

Fresvillia KENNEDY, 1986b, p. 61 [**F. constricta*; OD]. Whorl section circular; with constrictions, strongest on venter; feeble ribbing and growth lines strongly prorsiradiate. *Upper Cretaceous (Lower Maastrichtian–Upper Maastrichtian)*: France, southern India, Alaska, California, ?Western Australia.—FIG. 198, 1a–c. **F. constricta*, Upper Maastrichtian, France; a, b, $\times 1$; c, enlarged (Kennedy, 1986b).

Boehmoceras RIEDEL, 1931, p. 690 [**Ancyloceras krekeleri* WEGNER, 1905, p. 210; SD WRIGHT, 1957b, p. 220]. Loose cryptocone; whorl height increasing rapidly; with straight to strongly curved primary ribs, which may form large bulges, splitting into several secondaries on outer part of sides; keel entire, rounded to serrate. *Upper Cretaceous (Middle Santonian–Upper Santonian)*: France, northern Germany, Bornholm, Austria, Texas, Mississippi, Alabama.—FIG. 199, 4a–c. **B. krekeleri* (WEGNER), Upper Santonian, northern Germany; a, $\times 1$; b, c, enlarged (Summesburger, 1979).—FIG. 199, 4d. *B. loescheri* RIEDEL, Upper Santonian, Austria; $\times 1$ (Summesburger, 1979).

Superfamily SCAPHITACEAE Gill, 1871

[*nom. transl.* WRIGHT & WRIGHT, 1951, p. 13, ex Scaphitidae GILL, 1871, p. 3]

Coiled in loose or tight, plane spiral followed by long or short shaft and terminal hook, but shaft tending to shorten and hook may wrap around spire. Ornament varying, from almost none to strong ribs and numerous rows of tubercles. Suture initially quinquelobate followed by quadrilobate, but in later genera one or more auxiliary lobes appearing in saddle U/L (the pseudolobes of WIEDMANN, 1965); L bifid or trifid. Synptychi have been found in several species. *Lower Cretaceous (Upper Albian)–Upper Cretaceous (Maastrichtian)*.

Family SCAPHITIDAE Gill, 1871

[Scaphitidae GILL, 1871, p. 3]

Markedly dimorphic; in Otoscapitinae microconchs have long lateral lappets; in Scaphitinae microconchs lack such lappets. Throughout the family microconchs have the umbilicus less occluded by the inner seam of the shaft than macroconchs. *Lower Cretaceous (Upper Albian)–Upper Cretaceous (Maastrichtian)*.

Macroconchs of Otoscapitinae became increasingly involute with time and those of

late members are indistinguishable in characters of generic significance from those of contemporary and earlier Scaphitinae. It therefore seems more probable that basal Upper Albian Scaphitinae diverged from early Otoscapitinae than that the two stocks had independent origins as held by WIEDMANN (1965).

Subfamily OTOSCAPHITINAE Wright, 1953

[Otoscapitinae WRIGHT, 1953, p. 474 (Name retained under ICZN Article 40, although *Otoscapites* is synonym of *Yezoites*) [=Worthoceratidae MATSUMOTO in MATSUMOTO & YOKOI, 1987, p. 45]

Small; spire generally evolute except in some late macroconchs; umbilicus of macroconchs not concealed by beginning of shaft in early forms but increasingly concealed in later forms; shaft very to moderately long; ornament commonly weaker than in contemporary Scaphitinae. Macroconchs with simple aperture, constricted in some; microconchs with longer shafts, less inflated body chambers, and long lappets. *Lower Cretaceous (Upper Albian)–Upper Cretaceous (Santonian or Campanian)*.

Worthoceras ADKINS, 1928, p. 218 [**Macroscaphites platydorsus* SCOTT, 1924, p. 18; OD]. Small; with very evolute spire, long, straight shaft, and terminal hook; microconchs with long lappets on aperture and with whorl section of shaft and hook hardly expanding; macroconchs with simple aperture and whorl section expanding noticeably; generally smooth or with fine lirae, rarely with distinct ribs. Suture with generally bifid saddles; lobes very simple, trifid or merely pointed in early forms, tending to become bifid in later forms; saddle U/L not markedly enlarged and no auxiliary lobe. *Lower Cretaceous (Upper Albian)–Upper Cretaceous (Upper Turonian)*: western and central Europe, northern Africa, New Zealand, Texas.—FIG. 200a, b. **W. platydorsum* (SCOTT), holotype, ?macroconch, Upper Albian, Texas; a, $\times 5$ (Scott, 1924); b, $\times 10$ (Adkins, 1928).—FIG. 200c–f. *W. vermiculus* (SHUMARD), Upper Cenomanian, Texas; c, microconch, $\times 2$ (new); d–f, macroconch, $\times 2$ (Wiedmann, 1965).

Yezoites YABE, 1910, p. 167 [**Scaphites perrini* ANDERSON, 1902, p. 114; SD DIENER, 1925, p. 213] [=Otoscapites WRIGHT, 1953, p. 475 (type, *Ammonites? bladenensis* SCHLÜTER, 1871, p. 30; OD); *Hyposcapites* WIEDMANN, 1965, p. 436 (type, *Scaphites stephanoceroideus* YABE, 1909, p. 442; =?S. *perrini* ANDERSON)]. Whorl section compressed to inflated, even coronate; almost smooth to strongly

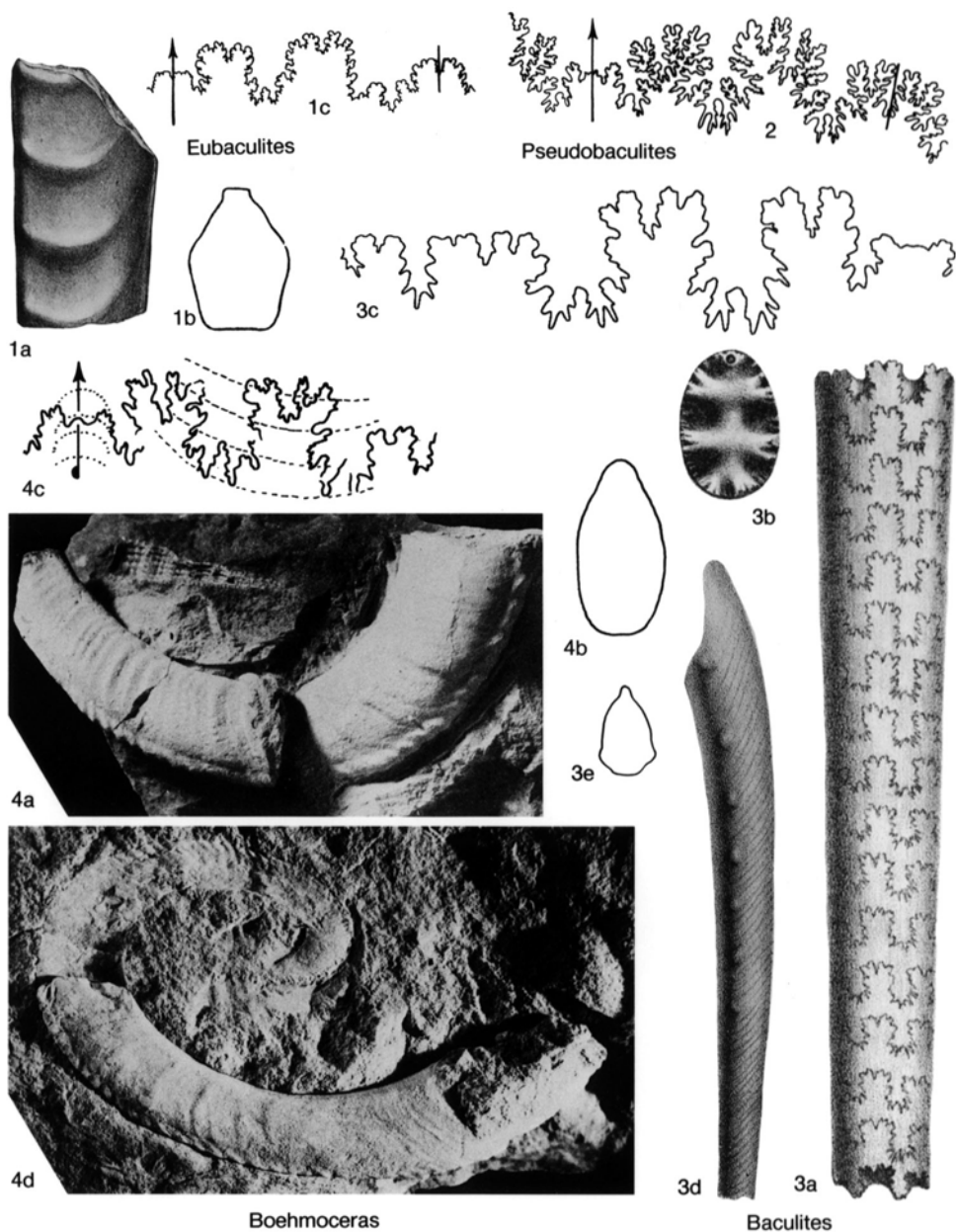


FIG. 199. Baculitidae (p. 256–258)

ribbed, with or without midlateral or ventrolateral tubercles; ribs commonly convex. Macroconchs with more or less straight inner margin on shaft, occluding umbilicus only slightly to largely; aperture with slight to strong constriction and collar. Microconchs with inner margin of shaft nearly straight to well curved, not occluding the umbilicus; aperture

constricted and collared with long lappets. Suture with elements more incised than in *Worthoceras*; L irregularly bifid; saddle U/L wide and becoming subdivided by auxiliary lobe. *Upper Cretaceous (Lower Cenomanian–Santonian)*: Europe, South Africa, Japan, New Zealand, Alaska, Oregon, California, Texas, Montana, Mexico.—FIG. 201a–d.

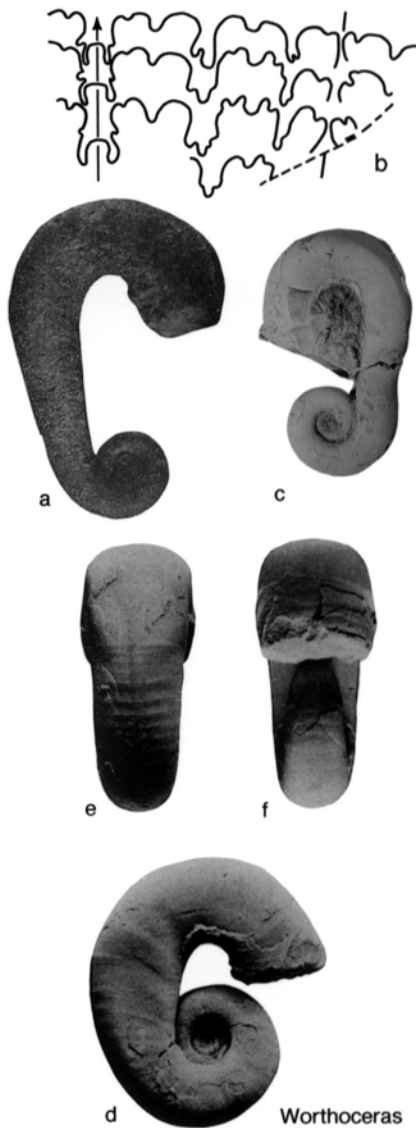


FIG. 200. Scaphitidae (p. 258)

Y. seabeensis (COBBAN & GRYS), Lower Turonian, Alaska; *a, b*, macroconch, $\times 1$; *c, d*, microconch, $\times 1$ (Cobban & Gryc, 1961).—FIG. 201*e-h*. *Y. puerculus* (JIMBO), Upper Turonian, Japan; *e, f*, macroconch, $\times 2$; *g, h*, microconch, $\times 2$ (Tanabe, 1977).—FIG. 201*i-k*. *Y. bladenensis* (SCHLÜTER), Upper Turonian; *i*, Germany, enlarged, $\times 2$ (Wiedmann, 1965); *j, k*, England, microconch, $\times 2$ (new).—FIG. 201*l*. *Y. stephanoceroides* (YABE), Upper Turonian, Japan; holotype, $\times 1$ (Jimbo, 1894).

Eorhaeboceras ALABUSHEV, 1989, p. 39 [**E. derivatum*; OD]. Based on small, incomplete specimens like *Yezoites*; distinction uncertain. *Upper Cretaceous* (Santonian or Campanian): Kamchatka.

Subfamily SCAPHITINAE Gill, 1871

[*nom. transl.* WRIGHT, 1953, p. 473, ex Scaphitidae GILL, 1871, p. 3]

Microconchs without lappets or with dorsal lappet only; inner margin of shaft generally concave, not straight or convex, and occluding less of umbilicus than in macroconchs. *Lower Cretaceous* (*Upper Albian*)—*Upper Cretaceous* (*Upper Maastrichtian*).

One stock, including *Eoscaphtes*, *Scaphites*, *Hoploscaphtes* and derivatives, originated by the beginning of the Late Albian, probably from early *Worthoceras*. Possibly another originated in North America in early Turonian from inflated *Yezoites* and included many species assigned to *Scaphites*, *Clioscaphtes*, and a group of endemic North American genera. The two stocks, if in fact different, are highly convergent and have not been satisfactorily differentiated.

Eoscaphtes BREISTROFFER, 1947b, p. 93(77) [**Ammonites? circularis* J. de C. SOWERBY, 1836, p. 337; OD]. Initial whorls with umbilical perforation; later whorls more involute, followed by shaft and terminal hook; whorl section increasing rapidly; dorsal impression lacking on inner whorls or throughout; ribs fine and dense, single or branching, reclined, strengthening on body chamber; no distinct tubercles. Suture quadrilobate throughout later ontogeny. *Lower Cretaceous* (*Upper Albian*)—*Upper Cretaceous* (*Middle Cenomanian*): England, France, Algeria.—FIG. 202, *1a-c*. **E. circularis* (J. de C. SOWERBY), Upper Albian, England; *a, b*, $\times 1$; *c*, enlarged (Spath, 1923–1943).—FIG. 202, *1d, e*. *E. subcircularis* (SPATH), Upper Albian, France; $\times 1$ (Wiedmann, 1965).

Scaphites PARKINSON, 1811, p. 145 [**Scaphites equalis* J. SOWERBY, 1813, p. 53; SD MEEK, 1876, p. 413] [= *Anascaphites* HYATT, 1900, p. 572 (type, *S. ventricosus* MEEK & HAYDEN, 1863, p. 22; OD); *Jahnites* HYATT, 1900, p. 572 (type, *S. geinitzii* var. *binodosus* JAHN, 1891, p. 180, non *S. binodosus* ROEMER, 1841, p. 90; OD); *Holoscaphites* NOWAK, 1911, p. 564, obj.; *Metascaphites* WIEDMANN, 1962a, p. 212 (type, *Scaphites* (?) *thomasi* PERVINQUIÈRE, 1907, p. 121; OD)]. Compressed to very inflated; spire more or less involute; early whorls in contact; shaft short to moderately long; hook not curved over spire; aperture constricted

and commonly collared, in some with long dorsal lappet; ribs on spire normally long and short or branching; ribs on shaft single or branching, commonly at ventrolateral tubercles; umbilical and ventrolateral tubercles may be present on shaft and hook. Suture with L initially bifid but becoming asymmetric in Upper Turonian and later trifold; saddle U/L very wide and divided by 1 or more auxiliary lobes (pseudolobes of WIEDMANN). [The holotype of *S. (?) thomasi* PERVINQUIÈRE, type species of *Metascaphites* WIEDMANN, appears to be a fragment of a late form of *S. equalis*.] *Lower Cretaceous (Upper Albian)–Upper Cretaceous (Campanian)*: northern hemisphere, Madagascar, Bathurst Island, Australia (Queensland), New Zealand, Argentina.——FIG. 202,3a–e. **S. equalis* (J. SOWERBY), Cenomanian, France; a, b, macroconch, X1; c, enlarged (Orbigny, 1840–1842); d, e, microconch, X1 (Wiedmann, 1965).

Clioscaphtes COBBAN, 1952a, p. 34 [**C. montanensis*; OD]. Very involute, inflated; hook closely pressed to spire. Suture with L more or less trifold. *Upper Cretaceous (Santonian–Campanian)*: USA.——FIG. 202,2a, b. *C. vermiformis* (MEEK & HAYDEN), Santonian, Montana; X1 (Cobban, 1952a).

Desmoscaphtes REESIDE, 1927a, p. 16 [**D. bassleri*; OD]. Differs from *Clioscaphtes* principally in having inner whorls with strong, rounded ribs and constrictions. *Upper Cretaceous (Upper Santonian–Campanian)*: USA.——FIG. 202,4a–c. **D. bassleri*, Upper Santonian, Montana; a, X0.75; b, X1; c, enlarged (Reeside, 1927a).

Argentoscaphites BLASCO DE NULLO, NULLO, & PROSERPIO, 1980, p. 477 [**A. mutans*, nom. correct. WRIGHT, herein, *pro mutantiibus*, which contravenes ICSN Article 11(g)(i); OD]. Differs from *Scaphites* only in having inner whorls with tabulate venter bounded by slight ventrolateral tubercles. *Upper Cretaceous (Upper Santonian or Lower Campanian)*: Argentina.——FIG. 203,2a, b. **A. mutans*; X1.1 (Blasco de Nullo, Nullo, & Proserpio, 1980).

Pteroscaphtes WRIGHT, 1953, p. 474 [**Scaphites auriculatus* COBBAN, 1952a, p. 30; OD]. Very small; whorl section depressed, coronate, the lateral angles prolonged onto body chamber; aperture with sides and ventral edge normally pinched to form projecting points; ribs prorsiradial on inner flanks, turning back at the lateral angle. Dimorphic in fashion comparable to that of *Scaphites* and *Clioscaphtes* and therefore not microconchs of those genera; probably a series of progenetic dwarf offshoots of successive species of *Scaphites* and *Clioscaphtes* (LANDMAN, 1989). *Upper Cretaceous (Upper Turonian–Santonian)*: Montana, North Dakota.——FIG. 203,4a, b. **P. auriculatus* (COBBAN), Coniacian, Montana; X4 (new).

Hoploscaphtes NOWAK, 1911, p. 565 [**Scaphites constrictus* J. SOWERBY, 1817d, p. 189; SD BIRKELUND, 1965, p. 102] [= *Mesoscaphites* ATABEKIAN, 1979, p. 523 (type, *Scaphites (Hoploscaphtes) elatensis* LEWY, 1969, p. 129; OD), nom. nud. for lack of differentia; *Jeletzkytes* RICCARDI, 1983, p. 14 (type,

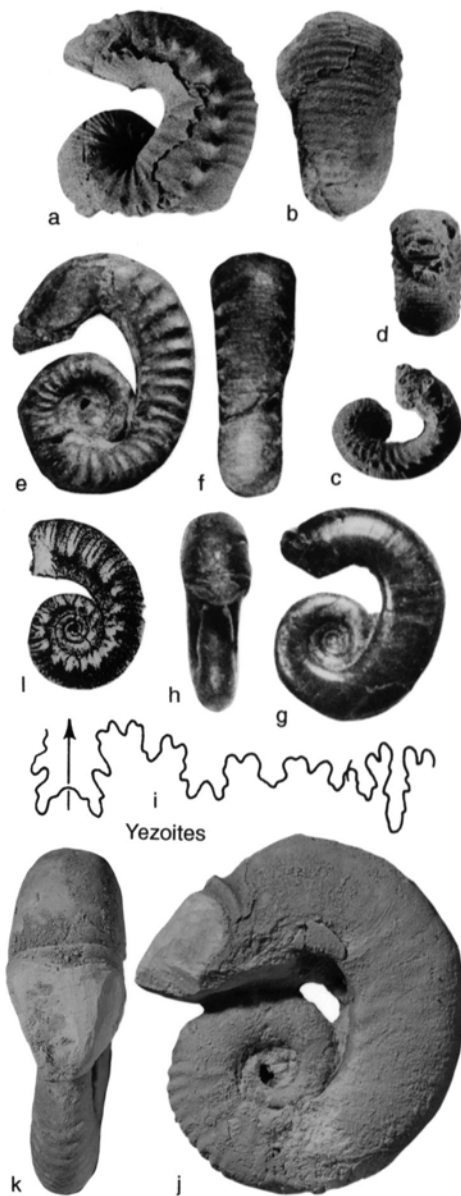


FIG. 201. Scaphitidae (p. 258–260)

Scaphites (Ammonites?) nodosus OWEN, 1852, p. 581; OD]. Compressed with flat sides to inflated with convex sides; venter flat or rounded, generally with strong, clavate or spinate ventrolateral tubercles at least on shaft and hook; shaft normally short. Not readily distinguished from later *Scaphites*. [Separation of the large and inflated species of the *nodosus* group as *Jeletzkytes* seems unnecessary, given the great variation within most

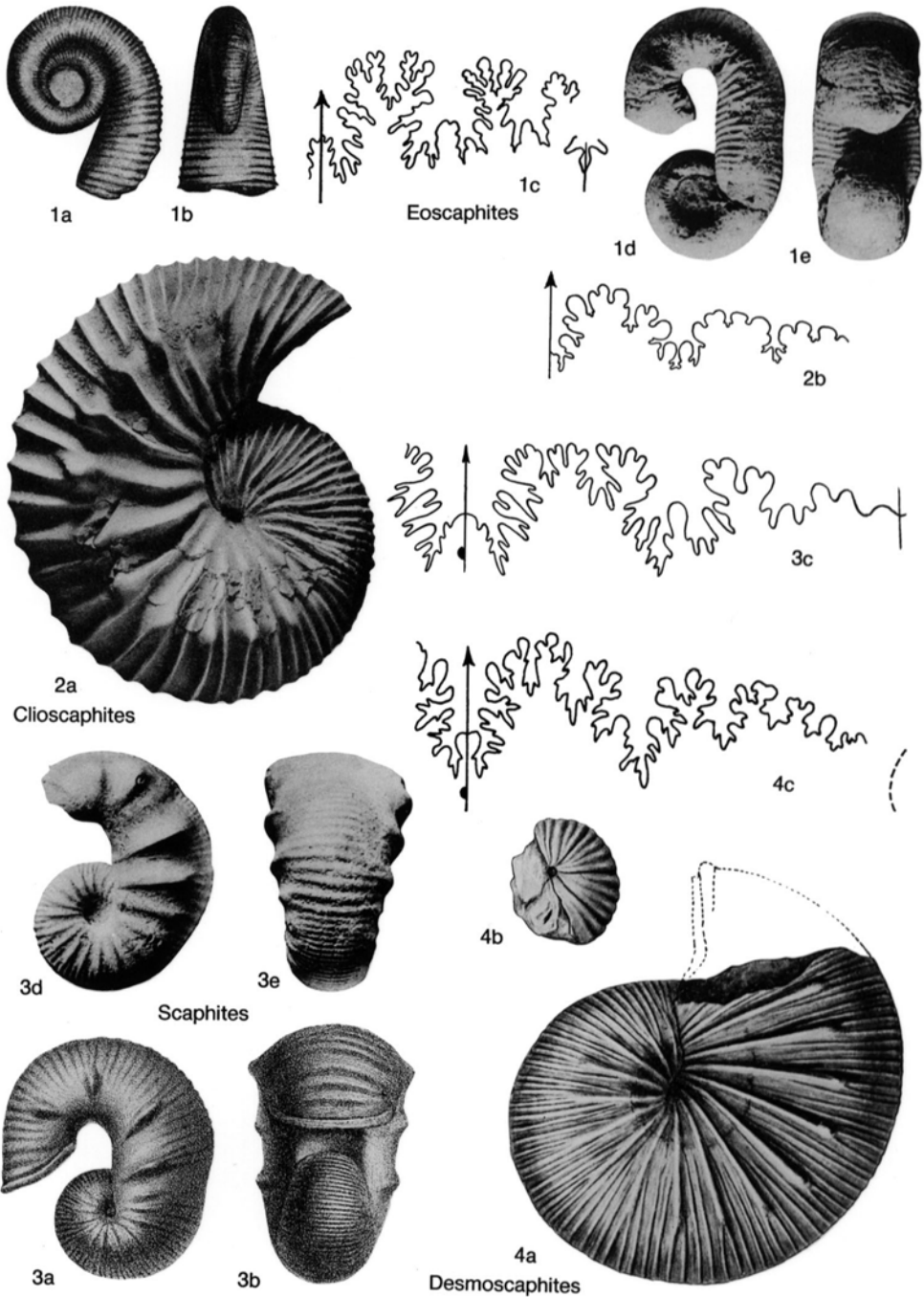


FIG. 202. Scaphitidae (p. 260–261)

scaphitid species.] *Upper Cretaceous (Campanian–Upper Maastrichtian)*: Europe, South Africa, Israel, Canada, USA, Chile, Antarctica (Graham Land), Greenland.—FIG. 204, 2a, b. **H. constrictus* (J.

SOWERBY, Maastrichtian, France; $\times 1$; b, enlarged (Orbigny, 1840–1842). *Discoscaphtes* MEEK, 1871a, p. 429 [*Ammonites conradi* MORTON, 1834, p. 39; OD]. Small to large,

compressed to inflated; shaft distinct and straight to short and curved, embracing the spire; finely or coarsely ribbed; multituberculate on shaft and hook or also on spire. *Upper Cretaceous (Campanian–Maastrichtian)*: Belgium, Sweden, central and eastern Europe, northern Africa, Israel, Canada, USA.

D. (Trachyscaphites) COBBAN & SCOTT, 1964, p. 6 [**T. redbirdensis*; OD]. Small to moderate sized; shaft and hook distinct; tubercles aligned or not. *Upper Cretaceous (Campanian)*: France, Belgium, Sweden, central and eastern Europe, Israel, central Asia, USA (Western Interior, Texas, New Jersey).—FIG. 204, 1a, b. **D. (T.) redbirdensis* (COBBAN & SCOTT), Wyoming; X0.5 (Cobban & Scott, 1964).

D. (Discoscaphites). Small to large; shaft generally embracing spire, with straight or curved inner

margin; tubercles always aligned. *Upper Cretaceous (Maastrichtian)*: USA.—FIG. 204, 3a–c. **D. (D.) conradi* (MORTON), Alabama; a, b, macroconch, X1; c, microconch, X1 (Jeletzky & Waage, 1978).—FIG. 204, 3d–f. *D. (D.) cheyennensis* (OWEN), North Dakota; d, e, macroconch, X0.5; f, X1.5 (Meek, 1876).

Acanthoscaphites NOWAK, 1911, p. 565 [**Scaphites tridens* KNER, 1850, p. 10; SD DIENER, 1925, p. 205]. Large and inflated, with fine ribs and only umbilical tubercles until body chamber, which also has ventrolateral and typically siphonal rows of large, blunt tubercles connected by irregular ribs. *Upper Cretaceous (Campanian)*: central and eastern Europe.—FIG. 203, 1a, b. **A. tridens trispinosus* (GEINITZ), Poland; a, X0.5; b, X1 (Nowak, 1911). **Rhaeboceras** MEEK, 1876, p. 462 [**Phylloceras? halli*

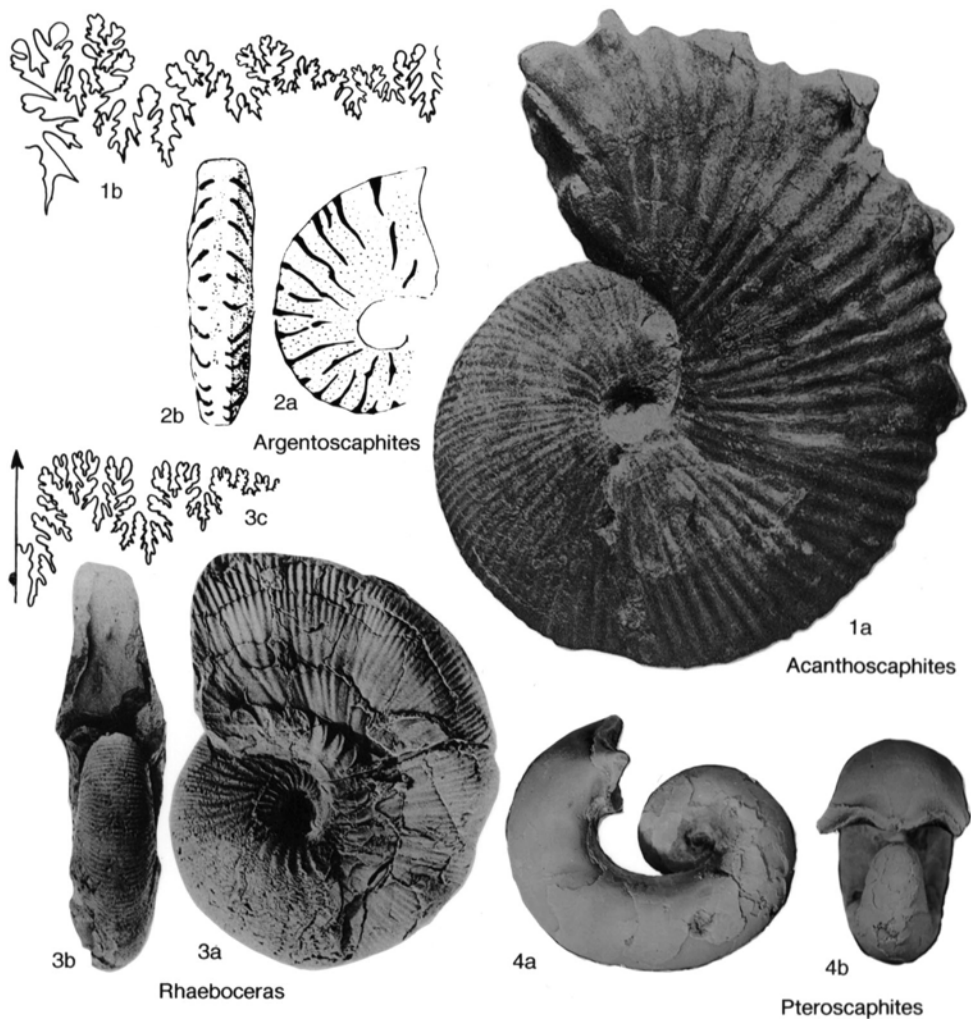


FIG. 203. Scaphitidae (p. 261–265)

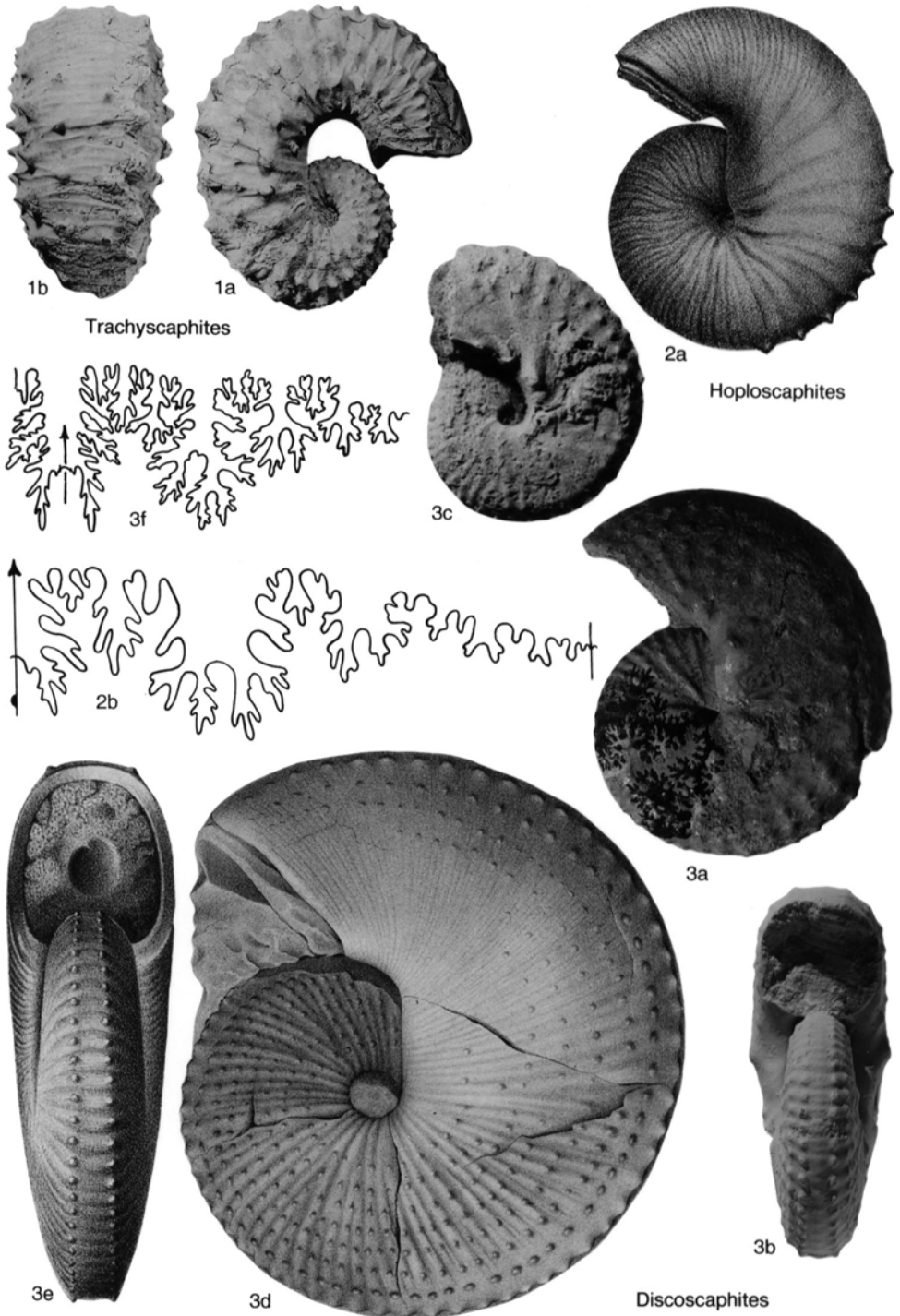


FIG. 204. Scaphitidae (p. 261–263)

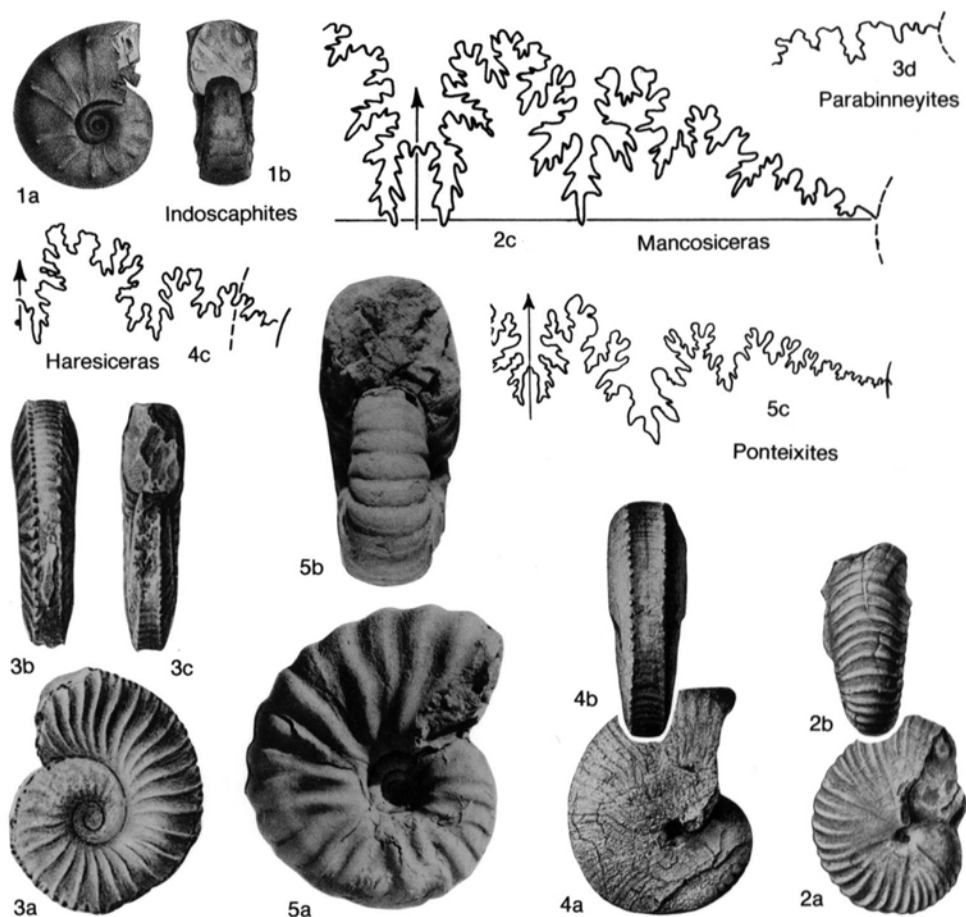


FIG. 205. Scaphitidae (p. 265–266)

MEEK, 1876, p. 70 [= *Ammonites halli* MEEK & HAYDEN, 1857, p. 70, *nom. nud.*]; OD] [= *Amopalus* OWEN, 1852, p. 579, *nom. oblit.*]. Medium-sized to very large, up to 300 mm in diameter; venter coiled normally, umbilical seam egressing on last quarter of whorl; rather compressed to very inflated; primary ribs fine to coarse, branching into dense, prorsiradiate secondaries; no tubercles. Suture complex, with long, narrow elements; lobes bifid or asymmetrically trifid. RICCARDI, 1983. *Upper Cretaceous (Campanian)*: Alberta, Saskatchewan, USA (Western Interior), ?Russia.—FIG. 203, 3a–c. **R. halli* (MEEK), Montana, holotype; a, b, $\times 0.5$ (Riccardi, 1983); c, $\times 0.75$ (Meek, 1876).

Ponteixites WARREN, 1934, p. 95 [**P. robustus*; SD RICCARDI, 1983, p. 42]. Small; coiling ammonitic; ribs fine to very coarse, slightly flexuous, well rounded, branching or long and short; ribs may flatten on venter; no tubercles. Suture with shorter and wider elements than *Rhaeboceras*. *Upper Cretaceous (Upper Campanian–Lower Maastrichtian)*:

Saskatchewan.—FIG. 205, 5a–c. **P. robustus*, Lower Maastrichtian; a, b, holotype, $\times 1$; c, enlarged (Riccardi, 1983; courtesy of the Geological Survey of Canada).

Indoscaphites SPATH, 1953, p. 14 [**Ammonites cunliffei* FORBES, 1846, p. 109; OD]. Compressed, with flat venter and very short shaft; primary ribs distant, single, joining distinct umbilical and ventrolateral clavi from early stage on spire. Western Australian form with fine, sinuous ribs (BRUNNSCHWEILER, 1966) may be *Haresiceras*. *Upper Cretaceous (Maastrichtian)*: southern India.—FIG. 205, 1a, b. **I. cunliffei* (FORBES); $\times 2$ (Stoliczka, 1864).

Haresiceras REESIDE, 1927c, p. 17 [**H. placentiforme*; OD]. Coiling barely scaphitoid; very involute; with flat sides and venter, at least on body chamber; ribs moderately strong to very fine, sinuous. Suture with long, asymmetrical L and many auxiliaries. *Upper Cretaceous (Upper Santonian–Lower Campanian)*: ?Western Australia, USA (Western Interior), Greenland.

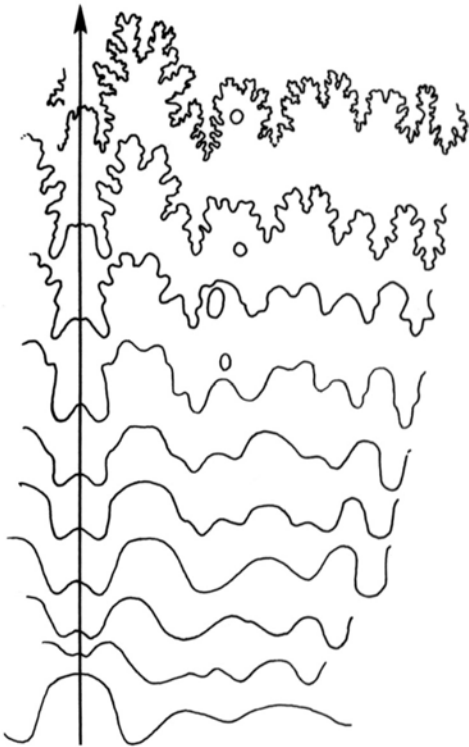


FIG. 206. Sutural ontogeny of *Eodouvilleiceras* showing quadriblobate suture (fourth from base of figure) following quinquelobate suture (second from base) (Mikhailova, 1976c).

H. (*Mancosiceras*) COBBAN, 1964, p. 17 [**Puzosia (Latidorosella) mancosensis* REESIDE, 1927a, p. 15; OD]. Inner whorls constricted; spire with rounded venter; ventrolateral nodes on body chamber only; ribs fairly strong. *Upper Cretaceous (Upper Santonian)*: Utah, Wyoming, Montana, New Mexico.—FIG. 205, 2a–c. **H. (M.) mancosense* (REESIDE), New Mexico; a, b, $\times 1$; c, $\times 4$ (Reeside, 1927c).

H. (*Haresiceras*). Venter flat or concave from an early stage, bordered by rows of fine, rounded ventrolateral nodes; ribs more or less fine, slightly sinuous, crossing venter transversely. *Upper Cretaceous (Lower Campanian)*: USA (Western Interior), Greenland.—FIG. 205, 4a–c. **H. (H.) placentiforme*, Wyoming; a, b, $\times 1$; c, $\times 2$ (Reeside, 1927c).

Parabinneyites A. F. LEANZA, 1964, p. 84, *nom. nov. pro Patagoniceras* A. F. LEANZA, 1963, p. 207, *non* WETZEL, 1960, p. 249 [**Leopoldia paynensis* FAVRE, 1908, p. 638; OD]. Inner whorls rather evolute, with last whorl just in contact with previous one; with slightly convex sides and wide, flat to slightly concave venter; primary ribs regular, distant, sinuous, forming small ventrolateral nodes and crossing venter transversely; between primary ribs are 1 or 2

intercalatories consisting of little more than ventrolateral nodes and ventral ribs. Probably allied to *Haresiceras*. BLASCO DE NULLO, NULLO, & PROSERPIO, 1980. *Upper Cretaceous (Lower Campanian)*: Argentina.—FIG. 205, 3a–d. **P. paynensis* (FAVRE); a–c, $\times 1$ (Favre, 1908); d, enlarged (A. F. Leanza, 1963).

Superfamily DOUVILLEICERATAE Parona & Bonarelli, 1897

[*nom. transl.* LUPPOV in LUPPOV & DRUSHCHITS, 1958, p. 116, *ex* Douvilleiceratidae PARONA & BONARELLI, 1897, p. 101]

Early forms have perforate umbilicus and appear to be incoiling criocones. Coiling rapidly becoming ammonitic, and sutural lobes U and L widening and subdividing. Early sutures unstable; primary suture may be quinquelobate or quadriblobate followed by quinquelobate; in either case succeeding lines quadriblobate before normal differentiation begins (Fig. 206). MIKHAILOVA, 1976c. *Lower Cretaceous (Barremian–Middle Albian)*.

Family DOUVILLEICERATIDAE Parona & Bonarelli, 1897

[Douvilleiceratidae PARONA & BONARELLI, 1897, p. 101]

Evolute; whorl section ranging from depressed to circular or polygonal; ribs strong, with various combinations of umbilical, lateral, or ventrolateral tubercles. Suture with massive saddle L/E, wide L subdivided into 2 lobes, and no to few auxiliaries. *Lower Cretaceous (Barremian–Middle Albian)*.

Subfamily ROLOBOCERATINAE Casey, 1961

[Roloboceratinae CASEY, 1961d, p. 176]

Venter broadly rounded at all stages; generally only 1 row of tubercles on each side, not septate. Suture tending to simplify. *Lower Cretaceous (Barremian–Lower Aptian)*.

Paraspiticeras KILIAN, 1910a, p. 7 [**Aspidoceras percevali* UHLIG, 1883, p. 238(114); SD SPATH, 1921a, p. 316]. Initial coil open, then evolute, with round or depressed, rapidly enlarging whorls; ribs strong, rounded, crossing venter with slight forward bend; more or less prominent lateral tubercles and (in some forms) umbilical tubercles on inner whorls; tubercles tending to weaken or disappear on

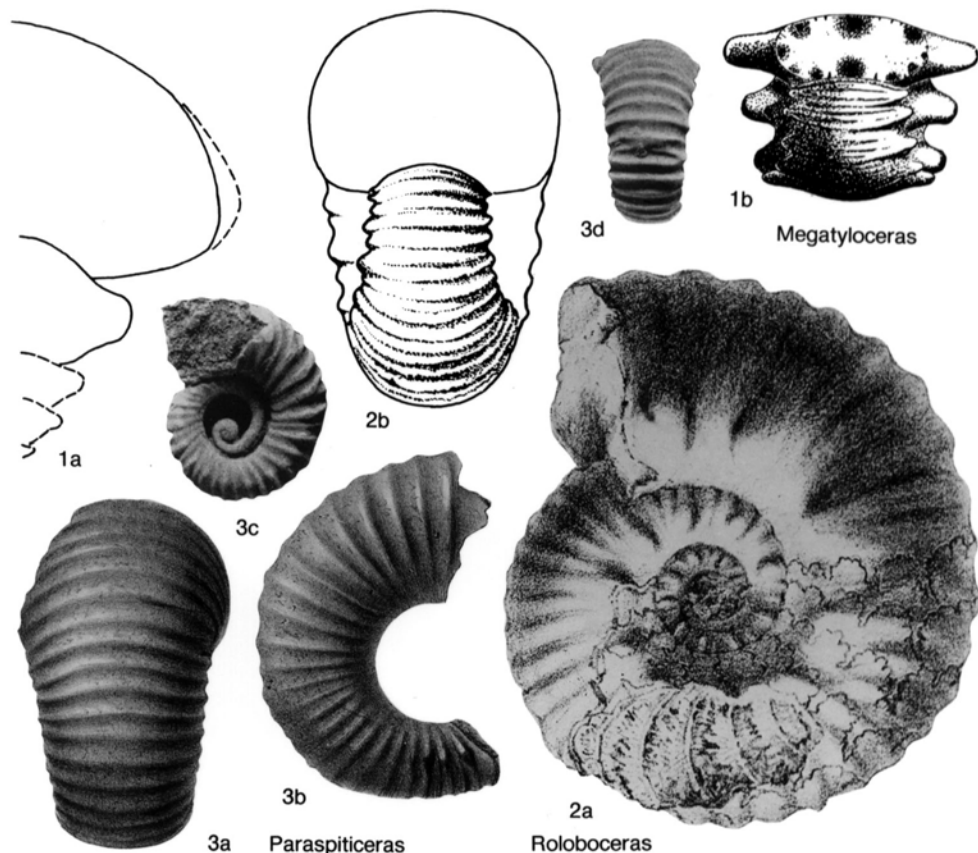


FIG. 207. Douvilleiceratidae (p. 266–267)

outer whorls. Suture quadrilobate throughout. *Lower Cretaceous* (*Barremian*): France, Spain, Austria.—FIG. 207,3a,b. **P. percevali* (UHLIG), Austria; $\times 0.5$ (Uhlig, 1883).—FIG. 207,3c,d. *P. schindewolfi* WIEDMANN, Spain; inner whorls, $\times 5$ (Wiedmann, 1960).

Roloboceras CASEY, 1954a, p. 114 [*Ammonites hambrovi* FORBES, 1845, p. 354; OD]. Whorl section semicircular; ribs thick, blunt, tending to form large bulges where they branch at umbilical edge. *Lower Cretaceous* (*Lower Aptian*): northwestern Europe.—FIG. 207,2a,b. **R. hambrovi* (FORBES), England; a, lectotype, $\times 1$; b, paralectotype, $\times 1$ (Forbes, 1845).

Megatyloceras HUMPHREY, 1949, p. 149, ICZN Opinion 428, 1956, Generic Name No. 1022 [*Douvilleicereras coronatum* ROUCHADZÉ, 1933, p. 195; OD; ICZN Specific Name No. 1041]. Whorl section coronate, with single, very large midlateral tubercle. *Lower Cretaceous* (*Lower Aptian*): England, France, Georgia.—FIG. 207,1a. **M. coronatum* (ROUCHADZÉ), Georgia; $\times 0.5$ (Casey, 1961d).—FIG. 207,1b. *M. ricatordeanum* (ORBIGNY), France; $\times 1$ (Casey, 1961d).

Subfamily CHELONICERATINAE Spath, 1923

[*nom. transl.* BREISTROFFER, 1953b, p. 74, ex Cheloniceratidae SPATH, 1923d, p. 64] [=Diadochoceratinae KVANTALIANI, 1978, p. 399]

Differs from Roloboceratinae in having 2 rows of septate tubercles on each side; later forms also developing ventral tubercles. *Lower Cretaceous* (*Lower Aptian–Upper Aptian*).

Procheloniceras SPATH, 1923d, p. 64 [*Ammonites stobieckii* ORBIGNY, 1850a, p. 113; OD]. Rather evolute; whorl section circular to oval, enlarging less rapidly than in *Paraspiticeras*; ribs more or less equal, branching at umbilical or midlateral tubercles in middle growth; tubercles later disappearing. Probably synonymous with *Chelonicereras*. *Lower Cretaceous* (*Lower Aptian*): France, Germany, Poland, Russia, Texas.—FIG. 208,6. *P. albrechti-austriacae* (UHLIG), France; $\times 0.3$ (Kilian, 1907–1913).

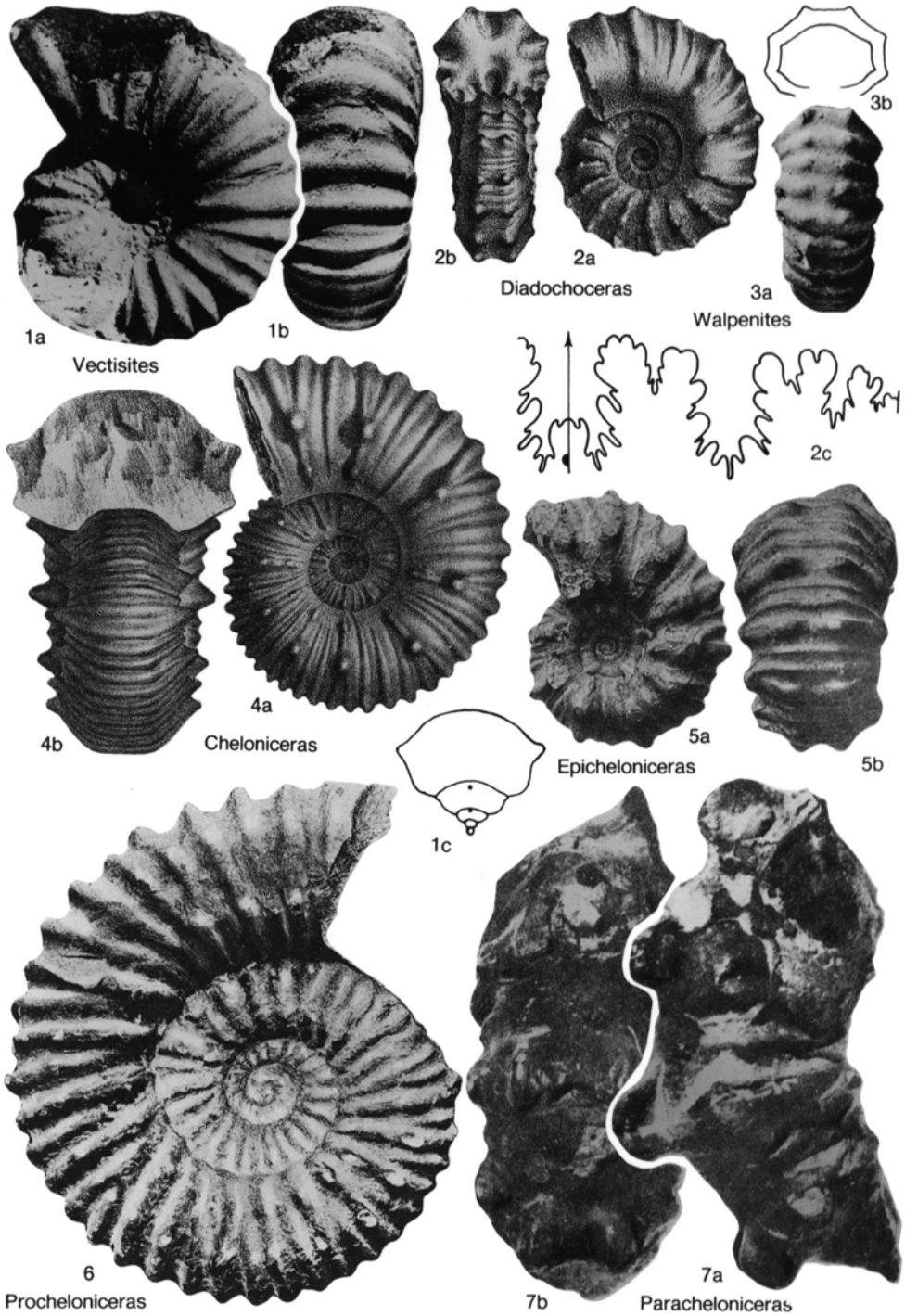


FIG. 208. Douvilleiceratidae (p. 267–269)

Chelonicer HYATT, 1903, p. 101, ICZN Opinion 428, 1956, Generic Name No. 1021 [**Ammonites cornuelianus* ORBIGNY, 1841, p. 364; ICZN Specific Name No. 1040]. Moderately evolute; whorl section circular to depressed; at some stage with lateral and umbilical tubercles; ribs branching at lateral tubercles and intercalated; shoulders rounded, angulate, or with tubercles. In late stages lateral tubercles disappearing and ribs branching from umbilical tubercles. Suture with long E and very broad, asymmetrically bifid L. *Lower Cretaceous (Upper Aptian)*: Europe, eastern Africa, South Africa, Madagascar, Egypt (Sinai), Iran, Japan, California, Texas, Mexico, South America.

C. (Chelonicer). Umbilical and lateral tubercles only; shoulders rounded or angulate but not with tubercles. Occurrence and distribution as for genus.—FIG. 208,4a,b. *C. (*C.*) *cornuelianum* (ORBIGNY), France; $\times 0.75$ (Orbigny, 1841).

C. (Epicheloniceras) CASEY, 1954a, p. 113 [**Douvillicer* *tschernyschewi* SINZOW, 1906, p. 182; OD]. Major ribs depressed on siphon and with distinct ventrolateral tubercles until later whorls. Occurrence and distribution as for genus.—FIG. 208,5a,b. *C. (*E.*) *tschernyschewi* (SINZOW), Transcaспia; $\times 1$ (Sinzow, 1906).

C. (Paracheloniceras) COLLIGNON, 1962b, p. 42 [**Epicheloniceras (P.) wrighti* COLLIGNON, 1962b, p. 42; OD]. Differs from *C. (Epicheloniceras)* only in its large, earlike outer tubercles and in ribs on body chamber being in some species broad and flat as in *Colombicer*. Occurrence as for genus: Madagascar.—FIG. 208,7a,b. *C. (*P.*) *wrighti* (COLLIGNON); $\times 1$ (Collignon, 1962b).

Diadochoceras HYATT, 1900, p. 587 [**Ammonites nodosocostatus* ORBIGNY, 1841, p. 258; OD] [= *Paracanthoplites* STOYANOW, 1949, p. 118 (type, *P. meridionalis*; OD); *Nodosohoplites* EGOIAN, 1965, p. 145 (type, *N. subplanatus*; OD); *Vergunnicer* THOMEL, 1980, p. 171, 180 (type, *Ammonites pretiosus* ORBIGNY, 1841, p. 193; OD)]. Moderately to very evolute; whorl section polygonal; primary ribs bearing umbilical, lateral, and ventrolateral tubercles; weaker secondaries with or without ventrolateral tubercles. Resembling *Epicheloniceras*, but generally more evolute and with weaker ribs. *Lower Cretaceous (Upper Aptian)*: France, Georgia, Madagascar, Arizona, Mexico.—FIG. 208,2a-c. **D. nodosocostatum* (ORBIGNY), France; a, b, $\times 1$; c, enlarged (Orbigny, 1840–1842).

Walpenites CASEY, 1962, p. 259 [**W. tardespinatus*; OD]. Dwarf; evolute; inner whorls as in *Chelonicer*, but body chamber with double ventral rows of sharp tubercles. *Lower Cretaceous (Upper Aptian)*: England.—FIG. 208,3a,b. **W. tardespinatus*, Isle of Wight; a, venter, $\times 2$; b, whorl sections of body chamber and inner whorls, $\times 1$ (Casey, 1962).

Vectisites CASEY, 1962, p. 256 [**V. caprocinus*; OD] [= *Zambranoites* ETAYO SERNA, 1979, p. 38 (type, *V.*

(*Z.*) *zambranoi* ETAYO SERNA, 1979, p. 38; OD)]. Dwarf, with whorl section depressed-oval or subcircular, ribs simple; a single row of septate lateral spines in young. [*Zambranoites* for species with ribs depressed on midline of venter seems unnecessary.] *Lower Cretaceous (Upper Aptian)*: England, France, Colombia.—FIG. 208,1a-c. **V. caprocinus*, Isle of Wight; a, side, $\times 1$; b, periphery, $\times 1$; c, section of inner whorls, $\times 2$ (Casey, 1962).

Subfamily DOUVILLEICERATINAE Parona & Bonarelli, 1897

[*nom. transl.* SPATH, 1922a, p. 111, ex Douvilleiceratidae PARONA & BONARELLI, 1897, p. 101]

Ribs at early stage with umbilical, lateral, and ventrolateral tubercles as in *Chelonicer* (*Epicheloniceras*); in later stages ribs typically multituberculate, with tubercles in some species very large, commonly strigate, sooner or later disappearing, leaving plain ribs on outer whorl. *Lower Cretaceous (Upper Aptian–Middle Albian)*.

Eodouvillicer CASEY, 1961d, p. 191 [**Douvillicer* *horridum* RIEDEL, 1938, p. 29; OD]. Ribs simple, with mammillate ventral tubercles, but these and the lateral and umbilical tubercles undivided until an advanced stage. *Lower Cretaceous (Upper Aptian)*: ?France, Turkmenistan, Japan, California, Venezuela, Colombia.—FIG. 209,1a,b. **E. horridum* (RIEDEL), Colombia; $\times 1$ (Casey, 1961d).

Douvillicer GROSSOUVER, 1894, p. 26, ICZN Opinion 422, 1956, Generic Name No. 1014 [**Ammonites mammillatus* SCHLOTHEIM, 1813, p. 111; ICZN Specific Name No. 764] [= *Trinitoceras* SCOTT, 1940, p. 1016 (type, *T. rex*; OD)]. Ribs unbranched at first, with strong umbilical and ventrolateral tubercles, then with numerous tubercles, uniform or not, and finally with no tubercles. *Lower Cretaceous (Lower Albian–Middle Albian)*: Europe, Madagascar, Egypt (Sinai), India, Siberia, USA, Peru, Colombia.—FIG. 209,2a. **D. mammillatum* (SCHLOTHEIM), Lower Albian, England; $\times 1$ (Spath, 1923–1943).—FIG. 209,2b. *D. monile* (J. SOWERBY), Lower Albian, England; $\times 3.5$ (Spath, 1923–1943).

Family TROCHLEICERATIDAE Breistroffer, 1951

[Trochleiceratidae BREISTROFFER, 1951b, p. 267]

Small; compressed and smooth to inflated with strong straight ribs; venter generally depressed or grooved. Suture quadrilobate throughout. *Lower Cretaceous (Upper Aptian–Lower Albian)*.

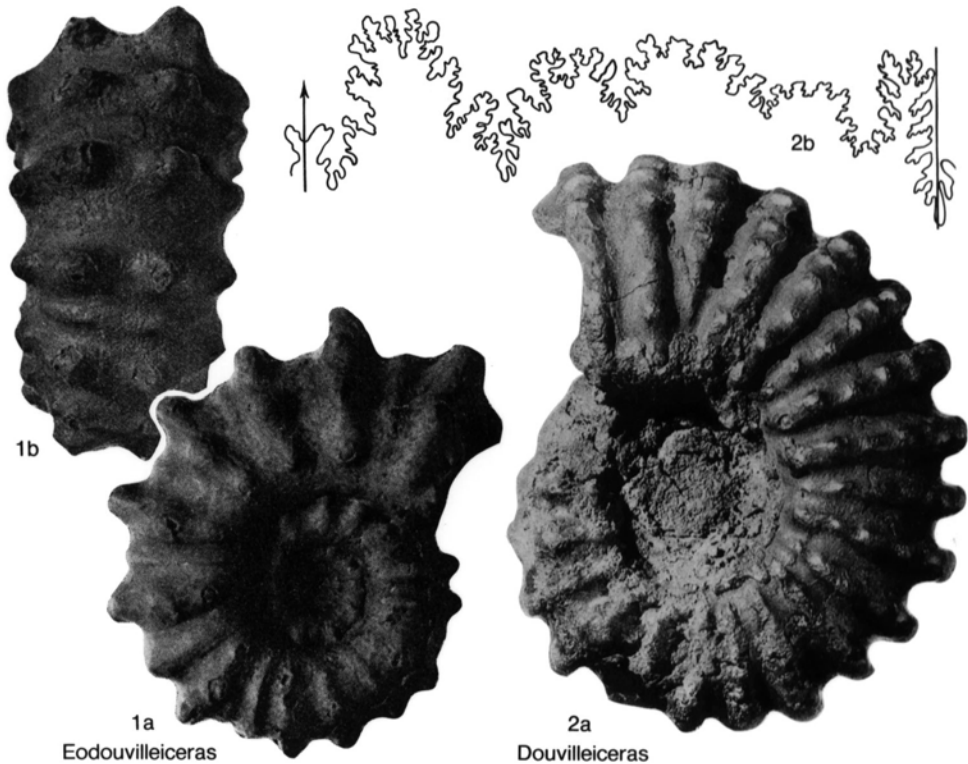


FIG. 209. Douvilleiceratidae (p. 269)

Trochleicerat FALLOT & TERMIER, 1923, p. 74 [**Waagenia? balearensis* FALLOT, 1920, p. 58; OD] [= *Magneticeras* COLLIGNON, 1950a, p. 48 (type, *M. magneti*; OD); *Juamportoceras* ETAYO SERNA, 1979, p. 31 (type, *T. (J.) hoffstetteri* ETAYO SERNA, 1979, p. 31; OD)]. Moderately evolute and compressed; venter rounded to flat, with deep to obsolescent, narrow median furrow; smooth or with feeble riblets. Suture with shallow and feebly indented elements. [*Juamportoceras* as subgenus for species with weak to absent sulcus is probably unnecessary.] *Lower Cretaceous (Upper Aptian–Lower Albian)*: Balearic Islands, Madagascar, Colombia.—FIG. 210, 1a, b. *T. magneti* (COLLIGNON), Lower Albian, Madagascar; $\times 2$ (Collignon, 1950a).—FIG. 210, 1c–e. *T. aff. termieri* COLLIGNON, Upper Aptian, Madagascar; outer whorl, $\times 1$ (Collignon, 1962b).

Pseudoleymeriella CASEY, 1957, p. 35 [**Hoplites haidaquensis* WHITEAVES, 1893b, p. 444; OD]. Evolute; whorl section more or less rounded; ribs simple, strong, irregularly long and short, straight to slightly flexuous, and interrupted by deep, narrow siphonal furrow. *Lower Cretaceous (Upper Aptian)*: Spain, Madagascar, Japan, British Columbia.—FIG. 210, 3a, b. **P. haidaquensis* (WHITEAVES), British Columbia; $\times 1$ (Casey, 1957).—

FIG. 210, 3c. *P. iberica* WIEDMANN, Spain; $\times 10$ (Wiedmann, 1966b).

Family ASTIERICERATIDAE Breistroffer, 1953

[Astiericeratidae BREISTROFFER, 1953b, p. 74]

Dwarf, scaphitoid forms with strong ribs and large umbilicolateral tubercles. Suture has wide L subdivided into 2 lobes as in Douvilleiceratidae. *Lower Cretaceous (Middle Albian)*.

Astiericerat PARONA & BONARELLI, 1897, p. 101 [**Scaphites astierianus* ORBIGNY, 1842a, p. 526, 624; OD]. At first with umbilical and ventrolateral tubercles, then (after nontuberculate stage) with large, round umbilicolateral tubercles emphasizing coronate whorl section; with short to moderately long shaft ending in hook, transversely oval in section, with ribs strong, slightly rursiradiate, simple or branching from small tubercles. Microconchs 25–30 mm long; macroconchs about twice as long (KENNEDY, 1986c). Suture with L subdivided into 2 trifold lobes. *Lower Cretaceous (Middle Albian)*:

France.—FIG. 210,2a–c. **A. astierianum* (ORBIGNY); a, b, $\times 1$ (Parona & Bonarelli, 1897); c, enlarged (Wiedmann, 1965).

Superfamily DESHAYESITACEAE Stoyanow, 1949

[*nom. transl.* WIEDMANN, 1966b, p. 46, ex Deshayesitinae STOYANOW, 1949, p. 123]

Ammoniticone by reversionary recoiling; probably derived from Heteroceratidae. Marked size dimorphism. *Lower Cretaceous* (*Upper Barremian–Lower Albian*).

Family DESHAYESITIDAE Stoyanow, 1949

[*nom. transl.* WRIGHT, 1955, p. 564, ex Deshayesitinae STOYANOW, 1949, p. 123]

Typically compressed; ribs strong, branching or long and short, crossing rounded venter or, in later forms with flat venter, may be interrupted; tubercles present in a few forms. Suture with first subdivision of umbilical lobe remaining next to saddle U/L, giving formula I U₂ U₃ U₁ L E. MIKHAILOVA, 1976b. *Lower Cretaceous* (*Upper Barremian–Upper Aptian*; ?*Lower Albian*).

Subfamily DESHAYESITINAE Stoyanow, 1949

[Deshayesitinae STOYANOW, 1949, p. 123]

If present, tubercles are only umbilical and ventrolateral. *Lower Cretaceous* (*Upper Barremian–Upper Aptian*; *Lower Albian*).

Turkmeniceras TOVBINA, 1962, p. 84 [**T. turkmenicum*; OD]. Umbilicus perforate, but later stages rather involute. Suture with broad, shallow lobes. *Lower Cretaceous* (*Upper Barremian*): Turkmenistan.—FIG. 211,3a. **T. turkmenicum*; $\times 1$ (Tovbina, 1963).—FIG. 211,3b,c. *T. geokderense* TOVBINA; $\times 1$ (Tovbina, 1963).

Prodeshayesites CASEY, 1961b, p. 592 [**Ammonites fissicostatus* PHILLIPS, 1829, p. 123; OD] [= *Paradeshayesites* KEMPER, 1967, p. 124 (type, *Hoplitides laeviusculus* KOENEN, 1902, p. 224; OD)]. Very compressed, with flat sides and arched or even fastigiate venter; evolute, with coiling loosening in middle growth; ribs strong throughout, in chevrons on venter, and tending to weaken on midline. Suture with broad, shallow elements and asymmetrical L. [*Paradeshayesites* may comprise macroconchs.] *Lower Cretaceous* (*Lower Aptian*): England, France, Germany.—FIG. 211,2a–c. **P. fissicostatus* (PHILLIPS), England; a, b, $\times 1$; c, enlarged (Casey,

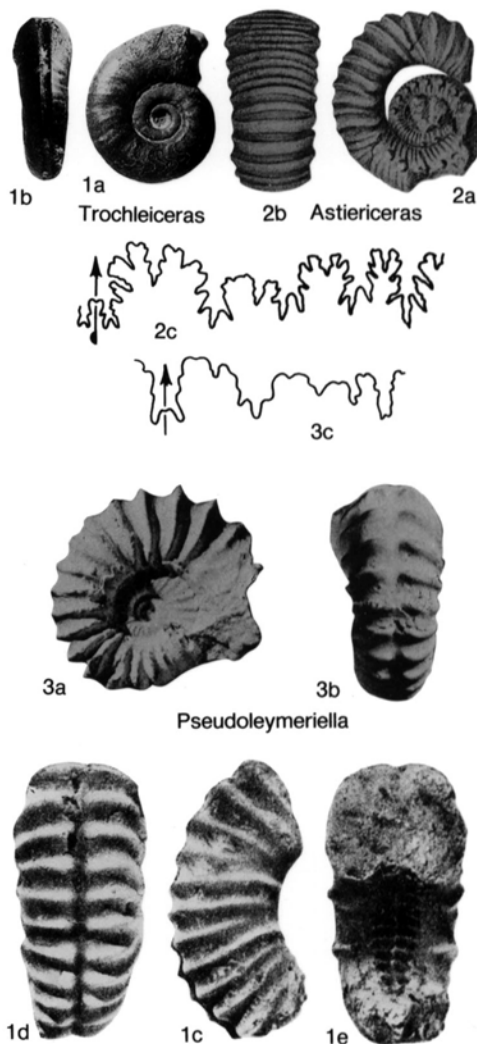


FIG. 210. Trochleiceratidae and Astiericeratidae (p. 270–271)

1964).—FIG. 211,2d,e. *P. laeviusculus* (KOENEN), Germany; inner whorls, $\times 1$ (Kemper, 1967).

Deshayesites KAZANSKY, 1914, p. 99 [**Ammonites deshayesi* ORBIGNY, 1840, p. 85] [= *Parahoplitoides* SPATH, 1922a, p. 111, obj.]. Moderately involute, with slight loosening of coiling with growth; compressed; sides and venter slightly convex to flat; ribs consisting of sigmoid primaries and branching or intercalated secondaries; ribbing may fade at middle growth but if so strengthening on body chamber; no distinct tubercles. *Lower Cretaceous* (*Lower Aptian*): Europe, Sardinia, Georgia, Greenland.—FIG. 211,1a–c. **D. deshayesi* (ORBIGNY), France; a, b, $\times 1$; c, enlarged (Casey, 1964).

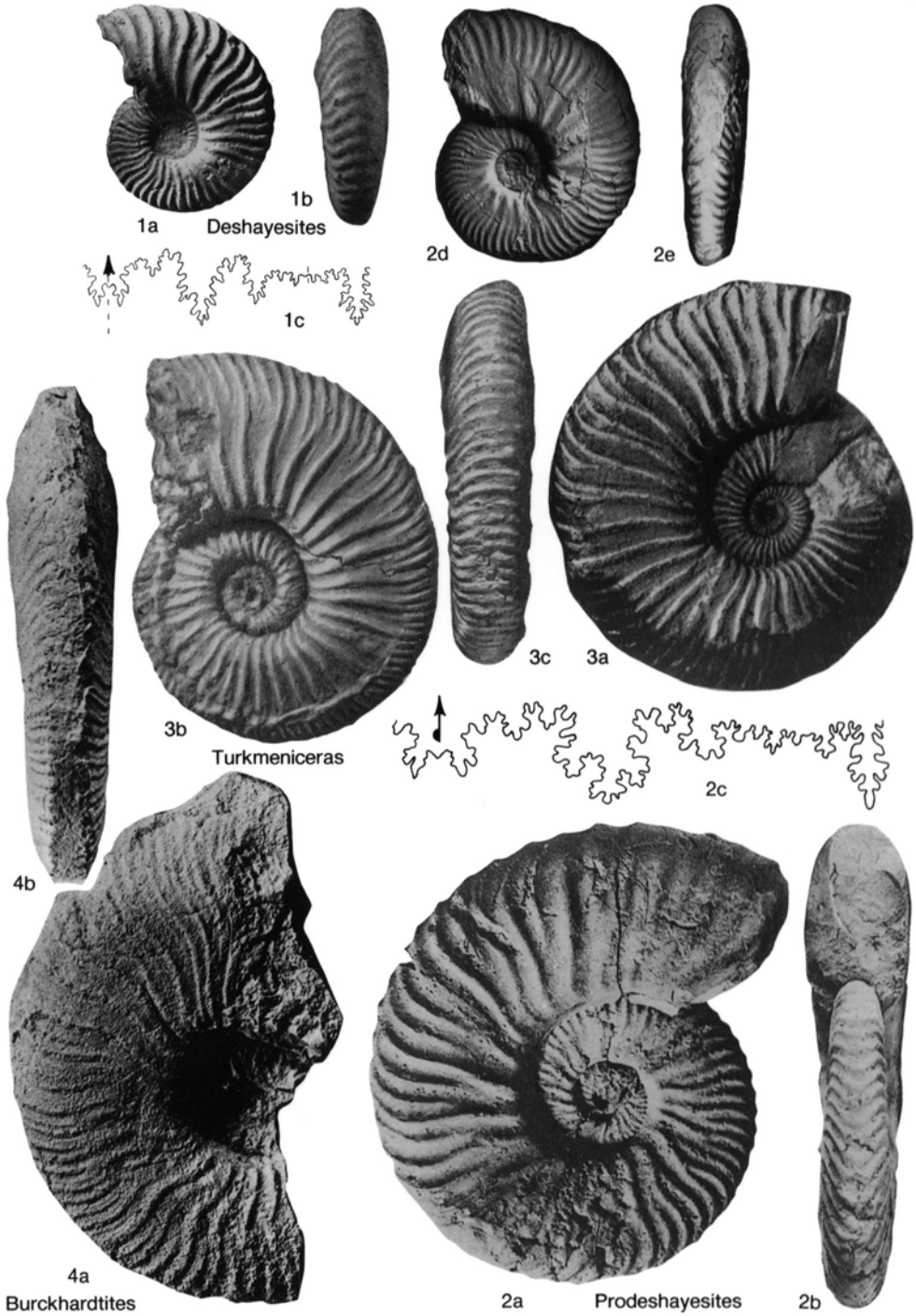


FIG. 211. Deshayesitidae (p. 271–273)

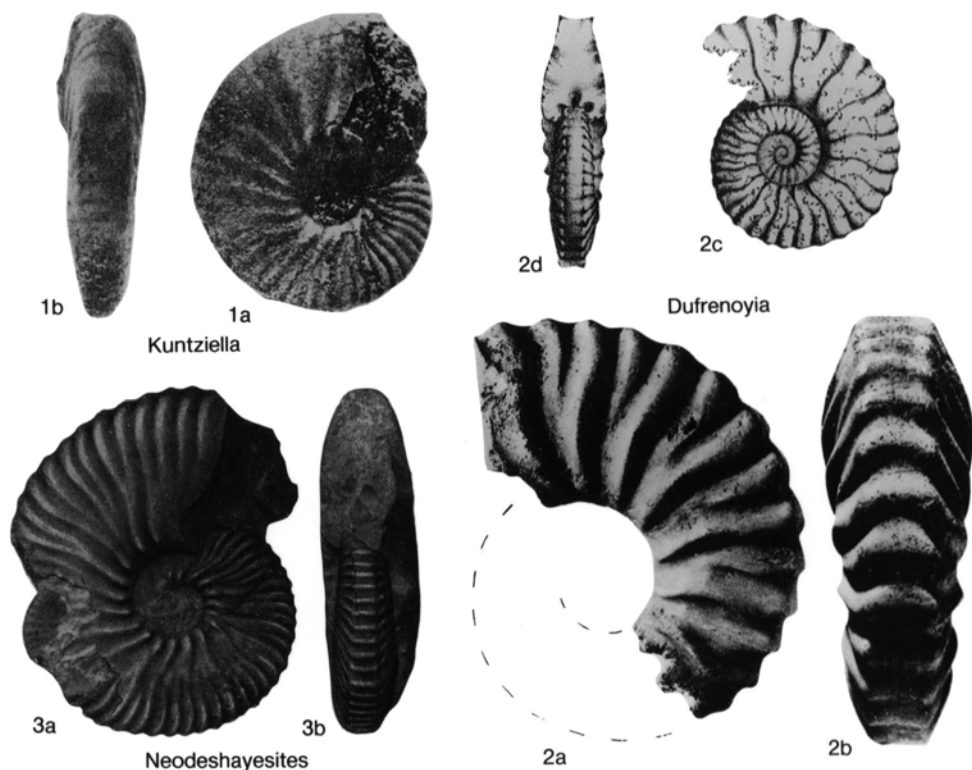


FIG. 212. Deshayesitidae (p. 273)

Neodeshayesites CASEY, 1964, p. 289 [**Deshayesites stutzeri* RIEDEL, 1938, p. 37; OD]. Like *Dufrenoyia* in early stage except that it has umbilical rather than ventrolateral tubercles; later with straight, high ribs on arched venter; lateral ribs tend to be biconcave. *Lower Cretaceous (Lower Albian)*: Colombia, Venezuela. —FIG. 212, 3a, b. **N. stutzeri* (RIEDEL), Colombia; $\times 1$ (Riedel, 1938).

Dufrenoyia KILIAN & REBOUL, 1915, p. 37 [**Ammonites furcatus* J. de C. SOWERBY, in FITTON, 1836, p. 339; OD] [= *Dufrenoyia* KILIAN & REBOUL, 1915, p. 178; *Stenhoplites* SPATH, 1922a, p. 110 (type, *Ammonites dufrenoyi* ORBIGNY, 1840, p. 100; OD); *Juandurhamiceras* ETAYO SERNA, 1979, p. 42 (type, *D. (J.) juandurhami* ETAYO SERNA, 1979, p. 42; OD)]. Compressed, with sides and venter flat; ribs more or less sinuous, fine or coarse, commonly broad and flat, branching or long and short, interrupted at first on venter, later continuous, raised in at least some growth stage into ventrolateral clavi. In macroconchs up to 400 mm in diameter, angularity of shoulders lost, but venter remaining flat and ribs strengthening. Derived directly from *Deshayesites*. [*Juandurhamiceras* for species with *Colombiceras*-like ribbing at end of body chamber seems unnecessary.] *Lower Cretaceous (Lower Aptian–Upper Aptian; ?Lower Albian)*: Europe, Ja-

pan, Texas, Mexico, Venezuela, Colombia. —FIG. 212, 2a, b. **D. furcata* (J. de C. SOWERBY), Lower Aptian, England; $\times 1$ (Casey, 1964). —FIG. 212, 2c, d. *D. dufrenoyi* (ORBIGNY), Upper Aptian, France; $\times 1$ (Orbigny, 1840–1842).

Kuntziella COLLIGNON, 1962b, p. 64 [**Deshayesites (Kuntziella) kuntzi*; OD]. Like early *Dufrenoyia* but with higher whorls, flatter sides, and no ventrolateral tubercles in young. *Lower Cretaceous (Upper Aptian)*: Madagascar. —FIG. 212, 1a, b. **K. kuntzi*; $\times 1$ (Collignon, 1962b).

Burckhardtites HUMPHREY, 1949, p. 130 [**Neocomites nazasensis* BURCKHARDT, 1925, p. 14; OD]. Differs from *Dufrenoyia* in more rapidly increasing whorl height and fine, irregular, biconcave ribs. *Lower Cretaceous (Upper Aptian)*: Mexico. —FIG. 211, 4a, b. **B. nazasensis* (BURCKHARDT); $\times 1$ (Humphrey, 1949).

Subfamily MATHOCERATINAE Casey, 1964

[Mathoceratinae CASEY, 1964, p. 289] [=Venezuellinae KVANTALIANI, 1980, p. 123]

Apparently small, with distinct umbilical, midlateral, ventrolateral, or siphonal tu-

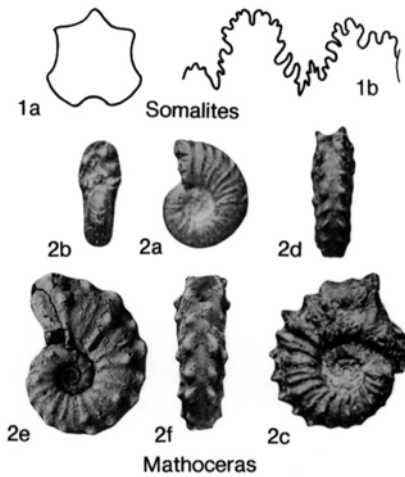


FIG. 213. Deshayesitidae (p. 274)

bercles and reduced suture. *Lower Cretaceous (Upper Aptian)*.

Cloioceras WHITEHOUSE, 1927, p. 118 [**Hoplites ruspolii* MAYER-EYMAR, 1893, p. 258; OD]. Differs from more strongly ribbed species of *Deshayesites* by its sharper and thinner simple ribs, which are raised into slight inner and outer ventrolateral tubercles. *Lower Cretaceous (Upper Aptian)*: Somalia.

Somalites TAVANI, 1949, p. 46 [**S. vertebralis*; OD]. Evolute; early ribs slightly flexuous, simple; later some tuberculate; finally all with large umbilical, ventrolateral, and siphonal tubercles. *Lower Cretaceous (Upper Aptian)*: Somalia.—FIG. 213, 1a, b. **S. vertebralis*; a, X1; b, X2 (Tavani, 1949).

Mathoceras CASEY, 1964, p. 289 [**Hoplites (Kilianella?) matho* PERVINQUIÈRE, 1907, p. 185; OD] [= *Venezuella* KVANTALIANI, 1980, p. 123 (type, *Mathoceras venezolanum* RENZ, 1978, p. 681; OD); *Renziella* KVANTALIANI, 1980, p. 123 (type, *Mathoceras laeve* RENZ, 1978, p. 684; OD)]. Compressed, with alternating clavi bordering flat or sulcate venter and sharp umbilical and lateral tubercles. [*Venezuella* and *Renziella* are Upper Aptian (RENZ, 1978; STOYKOVA, 1990) and not Lower Albian as KVANTALIANI argued.] *Lower Cretaceous (Upper Aptian)*: Balearic Islands, Bulgaria, Tunisia, Venezuela.—FIG. 213, 2a–d. **M. matho* (PERVINQUIÈRE), Tunisia; X1 (Pervinquierè, 1907).—FIG. 213, 2, e, f. *M. venezolanum* RENZ, Venezuela; X1 (Renz, 1982).

?Family PARAOPLITIDAE Spath, 1922

[Paraoplitidae SPATH, 1922a, p. 111]

Moderately involute; at least later whorls high and with broadly rounded venter; ribs

strong, without tubercles. Suture with trifold L; auxiliary lobes derived from saddle U/L, giving formula 1 U L3 L2 L1 E. MIKHAILOVA, 1976a, 1976b. *Lower Cretaceous (Upper Aptian–Lower Albian)*.

Perhaps derived from Deshayesitidae by way of *Dufrenoyia* (CASEY, 1965), but taxonomic position is uncertain (MIKHAILOVA, 1979); it was treated as a distinct superfamily by some (e.g., SCHINDEWOLF, 1968, p. 48(740)). The doubtful *Procolombiceras* SHARIKADZE, 1979, p. 381 (type, *P. aptum*; OD), if really Lower Aptian as stated, might be transitional from Deshayesitidae.

Subfamily ACANTHOHOPLITINAE Stoyanow, 1949

[Acanthoplitinae STOYANOW, 1949, p. 95] [=Colombiceratinae TOVBINA, 1979, p. 112]

Rather evolute; whorl section depressed to coronate in early stages and later higher than wide, with flat to convex sides. Early whorls generally having umbilical or lateral tubercles; primary ribs typically branching at lateral tubercles; ventrolateral tubercles may also occur. Suture has well-differentiated auxiliaries. *Lower Cretaceous (Upper Aptian–Lower Albian)*.

Colombiceras SPATH, 1923d, p. 64 [**Ammonites crassicosatus* ORBIGNY, 1840, p. 64; OD]. Early whorls with flat-topped ribs angulate at shoulders, branching at midflank, where one tubercle may be present, or at umbilical shoulder; later whorls compressed, with flat sides and flat to subrounded venter and less flat-topped ribs; some species losing flatness of ribs and tuberculation at early stage, then resembling *Parahooplites*. Suture with deep, subrectangular E, trifold L, bifid saddles, and simplified auxiliaries. *Lower Cretaceous (Upper Aptian)*: England, France, Sardinia, Romania, Georgia, Madagascar, Texas, Mexico, Colombia.

C. (Colombiceras). Lateral tubercles present in early stages. Occurrence and distribution as for genus.—FIG. 214, 3a, b. **C. (C.) crassicosatum* (ORBIGNY), France; X1 (Orbigny, 1840–1842).

C. (Egoianiceras) AVRAM, 1974, p. 5 [**C. crassicosatum angulatum* EGOIAN, 1969, p. 163; OD] [=? *Riedelites* ETAYO SERNA, 1979, p. 70 (type, *R. esthersernae*; OD)]. Lateral tubercles absent. Doubtfully necessary. Occurrence as for genus: Romania, Colombia.

Gargasiceras CASEY, 1954a, p. 114 [**Ammonites gargasensis* ORBIGNY, 1841, p. 199; OD]. Rather

evolute; sides and venter flat; umbilical margins and shoulders rounded; ribs thin on sides, tending to be flattened on venter; on inner whorls major ribs raised into thin flange, above which ribs branch at minute tubercle; ribs depressed on siphon; later ribs more uniform and venter rounded. *Lower Cretaceous (Upper Aptian)*: France, Mexico, Peru, Colombia.

G. (*Gargasicerus*). Ribs persistent, remaining transverse across venter. Occurrence and distribution as for genus.—FIG. 214, 2*a, b*. **G. (G.) gargasense* (ORBIGNY), France; $\times 1$ (Orbigny, 1841).

G. (*Pseudogargasicerus*) COLLIGNON, 1962b, p. 61 [**G. (P.) enigmaticum*; OD]. Small, evolute, and compressed; inner whorls with very fine ribs; ribs later reduced to obtuse chevrons on venter. *Lower Cretaceous (Upper Aptian)*: Madagascar.—FIG. 214, 1*a, b*. **G. (P.) enigmaticum*; $\times 1$ (Collignon, 1962b).

Acanthohoplites SINZOW, 1907, p. 499 [**Parahoplites aschiltaensis* ANTHULA, 1899, p. 117(63); SD ROMAN, 1938, p. 348] [= *Acanthohoplites* R. DOUVILLE, 1912a, p. 260, *nom. van.* (illegitimate emendation); *Protacanthohoplites* TOVBINA, 1970, p. 57 (type, *Parahoplites abichi* ANTHULA, 1899, p. 118(64); OD); *Chaschupseceras* KVANTALIANI, 1968, p. 62 (type, *C. abchasicum*; OD)]. Early whorls coronate and much as in *Chelonicerus*; later whorls round, then oval in section; primary ribs with or without umbilical bullae, at first branching at prominent lateral tubercles, which later disappear, and then branching at umbilical edge alone or also at midflank. [*Chaschupseceras* seems to show only minor differences in ornament (KVANTALIANI & SHARIKADZE, 1983).] *Lower Cretaceous (Upper Aptian)*: Europe, Georgia, Transcausia, eastern Africa, Madagascar, Japan, California, Arizona, Mexico.—FIG. 215, 2*a-c*. **A. aschiltaensis* (ANTHULA), Caucasus; *a*, $\times 1$; *b*, $\times 0.5$; *c*, $\times 1$ (Anthula, 1899).

Nolanicerus CASEY, 1961b, p. 598 [**Hoplites nolani* SEUNES, 1887, p. 564; OD]. Similar to compressed *Hypacanthoplites* but with close, fine ribs, rounded venter only slightly flattened in young, and no ventrolateral tubercles; lateral tubercles only briefly present and minute. *Lower Cretaceous (Lower Albian)*: England, France, Georgia, Algeria, Madagascar, Iran.—FIG. 215, 1*a, b*. **N. nolani* (SEUNES), France; $\times 1$ (Seunes, 1887).

Hypacanthoplites SPATH, 1923d, p. 64 [**Acanthoceras milletianum* (ORBIGNY) var. *plesiotypica* FRITEL, 1906, p. 245; OD] [= *Cuchillites* SCOTT, 1940, p. 1050 (type, *C. evolutus*; OD); *Sinzowites* GLAZUNOVA, 1949, p. 22 (type, *Parahoplites jacobi* COLLET, 1907, p. 520; OD)]. Up to 400 mm in diameter; whorl section depressed in initial stage and sometimes in later stages; early whorls hexagonal or rectangular in section, with flat or concave venter and angular shoulders; primary ribs straight or flexuous, tuberculate at umbilical margin, and branching at lateral tubercle; secondary ribs intercalated or

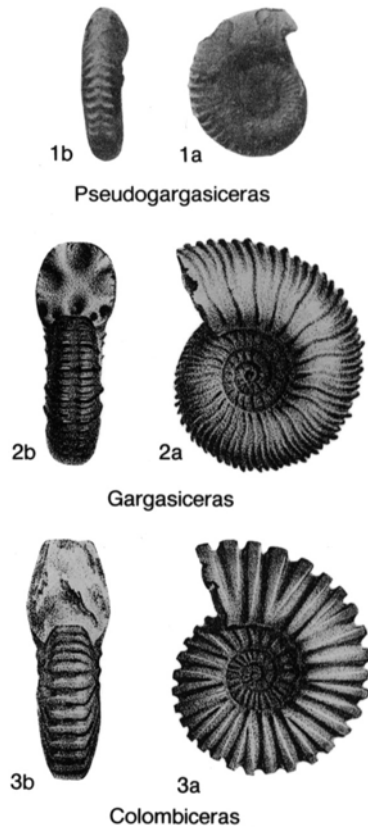


FIG. 214. Parahoplitidae (p. 274–275)

branching; all ribs nodose on shoulders; later tubercles disappearing and venter becoming rounded; test thickened on crest of ribs. *Lower Cretaceous (Upper Aptian–Lower Albian)*: Europe, northern Africa, Madagascar, Iran, California, Texas.—FIG. 215, 4*a-c*. **H. plesiotypicus* (FRITEL), Germany; *a, b*, $\times 1$; *c*, $\times 2$ (Collet, 1907).

Rhytidoplites SCOTT, 1940, p. 1034 [**R. robertsi*; OD]. Ribs dense, wider than interspaces; outer whorls with distant, sinuous primary ribs separated by 2 to 4 intercalatories on outer third of side. *Lower Cretaceous (Upper Aptian)*: Texas, Mexico.—FIG. 215, 3*a, b*. **R. robertsi*, Mexico; $\times 1$ (C. M. Cantu-Chapa, 1976).

Penaceras A. CANTU-CHAPA, 1963, p. 54 [**Hypacanthoplites? rursiradiatus* HUMPHREY, 1949, p. 142; OD] [= *Pegnaceras* ETAYO SERNA, 1979, p. 55, *nom. van.* (illegitimate emendation)]. Like *Colombicerus*, but primary ribs recti- or rursiradiate on inner half of side, then branching and rursiradiate, flattening toward venter; on early whorls periodic ribs enlarged. Perhaps synonymous with *Colombicerus*. *Lower Cretaceous (Upper Aptian)*: Mexico.—FIG. 215, 5*a, b*. **P. rursiradiatus* (HUMPHREY); $\times 1$ (Humphrey, 1949).

Subfamily PARAHOPLITINAE
Spath, 1922

[*nom. transl.* ROMAN, 1938, p. 346, *ex* Parahoplitidae SPATH, 1922a, p. 111]

Whorl section oval or rectangular; ribs strong, straight or sinuous, uninterrupted over venter, alternately long and short or branching at slight umbilical swellings, but no distinct tubercles at any stage. Tending to

be smooth at large diameters. Suture with rather simple auxiliaries in umbilical region. *Lower Cretaceous (Upper Aptian).*

Parahoplites ANTHULA, 1899, p. 111 [**P. melchioris*; OD] [= *Sioyanowiceras* ETAYO SERNA, 1979, p. 67 (type, *Ammonites treffryanus* KARSTEN, 1858, p. 109; OD)]. Ribs normally sinuous throughout, bent forward on venter; may weaken or disappear on body chamber. *Lower Cretaceous (Upper Aptian)*: Europe,

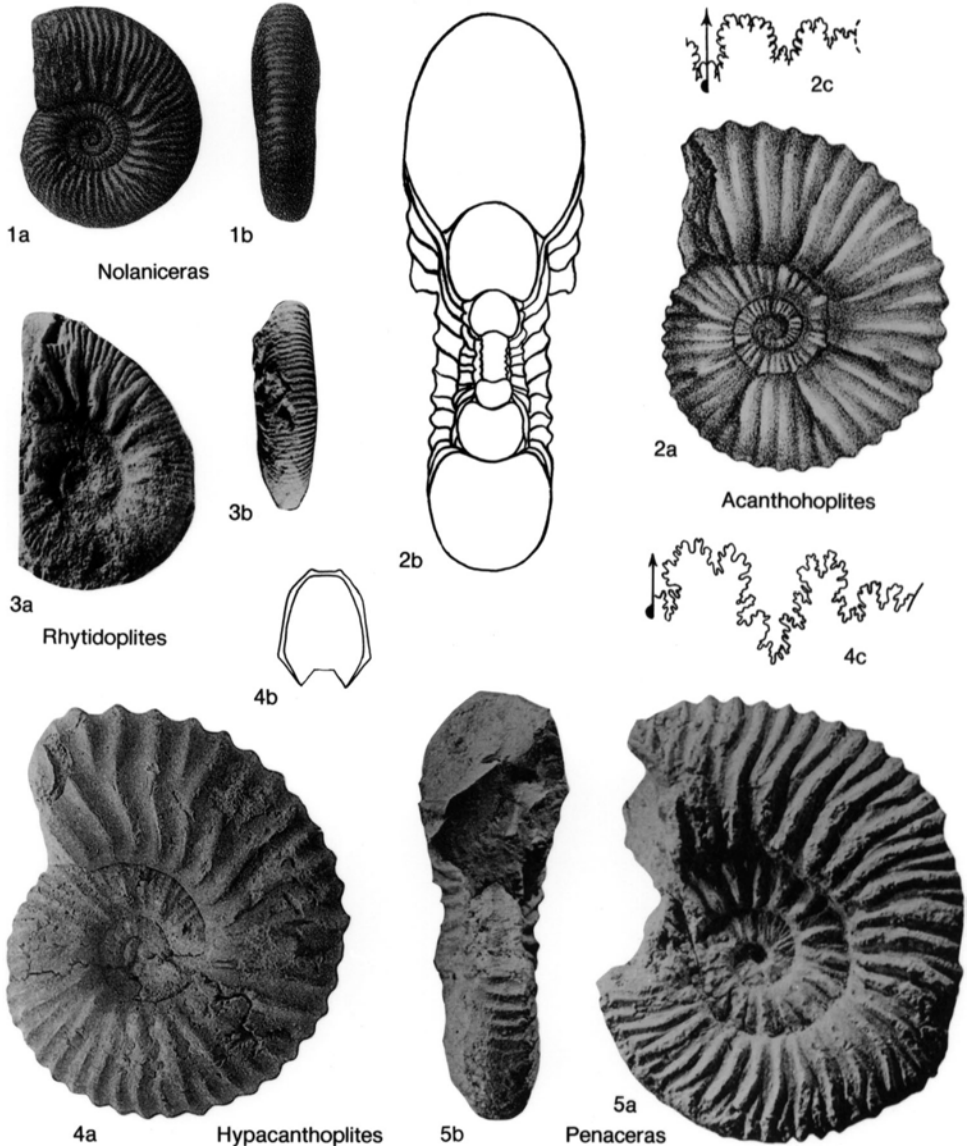


FIG. 215. Parahoplitidae (p. 275)

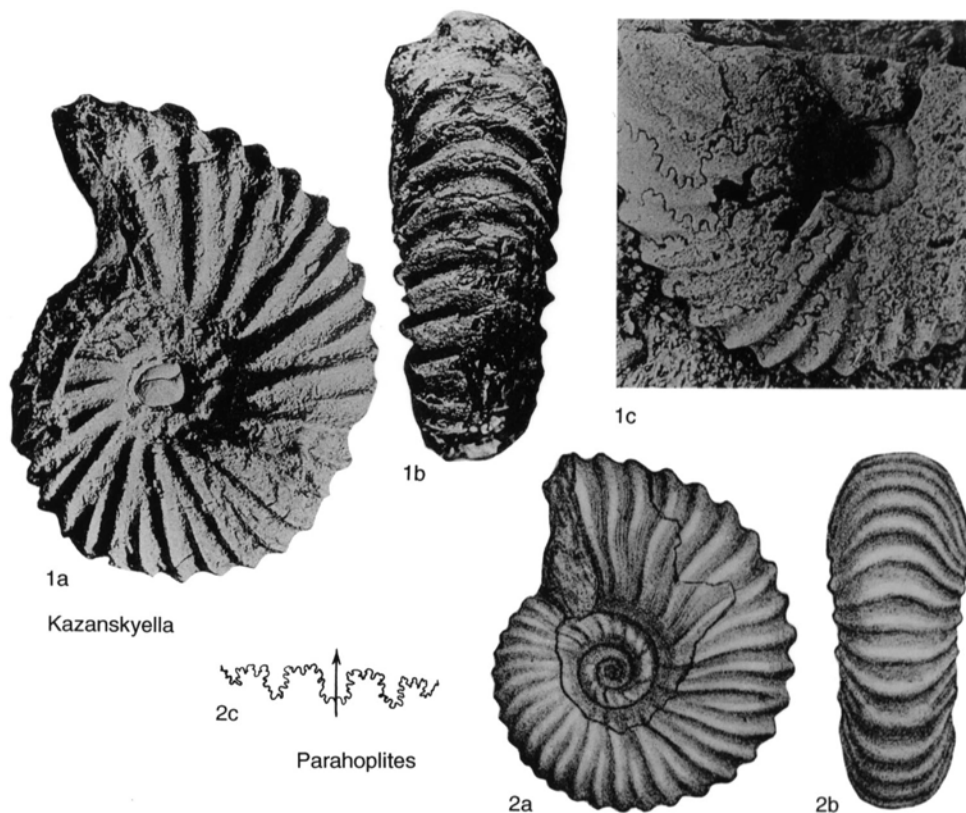


FIG. 216. Parahoplitidae (p. 276–277)

Transcaspia, Iran, Arizona, Texas, Colombia, Peru.—FIG 216,2a–c. **P. melchioris*, Caucasus; X1 (Anthula, 1899).

Kazanskyella STOYANOW, 1949, p. 99 [**K. arizonica*; OD] [= *Sinzowiella* STOYANOW, 1949, p. 101 (type, *S. spathi*; OD)]. Differs from *Parahoplites* in its rigid ribbing and wide, asymmetric L in suture. *Lower Cretaceous (Upper Aptian)*: Caucasus, Texas, Ari-

zona.—FIG. 216,1a–c. **K. arizonica*, Arizona; *a, b*, X1; *c*, X2 (Stoyanow, 1949).

Quitmanites SCOTT, 1940, p. 1048 [**Q. ceratitosus*; OD]. Very evolute; whorl section round. Suture with very wide L with 6 fingerlike folioles. Perhaps an aberrant *Kazanskyella*. *Lower Cretaceous (Upper Aptian)*: Texas.

EXPLANATION OF CORRELATION CHART

The table that follows sets out the stages and substages of the Cretaceous and of the uppermost Jurassic. In order to clarify the usage adopted, zones are also given. The lists of zones are synthesized from those in current use or proposed. For parts of the Lower Cretaceous, in which provincialism was extreme, separate lists for different regions are given. Generic names of zonal index species of ammonites have been amended to accord with the classification used in this volume.

It must be emphasized that these tables do not attempt to give zonal systems for all parts of the world but merely to explain the system

of stages in the classic areas in which most of the taxa in the genus and family groups were originally defined. There is not yet a fully agreed-upon system of zones; active discussion continues, particularly over the lower part of the Lower Cretaceous and the highest part of the Upper Cretaceous.

Exact correlation between regions should not be assumed. Indeed, on either side of the Jurassic-Cretaceous boundary, correlation is so uncertain that separate stage names, Volgian and Ryazanian, continue to be employed for boreal regions.

TABLE 1. Correlation Chart of the Cretaceous.

	Mediterranean and Submediterranean	Northwestern Europe [belemnite zones for Maastrichtian and Campanian]
Upper Cretaceous	Maastrichtian Upper { <i>Anapachydiscus terminus</i> <i>Anapachydiscus fresvillensis</i> Lower { <i>Pachydiscus epiplectus</i>	Upper { <i>Belemnella casimirovensis</i> <i>Belemnella junior</i> Lower { <i>Belemnella occidentalis</i> <i>Belemnella lanceolata</i>
	Campanian Upper { <i>Nostoceras hyatti</i> <i>Bostrychoceras polyplacum</i> <i>Hoplitoplacenticeras marroti</i> Lower { <i>Menabites delawarensis</i> <i>Placenticeras bidorsatum</i>	Upper { <i>Belemnitella langei</i> <i>Belemnitella minor</i> <i>Belemnitella mucronata</i> Lower { <i>Goniot euthis quadrata</i> <i>Goniot euthis granulatoquadrata</i>
	Santonian <i>Placenticeras polyopsis</i> [There is no satisfactory ammonite subdivision of the Santonian. The stage is more or less equivalent in Aquitaine to a zone of <i>Placenticeras polyopsis</i> .]	
	Coniacian	Upper { <i>Paratexanites serratomarginatus</i> <i>Gauthiericeras margae</i> Lower { <i>Peroniceras tridorsatum</i> <i>Forresteria petrocoriensis</i>
	Turonian	Upper { <i>Subprionocyclus neptuni</i> <i>Collignoniceras woollgari</i> Lower { <i>Mammites nodosoides</i> <i>Watinoceras coloradoense</i>
	Cenomanian	Upper { <i>Neocardioceras juddii</i> <i>Metioceras geslinianum</i> <i>Calycoceras guenangeri</i> Middle { <i>Acanthoceras jukesbrownei</i> <i>Acanthoceras rhotomagense</i> Lower { <i>Mantelliceras dixonii</i> <i>Mantelliceras mantelli</i>
Lower Cretaceous	Albian	Upper { <i>Stoliczkaia dispar</i> <i>Mortoniceras inflatum</i> Middle { <i>Euhoplites lautus</i> <i>Hoplites dentatus</i> Lower { <i>Douvilleiceras mammillatum</i> <i>Leymeriella tardefurcata</i>
	Aptian Upper { <i>Hypacanthoplites jacobi</i> <i>Acanthoplites nolani</i> Middle { <i>Parahoplites melchioris</i> <i>Cheloniceris subnodosocostatum</i> Lower { <i>Dufrenoyia furcata</i> <i>Deshayesites deshayesi</i> <i>Deshayesites weissii</i> <i>Deshayesites tuarkeyricus</i>	Upper { <i>Hypacanthoplites jacobi</i> <i>Parahoplites nutfeldiensis</i> <i>Cheloniceris martinoides</i> <i>Tropaeum bowerbanki</i> Lower { <i>Deshayesites deshayesi</i> <i>Deshayesites forbesi</i> <i>Prodeshayesites fissicostatus</i>
	Barremian Upper { <i>Martelites sarasini</i> <i>Heteroceras giraudi</i> <i>Hemihoplites feraudianus</i> <i>Heinzia sartousiana</i> <i>Ancyloceras vandenheckii</i> Lower { <i>Holcodiscus caillaudianus</i> <i>Subpulchellia nicklesi</i> <i>Spiritidiscus hugii</i>	Upper { <i>Parancycloceras bidentatum</i> <i>Hemicrioceras rude</i> <i>Crioceratites sparsicostata</i> <i>Crioceratites denckmanni</i> Lower { <i>Crioceratites elegans</i> <i>Hoplocrioceras fissicostatum</i> <i>Crioceratites rarocinctum</i>

TABLE 1. (Continued).

	Mediterranean and Submediterranean	Northwestern Europe
Lower Cretaceous	Hauterivian <ul style="list-style-type: none"> Upper { <i>Pseudothurmannia angulicostata</i> <i>Balearites balearis</i> <i>Plesiospitidiscus ligatus</i> <i>Subsavnella sayni</i> Lower { <i>Lyticoceras nodosoplicatum</i> <i>Crioceratites loryi</i> <i>Acanthodiscus radiatus</i> 	<ul style="list-style-type: none"> Upper { <i>Simbirskites marginatus</i> <i>Simbirskites gotschei</i> <i>Simbirskites spetonensis</i> <i>Simbirskites inversum</i> Lower { <i>Lyticoceras regale</i> <i>Lyticoceras noricum</i> <i>Lyticoceras amblygonium</i>
	Valanginian <ul style="list-style-type: none"> Upper { <i>Neocomites pachydicanus</i> <i>Saynoceras verrucosum</i> Lower { <i>Neocomites campylotoxus</i> <i>Thurmanniceras pertransiens</i> <i>Thurmanniceras otopeta</i> 	<ul style="list-style-type: none"> Upper { <i>Olcostephanus densicostatus</i> <i>Stoicoceras tuberculatum</i> <i>Dichotomites bidichotomoides</i> <i>Dichotomites triptychoides</i> <i>Dichotomites crassus</i> <i>Dichotomites polytomus</i> <i>Dichotomites hollwedensis</i> Lower { <i>Polyptychites hapkei</i> <i>Polyptychites clarki</i> <i>Polyptychites multicostatus</i> <i>Polyptychites pavlowi</i> <i>Platylenticeras involutum</i> <i>Platylenticeras heteropleurum</i> <i>Platylenticeras robustum</i>
	Berriasian <ul style="list-style-type: none"> Upper { <i>Subthurmannia boissieri</i> Lower { <i>Subthurmannia occitanica</i> <i>Berriasella euxinus</i> 	Ryazanian <ul style="list-style-type: none"> Upper { <i>Peregrinoceras albidum</i> <i>Surites stenomphalus</i> <i>Surites icenii</i> Lower { <i>Hectoroceras kochi</i> <i>Runctonia runctoni</i>
Upper Jurassic	Tithonian <ul style="list-style-type: none"> Upper { <i>Durangites</i> spp. <i>Micracanthoceras microcanthum</i> Lower { <i>Micracanthoceras ponti</i> <i>Semiformiceras fallauxi</i> <i>Semiformiceras semiforme</i> <i>Neohetoceras darwini</i> <i>Hybonoticeras hybonotum</i> 	<ul style="list-style-type: none"> Upper Volgian { <i>Subcraspedites lamplughi</i> <i>Subcraspedites preplicomphalus</i> <i>Subcraspedites primitivus</i> Portlandian { <i>Paracraspedites oppressus</i> <i>Titanites giganteus</i>

TABLE 1. (Continued).

Volga Basin and Russian Platform	Northern Siberia
Hauterivian Upper { <i>Simbirskites decheni</i> Lower { <i>Simbirskites versicolor</i>	Lower { <i>Homolsomites bojarkensis</i>
Valanginian Upper { _____ <i>Polyptychites keyserlingi</i> Lower { <i>Nikitinoceras hoplitoides</i> <i>Pseudogarnieria unduloplicatilis</i>	Upper { <i>Dichotomites bidichotomus</i> Lower { <i>Polyptychites stubendorfi</i> <i>Polyptychites astieriptychus</i> <i>Polyptychites quadrifidus</i> <i>Tollia klimovskiensis</i>
Ryazanian Upper { <i>Surites spasskensis</i> Lower { <i>Riasanites ryazanensis</i>	Upper { <i>Surites mesezhnikovi</i> <i>Surites analogus</i> Lower { <i>Hectoroceras kochi</i> <i>Chetaites sibiricus</i>
Volgian Upper { <i>Craspedites nodiger</i> <i>Craspedites subditus</i> <i>Kashpurites fulgens</i> Middle { <i>Epivirgatites nikitini</i> <i>Virgatites virgatus</i> <i>Dorsoplanites panderi</i> Lower { <i>Howaiskya pseudoscythica</i> <i>Howaiskya sokolovi</i> <i>Howaiskya klimovi</i>	Upper { <i>Chetaites chetae</i> <i>Craspedites taimyrensis</i> <i>Craspedites okensis</i>

RANGES OF TAXA

The stratigraphic distribution of the Cretaceous Ammonoidea recognized in this volume is shown graphically in the range chart (Table 2). Genera and subgenera belonging to the largely Jurassic Phylloceratina and Lytoceratina (Lytocerataceae) are only listed herein (see p. 1) and are not included in the range chart. Stratigraphic information about these taxa can be obtained from the text. Similarly, taxa designated in the text as *nomina dubia* or *nomina nuda* are not included in the chart.

The stratigraphic ranges older than the Cretaceous have been grouped into a single category, “pre-Cretaceous.” For more detailed stratigraphic information, see the systematic section of the volume. Taxa that are

preceded by an asterisk (e.g., *Garniericeras*) occur in the Ryazanian rather than the Berriasian, as indicated on the chart. As was discussed elsewhere, these two time units are not perfectly congruent, although they are largely correlative.

The following chart was compiled using software developed for the Paleontological Institute by Kenneth C. Hood and David W. Foster.

It must be emphasized that the order of taxa in this chart is governed entirely by their stratigraphic range and, within that, by alphabetical order and differs in some cases from the taxonomic order in the systematic part of the volume. No taxonomic conclusions should be drawn from the position of taxa in this chart.

TABLE 2. Stratigraphic Distribution of the Cretaceous Ammonoidea.

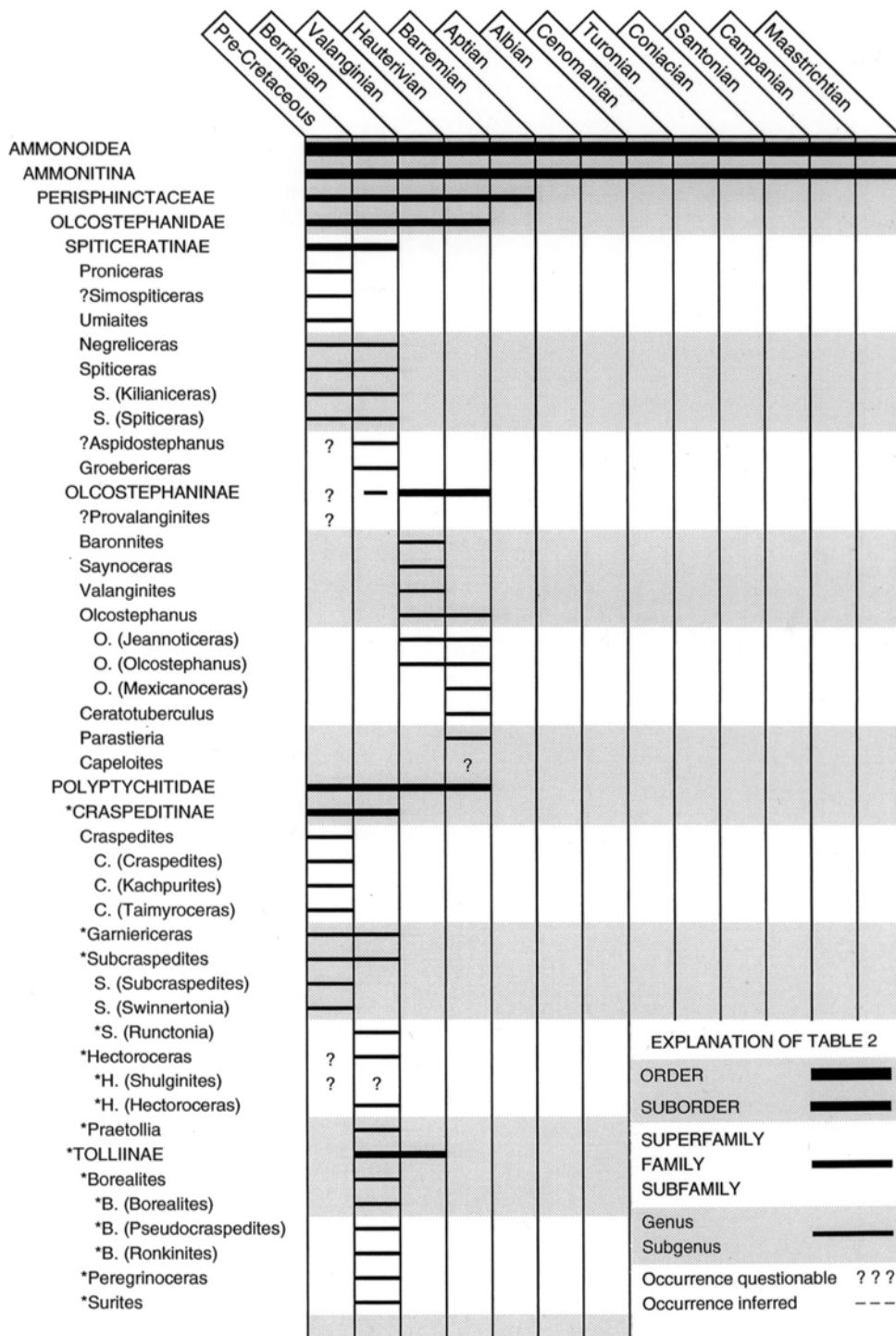


TABLE 2. (Continued).

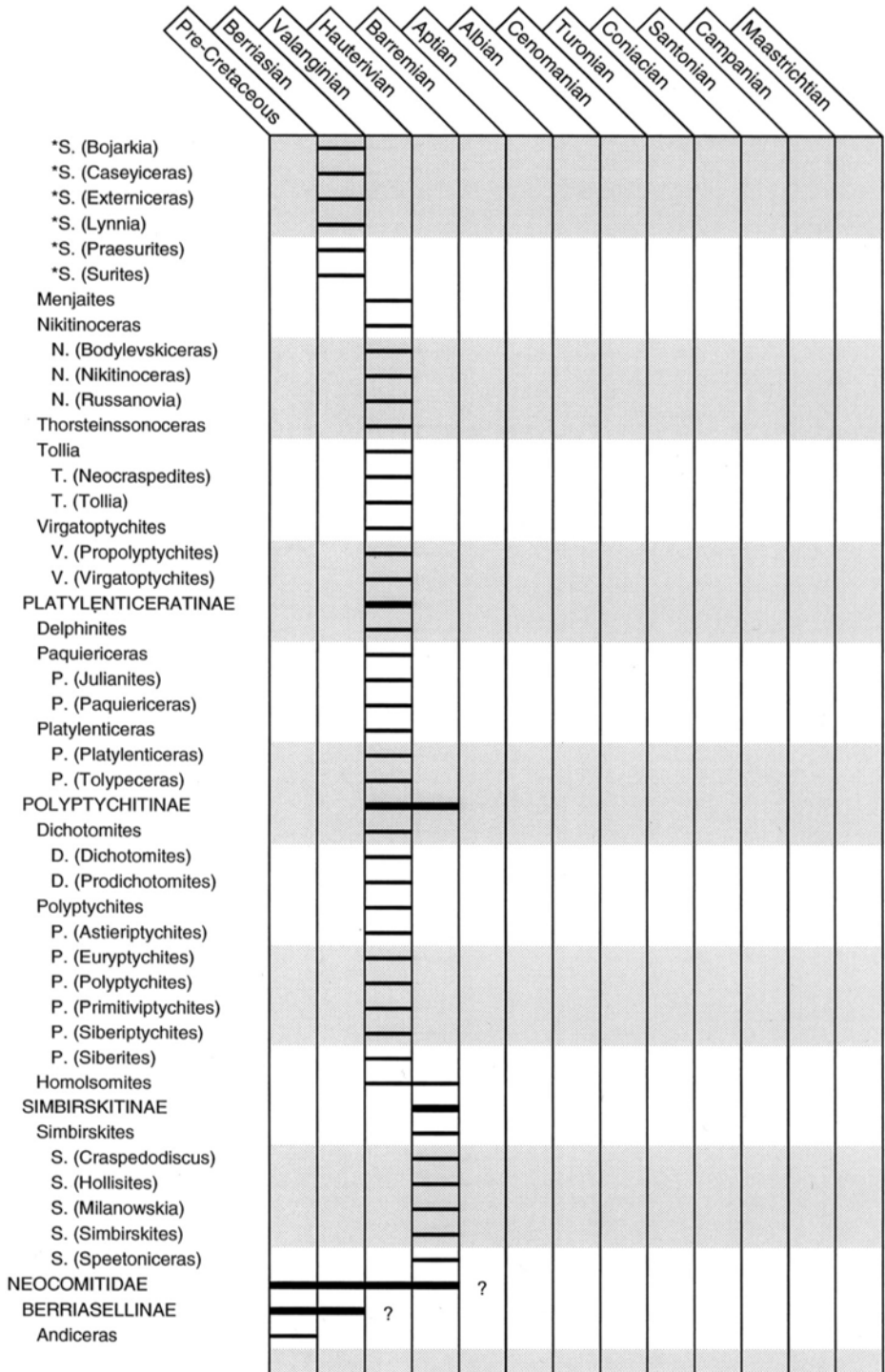


TABLE 2. (Continued).

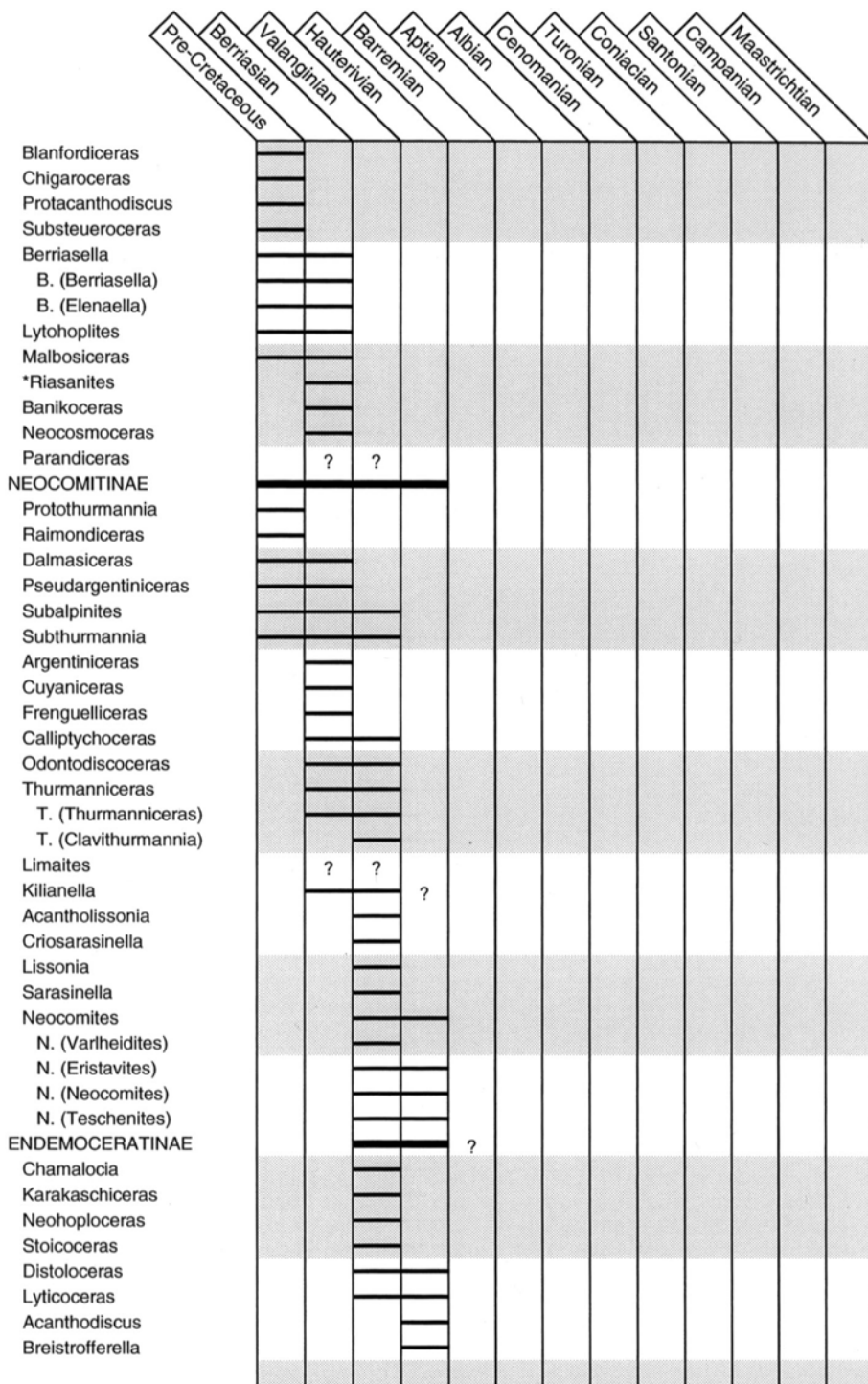


TABLE 2. (Continued).

	Pre-Cretaceous	Berriasian	Valanginian	Hauterivian	Barremian	Aptian	Albian	Cenomanian	Turonian	Coniacian	Santonian	Campanian	Maastrichtian
?Cruasicerias													
Hannaites													
Leopoldia													
Pseudofavrella													
Saynella													
Suboosterella													
Favrella						?							
Malgesaynella						?							
?Hatchericeras						?	?						
OOSTERELLIDAE													
Pseudosterella													
Oosterella													
HOLCODISCIDAE													
?Holcoptychites													
Almohadites													
Astieridiscus													
Holcodiscus													
Metahoplites													
M. (Medjeziceras)													
M. (Metahoplites)													
Parasaynoceras													
?Gymnoplites							?						
HAPLOCERATACEAE													
HAPLOCERATIDAE							?						
Haploceras													
Neolissoceras		?					?						
OPPELIIDAE													
STREBLITINAE													
Cyrtosiceras													
Substreblites													
Uhligites													
Bornhardtceras													
ACONECERATINAE													
Protaconeceras													
Aconeceras													
A. (Aconeceras)													
A. (Theganoceras)													
A. (Gyaloceras)													
A. (Sanmartinoceras)									?				
A. (Sinzovia)													
Doridiscus													
Nothodiscus													
Falciferella													
Koloceras													
Naramoceras													
BINNEYITIDAE													
Borissjakoceras													
Johnsonites													

TABLE 2. (Continued).

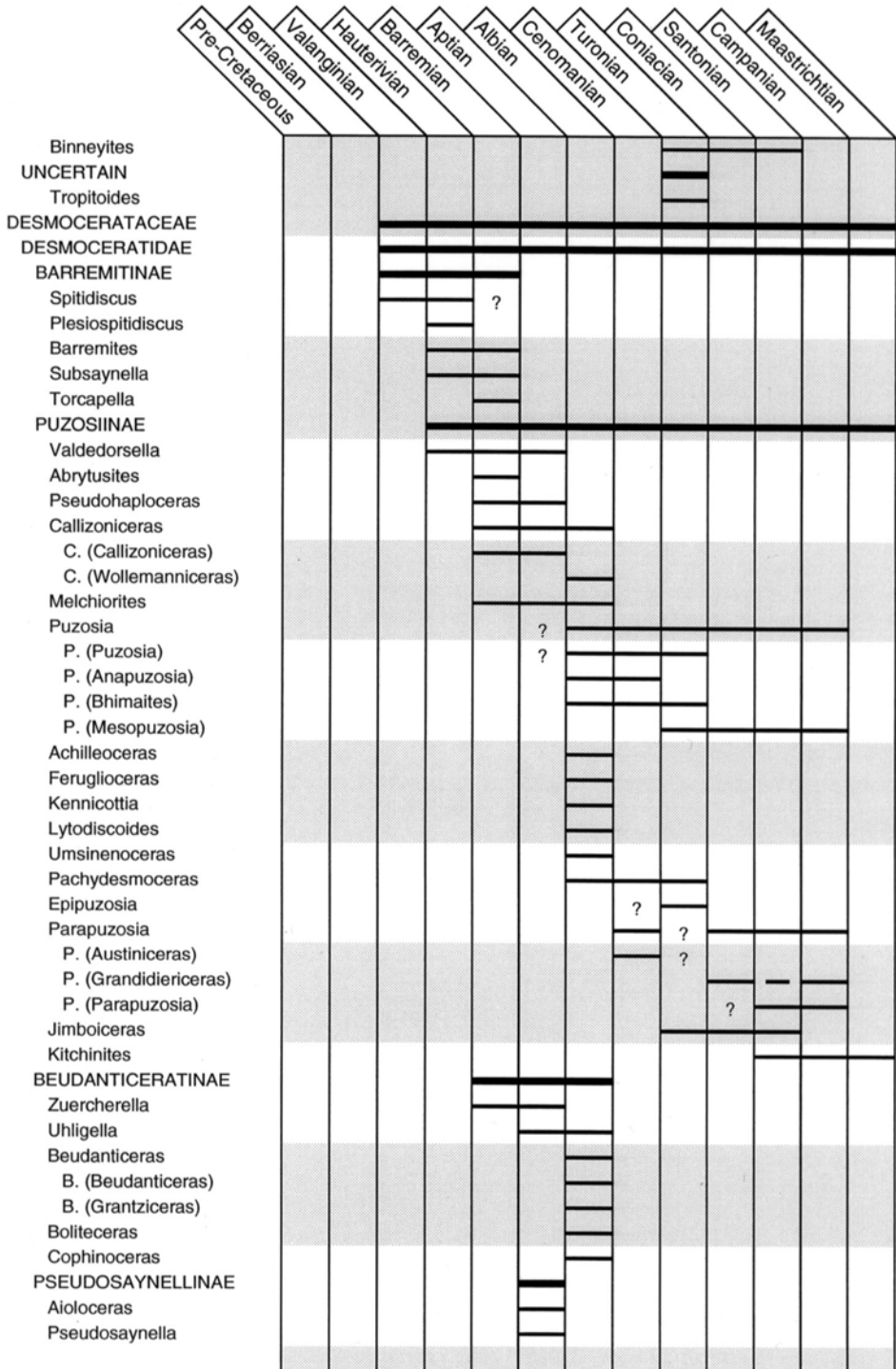


TABLE 2. (Continued).

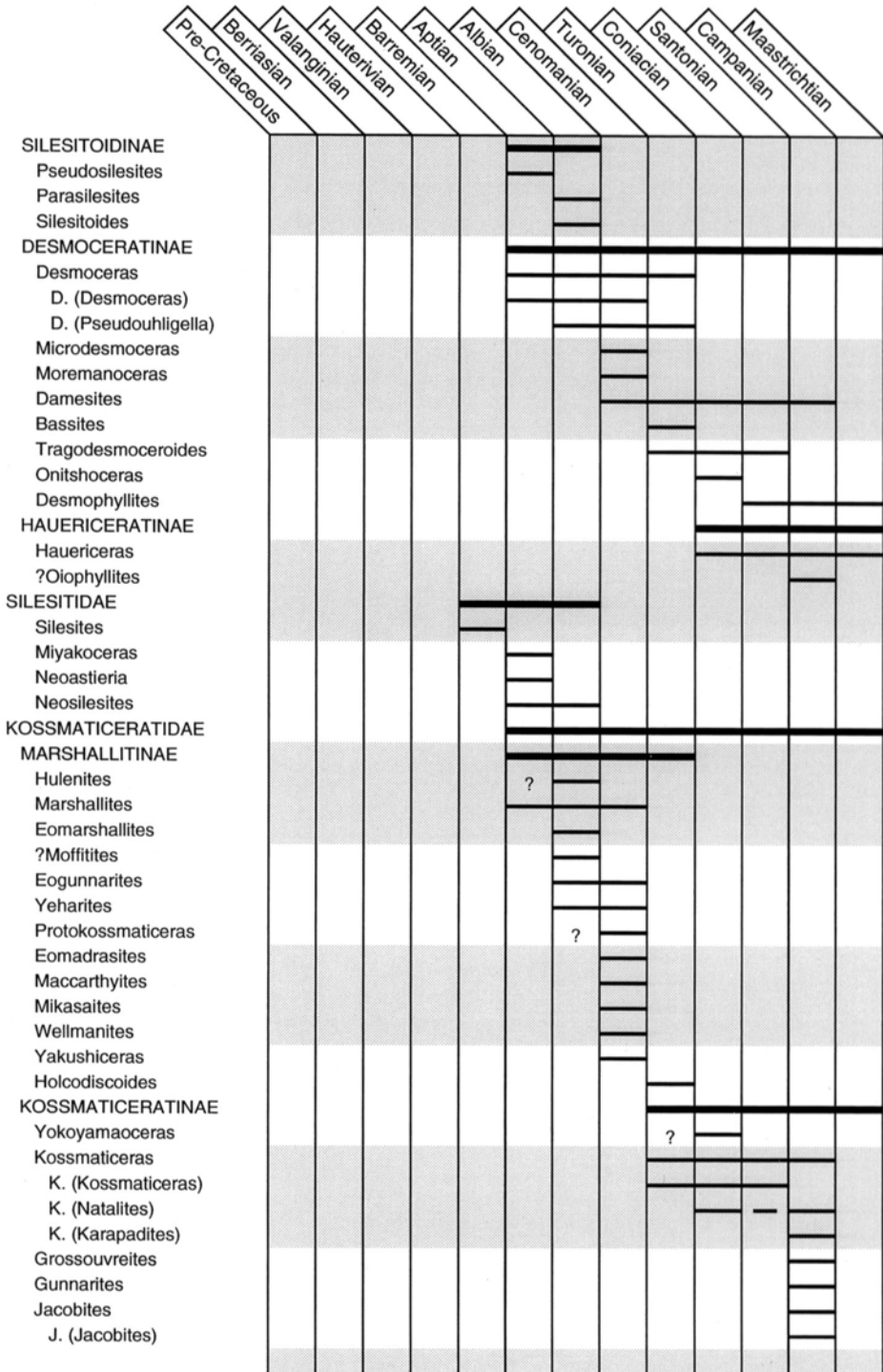


TABLE 2. (Continued).

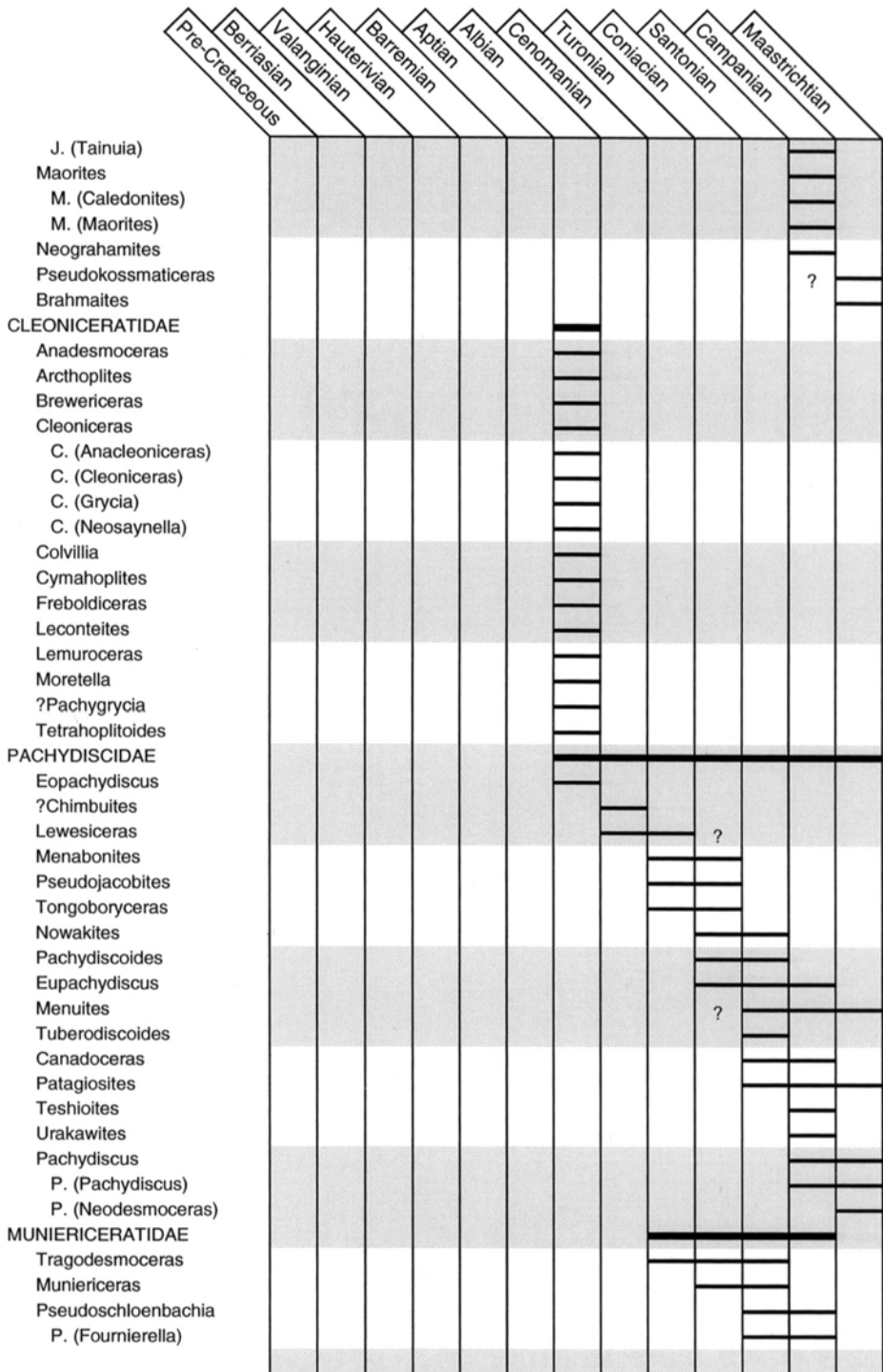


TABLE 2. (Continued).

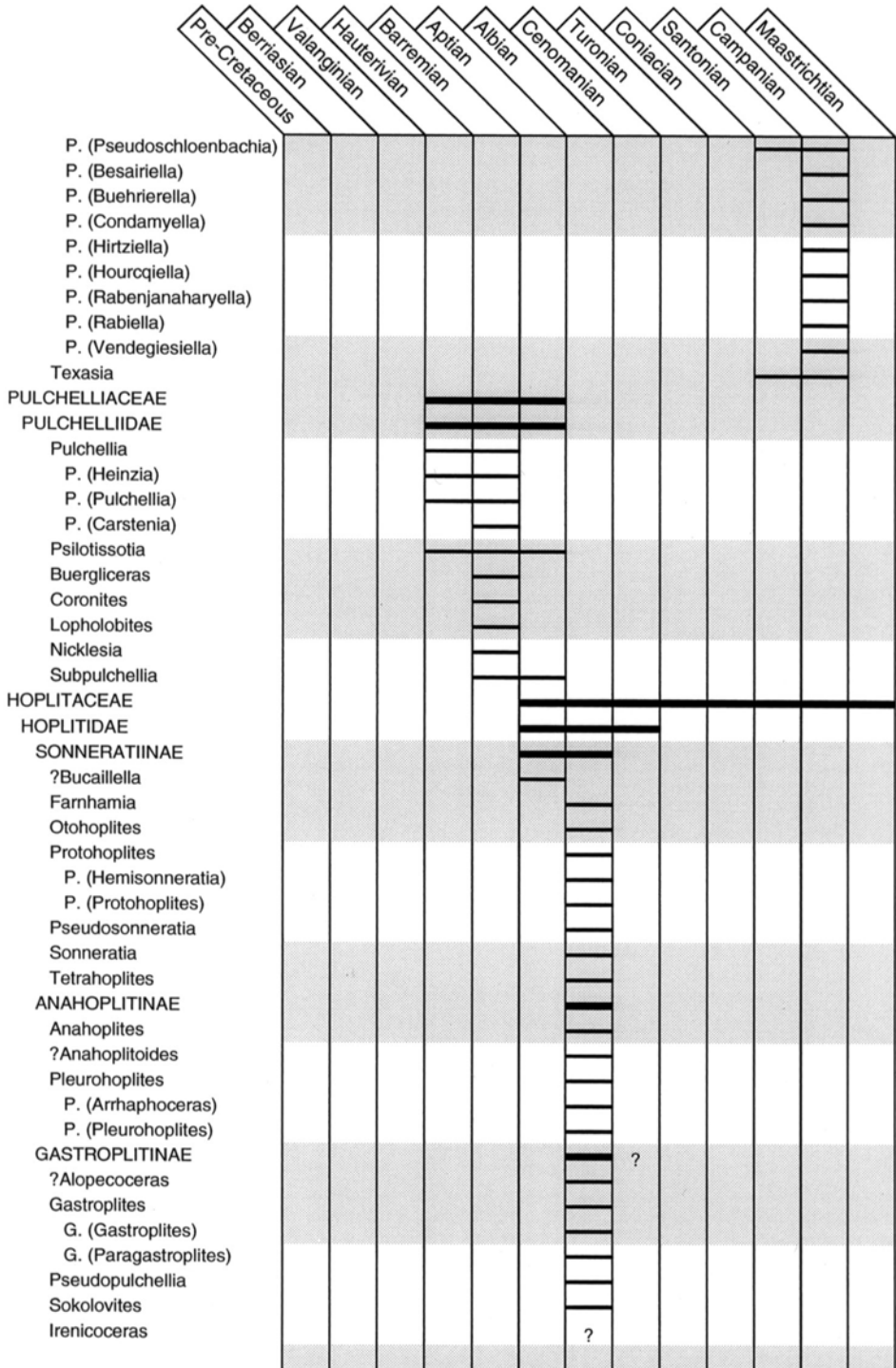


TABLE 2. (Continued).

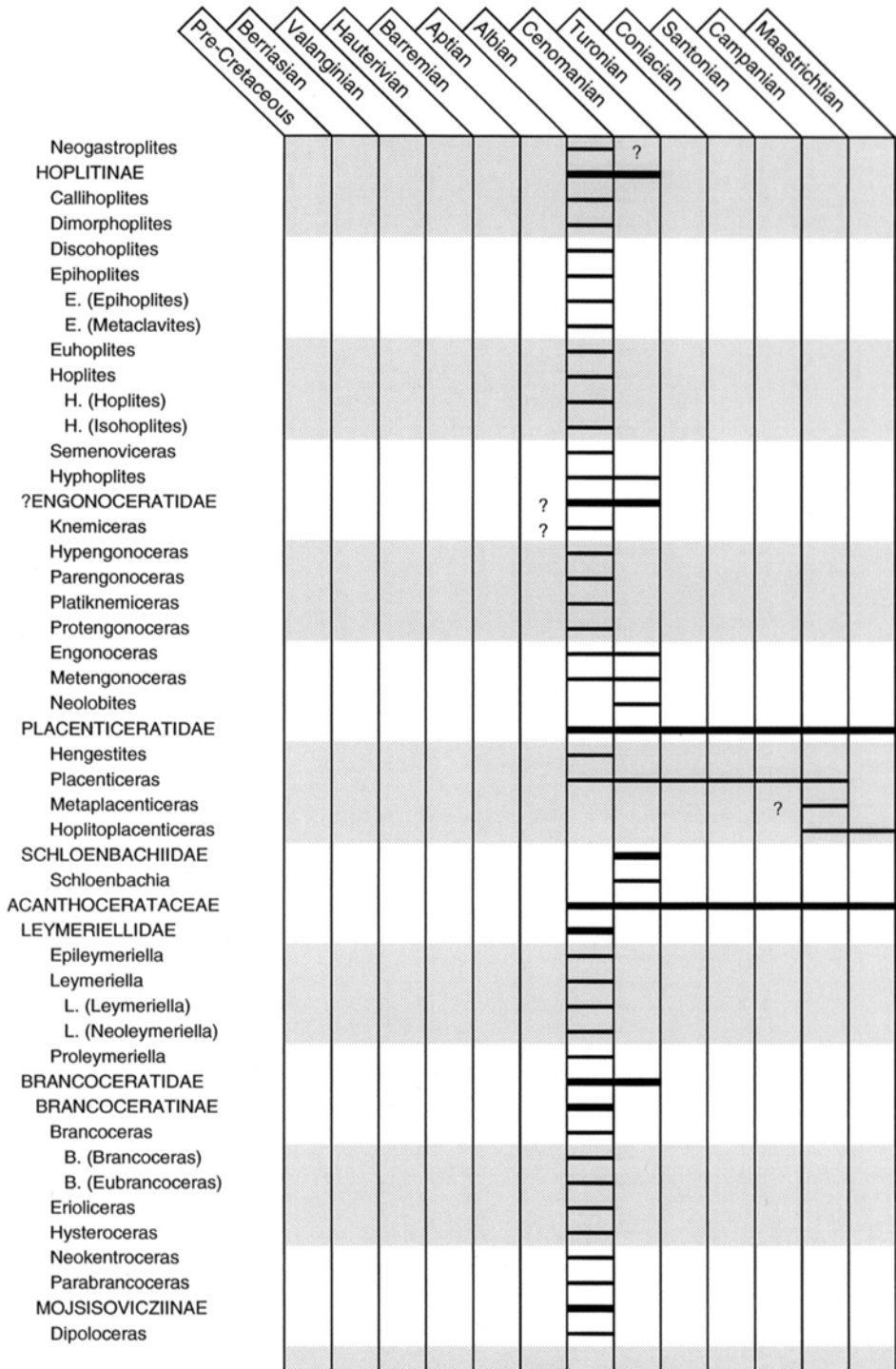


TABLE 2. (Continued).

	Pre-Cretaceous	Berriasian	Valanginian	Hauterivian	Barremian	Aptian	Albian	Cenomanian	Turonian	Coniacian	Santonian	Campanian	Maastrichtian
D. (Dipoloceras)													
D. (Rhytidoceras)													
Fallotioceras													
?Menuthengonoceras													
Mojsisoviczia													
Oxytropidoceras													
O. (Adkinsites)													
O. (Benavidesites)													
O. (Laraiceras)													
O. (Mirapelia)													
O. (Oxytropidoceras)													
O. (Venezoliceras)													
MORTONICERATINAE													
Arestoceras													
Cantabrigites													
Elobiceras													
E. (Craginites)													
E. (Elobiceras)													
Goodhallites													
Mortoniceras													
M. (Angolaites)													
M. (Boesites)													
M. (Deiradoceras)													
M. (Drakeoceras)													
M. (Durnovarites)													
M. (Mortoniceras)													
M. (Pagoceras)													
Neoharpoceras													
Prohysteroceas													
Algericeras													
A. (Algericeras)													
A. (Sakondryella)													
Euhystrioceras													
FLICKIIDAE													
FLICKIINAE													
Ficheuria													
Flickia													
Adkinsia													
?Litophragmatoceras													
SALAZICERATINAE													
Salaziceras													
Neosaynoceras													
FORBESICERATIDAE													
Paradolphia													
Forbesiceras													
LYELLICERATIDAE													
LYELLICERATINAE													
Lyelliceras													

TABLE 2. (Continued).

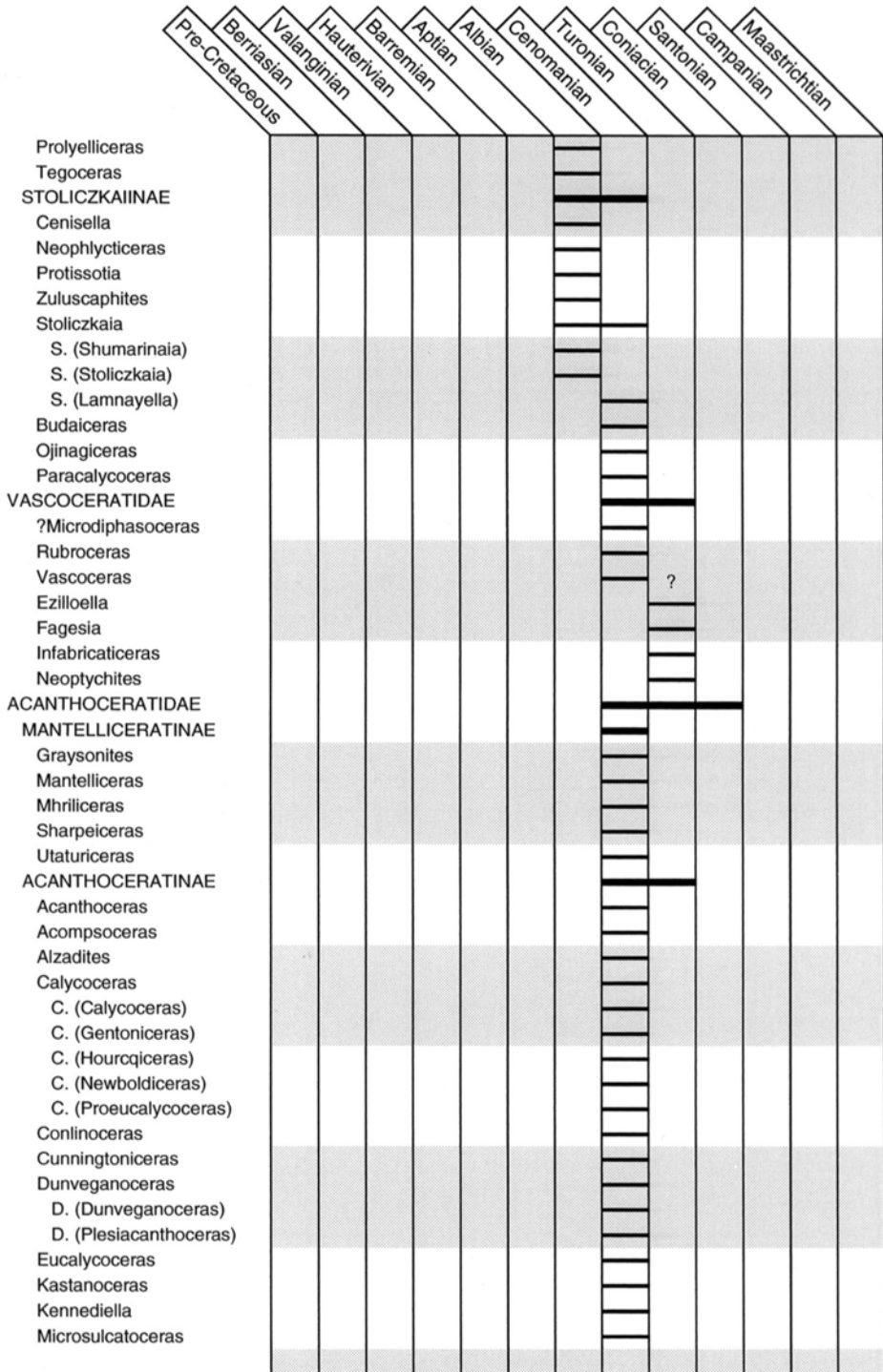


TABLE 2. (Continued).

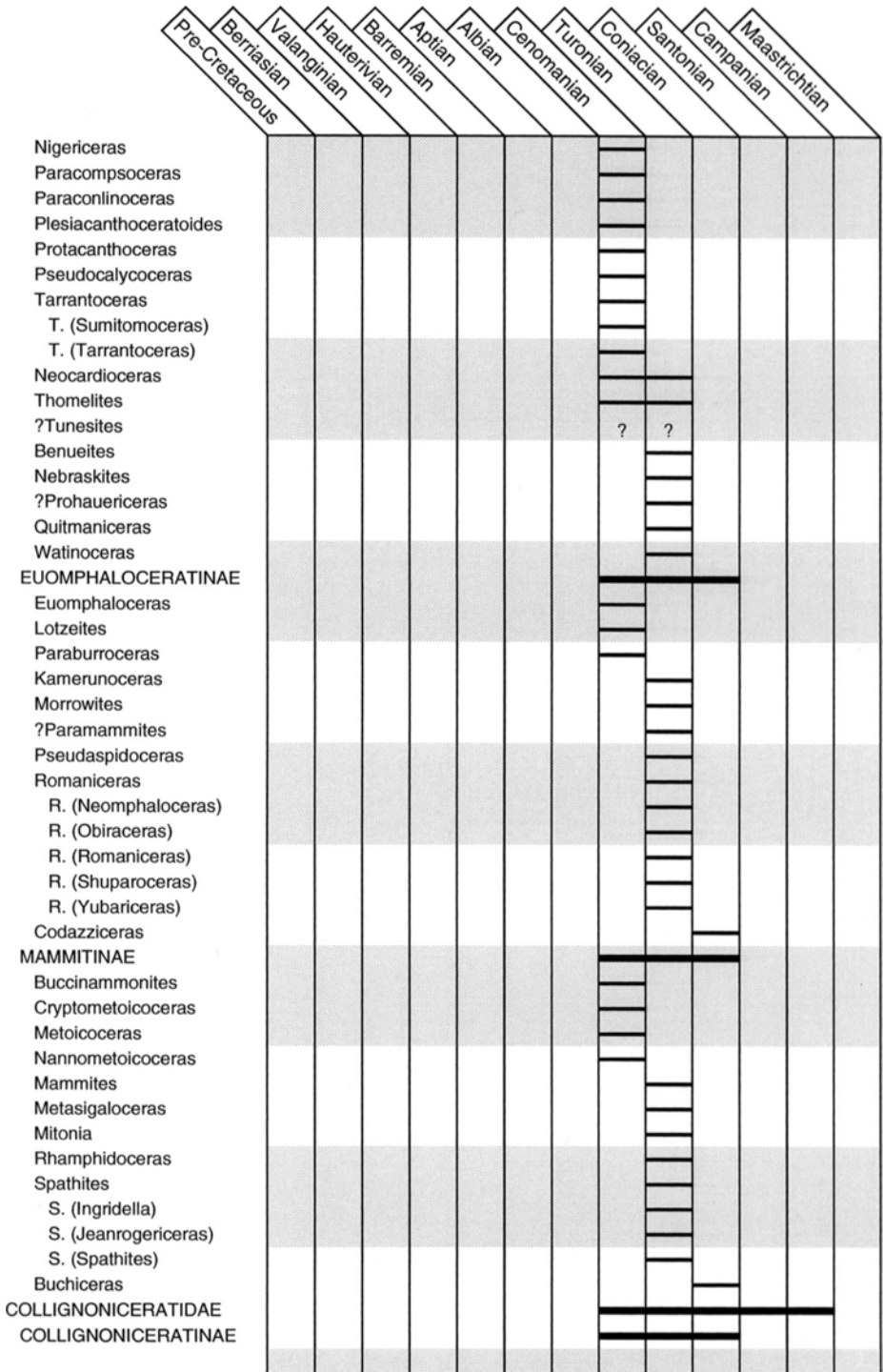


TABLE 2. (Continued).

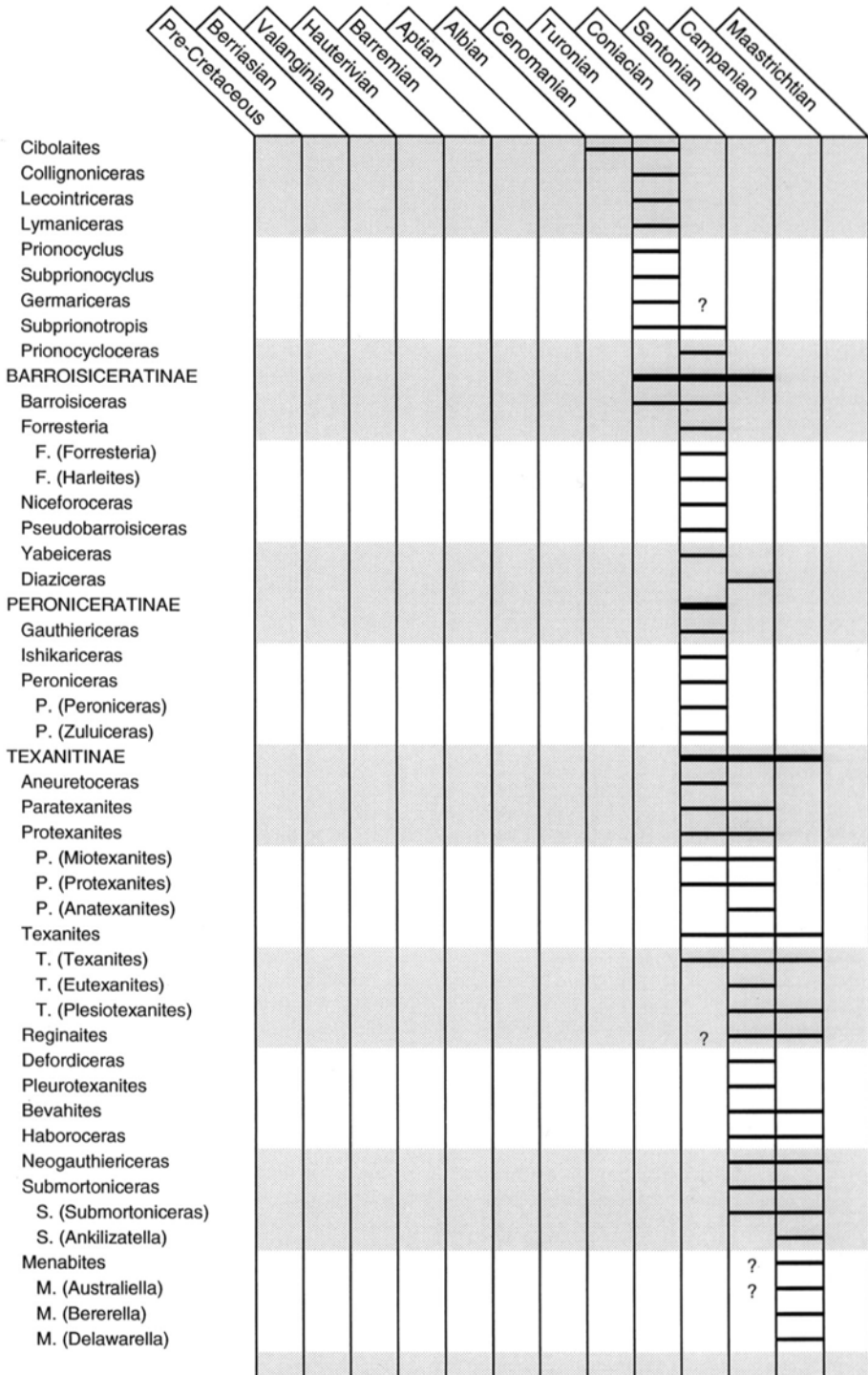


TABLE 2. (Continued).

	Pre-Cretaceous	Berriasian	Valanginian	Heulerivian	Barremian	Aptian	Albian	Cenomanian	Turonian	Coniacian	Santonian	Campanian	Maastrichtian
M. (Menabites)													
Cryptotexanites													
SPHENODISCIDAE										?	?		
SPHENODISCINAE										?	?	?	?
?Nubidites										?	?	?	?
Libycoceras													
Manambolites													
M. (Praemanambolites)													
M. (Manambolites)													
Sphenodiscus													
Coahuilites													?
Daradiceras													
Indoceras													
LENTICERATINAE													
Lenticeras													
Paralenticeras													
Eulophoceras													
COILOPOCERATIDAE													
Collopoceras													
Erichsenites													
Hoplitoides													
PSEUDOTISSOTIIDAE													
HOURCQIINAE													
Masiaposites													
Hourcqia													
PSEUDOTISSOTIINAE													
Choffaticeras													
C. (Choffaticeras)													
C. (Leoniceras)													
Donenriquoceras													
Eotissotia													
Pseudotissotia													
Thomasites													
Wrightoceras													
Hemitissotia													
TISSOTIIDAE													
?Heterotissotia													
Metatissotia													
Paratissotia													
Tissotia													
T. (Subtissotia)													
T. (Tissotia)													
Tissotioides													
ANCYLOCERATINA													
ANCYLOCERATACEAE													
BOCHIANITIDAE													
PROTANCYLOCERATINAE													
Cochlocioceras													

TABLE 2. (Continued).

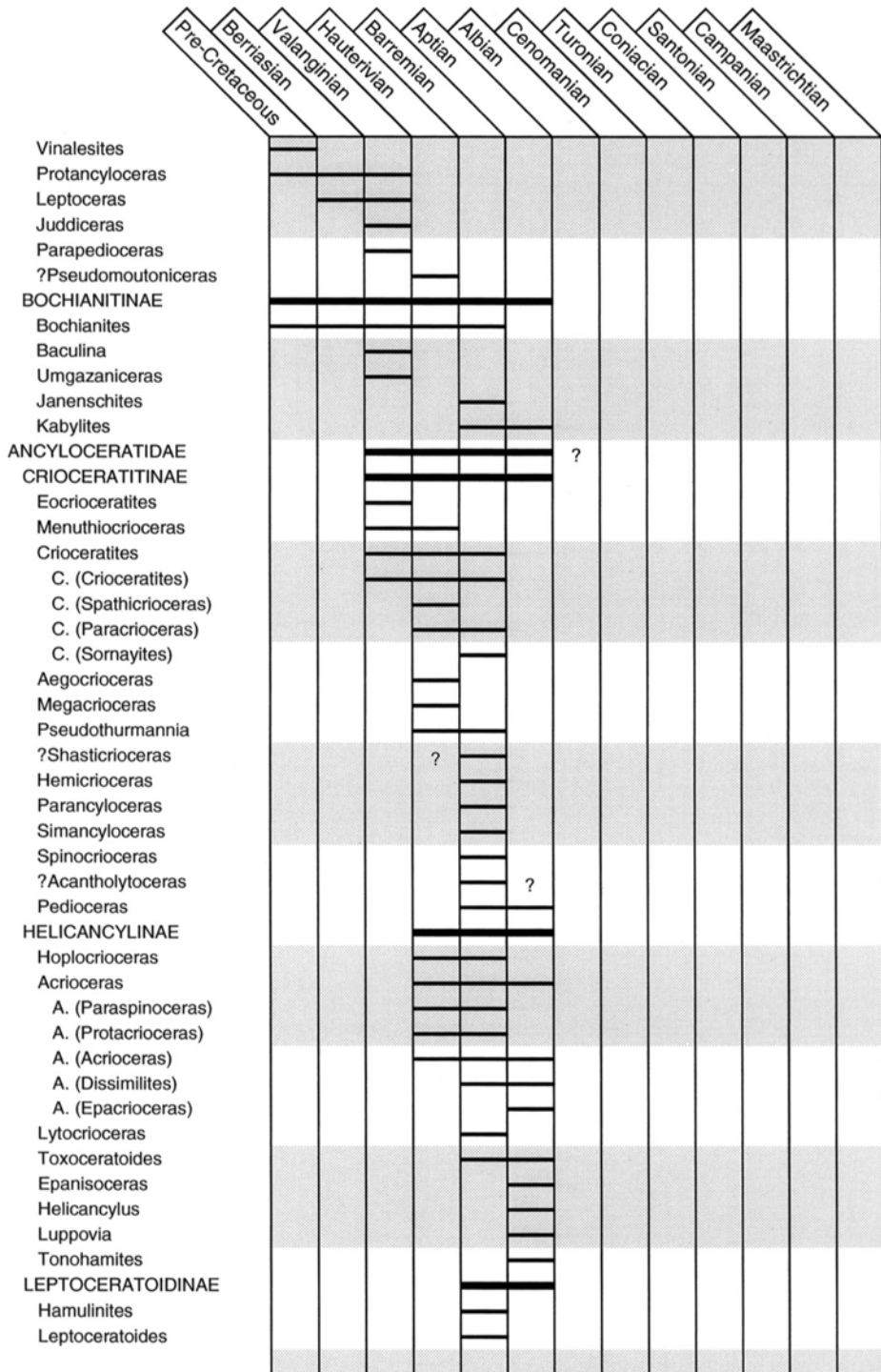


TABLE 2. (Continued).

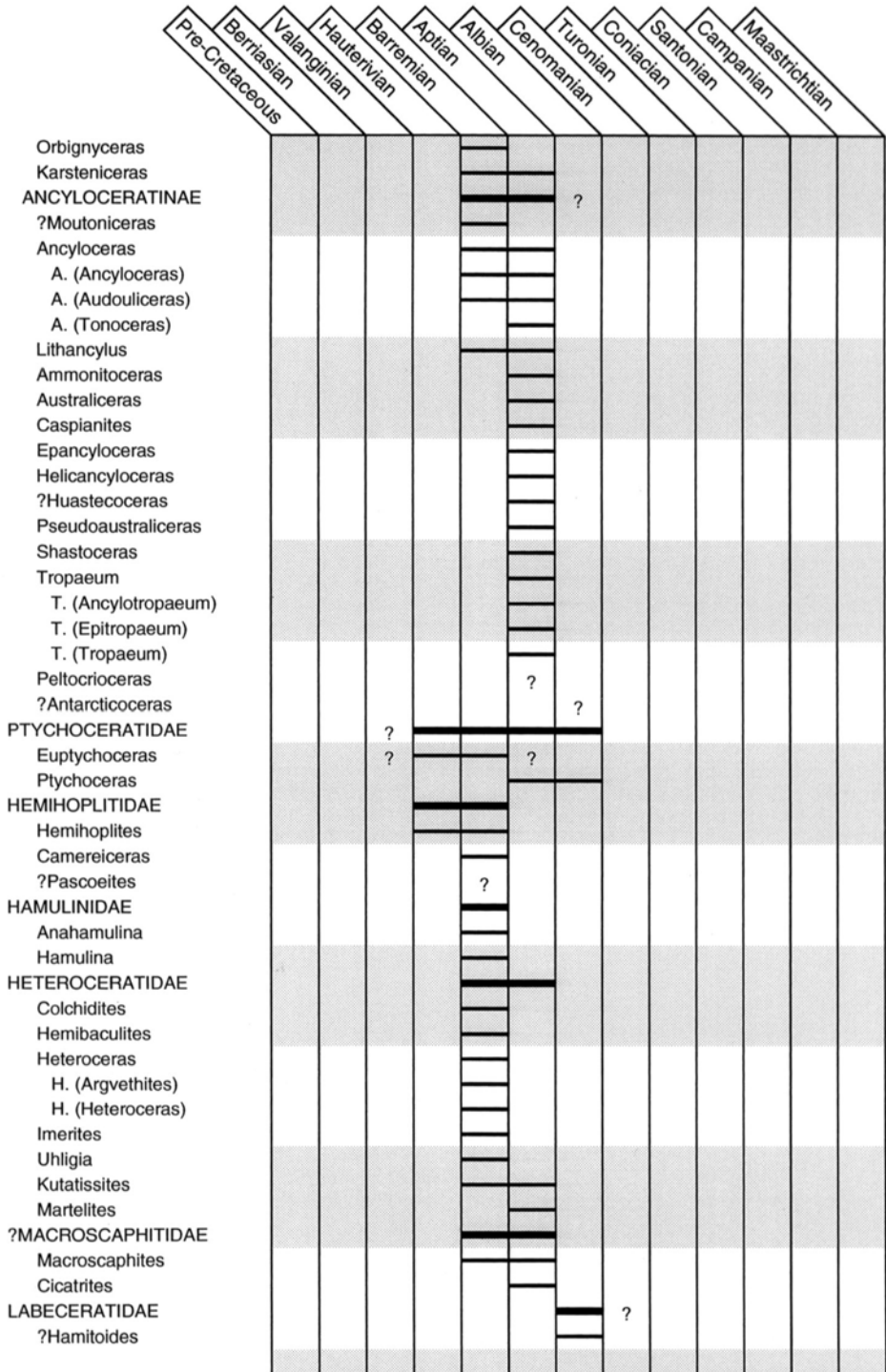


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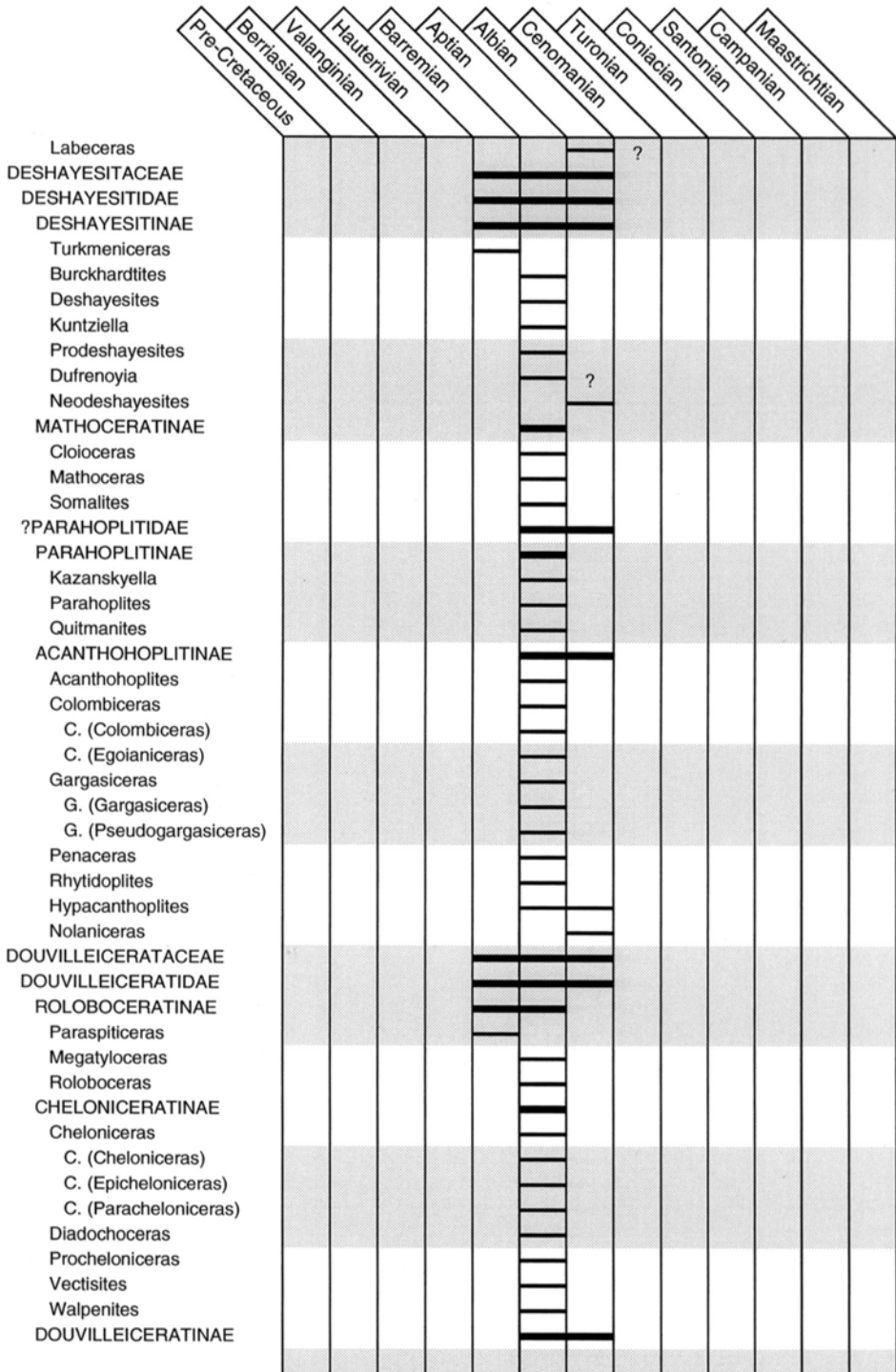


TABLE 2. (Continued).

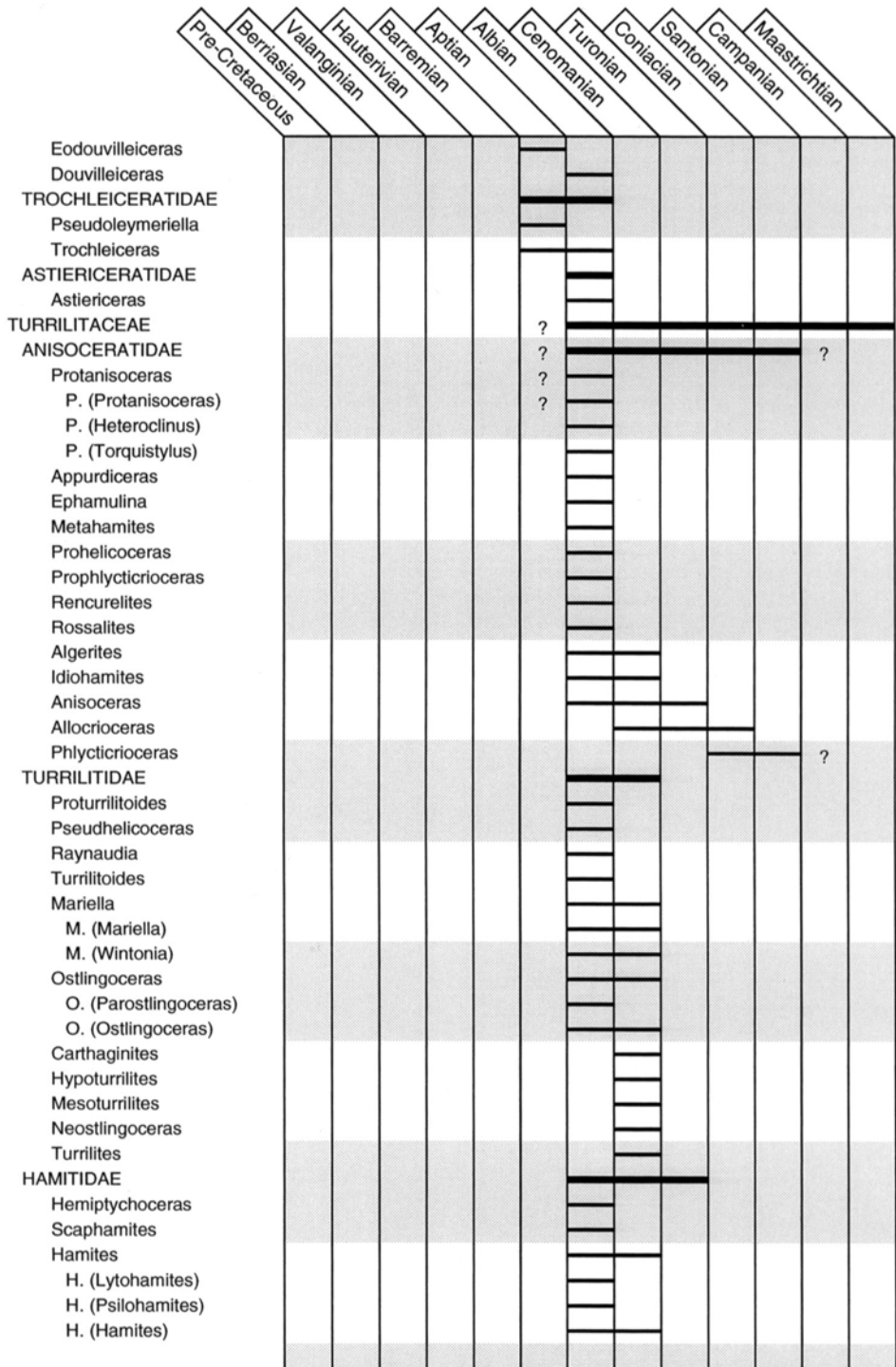


TABLE 2. (Continued).

	Pre-Cretaceous	Berriasian	Valanginian	Hauterivian	Barremian	Aptian	Albian	Cenomanian	Turonian	Coniacian	Santonian	Campanian	Maastrichtian
Metapythoceras													
Pueblites													
BACULITIDAE													
Lechites													
L. (Tuberolechites)													
L. (Lechites)													
Sciponoceras													
Baculites													
Pseudobaculites													
Boehmoceras													
Eubaculites													
Fresvillia												?	
DIPLOMOCERATIDAE													
DIPLOMOCERATINAE													
Scalarites													
Neocrioceras													
Glyptoxoceras													
Chesapeakeella													
Exiteloceras													
Neancyloceras													
Neoglyptoxoceras													
Smedalicerias													
Diplomoceras													
POLYPTYCHOCERATINAE													
Pseudoxybeloceras													
P. (Pseudoxybeloceras)													
P. (Schlueterella)													
P. (Parasolenoceras)													
P. (Lewyites)													
Ryugasella													
Rhyoptychoceras													
Polyptychoceras													
P. (Polyptychoceras)													
P. (Phylloptychoceras)													
P. (Subptychoceras)													
Astreptoceras													
Masonites													
Solenoceras													
Cyrtoptychoceras													
NOSTOCERATIDAE													
Muramotoceras													
Hyphantoceras													
H. (Hyphantoceras)													
H. (Madagascartites)													
Nipponites													
Nostoceras													
N. (Eubostrychoceras)													
N. (Yezoceras)													

TABLE 2. (Continued).

	Pre-Cretaceous	Berriasian	Valanginian	Hauterivian	Barremian	Aptian	Albian	Cenomanian	Turonian	Coniacian	Santonian	Campanian	Maastrichtian
N. (Anaklinoceras)													
N. (Didymoceras)													
N. (Nostoceras)													
N. (Planostoceras)													
N. (Bostrychoceras)													
Tridentoceras													
Jouaniceras													
J. (Jouaniceras)													?
J. (Ainoceras)													?
Didymoceratoides													
Pravitoceras													
UNCERTAIN													
Plesiohamites													
SCAPHITACEAE													
SCAPHITIDAE													
OTOSCAPHITINAE													?
Worthoceras													
Yezoites													
Eorhaeboceras												?	?
SCAPHITINAE													
Eoscaprites													
Scaphites													
Pteroscaphites													
Clioscaprites													
Desmoscaprites													
Haresiceras													
H. (Mancosiceras)													
H. (Haresiceras)													
Argentoscaphites												?	?
Acanthoscaphites													
Parabinneyites													
Rhaeboceras													
Discoscaphites													
D. (Trachyscaprites)													
D. (Discoscaphites)													
Hoploscaprites													
Ponteixites													
Indoscaphites													
LYTOCERATINA													
TETRAGONITACEAE													
GAUDRYCERATIDAE													
Eogaudryceras													
E. (Eogaudryceras)													
E. (Eotetragonites)													
Kossmatella													
Anagaudryceras													
Gaudryceras													
G. (Gaudryceras)													

TABLE 2. (Continued).

	Pre-Cretaceous	Berriasian	Valanginian	Hauterivian	Barremian	Aptian	Albian	Cenomanian	Turonian	Coniacian	Santonian	Campanian	Maastrichtian
G. (Mesogaudryceras)													
Zelandites													
Vertebrites													
TETRAGONITIDAE													
GABBIOCERATINAE													
Jauberticeras													
Gabbioceras													
TETRAGONITINAE													
Tetragonites													
T. (Tetragonites)													
T. (Carinites)													
Parajaubertella													
Takahashia													
Pseudophyllites													
Saghalinites													

GLOSSARY OF MORPHOLOGICAL TERMS

- accessory (lobe or saddle).** Secondary or minor element of sutures.
- acute (periphery).** With sides of shell meeting at sharp angle without shoulders.
- adapertural.** See adoral.
- adapical.** Toward apex of shell; backward direction.
- adoral.** Toward mouth of ammonoid or aperture of shell; forward direction (syn., adapertural).
- adoral septum.** See last septum.
- adventitious (or adventive) lobe.** Lobe of suture formed secondarily by subdivision of 1st lateral saddle.
- aigrettes (French).** See feather structure.
- ammonitella.** The earliest formed part of the ammonoid shell, consisting of the protoconch plus the first whorl, ending at the primary constriction and believed to represent the stage of growth at which the animal hatched.
- ammonitic (suture).** With all lobes and saddles of suture denticulate or frilled.
- ammoniticone.** Coiled in a plane, normally equiangular spiral with whorls in contact or overlapping.
- anaptychus.** Lower mandible, formerly interpreted as an operculum.
- ancyloceratoid.** See ancylocone.
- ancylocone.** Coiled in an initial crioconic spire followed by straight or curved shaft and terminal hook (syn., ancyloceratoid).
- aperture.** Open end of body chamber of shell (syn., mouth).
- apical chamber.** See protoconch.
- approximated (ribs).** Crowded together.
- approximated (sutures).** Crowded together toward body chamber, usually taken to indicate maturity of growth.
- aptychus.** One of a symmetrical pair of plates forming or replacing the lower mandible of some ammonoids from the Middle Jurassic onwards.
- auricle.** See lappet.
- auxiliary (lobe or saddle).** Lateral lobe or saddle of suture springing from umbilical lobe or saddle between second lateral and umbilical seam.
- baculicone.** Shell that is straight apart from small, initial, coiled portion (as in *Baculites*).
- bicarinata.** With two keels on venter.
- biconcave (rib).** With two distinct portions concave toward aperture.
- biconvex (rib).** With two distinct portions convex toward aperture.
- bidichotomous.** Rib that bifurcates, each branch of which then bifurcates again.
- bifurcate (rib).** Dividing into two branches toward venter (syn., biphicate).
- biphicate.** See bifurcate.
- bisulcate.** With two longitudinal grooves.
- body chamber.** Large, undivided space in shell extending adapically from aperture to last septum, inhabited by living animal (syn., chamber, living chamber).
- bullae.** Tubercle that is elongated radially (adj., bullate).
- bundled (ribs).** United in bunches or sheaves at or near umbilical edge, usually at a tubercle (see fasciculate).
- cadicone.** Depressed, barrel-shaped shell with more or less evolute coiling, wide venter, and craterlike umbilicus (as in *Cadoceras*).
- camera.** Compartment between two adjacent septa, comprising one of the spaces into which entire shell between protoconch and body chamber is divided by the septa (syn., chamber).
- capricorn.** Shell encircled by distant, blunt ribs and subequal, rounded interspaces, resembling a goat's horn (as in *Androgynoceras capricornus*).
- carina.** See keel.
- carinate.** Bearing a keel.
- ceratitic (suture).** With rounded, unbroken saddles and denticulate lobes (as in *Ceratites*; syn., unipolar).
- chamber.** See body chamber, camera.
- chevron.** V-shaped ridge on shell surface, commonly on venter.
- clavus.** Tubercle elongated in direction of coiling (longitudinally) (adj., clavate).
- collared (aperture).** Encircled by flared rib and constriction directly behind peristome.
- compressed (whorl section).** Higher than wide.
- concave (side or venter).** Broadly impressed; concave rib, bowed away from aperture.
- conch.** Complete shell of ammonoid less the protoconch.
- connecting ring.** Porous section of siphuncle between two adjacent septal necks, believed to have been originally of chiefly organic composition.
- constricted (aperture).** Encircled by constriction directly behind peristome.
- constriction.** Depression encircling a whorl.
- contracted (peristome).** With diameter smaller than that of body chamber.
- convergent (whorl sides).** Converging toward venter.
- convex (rib).** Bowed toward aperture.
- coronate.** With whorl section resembling a crown viewed from side.
- costa.** See rib.
- crioconic.** Coiled in plane, equiangular spiral, loose or tight, with whorls not in contact.
- cruciform.** Cross-shaped.
- cuneiform.** Wedge-shaped.
- cyrticone.** Shell curved without completing a single whorl.
- dense (ribs).** Closely spaced.
- dependent.** See retracted.
- depressed (whorl section).** Wider than high.
- dimensions.** Dimensions of normally coiled (planispiral) shells are conventionally given in the following order: diameter, whorl height, whorl thickness, umbilical diameter. Measurements are given in millimeters. The last three measurements are usually expressed as percentages of the diameter.
- dimorphic.** Descriptive term for ammonoid species comprising two distinct shell forms, usually of

- different sizes and termed the macroconch and microconch, the two forms being commonly regarded as female and male.
- diphylllic (saddle).** Terminating in two, equally-sized folioles.
- distant (ribs).** Widely spaced.
- divergent (whorl sides).** Diverging toward venter.
- dorsal lobe.** Median primary lobe of suture on dorsum, which is internal in normally coiled conchs (syn., internal lobe).
- dorsolateral area.** Side of impressed area on each flank of dorsum in involute shells.
- dorsum.** Dorsal side of conch (opposite ventral), generally grading into dorsolateral areas; in slightly involute shells equivalent to impressed area but in deeply involute shells refers only to portion of conch adjacent to venter of preceding whorl.
- dwarf.** An imprecise term sometimes applied to representatives of a taxon that are appreciably smaller than the norm for the taxon. See also *progenetic dwarf*.
- ear.** See *lappet*.
- ellipticone.** Shell with elliptical coiling of last whorl or half whorl.
- evolute.** With whorls overlapping little or not at all and therefore having a wide umbilicus. (As commonly used, *evolute* and *involute* are relative terms, since a shell form called *evolute* in one family may be classed as *involute* in another.)
- excentric (umbilicus).** Characterized by abrupt opening out of spiral described by umbilical seam or by the tendency of this spiral to close while the peripheral spiral is relatively unchanged (syn., *excentrumbilicate*).
- excentrumbilicate.** See *excentric (umbilicus)*.
- external lobe.** See *ventral lobe*.
- external saddle.** See *lateral saddle (1st)* and *ventral saddle*.
- external suture.** Part of suture (in coiled forms only) that is exposed on outside of whorls between the umbilical seams.
- falcate (rib).** Sickie-shaped.
- falcoid (rib).** Approaching sickie-shaped.
- fasciculate (ribbing).** With ribs bunched or bundled to form sheaves.
- fastigate.** With roof-shaped venter, periphery of shell being sharp but not keeled.
- feather structure.** Pattern of diverging fine lines occasionally seen on the whorl side of the shell (syn., *aigrettes*).
- fibulate (ribs).** Adjacent ribs branching and reuniting (syn., *loutiform*; see *looped*).
- fillet.** Longitudinal, raised, smooth band on venter or whorl side.
- flank.** See *whorl side*.
- flare.** Random annulation or very distinct rib that usually marks location of a former peristome and denotes a temporary halt in growth.
- flared peristome.** With diameter larger than that of body chamber.
- flared rib.** Swollen so as to stand in higher relief than average ribs.
- flored (hollow keel).** Divided from chambers by a partition (*septum*) external to the siphuncle.
- foliole.** Minor element of saddle of a suture.
- goniatic (suture).** With most or all lobes and saddles of suture entire (not denticulate or filled), the only common exception being the ventral lobe, which is subdivided.
- growth lines.** Striae encircling whorl marking growth increments of shell.
- gyrocone.** Loosely coiled shell that completes only a single whorl approximately.
- helical, -icoid.** Coiled in regular, three-dimensional spiral form with constant spiral angle, as in most gastropods.
- heteromorph.** Ammonoid shell of any form except planispiral with whorls in contact.
- impressed area.** Part of whorl between umbilical seams that is in contact with preceding whorl.
- initial chamber.** See *protoconch*.
- intercalatory (rib).** Secondary rib not attached to primary rib.
- intercosta.** See *interspace*.
- internal lobe.** See *dorsal lobe*.
- internal suture.** Part of suture located within impressed area between umbilical seams.
- interspace.** Area between adjacent ribs (syn., *intercosta*).
- involute.** With whorls overlapping considerably and hence with narrow umbilicus (see *evolute*).
- isocostate.** With ribs uniform in kind and density throughout ontogeny.
- keel.** Continuous, distinct, longitudinal ridge on venter; may be either solid or hollow, those of hollow type being floored (*septicarinate*) or without floor so as to open inward to chambers (syn., *carina*).
- labial ridge.** Linear elevation of shell corresponding to former apertural border (*peristome*).
- lanceolate.** Spear-shaped, referring to form of suture lobes or cross-section of acute periphery of shell.
- lappet.** Simple or necked (*spatulate*) projection of peristome on whorl sides or venter (called *ventral lappet* when located on venter); also called *ear* or *auricle*.
- last septum.** Septum separating body chamber from adjoining camera at any stage of growth (syn., *adoral septum*).
- lateral lobes.** Primary lobes of external suture other than ventral lobe; **1st lateral lobe** is next to ventral lobe, usually on whorl side but in depressed whorls commonly on venter; **2nd lateral lobe** is next to 1st lateral, commonly on whorl side and morphogenetically part of umbilical lobe.
- lateral saddles.** Primary saddles of external suture other than ventral saddle; **1st lateral saddle** (external saddle) separates ventral lobe from 1st lateral lobe; **2nd lateral saddle** (often called 1st lateral saddle) separates 1st and 2nd lateral lobes.
- lateral sinus.** Notch or re-entrant in peristome on whorl sides.
- lateral sulcus.** Spiral groove on whorl sides.
- loutiform (ribs).** See *fibulate* and *looped*.
- leiostracous.** Smooth-shelled. Commonly applied to the *Lytocerotina* and *Phyllocerotina* in contrast to the *trachyostracous* *Ammonitina*.
- lipped (peristome).** With liplike extension of shell set at an angle to the apertural rim.

- lira.** Fine, raised line on shell surface.
- living chamber.** See body chamber.
- lobe.** Element of suture directed backward (adapically).
- lobule.** Minor element of sutural lobe.
- longitudinal.** In direction of shell growth, generally equivalent to spiral.
- looped (ribs).** United on ventrolateral angle, usually at a tubercle (syn., lautiform; see fibulate).
- macroconch.** The larger of the two shell forms in a dimorphic (*q.v.*) species, often with a plain aperture.
- mature (shell).** Showing such features as modification of coiling, apertural features (lappets, rostrum), or approximated septa, commonly regarded as indicating that a shell had reached its final size.
- median saddle.** See ventral saddle.
- microconch.** The smaller of the two shell forms in a dimorphic (*q.v.*) species, sometimes with an aperture bearing lateral lappets or a ventral rostrum.
- monophyllic (saddle).** Terminating in a single foliole.
- mouth.** See aperture.
- neponic constriction.** See primary constriction.
- node.** Large, blunt, or formless tubercle.
- oblique whorl height.** See whorl height.
- occluded (umbilicus).** So narrow or closed that inner whorls are not visible.
- operculum.** A structure, the function of which was to close the aperture of the shell.
- ornament.** Such features of shell exterior as ribs, tubercles, bullae, clavi, spines, and striations.
- overlap.** Extent to which a whorl covers the preceding whorl.
- oxycone.** Discoidal shell with acute periphery and very narrow or occluded umbilicus (as in *Oxynoticeras*).
- parabola.** Collective term to describe rib, node, or constriction of parabolic form.
- parabolic node.** Small node or tubercle near ventrolateral angle of whorl, associated with an earlier cessation of growth and independent of ordinary tuberculation.
- perforate (umbilicus).** See umbilical perforation.
- peristome.** Edge of aperture of body chamber; border of mouth.
- phragmocone.** Camerated part of shell.
- phylloid.** Leaf-shaped or balloonlike, commonly referring to saddle endings (folioles) of sutures (as in *Phylloceras*).
- pila.** See rib.
- planispiral.** Coiled in a plane spiral (cf. heteromorph).
- planulate.** Moderately evolute, compressed shell with open umbilicus and bluntly rounded venter (as in *Perisphinctes*).
- platycone.** Shell with flattened form, without implication as to width of umbilicus or shape of venter.
- plicate(d).** With vague, coarse, radial folds on whorl side.
- polygyral.** Having many whorls.
- polymorphic.** Descriptive term for species believed to include more than two different shell forms (cf. dimorphic).
- polyptychitine, -itoid (ribs).** Branching at umbilical edge and again at midflank.
- polyshizotomous (ribs).** Branching at umbilical edge and then again repeatedly towards venter.
- primary constriction.** Constriction at the end of the first whorl of the ammonoid shell, marking the end of the ammonitella, *q.v.* (syn., nepionic constriction).
- primary rib.** Plain stem or simple inward part of a branched rib.
- progenetic dwarf.** Descriptive term for small species evolved by paedomorphosis, sexually mature at the size of juveniles of the ancestral species.
- projected (rib).** Swung forward (adaperturally) at or near venter.
- prosradiate (rib).** With generally forward (adaperturally) inclination from umbilical edge toward venter.
- protoconch.** First chamber of shell, closed by proseptum; sometimes called initial chamber or apical chamber.
- pseudoceratitic (suture).** Approximating to ceratitic in form in ammonoids other than Ceratitina.
- ptychoceratoid.** Coiled in successive, straight, parallel shafts, in contact or not.
- radial.** Direction outward from center of umbilicus, at right angles to axis of coiling and growth (syn., transverse).
- radius.** See shell radius, umbilical radius.
- rectiradiate (rib).** Straight, radial, bending neither forward nor backward.
- retracted (suspensive lobe).** Bent backward (adapically) on approaching umbilical edge and in umbilical area (syn., dependent).
- rib.** Radially (more or less) directed ridge on shell; sometimes called costa or pila.
- rostrum.** Pointed projection of peristome on venter; may continue spiral line or coiling or diverge from it.
- runcinate.** See tabulate.
- rursiradiate (rib).** Inclined backward (adapically) proceeding from umbilical area toward venter.
- saddle.** Element of suture directed forward (adaperturally).
- saltatory.** Of evolution proceeding in large jumps.
- scaphiticone, scaphitoid.** Shell with normally coiled inner whorls succeeded by a straight section and then a hooked body chamber (as in *Scaphites*).
- secondary rib.** Outer part of branched rib, ventral to branching point.
- septa lobe.** Lobe formed on adoral face of preceding septum.
- septa neck.** Tubular extension of septum forming part of siphuncle, termed prochoanitic if directed forward (adaperturally) and retrochoanitic if directed backward (adapically). See also connecting ring.
- septa suture.** See suture.
- septate (keel, ribs).** Hollow keel or ribs separated from the cavity of the shell by a partition.
- septate (whorl).** Divided into camerae by transverse septa (see phragmocone).
- septicarinate.** Having a hollow, floored keel.
- septum.** Transverse partition dividing shell into camerae, attached to inside of shell wall along suture line.
- serpenticone.** Very evolute, many-whorled shell with whorls hardly overlapping, like coiled snake or rope (as in *Skirroceras*).

- serrated (keel).** Toothed or notched.
- shell.** Complete hard parts of ammonoid, including protoconch and conch but excluding aptychus and beaks or jaw structures.
- shell radius.** Distance from origin of spiral to a point on the periphery in normally coiled ammonoids.
- shoulder.** Ventrolateral, blunt angle of whorl.
- sigmoid(al) (rib).** S-shaped, sinuous, flexuous.
- simple (peristome).** Devoid of lappets or rostrum.
- simple (rib).** Unbranched.
- simple (suture).** Not appreciably subdivided.
- sinus.** Re-entrant curve or notch in any part of peristome.
- sipho, siphon, siphonal tube.** See siphuncle.
- siphuncle.** Narrow, longitudinal tube passing through camerae and septa from protoconch to base of body chamber. Consists of septal necks and connecting rings, *q.v.* (syn., sipho, siphon, siphonal tube).
- spatulate (lappet).** Spoon-shaped, stalked, bud-shaped.
- sphaerocone.** Involute globular shell with small or occluded umbilicus which commonly opens out suddenly along last whorl (as in *Sphaeroceras*).
- spine.** Sharp projection on surface of shell. Commonly hollow or septate.
- stria.** Minute groove on shell surface, especially on otherwise smooth shell.
- strigate.** Shell surface finely ridged or furrowed longitudinally (as in *Strigoceras*).
- sulcate.** With longitudinal groove on venter.
- sulcus.** Groove on shell surface, usually referring to longitudinal groove on venter.
- suspensive lobe.** Visible external part of umbilical lobe of suture on exposed part of whorl, comprising portion from which auxiliaries spring.
- sutural elements.** Major undulations of suture alternately directed forward (adapturally) as saddles and backward (adapically) as lobes.
- suture.** Line of junction of septum with shell wall, visible only when this wall is removed (syn., septal suture, suture line).
- suture line.** See suture.
- tabulate (venter).** Truncated or flattened (syn., runcinate).
- test.** Fossil shell substance; material of the shell as opposed to the fossil as an object.
- torticone.** Shell coiled in irregular, three-dimensional spiral with progressive twisting of conch.
- trachyostracous.** Literally rough-shelled. Commonly applied to the ornamented Ammonitina (cf. leiostracous).
- transverse.** See radial.
- tricarinate.** Bearing three keels on venter.
- trifurcate (rib).** Dividing into three branches (syn., triplicate).
- triplicate.** See trifurcate.
- tubercle.** Projection or pimple on shell surface or on internal mold, commonly representing base of a spine.
- umbilical angle.** Generally blunt angle between whorl side and umbilical area (syn., umbilical border, umbilical edge, umbilical shoulder).
- umbilical area.** Inner part of whorl on each side, between umbilical angle and umbilical seam; called umbilical wall if it rises somewhat vertically from spiral plane and umbilical slope if it rises gently (syn., umbilical slope, umbilical wall).
- umbilical border.** See umbilical angle.
- umbilical callus.** Plug of test that more or less fills umbilicus.
- umbilical edge.** See umbilical angle.
- umbilical lobe.** Large primary lobe of suture centered on or near umbilical seam and thus forming part of both external and internal sutures.
- umbilical perforation.** Vacant space around axis of coiling and connecting umbilici.
- umbilical radius.** Distance from origin of spiral to a point on the umbilical seam in normally coiled ammonoids.
- umbilical seam.** Helical line of overlap of successive whorls, comprising *line of involution* analogous to suture of gastropods (syn., umbilical suture).
- umbilical shoulder.** See umbilical angle.
- umbilical slope.** See umbilical area.
- umbilical suture.** See umbilical seam.
- umbilical wall.** See umbilical area.
- umbilical width.** Diameter of umbilicus usually measured between umbilical seams.
- umbilicus.** External depression on each side of shell centered on axis of coiling, its rim being the umbilical angle or edge.
- uncoiled.** Colloquial term for heteromorph shells.
- unipolar.** See ceratitic.
- variocostate.** Ribbing style changing radically in the course of ontogeny.
- venter.** Peripheral part of shell in exogastric forms. In heteromorphs, the homologous area (syn., ventral area).
- ventral area.** See venter.
- ventral lappet.** See lappet.
- ventral lobe.** Median primary lobe of suture located on venter, external in normally coiled shells and therefore sometimes called external lobe.
- ventral saddle.** Median saddle of suture located on venter, external in normally coiled shells and therefore sometimes called external saddle (syn., median saddle).
- ventrolateral angle.** Angle between venter and whorl side, called shoulder if blunt or vaguely defined (syn., ventrolateral edge).
- ventrolateral edge (or margin).** See ventrolateral angle.
- virgatotome.** Type of ribbing in which three to six, straight secondaries may branch off in succession from forward (adaptural) side of a primary rib (as in *Virgatites*).
- volution.** See whorl.
- whorl.** Complete turn of shell through 360° (syn., volution).
- whorl breadth.** See whorl thickness.
- whorl flank.** See whorl side.
- whorl height.** Height of whorl measured at right angles to maximum width, comprising distance from middle of venter to middle of dorsum plus depth of impressed area; in practice, oblique whorl height commonly is used, consisting of distance from umbilical seam to middle of venter.
- whorl section.** Transverse section of a whorl.

whorl side. Lateral wall of whorl between umbilical seam and venter (syn., flank, whorl flank).

whorl thickness. Maximum horizontal distance between points located between ribs or spines on op-

posite whorl sides. Also termed whorl breadth, whorl width.

whorl width. See whorl thickness.