. Like Cornaptychus but surface smoother. *L.Jur., ?M.Jur.* [*Pseudolioceras,* ?Oppeliidae *(partim)*].——FIG. 557,*2.* Laevicornaptychus, L.Jur., Ger.; ×2.7 (TRAUTH).

Lamellaptychus. Narrow-valved, surface covered with strong oblique folds. *M.Jur.-L.Cret.* [Typically *U.Jur.* Oppeliidae, incl. *Taramelliceras, Neochetoceras, Haploceras, Oppelia (Baj.), ?Oecotraustes*].——FIG. 557,*4;* 558,*7.* Lamellaptychus, U.Jur., Ger.; all ×1 (TRAUTH).

Laevilamellaptychus. Like Lamellaptychus but smoother. *U.Jur.-L.Cret.* [*Haploceras, Pseudolissoceras*].——FIG. 558,*4.* Laevilamellaptychus; ×1 (TRAUTH).

Punctaptychus. Like Lamellaptychus but oblique folds overlap like tiles on a roof and intervening furrows coarsely punctate. *M.Jur.-L.Cret.* [*Oppelia (?partim), Haploceras (partim)*].——FIG. 558,*10.* Punctaptychus; *10a,b,* ×1, ×1.3 (TRAUTH).

Granulaptychus. Thin-shelled, usually broad; surface with concentrically arranged granulations or thorns; inside with strong growth lines. *M.Jur.-L. Cret.* [*Garantiana, ?Stephanoceras, Subplanites, ?Lithacoceras, ?Olcostephanus*].——FIG. 558,*6.*

Granulaptychus, U.Jur., Ger.; ×2 (TRAUTH).

Praestriaptychus. Broad; surface with concentric striae or folds; inside similar. *M.Jur.-L.Cret.* [*Normannites, Parkinsonia, Kepplerites, Kosmoceras; U.Jur.,* Perisphinctidae *(partim)*].——FIG. 558,*2*. Praestriaptychus, U.Jur., Ger.; ×1 (TRAUTH).

Laevaptychus. Broad, thick-shelled; surface covered with fine pores; inside with fine growth lines. *U.Jur.* [*Aspidoceras, Hybonoticeras, ?Simoceras*]. ——FIG. 558,*12*. Laevaptychus, U.Jur.; *12a,b,* ×1 (TRAUTH).

Pteraptychus. Valves fused, surface with feather-like ribbing. *L.Cret.-U.Cret.* [Ammonite unknown].——FIG. 558,*11*. Pteraptychus, U.Cret. (Senon.), Alg.; ×2 (TRAUTH).

Spinaptychus. Thin-shelled, surface covered irregularly with perforated spiny protuberances; inside with growth lines and folds. *U.Cret.* [?Texanitinae].——FIG. 558,*8*. Spinaptychus, U.Senon., Eng.; *8a,b,* ×1 (COX).

Lissaptychus. Small, very thin-shelled, smooth except for some fine growth lines and few fine radial striae. *U.Cret.* [*?Parapuzosia*].——FIG. 558,*9*. Lissaptychus; ×1 (TRAUTH).

Synaptychus FISCHER, 1882 [=Striaptychus TRAUTH, 1927]. Thin-shelled, surface striate or delicately waved, some also granulate. Valves may be fused or partly fused. *U.Cret.* [Scaphitidae].

Pseudostriaptychus. Similar to Synaptychus, but not known to have fused valves, and usually with more prominent folds. *U.Cret.* [?Pachydiscidae].—— FIG. 557,*1*. Pseudostriaptychus, Senon., Eng.; ×1 (SHARPE).

Rugaptychus. Valves elongate, with strong, sharp ribs in which is a right-angled or acute-angled bend; inside with growth lines. *U.Cret.*[*Baculites*]. ——FIG. 557,*3;* 558,*5*. Rugaptychus; ×1 (TRAUTH).

Crassaptychus. Shell extremely thick, especially the median layer, which has conspicuous tubular structure. *U.Cret.* [Ammonite unknown.]

REFERENCES

The publications here cited, although more numerous than customary in the *Treatise,* have been chosen with some care from the voluminous literature pertaining to Mesozoic ammonoids so as best to aid readers who wish to extend a study of these fossils, the selection of titles given being influenced necessarily by judgment of the authors. Some references of general scope are included because needed to accompany the introductory chapter by ARKELL on Mesozoic Ammonoidea. The numbers within parentheses below authors' names are employed in the text as indices to the individual publications.

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(see facing page)

FIG. 558. Aptychi. *1, Anaptychus,* U.Dev.-Cret.; *1a,* U.Cret. (reconstr.), ×2 (666a); *1b,* Cret., ×1 (628a). *2, Praestriaptychus,* M.Jur.-L.Cret., ×1 (725a). *3, Cornaptychus,* L.Jur.-M.Jur., ×1 (725a). *4, Laevilamellaptychus,* U.Jur.-L.Cret., ×1 (725a). *5, Rugaptychus,* U.Cret., ×1 (725a). *6, Granulaptychus,* M.Jur.-L.Cret., ×2 (725a). *7, Lamellaptychus,* M.Jur.-L.Cret., ×1 (725*a). *8, Spinaptychus,* U.Cret.; *8a,b,* interior, exterior, ×1 (601a). *9, Lissaptychus,* U.Cret., ×1 (725a). *10, Punctaptychus,* M.Jur.-L.Cret.; *10a,b,* ×1.5, ×1 (725a). *11, Pteraptychus,* L.Cret.-U.Cret., ×2 (725a). *12, Laevaptychus,* U.Jur.; *12a,b,* interior, exterior, ×1 (725a). [Orientation according to TRAUTH.]

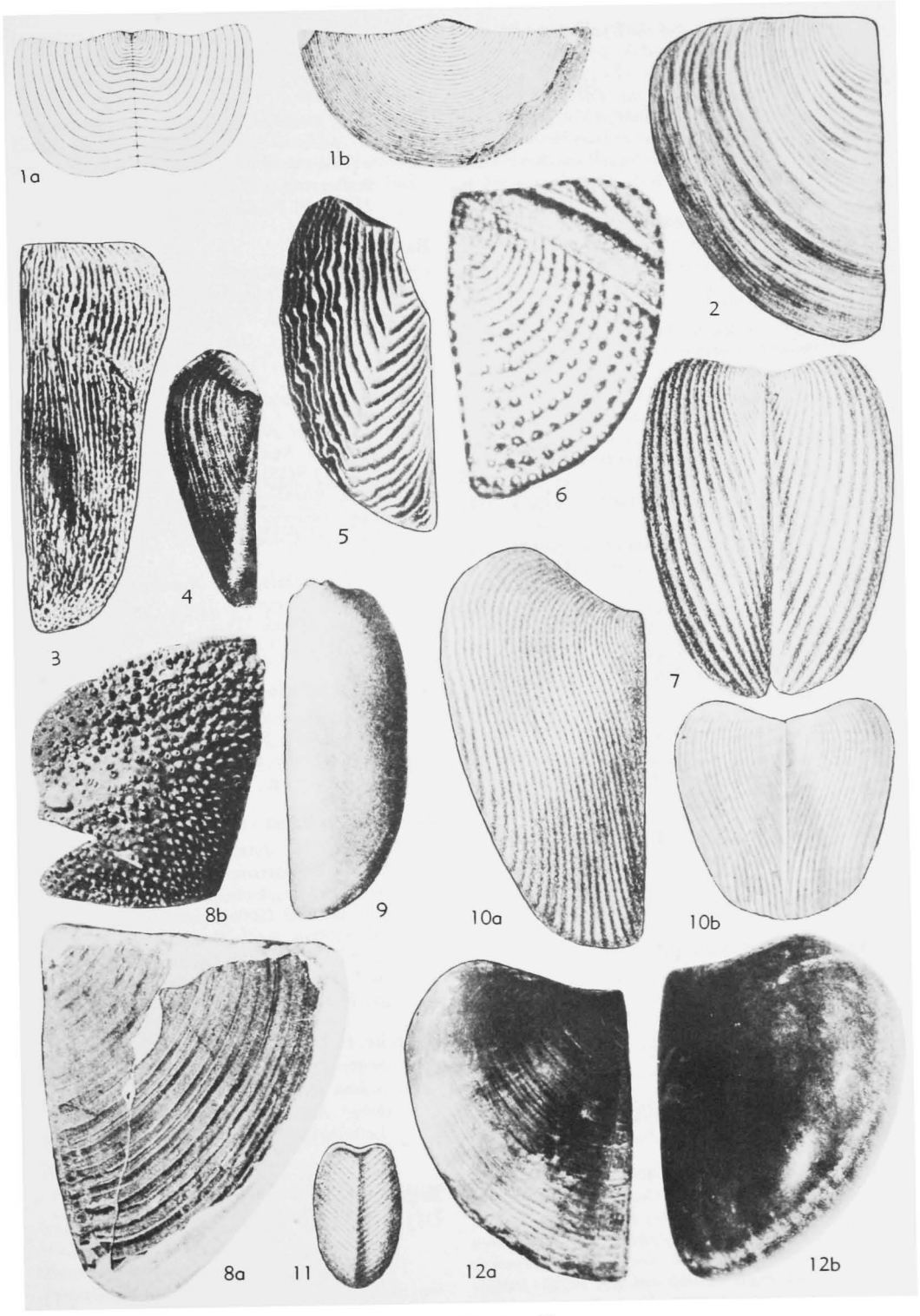

FIG. 558. Aptychi.

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TAXONOMY AND NOMENCLATURE OF APTYCHI

By R. C. Moore and P. C. Sylvester-Bradley

INTRODUCTION

The purpose of this chapter is to discuss briefly problems encountered in classifying and naming the fossils which have come to be called aptychi. As described in preceding parts of this volume by Miller & Furnish (p. L14) and Arkell (p. L99), these remains seem to comprise skeletal parts of ammonoid cephalopods, for in aggregate a large number of specimens have been found in the living chamber of ammonoid conchs. The fact that the outline of many aptychi approximately corresponds to the shape of the aperture of the conchs associated with them and the occurrence of aptychi in the living chamber of conchs have led to general interpretation of them as opercular structures. This explanation is rejected, however, by various investigators (as Zittel, Waagen, Deshayes, Quenstedt, Steinmann, Coquand, and Giebel) who have pointed out seemingly cogent reasons for inferring a different morphological function (shield over the funnel, cover of the nidamentary gland, mineralized structure equivalent to the cartilaginous knobs of modern dibranchs which fit into mantle sockets so as to insure efficient expulsion of water through the funnel, and others). Schindewolf (personal communication) reports that unpublished studies on various Upper Devonian ammonoids from western Germany establish beyond reasonable question the opercular nature of aptychi collected from Devonian beds. We are not concerned here with discussion of this problem except to note its bearing on questions of taxonomy and nomenclature of aptychi.

Chief pertinent observations concerning aptychi are the following: (1) These fossil remains comprise structures which exhibit no sign of hingement or other physical connection with the peristome or walls of ammonoid conchs; (2) associations of aptychi with conchs in such manner as to indicate that each conch-and-aptychus represents a single ammonoid individual are numbered in scores and yet are comparatively rare; (3)

most aptychi are found as discrete isolated fossils, generally scarce, but in some strata abundant enough to warrant designation of these deposits as aptychus beds; (4) as a rule, ammonoid conchs are rare or lacking in aptychus beds; (5) the stratigraphic occurrence of aptychi (Devonian to Cretaceous, inclusive) corresponds to the recorded distribution of ammonoids; and (6) aptychi possess demonstrated value for purposes of stratigraphic paleontology.

NEED FOR CLASSIFICATION AND NOMENCLATURE OF APTYCHI

The last-stated observation of the preceding paragraph—that aptychi have usefulness in stratigraphic paleontology—is in itself an adequate reason for concluding that effort to find any workable means for the classification and naming of these fossils should have the support of paleontologists. Utilitarian objectives here transcend questions of zoological affinities, particularly as regards the application of names for fossils consisting of aptychi. For example, it is interesting and helpful to learn that closely similar species of distinctive aptychi, in fact, all known representatives of the genus *Spinaptychus,* occur in Senonian beds of Syria, Palestine, England, and central United States, yet the conchs to which they belong have not been discovered. Because aptychi are useful fossils, we oppose an application which has been submitted by ARKELL (1954) to the International Commission on Zoological Nomenclature for the suppression of names published for aptychi, although we subscribe wholeheartedly to his essential aim, which is to avoid interference of aptychus names with those accepted for ammonoid conchs. Accordingly, a counterproposal prepared for us seeks approval of the Commission for establishment of dual nomenclature that provides definition of classificatory units (called parataxa) applicable to aptychi so that names for them are wholly distinct from those recognized for ammonoid conchs and incapable of interfering with the nomenclature of conchs.

It is appropriate to point out that scientific literature devoted to the description of aptychi has grown to many hundreds of pages and dozens of plates devoted to illustration of these fossils. The beginning of such publications actually antedates the 10th edition of LINNÉ's *Systema Naturae* (1758) and 2 generic names for aptychi were introduced by GESNER in 1758, even though at that time the zoological affinities of these fossils were not understood. Generic names for aptychi were published also by PARKINSON in 1811, SCHLOTHEIM in 1813 and 1820, BOURDET DE LA NIEVRE in 1822, VON MEYER in 1831, and by others shortly later. The literature on aptychi had early beginnings.

DISTINCTION BETWEEN ZOOLOGICAL NAMES AND MORPHOLOGICAL TERMS AS APPLIED TO APTYCHI

The first-used designations of aptychi are readily identifiable as generic and specific names. They are zoological names. Among these was *Aptychus,* introduced by VON MEYER in 1831 for several kinds of bipartite fossil forms which were distinguished by specific names such as *imbricatus, laevis, elasma,* and others.

GIEBEL (1847) seems first to have employed "aptychus" as designation for a particular kind of fossil when he used it in proposing *Sidetes* as a new generic name for a univalve form. Subsequently, "aptychus" and "aptychi" have come to be used universally as morphological terms for the structures of presumed opercular nature belonging to ammonoids or having other functions in the body of these and possibly other cephalopods. Originally, however, *Aptychus* was a generic name. At least some confusion is entailed in maintaining this usage when combined with employment of aptychus in the vernacular as a common noun.

In 1856 OPPEL observed an undivided type of *Aptychus*-like structure in the living chamber of *Ammonites planorbis* and he designated it as an "anaptychus" (unfolded aptychus), using both "aptychus" and "anaptychus" as morphological terms rather than as zoological names. The citation of OPPEL as author of *Anaptychus,* used as a generic name (although recorded by NEAVE's *Nomenclator Zoologicus,* v. 1, p. 178 and used by several writers) is therefore erroneous. It was in 1860 that *Anaptychus* first appeared as a generic name when STIMPSON published it as designation for a group of crustaceans. Later, in 1868, SCHLUMBERGER first employed *Anaptychus* in combination with specific names for some new species of Lower Jurassic aptychi. Thus, *Anaptychus*

SCHLUMBERGER is invalid because it is a junior homonym of *Anaptychus* STIMPSON.

Another sort of aptychus, consisting of 2 distinct halves partly or entirely fused together along their mid-line, was described and illustrated in 1882 by FISCHER, who chose for it the appropriate designation of "synaptychus." Like GIEBEL's use of "aptychus" and OPPEL's use of "aptychus" and "anaptychus" as common nouns, FISCHER did not employ "synaptychus" as a new generic name but as a morphological term. Nowhere is this designation used in combination with a specific name to form a binomen, but rather, FISCHER writes of "the synaptychus of *Scaphites spiniger*." The author who first published *Synaptychus* as a generic name is BASSE, 1952, and as shown later, this name is a junior objective synonym of *Striaptychus* TRAUTH, 1927.

Reviewing these matters of nomenclature and terminology, we may dispense with *Anaptychus* as a generic name applied to aptychi because of its status as an invalid name (junior homonym) and similarly we may discard *Synaptychus* because it is a junior objective synonym. This leaves *Aptychus,* which under the Règles stands as an available generic name. However, on the grounds of its disuse during more than 50 years and its replacement (both *sensu lato* and *sensu stricto*) by other names which have gained wide acceptance, we have proposed that the International Commission should suppress *Aptychus* VON MEYER, 1831, for purposes of the Law of Priority but not the Law of Homonymy. In this way the words "aptychus," "anaptychus," and "synaptychus" may have unambiguous signification as morphological terms alone. The additional term "diaptychus" is here proposed for bivalved aptychi. Thus the following morphological definitions may be given:

Morphological Terms for Aptychi

aptychus (pl., **aptychi**). All types of calcareous or corneous structures presumed to serve as opercula of ammonoid conchs.

diaptychus (pl., **diaptychi**). Aptychus composed of 2 discrete valves.

synaptychus (pl., **synaptychi**). Like diaptychus, but valves fused or partly fused along mid-line.

anaptychus (pl., **anaptychi**). Univalved type of aptychus.

GENERIC NAMES APPLIED TO APTYCHI

In this section we undertake to define generic names applicable to classification of aptychi, treating essential nomenclatural citations as compactly as possible but for purposes of reasonable completeness and convenience of readers, repeating with minor changes brief descriptions and references to illustrations which may be found in the immediately preceding chaper on aptychi by ARKELL (therefore acknowledged to him). Names for aptychi that may be used without any conflict involving names adopted for ammonoid conchs seem to be a necessity, but the status of nomenclature affecting these fossils depends on not-yet-made decisions of the International Commission on Zoological Nomenclature. According to our view, aptychus names should neither be suppressed (and thus removed from recognition by the Règles) nor accepted in manner that forces competition with conch names (thus overturning usage and perpetuating various sorts of ambiguities). In following text generic names applied to aptychi are arranged in chronologic order. Type species (both of recognized nominal genera and of synonyms) are marked by an asterisk and as elsewhere in the *Treatise* the abbreviations "SD" and "SM" stand for subsequent designation and subsequent monotypy; in addition, "OD" is used to denote original designation by monotypy (no other mode of original designation being found among aptychus names) and "MOORE-S.B." signifies MOORE & SYLVESTER-BRADLEY. Publications are cited by index numbers given in the list of references at end of the chapter.

Sidetes GIEBEL, 1847 (12, p. 821) [**S. striatus* GIEBEL, 1849, SM (13, p. 99; 14, p. 773)] [=*Anaptychus* SCHLUMBERGER, 1868 (29, p. 97), **Ammonites laqueus* QUENSTEDT, 1849, SD (MOORE-S.B., herein); *non* anaptychus OPPEL, 1856 (22, p. 108; 23, p. 194), morphological term; *non Anaptychus* STIMPSON, 1860 (Ann. Lyceum Nat. Hist. N.Y., v. 7, p. 183), Crust.] [=*Pholadocaris* H.WOODWARD, 1882 (47, p. 388), **P. leeii* WOODW., 1882, OD (47, p. 388, pl. 9, fig. 16); *fide* TRAUTH, 1935 (37, p. 69), confirmed MOORE-S.B.] [=*Cardiocaris* H.WOODWARD, 1882 (47, p. 386), **C. roemeri* WOODW., 1882 (47, p. 386, pl. 9, fig. 1-3), SD MOORE-S.B., herein; *fide* TRAUTH, 1935 (37, p. 65), confirmed MOORE-S.B.] [?=*Ellipsocaris* H.WOODWARD, 1882 (48, p. 444), **E.*

duwalquei WOODW., 1882, OD (48, p. 445, fig. 4); *fide* TRAUTH, 1935 (37, p. 58), confirmed MOORE-S.B.] [?=*Lisgocaris* CLARKE, 1882 (5, p. 478), *L. lutheri* CLARKE, 1882, OD (5, p. 478, fig. 5); *fide* TRAUTH, 1935 (37, p. 67), confirmed MOORE-S.B.] [=*Palanaptychus* TRAUTH, 1927 (33, p. 203), **Manticoceras intumescens* (BEYRICH), OD] [=*Neoanaptychus* NAGAO, 1931 (19, p. 109), **N. tenuiliratus* NAGAO, 1931, OD (19, p. 109, fig. 1-2); TRAUTH's (38, p. 459) designation of *N. semicostatus* NAGAO, 1932 (20, p. 175) as type species is invalid]. Anaptychi with varying outline, surface shiny and concentrically or radially striate or with concentric folds, some with thin outer calcareous layer but mostly of chitinous nature. *U. Dev.-U.Cret.,* world-wide.——FIG. 558,*1a. S. semicostatus* (NAGAO), U.Cret.(Senon.), Japan; reconstr., ×2 (NAGAO).——FIG. 558,*1b. *S. striatus* GIEBEL, U.Cret.(Senon.), Ger.; ×1 (GIEBEL). Others, FIGS. 3, 146.

Cornaptychus TRAUTH, 1927 (33, p. 189) [**Aptychus hectici* QUENSTEDT, 1849 (25, p. 119, 315, pl. 8, fig. 10); OD (33, p. 189, 228). Diaptychi, chitinous, with shiny black surface marked by corrugations subparallel to lateral margins. *L.Jur.-M.Jur.,* Eu.-N.Afr.——FIG. 558,*3. C. stenelasma davilaigranulata* TRAUTH, L.Jur., Ger.; ×1 (TRAUTH).

Crassaptychus TRAUTH, 1927 (33, p. 205, 228) [**Aptychus crassus* HÉBERT, 1855 (16, p. 368, pl. 28, fig. 8a,b); OD]. Diaptychi, very thick, especially middle layer which has prominent tubular structure. *U.Cret.,* Eu.

Granulaptychus TRAUTH, 1927 (33, p. 217, 228) [**G. suevicus* TRAUTH, 1930 (35, p. 389, pl. 5, fig. 4, lectotype herein designated, MOORE-S.B.); SD MOORE-S.B., herein (no species assigned to genus by TRAUTH in 1927)]. Diaptychi, thin-shelled, generally broad, with outer surface marked by concentric rows of granules and inner surface smooth except for growth lines. *M.Jur.-L.Cret.,* Eu.——FIG. 558,*6. G. planulati* (FRAAS), Jur., Ger.; ×2 (TRAUTH).

Laevaptychus TRAUTH, 1927 (33, p. 189, 228) [**Aptychus meneghinii* ZIGNO, 1870 (49, p. 11, pl. 8, fig. 1-4); OD] [=?*Tellinites* GESNER, 1758 (11, p. 38), **Tellina lapidea* GESNER, 1758 *(loc. cit.),* OD; *nomen dubium* recommended for suppression, ICZN pend.] [=*Ichthyosiagones* BOURDET DE LA NIEVRE, 1822 (4, p. 82), **Tellinites problematicus* SCHLOTHEIM, 1820 (28, p. 182), RÜPPELL, 1829 (26, p. 12, pl. 2, fig. 1-3); SD RÜPPELL, 1829 *(loc. cit.);* =**Trigonellites latus* PARKINSON, 1811 (24, p. 18); recommended for suppression as a long-overlooked name (ICZN pend.)] [=*Ichthyosiagon* HERRMANNSEN, 1847 (Index Gen. Malac., v. 1, p. 555), invalid subsequent spelling of *Ichthyosiagones*]. Diaptychi with broad, moderately thick calcareous valves, outer surface marked by fine pores and inner side with fine growth lines. *U.Jur.,* Eu.-N.Afr.——FIG. 558,*12. *L. latus* (PARKINSON), Solnhofen, Ger.; *12a,b,* outer and inner sides of valve, ×1 (TRAUTH).

Lamellaptychus TRAUTH, 1927 (33, p. 189, 228) [**Trigonellites lamellosus* PARKINSON, 1811 (24, p. 184, pl. 13, fig. 10-11); SD MOORE-S.B., herein] [=*Trigonellites* PARKINSON, 1811 (24, p. 184), obj., **T. lamellosus* PARKINSON, 1811 *(loc. cit.),* SD MOORE-S.B., herein] [=?*Solenites* GESNER, 1758 (11, p. 39) (*?non Solenites* SCHLOTH., 1820, p. 180). **Solen lapideus* GESNER, 1758, OD; *nomen dubium,* recommended for suppression, ICZN pend.] [=?*Solennites* SCHLOTHEIM, 1813 (27, p. 105), **S. annulatus* SCHLOTH., 1813 *(loc. cit.),* OD; *nomen dubium* recommended for suppression, ICZN pend.] [=*Aptychus* VON MEYER, 1831 (18, p. 125), commonly cited erroneously as 1829, **A. imbricatus* MEYER, 1831 (18, p. 127, pl. 59, fig. 1-12), SD MOORE-S.B., herein (=*Trigonellites lamellosus* PARKINSON, 1811, *fide* MEYER, 1831, p. 127; *fide* GIEBEL, 1851, p. 768; *fide* TRAUTH, 1938, p. 149; confirmed MOORE-S.B.); recommended for suppression in order to avoid extensive name changes, ICZN pend.] [=*Muensteria* EUDES-DESLONGCHAMPS, 1835 (9, p. 61), as *Münsteria* (*non* KNEBEL, 1909, Arch. Biont., v. 2, p. 222), **M. sulcata* EUDES-DESLONGCHAMPS, 1835 (9, p. 66, pl. 2, fig. 10-11), SD MOORE-S.B., herein (=*Trigonellites lamellosus* PARKINSON, 1811; *fide* TRAUTH, 1938, p. 149; confirmed MOORE-S.B.); recommended for suppression as a long-overlooked name, ICZN pend.] [=*Aptycus* DESHAYES, 1845 (in LAMARCK, Animaux sans verteb., ed. 2, v. 11, p. 228); erroneous subsequent spelling of *Aptychus* VON MEYER, 1831] [=*Aptichus* CROSSE, 1867 (Jour. Conchyliol., v. 15, p. 156); erroneous subsequent spelling of *Aptychus* VON MEYER, 1831] [?=*Palaptychus* TRAUTH, 1927 (33, p. 214), **Aptychus carbonarius* VON KOENEN, 1879 (17, p. 317), SD MOORE-S.B., herein]. Narrow diaptychi with outer surface covered by strong oblique folds, calcareous. *M.Jur.-L.Cret.,* Eu.-N.Afr.——FIG. 557,*4. *L. lamellosus lamellosus* (PARKINSON), U.Jur., Ger.; *4a,b,* exterior and transv. sec., ×1 (MEYER).——FIG. 558, *7. L. lamellosus solenoides* (SCHLOTH.), U.Jur., Ger.; exterior, ×1 (QUENSTEDT).

Lissaptychus TRAUTH, 1927 (33, p. 220, 231) [**Aptychus leptophyllus* SHARPE, 1856 (32, p. 55, pl. 24, fig. 1a,b), SD MOORE-S.B., herein]. Thin-shelled diaptychi with smooth surface except for fine growth lines and some radial striae. *U.Cret.,* Eu.——FIG. 558,*9. *L. leptophyllus* (SHARPE), Senon., Ger.; ×1 (STOLLEY).

Praestriaptychus TRAUTH, 1927 (33, p. 219, 230) [**P. gerzensis* TRAUTH, 1930 (35, p. 380, pl. 5, fig. 14-15, lectotype herein designated as original of fig. 14), SD MOORE-S.B., herein; no species assigned to genus by TRAUTH in 1927]. Broad diaptychi with both outer and inner surfaces

marked by concentric striae or folds. *M.Jur.-L.Cret.*, Eu.——FIG. 558,*2*. *P. fraasi* TRAUTH, Jur., Ger.; exterior, ×1 (TRAUTH).

Pseudostriaptychus TRAUTH, 1927 (33, p. 220, 231) [**P. pseudostobaei* TRAUTH, 1928 (34, p. 168), SM (ICZN pend.)]. Diaptychi with thin delicately waved or striate surface. *U.Cret.*, Eu.——FIG. 557, *1*. *P. gollevillensis* (SHARPE), Senon., Eng.; exterior, ×1 (SHARPE).

Pteraptychus TRAUTH, 1927 (33, p. 188, 218) [**Aptychus numida* COQUAND, 1854 (p. 140, pl. 3, fig. 1); OD]. Synaptychi with outer surface marked by pinnately arranged ribs diverging from midline. *L.Cret.-U.Cret.*, N.Afr.——FIG. 558,*11*. **P. numida* (COQUAND), U.Cret.(Senon.), Alg.; exterior, ×1 (COQUAND).

Punctaptychus TRAUTH, 1927 (33, p. 200, 228) [**Aptychus punctatus* VOLTZ, 1837 (46, p. 435; 40, p. 315, pl. 12, fig. 1-6); SD MOORE-S.B., herein.]. Diaptychi with outer surface bearing closely spaced ridges slightly oblique to line between valves, and furrows between ridges coarsely punctate. *M.Jur.-L.Cret.*, Eu.——FIG. 558,*10*. **P. punctatus* (VOLTZ), Jur., Ger.; *10a,b*, ×1 (TRAUTH).

Rugaptychus TRAUTH, 1927 (33, p. 220, 228) [**Aptychus rugosus* SHARPE, 1856 (32, p. 57, pl. 24, fig. 8-9); SD MOORE-S.B., herein]. Elongate diaptychi with strong sharp ridges on outer surface, ridges characteristically arranged with angulated bend; inner surface with growth lines, nearly smooth. *U.Cret.*, Eu.——FIG. 557,*3*. **R. rugosus rugosus* (SHARPE), Senon., Eng.; exterior, ×1 (SHARPE).——FIG. 558,*5*. *R. rugosus insignis* (HÉBERT), Senon., Fr.; exterior, ×1 (HÉBERT).

Spinaptychus TRAUTH, 1927 (33, p. 200, 220) [**Aptychus spinosus* Cox, 1926 (7, p. 577, pl. 24, fig. 1-3); OD]. Thin-shelled diaptychi with outer surface largely covered by spiny protuberances; inner surface with growth lines and gentle concentric folds. *U.Cret.*, NW.Eu.-E.Medit.-C.N.Am. (Kans.).——FIG. 558,*8*. **S. spinosus* (Cox), Senon., Eng.; *8a,b*, exterior, interior, ×1 (Cox).

Striaptychus TRAUTH, 1927 (33, p. 189, 229) [**S. spinigeri* TRAUTH, 1927 (33, p. 244; 30, p. 83, pl. 25, fig. 5-7, aptychus here illustrated defined as lectotype, MOORE-S.B., herein); SD MOORE-S.B., herein] [=*Synaptychus* BASSE, 1952 (3, p. 548) (*non* synaptychus FISCHER, 1882, p. 377, used as morphological term), **"Synaptychus spiniger* TRAUTH" (3, p. 548, fig. 12,*19*), =*Striaptychus spinigeri* TRAUTH; OD]. Thin-shelled synaptychi with outer surface generally striate or concentrically waved and may bear granules. *U.Cret.*, Eu.

Laevilamellaptychus TRAUTH, 1930 (35, p. 336) [**Trigonellites ceratoides* OOSTER, 1857 (21, p. 16, pl. 6, fig. 6-8); SD MOORE-S.B., herein]. Diaptychi resembling *Lamellaptychus* but outer surface nearly smooth. *U.Jur.-L.Cret.*, Eu.——FIG. 558,*4*. *L.* sp., U.Jur., Arg.; exterior of valve, ×1 (TRAUTH).

[**Laevicornaptychus** TRAUTH, 1936 (42, p. 28); *nom. nud.* because published subsequent to 1930 without indication of type species. *L.Jur., ?M.Jur.*, Eu.——FIG. 557,*2*. *L.* sp., L.Jur., Ger.; ×2.7 (TRAUTH).]

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INDEX

Names included in the following index are classified typographically as follows: (1) Roman capital letters are used for suprafamilial taxonomic units which are recognized as valid in classification; (2) italic capital letters are employed for suprafamilial categories which are considered to be junior synonyms of valid names; (3) morphological terms and generic and family names accepted as valid are printed in roman type; and (4) generic and family names classed as invalid, including junior homonyms and synonyms, are printed in italics. Page numbers printed in boldface type (as **L257**) indicate the location of systematic descriptions.

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