Part L, Revised, Volume 3B, Chapter 4: Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Michael K. Howarth

2013
INTRODUCTION

The revision of the original 1957 edition of Part L, Ammonoidea, of the Treatise on Invertebrate Paleontology had its origins in a letter from Curt Teichert sent on 15 February 1966, to all the original authors and contributors, enquiring whether a revision or a supplement would be preferable. The unanimous answer was that a revision would be preferred, and it was soon apparent that the size of any revision would require several volumes, divided according to geological periods. Later, in 1966, it was agreed that John Callomon, Raymond Casey, Desmond Donovan, and Michael Howarth would be the authors of the revised Jurassic volume.

Work started in the 1970s, and by the mid-1980s, finished manuscripts for some groups were submitted to the Treatise office but were not published, because manuscript for the whole volume was not forthcoming at that time. Further efforts to complete the volume in the 1990s and later were unsuccessful for similar reasons, and eventually the lower half of the Jurassic was taken over by Howarth, and the upper half remained with Callomon. After the death of John Callomon in April 2010, it appeared that the project might never be completed, but, by then, Howarth’s part was virtually complete, and manuscript left by Callomon was sufficiently advanced to be usable as the basis for some of his families in the upper half of the Jurassic. It is hoped to edit these groups into Treatise format and add the required figures. There are, however, substantial gaps in other families in the upper half of the Jurassic, especially in the later Perisphinctoidea. It is hoped to fill these gaps with contributions from other authors and so eventually to arrive at a complete volume for the Jurassic representatives of the suborder Ammonitina.

The study of Jurassic ammonites has seen some major advances in the years since the publication of the first Treatise in 1957. First, sexual dimorphism, about which the original Treatise authors were unsure, has gained wide, though not universal, acceptance. At many horizons in the Lower Jurassic, the dimorphs, macroconchs and microconchs, can be satisfactorily associated and referred to the same species, especially where collections from accurately known stratigraphical horizons are available. But where stratigraphical information is less accurate or the horizons are condensed, dimorphs cannot always be associated with confidence and are often referred to different genera or subgenera, pending more accurate information. Second, large collections of ammonites from single beds or from single nodules sometimes show a large range of continuous morphological variation, which may embrace several traditional morphological species or morphological genera. Well-known examples are the large range of variation in a species of Leioceras from a single horizon in Dorset, England, described by Chandler and Callomon (2009); the huge morphological variation in single species of Neogastroplites from nodules in the upper Albian of Montana, United States, described by Reeside and Cobbán (1960; see also Wright, 1996, p. 124); the wide variation in Polymorphites from single horizons in the lower Pliensbachian in Britain and at other localities in Europe; and there are examples in British Toarcian Dactylioceratidae when single bed collections were
obtained (Howarth, 1973). Such collections give insight into the range of variation of an ammonite so-called biospecies and can have a profound effect on the generic classification adopted. Third, study of collections from more accurately known stratigraphical horizons has led to much refinement of the generic classification in the last 50 years.

The part presented here comprises three superfamilies: Psiloceratoidea, Eoderoceratoidea, and Hildoceratoidea. These superfamilies represent all the Ammonitina from the base of the Jurassic up to approximately the middle of the Bajocian in the Middle Jurassic. All the taxonomic categories—superfamilies, families, subfamilies, genera, and subgenera—are described in an order that reflects, to some extent, their phylogenetic, biostratigraphic, and/or morphological relationships, as in the original ammonoid Treatise of 1957 and the Cretaceous ammonite Treatise revision of 1996, rather than an alphabetical order. The intention is that all generic names proposed up to the end of 2008 have been included in the text. I am indebted to Professor Desmond Donovan, who passed on to me his mid-1980s Treatise manuscript for the Psiloceratoidea and part of the Eoderoceratoidea for revision and completion.

Order AMMONITIDA
Fischer, 1882

Suborder AMMONITINA
Fischer, 1882

Note on nomenclature. The first publication of a satisfactory name for the order Ammonitida was Fischer’s (1882, p. 328, 367) “Ordre des Ammonée,” the earlier use of “Ammonoids . . . as a distinct order” by Hyatt (1867, p. 71) being unacceptable because “Ammonoids” is a vernacular name, though Hyatt’s intention was clear. Hyatt (1884a [1 February], p. 123), changed the spelling to the more correct Ammonoidea, then introduced the suborder Ammonitinacea a little later (Hyatt, 1884b [April], p. 260, 261, 308, 338). Later in 1884, Zittel (1884, p. 392) used the term Ammonoidea as one of the suborders of the order Tetrabranchiata.

Superfamily PSILOCERATOIDEA
Hyatt, 1867

The earliest member of the family Psiloceratidae was perhaps derived from the Triassic family Ussuritidae (of the Phylloceratoidea), but intermediate links have not been found. The Psiloceratidae retained the smooth, rounded venter of its supposed ancestors at all stages of growth, and the Schlotheimiidae developed characteristic ventral chevrons. All other families have a keel or an angular venter at some stage in ontogeny. They are probably all derived from Psiloceratidae. The great majority of Psiloceratoidea possess simple ribs only, but a few (some Schlotheimiidae, Pseudotopitinae, Oxynoticeratidae) develop secondary ribbing. Shells are predominately evolute, but some genera become involute, and the Oxynoticeratidae are ocycones.

Sutures are simple (E, L, U2, U1, I of Weedicke, 1916; see Kullmann & Wiedmann, 1970) and remarkably constant throughout the group. The only elaborations of sutural development involve the addition of extra subdivisions of U in a few of the more involute genera. In most genera, the sutural elements remain simple, with moderate indentation, but a few more involute forms (e.g., in Schlotheimiidae and Oxynoticeratidae) develop more complex sutures, especially in large individuals.

The superfamily has a worldwide range and flourished during the Hettangian and Sinemurian stages. Only Radstockiceras, Hypoxynoticeras, and the Cymbitidae survived into the Pliensbachian. In Europe, north of the alpine belt, the bisulcate forms (Arietitidae, Echioceratidae) are characteristic of, and restricted to, the Sinemurian
stage. Most genera and species have been described from Europe with stratigraphical knowledge of varying detail, but recently, rich faunas have been found in the western parts of both North and South America, with better stratigraphical data, especially from Nevada (Taylor, Guex, & Rakus, 2001). Lower Jurassic (Hettangian–Lower Pliensbachian).

**Family PSILOCRATIDAE Hyatt, 1867**

[Psiloceratidae Hyatt, 1867, p. 72] [=Caloceratidae Buckman, 1906, p. 233]

Planulates or serpenticones, smooth or with simple ribs. No ventral ornament, except weak ventral chevrons in Badouxia. Sutures often asymmetrical, and saddles are phylloid in some genera. Lower Jurassic (Hettangian).

**Subfamily PSILOCERATINAE Hyatt, 1867**

[nom. transl. Lange, 1941b, p. 37, ex Psiloceratidae Hyatt, 1867, p.72] [=Sunrisitinae Hillebrandt, 2000, p. 38]

Evolute planulates or serpenticones. Lower Jurassic (Hettangian–lower Sinemurian).


Planulates, whorl section compressed, up to 6–7 whorls; smooth or with 20–30 gently sigmoidal, striate or blunt ribs per whorl, which may be irregular; sutures moderately elaborate. Lower Jurassic (Hettangian, Planorbis–basal Angulata Zones): Europe, Russia (northeast), China (Tibet), Vietnam, Indonesia (Baton, Sulawesi), Canada (British Columbia, Yukon), United States (Alaska, Nevada), Chile, Argentina, Peru, New Zealand.—Fig. 1, 1a–d. *P. planorbis* (J. de C. Sowerby); a, lectotype (designated herein), Watchet, Somerset, England, ×1 (new, The Natural History Museum, London, England, BMNH 43875); b–c, ribbed form, Lia s (Psilonotenbank), Bebenhausen, Tübingen, Württemberg, Germany, ×1 (Schlegelmilch, 1976, pl. 4,15); d, suture, Psiloceras Bed, Bristol, England, ×3 (new).

**Psilophyllites Spath, 1914, p. 351** [*Ammonites hagenowi DUNKER, 1847, p. 115; OD*] [=Hagenowioceras Lange, 1922, p. 470, obj.; =Neophyllites Lange, 1941a, p. 137 (type, *Psilophyllites antecedens* Lange, 1931, p. 360, OD)]. Evolute, compressed whorl section, smooth. Similar to *Psiloceras* but with convergent whorl section and simplified sutures that have short saddles with broad, rounded terminations and cephalic lobes. Lower Jurassic (Hettangian, Planorbis–basal Angulata Zones): northern Europe.—Fig. 1, 2a–d. *P. hagenowi* (DUNKER); a–b, holotype, Halberstadt, Germany, ×1 (Dunker, 1847, pl. 13,22); c–d, Exten, Rinteln, Hanover, Germany; c, ×1.5 (Lange, 1941b, pl. 2,7); d, suture, ×10 (Spath, 1924, p. 192, fig. 12d).

**Caloceras Hyatt, 1870, p. 23, 29** [*Ammonites torus* d’ORBIGNY, 1844 in 1842–1851, p. 212; SD Buckman, 1912, p. viii]. Serpentine, up to 10 whorls; whorl section circular, umbilicus more than 60% of diameter; blunt or sharp ribs stronger than in *Psiloceras* and consistently present; suture like *Psiloceras*. Lower Jurassic (Hettangian, Planorbis–Liasic Zones): Europe, Canada (British Columbia, Yukon), United States (Alaska, Nevada), Chile, Argentina, Peru.—Fig. 2, 1a–d. *C. torus* (d’ORBIGNY); a–b, neotype, Baupre, Manche, France, ×0.7 (Fischer, 1994, pl. 12,2a–b); c–d, holotype of *Ammonites intermedius* PORTLOCK, Northern Ireland [possibly Gobbins Head, Island Magee], ×0.7 (new, The Natural History Museum, BMNH C.2236).

**Franchizceras Buckman, 1923b, pl. 423 [*E. rudivum* OD] [=Sunrisites Guex, 1980, p. 137 (type, S. sunrisense, OD)]. Whorls increase more rapidly than in Caloceras and umbilicus is 45–50% of diameter; whorl section rounded with slightly arched venter; ribs strong, nearly straight on whorl side; venter smooth or crossed by fine striae forming chevrons; suture like *Psiloceras*. Lower Jurassic (Hettangian, Liasic–Angulata Zones): Europe, Canada (British Columbia), United States (Alaska, Nevada, Oregon), Chile.—Fig. 1, 3a–d. *F. rudivum*, holotype, a complete adult, Coringriths, Radstock, Avon, England, ×0.9 (Buckman, 1923b, pl. 423).—Fig. 1, 3e–d. *F. sunrisense* (GUEX), holotype, Angulata Zone, New York Canyon, Gabbs Valley Range, Nevada, United States, ×1 (Guex, 1995, pl. 27,11–12).

**Badouxia Guex & Taylor, 1976, p. 525** [*Psiloceras canadense* FREBOULD, 1951, p. 3; OD]. Moderately involute, each whorl covering up to half of preceding whorl, umbilicus 30–45% of diameter; compressed oval whorl section; ribs strong, simple, fading on outer whorls, but largest whorls may have bullae; venter may have striae or weak secondary ribs on inner whorls, then becomes smooth; suture simple and asymmetric, with ventral lobe offset from median line. Dimorphic. More involute than *Goniptychoceras*. Lower Jurassic (Hettangian, Angulata Zone–lower Sinemurian, Bucklandi Zone): Europe (eastern Alps), Russia (northeast), Vietnam, Canada (British Columbia, Yukon), United States (Alaska, Nevada, Oregon), Mexico, Chile, Argentina, Peru.—Fig. 2, 2a–e. *B. canadense* (FREBOULD), Angulata Zone, Tyauhton Creek, Taseko Lakes, British Columbia, Canada; a–b, holotype, macroconch, ×1; c, suture, ×2; d–e, complete microconch, ×1 (Longridge, Smith, & Tipper, 2006, p. 803, fig. 11A, pl. 1,7–8, 17–18).
Fig. 1. Psiloceratidae (p. 3).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Caloceras

Badouxia

Fig. 2. Psiloceratidae (p. 3).
Paraphylloceras Salsefield, 1919, p. 459, non Shimizu, 1935, p. 173, 180 (Cretaceous, Phylloceratidae) [*Psiloceras calliphyllum Neumayr, 1879, p. 27; OD*]. Large evolute planulates, up to 9 whorls and reaching 200 mm in diameter; smooth or faintly ribbed, like Psiloceras, but distinguished by elaborate, slightly asymmetric suture with (at comparable diameters) more divisions to the saddles. Lower Jurassic (Hettangian): southern Europe, Canada (British Columbia, Alberta). ——Fig. 3, 1a–c. *P. calliphyllum* (Neumayr), Fonsjoch, near Jensbach, northeastern Austria; a, lectotype, suture, showing offset between middle of suture (S) and middle of venter (M), ×2 (Neumayr, 1879, pl. 4, 5); b–c, ×1 (Lange, 1952, pl. 13, 13a–b).

Laqueoceras Lange, 1925, p. 469, 472 [*Agoceras sublaqueus Wähner, 1886a, p. 142; OD*]. Large evolute planulates, up to 9 whorls, with a very wide umbilicus (60–72% of diameter) and compressed to circular whorl section; ribs faint, closely spaced. Lower Jurassic (Hettangian, Liasicus Zone): Europe, New Caledonia, Canada (Alberta), United States (Alaska). ——Fig. 3, 2a–c. *L. sublaqueus* (Wähner), lectotype, Schreinbach, Wolfgangsee, Austria; a, ×0.375 (new, Palaeontologische Staatsammlung, Munich, Germany); b, ×0.5 (Wähner, 1886a, pl. 15 (15), 1b).

Murihikuites Stevens, 2004, p. 28 [*M. mackellari*; OD]. Evolute, compressed, rounded whorl section, with an arched, smooth, and rounded venter; ribs moderately strong, straight or slightly curved on the side of the whorl, then curving strongly forward before fading on venter; suture with phylloid saddles. [Known only from poorly preserved incomplete specimens up to approximately 100 mm in diameter. Similar to some species of Waehneroceras and Kammerkarites, but placed in Psiloceratinae because of the smooth venter throughout and the phyllloid sutures.] Lower Jurassic (Hettangian, upper Planorbis–lower Liasicus Zones): New Zealand, New Caledonia. ——Fig. 3, 3a–d. *M. mackellari*. 

---

**Fig. 3.** Psiloceratidae (p. 6–7).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

junction of Otapiri and Taylor’s Streams, Hokonui Hills, Southland, South Island, New Zealand; a–b, holotype, ×1 (Stevens, 2004, p. 30, fig. 16, pl. 4,2); c, a paratype, suture, ×1 (Stevens, 2004, p. 30, fig. 17); d, another paratype, ×1 (Stevens, 2004, pl.4,9).

Subfamily DISCAMPHICERATINAE
Guex & Rakus, 1991
[Discamphiceratinae Guex & Rakus, 1991, p. 310]

Moderately involute, compressed platycones. Suture with more subdivisions of U lobe and more complex than in Psiloceratinae. Lower Jurassic (Hettangian, Liassic–Angulata Zones).

Discamphiceras Spath, 1923c, p. 288 [*Ammonites kammerkahrensis Gümbel, 1861, p. 474; OD]. Shell compressed, discoidal; overlap about one-half, umbilicus 20–30% of diameter; venter narrow, rounded; smooth or with low broad ribs on whorl side; suture may be asymmetrical, with large arborescent saddles between E/L and L/U2, and about 6 umbilical lobes on external suture. Lower Jurassic

Fig. 4. Psiloceratidae (p. 7–9).
Fig. 5. Schlotheimiidae (p. 9).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

(Hettangian, Liasicus–Angulata Zones): Austria, Italy, Canada (British Columbia), United States (Alaska, Nevada, Oregon), Chile, Argentina, Peru, New Zealand.——Fig. 4, 1a–c. *D. kammerkaerense* (GÜMBEL), holotype, Rother Kalk with Brauneisenconcretion, Kammerkörpel, Lofer, northern Austria; a–b, ×0.4; c, suture, ×8 (Wähner, 1884, pl. 25 (13), 1a–b, 2).

**Paradiscamphica** TAYLOR, 1988, p. 120 [*P. dickinsoni* OD]. Evolute with rounded whorl section; smooth or with simple ribs on inner whorls fading later. Close in morphology to *Psiloceras*, but has simple sutures with broader saddles, is derived from *Discamphiceras*, and occurs near the top of the Hettangian. **Lower Jurassic (Hettangian, Angulata Zone):** United States (Oregon).——Fig. 4, 2a–c. *P. dickinsoni*, holotype, Graylock Formation, Izee, Oregon, United States; a–b, ×0.8; c, suture, ×3 (Taylor, 1988, pl. 1, 1a–c).

**Kammerkaroceras** LANGE, 1941b, p. 43 [*Ammo-nites emmrichi* GÜMBEL, 1861, p. 473; OD]. Shell compressed, discoidal, involute, umbilicus 10–20% of diameter; ribs sigmoidal, joining in pairs at umbilical margin; intercalated secondary ribs on outer part of whorl side; all ribs pass over venter, forming chevrons; suture may be asymmetrical. **Lower Jurassic (Hettangian):** Austria (eastern Alps), Italy.——Fig. 4, 3a–d. *K. emmrichi* (GÜMBEL); a–b, holotype, Kammerkörpel, Lofer, northern Austria, ×1.5 (Canavari, 1882, pl. 18 (4), 16a–b); c–d, Megastoma Horizon, Adnet, Austria, ×1 (Wähner, 1886a, pl. 26 (26), 5a–b).

**Family SCHLOTHEIMIIDAE**

**Spath,** 1923

[nom. correct. ICZN Direction 14, 1955d, proposed by AREKEL, 1951b, p. 204, pro Schlotheimidae SPATH, 1923b, p. 78] [*Angularia HYATT, 1874, p. 15* (rejected by ICZN Direction 14, because not formed on a nominal genus); *Schlotheimidae* H. DOUVILLE, 1916, p. 117 (rejected by ICZN Direction 14 as a vernacular name); *Wähneroceratidae* RAUS, 1975, p. 14]

Evolute to involute planulates with simple ribs that form chevrons on the venter, which may be continuous or interrupted, or with bifurcating ribs on which chevrons are weakly developed or absent. No keel. Suture with 5 lobes (E, L, U2, U1, 1), which develops minor extra elements near umbilical suture (e.g., U3) during ontogeny. At larger sizes, saddles become aboreascent and constricted at their bases in some. Most genera include forms more than 300 mm in diameter, which usually have smooth outer whorls with highly subdivided sutural elements. **Lower Jurassic (Hettangian–Sinemurian).**

**Wähneroceras** HYATT, 1889, p. 125 [*Aegoceras tenerum* NEUMAYR, 1879, p. 31; SD SPATH, 1924, p. 195] [*Tenoceras LANGE, 1951, p. 119, nom. nud.; Lange, 1952, p. 97, obj.; =Tenoceras ARKELL, 1957, p. 236, nom. null.; =Cuviceras BLIND, 1963, p. 48 (type, Ammonites subangularis OPPEL, 1862, p. 130, OD)]. Very evolve serpentine, umbilicus increasing from about 45% of diameter on inner whors to 60% on large examples; body chamber nearly one whorl in length; ribs sharp, but more rounded in the ventral chevrons, which weaken across midventral line; no change in ornament with growth; suture may be asymmetrical, indicating ancestry in Psiloceratidae. **Lower Jurassic (Hettangian):** Europe, Russia (northeast), China (Tibet), United States (Alaska, Nevada), Chile, Argentina, Peru, New Zealand.——Fig. 5, 1a–c. *W. tenerum* (NEUMAYR), unterste Lias, Fonsjoch, near Jensbach, northeastern Austria; a–b, ×1.5; c, asymmetric suture, showing offset between middle of suture (S) and middle of venter (M), ×3 (Neumayr, 1879, pl. 3, 4–5).——Fig. 5, 1d–e. *W. harpochymum* (HOLLAND), lectotype, Schwarzer Jura a., Nürtigen, Stuttgart, Germany, ×0.75 (new, Staatliches Museum für Naturkunde, Stuttgart, Germany, no. 23201; also figured in Utlichs, 1977, pl. 1, 3).

**Macrogrammites** BUCKMAN, 1928, pl. 761A [*M. grammicus* OD; =Storsthoceras LANGE, 1941b, p. 41 (type, Aegoceras extracostatum WÄHNER, 1882, p. 74, OD)]. Compressed planulates of medium size, umbilicus about 50% of diameter; numerous strong radial ribs with ventral chevrons continuing to end of growth. More involute than *Wähneroceras*. **Lower Jurassic (Hettangian, Liasicus Zone):** Europe, New Zealand.——Fig. 5, 2a–b. *M. grammicus*, holotype, Long Itchington, Southam, Warwickshire, England, ×0.6 (Buckman, 1928, pl. 761A, B).——Fig. 5, 2c–d. *M. extracostatum* (WÄHNER), Schreinbach, Bavaria, Germany, ×0.5 (Wähner, 1882, pl. 14 (1), 1a–b).

**Saxoceras** LANGE, 1924, p. 194 [*S. costatum; OD*]. Serpentine, 5 or 6 whors, whorl section circular to compressed; ribs numerous, simple, with ventral chevrons on inner whors; venter on outer whors smooth. **Lower Jurassic (Hettangian, Liasicus Zone):** Europe, Vietnam, United States (Nevada), Peru, New Zealand.——Fig. 5, 3a–b. *S. costatum*, holotype, Oldentrup, northern Germany, ×1 (Lange, 1941b, pl. 13, 3a–b).

**Kammerkarites** SPATH, 1924, p. 195 [*Aegoceras diploptychum WÄHNER, 1882, p. 84; OD; =Megastomoceras LANGE, 1941b, p. 41 (LANGE, 1931, p. 354, nom. nud.) (type, Ammonites megastoma GÜMBEL, 1861, p. 474, OD)]. Compressed planulates, reaching large size, and up to 7 whors; umbilicus usually less than 50% of diameter; inner whors like *Macrogrammites*, outer whors have weak ribs on whorl side and smooth venter; rib frequency increases with growth; suture complex. **Lower Jurassic (Hettangian, Liasicus Zone):** Europe, Morocco, Russia (northeast), New Caledonia, Canada (British Columbia), United States (Nevada), New Zealand.——Fig. 6, 1a–b. *K. diploptychum* (WÄHNER), holotype, Kammerkörpel, Lofer, northern Austria; ×0.5 (Wähner, 1882, pl. 21 (36), 1a–b).——Fig. 6, 1c–d. *K. megastoma* (GÜMBEL), Schreinbach, Bavaria, Germany; c, ×0.4; d, whorl section, ×0.5 (Wähner, 1886b, pl. 18 (33), 1).
**Schlotheimia Bayle, 1878, pl. 65** [*Ammonites angulatus* Schlotheim, 1820, p. 70; OD; *non* J. Sowerby, 1815b, p. 9; ICZN Opinion 323, 1955a, proposed by Arkell, 1951b, p. 204] [=*Scannoceras Lange, 1924, p. 198, obj.; =Anguliferites Lange, 1951, p. 52 (type, *A. gonyphora*, OD)]. Planulates, up to 7 whorls, each whorl overlapping about one-third of the preceding; whorls compressed, flat sided, sides parallel or convergent; umbilicus 35–45% of diameter; attains large sizes; radial ribs numerous, simple, sharp, curving forward on venter; may join to form ventral chevrons or be interrupted by smooth band on venter; sides become smooth on outer whorls, leaving faint ribs on venter only. Lower Jurassic (*Hettangian, Angulata Zone*): Europe, Russia (north-east), Canada (British Columbia), United States (Alaska, Nevada, Oregon), Chile, Argentina, Peru, ?New Caledonia, New Zealand.——Fig. 6.2a–b. *S.
angulata (SCHLOTHEIM), lectotype, Wellersen, Saxony, Germany, ×1.5 (Lange, 1951, pl. 1, 2a, 2c).—Fig. 6, 2c–d. S. complanata (KÖNEN), holotype, Osterwald, Westphalia, Germany, ×1 (Dean, Donovan, & Howarth, 1961, pl. 64, 2a–b).

Angulaticeras QUENSTEDT, 1882 in 1882–1888, p. 26 [*Ammonites lacunatus J. BUCKMAN, 1844, p. 105; SD LANGE, 1924, p. 203, ICZN Opinion 324, 1955b, proposed by ARKELL, 1951d, p. 226] [=Hesperites POMPECK], 1895, p. 24 (type, H. clarae, OD); =Sulciferites SPATH, 1922a, p. 30 (type, Ammonites sulcatus J. BUCKMAN, 1844, p. 105, pl. 11, 2, OD, non Ammonites sulcatus LAMARCK, 1822, p. 638, nec ZIETEN, 1830, p. 6, nec SIMPSON, 1843, p. 55–56; =Schlotheimia sulcifera BUCKMAN, 1911, p. 38b, OD); =Boucaulticeras SPATH, 1924, p. 194
Evolute planulatrices or serpenticones. Ribs simple, straight or concave forward. Venter smooth on inner whorls, with keel on outer whorls, and shallow grooves may flank the keel. Suture like that of Psiloceratidae, but developing arborescent saddles with constricted bases at larger sizes. Lower Jurassic (Hettangian–Sinemurian).

Subfamily ALSATITINAE Spath, 1924

Evolute planulatrices or serpenticones. Ribs simple, straight or concave forward. Venter smooth on inner whorls, with keel on outer whorls, and shallow grooves may flank the keel. Suture like that of Psiloceratidae, but developing arborescent saddles with constricted bases at larger sizes. Lower Jurassic (Hettangian–Sinemurian).

Alsatites Haug, 1894, p. 411 [*Ammonites liasicus D'Orbigny, 1844 in 1842–1851, p. 199; OD] [nom. transl. Lange, 1941b, p. 36, pro Alsatidae Smith, 1924, p. 206]

Evolute planulatrices or serpenticones with simple ribs and a keel on at least the outer whorls. Whorl section depressed, subquadrate or compressed. Rib frequency usually increases with size, but ornament may degenerate and rib frequency fall on the outer whorls of large forms. Suture comparatively simple. The Alsatitinae were chiefly a Tethyan and western North American subfamily, with only Alsatites itself being found in northern Europe. At the base of the Sinemurian stage, the Arietitinae spread into northern Europe and as far as Russia (northeast). Much of the later evolution of the Arietitidae and their descendants, the Echioceratidae and Oxynoticeratidae, took place in the boreal province, and some genera are restricted to it. Lower Jurassic (Hettangian–Sinemurian).

Family ARIETITIDAE Hyatt, 1875

Evolute serpenticones or planulatrices with simple ribs and a keel on at least the outer whorls. Whorl section depressed, subquadrate or compressed. Rib frequency usually increases with size, but ornament may degenerate and rib frequency fall on the outer whorls of large forms. Suture comparatively simple. The Alsatitinae were chiefly a Tethyan and western North American subfamily, with only Alsatites itself being found in northern Europe. At the base of the Sinemurian stage, the Arietitinae spread into northern Europe and as far as Russia (northeast). Much of the later evolution of the Arietitidae and their descendants, the Echioceratidae and Oxynoticeratidae, took place in the boreal province, and some genera are restricted to it. Lower Jurassic (Hettangian–Sinemurian).
Psiloceratoidea, Eodoeratoidea, Hildoceratoidea

whorls; keel blunt; ribs strong, straight or slightly curved, swinging forward over venter; suture may be asymmetrical. More involute than Alsatites. Lower Jurassic (Hettangian): Austria, United States (Nevada, Oregon).——Fig. 8.2a–b. *G. gonioptychum (Wähner), holotype, Psiloceras megastoma limestone, Schreinbach, Wolfgangsee, Austria, ×0.75 (Wähner, 1886a, pl. 27 (27), 5).

Pseudaetomoceras Spath, 1923b, p. 77 [*Ariettes abnormilobatus Wähner, 1886b, p. 59; OD] [Pseudaetomoceras Roman, 1938, p. 85, nom. null., misspelling]. Planulates, with at least 7 whorls; whorls overlap by 20–33% and umbilicus 35–60% of diameter; whorl section high and compressed; keel blunt or sharp; ribs numerous, curving forward at both ends; suture develops arborescent saddles with constricted bases. Lower Jurassic (Hettangian): southern Germany, Austria, Canada (British Columbia), United States (Nevada), Chile, Argentina.—Fig. 8.3a–d. *P.
*Pseudaetomoceras* (Wähner), a–b, lectotype (designated by Spatt, 1923b, p. 77), Psiloceras megatoma limestone, Breitenberg, Bavaria, Germany; a, side view, ×1; b, first lateral saddle of suture, ×4 (Wähner, 1886b, pl. 23 (38), 5a–b); c–d, paralectotype, Schlotheimia marmorea horizon, Schreinbach, Wolfgangsee, Austria, ×1 (Wähner, 1886b, pl. 23 (38), 6a–b).

**Tipperoceras** Taylor, 1998, p. 494 [*T. mullerense*; OD]. Evolute, compressed inner whorls have arched venter with keel and many straight or slightly curved ribs; outer whorl is stout and trigonal, with a slight keel and fewer, much stronger ribs. Derived from *Pseudoaetomoceras* but has straighter ribs on inner whorls and thicker, strongly ribbed outer whorl. Lower Jurassic (lower Sinemurian): United States (Nevada), ?New Zealand. —— *Tipperoceras* Taylor, 1998, fig. 23-3, 23-4.

**Canavarites** Hyatt, 1900, p. 577 [*C. discreatum*; OD under ICZN Code (1999) Art. 11.10; *Arietites discretus Canavari*, 1882, p. 182 (60); *Ammomites discretus* J. DE C. Sowerby in De la Beche, 1831, p. 320 (see Donovan & Forsey, 1973, p. 8)]. Shell small, cadicone, with at least 6 whorls; evolve, rapidly expanding, with depressed whorl section, and umbilicus one-third to one-half of diameter; a ventral keel on outer whors is flanked by grooves; straight ribs curve forward onto the venter. Lower Jurassic (upper Hettangian–lower Sinemurian): northern Italy, eastern Alps. —— *Canavarites* Hyatt, 1900, fig. 9, 2a–b. [*C. discreatum*, lectotype, near La Spezia, Tuscany, Italy, ×2 (new, Geological Museum, Pisa, Italy, no. i 1889; also figured in Donovan & Forsey, 1973, pl. 1, 3).

**Subfamily ARIETITINAE Hyatt, 1875**

Fig. 10. Arietitidae (p. 14–16).
V. (Verniceras). Serpenticones; umbilicus of adult usually more than 60% of diameter, and as much as 70% in some; adults may reach large sizes and have 7–9 whorls; venter smooth on innermost whorls, but keel appears on or before fourth whorl at about 30 mm in diameter, and shallow, rudimentary grooves flanking the keel appear later in ontogeny; ribs begin on first or second whorls and then persist throughout; ribs are straight to slightly concave forward and increase in frequency steadily, with growth to 45–70 per whorl on outer whorls. Lower Jurassic (Hettangian–lower Sinemurian, Bucklandi Zone); geographic range as for genus.—Fig. 10, 1a. *V. (V.) spiratissimum (Quenstedt), neotype, Lias a, Reutlingen, Württemberg, Germany, X1 (new, Geologisches-Palaontologisches Institute, Tübinger University, Germany, Ge 5.12.7.).—Fig. 10, 1b–d. *V. (V.) conybeari (J. Sowerby), holotype, Bath, Avon, England, X0.7 (new, The Natural History Museum, London, BMNH 43971).

V. (Gyrophioceras) Spath, 1924, p. 201 [*Arietites praepaesi trium Wächner, 1886b, p. 50; OD]. Differs from V. (Verniceras) in having large, widely spaced round tubercles on innermost whorls up 5–6 mm in diameter, and ribs on larger whorls are more strongly concave forward, especially at the ventral ends. Lower Jurassic (upper Hettangian–lower Sinemurian): Europe, Peru, New Zealand.—Fig. 10, 2a–d. *V. (G.) praepaesi trium (Wächner); a–b, lectotype (now lost; designated by Spath, 1924, p. 201), Adnet, Austria, X1 (Wächner, 1886b, pl. 21 (36), 2a–b); c–d, paralectotype, Kammerkörälpe, Lofer, northern Austria, X1 (Bloo, 1994, pl. 3, 5a–b).

V. (Paracaloceras) Spath, 1923b, p. 77 [*Ammonites coregonensis J. de C. Sowerby in De la Beche, 1831, p. 318; OD] [*Alpinoceras Lange, 1941b, p. 47 (type, Ammonites baueri Gumbel, 1861, p. 473, OD); =Centauroceras Blind, 1963, p. 94 (type, Ammonites centauroides Slav & Meneghini, 1851, p. 75, OD)]. Differs from V. (Verniceras) in having more strongly curved ribs throughout; the venter of innermost whorls is rounded and is crossed by ribs or chevrons of low relief, then a larger ventral keel flanked by more prominent grooves is developed on later whorls. Lower Jurassic (upper Hettangian–lower Sinemurian): Europe, Indonesia (Timor, Rote), United States (Alaska, Nevada), Mexico, Chile, Argentina, Peru, United States (Alaska, Nevada), Mexico, Chile, Argentina, Peru, Colombia, New Zealand.

C. (Corinoceras). Serpenticones, with up to 9 whorls, and some species reach large sizes; umbilicus increases slightly in relative size with growth and is 45–65% of diameter in adult; whorl thickness equal to or less than height; ribsing persists throughout, and ribs bear tubercles at outer ends on some or all whorls; rib frequency increases steadily with growth on earlier whorls, but may fall on last 1 or 2 whorls. Lower Jurassic (lower Sinemurian, Bucklandi–Semicostatum Zones): Europe, Caucasus, Russia (northeast), China (Guangdong), Vietnam, Indonesia, Canada (British Columbia, Yukon), United States (Alaska, Nevada), Mexico, Chile, Argentina, Peru, Colombia, New Zealand.

1951a, p. 202] [=Arietites QUENSTEDT, 1882 in 1882–1888, p. 44, obj., nom. van., non SEGUENZA, 1885, ICZN Opinion 337, 1955c, p. 111; =Megarietites SPATH, 1922b, p. 174 (type, Ammonites meridionalis REYNES, 1879, pl. 22, OD); =Arietites SPATH, 1924, p. 204, nom. null., misspelling]. Large Coroniceras with thick subquadrate outer whorls; rib frequency decreases from 20–40 on inner whorls to 20–30 on outer whorls; tubercles weak, and absent on outer whorls. Lower Jurassic (lower Sinemurian, Bucklandi–Semicostatum Zones): Europe (north of Alps), Russia (northeast), Vietnam, Indonesia (Timor, Roti, Buton, Sulawesi), Canada (British Columbia), United States (Alaska), Chile.—Fig. 11a–b. *C. (A.) bucklandi (J. SOWERBY), neotype, Bucklandi Zone, Keynsham, Avon, England, ×0.15 (new, The Natural History Museum, London, BMNH C.41796).

C. (Eucoroniceras) SPATH, 1922b, p. 176 [*Ammonites sinemurienis D'ORBIGNY, 1844 in 1842–1851, p. 303; OD] [=Pseudasteroceras SPATH, 1922b, p. 172 (type, Ammonites stellaeformis GÜMBEL, 1861, p. 474, OD)]. Coroniceras with
Fig. 12. Arietitidae (p. 16–20).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 13. Arietitidae (p. 20–21).
paired ribs, each pair joined at ventral ends to an elongated tubercle; normal ribs may be intercalated between the pairs; the paired ribs are usually restricted to inner whorls; inner whorls quadrate in section; outer whorls indistinguishable from those of *C. (Coroniceras)*.

**Lower Jurassic** (*lower Sinemurian, Semicostatum Zone*): Europe, Vietnam, Peru, China, and this is the only surviving figure; ventral view, ×1.6 (Guérin-Franiatte, 1966, pl. 38).

**Semicostatum** Lower Jurassic (Sinemurian): Europe, north of Alps, United States (Alaska, ?California), Argentina, Peru.——**Fig. 12, 1a–b. *C. (P.) charlesi* (Donovan), holotype; Stuttgart, Württemberg, Germany, ×0.35 (Reynès, 1879, pl. 16, 1–2; original specimen also figured in Guérin-Franiatte, 1966, pl. 38).**

**Gueciceras** Taylor, 1998, p. 486 [*G. profundus*; OD]. Derivative of *Coroniceras* with rapidly expanding whorls, in which the middle whorls from 25–100 mm in diameter are evolve and strongly depressed, almost cadicone, and have strong forwardly curved ribs without tubercles; the outer whorl is more involute, compressed, and subtrigonal, and is nearly smooth. **Lower Jurassic** (*lower Sinemurian*): United States (Nevada).——**Fig. 12, 4a–c. *C. (G.) profundus*, holotype, New York Canyon; a, sepatate up to position of arrow, ×0.375; b–c, separate inner whorls, ×0.75 (Taylor, 1998, fig. 17.1–17.3).**

**Arnioceras** Hyatt, 1867, p. 73 [*A. cuneiforme*; OD]. *ICZN Opinion* 307, 1954c, proposed by Arkell, 1951c, p. 219] [*A. cuneiforme* Whaleys, 1889, p. 144 (type, Celsites †vencovarenisis Whaleys, 1887, p. 110B, OD); =Arnioceras Speth, 1919, p. 68, nom. null.; misspelling; =Eparrniceras Speth, 1924, p. 190 (type, Ammonites semicostatus Young & Bird, 1828, p. 257, OD); =Melanippites Crickmay, 1928, p. 61 (type, *M. barkeadowensis*, OD); =Arnioceras Arkell, 1951c, p. 219, nom. null.; misspelling; =Melanippites Crickmay, 1962, p. 10, nom. var.; =Burrhardticeras Lopez, 1967, p. 28 (type, *Arnioceras fallaxoides* Erben, 1956, p. 240, OD); =Laevipinacites Forsey & Nannarone, 2002, p. 148 (type, *Arietites ambiguous* Geyer, 1886, p. 252, OD).** Serpenticone with up to 7 whorls; umbilicus 42–60% of diameter in small forms, always more than 50% at diameters over 5 cm; whorls compressed, thickness 70–100% of whorl height; ventral keel sharp, flanked by well-defined grooves on outer whors of most species; innermost whors smooth, later whors may be smooth or ribs may appear at varying diameters; ribs straight, sharp, radial, usually prominent at umbilical edge, may become concave forward on last whors, and outer whors have 30–60 ribs. **Lower Jurassic** (*Sinemurian, Semicostatum–Obtusum Zones*): Europe, northern Africa (Atlas Ranges), Tunisia, Caucasus, Russia (northeast), China (Tibet, Guangdong), Vietnam, Japan, Indonesia (Timor, Roti, ?New Guinea), New Zealand, New Caledonia, Canada (British Columbia, Alberta, Yukon), United States (Alaska, Nevada, California), Chile, Argentina, Peru, Ecuador, Colombia.——**Fig. 13, 1a–b. *A. cuneiforme*, holotype, lower Sinemurian, Auxois region, France, ×1 (Guérin-Franiatte, 1966, pl. 135, 1a–b).**——**Fig. 13, 1c–d. A. bodleyi* (J. Buckman), Lower Lias Clay, topotype (but probably a syntype, and available for selection as lectotype), Gloucestershire, England, ×1 (Buckman, 1904b, no. 36, fig. T, T').**

**Metarnioceras** Speth, 1925a, p. 359 [*M. sheppardi*; OD]. Small evolute serpenticone with subquadrate whorl section; slightly arched venter has a low keel, which may bear faint chevrons, bordered by smooth or slightly subulate bands; smooth innermost whors followed by whors with sharp, straight ribs; sutures have long, nearly parallel-sided lateral saddles. Differs from *Arnioceras* in having a shorter smooth stage on inner whors and very shallow or no sulci bordering the keel. **Lower Jurassic** (*Sinemurian*): England, ?Mexico.——**Fig. 13, 2a. *M. sheppardi*, holotype, Glacial drift, Holderness, Yorkshire; the holotype, originally in Hull Museum, England, was destroyed, and this is the only surviving figure; ventral view, ×1 (Speth, 1925a, p. 359, fig. 11b).——**Fig. 13, 2b–c. *M. neea* (Reynes), Drift (Robin Hood’s Bay), Yorkshire, England, ×1 (Getty, 1973, pl. 1, 10).**

**Tmaegoceras** Hyatt, 1889, p. 125 [*Ammonites late­sulcatus* Hauer, 1856, p. 44; SD Pompecki, 1901, p. 158]. Serpenticone with rounded to strongly depressed whorl section; rounded venter has a deep central groove that contains a low central keel; no ribs. [See Gebhard and Schlatter (1977).] **Lower Jurassic** (*upper Hettangian, lower Sinemurian*): southern England, eastern France, southern Germany, Austria, Italy, China (Tibet), United States (Nevada).——**Fig. 13, 3a–b. *T. late­sulcatum* (Hauer), lectotype, lower Sinemurian, Adneth, Austria, ×0.8 (Hauer, 1856, pl. 9, 1–2).——**Fig. 13, 3c–d. *T. crassiceps* (Pompecki), lower Sinemurian, Aldingen, Spaichingen, southern Germany, ×1 (Gebhard & Schlatter, 1977, pl. 1, 3).**

**Longziceras** Wang & He, 1981, p. 327 [*L. longziense*; OD]. Cadicone inner whors, with depressed whorl section, rounded venter and ventral groove that contains a small median keel, like *Tmaegoceras*; the keel is lost on outer whors, which are more evolute, and have a smooth venter crossed by weak transverse folds; ribs absent throughout. **Lower Jurassic** (*Sinemurian*): China (Tibet, eastern Himalayas).——**Fig. 13, 4a–c. *L. longziense*, holotype, Ridang, Lhunze,
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Subfamily AGASSICERATINAE
Spath, 1924


Arietitidae characterized by simplification of ornament and sutures as compared with their supposed ancestors, the Arietitinae. Venter flat or fastigiate; keel reduced, although usually present, but ventral grooves usually absent. Both included genera are founded on small type species, but both also include large forms reaching at least 400 mm in diameter. Lower Jurassic (lower Sinemurian, probably restricted to Semicostatum Zone).


Platycone, with at least 7 whorls; earliest whorls circular in section, becoming compressed with fastigiate venter; umbilicus 33–40% of diameter in adult; whorl thickness about two-thirds of whorl height; ribs straight, radial, occasionally joined in pairs at dorsal ends; ribbing may fade on outer whorls of large specimens; rib frequency rises on inner whorls, then becomes stable or falls slightly on outer whorls. Lower Jurassic (lower Sinemurian, Semicostatum Zone): Europe, Canada (British Columbia), ?Mexico, Chile, Argentina, Colombia.——Fig. 14, 1a–d. *A. scipionianum (d’Orbigny); a–b, lectotype, Mont-de-Lans, Isère, France, ×1 (Fischer, 1994, pl. 16, 1a, 1c); c–d, Robin Hood’s Bay, Whitby, Yorkshire, England, ×1 (Dean, Donovan, & Howarth, 1961, pl. 65, 3a–b).

Euagassiceras Spath, 1924, p. 208 [*Ammonites sauzeanus d’Orbigny, 1844 in 1842–1851, p. 304; OD]

Shell evolute, with quadrate or subcircular whorl section; umbilicus 35–55% of diameter; keel weak and ventral grooves vestigial or absent; ribs straight, radial, weak on whorl side, with prominent ventral ends on quadrate-whorled species, or reduced to striae; rib frequency increases with growth on inner whorls; then becomes stable at 15–35 ribs per whorl; secondary ribs forming chevron ornament may be present on venter. Lower Jurassic (lower Sinemurian, Semicostatum Zone): Europe, Mexico, Argentina, Ecuador, Colombia.——Fig.

Fig. 14. Arietitidae (p. 21).

14, 2a–b. *E. sauzeanum (d’Orbigny), holotype, Lias inférieur, Champlong, Semur-en-Auxois, Côte d’Or, France, ×1.8 (Fischer, 1994, pl. 16, 3).

Subfamily PSEUDOTROPITINAE
Donovan & Forsey, 1973

[Pseudotropitinae Donovan & Forsey, 1973, p. 8]

Arietitidae with cadicone shells and tubercles at edge of umbilicus. Lower Jurassic (lower Sinemurian).
Pseudotropites Wahnert, 1894, p. 24 [*Tropites ultratraliatus* Canavari, 1882, p. 184; OD]. Cactoids, with 5 or more whorls, a craterlike umbilicus and a broad arched venter; a low keel in the middle of the venter is flanked (on the last whorl) by shallow grooves; ribs on the umbilical wall end at lateral tubercles, from which issue 1, 2, or occasionally 3 prorsiradiate ribs that are continuous across the venter and across the low keel and shallow grooves. *Lower Jurassic* (*lower Sinemurian*): northern Italy, Austria (eastern Alps).—Fig. 15a–b. *P. ultratraliatus* (Canavari), lectotype, La Spezia, Italy, ×1 (Canavari, 1882, pl. 21 (7), Sa–b).

**Subfamily ASTEROceratinae**

Spath, 1946

[Asteroceras Hyatt, 1867, p. 79 [*Ammonites stellaris* J. Sowerby, 1815a, p. 211; SD Buckman, 1911, p. 71, OD] **1a**–**d**. *Asteroceras* (Sp. asteroceras, Epophiocieras) are vestigial throughout ontogeny. Ribs sharp or blunt, either curving forward toward the venter and becoming tangential to the periphery of the shell (*Caenisites*, Eparietites) or making a distinct angle with the periphery. Suture has broad, often weakly indented saddles. The subfamily comprises all the Arietitidae in the *Turneri* and *Obtusum* Zones of the Sinemurian in northwestern Europe. *Lower Jurassic* (Sinemurian).

Caenisites Buckman, 1925a, pl. 572 [*C. caeneus*; OD; a malformed specimen of *Ammonites plottii* Reyes, 1879, pl. 36] [=Euasteroceras Donovan, 1953, p. xiii (type, *Ammonites turneri* J. de C. Sowerby, 1824, p. 75, OD, ICZN Opinion 482, 1957b, proposed by Arkell & Donovan, 1954, p. 365]. Evolute serpenticones to more involute forms, with each whorl covering about two-fifths of the preceding whorl; about 8 whorls and reaches large sizes; whorl section quadrate or compressed; umbilicus 35% to more than 50% of diameter; venter keeled, bisulcate; ribs straight or concave forward, curving forward on shoulders of whorl to become tangential to ventral grooves; rib frequency increases with size, and ribs may die out on outer whorls of large specimens. (The holotype of *C. caeneus* is deformed: the ventral keel and sulci on the inner whorls end abruptly at 68 mm in diameter, then the ribs pass over a rounded venter on the final one-third of a whorl.) *Lower Jurassic* (*lower Sinemurian*, *Turneri Zone*): Europe, Morocco, Russia (northeast), Canada (British Columbia), China, Australia, Africa (Atlas Ranges), ?Japan, China (Guangdong), ?Indonesia (New Guinea), Canada (British Columbia, Alberta), United States (California), Chile, Argentina, ?Peru.—Fig. 16,1a–d. *C. plottii* Reyes, holotype of *C. caeneus* Buckman, Cleeve, Gloucestershire, England; a, side; b–d, venter at beginning (b), middle (c), and end (d) of final whorl, ×0.9 (Buckman, 1925a, pl. 572).—Fig. 16,1e–f. *C. turneri* (J. de C. Sowerby), lectotype, Quaternary (derived from Lower Lias), Wymondham Abbey, Norfolk, England, ×1 (new, The Natural History Museum, London, BMNH 43973a).

Arietitidae with broad, rounded keel that, in some genera, is flanked by grooves. Keel and grooves commonly weak on outer whorls, and in some forms (*Aegasteroceras*, *Epophioceras*) are vestigial throughout ontogeny. Ribs sharp or blunt, either curving forward toward the venter and becoming tangential to the periphery of the shell (*Caenisites*, *Eparietites*) or making a distinct angle with the periphery. Suture has broad, often weakly indented saddles.

The subfamily comprises all the Arietitidae in the *Turneri* and *Obtusum* Zones of the Sinemurian in northwestern Europe. *Lower Jurassic* (Sinemurian).

Parasteroceras Dommergues, Faure, & Peybernes, 1986, p. 1111 [*P. rakusi*; OD]. Similar to *Asteroceras*, but more involute, has vertical or undercut umbilical walls, more compressed and flat inner whorls, and venter is rounded, with only a rudimentary keel throughout; ribs are flexuous, striate, and irregular on inner whorls, then stronger, mainly single and straight on the outer whorls. Dimorphic. *Lower Jurassic* (*upper Sinemurian*, *Obtusum Zone*): Morocco, Tunisia.—Fig. 17,2a–h. *P. rakusi*, lectotype, designated herein, a macroconch, Oust Formation, Djebel Oust, Tunisia, ×0.4 (Dommergues, Faure, & Peybernes, 1986, pl. 1,1a–b).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

distinct, crenulated, ventral keel, bordered by bands and traces of strigate ornament; lateral ribs divided or intercalated high on whorl and angled forward in crossing venter. upper Lower Jurassic (upper Sinemurian, top Obtusum–Oxynotum Zones): Canada (?British Columbia), Mexico, ?Chile, Peru.—Fig. 17,3a–b. *E. corinnae (Blau & others), holotype, Despí Formation, Tenango de Doria, Sierra Madre Oriental, Mexico, ×0.8 (Blau & others, 2001, p. 179,2a–b).

Aegasteroceras Spath, 1925a, p. 265 [*A. simile; OD]. Evolute, umbilicus about 40% of diameter;
whorl section rounded, and rounded venter may have a weak keel; ribs bold and straight or curving slightly forward. More evolute than Asteroceras and has a much reduced keel. Lower Jurassic (upper Sinemurian, Obtusum Zone): Europe, Morocco, Canada (Yukon), United States (Alaska, Nevada), Mexico, Chile, Argentina, Peru.——Fig. 16,2a–b. *A. simile*, holotype, Robin Hood’s Bay, North Yorkshire, England. ×1 (new, The Natural History Museum, London, BMNH C.26687).

**Arctoasteroceras** Frebold, 1960, p. 13 (Frebold, 1958, p. 30, *nom. nud.*) [*A. jeletzkyi*, OD]. Moderately involute, each whorl overlapping up to half of the preceding; umbilicus about 30% of diameter; ribs sharp, straight, curving forward at ventral ends, and faint secondary ribs may cross venter; on middle and outer whorls, ribs die out partway across side of whorl; venter flattened or slightly arched; a ventral keel may be present on inner but not on outer whorls, which have broad smooth venter distinguishing genus from others in family. Lower Jurassic (upper Sinemurian, Oxynotum Zone): United States (Alaska), Canada (British Columbia, Yukon, Northwest Territories).——Fig. 18,1a–b.
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

*A. jeletskyi*, holotype, Aklavik Range, Alaska, United States, ×1 (Frebold, 1960, pl. 2, f.).

**Epophioceras** Spath, 1924, p. 204 [*Ammonites landrioti d’Orbigny, 1849 in 1849–1850, p. 213*, nom. dub.; OD; clarified by Thevenin, 1907, p. 22]. Evolute; up to 9 whorls and reaches large sizes; whorl section subcircular with very slight overlap; umbilicus 60–70% of diameter; weak ventral keel; ribs blunt, frequency increasing steadily with size. Lower Jurassic (upper Sinemurian, Obtusum Zone): Europe, Tunisia, Canada (British Columbia, Alberta), United States (Nevada), Chile, Argentina, Peru, Antarctica (Antarctic Peninsula).——Fig. 18.2a–b. *E. landrioti* (d’Orbigny), holotype, Lias inférieur, Semur, Côte d’Or, France, ×0.5 (Thevenin, 1907, pl. 7, 4–5).

**Psychiatricites** Spath, 1925a, p. 267 [*Ariettes psycho­genus Pompecki, 1897, p. 643; OD*] [=Pompeckio­ceras Spath, 1925, p. 268 (type, Ariettes oncoceph­alus Pompecki, 1897, p. 654, OD)]. Inner whorls flat, compressed and smooth, with prominent ventral keel like *Eparietites*, but outer whorls have whorl section, ventral keel, and ribs like *Asteroceras* (Dommergues, Meister, Neige, & Rocha, 2004). Lower Jurassic (upper Sinemurian, Obtusum Zone): Portugal.—Fig. 18.3a–b. *P. psycho­genos* (Pompecki), lectotype, Penedo da Saudade, San Pedro de Muel, ×0.7 (Pompecki, 1897, pl. 23, 3a–b).

**Eparietites** Spath, 1924, p. 206 [*Ammonites tenellus* Simpson, 1855, p. 97; OD]. Shell compressed, near-ocycocye; whorl thickness 20–25%, umbilicus 20–30% of diameter; ventral keel sharp and high, bounded by concave shoulders and a ventrolateral angle; at least 5 whorls, and some species reach large sizes; ribs simple, straight or concave forward, curving forward onto venter (as in *Caenisites*), at least on inner whors; outer whorls have 25–40 ribs per whorl, or ribs are lost and whorl becomes smooth at large sizes. Lower Jurassic (upper Sinemurian, Obtusum Zone; Denotatus Subzone in Britain): Europe, Morocco, Algeria, Russia (northeast), China (Guangdong), Chile, Argentina, Peru.—Fig. 19.1a. *E. tenellus* (Simpson), holotype, Robin Hood’s Bay, North Yorkshire, England, ×1 (Buckman, 1912, pl. 54).——Fig. 19.10c–d. *E. denotatus* (Simpson), holotype, Denotatus Subzone, Robin Hood’s Bay, North Yorkshire, England, ×0.5 (Buckman, 1912, pl. 67a–67b).

**Bagnolites** Donovan, 1998, p. 993 [*B. stuarti*; OD]. Inner whorls very involute, with small umbilicus and undercut umbilical wall; umbilical seam uncoils on final part of phragmocone and (possible adult) outer whorl; whorl section triangular, with narrow keeled venter; smooth on all visible whorls; sutures have shallow lateral saddles. Known from the holotype only, which has a venter like that of *Eparietites* but differs in being more involute, has undercut umbilical walls, smooth whors and a reduced suture. Lower Jurassic (upper Sinemurian, Obtusum Zone, Stellare Subzone): England (Dorset).——Fig. 18.4a–d. *B. stuarti*, holotype, Charmouth, Dorset, England; a–b, ×0.6; c, whorl cross sections, ×0.6; d, reconstruction of suture, ×0.75 (Donovan, 1998, fig. 2, 3a; pl. 1, 1–2).

**Protoceritites** Spath, 1925a, p. 362, non Trueman & Williams, 1927; see Palaeo­ceritites Spath, 1929, p. 29 herein [*Vermiceras formosum Fucini, 1902, p. 158 (118); OD*]. Serpenticone, umbilicus 60–70% of diameter, whorl section nearly circular, with weak ventral keel and no sulci; smooth, or with faint ribs. The periodic lateral nodes on the lectotype (Fucini, 1902, pl. 13 (16), 13) may be artifacts. Poorly preserved, but possibly a synonym of *Epophioceras* (Getty, 1973, p. 26; see Géczy & Schlatter, 1984). Lower Jurassic (upper Sinemurian): Italy, Hungary.—Fig. 19.2a–b. *P. formosum* (Fucini), lectotype, Monte di Cetona, Tuscany, Italy, ×1 (Fucini, 1902, pl. 13 (16), 13–13a).——Fig. 19.2c–d. P. sp. cf. *formosum* (Fucini), Obtusum Zone, bed 207, Lőkút, Hungary, ×0.6 (new; also figured in Géczy & Schlatter, 1984, fig. 1).

**Tmaegophioceras** Spath, 1925a, p. 362 [*Ariettes laevis Geyer, 1886, p. 252; OD*]. Serpenticone; quadrate whorl section, with small ventral keel, flanked by sulci; ribs distant and weak; may have constrictions. The poorly preserved, corroded types are lost, and affinities are uncertain (Getty, 1973, p. 25). Lower Jurassic (upper Sinemurian): Austria, Italy, Hungary.—Fig. 19.3a–b. *T. laevis* (Geyer), lectotype, Hierflez Limestone, Hallstatt, Austria, ×1 (Geyer, 1886, pl. 3, 10a–b).

**Subfamily HYPASTEROCERATINAE**

Venturi & Nannarone, 2002


Hypasteroceratinae is an unsatisfactory subfamily proposed for some ammonites from Monte Cetona, central Italy. Almost all specimens referred to this subfamily are small, poorly preserved, and eroded. Characteristically, they have a tall ventral keel and smooth inner whors. Ventral ribbing on the outer part of the whorl side may or may not be present, depending on the state of preservation. Lack of knowledge of their stratigraphical position has led to their reference to different ammonite groups in the past, but Venturi and Nannarone (2002) appear to have determined their age as lower Sinemurian, Bucklandi Zone, which is considerably older than supposed hitherto. Cancellliceratia was proposed for some slightly better preserved specimens in which the ribbing is clearer than on the eroded types of *Hypasteroceras*, and *Oxydiscoceras* is based on small smooth inner whors. Both are
Fig. 18. Arietitidae (p. 24–25).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 19. Ariettidae (p. 25).
by grooves; smooth on inner whorls; some outer whorls develop striate or weak ribs on upper part of whorl that curves forward on the shoulder of whorl; suture simple, ceratitic (DONOVAN, 1990, p. 258; DOMMERGUES, FERRETTI, & MEISTER, 1994, p. 34). Lower Jurassic (lower Sinemurian, ‘Bucklandi Zone); Italy, Morocco.—Fig. 20, 1a–c. *H. montii (MENEGHINI), calcari grigi inferiori, Monte di Cetona, Tuscany, Italy; lectotype of Asteroceras? ceratiticum FUCINI, 1903 (designated by DONOVAN & FORSEY, 1973, p. 8); a–b, ×1; c, suture, ×2 (new; also figured in Fucini, 1903, pl. 23 (34), 1a–c).—Fig. 20, 1d–f. H. apenninicum (FUCINI), holotype, Pioraco, Central Apennines, Italy; d, ×1; e, whorl cross section, ×1.5; f, suture ×2 (Fucini, 1911, pl. 3, 4).

**INCERTAE SEDIS IN ARIETITIDAE**

*Bartoliniceras* TAYLOR, GUEX, & RAKUS, 2001, p. 401 [*B. lelei; OD]. Small, evolute, compressed, flat whorl sides, with low, blunt ventral keel; lower part of whorl side smooth, strong ribs on upper part of whorl side are curved forward and projected on venter, where they form small nodes. Known only up to 35 mm in diameter, and of unknown affinities, but probably within the Arietitidae. Lower Jurassic (lower Sinemurian, Turneri Zone): United States (Nevada).—Fig. 20, 2a–b. *B. lelei*, holotype, Five Card Draw Section, New York Canyon, ×1 (Taylor, Guex, & Rakus, 2001, pl. 3, l–2).

**Family ECHIOCERATIDAE**

Buckman, 1913

[Echioceratidae BUCKMAN, 1913, p. 1]

Serpenticones with circular or flat-sided whorl section, ornamented throughout with strong simple ribs, except in *Leptechioceras*, where the outer whorls become strongly compressed and smooth. A ventral keel is present in all forms, only feebly developed in some but prominent in others, and in some of the more densely ribbed, compressed forms, the keel is flanked by grooves. Tubercles are rare or absent. The initial smooth stage is very short and usually not discernible with the naked eye.

Suture simple with five principal lobes (U2=U1<L<E=I). U3 is not usually developed until a late stage and is generally small. U1 is not split, and there is a single internal saddle. L tends to be bifid, or, at least where the lobe is very broad, to possess an even number of accessories. Saddles are broad based and weakly incised, although the strength of the incisions varies considerably.
The external saddles tend to be asymmetrically divided by a deeper incision in most genera, but this may be obscured if other incisions are strongly developed. Umbilical lobes are only weakly retracted, if at all. Lower Jurassic (Sinemurian).


Nucleus globulo with depressed whorls, becoming evolute with circular or slightly compressed whorls, then either more compressed or depressed in later growth stages; an early smooth stage is followed on nucleus by stout prorsiradiate ribs, which become straighter and sharper as whorls become more evolute; in compressed forms, ribs are fine and dense on outer whorl; in depressed forms, they remain strong and distant; ribs are strongly projected on venter on inner whorls, rare secondary chevrons may be intercalated, and some ribs may be paired; on outer whorls, ribs fade on venters but retain marked forward projection; compressed forms have low keel that may be flanked by feeble sulci. Lower Jurassic (upper Sinemurian, Oxynotum Subzone); Europe, Morocco, Chile.——Fig. 21, a–d.

**Gagaticeras** Buckman, 1913, p. v [*Ammonites gagateus* Young & Bird, 1828, p. 255; OD] [*Aegoceras finitimum* Blake, 1876, p. 273, OD)].

Nucleus depressed, evolute, middle and outer whorls circular or slightly compressed; umbilicus 50–60% of diameter; low keel may be present on outer whorls; stout, blunt ribs on inner whorls, either densely spaced or very distant, give way to strong, usually rectiradiate, but sometimes strongly prorsiradiate ribs on middle and outer whorls; ribs pass over venter without weakening, except rarely on nucleus, and may be slightly projected forward. Lower Jurassic (upper Sinemurian, Oxynotum Zone, Simpson Subzone); northwestern Europe, Austria.——Fig. 21, a–c.

**Pleschiceras** Trueeman & Williams, 1925a, p. 706 [*Echiceras delicatum* Buckman, 1914, pl. 96c; OD; nom. nov. pro Ammonites tardocreccens Dumortier, 1867, p. 170, pl. 31, 3–5, non Hauser, 1854, p. 757; =*P. rothpletzi* (Böse, 1894, p. 730)]. Whorl section oval, with blunt keel; ribs regular, concave forward and extend ventrally almost to keel; rib density high, 65–70 per whorl, at 35–45 mm in diameter. Similar to *Paleschiceras*, but smaller, has higher rib density, and occurs in the *Densinodulum Subzone* (Dommegues, 1982). Lower Jurassic (upper Sinemurian, Raricostatum Zone, Densinodulum Zone); England, France, northern Africa (Atlas Ranges), Tunisia, Canada (British Columbia), United States (Alaska), Chile, Argentina.——Fig. 21, 3a–b. *P. delicatum* (Buckman) [*P. rothpletzi* (Böse)], holotype, *Densinodulum Subzone*, Nolay, Côte d’Or, France, ×1 (Getty, 1973, pl. 2, 5a–b).

**Orthechioceras** Trueeman & Williams, 1925a (September), p. 706 [*O. recticostatum*; OD] [*Homechioceras* Trueeman & Williams in Buckman, 1925b (December), pl. 609 (type, *H. similis*, OD)]. Inner whorls depressed, becoming subquadrate; keel blunt, flanked by grooves that are well marked in type species, but may be ill-defined in others; sharp, straight ribs, rectiradiate or slightly prorsiradiate, increasing in frequency to about 38 per whorl at 80 mm in diameter. Lower Jurassic (upper Sinemurian, Raricostatum Zone, Densinodulum Zone and Raricostatoides Subzones); Britain, Canada (Yukon), United States (Alaska), Ecuador.——Fig. 22, 1a–b. *O. recticostatum*, holotype, Armatum Bed (derived from *Raricostatum Zone*), Radstock, Avon, England, ×1 (Trueeman & Williams, 1925a, pl. 3, f).

**Echioceras** Bayley, 1878, pl. 77 [*Ammonites raricostatus* Zieten, 1831 in 1830–1833, p. 18; OD; ICZN Opinion 324, 1955b, proposed by Arkell, 1951d, p. 227] [*Ophioceras* Hyatt, 1867, p. 75, obj., non Barrande, 1865, pl. 45, 97, 99; =*Pleurochioceras* Trueeman & Williams, 1925a, p. 706 (type, *Ophioceras deciduum* Hyatt, 1867, p. 76, OD); =*Pleurochioceras* Roman, 1938, p. 92, nom. null., misspelling]. Evolute; inner whorls circular or quadrate, becoming depressed; in some, outer whorls again become circular or compressed at large diameters; umbilicus 50–70% of diameter on outer whorls; venter flat or slightly arched to fastigate, and a blunt and weakly developed keel, without sulci, appears at widely varying sizes; dense sharp ribs on nucleus, become less dense on middle whorls, and may become raricostate in some species, but rib frequency may increase slightly on outer whorls. Lower Jurassic (upper Sinemurian, Raricostatum Zone, Raricostatum Subzone); Europe, Turkey, Russia (Crimea), Caucasus, Indonesia (Timor), Canada (Yukon), United States (California).——Fig. 21, 4a–c. *E. raricostatum* (Zieten); a–b, neotype, Plenbsch, Würtemberg, Germany, ×1 (Getty, 1973, pl. 17); c, suture, at 3.5 mm whorl height, ×9 (Getty, 1973, p. 10, fig. 2–2).——Fig. 21, 4d–f. *E. raricostatoides* Vadasz; d, neotype (designated by Getty, 1973, p. 13), Seichamp, Nancy, Lorraine, France, ×1 (Getty, 1973, pl. 1, 12); e–f, Armatum Bed (derived from *Raricostatum Zone*), Kilmersdon Colliery Quarry, Radstock, Avon, England, (holotype of *E. sparsi­costatum* Trueeman & Williams, 1925a, p. 713); e, side; f, whorl cross section, ×1 (Trueeman & Williams, 1925a, pl. 2, 8).
Fig. 21. Echioceratidae (p. 29).
Orthechioceras

Paltechioceras

Leptechioceras

Fig. 22. Echioceratidae (p. 29–32).
Paltechioceras Buckman, 1924, pl. 483 [*P. elicium; OD] [=Echioceratoidea TRUERM & WILLIAMS, 1925a, p. 706 (type, E. regule; OD); *Epechioceras TRUERM & WILLIAMS, 1925a, p. 706 (type, E. expansum; OD); =Euechioceras TRUERM & WILLIAMS, 1925a, p. 706 (type, E. nobile, OD); =Kamptechioceras TRUERM & WILLIAMS, 1925a, p. 706 (type, K. variabile, OD); =Metechioceras TRUERM & WILLIAMS, 1925a, p. 706 (type, M. tarderecens, OD); =Ariettites tarderecens BLAKE, 1876, pl. 5, 5, non HAUER, 1856); =Vohlstericeras TRUERM & WILLIAMS, 1925a, p. 706 (type, V. flexicosatum, OD); =Stenechioceras BUCKMAN, 1927a, pl. 697 (type, Euechioceras angustilobatum TRUERM & WILLIAMS, 1925a, p. 726, OD)]. Compressed, with carinate-bisulcate venter; ribs straight or nearly straight, increasing from 20–40 per whorl on inner whorls to higher frequencies on outer whorls, commonly more than 50 ribs at diameters of 60 mm or more. Homeomorphic with Verniceras (early Arietitidae). Lower Jurassic (upper Sinemurian, Raricostatum Zone): Europe, Turkey, northern Africa (Atlas Ranges), Tunisia, Indonesia (New Guinea), Canada (British Columbia, Yukon), United States (Alaska, California), Mexico, Chile, Peru, Argentina, Peru.——Fig. 22, 4a–c. *L. (N.) commune, holotype, Raricostatum Zone, Macdonelli Subzone, Witney (Appley Barn) Borehole, Oxfordshire, England; a–b, X3; c, last three sutures, X6 (Donovan, 1966, p. 314, fig. 1a: pl. 53, f–2).

Family OXYNOTICERATIDAE

Hyatt, 1875

Medium to involute oxycones and planulates, with keel usually present, but no ventral grooves; ribs are projected or falcoild, but are obsolescent in many forms; secondary ribs may be present; suture develops additional elements in umbilical region of involute forms by subdivision of umbilical lobes and saddles; in large oxycones, the suture may become highly complex with arborescent saddles. Lower Jurassic (upper Sinemurian—lower Piensbachian).

Oxynoticeras HYATT, 1875, p. 230 [*Ammonites oxynotus QUENSTEDT, 1843, p. 161; SD BUCKMAN, 1909, p. ii, ICZN Opinion 575, 1959a] [=Oxytocoleras BUCKMAN, 1894, p. 361, nom. null., misspelling]. Oxycones, umbilicus 20–30% of diameter; whorls cover half to three-quarters of preceding one; falcoild ribs numerous, with extra ribs intercalated on outer part of whorl, and ribs often weaken with growth; suture culminates at point of contact with previous whorl in the umbilicus (SCHINDWOLF, 1962, fig. 91), and extra sutural elements are added near umbilical margin during ontogeny. Lower Jurassic (upper Sinemurian, Oxynotum Zone): Europe, Morocco, Turkey, Russia (Far East), Vietnam, Indonesia (Timor), Canada (British Columbia, Yukon), United States (Alaska, Nevada), Mexico, Chile, Argentina, Peru.——Fig. 23, 1a–b. *O. oxynotum (QUENSTEDT), holotype, Lias b, Schömberg, Württemberg, Germany, ×1 (new; also figured in Dean, Donovan, & Howarth, 1961, pl. 66, 5).

Cheltonia BUCKMAN, 1904b, p. 27a [*Ammonites accipitris J. BUCKMAN, 1844, p. 102, OD]. Small compressed ptychyocones, umbilicus 30–40% of diameter; last whorl eccentrically coiled and has aperture with ventral rostrum that may be preceded by 3 to 5 corrugations on venter; ribs weak, falcoild; suture as in young Oxynoticeras. May be the microconch of Oxynoticeras. Lower Jurassic (upper Sinemurian): Europe, Morocco, Tunisia, Chile, Argentina, Peru.——Fig. 23, 2a–d. *C. accipitris (J. BUCKMAN), Lower Lias Clay, near Cheltenham, Gloucestershire, England; a–b, lectotype, ×1; c–d, paralecotype, ×1 (BUCKMAN, 1904b, p. 27, fig. T′, T′′ T′b, T′).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

33

Gleviceras Buckman, 1918b, p. 269, 289 [*G. glevense; OD; = Oxynoticeras subguibalianum Pia, 1914, p. 11] [*Guibaliceras Buckman, 1918b, p. 293 (type, Ammonites guibalianus d’ Orbigny, 1844 in 1842–1851, p. 259, OD); = Tuchericeras Buckman, 1919b, pl. 137 (type, T. perfoliatum, OD); = Victoriceras Buckman, 1918b, p. 293 (type, Ammonites victorius Dumortier, 1867, p. 136, OD); = Glevunites Buckman, 1924, pl. 527 (type, Oxynoticeras subguibalianum Pia, 1914, p. 11, OD); = Glevunites Lang, 1926, p. 156, nom. null, misspelling; = Riparioiceras Schindewolf, 1962, p. 490 (type, Ammonites riparius Oppel, 1862, p. 132, OD)]. Earliest whorls quadrate with widely spaced ribs, about 10 per whorl, ending in ventrolateral clavi that may be joined by sharp ridge; venter with acute chevrons and small, well-defined keel; umbilical margin may be pentagonal rather than spiral. This stage (Riparioiceras) is succeeded after about two whorls (approximately 15 mm) by oxycone shell form with umbilicus 12–25%, and whorl thickness 20–25% of diameter; keel sharp and ribs falcoid with intercalated secondaries. On later whorls, ribs become faint or intermittently developed (Guibaliceras). Species may reach large sizes (450 mm in diameter), and body chamber may become smooth with rounded venter and eccentric coiling. Suture like Oxynoticeras, but without umbilical culmination, becoming elaborate on large examples. Lower Jurassic (upper Sinemurian): Europe, Morocco, Canada (British Columbia, Alberta, Yukon), United States (Alaska), Mexico, Peru.—Fig. 24a–e. *G. subguibalianum (Pia); a–b, holotype of Gleviceras glevense, Raricostatum
Fig. 24. Oxynoticeratidae (p. 33–35).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Zone, Folly Lane Brickyard, Cheltenham, Gloucestershire, England, x0.4 (a, Buckman, 1918b, pl. 28, 1; b, Buckman, 1918b, pl. 27, 2); c, paratype of *G. glebense*, Lower Lias Shales, Cheltenham, Gloucestershire, England, x0.67 (new; also figured in Buckman, 1918b, pl. 27, 2, and Buckman, 1924, p. 526); d–e, Lansdown, Cheltenham, Gloucestershire, England, x0.67 (Buckman, 1924, p. 527).—Fig. 24f–g. *G. riparium* (Oppel), holotype, Balingen, Württemberg, Germany, x4 (Schindewolf, 1962, pl. 3, 2).—Fig. 24h–i. *G. victorius* (Dumontier), lectotype, Nolay, Côte d’Or, France, x0.67 (Dumontier, 1867, pl. 42, 1–2).

Radstockiceras Buckman, 1918b, p. 269, 287 [*R. complicatum*; OD] =Fastigiceras Buckman, 1919b, pl. 144 (type, *E. clausum*, OD); =Retenticeras Buckman, 1920, pl. 166 (type, Ammonites retentus Simpson, 1855, p. 84, OD); =Metoxynoticeras Spath, 1922c, p. 550 (type, Ammonites oppeli Schloenbach, 1863, p. 515, OD); =Phylloxynoticeras Buckman, 1924, p. 465 (type, *P. phyllinus*, OD); =Homoxynoticeras Buckman, 1925a, p. 575 (type, *H. homoecum*, OD); =Kleistoxynoticeras Buckman, 1925a, p. 576 (type, *K. columnellatum*, OD); =Caricisiceras Spath, 1925a, p. 112 (type, Amaltheus wilshirei Wright, 1881, pl. 48, OD); =Rastokiceras Roman, 1938, p. 98, nom. null., misspelling; =Oxynoticeras Dommeregues, Faure, & Peybernes, 1986, p. 1112 (type, *O. simplicatum*, OD)). Involute oxycones, umbilicus 0–12% of diameter on outer whorls; venter sharp on inner whorls, rounded on outer whorls; attains large sizes; ribs falcoid, faint or absent; suture complex like Oxynoticeras but without culmination at umbilical margin. Lower Jurassic (upper Sinemurian, Oxynotum–Raricostatum Zones–lower Pliensbachian).—Fig. 23, 5a–c. *R. complicatum*, holotype, Jamesoni Zone, Radstock, Avon, England, x0.35 (Buckman, 1918b, pl. 27, 1).

Hypoxynotinoticeras Spath, 1925a, p. 111 [*Ammonites sphenosphatos Monke, 1888, p. 228; OD*]. Small platycones; umbilicus 25–30% of diameter; prominent ventrolateral shoulders and strong keel on venter; weak ribs are falcoid and bifurcating; simple suture. Might be microconch or juvenile of Radstockiceras. Lower Jurassic (lower Pliensbachian, Jamesoni Zone); England, western Scotland, lower Pliensbachian Zone). England.—Fig. 23, 4a–b. *H. sphenosphatos* (Monke), lectotype, Caprarious-schichten, Herford, Westphalia, Germany, x1.5 (Monke, 1888, pl. 3, 14, 14a).

Paracymbites Trueeman & Williams, 1927, p. 247 [*P. obsoletus*; OD] =Ammonites dennyi Simpson, 1843, p. 9). Shell small, involute; umbilicus about 25% of diameter, but last whorl may be excentric; whorl section semicircular, becoming parallel sided; venter rounded or fastigate with very faint keel; aperture with ventral rostrum; body chamber about three-quarters of a whorl; smooth or faintly plicate (Donovan, 1966). Lower Jurassic (upper Sinemurian, Raricostatum Zone): Britain, Morocco, Tunisia.—Fig. 23, 5a–c. *P. dennyi* (Simpson); a–b, lectotype, Robin Hood’s Bay, North Yorkshire, England, x2 (Buckman, 1909, pl. 7, 1); c–d, holotype of Paracymbites obsoletus Trueeman & Williams, Stanton Fields railway cutting, Cheltenham, Gloucestershire, England, x4 (Donovan, 1966, pl. 53, 6–7); e, Folly Lane brick pit, Cheltenham, Gloucestershire, England, suture, x8 (Donovan, 1966, p. 316, fig. 2c).

Paraxynotinoticeras Pia, 1914, p. 18 [*Ammonites salisburyensis Hauer, 1856, p. 47; SD Spath, 1924, p. 206] =Paracymbites Arkell, 1957, p. 243, nom. null., misspelling. Platycones with compressed whorls and attains large sizes; umbilicus small on inner whorls, increasing with growth, and last whorl eccentrically coiled; venter sharp or rounded on inner whorls, rounded on outer whorls; ornament on inner whorls like Oxynoticeras, changing on later whorls to straight, blunt, simple ribs, which may bear midlateral tubercles; suture as in Oxynoticeras. Lower Jurassic (upper Sinemurian); England, Europe, Morocco, Tunisia.—Fig. 25, 1a–b. *P. salisburyensis* (Hauer), lectotype, red cephalopod limestone, Adnet, Austria, x0.7 (Hauer, 1856, pl. 13, 1–2).—Fig. 25, 1c–d. Adnet, Austria; c, side, x0.5 (Pia, 1914, pl. 1, 2f); d, cross section of outer whorl, x0.5 (Pia, 1914, p. 20, 1a).

Slatterites Spath, 1923b, p. 87 [*Agcoceras slatteri* Wright, 1882, p. 374; OD]. Small sizes; oxyzone inner whorls with sharp venter passing rapidly into more evolute, thicker, oval whors with rounded venter; last whorl has blunt ribs, straight or curving backward; ribs may alternate on opposite sides of shell; suture has broad, simple elements like those of Eparietites. Lower Jurassic (upper Sinemurian, Oxynotum Zone): England.—Fig. 25, 2a–c. *S. slatteri* (Wright), holotype, Lower Lias Clay, Pershore, Worcestershire, x1 (Wright, 1882, pl. 50, 1–3).

Family CYMBITIDAE Buckman, 1919

[Cymbitidae Buckman, 1919a, p. B]

Diagnosis as for Cymbites. [This is a long-ranging genus showing little change with time. Its origin is obscure. The suture resembles those of the Psiloceratidae and early Arietitidae; Cymbitidae are probably derived from Arietitidae in view of the low keel present in some examples.] Lower Jurassic (Sinemurian–Pliensbachian).
umbilicus opening out from less than 20% to 35–40% of the diameter; small size, usually less than 20 mm, and has about four whorls; venter smooth, rounded or fastigiate; aperture constricted and has ventral rostrum; shell smooth or plicate, rarely with lateral tubercles, giving cadicone appearance to inner whorls; suture simple, with constricted saddles in some specimens. Lower Jurassic (Sinemurian–Pliensbachian): northern Europe, Tunisia, United States (Oregon).——Fig. 26, 1a–c. *C. globosus* (Zieten), neotype, Sinemurian, Fulbach, near Dürnau, Württemberg, Germany; a–b, ×3; c, suture, ×7 (Schindewolf, 1961, pl. 29, 1; p. 203, fig. 1).——Fig. 26, 1d–f. *C. centriglobus* (Oppel), lectotype, upper Pliensbachian, Dürnau, Württemberg, Germany; d–e, ×3; f, suture ×6 (Schindewolf, 1961, pl. 31, 1; p. 219, fig. 22).

?Hyerifalchia FUCINI, 1907, p. 648 [*H. solitaria*; OD] [=Hierifalchia FUCINI, 1907, p. 654, nom. null., misspelling]. Small (7 mm in diameter), smooth sphaerocone with closed umbilicus, and depressed inner whorls that become more compressed; ventral keel well defined; suture has 3 nearly equal saddles. Known from a single specimen; probably a synonym of *Cymbites* (Donovan, 1990, p.
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

258. Lower Jurassic (?Sinemurian): Italy.—Fig. 26, 2a–b. *H. solitaria*, holotype, Gerfalco, La Spezia, Tuscany, ×2 (Fucini, 1907, pl. 11, 28, 30).

**Superfamily**

**EODEROCEARIOIDEA**

Spath, 1929

The basic shell form is an evolute septiconic, present from the earliest member (Eoderoceratidae) to the latest (Dactylioceratidae). Involute shells occur in Liparoceratidae and Amaltheidae, although both of these families also include septiconic genera, and _Pseudoamaltheus_ is an oxycone. The venter is typically rounded, but some Polymorphitidae have a fastigate venter, developing into a keel in _Tropidoceras_, and Amaltheidae have a ventral keel. Simple radial ribs are present on the side of the whorl in most genera. The ribs typically bear tubercles or spines at their outer ends and sometimes at or near their inner ends as well. Normally the number of outer and inner spines is the same, but in _L. (Liparoceras)_ there are more outer spines than inner ones. Some genera bear striae, fine ribs, or secondary ribs that may pass over the venter. Longitudinal (spiral) ornament is present in some Liparoceratidae and their derivatives Amaltheidae. The majority of genera show little change of ornament with growth, but there are notable exceptions, such as _Androgynoceras_ (see diagnosis for Liparoceratidae), _Epidoceras_, and _Phricodoceras_, in which strong modifications of the outer whorls may occur. Adult sizes range from a diameter of only 20–30 mm in some genera, to up to 500 mm in the giant genera _Apoderoceras_, _Epidoceras_, and _Liparoceras_.

The suture is very similar to that of Psiloceratoidea, except that in the interpretation of Schindewolf (1962), it lacks the minor umbilical element U4. Many genera have sutures with highly subdivided, arborescent saddles, and a few have simplified sutures.

The earliest genus is _Microderoceras_ from the _Semicostatum_ Zone of Germany; its immediate ancestors are unknown. The origin of the superfamily may be found in such Tethyan genera as _Ectocentrites_, which is among the earliest Lytoceratoidea, but Schindewolf (1962) suggested derivation from the Psiloceratoidea, on the basis of suture comparisons. The latest members of the superfamily are the Dactylioceratidae genera _Catacoeloceras_ and _Collina_ in the upper Toarcian, _Variabilis_ Zone.
Geographical range is worldwide. In Europe, the greatest variety of genera occur in countries to the north of the alpine belt, and some genera are largely or wholly restricted to this area (DOMMENGUES & MEISTER, 1999). The family-group names based on the genus *Eoderoceras* have a complicated nomenclatural history that has been summarized by EDMUNDS (2009, p. 22–23). Despite the inclusion in the superfamily EoderoCeratoidea of many family names that have date priority but have never been used, previous family and subfamily names dating from the Lower Jurassic (Sinemurian–upper Toarcian).

Shells evolve with little change of form during growth. Early smooth stage may be prolonged, followed by simple ribs, which at some stage of growth bear spines at their ventral ends, and at their umbilical ends as well in some genera (*Microderoceras*, *Bifericeras*). Venter smooth, or with blunt ribs (*Promicroceras*) or weak secondary ribs. Keel absent. *Lower Jurassic* (Sinemurian–lower Pliensbachian).

**Subfamily EODEROCCERATINAE**

Spath, 1929

[=Deroceratidae, 1867, p. 81, invalid based on junior homonym; =Promicroceratidae, 1867, p. 90, invalid based on junior homonym; =Promicroceratidae, 1867, p. 91, invalid based on junior homonym; =Hemimicroceratinae, 1867, p. 91, invalid based on junior homonym; =Microceratidae, 1867, p. 121; SD Spath, 1926b, p. 171]. Evolute, with very slight overlap of whorls; whorl section subcircular or subquadrate; seven or more whorls that may reach large size; innermost whorls smooth, ribs appearing on about third or fourth whorl and becoming bituberculate on outer whorls; venter smooth or with faint, close ribbing. *Lower Jurassic* (lower Sinemurian, Semicoctatum–Turneri Zones): Europe, Morocco, Tunisia, Indonesia (Timor, Roti), Canada (Yukon), USA (Alaska), Mexico, Chile, Argentina, Peru.——Fig. 27,1a–b. *M. birchi* (J. Sowerby), lectotype (designated by DONOVAN & FORSEY, 1973, p. 10), Turneri Zone, Dorset, England, X0.7 (new, The Natural History Museum, London, BMNH 43923).

**Xipheroceras** Buckman, 1911, p. iv [*X. planicosta*; OD; Article 11.10, ICNZ Code (1999); =Ammonites ziziphus Zieten, 1830 in 1830–1833, p. 6] (=Praederoceras Dietz, 1916, p. 199; Dietz, 1923, p. 407, obj.; =Postderoceras Schinde-Wolf, 1923, p. 368, nom. nud.]. Evolute, with very slight overlap of adjacent whorls; whorl section subcircular, becoming more compressed on outer whorls; 7 to 8 whors, reaching large size; innermost whors smooth, all later whors bear straight ribs; periodic ribs are enlarged on middle whors and bear strong ventral tubercles or spines; this stage is preceded and followed by ordinary ribs, which may bear ventrolateral tubercles. *Lower Jurassic* (upper Sinemurian, Obtrusum Zone): Europe, Vietnam, Indonesia (Borneo).— —Fig. 27,2a–d. *X. ziziphus* (Zieten); a–b, holotype, Boll, Württemberg, Germany, X1 (new, The Natural History Museum, London, BMNH 62590); c–d, Obtrusum Zone, Dorset, England, holotype of *X. planicosta* Buckman, X0.4 (new, British Geological Survey, Keyworth, Nottingham, England, GSM 25033).

**Family EODEROCCERATIDAE**

Spath, 1929

[=Deroceratidae, 1867, p. 81, invalid based on junior homonym; =Xipheroceratidae Spath, 1925a, p. 305; =Microceratidae Spath, 1926b, p. 176, invalid based on junior homonym; =Hemimicroceratidae Smith, 1929, p. 270; replacement for Microceratidae. —DUBarieRiceratidae DOMMENGUES & MEISTER, 1999, p. 281]
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 27. Eoderoceratidae (p. 38–40).

1a

1b

Microderoceras

1c

Promicroceras

2a

2b

Xipheroceras

2c

2d

3a

3b

4a

4b

4c

4d

4e

Bifericeras

Fig. 27. Eoderoceratidae (p. 38–40).
Promicroceras Spath, 1925a, p. 304 [*Ammonites planicosta J. Sowerby, 1814, p. 167; OD]. Evolute, slight overlap of whorls, compressed whorl section; small in size and attains about 5 whorls; inner whorls smooth, outer whorls bear straight, sharp ribs that become broad and flattened as they pass over venter. May be the microconch of Microderoceras or Xipheroceras. Lower Jurassic (Sinemurian, Turneri–Obtusum Zones): Europe.—Fig. 27, 3a–b. *P. planicosta (J. Sowerby), neotype, Obtusum Zone, Dorset, England, ×1.5 (new, The Natural History Museum, London, C.2235b).

Bifericeras Buckman, 1913, p. iii [*Ammonites bifer Hyatt, 1867, p. 80, non Hall, 1845, p. 294 (type, Ammonites confusus Quenstedt, 1856 in 1856–1858, p. 127, SD Buckman, 1924, p. 24); =Hemi­microceras Spath, 1925a, p. 140 (type, H. thompsoni, OD); =Ophideroceras Spath, 1925a, p. 137 (type, O. ziphoides, OD)]. Evolute, small size and up to 6 whorls; only slight overlap of whorls; whorl section subcircular or depressed; umbilicus 50–60% of diameter; inner whorls smooth, outer whorls develop bold straight ribs that bear umbilical and ventrolateral spines in some species (including the type species), but ribs are poorly developed in other species; venter smooth or crossed by low ribs. Lower Jurassic (upper Sinemurian); Europe.—Fig. 27, 4a–c. *B. bifer (Quenstedt), Balingen, Württemberg, Germany; a–b, holotype, ×1 (Quenstedt, 1846 in 1845–1849, pl. 14.4); c–d, ×2 (Söll, 1957, pl. 19.4); e, suture, ×4 (Söll, 1957, pl. 404, fig. 32).

Eoderoceras Spath, 1925a, p. 363 [*Deroceras bispini­gerum Buckman, 1918b, p. 302; OD] =Paramicro­deroceras Dommergues, Ferretti, & Meister, 1994, p. 36 (type, Microderoceras birchiades Rosenberg, 1909, p. 262, OD); =Paraderoceras Venturi, Nannarone, & Bilotta, 2004, p. 372 (type, P. piceum, OD). Evolute serpenticones; whorl section subcircular to coronate; umbilicus about 50% of diameter; innermost whorls smooth; later whorls become ribbed; prominent ventrolateral tubercles or spines and smaller umbilical edge tubercles occur on the ribs; minor ribs or striae develop between the spinose ribs and pass over the venter; suture has arborescent saddles. Lower Jurassic (upper Sinemurian, Oxynotum Zone–lower Plenus­bacinian, lowest part of Jamesoni Zone): Europe, Turkey, Morocco, Tunisia, Japan, Indonesia (Timor), Canada (British Columbia, Alberta), USA (Nevada, Oregon), Mexico.—Fig. 29, 1a–c. *M. muticum (d’Orbigny), Saint-Amand-Montond, Cher, France; a, lectotype, ×0.8 (J. C. Fischer, 1994, pl. 22, 12); b–c, d’Orbigny’s original reconstructed figure based on the lectotype, ×0.8 (d’Orbigny, 1844 in 1842–1851, pl. 80).

Dubariceras Dommergues, Mouterde, & Rivas, 1984, p. 833 [*D. dubari; OD] =Farrinaccites Faraoni & others, 1997, p. 98 (type, P. clavatus, OD). Similar to Metaderoceras, but whorl section higher and more compressed, has low, rounded venter, and many more ribs; inner whorls almost smooth, then with closely spaced, weakly sigmoidal ribs that do not change with growth; ventrolateral spines small, sharp, joined across venter by weak ribs with slight forward curve; suture similar to Meta­deroceras. Lower Jurassic (lower Plenus­bacinian, mainly Ibex Zone): Italy, Hungary, southeastern Spain, Turkey, Morocco, Canada (British Columbia), USA (Alaska, Nevada, Oregon), Mexico, Chile, Argentina.—Fig. 29, 2a–b. *D. dubari, holotype, Caravaca, Murcia, Spain, ×1 (new, Palaeontology Department, Granada University, Spain, no. G2-1; also figured in Dommergues, Mouterde, & Rivas, 1984, pl. 1, 10–11).
Hyperderoceras Spath, 1926a, p. 47, footnote 1 [*Ammonites armatus ruga Quenstedt, 1884 in 1882–1888, p. 206; OD; =Ammonites retusus Simpson, 1855, p. 62]. Evolute, strongly ribbed eoderoceratids, in which some ribs, at irregular intervals (about 5 to 12 per whorl), are flared and bear ventrolateral tubercles; the tuberculate ribs bifurcate, others cross venter without loss of strength, giving it a corrugated appearance. Lower Jurassic (lower Pliensbachian, Jamesoni Zone): England, southern Germany.—Fig. 29,3a–b. H. retusum (Simpson), paralectotype of Ammonites armatus ruga Quenstedt (1884 in 1882–1888, pl. 25,10) (the lectotype [Quenstedt, 1884 in 1882–1888, pl. 25,9] is lost), Gomaringen-Hinterweiler, Tübingen, Germany, X1 (new, Geologisches-Paläontologisches Institute, Tübingen University, Germany, Ce 5/25/10; also figured in Schlegelmilch, 1976, pl. 26,4).
Parahyperderoceras SCHLATTER, 1980, p. 62 [“Ammonites planarnatum” QUENSTEDT, 1856 in 1856–1858, p. 153; OD]. Shells fairly evolve with strong, straight, primary ribs that cross venter, separated by concave spaces in which there may be fine striate ribs; some slightly weaker secondary ribs are intercalated, and this ornament shows little change with growth. Lower Jurassic (lower Pliensbachian, Jameson Zone): southern Germany.—Fig. 29,a–b. *P. planarnatum* (QUENSTEDT), holotype, Pliensbach, Göppingen, Württemberg, ×0.67 (new, Geologisches-Palaeontologisches Institute, Tübingen University, Germany, Ce 5/271; also figured in Schlegelmilch, 1976, pl. 27,2).

Subfamily FANNINOCERATINAE Dommergues & Meister, 1999

[“Fanninoceratinae” DOMMERGUES & MEISTER, 1999, p. 282]

Involute oxycones, with sharp, fastigiated, or keeled venter; ribs at least on inner whorls, and ventrolateral tubercles in some; outer whorls becoming smooth in some. [*Fanninoceras*] has usually been placed in the Oxynoticeratidae because of its resemblance to the genus *Radstockiceras* (DONOVAN, CALLOMON, & HOWARTH, 1981; SMITH & TIPPER, 1996); but in the lower Pliensbachian of South America, an evolutionary series can be demonstrated from *Eoamaltheus* in the *Ibex* Zone through intermediates (e.g., HILLEBRANDT, 1990, fig. 4–4; HILLEBRANDT & others, 1992, pl. 11,6, into *Andidiscus* and *Fanninoceras*, which then ranges up into the lowest Toarcian (HILLEBRANDT, 1987, 2006; HILLEBRANDT & others, 1992). *Eoamaltheus* may be derived from *Dubariceras* or *Metaderoceras*, and the subfamily *Fanninoceratinae* is placed here in the Eoderoceratidae (Dubariceratidae of DOMMERGUES & MEISTER, 1999, p. 282); however, an alternative placement of Fanninoceratinae is in the Polymorphitidae, from the resemblance of the ancestral *Eoamaltheus* to some species of *Polymorphites*, e.g., some of the more costate specimens of *P. polymorphus* (HILLEBRANDT & SCHMIDT-EFFING, 1981; SMITH & TIPPER, 1996)]. Lower Jurassic (Pliensbachian–lowest Toarcian): western North and South America.

*Eoamaltheus* HILLEBRANDT, 1981, p. 510 [“E. meridians” OD]. Inner whorls evolve, with ventral keel; sigmoidal ribs are projected well forward on venter and bear medium to large ventrolateral tubercles; larger whorls more compressed, with some bifurcating or intercalated ribs, and tubercles are gradually lost. Lower Jurassic (lower Pliensbachian, Meridians Zone [=top Ibex Zone–lower Davoci Zone]): Chile, Argentina.—Fig. 30,4a–d. [“E. meridians”, Quebrada Amolanus, southeast of Copiapo, Atacama, Chile; a–b, holotype, microconch, ×2; c–d, macroconch, ×1 (Hillebrandt, 2006, pl. 27,18a–b, 19a–b).

*Andidiscus* HILLEBRANDT, 2006, p. 167 [“A. volkheimeri” OD]. Early whorls moderately evolve, with sharp, straight to gently sinuous ribs curving forward to join the midventral keel; middle and outer whorls become more involute and compressed with an angled umbilical edge, vertical or undercut umbilical wall, and a more acute venter. Appears to be dimorphic: macroconchs attain 200 mm in diameter with fading ribs at large sizes in some species; microconchs are much smaller and strongly ribbed to the end of growth. Intermediate in morphology and age between *Eoamaltheus* and *Fanninoceras*. Lower Jurassic (lower Pliensbachian, Behrendseni Zone [=mid–upper Davoci Zone]): Argentina, Chile.—Fig. 30,2a–b. [“A. volkheimeri” holotype, macroconch, Puesto Araya, Rio Atuel, Mendoza, Argentina, ×1 (Hillebrandt, 2006, pl. 39,1,2a–b).

*Fanninoceras* McLearN, 1930, p. 4 [“E. fannini” OD] [=*Austromorphone* LEANZA & BLASCO, 1990, p. 164 (type, “Amaltheus spinatus BURCKHARDT, 1900,” p. 22, non Ammonites spinatus BRUGUIERE, 1789 in 1789–1792, =*Oxynoticeras behrendseni* JAWSKIE, 1926, p. 233)]. Early whorls moderately evolve and depressed, with rounded venter and variable ribbing; then whorls quickly become involute, compressed oxycones, with sharp venter, angled umbilical edge, undercut umbilical wall, and ribbing that gradually disappears; attains sizes of at least 200 mm in diameter. Lower Jurassic (upper Pliensbachian–base of Toarcian).

F. (*Fanninoceras*). Inner whorls have rounded venter without a keel, and single, undivided ribs; large whorls are highly involute, compressed oxycones, and are smooth. Lower Jurassic (upper lower Pliensbachian–base of Toarcian): Canada (British Columbia), USA (Alaska, Nevada, Oregon), Mexico, Chile, Argentina, Peru.—Fig. 30,3a–b. [“F. (E.) fannini” holotype, Kunae Zone, upper Pliensbachian, Fannin Bay, Maude Island, Queen Charlotte Islands, Canada, ×1 (Smith & TIPPER, 1996, pl. 3.2)].

F. (*Charlotticeras*) SMITH & TIPPER, 1996, p. 32 [“F. (C.) carteri” OD]. Inner whorls have incipient ventral keel and ribs that bifurcate irregularly with some intercalated secondaries; ribs are projected on venter; known only up to 26 mm in diameter; ostechome stage unknown. Lower Jurassic (upper Pliensbachian, Kunae Zone): Canada (British Columbia).—Fig. 30,4a–b. [“F. (C.) carteri” holotype, Fannin Bay, Maude Island, Queen Charlotte Islands, ×1.5 (Smith & TIPPER, 1996, pl. 6.1).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 29. Eoderoceratidae (p. 40–41).
Inner whorls depressed, coronate, with strong primary ribs. Tubercles at outer ends of primaries give rise to fine secondary ribs. On middle and outer whorls of large forms (Apoderoceras, Pseudoskirroceras, Tetraspidoceras), the coronate shell form is lost and the shell becomes evolute with subcircular or subquadrate whorl section; the middle whorls of these large forms are ribbed and have moderate or large ventrolateral or lateral tubercles, while the ribbing may be lost on the outer whorls. Suture very elaborate, with large saddle between lobes E and L. [The presence of coronate inner whorls in Tetraspidoceras is uncertain, and this genus is included in the family on the basis of its resemblance to Apoderoceras]. Lower Jurassic (upper Sinemurian–lower Pliensbachian).

Fig. 30. Eoderoceratidae (p. 42).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Coeloceras HYATT, 1867, p. 87 [*Ammonites pettos QUENSTEDT, 1843, p. 178; SD BUCKMAN, 1898b, p. 454]. Shell corona, with possibly 7 whorls, each whorl overlapping about one-third of previous one; primary ribs end at ventrolateral angle in tubercles that give rise to secondary ribs; body chamber unknown. Lower Jurassic (lower Pliensbachian): Europe, Turkey, Tunisia.—Fig. 31.1a–c. *C. pettos (QUENSTEDT), lectotype, Lias t, Pliensbach, Württemberg, Germany; a–b, ×1 (Schlatter, 1977, pl. 2, 5a–b; also figured in Donovan & Forsey, 1973, p. 10, pl. 2,2); c, suture, Kirkheim, ×1.5 (Schindewolf, 1962, p. 522, fig. 112e).

Andicoeloceras HILLEBRANDT, 2006, p. 80 [*A. jeneni; OD]. Evolute and cadicone, with corono inner whors and attains large sizes; depressed whorl section with greatest width at ventrolateral angle; broad arched venter; straight ribs up to large ventrolateral tubercles give rise to 2 or more secondary ribs curving gently forward across venter; dimorphism unknown. With larger and more massive whors and tubercles and coarser ribs than Coeloceras. Lower Jurassic (lower Pliensbachian, lower Externum Zone [=upper Jameson–lower Ibex Zones]): Chile, Argentina.—Fig. 31.2a–b. *A. jeneni, Hacienda Manflas Region, Atacama, Chile; a, holotype (Hillebrandt, 1981, pl. 4,2a); b, holotype, ×0.8 (Hillebrandt, 2006, pl. 16,7b).

Pimelites FUCINI, 1896a, p. 124 [*P. populonius; OD]. Small involute cadicione, inner whors smooth or weakly ornamented, later whors develop ornament like Coeloceras; last whor becomes abruptly contracted and more evolute; suture has large external saddle. Probably a microconch. Lower Jurassic (lower Pliensbachian, probably Ibex Zone): Italy, Turkey.—Fig. 31.3a–c. *P. populonius, lectotype, Monte Calvi, Tuscany, Italy; a–b, ×2; c, suture, ×3 (Fucini, 1896b, pl. 25(2),16).

Praesphaeroceras LEVI, 1896, p. 275 (15th September 1896) [*P. campiliense; OD] [=Diaporthis FUCINI, 1896a, p. 124 (before 22nd December 1896) (type, D. vetulonius, OD)]. Inner whors involute, sphaerocone, or cadicone, with strong ribs on umbilical slope; later whors become compressed, and final whorl is eccentrically coiled; small size (less than 20 mm in diameter); aperture plain, hooded; blunt primary ribs on middle whors are continuous across venter; secondary ribs appear on final whors; suture has large external saddle, like that of Pimelites. Probably a microconch. Lower Jurassic (lower Pliensbachian, Ibex Zone): Italy.—Fig. 31.4a. *P. campiliense, lectotype (designated by DONOVAN & FORSEY, 1973, p. 11), beds with ‘Terebratula′ aapisia, near CETONA, Tuscany, ×1,5 (Levi, 1896, pl. 8,13).—Fig. 31.4b–d. *P. vetulonius (FUCINI), lectotype (designated by DONOVAN & FORSEY, 1973, p. 10), Monte Calvi, Tuscany; b–c, ×3; d, suture, ×8 (Fucini, 1896b, pl. 25(2),1e, 1e, 9).

Miltoceras WIEDENMAYER, 1980, p. 172 [*Argoceras sellae GEMMELLARO, 1884, p. 179; OD]. Planulates, with closely spaced ribs and small ventrolateral tubercles that give rise to numerous secondary ribs on venter. Ornament somewhat like middle whors of Apoderoceras, but shows little change with growth and lacks cadicone inner whors of that genus. Lower Jurassic (lower Pliensbachian): Austria, southern Europe, Tunisia, Canada (British Columbia), Chile, Argentina.—Fig. 31.5a–b. *M. sellae (GEMMELLARO), lectotype (designated by HOWARTH, herein), Strati a ‘Terebratula′ aapisia, Galati, Province Messina, Sicily, ×1 (Gemmellaro, 1884, pl. 3,1–2).

Meridiceras HILLEBRANDT, 2006, p. 60 [*M. externum; OD]. Evolute whors, only slightly overlapping; quadrate whorl section, with flat whorl sides and arched venter; straight or slightly curved ribs on inner whors with small ventrolateral tubercles angled strongly forward on venter to form a raised and corded midventral pseudokeel. Dimorphic: microconchs are adult at about 33 mm in diameter, and retain ribs and pseudokeel to the end of growth; macroconchs reach 145 mm in diameter, and ribs, tubercles, and keel diminish on whors larger than 50 mm in diameter. Differs from Miltoceras in its arched venter with corded pseudokeel on inner and middle whors. Lower Jurassic (lower Pliensbachian, Externum Zone [=upper Jamesoni and Ibex Zones]): Chile, Argentina, Peru.—Fig. 32.1a–d. *M. externum, Quebrada Dona Ines Chica, northeast of El Salvador, northern Chile; a–b, holotype, complete macroconch, ×0.5 (Hillebrandt, 2006, pl. 8,1a, 1d); c–d, paratype, complete microconch, ×1 (Hillebrandt, 2006, pl. 7,16a–b).

Pseudoskirroceras WIEDENMAYER, 1980, p. 172 [*Coeloceras mastodon FUCINI, 1935, p. 90 (166); OD]. Very evolute, has many whors, and attains sizes up to 480 mm in diameter. Differs from Miltoceras in having depressed, cadicone inner whors, more widely spaced primary ribs that end in tubercles that are lower on the whor side, and fewer, coarser secondary ribs on the venter. Lower Jurassic (lower Pliensbachian): southern Europe, Tunisia, Morocco, Canada (British Columbia), USA (Oregon), Mexico, Chile, Argentina.—Fig. 32.2. *P. mastodon (FUCINI), lectotype (designated by HOWARTH, herein), Serra Franchise, Taormina, Sicily, ×0.15 (Fucini, 1935, pl. 10(40),3).

Zamaiceras RAKUS & GUEx, 2002, p. 115 [*Z. mangoldi; OD]. Evolute, with depressed, cadicone inner whors, becoming more compressed on outer whors; fine, slightly sigmoidal ribs are continuous, though diminished, across venter; small ventrolateral tubercles. Small, known only up to 15 mm in diameter, and apparently are adult microconchs at this size. Corresponding macroconchs are not known; possible macroconchs are Pseudoskirroceras or Coeloceras, but these are older in age, i.e., occur in the Jamesoni Zone, not Ibex Zone. Differs from Polymorphites (Polyomorphitinae) in having cadicone inner whors. Lower Jurassic (lower Pliensbachian, Ibex Zone): Tunisia.—Fig. 32.3a–c. *Z. mangoldi, holotype, bed 5, Jebel Staa mines, Massif de Zaghoun; a, side view; b, venter; c, whorl
section, ×2 (Rakus & Guex, 2002, pl. 32,13; p. 117, fig. 92a, 92c).

**Apoderoceras** Buckman, 1921, pl. 235 [*A. lobulatum; OD]. Evolute with about 8 whorls having slight overlap; innermost whorls coronate, like *Coeloceras*, then becoming serpenticone with subquadrate whorl section that has ventrally divergent whorl sides; attains large sizes; moderately strong, straight ribs on inner whorls become weaker or striate on middle and outer whorls; moderate to
strong ventrolateral tubercles throughout but may weaken on large outer whorls; suture has strongly dissected arborescent saddles. Lower Jurassic (lower Pliensbachian, Jamesoni Zone): Europe, USA (Alaska), Argentina.—FIG. 33,1a–b. *A. lobulatum*, holotype, Armatum Bed, Jamesoni Zone, Radstock, Avon, England, ×0.4 (Buckman, 1921, pl. 235).—FIG. 33,1c–d. *A. aculeatum* (SIMPSON), holotype of *A. triornatum* BUCKMAN, 1928, pl. 783A–B, Armatum Bed, Radstock, Avon, England, ×0.3 (new, British Geological Survey, Keyworth, Nottingham, England, GSM 49353).

**Tetraspidoceras** Sp. Th, 1926a, p. 47 [*Ammonites quadrarmatus* DUMORTIER, 1869, p. 60; OD]. Planulate, becoming serpentine; whorl section compressed, becoming subquadrate; umbilicus increases proportionately with growth to nearly 60% of diameter in adult; attains large sizes; inner and middle whors have closely spaced ribs or striae, continuous over venter, with periodic
stronger, bituberculate ribs; final whorl smooth with distant pairs of tubercles only. *Lower Jurassic (upper Sinemurian, Racirostatum Zone–lower Pliensbachian, Jamesoni Zone): Europe, Morocco, Tunisia, Indonesia.*——Fig. 32, a–b. *T. quadrarmatum* (Dumortier), lectotype (designated by Edmunds, 2009, p. 60; original of Dumortier, 1869, pl. 9), “Zone of Belemnites clavatus” (Jamesoni Zone), St-Fortunat-au-Mont d’Or, France, ×0.25 (Dumortier, 1869, pl. 9, pl. 11, 1).

**Bakonyceras** Meister & Géczy in Géczy & Meister, 2007, p. 206 [*Tetraspideroceras quadrarmatum evolutum Géczy, 1976, p. 49; OD.*] Highly evolve serpenticones attaining large sizes, with quadrate whorl section, large, wide umbilicus and flat venter; straight, single ribs bear moderate to large tubercles or spines near umbilical edge and end at larger ventrolateral spines; 3–4 low secondary ribs cross venter between each primary rib. More evolve than *Tetraspideroceras.* *Lower Jurassic (lower Pliensbachian, basal Jamesoni Zone): Hungary.*——Fig. 33, a–c. *B. evolutum* (Géczy), Kávésterő, Bakony Mountains, Hungary: a, holotype, side, ×0.3; b, paratype, venter, ×0.5 (Géczy, 1976, pl. 7, 1, holotype; pl. 9, 1a, paratype); c, venter of a topotype, ×0.3 (Géczy & Meister, 2007, pl. 34, 1).

**Family PHRICOCERATIDAE** Spath, 1938


Inner whorls strongly ribbed, bituberculate, with secondary ribs on venter. Large forms develop compressed outer whorls, with loss of ornament, so that there is a strong contrast between inner and outer whorls. Suture very complex. *Lower Jurassic (upper Sinemurian–lower Pliensbachian).*

**Phricodoceras** Hyatt, 1900, p. 587 [*Ammonites taylori* J. de C. Sowerby, 1826, p. 23; OD] [*Hemipariodiceras Géczy, 1959, p. 143 (type, H. urruticum, OD)]. Can attain large sizes, and large individuals have contrasting inner and outer whorls; earliest whorls are evolute, becoming platycone, each whorl overlapping up to one-third of preceding whorl; middle whorls have strong ribs that are continuous over venter and have large lateral and ventrolateral spines; outer whorls become rapidly expanding and compressed, with trapezoidal whorl section, close ribs and spines much reduced or absent; suture has arborescent saddles in large examples. Small individuals with body chambers may be microconchs. *Lower Jurassic (lower Pliensbachian):* Europe, Turkey, Indonesia (Timor, Rote), Canada (British Columbia), USA (Oregon).——Fig. 34, a–b. *P. taylori* (J. de C. Sowerby), Jamesoni Zone, Robin Hood’s Bay, Yorkshire, England (holotype is lost), ×1 (new, The Natural History Museum, London, BMNH C.17981; also figured in Dean, Donovan, & Howarth, 1961, pl. 68, 5).——Fig. 34, 1c–d. *P. lamellosum* (D’Orbigny), Jamesoni Zone, Jamesoni Limestone, Radstock, Avon, England, ×0.67 (new, The Natural History Museum, London, BMNH C.41767; also figured in Buckman, 1920, pl. 149D).

**Pseudophricodoceras** Mouterde, Dommergues, & Rocha, 1983, p. 196 [*P. caprariforme; OD.*] Moderately evolve platocones, umbilicus 35–45% of diameter; whorl section subquadrate, compressed, becoming oval, and convergent on outer whorls; ribs curve slightly forward, and pass over venter without loss of strength on all whorls; ribs are bituberculate, but tubercules may be lost on outer whorls. *Lower Jurassic (lower Pliensbachian, Jamesoni Zone):* Portugal, northern Germany.——Fig. 34, a–b. *P. caprariforme,* holotype, Taylor Subzone, Quiaios, Vale das Fontes, Portugal, ×1 (Mouterde, Dommergues, & Rocha, 1983, pl. 1, 2a–b).

**Villaniana** Till, 1909, p. 194; Till, 1911, p. 45 [*Perisphinctes (Villania) densilobata; OD] [*Epidoceras Spath, 1923a, 10 (type, Ammonites roberti Hauer, 1854, p. 748, OD); = Coledoceras Spath, 1923a, p. 11 (type, Coledoceras ponticum Pia, 1913, p. 353, OD); = Omoderoceras Venteri, Nannarone, & Bilotta, 2004, p. 367 (type, O. cantianneuse, OD)]. Shell planulate, reaching large sizes, with 6–7 whorls; inner whorls subcircular in section, becoming more compressed; umbilicus 30–40% of diameter on inner whorls, 40–55% on outer whorls; primary ribs bituberculate on inner whorls, with secondary ribs crossing venter; tubercles and secondaries fade with growth, but primary ribs may fade or persist; rib frequency increases with size; suture has complex arborescent saddles. *Omoderoceras* is poorly known. [The Till (1909) publication date has not been recorded before, and the Till (1911) date is much better known.] *Lower Jurassic (upper Sinemurian, Racirostatum Zone–lower Pliensbachian, Jamesoni–Ibex Zones):* southern England, France, Switzerland, Austria, Hungary, Romania, Turkey.——Fig. 35, 1a–b. *V. densilobata,* holotype, wholly septate at 222 mm in diameter, lower Pliensbachian, Villány, Hungary, ×0.35 (new, Geological Institute, Budapest, Hungary).——Fig. 35, 1e–d. *V. steinmannii* (Hug), condensed fossil bed, Langeneckgrat, Canton Bern, Switzerland, half a whorl of body chamber; c, side; d, whorl section, ×0.3 (Donovan, 1958, pl. 7, 1).——Fig. 35, 1e–f. *V. ponticum* (Pia), holotype, lower Pliensbachian, Akdag, Amasya, Turkey, ×1 (Pia, 1913, pl. 15, 2).

**Foeterringeceras** Rakus & Guex, 2002, p. 103 [*Ammonites foetertas* Hauer, 1856, p. 61, OD.*] Moderately evolve platocones, with compressed, oval whorl section; slightly prostriated ribs issue in bundles of 3 or 4 from prominent tubercles at umbilical edge and pass over venter without interruption; ribs and umbilical tubercles may fade on outer whorl, but tubercules usually persist longer than ribs. Differs from *Villaniana* in the absence of a bituberculate stage, and strong umbilical tubercles that persist onto early part of final whorl. *Lower Jurassic (lower...
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 33. Coeloceratidae (p. 46–48).

*Pliensbachian, ?Jamesoni Zone*: Austria, eastern France, southwestern Germany, Turkey, Tunisia.——Fig. 34, 3a–b. *P. foetterlei* (HAUER), ?holotype, Adneth, Austria, ×0.7 (Hauer, 1856, pl. 19, 4–5).

*Pseuduptonia* BREMER, 1965, p. 162 [*Uptonia micromphala* Pia, 1913, p. 345; OD]. Inner whorls evolute, depressed, becoming subcircular in section; outer whorls compressed, each whorl overlapping one half or more of the preceding one. Has 5–6 whorls and adult at 50–100 mm in diameter; strong, straight primary ribs give rise to secondary ribs that continue over venter; rib density can increase or decrease with growth, and outer whorls have 25–40 ribs per whorl; ventrolateral tubercles usually absent, but rarely are present on inner whorls. *Lower Jurassic* (upper Sinemurian, lower Pliensbachian): Turkey.——Fig. 34, 4a–b. *P. micromphala* (Pia), lectotype (designated by DONOVAN & FORSEY, 1973, p. 11), lower Pliensbachian, Akdagh, Amasya, ×1 (Pia, 1913, pl. 14, 4d).
Fig. 34. Phricodoceratidae (p. 48–49).
Capreoliceras Alkaya & Meister, 1995, p. 153
[*C. asagiense; OD]. Evolute platycones, with compressed whorls and narrow, rounded venter; slightly prorsiradiate primary ribs are angled further forward in passing over unkeeled venter; on larger whorls, primary ribs bifurcate at ventrolateral edge or secondaries are intercalated; no tubercles. Similar to Pseuduptonia but more compressed and more evolute. Lower Jurassic (lower Pliensbachian, ?Jamesoni Zone): Italy, Turkey.—Fig. 35, 2a–b.  


Family POLYMORPHITIDAE
Haug, 1887

Evolute ammonites with compressed whorls; venter rounded, fastigiated, or with
small keel (*Tropidoceras*); smooth or ribbed, ribs usually forming ventral chevrons at some stage in growth; secondary ribs on outer whorls of some forms (*Acanthopleuroceras, Tropidoceras*); ribs may be plain or bear ventrolateral tubercles or both ventrolateral and umbilical tubercles during part of ontogeny. Usually distinguishable from Eoderoceratidae by fastigate venter or ventral chevrons or both. Lower Jurassic (upper Sinemurian—lower Pliensbachian).

*Kondiloceras* FUCINI (1901b, p. 14 [14]; type, *K. manciatti*, OD) was included in the family Polymorphitidae in the first edition of the ammonoid *Treatise* (ARKELL, 1957, p. 249, fig. 275,4), on account of the alleged Sinemurian or Pliensbachian age of the holotype, the only known specimen, at Monte Cetona, Italy. Though best treated as a *nomen dubium* owing to its poor preservation, it is probably a junior synonym of the Cretaceous genus *Barrausiceras* of Turonian or Coniacian age, and it was included as such in the revised volume of the Cretaceous ammonite *Treatise* (WRIGHT, 1996, p. 187).

**Subfamily POLYMORPHITINAE**

HAUG, 1887

*[nom. correct. ARKELL, 1950, p. 361, pro Polymorphitinae J. P. SMITH, 1913, p. 657, nom. transl. ex Polymorphitinae HAUG, 1887, p. 89] [=Tubellites BUCKMAN, 1924, pl. 491 (type, *Ammonites tubellus SIMPSON, 1855, p. 42, OD); =Leptonotoceras SPATH, 1925a, p. 170 (type, *Ammonites abnormalis HAUER, 1854, p. 757, OD); =Furlites VENTURI & FERRI, 2001, p. 134 (type, *F. involutus, OD); =Peliogoceras VENTURI, NANNARONE, & BILLOTTA, 2005, p. 109 (type, *P. pseudocarinatum, OD*)); Shell small, evolute, with circular, oval or compressed whorl section; smooth throughout, or ribbed and sometimes tuberculate) may occur in the present. Large variation in ornament (from striate to ribbed and sometimes tuberculate) may occur in an individual specimen (e.g., as on the questionable lectotype figured here). The specimen figured here is undoubtedly the original of QUENSTEDT (1884 in 1882–1889, pl. 30,32), from Hinterweiler; it might also be the lectotype, the original of QUENSTEDT (1845 in 1845–1849, pl. 4,9a–d), as designated by DONOVAN and FORSEY (1973, p. 12). Lower Jurassic (lower Pliensbachian, Jamesoni Zone): Europe, Russia (northeast), Canada (British Columbia).——Fig. 36.1a–d. *P. polymorphus* (QUENSTEDT); a–b, lectotype, Hinterweiler, Tübingen, Germany, ×2 (new, Geologisches-Palaeontologisches Institute, Tübingen University, Germany, Ce 5/30/32); c–d, Gomaringen-Hinterweiler, Tübingen, Germany, ×2 (new, Geologisches-Palaeontologisches Institute, Tübingen University, Germany, Ce 5/30/9).

**Gemmellaroceras** HYATT, 1906, p. 574 [*Aegoceras aenigmaticum* GEMMELARO, 1884, p. 189; OD] [=Tubellites BUCKMAN, 1924, pl. 491 (type, *Ammonites tubellus SIMPSON, 1855, p. 42, OD); =Leptonotoceras SPATH, 1925a, p. 170 (type, *Ammonites abnormalis HAUER, 1854, p. 757, OD); =Furlites VENTURI & FERRI, 2001, p. 134 (type, *F. involutus, OD); =Peliogoceras VENTURI, NANNARONE, & BILLOTTA, 2005, p. 109 (type, *P. pseudocarinatum, OD*)): Shell small, evolute, with circular, oval or compressed whorl section; smooth throughout, or smooth at first, then developing numerous, sharp, straight or sigmoidal ribs, which may be irregularly spaced, giving rise to fine secondary ribs that form chevrons on venter; suture may be asymmetrical. Lower Jurassic (upper Sinemurian, Raricostatum Zone–lower Pliensbachian, Jamesoni Zone): Europe, Morocco, Tunisia, Canada (British Columbia).——Fig. 36.2a–b. *G. aenigmaticum* (GEMMELARO), holotype, Strati a *Terebratula aspasia* Galati, Messina province, Sicily, ×1.3 (Gemmellaro, 1884, pl. 3,12,14).——Fig. 36.2c–d. *G. tubellus* (SIMPSON), holotype, probably Robin Hood's Bay, North Yorkshire, England, ×5 (Buckman, 1924, pl. 491).

**Parinodiceras** TRUEMAN, 1918, p. 66 [*Ammonites striatus parinodus QUENSTEDT, 1884 in 1882–1888, p. 226; OD] [=Platytoniceras SPATH, 1938, p. 17, 86 (type, *Ammonites alter OPPEL, 1862, p. 133, OD*)): Inner whorls fairly evolute, rather like Polymorphites, but whorl then expands rapidly, reaching diameter of more than 100 mm; flat whorl side bears primary ribs with small umbilical and ventrolateral tubercles, and fine secondary ribs cross venter; ornament varies between feebly and strong. Lower Jurassic (lower Pliensbachian, Jamesoni Zone): Europe, Indonesia.——Fig. 36.3a–c. *P. parinodus* (QUENSTEDT), lectotype, Ofderdingen, Württemberg, Germany, ×0.8 (new, Geologisches-Palaeontologisches Institute, Tübingen University, Germany, Ce 5/28/16).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

**Uptonia** Buckman, 1898b, p. 453 [*Ammonites jamesoni* J. de C. Sowerby, 1827, p. 105; OD]. Evolute planulates, with compressed, flat-sided whorls, each overlapping up to one-quarter of preceding one; up to 8 whorls and reaches large sizes; ribs on inner whorls form ventral chevrons, and ventrolateral tubercles may occur; tubercles are lost on larger whorls and ribs become thicker and tend to curve forward over venter. Inner whorls like those in some species of *Polymorphites*, except lacking irregularity of ornament. Lower Jurassic (lower Pliensbachian, Jamesoni Zone): Europe, Russia, Indonesia (Roti, Timor), Hong Kong, eastern Greenland, Canada (British Columbia), USA (Alaska), Chile, Argentina, Peru.——Fig. 37.1a–b. *U. jamesoni* (J. de C. Sowerby), neotype, Pabay Beds, Pabay, Scotland, ×0.5 (new, The Natural History Museum, London, BMNH C.40426; also figured in Donovan & Forsey, 1973, pl. 4, 3).——Fig. 37.1c–d. *U. lata* (Quenstedt), Cheltenham, Gloucestershire, England, ×1 (new, The Natural History Museum, London, BMNH C.2209).

**Platycleuroceras** Hyatt, 1867, p. 92 [*Ammonites brevispina* J. de C. Sowerby, 1827, p. 106; OD]. Platycone, more than 6 whorls; umbilicus 50–60% of diameter, whorl sides flat; venter smooth on inner whorls, crossed by ribs on outer whorls; ribs strong, and typically 20–30 ribs per whorl; bituberculate, inner tubercles appearing later than, and may fade earlier than, outer ones. Lower Jurassic (lower Pliensbachian, Jamesoni Zone): Europe, Morocco.——Fig. 37.2a–d. *P. brevispina* (J. de C. Sowerby); a–b, holotype, Pabay, Scotland, ×1 (new, The Natural History Museum, London, BMNH 43915); c–d, Radstock, Somerset, England, ×0.9 (new, The Natural History Museum, London, BMNH C.48955).

**Jamesonites** Buckman, 1923a, pl. 407 [*J. reticulatus*; OD]. Evolute planulates, attains large sizes and has about 7 whorls; closely spaced, weak ribs may give rise to secondaries that pass over venter; this ornament does not change with growth; suture complex with arborescent saddles. Lower Jurassic (Pliensbachian, Jamesoni Zone): southern

---

**Fig. 36. Polymorphitidae** (p. 52).
Fig. 37. Polymorphitidae (p. 53–55).
England, southern Germany, Tunisia.—*Fig. 37,3.* "J. reticulatus", holotype, Jamesoni Limestone, Radstock, Avon, England, ×0.3 (Buckman, 1923a, pl. 407).

Subfamily TROPIDOCERATINAE

Hyatt, 1900

[=Acanthopleuroceratinae ex Hyatt, 1900, p. 578] [=Tropidoceratinae Akelei, 1950, p. 361, pro Cycloceratinae Hyatt, 1867, p. 91, based on Cycloceras Hyatt, 1867, p. 93, non M'Coy, 1844, p. 10].

Platycones, with fastigiate or keeled venter. Lower Jurassic (lower Pliensbachian—lowest upper Pliensbachian).

Acanthopleuroceras Hyatt, 1900, p. 578 [*Ammonites valdani D'Orbigny, 1844 in 1842–1851, p. 255; SD Haug, 1885, p. 223; SD ICZIN Opinion 996, 1973, proposed by Hyatt, 1971, p. 8, amending Getty, 1970, p. 105] [*Cycloceras Hyatt, 1867, p. 92, non M'Coy, 1844, p. 10, obj.]. Platycone with about 7 whorls; umbilicus about 50% of diameter; venter fastigiate, becoming rounded on outer whorls; whorl section compressed with flat sides; earliest 2–3 whorls are corona and smooth; larger whorls bear bituberculate ribs that tend to be rursicostate, and weak secondary ribs cross venter to form chevrons. Lower Jurassic (lower Pliensbachian, Ibex Zone); Europe, Tunisia, Canada (British Columbia), USA (Alaska, Nevada), Argentina.——*Fig. 38,1a–b. *A. valdani (D'Orbigny), lectotype, Saint-Amand-Montrond, Cher, France, ×1 (Fischer, 1994, pl. 23,3a, 3c).

Tropidoceras Hyatt, 1867, p. 93 [*Ammonites massanum D'Orbigny, 1844 in 1842–1851, p. 225; SD Haug, 1885, p. 606] [*Eremiticeras Faroani & others, 2002, p. 223 (type, E. evolutum, OD)]. Platycone, with about 6 whorls, each whorl overlapping about one-third of preceding one; umbilicus 35–45% of diameter; venter angular on inner whorls but with strong keel on outer whorls; straight or sigmoidal bituberculate primary ribs give rise to fine secondary ribs that are angled forward over ventrolateral shoulder on outer whorls. Lower Jurassic (lower Pliensbachian, Jamesoni–Ibex Zones); Europe, Morocco, Tunisia, Turkey, ?Caucasus, Indonesia (New Guinea, Timor), Canada (British Columbia), USA (Alaska), Chile, Argentina, Peru.——*Fig. 38,2a–b. *T. massanum (D'Orbigny), holotype, Saint-Amand-Montrond, Cher, France, ×1 (new, IMP-R.1397, Institut de Paléontologie, Muséum d'Histoire naturelle, Paris, France; also figured in Dean, Donovan, & Hyatt, 1961, pl. 69,2).

Catriceras Venturi, 1978, p. 100, 111 [*C. cattienae, OD]. Platycones with whorls overlapping one-fifth to one-quarter of previous whorl; umbilicus 40–50% of diameter; venter with low, blunt keel; ribs sigmoidal and rursiradiate, bearing small umbilical tubercles and larger ventrolateral tubercles or nodes. Lower Jurassic (lower Pliensbachian); Europe.——*Fig. 38,3a–b. *C. cattienae, holotype, Corniola, Monte Catria, Appennino Marchigiano, Italy, ×1 (Venturi, 1978, pl. 1,3).

Daviceras Spath, 1920, p. 538 [*D. polymorphoides, OD]. Platycones with up to 6 whorls; umbilicus about 50% of diameter in adult; compressed, oval whorl section; dense, faintly biconcave, ribs throughout increase to about 100 per whorl on outer whorls; ribs terminate ventrally in small, elongated tubercles; midventral tubercles correspond to spacing of ribs; outer whorls may become smooth. Lower Jurassic (lower Pliensbachian—lowest upper Pliensbachian); southwestern England, Portugal, Italy, Canada (British Columbia), USA (Nevada, Oregon).——*Fig. 38,4a–b. *D. polymorphoides, holotype, Ibex Zone, Charmouth, Dorset, England, ×1 (new, The Natural History Museum, London, C.22102).

Paratropidoceras Dommergues, Meister, Souissi, & Abdallah, 2004, p. 470 [*P. numidiumanum, OD] [*Tunisiceras Dommergues, Meister, Souissi, & Abdallah, 2004, p. 466 (type, T. insolitus, OD)]. Large sub-oxycones with compressed, high whorls, and umbilicus about 25% of diameter; dense, sinusuous ribs bend strongly forward near venter to join strong keel; a few ribs branch, or secondary ribs are intercalated. More involute and has more ribs than Tropidoceras, and more involute, but generally less densely ribbed than Dayiceras. Lower Jurassic (lower Pliensbachian, upper Jamesoni–lower Ibex Zones); Tunisia.——*Fig. 38,5a–b. *P. numidianum, holotype, lower Ibex Zone, Jebel Stah, ×0.6 (Dommergues, Meister, Souissi, & Abdallah, 2004, pl. 1,1a–b).

Family LIPAROCERATIDAE

Hyatt, 1867

*Liparoceratidae Hyatt, 1867, p. 80* [*=Aegoceratidae Neuhaus, 1875, p. 878]*

The family includes two extreme morphological types: inflated sphaerocones (*Liparoceras*) and evolute serpenticones or so-called capricorns (*Aegoceras*). They are united in one family because ammonites occur in the Ibex and Davoei Zones, have inner whorls indistinguishable from contemporary *Aegoceras*, and body chambers indistinguishable from *Liparoceras*. These intermediate forms (*Androgynoceras*), variously referred to as hybrids or variocostates (and dimorphs by Spath, 1938), occur in association with the capricorns but are always more rare. The capricorns and hybrids show parallel evolutionary changes in size and ornament. For this reason, the capricorns and sphaerocones are regarded as being closely related.
Fig. 38. Polymorphitidae (p. 55).
in number (parinode), or there may be more tubercles in the outer row than the inner (imparinode). In imparinode forms, some inner tubercles are joined to two outer ones by ribs forming a V. The venter is crossed by blunt ribs that show much variation, from fine to coarse, in a single species. The inner row of tubercles is usually on or close to the umbilical edge. The sphaerocones have long body chambers and apertures with plain margins. The capricorns bear strong, simple body chambers and apertures with plain umbilical edge. The sphaerocones have long row of tubercles is usually on or close to the venter, which they may be projected forward, and their apertures may have a ventral rostrum. Most capricorns are smaller than most sphaerocones.

The coexistence of the three morphological forms, capricorns, hybrids, and sphaerocones, and the persistence of sphaerocones Liparoceras (Becheiceras) well into the Margaritatus Zone after all capricorns Aegoceras (Oistoceras) had disappeared at the top of the Davoei Zone, precludes the identification of dimorphism in Liparoceratidae at the present time. Liparoceratidae were probably derived either from Jamesoni Zone Parinodiceras (Pomphorhaphidae) or from Raricostatum Zone Tetraspidoceras (Coeloceratidae) (SPATH, 1938, p. 17). Lower Jurassic (Pliensbachian).

Vicinindiceras TRUEMAN, 1919, p. 264 ["V. simplicicosta; OD] [=Vicinindiceras ROMAN, 1938, p. 81, nom. null., misspelling]. Sphaerocones, attaining large sizes; with broad, rounded venter, and whorl thickness usually greater than whorl height; narrow umbilicus opens out on body chamber; numerous blunt ribs pass right around whorl, including umbilical wall and venter; pairs of small spines occur on every 2nd, 3rd, or 4th rib on middle part of whorl side; inner and outer rows of spines closer together than in later Liparoceras and always parinode; on body chamber, ribs may fade between rows of spines. Lower Jurassic (lower Pliensbachian, Jamesoni Zone, Taylori Subzone); Britain, Portugal, Austria. —— Fig. 39,1a–b. "V. simplicicosta, holotype, Jamesoni Limestone, Radstock, Avon, England, ×0.75 (new, The Natural History Museum, London, C.38329).

Liparoceras HYATT, 1867, p. 83 ["L. bronni SPATH, 1938, p. 43; SD ICZN Opinion 308, 1954d]. Sphaerocones; can attain large size; umbilicus 10–30% of diameter; whorl thickness ranges from slightly to much greater than whorl height; inner whorls smooth, becoming ribbed and bitubercu-

late, with more outer tubercles than inner (imparinode), thus differing from Vicinindiceras; on body chamber, ornament differentiated into three zones: umbilical slope striate or with fine ribs; middle of whorl side with tubercles and irregular ribs, some joining inner and outer tubercles; and venter crossed by strong, blunt ribs, some of which arise from tubercles. Lower Jurassic (Pliensbachian, Ibex–Margaritatus Zones).

L. (Liparoceras) Ornament strong, coarse to very coarse. Lower Jurassic (lower Pliensbachian, Ibex–Davoei Zones): northern and central Europe, Morocco, Indonesia (Timor, Roti), Canada (British Columbia), USA (California), Chile.——Fig. 39,2a–b. *L. (L.) bronni SPATH, holotype, Bettlingen, Württemberg, Germany, ×1 (new, The Natural History Museum, London, BMNH 22118).

L. (Becheiceras) TRUEMAN, 1918, p. 66 ["Ammonites bechei J. SOWERBY, 1821, p. 143; OD] [=Anisolithoceras TRUEMAN, 1918, p. 66 (type, Ammonites nautiliformis) J. BUCKMAN, 1844, p. 105; OD]; =Becheiceras DACQUE, 1934 in 1933–1934, p. 292, nom. null.]. Reaches large sizes of more than 300 mm in diameter; umbilicus small (about 10%) on inner whorls; ribs much finer and tubercles smaller than in Liparoceras. Lower Jurassic (Pliensbachian, Ibex–Margaritatus Zones): Europe, Morocco, Tunisia, Canada (British Columbia), USA (Oregon). —— Fig. 39,3a–b. *L. (B.) bechei (J. SOWERBY), neotype (designated by DONOVAN & FORSEY, 1973, p. 13). Davoei Zone, Capricornus Subzone, The Red Band, Charmouth, Dorset, England. ×0.8 (new, The Natural History Museum, BMNH 39731; also figured in Donovan & Forsey, 1973, pl. 2,4).

Androgynoceras HYATT, 1867, p. 83 ["Ammonites hybrida d’ORBIGNY, 1844 in 1842–1851, p. 285; SD BUCKMAN, 1911, p. iii = A. subhybridum SPATH (1938, p. 122, pl. 9,1)]. Variocostate: inner whorls capricorn, similar to Aegoceras; middle and outer whorls expand more rapidly and body chambers resemble Liparoceras, though not so markedly sphaeroconic in form; body chambers reach about 300 mm in diameter; bold, single ribs of inner capricorn whorls become blunt and broad as they cross venter, forming chevrons in some species; ribs on middle and outer whorls are sharp, radial, or prosiradiate, and there are some secondary ribs; primary ribs may bear pairs of tubercles or spines, which may become impari-

node. [There is no satisfactory type specimen for Ammonites hybridus d’Orbigny (FISCHER, 1994, p. 74), so pending the designation of a suitable neotype, the holotype of its junior synonym, A. subhybridum SPATH (1938, p. 122, pl. 9,1), is figured here.] Lower Jurassic (lower Pliensbachian, Ibex–Davoei Zones): Europe, Russia, eastern Greenland, Peru.——Fig. 39,4a–b. *A. hybrida (d’ORBIGNY); holotype of A. subhybridum SPATH, Green Ammonite Beds, near Charmouth, Dorset, England. ×0.5 (new, The Natural History Museum, London, C.36924).
Aegoceras Waagen, 1869, pl. 247 [*Ammonites capricornus Schlotheim, 1820, p. 71; SD Haug, 1900, p. 82] [=Amblyoceras Hyatt, 1900, p. 578, obj. (type, Ammonites capricornus Schlotheim, 1820, p. 71, M); = Defossiceras Buckman, 1913, p. vii (type, Ammonites defossus Simpson, 1843, p. 15, ICZN Opinion No. 1088, 1977, p. 42)]. Inner whorls coronate, becoming capricorn, reaching 150 mm in diameter on some body chambers; ribs single, strong, passing over venter with or without forward projection; ribs bituberculare in some; adult aperture with ventral rostrum. Lower Jurassic (lower Pliensbachian, Ibex–Davoei Zones): Europe, eastern Greenland.

A. (Aegoceras). Ribs bold and prominent on venter, without chevrons. Lower Jurassic (lower Pliensbachian, Davoei Zone, Macalutum–Capricornus Subzones): Europe, eastern Greenland. —— Fig. 40, 1a–b. *A. (A.) capricornus (Schlotheim), lectotype, Amberg, Bavaria, Germany, ×1 (new, Geological-Palaeontological Museum, Berlin, Germany).

A. (Beaniceras) Buckman, 1913, p. iii [*Ammonites luridus Simpson, 1855, p. 46; OD]. Usually smaller than 50 mm in diameter; aperture of body chamber with ventral rostrum; inner whorls coronate; ribs on venter usually weak, often projected. Smaller than A. (Aegoceras) or A. (Oistoceras). Possibly microconchs. Lower Jurassic (lower Pliensbachian, Ibex Zone): Europe. —— Fig. 40, 2a–b. *A. (B.) luridum (Simpson), holotype, Robin Hood’s Bay, Yorkshire, England, ×1 (new, Sedgwick Museum, Cambridge, J. 3274). —— Fig. 40, 2c–d. A. (B.) senile (Buckman), holotype, questionable adult with contracting whorl thickness, Hewletts Road, Cheltenham, Gloucestershire, England, ×2 (Buckman, 1918a, pl. 126).

A. (Oistoceras) Buckman, 1911, p. iv [*Ammonites figulinus Simpson, 1855, p. 47; OD]. Differs from A. (Aegoceras) by ribs forming well-marked chevrons on venter, ribs usually finer on inner whorls, and ribs may be bituberculare throughout in later species. Lower Jurassic (lower Pliensbachian, Davoei Zone, Figulinum Subzone): Europe. —— Fig. 40, 3a–d. *A. (O.) figulinum (Simpson); a–b, holotype, Robin Hood’s Bay, Yorkshire, England, ×1 (Buckman, 1911, pl. 26); c–d, near adult with body chamber 0.8 whors long, Charmouth, Lyme Regis, Dorset, England, ×0.75 (Spath, 1938, pl. 21, 8a–b).

Family AMALTHEIDAE Hyatt, 1867


Discoidal oxycones evolving into quadrate-whorled planulates. Oxycones ribbed, strigate, tuberculate, or smooth; planulates strongly ribbed, sometimes with ventral tubercles or spines. Strong, crenulated keel is characteristic, but is secondarily lost in Pseudoamaltheus and Amauroceras. Dimorphic: microconchs of Pleuroceras are known from southern Germany, but are not yet described; dimorphism is almost certainly present in Amaltheus, but paired dimorphs have yet to be associated. Derived from Aegoceras (Oistoceras) (Liparoceratidae) at the base of the upper Pliensbachian (HOWARTH, 1959, p. xxviii) and became extinct at top of the upper Pliensbachian, leaving no successors. The apparent polymorphism in Amaltheidae has led to major descriptions of the family in which normal zoological nomenclature was abandoned in favor of a nomenclature based on tri- and quadrinomial names for morphological growth stages. These were of collections from Germany (FRENZEN, 1937) and France (MATTEI, 1985), which were dominated by small pyritized specimens. Other descriptions by HOWARTH (1959) and DAGIS (1976) on rich collections from Britain and Russia (northeast) have shown that it is possible to use conventional zoological nomenclature, especially when stratigraphical relationships are known within the collections. Lower Jurassic (upper Pliensbachian): northern hemisphere, Boreal Province (common), Tethyan Province (rare).

Amaltheus de Montfort, 1808, p. 90–91 [*A. margaritatus; M] [=Proamaltheus LANGE, 1932, p. 235, 238 (type, P. wertheri, OD); =Nordomaltheus Repin in Efimova & others, 1968, p. 111 (type, Acanthopleuroceras viligiaenis Tuchkov, 1954, p. 109, OD)]. Oxycones with moderately open umbilicus or evolute plectycones; ribs straight or gently sigmoidal, usually bifurcating, projected forward near venter, forming crenulations on keel or angled venter; striate ornament or ventrolateral tubercles in some forms; aperture with ventral rostrum. Forms (e.g., Nordomaltheus) transitional to Amauroceras are smooth on the venter at some stage. Lower Jurassic (upper Pliensbachian, Margaritatus–Spinatum Zones): Europe, northern Africa (Atlas Ranges), Tunisia, Caucasus, Russia (eastern Transbaikalia, Far East, northeast), Japan, Canada (British Columbia, Alberta, Yukon), USA (Alaska), Honduras.

A. (Amaltheus). Description as for genus; striate ornament occurs on dorsal shell only. Lower
Fig. 39. Liparoceratidae (p. 57).
Aegoceras (Aegoceras)

Aegoceras (Oistoceras)

Fig. 40. Liparoceratidae (p. 58).
Jurassic (upper Pliensbachian, Margaritatus Zone–Spinatum Zone): geographic range as for genus.—Fig. 41.1a–b. A. (A.) margaritatus, neotype, Spinatum Zone, Croisilles Calvados, France; a. ×0.5 (Fischer, 1994, pl. 27,1); b. ×0.5 (new, The Natural History Museum, London, BMNH 37039).—Fig. 41.1c–d. A. (A.) subnodosus (Young & Bird), possible adult macroconch, Margaritatus Zone, Hawsker Bottoms, Robin Hood’s Bay, Whitby, North Yorkshire, England, ×1 (Dean, Donovan, & Howarth, 1961, pl. 71,3a–b).—Fig. 41.1e–f. A. (A.) bifurcus Howarth, inner whorls showing resemblance to ancestral Oistoceras, basal Margaritatus Zone, Seatown, Lyme Regis, Dorset, England, ×1.5 (Howarth, 1958, pl. 1,8a–b).

A. (Pseudoamaltheus) FREBOLD, 1922, p. 3, 4, 13 [*Ammonites engelhardsi D’Orbigny, 1844 in 1842–1851, p. 245; SD Frentzen 1937, p. 24]. Late derivative of A. (Amaltheus), with coarse striate ornament on whole shell dominant over radial ribs; venter angled and keel and crenulations lost. Lower Jurassic (upper Pliensbachian, Margaritatus Zone, Gibbosus Subzone–Spinatum Zone): Europe, USA (Alaska).—Fig. 41.2a–b. *A. (D.) engelhardsi (D’Orbigny), holotype, Selzbrunner, Bas Rhin, France; a. ×0.42 (Fischer, 1994, pl. 26,2); b. ×0.42 (Howarth, 1958, p. 22, fig. 11).

Amacoer as BUCKMAN, 1913, p. vii [*Ammonites ferrugineus Simpson, 1855, p. 79; OD]. Involute o xocones, venter rounded or sharp, no keel; smooth or with striate or rudimentary ribs; suture with prominent saddle in middle of first lateral lobe. Development from Amaltheus. Lower Jurassic (upper Pliensbachian, Margaritatus–Spinatum Zones): Europe, Canada (?Alberta).—Fig. 41.3a–b. *A. ferrugineum (Simpson), lectotype, Spinatum Zone, Hawsker Bottoms, Whitby, Yorkshire, England, ×2 (Buckman, 1919b, pl. 142).—Fig. 41.3c–d. A. lenticulare (Young & Bird), holotype, Spinatum Zone, near Whitby, Yorkshire, England, ×1 (Buckman, 1910a, pl. 20).

Pleuroceras HYATT, 1867, p. 89 [*Ammonites spinatus BRUGUIERE, 1789 in 1789–1792, p. 40; SD Fischer, 1882, p. 388] [=Paltopleuroceras BUCKMAN, 1898b, p. 453, obj.]. Planulates with quadrate whorl section; tabulate venter has a strong, crenulated keel; ribs strong, straight, projected forward on venter in some, ending at high ventrolateral tubercles or spines in others. Complete adult microconchs occur where favorable preservation conditions existed (e.g., southwestern Germany). Derived from Amaltheus. Lower Jurassic (upper Pliensbachian, Spinatum Zone): Europe, northern Africa (Atlas Ranges), Canada (?British Columbia, ?Yukon).—Fig. 42a–b. *P. spinatum (Bruugiére), neotype, complete macroconch, South Petherton, Somerset, England, ×0.4 (new, Sedgwick Museum, Cambridge, England, SM J.35923).—Fig. 42c–d. *P. hawskerense (Young & Bird), Kettleness, Whitby, North Yorkshire, England, ×1 (Howarth, 1959, pl. 9,5a–b).—Fig. 42e–f. P. solare (Phillips), Marlstone Rock Bed, Thorncombe Beacon, Dorset coast, England, ×1 (Howarth, 1959, pl. 5,9a–b).—Fig. 42g–h. P. transiens (Frentzen), coastal cliff 1 km northeast of Dun Caan, Isle of Raasay, western Scotland, ×1 (Howarth, 1958, pl. 4,16a–b).

Family DACTYLIOCERATIDAE
HYATT, 1867
[nom. correct. ICZN Opinion 576, 1959b, pro Dactylitidae HYATT, 1867, p. 87, 94]

Evolute, serpenticone to cadicone, ribbed, tuberculate and keel-less forms. Homeomorphic with some Bajocian stephanoceratids and Oxfordian perispinctids, but unique shell structure, with double shells and flat-topped ribs on the inner shell, seen in some favorable modes of preservation, is distinctive of Dactylioceratidae (Howarth, 1975). Divided into two subfamilies on suture differences: earlier Reynoldsocoeiloceratinae has two major secondary lobes in dorsal side of external saddle; in Dactylioceratinae, external saddle is not so divided, and lateral lobe is deeply trifid. Reynoldsocoeiloceratinae, the earliest subfamily, was derived from Metaderoceras (Eodoceratidae) at the bottom of the Luridum Subzone, Ibex Zone (Buckman, 1911, p. iv; Spath, 1936a, p. 443; Dommergues, 1986, p. 9), and not from Lytoceratidae, as has sometimes been suggested. Lower Jurassic (lower Pliensbachian, Ibex Zone–upper Toarcian, Variabilis Zone): worldwide.

Subfamily REYNESOCOELOCERATINAE
Dommergues, 1986
[Reynesocoeiloceratinae DOMMERGUES, 1986, p. 23]

The earliest subfamily, consisting of depressed, cadicone, tuberculate forms, as well as some evolute, serpenticone, fine-ribbed forms; single ribs are common in some genera; some species are size dimorphic; characterized by major subdivisions in dorsal side of external saddle. Lower Jurassic (Pliensbachian, Ibex–Spinatum Zones): Europe, northern Africa, North America, South America.
Fig. 41. Amaltheidae (p. 58–61).
Reynesocoeloceras Géczy, 1976, p. 123 [*Ammo-
nites (Stephanoceras) crassus Young & Bird, 1828, p. 253, var. indunense Meneghini, 1874 in 1867–1881, p. 72; OD] [=Indunoceras Wieden-
maier, 1977, p. 75, obj.]. Evolute cadicones with depressed whorls and a flat venter; ribs are mostly single, but some bifurcation occurs at small to large tubercles at ventrolateral edge. Lower Jurassic (lower Pliensbachian, Ibex–Davoei Zones): Switzerland, Italy, Portugal, Spain, France, Morocco, Canada (British Columbia, Alberta), USA (Oregon), Argentina.—Fig. 43,1a–b. *R. indunense (Meneghini); a, neotype, Ibex Zone, Breggia Gorge, Switzerland, ×1 (Pinna, 1969, pl. 5,7); b, Monte di Cetona, Tuscany, Italy, ×1 (Fischer, 1971, pl. 2,3).—Fig. 43,1c–d. R. levi-
costa (Fucini), lectotype (designated by Howarth, herein), venters of outer and inner whorls, Monte di Cetona, Tuscany, Italy, ×1 (Fucini, 1905, pl. 9 (49),16b, 16e).

Bettoniceras Wiedenmayer, 1977, p. 80 [*Coeloceras italicum Fucini, 1900, p. 55 (Fucini, 1901a, p. 72 (98)); OD]. Evolute serpenticone planulates, with round whorl section and very fine, mainly single ribs; no tubercles. Differs from Protecyl-
ticeras only in lacking all tubercles. Derived from Reynesocoeloceras. Lower Jurassic (Pliensbachian, Davoei Zone–Margaritatus Zone): Portugal, Swit-
zerland, Italy, Hungary, Morocco, Chile.—Fig. 43,2a–b. *B. italicum (Fucini), holotype, Margaritatus Zone, Marconessa, Appennino Centrale, Italy, ×1 (Fucini, 1901a, pl. 13 (13),4).

Prodactylioceras Spath, 1923a, p. 10 [*Ammonites davoisi J. Sowerby, 1822, p. 71; OD] [=Paraly-
toceras Frebold, 1922, p. 15, non Frech, 1902, p. 83 (Upper Devonian goniatite) (type, Ammonites davoisi J. Sowerby, 1822, p. 71, SD Howarth herein); =Praedactylioceras Frentzen, 1937, p. 19, obj., nom. null., misspelling]. Evolute, circular to slightly depressed whorls; ribs fine,
often protracted, single or bifurcating, with sporadic ribs bearing ventrolateral tubercles in compressed forms, but ribs coarser and swollen, and ventrolateral tubercles larger in depressed forms. Derived from *Reynesocoeloceras*, possibly via *Bettoniceras* (Dommegues, 1986). Lower Jurassic (Pliensbachian, Davoei Zone—Margaritatus Zone): Europe, Turkey, Japan, China (Guangdong), Canada (British Columbia, USA (Alaska, Nevada, Oregon).——Fig. 43,3a–b. *P. davoei* (J. Sowerby), toptype (holotype, figured by Sowerby, 182, pl. 350, is lost), *Davoei Zone, Charmouth, Dorset, England, x0.75 (new, The Natural History Museum, London, BMNH 39892).

*Cetonoceras* Wiedenmayer, 1977, p. 79 [*Coeloceras pisoloceroides* Fucini, 1905, p. 118 (290); OD] [*=Secchianoceras Venturi in Faraoni & others, 1995, p. 254 (type, *S. secchianense*, OD)]. Early whorls depressed, becoming rounded and more compressed later; strong primary ribs mostly bifurcate ventrolaterally, and ventrolateral tubercles on inner whorls diminish at larger sizes; differs from *Reynesocoeloceras* in having bifurcating ribs. Lower Jurassic (upper Pliensbachian, Margaritatus–Pinatunum Zones): Portugal, Spain, France, Italy.——Fig. 43,4a–b. *C. pisoloceroides* (Fucini), lectotype (designated by Howarth, herein), *Margaritatus Zone, Monte Cetona, Apennines, Italy, X1 (Fucini, 1905, pl. 7 (47),6, 9b).

**Subfamily DACYTILOCERATINAE** Hyatt, 1867


Ribs that bifurcate at ventrolateral edge predominate over single ribs throughout subfamily; presence or absence of ventrolateral tubercles is especially variable; adults have simple, contracted final apertures, and dimorphism on size alone is widespread (Lehmann, 1968; Guex, 1973b). Complete graduations between compressed serpenticones and depressed cadicones occur at many horizons, and specific or generic separation of depressed forms is arbitrary. In many cases, depressed forms are clearly related to compressed forms they accompany, as can be seen on final adult whorl that reverts to that of compressed forms, and depressed forms do not belong to a separate evolving lineage of cadicones. Although fibulation (primary ribs looped in pairs to ventrolateral tubercles) may occur in any of the tuberculate cadicone forms, regular fibulation in compressed forms first appears in *Peronoceras* at the base of the *Fibulatum* Subzone, and the family is divided naturally at this point. Derived from *Reynesocoeloceratinae* in the *Margaritatus* Zone and died out near the top of the *Variosili* Zone, leaving no successors. Lower Jurassic (upper Pliensbachian, Margaritatus Zone–upper Toarcian, Variabilis Zone): worldwide.


*Dactylioceras* Hyatt, 1867, p. 95 [*Ammonites communis* Sowerby, 1815b, p. 10; SD ICZN Opinion 576, 1959b] [*=Arcticdactylites Buckman, 1926, pl. 657 (type, *A. arcus*, OD); =Microdactylites Buckman, 1926, pl. 655 (type, *Ammonites attenuatus* Simpson, 1855, p. 54, OD); =Anguidactylites Buckman, 1926, p. 41 (type, *A. anguiformis*, OD); =Leptodactylites Buckman, 1926, p. 42 (type, *L. leptum*, OD); =Peridactylites Buckman, 1926, p. 42 (type, *P. consimilis*, OD); =Toxodactylites Buckman, 1926, p. 42 (type, *T. toxophorius*, OD); =Vermidactylites Buckman, 1926, p. 42 (type, *Ammonites vermicelli Simpson, 1855, p. 51, OD); =Xeino­dactylites Buckman, 1926, p. 41 (type, *Dactylioceras helianthoides* Yokoyama, 1904b, p. 16, OD); =Athlodactylites Buckman, 1927a, p. 43 (type, *Ammonites athleticus Simpson, 1855, p. 102, OD); =Curvidactylites Buckman, 1927a, p. 43 (type, *C. curvicoasta*, OD); =Koidactylites Buckman, 1927a, p. 43, obj.; =Nomodactylites Buckman, 1927a, p. 43 (type, *N. temperatus*, OD); =Parvidactylites Buckman, 1927a, p. 43 (type, *P. parvus*, OD); =Simplidactylites Buckman, 1927a, p. 43 (type, *S. simplicicoasta*, OD); =Rakusites Guex, 1971, p. 232 (type, *R. ruddini*, OD); =Eodactylites Schmidt-Effing, 1972, p. 55 (type, *Dactylioceras pseudocommune* Fucini, 1935, p. 86 (162), OD); =Planicoeloceras Venturi & Ferrill, 2001, p. 151 (type, *P. simplex*, OD)). Evolute planululates or serpenticones, with compressed to equidimensional, flat-sided whorls; inner whors are depressed cadicones in some species; adults have simple, contracted final apertures and are size dimorphic; ribs numerous, straight, single
or bifurcating at ventrolateral edge and usually continuous across venter; ventrolateral tubercles small or absent; occasional fibulate ribs and sporadic ventrolateral spines occur in some species. Lower Jurassic (?upper Pliensbachian, Spinatum Zone–lower Toarcian, Tenuicostatum Zone–Bifrons Zone, Commune Subzone).

D. (Dactylioceras). Ribs typically distant, though dense in some, and usually projected forward on venter; few or no single ribs. Lower Jurassic (?upper Pliensbachian, Spinatum Zone–lower Toarcian, Tenuicostatum Zone–Bifrons Zone, Commune Subzone): Europe, northern Africa (Atlas Ranges), Russia (Transbaikal, Far East, northeast), Iran, Pakistan, Japan, Vietnam, western Borneo, Indonesia (Roti), Spitzbergen, Greenland, Canada (British Columbia, Alberta, Yukon), USA (Alaska, Oregon), Chile, Argentina, Peru, New Zealand. — Fig. 44, 2a–b. *D. (D.) commune (J. Sowerby), lectotype (a so-called snake stone, with a roughly carved snake's head in the matrix at the aperture), Bifrons Zone, Commune Subzone, Whitby, Yorkshire, England, ×1 (new, The Natural History Museum, London, BMNH 43895a).

D. (Orthodactylites) BUCKMAN, 1926, pl. 654 [*O. directum; OD] [=Kryptodactylites BUCKMAN, 1926, p. 41 (type, Ammonites semicelatus SIMPSON, 1843, p. 22, OD); =Tenuidactylites BUCKMAN, 1926, p. 41 (type, Ammonites tenuicostatus YOUNG & BIRD, 1822, p. 247, OD); =Kedonoceras DAGE, 1968, p. 56 (type,
K. asperum, OD). Evolute, round-whorled serpenticones, but inner whorls highly variable and include depressed cadicones with broad flat venters and ventrolateral spines; ribs typically annular and dense, rectiradiate or prorsiradiate, but some are distantly ribbed; single ribs occur, as well as bifurcating or trifurcating ribs, especially on inner whorls; tubercles or spines may occur at ventrolateral edge and ribs may be fibulate; final adult whorl may be totally different from cadicone inner whorls, reverting to round-whorled serpentine, with fine, annular ribs, no tubercles, and whorl breadth less than that of previous whorl (Howarth, 1973). Lower Jurassic (lower Toarcian, Tenuicoeloceras–Falceriferum Zone, Exaratum Subzone): Europe, northern Africa (Atlas Ranges), Russia (northeast), Canada (British Columbia, USA (Alaska), Chile, Argentina. ——— Fig. 44, 3a–b. *D. (O.) directum* (Buckman), holotype, Tenuicoeloceras Zone, Middleton Cheney, Northamptonshire, England, ×1 (Buckman, 1926, pl. 654).—— Fig. 44, 3c–e. *D. (O.) clevelandicum* Howarth, paratype, Tenuicoeloceras Zone, Clevelandicium Subzone, Holmsgrove Sand, Whitby, North Yorkshire, England, ×0.9 (new, The Natural History Museum, London, EN).—— Fig. 44, 3f–g. *D. (O.)asperum* (Dagis), holotype, Omolon area, Brodny, northeastern Russia, ×1 (Dagis, 1968, pl. 11.7).  

D. (Iranodactylites) Repin, 2000, p. 39 [*I. ketevanae* OD]. Similar to Orthodactylites, with fine, single, and bifurcating, prorsiradiate ribs, but with higher whors and considerably more involute, especially on inner whors; whors oval and compressed; umbilicus 39–42% of diameter, whorl height 30–36%; no tubercles; some specimens possibly adult at about 70 mm in diameter. Lower Jurassic (lower Toarcian, ?Bifrons Zone): Iran. ——— Fig. 44, A. *D. (I.) ketevanae*, holotype, Shakhmirzad, 30 km north of Semnan, Elburz Mountains, northern Iran, ×1 (Repin, 2000, p. 40, fig. 3-1a).  

Nodicoeloceras Buckman, 1926, p. 42 [*Ammonites crassoides* Simpson, 1855, p. 55; OD] = C. crassoides* Buckman, 1926, p. 42 (type, C. pingué, OD); = Lobodactylites Buckman, 1926, p. 42 (type, L. lobatum, OD); = Multicoeloceras Buckman, 1926, p. 42 (type, M. multum, OD); = Spinicoeloceras Buckman, 1926, p. 42 (type, S. spicatum, OD); = Mesodactylites Pinna & Levi-Setti, 1971, p. 91 (type, C. annulatiforme Bonarelli, 1899, p. 212, OD); = Fibulicoeloceras Venturi & Ferrli, 2001, p. 150 (type, F. concavum, OD). Depressed cadicones, which accompany Dactyliocercas s.l.; ribs distant, fibulate in tuberculate forms, bifurcating at ventrolateral edge; ventrolateral tubercles or spines usually present, at least on inner whors. Lower Jurassic (lower Toarcian, Falceriferum Zone, Exaratum Subzone–Bifrons Zone, Commune Subzone): Europe, northern Africa (Atlas Ranges), Pakistan, Indonesia, USA (Nevada), Chile, Argentina. ——— Fig. 45, 1a–b. *N. crassoides* (Simpson), holotype, Exaratum Subzone, Whitby, Yorkshire, England, ×1 (Buckman, 1913, pl. 89).  

Peronoceras Hyatt, 1867, p. 85 [*Ammonites fibulatus* J. C. Sowerby, 1823a, p. 147; SD Buckman, 1911, p. v.]. Gradational from compressed ellipticocones to depressed cadicones; whors quadrate, with flat sides and venter; ribs fine to distant, always fibulate, except on inner whors of fine-ribbed forms; ventrolateral tubercles present. Lower Jurassic (lower Toarcian, Bifrons Zone, Fibulatum Subzone only): Europe, northern Africa (Atlas Ranges), Caucasus, Vietnam, Japan, Canada (British Columbia, Alberta, Yukon), USA (Alaska), Chile, Argentina, Peru. ——— Fig. 45, 2a–b. *P. fibulatum* (J. C. Sowerby), lectotype (designated by Howarth, 1978, p. 260), Whitby, North Yorkshire, England, ×1 (new, The Natural History Museum, London, BMNH 43911).  

Zugadoctylites Buckman, 1926, pl. 658 [*Ammonites braunianus* d’Orbigny, 1845 in 1849–1851, p. 327; OD] = Omolonoeceras Dagis, 1967, p. 48 (type, O. manifestum, OD); = Gablilutes Gues, 1971, p. 234 (type, G. larbuselenus, OD). Compressed, equidimensional or depressed whors; adult whorl has collar and constriction at final aperture; fine, dense ribs bifurcate at sharp, pointed ventrolateral tubercles or spines; no fibulate ribs. Size dimorphic (Gablilutes, microconch). Derived from fine-ribbed Peronoceras. Lower Jurassic (lower Toarcian, Bifrons Zone, Fibulatum Subzone only): Europe, Russia (eastern Transbaikalia, Far East, northeast), Canada (Alberta, Yukon). ——— Fig. 45, 3a–d. *Z. braunianus* (d’Orbigny); a–d, lectotype, Le Clapier, Aveyron, France, ×1 (Fischer, 1994, pl. 29, 5a, 5c); c–d, Northampton, England, ×1 (new, The Natural History Museum, London, England, BMNH C.67521; also figured in Howarth, 1978, pl. 6, 4).—— Fig. 45, 3e–f. *Z. manifestum* (Dagis), holotype, Omolon area, Tokur-Yuryakh, northeastern Russia, ×1 (Dagis, 1967, pl. 1.5).  

Porporoceras Buckman, 1911, p. v. [*Ammonites vortex* Simpson, 1855, p. 60; OD] = Telodactylites Penna & Levi-Setti, 1971, p. 114 (type, Ammonites desplacei d’Orbigny, 1845 in 1842–1851, p. 334, OD); = Platyptrochus Levi-Setti & Penna, 1971, p. 476 (type, P. latus, OD). Whorl shape varies from rounded-quadrate to depressed; ribs bearing ventrolateral tubercles tend to alternate with non-tuberculate ribs, and only some of the tuberculate ribs are fibulate. Occurs with Peronoceras, but does not have compressed whors and lacks its regular fibulation; Cactacoeloceras has regular ventrolateral tubercles and no fibulation. Lower Jurassic (lower Toarcian, Bifrons Zone, Fibulatum Subzone only): Europe, Caucasus, Pakistan, Russia (Far East, northeast), Canada (British Columbia, Yukon), Chile, Argentina. ——— Fig. 46, 1a–b. *P. vortex* (Simpson), holotype, Ravenscar, Whitby, North Yorkshire, England, ×0.8 (Buckman, 1911, pl. 29A).  

Septimaniceras Faure, 2002, p. 711 [*Ammonites zitteli* Oppel, 1862, p. 139; OD]. Small (30 mm maximum diameter), very evolute, early whors cadicone, later whors quadrate in section; inner whors have widely spaced, bold ribs bearing prominent ventrolateral tubercles and fine striate ribs
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 44. Dactylioceratidae (p. 64–66).
between; later whorls have alternating single and looped ribs with ventrolateral tubercles on looped ribs. Dimorphic: microconchs adult at 10–12 mm in diameter, macroconchs at approximately 30 mm in diameter. Lower Jurassic (lower Toarcian, upper Bifrons Zone): France.———Fig. 46.2a–f. *S. zittelii (Oppel); a–b, lectotype (designated by HOWARTH, herein), macroconch, Millau, Aveyron, ×4 (Oppel, 1862, pl. 42a–b); c–f, Saint-Paul-de-Font, Aveyron; c–d, macroconch; e–f, microconch, ×1.5 (Fauré, 2002, p. 9, 27–28.

Catocoeloceras Buckman, 1923a, pl. 413 [*C. confectum (OD) [=Transicoeloceras Pinna, 1966, p. 124 (type, T. angustum, OD)]. Cadicones, with depressed rounded whorls, some extreme forms (Transicoeloceras) almost sphaerocones; ribs simple or bifurcating, and regular ventrolateral tubercles present in most forms; venter may become flat and smooth between tubercles on adult body chamber, which contracts toward mouth border. Size dimorphic. Lower Jurassic (lower Toarcian, Bifrons Zone, Crassum Subzone—upper Toarcian, Variabilis Zone): Europe, northern Africa (Atlas Ranges), Turkey, Caucasus, Russia (Crimea, northeast), Indonesia, Greenland, Canada (British Columbia, Yukon), Chile, Argentina, Peru, Bolivia.———Fig. 46.3a–b. *C. confectum, holotype. Variabilis Zone, North Nibley, Gloucestershire, England, ×1.5 (new, British Geological Survey, Keyworth, Nottingham, England, GSM 47198).——Fig. 46.3c–d. C. dumortieri (de Brun), Variabilis Zone, Ilminster, Somerset, England, ×1 (new, The Natural History Museum, London, BMNH C.67678).

Collina Bonarelli, 1893, p. 205, 207 [*C. gemma; SD Buckman, 1927a, p. 44] [=Microdactylites Buckman, 1927a, p. 43 (type, Ammonites microconatus d’Orbigny, 1845 in 1842–1851, p. 328, OD); =Collinites Atrops, 1972, p. 1598 (type, Collina meneghinii Bonarelli, 1899, p. 210, OD)]. Whorls angular, quadrate whorl section; ribs distant, bifurcating or trifurcating at a high ventrolateral tubercle; secondary ribs projected strongly forward and raised in middle of venter. Size dimorphic. Lower Jurassic (lower Toarcian, Braunianus Subzone—upper Toarcian, Variabilis Zone): Europe, Russia (eastern Transbaikalia, northeast), Canada (British Columbia, Yukon), Chile, Argentina, Peru.———Fig. 45.4a–b. *C. gemma, holotype, Valdorbia, Umbria, Italy, ×1 (Gallielli-Wendt, 1970, pl. 6,3).

Superfamily HILDOCERATOIDEA
Hyatt, 1867

Variable from involute planulataes, with quadrate whorl sections, to involute oyocones with compressed whorls; all have keels and sigmoidal to falcate ribs; dimorphism probably widespread but is poorly documented. Some forms are very similar to various genera of Harpoceratinae. Includes the earliest forms and is the root stock for all the other subfamilies. Lower Jurassic (lower Pliensbachian, Jamesoni Zone—Lower Toarcian, Tenuicostatum Zone): worldwide.

Typical Hildoceratoidea, derived from Polymorphitidae in the Jamesoni Zone. Lower Jurassic (lower Pliensbachian, Jamesoni Zone—Middle Jurassic (lower Bajocian, Laeviuscula Zone): worldwide.

Subfamily PROTOGRAMMOCERATINAE
Mattei, 1974

Variable from involute planulataes, with quadrate whorl sections, to involute oyocones with compressed whorls; all have keels and sigmoidal to falcate ribs; dimorphism probably widespread but is poorly documented. Some forms are very similar to various genera of Harpoceratinae. Includes the earliest forms and is the root stock for all the other subfamilies. Lower Jurassic (lower Pliensbachian, Jamesoni Zone—lower Toarcian, Tenuicostatum Zone): worldwide.

Protopogrammoceras Spath, 1913, p. 547 [*Grammoceras bassani Fucini, 1901a, p. 46 (72); SD Spath, 1919, p. 174] [=Wrightia Gemmellaro, 1886b, p. 190, non Agassiz, 1862 (Goelen-terata) (type, Harpoceras (Wrightia) alternans, M); =Paltarites Buckman, 1922, pl. 362A (type, P. paltus, OD); =Argutarites Buckman, 1923a, pl. 363 (type, A. argutus, OD); =Bassanites Fucini, 1929, p. 63 (87), obj.; =Eprotopogram- moceras Cantaluppi, 1970, p. 42 (type, Protoprammoceras mellahense Dubar, 1961, p. 253, OD); =Neoprotogrammoceras Cantaluppi, 1970, p. 42 (type, Harpoceras meneghinii Bonarelli, 1899,
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 45. Dactylioceratidae (p. 66–68).
Planulates, with moderately wide umbilicus, flat whorl sides, and venter acute or flat with keel and sulci; ribs straight, sinuous or falcoid, fine and dense to coarse and distant, sometimes broad and flat topped, usually strongly projected forward on venter; some forms develop strong, distant, rursiradiate ribs on outer half of whorl, ending in a ventrolateral tubercle. Derived from Polymorphitidae in Jamesoni Zone. Lower Jurassic (lower Pliensbachian, Jamesoni Zone–lower Toarcian, Tenuicostatum Zone): Europe, northern Africa (Atlas Ranges), Madagascar, Somalia, Saudi Arabia, Russia (Far East), Pakistan, Vietnam, Japan, Canada (British Columbia, Alberta), USA (Alaska, Nevada, Oregon), Chile, Argentina.

**P. (Protogrammoceras)**. Protogrammoceras with sinuous to falcoid ribs that are strongly projected forward on approaching venter. Age and geographic range as for genus.—

*P. (P.) bassanii* (Fucini), lectotype, upper Pliensbachian, Pian de’Giugoli, Central Apennines, Italy; a, lectotype, ×0.8 (Fucini, 1901a, pl. 10 (10), 6a); b, lectotype, ×0.8 (Cantaluppi, 1972, pl. 15, 2c).—

---

**Fig. 46. Dactylioceratidae** (p. 66–68).
47.1c–d. P. (P.) paltum (Buckman), holotype, lower Toarcian, Tenuncostatum Zone, Junction Bed, Thorncombe Beacon, Dorset, England, ×0.75 (Howarth, 1992a, pl. 2.2).

P. (Matecieceras) Wiedenmayer, 1980, p. 124 [*Ammonites nitescens Young & Bird, 1828, p. 257; OD] [=Procanavaria Mattei, 1974, p. 551, 555, 557, nom. nud.]. Protagromoceras with moderate to coarse, straight to rursiradiate ribs, ending in small or medium ventrolateral tubercles, from which ribs may be projected strongly forward on venter. Lower Jurassic (upper Pliensbachian, Margaritatus Zone, Stokesi Subzone): England, France, Germany, Portugal, Spain.——Fig. 47, 2a–b. *P. (M.) nitescens (Young & Bird), holotype, Hawker Bottoms, Whirby, Yorkshire, England, ×0.75 (Howarth, 1992a, pl. 4.4).

P. (Fieldingiceras) Wiedenmayer, 1980, p. 128, nom. nov. pro Fieldingia Cantaluppi, 1970, p. 41, non Kent, 1870 (sponge) [*Ammonites fieldingi Reyès, 1868, p. 97; OD]. Small, adult at 25–35 mm in diameter; evolve, compressed, with ventral keel; inner whorls smooth to a variable size, then single, gently sigmoidal ribs appear, which may be irregular and widely spaced. Possibly a microconch accompanying many larger P. (Protagromoceras), e.g., P. (F.) depressum (Quenstedt) (Dommeregues, 1987, p. 217; Meister, 1989, p. 40). Lower Jurassic (upper Pliensbachian, Margaritatus Zone, top Stokesi Subzone–basal Subnodosus Subzone): France, Spain, Italy, Canada (British Columbia).——Fig. 47, 3a–c. *P. (F.) fieldingi (Reyès); a–b, lectotype, Rivière, Milhau, Aveyron, France, ×1 (Reyès, 1868, pl. 4, 1a–b); c, Le Samonta, Aveyron, ×1.5 (Monestier, 1934, pl. 4.29).

Fuciniceras Haas, 1913, p. 75 [*Harpoceras laviniatum Fucini, 1901a, pl. 52 (78); OD] [=EoFuciniceras Cantaluppi, 1970, p. 41 (type, Fuciniceras dubari Cantaluppi in Cantaluppi & Montanari, 1969, p. 75; OD); =NeoFuciniceras Cantaluppi, 1970, p. 41 (type, Harpoceras? ambiguum Fucini, 1901a, p. 24 (50); OD)]. Similar to Protagromoceras, but some species are more evolute; differs in having ribs that are more rursiradiate on outer half of whorl, and ending abruptly at ventrolateral edge with no forward projection. Possibly derived independently from Tropidoceras (Polyplacophoridae). Lower Jurassic (lower Pliensbachian, Ibex Zone–upper Pliensbachian, Spinatum Zone).——Fig. 48, 1a–b. *E. laviniatum (Fucini), lectotype (designated by Braga, 1983, p. 136), Canfaiato, Central Apennines, Italy, ×0.8 (Fucini, 1901a, pl. 11 (11), 6).——Fig. 48, 1c. F. suecicus Monestier, upper Pliensbachian, Margaritatus Zone, Rivière, Aveyron, France, ×1 (Monestier, 1934, pl. 2.11).

Lioceratoides Spath, 1919, p. 174 [*Lioceras grecoi Fucini, 1901a, p. 65 (91); OD] [=Platyharpites Buckman, 1927a, pl. 698 (type, P. platypleurus, OD); =Praeleioceras Fucini, 1929, p. 71 (95) (type, P. aradasi, SD Howarth, 1992a, p. 68); =Harpoceras Matsumoto, 1947, p. 28 (type, Harpoceras (Nagatoceras) toyotanum, M); =Neolioceratoidea Cantaluppi, 1970, p. 40 (type, Hildoceras (Lilia) hoffmanni Gemmellaro, 1886a, p. 122, OD)]. More involute than Protagromoceras, and compressed with tall ventral keel; falcoid ribs vary from coarse to fine and are sometimes almost striate or smooth; at small sizes, ribs may bifurcate, but at larger sizes, most are single, and may be broad and flat topped, with narrower sulci between; some species are homeomorphic with the much later Clevericeras and Harpoceras. Lower Jurassic (upper Pliensbachian); Europe, Morocco, Japan, Japan, Indonesia (Sulawesi, Pacificeras).——Fig. 48, 2a–b. *L. greci (Fucini), lectotype (designated herein), Monte Nerone, Central Apennines, Italy, ×1 (Fucini, 1901a, pl. 11 (11), 4).——Fig. 48, 2b. *L. praecoxarum (Fucini), upper Pliensbachian, Spinatum Zone, Fontanelle, Taormina, Sicily, ×0.8 (new, The Natural History Museum, London, BMNH C.50911).

Subfamily HARPOCERATINAE

Neumayr, 1875


Involute and compressed, with strong keel and moderate to fine, single or bifurcating, sigmoidal to falcate ribs, or occasionally smooth; tubercles rare. Dimorphism widespread: macroconchs are 4X to 6X larger than microconchs, and adult size variation within each dimorph usually at least 2:1 and can be 3:1; adult mouth borders of dimorphs similar, any difference only reflecting greater curvature of ribs at the smaller size of the microconchs; no true lappets. Lower Jurassic (upper Pliensbachian, Spinatum Zone)–Middle Jurassic (lower Bajocian, Laeviuscula Zone): worldwide.

Tiltoniceras Buckman, 1913, p. viii [*T. costatum; OD]; =Harpoceras antiquum Wright, 1883, p. 431) [*Pacificeras Repin, 1970, p. 41 (type, Schloenbachia praepingua Whiteaves, 1884, p. 247, OD)]. Moderately to very involute, compressed, nearly flat whorl sides, rounded umbilical edge, strong keel on venter but no sulci; ribs moderately strong to firm, striate or smooth, straight, or gently sigmoidal, and strongly projected forward on venter. Size dimorphic. Lower Jurassic (upper Pliensbachian, Spinatum Zone–lower Toarcian, Tenuncostatum Zone): England, Germany, Russia (northeast), Canada (British Columbia), USA (Nevada, California).——
Fig. 49, 1a–b. *T. antiquum* (Wright), holotype of originally designated type *T. costatum*, Tilton, Leicestershire, England, ×1.5 (new, Manchester University Museum L.11431).—Fig. 49, 1c–d. *T. propinquum* (Whiteaves), paratype, Carlottense Zone (=Spinatum Zone), Fannin Bay, Queen Charlotte Islands, western Canada, ×1 (Smith & others, 1988, p. 1516, pl. 5, 3–4).

**Eleganticeras** Buckman, 1913, p. viii [*E. pseudoelgans*; OD; =Ammonites elegantulus Young & Bird,
Cleviceras Howarth, 1992a, p. 89 [*Ammonites exaratus Young & Bird, 1828, p. 266; OD*]. Moderately involute, compressed, flat whorl sides, sloping, vertical, or undercut umbilical wall, strong, floored ventral keel; ribs falcoid, bifurcating at small sizes, single at larger sizes, broad and flat on outer part of whorl, becoming striate on adults; no tubercles. Abnormal specimens of Cleviceras and Harpoceras with no ventral keel occur occasionally; they have often been referred to "Monestieria," but the type specimen of Monestieria is a similarly abnormal specimen of Pseudogrammoceras (see below). Dimorphic: macroconchs 85–200 mm in diameter; microconchs 16–62 mm, with strong bifurcating ribs. Harpoceras attains a larger adult size in both dimorphs, is more evolute, and has falcate, rather than falcoid, ribbing, with a midlateral groove or series of undulations in many specimens. Lower Jurassic (lower Tocarcian, Falciferum Zone, middle–upper Exaratum Subzone): England, France, Germany, Switzerland, Russia (northeast), Canada (British Columbia).—Fig. 50, 1a–f. *C. exaratum (Young & Bird); a–b, holotype, Whitby, Yorkshire, England, ×0.75 (Howarth, 1992a, pl. 10, 1); c–d, complete adult macroconch, with a
complete adult microconch attached near aperture, Whitby, Yorkshire, England, ×0.75 (Howarth, 1992a, pl. 10.2); e–f complete adult microconch, Hawsker Bottoms, Whitby, Yorkshire, England, ×1.5 (Howarth, 1992a, pl. 11.1f).

Harpoceras Waagen, 1869, p. 245 [*Ammonites falcifer J. Sowerby, 1820, p. 99; SD ICZN Opinion 303, 1954a] [=Lioceras Bayle, 1878, explanation of pl. 87–88 (type, Ammonites subplanatus Opell, 1856 in 1856–1858, p. 244, SD Howarth, 1992b, p. 107); =Harpoceratoides Buckman, 1909, p. ii (type, Ammonites alternatus Simpson, 1843, p. 43, OD); =Maconiceras Buckman, 1926, pl. 684 (type, M. vigense, OD); = Glyptapites Buckman, 1927b, p. 8 (type, G. glyptus, OD); = Tardarceras Buckman, 1927b, pl. 741 (type, T. tardum, OD); = Phaularpites Buckman, 1928, p. 13 (type, P. exigus, OD); = Falcifericeras Breistroffer, 1949, p. 100, obj.; = Falcifericeras Arkell, 1957, p. 255, misspelling of Falcifericeras Breistroffer, 1949, p. 100; = Koly­moceras Dagis, 1970, p. 863 (type, Oserlioceras viluisa Krumholz, 1963, p. 216, OD); = Gallittella Venturi & Ferré, 2001, p. 182 (type, G. costa­tostrata, OD)]. Moderately evolute to involute, compressed, flat whorl sides, sloping, vertical, or undercut umbilical walls, strong keel on venter; ribs biconcave, falcoid or falcate, strong and projected, and sometimes broad and flat topped on outer half of whorl; striate on inner half in some forms; midlateral groove, or series of undulating depressions on inner half of whorl in some species. Dimorphic: macroconchs more than 150 mm in diameter, microconchs adult at 35–50 mm in diameter. The type specimen of Praehaploceras is an abnormal (malformed) Pseudolioceras without a keel. Lower Jurassic (lower Toarcian, Bifrons Zone)—Middle Jurassic (lower Bajocian, Laeviuscula Zone)– Europe, northern Africa (Atlas Ranges), Turkey, Russia (Transbaikalia, Bureya Basin, Far East, northeast), Thailand, Japan, Spitzbergen, Greenland, Canada (British Columbia, Yukon), USA (Alaska).

P. (Pseudolioceras). Ribs falcoid, and weak to smooth on inner half of whorl. Lower Jurassic (lower Toarcian, Bifrons Zone)—Middle Jurassic (Aalenian, Opalinum Zone); age and geographic range as for genus.—Fig. 51.2a–d. *P. (P.) boulbiense (Young & Bird), holotype of Ammonites compactilis Simpson, upper Toarcian, Thouarsienne Zone, Striatulum Subzone, Ravenscar, Whitby, Yorkshire, England, ×1 (new, British Geological Survey, Keyworth, Nottingham, England, GSM 24914).—Fig. 51.2c–d. P. (P.) lythense (Young & Bird), lower Toarcian, Bifrons Zone, Whitby, Yorkshire, ×1 (Howarth, 1992b, pl. 26.3).

Ovatoceras Buckman, 1918a, p. xi [*Ammonites ovatus Young & Bird, 1822, p. 251; OD]. Moderately involute, compressed, narrow venter with keel, and characteristic elliptical (“oval”) whorl section; rounded umbilical edge, sloping umbilical wall; ribs sinuous or falcoid, moderate or weak on inner whorls, striate or smooth on outer whorl. Complete adults 120–250 mm in diameter; dimorphism unknown. Lower Jurassic (lower Toarcian, top Falciferum Subzone)– Europe, ?Vietnam, ?Canada (British Columbia, Yukon).—Fig. 50.3a–b. *O. ovatum (Young & Bird), holotype, Whitby, Yorkshire, England, ×1 (Howarth, 1992b, pl. 24.4).

Taffitia Gueix, 1973a, p. 503 [*T. taffertensis; OD]. Similar to Pseudolioceras, but more evolute, and with bold, regularly bifurcating ribs. Lower Jurassic (lower Toarcian, Falciferum Zone, *Exaratum Subzone); Morocco, Canada (British Columbia).—Fig. 51.1a–b. *T. taffertensis, holotype, Taffert, Moyen Atlas, Morocco; a; ×1; b, cross section of whorl, ×1 (Gueix, 1973a, pl. 2.6, pl. 14.7).

Pseudolioceras Buckman, 1889a, p. 81 [*Ammonites compactilis Simpson, 1855, p. 74; OD; = Ammonites boulbiensis Young & Bird, 1822, p. 252] [= Prae­haploceras Monestier, 1930, p. 28–29; Monestier, 1931, p. 69 (type, P. zwieielei, M); = Pseudow alkericeras Maureuge, 1949b, p. 151 (type, P. busignysene, M); = Buckmanites Gueix, 1973d, p. 470 (type, Oxynoticeras buckmanii Monestier, 1921, p. 39, OD)]. More involute than Harpoceras, with vertical, sloping, or undercut umbilical walls, compressed whorl section narrowing toward venter; tall, hollow, floored ventral keel, no ventral sulci; ribs single and falcoid or falcate, weak or striate on inner half of whorl, stronger, nearly straight and rursiradiate on outer half of whorl, and suddenly projected forward near venter in some. Dimorphic: macroconchs more than 150 mm in diameter, microconchs adult at 35–50 mm in diameter. The type specimen of Praehaploceras is an abnormal (malformed) Pseudolioceras without a keel. Lower Jurassic (lower Toarcian, Bifrons Zone)—Middle Jurassic (lower Bajocian, Laeviuscula Zone)– Europe, northern Africa (Atlas Ranges), Turkey, Russia (Transbaikalia, Bureya Basin, Far East, northeast), Thailand, Japan, Spitzbergen, Greenland, Canada (British Columbia, Yukon), USA (Alaska).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 49. Hildoceratidae (p. 71–76).
Oesperleioceras  
Krimholz in Krimholz & Tazikhin, 1957, p. 130 [*Pseudolioceras beauliziense Monestier, 1921, p. 30; OD] [=Pseudopolyplectus Mattei, 1969, p. 15 (type, Ammonites bicarinatus Zieten, 1831 in 1830–1833, p. 21, OD); =Oesperleioceras Guex, 1972, p. 639, nom. null., misspelling]. Similar to Harpoceras, but more involute and has a more triangular whorl section, with greatest width near umbilicus, and flat whorl sides converging toward a narrow, flat venter; venter tends to be tricarinate, with strong central keel and weaker lateral keels; ribs falcoïd, strongly projected forward near venter; suture highly incised and ornate, with many auxiliary saddles. Lower Jurassic (lower Toarcian, Bifrons Zone, Crassum Subzone—upper Toarcian, Levesquei Zone, Dispansum Subzone): England, France, Germany, Italy, Greece, Chile.——Fig. 49, 3a. *O. beauliziense (Monestier), lectotype (designated herein), upper Toarcian, Thouarsense Zone, Cornus, Aveyron, France. X1 (Monestier, 1921, pl. 1, 1. ).——Fig. 49, 3b–e. O. bicarinatum (Zieten); upper Toarcian, ?Variabilis Zone, Milhau, Aveyron, France. X1 (new, The Natural History Museum, London, BMNH C.75300).

Polyplectus Buckman, 1890, p. 214 [*Ammonites discoïdes Zieten, 1831 in 1830–1833, p. 21; M] [=Micropolyplectus Guex, 1973d, p. 470 (type, Oxynticeratinae meunieri Monestier, 1921, p. 38, OD); =Praepolyplectus Venturi, 1981b, p. 588 (type, P. forzanensis, OD)]. Oxycone, with very small umbilicus; more involute than Cleviceris, Harpoceras, or Oesperleioceras; venter acutely angled, but without a differentiated keel; whorl section triangular and sides only slightly rounded; ribs single, falcoïd, projected strongly forward on ventral half of whorl; suture highly incised and ornate, and has 4 or more auxiliary saddles. Probably dimorphic. Lower Jurassic (lower Toarcian, Falciferum Zone, Falciferum Subzone—upper Toarcian, Levesquei Zone, Dispansum Subzone): Europe, Morocco, Algeria, Pakistan, Japan, Canada (British Columbia, Alberta), USA (Oregon), Chile, Argentina.——Fig. 51, 4a–b. *P. discoïdes (Zieten), holotype, Heiningen, Württemberg, Germany, X1 (new, The Natural History Museum, London, BMNH 62568).

Sphenarites Spath, 1936b, p. 643 [*S. haukinsi; OD]. Single known specimen. Involute oxycone, very small umbilicus, smoothly rounded umbilical wall; apparently smooth; suture much reduced, but has many elements, including about 10 auxiliary saddles in external suture and 1 or 2 adventitious saddles. Lower Jurassic (Toarcian): Pakistan.——Fig. 51, 5a–c. *S. haukinsi, holotype, Kelat, Baluchistan; a–b, X1; c, suture, X2 (new, The Natural History Museum, London, C.40703).

Subfamily HILDOCERATINAE

Hyatt, 1867

[Sphenarites haukinsi; OD]. Single known specimen. Involute oxycone, very small umbilicus, smoothly rounded umbilical wall; apparently smooth; suture much reduced, but has many elements, including about 10 auxiliary saddles in external suture and 1 or 2 adventitious saddles. Lower Jurassic (Toarcian): Pakistan.——Fig. 51, 5a–c. *S. haukinsi, holotype, Kelat, Baluchistan; a–b, X1; c, suture, X2 (new, The Natural History Museum, London, C.40703). Evolute planulates with quadrate or elliptical whorl section and keeled or tricarinate-bisculate venter; ribs vary from fine to angled, and straight to falcate or strongly angled, and they may be interrupted by a midlateral spiral groove; some forms are smooth, but strongly ribbed forms may have ventrolateral tubercles. Some genera are dimorphic: microconchs have short lateral lappets reflecting forward projection of growth lines in midlateral spiral groove. The earliest form (Hildaites) was probably derived from an evolute form of Proto grammoceras in the upper Pliensbachian, Spinatum Zone. Lower Jurassic (upper Pliensbachian, Spinatum Zone—lower Toarcian, Variabilis Zone): worldwide.

Hildaites Buckman, 1921, pl. 217 [*H. subserpentinus; OD] [=Murlyiceras Buckman, 1921, pl. 216 (type, Ammonites murleyi Moxon, 1841, pl. 24, OD); =Hildoceratoides Buckman, 1921, pl. 218 (type H. propserpentinus, OD); =Harpohildoceras Repin, 1970, p. 44 (type, Hildoceras grandis Repin in Polubotko & Repin, 1966, p. 47, OD); =Praehildoceras Venturi, 1981b, p. 592 (type, P. forzanensis, OD); =Petronoceras Venturi in Farani & others, 1995, p. 256 (type, P. rinaldini, OD); =Neoastaffertia Venturi & Ferrè, 2001, p. 186 (type, N. alternans, OD); =Cingolites Sassaoli & Venturi, 2010, p. 105 (type, C. clavatus, OD)]. Moderately evolute; whorl section elliptical, rounded, or quadrate, umbilical walls vertical or sloping; strong ventral keel bordered by sulci or flat areas; ribs fine to coarse, single or bifurcating, sinuous, projected on venter; inner part of whorl may be striate or smooth; coarse-ribbed species may have ventrolateral swellings or tubercles. Dimorphic: both dimorphs have similar plain mouth borders. Lower Jurassic (upper Pliensbachian, Spinatum Zone—lower Toarcian, Falciferum Zone): Europe, Morocco, Turkey, Saudi Arabia, Somalia, Madagascar, Russia (northeast), Canada (British Columbia, Alberta, Yukon), USA (Nevada), Chile, Argentina. H. (Hildaites). Whorls typically evolve with quadrate or rounded whorl section; ribs mostly bifurcate, but some single ribs may also be present. Age and geographic range as for genus.——Fig. 52, 1a–b. *H. (H.) subserpentinus, holotype, Falciferum Zone, Falciferum Subzone, Ilminster, Somerset, England, X0.75 (new, Manchester University Museum, England, L.11544).——Fig. 52, 1c–d. H. murleyi (Moxon), holotype, Falciferum Zone, Escaratum Subzone, Dumbleton Hill, Gloucestershire, England, X1 (new, British Geological Survey, Keyworth, Nottingham, England, GSN 32040).

H. (Martanites) Venturi, 1997, p. 324 [*Martanites prorsiradiatus; OD]. More involute than most Hildaites with higher whorls and a
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 50. Hildoceratidae (p. 73–74).
more rounded and compressed whorl section; falcoid ribs are single throughout growth and are bold from the umbilical edge. Lower Jurassic (lower Toarcian, Falciferum Zone, Falciferum Subzone): England, Italy, Greece, Algeria.—Fig. 52, 2a–b. *H. (M.) prosiradiatus, holotype, Cima Panco, Monti Martani, Umbria, Italy, ×1 (Venturi, 1997, pl. 1.1).

Orthidae BUCKMAN, 1923b, pl. 444 [*O. orbustus; OD: =Harpceras douvilleri HAUG, 1884, p. 353]. Evolute; quadratic whorl section; broad venter with strong central keel, bordered by sulci and moderately strong ventrolateral keels; ribs strong, almost straight, and curving slightly forward at ventrolateral edge. Lower Jurassic (lower Toarcian, Falciferum Subzone): England, France, Germany, Italy, Portugal, Spain, Greece, Algeria.—Fig. 52, 3a–c. *O. douvilleri (HAUG); a, holotype of *O. orbustus BUCKMAN, Down Cliff, Chideock, Lyme Regis, Dorset, England, ×0.5 (Buckman, 1923b, pl. 444); b–c, holotype of *O. douvilleri (HAUG), St-Jacques, Thouars, Deux-Sèvres, France, ×1 (Gably, 1976, pl. 19, l.3).

Hildoceras HYATT, 1867, p. 99 [*Ammonites bifrons BRUGUIÈRE, 1789 in 1789–1792, p. 40; SD BUCKMAN, 1889a, p. 111] (=Goniobranchites Sequenza, 1886, p. 1385 (type, G. bipartitum, M); =Urkutites GECZY, 1967, p. 124 (type, U. boechhi, OD)]. Evolute, with quadratic whorl section; differs from *Hildaites in its more marked tricarinate-bisulcate venter, and midlateral spiral groove that develops in later species; ribs vary from weak or striate to strong, and from nearly straight to falcate or highly arcuate, and are projected strongly forward in spiral groove when that feature is present; dorsal part of whorl may be smooth. Dimorphic: macroconchs are 80–250 mm in diameter, microconchs are 24–65 mm in diameter when adult and have constricted mouth borders with short lateral lappets. Lower Jurassic (lower Toarcian, Falciferum Zone, Falciferum Subzone–upper Toarcian, Variabilis Zone): Europe, northern Africa (Atlas ranges), Turkey, Iran, Japan, Russia (north-east).—Fig. 53, 1a–d. *H. bifrons (BRUGUIÈRE); a–b, holotype, Bifrons Zone, Whirby, Yorkshire, England, macroconch, ×0.9 (new, The Natural History Museum, London, C.55840); c–d, microconch, Northampton, England, ×1 (new, The Natural History Museum, London, C.68821).

Para-hildoides BLAISON, 1967, p. 104–105 [*Hildaites sanderi ARKELL, 1952, p. 265; OD]. Differs from *Hildoceras and *Hildaites in being entirely smooth, at least at sizes more than 40 mm in diameter, though fine sigmoidal ribs or striae may occur on smaller whorls; no spiral groove; venter has strong keel, bordered by flat areas or slight sulci. Lower Jurassic (lower Toarcian, Bifrons Zone); central Saudi Arabia, Madagascar.—Fig. 53, 2a–b. *P. sanderi (ARKELL), holotype, Jafair Trail, Jebel Tuwaig, Saudi Arabia, ×0.6 (new, Sedgwick Museum, Cambridge, England, F.10682).

Mercaticeras BUCKMAN, 1913, p. vii [*Ammonites mercati HAUER, 1856, p. 43; OD]. Evolute, depressed; whorl section broad, with rounded ventrolateral shoulders converging to a narrowly tricarinate-bisulcate venter; ventral sulci may be lost at large sizes; ribs strong, straight to sinuose, projected forward on ventrolateral shoulders. Lower Jurassic (lower Toarcian, Mercati Zone (=Bifrons Zone)); southern and eastern Europe, northern Africa (Atlas ranges), Canada (British Columbia).—Fig. 53, 3a–b. *M. mercati (HAUER), lectotype, Erba, Italy, ×1 (Hauer, 1856, pl. 23, 6–7).

Hildoidae HILLEBRANDT, 1987, p. 125 [*H. retrocostatus; OD]. Evolute, whorl section round or elliptical, and rounded umbilical edge; venter has single keel, with no sulci; ribs strong, sinuous, and rursiradiate, fading at large sizes. Lower Jurassic (lower Toarcian, Chilensis Zone (=top Bifrons Zone–upper Toarcian, Variabilis Zone): Chile.—Fig. 53, 4a–b. *H. retrocostatus, holotype, Quebrada El Bolito, Atacama, Chile, ×0.6 (Hillebrandt, 1987, pl. 9, l.1a, p. 123, fig. 1c).

Atacamiceras HILLEBRANDT, 1987, p. 123 [*A. glabrum; OD]. Evolute, whorl section elliptical, slightly compressed; venter has single keel, with no sulci; smooth or has very weak simple ribs; suture simplified. Lower Jurassic (lower Toarcian, Chilensis Zone (=top Bifrons Zone–upper Toarcian, Variabilis Zone): Chile.—Fig. 53, 5a–b. *A. glabrum, holotype, Rio Manflas, Atacama, ×0.75 (Hillebrandt, 1987, pl. 8, l.3, p. 123, fig. 1a).

Subfamily BOULEICERATINAe

ARKELL, 1950


Aberrant forms with reduced and simplified sutures, which are ceratic in some genera. *Bouleiceras* is an evolve planulate, with strong ribs and tubercles, but most others are much more involute, varying from sphaerocones with a rounded venter to oxycones with a sharp or keeled venter. Dimorphism known in some genera. The earliest genus, *Bouleiceras*, was probably derived from the Arieticeratinae (Canavaria or Tauronemericas) at the top of the upper Pliensbachian; younger genera may form a phylogeny that extends nearly to the top of the Toarcian, though an alternative view has placed the sphaeroconic genera (*Frechiella, Paroniceras, Jacobella*) in a subfamily, Paroniceratinae, that was derived separately from the Hildoceratinae (*RULLEAU, BÉCAUD, & NEIGE, 2003*; THEVENIN, 1908; RENZ, 1925a, 1927; ARKELL, 1952; COLLIGNON, 1958; GALLITELLI-WENDT, 1963; WENDT, 1966; BLAISON, 1968; HILLEBRANDT, 1973; REPIN, 1991. Lower Jurassic (lower
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 51. Hildoceratidae (p. 74–76).
Fig. 52. Hildoceratidae (p. 76–78).
Toarcian, Tenuicostratum Zone–upper Toarcian, Levesquei Zone: Europe (especially Tethys), northern Africa, eastern Africa, Canada, South America.

Bouleiceras THEVENIN, 1906, p. 171 [*B. nitescens; M] [=Colcanapites COLLIGNON, 1958, pl. 1, 7 (type, Bouleiceras (Colcanapites) colcanapi, M)]. Evolute, coronate inner whorls, becoming more involute, planulate, and compressed on outer whorls; strong ventral keel throughout; innermost whorls are smooth, followed by a uni- or bituberculate stage, with or without ribs, then a stage with strongly rursiradiate, straight or sinuous ribs that bifurcate from umbilical tubercles, and finally a flat-sided smooth adult stage; sutures ceratitic, with wide entire saddles, and a deep digitate first lateral lobe. Lower Jurassic (lower Toarcian, Tenuicostratum–Falciferum Zones): Portugal, Spain, Morocco, Somalia, northeastern Kenya, Madagascar, Saudi Arabia, Pakistan, Chile, Argentina.——Fig. 54, 1a–c. *B. nitescens; lectotype, Bekoratsaky, Maevatavana, Madagascar; a–b, X1; c, suture, X2 (Thevenin, 1908, pl. 2.6).

Kohaticeras FATMI & HOLDER, 1975, p. 36 [*K. razeri; OD]. Moderately involute, subquadrate whorl section, venter with narrow central sulcus bordered by two weak keels; ribs prorsiradiate, sinuous; moderate to large midlateral bullae and moderate to large ventrolateral clavi; sutures ceratitic with almost entire saddles. Lower Jurassic (lower Toarcian, Pakistan).——Fig. 54, 2a–c. *K. razeri, holotype, Saramela, Kohat Tribal Belt; a–b, X0.75; c, suture, X1.5 (Fatmi & Holder, 1975, pl. 5, 1.4, p. 38, fig. 1).

Nejdia ARKELL, 1952, p. 266 [*N. bramkampi; OD]. Involute, whorl section lanceolate, with vertical or undercut umbilical wall, rounded umbilical edge, and ventral keel; smooth; sutures subceratitic, highly variable (Gautier, 1973a). Lower Jurassic (lower Toarcian, Falciferum–Bifrons Zones): Italy, Spain, Morocco, central Saudi Arabia, Madison.——Fig. 54, 3a–c. *N. bramkampi, holotype, Jebel Tuwaiq, Saudi Arabia; a–b, X0.7; c, suture, X1.5 (Arkell, 1952, pl. 17.5).

Frechiella PRINZ, 1904, p. 31 [*Nautilus subcarinatus YOUNG & BIRD, 1822, p. 255; OD] [=Achillea RENZ, 1913, p. 595 (type, Frechiella (Achillea) achillei, M)]. Involute to moderately evolve, swollen whorls, with characteristic narrowly tricarinate-bisulcate venter, fading on outer whorl; smooth, or with low distant primary ribs that fade or divide into obscure secondaries in middle of whorl side; sutures simplified, both saddles and lobes digitate or ceratitic. Lower Jurassic (lower Toarcian, Bifrons Zone [=Mercati Zone]): England, France, Germany, Spain, Portugal, Switzerland, Austria, Italy, Hungary, Greece, Chile, Argentina.——Fig. 55, 1a–c. *F. subcarinata (Young & Bird), holotype, Whitby, Yorkshire, England; a–b, X0.7 (Howarth, 1992b, pl. 29, 7); c, suture, X1.5 (Howarth, 1992b, p. 159, fig. 39A).

Paroniceras BONARELLI, 1893, p. 202 [*Ammonites sternalis d’ORBIGNY, 1845 in 1842–1851, p. 345; M]. Involute sphaerocones, with swollen whorls, a small umbilicus and a smoothly rounded venter that is not tricarinate-bisulcate; smooth or with low ribs on inner whorls; sutures simplified, with digitate lobes and saddles. Probably dimorphic. Lower Jurassic (upper Toarcian, Variabilis–Levesquei Zones): France, Germany, Switzerland, Austria, Hungary, Italy, Portugal, Spain, Greece, Morocco, Algeria, Canada (British Columbia).——Fig. 55, 2a–f. *P. sternale (d’Orbigny); a–b, lectotype, France; X0.75 (d’Orbigny, 1845 in 1842–1851, pl. 111, l–2); c–d, possible adult microconch, Fonte Calderare, Cesi, Terni, Italy, X1 (Renz, 1923, pl. 12, l–2); e–f, macroconch, with uncoiling body chamber, Variabilis Zone, Carrière Lafarge, Belmont, Gers, France, X1 (Rulleau, Bécaud, & Neige, 2003, p. 357, fig. 15-a1, 15-c).

Jacobbella JEANNET, 1908, p. 205 [*J. lugeoni; M] [=Oxyaponeurites GUEx, 1974, p. 429 (type, Paroniceras telemachi RENZ, 1913, p. 603, OD); =Neoparoniceras RULLEAU, BÉCAUD, & NEIGE, 2003, p. 341 (type, Paroniceras undulosum MONESTIER, 1921, p. 8, OD)]. Similar to Paroniceras, but more compressed, and venter becomes angled, keeled, or lanceolate; obscure ribs on inner whorls, smooth outer whorls; simplified sutures. Dimorphic: microconchs (synonym Neoparoniceras) are adult at a diameter of approximately 15–25 mm and have a rounded venter, because their maximum size is less than the size at which an angled or keeled venter was developed in the larger macroconchs (synonym Oxyaponeurites). *Jacobbella is not a nomen oblitum as claimed by Rulleau, Bécaud, and Neige (2003, p. 336), because its usage does not conform to the requirements of Articles 23.9.1 and 23.9.2 of the ICZN Code of Nomenclature (1999) for a nomen oblitum. Lower Jurassic (upper Toarcian, Thouarsense Zone–Levesquei Zone, Dispansum Subzone): England, France, Germany, Spain, Italy, Greece, Morocco.——Fig. 55, 3a–c. *J. lugeoni, holotype, Pontarlier, Doubs, France; a–b, X1; c, suture, X2.5 (Jeannet, 1908, pl. 9, 1.3, p. 210, fig. 4).——Fig. 55, 3d–e. *J. suevicum (RENZ), St.-Quentin Fallavier (Isère), France, X1 (Rulleau, Bécaud, & Neige, 2003, fig. 15-6a, 6b).

Subfamily LEUKADIÉLLINAE

Macchioni & Venturi, 2000

[Leukadiellinae Macchioni & Venturi, 2000, p. 323]

Mainly evolve forms with rounded-rectangular whorl section, a flat, keeled venter, and depressed inner whorls that become more compressed later; ribs strong and rursiradiate, usually single, but sometimes bifurcating; large ventrolateral tubercles or spines are common, and smaller umbilical tubercles occur in some forms; suture reduced and simplified from probable Hildoceratinae ancestors. The earliest
Fig. 53. Hildoceratidae (p. 78).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

...the reason for separation of the subfamily from the Bouleicerasinae (Macchioni & Venturi, 2000). Lower Jurassic (lower Toarcian): Europe (especially Tethys), Algeria, western Canada, Chile.

Renziceras Arkell, 1953, p. 36 [*Hildoceras nasikaeae Renz, 1913, p. 607; OD]. Small (up to 60 mm in diameter), evolute, whorl section quadrate; strong keel on flat venter; inner whorls coronate with strong, rursiradiate, simple ribs ending in large ventrolateral tubercles; tubercles disappear on outer whorls and ribs project forward on venter; suture hildoceratid, but somewhat reduced. Lower Jurassic (lower Toarcian): Spain, Greece, Italy, Algeria.——Fig. 56,1a–c. *R. nasikaeae (Renz); a–b, holotype, Epirus, Greece, ×1 (Renz, 1913, p. 609, fig. 25); c, Migiani di M. Malba, Umbria-Marche Appennines, Italy, ×1.5 (Macchioni & Venturi, 2000, pl. 3,5).

Leukadiella Renz, 1913, p. 584 [*L. helenae; M]. Evolute, whorl section quadrate, venter unicarinate or tricarinate-bisulcate; ribs rursiradiate, distant, simple or twinned from umbilical edge, ending in tubercles, parabolic nodes or clavi at ventrolateral edge, which...
may overtop the keel sunk in a concave venter; sutures simplified, both lobes and saddles digitate or ceratitic. All known European and northern African examples are less than 60 mm in diameter, while much larger specimens up to 155 mm in diameter occur in British Columbia, Canada (Jacobs, 1995). Lower Jurassic (lower Toarcian, Bifrons Zone): England, Italy, Greece, Spain, Algeria, Canada (British Columbia), Chile, Argentina.— Fig. 56, 2a–c. *L. helenae*, holotype, Ananysvads, Leukas, Greece, ×1.5 (Wendt, 1966, pl. 13,2).— Fig. 56, 2d–e. *L. ionica* RENZ & RENZ, Whiteways Bay, Moresby Island, Queen Charlotte Islands, British Columbia, Canada, ×0.45 (Jacobs, 1995, p. 93, fig. 5-1, 5-2).

Subfamily ARIETICERATINAE

Howarth, 1955


Evolute planulates, with quadratic to compressed whorls and mainly uncinurate venter; ribs weak to strong, straight, slightly sinuous or occasionally smooth; some forms uni- or bituberculate; dimorphism not documented. Evolute developments of lower Pliensbachian-Haploceratinae, probably derived from *Protogrammoceras* at the Margaritatus Zone, Stokes-Subnodosus Subzone boundary. *Fucini*, 1901a, 1901b, 1902, 1903, 1905, 1907, 1911, 1929, 1931, 1935; Wiedenmayer, 1977, 1980; Braga, 1983. Eight generic names were proposed by *Fucini* (1931) for this subfamily without original fixation of their type species, contrary to the requirements of ICZN Code (1999), Article 13.3. Haas (1947, p. 80) pointed out that all were invalid because the type species were not fixed in the original descriptions. This was accepted for five of the genera by Vecchia (1949, p. 142) and Canta-luppi (1970, p. 14–17), but they maintained that three genera were valid because of the tautonomy of genus and species names in the original description. This is not correct: ICZN Code (1999), Article 68.4 only allows type species fixation in the original description by “absolute tautonomy,” for which the genus and species names have to be identical. “Virtual tautonomy”—genus and species names derived from the same root, as in the three *Fucini* genera—can only be taken into account in the subsequent designation of a type species, which is not an allowable procedure for genus-group names proposed after 1930 (Article 69 and Recommendation 69A.2). None of the species names used by *Fucini* in 1931 are identical with his newly proposed genera; all eight are therefore unavailable and are replaced here, where appropriate, by subsequent valid uses of the same names. Lower Jurassic (upper Pliensbachian–lower Toarcian, Tenuicostatum Zone): typically Tethyan, rarely boreal.

Arieticeras Seguenza, 1885, p. 255, non Quenstedt, 1882 in 1882–1888, p. 44, rejected as a generic name by ICZN Opinion 337, 1955c [*Ammonites algovianus* Oppel, 1862, p. 137; *SD Levi*, 1896, p. 272] [=Seguezniceras Levi, 1896, p. 272, obj., ICZN Opinion 337, 1955c; =Meneghinia Vecchia, 1949, p. 142 (*Fucini*, 1931, p. 108 (118), nom. nud., type species not designated), non Silvestri, 1889 (Protozoa) (type, *Ammonites rutherensis* Reynes, 1868, p. 94, OD); =Distefania Fucini, 1931, p. 143 (153), nom. nud., type species not designated, non Chechfia-Rispoli, 1917 (Crustacea); =Protoarieticeras Cantaluppi, 1970, p. 40 (type, *Arieticeratinae* apertura Monestier, 1934, p. 50, OD); =Pseudoarie ticeratina Cantaluppi, 1970, p. 40 (type, *Harpoceras* (Hildoceras) geyeri del Campana, 1900, p. 607, OD); =Gezzya Fantini Sestini, 1977, p. 710, 724 (type, *Ammonites radians amalthei* Oppel, 1853, p. 51, OD). Evolute, whorl section quadrato to compressed, usually with rounded ventrolateral shoulders; venter with strong keel, with or without sulci; ribs strong, single, straight to sinuous, projected forward near venter; no tubercles. Lower Jurassic (upper Pliensbachian, Margaritatus Zone, basal Subnodosus Subzone–Spinatum Zone): Europe, northern Africa (Atlas Ranges), Caucasus, Russia (Far East), Vietnam, Japan, Canada (British Columbia), USA (Alaska, Nevada, Oregon, California), Mexico, Chile, Argentina.— Fig. 57, 1a. *A. algovianum* (Oppel), lectotype (designated by Wiedenmayer, 1977, p. 86), *Margaritatus Zone*, Tannheim, Tirol, Austria, ×1.5 (new, Bayerische Staatsammlung für Paläontologie und Geologie, Munich).— Fig. 57, 1k–c. *A. amalthei* (Oppel), neotype (designated by Fischer, 1975, p. 71), Reutlingen, Württemberg, Germany (type species of *Gezzya*): b, ×1; c, cross section, ×1 (Fischer, 1975, pl. 2, 10, p. 72, fig. 16).

Psilceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 55. Hildoceratidae (p. 81).
null., misspelling of Ugdelenia]. More compressed and slightly more involute than Arieticeras, and has higher, flat-sided whorls, with straight, rursiradiate, slightly curved or gently flexuous ribs that end abruptly at ventrolateral edge in some forms; some ribs on inner whorls may bifurcate; no tubercles. Braga, 1983, p. 269; Comas Rengifo, 1985, p. 511. Lower Jurassic (upper Pliensbachian, mid-Margaritatus Zone–Spinatum Zone): Italy, Switzerland, Spain, Portugal, France, Austria, Hungary, Morocco, Algeria.—Fig. 57,2a–b.*E. emaciatum (Catullo), holotype, Venetia, Italy, ×1 (Fucini, 1931, pl. 11 (27),4).—Fig. 57,2c. E. ugdulenai (Gemmellaro), neotype, type species of Ugdulenia, Don Marteo, Taormina, Sicily, Italy, ×1 (Pavia in Pavia & Cresta, 2002, p. 132, fig. 78a) [The lectotype of E. ugdulenai (Fucini, 1931, pl. 9 (25),1), selected by Braga (1983, p. 247), from the same locality, is missing].

Canavaria Gemmellaro, 1886b, p. 190 [*Harpoceras (Dumortieria) haugi Gemmellaro, 1886a, p. 111; SD Howarth, 1955, p. 167] [=Naxensiceras Fucini, 1931, p. 137 (147), nom. nud., type species not designated; =Naxensiceras Vecchia, 1949, p. 142 (type, Harpoceras (Grammoceras) naxense Gemmellaro, 1886a, p. 112, OD); =Oregonites Wiedenmayer, 1980, p. 124 (type, O. imlaiyi, OD)]. Differs from Arieticeras in development of ventrolateral tubercles and some umbilical tubercles; ribs tend to be stronger, straighter, and more widely spaced. Lower Jurassic (upper Pliensbachian, Spinatum Zone): England, France, Italy, Spain, Portugal, northern Africa (Atlas Ranges), Japan, Canada (British Columbia), USA (Oregon).—Fig. 57,3. *C. haugi (Gemmellaro), lectotype, Valle Agonia, Taormina, Sicily, ×0.8 (Pavia in Pavia & Cresta, 2002, p. 135, fig. 80a).

Tauromeniceras Mouterde, 1967, p. 223 [*Tauromenia elisa Fucini, 1931, p. 115 (125); OD] [=Tauromenia Fucini, 1931, p. 114 (124), nom. nud., type species not designated, non Seguenza, 1885; =Neoemaciaticeras Cantaluppi, 1970, p. 39, obj.]. Differs from Canavaria in being slightly more involute, with higher whors and is more compressed; ribs are straighter and rursiradiate; umbilical and ventrolateral tubercles are more pronounced, and ribs are sometimes twinned from umbilical tubercles. Braga, 1983, p. 308; Comas Rengifo, 1985, p. 522; Dubar & Mouterde, 1978. Lower Jurassic (upper Pliensbachian, Spinatum Zone): Italy, Spain, Portugal, France, Hungary, Morocco.—Fig. 57,4.*T. elisa (Fucini), lectotype, Paladino, Taormina, Sicily, ×0.8 (Fucini, 1931, pl. 10 (26),1).

Fontanelliceras Vecchia, 1949, p. 142 (Fucini, 1931, p. 110 (120), nom. nud., type species not designated) [*Harpoceras fontanellense Gemmellaro, 1886a, p. 118; OD]. Evolute, more serpenticone and whorl section more depressed than Canavaria; venter tricarinate-bisulcate; ribs simple, straight, distant and thick; most species have umbilical and ventrolateral tubercles. Lower Jurassic (upper Pliensbachian): France, Italy, Spain, Japan, Canada (British Columbia), USA (Oregon).—Fig. 57,5.*E. fontanellense (Gemmellaro), lectotype (designated by Braga, 1983, p. 265), Fontanelle,
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Taormina, Sicily, ×1.5 (Pavia in Pavia & Cresta, 2002, p. 146, fig. 88a).

**Leptaleoceras** BUCKMAN, 1918b, p. 284 [*L. leptum; OD]. Evolute, whorl section compressed, elliptical, with narrow, angled, or keeled venter; ribs fine to moderate, straight, sinuous, or curved gently backward, becoming striate or smooth on outer whorls; no tubercles. **Lower Jurassic** (upper Plenistionichia, Margaritarites–Spinita Zone): England, France, Italy, Spain, Hungary, Canada (British Columbia), USA (Alaska, Oregon), Mexico, Chile.—FIG. 57, 6a–b. *L. leptum*, holotype, Spinatum Zone, South Petherton, Somerset, England, ×0.8 (Buckman, 1918b, pl. 26, f.).

**Arctomeroceratinae** REPIN, 1968, p. 140 [*A. costatum; OD]. Cadincone, whorl section depressed, whorl height/breadth ratio about 1:2; rounded ventrolateral shoulders; venter flat or slightly arched, with keel; ribs curved strongly forward on whorl side and venter. **Lower Jurassic** (lower Toarcian, Tenuicostatum Zone): Russia (northeast, Omolon Basin).—FIG. 58a–b. *A. costatum*, holotype, Golovnoy river, Omolon, Russia (northeast), ×1 (Hillebrandt & others, 1992, pl. 18, 2).

**Subfamily** GRAMMOCERATINAE


Mainly evolute, straight-ribbed derivatives of Hildoceratinae, giving rise to more involute forms; ribs gently curved, occasionally almost straight, and falcoid or sharply bent style of ribbing of earlier subfamilies has been lost; large whorls may become smooth. Dimorphism marked in some genera, and long lateral lappets appear in adult mouth borders of microconchs for the first time.

**Buckman, 1887–1907. Lower Jurassic** (upper Toarcian, Variabilis Zone–Middle Jurassic (Aalenian, Opalinum Zone): worldwide.

**Grammoceras** HYATT, 1867, p. 99 [*Ammonites striatulatus* J. DE C. SOWERBY, 1823b, p. 23; SD BUCKMAN, 1890, p. 158] = Costigrammoceras BUCKMAN, 1826, pl. 686 (type, *C. cottigerum*, OD). Evolute, compressed elliptical whors, with rounded umbilical slope, no umbilical edge, and blunt ventral keel; ribs simple, straight to sinuous, projected on venter; umbilical slope and inner part of whorl usually smooth or only striate. Dimorphic; microconchs small (20–25 mm in diameter), with long spatulate lateral lappets. **Lower Jurassic** (upper Toarcian, Thouarsense Zone): Europe, northern Africa (Atlas Ranges), Caucasus, northern Iran, Russia (Far East), Japan, Indonesia (Sulawesi), Canada (British Columbia), USA (Alaska, Nevada, Oregon).—FIG. 59, 1a–e. *G. striatulum* (J. DE C. SOWERBY, 1887, p. 72; M; ICZN Opinion 324, 1955b) = Monestieria C. SOWERBY, 1905a, p. cxlv, fig. 138).—FIG. 59, 2c–d. *P. regale* BUCKMAN, holotype, Thouarsense Zone, Fallaciosum Subzone: Europe, northern Africa (Atlas Ranges), Caucasus, Japan, Indonesia (Sulawesi), Spitzbergen, Canada (British Columbia), USA (Alaska).—FIG. 59, 2a–h. *P. strukmanni* (DENCKMANN), lectotype (designated herein), Variabilis Zone, Dörnten, Germany, ×0.75 (new, Göttingen Geological Institute, 458–14).—FIG. 59, 2c–d. *P. regale* BUCKMAN, holotype, Thouarsense Zone, Fallaciosum Subzone, Coaley Wood, Stroud, Gloucestershire, England, ×0.5 (new, Museum of Comparative Zoology, Cambridge, Massachusetts, 2402; also figured in Buckman, 1904a, p. cxlv, fig. 138).—FIG. 59, 2c–f. *P. regale* (MONESTIER), holotype, Thouarsense Zone, Saint-Paul, Aveyron, France (type species of Monestieria), ×1 (Monestier, 1921, pl. 2, 19, pl. 4, 39).

**Podagrosites** GUEx, 1973d, p. 470 [*Pseudogrammoceras podagrosus MONESTIER, 1921, p. 18; OD]. Evolute, whorl section subquadrate, venter tricarinate-bisulcata on inner whors, but sulci and lateral keels lost on larger whors; strong sinuous ribs single or bifurcate from umbilical edge. Differs from Pseudogrammoceras in being more evolute, less compressed, has sulci bordering ventral keel on inner whors and generally stronger ribbing. **Lower Jurassic** (upper Toarcian, Variabilis–Thouarsense Zones): France, England, Germany, Spain, Canada (British Columbia).—FIG. 60, 1a–b. *P. podagrosus* (MONESTIER), lectotype (designated herein), le Guilhomard, Aveyron, France, ×1 (Monestier, 1921, pl. 3, 23, pl. 4, 19).—FIG. 60, 1a–d. *P. late-scum* (SIMPSON), holotype, Peak, Whitby, England, ×1 (Buckman, 1913, pl. 79).

**Pseudolitillia** MAU BEUGE, 1949b, p. 150 [*P. murivel-lensis*; M]. Inner whors moderately evolute, with quadrate whorl section and venter with keel and sulci on venter; straight simple ribs curve forward near venter; outer whors become smooth, more involute, and whorl section becomes convergent
Fig. 57. Hildoceratidae (p. 84–87).
toward venter, which has no sulci. Donovan, 1962. Lower Jurassic (upper Toarcian, Thouarsense Zone, Fallacioceras Subzone [=Erahsense Zone, Bayani Subzone]): France, Spain, Morocco.—Fig. 60, 2a–b. *P. murvilleensis, holotype, Mine de Murville, Meuth & Moselle, France, ×0.5 (new, Museum d'Histoire Naturelle, Paris).

Shakraceras Basse in Basse & Karoff, 1957, p. 329 [*S. loewe; M]. Single known specimen is moderately evolute, with robust quadrate whorls, ventral keel, and vague spiral depression in center of whorl side; low sinusuous ribs are mainly on dorsal half of whorl, and there are low swellings at umbilical edge. Relationships unknown. Lower Jurassic (lower Toarcian, Bifrons Zone or lower upper Toarcian): central Saudi Arabia.——Fig. 59, 3a–b. *S. loewe, holotype, Shakra, Jebel Tuwaq, ×0.5 (Basse & Karoff, 1957, pl. 19, 1–2).

Phlyseogrammoceras Buckman, 1901, p. 266 [*Ammonites dispansus Lycett, 1860, p. 146; M, ICZN Opinion 324, 1955b] [=Gruneria Gably, 1974, p. 1247 (type, Ammonites gruneri Dumortier, 1874, p. 70, OD)]. Moderately involute, compressed, lanceolate whorl section, sloping umbilical walls, and high ventral keel; sinusous ribs emerge in bundles from radially elongated umbilical tubercles, and are projected forward on venter; final whorl tends to become smooth. Lower Jurassic (upper Toarcian, Levesquei Zone, Dispansum Subzone): Europe, Canada (British Columbia), Chile, Argentina.——Fig. 61, 1a–b. *P. dispansum (Lycett), lectotype (designated herein), Frocester Hill, Stroud, Gloucestershire, England, ×0.5 (new, British Geological Survey, Keyworth, Nottingham, England, G&M 24924, also figured in Buckman, 1922, pl. 340).

Hudlestonia Buckman, 1891, p. 225 [*Ammonites affinis Seebach, 1864, p. 143; OD]. Involute oxycone, compressed, triangular or lanceolate whorl section, angled venter; inner whorls may have keel and sinusuous ribs that are bundled or bifurcate at umbilical tubercles; outer whorls smooth; suture simplified. Lower Jurassic (upper Toarcian, Levesquei Zone): Europe,——Fig. 61, 2a–e. *H. affinis (Seebach); a–c, holotype, Levesquei Zone, Dispansum Subzone, Röckengraban, Westen, Germany, ×0.7 (new, Göttingen Geological Institute, 460–29); d–e, Bethel, Bielefeld, Germany, ×0.75 (Schlegelmilch, 1976, pl. 47, 3).

Dumortieria Haug, 1885, p. 605, 666, 710 [*Ammonites levesquei d’Orbigny, 1844 in 1842–1851, p. 230; SD Buckman, 1891, p. 231] [=Phenakoceras Maubeuge, 1949a, p. 131 (type, P. phenax, OD); =Phenakoceras Maubeuge, 1950, p. 397, obj.; =Paradumortieria Elmi & Calvo-Fortier, 1985, p. 46 (type, P. tectiforme, OD)]. Evolute planu-lates, with rounded to quadrato whorl section and ventral keel; ribs variable, strong and distant to fine or striate, almost straight, sometimes bundled at umbilical edge, curving forward on venter, but disappear before reaching keel. Dimorphic: mouth border of microconch has small lateral lappet, macroconch mouth border plain with ventral rostrum. Type specimen of Phenakoceras in an abnormal Dumortieria without a keel. Lower Jurassic (upper Toarcian, Levesquei Zone, Levesquei–Moorei Subzones): Europe, northern Africa (Atlas Ranges), Turkey, northern Iran, China (Tibet), Vietnam, Borneo, Canada (British Columbia), USA (Oregon), Chile, Argentina.——Fig. 62, 1a–b. *D. levesquei (d’Orbigny), lectotype (designated by Fischer, 1994, p. 59), macroconch, Charrolles, Saone-et-Loire, France, ×0.75 (Fischer, 1994, pl. 36, 3).——Fig. 62, 1c–d. *D. subundulata (Branco), microconch, Moorei Subzone, Buckholt Wood, Stroud, Gloucestershire, England, ×1 (new, Sedgwick Museum, Cambridge, England, J.6235; also figured in Buckman, 1892, pl. 45, 1–2).

Troitsiaia Poulton & Tipper, 1991, p. 30 [*T. westermannii; OD]. Derived from Dumortieria, which it resembles, but has small spines or tubercles at umbilical edge, and whorl height is lower on inner and intermediate whorls. Middle Jurassic (Aalenian, lower half of Opalinum Zone): Canada (British Columbia).——Fig. 62, 2a–b. *T. westermannii, Troitsa Peak, Whitesail Range, British Columbia; a, holotype, ×1; b, venter of paratype, ×1 (Poulton & Tipper, 1991, pl. 7, 14, 17).
Fig. 59. Hildoceratidae (p. 87–89).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

**Catulloceras** *Gemellaro*, 1886c, p. 203 [*Ammnites dumortieri* *Dumortier*, 1874, p. 269; SD Buckman, 1892, p. 276] [=Dactylogrammites Buckman, 1925a, pl. 573 (type *D. digitatus*, OD)]. Whorls more evolute, thicker and more quadrate than *Dumortieria*, and venter flat with poorly developed keel; ribs strong, straight or concave, inclined forward on venter. Lower Jurassic (upper Toarcian, Levesquei Zone, Levesquei–Moorei Subzones): Europe, northern Africa (Atlas Ranges), Canada (British Columbia), USA (Oregon), Chile.—Fig. 62, 3a–b. *C. *dumortieri (Dumortier), lectotype (designated herein), Verpillière, Rhône, France, ×0.75 (Dumortier, 1874, pl. 57, 3–4).

**Pleydellia** Buckman, 1899, supplement pl. 10, explanation for fig. 11–13 [*P. comata; M*] =Cotteswoldia Buckman, 1902, p. 3 (type, *Ammonites costulatus* Zieten, 1830 in 1830–1833, p. 10, SD Buckman, 1923a, pl. 56). =Canavarina Buckman, 1904a, p. cxli, nom. nov. pro Canavaria Buckman, 1902, p. 3 (type, *C. folleata*, SD herein), non Gemellaro, 1886b, p. 190; =Walkericeras Buckman, 1913, p. iii (type, *W. burtonensis*, SD herein), nom. nov. pro Walkeria Buckman, 1902, p. 5, non Fleming, 1823 (Bryozoa); =Cotteswoldia Theobald & Maubéuge, 1949, p. 274, nom. null., misspelling; =Nadorettes Elm & Callo-Fortier, 1985, p. 49 (type, *Cotteswoldia costulata* Schlotheim) var. sourens Perrot, 1957, p. 382, OD]. Moderately evolute to involute, compressed, some tending to oxycone form; strong keel; umbilical edge may be angled; ribs variable, strong to striate, often changing in same specimen, sinuous to falcoid, sometimes bifurcating, or bundled at umbilical edge, and projected strongly forward near venter; small or incipient tubercles at umbilical edge in some species. Dimorphic: microconchs have long narrow lateral lappet, macroconchs have plain mouth border and ventral rostrum. More involute and with more flexuous ribbing than *Dumortieria*, from which it is derived. Lower Jurassic (upper Toarcian, Levesquei Zone, Aalenic Subzone)–Middle Jurassic (Aalenian, Opalinum Zone): Europe, northern Africa (Atlas Ranges), Turkey, northern Iran, Canada (British Columbia), USA (Alaska, Oregon), Chile, Argentina.—Fig. 62, 4a–b. *P. comata*, holotype, microconch, *Aalenic* Subzone, Burton Bradstock, Dorset, England, ×1.5 (new, Museum of Comparative Zoology, Cambridge, Massachusetts, 2441). —Fig. 62, 4c. *P. egena* Buckman, microconch, *Aalenic* Subzone, Buckholt Wood, Stroud, Gloucestershire, England, Museum of Comparative Zoology, Cambridge, Massachusetts, 2438, ×1.5 (new; also figured in Buckman, 1905a, supplement pl. 23, 9–10).

**Yakounia** Jakobs & Smith, 1996, p. 130 [*Y. yakouensis*; OD]. Moderately evolute, compressed, with ventral keel and rounded umbilical edge; ribs generally strong, sinuous or falcoid and bundled from moderate to strong umbilical tubercles or bifurcating on side of whorl. [*Yakounia* was originally referred to the Phymatoceratinae, but some species of *Yakounia* greatly resemble contemporary species of *Pleydellia* that occur at the same horizon, from which it was probably derived by becoming more evolute, increasing size of the tubercles at the umbilical edge and developing generally stronger ribs]. Lower Jurassic (upper Toarcian, Yakouensis Zone [=Levesquei Zone]): Canada (British Columbia).—Fig. 62, 5a–b. *Y. yakouensis*, holotype, Phantom Creek Formation, Yakoun River, Graham Island, Queen Charlotte.
Islands, British Columbia, Canada, ×1 (Jakobs, Smith, & Tipper, 1994, pl. 5, 15–16).

**Subfamily TMETOCERATINAE**

**Spath, 1936**

[Tmetoceratinae Spath, 1936c, p. 3]

Derivatives of Grammoceratinae, especially *Dumortieria* and *Catulloceras*, that have lost the keel. Lower Jurassic (upper Toarcian)–Middle Jurassic (lower Bajocian): worldwide.

**Tmetoceras** Buckman, 1892, p. 269 [*Ammonites scissus Benecke, 1865, p. 170; OD*] [= *Tmetoites Westermann*, 1964, p. 442 (type, *T. tenue*, OD)]. Evolute planulate, whorl section subquadrate or rounded, venter flat with deep median groove; ribs simple, straight, ending in a small tubercle at edge of venter; constrictions present at least on outer
whorls. Dimorphic: synonym *Tetroites* has been used as a subgenus for microconchs, which have short lateral lappets; macroconchs are 2–4 times larger and have plain mouth borders. Lower Jurassic (upper Toarcian, Levesquei Zone)–Middle Jurassic (Aalenian, Concavum Zone): Europe, northern Africa (Atlas Ranges), Thailand, Vietnam, Japan, Canada (British Columbia), USA (Alaska, Oregon, California), Chile, Argentina, Venezuela. ——— **Fig. 63a–b. *T. scissum* (Benecke).** Lectotype (designated herein), macroconch, Aalenian, *Marchisonae Zone*, Cape San Vigilio, Lake Garda, Italy, ×1 (Benecke, 1865, pl. 6.4). ——— **Fig. 63c–e. *T. tenue Westermann*, holotype, complete microconch, Concavum Zone, Wide Bay, Alaska Peninsula; ×<sub>1.5</sub>. **e,** aperture with lappet, ×3 (Westermann, 1964, pl. 73.1).

**Family GRAPHOCERATIDAE**

**Buckman, 1905**


Moderately to highly involute, compressed whorl section, with unflored keel; ribs strong, sinus to falcate, occasionally striate or becoming smooth; tubercles rare; no constrictions. Nearly all genera dimorphic: microconchs have lateral lappets, macroconchs are 3× to 5× larger and have plain mouth borders. Buckman, 1887–1907; Dorn, 1935; Hoffmann, 1913; Rieber, 1963; Chandler, 1997. Collections from a single horizon that undoubtedly belong to a single species can show a very wide range of variation, which apparently embraces the morphology of several described genera (Chandler & Callomon, 2009). *Middle Jurassic (Aalenian–lower Bajocian, Discites Zone): worldwide.*

**Subfamily LEIOCERATINAE**

**Spath, 1936**

[Leioceratinae Spath, 1936c, p. 7] [=Staunieiinae Maude, 1950, p. 391]

Early forms derived from *Pleydellia* that are mainly very involute, with weak to moderate keel. *Middle Jurassic (Aalenian, Opalinum Zone–Marchisonae Zone).*

**Leioceras** Hyatt, 1867, p. 101 [*Nautilus opalinus* Reinecke, 1818, p. 55; SD Buckman, 1887, p. 12] [=Anciloceras Buckman, 1899, pl. lxvii (type, *A. substratum*, OD); =Cyphoceras Buckman, 1899, p. lxxiii (type, *C. plicatum*, OD); =Manuelia Buckman, 1899, pl. lvii (type, *M. subfalcata*, OD)]. Involute, compressed, venter keeled or sharply angled; smooth, striate or finely ribbed; striae and ribs sinuous or falcoid, sometimes bifurcating; ribs in early whors often give way to folds or undulations on middle and dorsal part of striate later whors. Derived from *Pleydellia*. Dimorphic: microconchs have lappets. ([Reinecke](https://www.biodiversitylibrary.org))*'s original figure is too poor to determine the species, and Buckman (1899, xxxiv, xli) selected the "next specimen figured," i.e., Quenstedt, 1846 in 1845–1849, pl. 7.10, to be the so-called type of the species. [Quenstedt](https://www.biodiversitylibrary.org)'s figure of a microconch is reproduced here, together with better figures of both dimorphs. *Lioceras Bayle*, 1878, is a synonym of *Harptoceras Waagen*, 1869; see p. 75 herein. *Middle Jurassic (Aalenian, Opalinum Zone–Marchisonae Zone, Bradfordensis Subzone):* Europe, northern Africa (Atlas Ranges), Turkey, Caucasus, Iran, Russia (Transbaikal), Canada (Yukon), Chile, Argentina. ——— **Fig. 64,1a–e. *L. opalinum* (Reinecke); a,** type selected by Buckman, microconch, Teufelsloch, Boll, Württemberg, Germany, ×1 (Quenstedt, 1846 in 1845–1849, pl. 7.10); **b–c,** macroconch, Boll, Württemberg, Germany, ×1 (new, The Natural History Museum, London, 37842); **d–e,** microconch, Ottenbach, Baden, Germany, ×1 (new, Geology Department, Hull University, England, no. 5118).

**Canavarella** Buckman, 1904a, p. cxxvii [*C. belophora: OD*] [=Rhebeceras Buckman, 1899, supplement pl. 11, explanation of fig. 1–6 (type, *R. tortum*, SD Buckman, 1904a, pl. lxxii), non Meek, 1876, p. 462 (an Upper Cretaceous scaphitid); =Costiceras Contini, 1969, p. 25 (type, *Leioceras paucicostatum* Rieber, 1963, p. 35, OD)]. Similar to *Leioceras* but with moderate to strong falcoid ribs, sometimes bifurcating; may also be less involute and less compressed. *Middle Jurassic (Aalenian, Opalinum Zone, Scissum Subzone):* Europe, northern Africa (Atlas Ranges), Iran. ——— **Fig. 64,2a–b. *C. belophora*, holotype, *m*icroconch, Stoke Knap, Dorset, England, ×1 (new, Museum of Comparative Zoology, Cambridge, Massachusetts, 2430). ——— **Fig. 64,2c–d. *C. fasciata* (Buckman), holotype, macroconch, Sherborne, Dorset, ×1 (new, Museum of Comparative Zoology, Cambridge, Massachusetts, 2529).

**Cyliloceras** Buckman, 1899, p. xlix [*C. undatum; OD*] [=Hyattina Buckman, 1899, p. lvii (type, *H. brasili*; OD); =Geyerina Buckman, 1913, p. iv (type, *G. fasciata*, OD), nom. nov. pro Geyerina Buckman, 1899, p. 1, non Bucheker, 1880 (Insect)]. Similar to *Canavarella*, but more evolve, with thick quadrate whorls and coarse, bifurcating ribs. *Middle Jurassic (Aalenian, Opalinum Zone, Scissum Subzone–Marchisonae Zone, Haugi Subzone):* England. ——— **Fig. 64,3a–b. *C. undatum*, holotype, macroconch, Haresfield Hill, Stroud, Gloucestershire, ×1 (new, Museum of Comparative Zoology, Cambridge, Massachusetts, 2528).

**Staunieiina** Pompeckj, 1906, p. 251 [*Ammonites stauensi* Oppel, 1856 in 1856–1858, p. 371; M]. Highly involute oxicone, triangular compressed whorl section, acutely angled venter; sinuous striae or weak ribs on inner whorls, striate or
Fig. 62. Hildoceratidae (p. 89–92).
smooth on outer whorls; sutures strongly modified; saddles broad and low, lobes shallow, with simple indentations, and up to 6 auxiliary lobes and saddles. Dimorphic. Middle Jurassic (Aalenian, Murchisonac Zone, Murchisonac–Bradfordensis Subzones): Europe.— Fig. 65, 1. *S. staufensis (OPPEL), Heiningen, Württemburg, Germany, ×0.75 (Hoffmann, 1913, pl. 9, 3).

Costileioceras MAUBEUGE, 1950, p. 386 [*Ludwigia sinon BAYLE, 1878, pl. 83; OD]. General morphology like Ludwigia, but suture modified as in Staufenia, although with only 2 or 3 auxiliary lobes. Middle Jurassic (Aalenian, Murchisonac Zone, Murchisonac Subzone only): Europe.— — Fig. 65, 2a–b. *C. sinon (BAYLE), lectotype, Wasseralfingen, Württemburg, Germany, ×0.8 (Schlegelmilch, 1985, pl. 10, 4, plaster cast of lectotype).

Subfamily GRAPHOCERATINAE

Buckman, 1905

[Graphoceratinae BUCKMAN, 1905a, p. cxcviii] [Darelleinae BUCKMAN, 1905a, p. cxcviii; Hyatteinae BUCKMAN, 1905a, p. cxcviii; Lucininae BUCKMAN, 1905a, p. cxcviii; Ludwigellidae SPATH, 1925b, p. 113; Ludwiginae GERARD & BICHÉLONNE, 1940, p. 42]

Moderately evolute forms, with quadrate whorls and strong ribs, giving rise to more involute forms again, in which ribs tend to fade. Keel generally stronger than in Leioceratinae. Middle Jurassic (Aalenian, Murchisonac Zone, Murchisonac Subzone–lower Bajocian, Discites Zone).

Ludwigia BAYLE, 1878, explanation for pl. 79 [*Ammonites murchisonae J. DE C. SOWERBY, 1827, p. 95; SD H. DOUVILLE, 1879, p. 91] [=Murchisonia ENGEL, 1896, p. 218, non D’ARCHAC & DE VERNEUIL, 1841 (gastropod), nec COSTA, 1861 (gastropod), obj.; =Cosmosygria BUCKMAN, 1898a, supplement for pl. 4, explanation for fig. 12–15 (type, Ammonites murchisonae obtusus QUENSTEED, 1846 in 1845–1849, p. 116, SD BUCKMAN, 1899, p. lii); =Welchia BUCKMAN, 1898a, supplement pl. 4, explanation for fig. 16–19 (type W. obtusiformis, SD BUCKMAN, 1899, p. li); =Crickia BUCKMAN 1899, supplement for pl. 11, explanation for fig. 16–18 (type C. reflexa, M) =Hyattia BUCKMAN, 1899, p. lv (type, H. pastulisfera, OD); =Kiliania BUCKMAN, 1899, p. lixiv (type, K. laciniosa, OD); =Ludwigina BUCKMAN, 1899, p. li (type, L. patula, OD) =Pseudographoceras BUCKMAN, 1899, supplement for pl. 11, explanation for fig. 19–24 (type, P. literatum, SD BUCKMAN, 1904a, p. xci); =Strophogyria BUCKMAN, 1899, p. lixi (type, S. cosmia, OD)]. Moderately evolute, robust whorls, quadrate whorl section in some forms, angled umbilical edge, strong keel; ribs strong, sinuous to falcoide, bifurcating and rursiradiate on outer part of whorl, occasionally tuberculate near point of bifurcation; adult whorls of macroconchs become striate or smooth and massive. Dimorphic: macroconchs have plain mouth borders, microconchs have narrow lateral

lappets; type species of Ludwigina (and Pseudographoceras) are microconchs, all others are macroconchs. Middle Jurassic (Aalenian, Opalinum Zone, Scissum Subzone–Murchisonac Zone): Europe, northern Africa (Atlas Ranges), Caucasus, Iran, Russia (Bureya Basin, northeast).— Fig. 66, 1a–b. *L. murchisonae (J. DE C. SOWERBY), holotype, macroconch, Holme, Portree, Isle of Skye, Scotland, ×0.4 (new, The Natural History Museum,
London, BMNH 43948).——Fig. 66,1e–d. L. patula (BUCKMAN), lectotype (designated herein), microconch, Halfway House, Sherborne, Dorset, England, X1 (new, Sedgwick Museum, Cambridge, England, J. 6320; also figured in Buckman, 1887, pl. 3, 3).

**Brasilia** Buckman, 1898b, p. 458 [*Harpiosceras murchisoniae* var. *broadfordensis* Buckman, 1881, p. 604; OD] [=Apodyogrya Buckman, 1899, p. lix (type, *A. patellaria*, OD); *Brasilia* Buckman, 1889, supplement for pl. 10, explanation for fig. 29–31 (type, *Ludwigia murchisoniae* var. *beylii* Buckman, 1887, p. 18, SD Buckman, 1904a, p. lixiii)]; =*Paquieria* Buckman, 1889, supplement for pl. 10, explanation for fig. 20–22 (type, *P. floccosa*, M); =Wiltshireia Buckman, 1899, supplement for pl. 11, explanation for fig. 31 (type, *Lioceras broadfordensis* var. *giganteum* Buckman, 1888, p. 25, M); =*Vacekia* Buckman, 1889, supplement for pl. 10, explanation for fig. 17–19 (type, *V. stephensi*, M); =*Patnaecia* Buckman, 1904a, p. lxvi (type, *P. nitens*, OD); =*Planisfastigites* Buckman, 1925b, pl. 579 (type, *P. platyu*, OD). More involute, more compressed and more finely ribbed than *Ludwigia*. Dimorphic: microconchs have narrow lateral lappet; types of the genus and all synonyms are macroconchs. *Middle Jurassic* (Aalenian, Murchisoniae Zone, Bradfordensis Subzone only): Europe, northern Africa (Atlas Ranges), Iran.———Fig. 66,2a–b. *B. broadfordensis* (BUCKMAN), lectotype (designated herein), macroconch, Bradford Abbas, Dorset, England, X0.65 (new, Sedgwick Museum, Cambridge, England, J. 6325; also figured in Buckman, 1887, pl. 4, 5).——Fig. 66,2c–d. *B. rude* (BUCKMAN), holotype, microconch, Louise Hill Quarry, Halfway House, Sherborne, Dorset, England, X1 (new, Sedgwick Museum, Cambridge, England, J. 6331; also figured in Buckman, 1889a, pl. 15,11–12).

**Graphoceras** Buckman, 1898b, p. 458 [*Lioceras concavum* var. *v-scriptum* Buckman, 1888, pl. 10,5–6; OD] [=*Ludwigella Buckman, 1901, p. 266 (type, *Ammonites concavus* J. SWERBY, 1815a, p. 214, M); =*Depaoceras* Buckman, 1902, p. 3 (type, *Lioceras fallax* Buckman, 1888, pl. 14,10–11, OD); =*Platygraphoceras* Buckman, 1902, p. 4 (type, *Lioceras apertum* Buckman, 1888, pl. 10,10–11, SD Buckman, 1904a, p. xiii); =*Lucys Buckman, 1902, p. 4 (type, *L. caulifera*, OD); =*Oedania Buckman, 1904a, p. cvii (type, *O. falcigera*, OD); =*Stoekeia* Buckman, 1904a, p. cxxvii (type, *S. marmorata*, OD); =*Hosouveites SATO, 1958, p. 155 (type, *Harpiosceras ikianum* YOKOMI, 1904a, p. 5, OD)].

More involute and more compressed than *Brasilia*, and with distinctive raised umbilical edge; ribs tend to be falcate. Dimorphic: type of *Oedania* is probably a microconch; types of the genus and all other synonyms are macroconchs or immature. *Middle Jurassic* (Aalenian, Concavum Zone—lower Bajocian, Discites Zone): Europe, northern Africa (Atlas Ranges), Caucasus, Iran, Thailand, Japan.——Fig. 67a–b. *G. v-scriptum* (BUCKMAN), lectotype, macroconch, Concavum Zone, Bradford Abbas, Dorset, England, X0.5 (new, Sedgwick Museum, Cambridge, England, J. 6341).——Fig. 67c–d. *G. cornu* (BUCKMAN), holotype, microconch with a very long lappet in adult mouth border. Concavum Zone, Bradford Abbas, Dorset, England, X0.9 (new, Sedgwick Museum, Cambridge, England, J. 6324; also figured in Buckman, 1887, pl. 4,3–4).

**Hyperiocioceras** Buckman, 1889a, p. 88 [*Ammonites discites* WAAGEN, 1867, p. 599; OD] [=*Darellia* Buckman, 1898b, p. 459 (type, *D. semicostata*, OD); =*Braunissa Buckman, 1902, p. 3 (type, *B. futilis*, OD); =*Deltoidoceras* Buckman, 1902, p. 3 (type, *Hyperiocioceras subdiscoideum* Buckman, 1889a, p. 100, M); =*Dissoceras* Buckman, 1902, p. 3 (type, *D. tabulatum*, M); =*Reynesia Buckman, 1902, p. 5 (type, *Lioceras decipiens* var. intermedia Buckman, 1888, pl. 33, OD); =*Reynesella Buckman, 1902, p. 5 (type, *R. piodes*, OD); =*Toxioiceras* Buckman, 1902, p. 5 (type, *Hyperiocioceras walkerii* Buckman, 1889a, p. 92, M); =*Braun­zella Buckman, 1904a, p. cii (type, *B. lenis*, OD, nom. nov. pro *Braunissa Buckman, 1902, p. 3, nov. kreischbaumer, 1894 (insect); =*Darellina Buckman, 1904a, p. ciii (type, *D. planariss*, OD); =*Hugia Buckman, 1904a, p. cixi (type, *H. curva*, OD); =*Lopadoceras* Buckman, 1904a, p. cixi (type, *L. arcuatum*, OD); =*Deltoceras* Buckman, 1904a, p. cixix (type, *D. subsectum*, M), nom. nov. pro *Deltoceras Buckman, 1902, p. 3, nov. HYATT, 1894, p. 449). Very involute, flat whorl sides, greatest whorl breadth at umbilical edge, tall unfooted keel; ribs falcoid, bifurcating, but fade rapidly, and some forms almost smooth throughout. Dimorphic: type species of *Reynesella* is a microconch; types of all other synonyms are macroconchs. *Middle Jurassic* (lower Bajocian, Discites Zone): Europe, northern Africa (Atlas Ranges), Japan.———Fig. 68a. *H. discites* (WAAGEN), holotype, macroconch, Dohusen, Braunschweig, Germany, X1 (Buckman, 1904a, p. cxxiii, fig. 88).——Fig. 68b–c. *H. rudi­discites Buckman, macroconch, Bradford Abbas, Dorset, England, X0.7 (new, Sedgwick Museum, Cambridge, England, J.6382; also figured in Buckman, 1889a, pl. 17,3–4).——Fig. 68d–e. *H. semicosta* (BUCKMAN), holotype, macroconch, type species of *Darellia*, Bradford Abbas, Dorset, England, X1 (new, Sedgwick Museum, Cambridge, England, J.6425).——Fig. 68f–g. *H. piodes* (BUCKMAN), lectotype, adult microconch, type species of *Reynesella*, Bradford Abbas, Dorset, England, X1.5 (new, Sedgwick Museum, Cambridge, England, J. 6429).

**Family PHYMATOCERATIDAE**

*Hyatt, 1867*

[nov. ord. SYNSH, 1936c, p. 2, pro Phyomatoceridae HYATT, 1867, p. 88, 97, validated (as Phymatoceratinae) by ICZN Opinion 575, 1959a] [=Hauginae BUCKMAN, 1905a, p. cxxviii]

Planulates, evolve to involute, keeled; ribs strong, straight to sinusuous, bundled at umbilical edge, with long secondaries, and
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 64. Graphoceratidae (p. 93).

**Phymatoceras hyatt**, 1867, p. 88, 97 [*P. robustum; SD Hyatt* 1900, p. 577] [= *Pelecoceras hyatt*; **Buckman**, 1898a, p. ix, xvii (type, *D. tumefacta*, OD); = *P. attenuatum*, **Buckman**, 1899 (type, OD); = *Loryella Breistroffer*, 1949, p. 99 (type, *Ammonites lilli Hauer*, 1856, p. 40, M), nom. nov. pro *Lillia bayle*, 1878, pl. 82, 1, non *Boe*, 1844 (Aves); = *Lillia chelussii* (parisch & **Viale**, 1906, pl. 11, 10–11). Evolute, quadrate whorl section, keeled, flat or bisulcate venter, but sulci usually lost in adult; ribs strong, straight to sinuous, usually rectiradiate to rursiradiate, and bundled from tubercles at umbilical edge; extent and size of tubercles, and presence or absence of constrictions on inner whorls, is variable, perhaps within same species: some have all ribs bundled at tubercles, others have ribs bundled to a large tubercle, followed by a constriction alternating with 2–4 simple nontuberculate ribs. Lower Jurassic (lower Toarcian, *Falciferum* Zone–upper Toarcian, *Thouarsense* Zone): Europe, northern Africa (Atlas Ranges), Turkey, Japan, Canada (British Columbia, Alberta), USA (Alaska, Nevada), Chile, Argentina, Peru.——Fig. 69,1a–b. *P. robustum*, lectotype (designated herein), Plateau de Larzac, France, ×1.5 (new, Museum of Comparative Zoology, Cambridge, Massachusetts, 1986).

**Paronychoceras Guex**, 2000, p. 116 [*P. pseudoplanum; OD*]. Microconchs, up to 15 mm in diameter. Evolute, with round whorl section and no ventral keel; smooth, or with curved ribs arcing strongly backward on side of whorl; venter smooth. Very similar to *Onychoceras* (Hammatoceratinae), but more evolute. Probably the microconch of some species of *Phymatoceras*. Lower Jurassic (lower Toarcian, *Bifrons* Zone): Fig. 69,2a–c. *P. pseudoplanum*, holotype, Le Clapier, Aveyron; a–b, ×3; c, ×5 (Guex, 2000, p. 119, fig. 1A).

**Furloceras elMi & **Rulleau**, 1995, p. 87 [*Lillia chelussii* **Parisch** & **Viale**, 1906, p. 156; OD] [= *Mouterdeiceras elMi & **Rulleau**, 1995, p. 89 (type, *M. dubourgi*, OD)]. Evolute, compressed whorls, venter tricarinate–bisulcate, becoming tabulate with central keel at large sizes; dense rursiradiate ribs are paired to small umbilical tubercles, but tubercles tend to fade on larger whorls where ribs are mainly single. Differs from *Phymatoceras* in having more compressed whors, denser ribs, and smaller tubercles at umbilical edge. Lower Jurassic (upper Toarcian, *Variabilis*–*Thouarsense* Zones): Fig. 69,3a–b. *F. chelussii* (parisch & **Viale**), holotype, Monti del Furlo, Pesaro, Italy, ×0.8 (Parisch & **Viale**, 1906, pl. 11,10–11).

**Brodieia** **Buckman**, 1898a, p. xxxi [*B. curva; OD*] [= *Brodiceras** Buckman**, 1899, p. xxxiii, obj.; = *Whitbyiceras** Buckman**, 1913, p. v (type, *Ammonites pinguis* **Simpson**, 1855, p. 100, OD);
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

= *Psilobrodieia* Guex, 1972, p. 628 (type, *P. lehmanni*, OD); = *Merlaites* Gabiley, 1974, p. 1246 (type, *Brodiceras alticarinatum* Merla, 1933, p. 37, OD)]. Involute, rounded or elliptical whorl section, with ventral keel; sinuous ribs, projected on venter, may be bundled from umbilical tubercles, or nontuberculate with ribs fading on inner half of whorl. Considered by some (Guex, 1975, p. 109) to be the microconch of *Haugia*. Lower Jurassic (upper Toarcian, Variabilis Zone): Europe, Canada (British Columbia), USA (Alaska), Chile.—

Fig. 66. Graphoceratidae (p. 95–96).

=Pseudomercaticeras* Arkell, 1957, p. 266 (Merla, 1933, p. 39, nom. nud., type species not selected) [*P. parvilobum* Merla, 1933, p. 41; OD]. Evolute, with rounded whorl section and tricarinate-bisulcate venter; strong, curving ribs are single or paired from incipient umbilical tubercles, and are projected forward at the ventral edge. Similar to *Brodieia*, but more evolute, tricarinate-bisulcate venter more prominent and ribs are stronger.
Lower Jurassic (upper Tournaisian): Italy, France.—
Fig. 69, 5a. *P. parvilobatum* Merla, holotype, Porcarella, Sanvicino, Central Apennines, Italy, ×1
(Merla, 1933, pl. 5, 13).—Fig. 69, 5b–c. *P. rotaries* Merla, holotype, Monte dei Fiori, Central Apennines, Italy, ×1
(Merla, 1933, pl. 5, 4a–b).

**Crassiceras** Arkell, 1957, p. 266 (*Merla*, 1933, p. 42, nom. nud., type species not selected) [*P. latum* Merla,
1933, p. 43; OD]. Similar to *Pseudomercaticeras*, but more involute and has thicker and more robust whorls. Differs from *Brodieia* in stronger ribs and more prominent tricarinate-bisulcate venter.

Lower Jurassic (upper Tournaisian): Italy.—
Fig. 69, 6a–b. *P. latum* Merla, holotype, Porcarella, Sanvicino, Central Apennines, Italy, ×1
(Merla, 1933, pl. 5, 10).

**Haugia** Buckman, 1888, p. 45 [*Ammonites variabilis* d’Orbigny, 1845 in 1842–1851, p. 350; OD].
Moderately involute, compressed, tall massive ventral keel; ribs strong, twinned or triploid to regular tubercles at umbilical edge; outer whorl becomes smooth. *Upper Jurassic (upper Tournaisian, Variabilis Zone):* Europe, northern Africa (Atlas Ranges), Thailand, Japan, Canada (?British Columbia, ?Alberta), USA (?Alaska).—Fig. 70, 1a–d. *H. variabilis* (d’Orbigny); a–b, lectotype, France, ×0.35 (d’Orbigny, 1845 in 1842–1851, pl. 113, 1–2); c–d, Autun, Saône et Loire, France, ×0.35 (Fischer, 1994, pl. 33, 3).

**Esericeras** Buckman, 1920, pl. 182 [*Haugia inaqua* Buckman, 1898a, p. xxix; OD]. Development from *Haugia*; more involute and more compressed, venter keeled or merely angled, ribs weaker, and no tubercles at umbilical edge. *Lower Jurassic (upper Tournaisian, Thouarsense Zone, Striatulum Subzone):* Europe, Indonesia (Timor, Rote), Peru.—Fig. 70, 2a–b. *E. inaqua* (Buckman), holotype, North Nibley, Gloucestershire, England, ×0.6 (new, Sedgwick Museum, Cambridge, England, J. 6375).

**NOMEN DUBIUM IN PHYMATOCERATIDAE**

*Haugiella* Gabley, 1974, p. 1247 [*Cypholioceras vitiosum* Buckman, 1899, supplement p. xlv; OD]. Based on a type species that consists of two unconnected fragments (possibly parts of two specimens) said to have come from strata of *Levesquei* or *Moorei* Subzone (*Levesquei Zone*, upper Tournaisian) at Standish Beacon, Gloucestershire, England (Buckman, 1888, p. 44; Buckman, 1890, p. 166; Buckman, 1899, supplement p. xlv). Gabley (1976, p. 99–100) found apparently similar ammonites high in the *Variabilis* Zone in France, and claimed that Buckman’s original specimen(s) must have come from beds of a similar age, i.e., the *Variabilis* Zone, from which they were derived into the higher *Levesquei* Zone strata at the type locality. Both Guex (1975, p. 108, 120, 127) and Gabley (1976, p. 98) used *Haugiella vitiosa* as the index species of a *Vitiosa* Subzone at the top of the *Variabilis Zone*. The type specimen of *H. vitiosa* is a small fragment and is not interpretable, so the genus *Haugiella* can only be regarded as a nomen dubium. Guex and Gabley’s specimens from the top of the *Variabilis Zone* probably belong to *Haugia*.

**Family HAMMATOCERATIDAE**

*Buckman, 1887*

[Hammatoceratidae Buckman, 1887, p. 15]

Descendants of Phymatoceratidae, differing chiefly in ribbing, which branches higher on whorl sides and is differentiated into primaries and secondaries, and sutures.
tend to be more elaborated with retracted umbilical lobe–bearing auxiliaries. Dimorphism known in a few cases: microconchs have lateral lappets; macroconchs have plain contracted mouth borders with a ventral rostrum.

Subfamily HAMMATOCERATINAE

Buckman, 1887

[Wammatoiceratinae Buckman, 1887, p. 15]

Widely variable in whorl thickness and between evolute and involute forms, even within one genus, but most genera have
Fig. 69. Phymatoceratidae (p. 98–100).
lateral tubercles and moderate to strong ventral keels. Microconchs are adult at small sizes, but association with the generally much larger macroconchs is sometimes obscure. Lower Jurassic (upper Toarcian, Thouarsense Zone)—Middle Jurassic (lower Bajocian, Laeviuscula Zone): worldwide, mainly Tethyan, rarely Boreal.

_Hammamoceras_ HYATT, 1867, p. 88 [*Ammonites inquisitus ZIETEN, 1831 in 1830–1833, p. 20; SD BUCKMAN, 1887, p. 13; =Ammonoceras HYATT, 1867, p. 98, obj.; SD BUCKMAN, 1887, p. 13; =Chartronia BUCKMAN, 1898a, p. ix, xvi (type, C. binodata, OD); *=Pachammatoceras BUCKMAN, 1921, pl. 207 (type, _P. pachu_, OD); =Gezyceras MARTINEZ GUTIÉRREZ, 1992, p. 65 (type, Hammadtoceras speciosum JANENSCHI, 1902, p. 102, OD); *=Accardia CRESTA, 1997, p. 34 (type, _Ammonites longinerti DUMONTIER, 1874, p. 262, OD)). Evolute to moderately involute, whorl section rounded or subtriangular, with ventral keel; primary ribs short; secondary ribs branch from tubercles situated slightly ventral of edge of umbilicus, then pass on to venter and join keel; outer whorl may become smooth. Holotype of _Pachammatoceras_ has rapidly expanding, thick whorls, and is of uncertain age; it could be an involute, thick-whorled species of either _Hammamoceras_ or _Euapactoceras_. Lower Jurassic (upper Toarcian, Thouarsense Zone)—Fallacia subzone [=Erbaense Zone, Bayani Subzone]—Levesquei Zone: Europe, northern Africa (Atlas Ranges), Turkey, Caucasus, Iran, Russia (Bureya basin), Vietnam, Japan, Indonesia (Sulawesi), Canada (British Columbia), USA (Alaska, Oregon), Chile, Argentina.——Fig. 71a–c. *H. inquisitus (ZIETEN), holotype, Reichenbach, Württemburg, Germany, X1 (Zieten, 1831 in 1830–1833, pl. 15,2).——Fig. 71d–e. _H. pachu_ (BUCKMAN), holotype, type species of _Pachammatoceras_, Charolles, Saône et Loire, France, X0.5 (BUCKMAN, 1921, pl. 207).——Fig. 71f–g. _H. binodata_ (BUCKMAN), type species of _Chartronia_, holotype, Frocester Hill, Stroud, Gloucestershire, England, X1 (BUCKMAN, 1898a, supplement pl. 1, 11–12).

_Crestaites_ RULLEAU & ELMI, 2001, p. 76 [*Hammatoceras meneghini Bonarelli, 1899, p. 208; OD]). Evolute, compressed and flat whorl sides, with rounded venter and keel; fine, straight primary ribs bifurcate or are intercalated at middle of upper part of whorl side, and are projected forward onto venter; no tubercles at umbilical edge or on side of whorl. Resembles the younger _Planammatoceras_, but is more evolute and lacks any tubercles. Lower Jurassic (Toarcian, Levesquei Zone [Meneghini Zone in Tethyan Realm]): Italy, France, Spain.——Fig. 72, 1. *C. meneghini* (BONARELLI), holotype, Marconessa, Central Apennines, Italy, X0.7 (Merla, 1934, p. 10, pl. 1, 1).

_ONYCHOCERAS_ WÜNSTORF, 1905, p. 508 [*O. differens_ M]. Dwarf Cymbites-like microconchs that are adult at 15–20 mm in diameter and have lateral lappets in the mouth border. Whorls globular and depressed, with rounded venter and no keel; ribs are strongly backward on side of whorl, then disappear, leaving venter smooth, or divide into much reduced striate secondaries on venter. Affinities uncertain, but is possibly microconch corresponding to some species of _Hammatoceras_ at same horizon (GUX, 1967). Lower Jurassic (upper Toarcian, Levesquei Zone, Dispansum Subzone): France, Germany, Thailand.—Fig. 72, 2a–d. *O. differens, Gallberg, Salzgitten, Germany; a–c, lectotype (designated herein); d, pararlectotype, X1 (WÜNSTORF, 1905, pl. 20, 12–13, 16)."

_Bredyia_ BUCKMAN, 1910c, p. 111, nom. nov. pro _Burtonia_ BUCKMAN, 1910b, p. 97, non BONAPARTE, 1850 (Aves) [*Burtonia crassornata_ BUCKMAN, 1910b, p. 98; SD BUCKMAN, 1914, p. x; *=Ammonites subinsignis OPPÉL, 1856 in 1856–1858, p. 367] [*Pseudammatoceras ELMI, 1963a, p. 59 (type, _Ammonites subinsignis_ OPPÉL, 1856 in 1856–1858, p. 367, OD)]. Whorls more massive than in _Hammatoceras_, and ribs and tubercles very large and coarse on inner whorls, fading on outer whorls. Dimorphic: microconchs are adult at about 35–40 mm in diameter, have small lappets, and strong secondary ribs up to the end of growth, branching from large dorsolateral tubercles; macroconchs are adult at an average of 240 mm in diameter and have plain, sinuous mouth borders. Lower Jurassic (Toarcian, Levesquei Zone, Aalenensis Subzone)—Middle Jurassic (Aalenian, Opalinum Zone, Scissum Subzone): Europe, northern Africa (Atlas Ranges), Caucasus, Vietnam, New Guinea, Indonesia (Sulawesi), Canada (British Columbia), Chile, Argentina.——Fig. 72, 3a–g. *B. subinsignis (OPPEL), Opalinum Zone; a–b, lectotype, Gomaringen, Tübingen, Germany, X1 (Senior, 1977, pl. 84, 3–4); c–d, holotype of _B. crassornata_, macroconch, Burton Bradstock, Dorset, England, X0.4 (BUCKMAN, 1910b, pl. 9, pl. 10, 1); e–g, microconch, Burton Cliff, Dorset; e–f, X1; g, detail of lappet, X3 (Senior, 1977, pl. 84, 22–24)."
Haugia *Esericeras* Paviaites *cresta* in Pavia & Cresta, 2002, p. 190 (Cresta, 1997, p. 35, nom. nud.) [*Hammatoceras iris* Gemmellaro, 1886c, p. 206 (9); OD]. Small, adult at 62 mm in diameter or smaller, with a body chamber half a whorl long that has a simple sinuous mouth border; evolute, compressed, subacute or rounded venter with keel; fine, prorsiradiate ribs issue from small umbilical tubercles and bifurcate or are intercalated higher on whorl side; ribbing fades on body chamber. Probably a microconch, despite absence of lappets in mouth border, but accompanying macroconch not identified. [*Paviaites cresta*, 1997, p. 35, is invalid, because the type species was not fixed in the original publication]. Middle Jurassic (Aalenian, Opalinum–Murchison Zones): Italy.—Fig. 73, 1a–b. *P. iris* (Gemmellaro), lectotype, Fontana Difali, Monte Erice, Sicily; a, ×1 (Cresta in Pavia & Cresta, 2002, p. 191, fig. 124a); b, ×1 (Cresta, 1997, p. 37, fig. 13B).

**Pseudaptoconceras** Géczy, 1966, p. 77 [*Harpoceras klimatophalum Vacek, 1886, p. 81; OD*. Involute, almost oxycone, with sharp umbilical edge and vertical umbilical walls; fine, gently sigmoidal ribs bifurcate at middle of whorl side; quickly becomes smooth on outer whorls except for remnants of ribs near ventral edge; no tubercles; reaches large sizes. Much more involute and smoother than *Planamatoceras* and lacks tubercles. Middle Jurassic (Aalenian, Murchison Zones): Europe, USA (Alaska),
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Argentina.—Fig. 74, 1a–c. *P. klimakomphalum (Vacek), Cape St. Viglio, Lake Garda, Italy; a, lectotype, ×0.5; b–c, paralecotype, ×1 (Vacek, 1886, p. 81, pl. 8,16,17a).

Euaptoceras Buckman, 1922, pl. 299 [*E. euaptetum; OD] [=Parammatoceras Buckman, 1925a, pl. 555 (type P. obtectum, OD); =Crempyeceras Géczy, 1966, p. 83 (type, Hammatoceras verpillierense Roman & Boyer, 1923, p. 34, OD); =Ceccaites Cresta, 1997, p. 40 (type, Ammonites sieboldi Oppel, 1862, p. 144, OD)]. Moderately involute, with heavy, rapidly increasing whorls, rounded venter and keel, and whorl section lanceolate in some; ribs mainly straight, bifurcating at moderate to large lateral tubercle, and smaller tubercles at umbilical edge on inner whorls; ribs and tubercles fade gradually on outer whorls. More involute than Eudmetoceras, and becomes smooth on outer whorl or sooner. Middle Jurassic (Aalenian, Murchisonae-Concavum Zones), Europe, northern Africa (Atlas
Fig. 72. Hammatoceratidae (p. 103).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 73. Hammatoceratidae (p. 104–110).
Pseudaptetoceras

Erycitoides

Fig. 74. Hammatoceratidae (p. 104–110).
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

Fig. 75. Hammatoceratidae (p. 110).
Ranges), Turkey, USA (Alaska), Chile, Argentina.—Fig. 73, 2a–b. *E. eudmetum; holotype, *Concavum Zone, Bradford Abbas, Dorset, England, ×0.6 (new, British Geological Survey, Keyworth, Nottingham, England, GSN 47119).

**Eudmetoceras** BUCKMAN, 1920, pl. 179 [*E. eudmetum*; OD] [=*Rhodoceras Elmi*, 1963a, p. 59 (type, *Hammatoceras rhodanicum* RENZ, 1925b, p. 15, OD)]. Moderately evolve; whorls have flat sides and rounded venter with keel; primary ribs long, sharp, and prorsiradiate, and branch into secondaries at a small lateral tubercle at middle of whorl side; ribs tend to fade on outer whorl. More evolve than *Eupatetoceras* and has sharper, more regular ribs. Dimorphic: microconchs (*Rhodaniceras*) are adult at 35–50 mm in diameter, and have small lappets in adult mouth border, and sharp ribs and tubercles throughout. *Middle Jurassic (Aalenian, Concavum Zone–lower Bajocian, Discites Zone):* Europe, Iran, USA (Alaska, Oregon), Chile, Argentina.—Fig. 73, 3a–b. *E. eudmetum*, holotype, macroconch, *Discites Subzone*, Bradford Abbas, Dorset, England, ×0.6 (new, British Geological Survey, Keyworth, Nottingham, England, GSN 32025).—Fig. 73, 3c–e. *E. rhodanicum* (RENZ), holotype, microconch, *Concavum Zone, La Verpillière, Isère, France*, ×1; c, nearly complete macroconch, ×0.8; d–e, complete microconch, ×1 (Westermann & Riccardi, 1972, pl. 6, 1a–b, 5, pl. 7, 5a–b).

**P. (Puchenquia)**. Macroconchs are complete at 70–125 mm in diameter and have more involute final whorls and fine ribs that tend to fade on body chamber; no tubercles. Age and geographic range as for genus.—Fig. 75, 1a–e. *P. (P.) malarguense* (BURCKHARDT), Cerro Puchenque, Mendoza, Argentina; a–b, lectotype, phragmocone of macroconch, ×1; c, nearly complete macroconch, ×0.8; d–e, complete microconch, ×1 (Westermann & Riccardi, 1972, pl. 6, 1a–b, 5, pl. 7, 5a–b).

**P. (Gerthiceras)** WESTERMANN & RICCARDI, 1982, p. 32 [*P. (Gerthiceras) compressa; OD]*. Larger than *P. (Puchenquia)* and macroconchs are up to 150 mm in diameter; develops thicker whorls and heavier ribs, and lateral tubercles or bullae occur in some species; ornament does not fade on body chamber. Age as for genus: Chile, Argentina.—Fig. 75, 2a–c. *P. (G.) compressa*, holotype, macroconch, Rio Potimalal, Mendoza, Argentina, ×0.8 (Westermann & Riccardi, 1982, p. 36, fig. 6a–c).

**Fissilobiceras** BUCKMAN, 1919a, p. xx [*Ammonites fissilobatus WÄNGEN, 1867, p. 599; OD]*. Large, involute oxycones; whorl section oval and compressed, with ventral keel that may persist to end of body chamber; smooth except for vague folds on side of whorl; suture complex and highly divided. Similar to *Shirbuirnia* (Sonninidae, lower Bajocian, *Sauzei Zone*), but more involute and suture much more complex. *Middle Jurassic (lower Bajocian, Discites Zone–Laeviuscula Zone, Ovalis Subzone):* Europe, USA (Oregon), Chile, Argentina.—Fig. 75, 3a–c. *F. fissilobatum* (WÄNGEN), lectotype (designated by CALLOMON & CHANDLER, 1990, p. 97), Gingen, Schwabia, Germany; a, ×0.3 (Dorn, 1935, pl. 13, 1); b, ×0.3 (Schlegelmilch, 1985, pl. 17, 4); c, suture, ×0.5 (Dorn, 1935, text-fig. pl. 5, 9).

**Subfamily ERYCITINAE** Spath, 1928

[nom. transl. WESTERMANN & RICCARDI, 1979, p. 113, 115, ex Erycitiidae Spath, 1928, p. 74]

Whorls are generally more inflated and rounded than in Hammatoceratinae and have a midventral smooth band, and no ventral keel; the sutures have reduced ventral elements. KOVÁCS & GÉCZY, 2008. *Lower Jurassic (upper Toarcian, Thouarsense Zone)–Middle Jurassic (lower Bajocian, Discites Zone):* worldwide.
Erycites Gemmellaro 1886c, p. 205 [*Ammonites fallax* Benecke, 1865 (December), p. 171; SD Loczy, 1915, p. 381; *non* Guéranger, 1865 (April–August) (Bathonian *Oxycerites*, Oppeliidae).] *E. fallifax* Arkell, 1957, p. 267] = *Abbasitoides* Géczy, 1966, p. 115 (type, Coeloceras modestum Vacek, 1886, p. 100, OD). involute, sphaeroconic inner whorls, then moderately evolute outer whorls; whorl section broad and rounded and without a ventral keel; primary ribs branch into secondaries at middle of whorl side and ribs are interrupted at midventer; no tubercles. Dimorphic: macroconchs (*Erycites, Abbasitoides*) have contracted aperture with ventral rostrum; microconchs are small (25–60 mm diameter) and have large lateral lappets. *Lower Jurassic* (upper Toarcian, Levesquei Zone)–*Middle Jurassic* (Aalenian, Opalinum–Concavum Zones): Europe, northern Africa (Atlas Ranges), Turkey, Iran, Caucasus, Russia (Crimea), ?Thailand, China (Tibet), New Zealand, USA (Alaska), Argentina, Chile.—Fig. 76, 1a–b. *E. fallifax* Arkell, lectotype (designated herein), macroconch, *Murchisonae* Zone, Cap San Vigilio, Lake Garda, Italy. ×1 (Benecke, 1865, pl. 6, 1).

Cagliceras Rulleave & Elmi, 2001, p. 76 [*Erycites elaphas* Merla, 1933, p. 25; OD]. Evolute platycones; whorl section rounded, compressed on final whorl, and without a ventral keel; strong primary ribs are swollen radially or tuberculate

Fig. 76. Hammatoceratidae (p. 110–112).
near umbilical edge, then branch into secondaries at midwhorl of whorl side; ribs are interrupted at midventer. Stratigraphically older, more evolve, and more compressed than *Erycites*, and has stronger, swollen or tuberculate primary ribs. **Lower Jurassic (upper Toarcian, Levesquei Zone): France, Italy.**—Fig. 76.2. *C. elaphus* (Merla), holotype, Val d’Urbia, Central Apennines, Italy. X0.6 (Merla, 1934, pl. 4.5).

**Abbasites** Buckman, 1921, pl. 236 [*A. abbas*; OD] [=Ambersites Buckman, 1921, pl. 237 (type, *A. aegerotus*, OD)]. Similar to *Erycites*, but is small, has cadicone, depressed whorls, and ribs are interrupted at midventer; no keel; adults with a plain mouth border are known as small as 40 mm in diameter, but dimorphism has not been found. **Middle Jurassic (Aalenian, Murchisonae Zone, Bradfordensis Subzone): Europe, USA (Alaska, Oregon).**—*Fig.* 76.3a–b. *A. abbas* holotype, Bradford Abbas, Dorset, England, ×1.2 (new, British Geological Survey, Keyworth, Nottingham, England, GSM 32045).

**Subfamily PODAGROSICERATINAE** Westermann & Riccardi, 1979

[Podagrosiceras Westermann & Riccardi, 1979, p. 114]

Differing from the subfamily Erycitinae only by its normal suture lines, i.e., the ventral elements are not reduced. Podagrosicerae are restricted to the central and southern Andes of South America, except for the occurrence of the earliest genus *Sphaerooceloceras* in the Toarcian of western Canada. The subfamily is derived from the ancestral Erycitinae. **Lower Jurassic (upper Toarcian, Thouarsense Zone)—Middle Jurassic (lower Bajocian, Discites Zone): worldwide.**

**Sphaerooceloceras** Jaworski, 1926, p. 259 [*S. brochiforme*; OD]. Small sphaerocones, with egressing whorls on final part of phragmocone and body chamber, and sinuous adult mouth border; venter smoothly rounded with no keel; attains only 28–30 mm in diameter when adult; blunt ribs bifurcate, or secondaries are intercalated, at midflank, then curve backward on outer half of whorl and are interrupted at midventer. Similar to *Onychoceras* (Hammatocearinaceae), but is larger and has a sinuous mouth border without lappets. Possibly dimorphic, and probably derived from Toarcian species of *Erycites*. **Lower Jurassic (upper Toarcian, Levesquei Zone): Canada (British Columbia), USA (Alaska, Nevada, Oregon, California), Mexico, Chile, Argentina.**—*Fig.* 77,1a–e. *S. brochiforme* a–e, lectotype, phragmocone of probable macroconch, Arroyo Negro, Mendoza Province, Argentina, ×2 (Jaworski, 1926, pl. 3,10); d–e, complete adult probably a microconch, Arroyo Honda, San Juan Province, Argentina, ×2 (Hillebrandt, 1987, pl. 13,9a,9c).

**Westermanniceras** Riccardi, 2000, p. 23 [*Zurcheria groebneri* Westermann & Riccardi, 1972, p. 94; OD]. Inner whorls globular, becoming evolve on outer whorls with rounded to subrectangular whorl section; venter rounded with no keel; slightly sinuous ribs, are paired from umbilical margin on inner whorls, then simple or bifurcating on upper part of larger whorls; ribs are gently projected up to midventral smooth band, and ribs alternate across venter. **Middle Jurassic (Aalenian, Groebi–lower Malarguensis Zones [=upper Murchisonae–Concavum Zones]): Chile, Argentina.**—*Fig.* 77,2a–b. *W. groebneri* (Westermann & Riccardi), holotype, Rio Grande, Bardas Blancas, Mendoza, Argentina, ×1 (Riccardi, 2000, pl. 1,10a–b).

**Podagrosiceras** Maubeuge & Lambert, 1956, p. 621 [*P. athleticum*; M]. Whorl section rounded with no ventral keel. Microconchs are complete at 28–42 mm in diameter, have evolve whorls throughout, and long lateral lappets in mouth border; moderate to strong sinuous primary ribs bifurcate at midflank and secondaries are interrupted and alternate at midventer. Macroconchs reach about 90 mm in diameter, have much more involute, thick, rounded whorls, and ribs become fine and prorsiradiate. In *Erycitoidea* (Hammatocearinae), microconchs differ only in having a rudimentary keel, while macroconchs also have a rudimentary keel, but are also larger, more evolve, and compressed, and have stronger ribs throughout. **Middle Jurassic (Aalenian–lower Bajocian, Malarguensis Zone [=Aalenian, Concavum Zone–lower Bajocian, Discites Zone]): Chile, Argentina.**—*Fig.* 77,3a–d. *P. athleticum* a–b, holotype, microconch, Arroyo Picun Leufu, Los Molles, Neuquen, Argentina; a, ×1 (Maubeuge & Lambert, 1956, pl. 64,1a); b, ×1 (Westermann, 1964, p. 388, fig. 18); c–d, macroconch, Arroyo de Los Radales, Chos Malal, Neuquen, Argentina, ×0.75 (Riccardi, 2000, pl. 1,5a,5c).

**Subfamily ZURCHERINAE** Hyatt, 1900


Ribbing becomes more tuberculate than in *Erycitanae*, with both ventrolateral and lower lateral or umbilical rows of tubercles in some; tubercles develop proterogenetically on inner whorls, and may or may not extend to middle and outer whorls. A ventral keel is developed in *Haplopleuroceras*. **Lower Jurassic**
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea

(upper Toarcian, Thouarsense Zone)–Middle Jurassic (lower Bajocian, Discites Zone): worldwide.

**Spinammatoceras** Schindewolf, 1964, p. 340
[*Hammatoceras pugnax* Vacek, 1886, p. 96; OD]
[=Shabrudites *Seyed-Emami* in *Seyed-Emami & others*, 2006, p. 270 (type, *S. asseretoi*, OD)]. Moderately evolute, whorl section cadicone on inner whorls, rounded or oval on middle and outer whorls; venter rounded without keel; on inner whorls, strong primary ribs bi- or trifurcate at ventrolateral tubercles, and there are smaller umbilical tubercles; on larger whorls, ribs issue

Fig. 77. Hammatoceratidae (p. 112).
in bunches from umbilical tubercles, but later ribs become more widely spaced and tubercles diminish. Dimorphic: microconchs are adult and have lateral lappets at the single-ribbed, bituberculate stage; macroconchs have sinuous mouth borders and diminished ornament on final whorl. Similar to Erycites, but the latter lacks tubercles and has more constant primary and secondary ribbing throughout. Middle Jurassic (Aalenian, Opalinum–Murchisonae Zones): Italy, Spain, France, Portugal, northern Africa (Atlas Ranges).—Fig. 78, 1a–c.

*Spinammatoceras* (Vacek), Cape St. Vigilio, Lake Garda, Italy; a, lectotype, microconch, ×1.3 (Vacek, 1886, pl. 16,1); b–c, macroconch (lectotype of *Hammatoceras tenax* Vacek), ×0.8 (Vacek, 1886, pl. 15,10,10a).

*Zurcheria* Douville, 1885, p. 36 [*Z. ubaldi* OD] [=Parazurcheria Fernandez-Lopez in Fernandez-Lopez, Mouterde, & Rocha, 1988, p. 290 (type, Z. (Parazurcheria) costulata, OD)]. Moderately evolute, with compressed whorls, rounded venter, and no keel; ribbing weak or striate, but stronger in some, gently flexuous, fading on outer part of whorl and on venter; inner whorls of some species have small ventrolateral tubercles and occasionally smaller tubercles on umbilical edge. Dimorphic: microconchs are up to approximately 50 mm in diameter.
and have small lappets in adult mouth border; macroconchs (*Paraceras*) are larger and have a smooth sinuous mouth border. *Middle Jurassic* (*Aalenian, Concavum Zone–lower Bajocian, Discites Zone*): Europe, northern Africa (Atlas Ranges), Chile, Argentina.——Fig. 78,2a–b. *Z. ubaldii*, holotype, *Discites Zone*, Valeury, Toulon, France, X1 (Douvillé, 1885, pl. 1.8).

**Malladaites** LINARES & SANDOVAL, 1986, p. 214 [*Hammatoceras pertinax* VACEK, 1886, p. 96; OD]. Moderately evolute, whorl section compressed with flat sides and arched venter; rudimentary ventral keel on inner whorls disappears near end of phragmocone; fine ribs projected strongly forward on venter; some ribs issue from small umbilical tubercles, and small ventrolateral tubercles in some species. Dimorphic: microconchs have long lateral lappets; macroconchs have a plain mouth border, and tubercles fade on final whorl. Differs from *Spinammatoceras* in having whorls with flat sides, finer ribs throughout, and much smaller tubercles. *Middle Jurassic* (*Aalenian, Murchisona–Concavum Zones; lower Bajocian, basal Discites Zone*): Italy, Spain, northern Africa (Atlas Ranges), southeastern Iran.——Fig. 78,3. *M. pertinax* (VACEK), lectotype, macroconch, Cape St. Vigilio, Lake Garda, Italy, X1.2 (Vacek, 1886, pl. 16.5).

**Haplopleuroceras** BUCKMAN, 1892, p. 299 [*Amaltheus subspinatus* BUCKMAN, 1881, p. 606; OD]. Evolute, whorl section quadrate and compressed, with flat whorl sides; venter has a keel and is usually bisculate; fine, gently sinuous ribs are single or divided from umbilical edge and curve forward on venter; small lower lateral and ventrolateral tubercles or spines occur in some species, and may disappear on outer whorls; thick bisculate ribs alternate with thin nontuberculate ribs on inner and middle whorls of some species. Probably dimorphic, but evidence is poor. Derived from *Malladaites*, differing by development of a keel and sulci on venter and stronger tubercles (LINARES & SANDOVAL, 1996). *Middle Jurassic* (*Aalenian, Concavum Zone–lower Bajocian, Discites Zone*): England, Spain, Portugal, France, Italy, Greece, Algeria, Morocco, Caucasus, Iran.——Fig. 78,4a–b. *H. subspinatum* (BUCKMAN), lectotype (designated herein), probably a macroconch, *Concavum Zone*, Halfway House, Sherborne, Dorset, England, X1 (new, Sedgwick Museum, Cambridge, J. 6286).

**Family SONNINIIDAE** BUCKMAN, 1892


Typical forms are stout planulakes with strong hollow keel, ribs, and midlateral tubercles at least early in growth. Other forms show great variety, from evolute planulakes to sphaerocones and o xocones, but almost all have *Sonninia*-like innermost whors, and ribs, tubercles, or spines at some stage. Several genera are dimorphic. BUCKMAN, 1887–1907; DORN, 1935; HILTERMANN, 1939; ARKELL & PLAYFORD, 1954; OECHSLE, 1958; WESTERMANN, 1966. *Middle Jurassic* (*Aalenian–lower Bajocian*): worldwide, except boreal.

**Subfamily SONNININAE**

**Buckman, 1892**

[nom. orth. CALLIISON & CHANDLER in CHANDLER & others, 2006, p. 367, pro Sonnininae BUCKMAN, 1892, p. 287]

Macroconchs of most genera attain large sizes, while microconchs are much smaller (size ratio approximately 1:5) and have plain mouth borders, at least in *Sonninia* and its subgenera, but microconchs of *Dorsetensia* have lateral lappets.

**Sonninia** DOUVILLE, 1879, p. 92, nom. nov. pro *Waagenia* BAYLE, 1878, p. 44, non KREICBAUMER, 1874 (insect) [*Waagenia propinquans* BAYLE, 1878, pl. 84; M1]. Evolute planulakes becoming more involute and compressed on larger whors; whorl section rounded initially, becoming compressed on outer whors in some forms; strong keel on rounded or arched venter; ribs and tubercles highly variable; ribs are often strong, but may be irregular; large, well-spaced midlateral tubercles or spines occur at least on early and middle whors. Probably dimorphic, but microconchs have plain mouth borders and are not well known. [The author of *Sonninia* is DOUVILLE, not BAYLE, as always quoted hitherto, because DOUVILLE was the author of the note in which *Sonninia* was proposed as a replacement for BAYLE’s preoccupied genus *Waagenia*. *Middle Jurassic* (*Aalenian, Concavum Zone–lower Bajocian, Sauzei Zone*): worldwide.

**S. (Sonninia)**. Tubercles fade on middle whors, and ribs fade on outer whors, which become involute and compressed. *Middle Jurassic* (lower Bajocian, Sauzei Zone): Europe, northern Africa (Atlas Ranges), Madagascar, Caucasus, Azerbaijan, Iran, China (Tibet), Japan, Western Australia, USA (Alaska, Oregon), Chile, Argentina.——Fig. 79,1a–b. *S. (S.) propinquans* (BAYLE), lectotype (designated by GILLET, 1937, p. 30, 32), macroconch, Les Moutiers, Caen, Calvados, France, X0.6 (new, Puvis Collection, Ecole de Mines, Paris; also figured in BAYLE, 1878, pl. 84.1).
S. (Euhoploceras) Buckman, 1913, p. iv [*Sonninia acanthodes Buckman, 1889b, p. 658; OD]
[=Stiphromorphites Buckman, 1923a, pl. 398 (type, S. nodatipinguis, OD); =Sherburnites Buckman, 1923a, pl. 411 (type, S. projectifer, OD)]. Outer whorls evolute and massive, with strong rursiradiate ribs, and keel persisting to end of body chamber; attains large sizes. Middle Jurassic (Aalenian, Concavum Zone–lower Bajocian, Laeviuscula Zone): Europe, northern Africa (Atlas Ranges), China (Tibet), Western Australia, Canada (British Columbia, Alberta), USA (Alaska, Oregon, California), Chile, Argentina.—Fig. 79,2a–b. *S. (E.) acanthodes (Buckman), lectotype, Concavum Zone, Bradford Abbas, Dorset, England, ×0.35 (Buckman, 1892, pl. 60).

S. (Papilliceras) Buckman, 1920, pl. 150 [*P. papillatum; OD] [=Prepapillites Buckman, 1927a, pl. 709 (type, Ammonites arenatus...
Row of lateral tubercles on every rib persists onto evolute compressed body chamber, even after ribs have faded, or tubercles occur only on body chamber; some specimens have strigate ornament. Middle Jurassic (lower Bajocian, Laeviuscula Zone): Europe, Thailand, USA (Alaska, Oregon), Chile, Argentina, Peru.—Fig. 79, 3a–b. *S. (P.) papillatum

Buckman, holotype, Sherborne, Dorset, England, ×0.35 (new, British Geological Survey, Keyworth, Nottingham, England, GSM 32009).

*S. (Alaskinia) Westermann, 1978, p. 604, nom. nov. pro Alaskoceras Westermann, 1969, p. 102, non Miller & Kummel, 1945, p. 126 (Ordovician nautiloid) [*S. (Alaskoceras) alaskensis; OD]. Similar to S. (Euboploceras),
but smaller, with trapezoidal whorl section, divergent whorl sides, and large ventrolateral spines persisting on to body chamber. Middle Jurassic (lower Bajocian, Laeviuscula Zone–Sauzei Zone): Canada (British Columbia, Alberta), USA (Alaska).—Fig. 80, la–b. *S. (A.) alaskensis (WESTERMANN), holotype, Laeviuscula Zone, Wide Bay, Alaska Peninsula, USA, ×1 (Westermann, 1969, pl. 27,3).

**Sonninites** BUCKMAN, 1923b, pl. 428A [*S. felix; OD] [=Sonnites BUCKMAN, 1925b, pl. 528A, nom. null., misspelling; =Dundryrites BUCKMAN, 1926, pl. 687 (type, D. albidus, OD)]. Planulate inner whorls, then involute, oxycone middle and outer whorls; whorl section compressed, with flat sides, steep, sharp-edged umbilical walls and rounded to fastigate keeled venter; ribs on inner whorls fade on middle and outer whorls, which become striate or smooth; suture complex and highly indented. More involute, smoother, and has a more complicated suture than *Witchellia*, and lacks subquadrate whorl section and bisulcate venter of that genus. DIETZE, CHANDLER, & CALLOMON, 2007, p. 13. Middle Jurassic (lower Bajocian, Laeviuscula Zone–Sauzei Zone): England.—Fig. 80,2a–c. *S. felix, Sandford Lane, Sherborne, Dorset, England; a, holotype, ×0.35 (Buckman, 1923b, pl. 428A); b–c, paratype, inner whorls, ×1 (Buckman, 1923b, pl. 428B).

**Shirbuirnia** BUCKMAN, 1910b, p. 91 [*S. trigonalis; SD ARKELL in ARKELL & PLAYFORD, 1954, p. 561]. Inner whorls Sonninia-like, but soon becomes more involute and smooth; body chamber massive, moderately involute, whorl section subtriangular-rounded, no keel, smooth. Middle Jurassic (lower Bajocian, Laeviuscula Zone): Europe.—Fig.
Psiloceratoidea, Eodiceratoidea, Hildiceratoidea

80.3a–c. *S. trigonalis*, holotype, Sandford Lane Quarry, Sherborne, Dorset, England; a–b, x0.25; c, sutures, x0.5 (Buckman, 1924, pl. 517A–B).

**Pseudoshirbuirnia** Dietze & others, 2005, p. 48 [*Amaltheus? stephani* Buckman, 1883, p. 138; OD]. Involute, massive whorls expanding rapidly; whorl section compressed and rounded, and has well-rounded umbilical shoulders, a fastigiate venter, and a plain sigmoidal mouth border; weak ribs on inner whorls fade rapidly on middle and outer whorls, which are smooth. More involute than *Shirbuirnia*, and has a more compressed, higher, oval to discoidal whorl section, a more rounded umbilical margin and a simpler suture. *Middle Jurassic (lower Bajocian, Laeviuscula Zone–Sauzei Zone):* England, Germany.——Fig. 81,1a–b. *P. stephani* (Buckman), lectotype, Sandford Lane Quarry, Sherborne, Dorset, England, x0.4 (Buckman, 1883, pl. 1, f).

**Dorsetensia** Buckman, 1892, p. 302 [*Ammonites edoardianus* d’Orbigny, 1846 in 1842–1851, p. 392; OD]. Inner whorls evolve, with simple, slightly flexuous ribs and no tubercles; middle and outer whorls more involute, compressed, with sharp, sometimes undercut, umbilical edge, a narrow keeled venter, and becoming smooth. Dimorphic: small, evolve microconchs have ribs to end of body chamber and lateral lappets in mouth border; larger macroconchs are more involute, compressed, smooth on outer whorls, and have plain mouth borders. *Middle Jurassic (lower Bajocian, Humphriesianum Zone):* Europe, northern Africa (Atlas Ranges), Kenya, Madagascar, Saudi Arabia, Russia (southeastern Pamirs), China (Tibet), USA (Alaska, Oregon, California), Chile, Argentina.——Fig. 81,2a–f. *D. edoardianus* (d’Orbigny); a–b, lectotype, macroconch, Bayeux, Calvados, France, x1 (d’Orbigny, 1846 in 1842–1851, pl. 130, 3–4); c–d, Carcagny, Calvados, France, x1 (Fischer, 1994, pl. 42, 2); e–f, microconch with lappet (*Witchellia regadiens* of Haug, 1893), Sherborne, Dorset, x1 (new, Sedgwick Museum, Cambridge, England, J. 6246; also figured in Buckman, 1892, pl. 52, 15–16).

Subfamily WITCHHELLIINAE

Callomon & Chandler, 2006

[Witchelliinae Callomon & Chandler in Chandler & others, 2006, p. 570]

Macroconchs smaller than those of Sonniini, and microconchs have final adult mouth borders with lappets that are long and spatulate in some forms.

**Asthenceras** Buckman, 1899, p. xlii [*Grammoceras nannodes* Buckman, 1890, p. 213; OD]. Small, evolute, compressed whorls, with strong ventral keel, flanked by shallow sulci in some; inner whorls smooth, then develops striae or fine ribs. Probably dimorphic: microconchs may be complete at 15–30 mm in diameter with rudimentary lateral lappets; macroconchs poorly known, possibly 35–70 mm in diameter when complete (Westermann, 1969). *Middle Jurassic (Aalenian, Murchisonia Zone–lower Bajocian, Sauzei Zone):* England, Canada (British Columbia), USA (Alaska, Oregon).——Fig. 82,1a–b. *A. nannodes* (Buckman), lectotype, macroconch, *Murchisonia Zone, Stoford, Somerset, England, x2 (new, British Geological Survey, Keyworth, Nottingham, England, GSM 6726).

**Fontannesia** Buckman, 1902, p. 6 [*Dumortieria grammoceroides* Haug, 1887, p. 137; OD] [=Darellella Buckman, 1904a, p. cvii (type, *D. recticostata*, OD); =Nannoceras* Buckman, 1923b, pl. 445 (type, *N. nannomorphum*, OD); =Nannina Buckman, 1927b, pl. 752 (type, *N. evoluta*, OD)]. Almost a Bajocian homeomorph of *Grammoceras*, but attains larger sizes, whorl section is more quadrate, and some ribs usually bifurcate or are twinned at umbilical edge. Dimorphic: microconchs (*Darellella, Nannoceras, Nannina*) have narrow lateral lappets. *Middle Jurassic (Aalenian, Concavum Zone–lower Bajocian, Discites Zone–Laeviuscula Zone):* England, France, Germany, Portugal, Spain, Turkey, China (Tibet), Borneo, New Guinea, Indonesia (Sula Islands, Maluku [Moluccas]), Western Australia, Canada (British Columbia), USA (Oregon), Argentina.——Fig. 82,2a–b. *E grammoceroides* (Haug), holotype, macroconch, Dorset, England, x1 (new, Manchester University Museum, England, L. 11252a, plaster cast of the original in Strasbourg Museum, which was destroyed by fire in 1967).——Fig. 82,2c–d. *F recticostata* (Buckman), adult microconch with small lappet, Bradford Abbas, Dorset, England, x1 (new, Museum of Comparative Zoology, Cambridge, Massachusetts, USA, 2620; also figured in Buckman, 1904a, supplement pl. 17, 10–11).

**Newmarracarroceras** Hall, 1989, p. 6 [*Dorsetensia clarkei* Crick, 1894, p. 388; OD]. Whorls are evolute and discoidal; whorl section compressed oval, without an umbilical edge or separate umbilical wall, and has a rounded venter with keel bordered by grooves of variable development; flexuous ribs curving strongly forward onto venter are moderately strong on inner whorls, then diminish to striae and disappear before end of phragmocone to leave body chamber smooth and with no ventral keel; no tubercles. *Newmarracarroceras* is more compressed and lacks
Fig. 82. Sonniniidae (p. 119).
distinct umbilical wall of *Fontannesia*, and has less strong ribbing that disappears before end of phragmocone. *Middle Jurassic (lower Bajocian, Laeviuscula Zone)*: Western Australia.— —Fig. 82, 3a–d. *N. clarkei* (CRICK), Newmanraccara Limestone, Champion Bay, Geraldton; a–b, holotype, ×1 (new, The Natural History Museum, London, C.30376); c–d, large, nearly complete example, ×0.8 (Hall, 1989, fig. 10a–b).

**Witchellia** Buckman, 1889a, p. 82 [*Ammonites laeviusculus* J. de C. Sowerby, 1824, p. 73; OD] [=Zugophorites Buckman, 1922, pl. 341 (type, Z. zugophor, OD); =Pelekodites Buckman, 1923a, pl. 399 (type, *P. pelekus*, OD); =Hyalinites Buckman, 1924, pl. 519 (type, *H. hyalinus*, OD); =Gelasinites Buckman, 1925b, pl. 593A (type, *G. gelasinus*, OD); =Rubrileiites Buckman, 1926, pl. 642 (type, *R. ruber*, OD); =Anolkoleiites Buckman, 1926, pl. 659 (type, *A. plenus*, OD); =Zugella Buckman, 1927b, pl. 750 (type, *Z. connata*, OD); =Spatulites Buckman, 1928, pl. 765 (type, *S. spatians*, OD); =Maceratites Buckman, 1928, pl. 766 (type, *M. aurifer*, OD)]. Innermost whorls evolute, with ribs and some with lateral tubercles like *Sonninia*; middle whorls more involute and compressed, with tabulate, carinate-bisulcate or tricarinate-bisulcate venter, no tubercles, and much reduced ribs; outer whorls involute, compressed, smooth, venter subtabulate, but with high keel. Dimorphic: small microconchs, adult at 35–60 mm in diameter, are ribbed to end of body chamber, and have lateral lappets with very large spatulate ends; types of *Pelekodites, Macerites, and Spatulites* are microconchs, all others are macroconchs. *Fontannesia* microconchs are similar, and microconch generic names may not be correctly allocated between *Witchellia* and *Fontannesia*. *Middle Jurassic (lower Bajocian, Laeviuscula Zone–Humphriesianum Zone)*: Europe, northern Africa (Atlas Ranges), Madagascar, Caucasus, Iran, China (Tibet), Japan, Western Australia, Canada (British Columbia), USA (Alaska, Oregon), Argentina.— —Fig. 82, 4a–b. *W. laeviuscula* (J. de C. Sowerby), lectotype, macroconch, Dundry, Somerset, England, ×1 (new, The Natural History Museum, London, 43950; also figured in Sowerby, 1824, pl. 451, 1).— —Fig. 82, 4c–d. *W. pelekus* (Buckman), holotype, microconch with spatulate lappet, *Laeviuscula* Zone, Rackledown, Dundry, Somerset, England, ×1.2 (new, British Geological Survey, Keyworth, Nottingham, England, GSM 47187).

**Guhsania** McLearn, 1926, p. 98 [*G. bella*; OD]. Similar to *Witchellia*, but less involute and ribs become large and widely spaced on outer whorl. *Middle Jurassic (lower Bajocian, Laeviuscula Zone)*: Canada (British Columbia).— —Fig. 83, 1a–b. *G. bella*, holotype, Silver Lake, Hudson Bay Mountain, ×0.5 (new, from plaster cast; also figured in McLearn, 1926, pl. 25, 7).

**Dipleioceras** Buckman, 1920, pl. 177 [*D. diplesium*; OD]. Founded on a single small nucleus, with thick keel, ribs, and large widely spaced ventrolateral tubercles. Affinities unknown. *Middle Jurassic (upper Bajocian, Garantiana Zone)*: England, France, Spain.— —Fig. 83, 2a–b. *D. diplesium*, holotype, Vetney Cross, Bridport, Dorset, England, ×2 (Buckman, 1920, pl. 177). 

**INCERTAE SEDIS IN HILDCERATOIDEA**

**Dipleioceras** Buckman, 1920, pl. 177 [*D. diplesium*; OD]. Founded on a single small nucleus, with thick keel, ribs, and large widely spaced ventrolateral tubercles. Affinities unknown. *Middle Jurassic (upper Bajocian, Garantiana Zone)*: England, France, Spain.— —Fig. 83, 2a–b. *D. diplesium*, holotype, Vetney Cross, Bridport, Dorset, England, ×2 (Buckman, 1920, pl. 177).
REFERENCES


Arkell, William J. 1951b. On the generic names “Schlotheimia” Bayle, 1878, and “Scamnoceras” Lange, 1924; proposed use of the plenary powers to validate the name “Ammonites angulatus” Schlotheim, 1820 (Class Cephalopoda, Order Ammonoida) (Jurassic). Bulletin of Zoological Nomenclature 2:204–207.


Benecke, E. W. 1865. Über Trias und Jura in den Südalen. Geognostisch-Paläontologische Beiträge, Munchen 1:1–204, pl. 1–11.


von Württemberg (SW-Deutschland). Stuttgarter Beiträge zur Naturkunde (B) 219:1–67.
Psiloceratoidea, Eodoceratoidea, Hildoceratoidea


Dacqué, É. 1933–1934. Leitfossilien. [The stratigraphical position of beds containing Psiloceratoidea, Eodoceratoidea, Hildoceratoidea gen. nov. v Arkticheskom T oare, Psiloceratoidea, Eodoceratoidea, Hildoceratoidea superfamily of Lower Jurassic Ammonitina: Eo-


Denckmann, A. 1887. Über geognostischen Verhalt-


(Class Cephalopoda, Order Ammonoidea), a genus based upon a misidentified type species. In Francis Hemming, ed., Opinions and Declarations Rendered by The International Commission on Zoological Nomenclature 8(25):335–344.


Lamarck, J. B. de. 1822. Histoire Naturelle des Ani-

don 82:144–165, pl. 8.

Lange, Werner. 1922. Über den untersten Lias der Herforder Mulde (Psilonoten- und Angulaten-

Lange, Werner. 1924. Über die Psilonotenstufe und die Ammoniten fauna des untersten Lias Nord-
deutschlands. Jahrbuch der Preussischen Geo-
gischen Landesanstalt 44:177–207, fig. 1–2.

Lange, Werner. 1925. Zur Paläogeographie und Am-
onitenfauna des Lias a, nebst einer Revision der Nürtinger Psilonotenfauna. Zeitschrift der Deutsch-
gen Geologischen Gesellschaft 77:439–528, fig. 1–18, pl. 18–21.

Lange, Werner. 1931. Die biostratigraphischen Zonen des Lias a und Vollraths petrographische Leithori-
zonte. Zentralblatt für Mineralogie, Geologie und Palaconteology (B)7:349–372.


Lange, Werner. 1952. Der untere Lias am Fonsjoch (östliches Karwendelgebirge) und seine Ammoni-
tenfauna. Palaconetoigraphy 102A:49–162, fig. 1–76, pl. 8–18.

Leanza, H., & G. Blasco. 1990. Estratigrafia e ammo-
nites pliensbachianos del area del Arroyo Ni-
reco, Neuquen, Argentina, con la descripcio-

Lehmann, Ulrich. 1968. Stratigrafie und Ammoni-
tenführung der Ahrensburger Grazil-Geschiebe aus dem Lias epsilon (= Unt. Toarcium). Mitteilun-

Levi, Gustavo. 1896. Sui fossili degli stratii a Ter-

Levi-Setti, Franco, & Giovanni Pinna. 1971. Platystro-
phites, nuova genere nella serie toarciana ad ammoniti del Paso del Furlo (Pesarò) (Ammonoidea, Dactyli-
ceratidae). Atti della Società italiana di Scien
ci naturali e del Museo Civico di Storia naturale di Milano 112:475–484, pl. 79.

et Spinammatoceras (Hammatocteras, Ammo-

Linares, A., & J. Sandoval. 1996. The genus Ha-
oplolem-
roroceras (Erycitidae, Ammonitina) in the Betic Cordil-

Loczy, Ludwig von. 1915. Monographie der Villayer Callovien-Ammoniten. Geologica Hungarica, Buda-

Longridge, L. M., Paul M. Smith, & Howard W. Tipp-


Macchioni, F., & Federico Venturi. 2000. Leukadiel-


Matsumoto, Tatsuuro. 1947. A biostratigraphical study of the Jurassic Toyora Group, with special reference to ammonites. Science Reports, Department of Geology, Faculty of Science, Kyushu University 2 (1):20–33, 2 pl.

Mattei, Jean. 1969. Définition et interprétation de Pseudo(poly)pectoceras nov. gen. (Harpoceratinae, Am-

Mattei, Jean. 1974. Analyse des termes fossilières do-
Ammoniti giuresi dell’Appennino
Merla, G. 1933. Ammoniti giuresi dell’Appennino
Merla, G. 1934. Ammoniti giuresi dell’Appennino
Meneghini, Joseph. 1867–1881. Monographie des fossiles du calcaire rouge ammonitique (Lias supérieur) de Lombardie et de l’Apennin central; Appendice: Monoceratoidea, Eodoceratoidea, Hildoceratoidea


Spath, Leonard F. 1928. Revision of the Jurassic cephalopod faunas of Katch (Cutch); parts 2, 3. Palaeontologica Indica (NS) 9(2):73–278, pl. 8–47.


---

*Psiloceratoidea, Eodoceratoidea, Hildoceratoidea* 137


