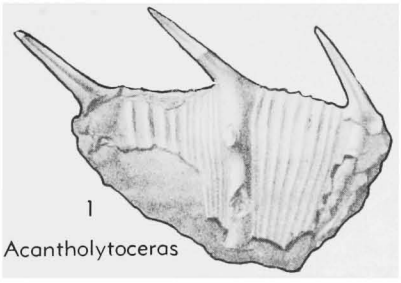


FIG. 234. *Acantholytoceras longispinus* (UHLIG), L. Cret.(Barrem.), Silesia; ×0.5 (530*) (p. L205).

Macroscaphites apparently gave rise to various heteromorph offshoots by reduction and disappearance of normally coiled part of shell (229, 530). *L.Cret.(Barrem.-U. Apt.)*.

Costidiscus UHLIG, 1882 [**Am. recticostatus* D'ORBIGNY, 1841]. Normally coiled, rather evolute, with dense strong straight radial ribs, which in some species are thickened on umbilical edge or even tuberculate; some forms also with distinct small ventrolateral tubercles; constrictions with enlarged ribs in front and behind usually present. Suture with sharp ends to all lobules; internal lobe with single point. *Barrem.-L.Apt.*, S.Eu.-C.Eu.-Sinai-Mex.——FIG. 233,*1*. **C. recticostatus* (ORB.), Barrem., Silesia; *1a,b*, ×0.75; *1c,d*, ×1 (530*).

Macroscaphites MEEK, 1876 [**Scaphites yvani* PUZOS, 1831]. Septate whorls exactly as in untuberculate or tuberculate species of *Costidiscus* (but usually smaller) followed by uncoiled body chamber with straight or even recurved shaft and final hook. *Barrem.-Apt.*, S.Eu.-C.Eu.-N.Afr.——FIG. 233,*3*. **M. yvani* (PUZOS), Barrem., Silesia; ×0.75 (530*).

Acantholytoceras SPATH, 1923 [**Hamites (Pictetia) longispinus* UHLIG, 1883]. Whorls not in contact, whorl section oval; periodic enlarged ribs with long hollow umbilical, lower and upper lateral and ventrolateral spines. *Barrem.*, C.Eu.-E.Eu.——FIG. 234,*1*. **A. longispinum* (UHLIG), Barrem., Silesia; ×0.5 (530*).

Family CICATRITIDAE Spath, 1927

Known only in a few examples of a single species which seems to be derived from *Costidiscus* but differs primarily in its asymmetric suture (3). *L.Cret.(Apt.)*.

Cicatrites ANTHULA, 1899 [**C. abichi*]. Very evolute with depressed whorl section; regular flattened umbilical bullae each cover 3 of the dense straight ribs and presumably formed bases of long hollow spines. Suture with bifid elements but irregular and with asymmetric 1st lateral lobe. *L.Apt.-U. Apt.*, Fr.-Cauc.——FIG. 233,*2*. **C. abichi*, U.Apt., Cauc.; *2a-c*, ×1 (581*).

Superfamily SPIROCERATACEAE Hyatt, 1900

[*nom. transl.* ARKELL, 1950 (*ex* Spiroceratidae HYATT, 1900)]

Uncoiled ammonoids of Jurassic. Possibly offshoots derived from Lytoceratina and hence classifiable with this suborder (12, 201, 355). *L.Jur.(Pliensb.)-U.Jur.(Oxf.)*.

Family ARCUCERATIDAE Arkell, 1950

Shell in form of open bow, enlarging very slowly; no ventral sulcus; ribs never oblique. Sutures unknown (12, 355). *L.Jur. (Pliensb.)*.

Arcuceras POTONIÉ, 1929 [**A. marthae*]. Only genus. *Pliensb.*, Eu.——FIG. 235,*4*. **A. marthae* POTONIÉ, Ger.; × (360*).

Family SPIROCERATIDAE Hyatt, 1900

[=Parapatoceratidae BUCKMAN, 1926]

Suture lines simple, consisting of 3 lobes

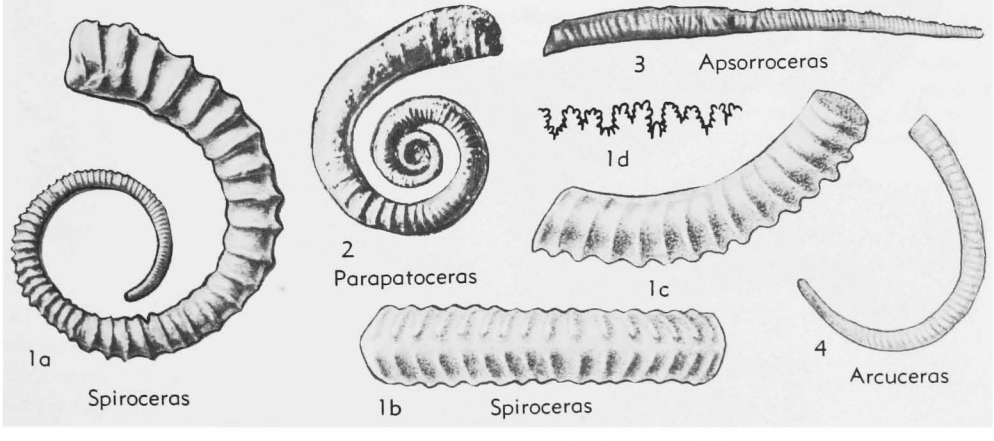


FIG. 235. Arcuceratidae, Spiroceratidae (p. L205-L207).

(external, lateral, internal), but according to SCHINDEWOLF (1951) lateral lobe not homologous with that in coiled ammonoids but ontogenetically comprising "2nd lateral" (2nd umbilical lobe), true 1st lateral having been suppressed to status of a small accessory. The presence of *Arcuceras* in the Lias makes it unlikely that Spiroceratidae are derived from Parkinsoniidae, despite strong resemblance to *Strenoceras*. The hypothesis adopted here is that Spiroceratacea are derivatives of Lytoceratina, perhaps of Ectocentritidae, analogous with the many Cretaceous uncoiled forms generally agreed (since HYATT, 1900) to have arisen from Lytoceratina. POTONIÉ (1929) proved a lineage from *Baj.* to *M.Callov.* The latest known form is *"Ancyloceras" ischeri* FAVRE, *Oxf.(bimammatum z.)*, Switz. (201, 355). *M.Jur.(U. Baj.)-U.Jur.(U.Oxf.)*.

Apsorroceras HYATT, 1900 [**Hamites baculatus* QUENSTEDT, 1858]. Shell long, mostly straight; distinction from *Spiroceras* difficult and in many doubtful. *U.Baj.(subfurcatum z.)*, Eu.——FIG. 235,*3*. **A. baculatum* (QUENST.), Ger.; ×0.2 (355*).

Spiroceras QUENSTEDT, 1858 [**Hamites bifurcati* QUENST., 1846; SD MASCKE, 1907; lectotype (QUENST., 1846, pl. 11, fig. 14) SD herein (designations by BUCKMAN, 1924, and POTONIÉ, 1929, invalid because not based on syntypes)] [=*Patoceras* MEEK, 1876; *Rhabdodites* BUCK., 1923; *Plagiamites* BUCK., 1925]. Shell usually in form of open spiral (cyrtocone) but genus includes twisted and loose helicoid forms; ribs simple, usually with 2 rows of tubercles or spines (lateral and ventrolateral) and broken by a ventral smooth band; on

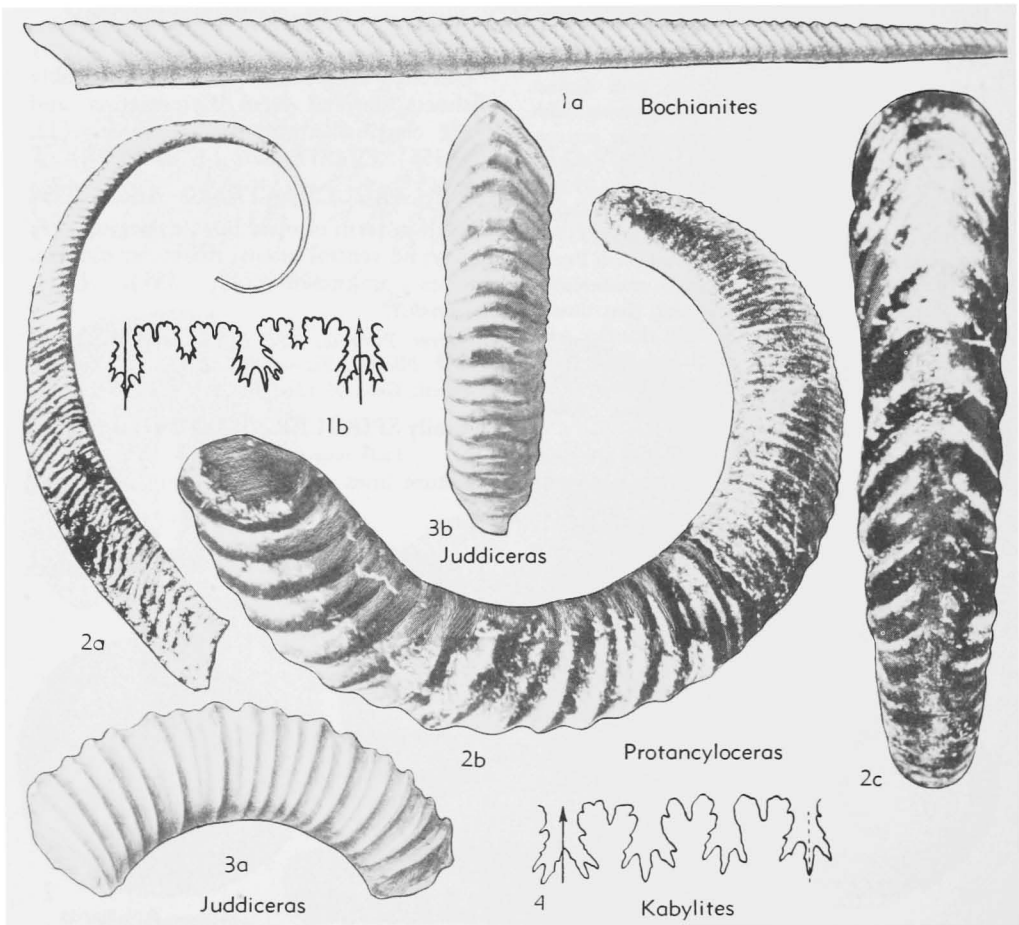


FIG. 236. Bochianitidae (p. L207).

dorsal area ribs invariably swing forward and weaken or die out. *U.Baj.-U.Bath.*, Eu.-Donetz-N. Afr.-Sinai-Kenya.——FIG. 235,*1*. **S. bifurcati* (QUENST.), U.Baj., Ger.; *1a*, ×0.7 (355*); *1b-d*, ×1 (358*).

Parapatoceras SPATH, 1924 [**Ancyloceras calloviense* MORRIS, 1845 (=**A. distans* BAUGIER & SAUZÉ, 1843)] [=*Crioconites* BUCKMAN, 1925]. Shell at first more closely coiled than in *Spiroceras*, later becoming straighter; ribs usually more distant than in *Spiroceras*, passing strongly over dorsum without fading or projecting. *U.Bath.-U.Oxf.*, Eu.-Persia-Cutch-Madag.——FIG. 235,*2*. **P. distans* (BAUG.-S.), Callov.; ×1 (65*).

Superfamily ANCYLOCERATACEAE Meek, 1876

[*nom. transl.* WRIGHT, herein (*ex* Ancyloceratidae MEEK, 1876)] [=Crioceratitaceae WRIGHT, 1952 (*nom. transl. ex* Crioceratitidae WRIGHT, 1952, erroneously attributed to HYATT, 1900)]

Majority of members uncoiled but form of coiling may vary much within genera. Stratigraphical association and intrinsic evidence suggests derivation from Lytoceratacea, but the succession and relation of many forms are obscure. The probable main course of phylogeny is that late Jurassic Protetragonitidae produced an uncoiled offshoot with strong ribs *(Protancyloceras)*, which in turn gave rise both to straight forms *(Bochianites)* and by late Valanginian or early Hauterivian to more closely coiled but still open-whorled genera (Crioceratitinae). During the Hauterivian one stock became more closely coiled and apparently led to Hemihoplitidae, while another developed hooked body chambers (Ancyloceratinae). The Heteroceratidae, with initially helical coiling, probably were derived from Ancyloceratinae. While earliest forms may retain a lytoceratid suture, the lobes soon become trifid. *U.Jur.(Tithon.)-L.Cret.(L.Alb.)*.

Family BOCHIANITIDAE Spath, 1922

[*nom. transl.* BREISTROFFER, 1947 (*ex* Bochianitinae SPATH, 1922)]

Loosely coiled to straight, normally with oblique ribs, rarely smooth. Tubercles occur very rarely. The suture has the same number of elements as in Lytoceratidae, but the lobes, except for the external one, are in most cases trifid (50, 486). *U.Jur.(Tithon.)-L.Cret.(L.Apt.)*.

Subfamily PROTANCYLOCERATINAE Breistroffer, 1947

[*nom. transl.* WRIGHT, 1952 (*ex* Protancyloceratidae BREIST., 1947)]

Loosely coiled, rarely helical, strongly ribbed; a few tuberculate forms. *U.Jur.(Tithon.)-L.Cret.(Valang.)*.

Protancyloceras SPATH, 1924 [**Ancyloceras gümbeli* OPPEL in ZITTEL, 1868]. Coiled in very open spiral; whorls slender, with round, oval, or subquadrate section; ribs fine on early whorls, typically coarser on later, prorsiradiate to radial, forming chevrons or interrupted on venter; ventrolateral tubercles may occur and pairs of ribs may join at these points. Suture with irregularly bifid saddles and trifid lateral lobes. *U.Jur.(Tithon.)-L.Cret.(Berrias.)*, Fr. - C.Eu. - Crimea - N.Afr.-Kurdistan-Mex.-Peru-Cuba.——FIG. 236,*2*. *P. kurdistanense* (SPATH), Tithon., Kurdistan; *2a-c*, ×1 (713*).

Cochlocrioceras SPATH, 1950 [**C. turriculatum*]. Differs from *Protancyloceras* in its helically coiled inner whorls, with ribs interrupted on venter. *U. Jur.(Tithon.)*, Kurdistan.

Juddiceras SPATH, 1924 [**Crioceras curvicosta* KOENEN, 1902]. Rather large, known only in slightly curved fragments but probably not completing 360°. Prominent, rather distant, slightly concave ribs, irregularly stronger and weaker, former with pair of ventral tubercles. *L.Cret.(U. Valang.)*, Ger.——FIG. 236,*3*. **J. curvicostum* (KOENEN); *3a,b*, ×0.5 (237*).

Subfamily BOCHIANITINAE Spath, 1922

Straight forms with oblique annular ribs or smooth. *U.Jur.(Tithon.)-L.Cret.(L.Apt.)*.

Bochianites LORY, 1898 [**Baculites neocomensis* D'ORBIGNY, 1842]. Smooth or with weak to strong oblique annular ribs. Sutures have short elements; umbilical lobe much reduced in size, no larger than lobule that divides 1st lateral saddle. *U.Jur. (Tithon.)-L.Cret.(Hauteriv.)*, Eu.-?CapeVerdeI.-N. Afr.-Natal-Himalaya-Indon.-Calif.-Mex. —— FIG. 236,*1*. **B. neocomensis* (ORB.), U.Valang., Fr.; *1a*, ×1; *1b*, enlarged (329*).

Janenschites DURAND DELGA, 1954 [**Bochianites janenschi* ZWIERZYCKI, 1914]. Doubtfully distinct from *Bochianites*. Suture with long and narrow elements, more denticulate than in *Bochianites*. *L. Cret.(Barrem.)*, Tanganyika.

Kabylites DURAND DELGA, 1954 [**Bochianites superstes* PERVINQUIÈRE, 1910]. Differs from *Bochianites* in having umbilical lobe of suture more or less same in size as 1st lateral. *L.Cret.(Barrem.-L.Apt.)*, Fr.-Ger.-N.Afr.——FIG. 236,*4*. **K. superstes* (PERVINQUIÈRE), Barrem., Algeria; ×1 (616*).

?Baculina D'ORBIGNY, 1847 [**B. rouyana (nom. dub.)*]. Holotype of *B. rouyana* may be a worn *Bochianites*. *L.Cret.(Valang.)*, Fr.

Family ANCYLOCERATIDAE Meek, 1876

[=Crioceratidae, Pediocerati dae Hyatt, 1900; Crioceratitidae Wright, 1952 (erroneously attributed to Hyatt, 1900)]

Typically regularly coiled with the whorls not in contact but some forms have early or all whorls in contact, whereas others have straight or hooked body chambers; whorl section ranging from circular to square; ribs weak or strong, showing tendency to have stronger periodic ribs with umbilical, lateral and ventrolateral spines; ornament rarely constant through growth. Sutures ornate, of lytoceratid plan, without auxiliaries, but with trifid lobes (2, 394, 405, 460, 566). *?L. Cret. (Valang.), L. Cret. (L. Hauteriv. - U. Apt.), ?L.Cret.(L.Alb.).*

Although the outer whorls of some early species resemble the outer whorls of evolute Berriasellidae *(Distoloceras)*, the sutures are different and resemblance is restricted to certain growth stages. Monophyletic origin in *Juddiceras* or some as yet unknown Upper Valanginian member of the Protancyloceratinae seems probable.

Subfamily CRIOCERATITINAE Wright, 1952

[*nom. transl.* Wright, herein (*ex* Crioceratitidae Wright, 1952, erroneously attributed to Hyatt, 1900; *nom. conserv.* proposed Wright, 1955, ICZN pend.)]

Normally coiled in a regular plane open spiral; if body chamber is hooked, it is only so irregularly and does not have a distinct straight shaft. *L.Cret.(L.Hauteriv.-U.Apt.).*

Aegocrioceras Spath, 1924 [**Crioceras capricornu* Roemer, 1841]. Differs from *Juddiceras* in having all ribs equal, strong, rather distant and with ventrolateral spines on inner whorls, and in being more closely and regularly coiled. *Hauteriv.*, N.Eu. ——Fig. 237,*3*. **A. capricornu* (Roemer), L. Hauteriv., Eng.; *3a,b*, ×1 (679*).

Crioceratites Leveillé, 1837 [**C. duvali*] [*Crioceras, Toxoceras* d'Orbigny, 1842; *?Emericiceras* Sarkar, 1954]. Typically coiled in open, equiangular spiral but spiral angle may increase with age; whorl section may be oval or subquadrate, with more or less distinctly trapezoidal top; ribs generally dense, rounded, straight or slightly curved and untuberculate, with periodic stronger ribs strengthened on shoulders or carrying ventrolateral or umbilical, lateral and ventrolateral spines. *Hauteriv.-Barrem.*, Eu. - Turkey - Madag. - Japan - Calif.-Mex.——Fig. 237,*6*. *C. nolani* (Kilian), U. Hauteriv., Fr.; *6a,b*, ×0.25; *6c*, ×0.5 (329*).

Balearites Sarkar, 1954 [**Crioceras balearense* Nolan, 1894]. Compressed, with rounded venter. For most of growth fine, flexuous, equal ribs branch 2, 3 or 4 from weak umbilical tubercles, but there are a few periodic stronger ribs and rather feeble ventrolateral tubercles may occur. *U.Hauteriv.*, Fr.-Balearics.——Fig. 238,*1*. **B. balearensis* (Nolan), Balearics; *1a,b*, ×1 (671*).

[**Neohoplites** Gerth, 1921 *(nom. nud.)*].

[**Jaubertites** Sarkar, 1954 *(nom. nud.)*].

[**Sapthicrioceras** *(errore pro Spathicrioceras)* Sarkar, 1954 *(nom. nud.)*].

Paracrioceras Spath, 1924 [**Crioceras occultum* Seeley, 1865] [*?Peltocrioceras, ?Hemicrioceras* Spath, 1924]. Early whorls bearing fine equal more or less straight nontuberculate ribs. Differs from *Crioceratites* mainly in having more frequent and stronger periodic ribs with larger spines between which there may be no intermediate ribs on outer whorls; some forms have close coiling and reduced ornament from an early stage. *U.Hauteriv.-Barrem.*, Eu.-Patag.——Fig. 238,*3*. *P. elegans* (Koenen), Barrem., Ger.; ×0.7 (237*).

Menuthiocrioceras Collignon, 1949 [**Crioceras (M.) lenoblei*]. Whorls touching each other, whorl sections becoming more inflated with growth and with flat venter to a late stage; ribs nearly straight and radial at first, then sinuous and finally biconcave, fairly fine and dense, up to 8 plain ribs occurring between enlarged trituberculate ribs. *U. Hauteriv.*, Madag.——Fig. 238,*2*. *M. hourcqui* Collignon; inner whorls, *2a,b*, ×1 (601*).

Hoplocrioceras Spath, 1924 [**Hamites phillipsi* Bean in Phillips, 1828]. Early whorls with subquadrate section, ribs springing in bundles from subdued umbilical tubercles, with or without ventrolateral spines, on later whorls with ribs single and more distant; body chamber may straighten and ornament disappear. *U.Hauteriv.-Barrem.*, W. Eu.-Calif.——Fig. 237,*7*. *H. fissicostatum* (Roemer), L.Barrem., Ger.; ×0.25 (237*).

Shasticrioceras Anderson, 1938 [**S. poniente;* SD Wright, herein]. Early whorls compressed, with dense single rarely branching sinuous ribs, which may be flat, bearing slightly clavate tubercles on sharp shoulders; later the section becomes quadrate and ribs coarse and distant, wtih blunt ventrolateral tubercles. *Barrem.*, Japan-Calif.——Fig. 237, *2*. **S. poniente*, Calif.; ×1 (2*).

Pedioceras Gerhardt, 1897 [**P. cundinamarcae*] [*Pseudocrioceras* Spath, 1924]. Early whorls much as in *Menuthiocrioceras*, subquadrate, with equal, straight or sinuous, mainly single ribs angulate or with upper and lower tubercles on shoulders, ribs then differentiated into plain and tuberculate ones; later coiling loosens and ornament becomes coarser and weaker. *Barrem.-Apt.*, Cauc.-Calif.-Mex.-Colombia.——Fig. 237,*5*. **P. cundinamarcae*, Barrem., Colombia; inner whorls, *5a-c*, ×1 (173*).

Parancyloceras Spath, 1924 [**Crioceras bidentatum* Koenen, 1902]. Coiled either in plane spiral with whorls just touching or not in contact or straight-

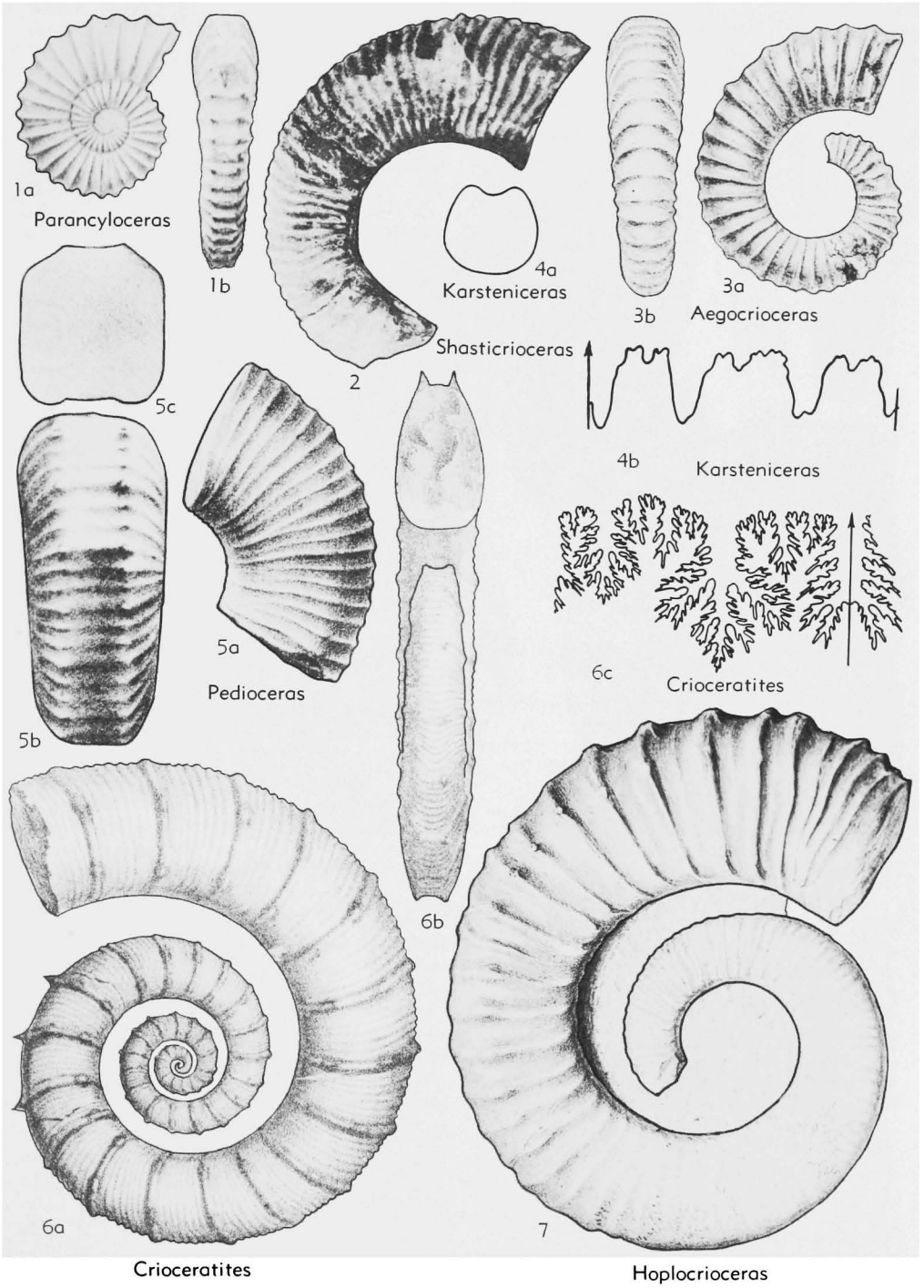


FIG. 237. Ancyloceratidae (p. L208-L210).

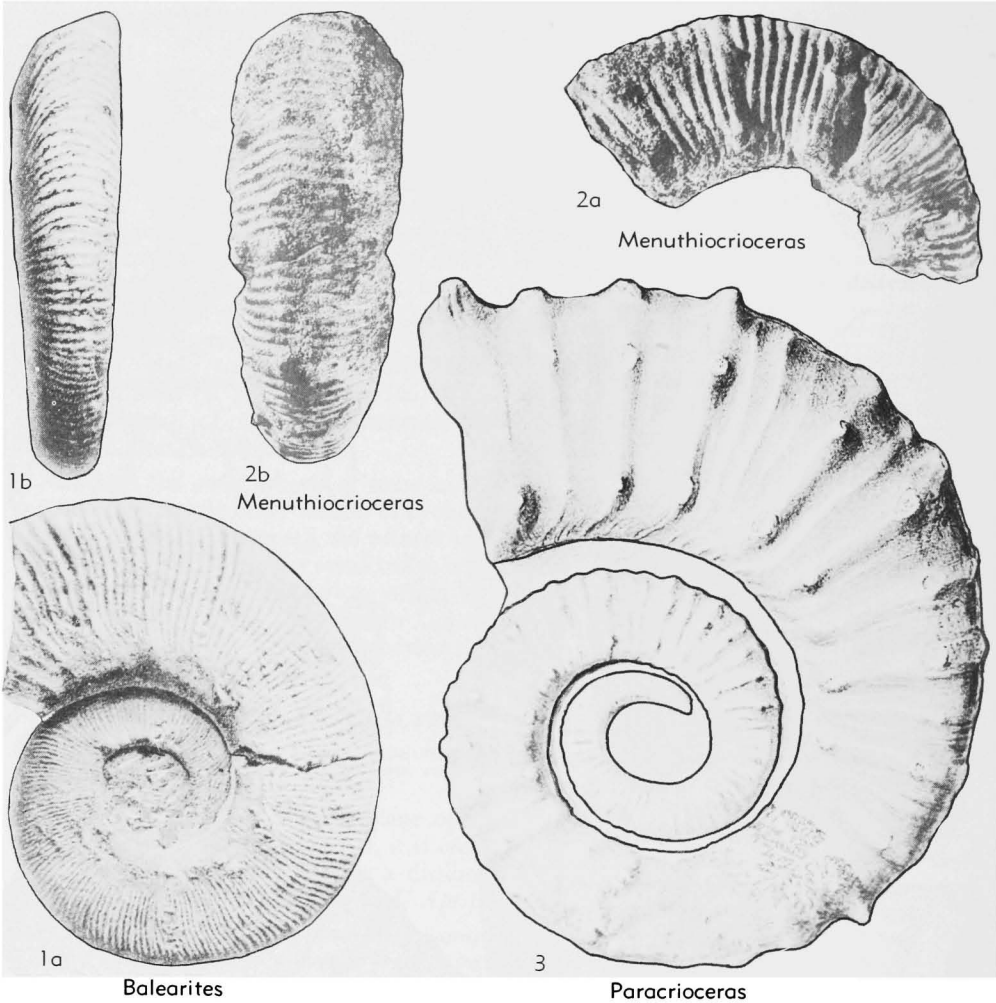


FIG. 238. Ancyloceratidae (p. L208).

ening (?and then hooked) after a few coiled whorls; ribs distant, sharp, equal, steep, radial or oblique, with more or less distinct upper and (in some species) also lower ventrolateral tubercles; ribs may be doubled between outer tubercles. *U. Barrem.*, Eng.-Ger.——FIG. 237,*1*. **P. bidentatum* (KOENEN), U.Barrem., Ger.; *1a,b*, ×1 (237*).

?**Karsteniceras** ROYO Y GOMEZ, 1945 [**Ancyloceras beyrichi* KARSTEN, 1858]. Coiling more or less as in *Crioceratites;* ribs sharp and irregularly strong and weak. Suture with finger-like lobes and equal, square, feebly bifid saddles. *Barrem.*, Colombia. ——FIG. 237,*4*. **K. beyrichi* (KARSTEN); *4a*, ×1; *4b*, ×4 (394*).

?**Veleziceras** WRIGHT [*nom. nov.* herein, *pro Orbignyiceras* ROYO Y GOMEZ, 1945 (*non* GÉRARD & CONTAUT, 1936)] [**Orbignyiceras veleziense* ROYO Y GOMEZ, 1945]. Only straight or slightly curved shafts are known. Ribs fairly prominent and oblique, without tubercles. Suture much as in *Karsteniceras. Barrem.*, Colombia.

Subfamily ANCYLOCERATINAE Meek, 1876

[*nom. transl.* WRIGHT, herein (*ex* Ancyloceratidae MEEK, 1876)] [=Helicancylidae HYATT, 1894]

Typically with early whorls forming a more or less regular open spire, commonly with periodic trituberculate ribs and fine intermediaries, followed by curved or straight shaft and terminal hook. Many genera, however, show fine subdued equal ribs at some stage and coarse tuberculate ones at another (2, 51, 329, 566). *L.Cret.-(U.Hauteriv.-U. Apt.), ?L.Cret.(L.Alb.).*

Acrioceras HYATT, 1900 [**Ancyloceras tabarelli* ASTIER, 1851] [?Includes as subgenera *Mesocrioceras* BREISTROFFER, 1952 *(nom. nud.)*; *Dissimilites* SARKAR, 1954]. Small; spire composed of 1 or 2 loosely coiled whorls bearing fine ribs with periodic enlarged ones carrying 1 to 3 tubercles, periodic ribs weakening or disappearing on shaft; rather strong ribs that branch irregularly from weak umbilical tubercles occur on hook. *U.Hauteriv.-L. Apt.*, W.Eu.-C.Eu.-Calif.——FIG. 239,*1*. **A. tabarelli* (ASTIER), ?L.Barrem., Fr.; ×1 (405*).

Aspinoceras ANDERSON, 1938 [**A. hamlini*]. Small, with few regularly coiled whorls followed by short shaft and rounded hook; ribs very close, regular, alternately simple and branched, nontuberculate, obliquely disposed on shaft; constrictions may occur. *U.Hauteriv.-L.Barrem.* (reference of type species to Valang. very doubtful), W.Eu.-C.Eu.-Calif.——FIG. 240,*5*. *A. dilatatum* (ORB.), L. Barrem., Fr.; ×0.75 (329*).

Uhligia KOENEN, 1904 [**Hamites minutus* NEUMAYR & UHLIG, 1881]. Early part more or less straight, then sharply bent, with following straight shaft and final hook; ribs nontuberculate, fine, weak and irregular, prorsiradiate on early part, radial on later. *L.Barrem.*, Ger.——FIG. 240,*2*. **U. minutus* (NEUMAYR & UHLIG); *2a-c*, ×1 (237*).

Lytocrioceras SPATH, 1924 [**Ancyloceras jauberti* ASTIER, 1851] [*?Paraspinoceras* BREISTROFFER, 1952 *(nom. nud.)*]. Very loosely coiled, with long shaft and irregular hook; periodic tuberculate ribs on spire but otherwise all are equal, dense, fine, straight, and prorsiradiate. *Barrem.*, Fr.-Switz.—— FIG. 239,*2*. **L. jauberti* (ASTIER), Barrem., Fr.; diagram (726*).

Leptoceras UHLIG, 1883 [**L. pumilum*]. Small; slight spire followed by relatively long shaft and massive hook; ribs equal and nontuberculate on spire, a few periodic ribs with 1 or 2 tubercles on shaft, ribs on hook branch in pairs from weak tubercles or none. *Barrem.*, Fr.-C.Eu.

Ancyloceras D'ORBIGNY, 1842 [**A. matheronianum* ORB., 1842; SD HAUG, 1889]. Plane open spiral followed by fairly long shaft and final hook; ribs fine, straight, radial or prorsiradiate, with periodic trituberculate ones at least on early whorls and hook; tubercles all spinose. *U.Barrem.-L.Apt.*, Eu.-Japan-Calif.-Colombia.——FIG. 240,*1*. **A. matheronianum* (ORB.), Barrem., Fr.; ×0.125 (329*).

Tonoceras HYATT, 1900 [**Ancyloceras duvalianum* D'ORBIGNY, 1842]. Differs from *Ancyloceras* in having short, curved shaft and prominent lateral and ventrolateral clavate (not spinate) tubercles. *U.Barrem.*, Fr.

Dirrymoceras HYATT, 1900 [**Ancyloceras simplex* D'ORBIGNY, 1842]. Large, with coiling of *Ancyloceras* but ornament of *Aspinoceras*. *U.Barrem.-L. Apt.*, Fr.-Calif.

Shastoceras ANDERSON, 1938 [**S. californicum*]. Very large; ribs as in *Dirrymoceras* but most of hook swollen and smooth. *L.Apt.*, Calif.

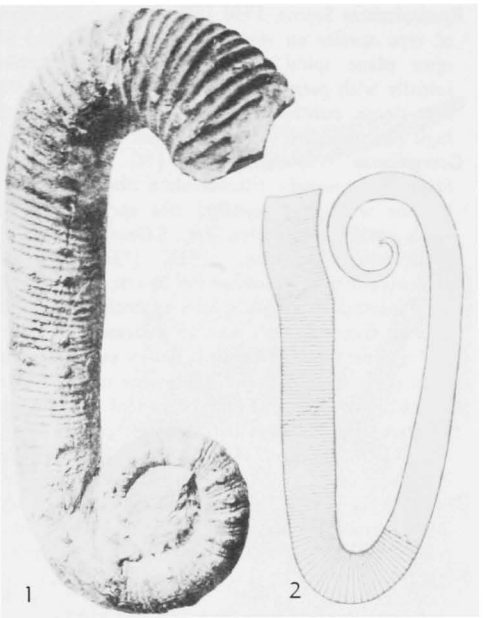


FIG. 239. Ancyloceratidae (p. L211).

Australiceras WHITEHOUSE, 1926 [**Crioceras jacki* ETHERIDGE, JR., 1880] [*?Colombiaticeras* ROYO Y GOMEZ, 1949]. Coiled in a more or less regular spiral with no final hook; alternate ribs with stout blunt or conical umbilical, ventrolateral and normally mediolateral tubercles persist to a late stage but sooner or later ribs lose their tubercles. *L.Apt.-U.Apt.*, *?L.Alb.*, Pak.-Austral.-Calif.-?Colombia. ——FIG. 240,*6*. **A. jacki* (ETH.), L.Apt., Queensl.; ×0.75 (566*).

Ammonitoceras DUMAS, 1876 [**A. ucetiae*]. Initial whorls irregular, then whorls just in contact to body chamber which uncoils slightly; periodic ribs with umbilical and mediolateral tubercles and 1 to 3 intermediate ribs persisting to fairly late stage; tubercles gradually weaken, then disappear, leaving rather close rounded ribs; on body chamber ribs are simple, distant and high. *?U.Barrem.*, *L.Apt.-U.Apt.*, Eu.-Transcaspia.

Tropaeum J.DEC.SOWERBY, 1837 [**Crioceratites bowerbanki* J.DEC.SOW., 1837]. Large; like *Ammonitoceras* but mainly without tubercles; earliest part with some trituberculate ribs, then all ribs equal, fine and dense to last whorl, on which they become coarse and distant. *U.Apt.*, W.Eu.-Spitz.-S.Russ.-Alaska-Calif.-Patag.-Greenl.——FIG. 240,*4*. **T. bowerbanki* (J.DEC.SOW.), U.Apt., Ger.; ×0.25 (237*).

Epancyloceras SPATH, 1930 [**E. hythense* (holotype of type species an injured specimen)]. Coiled in open plane spiral followed by terminal hook; initially with periodic trituberculate ribs, then with fine, dense, nontuberculate ones, finally with very high ribs produced into thin bullae. *U.Apt.*, W.Eu.

Georgioceras WILCKENS, 1947 [**G. kohllarseni*]. Stage with periodic trituberculate ribs is followed by one with fine, bundled ribs springing from weak umbilical tubercles. *Apt.*, S.Georgia.

Hamiticeras ANDERSON, 1938 [**H. pilsbryi*] [*?Toxoceratoides, Tonohamites* SPATH, 1924 *(nom. dub.* inasmuch as type species of both are known only in fragments too poor to indicate their form and ornament at all stages)]. Rather small; coiling as in *Ancyloceras;* ribs oblique, some trituberculate on early part, then on some or all of shaft; hook without tubercles, rounded and close or sharp and distant. *U.Barrem.-U.Apt.*, W.Eu.-Calif.——FIG. 240,*3*. **H. pilsbryi*, U.Apt., Calif.; ×0.5 (2*).

Helicancylus GABB, 1869 [**H. aequicostatum*]. Only initial helix known; it has oblique subdued ribs, periodically with 3 rather prominent tubercles. *Apt.*, Calif.

Family HETEROCERATIDAE Hyatt, 1900

Helically coiled initial whorls are followed by a more or less plane spiral of loosely or tightly coiled whorls, in some shells comprising only a straightened shaft and final hook; usually with dense, fairly fine ribs throughout; tubercles rarely present and if so not very prominent. Suture with bifid saddles and asymmetrically trifid lobes. Origin uncertain but presumed to lie in some Barremian members of Ancyloceratinae (229, 393). *L.Cret.(Barrem.-Apt.)*.

Heteroceras D'ORBIGNY, 1849 [**H. emericianum;* SD MEEK, 1876] [*Lindigia* KARSTEN, 1858]. More or less tightly coiled helix followed by long slightly curved shaft; ribs concave and oblique on helix but straight and radial later. *Barrem-Apt.*, Fr.-C. Eu.-Cauc.-Peru.

H. (Heteroceras). Aperture level with base of helix; no tubercles. Occurrence as for genus.—— FIG. 241,*4*. *H. (H.) tardieui* KILIAN, Barrem., Fr.; ×0.38 (229*).

H. (Argvethites) ROUCHADZÉ, 1933 [**H. (A.) lashense*]. Aperture level with top of helix; venter of shaft and hook flat, in some bearing paired ventral tubercles; on shaft ribs may join these tubercles in pairs; some branching ribs on hook. *L.Apt.*, Cauc.

Hemibaculites HYATT, 1900 [**Toxoceras obliquatum* D'ORBIGNY, 1942] [*?Moutoniceras* SARKAR, 1954]. With small spire followed by straight or slightly curved shaft with open hook; no tubercles present; ribs strong or weak, rounded, prorsiradiate and may form a chevron on venter at point of which they are weak or interrupted. *U. Barrem., ?Apt.*, Fr.-Calif.

Colchidites DJANELIDZÉ, 1924 [**C. colchicus*] [*Santandericeras* ROYO Y GOMEZ, 1945]. Initial tightly coiled helix surrounded by plane spiral of more or less tightly coiled whorls with axis of coiling at right angles to that of the helix. *Barrem.-Apt.*, Fr.-Cauc.-Transcaspia-Colombia.

C. (Colchidites). No tubercles. *Barrem.-Apt.*, Fr.-Cauc.——FIG. 241,*3*. *C. (C.) sarasini* ROUCHADZÉ, L.Apt., Cauc.; ×0.75 (393*).

C. (Imerites) ROUCHADZÉ, 1933 [**Heteroceras giraudi* KILIAN, 1888 (=**Crioceras cristatum* D'ORBIGNY, 1842)] [*Atopoceras* JAUBERT in KILIAN, 1888 *(nom. nud.); Escragnolleites* SARKAR, 1954]. With pair of ventral tubercles or both ventral and ventrolateral tubercles generally only on early whorls of helix. *Barrem.*, Fr.-Cauc.-Transcaspia.

Family HEMIHOPLITIDAE Spath, 1924

Compressed, moderately evolute to uncoiled forms, with flat venter and simple straight or branched flexuous ribs; umbilical and single or double ventrolateral tubercles may occur. Suture apparently without auxiliary elements and resembling that of many Crioceratitidae. Since transitional forms between typical *Crioceratites* and *Pseudothurmannia* are known, the family is more probably related to Crioceratitidae than to early hoplitacean families derived from Desmoceratidae, with which it has many points of resemblance (459,460). *L.Cret.(Hauteriv.-U.Barrem.)*.

Pseudothurmannia SPATH, 1923 [**Am. angulicostatus* D'ORBIGNY, 1841]. Uncoiled or evolute; whorl section with sloping or parallel sides, venter arched to flat; umbilical tubercles and weak lower and stronger upper ventrolateral tubercles may be present. *?L.Hauteriv., U.Hauteriv.-Barrem.*, Fr.-Balearics-Turkey-Georgia.——FIG. 241,*1*. **P. angulicostata* (ORB.), U.Hauteriv., Fr.; *1a,b*, ×1 (329*).

Hemihoplites SPATH, 1924 [**Am. feraudianus* D'ORBIGNY, 1841] [*Matheronites* RENNGARTEN, 1926]. Rather evolute, compressed, with rectangular whorl section; ribs simple or branching, long and short, well spaced, straight or slightly flexuous, crossing flat venter transversely, typically with fairly distinct umbilical and ventrolateral tubercles. *U. Hauteriv.-Barrem.*, Fr.-Balearics-Georgia.——FIG. 241,*2;* 554,*6*. *H. soulieri* (MATHERON), Barrem., Fr.; 241,*2a,b*, ×1 (MATHERON, 1878); 554,*6*, enlarged (143*).

Pascoeites SPATH, 1933 [**P. budavadensis*]. Ill known. *?Barrem.*, W.India.

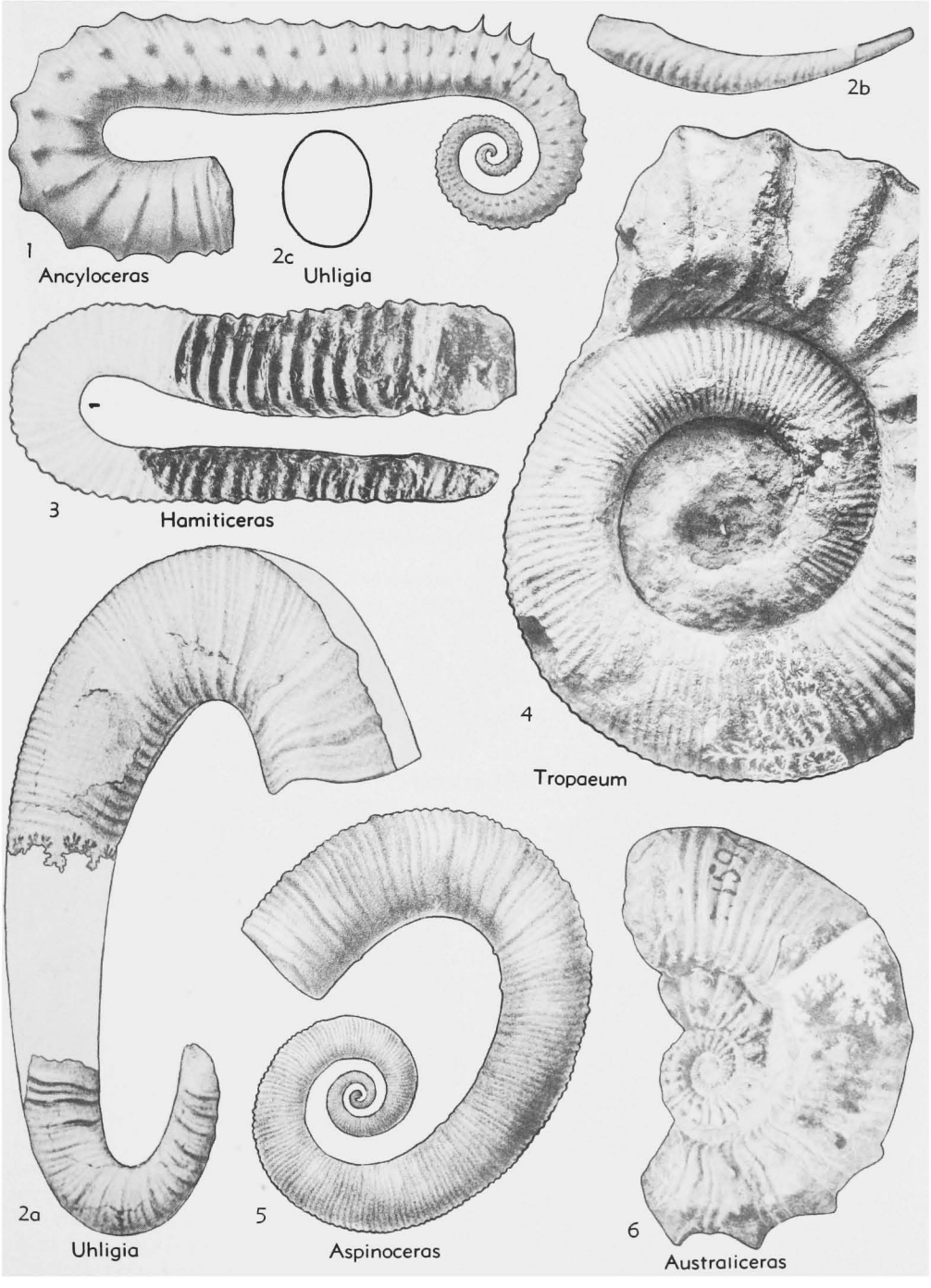


FIG. 240. Ancyloceratidae (p. L211-L212).

Superfamily TURRILITACEAE Meek, 1876

[*nom. transl.* Wright, herein (*ex* Turrilitidae Meek, 1876)] [=Hamitaceae Hyatt, 1900 (*nom. transl.* Wright & Wright, 1951, *ex* Hamitidae Hyatt, 1900)]

Comprises a series of families presumed to be derived by way of Hamitidae from Macroscaphitidae. They exhibit almost every known form of heteromorph coiling and include smooth, ribbed and tuberculate genera. The suture generally has no auxiliary elements but does not in all forms retain the ancestral bifidity of the lobes. With these families are associated Ptychoceratidae

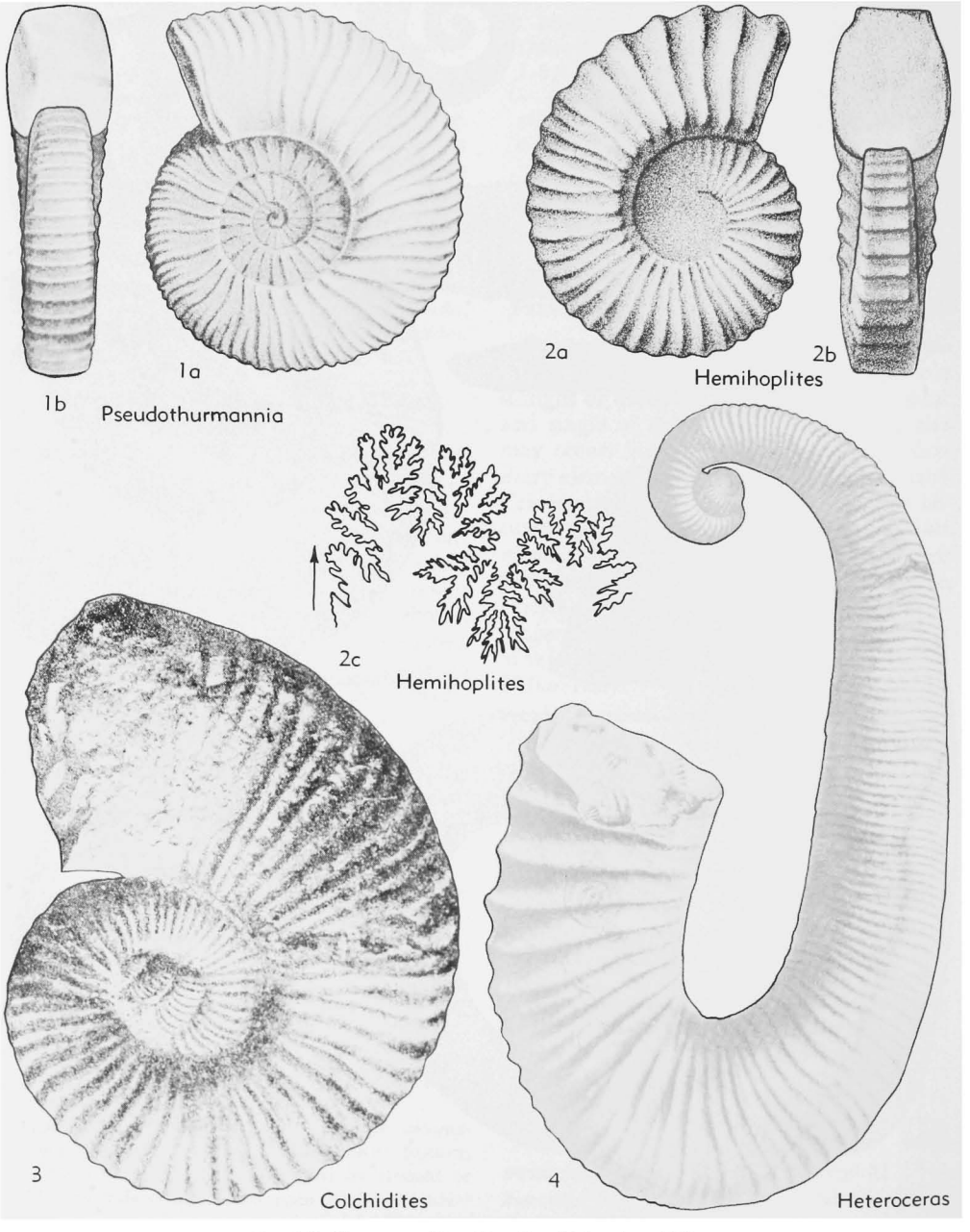


Fig. 241. Heteroceratidae, Hemihoplitidae (p. L212).

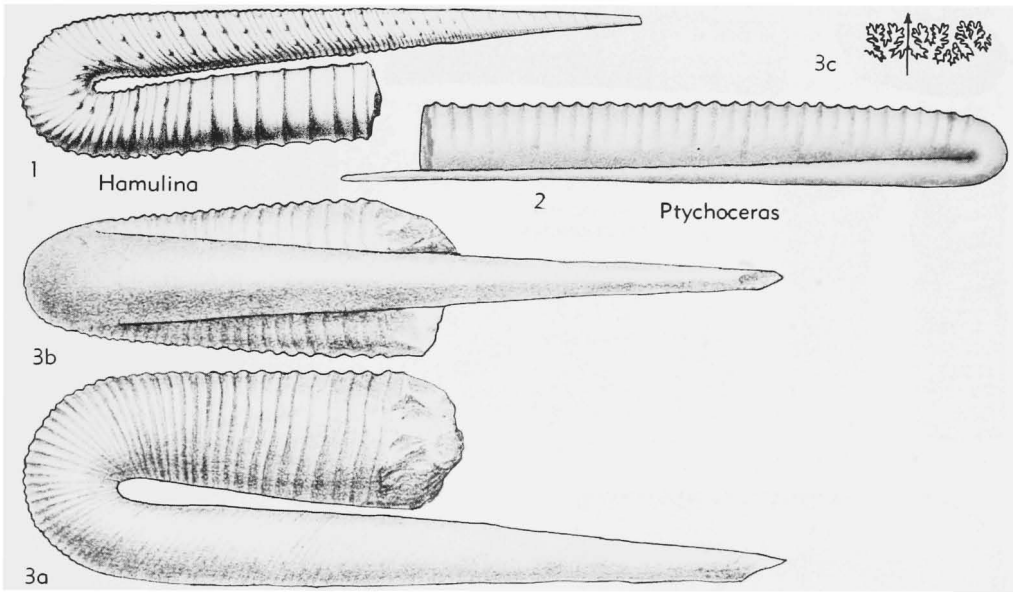


FIG. 242. Ptychoceratidae (p. L215-L216).

which may be descended from Macroscaphitidae or may have had an independent origin in some other member of the Lytoceratacеae at about the same date. So far as form of shell goes, the Ptychoceratidae might be related to certain Crioceratitidae, but since there are Ptychoceratidae with bifid lobes, it is reasonable to assume a direct connection with the Lytoceratacеae (568). *L.Cret.(Barrem.)-U.Cret.(Maastr.).*

Family PTYCHOCERATIDAE Meek, 1876

[Incl. Anahamulinidae BREISTROFFER, 1951]

With 2 or 3 nearly straight parallel shafts, smooth or with fine or coarse straight, radial or oblique ribs, which may be tritubercullate. Suture primitively lytoceratoid, with bifid lobes, but in some genera with trifid lobes (51, 530). *L.Cret.(U.Hauteriv.-U.Alb.).*

Too little is known of the order of appearance of the heteromorphs from Upper Hauterivian deposits of southeastern France to be sure of the phylogeny of this family, but on assumption of their origin in Lytoceratacеae, *Anahamulina* is interpretable as the most primitive form, continuing with bifid lobes to *Hamulina* and giving rise to *Euptychoceras* and its successors by closer contact of the shafts of the shell and by increasing trifidity of the lobes. *Anahamulina* probably originated in a form with macroscaphitid coiling derived by acceleration in appearance of the uncoiled hook and consequent dropping of the normally coiled spire.

Anahamulina HYATT, 1900 [**Hamulina subcylindrica* D'ORBIGNY, 1849]. Of moderate size, with long slowly increasing straight shaft that bends sharply (commonly with constriction at the bend) to a much shorter 2nd shaft, which is not in contact with the 1st; fine dense annular ribs, oblique on 1st shaft, radial and stronger on 2nd. Suture with lobes symmetrically bifid or asymmetric and tending to trifidity. *U.Hauteriv.-Barrem.,* S.Eu.-C.Eu.-Calif.——FIG. 242,*3*. **A. subcylindrica* (ORB.), Barrem., Silesia; *3a-c,* ×1 (530*).

Hamulina D'ORBIGNY, 1843 [**H. astieriana* ORB., 1843; SD ROMAN, 1938]. Much as *Anahamulina* but larger, with bifid lobes and periodic tritubercullate ribs on part of shell. *Barrem.,* S.Eu.-C.Eu.-Calif.——FIG. 242,*1*. **H. astieriana* ORB., Barrem., Fr.; ×0.2 (673*).

Hamulinites PAQUIER, 1900 [**Hamulina munieri* NICKLÉS, 1894]. Differs from *Anahamulina* in its small size, strong ribs and simple sutures with distinctly trifid lobes. *Barrem.,* Sp.-?Fr.

Euptychoceras BREISTROFFER, 1952 [**Ptychoceras meyrati* OOSTER, 1860]. With long straight slowly increasing initial shaft followed by rather longer 2nd shaft parallel to it and barely or not touching it, and finally by 3rd shaft which may slightly overlap 1st; smooth or with rather weak ribbing ex-

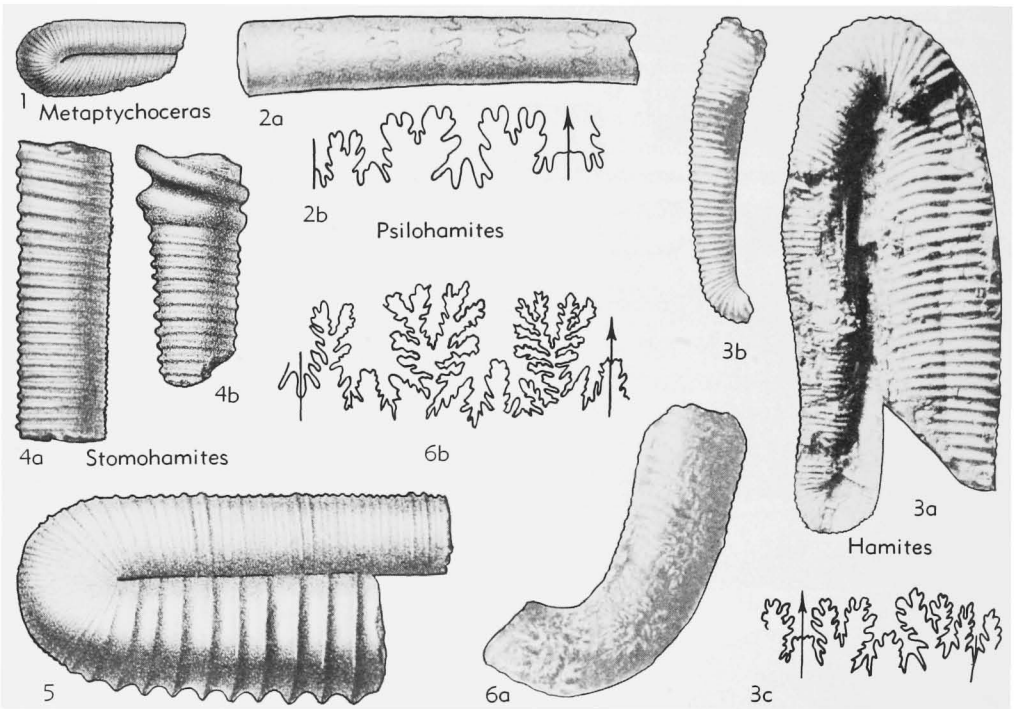


FIG. 243. Hamitidae (p. L216-L217).

cept that prominent broad scalelike ribs may occur on last shaft. Suture with trifid lobes. *Barrem.*, S. Eu.-C.Eu.-Calif. (*E. teschenense* HOHENEGGER in UHLIG, 1901, is said to be Upper Valanginian, but this is doubtful.)

Ptychoceras D'ORBIGNY, 1842 [**P. emericianum* ORB., 1842; SD DIENER, 1925] [*Diptychoceras* GABB, 1869; *Mastigoceras* BOEHM, 1925 (*non* HANDSCHIN, 1924; *?Tricoloceras* WHITEHOUSE, 1928; *Mastigohamites* BREISTROFFER, 1947]. Differs from *Euptychoceras* only in being smaller, having initial shaft closely pressed into dorsum of 2nd and in having weaker ornament except on venter where strong rounded ribs may be present. *U.Apt.-U.Alb.*, Fr.-Cauc.-Madag.-S.India-?B.C.-Calif.-Mex. ——FIG. 242,*2*. **P. emericianum* ORB., U.Apt., Fr.; side of 1st shaft and part of 2nd, ×1 (329*).

Family HAMITIDAE Hyatt, 1900

Coiling rather irregular but typically an open plane spiral tending to end in 2 or 3 more or less parallel shafts; early whorls may be helical; section circular to compressed; dense, normally straight radial or oblique ribs, continuous over venter, in some shells interrupted on dorsum; no tubercles. Suture lytoceratoid. The earliest *Hamites* are probably U.Apt. and derived from *Macroscaphites* by loosening of the coiling (50, 459). *L. Cret.(U.Apt.)-U.Cret.(Turon.)*.

Hamites PARKINSON, 1811 [**H. attenuatus* J.SOWERBY, 1814; SD DIENER, 1925] [=*Torneutoceras* HYATT, 1900]. Typically with 3 well-separated subparallel shafts but early helical coiling often persists; section circular, depressed or compressed; ribs typically strong, fine and dense to coarse and distant. Suture with small, not bifid 3rd lateral saddle. *U.Apt.-U.Alb.*, Eu.-Afr.-India-USA.

H. (Hamites). Coiling after early whorls in one plane; ribs invariably present. Occurrence as for genus.——FIG. 243,*3*. **H. (H.) attenuatus* J.Sow., M.Alb., Eng.; ×1 (713*).

H. (Hamitella) BREISTROFFER, 1947 [**Helicoceras annulatum* D'ORBIGNY, 1842] [=*Helicoceras* ORB., 1842 (*non* KOENIG, 1825)]. Coiled asymmetrically throughout, forming loose helix (doubtfully distinct). *M.Alb.*, Fr.-Zululand.

H. (Psilohamites) SPATH, 1941 [**Hamites bouchardianus* D'ORBIGNY, 1842]. Almost smooth; only straight shafts are known. *U.Alb.*, W.Eu. ——FIG. 243,*2*. **H. (P.) bouchardianus* ORB., U.Alb., Fr.; *2a*, ×1; *2b*, enlarged (329*).

Hemiptychoceras SPATH, 1925 [**Ptychoceras gaultinum* PICTET, 1847]. With 3 shafts of typical

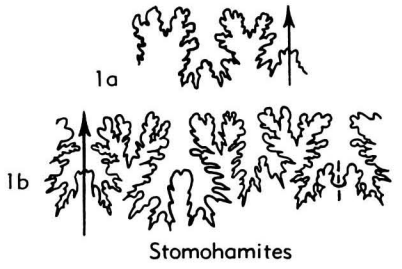


FIG. 244. *Stomohamites duplicatus* (PICTET & CAMPICHE), L.Cret.(U.Alb.), Fr.; *1a,b,* ×3 (713*) (p. L217).

Hamites closely pressed together; ribs as in *Hamites* except on 2nd bend where they tend to be scale-like, as in some *Euptychoceras. U.Alb.,* W.Eu.——FIG. 243,*5.* **H. gaultinum* (PICTET), U.Alb., Fr.; ×1 (346*).

Stomohamites BREISTROFFER, 1940 [**Hamites virgulatus* BRONGNIART, 1822]. Typically with denser ribs than *Hamites* and at least some species have strongly collared and constricted aperture; venter tends to be flat. Suture with 3rd lateral saddle nearly as big as others and symmetrically bifid. U.Alb.-L.Turon., Eu.-USA-Mex.——FIG. 243,*4;* 244,*1. S. duplicatus* (PICTET & CAMPICHE), U.Alb., Fr.; 243,*4a,b,* ×1 (346*); 244,*1a,b,* ×3 (713*).

Metaptychoceras SPATH, 1926 [**Ptychoceras smithi* WOODS, 1896]. Small; much like *Hemiptychoceras* but has fine ribbing of *Stomohamites. U.Turon.,* Eng.——FIG. 243,*1.* **M. smithi* (WOODS); ×2 (734*).

Plesiohamites BREISTROFFER, 1947 [**Hamites multicostatus* BROWN, 1837]. Rather large, with straight shafts and fine straight oblique ribs. Suture florid. Generally resembles in fragments some *Hamulina* or *Diplomoceras. U.Alb.,* W.Eu.——FIG. 243,*6.* **P. multicostatus* (BROWN), U.Alb., Eng.; *6a,* ×1; *6b,* ×2 (713*).

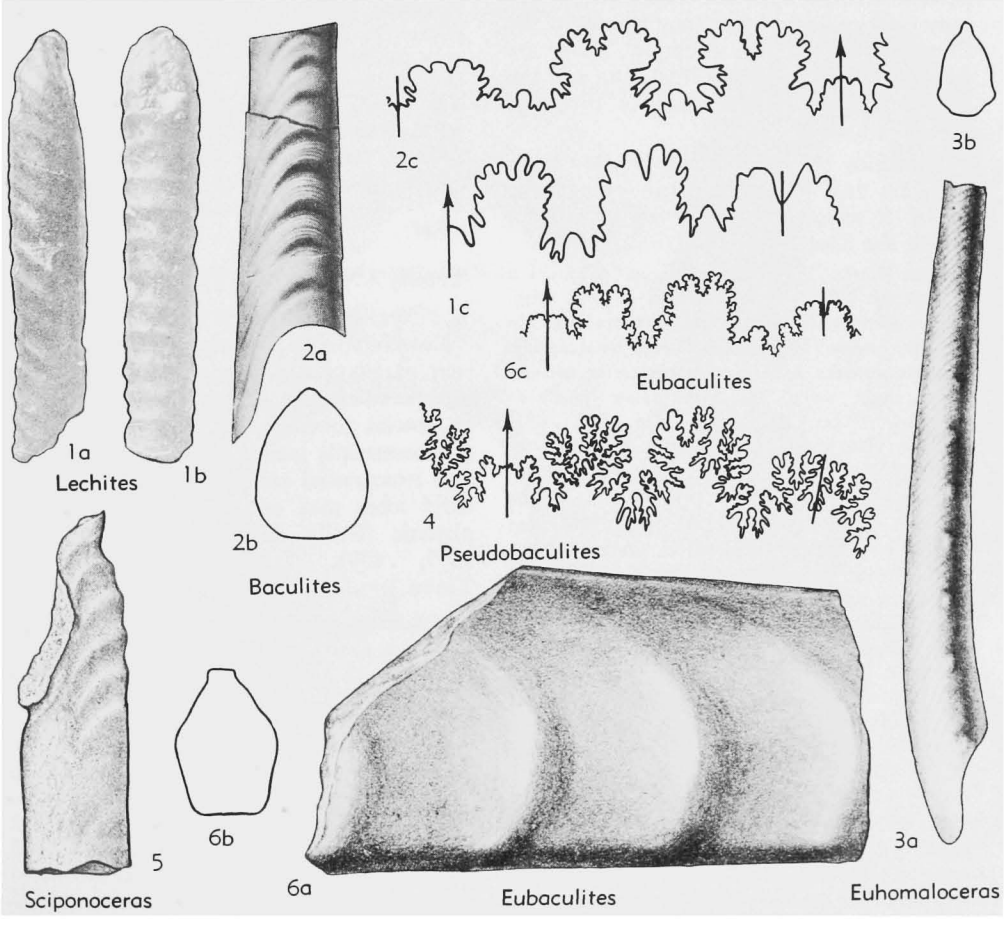


FIG. 245. Baculitidae (p. L218).

Family BACULITIDAE Meek, 1876

Minute initial coil of 1 or 2 whorls followed by straight or very slightly curved single shaft; section circular, oval, pear-shaped, or acute; constrictions may be present; surface smooth or with flexuous striae or ribs, which may be enlarged into tubercles on sides or venter; aperture oblique, with or without collar, or simple and directed forward. Suture with all elements more or less bifid except for internal and (rarely) external lobes, varying in floridity and detail. Rugaptychi are present in *Baculites* at least (323, 459, 465). *L.Cret.(U.Alb.)-U.Cret. (Maastr.).*

Rather small forms appear in the Upper Albian, representing hamitids that have straightened, lost their ribs and are developing oblique apertures. There is little important change until the Santonian, when some species several feet long occur. In the Campanian and Maastrichtian there are forms as much as 6 feet (2m.) long and the family reaches its maximum of diversity, though a limited one.

Baculitids are often found in very large numbers and representing all ontogenetic stages. It seems that they lived in colonies on the sea floor.

Lechites NOWAK, 1908 [**Baculites gaudini* PICTET & CAMPICHE, 1861]. Section circular or oval, without constrictions; regular low prorsiradiate ribs may be grouped in 2's or 3's or even amalgamated to form scalelike swellings; aperture facing dorsum, with slight collar and constriction. *U.Alb.-L. Cenom.*, W.Eu.-C.Eu.-Mex.——FIG. 245,*1*. **L. gaudini* (PICTET-C.), U.Alb., Eng.; *1a,b*, ×1; *1c*, ×2 (713*).

Sciponoceras HYATT, 1894 [**Hamites baculoides* MANTELL, 1822] [=*Cyrtochilus* MEEK, 1876 (*non* JAKOWLEW, 1875); *Cyrtochilella* STRAND, 1929]. With strong prorsiradiate constrictions; aperture differs from that of *Lechites* in having few strong, broad folds and high collar and in some forms lateral lappets. Suture more finely divided than in *Lechites*. In latest species ribs on body chamber are rursiradiate on inner 3rd and then prorsiradiate, with faint tubercle at the bend, thus foreshadowing *Baculites*. *U.Alb.-U.Turon.*, Eu.-N.Afr.-Madag.-S. India-USA.——FIG. 245,*5*. **S. baculoides* (MANTELL), Cenom., Eng.; lateral view of body chamber, venter to right, ×1 (602*).

Baculites LAMARCK, 1799 [**Baculites vertebralis* DEFRANCE, 1830; SD MEEK, 1876] [=*Homaloceras* HUBSCH, 1786 *(non. binom.)*]. Straight shell, some large, surface smooth or with sinuous striae, rursiradiate on inner and prorsiradiate on outer part, in some with large curved bulla at the bend; venter narrowly rounded to acute; aperture typically directed forward, with long dorsal rostrum but a gradual transition occurs during Turonian and Coniacian from *Sciponoceras*-type of aperture. Suture more florid than in earlier genera. *U.Turon.-Maastr.*, world-wide.——FIG. 245,*2*. *B. anceps* (LAM.), Camp., Fr.; *2a*, side of body chamber, venter to left, ×0.5; *2b*, ×1; *2c*, enlarged (329*).

Pseudobaculites COBBAN, 1952 [**P. nodosus*]. Differs from *Baculites* in its more rapidly expanding section and broad, much divided, asymmetric saddles. *Coni.*, Wyo.-Utah.——FIG. 245,*4*. **P. nodosus*; ×2 (599a).

Euhomaloceras SPATH, 1926 [**Baculites incurvatus* DUJARDIN, 1837]. Body chamber gently curved with distinct rounded siphonal and laterodorsal tubercles. *?Coni., Santon.-Camp.*, Fr.——FIG. 245, *3*. **E. incurvatus* (DUJARDIN); *3a,b*, ×0.75 (329*).

Eubaculites SPATH, 1926 [**Baculites otacodensis* STOLICZKA, 1866]. Section pear-shaped, with flat venter; ribs normally faint toward venter but on inner part form prominent long curved bullae; row of lower lateral tubercles may be present. Suture with plump, minutely frilled elements. *Maastr.*, Madag.-S.India-W.Austral.-Japan-Chile. —— FIG. 245,*6a,b*. **E. otacodensis* (STOLICZKA), L.Maastr., S.India; *6a*, ×1; *6b*, ×0.5 (238*).——FIG. 245, *6c*. *E. vagina* (FORBES), L.Maastr., S.India; ×1 (238*).

Family ANISOCERATIDAE Hyatt, 1900

[Includes Algeritidae SPATH, 1925]

Loosely coiled, irregularly helical at first, later part typically in one plane, some with straight final shaft. There is normally a pair of ventral tubercles on some ribs at least and commonly lateral tubercles as well. Suture lytoceratoid except that in some genera trifid lobes may occur. Probably a monophyletic family derived from Hamitidae (345, 459). *L.Cret.(L.Alb.)-U.Cret.(U. Turon.).*

Prohelicoceras SPATH, 1925 [**Hamites thurmanni* PICTET & CAMPICHE, 1861]. Coiling twisted at all stages; sharp annular ribs, normally some with pair of ventral tubercles. *L.Alb.-M.Alb.*, W.Eu.-Madag.——FIG. 246,*4*. **P. thurmanni* (PICTET-C.), M.Alb., Switz.; *4a,b*, ×1 (345*).

Protanisoceras SPATH, 1923 [**Hamites raulinianus* D'ORBIGNY, 1842]. More or less regular loose slightly helical spire that normally ends in 1 or 2 straight shafts; prominent sharp or blunt ribs with sharp lateral and a pair of ventral tubercles joined over venter by double rib. Suture simpler than in *Anisoceras*. *L.Alb.-M.Alb.*, W.Eu.-Madag.-India-

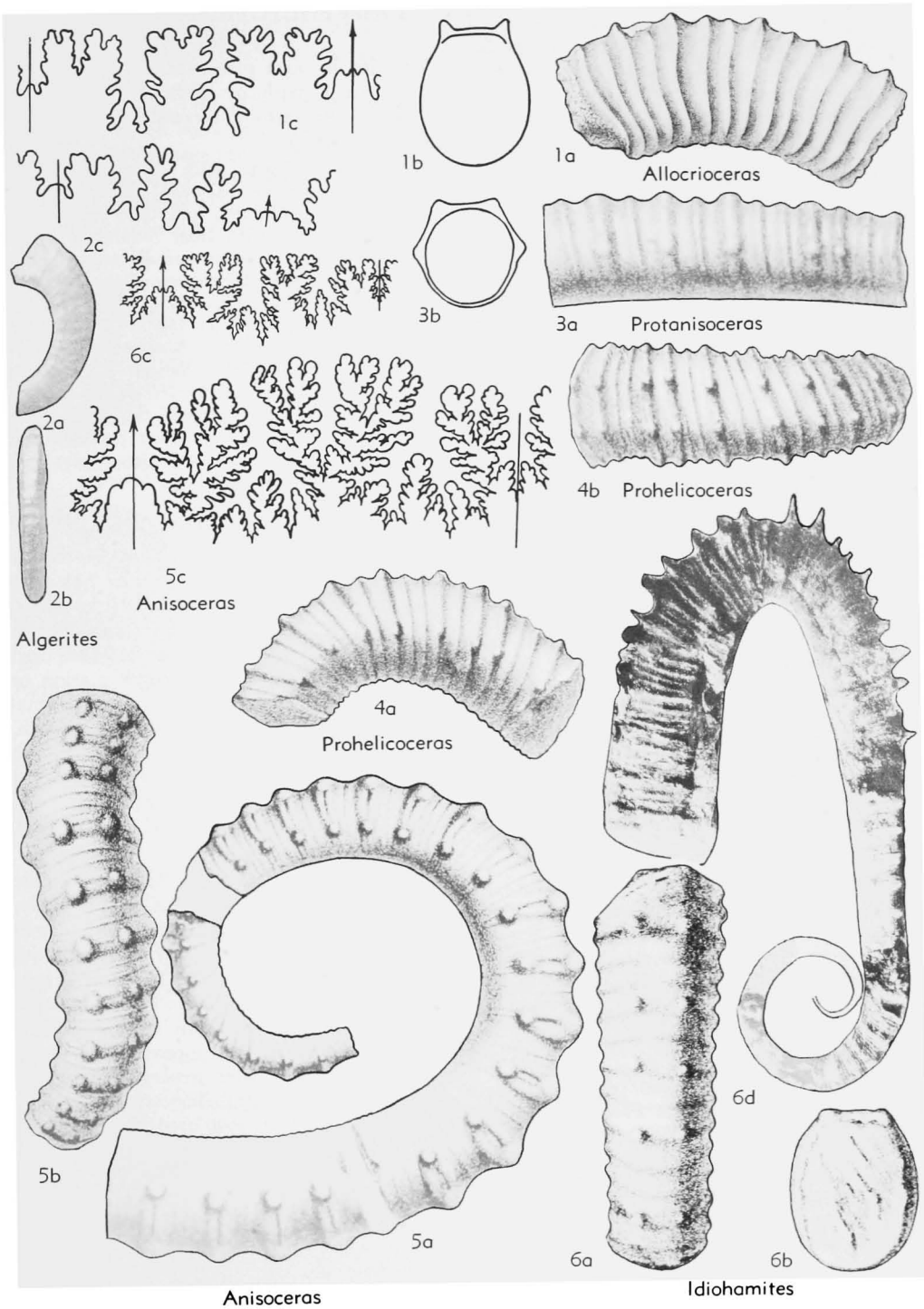


FIG. 246. Anisoceratidae (p. L218-L220).

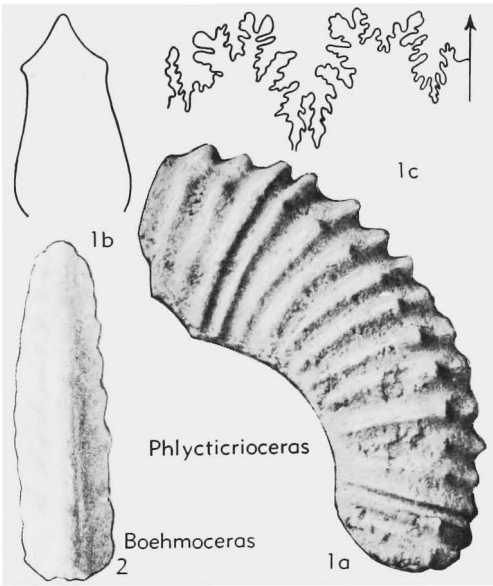


FIG. 247. Phlycticrioceratidae (p. L220).

Peru.——FIG. 246,*3*. **P. raulinianum*, L.Alb., Fr.; *3a,b*, ×1 (329*).

Anisoceras PICTET, 1854 [**Hamites saussureanus* PICTET, 1847]. Differs little from *Protanisoceras* but ornament is generally coarser and suture more complicated. *U.Alb.-U.Turon.*, Eu.-N.Afr.-E.Afr.-Madag.-Pak.-India-Tex.-Mex.——FIG. 246,*5*. **A. saussureanum* (PICTET), U.Alb., Fr.; *5a,b*, ×1; *5c*, enlarged (346*).

Metahamites SPATH, 1930 [**Hamites sablieri* D'ORBIGNY, 1842]. Differs from *Protanisoceras* in that coiling is in one plane, with final hook on which ornament may change. *M.Alb.*, Fr.-Madag.-India.

Idiohamites SPATH, 1925 [**Hamites tuberculatus* J. SOWERBY, 1818]. Coiling rather irregular, in one plane; ribs straight or oblique, with pair of ventral tubercles, joined only by single rib on venter; lateral tubercles rarely present. *U.Alb.-Cenom.*, W. Eu.-N.Afr.-Madag.-Tex.——FIG. 246,*6a-c*. *I. dorsetensis* SPATH, U.Alb., Eng.; *6a,b*, ×1; *6c*, enlarged (345*).——FIG. 246,*6d*. *I. spiniger* (J. Sow.), U.Alb., Fr.; ×0.4 (713*).

Algerites PERVINQUIÈRE, 1910 [**A. sayni*]. Regularly and (after initial open whorls) closely coiled, with whorls in contact; pair of sharp ventral tubercles on every rib. Derived from closely coiled *Idiohamites*. *Cenom.*, N.Afr.——FIG. 246,*2*. **A. sayni; 2a,b*, ×1; *2c*, ×4 (340*).

Allocrioceras SPATH, 1926 [**A. woodsi*]. Similar to the more finely ribbed and sharply tuberculate species of *Idiohamites* but early whorls at least are distinctly helical and twisted. *Turon.*, Eng.-Ger.-USA.——FIG. 246,*1*. **A. woodsi;* U.Turon., Eng.; *1a,b*, ×0.75; *1c*, enlarged (734*).

Family PHLYCTICRIOCERATIDAE Spath, 1926

Coiled in open plane spiral; section oval; ribs strong, with or without ventrolateral tubercles; keel strong, serrate or entire (465). *U.Cret.(Coni.)*.

Phlycticrioceras SPATH, 1926 [**Ancyloceras* (?) *douvilléi* DE GROSSOUVRE, 1894]. Sharp, straight, radial or rursiradiate ribs, with strong ventrolateral and siphonal tubercles, latter forming a serrate keel; collared constrictions normally present. Probably derived from *Allocrioceras*. *Coni.*, Fr.-Ger.-Wyo.-Mex.——FIG. 247,*1*. **P. douvillei* (GROSS.), Fr.; *1a,b*, ×1; *1c*, ×2 (179*).

?**Boehmoceras** RIEDEL, 1931 [**Ancyloceras krekeleri* WEGNER, 1905; SD WRIGHT, herein]. Whorl height increases rapidly; with strongly curved primary ribs, which may form large distant bulges, split into several secondaries on outer part of sides; keel entire and rounded. *Coni.*, Ger.——FIG. 247, *2*. **B. krekeleri* (WEGNER); ×1 (690*).

Family TURRILITIDAE Meek, 1876

Helical forms, dextral or sinistral, loosely or tightly coiled, typically regular but early and late whorls somewhat unstable; apical angle more or less acute, less than 90°; in early species, siphon is in middle of exposed side but later migrates to upper margin or even to upper internal angle of whorl; ornamented with strong ribs or tubercles or both, rarely smooth. Suture asymmetrical because of the helical coiling; primitively, lobes are bifid but they are variable and tend to trifidity (52, 459). *L.Cret.(M.Alb.)-U.Cret.(Turon.)*.

Two genera appear in the early Middle Albian, *Proturrilitoides* without tubercles and *Pseudhelicoceras* with them. The former seems to be derived from a helical hamitid, the latter from *Protanisoceras*. Any subfamily division should reflect distinction of the stocks descended from these 2 genera, but because of doubt concerning the stock to which certain later genera belong subfamilies (e.g., Pseudhelicoceratinae BREISTROFFER, 1953) are not used here.

The last typical Turrilitidae appear in the Lower Turonian. The occasional tightly coiled Senonian forms belong to Nostoceratidae.

Proturrilitoides BREISTROFFER, 1947 [**Turrilites astierianus* D'ORBIGNY, 1842]. Whorl section more or less circular, with siphuncle at middle of exposed part; apical angle variable; umbilicus wide; aperture slightly constricted and collared; ribs more

or less dense, radial or prorsiradiate, strong and simple, without tubercles. *M.Alb.*, Fr.-Pol.——Fig. 248,*1*. **P. astierianus* (Orb.), M.Alb., Fr.; ×1 (329*).

Turrilitoides Spath, 1923 [**Turrilites hugardianus* d'Orbigny, 1842]. Apical angle more acute than in *Proturrilitoides*, more tightly coiled, with oval or angular whorl section and flatter sides; siphuncle at upper margin of side; aperture with strong constriction, collared on both sides. *U.Alb.*, Eu.-Pak.——Fig. 248,*3*. *T. densicostatus* Passendorfer, U.Alb., Eng.; *3a*, ×1; *3b*, ×2 (713*).

Ostlingoceras Hyatt, 1900 [**Turrilites puzosianus* d'Orbigny, 1842]. Very closely coiled, with acute apical angle; whorl section more angular and flat-sided than in *Turrilitoides*, although it becomes more inflated in latest species; dense straight or slightly flexuous ribs, with up to 3 tubercles at lower end. Derived from *Proturrilitoides* in parallel with *Turrilitoides*. *M.Alb.-L.Cenom.*, Eu.-N. Afr.-Madag.

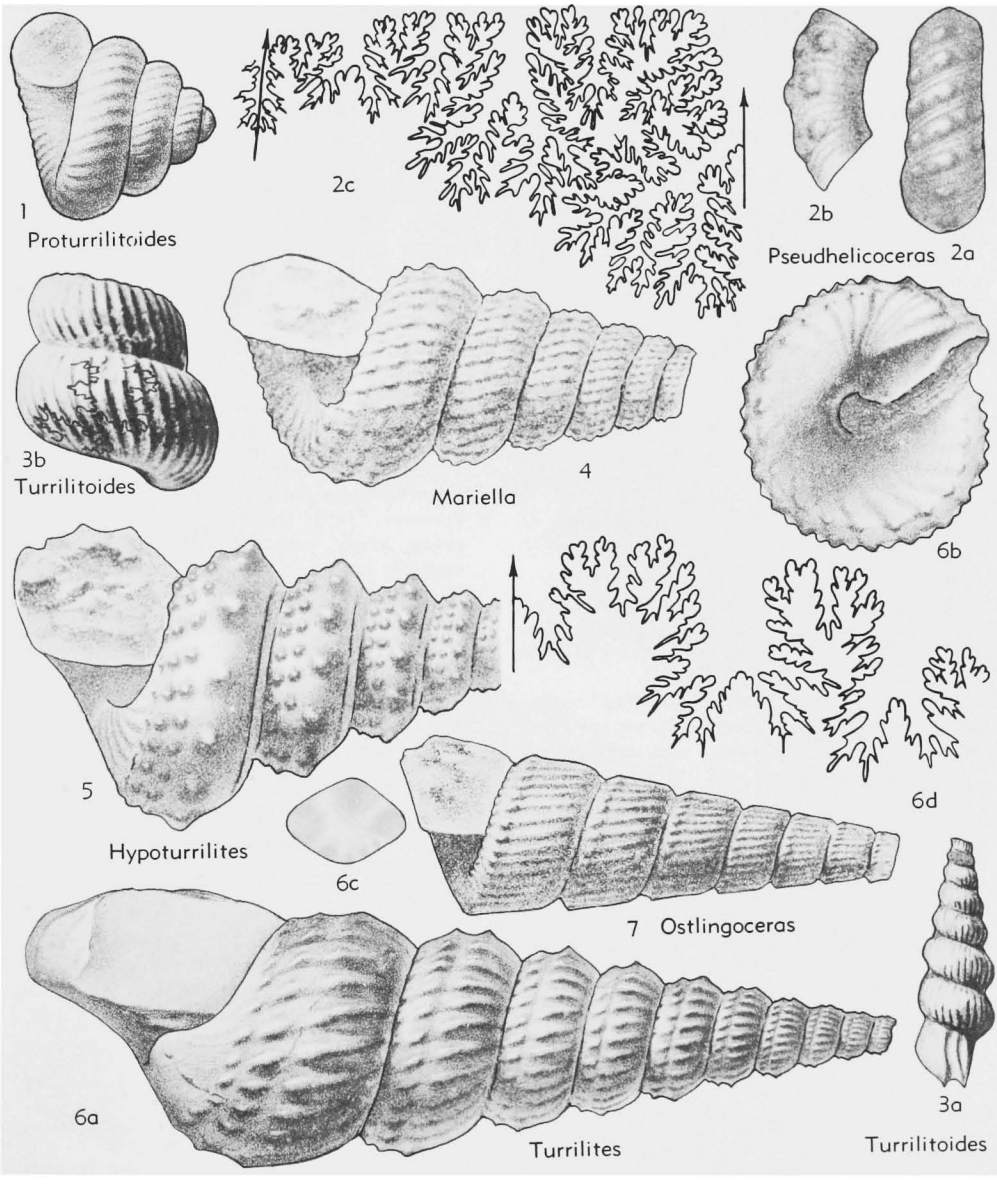


Fig. 248. Turrilitidae (p. L220-L222).

FIG. 249. *Plesioturrilites brazoensis* (ROEMER), U. Cret.(L.Cenom.), Tex.; *1*, ×0.75 (653*) (p. L222).

O. (Parostlingoceras) BREISTROFFER, 1953 [**Turrilites moutonianus* D'ORBIGNY, 1842]. Ribs rather irregular, angulate or weakly tuberculate at lower angle of side. *M.Alb.*, Fr.-Pol.

O. (Ostlingoceras) HYATT, 1900. Ribs regular, with 2 or 3 distinct tubercles at the lower end of each. *U.Alb.-L.Cenom.*, occurrence as for genus.——FIG. 248,*7*. **O. (O.) puzosianum* (ORB.), U.Alb., Fr.; ×1 (329*).

Pseudhelicoceras SPATH, 1921 [**Turrilites robertianus* D'ORBIGNY, 1842] [=*Subhelicoceras, Parahelicoceras* BREISTROFFER, 1953]. Apical angle moderately to very acute; coiling loose or tight; as here interpreted, ribbing variable, branching or simple, radial or prorsiradiate, with 2 to 4 tubercles, which may cover several ribs, normally with intermediate nontuberculate ribs; siphuncle at or near middle of exposed side. *M.Alb.-U.Alb.*, W.Eu.-C.Eu.-Madag.——FIG. 248,*2*. **P. robertianum* (ORB.), U.Alb., Fr.; *2a,b*, ×1; *2c*, enlarged (329*).

Mariella NOWAK, 1916 [not invalidated by *Mariaella* GRAY, 1855] [**Turrilites bergeri* BRONGNIART, 1822] [*Paraturrilites* BREISTROFFER, 1947; *?Hemiturrilites* BREISTR., 1953] Apical angle variable; closely coiled; ribs slightly oblique, rather feeble, each with 4 more or less equal tubercles. *U.Alb.-Cenom.*, Eu.-N.Afr.-Madag.-Iran-S.India-Tex.

M. (Mariella). Tubercles more or less equidistant, intercostal section rounded. Occurrence as for genus.——FIG. 248,*4*. **M. (M.) bergeri* (BRONGN.), U.Alb., Fr.; ×1 (329*).

M. (Plesioturrilites) BREISTROFFER, 1953 [**Turrilites brazoensis* ROEMER, 1852]. Upper and lower pairs of tubercles separated by marked spiral furrow; body chamber uncoils. *L.Cenom.*, Tex.——FIG. 249,*1*. **P. brazoensis* (ROEMER); ×0.75 (653*).

Hypoturrilites DUBOURDIEU, 1953 [SHIMIZU, 1935 *(nom. nud.)*] [**Turrilites gravesianus* D'ORBIGNY, 1842]. Differs from *Mariella* in that ribs are almost absent and middle row of tubercles contain fewer and much larger tubercles than remainder. May be large. *Cenom.*, Eu.-Afr.-India-Japan-Tex.——FIG. 248,*5*. **H. gravesianus* (ORB.), Fr.; ×1 (329*).

Turrilites LAMARCK, 1801 [**T. costatus*]. Apical angle acute, shell tightly coiled; ribs weak to strong, with or without 3 or 4 rows of equal numbers of tubercles. Probably derived from *Mariella. Cenom., ?L.Turon.*, Eu.-Afr.-India-USA-Mex.

T. (Turrilites). Ribs weak, tubercles strong, bullate or spinate. Occurrence as for genus.——FIG. 248, *6*. **T. (T.) costatus*, L.Cenom., Fr.; *6a,b*, ×0.75; *6c*, ×0.5; *6d*, enlarged (329*).

T. (Euturrilites) BREISTROFFER, 1953 [**Turrillites scheuchzerianus* BOSC, 1801] [=*Turbinites* DUBOURDIEU, 1953 (*non* MARTIN, 1809)]. Ribs strong, simple, commonly depressed in middle, especially on early whorls; no tubercles. *Cenom.*, Eu.-W.Afr.-Madag.-Japan.

T. (Mesoturrilites) BREISTROFFER, 1953 [**Turrilites aumalensis* COQUAND, 1862]. Ribs almost absent; tubercles clavate, tending to form spiral ridges. *L.Cenom.*, W.Eu.-N.Afr.-Madag.

Wintonia ADKINS, 1928 [**W. graysonensis*]. Like small *Turrilites* but with initial part consisting of 2 subparallel nearly straight shafts. *L.Cenom.*, Tex.

Raynaudia DUBOURDIEU, 1953 [**Carthaginites raynaudiensis* COLLIGNON, 1932]. Smooth, suture with reduced elements; siphuncle at external upper angle of whorl. *U.Alb.*, Madag.

Carthaginites PERVINQUIÈRE, 1907 [**Turrilites (Carthaginites) kerimensis*]. Only minute fragments known. Differs from *Raynaudia* in having spiral groove long middle of side, with or without a single row of small tubercles, and siphuncle at inner upper angle of whorl. *L.Cenom.*, N.Afr.-Tex.

Family NOSTOCERATIDAE Hyatt, 1894

[Includes Jouaniceratidae WRIGHT, 1952; Hyphantoceratinae, Bostrychoceratinae, Emperoceratinae, and Neocrioceratinae SPATH, 1953]

Helicoid forms in which coiling is normally irregular in early or late stages or

both or throughout life. Several stocks tend to revert to bilateral symmetry. Tubercles commonly occur but are typically subordinate to dense ribs. Constrictions are general. Suture normally of lytoceratid type and florid. Although form of the genera is very variable, they are closely connected and separation into subfamilies is probably unnecessary. The family is almost certainly monophyletic, being derived (presumably in the Cenomanian) from a descendant of the Albian *Turrilitoides* (489, 497, 572). *U.Cret. (Cenom.-Maastr.).*

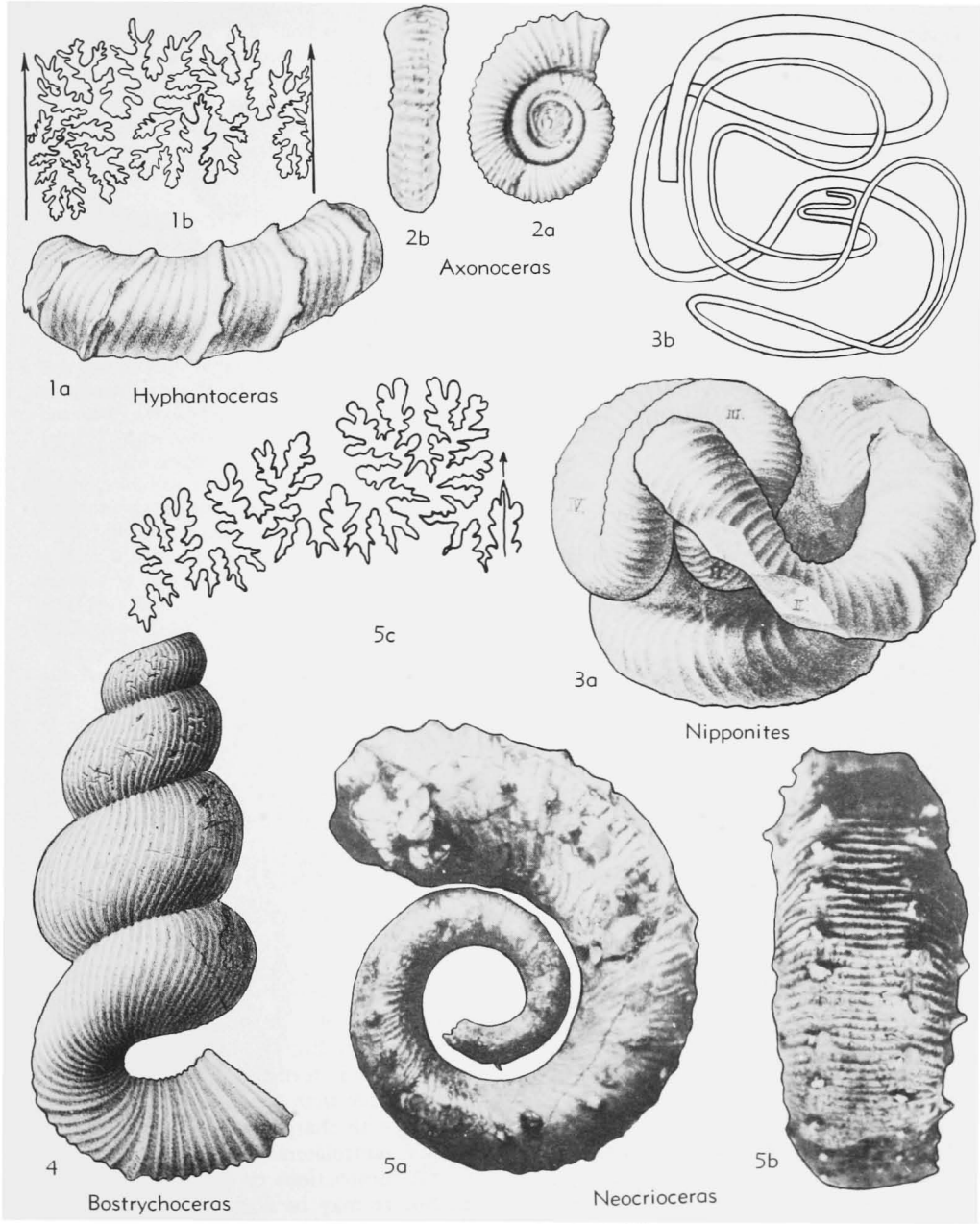


FIG. 250. Nostoceratidae (p. L224).

Bostrychoceras HYATT, 1900 [**Turrilites polyplocus* ROEMER, 1841]. More or less acute-angled, tightly coiled spire with loose, U-shaped body chamber; dense, rather strong ribs, normally slightly sinuous and oblique; with or without strong constrictions, but with no flared ribs. *Cenom.-L.Maastr.*, Eu.-N. Afr. - Madag. - S. India-Japan-W. Austral.-Tex.-Mex.——FIG. 250,*4*. **B. polyplocum* (ROEMER), Camp., N.Ger.; ×0.5 (422*).

Nipponites YABE, 1904 [**N. mirabilis*]. Coiled in a succession of U's in 3 dimensions, forming a tangle; single regular ribs and constrictions as in *Bostrychoceras*. *?U.Turon., L.Santon.*, ?Eng.-Madag.-Japan.——FIG. 250,*3*. **N. mirabilis*, Coni., Japan; *3a*, ×0.75; *3b*, diagram of coiling ×0.5 (739*).

Jouaniceras BASSE, 1939 [**Heteroceras sicardi* DE GROSSOUVRE, 1894]. First 2 or 3 whorls as in *Bostrychoceras*, then suddenly becoming coiled in plane spiral with axis at right angles to that of initial spire; on plane part there are distant, thin, high ribs that become sharper with age, some on outer whorl being flared. *Santon.*, Fr.——FIG. 251, *4*. **J. sicardi* (GROSS.); *4a,c*, ×2; *4b*, ×1 (585*).

Hyphantoceras HYATT, 1900 [**Hamites reussianus* D'ORBIGNY, 1850 (=**Heteroceras reussianum* SCHLÜTER, 1872)] [=*Euhyphantoceras, Orientoceras* SHIMIZU, 1935]. Loosely and commonly irregularly coiled spire ending in U-shaped or irregular body chamber; whorl section circular or oval; dense slightly oblique weak nontuberculate ribs, with periodic very thin flared ones, normally with 2 or 4 tubercles; no constrictions. *Turon.-Santon.*, N.Eu.-N.Afr.-S.India-N.Z.-Japan.——FIG. 250,*1*. **H. reussianum* (SCHLÜTER), U.Turon., Eng.; *1a*, ×1; *1b*, ×2 (734).

Nostoceras HYATT, 1894 [**N. stantoni*]. Differs from *Bostrychoceras* mainly in having on most of shell 2 rows of more or less prominent tubercles on all or some ribs; collared constrictions may or may not be present. *Camp.*, Angola-Eng.-Madag.-USA.

N. (Nostoceras). Final U-shaped part hanging below spire. Occurrence as for genus.——FIG. 251,*6*. **N. (N.) stantoni*, Camp., Tex.; ×1 (497*).

N. (Anaklinoceras) STEPHENSON, 1941 [**A. reflexum*]. Final part bent up one side of spire and down other. *Camp.*, Tex.——FIG. 251,*2*. **N. (A.) reflexum*; ×1 (497*).

Axonoceras STEPHENSON, 1941 [**A. compressum*]. Small; coiled almost symmetrically in one plane, initial hoop being followed by whorls irregularly in contact or not; fine, dense simple ribs; bituberculate periphery. Derived from *Nostoceras* with wide apical angle. *Camp.*, Angola-Tex.——FIG. 250,*2*. **A. compressum*, Camp., Tex.; *2a,b*, ×1.5 (497*).

Exiteloceras HYATT, 1894 [**Ancyloceras jenneyi* WHITFIELD, 1880; SD DIENER, 1925]. Coiling elliptical, almost symmetrically in one plane, at least until beginning of body chamber; whorl section oval; ribs simple at first, later some branching, looped and intercalated, all with ventrolateral spines. *Camp.*, N.Dak.——FIG. 251,*7*. **E. jenneyi* (WHITF.); *7a,b*, ×1; *7c*, ×2 (733*).

Solenoceras CONRAD, 1860 [**Hamites annulifer* MORTON, 1842] [*Oxybeloceras* HYATT, 1900]. Two straight or slightly curved parallel or diverging shafts, in some shells closely in contact, with circular to oval section; first shaft normally constricted, aperture constricted and collared; ribs straight, radial or rursiradiate, bearing small sharp ventrolateral spines, but ribs may be weakened or interrupted on venter. *Camp.-Maastr.*, N.Eu.-Angola-Madag.-USA-GrahamLand.——FIG. 251,*1*. *S. multicostatum* (STEPHENSON), Camp., Tex.; *7a,b*, ×2 (497*).

Neocrioceras SPATH, 1921 [**Crioceras spinigerum* JIMBO, 1894]. Initially irregular, loose, shallow helix but later in one plane with J-shaped body chamber on which ribs coarsen; section circular to depressed; periodic strong ribs have lateral and ventrolateral tubercles, ribs commonly being looped between them, as in *Anisoceras;* up to 3 fine nontuberculate intermediate ribs, in some angulate on shoulders. *Camp.*, Eng.-Ger.-Rumania-Pondoland-Japan.——FIG. 250,*5*. **N. spinigerum* (JIMBO), Camp., Japan; *5a,b*, ×1; *5c*, enlarged (708*).

Cirroceras CONRAD, 1868 [**Ammonceratites conradi* MORTON, 1841] [*Didymoceras* HYATT, 1894]. Similar to *Nostoceras* but larger and with whorls of spire not touching; as in *Nostoceras*, 2 rows of tubercles may be present throughout or only on body chamber. *Camp.-Maastr.*, W.Eu.-Nigeria-Angola-B.C.-USA.——FIG. 251,*3*. *C. nebraskense* (HYATT), Camp., N.Dak.; ×0.3 (638*).

Emperoceras HYATT, 1894 [**E. beecheri* (=*Helicoceras simplicicostatum* WHITFIELD, 1880)]. Like *Cirroceras* except body chamber may not be U-shaped and early part consists of 2 elliptical whorls, nearly in one plane, with 2 ribs joining at most of ventrolateral tubercles. *Camp.*, N.Dak.——FIG. 251, *5*. **E. simplicicostatum* (WHITF.); *5a,b*, ×0.3 (638*).

[**Neoturrilites** SHIMIZU, 1935 *(nom. nud.)*].

Family DIPLOMOCERATIDAE Spath, 1926

[Includes Polyptychoceratidae MATSUMOTO, 1938; Proavitoceratinae SPATH, 1953]

Offshoots of Nostoceratidae, loosely coiled and tending to bilateral symmetry; ptychoceratoid forms develop which are more extreme than those in Nostoceratidae; typically with sharp annular nontuberculate ribs but ventrolateral spines occur in a few genera; constrictions or flares may be present. Suture may be florid, as in Nostoceratidae, or may simplify in extreme genera.

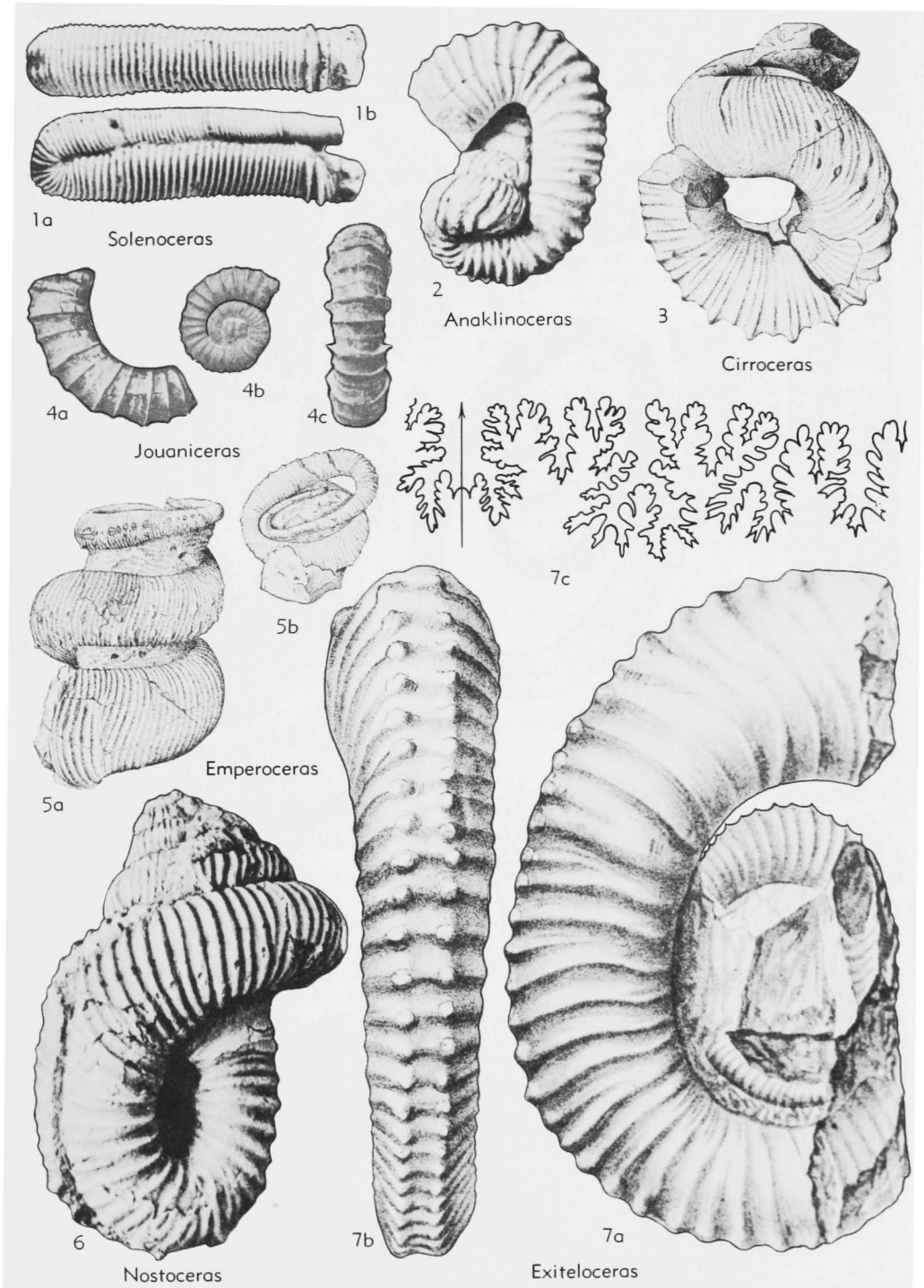


FIG. 251. Nostoceratidae (p. L224).

The family probably has single origin in *Hyphantoceras* of the Nostoceratidae but may include parallel offshoots of other members of that family (465, 489, 571). *U.Cret. (Turon.-Maastr.).*

Scalarites WRIGHT & MATSUMOTO, 1954 [**Helioceras scalare* YABE, 1904]. Very shallow open helicoid spire followed by loose elliptical coiling nearly in one plane; section more or less circular; ribs simple and annular, with sparse flared ribs or

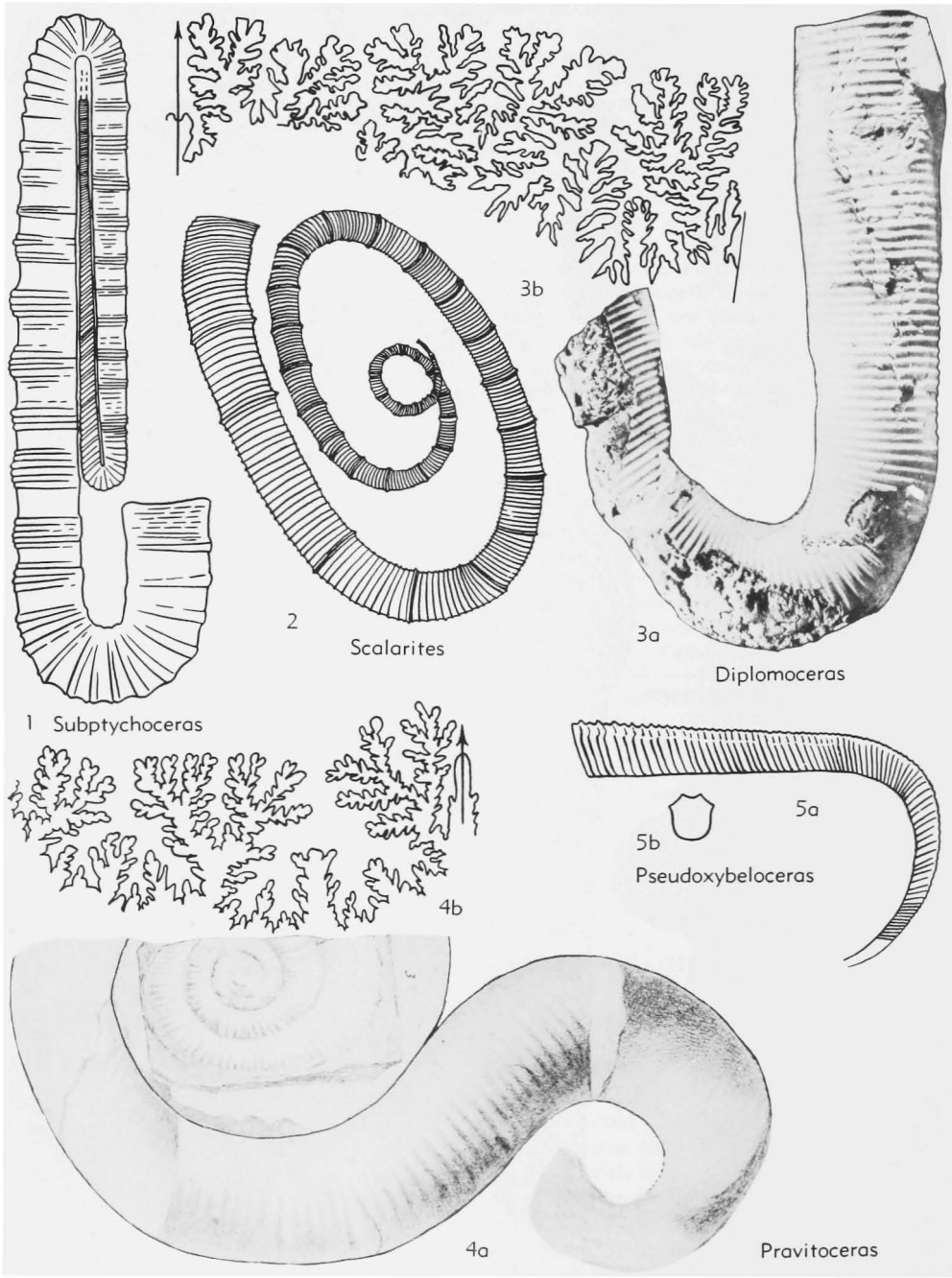


FIG. 252. Diplomoceratidae (p. L226-L228).

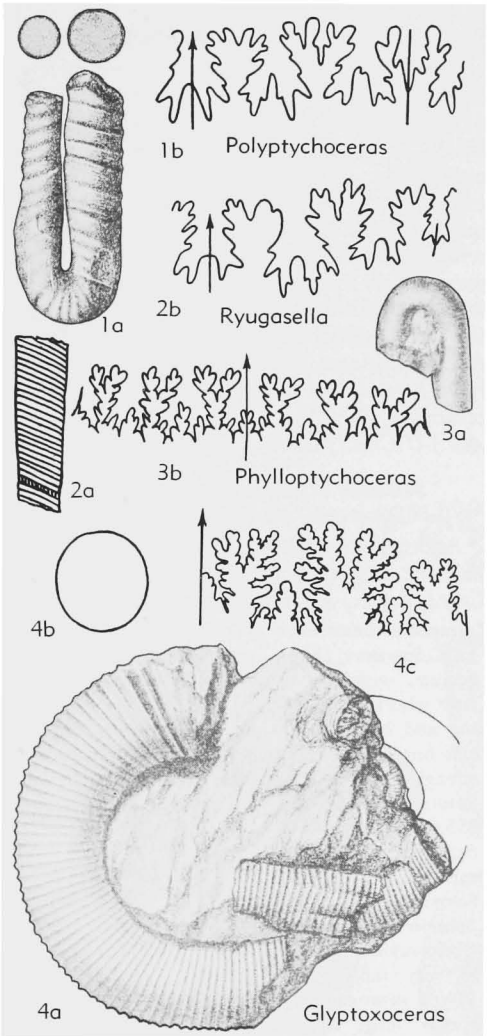


FIG. 253. Diplomoceratidae (p. L227-L228).

constrictions or both. *Turon.-Coni.,* ?Eng.-Japan. ——FIG. 252,*2*. **S. scalaris* (YABE), Turon., Japan; diagrammatic, ×0.5 (571*).

Glyptoxoceras SPATH, 1925 [**Hamites rugatus* FORBES, 1845]. Initial shallow helix followed by loose, regular or elliptical coiling; section circular to oval; ribs sharp, straight, close or distant, annular; a few collared constrictions. *Santon.-Maastr.,* N.Eu.-S.India-Japan-USA-Brazil.——FIG. 253,*4*. *G. indicum* (FORBES), Camp., S.India; *4a-c,* ×1 (238*).

Neancyloceras SPATH, 1926 [**Hamites bipunctatus* SCHLÜTER, 1872]. Differs from open-whorled species of *Glyptoxoceras* in less regular coiling and bituberculate periphery. *Camp.,* Eu.-Angola.

Diplomoceras HYATT, 1900 [**Hamites cylindraceus* DEFRANCE, 1822]. Loose helicoid spire followed by 2 or 3 subparallel straight or curved shafts; section circular to oval; fine, dense, rather subdued ribbing, weaker on inside than on outside of shell; collared constriction at aperture. Suture very florid. *Camp.-Maastr.,* Eu.-S.India-Japan-N.Z.-B.C.-GrahamLand. ——FIG. 252,*3*. *D. notabile* WHITEAVES, Camp., B.C.; *3a,* ×0.5; *3b,* ×1 (535*).

Pravitoceras YABE, 1902 [**P. sigmoidale*]. Camerate whorls are coiled regularly in one plane and just touching; body chamber uncoiled and irregularly S-shaped; section more or less circular; nearly straight radial ribs, a few with rather sharp ventrolateral bulla. Suture as in *Diplomoceras. Maastr.,* Japan.——FIG. 252,*4*. **P. sigmoidale; 4a,b,* ×0.4; *4c,* ×1 (739*).

Polyptychoceras YABE, 1902 [**Ptychoceras pseudogaultinum* YOKOYAMA, 1890]. Three parallel shafts which may or may not touch, followed by more or less open hook; oblique nontuberculate ribs on 1st shaft, later tending to become radial; constrictions on 1st and in some shells on later shafts. *Coni.-Camp.,* Sinai-S.India-Japan-B.C.

P. (Polyptychoceras). Ribs remain simple and sharp throughout. Occurrence as for genus.—— FIG. 253,*1*. **P. (P.) pseudogaultinum* (YOKOYAMA), Santon., Japan; *1a,* ×1; *1b,* enlarged (741*).——FIG. 254,*1*. *P. obstrictum,* Santon., Japan; ×0.5 (571*).

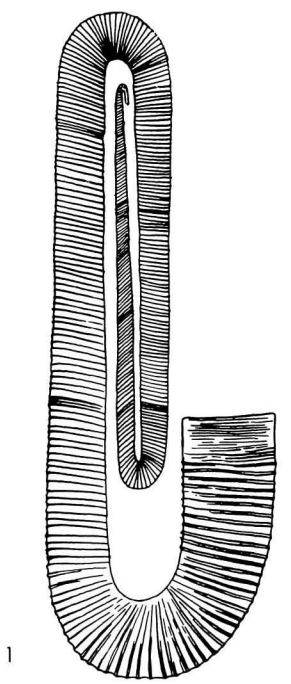


FIG. 254. *Polyptychoceras (Polyptychoceras) obstrictum* (JIMBO), U.Cret.(Santon.), Japan; ×0.5 (571*) (p. L227).

P. (Subptychoceras) SHIMIZU, 1935 [**Hamites (Polyptychoceras) yubarensis* YABE, 1927]. On last 2 shafts and hook ribs are in groups on broad low bulges. *Camp.*, Japan-B.C.——FIG. 252,*1*. **P. (S.) yubarense* (YABE), Camp., Japan; diagrammatic, ×0.4 (571*).

Phylloptychoceras SPATH, 1953 [**Ptychoceras sipho* FORBES, 1845]. Two shafts closely in contact followed by final hook; smooth at first, then with irregular ribs, then blunt folds on last shaft, finally closer ribs grading to striae on hook; aperture flared. Suture very simple. *Camp.*, S.India-N.Z.-Chile.——FIG. 253,*3*. **P. sipho* (FORBES), Camp., S.India; *3a*, ×1; *3b*, enlarged (718*).

Ryugasella WRIGHT & MATSUMOTO, 1954 [**R. ryugasensis*]. Broadly curved at first, then straight, with dense annular, prorsiradiate, nontuberculate ribs and few oblique constrictions. *?U.Santon., Camp.*, Japan-Sakhalin-GrahamLand.——FIG. 253,*2*. **R. ryugasensis*, Camp., Sakhalin; *2a*, ×0.75; *2b*, enlarged (571*).

Pseudoxybeloceras WRIGHT & MATSUMOTO, 1954 [**Hamites quadrinodosus* JIMBO, 1894]. Early part of shell slightly helical, coiling flattened elliptical in plan; with fine simple prorsiradiate ribs, each bearing lower and upper ventrolateral spines. *U. Santon.-Camp.*, Pondoland - Japan - Sakhalin - N.Z. ——FIG. 252,*5*. **P. quadrinodosum* (JIMBO), Camp., Japan; *5a,b*, diagrammatic, ×0.5 (571*).

Superfamily SCAPHITACEAE Meek, 1876

[*nom. transl.* WRIGHT & WRIGHT, 1951 (*ex* Scaphitidae MEEK, 1876)]

Coiled in loose or tight plane spiral, followed usually by terminal hook on short or long shaft. The 2 included families probably originated independently but at about the same date in Lytoceratacae. One family (Labeceratidae) remains loosely coiled, whereas the other (Scaphitidae) has a spire that tends to become tightly coiled and eventually the shaft shortens so that the hook comes into contact with the spire. Each family includes members with lappeted and nonlappeted apertures and varying much in ornament. The suture is of lytoceratid type in some early forms but soon varies considerably. *L. Cret.(U. Alb.) - U. Cret. (Maastr.)*.

While Labeceratidae are mainly restricted to the Albian of the Southern Hemisphere, Scaphitidae belong mainly, though not entirely, to the Northern Hemisphere and commonly are dominant ammonites in the Campanian and Maastrichtian.

Family SCAPHITIDAE Meek, 1876

Except in the earliest genus, more or less involute camerate whorls are followed by a long or short shaft with terminal hook, which in some genera is closely wrapped round the camerate whorls; constrictions may occur in the inner whorls. The aperture may be simple, collared, and constricted or with dorsal, ventral, or lateral lappets. Ornament varies from fine lirae to strong branching ribs, with or without tubercles. Synaptychi have been found in several members of the Scaphitinae. The family is probably derived direct from some member of the Lytoceratidae (79, 324, 362, 459). *L.Cret.(U. Alb.)-U.Cret.(Maastr.)*.

Subfamily SCAPHITINAE Meek, 1876

[*nom. transl.* WRIGHT, 1953 (*ex* Scaphitidae MEEK, 1876)]

Aperture simple or collared and constricted; lappets, if present, dorsal only. *L. Cret.(U.Alb.)-U.Cret.(Maastr.)*.

Eoscaphites BREISTROFFER, 1947 [**Am.? circularis* J.DEC.SOWERBY, 1836]. Initial whorls more or less evolute, with or without umbilical perforation; later whorls more involute but followed by uncoiling and hooked body chamber; aperture simple; ribs fine and dense, single or branching, reclined, strengthening on body chamber; no tubercles. Suture lytoceratid. *U.Alb.*, Eng.-Fr.-Alg.——FIG. 255,*6*. **E. circularis* (J.DEC.Sow.); *6a,b*, ×1; *6c*, enlarged (713*).

Scaphites PARKINSON, 1811 [**Scaphites equalis* J. SOWERBY, 1813; SD MEEK, 1876] [*Anascaphites, Jahnnites* HYATT, 1900; *Yezoites* YABE, 1910; *Holcoscaphites* NOWAK, 1911 (obj.)]. Compressed to very inflated, more or less involute, early whorls invariably in contact, shaft short or moderately long, hook not curved over camerate whorls; aperture constricted and commonly collared, in some shells with long dorsal lappet; ribs normally branching or intercalated on coiled part, commonly single or joining at ventrolateral tubercles on shaft; umbilical and normally ventrolateral tubercles present on shaft or hook. Suture soon ceases to be regularly lytoceratid. *U.Alb.-Camp.*, N.Hemis.-Madag.-Queensl.——FIG. 256,*3*. **S. equalis* (J.Sow.), Cenom., Fr.; *3a,b*, ×1; *3c*, enlarged (329*).

Clioscaphites COBBAN, 1952 [**C. montanensis*]. Very involute and inflated, with hook closely pressed to initial spire; inner whorls very inflated, bearing strong rounded ribs. First lateral lobe trifid or more asymmetrically bifid than in *Scaphites*. Includes close homeomorphs of M.Jur. Sphaeroceratidae. *Santon.-Camp.*, USA.——FIG. 255,*7*. *C. vermiformis* (MEEK & HAYDEN), Santon., Mont.; *7a,b*, ×1 (79*).

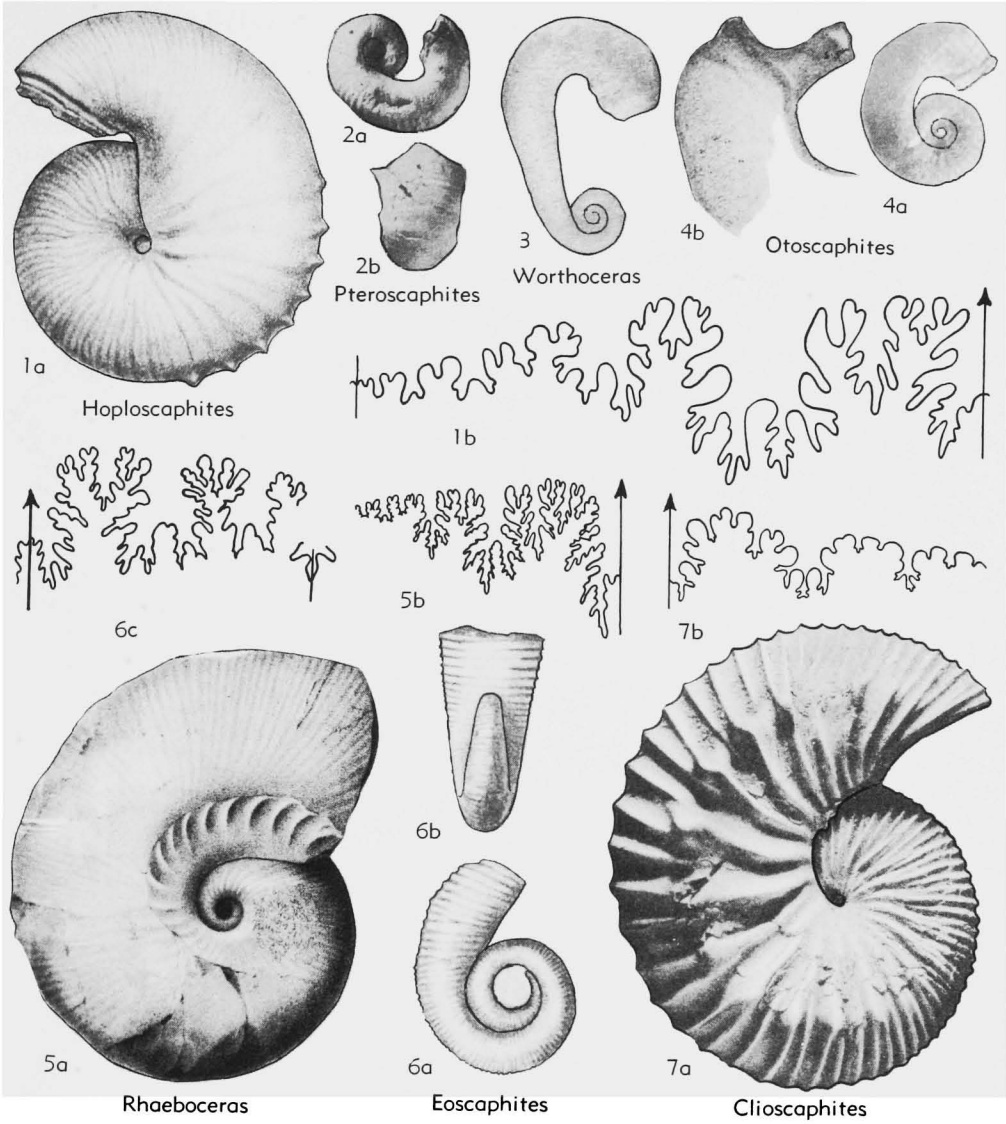


FIG. 255. Scaphitidae (p. L228-L231).

Desmoscaphites REESIDE, 1927 [**D. bassleri*]. Differs from *Clioscaphites* principally in having constrictions on inner whorls. *U.Santon.-Camp.*, USA.

Rhaeboceras MEEK, 1876 [**Phylloceras? halli* MEEK, 1876] [*Ponteixites* WARREN, 1934]. Differs from *Clioscaphites* in its less involute and more compressed inner whorls with strong, slightly sinuous, rounded ribs, resembling *Parahoplites;* outer whorls with dense fine ribs. *Camp.*, Alba.-USA.——FIG. 255,*5*. **R. halli* (MEEK), USA; *5a*, ×0.5; *5b*, ×0.75 (285*).

Hoploscaphites NOWAK, 1911 [**Scaphites constrictus* J.SOWERBY, 1817]. Compressed and flat-sided to inflated with convex sides; venter flat or rounded, bordered with strong ventrolateral clavi, at least on shaft and hook; shaft normally short. *Camp.-Maastr.*, Eu.-S.Afr.-Can.-USA-Chile-GrahamLand. ——FIG. 255,*1*. **H. constrictus* (J.Sow.), Maastr., Fr.; *1a*, ×1; *1b*, enlarged (329*).

Indoscaphites SPATH, 1953 [**Am. cunliffei* FORBES, 1845]. Compressed, with flat venter and very short shaft; ornament of single ribs joining distinct umbilical and ventrolateral tubercles starts at a much earlier stage than in other genera. *Maastr.*, S.India.

Discoscaphites MEEK, 1870 [**Scaphites conradi* MORTON, 1834]. Compressed and normally flat-

sided with hook coiled in over spire; ribs moderately strong, with 3 or more rows of small, more or less equal tubercles. *Camp.-Maastr.*, N.Afr.-Can.-USA.——Fig. 256,2. **D. conradi* (Morton), Maastr., N.Dak.; *2a,b*, ×0.5; *2c*, ×1.5 (285*).

Acanthoscaphites Nowak, 1911 [**Scaphites tridens* Kner, 1850]. Large and inflated, with fine ribs and only umbilical tubercles until body chamber, which has also ventrolateral and typically siphonal rows of large blunt tubercles connected by irregu-

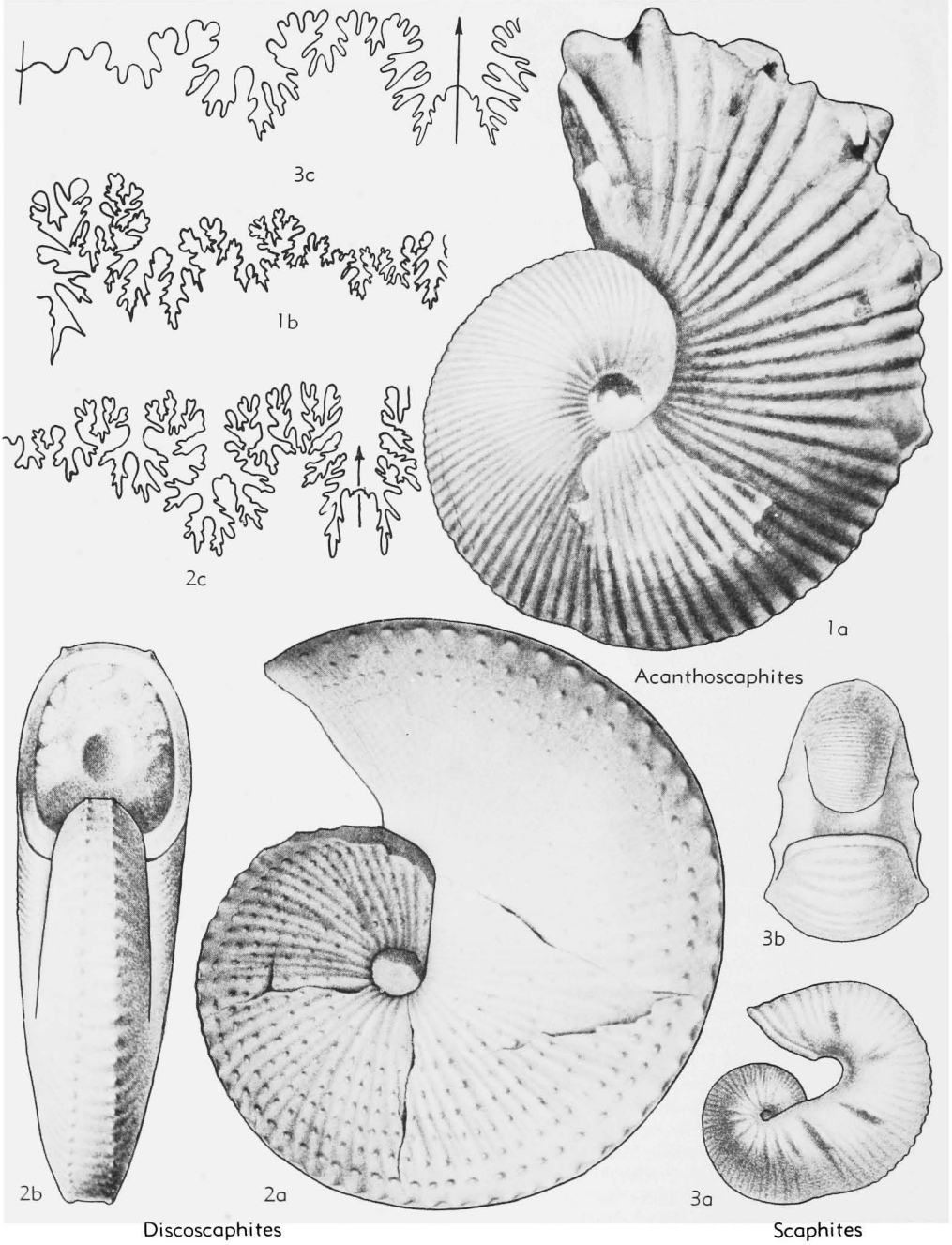


Fig. 256. Scaphitidae (p. L228-L230).

lar ribs. *Camp.*, C.Eu.-E.Eu.——Fig. 256,*1*. *A. tridens trispinosus* (Geinitz), Pol.; *1a*, ×0.5; *1b*, ×1 (324*).

Pteroscaphites Wright, 1953 [**Scaphites auriculatus* Cobban, 1952]. Small, with weak ornament or none; aperture with sides and ventral edge pinched to form projecting points. Probably a local offshoot of *S. larvaeformis. Coni.*, Mont.-N.Dak.——Fig. 255,*2*. **P. auriculatus* (Cobban), Mont.; *2a,b*, ×2 (79*).

?Zuluscaphites van Hoepen, 1955 [**Z. orycteropusi*]. Whorl section inflated, increasing rapidly, then decreasing before last suture; with long and short ribs, with siphonal tubercles on at least part of shell. First lateral lobe trifid. Doubtfully a scaphitid. *M.Alb.* (or *U.Alb.*), Zululand.

Subfamily OTOSCAPHITINAE Wright, 1953

Aperture with large lateral lappets. Ornament weaker than in contemporary Scaphitinae but tending to strengthen. Probably an early offshoot of *Eoscaphites* developing in parallel with Scaphitinae (569). *L.Cret.(U. Alb.)-U.Cret.(Coni.)*.

Worthoceras Adkins, 1928 [**Macroscaphites platydorsus* Scott, 1924]. Small, with evolute spire followed by long straight shaft and final hook; aperture with long straight lappets; smooth or with fine striae. Suture with bifid saddles and lobes of very simple outline. *U.Alb.-L.Turon.*, Fr.-C.Eu.-Tex.——Fig. 255,*3*; 554,*1*. **W. platydorsus* (Scott), U.Alb., Tex.; 255,*3*, ×4 (705*); 554,*1*, ×10 (579*).

Otoscaphites Wright, 1953 [**Am. bladenensis* Schlüter, 1871]. With rather evolute spire followed by curved shaft and hook, more open than in Scaphitinae; whorl section compressed to coronate; strong, long and short or branching ribs on spire at least, shaft and hook smooth or with weak to rather strong ribs; in later species with umbilical or ventrolateral tubercles. Suture has an irregularly bifid 1st lateral lobe but elements are more frilled than in *Worthoceras*. The genus includes all species referred to *Yezoites* Yabe except the type, which is a *Scaphites. L.Turon.-Coni.*, Eu.-Japan-Tex.-Mex.——Fig. 255,*4*. **O. bladenensis* (Schlüter), U.Turon., Eng.; *4a*, ×1; *4b*, ×2 (736*).

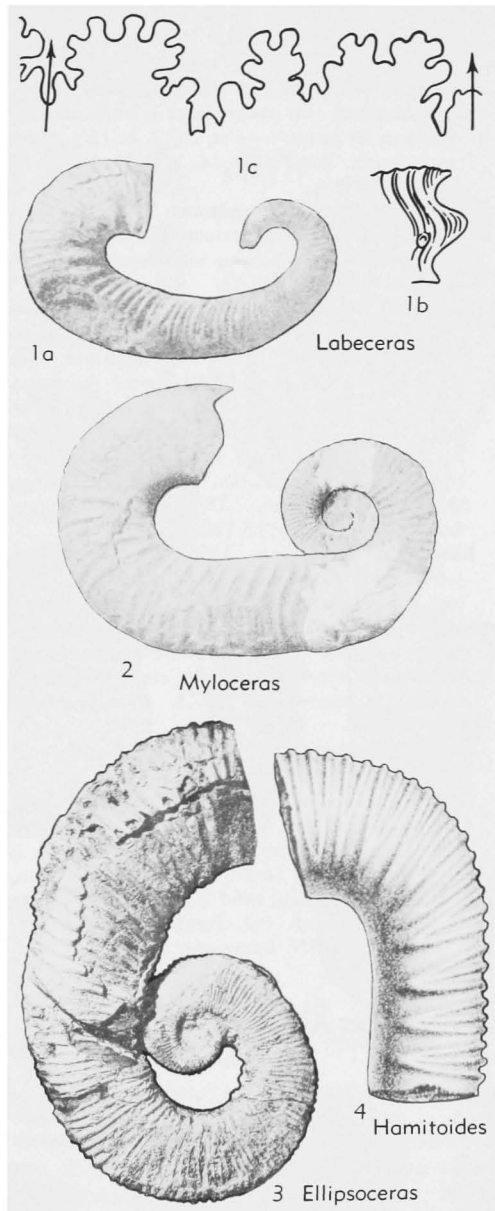


Fig. 257. Labeceratidae (p. L231-L232).

Family LABECERATIDAE Spath, 1925

[Includes Aleteceratidae Whitehouse, 1926; Myloceratidae Spath, 1939]

At first coiled in open spiral but later whorls may be in contact, shell ending in hook; aperture with weak to moderate rounded lateral lappets; whorl section moderately to very compressed; all genera have fine branching ribs that pass over venter, some having also umbilical or ventrolateral tubercles or both. Suture with bifid saddles and generally small trifid lobes. The family is probably derived, like Scaphitidae, from the Lytoceratidae (459, 566). *?L.Cret.(M. Alb.), L.Cret.(U.Alb.)*.

Labeceras Spath, 1925 [**L. bryani* Whitehouse, 1926 (ICZN pend.)]. Small, with open spire of few whorls followed by curved shaft and final

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 Psiloceratataceae)] [=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*).

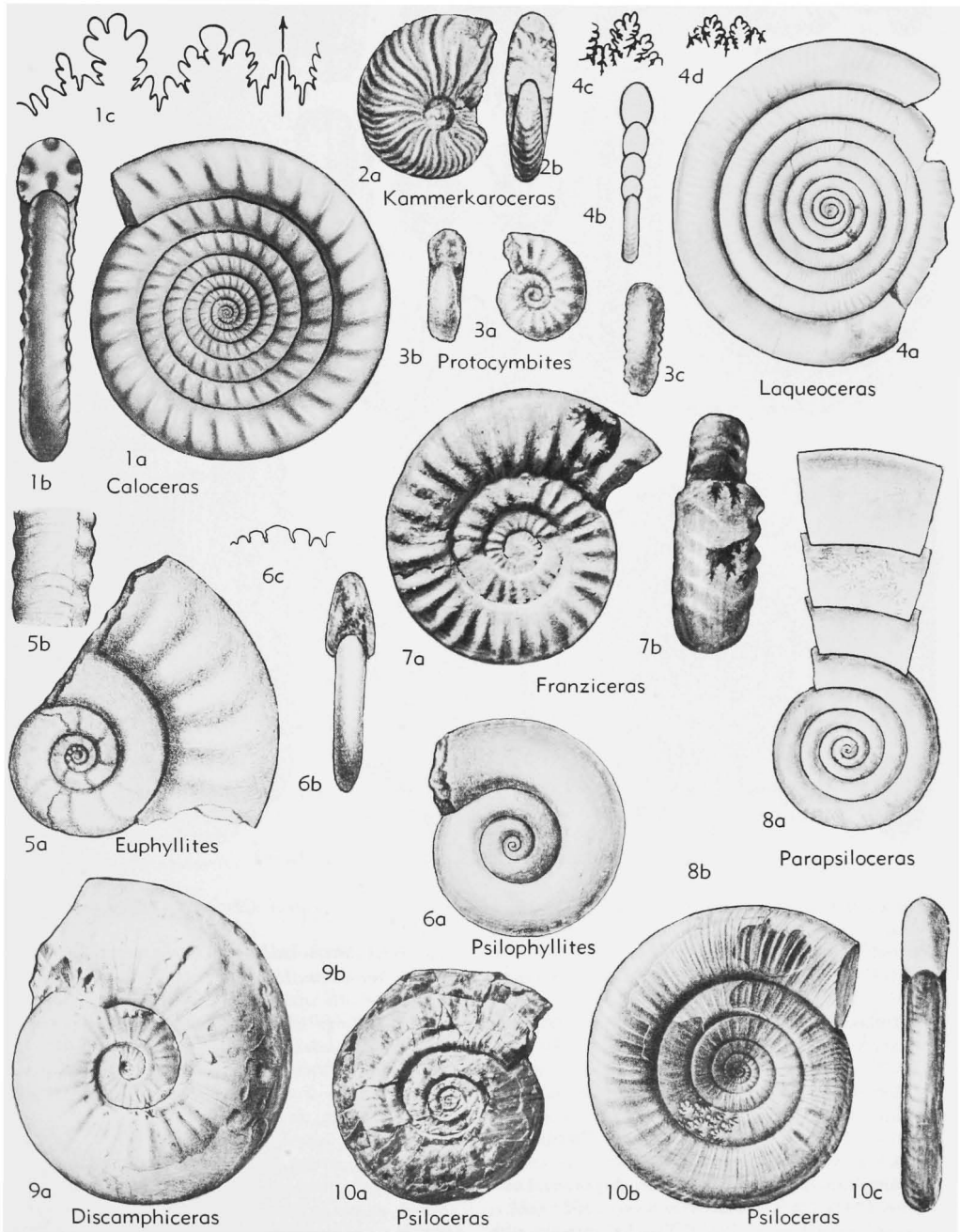


FIG. 258. Psiloceratidae (Psiloceratinae) (p. L232-L234).

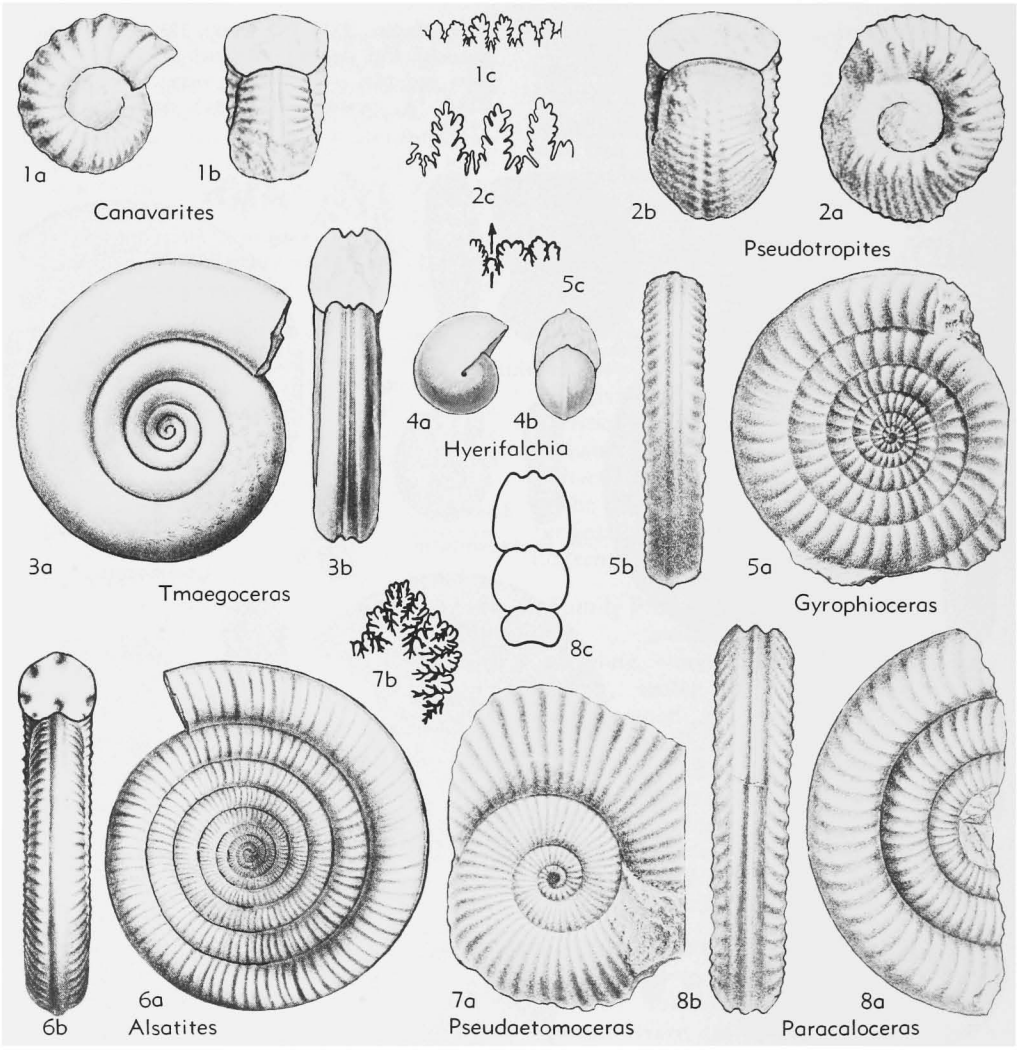


FIG. 259. Psiloceratidae (Alsatitinae) (p. L235-L236).

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*).

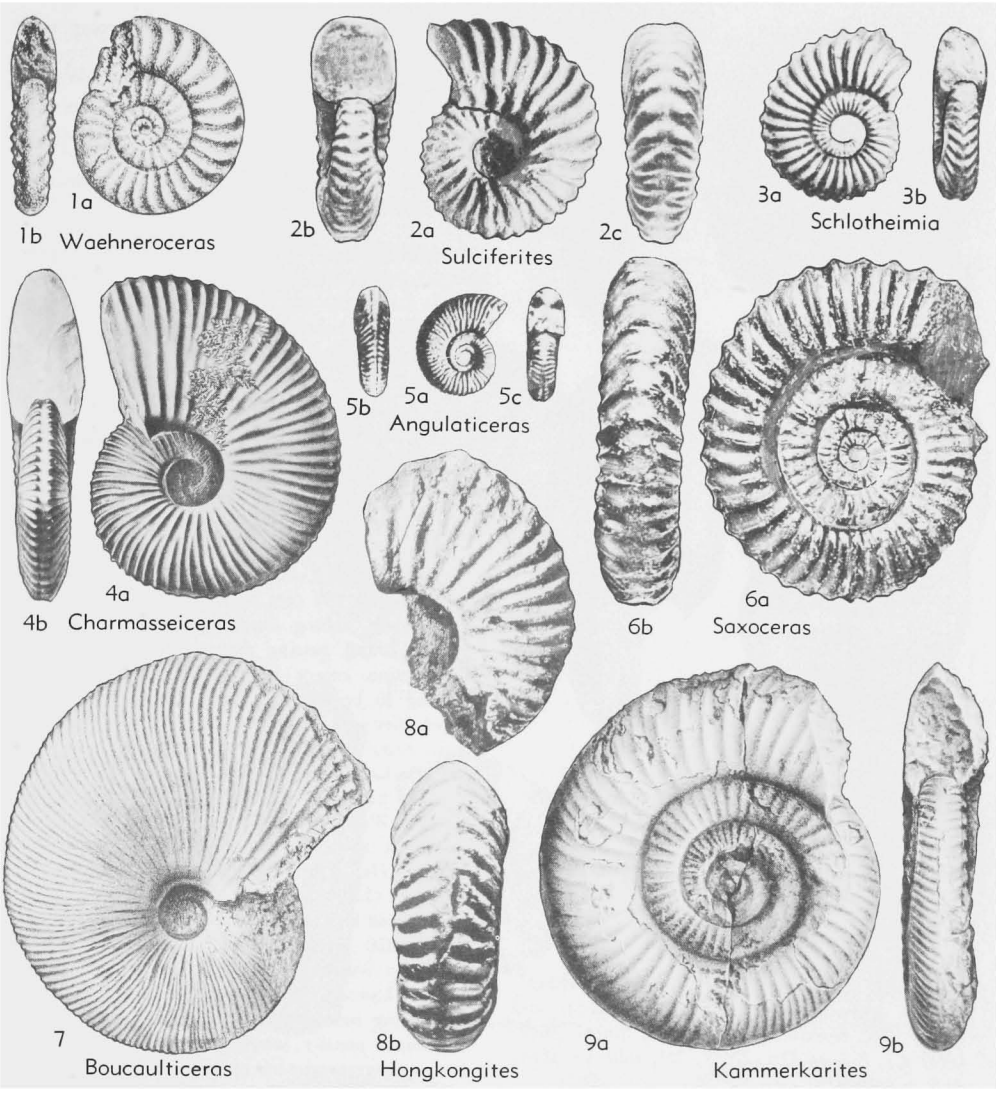


FIG. 260. Schlotheimiidae (p. L236-L237).

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-*

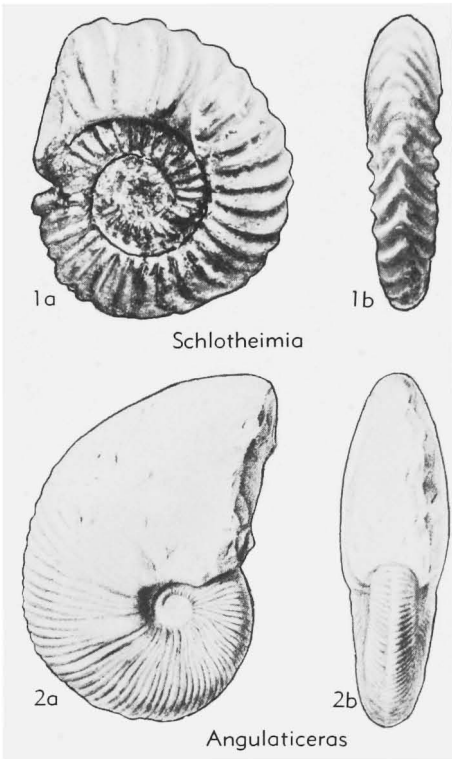


FIG. 261. Schlotheimiidae (p. L236).

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-

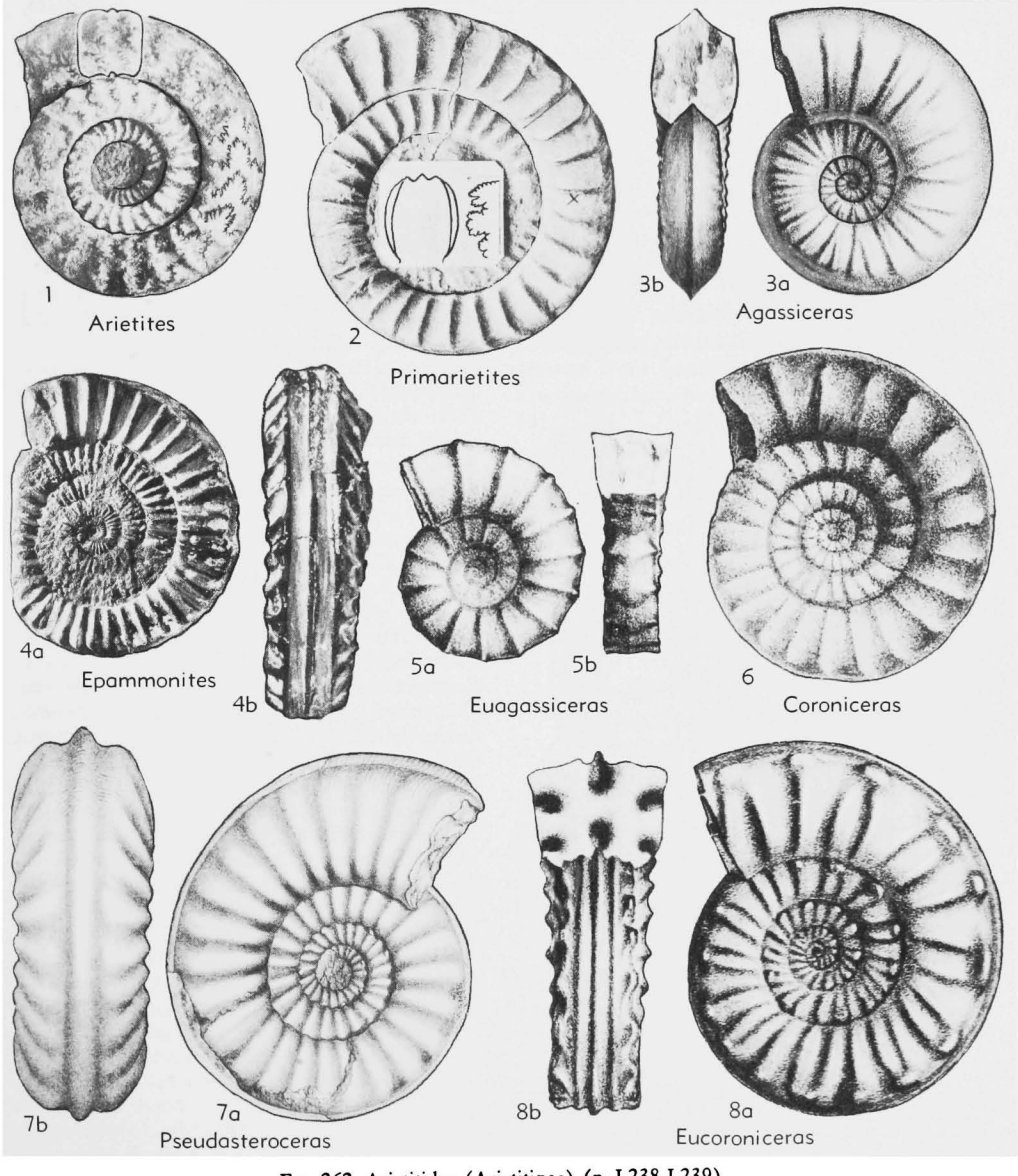


Fig. 262. Arietitidae (Arietitinae) (p. L238-L239).

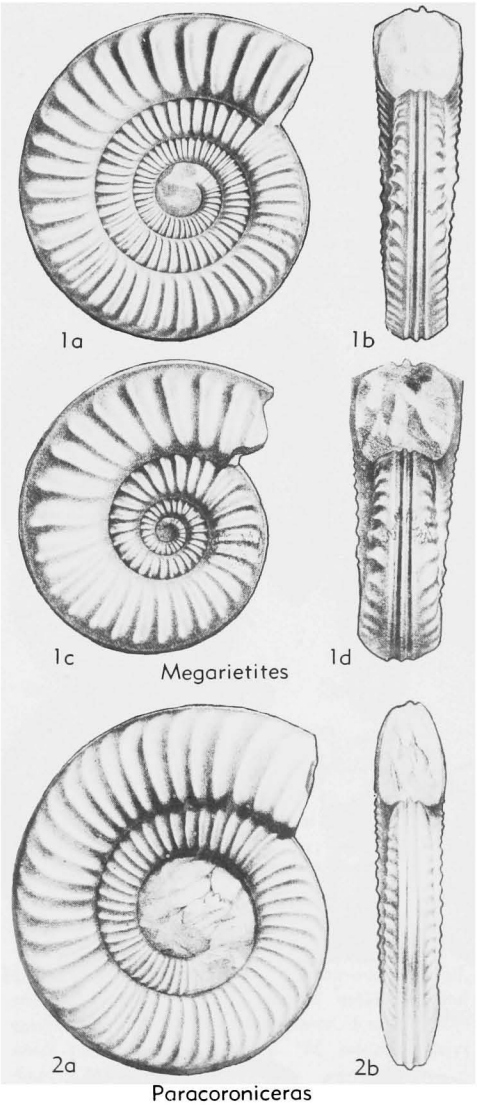


FIG. 263. Arietitidae (Arietitinae) (p. L238).

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

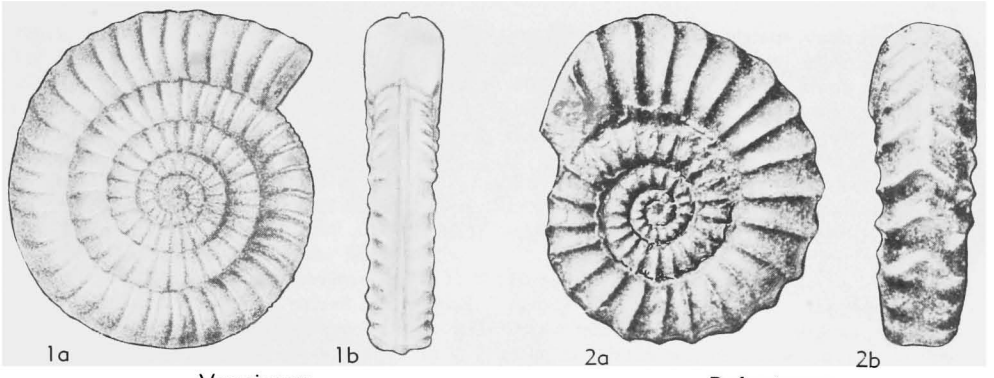


FIG. 264. Arietitidae (Arietitinae) (p. L238-L239).

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,

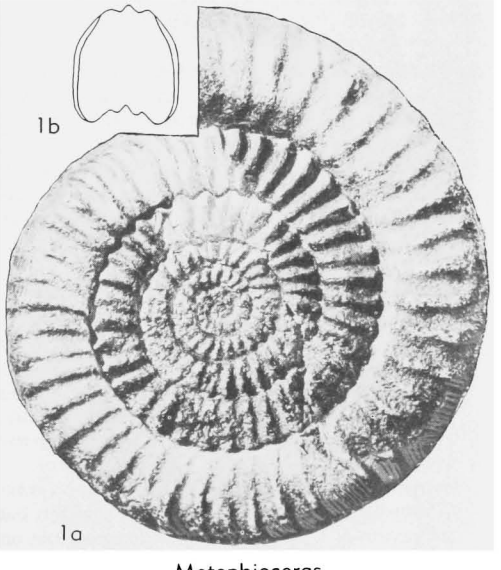


FIG. 265. *Metophioceras conybeari* (SOWERBY), L. Jur.(Sinem.), Eng.; ×0.7 (608n) (p. L239).

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

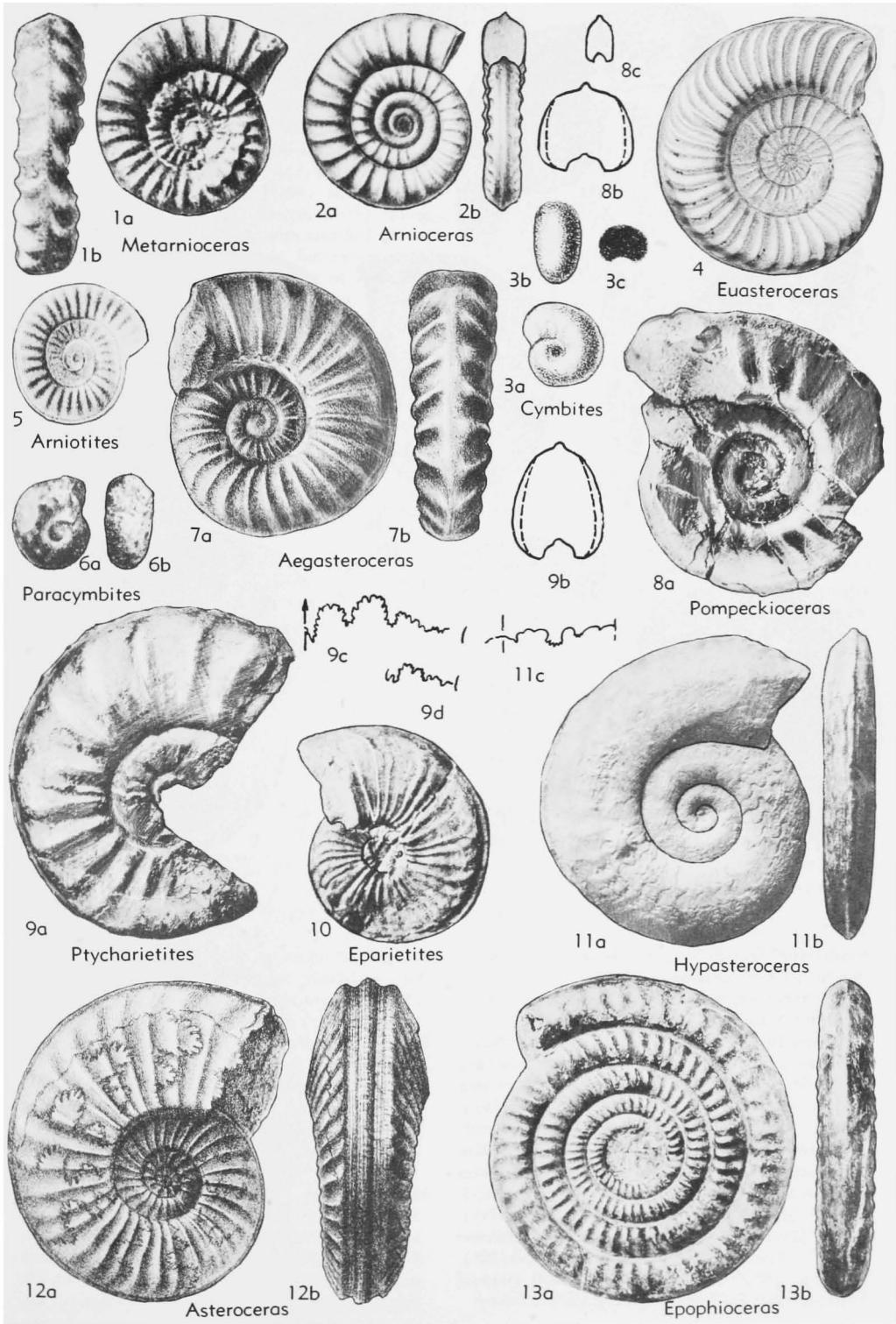


FIG. 266. Arietitidae (Arnioceratinae, Asteroceratinae, Cymbitinae) (p. L239-L240).

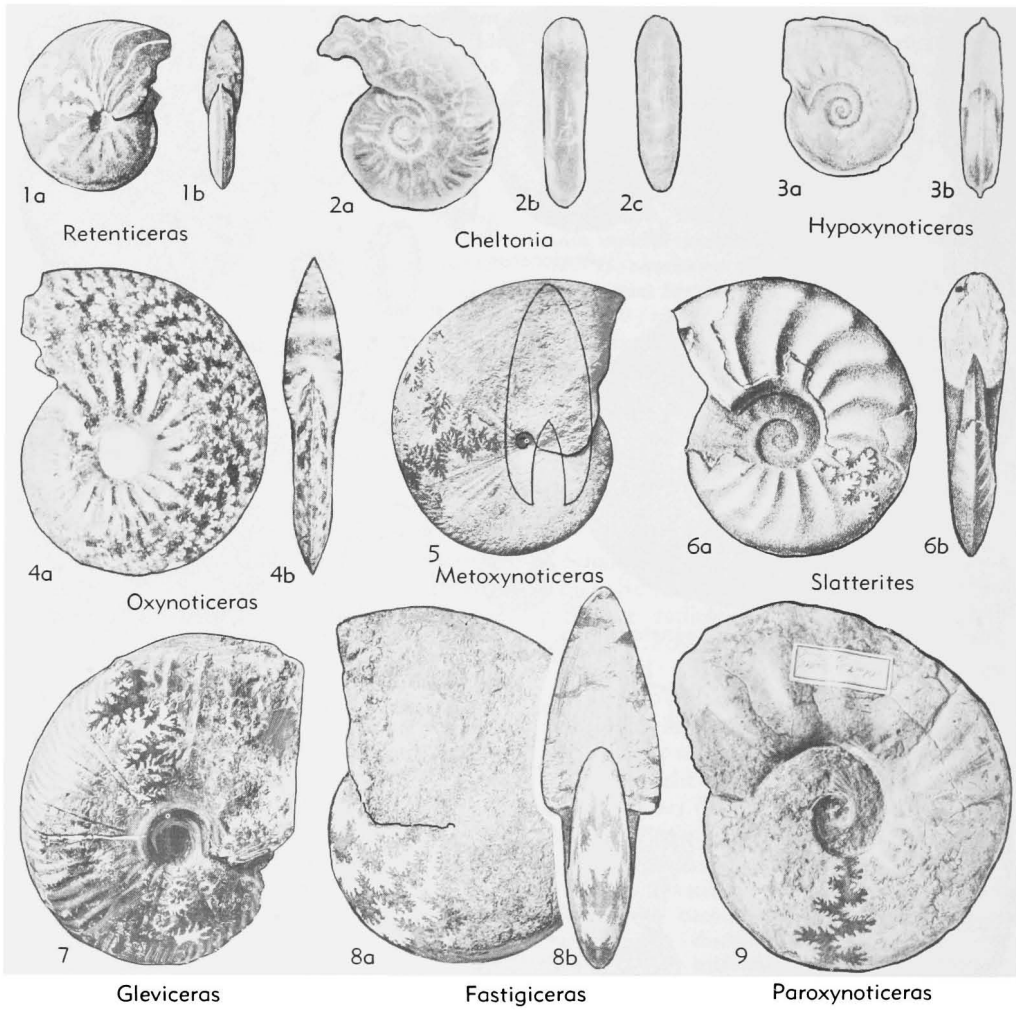


FIG. 267. Oxynoticeratidae (p. L240-L243).

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*).

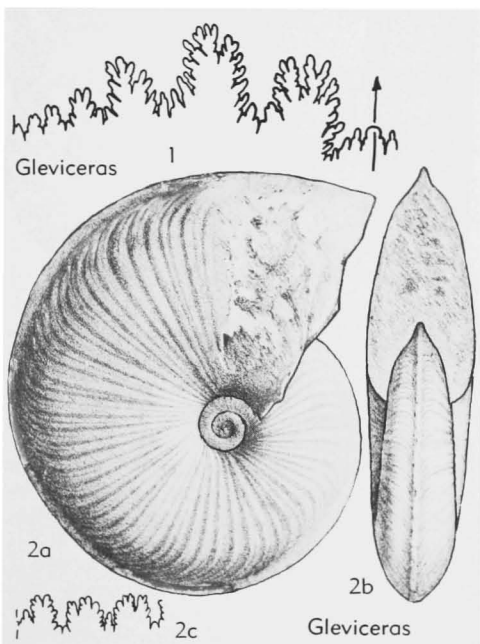
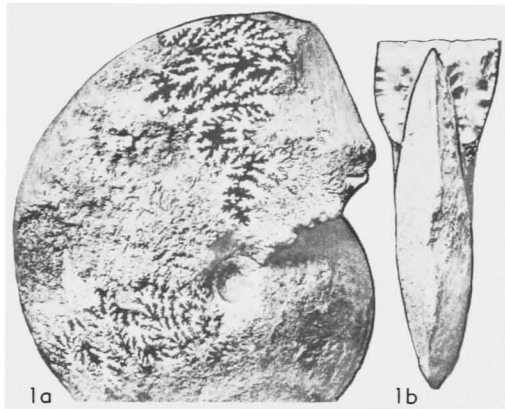


Fig. 268. Oxynoticeratidae (p. L242).



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.

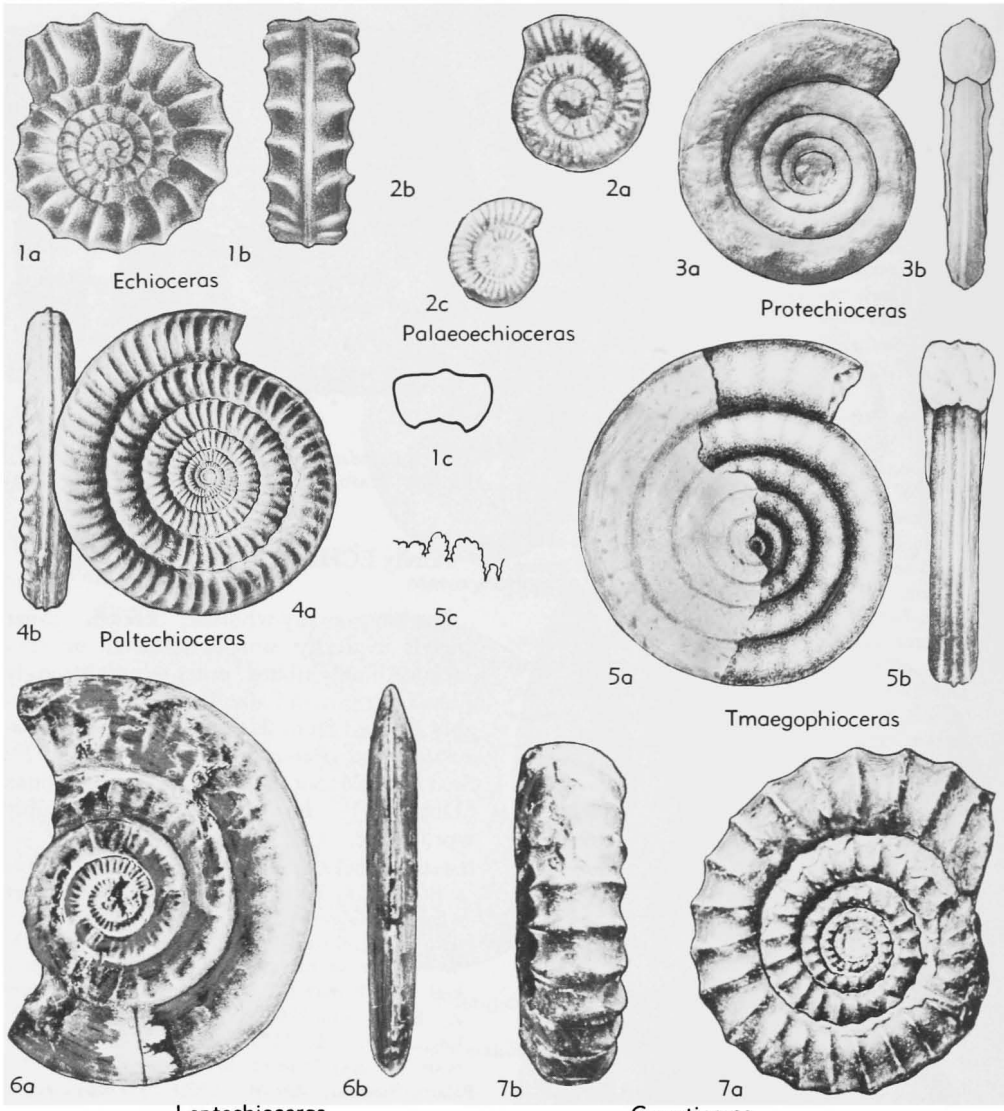


FIG. 270. Echioceratidae (p. L243-L245).

**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*

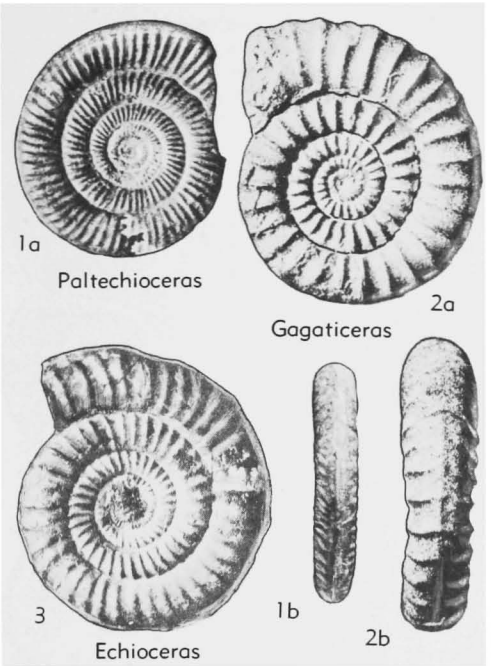


FIG. 271. Echioceratidae (p. L243-L244).

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.-

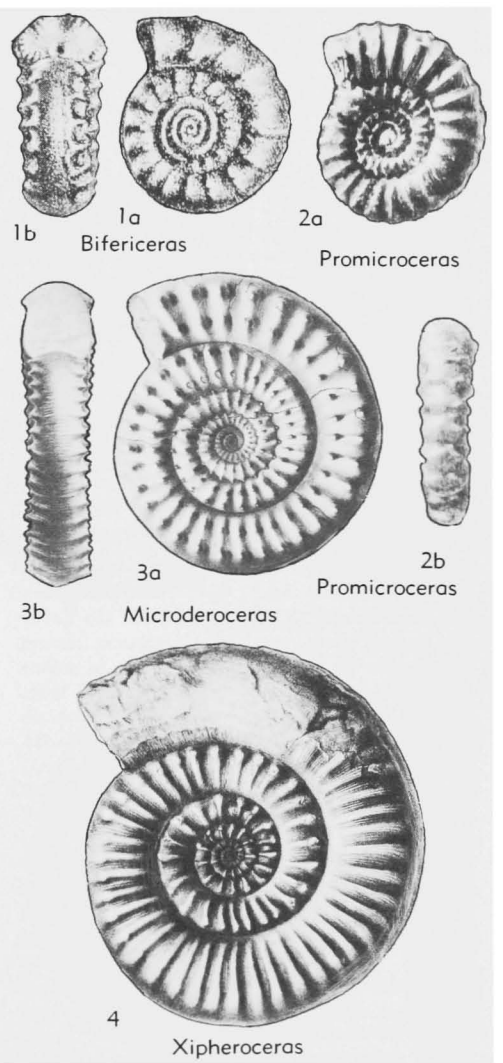


FIG. 272. Eoderoceratidae (Xipheroceratinae) (p. L245-L247).

?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,

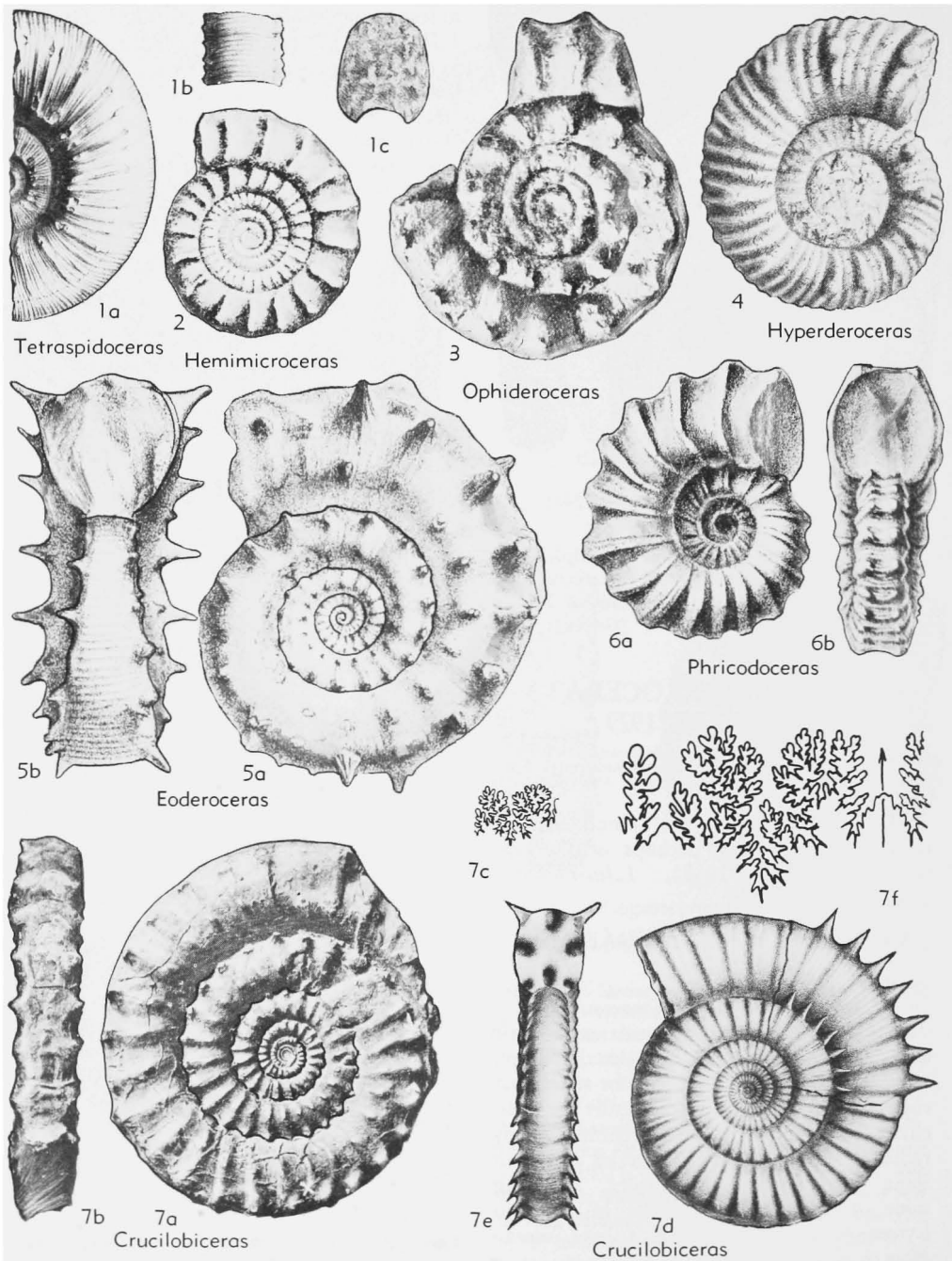


Fig. 273. Eoderoceratidae (Eoderoceratinae, Phricodoceratinae) (p. L247).

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.*

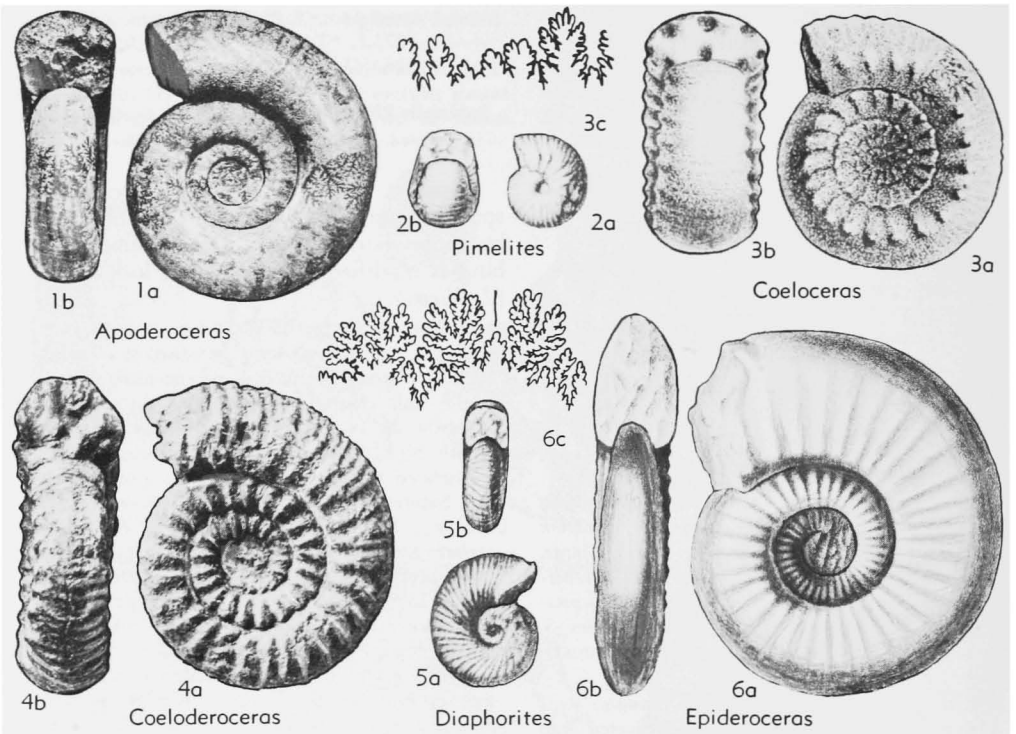


FIG. 274. Eoderoceratidae (Phricodoceratinae, Coeloceratinae) (p. L247-L248).

(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

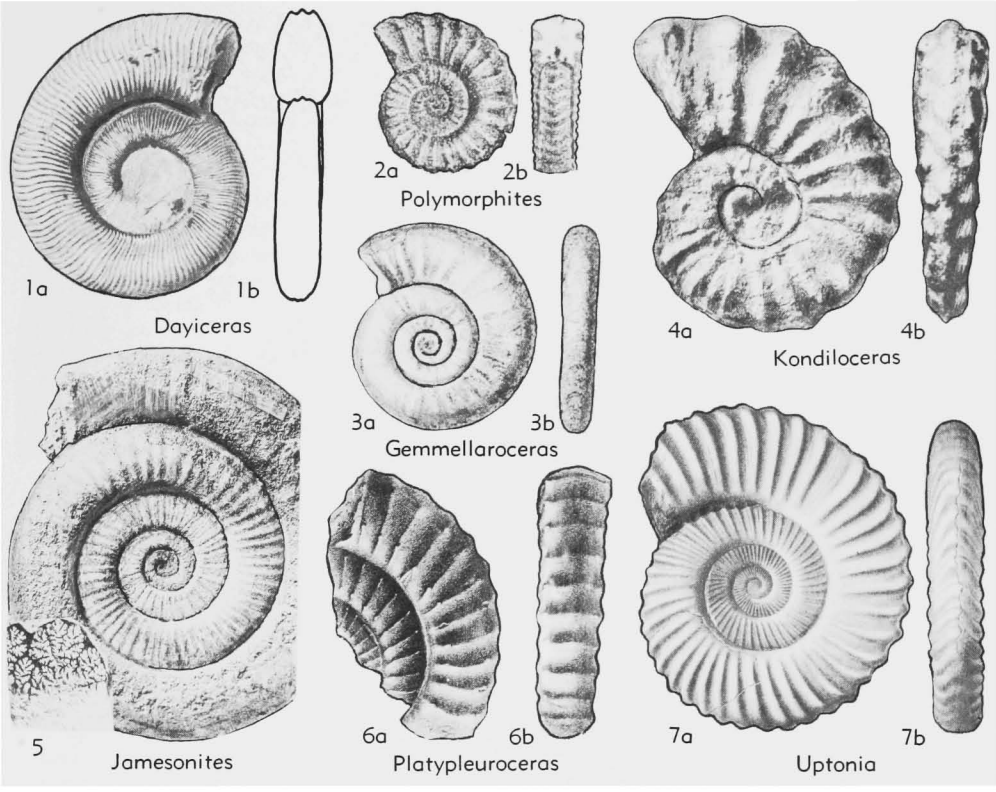


FIG. 275. Polymorphitidae (Polymorphitinae) (p. L248-L249).

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.)*,

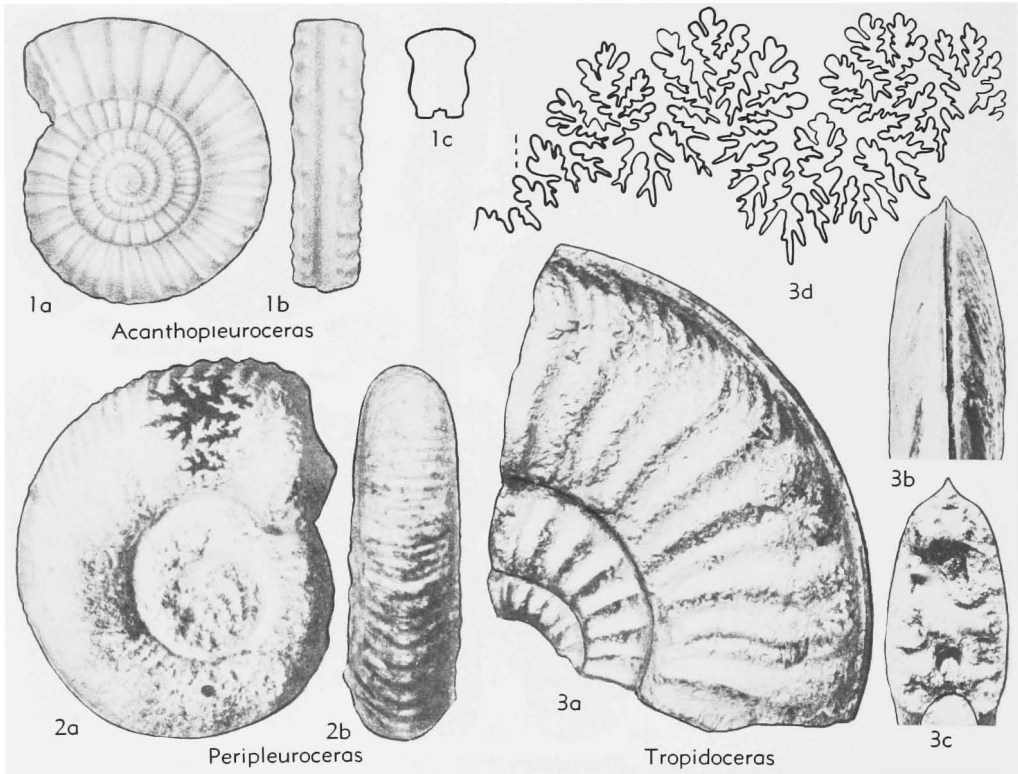


FIG. 276. Polymorphitidae (Polymorphitinae, Acanthopleuroceratinae) (p. L249-L250).

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.

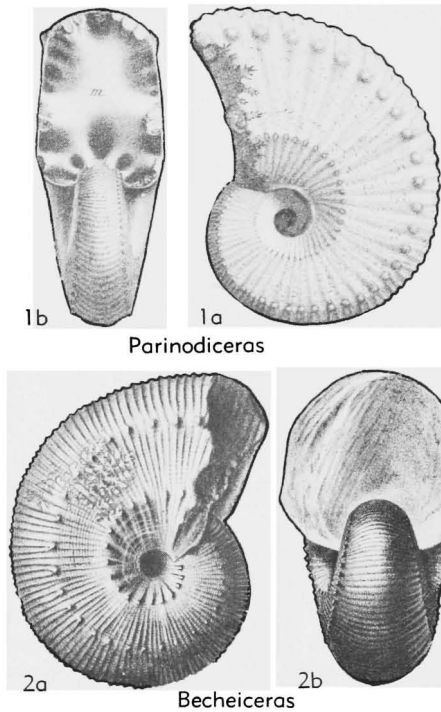


Fig. 277. Liparoceratidae (p. L250).

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*).

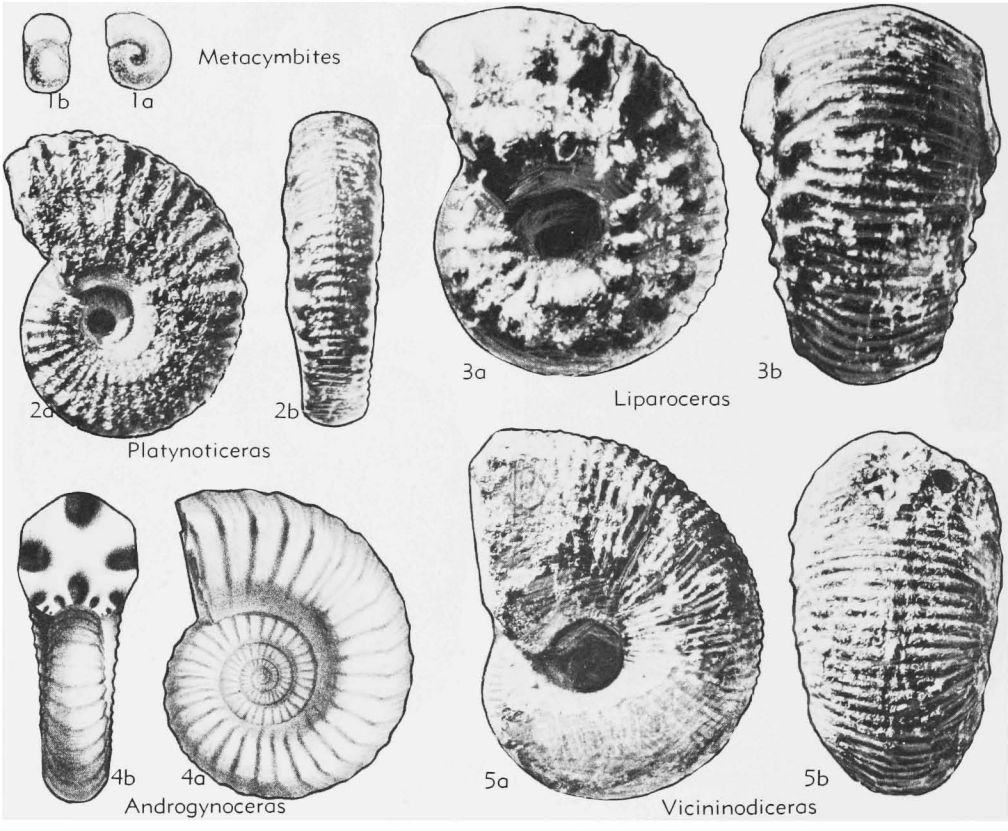


FIG. 278. Liparoceratidae (p. L250-L251).

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-*

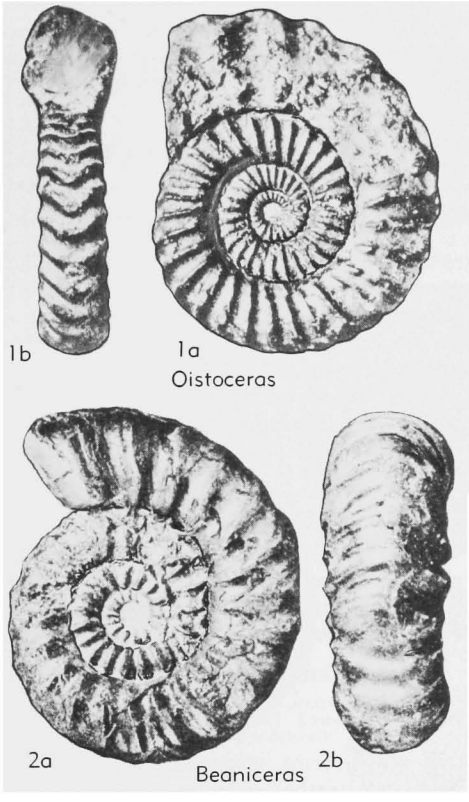


FIG. 279. Liparoceratidae (p. L251).

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*

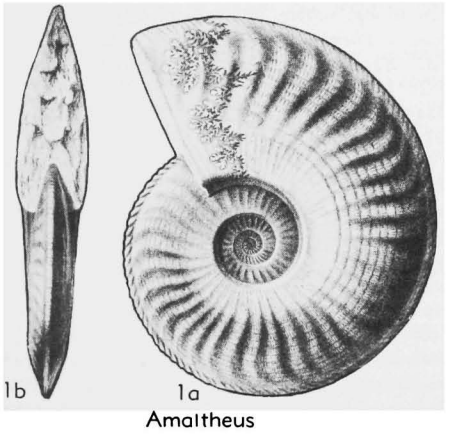


FIG. 280. *Amaltheus (Amaltheus) margaritatus* (DE MONTFORT), L.Jur.(U.Pliensb.), Eu.; *1a,b*, ×0.25 (737*) (p. L251).

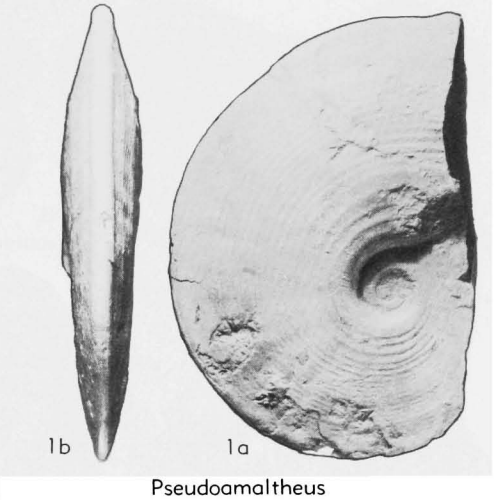


FIG. 281. *Amaltheus (Pseudoamaltheus) engelhardti* (D'ORBIGNY), L.Jur.(U.Pliensb.), Fr.(Alsace); *1a,b*, ×0.3 (583n) (p. L251).

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,

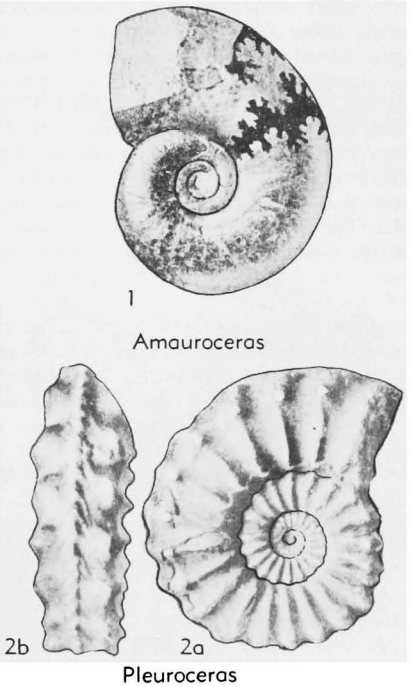


FIG. 282. Amaltheidae (p. L251).

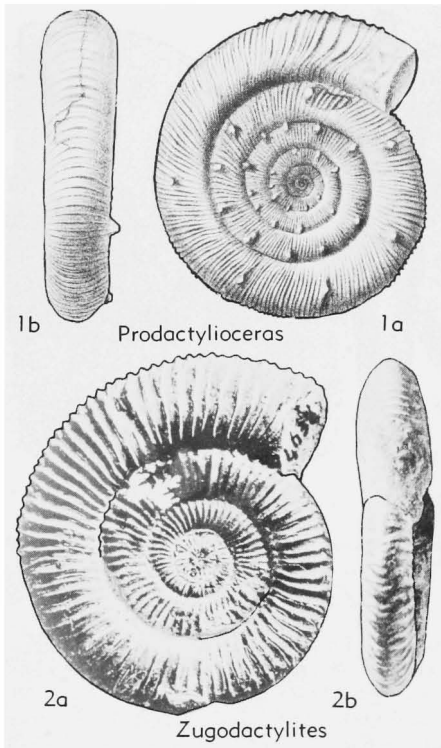


FIG. 283. Dactylioceratidae (p. L252-L253).

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-

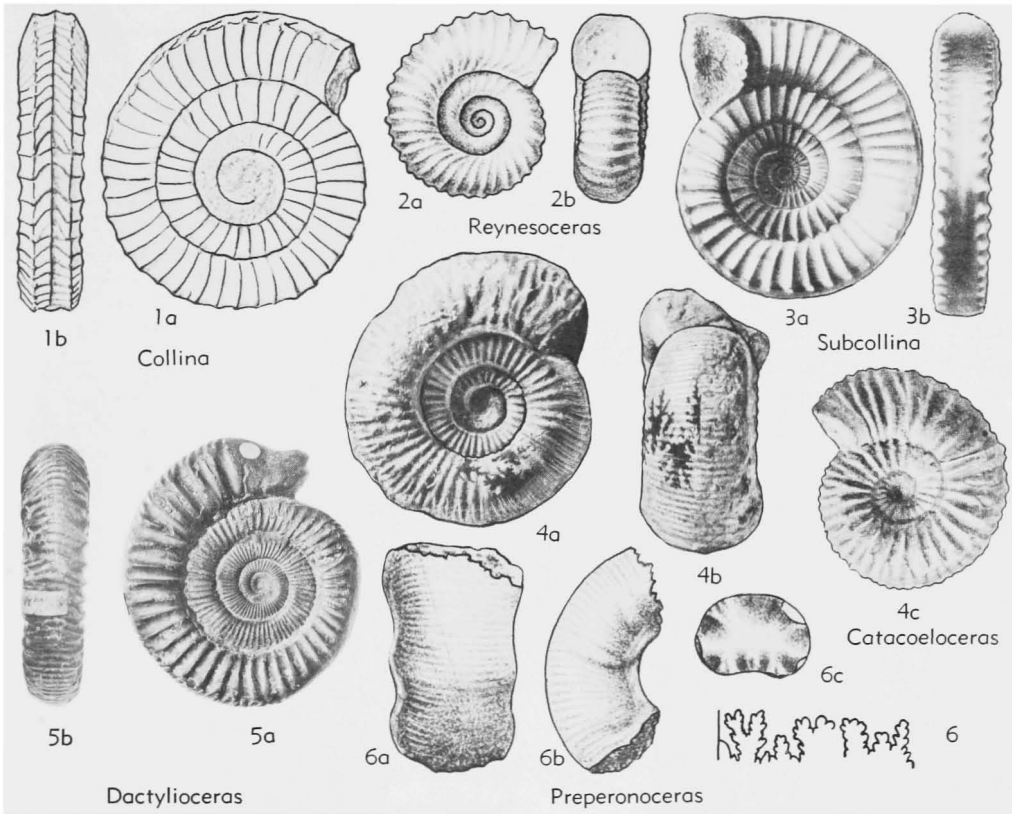


FIG. 284. Dactylioceratidae (p. L252-L254).

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

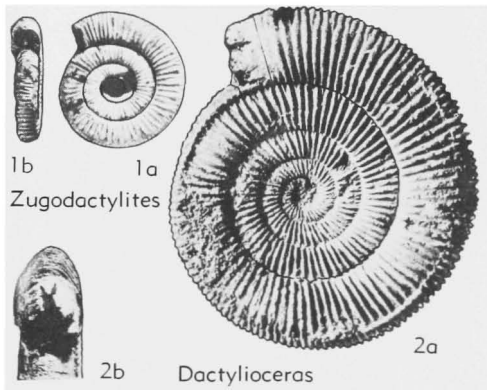


FIG. 285. Dactylioceratidae (p. L252-L253).

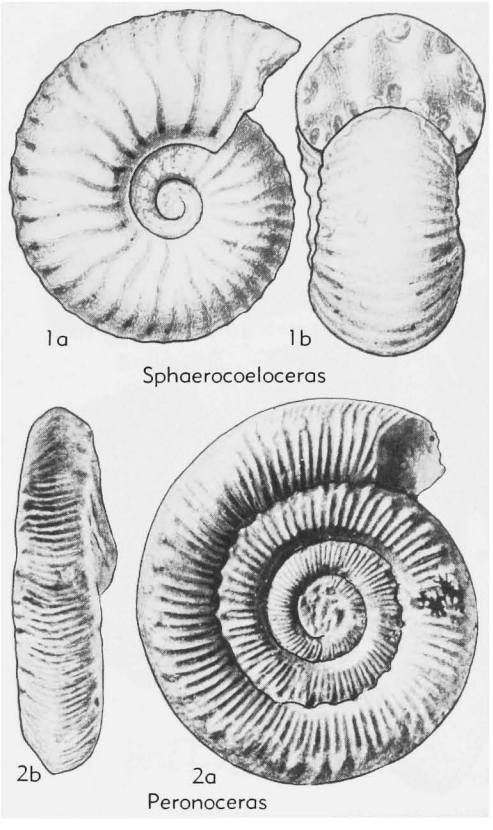


FIG. 286. Dactylioceratidae (p. L253-L254).

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*).

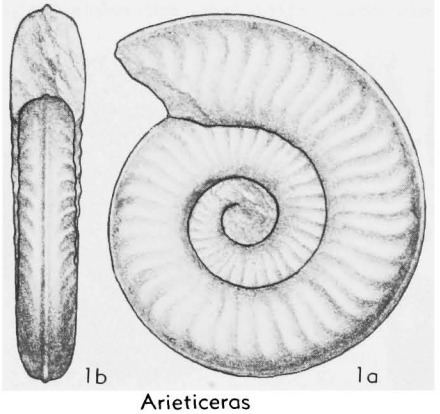


FIG. 287. *Arieticeras algovianum* (OPPEL), L.Jur. (U.Pliensb.), Alps; *1a,b*, ×0.7 (628*) (p. L254).

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,

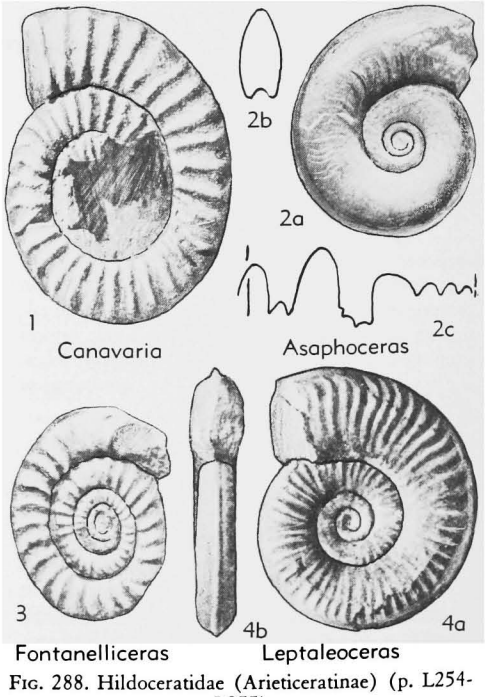


FIG. 288. Hildoceratidae (Arieticeratinae) (p. L254-L255).

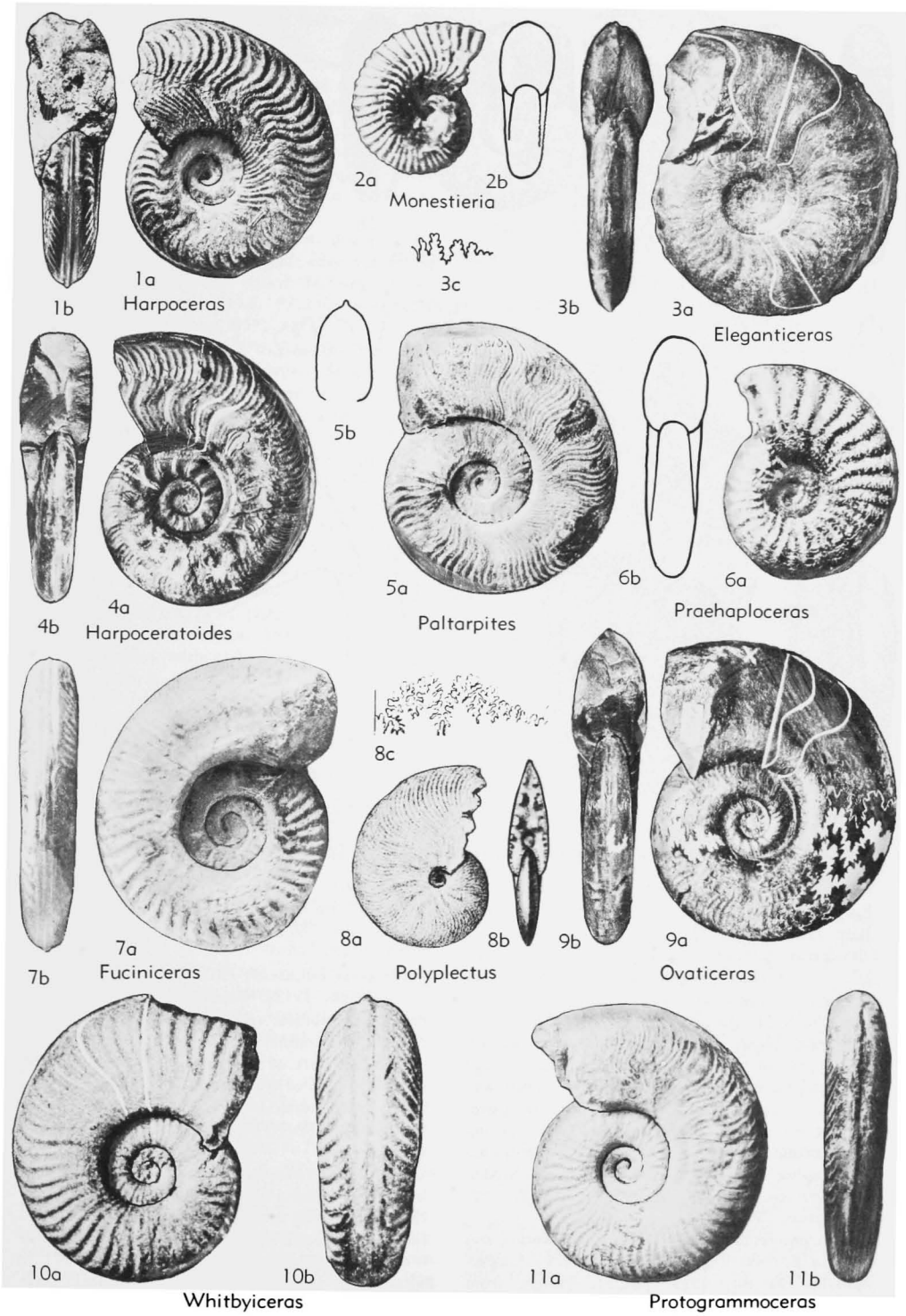


FIG. 289. Hildoceratidae (Harpoceratinae) (p. L255-L259).

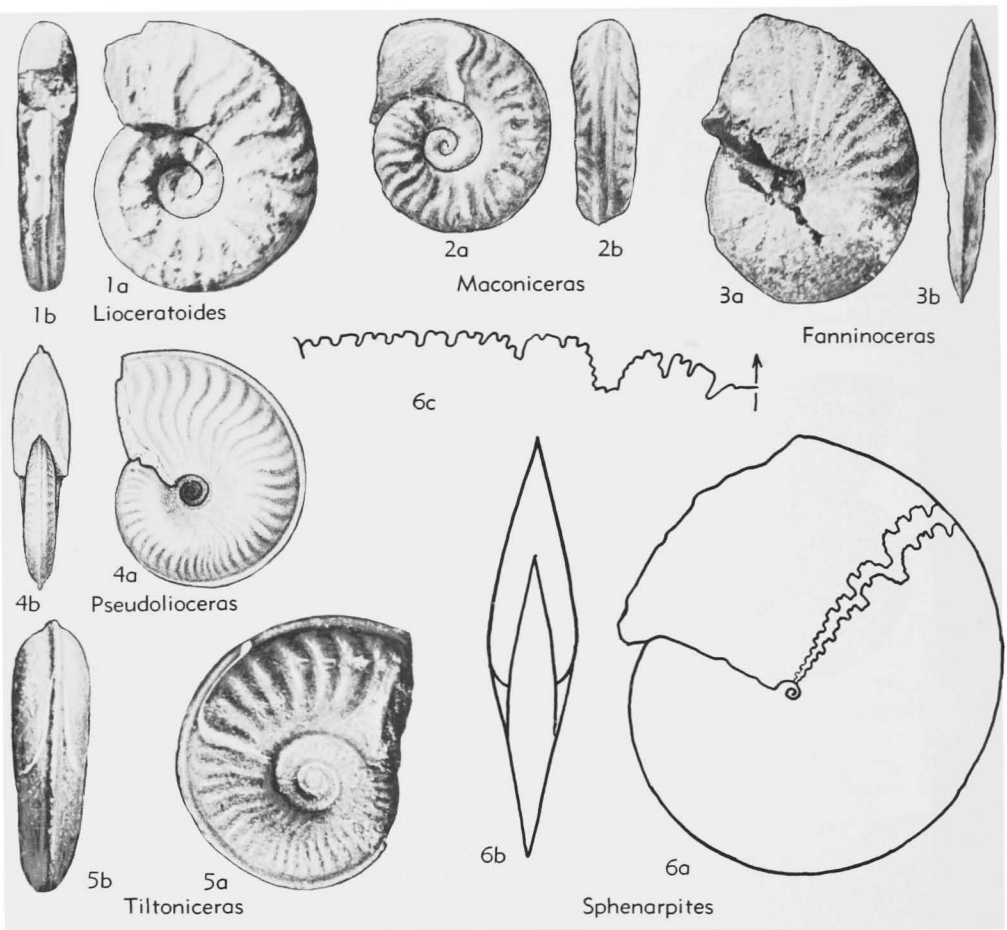


FIG. 290. Hildoceratidae (Harpoceratinae) (p. L256-L259).

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

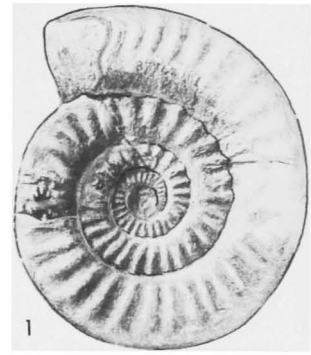
Evolute planulates with quadrate whorl section, tricarinate-bisulcate venter, and falcate ribs which may be interrupted by longitudinal groove on whorl sides (65, 288). *L. Jur.(L.Toarc.)*, world-wide.

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*).

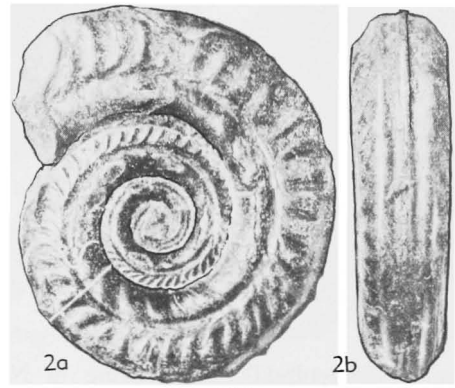
Hildaites Buckman, 1921 [**H. subserpentinum*] [=*Hildoceratoides* Buck., 1921]. Lacks lateral groove of *Hildoceras*, and ventral sulci are shallower. ?Subgen. of *Hildoceras*. *L.Toarc.*, Eu.-Anatolia-C.Arabia.——Fig. 292,*2*. **H.? (H.) subserpentinum*, Eng.; *2a*, ×0.5; *2b*, ×1 (65*).

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.)*,

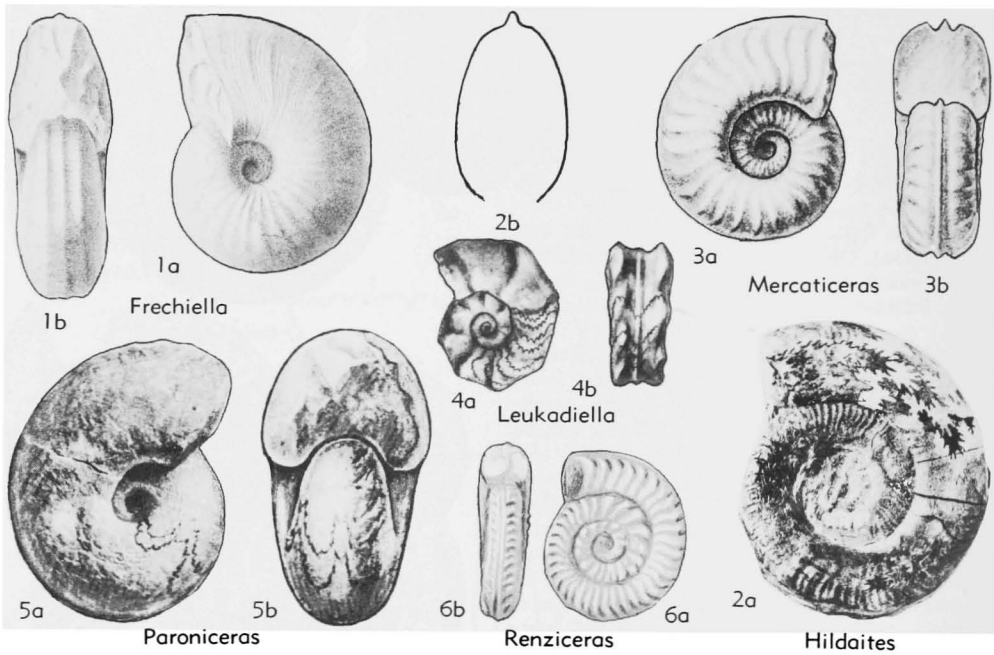


FIG. 292. Hildoceratidae (Hildoceratinae, Bouleiceratinae) (p. L259-L260).

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*).

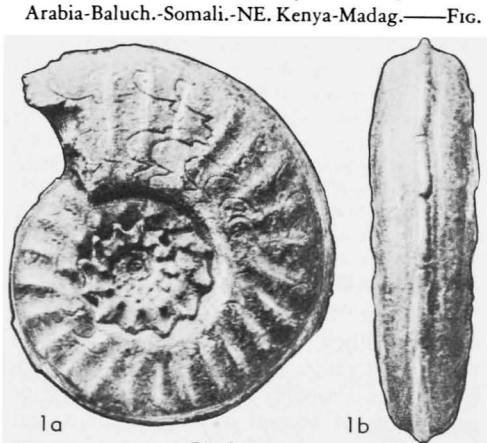


FIG. 293. *Bouleiceras nitescens* (THEVENIN), L.Jur. (Toarc.), Madag. (p. L260).

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

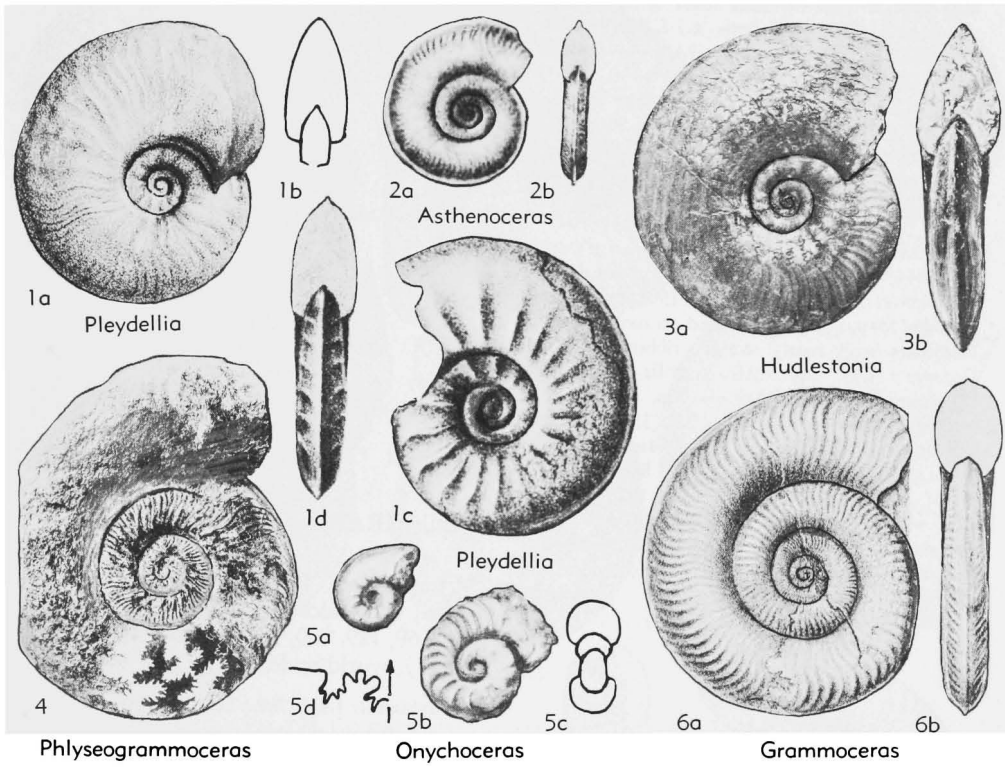


FIG. 294. Hildoceratidae (Grammoceratinae) (p. L261-L262).

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-

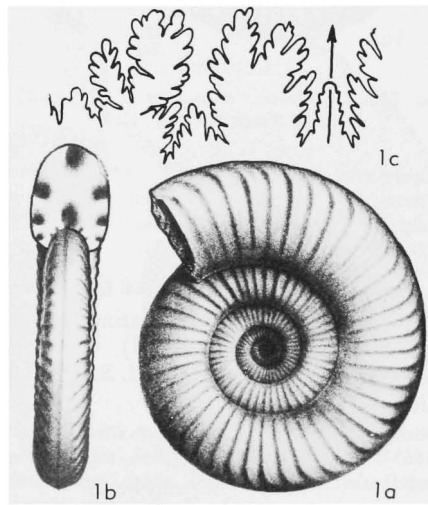


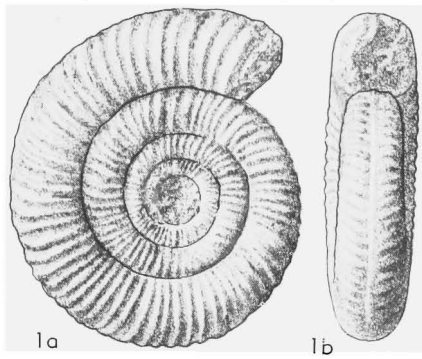
FIG. 295. *Dumortieria levesquei* (D'ORBIGNY), L.Jur. (U.Toarc.), Fr. (p. L262).

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

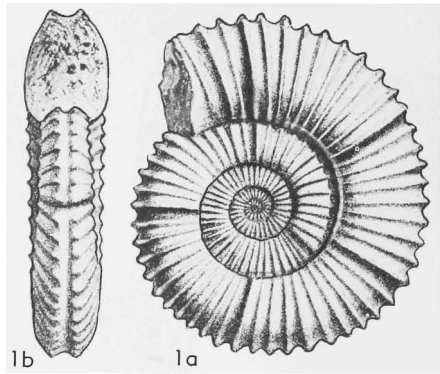
FIG. 296. *Catulloceras dumortieri* (THIOLLIER), L. Jur.(U.Toarc.), Fr. (p. L262).

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.)*, worldwide.

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.*

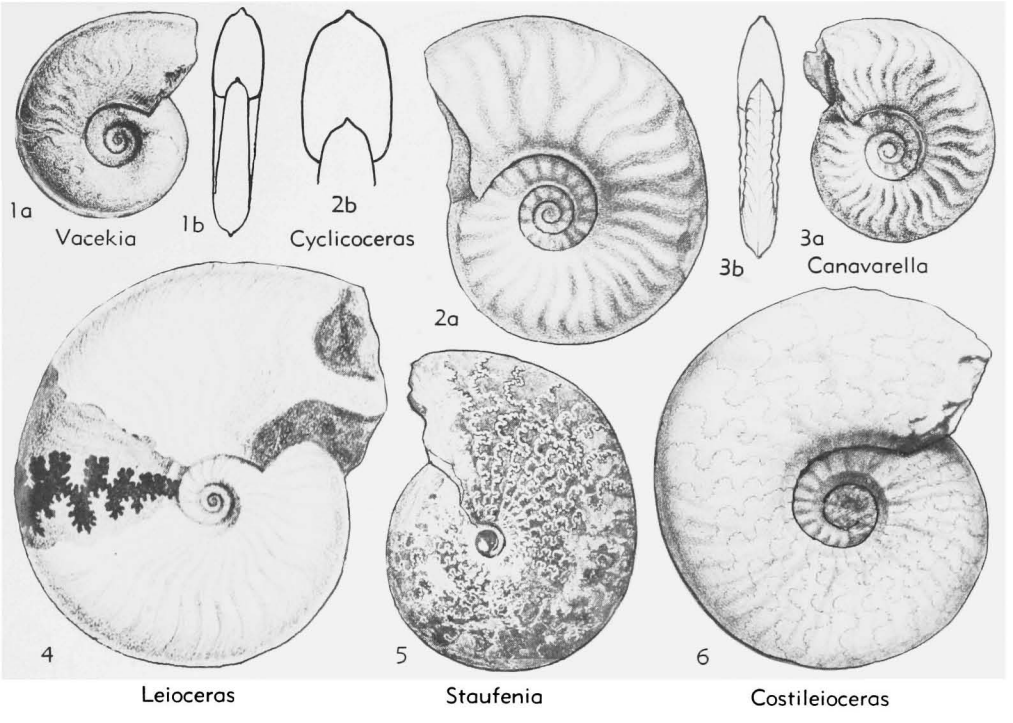


FIG. 298. Graphceratidae (Leioceratinae) (p. L262-L263).

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*].

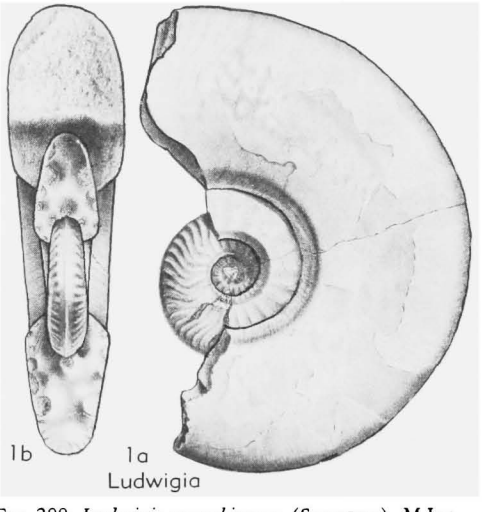


FIG. 299. *Ludwigia murchisonae* (SOWERBY), M.Jur. (L.Baj.), Scot.; *1a,b*, ×0.3 (595*) (p. L263).

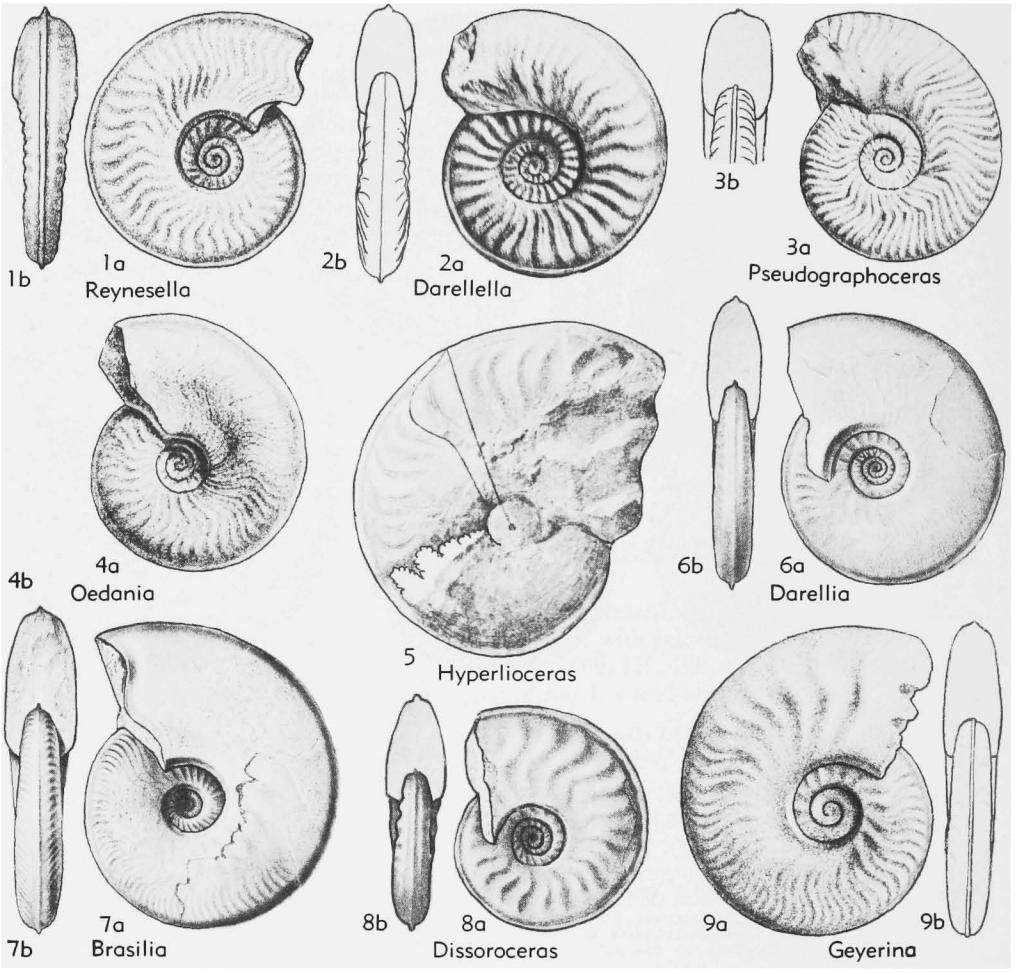


FIG. 300. Graphoceratidae (Graphoceratinae) (p. L263-L265).

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

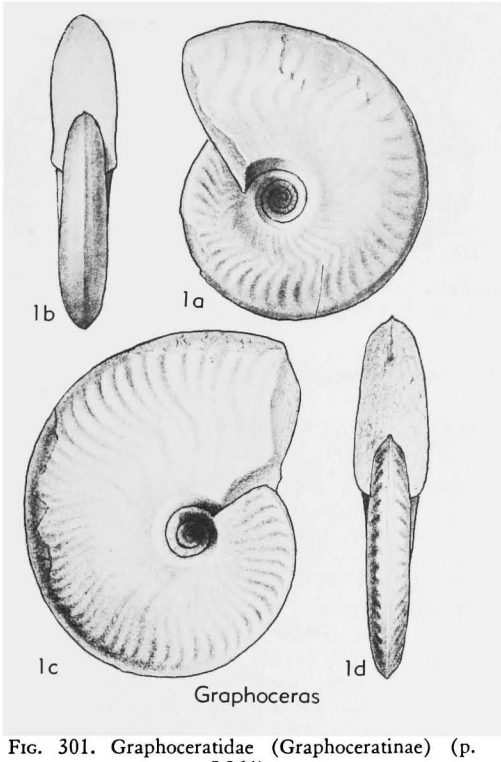


FIG. 301. Graphoceratidae (Graphoceratinae) (p. L264).

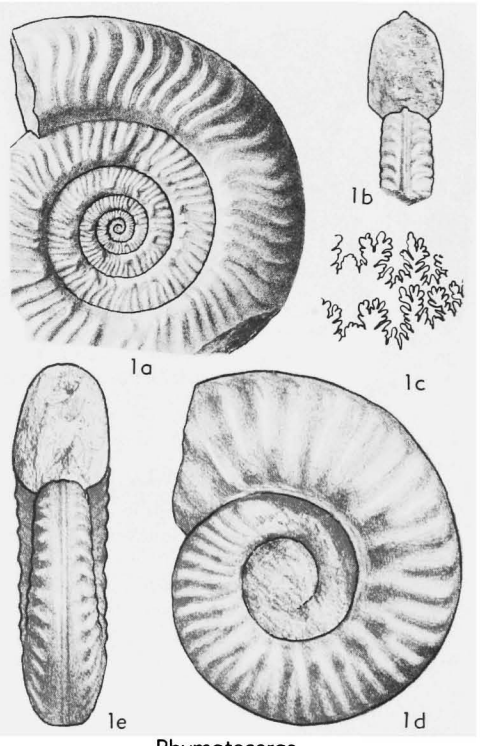


FIG. 302. Hammatoceratidae (Phymatoceratinae) (p. 265).

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.

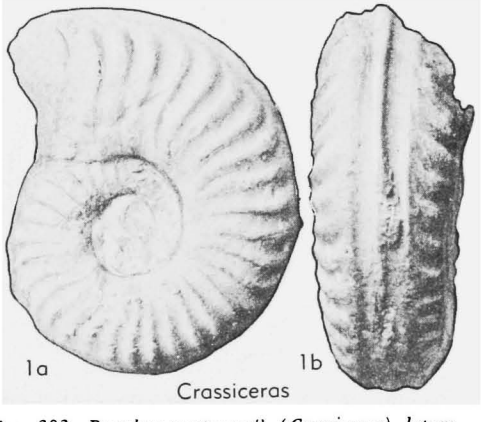


FIG. 303. *Pseudomercaticeras? (Crassiceras) latum* (MERLA), L.Jur.(U.Toarc.), Italy (p. L266).

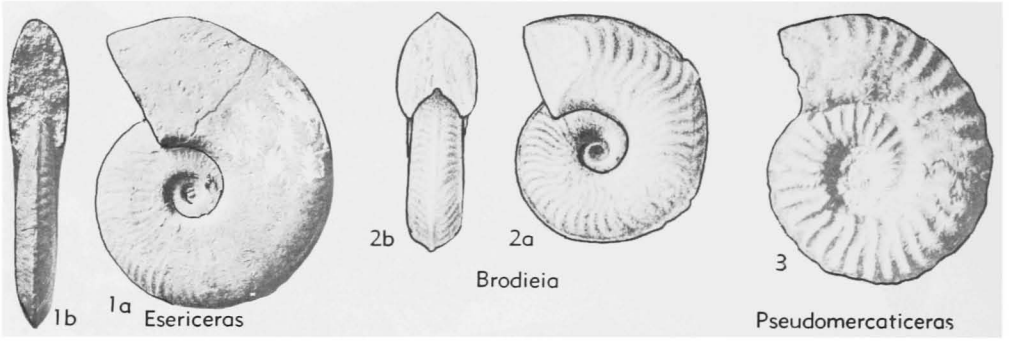


FIG. 304. Hammatoceratidae (Phymatoceratinae) (p. L266).

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*).

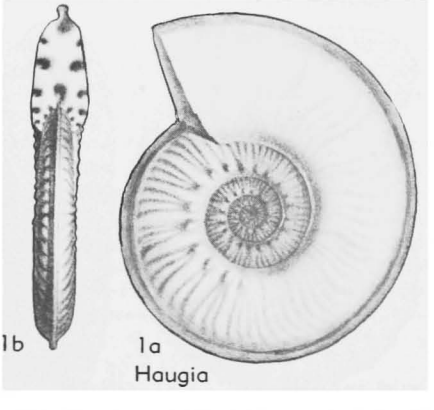


FIG. 305. *Haugia variabilis* (D'ORBIGNY), L.Jur.(U. Toarc.), Fr. (p. L266).

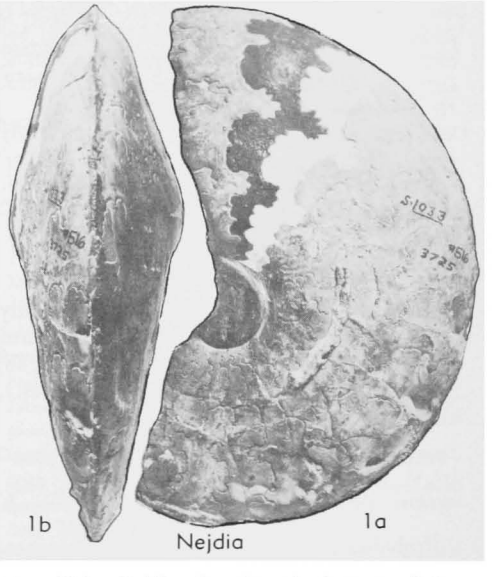


FIG. 306. *Nejdia bramkampi* ARKELL, L.Jur. (Toarc.), C.Arabia; *1a,b*, ×0.7 (583*) (p. L266).

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*).

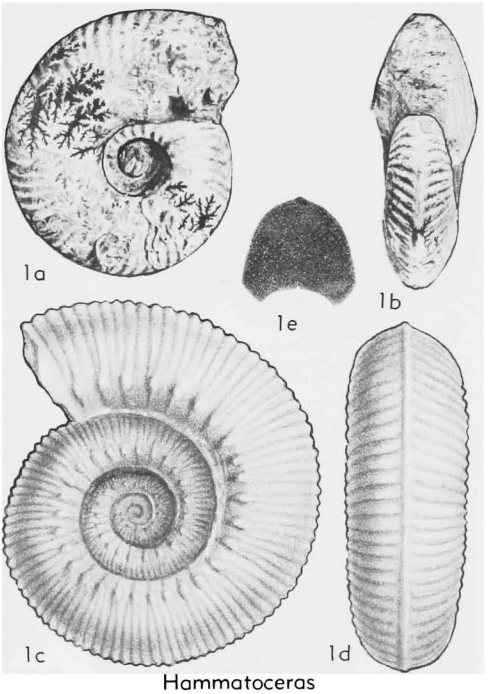
Planammatoceras Buckman, 1922 [**P. planiforme*] [*Parammatoceras* Buck., 1925]. Ribbing with distinct lengthened primaries, some flared on inner whorls, but no tubercles; ribbing fades toward aperture, which is sigmoid. *L.Baj.(murchisonae z.)*, Eu.-Tangan.-?Persia-Japan-S.Am.——Fig. 308, *2a. *P. planiforme*,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

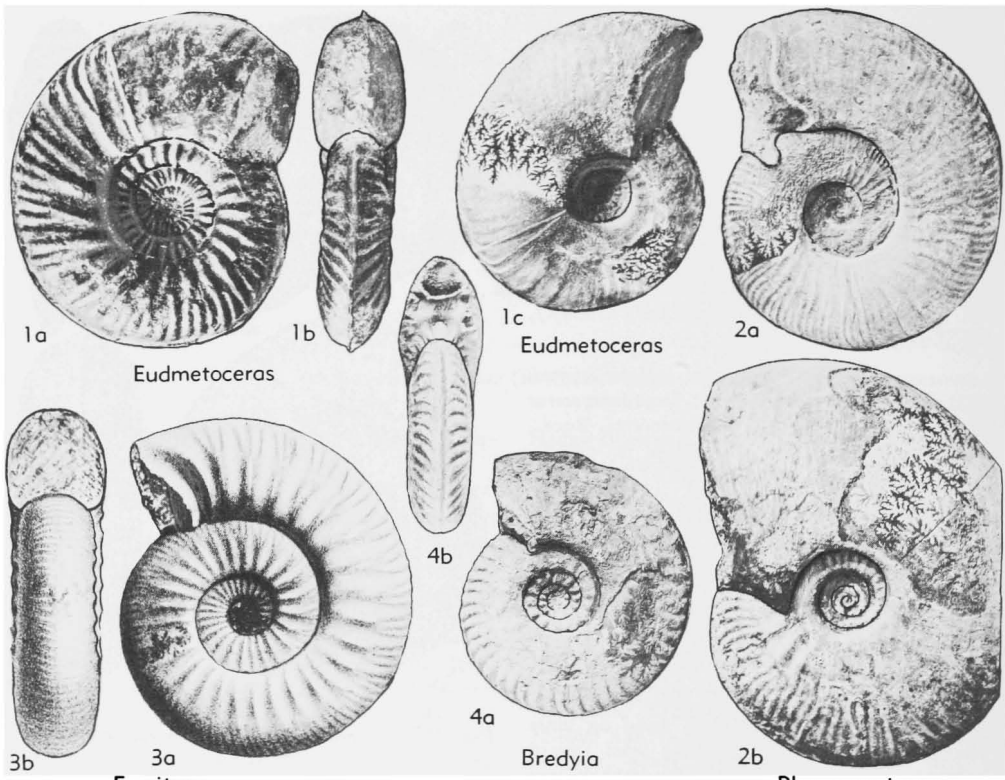


FIG. 308. Hammatoceratidae (Hammatoceratinae) (p. L267).

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

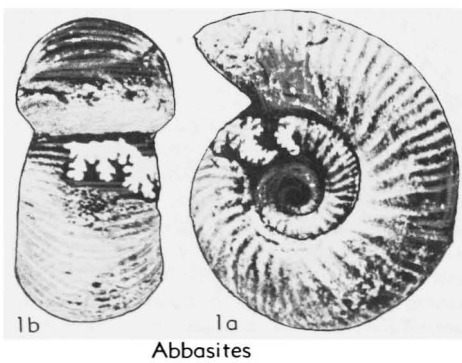


FIG. 309. *Erycites (Abbasites) abbas* (BUCKMAN), M.Jur.(L.Baj.), Eng. (p. L267).

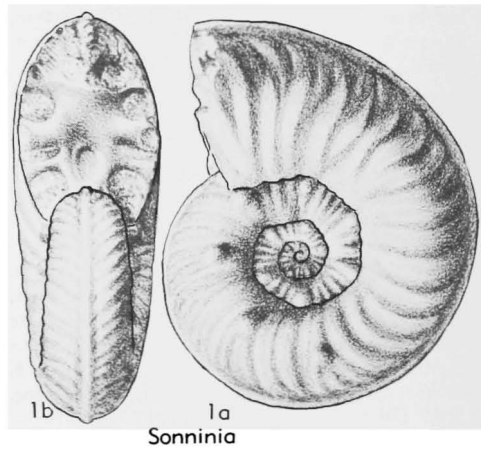


FIG. 310. *Sonninia (Sonninia) propinquans* (BAYLE), M.Jur.(M.Baj.), Fr. (p. L267).

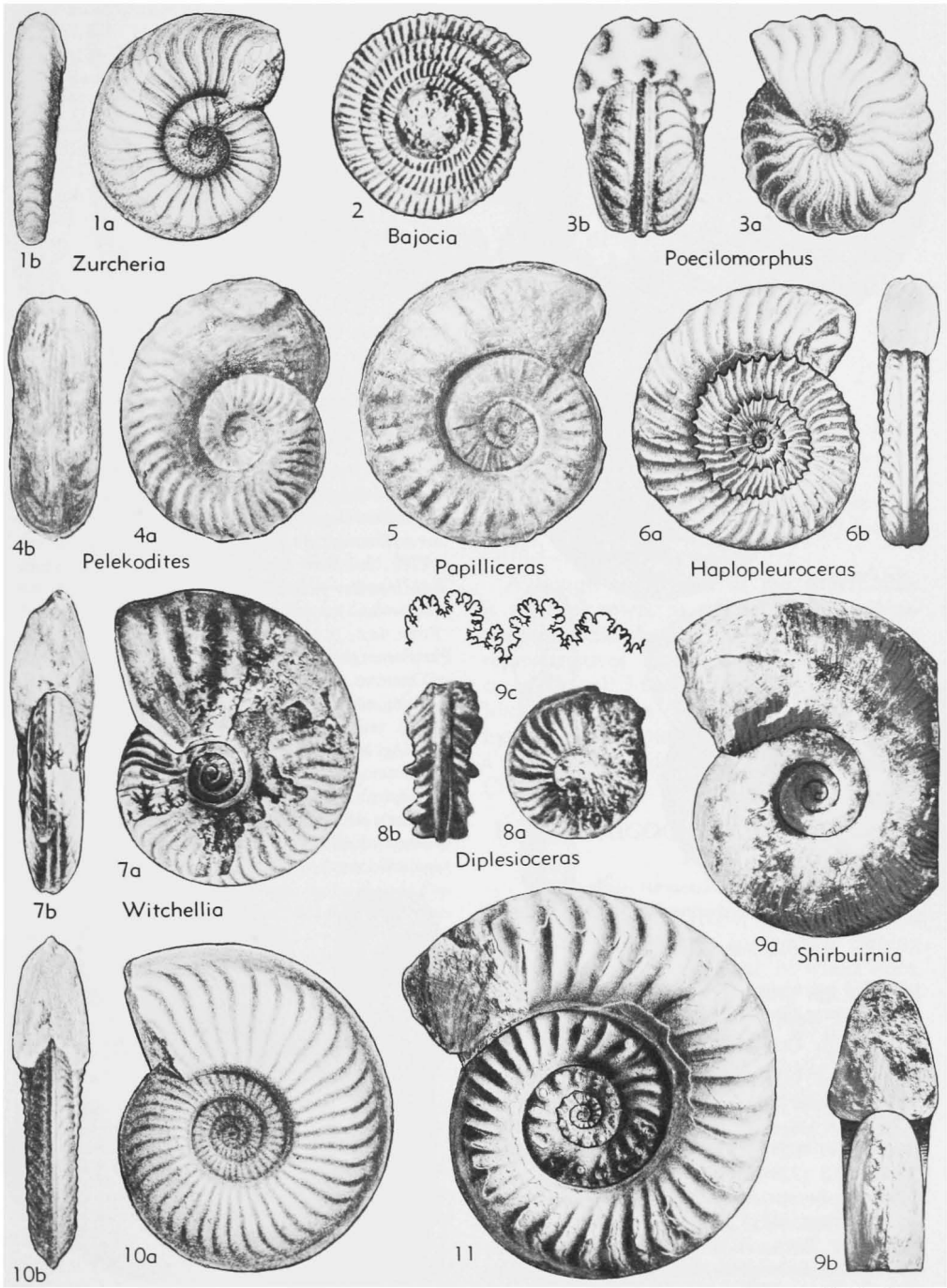


FIG. 311. Sonniniidae (p. L268-L270).

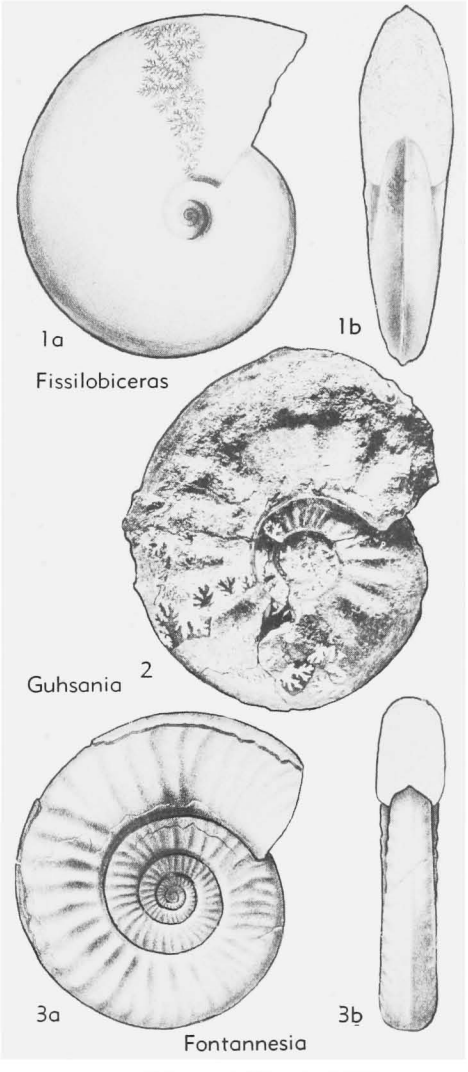


FIG. 312. Sonniniidae (p. L270).

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

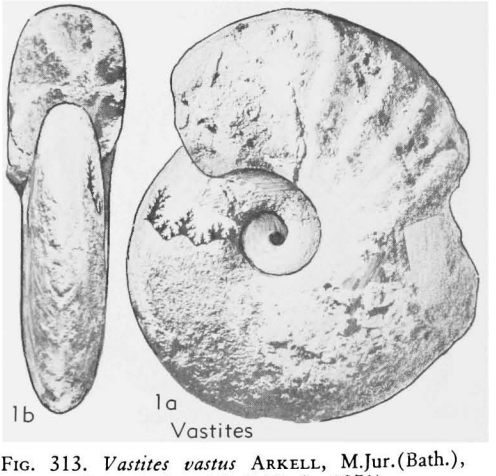


FIG. 313. *Vastites vastus* ARKELL, M.Jur.(Bath.), Eng.; *1a,b*, ×0.2 (14*) (p. L271).

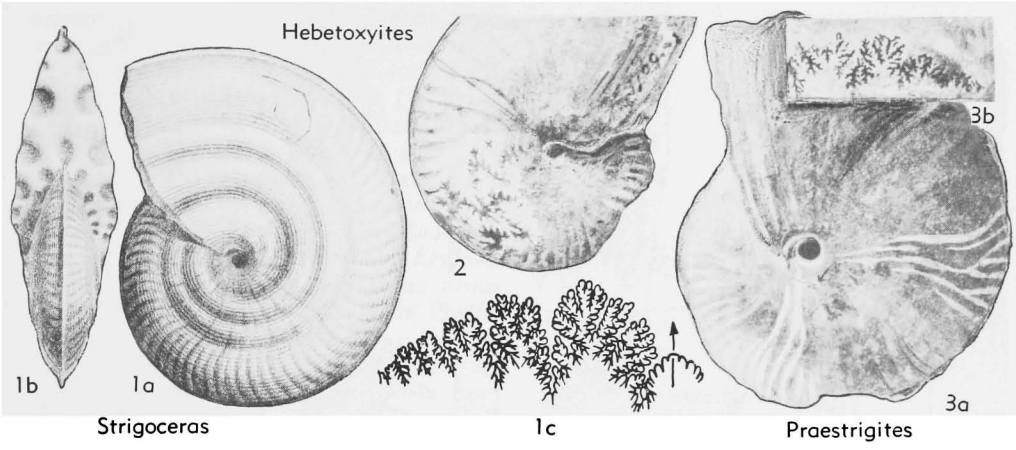


FIG. 314. Strigoceratidae (p. L271-L272).

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*).

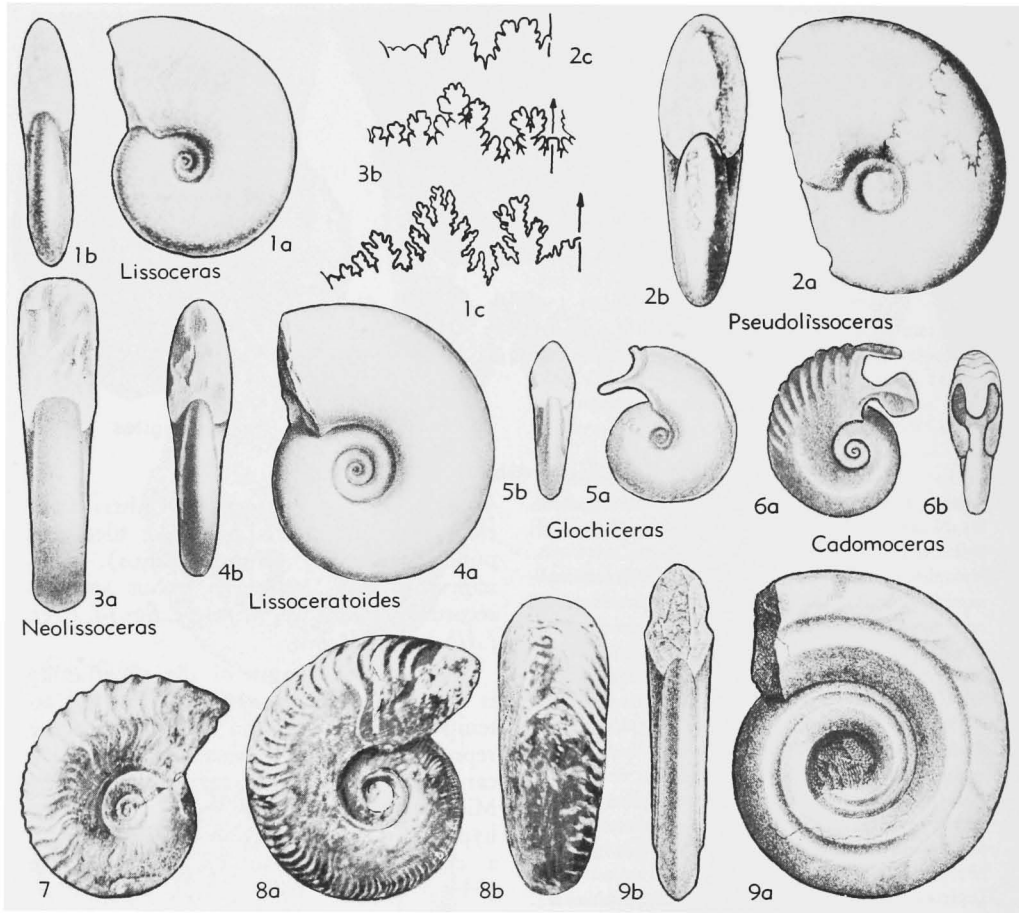


FIG. 315. Haploceratidae (p. L273-L274).

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*).

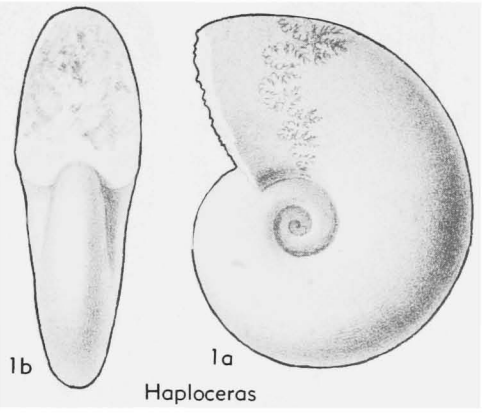


FIG. 316. *Haploceras elimatum* (OPPEL), U.Jur. (Tithon.), Eu. (p. L273).

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*).

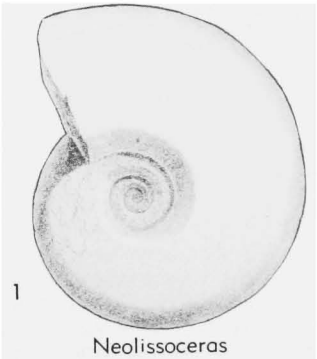
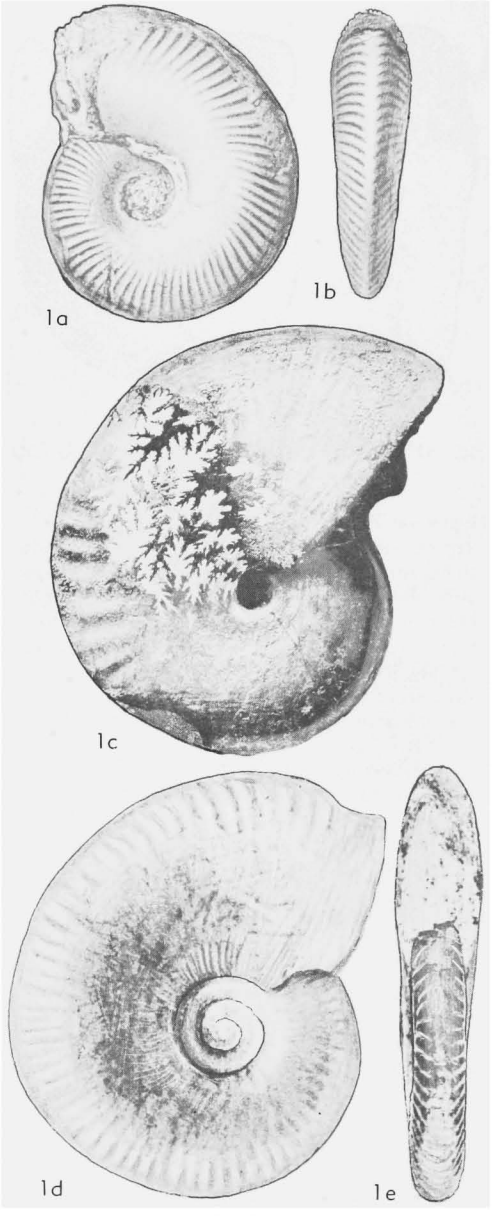


FIG. 317. *Neolissoceras grasianum* (D'ORBIGNY), U. Jur.(U.Tithon.), Fr.; ×0.5 (329*) (p. L273).



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.

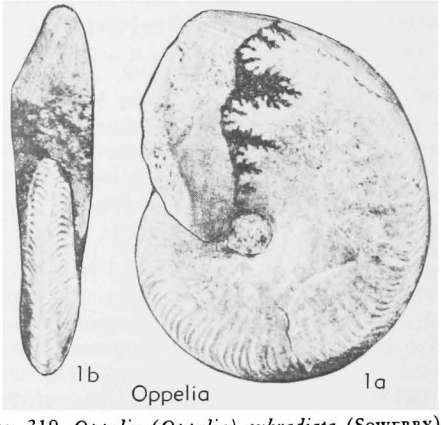


FIG. 319. *Oppelia (Oppelia) subradiata* (SOWERBY), M.Jur.(M.Baj.), Eng. (p. L275).

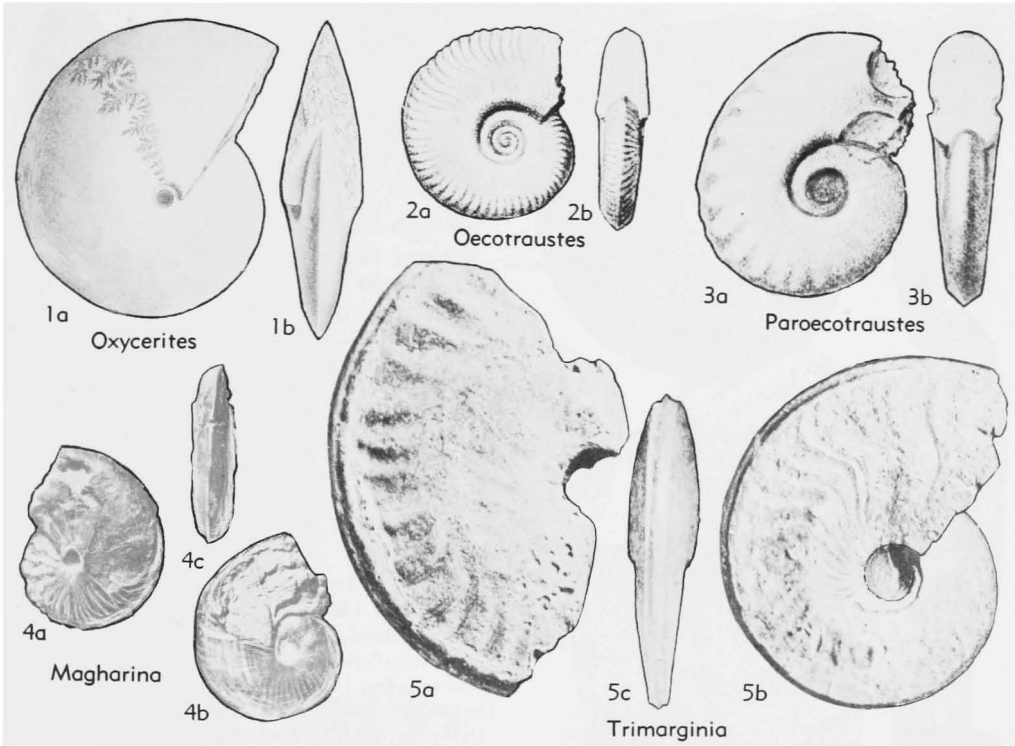


FIG. 320. Oppeliidae (Oppeliinae) (p. L275-L276).

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*).

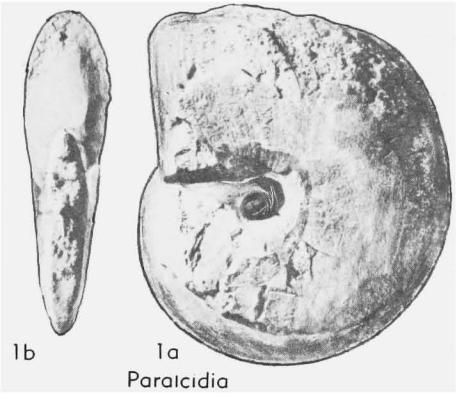


FIG. 321. *Paralcidia khengari* SPATH, M.Jur. (Callov.), Cutch; *1a,b,* ×0.7 (p. L275).

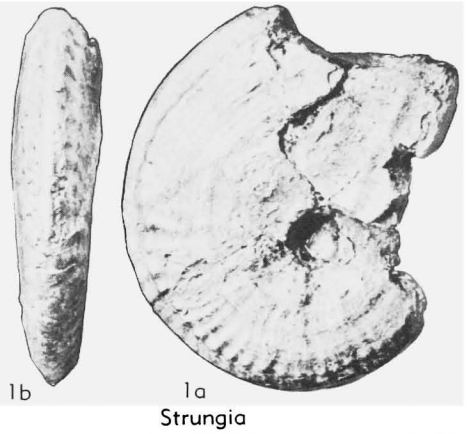


FIG. 322. *Strungia redlichi* (POPOVICI-HATZEG), M. Jur.(Bath.), Rumania (p. L275).

?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-

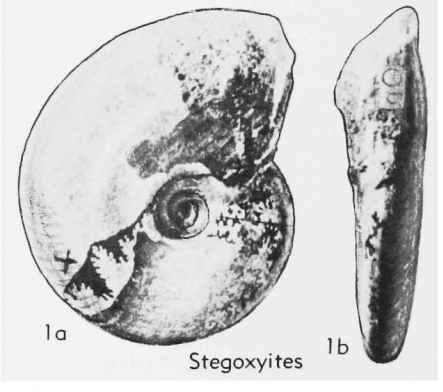


FIG. 323. *Oecotraustes? (Stegoxyites) parcicarinatus* (BUCKMAN), M.Jur.(M.Baj.), Eng. (p. L276).

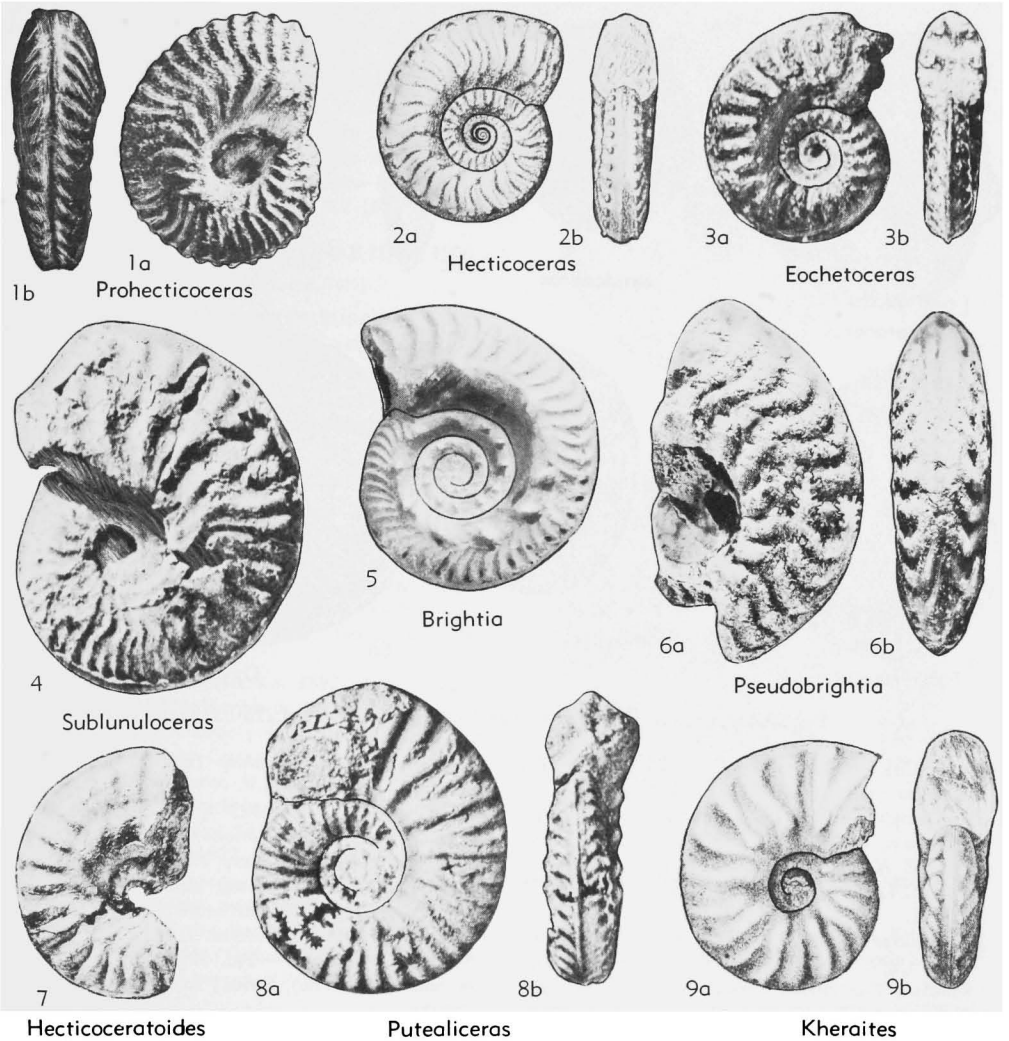


FIG. 324. Oppeliidae (Hecticoceratinae) (p. L276-L278).

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.-

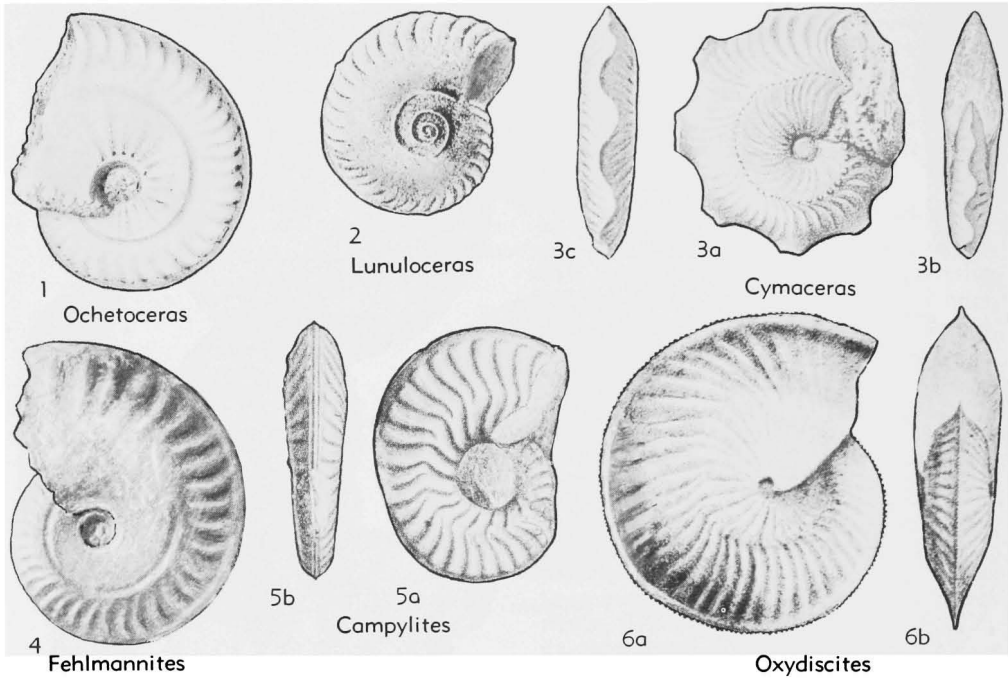


FIG. 325. Oppeliidae (Hecticoceratinae, Ochetoceratinae) (p. L276-L279).

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*).

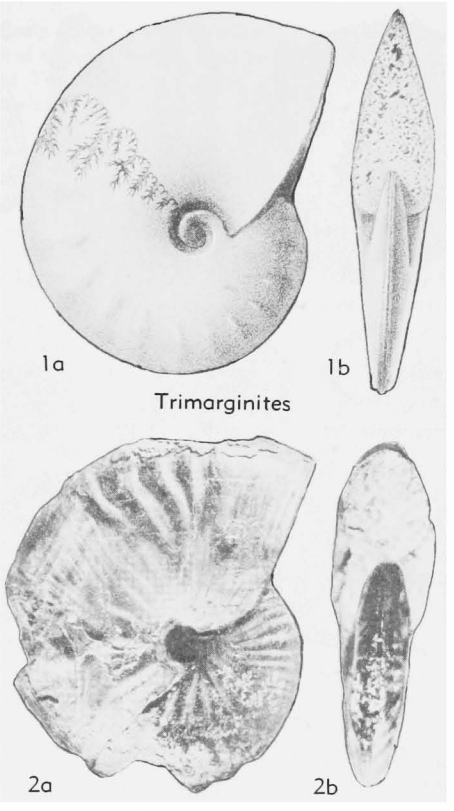


Fig. 326. Oppeliidae (Ochetoceratinae) (p. L278).

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

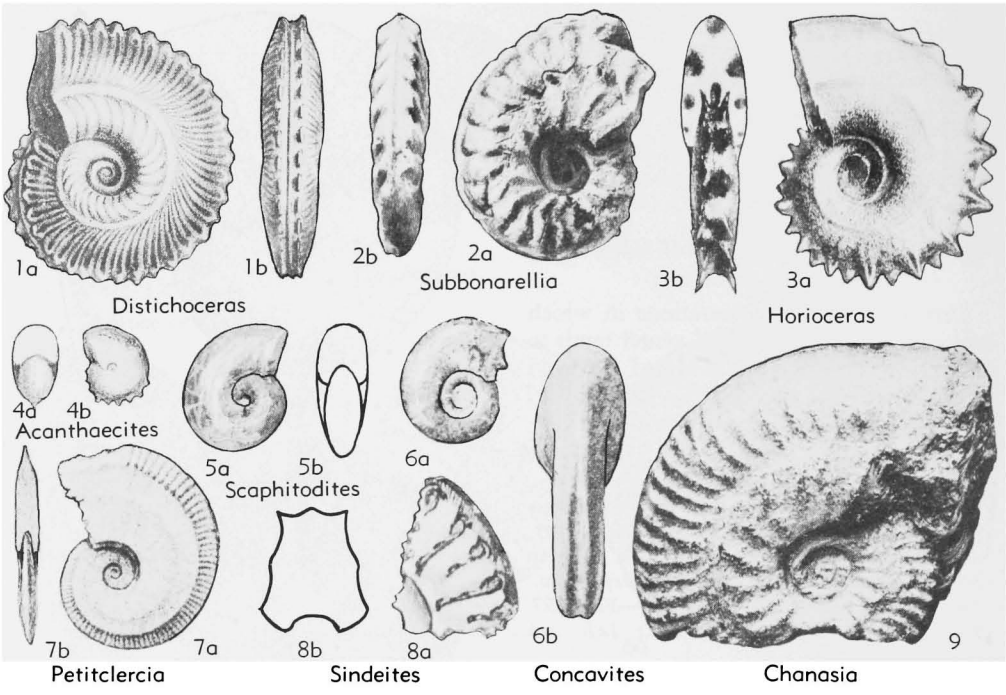


FIG. 327. Oppeliidae (Distichoceratinae, Taramelliceratinae) (p. L279-L282).

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*).

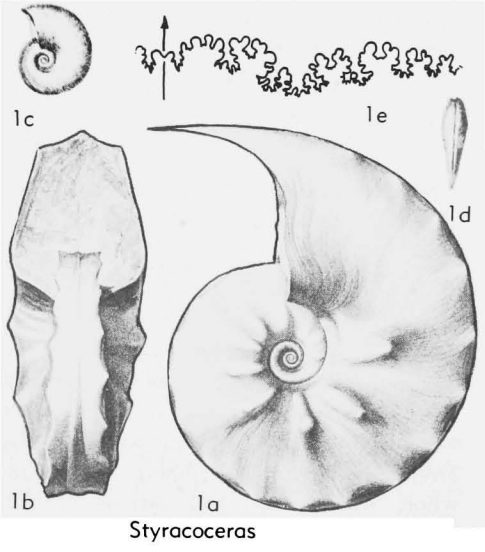


FIG. 328. *Styracoceras balduri* (KEYSERLING), M.Jur. (M.Callov.), N.Russ. (p. L279).

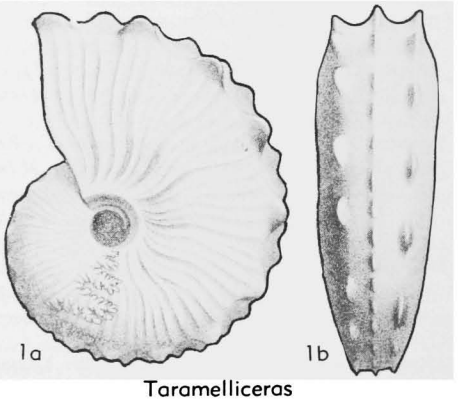


FIG. 329. *Taramelliceras (Taramelliceras) trachinotum* (OPPEL), U.Jur.(L.Kimm.), Ger. (p. L280).

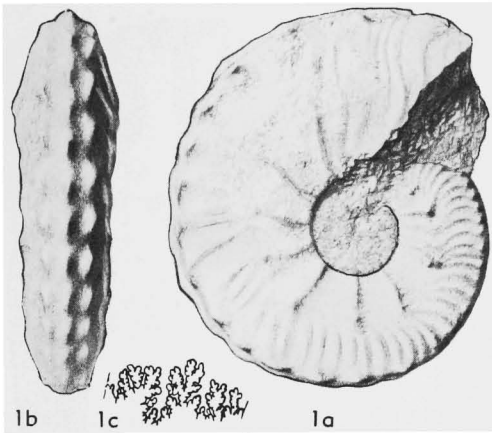


FIG. 330. *Taramelliceras (Fontannesiella) valentina* (FONTANNES), U.Jur.(Kimm.), Fr. (p. L281).

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).

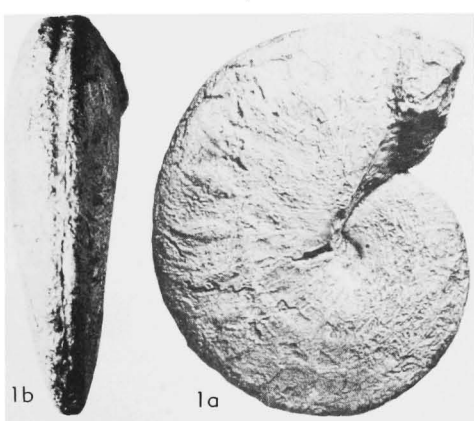


FIG. 331. *Taramelliceras (Strebliticeras) pictus tegulatus* (QUENSTEDT), U.Jur.(L.Kimm.), Ger. (p. L281).

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*).

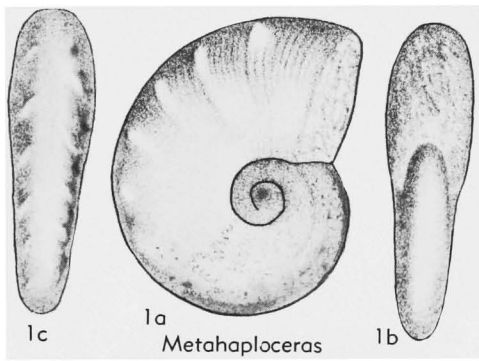


FIG. 332. *Taramelliceras (Metahaploceras) affine* (SPATH), U.Jur.(Kimm.), Ger. (p. L281).

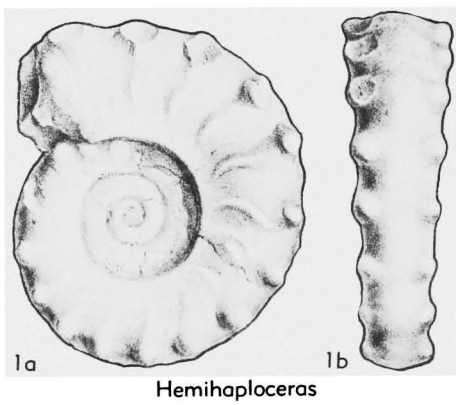


FIG. 333. *Hemihaploceras nobilis* (NEUMAYR), U. Jur.(Kimm.), Rumania (p. L281).

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.*

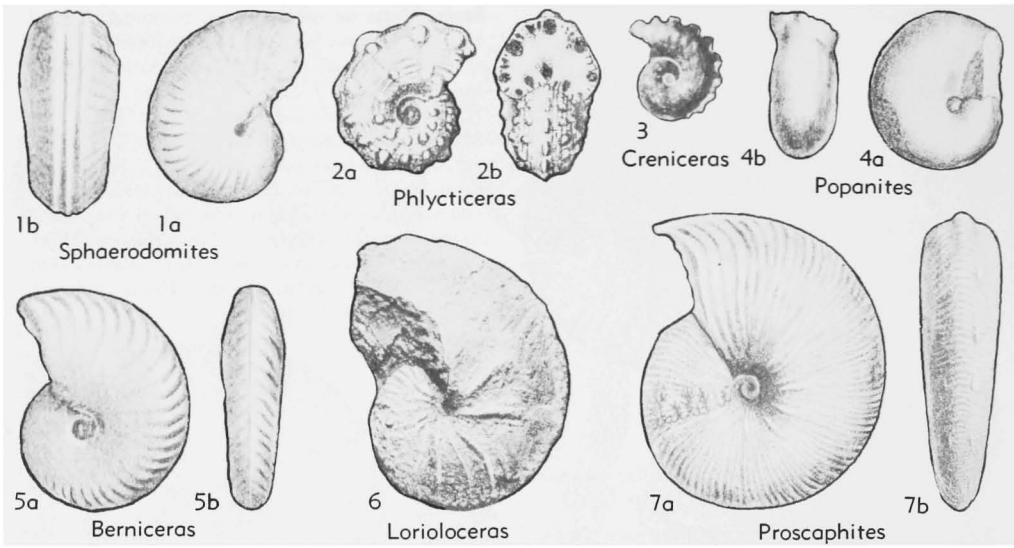


FIG. 334. Oppeliidae (Taramelliceratinae, Phlycticeratinae) (p. L281-L283).

(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-*

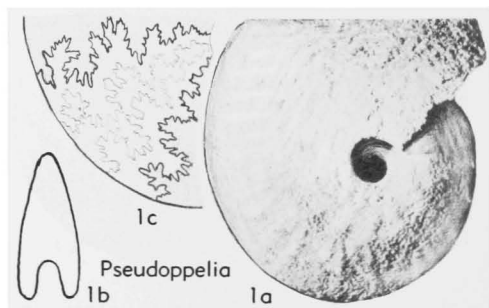


FIG. 335. *Streblites (Pseudoppelia) oxynotus* (LEANZA), U.Jur.(L.Kimm.), Arg. (p. L284).

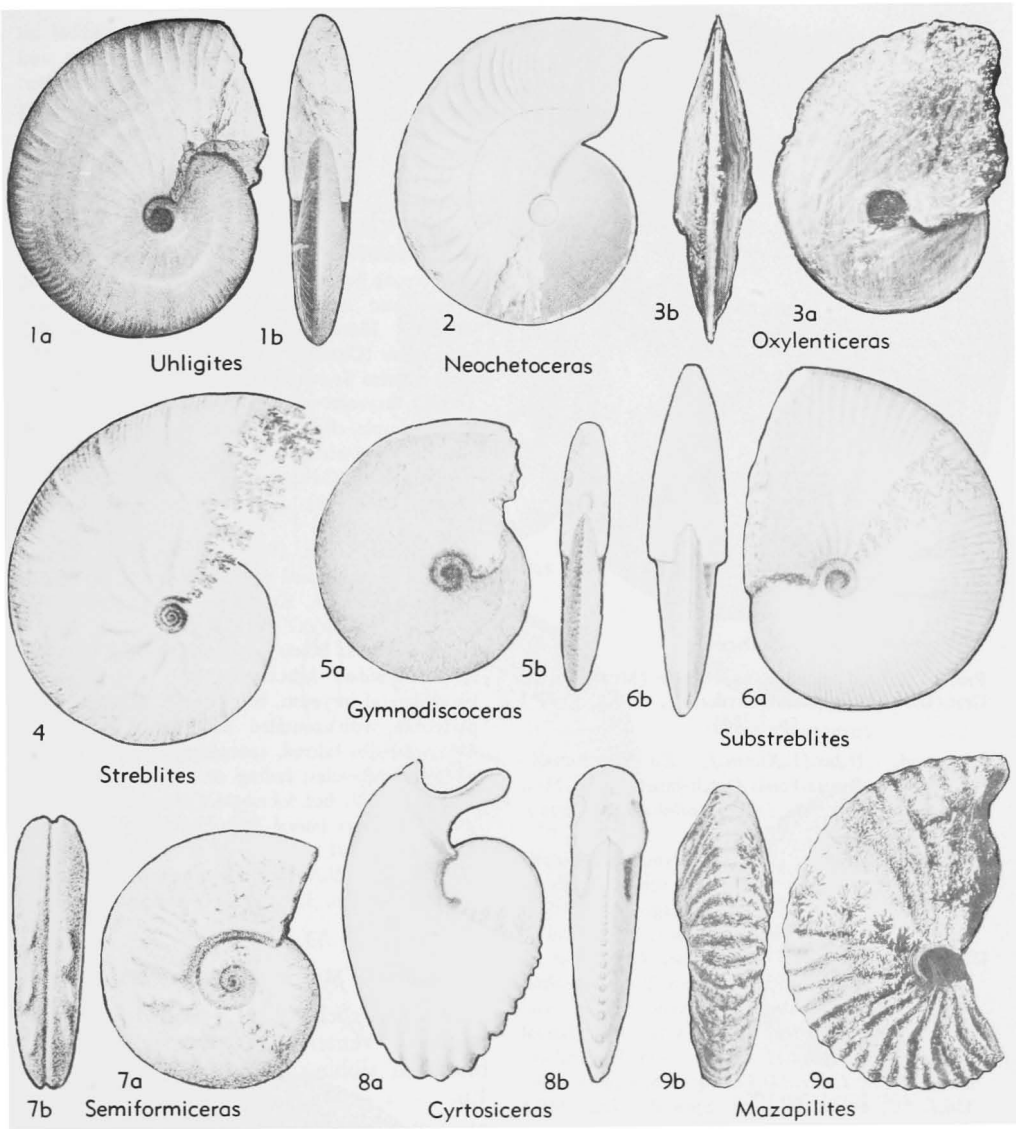


FIG. 336. Oppeliidae (Streblitinae, Mazapilitinae) (p. L283-L284).

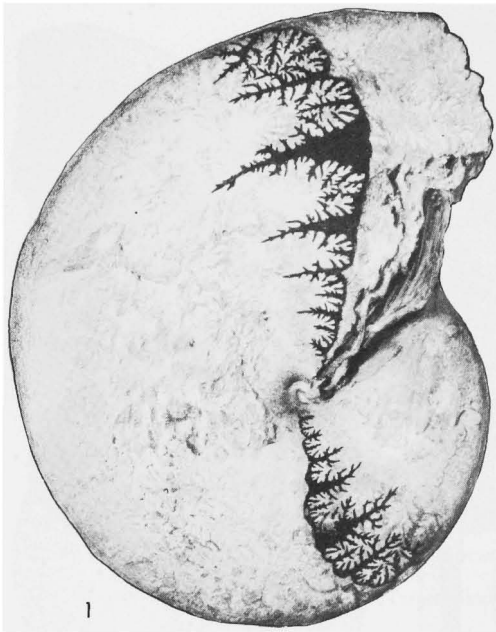
ceras (pointed out by LOCZY, 1915, p. 313) might be taken to point to affinity with Stephanoceratacea, alongside *Chamoussetia;* and BUCKMAN (1914, pl. 98) even figured a *Chamoussetia* as *Phlycticeras*. But the true derivation is more likely to be from some Bathonian Oppeliinae, perhaps via *Strungia*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

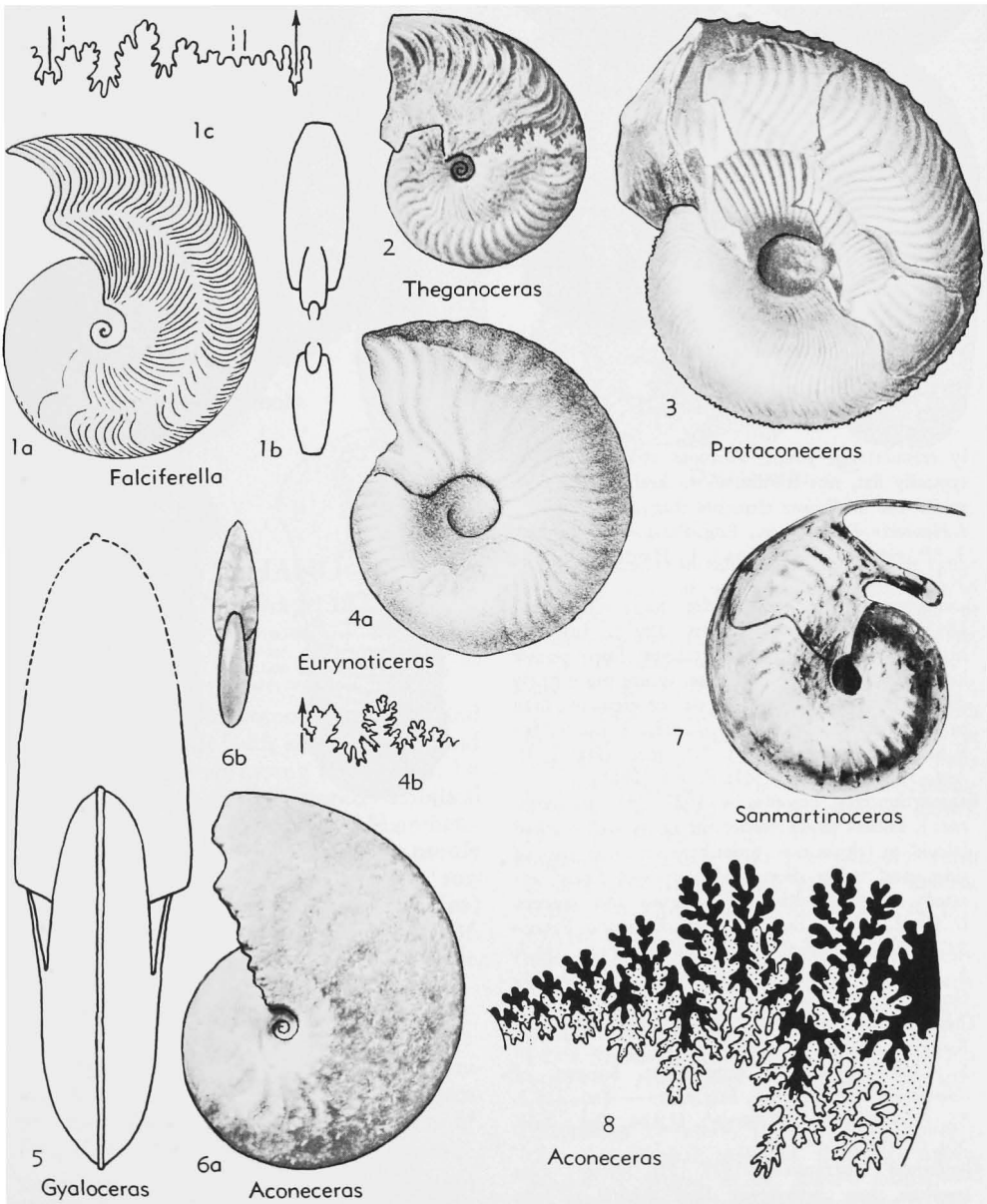


Fig. 338. Oppeliidae (Mazapilitinae, Aconeceratinae) (p. L284-L286).

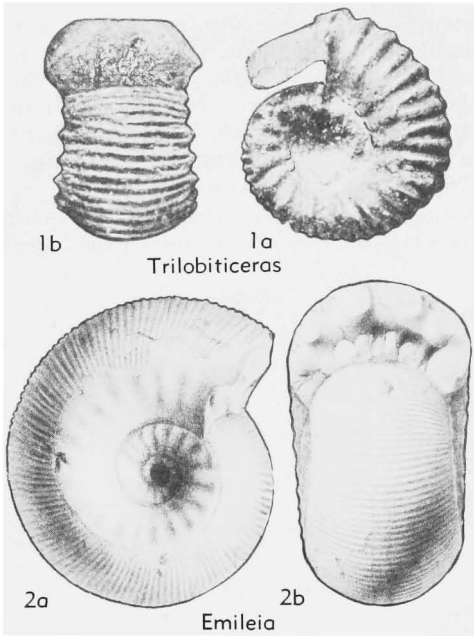


FIG. 339. Otoitidae (p. L287).

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*).

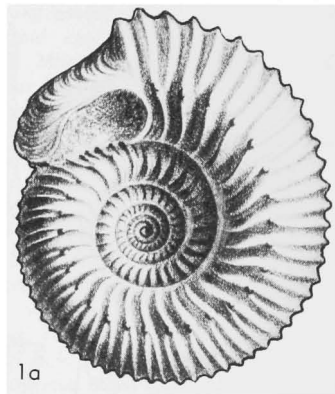
Aconeceras HYATT, 1903 [**Am. nisus* D'ORBIGNY, 1841] [=*Adolphia* STOLLEY, 1907]. Involute, high-whorled with flat sides and very finely serrate keel. Radial line more angulate, suture more finely divided and with narrower, deeper elements than in *Protaconeceras*. *U.Barrem.-L.Alb.*, W.Eu.-S.Afr.-E.Austral.——FIG. 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*).



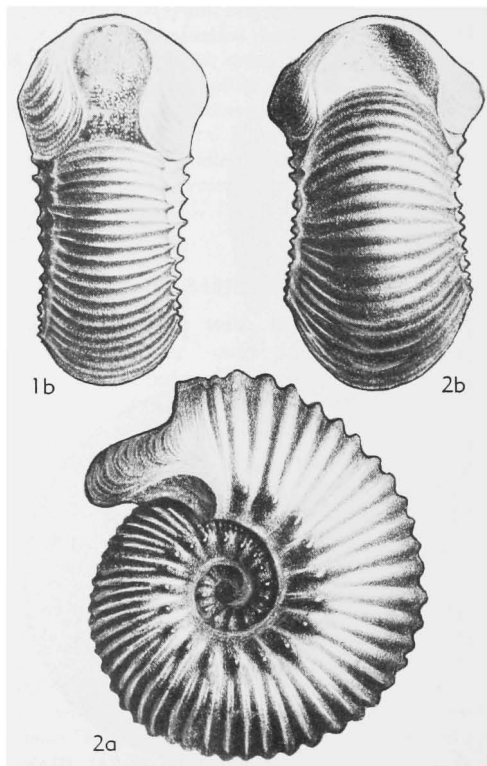


FIG. 340. Otoitidae (p. L287-L289).

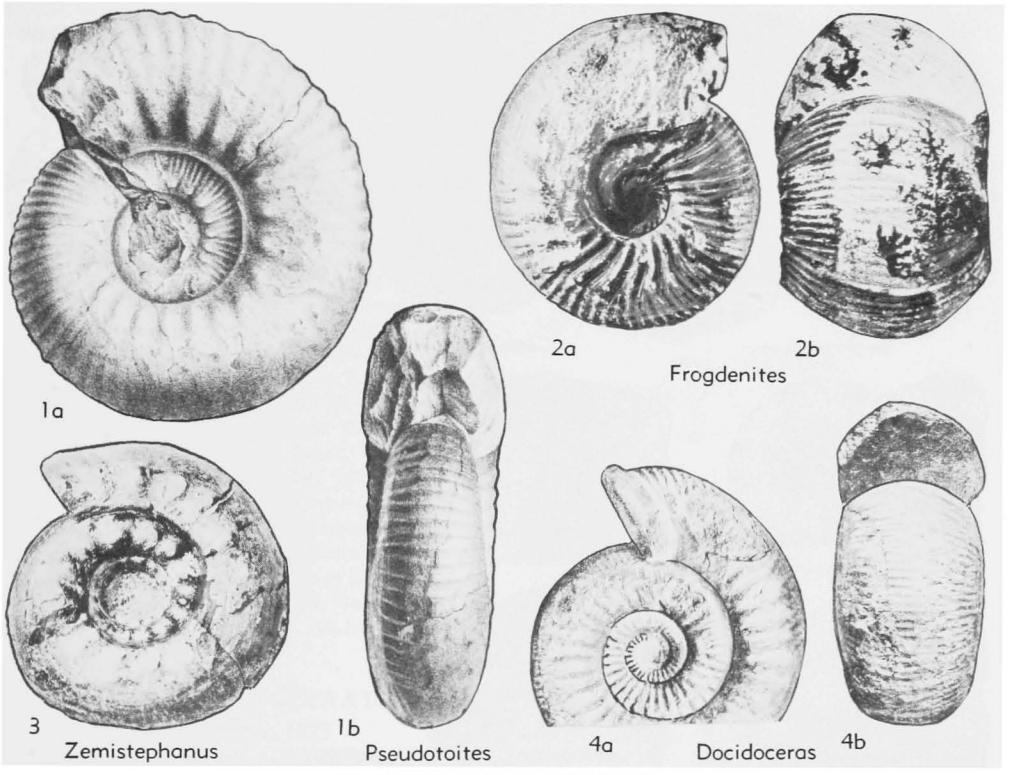


FIG. 341. Otoitidae (p. L287-L289).

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*).

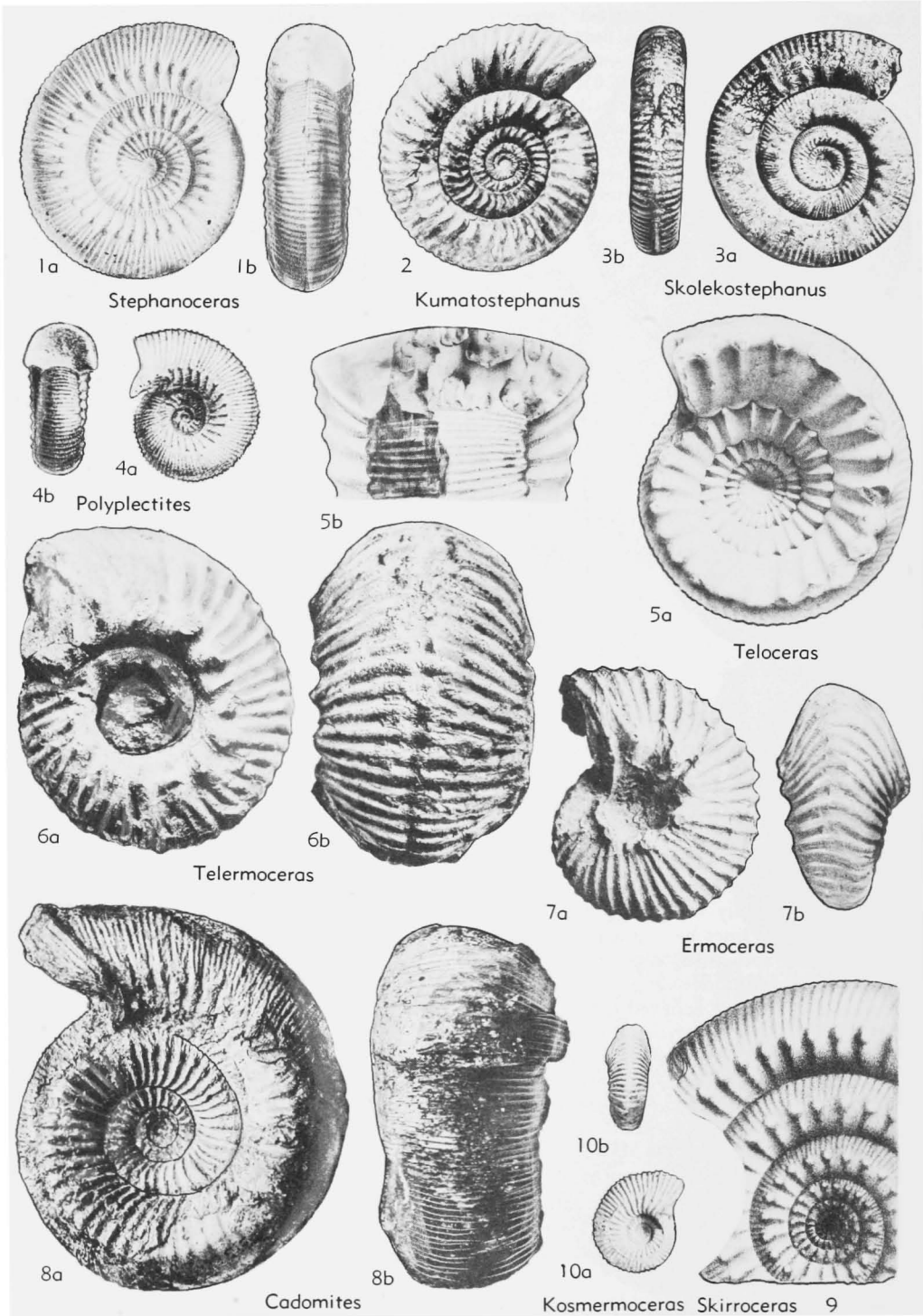


FIG. 342. Stephanoceratidae (p. L289-L290).

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*).

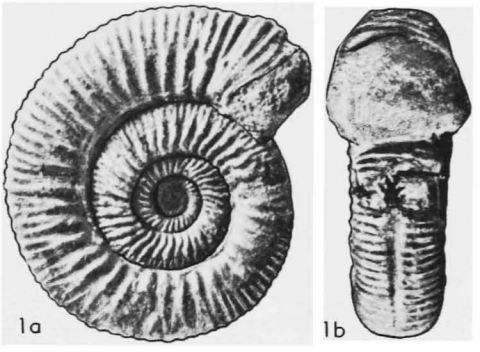
Family STEPHANOCERATIDAE Neumayr, 1875

[*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

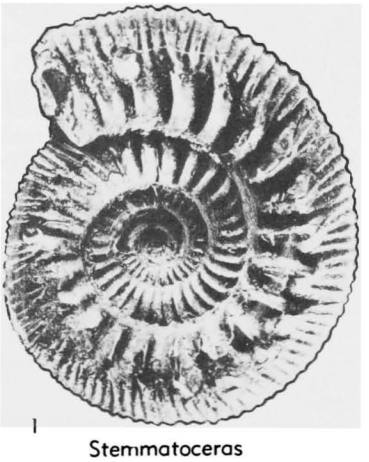
FIG. 343. *Stephanoceras (Phaulostephanus) paululum* (BUCKMAN), M.Jur.(M.Baj.), Eng.; *1a,b*, ×1 (65*) (p. L289).

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).

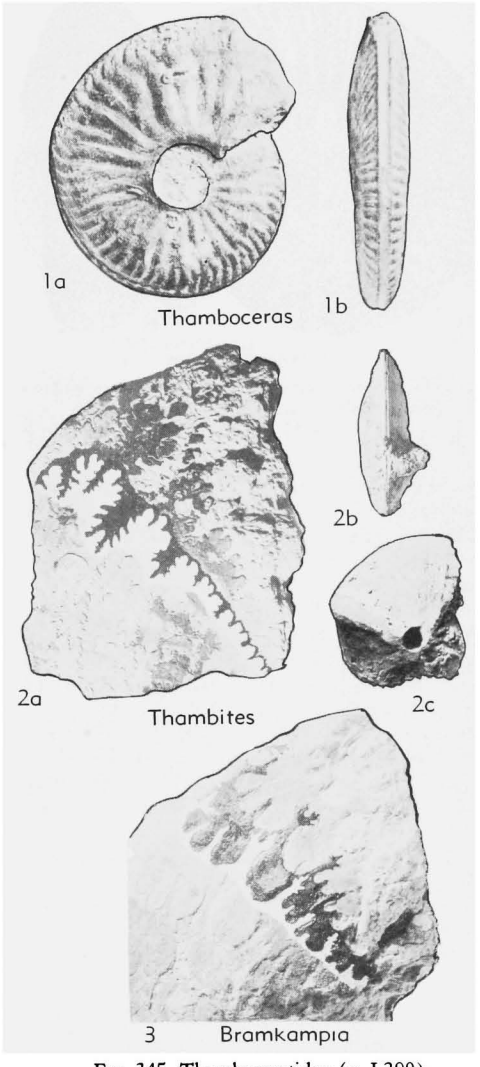


FIG. 345. Thamboceratidae (p. L290).

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*).

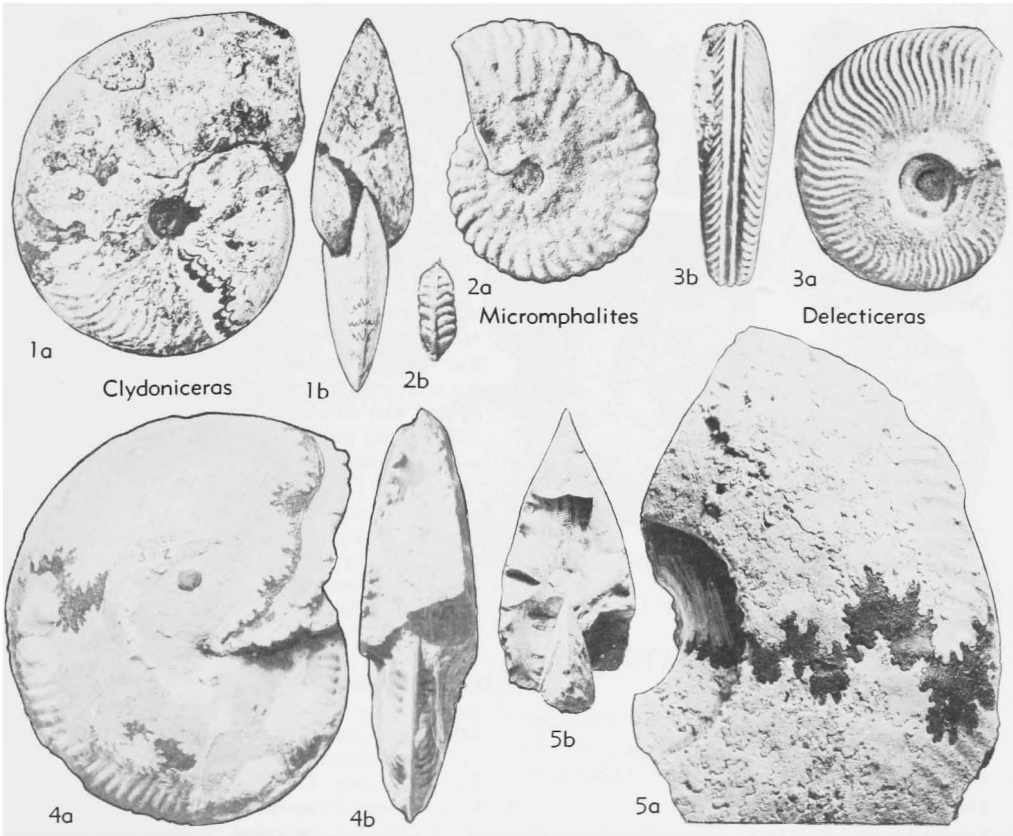


FIG. 346. Clydoniceratidae (p. L291).

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*).

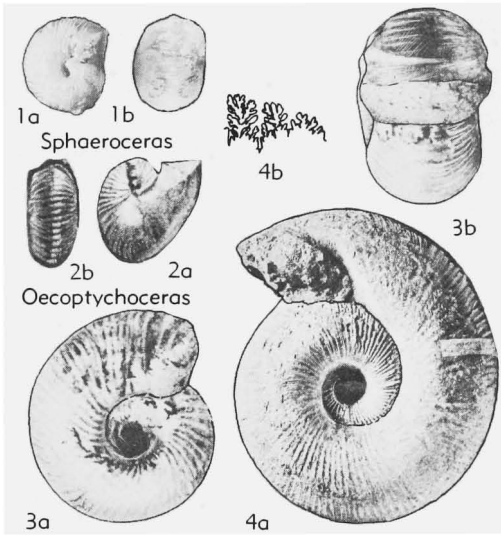


FIG. 347. Sphaeroceratidae (p. L292).

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.*

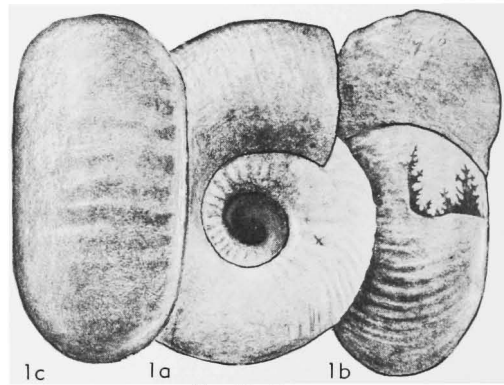


FIG. 348. *Tulites (Rugiferites) rugifer* (BUCKMAN), M.Jur.(M.Bath.), Eng.; *1a-c*, ×0.5 (65*) (p. L292).

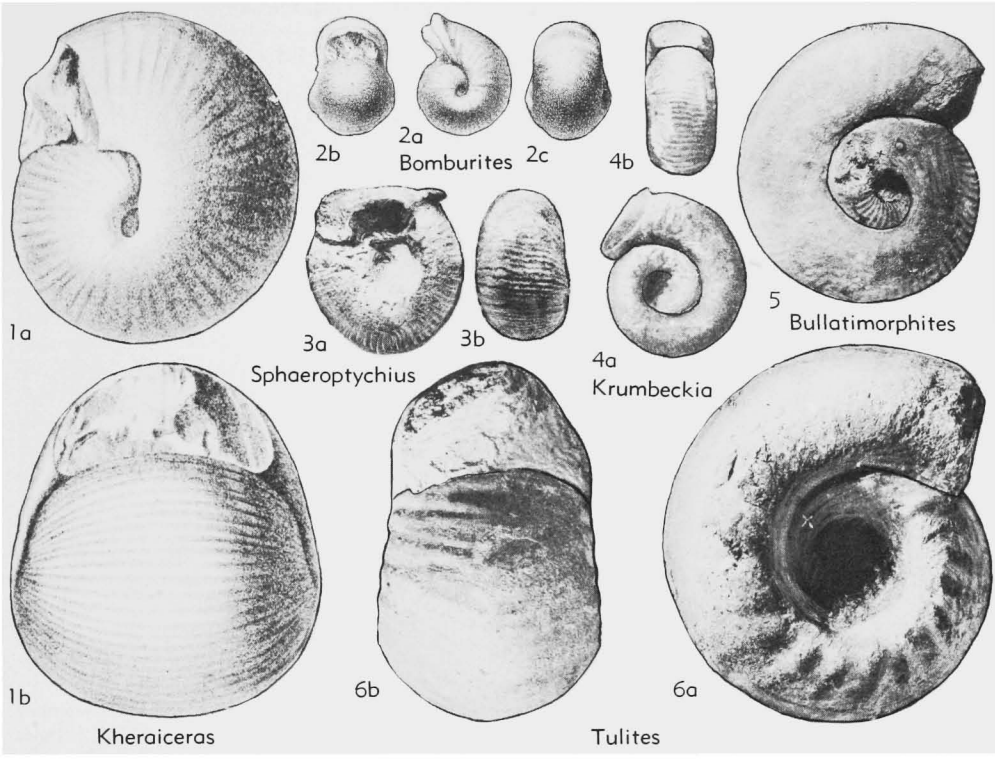


FIG. 349. Tulitidae (p. L292-L293).

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.*

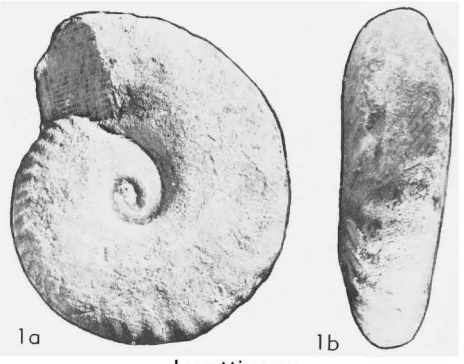


FIG. 350. *Lycetticeras lycetti* ARKELL, M.Jur.(M. Bath.), Eng.; *1a,b*, ×0.7 (16*) (p. L293).

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*).

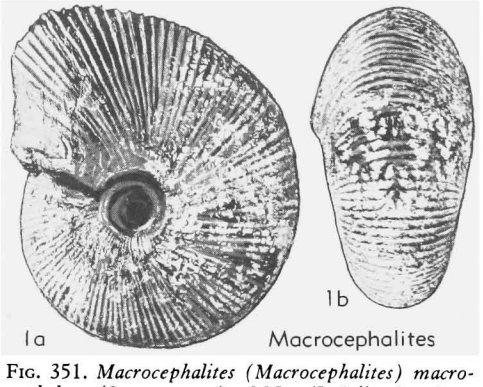


FIG. 351. *Macrocephalites (Macrocephalites) macrocephalus* (SCHLOTHEIM), M.Jur.(L.Callov.), Ger.; *1a,b*, ×0.5 (65*) (p. L294).

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*).

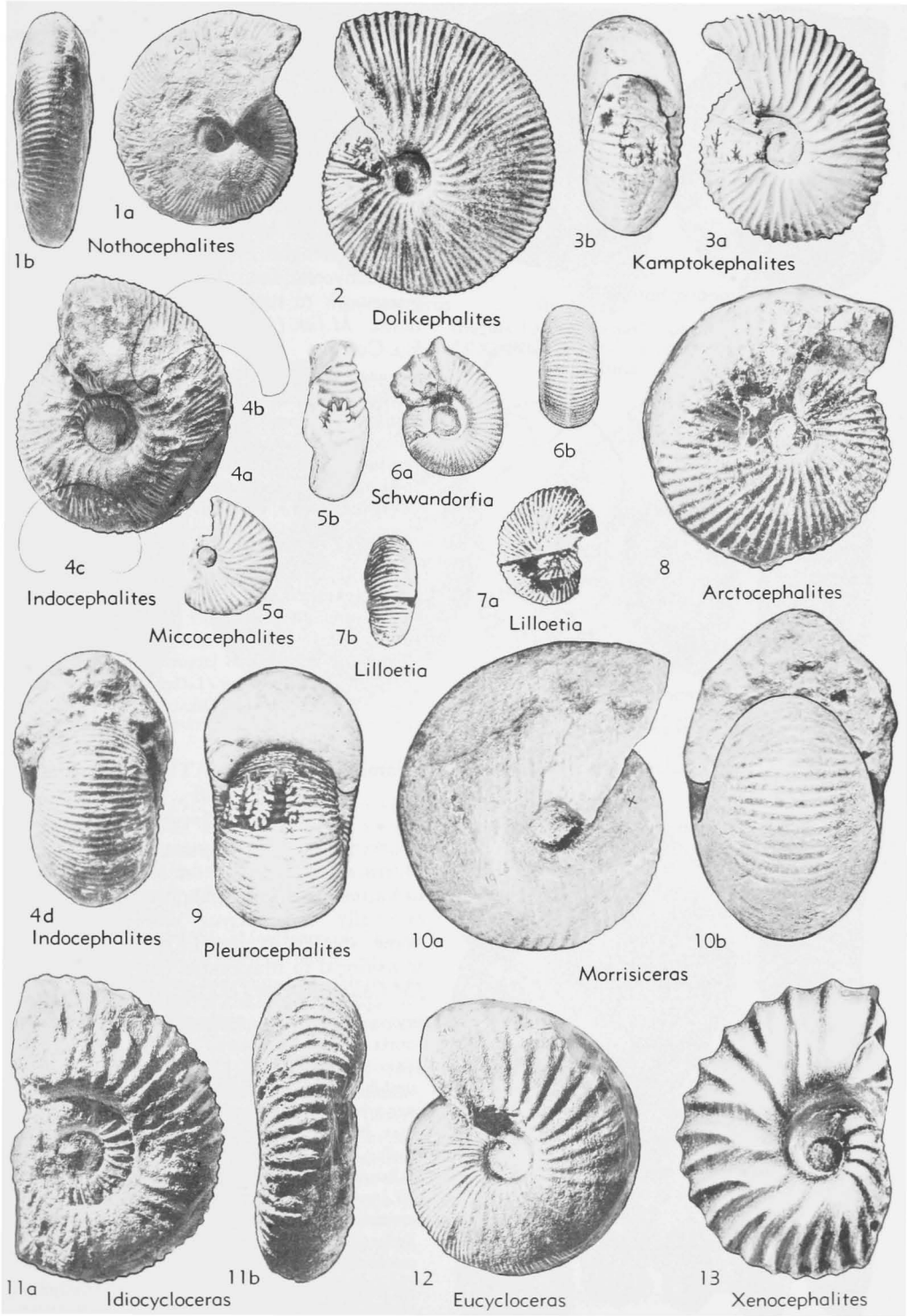


FIG. 352. Tulitidae, Macrocephalitidae (p. L293-L294, L301-L302).

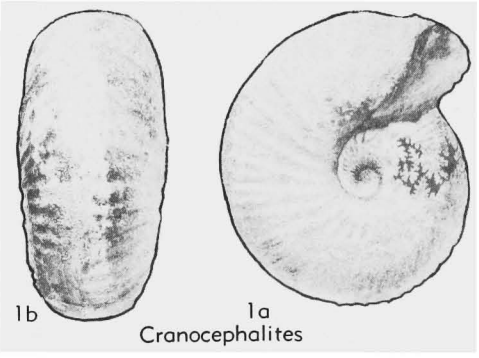


FIG. 353. *Arctocephalites (Cranocephalites) vulgaris* (SPATH), M.Jur.(L.Callov.), Greenl.; *1a,b*, ×0.5 (469*) (p. L301).

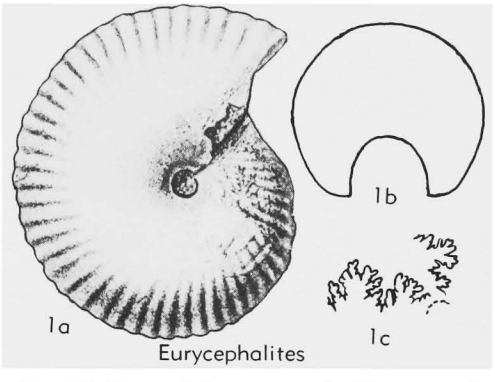


FIG. 354. *Eurycephalites vergarensis* (BURCKHARDT), M.Jur.(L.Callov.), Arg.; *1a-c*, ×0.7 (68*) (p. L294).

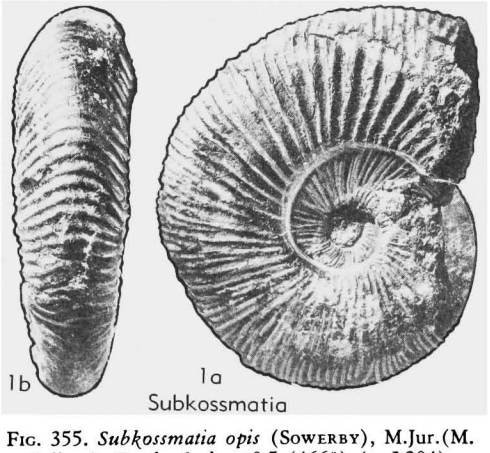


FIG. 355. *Subkossmatia opis* (SOWERBY), M.Jur.(M. Callov.), Cutch; *1a,b*, ×0.5 (466*) (p. L294).

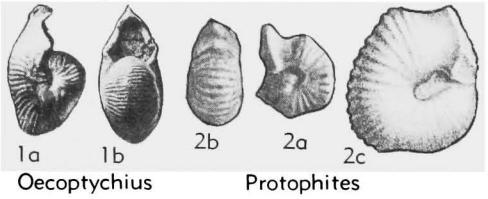


FIG. 356. Oecoptychiidae (p. L296).

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*

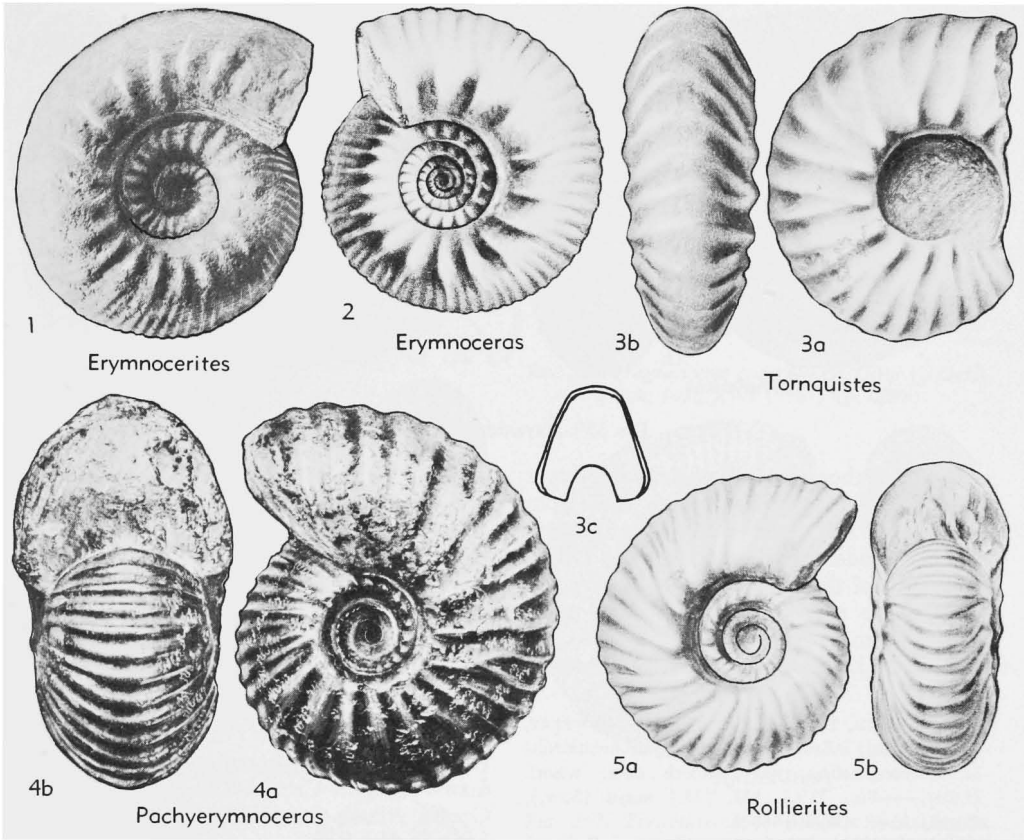


FIG. 357. Pachyceratidae (p. L296-L297).

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-

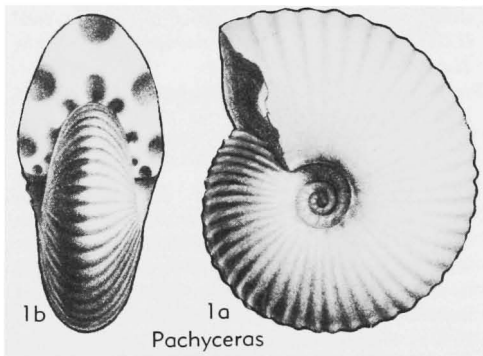


FIG. 358. *Pachyceras (Pachyceras) lalandeanum* (D'ORBIGNY), U.Jur., Fr.; *1a,b*, ×0.5 (330*) (p. L297).

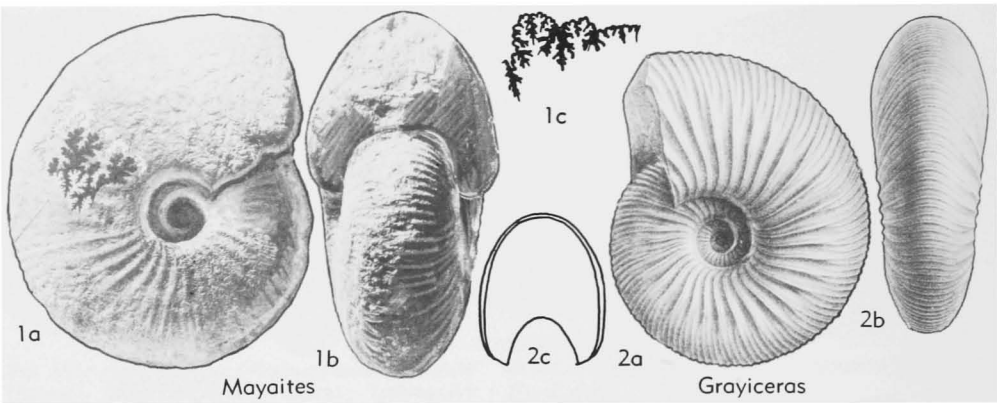


FIG. 359. Mayaitidae (p. L298).

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-

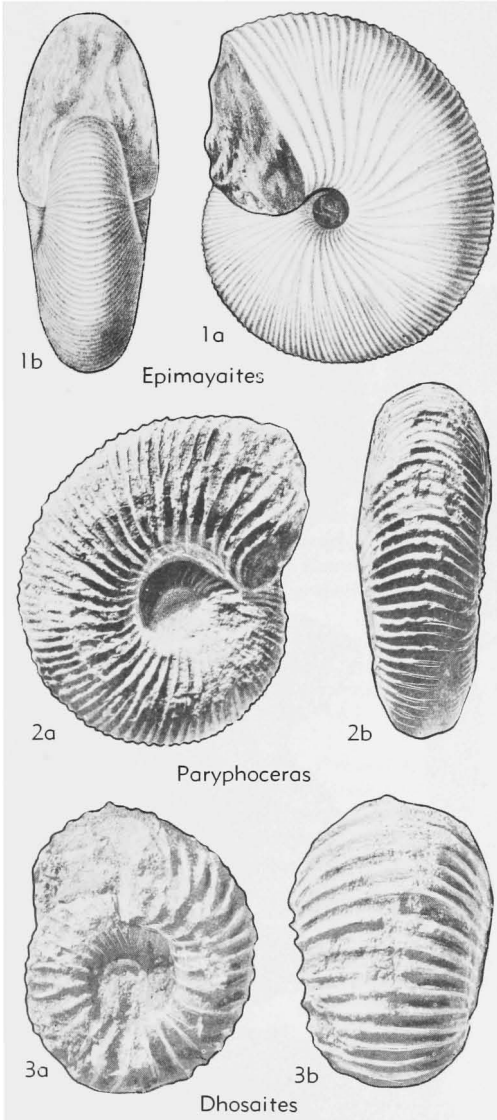


FIG. 360. Mayaitidae (p. L298).

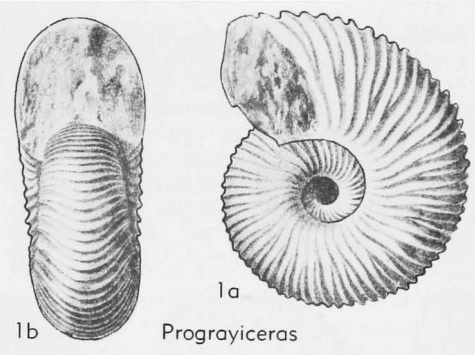


FIG. 361. *Prograyiceras grayi* SPATH, U.Jur.(U.Oxf.), Cutch; *1a,b,* ×0.3 (546*) (p. L298).

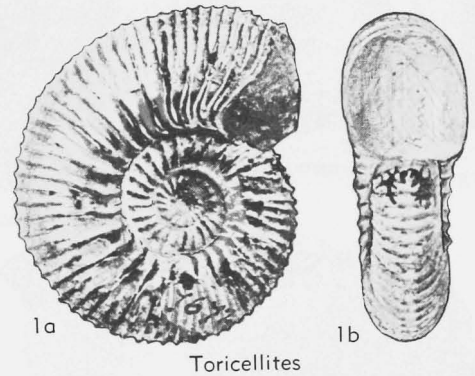


FIG. 362. *Toricellites approximatus* BUCKMAN, M. Jur.(L.Callov.), Eng.; *1a,b,* ×1 (65*) (p. L298).

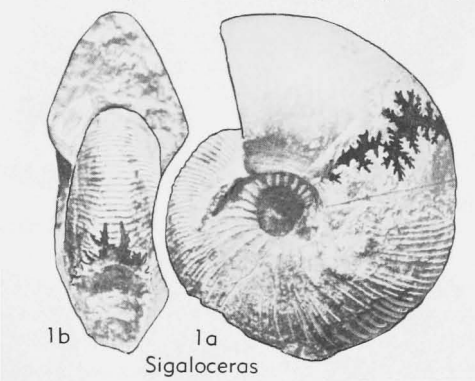


FIG. 363. *Sigaloceras (Sigaloceras) calloviense* (SOWERBY), M.Jur.(L.Callov.), Eng.; *1a,b,* ×0.5 (*4) (p. L299).

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*

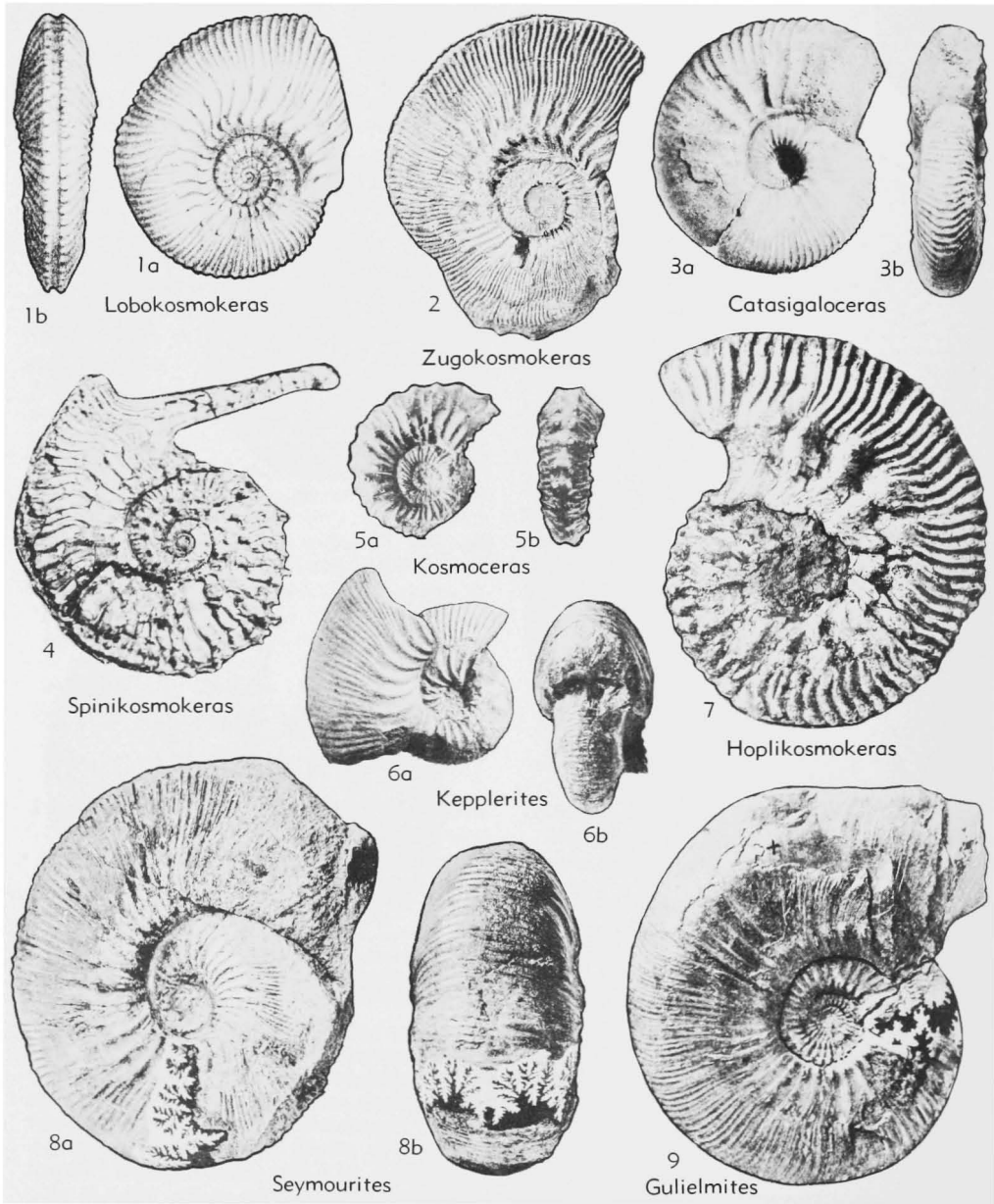


FIG. 364. Kosmoceratidae (p. L298-L301).

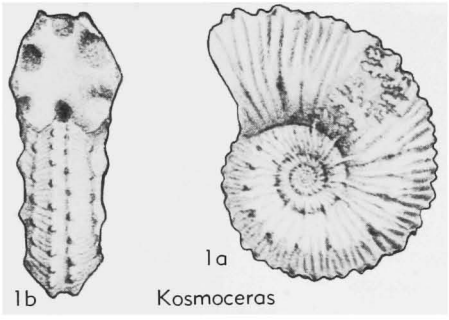


FIG. 365. *Kosmoceras (Kosmoceras) ornatum rotundum* (QUENSTEDT), M.Jur.(U.Callov.), Ger.; *1a,b,* ×0.7 (358*) (p. L299).

(=**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*).

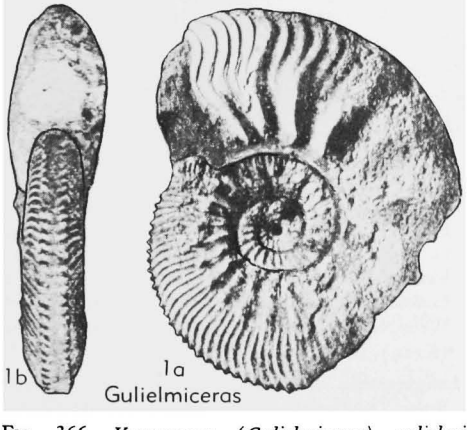


FIG. 366. *Kosmoceras (Gulielmiceras) gulielmi* (SOWERBY), M.Jur.(M.Callov.), Eng.; *1a,b,* ×1 (65*) (p. L300).

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.).*

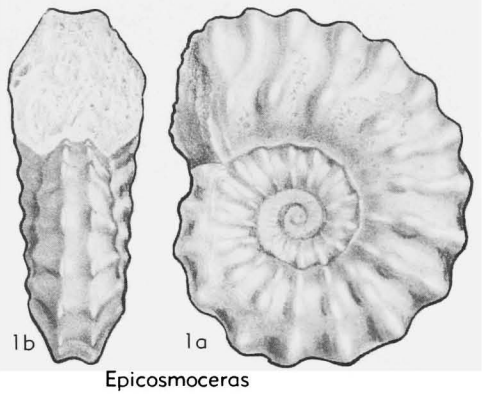


FIG. 367. *Epicosmoceras fuchsi* (NEUMAYR), M.Jur. (Callov.), Pol.; *1a,b,* ×0.7 (667*) (p. L301).

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.

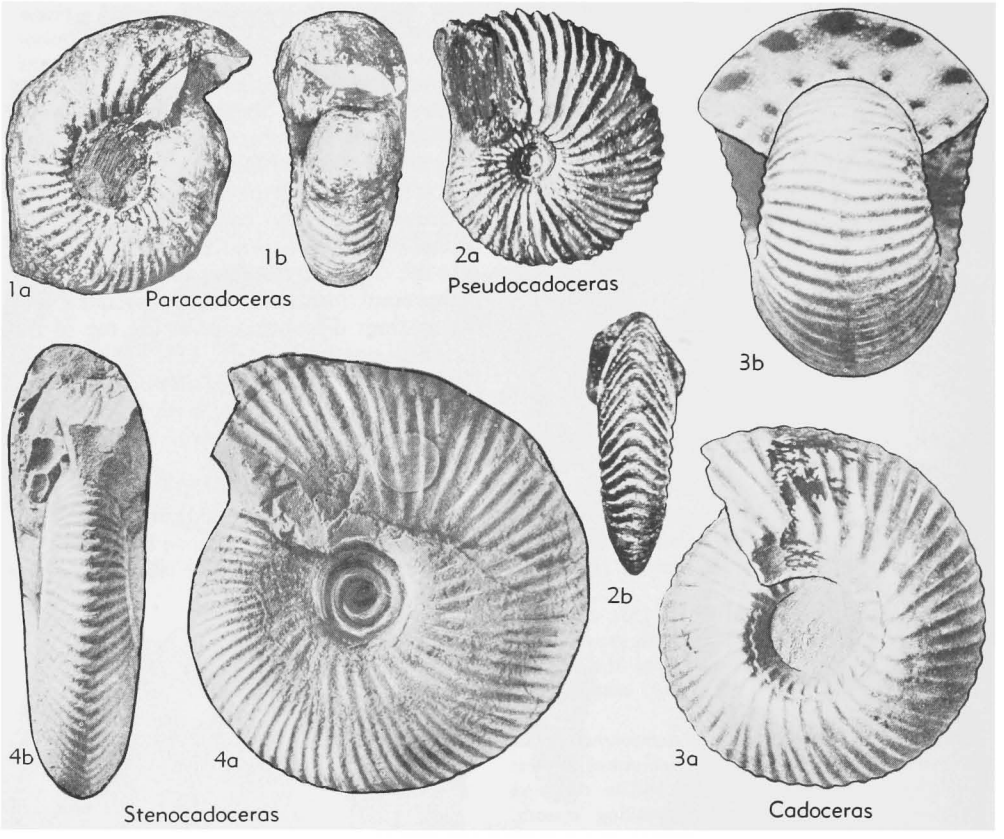


FIG. 368. Cardioceratidae (p. L302).

——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.

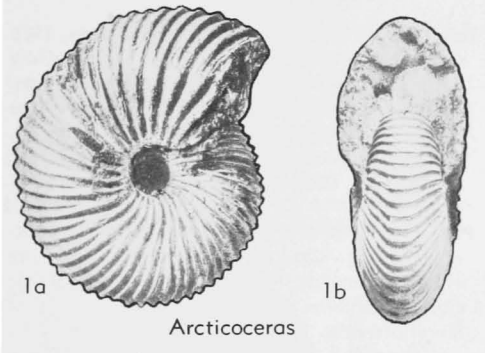
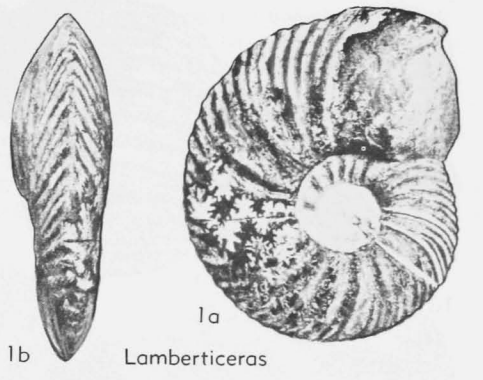


FIG. 369. *Arcticoceras ishmae* (KEYSERLING), M.Jur. (L.Callov.), Russ.; *1a,b,* ×0.5 (469*) (p. L302).



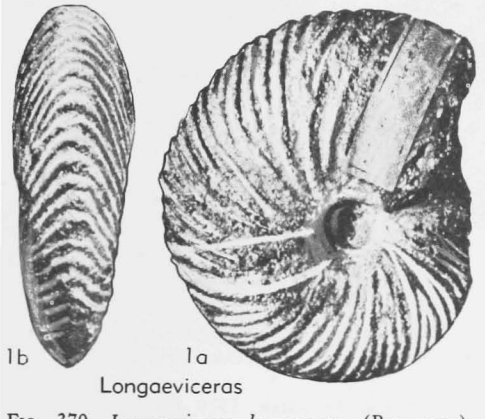
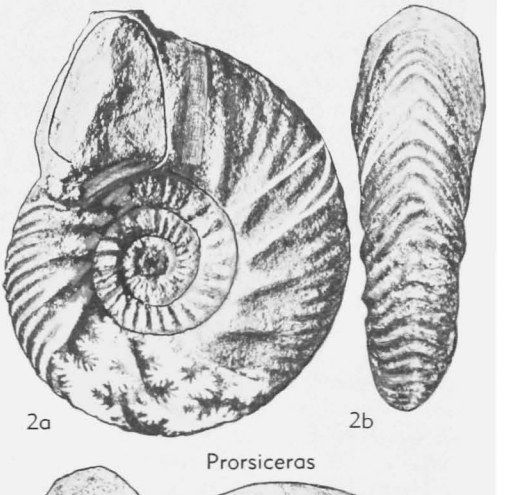


FIG. 370. *Longaeviceras longaevum* (BUCKMAN), M.Jur.(Callov.), Eng.; *1a,b,* ×1 (65*) (p. L302).



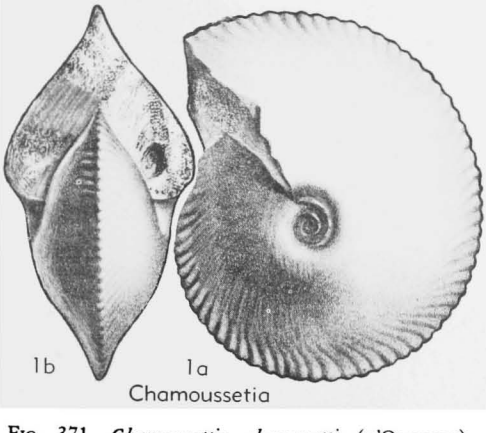


FIG. 371. *Chamousettia chamusetti* (D'ORBIGNY), M.Jur.(Callov.), Fr.; *1a,b,* ×0.5 (330*) (p. L303).

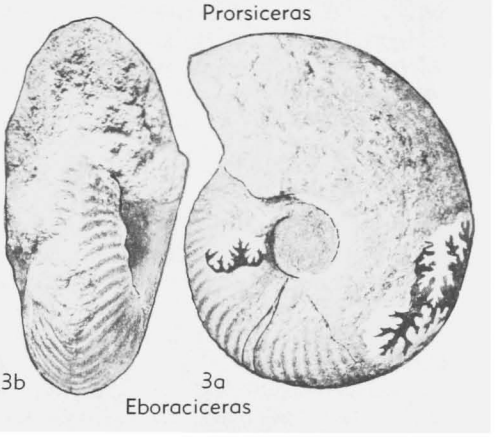


FIG. 372. Cardioceratidae (Cardioceratinae) (p. L304).

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,*

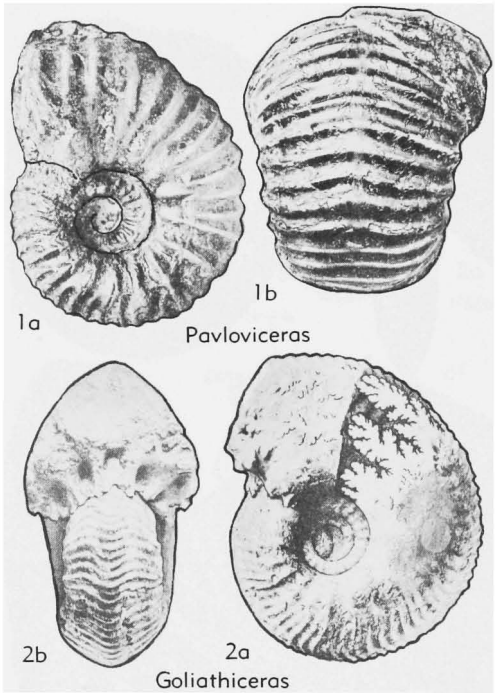


FIG. 373. Cardioceratidae (Cardioceratinae) (p. L304).

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.*

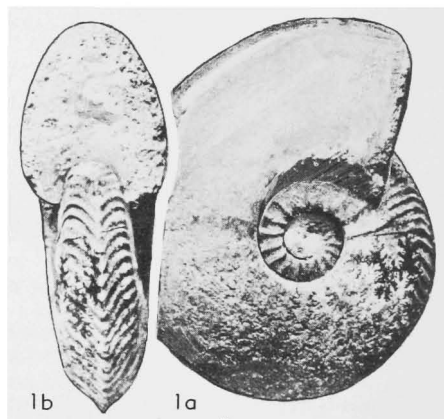


FIG. 374. *Goliathiceras (Pachycardioceras) robustum* (BUCKMAN) U.Jur.(U.Oxf.), Eng.; *1a,b*, ×0.5 (6*) (p. L305).

(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*).

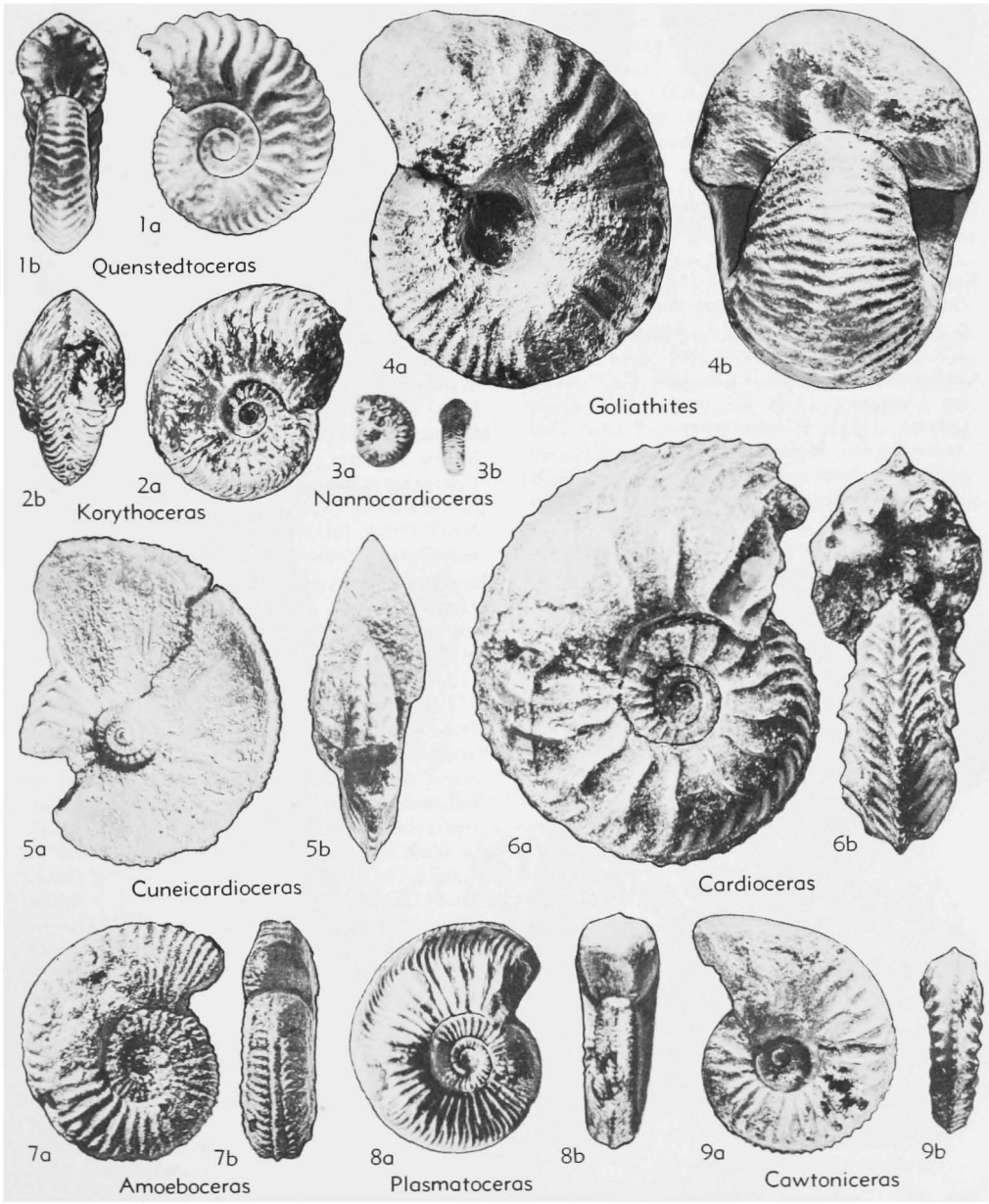


FIG. 375. Cardioceratidae (Cardioceratinae) (p. L304-L307).

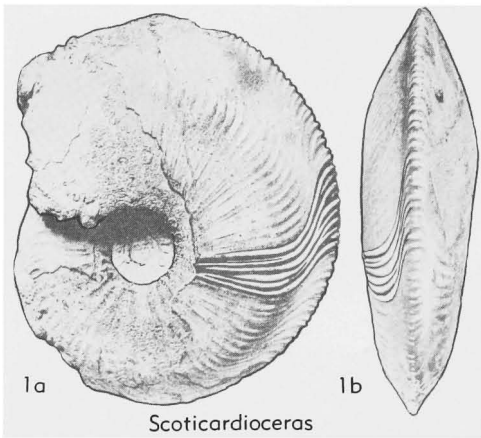


FIG. 376. *Cardioceras (Scoticardioceras) excavatum* (SOWERBY), U.Jur.(Oxf.), Eng. (p. L306).

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*

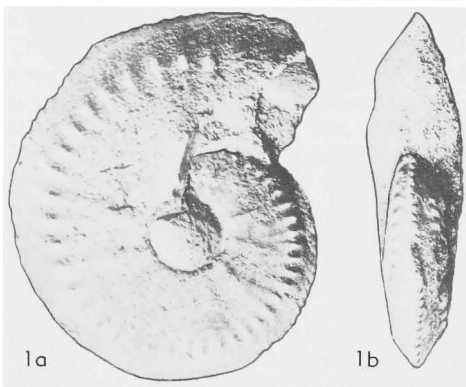


FIG. 377. *Cardioceras (Maltoniceras) maltonense* (YOUNG & BIRD), U.Jur.(U.Oxf.), Eng.

(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*

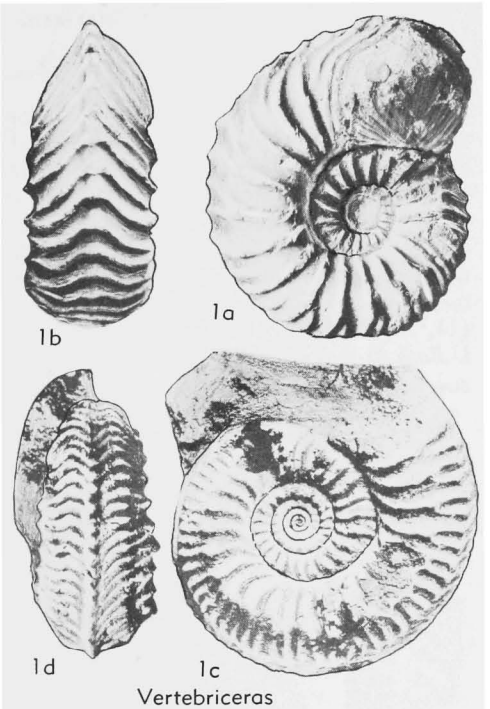


FIG. 378. Cardioceratidae (Cardioceratinae) (p. L306).

(=**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

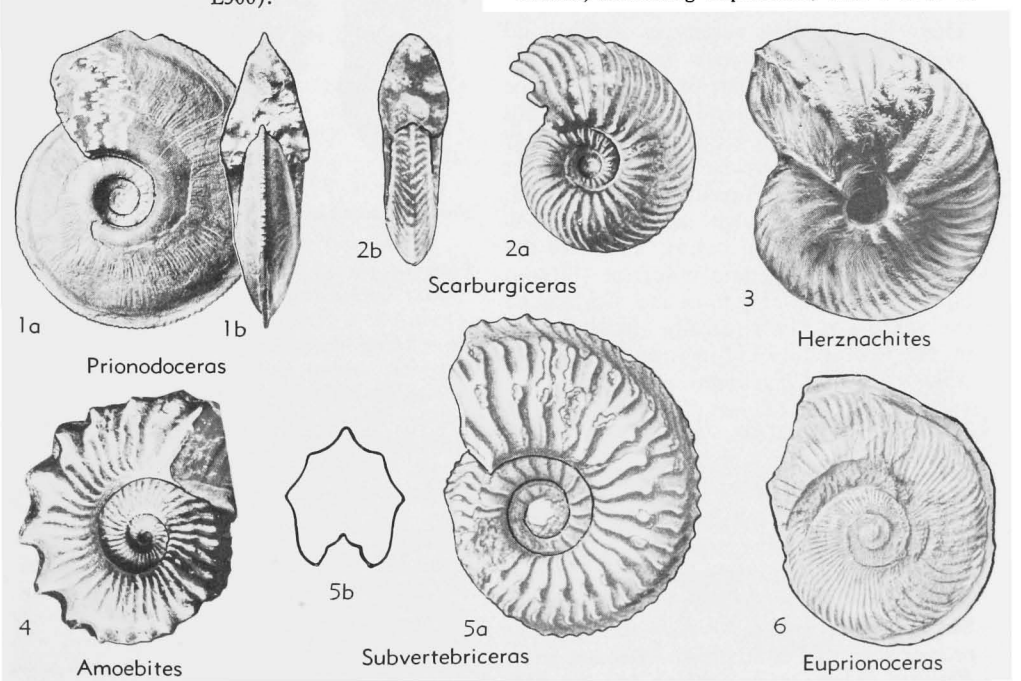


FIG. 379. Cardioceratidae (Cardioceratinae) (p. L305-L307).

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Hoplocardioceras

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.

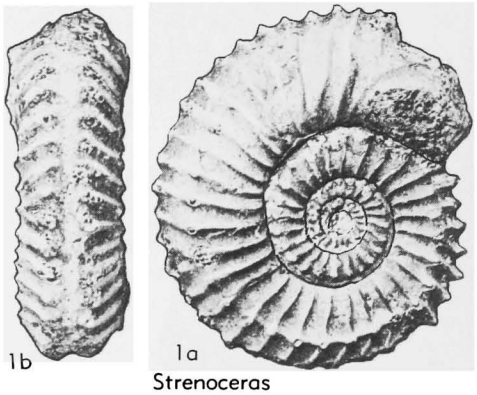
In Europe, the earliest known Perisphinctaceae appear suddenly in quantity at the base of the Upper Bajocian. In southern Alaska and South America there are isolated records in the Middle Bajocian. Derivation unknown, but may have been from Stephanoceratidae such as *Kumatostephanus* or independently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



1b 1a

Strenoceras

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*.