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PART L, REVISED, VOLUME 3B, CHAPTER 3: SYSTEMATIC DESCRIPTIONS OF THE LYTOCERATOIDEA

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SUPERFAMILY LYTOCERATOIDEA NEUMAYR, 1875

[*nom. correct.* DOMMERGUES, 2002, p. 257, *pro* Lytocerataceae BUCKMAN, 1894, p. 299, *nom. transl. ex* Lytoceratidae NEUMAYR, 1875, p. 878] [=Analytoceratoidea VENTURI & BILOTTA, 2008, p. 881]

Very evolute, plane-spirally coiled. Whorl section usually round, ornamented with striae, ribs, tubercles, constrictions, and flares in normally coiled forms. Suture line typically has only 3 pairs of very complex saddles with mosslike endings, usually not phylloid; ventral lobe very shallow, so that first lateral saddle highly asymmetrical; presence of septal lobe constitutes their monophyly, tendency to develop bifid lobes (HOFFMANN, 2010). Descended from lowermost Jurassic Psiloceratinae (GUÉX 1987, 1995; HOFFMANN & KEUPP, 2010); previous records from the Upper Triassic having been shown to be based on stratigraphically misplaced specimens, though such Triassic records were included in HYATT's (1889, p. 7) use of the subfamily Lytoceratinae and BUCKMAN's (1894, p. 299) use of the superfamily Lytocerataceae (Fig. 1). *Jurassic–Cretaceous*, worldwide, especially Tethyan and Pacific realms, scarce in Boreal realm.

FAMILY LYTOCERATIDAE NEUMAYR, 1875

[Lytoceratidae NEUMAYR, 1875, p. 878] [=Thysanoidae HYATT, 1867, p. 86]

Very evolute, whorls in contact with small or no overlap; whorls enlarging rapidly

in some forms, but others are serpentine. Ornamented with growth lines, often crinkled, and with occasional constrictions and associated flares, more rarely ribbed or plicate. Suture lines typically lytoceratid, with 5 lobes and highly complex mosslike saddles that are undercut by the widely splayed lateral lobes; ventral lobe shallow. *Lower Jurassic (Sinemurian)–Upper Cretaceous (Cenomanian)*.

SUBFAMILY PLEUROACANTHITINAE HYATT, 1900

[*nom. trans. et correct.* ARKELL, 1950, p. 359, *pro* Pleuroacanthitidae HYATT, 1900, p. 568, validated ICZN Opinion 575, 1959] [=Analytoceratidae SPATH, 1927, p. 64]

The earliest group, combining the evolute whorls, some serpentine, and the general suture line pattern of Lytoceratoidea with trifid lobes and phylloid saddle endings of Phylloceratina, and special characters of their own, especially parabolaes (WÄHNER, 1894; GUÉX, 1980), megastriae (*sensu* BUCHER & GUÉX, 1990), and first appearance of a faint septal lobe (HOFFMANN, 2010). ARKELL (1957a, p. 106) derived the Pleuroacanthitinae directly from early Ammonitida (Psiloceratinae) occurring in the lower Hettangian (WÄHNER, 1894; DIENER, 1922; GUÉX, 1987, 1995, GUÉX & others, 2012). *Lower Jurassic (Hettangian–Lower Sinemurian)*: Austria, Italy, China, Indonesia (Timor), USA (Nevada).

Pleuroacanthites CANAVARI, 1883, p. 279 [**Ammonites bififormis* J. DE C. SOWERBY in DE LA BECHE,

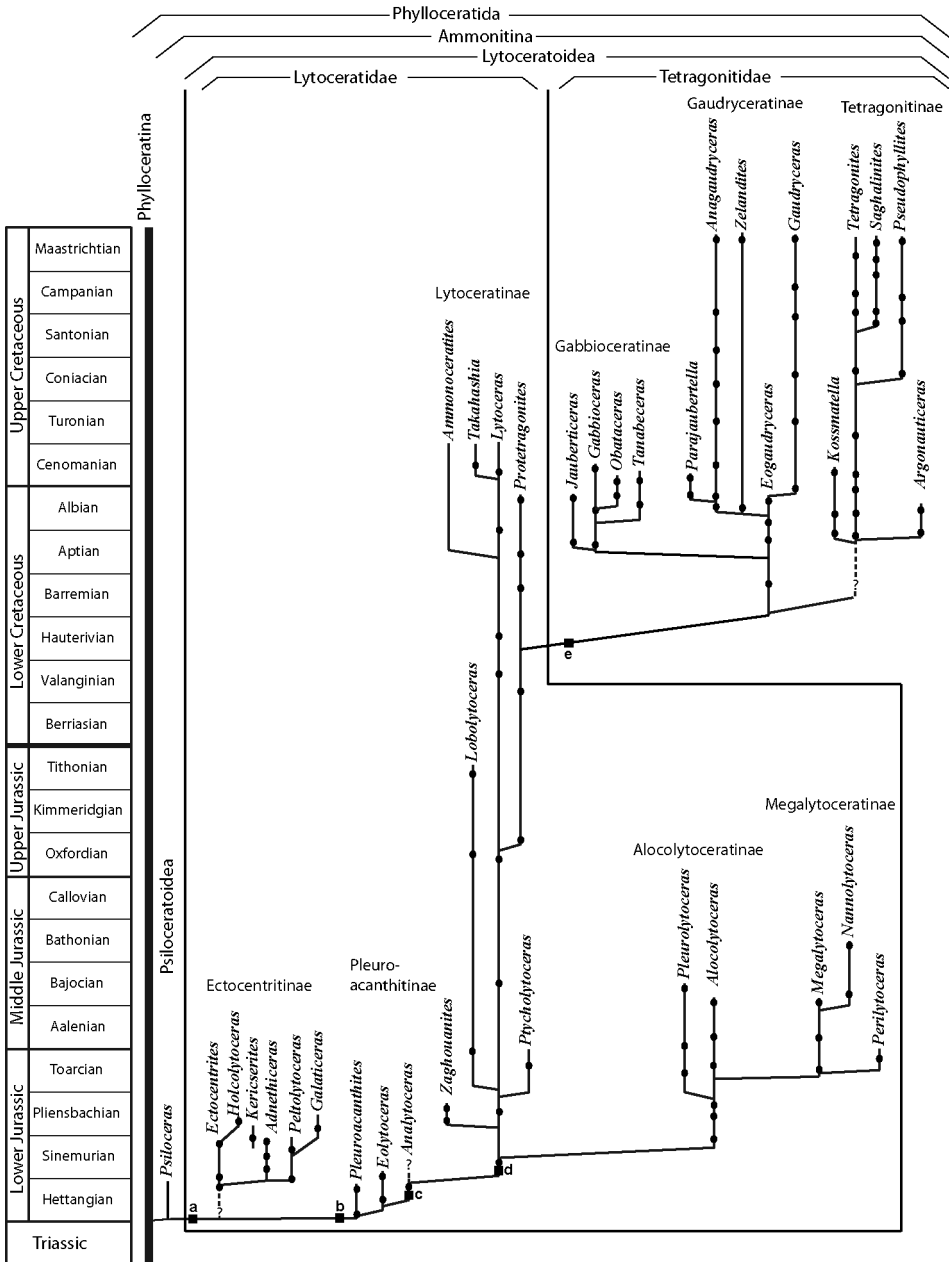


Fig. 1. Phylogenetic tree for the Lyceratoidea; *a*, septal lobe; *b*, megastriae (parable ribs); *c*, crenulated ribs (fimbriation); *d*, bifid lateral lobes; *e*, six lobate primary suture line, rhynchaptychus (new).

1831, p. 319; SD ICZN, 1974, Opinion 1020] [=Pleuroacanthites ZITTEL, 1884, p. 442, *nom. van.*, ICZN Opinion 575; Parapsiloceras HYATT 1900, p. 574 (type, *Aegoceras calliphyllum* var. *polycy-*

clus WÄHNER 1886, p. 138]. Very evolute, many whorls, whorl section depressed in earliest whorls, subcircular later; early whorls bear lateral parabolic nodes, which turn into curved parabolic lines on

middle whorls that are markedly rursiradiate on the whorl sides, and curve strongly forwards over the ventrolateral shoulders to form a long ventral sinus; adult body chamber may have an obliquely angled venter and large ventrolateral parabolic spines; occasional constrictions on the inner whorls; suture line lytoceratid, but with phylloid saddle endings; possibly dimorphic from the presence of small-sized adult microconchs (WÄHNER, 1894; WIEDMANN, 1970; GUÉX, 1980). *Lower Jurassic (Hettangian–Lower Sinemurian)*: Austria, Italy, USA (Nevada), Hungary, China (southern Tibet).—FIG. 2, 1*a–f*. **P. bififormis* (J. DE C. SOWERBY); *a–c*, Museo di Storia Naturale–Università di Pisa, I-422, original of CANAVARI (1882, pl. 17, 10*a–b*), Hettangian, La Spezia, Italy, $\times 1.0$ (new); *d–e*, Wien University Geological Institute 1884, IX 62, original of WÄHNER (1894, pl. 3, 2*a–b*), Hettangian, Schreinbach River, Austria, $\times 0.6$ (new); *f*, suture (adapted from Canavari, 1888, text-fig. 2.3).—FIG. 2, 1*g–i*. *P. polycyclus* (WÄHNER); *g–h*, Wien University Geological Institute, 1884, VII 76, original of WÄHNER (1894, pl. 6, 1), Hettangian, Pfonsjoch, Austria, $\times 0.35$ (new); *i*, suture (adapted from Wähner, 1886, pl. 15, 2*d*).

Analytoceras HYATT, 1900, p. 568 [**Ammonites articulatus* J. DE C. SOWERBY in DE LA BECHE, 1831, p. 319; OD] [= *Trachyphyllites* ARTHABER, 1927, p. 141 (type, *T. costatus*, M; = *Ammonites hermanni* GÜMBEL, 1861, p. 474)]. Similar to *Pleuroacanthites*, but whorl section is circular, whorl height increases more rapidly, and innermost whorls have strong, closely spaced constrictions; constrictions and associated flares on later whorls straight to slightly sinuous, parabolic lines are straighter on the middle whorls, where they include ventrolateral nodes; then they develop into sinuous flares on the outer whorls; large forwardly curving ventrolateral spines occur on the adult body chamber, growth lines minutely crinkled (HOFFMANN & KEUPP, 2010). The original figure of *Ammonites articulatus* SOWERBY (in DE LA BECHE, 1831, p. 319, fig. 70) from La Spezia, Italy, is a poor woodcut and is not recognizable. D'ORBIGNY's (1846 in 1842–1851, pl. 97, 10–11) figure of the inner whorls of a topotype (now lost, *vide* FISCHER, 1994, p. 87) is the first recognizable figure of the species. *Lower Jurassic (Hettangian–Lower Sinemurian, Bucklandi Zone)*: Austria, Italy, China (southern Tibet), Indonesia (Timor).—FIG. 2, 2*a–g*. **A. articulatum* (J. DE C. SOWERBY); *a–d*, Hettangian, Schreinbach River, Austria; *a–c*, $\times 1.0$ (Wähner, 1894, pl. 7, 4*a–c*); *d*, suture (adapted from Wähner, 1894, pl. 7, 4*d*); *e–g*, Museo di Storia Naturale–Università di Pisa, I-479, Hettangian, La Spezia, Italy, original of CANAVARI (1882, pl. 3, 4*a–c*), $\times 2.0$ (new).—FIG. 2, 2*h–k*. *A. costatum* (ARTHABER), Museum Delft, MGMT KA 13559; *h–j*, Hettangian, Oë Bihati-Baun, southeastern Timor, $\times 1.0$ (Wiedmann, 1970, pl. 5, 6*a–c*); *k*, suture at Wh = 10 mm (adapted from Wiedmann, 1970, text-fig. 8*a*).

Eolytoceras FREBOLD, 1967, p. 14 [**E. tasekoi*; OD]. Similar to *Ectocentrites*, but quickly becomes striate

or smooth and more similar to *Analytoceras*; evolute, whorl section rounded to quadrate; fine to medium, radial to subradial ribs on inner whorls fading to slightly prorsiradiate striae or becoming smooth on outer whorls; 5 to 6 constrictions per whorl throughout growth, associated with parabolas with weak ventrolateral nodes; saddle endings tend to be phylloid (LONGRIDGE, SMITH, & TIPPER, 2008). *Lower Jurassic (Upper Hettangian–Lower Sinemurian)*: Austria (Karwendel Mountains), France, Canada (British Columbia), USA (Nevada), New Zealand, northern Peru, Chile.—FIG. 3*a–e*. **E. tasekoi*, holotype; *a–c*, Geological Survey Canada, GSC 20059, original of FREBOLD (1967, pl. 8, 2*a–c*), Hettangian, Taseko Lakes, British Columbia, *a–b*, $\times 1.0$, *c*, $\times 2.0$ (new); *d*, cross section, $\times 1.0$ (Wiedmann, 1970, p. 1005, fig. 30D); *e*, suture at Wh = 12 mm (adapted from Wiedmann, 1970, fig. 31).

SUBFAMILY ECTOCENTRITINAE SPATH, 1926

[*nom. transl.* WIEDMANN, 1970, p. 1002, ex Ectocentritidae SPATH, 1926, p. 138] [= Fucinitinae VENTURI & BILOTTA, 2001, p. 333; = Pelto-lytoceratinae VENTURI & BILOTTA, 2001, p. 333; = Holcolytoceratidae VENTURI, NANNARONE, & BILOTTA, 2005, p. 91]

Lytocerataceae, with a tendency to quadrate whorls, straight ribs and ventrolateral tubercles, lack of crinkled ornament, but with a smooth venter. Suture line lytoceratid, moderately complex, but ventral lobe longer than in Lytoceratinae, and saddle endings tend to be phylloid (WÄHNER, 1894, 1898 in 1882–1898). *Lower Jurassic (Hettangian–Lower Pliensbachian)*: Italy, Austria, Germany, Hungary, Albania, Morocco, northern Tunisia, China (Tibet), Indonesia (Timor), New Zealand, Canada (British Columbia), USA (Nevada), Chile.

Ectocentrites CANAVARI, 1888, p. 126 [**Ammonites petersi* HAUER, 1856, p. 65; SD BONARELLI, 1900, p. 71] [= *Cosmolytoceras* SPATH, 1924*b*, p. 189 (type, *Ectocentrites canavarii* BONARELLI, 1900, p. 70; OD)]. Large, evolute shells; whorl section compressed, quadrate or rounded; moderate whorl expansion rate, with broad flat venter; innermost whorls with about 8 wide, bandlike, straight constrictions and weak ribs; rib interspace variable in depth and width, and ventrolateral tubercles between which the smooth venter may be concave; on middle whorls constrictions quickly fade to leave regular, fine to medium, straight ribs, ending in ventrolateral tubercles; tubercles weak on later whorl and occasionally not present on the adult body chamber, rare intercalated or bifurcated ribs, venter smooth and flat or broadly arched (GUÉX, 1975), possibly dimorphic from the presence of small-sized adult microconchs (CALLOMON, 1981).

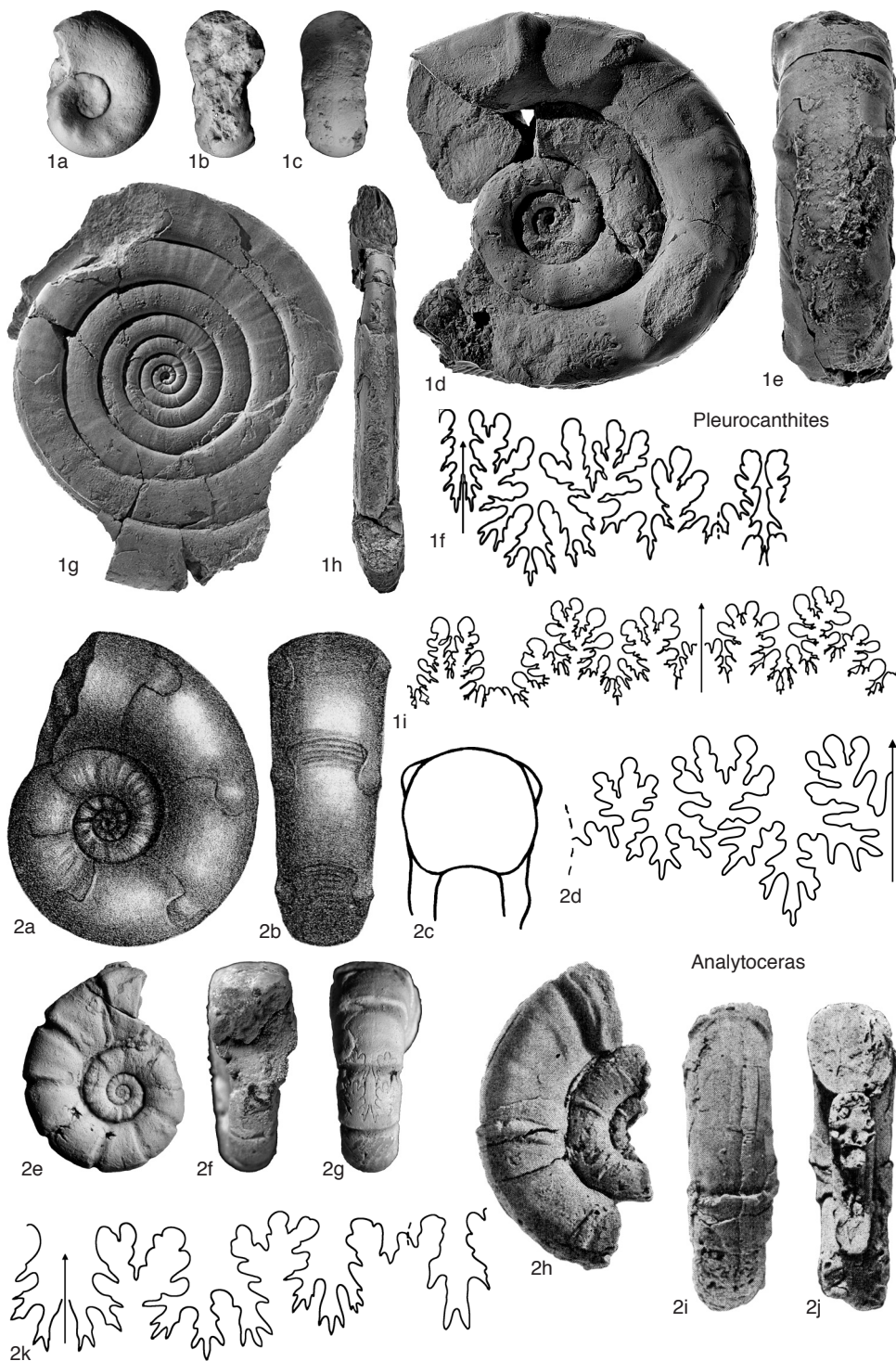


FIG. 2. Lytoceratidae (p. 1–3).

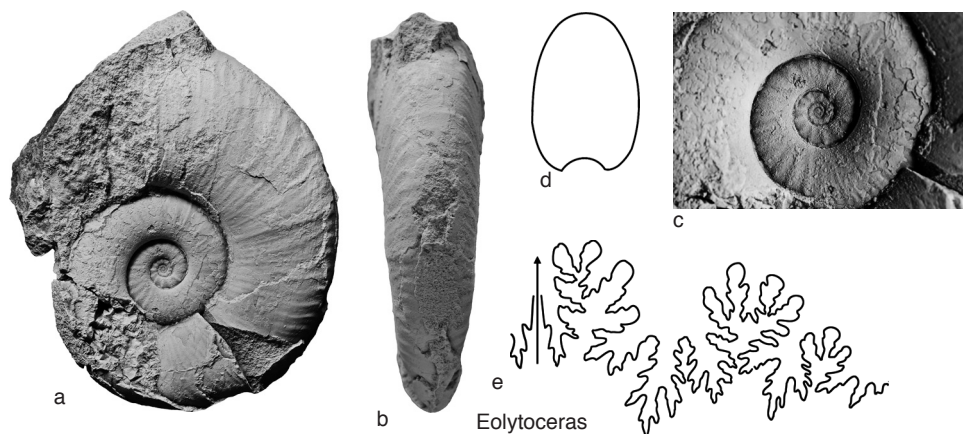


FIG. 3. *Lytoceratidae* (p. 3).

Lower Jurassic (Hettangian–Upper Sinemurian, Raricostatum Zone): France, Austria, Slovakia, Hungary, Italy, Mexico, ?Canada (British Columbia), USA (Nevada), Chile, Timor (Indonesia), Morocco, China (Tibet), New Zealand. —FIG. 4, 1a–c. **E. petersi*, holotype; a–b, the original of HAUER (1856, pl. 21, 1–2), Geological Survey Austria (Vienna), GBA 1856/001/0063, middle–upper Hettangian, Kammerkaralpe, Tyrol, Austria, $\times 0.5$ (Schlögl & Zorn, 2012, pl. 7, 1–2); c, suture at Wh = 40 mm (adapted from Wiedmann, 1970, p. 944, text-fig. 9b).

Peltolytoceras SPATH, 1924b, p. 194 [**Ectocentrites giordanii* BONARELLI, 1900, p. 75; OD]. Similar to *Ectocentrites*, but higher whorl expansion rate, ribs stronger, prorsiradial, and end in much larger ventrolateral tubercles; ribs persist beyond tubercles on to the sides of the venter, but the middle of the venter remains smooth (WIEDMANN, 1970; VENTURI & BILOTTA, 2001). *Lower Jurassic (Sinemurian)*: ?Hungary, Italy. —FIG. 4, 2a–d. **P. giordanii* (BONARELLI); a–b, lectotype (designated by HOFFMANN, herein), The Natural History Museum, London, NHMUK C.8471, original of BONARELLI (1900, pl. 10, 4), Foci, Pontalto, Central Apennines, Italy $\times 0.5$ (new); c–d, hypotypoid, Istituto di Geologia Torino, MGPT-PU 30004; c, cross section, $\times 0.5$ (Wiedmann, 1970, fig. 30e); d, suture at Wh = 18 mm (adapted from Wiedmann, 1970, p. 944, text-fig. 9d).

Holcolytoceras SPATH, 1924b, p. 189 [**Ammonites nodostrictus* QUENSTEDT, 1885 in 1892–1888, p. 264; OD]. Dwarfish (only up to 15 mm diameter), evolute, subrectangular, compressed cross section, smooth, except for ventrolateral tubercles and 4 to 6 straight constrictions per whorl, 4 to 8 nodes between constriction, nodes connected with straight ribs over the venter; venter slightly convex. Differs from juvenile whorls of *Ectocentrites* by rudimentary ribs (WIEDMANN, 1970). *Lower Jurassic (lower Pliensbachian, Ibex Zone)*: Germany,

Austria. —FIG. 4, 3a–d. **H. nodostrictus* (QUENSTEDT); a–b, holotype, Museum of Natural History Stuttgart, SMNS 28046, original of QUENSTEDT (1885 in 1892–1888, pl. 33, fig. 20), Hinterweiler, Swabia, Germany, $\times 2.0$ (new); c, cross section, $\times 2.0$ (adapted from Quenstedt, 1885 in 1892–1888, pl. 33, 20M); d, suture at Wh = 3.5 mm (adapted from WIEDMANN, 1970, p. 991, text-fig. 24a).

Adnethiceras WIEDMANN, 1970, p. 997 [**Ammonites adnethicus* HAUER, 1854a, p. 748; OD] [= *Alloderoceras* WIEDENMAYER, 1980, p. 170 (type, *Deroceras mutans* FUCINI, 1903, p. 167, OD)]. Evolute, large (up to 165 mm diameter), whorls rounded, becoming quadrate; low whorl expansion rate, inner whorls smooth, then has strong ribs that may become large and widely spaced, ribs prorsiradial on the sides and radial over the venter; small lateral tubercles and moderately large ventrolateral tubercles, venter slightly convex to flat. *Lower Jurassic (Sinemurian)*: Austria, Italy, Hungary, Romania. —FIG. 4, 4a–e. **A. adnethicum* (HAUER), syntype; a–c, Geological Survey Austria (Vienna), coll. no GBA 1854/002/0003, original of WIEDMANN (1970, pl. 8, 1a–c), Upper Sinemurian, Adnet, Salzburg, Austria, $\times 0.5$ (new); d, cross section, $\times 0.5$ (Wiedmann, 1970, p. 1005, fig. 30k); e, suture (adapted from Hauer, 1854b, pl. 1).

Galaticeras SPATH, 1938, p. 11 [**Amphiceras harpoceroideis* GEMMELLARO, 1884, p. 32; OD]. Shell moderate involute, whorl section compressed, subtriangular, high whorl expansion rate, narrow umbilicus, sigmoid ribs, marked umbilical shoulder, steep umbilical wall, venter narrow, highly convex (VENTURI & BILOTTA, 2001; RAKÚS & GÜEX, 2002). *Lower Jurassic (Pliensbachian)*: Italy, ?Caucasus, Morocco, northern Tunisia, Albania, Switzerland, Austria. —FIG. 5a–d. **G. harpoceroideis* (GEMMELLARO), holotype; a–c, Gemmellaro collection, Dipartimento di Scienze della Terra e del Mare MGUP-010.36, original of GEMMELLARO

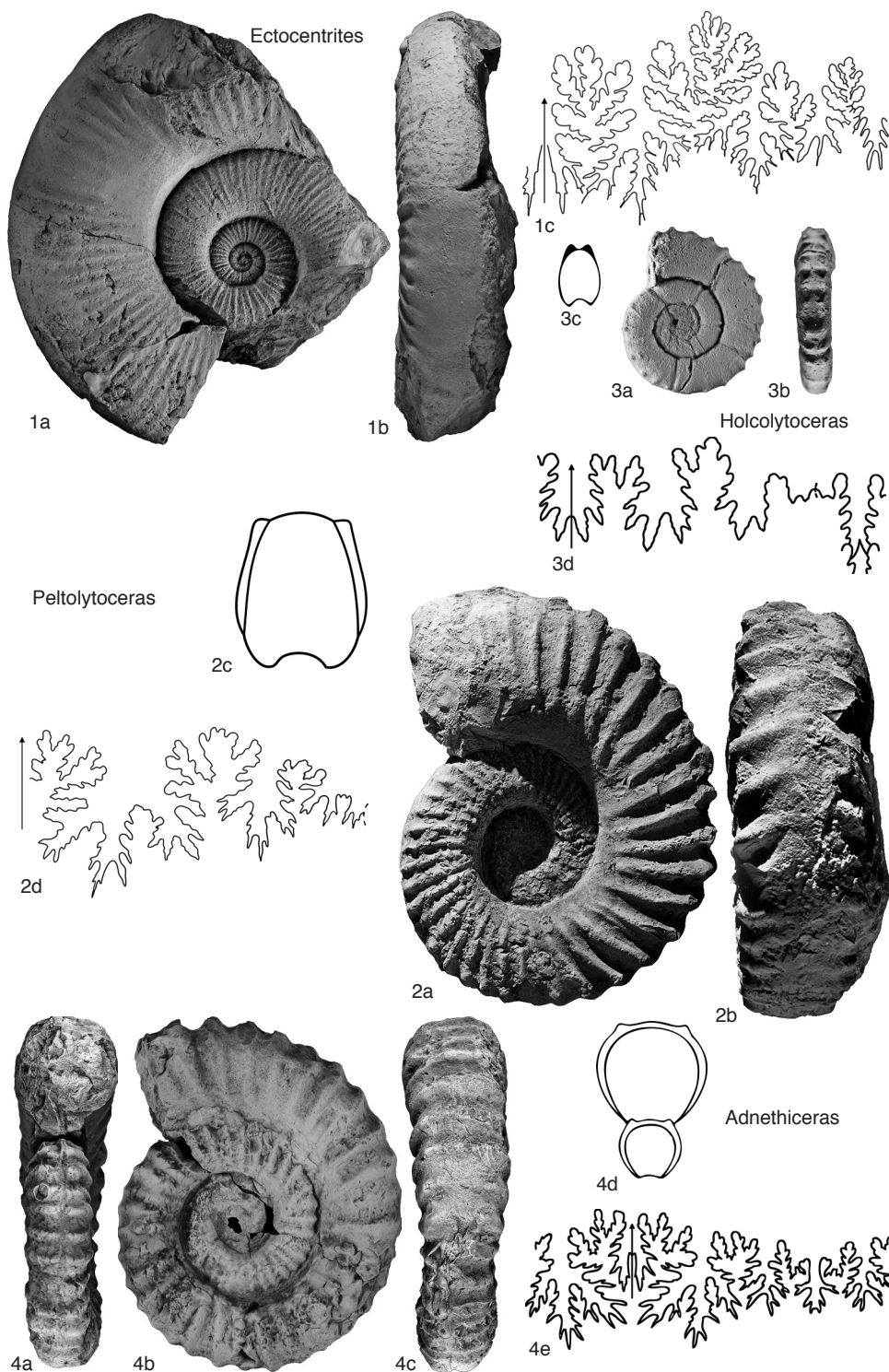


FIG. 4. Lytoceratidae (p. 3–5).

(1884, pl. 1,8–9), lower Pliensbachian (*Terebratula aspasia* Zone), Italy (Messina Province, Sicily), $\times 0.5$ (new); *d*, suture (adapted from Gemmellaro, 1884, pl. 1,12).

SUBFAMILY LYTOCERATINAE NEUMAYR, 1875

[*nom. transl.* SPATH, 1927, p. 64, ex *Lytoceratidae* NEUMAYR, 1875, p. 878] [=Derolytoceratidae SPATH, 1927, p. 63; =Hemilytoceratinae SPATH, 1927, p. 64; =Protetragonitidae SPATH, 1927, p. 66; =Carinolytoceratinae WIEDMANN, 1962c, p. 319; =Ammonoceratitidae BRUNNSCHWEILER, 1966, p. 15; =Trachyphyllocleritidae WIEDMANN, 1966, p. 67; =Trachyphylitidae SHEVYREV, 1968, p. 67]

Ornamented with growth lines or riblets, and occasional flares corresponding to constrictions on internal mold. Suture line as for family; dorsal lobe cruciform. This subfamily remains relatively little changed from the Lower Jurassic to the middle of the Cretaceous, though this essential unity has been obscured by the generic separation of many Cretaceous forms. Most of these are reunited with *Lytoceras* in the classification adopted here, though *Ammonoceratites* is kept separate mainly for reasons of priority. *Lower Jurassic (Sinemurian)–Upper Cretaceous (Cenomanian)*: worldwide.

Lytoceras SUESS, 1865, p. 78 [*Ammonites fimbriatus* J. SOWERBY, 1817, p. 145; OD] [=*Ophiceras* SUESS, 1865, p. 112, obj., non GRIESBACH, 1880, p. 109; ICZN Opinions 130 (1936) and 194 (1947); =*Thysanoceras* HYATT, 1867, p. 86, 96 (type, *Ammonites cornucopia* YOUNG & BIRD, 1822, p. 252, SD BUCKMAN, 1905, p. 148); =*Thysanolytoceras* BUCKMAN, 1905, p. 149 (type, *Ammonites eudesianus* D'ORBIGNY, 1846 in 1842–1857, p. 386, OD); =*Fimbriolytoceras* BUCKMAN, 1918 in 1909–1930, p. xiii, obj., OD; =*Kallilytoceras* BUCKMAN, 1921 in 1909–1930, pl. 204A (*K. interlineatum*, OD); =*Crenilytoceras* BUCKMAN, 1926 in 1909–1930, pl. 665 (type *C. crenatum*, OD); =*Orcholytoceras* BUCKMAN, 1926 in 1909–1930, pl. 666 (type, *O. metorchion*, OD); =*Eulytoceras* SPATH, 1927, p. 64 (type, *Ammonites inaequalicostatus* D'ORBIGNY, 1840 in 1840–1842, p. 118, OD); =*Hemilytoceras* SPATH, 1927, p. 64 [*Ammonites immanis* OPPEL, 1865, p. 551, OD); =*Metalytoceras* SPATH, 1927, p. 64 (type, *L. triboleti* UHLIG, 1902, p. 22, OD); =*Pterolytoceras* SPATH 1927, p. 64 (type, *Ammonites exoticus* OPPEL, 1863, p. 278, OD); =*Saturnoceras* ANDERSON, 1938, p. 145, *nom. nud.* (type, *L. (Saturnoceras) saturnale*, OD); =*Biasaloceras* DRUSCHITS, 1953, p. 157 (type, *L. subsequens* KARAKASCH, 1907, p. 44, OD); =*Dinolytoceras* BESNOSSOV, 1956, p. 110 (type, *D. zhivagoi*, OD); =*Valentolytoceras* BESNOSSOV, 1956, p. 110 (type, *V. elegans*, OD)]. Shell size ranges from small to huge; whorl section rounded-circular to depressed or compressed, or subquadrate; whorl expansion rate

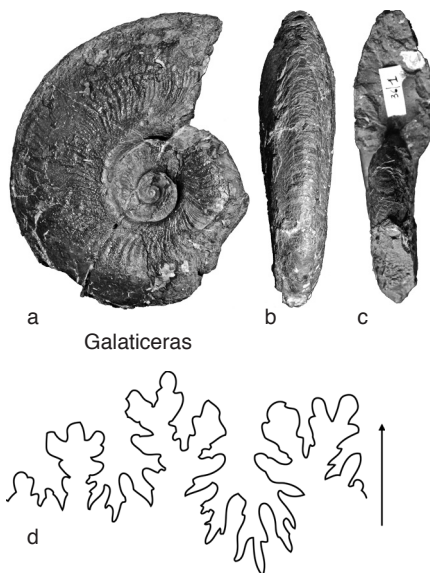


FIG. 5. Lytoceratidae (p. 5–7).

varies from low to high; whorls very evolute, only touching or slightly overlapping, ornamented with prominent growth lines or riblets, usually fimbriate, and strigate ornament in some; ribs straight to sinuous, occasional weak to strong, regular to irregularly spaced, constrictions on internal mold, associated with lamellar flares on shell, and these may be more numerous on inner whorls. Suture line as for family, septal lobe in Cretaceous forms stronger than in Jurassic forms (KENNEDY & KLINGER, 1978; HOFFMANN, 2010). (Many Lower Cretaceous forms—e.g., type species of *Biasaloceras*—are hardly different from some Lower Liassic species.) *Lower Jurassic (Sinemurian, Bucklandi Subzone)–Upper Cretaceous (Cenomanian)*: worldwide, but rarer in Boreal realm than in Tethyan or Indo-Pacific realms.—FIG. 6a–b. **L. fimbriatum* (J. SOWERBY), holotype, Oxford University Museum, J.20276, lower Pliensbachian, *Ibex* Zone, Charmouth, Dorset, England, $\times 0.65$ (new).—FIG. 6c, *L. subsequens* (KARAKASCH), Barremian, Wehoretschye (formerly Biasala), Crimea, Ukraine, $\times 0.5$ (Karakasch, 1907, pl. 5,9a).—FIG. 6d–e, *L. inaequalicostatus* (D'ORBIGNY), Muséum National d'Histoire Naturelle Paris, MNHN B46089, original of D'ORBIGNY (1840 in 1840–1842, pl. 29,3–4), Barremian, Alpes-de-Haute-Provence, France, $\times 1.0$ (new).—FIG. 6f–g, *L. liebigei strambergensis* (ZITTEL), lectotype of *L. immane* OPPEL (SAPUNOV, 1979, p. 40), Staatliche Sammlung für Paläontologie und historische Geologie München, AS III 254, original of ZITTEL (1868, pl. 11,3), Tithonian, Germany (Stramberg, Mähren), $\times 0.5$ (new).

L. (*Derolytoceras*) ROSENBERG, 1909, p. 249 [*Ammonites lineatus tortus* QUENSTEDT, 1885 in 1882–1888,

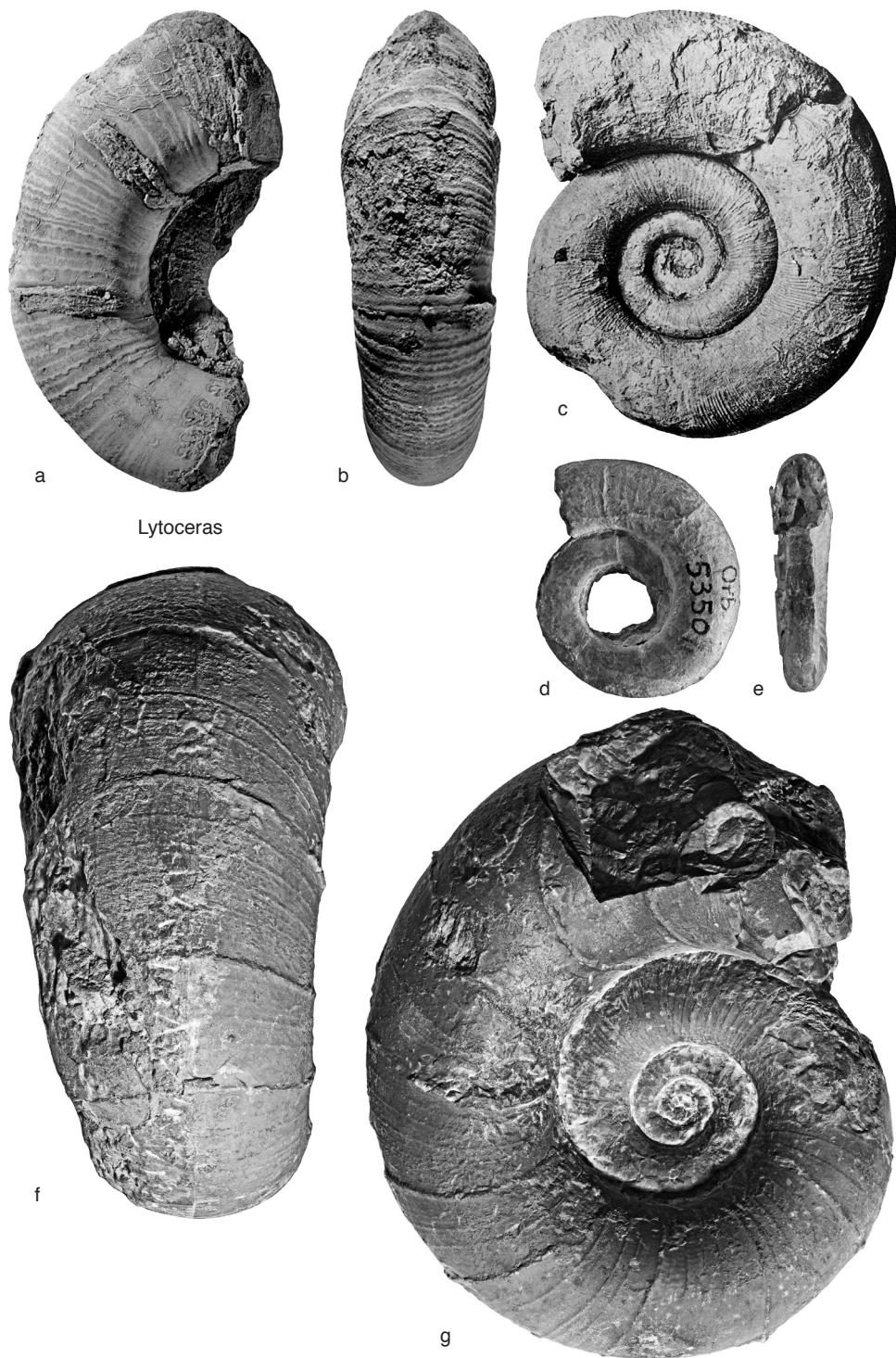


FIG. 6. Lytoceratidae (p. 7).

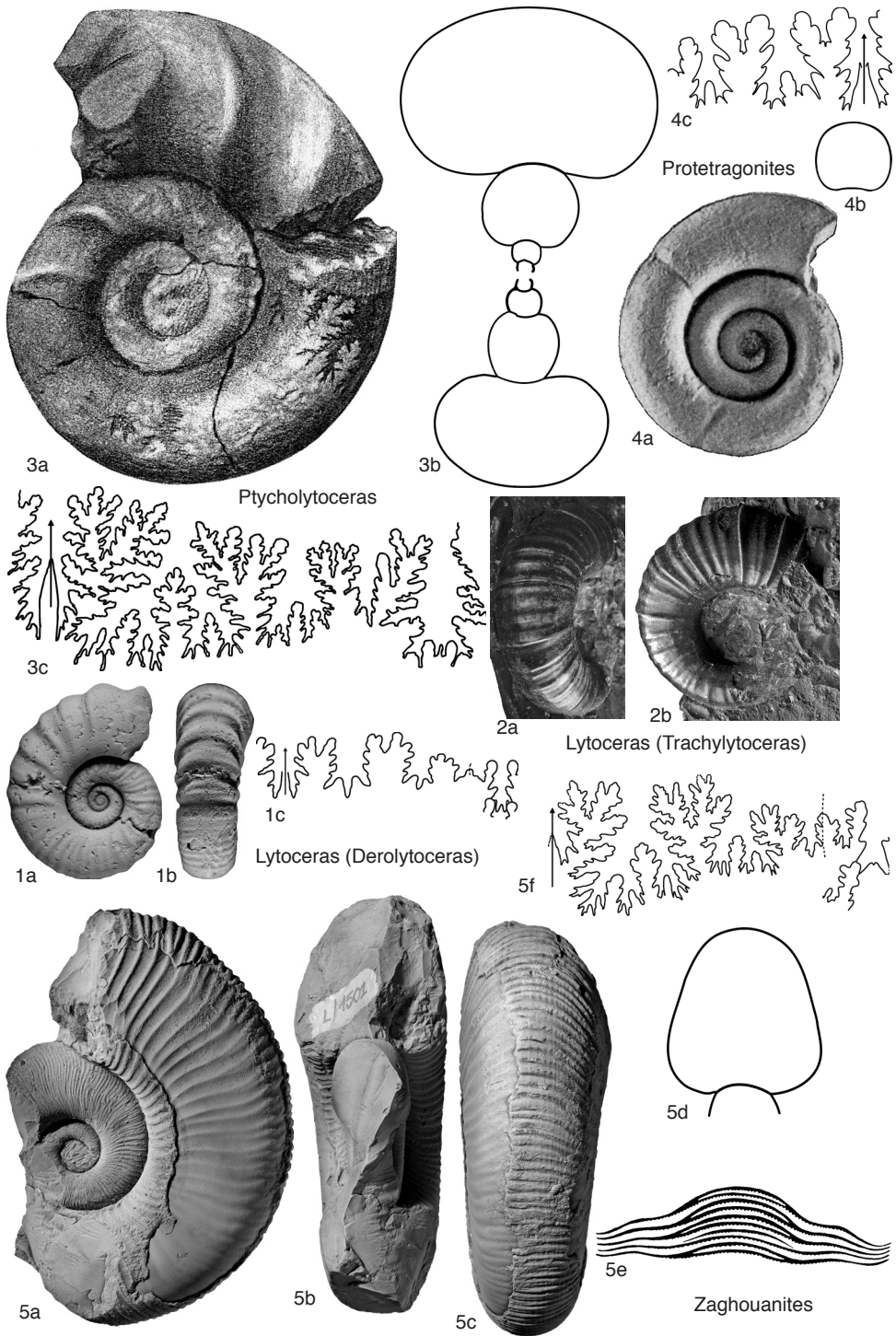


FIG. 7. *Lytoceratidae* (p. 7–10).

- p. 309; SD SPATH, 1924a, p. 4]. Very evolute, small shells up to 40 mm, slowly expanding whorls; rounded to subquadrate whorl section; ribs of subsequent whorls more distantly spaced and varying in strength, then ribs become stronger, prorsiradiate, and capricorn or foldlike across the venter, microconch of *Lytoceras* (MEISTER, 1986). *Lower Jurassic (Pliensbachian)*: Austria, Italy, France, Germany.——FIG. 7,1a–c. **L. (D.) tortum* (QUENSTEDT), lectotype, upper Pliensbachian, Heiningen, Tübingen, Germany; a–b, Museum of Natural History Stuttgart, SMNS 27741, original of QUENSTEDT (1885 in 1882–1888, pl. 39,12), $\times 2.0$ (new); c, suture at Wh = 4 mm (Wiedmann, 1970, p. 941, fig. 8e).
- L. (Trachilytoceras) BUCKMAN, 1913 in 1909–1930, p. vii, pl. 86 [**Ammonites nitidus* YOUNG & BIRD, 1828, p. 256; OD]. Evolute, small shells, with circular whorl section, early whorls smooth except for rursiradiate, fine growth lines that rise to irregularly spaced rings of variable expression on later whorls, about 25 per whorl, microconch of *Lytoceras*. *Lower Jurassic (Toarcian)*: UK (England), Germany, France.——FIG. 7,2a–b. **L. (T.) nitidus* (YOUNG & BIRD), lectotype, Whitby Museum, WHITM-SIM2547, original of BUCKMAN (1913 in 1909–1930, pl. 86), England (Whitby), $\times 1.0$ (new).
- Zaghuanites RAKÚS & GUÉX, 2002, p. 69 [**Kallilytoceras arcanum* WIEDENMAYER, 1977, p. 49; OD]. Large size; whorl section compressed oval to subtrapezoidal, with converging flanks; whorl expansion rate decreases during ontogeny, contrary involution increases; umbilical wall steep; ribs fimbriate only at midflank and on venter, which they cross radially, prorsiradiate, sigmoid, or biconcave, regularly bifurcated at the ventrolateral shoulder (dactylioceratid-like), no flares or constrictions; external lobe only half as long as the lateral lobe. *Lower Jurassic (lower Pliensbachian, Ibex Zone–upper Pliensbachian)*: Morocco, Austria, southern Germany, Spain, Portugal, Carpathian Mountains, Hungary, Italy, southeastern France, Tunisia.——FIG. 7,5a–f. **Z. arcanum*; a–d, holotype, Palaeontological Institute University of Zurich, coll. no PIMUZ 4201 (formerly, L/1501, FB 732), original of WIEDENMAYER (1977, p. 47, fig. 10c; pl. 11,3–5), Italy (Arzo quarries, Sondria), $\times 0.75$ (new); d, cross section, $\times 0.75$ (Wiedenmayer, 1977, p. 47, fig. 10c); e–f, ornamentation pattern (e) and suture (f) (Rakús & Guéx, 2002, p. 71, text-fig. 54d–f).
- Ptycholytoceras SPATH, 1927, p. 65 [**Lytoceras humile* PRINZ, 1904, p. 60; OD]. Early whorls rounded, later whorls markedly depressed, very evolute, moderate whorl expansion rate, rounded umbilical shoulder, rounded flanks and broad rounded venter, irregularly spaced bulges on the sides, starting at about 30 mm in diameter, prorsiradiate and slightly sinuous, fading out at ventrolateral shoulder, surface ornamentation unknown. *Lower Jurassic (Toarcian)*: Hungary, Germany, France.——FIG. 7,3a–c. **P. humile*, holotype, middle Toarcian, Hungary (Csérnye); a–b, holotype, $\times 1.0$ (Prinz, 1904, p. 61, text-fig. 7; pl. 31,1); c, suture (Prinz, 1904, pl. 37,5).
- Lobolytoceras BUCKMAN, 1923, pl. 440 [**Lytoceras siemensi* DENCKMANN, 1887, p. 43; OD]. Inner whorls rounded with large swollen ribs, later whorls become strongly compressed with fimbriate ribs at about the third whorl, high whorl expansion rate, whorl height of last whorl may exceed umbilical width, 4 to 5 volutions; ribs straight to prorsiradiate, slightly sinuous, often but irregularly bifurcated, no flares or constrictions; anaptychus (LEHMANN, 1968); dimorphic genus, microconch of type species with coarser ribs on body chamber; suture line very similar to *Lytoceras* (HOFFMANN & KEUPP, 2008). *Lower Jurassic (Toarcian)–Upper Jurassic (Tithonian)*: Germany, France, Madagascar, Italy (western Sicily).——FIG. 8,1a–e. **L. siemensi* (DENCKMANN), Toarcian, Tenuicostatum Zone, Hattorf and Dörnten, north of Goslar, Lower Saxony, Germany; a–b, holotype, macroconch, Geoscience Centre of the University of Göttingen Museum, GZG.INV. 458-8, original of DENCKMANN (1887, pl. 1,8a–b), $\times 0.5$ (new); c–d, microconch, Geoscience Centre of the University of Göttingen Museum, GZG.INV. 458-5, original of DENCKMANN (1887, pl. 1,5), $\times 1.0$ (new); e, suture at Wh = 1 mm (adapted from Schindewolf, 1961, p. 672, text-fig. 11c).
- Protetragonites HYATT, 1900, p. 569 [**Ammonites quadrisculcatus* D'ORBIGNY, 1841 in 1840–1842, p. 151; OD] [= *Hemitetragonites* SPATH, 1927, p. 66 (type, *Lytoceras crebrisulcatum* UHLIG, 1883, p. 191, OD); *Leptotetragonites* SPATH, 1927, p. 66 (type, *Ammonites honnoratianus* D'ORBIGNY, 1841 in 1840–1842, p. 124, OD)]. Very evolute, serpentine, whorls barely in contact, very low whorl expansion rate, whorl section circular or compressed elliptical to subquadratic; shell smooth except for growth lines, regular constrictions on mold and surface throughout shell, 4 to 12 per whorl, radial and straight, or prorsiradiate or curving forwards, occasionally with a preceding rib, suture typical lytoceratid but simplified (WIEDMANN, 1962a, HOFFMANN, 2010). *Upper Jurassic (Oxfordian)–Lower Cretaceous (upper Albian)*: Spain (Majorca), France, Austria, Italy (Sardinia), Poland, Hungary, Bulgaria, Romania, Ukraine (Crimea), northern Caucasus (Georgia), Turkmenia, northern Africa (central Tunisia, Morocco, Egypt), Madagascar, USA (northern California), Cuba, Dominican Republic, Mozambique, southern Africa (Zululand), Japan, Russia.——FIG. 7,4a–c. **P. quadrisulcatus* (D'ORBIGNY); a–b, neotype, Puzos collection at University of Lyon-Villeurbanne (Rhône), 1083 (EM-5501), Valanginian, France (Senez, Alpes-de-Haute-Provence), $\times 2.0$ (Busnardo in Fischer & Gauthier, 2006, p. 54, fig. 33, pl. 8,1); c, suture (adapted from d'Orbigny, 1841 in 1840–1842, pl. 49, fig. 3).
- Ammonoceratites BOWDICH, 1822 (February), p. 21, non *Ammonoceratites* RAFINESQUE, 1815, p. 140, nom. nud. [**A. lamarcki*; M] [= *Ammonoceras* LAMARCK, 1822 (August), p. 644 (type, *Ammonoceratites glossoidea*; SD SPATH, 1927, p. 64; = *A.*

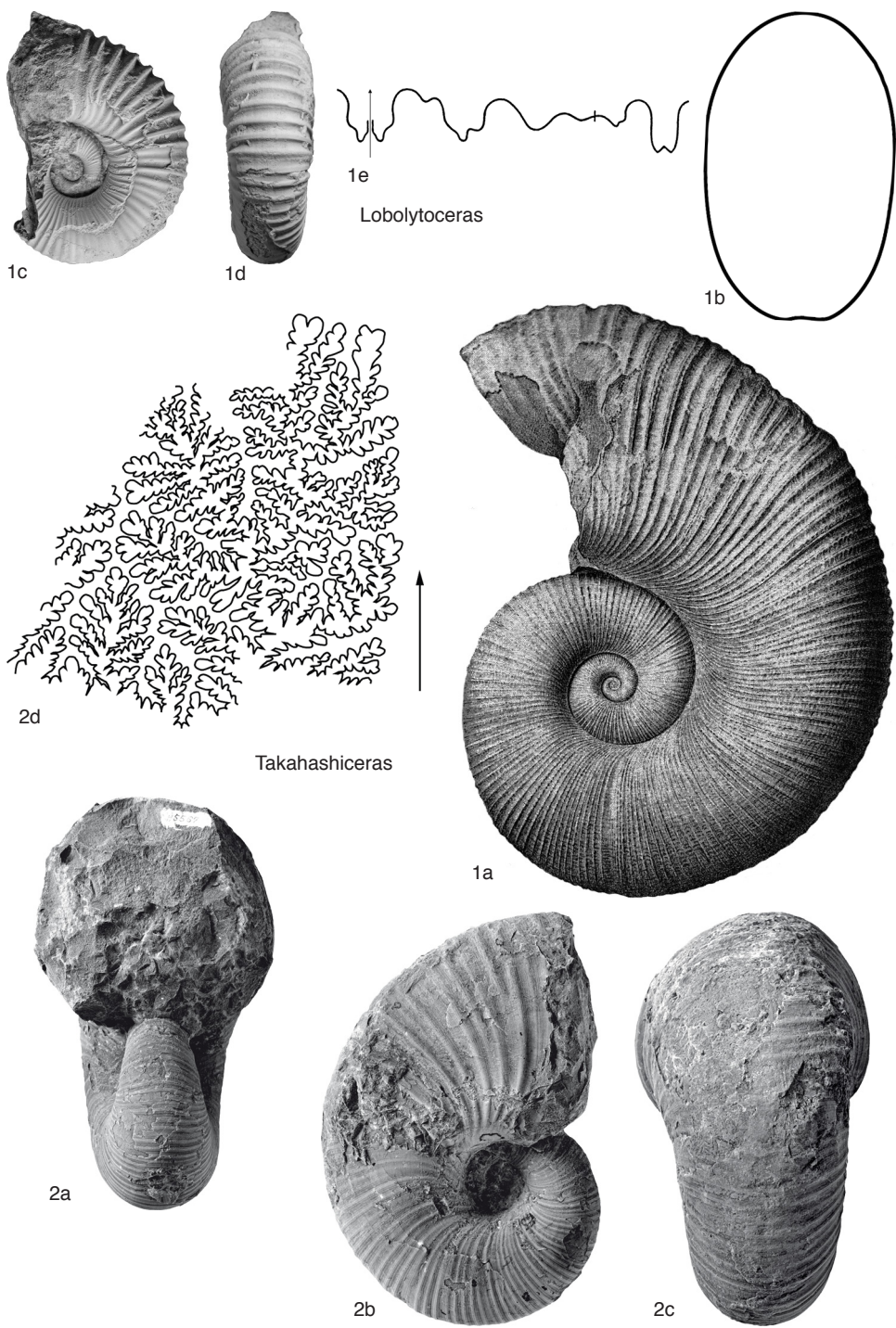


FIG. 8. Lytoceratidae (p. 10–12).

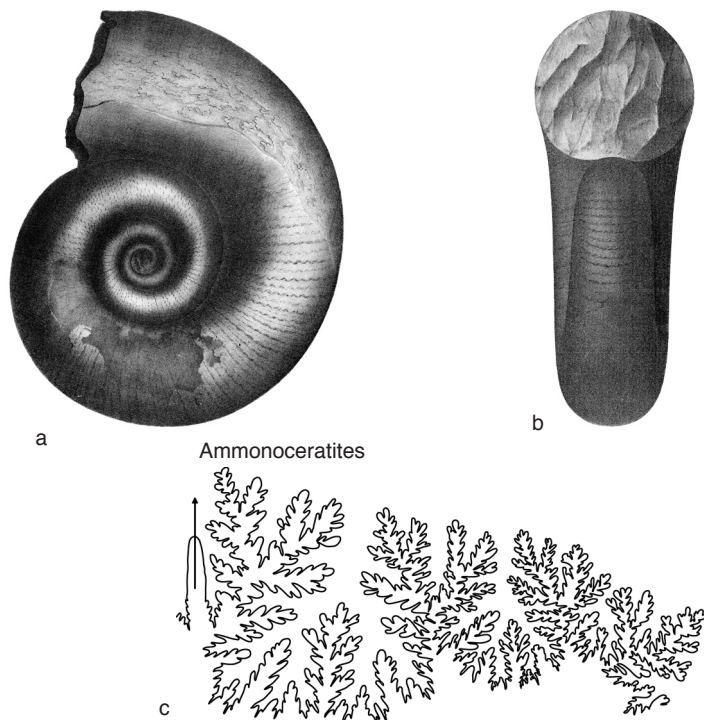


FIG. 9. Lytoceratidae (p. 10–12).

lamarcki BOWDITCH, 1822, obj.]. Large, evolute, whorls barely in contact, circular whorl section. Dense, fine, strongly crinkled riblets or growth lines, moderate to high whorl expansion rate; doubtfully distinct from *Lytoceras* (KENNEDY & KLINGER, 1978). *Lower Cretaceous (upper Aptian)–Upper Cretaceous (Cenomanian)*: southern France, Canada (British Columbia), southern India, ?Madagascar, Greenland, Japan, southern Africa (Zulu-land).—FIG. 9a–c. *A. mahadeva* (STOLICZKA), holotype; a–b, upper Albian, southeastern India (Moraviatoor) (Stoliczka, 1866 in 1863–1866, pl. 80, 1, 1a), $\times 0.25$, c, suture (adapted from Stoliczka, 1866 in 1863–1866, pl. 80, 1b).

Takahashiceras HOFFMANN & HOWARTH, 2015, p. 1 [**T. eureka*; OD] [= *Takahashia* MATSUMOTO, 1984, p. 33, obj.]. Like *Pseudophyllites* with rapidly expanding whorls, fairly large with involute shell, subcircular whorl section; ornament with fine, rursiradial, minutely fimbriate ribs, crossing the venter and forming a shallow backward sinus on later whorls; suture highly complex. Derived from *Lytoceras ezoense*. *Upper Cretaceous (lower Cenomanian)*: Japan.—FIG. 8, 2a–d. **T. eureka*, holotype, Department of Earth and Planetary Sciences, Kyushu University Fukuoka, GK. H5567, *Manteliceris japonicum* Zone, Loc. IK1101, Yezo group, Mikasa Formation, Japan (Ikushumbets River, Katsurazawa quarry, Hokkaido), $\times 0.4$ (Shigeta, Hoffmann, & Izukura, 2010, p. 199,

fig. 3a–d); d, suture at Wh = 74 mm (Shigeta, Hoffmann, & Izukura, 2010, p. 197, fig. 1B).

SUBFAMILY MEGALYTOCERATINAE SPATH, 1927

[Megalytoceratinae SPATH, 1927, p. 65] [= Nannolytoceratinae SPATH, 1927, p. 66]

Small to large, smooth taxa, without fimbriate ornamentation and with occasional flares; constrictions weak to strong; some planulate, evolute to moderately evolute forms with triangular to subquadrate whorl sections that tend to lose lytoceratid whorl characters to resemble perisphinctids. Derived from *Alocolytoceras* with smooth last whorl. *Lower Jurassic (lower Toarcian)–Upper Jurassic (middle Callovian)*: Europe, Russia, Ukraine, Morocco, Kenya, Iran, Daghestan.

Megalytoceras BUCKMAN, 1905, p. 150 [**Lytoceras confusum* BUCKMAN, 1881, p. 601; OD] [= *Metrolytoceras* BUCKMAN, 1923, pl. 429 (type, *M. metretum*; OD); = *Asapholytoceras* SPATH, 1927, p. 65 (type, *Lytoceras forojuliense* TARAMELLI, 1880, p. 74; OD)]. Evolute, large shells; slow whorl expansion rate throughout ontogeny; whorl section elliptical in

early whorls, later higher, more compressed, with flat or convergent sides forming an equilateral triangular section but with rounded venter; later whorls with prominent, abrupt umbilical edge with nearly vertical umbilical wall. Occasional nonfimbriate flares and rare, faint constrictions on inner whorls; later whorls smooth, but may show growth lines or striae on venter; umbilicus wide and shallow. Suture with bifid lateral but trifid umbilical lobes, saddles asymmetric bifid, internal lobe cruciform. *Lower Jurassic (lower Toarcian)*–*Middle Jurassic (middle Bajocian)*: France, UK (England), Italy, Hungary, Russia, Ukraine (Crimea), Caucasus, Daghestan, northern Africa.—FIG. 10, 1a–b. **M. confusum* (BUCKMAN), lectotype (designated by Hoffmann, herein), University of Manchester Museum, L 11344, middle Bajocian (*Sowerbyi* Zone), England (Bradford Abbas, Dorset), $\times 0.25$ (Buckman, 1883, pl. 3, 1).—FIG. 10, 1c, *M. metretum*, Bajocian, England, $\times 0.25$ (Buckman, 1923, pl. 429, 1–3).—FIG. 10, 1d–f, *M. forojuliense* (TARAMELLI), Toarcian, Italy, Hungary; d–e, holotype, $\times 0.5$ (Taramelli, 1880, pl. 5, 1–2); f, suture (adapted from Prinz, 1904, pl. 37, 4).

Perilytoceras RULLEAU, 1997, p. 451 [**Ammonites jurensis* ZIETEN, 1833 in 1830–1833, p. 90; OD]. Whorl section compressed; later whorls vary from triangular to subtrapezoidal section, convex flanks, venter rounded, marked umbilical shoulder, involution about one-third of whorl height; mold smooth, no constrictions, shell surface without ornament except for growth lines, projected at the lower flank, curved backwards at midflank, strongly projected forwards on the venter, suture line simplified with phylloid saddle terminations; derived from *Alocolytoceras*. *Lower Jurassic (upper Toarcian)*: France, Germany, UK (England), Morocco, Ukraine (Crimea), Indonesia (Rotti, Timor).—FIG. 10, 2a–d. **P. jurensis* (Zieten); a–c, lectotype (designated by Hoffmann, herein), Staatliche Sammlung für Paläontologie und historische Geologie München, BSPG AS XX 502, *Jurensis* Zone, Heiningen, Braunberg (near Wasseralfingen), Gruibing (near Boll), Württemberg, Germany, $\times 0.5$ (new); d, suture at Wh = 12.5 mm, Heiningen, Germany (adapted from Schindewolf, 1961, fig. 10).

Nannolytoceras BUCKMAN, 1905, p. 151 [**Ammonites pygmaeus* D'ORBIGNY, 1845 in 1842–1851, p. 391; OD] [= *Polystomiceras* SPATH, 1924a, p. 5 (type, *Ammonites tripartitus* RASPAIL, 1831, p. 120; OD); = *Polystomiceras* SPATH, 1931, p. 281 (misspelling of *Polystomiceras*); = *Eurystomiceras* BESNOSSOV, 1956, p. 110 (type, *Lytoceras polyhelictum* BÖCKH, 1881, p. 35; OD); = *Eurystomiceras* BESNOSSOV, 1958a, p. 116, *nom. van.*; = *Eurystomiceras* BESNOSSOV, 1958b, p. 101, *nom. van.*]. Small, very evolute, serpentine-planulate forms with compressed, subquadrate whorl section, low whorl expansion rate; 1 to 6 deep, narrow to broad constrictions of variable orientation, straight to sigmoidal, on shell surface and internal mold, associated with flared ribs similar to *Megalytoceras*; surface smooth except for growth

lines; venter nearly flat, with remarkable ventral sinus on internal mold of some species; suture line extremely simplified with reduced number of elements, saddles bifid with phylloid terminations, weak septal lobe (PUGIN, 1964; GALÁČZ, 1980). *Middle Jurassic (lower Bajocian–middle Bathonian)*–*Upper Jurassic (middle Callovian)*: UK (England), Switzerland, Austria, Poland, France, Italy, Hungary, Morocco, Algeria, Spain (Balearic Islands, Iberia), Kenya, Iran, Ukraine (Crimea), Caucasus (Kuban River), Russia (Kumukh, Daghestan).—FIG. 11a–b. **N. pygmaeus* (D'ORBIGNY), neotype, plaster cast, Muséum National d'Histoire Naturelle Paris, MNHN A25688 (BJ IV-B 50), original of MANGOLD in FISCHER (1994, pl. 45, 1a–b), middle Bajocian (*Humphriesianum* Zone), Bayeux, Calvados, France, $\times 1.0$ (new).—FIG. 11c–e, *N. polyhelictum*, middle Bajocian (*Srenoceras niortense* Zone), Mecsek Mountains, southern Hungary; c, lectotype, Hungarian Geological Institute, J616, $\times 1.0$, d, paralectotype, J615, $\times 1.0$ (Galácz & Kassai, 2012, p. 291, fig. 7B,D; original of BÖCKH, 1881, pl. 1, fig. 2–3); e, suture (adapted from Schindewolf, 1961, p. 675, fig. 15d).—FIG. 11f–g, *N. tripartitum* (RASPAIL), neotype, designated by PUGIN (1964, p. 51), upper Bajocian–lower Bathonian, Castellane, Alpes-de-Haute Provence (formerly Basses-Alpes), France, $\times 1.0$ (D'ORBIGNY, 1848b, pl. 197, 3).

SUBFAMILY ALOCOLYTOCERATINAE SPATH, 1927

[*Alocolytoceratinae* Spath, 1927, p. 65]

Rather small forms with many deep constrictions, which produce some resemblance to capricorns in middle whorls but pass to a smooth and more involute stage in some representatives; ornament with nonfimbriate, simple, sharp ribs. Suture line simplified, with saddle endings tending to be phylloid. *Lower Jurassic (upper Sinemurian)*–*Middle Jurassic (lower Bajocian)*: Europe, northern Africa, Ukraine (Crimea), eastern Asia, Indonesia, Chile.

Alocolytoceras HYATT, 1900, p. 572 [**Ammonites germaini* D'ORBIGNY, 1845 in 1842–1851, p. 320; OD] [= *Geyeria* FUCINI, 1901, p. 75, *non* BUCHECKER, 1876, pl. 2, 25–26 (insect), *non* BUCKMAN, 1899, p. 1 (Bajocian Leioceratinae ammonite) (type, *Ammonites serorugatum* GEYER, 1886, p. 229; SD SPATH, 1924a, p. 4); = *Audaxlytoceras* FUCINI, 1923, p. 105 (type, *Ammonites (Lytoceras) audax* MENEGHINI, 1876 in 1867–1881, p. 38; SD ARKELL, 1957b, p. 199); = *Aegolytoceras* SPATH, 1924a, p. 4, *nom. nov. pro* *Geyeria* FUCINI, 1901 (type, *Ammonites serorugatus* STUR in FUCINI 1901, p. 75, OD); = *Peripleuroceras* TUTCHER & TRUEMAN, 1925, p. 646 (type, *P. rotundicosta*, OD); = *Fucinia* TOMLIN, 1930, p. 24,

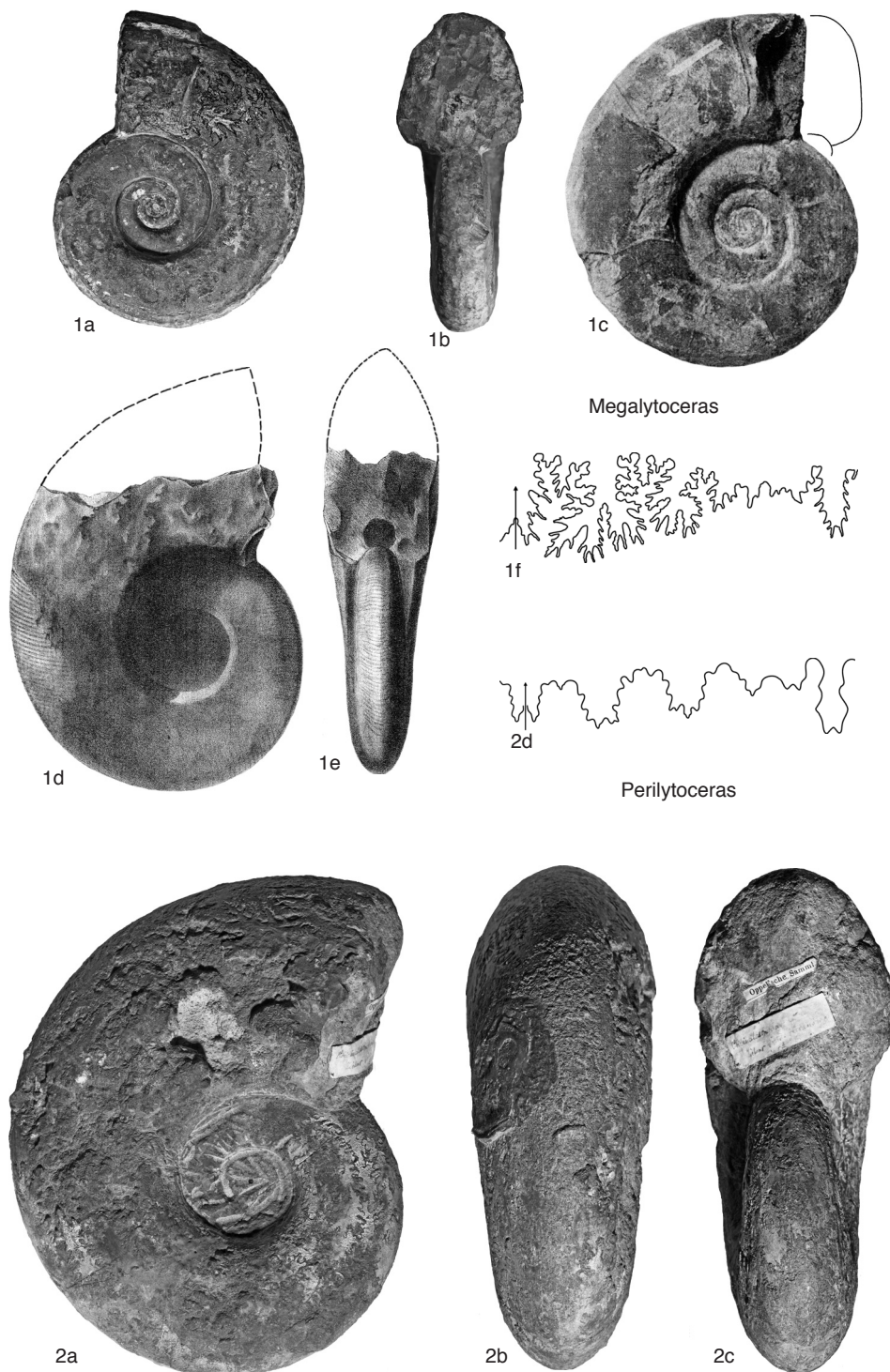


FIG. 10. Lytoceratidae (p. 12–13).



FIG. 11. Lytoceratidae (p. 13).

nom. nov. pro Geyeria FUCINI, 1901, p. 75 (type, *Lytoceras etruscum* FUCINI, 1901, p. 75, OD)]. Small, evolute, whorl section round, subquadrate to quadrate, sometimes compressed, low whorl expansion rate, more involute in later whorls, early whorl occasionally smooth, umbilical wall steep in later whorls, venter broad, rounded to flat, sides slightly convex to flat, ribs simple, straight, prorsiradiate, or convex, stronger over the venter in some; about 4 to 10 deep, wide constrictions per whorl on mold and surface, parallel to ribs, and 4 to 20 sharp ribs between each constriction; in front of constrictions occasionally stronger, flare-like ribs; some forms without constrictions on outer whorls foreshadowing *Perilytoceras*; septal lobe weak. A lectotype has never been validly designated for the type species, *A. germaini*. Although

MOUTERDE (in FISCHER, 1994, p. 89) stated that one of D'ORBIGNY's (1845 in 1842–1851) syntypes (illustrated in pl. 101, fig. 6) is labeled “lectotype de la fig. 6,” this label only indicates that the syntype was the original of that figure; it is not an acceptable designation of a lectotype for the species. D'ORBIGNY's figure (1845 in 1842–1851, pl. 101, fig. 6) represents *Pleurolytoceras* and was collected from the same locality as the lectotype of *Pleurolytoceras* (Amberg, see below). The original of D'ORBIGNY (1845 in 1842–1851, pl. 101, 1–2) is designated the lectotype of *Ammonites germaini* D'ORBIGNY, herein (RULLEAU, 1998; BOURILLOT & others, 2008; HOFFMANN, 2010). *Lower Jurassic (upper Sinemurian)–Middle Jurassic (lower Bajocian)*: Germany, UK, Italy, Hungary, France, Morocco, Chile, Austria, the Himalaya.—FIG.

12, 1a–c. **A. germaini* (D'ORBIGNY); a–b, lectotype (designated by HOFFMANN, herein), upper Toarcian, Jura Mountains, Salins, France, $\times 1.0$ (d'Orbigny, 1845 in 1842–1851, pl. 101, 1–2); c, suture, Toarcian, Germany (Reutlingen) (adapted from Schindewolf, 1961, p. 672, fig. 12b).

Pleurolytoceras HYATT, 1900, p. 572 [**Ammonites hircinus* SCHLOTHEIM, 1820, p. 72; OD] [= *Pachylitoceras* BUCKMAN, 1905, p. 144 (type, *Ammonites torulosus* ZIETEN, 1831 in 1830–1833, p. 19, OD); = *Preperonoceras* MAUBEUGE, 1949, p. 136 (type, *P. brancoi*, OD)]. Slightly more involute than *Alocolytoceras*, with higher whorl expansion rate and more constrictions per whorl; whorl section rounded, circular to compressed or subtriangular with narrower venter; 10 to 20 weak to strong constrictions per whorl on mold and shell surface, which curve forward to form coarse chevrons on venter (chevrons not developed in *Alocolytoceras*), occasionally with preceding collar, depth, width, and ventral projection more strongly expressed in later whorls; interspaces with about 4 ribs; other forms with numerous constrictions that break up surface into a series of swollen ribs; contains dimorphs (HOFFMANN, 2010). *Lower Jurassic (Toarcian)–Middle Jurassic (lower Bajocian)*: Germany, Luxembourg, France, UK (England), northern Asia, southeastern Siberia.—FIG. 12, 2a–d. **P. hircinum* (SCHLOTHEIM); a–c, lectotype (designated by HOFFMANN, 2010, p. 46), Museum of Natural History Berlin, specimen number MB.C.14485.1, Toarcian, Germany (Aschach, near Amberg), $\times 1.0$ (new); d, suture, Toarcian, Germany (Dörnten) (adapted from Schindewolf, 1961, p. 670, fig. 8e).—FIG. 12, 2e–g. *P. torulosum*, holotype, upper Toarcian, Baden-Württemberg, Germany, $\times 0.5$ (Zieten, 1831 in 1830–1833, pl. 14, 1).

FAMILY TETRAGONITIDAE HYATT, 1900

[Tetragonitidae HYATT, 1900, p. 568, *nom. transl.* WIEDMANN, 1962b, p. 147, *ex Tetragonitinae* HYATT, 1900, p. 568]

More involute than *Lytoceratidae*, with whorl section less circular and becoming angled in some forms; several auxiliary saddles developing in suture line; shell liriate, striate, smooth, or occasionally strongly ribbed, with no fimbriate ornament, and constrictions usually present. Derived from *Protetragonites* (*Lytoceratinae*) during the Barremian. The three subfamilies, *Gaudryceratinae*, *Tetragonitinae*, and *Gabbio-ceratinae*, are closely related in the Lower Cretaceous but more distinct in the Upper Cretaceous. For *Anagaudryceras*, *Eogaudryceras*, *Gaudryceras*, *Jauberticeras*, *Para-jaubertella*, *Saghalinites*, and *Tetragonites*, a

six-lobate suture line and, for some representatives, a rhynchaptchus jaw has been reported. Both characters had been tentatively used as apomorphy for the whole family. *Lower Cretaceous (Barremian)–Upper Cretaceous (Maastrichtian)*.

SUBFAMILY GAUDRYCERATINAE SPATH, 1927

[*nom. transl.* WRIGHT, 1957, p. 200, *ex Gaudryceratidae* SPATH, 1927, p. 66] [= *Hypogaudryceratinae* SHIMIZU, 1934, p. 67; = *Vertebrinitinae* WIEDMANN, 1962b, p. 150]

Whorl section typically rounded or elliptical; early whorls depressed, with later whorls compressed; shell ornamented with noncrenulated lirae or fine riblets, occasionally smooth or with broad ribs, and with constrictions; suture with symmetrically bifid saddles and a single main saddle in internal suture, but with additional small saddles in some forms. *Lower Cretaceous (Barremian)–Upper Cretaceous (Maastrichtian)*: worldwide.

Eogaudryceras SPATH, 1927, p. 66 [**Ammonites numidus* COQUAND, 1880, p. 22; OD] [= *Eotetragonites* BREISTROFFER, 1947, p. 72 (type, *E. raspaili*; OD)]. Moderately evolute; whorl section rounded to rectangular or subtriangular; whorl expansion rate variable; shell smooth or with fine radial lirae; constrictions present in some, spacing and orientation highly variable, expression weak to strong, regular or irregular; collars weak or absent, projected forwards over venter; suture line with symmetric or slightly asymmetric saddles and broad suspensive lobe; consistent morphocline between *Eogaudryceras* and “*Eotetragonites*” (WIEDMANN, 1962b), great morphological plasticity, and lack of apomorphy for the latter. *Lower Cretaceous (Barremian–upper Albian)*: France, Spain, UK (England), Bulgaria, Caucasus, Italy, Switzerland, Algeria, South Africa (Zululand), Madagascar, Egypt (Sinai), USA (California), Antarctica (Alexander Island), USA (northern California), Japan.—FIG. 13, 1a–c. **E. numidum* (COQUAND); a–b, lectotype, note presence of septal lobe, Barremian, Algeria (Djebel-Ouach, Constantine), $\times 1.0$ (Sayn, 1891, pl. 1, 3a–b); c, hypotypoid, Museo de Sociedad de las Islas Baleares, Sociedad de Historia Natural de las Baleares, MSHNB A 95, suture at dm = 50 mm, Albian, Spain (Son Vida, Majorca) (adapted from Wiedmann, 1962a, p. 37, fig. 11).—FIG. 13, 1d–e. *E. raspaili* (BREISTROFFER), upper Aptian, France (Hyèges, Alpes-de-Haute Provence), $\times 1.0$ (Kilian, 1913, pl. 11, 3).

Gaudryceras GROSSOUVRE, 1894, p. 225 [**Ammonites mitis* HAUER, 1866, p. 305; SD BOULE, LEMOINE,

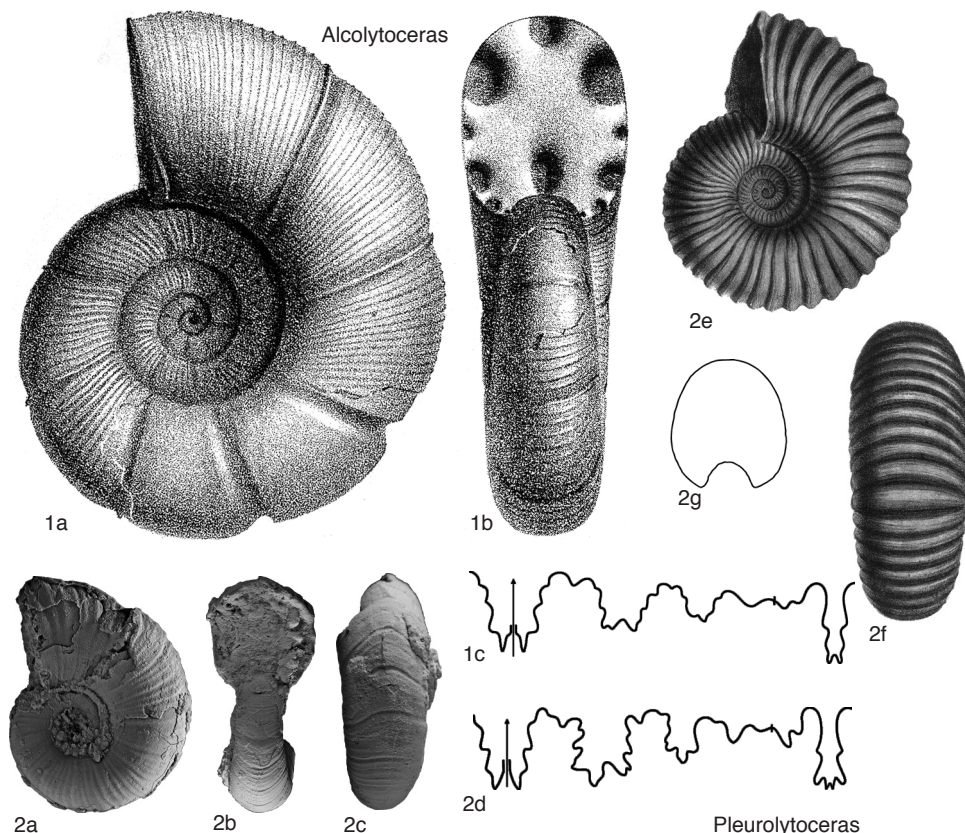


FIG. 12. Lytoceratidae (p. 13–16).

& THEVENIN, 1906, p. 11] [= *Vertebrites* MARSHALL, 1926, p. 138 (type, *V. murchisoni*, M), paedomorphic dwarf of *Gaudryceras*; = *Mesogaudryceras* SPATH, 1927, p. 66 (type, *Ammonites leptoneuma* SHARPE, 1855 in 1853–1857, p. 32, OD); = *Epigaudryceras* SHIMIZU, 1934, p. 67 (type, *Lytoceras striatum* JIMBO, 1894, p. 35, OD); = *Hemigaudryceras* SHIMIZU, 1934, p. 67 (type, *Lytoceras (Gaudryceras) denmanense* WHITEAVES, 1901, p. 31, OD); = *Neogaudryceras* SHIMIZU, 1934, p. 67 (type, *Gaudryceras tenuiliratum* YABE, 1903, p. 19, OD); = *Pseudogaudryceras* SHIMIZU, 1934, p. 67 (type, *Gaudryceras tenuiliratum* var. *infrequens* YABE, 1903, p. 28, OD); = *Miogaudryceras* MATSUMOTO, 1995, p. 27 (type, *M. yokoi*, OD)]. Inner whorls evolute, serpenticonic, rounded or depressed; later whorls expanding more rapidly and becoming compressed with moderately wide to fairly narrow umbilicus; ornamented with lirae or wirelike, flexuous ribs coarser and more flexuous than in *Anagaudryceras*, single or branched, which may coarsen and bunch on the outer whorls; variable foldlike ribs may also develop on outer whorls; periodic constrictions normal to weak on inner mold and collars

on the shell surface; suture with wide bifid saddles and lobes and retracted suspensive lobe; additional dark outer shell layer (KOSSMAT, 1895). Derived from *Eogaudryceras*. Lower Cretaceous (upper Albian)–Upper Cretaceous (upper Maastichtian): worldwide.—FIG. 13, 2a–d. **G. mite*, holotype; a–c, Geological Survey Austria (Vienna), GBA 1866/001/0003 (previous number, 3433), Coniacian, Gosau beds, Salzkammergut, Austria, $\times 0.5$ (Summesberger & Zorn, 2012, pl. 4, 4a–b, pl. 5, 1a–b); d, suture (Kennedy & Summesberger, 1979, p. 75, fig. 1).—FIG. 13, 2e–f. *G. yokoi*, Department of Earth and Planetary Sciences, Kyushu University Fukuoka, GKH 8411, Cenomanian, Japan (Hokkaido), $\times 1.0$ (adapted from Matsumoto, 1995, p. 31, fig. 15A).

Anagaudryceras SHIMIZU, 1934, p. 67 [**Ammonites sacya* FORBES, 1846, p. 113; OD] [= *Paragaudryceras* SHIMIZU, 1934, p. 67 (type, *Gaudryceras limatum* YABE, 1903, p. 34, OD); = *Murphyella* MATSUMOTO in MATSUMOTO, MURAMOTO, & TAKAHASHI, 1972, p. 208 (type, *Kossmatella (Murphyella) enigma*, OD)]. Medium-sized to large shell, cross section always rounded, reniform-depressed in early whorls

becoming nearly circular and compressed in outer whorls, later whorls expand more rapidly, umbilicus moderately evolute in early whorls and more involute in later stages; mold smooth; shell with fine, prorsiradiate or sinuous lirae; constrictions associated with collars on inner whorls, becoming more numerous on outer whorls, where they form broad, flattened, foldlike ribs with variable spacing, foldlike ribs and collars covered with lirae; suture line with bifid lobes and saddles and retracted suspensive lobe. *Lower Cretaceous (middle Albian)–Upper Cretaceous (Maastrichtian)*: UK (England), France, Germany, Austria, Romania, Bulgaria, Spain (Biscay region), Tunisia, Pakistan, Angola, Algeria, South Africa (Zululand), Madagascar, southeastern India, Japan, Russia (Sakhalin, Kamchatka), USA (Alaska, California), Canada (British Columbia), Mexico, ?Chile, New Zealand, Antarctica (Seymour Island).—FIG. 14, 1a–b. **A. sacya*, holotype, The Natural History Museum, London, NHMUK C.51067, original of FORBES (1846, pl. 14, 10a–b), Albian or Cenomanian, Verdachellum, southeastern India, $\times 1.0$ (new).—FIG. 14, 1c–d. *A. buddha* (FORBES), holotype, NHMUK C.22673, original of FORBES (1846, pl. 14, 9a–b), $\times 0.7$ (new).

Zelandites MARSHALL, 1926, p. 147 [**Z. kaiparaensis* MARSHALL; M] [= *Varunaites* SHIMIZU, 1926, p. 548, OD]; = *Hypogaudryceras* SHIMIZU, 1934, p. 67 (type, *Desmoceras kawanoii* JIMBO, 1894, p. 28, M); = *Anazelandites* MATSUMOTO, 1938, p. 146 (type, *Lytoceras (Gaudryceras) flicki* PERVINQUIÈRE, 1907, p. 65, OD)]. Small and fairly involute shells, cross section of early whorl circular but expanding rapidly, becoming soon compressed, flanks converging towards the high-arched venter, long sloping umbilical wall; shell surface smooth except for growth lines, fine lirae, constrictions on the mold weak to strong, irregularly spaced, straight, prorsiradiate to simple convex or sinuous, occasionally omitted in middle stages, suture line strongly slit in the umbilical region. *Lower Cretaceous (lower Albian)–Upper Cretaceous (upper Maastrichtian)*: UK (England), France, Sardinia, Spain, Tunisia, South Africa (Zululand), Madagascar, southeastern India, Japan, Russia (Sakhalin), New Zealand, USA (Alaska, California), Canada (British Columbia), Mexico, Chile, Antarctica (Seymour Island).—FIG. 14, 2a–e. **Z. kaiparaensis*; a–c, paralectotype, upper Campanian, Bull's Point, Kaipara Harbour, New Zealand, $\times 1.5$ (Marshall, 1926, pl. 31, 1–2); c, suture at Wh = 7.6 mm (Marshall, 1926, pl. 19, 9–9a); d–e, lectotype, CE631, designated by HENDERSON (1970, p. 21), $\times 2.0$ (new).

Parajaubertella MATSUMOTO, 1943, p. 666 [**P. kawakitana*; OD]. Fairly large to very large shells; outer whorls rapidly expanding, with flat-topped ribs like *Anagaudryceras*, defined as *sacya*-type ornament; inner whorls up to 40 mm diameter, more depressed with vertical umbilical wall and rounded umbilical edge; funnel shaped umbilicus, ornamented with slightly flexuous lirae and collars in early whorls and strong, flexuous ribs at later stages and on the body chamber; suture highly complex

with several recurved auxiliary saddles. *Lower Cretaceous (upper Albian)–Upper Cretaceous (lower Cenomanian)*: Japan, Sakhalin, Alaska, northeast Russia, ?Egypt (Sinai).—FIG. 15a–f. **P. kawakitana*; a–d, holotype, University Museum, University of Tokyo, Hongo, UMUT.MM19698 (previous number, I-3716), original of MATSUMOTO (1943, p. 666, fig. 2a–b), lower Cenomanian, South Sakhalin (Yunosawa, Naibuchi valley), $\times 0.5$ (new); e–f, paratype, University Museum, University of Tokyo, Hongo, GK H1136, cross section, $\times 2.5$ (Matsumoto, 1943, p. 668, fig. 2c); f, paratype, University Museum, University of Tokyo, Hongo, GT.I-3717, suture at dm = 27.5 mm (adapted from Matsumoto, 1943, p. 668, fig. 2d).

SUBFAMILY TETRAGONITINAE HYATT, 1900

[*nom. transl.* WRIGHT, 1957, p. 203, *ex* Tetragonitidae HYATT, 1900, p. 568] [= Kosmatellinae BREISTROFFER, 1953, p. 71]

Whorl section angled in early whorls, but may become rounded and inflated in later whorls, derived from the upper Aptian *Eogaudryceras duvali* or from upper Barremian *Eogaudryceras raspaili* (OBATA & MATSUKAWA 2007), main saddles trifid, constrictions more prominent compared to Gaudryceratinae, septal lobe reduced (not absent) in some members. *Lower Cretaceous (upper Aptian)–Upper Cretaceous (Maastrichtian)*: worldwide.

Tetragonites KOSSMAT, 1895, p. 131 [**Ammonites timotheanus*, PICTET, 1847, p. 295; OD] [= *Epi-goniceras* SPATH, 1925, p. 29 (type, *Lytoceras (Tetragonites) epigonus* KOSSMAT, 1895, p. 135, OD); = *Neopigoniceras* SHIMIZU, 1935, p. 165, *nom. nud.* (type, *N. schmidtii* SHIMIZU, 1935, p. 165, OD); = *Carinites* WIEDMANN, 1973, p. 609 (type, *Tetragonites spathi* FABRE, 1940, p. 214, OD)]. Moderately evolute, whorl section subrectangular, trapezoidal, or rounded; shell smooth or with growth lines, constrictions oblique, prorsiradiate on internal mold only and corresponding collars on the shell surface, all ornaments with wide variability in persistence, expression and orientation, convex or concave on venter, occasionally with siphonal ridge on venter, body chamber half volution, external lobe the deepest, additional lobes are attached to the preceding septum, re- and upcurved suspensive lobes. *Lower Cretaceous (upper Aptian)–Upper Cretaceous (Maastrichtian)*: UK (England), France, Spain (Majorca, Biscay region), Switzerland, Germany, Poland, Italy (Sardinia), Ukraine (Crimea), Caucasus, Algeria, Tunisia, Angola, South Africa (Pondoland, Zululand), southern Mozambique, Madagascar, Egypt (Sinai), southeastern India, China (Tibet), Japan, Russia (Sakhalin), New Zealand, USA (southern Alaska, California,

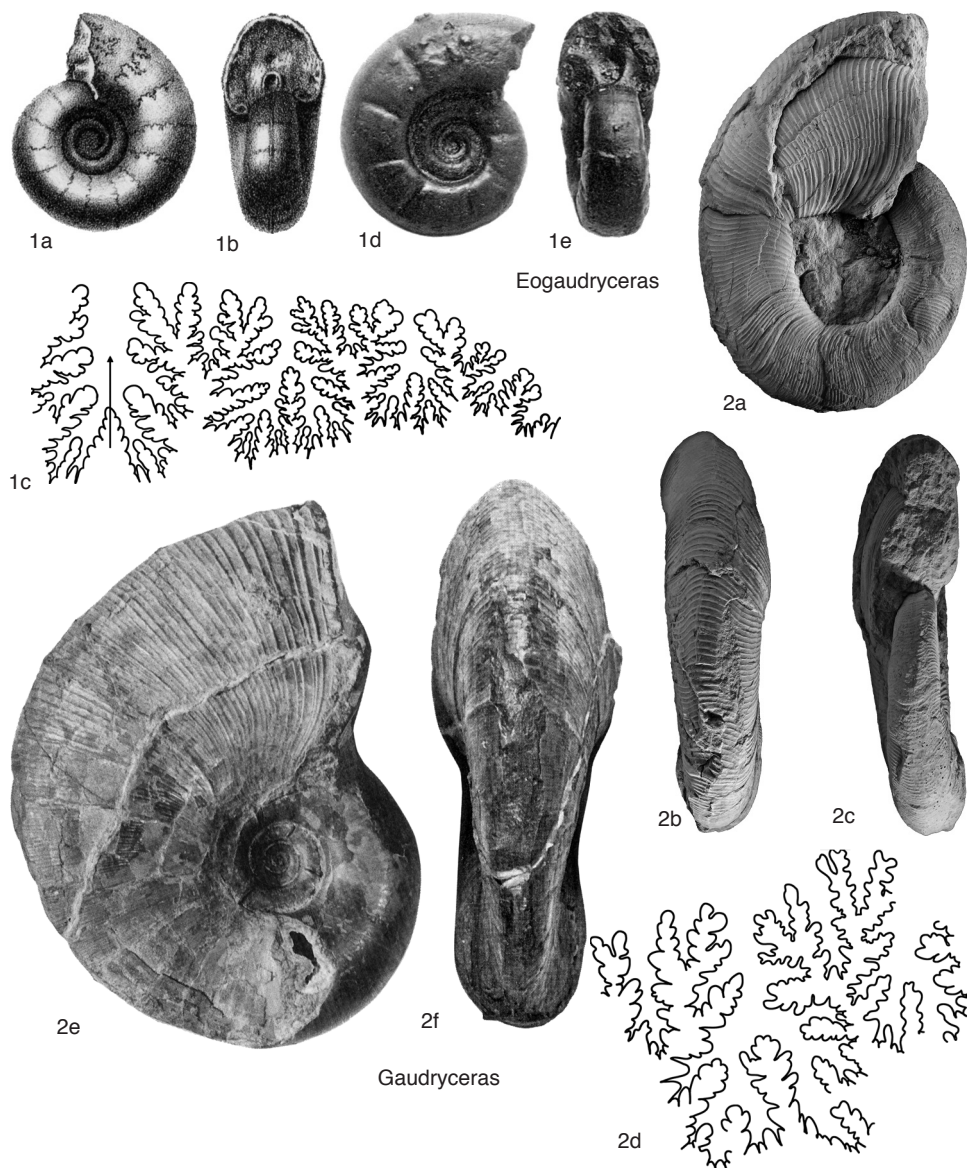


FIG. 13. Tetragonitidae (p. 16–17).

Florida, Oregon, Texas), Canada (British Columbia), Dominican Republic, Jamaica, northern Mexico, Peru, Antarctic Peninsula (Seymour Island).—FIG. 16, 1a–d. **T. timotheanus* (Pictet), lectotype (designated by Wiedmann 1962b, p. 172); a–c, Muséum d'Histoire Naturelle de Genève, Pi“GV”/3.1, original of Pictet (1847, pl. 3, 1a–b), upper Albian, Saxonet (Savoyen), southeastern France, $\times 1.0$ (new); d, external and internal suture (Wiedmann, 1962b, p. 172, fig. 31).

Kossmatella JACOB, 1907, p. 285 [*Ammonites agassizianus*, PICTET, 1847, p. 303; SD ROMAN, 1938, p. 43] [= *Kosmatella* ROMAN, 1938, p. 43 (incorrect spelling); = *Guderianites* WIEDMANN, 1962a, p. 63 (type, *Kosmatella costata* H. DOUVILLÉ, 1916, p. 96, OD)]. Whorl section variable; in early whorls rounded-angled, depressed; becoming higher, compressed, and more involute in later whorls; shell with deep, regularly spaced, wide constrictions and morphologically variable lateral bulges between

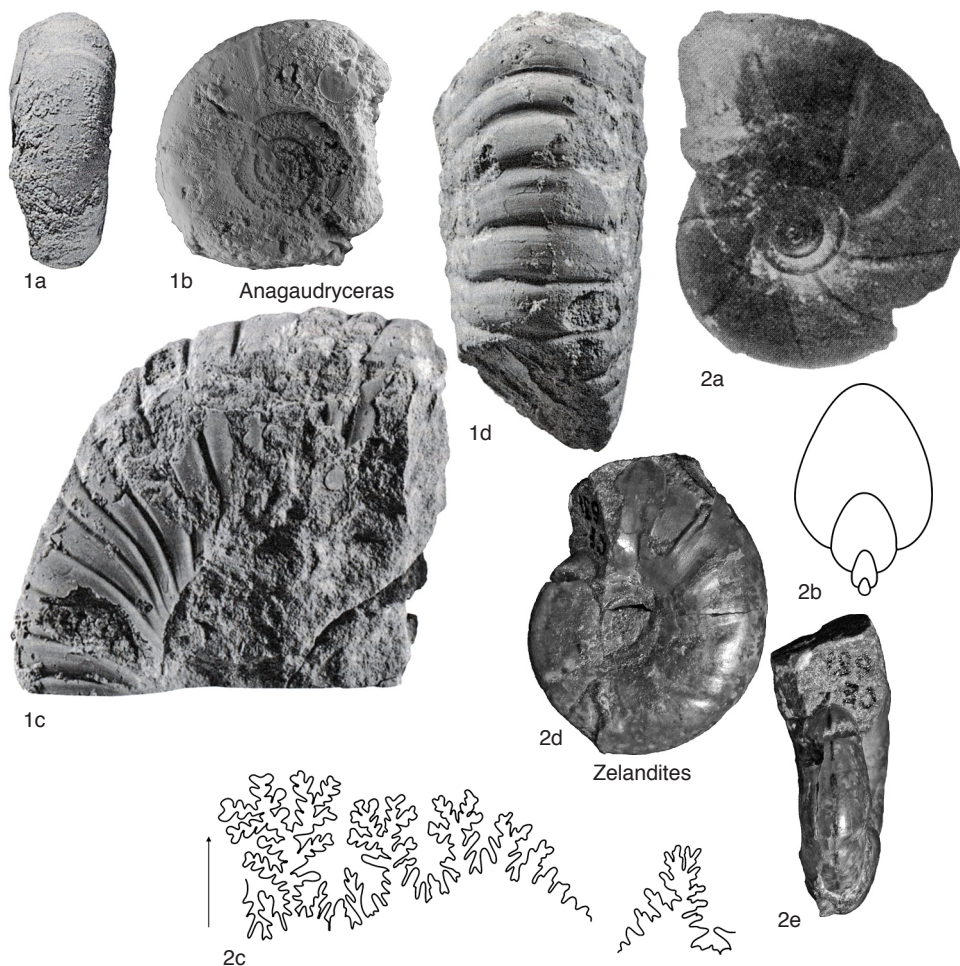


FIG. 14. Tetragonitidae (p. 17–18).

constrictions on outer whorls; bulges in some forming lateral tubercles, in others forming a row of nodes near umbilical edge that bifurcate or trifurcate into smaller bulges that are continuous over venter; inner whorls with less-pronounced constrictions and bulges, but occasionally with irregularly spaced, stronger ribs starting at midflank; shell surface covered with fine, single or bifurcating, intercalating lirae appearing at different positions at the flank, becoming weaker on outer whorls; suture with recurved auxiliary saddles, umbilical lobes are also in connection with the preceding septum, lateral lobe deeper than external lobe in outer whorls; body chamber about three-fourths of whorl. *Lower Cretaceous (upper Aptian)*—*Upper Cretaceous (middle Cenomanian)*: France, Spain (Balearic Islands), Italy (Sardinia), Poland, South Africa (Zululand), Madagascar, Egypt (Sinai), southeastern India, USA (Alaska, California),

Mexico, Caucasus, Canada (British Columbia), Dominican Republic, Japan. —FIG. 16, 2a–d. **K. agassizianus* (PICTET), lectotype, designated by WIEDMANN (1962b, p. 165); a–c, Muséum d'Histoire Naturelle de Genève, Pi⁷GV^m/4, 3a, b, d (original of PICTET, 1847, pl. 4, 3a–b), Upper Albian, Saxonet (Savoyen), southeastern France, ×1.0 (new); d, suture (adapted from Wiedmann, 1962b, p. 166, fig. 25).

Argonauticeras ANDERSON, 1938, p. 148 [**Lytoceras argonautarum* ANDERSON, 1902, p. 85; OD] [= *Pseudotetragonites* DRUSHCHITS, 1956, p. 80 (type, *P. kudrjavzevi*, OD)]. Large shells with evolute whorls, cross section trapezoidal to subrectangular, earlier whorls with nearly parallel flanks and narrow, irregularly spaced constrictions associated with strong ribs, nearly flat, broad venter, ornamentation with fine, evenly expressed, nonrenulated ribs crossing the venter throughout, flanks converging in outer

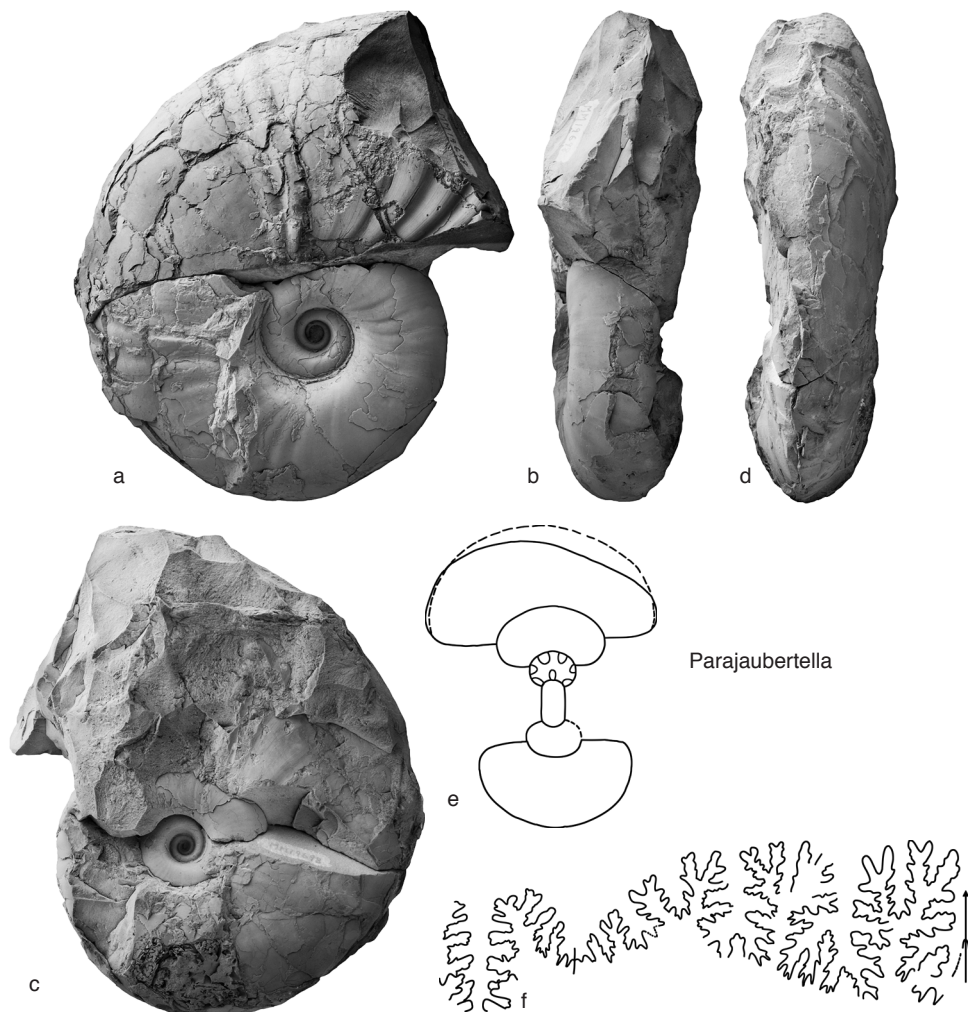


FIG. 15. Tetragonitidae (p. 18).

whorls. *Lower Cretaceous* (upper Aptian–middle Albian): France, Caucasus, USA (California), South Africa, Madagascar. — FIG. 16, 3a–c. **A. argonautarum*, holotype, California Institute of Sciences, 66622.01 (original of ANDERSON, 1902, pl. 7, 154; 7, 155), upper Aptian, middle Horse-town Group, Cottonwood district, Ono, Shasta County, California, $\times 0.4$ (new). — FIG. 16, 3d, *A. depereti* (KILIAN, 1893), Albian, Mzinene Formation, Mlambongwenya Dam, Zululand, northern KwaZulu-Natal province, South Africa, suture (line slightly modified from Kennedy & Klinger, 1978, p. 318, fig. 46).

Pseudophyllites KOSSMAT, 1895, p. 137 [**Ammonites indra*, FORBES, 1846, p. 105; M]. Large shell, up to 300 mm in diameter; moderately evolute inner whorls comparable with *Tetragonites* but quickly becoming

much more involute and inflated; high whorl expansion rate with rounded whorl section, no constrictions; fine growth lines and spiral striae forming a nautiloid reticulate pattern; larger forms with weak lateral folds parallel to growth lines; suture phylloid in early whorls, becoming highly incised with several auxiliary saddles with subphylloid terminations. *Upper Cretaceous* (middle Coniacian–upper Maastrichtian): Antarctica (Seymour Island), Egypt, Tunisia, South Africa (Zululand), Madagascar, northern Ireland, northern Germany, France (Aquitaine, Landes), Spain, Poland (Vistula River valley), Austria, southern Sweden, Turkey, Iran, Russia (Sakhalin, Kamchatka), Turkmenistan (Koppeh Dagh, Western Australia, New Zealand, southeastern India, Japan, western Greenland, USA (southern Alaska, California, New Jersey, Mississippi, Texas, Arkansas, Alabama), Canada (British Columbia),

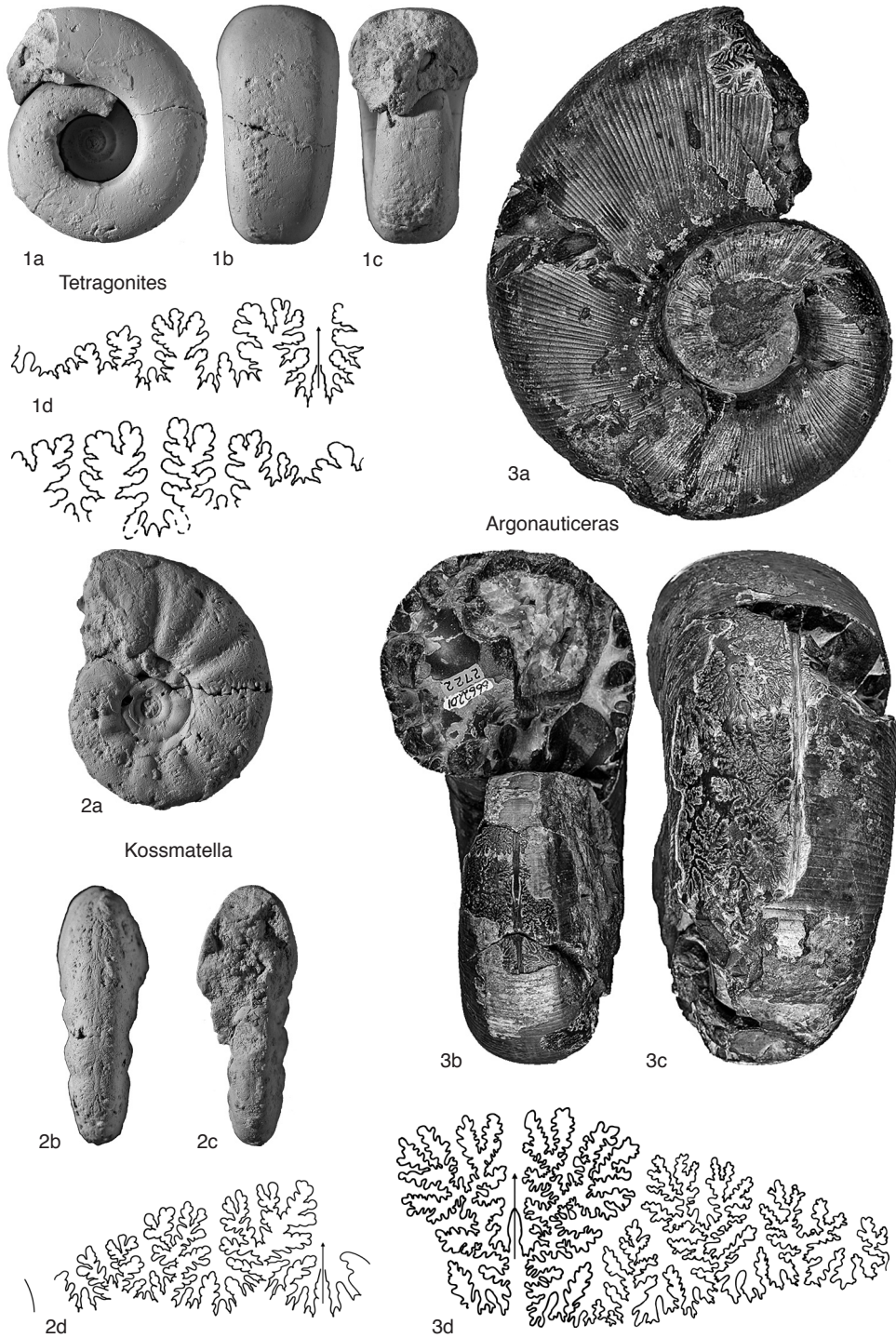


FIG. 16. Tetragonitidae (p. 18–21).

Mexico, Chile, Argentina.—FIG. 17,1a–e. **P. indra* (FORBES), lectotype, The Natural History Museum, London, NHMUK C.51068 (original of FORBES, 1846, pl. 11,7a–c), Maastrichtian, southeastern India (Pondicherry); a–d, $\times 0.5$ (new); e, suture (adapted from KOSSMAT, 1895, pl. 17[3],6).

Saghalinites WRIGHT & MATSUMOTO, 1954, p. 110 (SHIMIZU 1935, p. 181, *nom. nud.*) [**Ammonites cala* FORBES, 1846, p. 104; OD] [= *Eoepigonicer* SHIMIZU, 1935, p. 165, *nom. nud.* (type, *Tetragonites kingianus* KOSSMAT, 1895, p. 137, & STOLICZKA, 1865 in 1863–1866, p. 153, OD)]. Evolute, serpentine, low whorl expansion rate, whorl section rounded, slightly depressed, becoming trapezoidal to octagonal; shallow umbilicus, broad, slightly curved venter with siphonal ridge in outer whorls, shell surface smooth except for growth lines, per whorl four to eight weak to strong constrictions, usually highly oblique and curved but highly variable, slightly concave on venter, occasionally associated with collar; suture line simplified with rounded phylloid-like saddle terminations, external lobe deeper than lateral lobe throughout ontogeny, suspensive lobe broad and retracted, weak septal lobe. *Upper Cretaceous (upper Santonian–Maastrichtian)*: France, Switzerland, The Netherlands, Denmark, Italy, Germany, Austria, Spain, Ukraine, Tunisia, South Africa (Zululand, Pondoland), Madagascar, Japan, southeastern India, Russia (Sakhalin), Greenland, Argentina (Patagonia), Antarctic Peninsula, Mexico.—FIG. 17,2a–d. **S. cala* (FORBES), lectotype; a–c, The Natural History Museum, London, NHMUK C.51057 (original of FORBES, 1846, pl. 8,4a–b), Maastrichtian, southeastern India (Pondicherry), $\times 1.0$ (new); d, suture, NHMUK C.78545, Maastrichtian, St. Lucia Formation, Charters Creek Rest Camp, Zululand, South Africa (Kennedy & Klinger, 1977b, fig. 15D).

SUBFAMILY GABBIOCERATINAE BREISTROFFER, 1953

[Gabbioiceratinae BREISTROFFER, 1953, p. 71]

Highly depressed, very small to fairly small, cadicone forms, with a sharp ventrolateral angle, but whorls may become compressed and rounded during ontogeny, deep umbilicus, shell smooth except for growth lines, fine ribs, lirae, and constrictions and occasionally collars; suture of early gaudryceratid type with $ELU_2U_1I_s$ and with one or two auxiliary saddles and two unequal internal saddles, adults and complete body chambers unknown. Derived from *Eogaudryceras numidum* (COQUAND) in the mid-Aptian. *Lower Cretaceous (upper Aptian)–Upper Cretaceous (lower Cenomanian)*:

southern France, Hungary, Madagascar, Asia (Caucasus), Spain (Majorca), USA (northern California), Japan (Hokkaido), Russia (Sakhalin).

Gabbioicer HYATT, 1900, p. 570 [**Lytoceras (Gabbioicer)* *angulatum* ANDERSON, 1902, p. 87; SD HOFFMANN, herein; originally designated by HYATT (1900, p. 570) as “*Gabbioicer* *gen. nov.* Type *G. (Amm.) Batesi*, GABB sp. (Palaeont. Calif. II., pl. 20, 21; *non A. Batesi*, I., pl. 13)” (i.e., GABB, 1869, Palaeont. Calif. vol. II, p. 132, pl. 20, 21; *non A. Batesi* GABB, 1864, Palaeont. Calif. vol. I, p. 67, pl. 13), the type species is now fixed (under the provisions of Article 70.3.2 of the Code, 1999, p. 74) as *Lytoceras (Gabbioicer)* *angulatum* ANDERSON, 1902, p. 87, this being the species actually involved in GABB’s (1869, p. 132) misidentification of *Ammonites batesi* TRASK, 1855, p. 40, which is a species of *Lytoceras* that was first figured by GABB, 1864, pl. 13] [= *Gabbioicer* YABE, 1915, p. 19, misspelling]. Inner whorls evolute, highly depressed, cadicone, with flat sloping umbilical walls, sharp ventrolateral angle, and highly arched venter; umbilicus is deep, conical and stepped, later whorls moderate involute with circular to compressed whorl section without marked ventrolateral angle; shell surface covered with growth lines, fine ribs, constrictions on inner mold, with corresponding collars on shell surface, occurring occasionally on inner whorls and more frequently on outer whorls, all projected forwards on the venter and prorsiradate on the flanks (WIEDMANN, 1962d; MURPHY, 1967; SHIGETA, FUTAKAMI, & HOFFMANN, 2012, p. 210). The type species of *Gabbioicer* has been widely accepted as *Lytoceras (Gabbioicer)* *angulatum* ANDERSON, 1902, though it has never been validly designated as such; this is now rectified with the designation given above. *Lower Cretaceous (Upper Aptian–Lower Albian)*: southern France, Hungary, Caucasus, Madagascar, USA (northern California).—FIG. 18,1a–b. **G. angulatum* (ANDERSON), lectotype (designated by ANDERSON, 1938, p. 150), upper Aptian, northern California, $\times 0.7$ (Gabb, 1869, pl. 21,10–10a).

Jauberticeras JACOB, 1907, p. 285 [**Ammonites jaubertianus* D’ORBIGNY, 1850a, p. 113; D’ORBIGNY, 1850b, p. 200; OD] [= *Jaubertella* JACOB, 1908, p. 12, 17 (type, *Ammonites jaubertianus* D’ORBIGNY, 1850b, p. 200, SD SPATH, 1927, p. 66)]. Small sized, moderately evolute shells with outer whorls cadicone with sharp lateral angle high on flank and flat or slightly arched venter, inner whorls more rounded; conical, nonstepped umbilicus, ornamentation consists of growth lines, fine ribs and weak constrictions occasionally associated with collars, lirae on the flanks, projected on the flanks and convex on the venter (KENNEDY & KLINGER 1977a). *Lower Cretaceous (upper Aptian–Albian)*: southern France, Hungary, Caucasus, Morocco, Madagascar, South Africa (Zululand).—FIG. 18,2a–c. **J. jaubertianus* (D’ORBIGNY), lectotype, Muséum National d’Histoire Naturelle Paris, MNHN 5591, upper Aptian, France (Hyèges, Alpes-

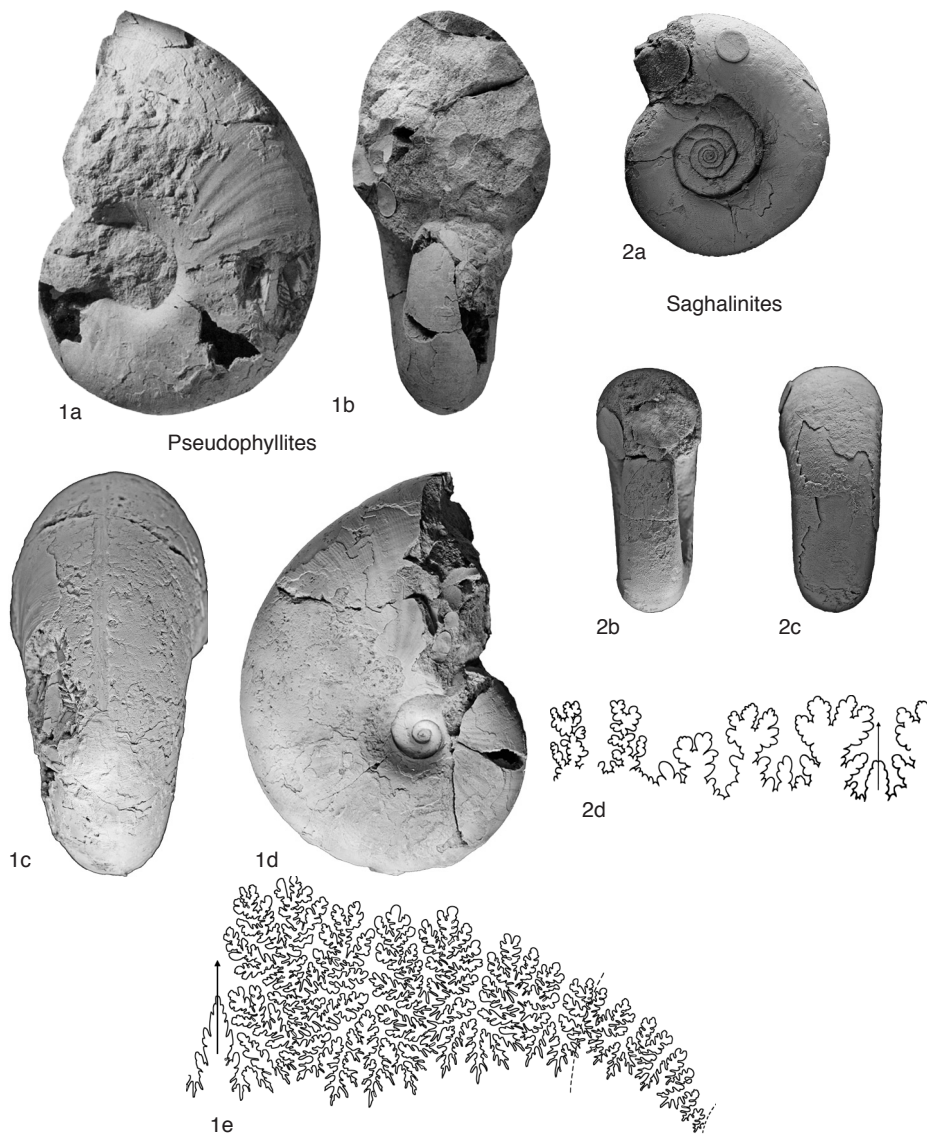


FIG. 17. Tetragonitidae (p. 21–23).

de-Haute Provence), $\times 1.0$ (Wright, 1996, fig. 5, 2a–c).—FIG. 18, 2d–f, *J. latericarinatum* (ANTHULA), University of Vienna, Institute of Palaeontological specimen number for the holotype 1900-3 (original of ANTHULA, 1899, pl. 7[6], 2a–b), Aptian, Caucasus (Akuscha valley), $\times 1.0$ (new).

Tanabecer SHIGETA, FUTAKAMI, & HOFFMANN, 2012, p. 211 [**Gabbioceras yezoense* SHIGETA, 1996, p. 2; OD]. Very involute with depressed, reniform whorl

section throughout ontogeny, rounded venter, narrow, deep, funnel-shaped umbilicus, umbilical shoulder angular or subangular, ornamentation consists of growth lines, fine ribs, and constrictions that are prorsiradiate on the inner flank, rectiradiate or slightly rursiradiate on the outer flank and slightly concave across the venter. *Lower Cretaceous (Albian)–upper Cretaceous (Cenomanian)*: Caucasus, Georgia, southern France, Spain (Majorca), USA

- (northern California), Japan (Hokkaido), Russia (Sakhalin).—FIG. 18, 3a–f. **T. yezoense*; a–d, holotype, National Museum of Nature and Science, Tsukuba, specimen number NSM PM8300 (original of SHIGETA, 1996, fig. 2, 2a–b), lower Cenomanian, Middle Yezo Group, Japan (Shumarinai-gawa River, Horokanai-cho, Hokkaido), $\times 2.0$ (new); e, paratype, cross section, lower Cenomanian, Middle Yezo Group, Japan (Shumarinai-gawa River, Horokanai-cho, Hokkaido), $\times 2.0$ (adapted from Shigeta, 1996, fig. 2, 7); f, suture at Wh = 5 mm (Shigeta, 1996, fig. 1, 1).
- Obataceras** SHIGETA, FUTAKAMI, & HOFFMANN, 2012, p. 210 [**Obataceras manjiense*; OD]. Very involute, depressed whorls, rounded venter, and narrow, deep, funnel-shaped umbilicus with angular or subangular umbilical shoulder, shell smooth except for growth lines and fine ribs; suture line represents the early gaudryceratid type with ELU₂U₃U₁I₁; differs from *Tanabecer*as by convex ornamentation on the venter and from *Gabbicer*as by its more complex suture line. *Lower Cretaceous (upper Albian)–Lower Cretaceous (lower Cenomanian)*: Japan (Hokkaido), Madagascar.—FIG. 18, 4a–f. **O. manjiense*; a–d, holotype, National Museum of Nature and Science, Tsukuba, NMNS PM7442, upper Albian, Hokkaido (Shikoro-zawa River, Manji area), $\times 1.0$ (Shigeta, Futakami, & Hoffmann, 2012, fig. 2.2–5); e, cross section, $\times 1.0$ (Shigeta, Futakami, & Hoffmann, 2012, fig. 2.1); f, paratype, specimen number NMNS PM23445, suture at Wh = 5.2 mm, Hokkaido (Manji area) (Shigeta, Futakami, & Hoffmann, 2012, fig. 3).
- ### INCERTAE SEDIS IN LYTOCERATOIDEA
- Castanyicer**as RAKÚS & GUEx, 2002, p. 60 [**C. parvulum*; OD]. Small, moderately evolute shells; whorl section oval-compressed; venter narrow, convex, only sigmoidal to fasciculate growth lines and thin ribs, occasionally megastriae and constrictions; adult body chamber with terminal constriction; aperture beak shaped with apophyses, lituid I, trifold L. Possibly the microconch of the contemporaneous *Galaticer*as *aegoceroide*s (RAKÚS & GUEx, 2002). *Lower Jurassic (lower Pliensbachian)*: Tunisia.—FIG. 19, 1a–d. **C. parvulum*; a–b, holotype, Service de la Carte Géologique de Tunisie, specimen number J-1312, *Aenigmaticum* Zone, Djebel Staa, $\times 1.5$ (Rakús & Guex, 2002, pl. 24, 1–2); c–d, paratype, J-1273; c, cross section, $\times 1.5$ (Rakús & Guex, 2002, fig. 47b); d, suture (Rakús & Guex, 2002, fig. 47d).
- Exomilocer**as WIEDENMAYER, 1979, p. 867 [**Ammonites alius* HAUER, 1856, p. 66; OD] [= *Exomilocer*as WIEDENMAYER in VENTURI, 1978, p. 104, *nom. nud.*]. Large, platycone, moderately involute shells, whorl section compressed, narrow convex venter, steep umbilical wall, shell smooth except for growth lines, asymmetric suture line. *Lower Jurassic (lower Sinemurian, Semicostatum Zone–lower Pliensbachian)*: Austria, France, Switzerland, Tunisia, Hungary.—FIG. 19, 2a–c. **E. alius* (HAUER), lectotype, Geologische Bundesanstalt Vienna, specimen number 1999/086/0002b (original of HAUER, 1856, pl. 20, 7–8), upper Sinemurian, *Oxynotum* Zone, Austria (Adnet); a, $\times 0.5$ (Rakús, 1999); b, outline, $\times 0.5$; c, suture (Rakús, 1999, text-fig. 2, pl. 1, 1).
- Fucinites** GUGENBERGER, 1936, p. 175 [**Fucinites sicilianus* GUGENBERGER, 1936, p. 175; SD ARKELL, 1957b, p. 194]. Shell evolute; whorl expansion rate low, whorl cross section with rounded external edges; ribs fine, straight, densely spaced; keeled venter; bifid external saddle, lateral lobe trifid. Probably related to *Ectocentrites* or a synonym of *Lytotropites* SPATH, 1924a. *Lower Jurassic (Hettangian–lower Sinemurian)*: Italy (Sicily), Slovakia.—FIG. 19, 3a–c. **F. sicilianus* GUGENBERGER, lectotype, lower Sinemurian, *Bucklandi* Zone, Italy (Palermo, Sicily), $\times 0.5$ (original of Gugenberger, 1936, pl. 15[3], 1a–b, d).
- Kericerites** MEISTER & GÉCZY in GÉCZY & MEISTER, 2007, p. 159 [**Kericerites spinosus*; OD]. Small, platycone, evolute, shell, cross section from quadratic to subrectangular, flanks slightly divergent, 6 to 7 strong, irregularly spaced ribs per demiwhorl, ribs simple, strong, straight to prorsiradiate, ventrolateral nodes comparable with *Holcolytoceras*. Genus is best included in *Ectocentritinae*, where it is nearest to *Adnethicer*as. *Lower Jurassic (upper Sinemurian–lower Pliensbachian)*: Hungary.—FIG. 19, 4a–b. **K. spinosus*, holotype, Bakony Forest, Kericser (south of Lókút); a, $\times 1.0$; b, cross section, $\times 2.0$ (original of Meister & Géczy, 2007, text-fig. 14, pl. 9, 7a).
- Tragolytocer**as SPATH, 1924a, p. 194 [**T. bonarellii*; SD TOMAS & PÁLFY, 2007, p. 252; originally designated by SPATH (1924b, p. 194) as “*Tragolytocer*as gen. nov. (genotype: *Lytoceras altrecinctum* [Hauer] Bonarelli, 1900, p. 70, pl. 9, fig. 1, B.M. no C8480”), the type species was fixed by TOMAS & PÁLFY, 2007, p. 251, under the provisions of Article 70.3.2 of the Code, 1999, p. 74, as *Tragolytoceras bonarellii* TOMAS & PÁLFY, 2007, p. 252, this being the taxonomic species actually involved in Spath’s misidentification of Hauer’s species]. Similar to *Derolytoceras*, but larger and lower whorl expansion rate, early whorls with constrictions, evolute throughout, whorl section compressed ellipsoid to subquadratic, ribs coarse, radial, and straight, crossing the venter without interruption, and occasionally bifurcated or intercalated. Genus could represent a micromorphic group of *Ectocentritinae* (PÁLFY, SMITH, & TIPPER, 1994; TOMAS & PÁLFY, 2007). *Lower Jurassic (Sinemurian)*: Hungary, Italy, Romania, France, ?Canada.—FIG. 19, 5a–c. **T. bonarellii* (TOMAS & PÁLFY), holotype, The Natural History Museum, London, NHMUK C.8480 (original of BONARELLI, 1900, pl. 9, 1), Cava di Ponte Alto, Foci di Cagli, central Apennines, Italy, $\times 1.0$ (new).

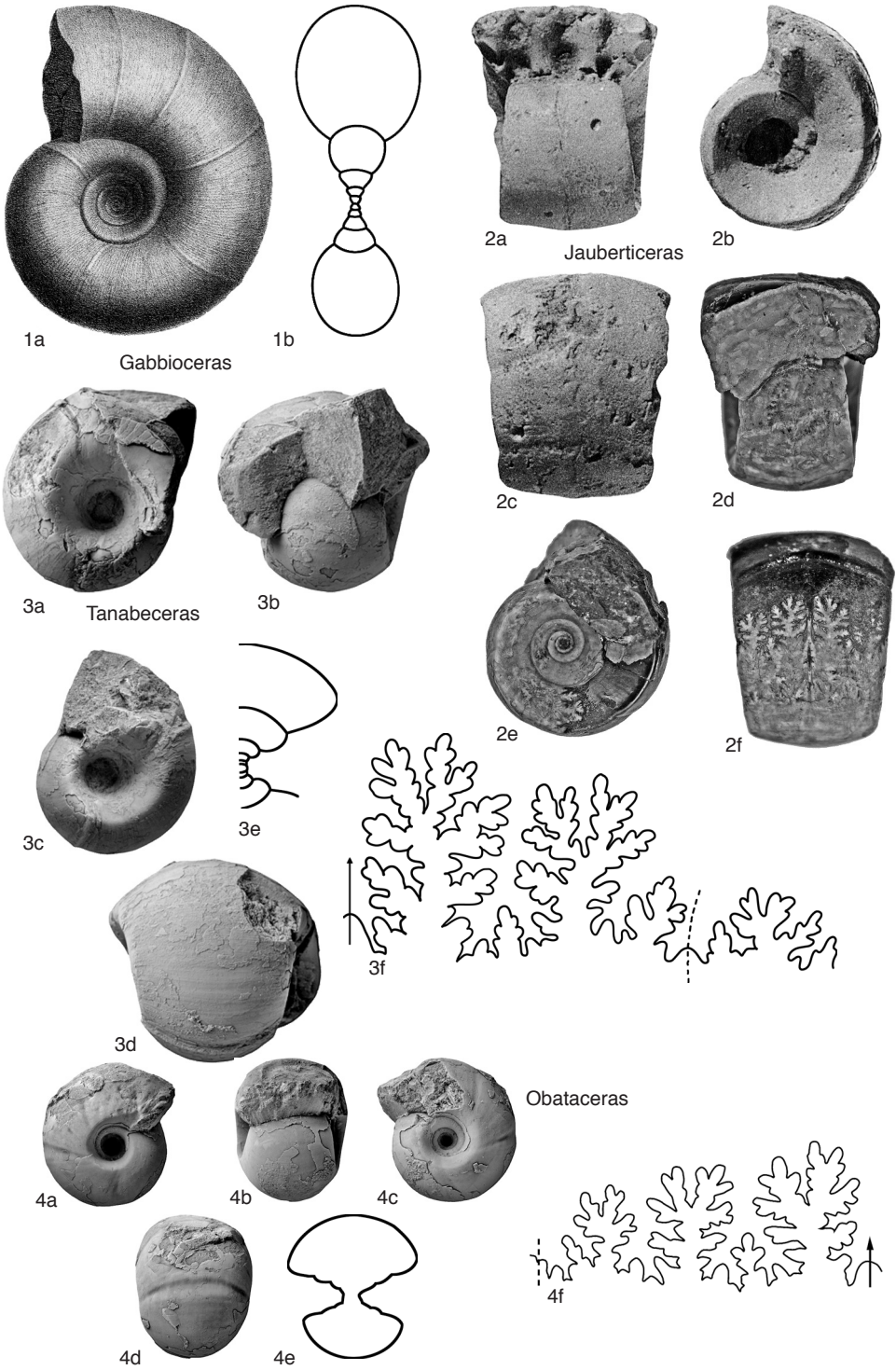


FIG. 18. Tetragnonitidae (p. 23–25).

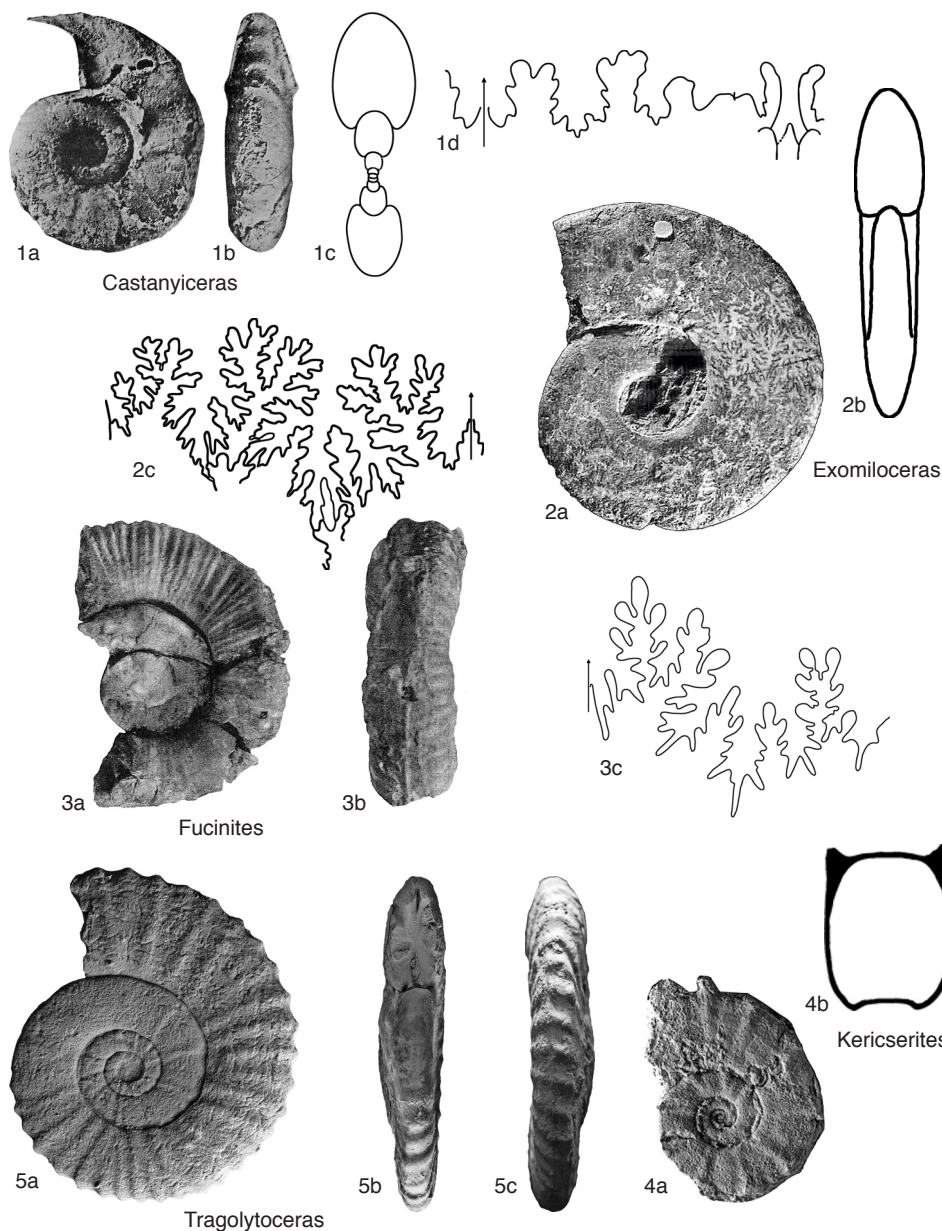


FIG. 19. Family Uncertain (p. 25).

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