# Upper Cenomanian–Lower Turonian ammonoids from the Saxonian Cretaceous (lower Elbtal Group, Saxony, Germany)

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The Upper Cenomanian to Lower Turonian ammonoid fauna of the Saxonian Cretaceous (Elbtal Group, Saxony, Germany) has been revised based on the study of 270 specimens hosted in the Museum für Mineralogie und Geologie (MMG) of the Senckenberg Naturhistorische Sammlungen Dresden. In total, 12 species have been identified and, based on this revision, a number of ammonoids are now reported and/or illustrated for the first time from the Elbtal Group of Saxony: *Euomphaloceras septemseriatum, Neocardioceras juddii barroisi, Watinoceras coloradoense, Spathites* (*Jeanrogericeras*) *reveliereanus, Sciponoceras gracile* and *Scaphites equalis*. The study demonstrated the presence of all Upper Cenomanian and Lower Turonian standard ammonite biozones in the lithostratigraphic succession of the lower Elbtal Group: the lower Upper Cenomanian *Calycoceras naviculare* Zone (represented by the Oberhäslich Formation), the mid- and upper Upper Cenomanian *Metoicoceras geslinianum* and *Neocardioceras juddii* zones (represented by the Dölzschen Formation), and the Lower Turonian *Watinoceras coloradoense* and *Mammites nodosoides* zones (represented by the Brießnitz Formation). The ammonoid fauna from the Saxonian Cretaceous is dominated by strongly ornamented and widely distributed Acanthoceratidae. • Key words: Upper Cretaceous, Saxo-Bohemian Cretaceous Basin, ammonites, taxonomic revision, biostratigraphy.

WILMSEN, M. & NAGM, E. 2013. Upper Cenomanian–Lower Turonian ammonoids from the Saxonian Cretaceous (lower Elbtal Group, Saxony, Germany). *Bulletin of Geosciences 88(3)*, 647–674 (18 figures). Czech Geological Survey, Prague. ISSN 1214-1119. Manuscript received September 26, 2012; accepted in revised form January 25, 2013; published online July 3, 2013; issued July 3, 2013.

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In Saxony, the area between Meißen, Dresden, Pirna and the Czech border is characterized by sedimentary rocks of early Late Cretaceous (Cenomanian–Lower Coniacian) age, more-or-less following the river Elbe valley (Fig. 1A). The lithofacies of these Cretaceous strata is dominated by marine siliciclastics and marls or marly limestones (so-called Pläner). Lithostratigraphically, they are combined in the so-called Elbtal Group (Tröger & Voigt *in* Niebuhr *et al*. 2007), which forms an important link between the temperate Boreal shelf of northern and northwestern Europe and the Tethyan warm-water areas to the south. The Elbtal Group was deposited in a relatively narrow strait between the Westsudetic and the Mid-European islands and shows strong relationships in terms of facies and palaeontology to contemporaneous strata from the Bohemian Cretaceous Basin towards the southeast. The Saxonian Cretaceous is a classical topic of geognostic research in Germany and its palaeontology and stratigraphy have been studied in considerable detail (*e.g*., Geinitz 1839–1843, 1849, 1871–1875; Petrascheck 1902; Wanderer 1909; Tröger 1967, 1969, 2003).

The ammonites of the Saxonian Cretaceous have for the last time been monographed by Petrascheck (1902) over a century ago. Since those times, only some papers have been published dealing with individual taxa [*e.g*., Tröger 1968 on *Hyphantoceras reussianum* (d'Orbigny); Köhler 2001 on *Turrilites* (*T.*) cf. *scheuchzerianus* Bosc; Wilmsen & Mosavinia 2011 on *Schloenbachia varians* (J. Sowerby)]. Thus, a comprehensive systematic revision was long overdue (for the Bohemian and Moravian part of the Saxo-Bohemian Cretaceous Basin, Cenomanian–Lower Turonian ammonites have been revised in more recent times by Houša 1967; Konečný & Vašíček 1983, 1987; and Vašíček 1989). In this first part, we focus on the Upper Cenomanian–Lower Turonian ammonite fauna. The few ammonites from the Lower Cenomanian Meißen

Formation have been excluded from the revision; they have already been treated in some recent papers (Dietze 1960, Köhler 2001, Wilmsen & Mosavinia 2011). A second part on the Middle–Upper Turonian ammonites of the Saxonian Cretaceous will follow (Nagm & Wilmsen in prep.).

## Geological setting

Palaeogeographically and in terms of (bio-)facies, the Elbtal Group is mediating between the Tethyan-influenced Bohemian Cretaceous in the southeast and the Boreal North German shelf sea in the northwest (Fig. 1B, C). The Saxonian Cretaceous Basin has a special palaeogeographic position between the Westsudetic Island in the northeast and the Osterzgebirge as an emergent part of the central Mid-European Island in the southwest. Today, the basin fill is preserved in a tectonic halfgraben, the active northeastern margin is represented by the Lausitz Fault (Fig. 1A). The facies and thickness changes of the Cretaceous strata within the Saxonian Cretaceous Basin show that at least from the Middle Turonian, deposition was influenced by syn-sedimentary activity of the Lausitz Fault (Voigt 1994, Kley & Voigt 2008). The Lausitz Fault is joined by a number of other NW–SE-trending structural elements in Middle Europe (*e.g.*, T. Voigt *et al*. 2006, Niebuhr *et al*. 2011) that have been characterized by compression since Turonian times (Kley & Voigt 2008).

The following brief geological overview follows the revised lithostratigraphy of the Elbtal Group (Tröger & Voigt *in* Niebuhr *et al*. 2007; see Fig. 2). A first marine transgression from the north took place in the late Early Cenomanian, reaching the area of Meißen (Meißen Formation). Conglomeratic bioclastic limestones indicate high-energy nearshore deposition. Marine Middle Cenomanian is unknown, but the back-filling of fluvial valleys (Niederschöna Formation; see Voigt 1998) indicates a continuing base-level rise. The major transgression occurred during the Late Cenomanian, submerging a pronounced relief of depressions and cliffs related to the different erosional resistance of the basement. In that time, a chain of isolated cliffs and islands was located at the southwestern margin of the basin (Voigt 1994, Voigt *et al*. 1994, S. Voigt *et al*. 2006, Wilmsen *et al*. 2011). Clastic sediments were predominantly sourced from the southwest (Osterzgebirge as a part of the Bohemian Massif) and the northeast (Westsudetic Island). The Late Cenomanian transgression took place in two major pulses: in the early Late Cenomanian (*Calycoceras naviculare* Zone), the shallow-marine conglomerates, fossiliferous sands and argillaceous silts of the Oberhäslich Formation ("Unterquader") have been deposited, usually missing on swells. The second pulse occurred in the *Metoicoceras geslinianum* Zone. This rapid (eustatic) rise of sea-level (*plenus* Transgression of authors) resulted in the drowning of many islands and the onlap of the Dölzschen Formation (proximal fine-grained sandstones grading into silty spiculitic marlstones; "Unterer Pläner" or "*plenus*-Pläner") onto formerly emergent basement areas, not only in Saxony but also in many parts of the Bohemian Cretaceous Basin (*e.g.*, Žítt *et al*. 1998, 2006, 2010) as well as on the opposite side of the Bohemian Massif in NE Bavaria (Wilmsen *et al*. 2010a, b; Richardt *et al*. 2013).

After the levelling of the pre-transgression topography during the Late Cenomanian, more uniform sedimentation patterns became established during the Turonian. In the Early Turonian, the still relatively narrow strait between the Westsudetic Island and the Bohemian Massif (Osterzgebirge) was characterized by cross-bedded, tidally influenced sands (Schmilka Formation; see Voigt 1999, Mitchell *et al*. 2010). These shallow-water deposits grade, with a transitional facies of bioturbated, silty-argillaceous, fine-grained sandstones and silts, into fine-grained basinal deposits characterizing the "Pläner-Fazies" of the Dresden area (calcareous siltstones and silty marls of the Brießnitz Formation; Fig. 2). The Brießnitz Formation ranges into the lowermost Middle Turonian and is overlain by fine-grained, calcareous basinal deposits (Pläner sediments of the Räcknitz Formation) while in the Elbsandsteingebirge ("Saxonian Switzerland"), the sandstones, sandy marls and greensands of the Postelwitz Formation have been deposited, sourced from the rising Lausitz Massif.

## Conventions

More than 270 specimens have been studied, mostly well to moderately well preserved (composite) internal moulds. All specimens, except one (*Scaphites equalis* Sowerby, M. Fengler collection, Dresden) are kept in the Museum für Mineralogie und Geologie (MMG) of the Senckenberg Naturhistorische Sammlungen Dresden (SNSD), Germany (repository SaK). Most of the ammonoids are historical specimens that have been collected in the nineteenth and twentieth century, and some of them have already been illustrated in earlier publications (Geinitz 1839–1843, 1849, 1871–1875; Petrascheck 1902; Wanderer 1909). If a specimen is re-figured herein, this is stated in the captions.

Suture terminology follows Wedekind (1916) as put forward by Kullman & Wiedmann (1970) and revised in parts by Korn *et al*. (2003): E = external lobe, A = adventive lobe (= lateral lobe, L, of former nomenclature), U = umbilical lobe, I = internal lobe. A Vernier Caliper has been used to measure all linear dimensions (given in millimeters). Abbreviations are: maximum diameter (D), whorl breadth (Wb),

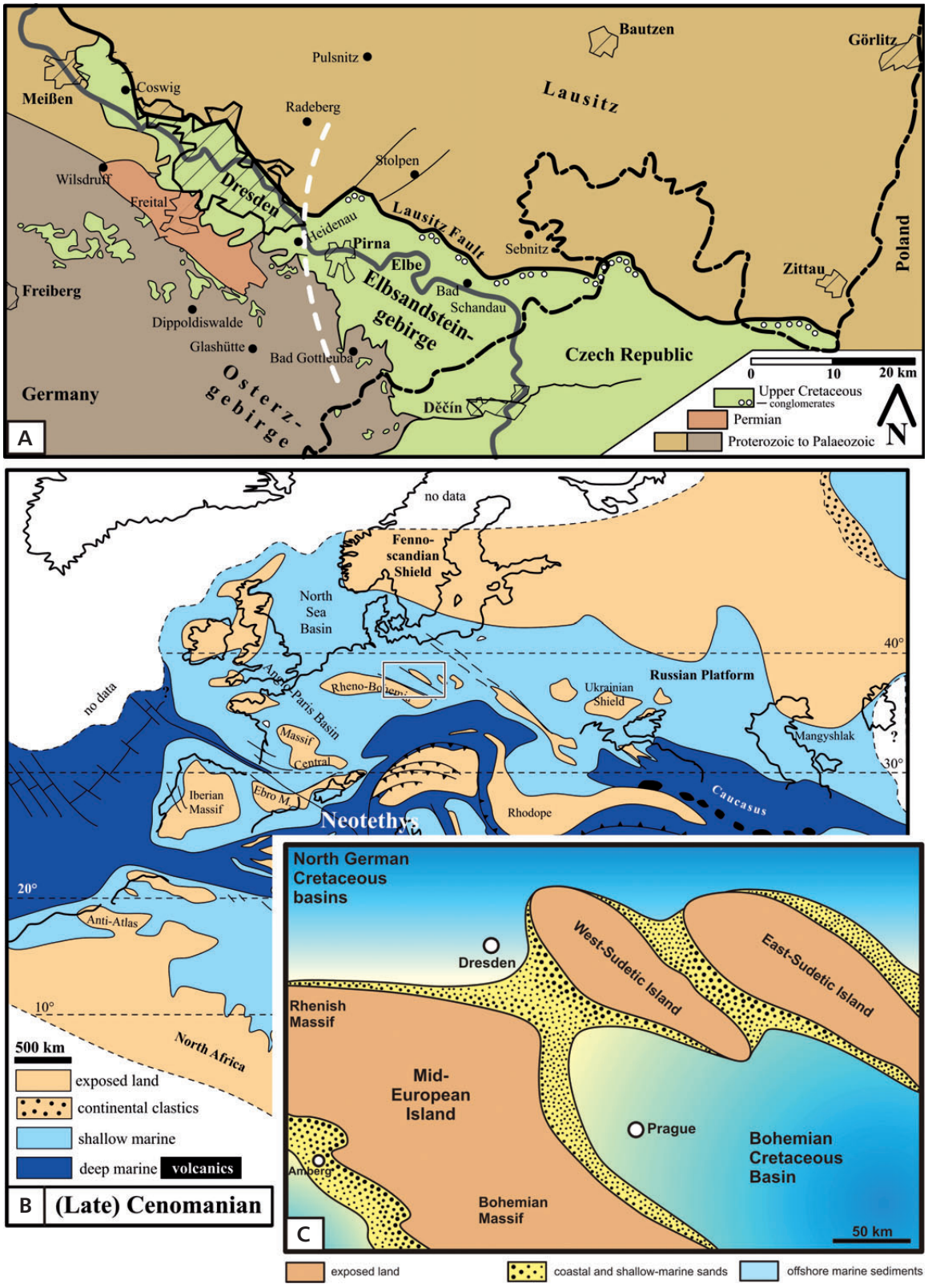


**Figure 1.** Regional and palaeogeographic framework. • A – distribution of the Cretaceous strata of the Elbtal Group (green) in Saxony; the dashed line separates the two principal lithofacies zones, *i.e.* sandy nearshore facies in the Saxonian Switzerland and marly offshore facies (Pläner) around Dresden (see Fig. 2). • B – Late Cenomanian palaeogeography of northwestern Europe (modified after Philip & Floquet 2000); the study area (see Fig. 1C) is indicated by a rectangle. • C – detailed palaeogeography of the Saxo-Bohemian area (modified after Voigt 1994).

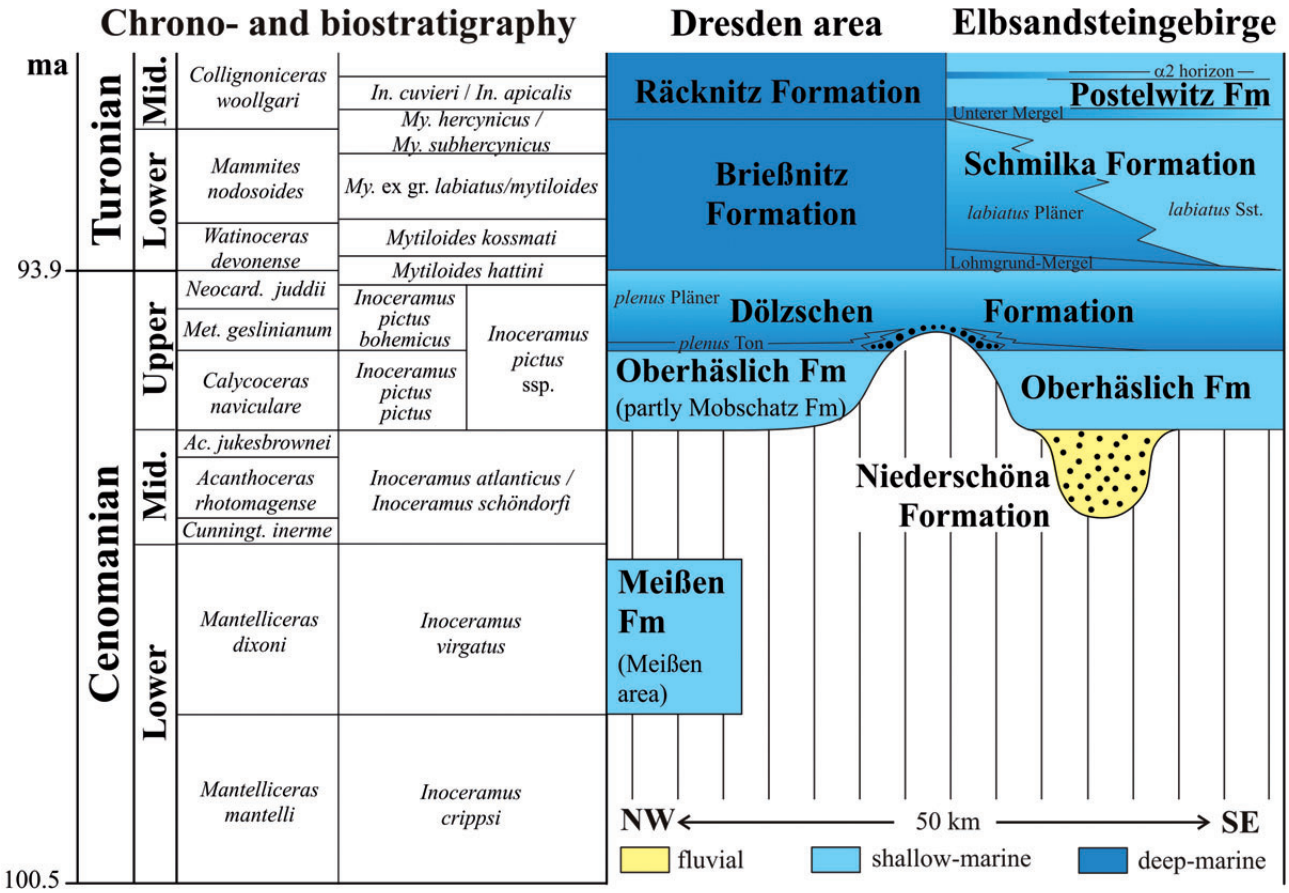


**Figure 2.** Stratigraphy of the lower part of the Elbtal Group (modified after Wilmsen & Niebuhr 2009). Ammonite standard zones after Kennedy (1984, 1986), Wright *et al. in* Wright & Kennedy (1984) and Hancock (1991), inoceramid zones after Tröger (1989), partly modified; absolute ages after Ogg & Hinnov (2012).

whorl height (Wh), diameter of umbilicus (U). Figures in parentheses are dimensions as a percentage of diameter.

The terminology used for the description of the taxa and the systematics follows Wright *et al*. (1996). In order to keep this article as short as possible, the synonymies only contain the most recent ones as well as those being of regional interest or those being important for the discussion. Open nomenclature follows Bengtson (1988).

## Systematic palaeontology

Order Ammonoidea Zittel, 1884
Suborder Ammonitina Hyatt, 1889
Superfamily Desmoceratoidea Zittel, 1895
Family Pachydiscidae Spath, 1922

### Genus *Lewesiceras* Spath, 1939

*Type species*. – *Ammonites peramplus* Mantell, 1822, p. 200; by original designation.

***Lewesiceras peramplum* (Mantell, 1822)**
Figures 3–5

*1822 *Ammonites peramplus*; Mantell, p. 200.
1871–72 *Ammonites Lewesiensis* Mnt. – Schlüter, p. 23, pl. 8, figs 5, 6 (*non 7*) [1871]; pl. 9, fig. 7 [1872].
1872 *Ammonites peramplus* Mant. – Fritsch, p. 38, figs 1–4.
1887 *Pachydiscus peramplus* Mantell sp. – Laube & Bruder, p. 225, text-fig. 3a, b.
1887 *Pachydiscus Lewesiensis* Mantell sp. – Laube & Bruder, p. 226, text-fig. 4a–c.

**Figure 3.** *Lewesiceras peramplum* (Mantell, 1822). • A – apertural view, B – lateral view, C – ventral view. MMG: SaK4039 (original of Petrascheck 1902, pl. 7, fig. 2, and probably of Wanderer, pl. 9, fig. 4). Upper Cenomanian Dölzschen Formation, Dresden-Ockerwitz. • D – lateral view; E – apertural view. MMG: SaK12100. Lower Turonian Briesnitz Formation, Dresden-Lockwitz. • F – lateral view; G – ventral view. MMG: SaK5350. Lower Turonian Briesnitz Formation, Dresden-Leubnitz. × 1


A
B
C
D
E
F
G
SaK 12100

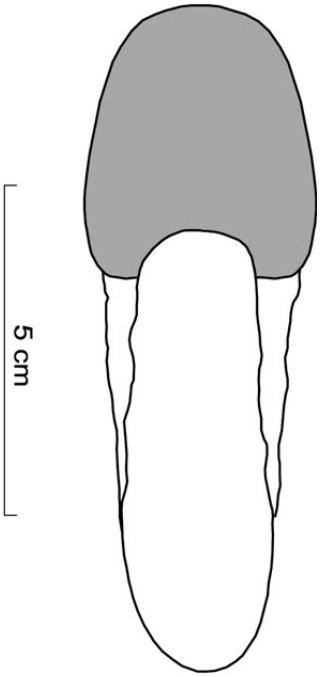


**Figure 4.** Whorl section of *Lewesiceras peramplum* (Mantell, 1822). MMG: SaK5559. Lower Turonian Brießnitz Formation, Dresden-Brießnitz.

1887 *Pachydiscus juvencus*; Laube & Bruder, p. 228, pl. 29, fig. 1.
1902 *Pachydiscus peramplus* Mant. Spec. – Petrascheck, p. 137, pl. 7, fig. 2.
1909 *Pachydiscus peramplus* Mant. sp. – Wanderer, p. 62, pl. 9, fig. 4.
1981 *Lewesiceras peramplum* (Mantell, 1822). – Wright & Kennedy, p. 29, pl. 2, figs 1–3; pl. 3; text-figs 9, 12 (with synonymy).
1983 *Lewesiceras peramplum* (Mantell, 1822). – Konečný & Vašíček, p. 176, pl. 3, fig. 1.
1987 *Lewesiceras peramplum* (Mantell, 1822). – Konečný & Vašíček, p. 84, pl. 1, fig. 2.
1994 *Lewesiceras peramplum* (Mantell, 1822). – Chancellor *et al*., p. 22, pl. 3, figs 1–3.
2009 *Lewesiceras peramplum* (Mantell, 1822). – Lehmann & Herbig, p. 64, pl. 1, figs H, I.
2012 *Lewesiceras peramplum* (Mantell, 1822). – Chrząstek, p. 88, fig. 6A–E.

*Material*. – Three specimens (SaK3181, 4022, 4039) from the Upper Cenomanian Dölzschen Formation in Dresden-Ockerwitz and Dresden-Leubnitz/Kauscha as well as in total 51 specimens from the Lower Turonian Brießnitz Formation in Dresden-Lockwitz (24 specimens), Dresden-Leubnitz (22 specimens), Dresden-Cotta (3 specimens) and Dresden-Leutewitz (2 specimens). In addition to the three Cenomanian specimens, 32 specimens from the Lower Turonian have been measured (see below). 19 specimens (SaK5342, 5351, 5352, 12101, 12103, 12105, 12119, 12120, 12121, 12126, 12129, 12145, 12192, 12210, 12211, 12214, 12232, 14802, 14893) are incomplete.

*Measurements*. –

| Specimen | D | Wb | Wh | Wb/Wh | U |
|---|---|---|---|---|---|
| SaK5171 | 40.6 (100) | 15.2 (37.4) | 20.5 (50.4) | 0.74 | 12.5 (30.7) |
| SaK12245 | 48.3 (100) | 13.0 (26.9) | 19.7 (40.7) | 0.65 | 16.1 (33.3) |
| SaK5350 | 50.2 (100) | 13.3 (26.4) | 22.0 (43.8) | 0.60 | 14.1 (28.0) |
| SaK5343 | 51.8 (100) | 15.0 (28.9) | 20.2 (38.9) | 0.74 | 17.1 (33.0) |
| SaK5530 | 65.9 (100) | 17.0 (25.7) | 22.5 (34.1) | 0.75 | 20.2 (30.6) |
| SaK5345 | 66.4 (100) | 19.7 (29.6) | 24.2 (36.4) | 0.81 | 22.5 (33.8) |
| SaK5440 | 75.4 (100) | 17.2 (22.8) | 29.7 (39.3) | 0.57 | 24.8 (32.8) |
| SaK5341 | 75.9 (100) | 16.5 (21.7) | 32.1 (42.2) | 0.51 | 18.6 (24.5) |
| SaK5166 | 84.4 (100) | 24.0 (28.4) | 30.3 (35.9) | 0.79 | 32.1 (38.0) |
| SaK5384 | 84.8 (100) | 23.8 (28.0) | 36.6 (43.1) | 0.65 | 26.9 (31.7) |
| SaK5180 | 94.3 (100) | 23.9 (25.3) | 35.2 (37.3) | 0.67 | 29.2 (30.9) |
| *SaK5279* | *94.7 (100)* | *16.7 (17.6)* | *36.2 (38.2)* | *0.46* | *31.8 (33.5)* |
| SaK5349 | 94.8 (100) | 26.5 (27.9) | 39.1 (41.2) | 0.67 | 31.0 (32.7) |
| SaK5559 | 95.8 (100) | 29.3 (30.5) | 42.2 (44.0) | 0.69 | 27.9 (29.1) |
| SaK12165 | 96.4 (100) | 25.9 (26.8) | 41.0 (42.5) | 0.63 | 28.7 (29.7) |
| SaK5172 | 97.9 (100) | 25.0 (25.5) | 42.4 (43.3) | 0.58 | 30.0 (30.6) |
| SaK4039 | 101.0 (100) | 38.3 (37.9) | 42.5 (42.0) | 0.90 | 31.5 (31.1) |
| SaK5522 | 108.9 (100) | 37.0 (33.9) | 51.5 (47.2) | 0.71 | 27.8 (25.5) |
| SaK5164 | 111.0 (100) | 30.3 (27.2) | 51.4 (46.3) | 0.58 | 32.1 (28.9) |
| SaK5373 | 114.3 (100) | 27.5 (24.0) | 51.2 (44.7) | 0.53 | 29.1 (25.4) |
| SaK12235 | 117.0 (100) | 26.2 (22.3) | 47.4 (40.5) | 0.55 | 32.2 (27.5) |
| *SaK5330* | *123.4 (100)* | *27.9 (22.6)* | *60.6 (49.1)* | *0.46* | *38.2 (30.9)* |
| SaK12170 | 123.5 (100) | 28.7 (23.2) | 57.1 (46.2) | 0.50 | 36.7 (29.7) |
| SaK5326 | 126.0 (100) | 36.4 (28.8) | 55.2 (43.8) | 0.65 | 38.3 (30.3) |
| SaK5348 | 132.1 (100) | 32.9 (24.9) | 56.8 (42.9) | 0.57 | 39.7 (30.0) |
| *SaK12100* | *132.3 (100)* | *23.4 (17.6)* | *57.0 (43.0)* | *0.41* | *35.5 (26.8)* |
| SaK5325 | 133.9 (100) | 32.5 (24.2) | 58.9 (43.9) | 0.55 | 45.1 (33.6) |
| *SaK14893* | *134.2 (100)* | *22.0 (16.3)* | *56.3 (41.9)* | *0.39* | *41.9 (31.2)* |
| SaK12229 | 154.9 (100) | 31.0 (20.0) | 61.9 (39.9) | 0.50 | 49.6 (32.0) |
| SaK5353 | 159.8 (100) | 47.4 (29.6) | 70.6 (44.1) | 0.67 | 35.4 (22.1) |
| SaK3181 | 172.0 (100) | 43.8 (25.4) | 65.8 (38.2) | 0.66 | 53.9 (31.3) |
| SaK5163 | 178.9 (100) | 42.5 (23.7) | 70.2 (39.2) | 0.60 | 57.0 (31.8) |
| SaK4022 | 193.8 (100) | 40.0 (20.6) | 82.2 (42.4) | 0.48 | 54.5 (28.1) |
| SaK5444 | 194.4 (100) | 58.5 (30.0) | 79.8 (41.0) | 0.73 | 66.8 (34.3) |
| *SaK12190* | *225.4 (100)* | *43.0 (19.0)* | *95.1 (42.1)* | *0.45* | *66.6 (29.5)* |
| average | 112.9 | 28.3 | 47.5 | 0.61 | 34.1 |

*Description*. – Medium- to large-sized, with moderately evolute coiling (U ~34%) and steep umbilical wall. The whorl section is subcircular to high-oval (Fig. 4) and has a broadly rounded venter. Some specimens (*e.g*., SaK12100; Fig. 3D, E) are strongly compressed (Wb/Wh < 0.50) and have acute venters, related to lateral compaction (they are marked by italic font in the Measurements table). There are strong umbilical bullae on the inner flanks (about eight in SaK4039), giving rise to coarse prorsiradiate primaries; intercalated ribs arise on the middle flank and venter. All ribs are concave on the outer flank and convex across the venter. During ontogeny, the umbilical bullae fade and the ornament only consists of distant primary ribs. Sutures are not preserved.

*Remarks*. – *Lewesiceras peramplum* is a very common species in Turonian successions of Germany. It has first been described by Schlüter (1871–1872) from the Lower Saxony Basin and by Petrascheck (1902) and Wanderer (1909) from the Saxonian Cretaceous Basin. In addition, it has been recorded from the Turonian of the Bohemian Cretaceous by Fritsch (1872), Laube & Bruder (1887), Houša (1967, p. 10, pls 1–3, pl. 4, figs 1, 2, text-fig. 3) and Konečný & Vašíček (1983, 1987). Most specimens have been collected from the Lower Turonian Brießnitz Formation. However, three specimens (SaK3181, 4022, 4039) are labeled to come from the Dölzschen Formation of Dresden-Ockerwitz (uppermost Cenomanian, *Metoicoceras geslinianum* and *Neocardioceras juddii* zones). If these data are correct, the range of *Lewesiceras peramplum* may be extended down into the upper Upper Cenomanian (also Wanderer 1909 reported records from the Cenomanian of Dresden-Ockerwitz). The studied material shows a variety in size from small- to large-sized and in shape from subcircular to strongly compressed whorl sections. Wright & Kennedy (1981) have revised this species with a full discussion of its taxonomy and a recent discussion of the species has been provided by Chrząstek (2012) based on occurrences from Poland.

*Occurrence*. – According to Wright & Kennedy (1981), the species occurs abundantly in the Lower and Middle–lower Upper Turonian of Germany, the Czech Republic, Poland, France, Tunisia and Morocco. However, the first appearance date (FAD) of *Lewesiceras peramplum* may be already in the latest Cenomanian based on the potential records from the Dölzschen Formation in Saxony.

Superfamily Hoplitoidea Douvillé, 1890
Family Placenticeratidae Hyatt, 1900

**Genus *Placenticeras* Meek, 1876**

*Type species*. – *Ammonites placenta* DeKay, 1828, p. 278; by original designation.

***Placenticeras memoriaschloenbachi*?**
**Laube & Bruder, 1887**
Figures 6, 7A–B

1849 *Ammonites bicurvatus* Michelin. – Geinitz, p. 112, pl. 4, fig. 2a, b.
1875 *Ammonites* cf. *bicurvatus* Michelin, 1838. – Geinitz, p. 188, pl. 34, fig. 3.
?*1887 *Placenticeras Memoria-Schloenbachi*; Laube & Bruder, p. 221, pl. 23, figs 1a, b.
1909 *Placenticeras memoria Schloenbachi* Laube & Bruder. – Wanderer, p. 61, pl. 9, fig. 3.
? 1981 *Proplacenticeras* cf. *memoriaschloenbachi* (Laube & Bruder). – Kennedy *et al*., p. 31, pl. 23, figs 4, 5; text-fig. 11F.
? 1984 *Placenticeras* cf. *memoriaschloenbachi* Laube & Bruder. – Kennedy & Juignet, p. 107, figs 7a–i.

*Material*. – Two specimens (SaK2177, 4043) from the Upper Cenomanian Dölzschen Formation in Dresden-Plauen and Dresden-Ockerwitz, and two specimens (SaK12169, 12178) from the Lower Turonian Brießnitz Formation in Dresden-Lockwitz.

*Measurements*. –

| Specimen | D | Wb | Wh | Wb/Wh | U |
|---|---|---|---|---|---|
| SaK2177 | 262.0 (100) | 43.3 (16.5) | 124.9 (47.6) | 0.34 | 52.9 (20.1) |

*Description*. – The large specimens are characterized by involute coiling with a highly compressed oxycone whorl section (Fig. 6A). The umbilicus is relatively small (U ≤ 20%) with steep umbilical wall and rounded umbilical shoulder. The flanks are wide, slightly concave, and smooth, with greatest breadth on the inner flanks. The venter is narrowly tabulate in SaK4043 and 12169 and sharp in the other two specimens (which may be a result of lateral compaction). The suture line (Fig. 6B) is incompletely preserved, but it shows the main sutural characters of the genus with strong subdivisions as well as narrow-necked lobes and saddles.

*Remarks*. – The species has first been described and illustrated from Saxony by Geinitz (1849) from the Cenomanian-Turonian boundary strata of Goppeln, south of Dresden, and assigned to *A. bicurvatus* Michelin, referring to pl. 84 in d'Orbigny (1841). However, this plate shows two different taxa from the Lower Cretaceous [*Cleoniceras cleon* (d'Orbigny) and *Pseudosaynella bicurvata* (Michelin)] that cannot be compared to the Late Cenomanian–Early Turonian specimens from Saxony. Laube & Bruder (1887, p. 221) already discussed the affinitiy of *A. bicurvatus* as illustrated by Geinitz (1849, 1875) in the first description of *Placenticeras Memoria-Schloenbachi*, but pointed out the lack of the faint umibilical tubercles and the sharp venter in the Saxonian specimen (the latter is probably a result of taphonomic alteration). The material of the present study matches the stratigraphic position of, and is morphologically close to the type specimen as described and illustrated by Laube & Bruder (1887) from the Lower Turonian of the Bohemian Cretaceous Basin, apart from the absence of the faint umbilical tubercles. We thus assign the specimens from Saxony to Laube & Bruder's species only with hesitation. Kennedy *et al*. (1981) and Kennedy & Juignet (1984) demonstrated that placenticeratids are characterized by considerable intraspecific variation from smooth oxyconic individuals with narrow tabulate venters to robust, ribbed, and tuberculate individuals.

They described some specimens from France that they considered to be very closely related to *Placenticeras memoriaschloenbachi*, but also pointed out the need for a revision of Cenomanian-Turonian placenticeratids.

*Occurrence*. – The species has so far only been recorded from the Upper Cenomanian and Lower Turonian of Germany, the Czech Republic and France.

Superfamily Acanthoceratoidea de Grossouvre, 1894
Family Acanthoceratidae de Grossouvre, 1894
Subfamily Acanthoceratinae de Grossouvre, 1894

**Genus *Neocardioceras* Spath, 1926**

*Type species*. – *Ammonites juddii* Barrois & Guerne, 1878, p. 46, pl. 1, figs 1, 2; by original designation.

***Neocardioceras juddii barroisi* Wright & Kennedy, 1981**
Figures 7C–E, 8A

1875 *Ammonites Neptuni*; Gein., p. 280, pl. 62, fig. 4A, B.
*1981 *Neocardioceras juddii barroisi* subsp. nov.; Wright & Kennedy, p. 50, pl. 8, fig. 1, pl. 9, figs 4, 12–20, text-fig. 19J, L.
1986 *Neocardioceras juddii barroisi* Wright & Kennedy. – Kennedy, pl. 8, figs 4, 5.
2003 *Neocardioceras juddii barroisi* Wright & Kennedy, 1981. – Kennedy *et al*., p. 9, pl. 1, figs 7, 8.

*Material*. – One specimen (SaK1409) from the Dölzschen Formation of the Plauen'scher Grund in Dresden-Plauen.

*Measurements*. –

| Specimen | D | Wb | Wh | Wb/Wh | U |
|---|---|---|---|---|---|
| SaK1409 | – | 12.0 | 11.1 | 1.08 | – |

*Description*. – The specimen is a small fragment, with nearly quadratic whorl section (Fig. 8A). The flanks are short and ornamented by dense, slightly flexed, coarse ribs, starting at the umbilical wall and persisting on the flanks and across the venter. The ribs are slightly prorsiradiate and project on the venter to join in chevron pattern. Each rib bears outer ventrolateral clavi and a siphonal clavus. Sutures are not preserved.

*Remarks*. – The present specimen has been described and illustrated by Geinitz (1875, p. 280, pl. 62, fig. 4A, B) as *Ammonites neptuni*. However, *Subprionocyclus neptuni* (Geinitz, 1849) is a Late Turonian species, having its *stratum typicum* in the lower part of the Strehlen Formation in Dresden (Kalkstein von Strehlen, mid-Upper Turonian). Wright & Kennedy (1981) erected *Neocardioceras juddii barroisi* as a new subspecies to comprise the forms that are characterized by coarser and bluntly dense ribbing, less compressed whorl section and a more obtuse ventral chevron. These features are well developed in specimen SaK1409, and therefore, they considered the specimen illustrated by Geinitz (1875, pl. 62, fig. 4A, B) as *N. juddii barroisi*. Fig. 7C–E is the first photographic illustration of the specimen. The subspecies has also been described from northwest France (Kennedy *et al*. 2003, pl. 1, figs 7, 8).

*Occurrence*. – *Neocardioceras juddii* is the index fossil of the latest Cenomanian *Neocardioceras juddii* standard ammonite zone (see Kennedy 1984, Wright *et al*. *in* Wright & Kennedy 1984 and Hancock 1991) and has been recorded from Germany, England, and France (Wright & Kennedy 1981). This is the first proof of the *N. juddii* Zone in Saxony by means of ammonite evidence.

**Genus *Watinoceras* Warren, 1930**

*Type species*. – *Watinoceras reesidei* Warren, 1930, p. 67, pl. 3, fig. 2; pl. 4, figs 9–12; by original designation.

***Watinoceras coloradoense* (Henderson, 1908)**
Figures 7F, 8B

1902 *Schlönbachia gracillima* Kossmat. – Petrascheck, p. 153, pl. 9, fig. 3a, b.
*1908 *Acanthoceras coloradoense*; Henderson, p. 259, pl. 13, figs 10, 11.
1972 *Watinoceras coloradoense* (Henderson). – Cobban & Scott, p. 76, pl. 27, figs 11–19; pl. 28, figs 1–3, 5–9; text-figs 35–37.
1988 *Watinoceras coloradoense* (Henderson). – Cobban, p. 7, pl. 2, figs 1–23; pl. 3, figs 4, 5; text-fig. 4 (with full synonymy).
1994 *Watinoceras coloradoense* (Henderson, 1908). – Chancellor *et al*., p. 24, pl. 2, figs 2–3.
2005 *Watinoceras coloradoense* (Henderson, 1908). – Gale *et al*., p. 172, fig. 5A–D.
2007 *Watinoceras coloradoense* (Henderson, 1908). – Ifrim & Stinnesbeck, p. 646, fig. 6A–C.

**Figure 5.** *Lewesiceras peramplum* (Mantell, 1822), × 1. • A – apertural view. MMG: SaK5176. Lower Turonian Brießnitz Formation, Dresden-Leubnitz. • B – ventral view, C – lateral view. MMG: SaK5348. Lower Turonian Brießnitz Formation, Dresden-Leubnitz. • D – apertural view, E – lateral view, F – ventral view. MMG: SaK5559. Lower Turonian Brießnitz Formation, Dresden-Brießnitz.


SaK S176
DRESDEN
Strehlen
A
B
C
D
E
F

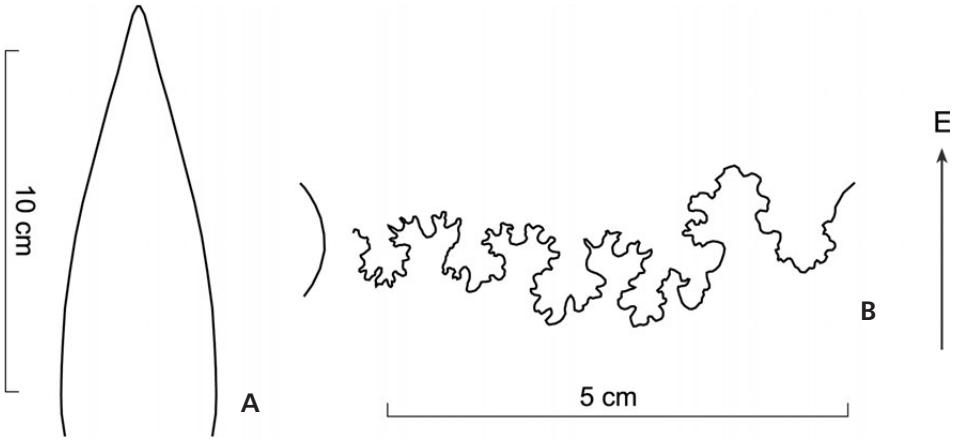


**Figure 6.** *Placenticeras memoriaschloenbachi*? Laube & Bruder, 1887. • A – whorl section, B – incompletely preserved external suture line. MMG: SaK2177. Upper Cenomanian Dölzschen Formation, Dresden-Plauen.

*Material*. – A single specimen (SaK5517) from the Brießnitz Formation of Dresden-Cotta.

*Measurements*. –

| Specimen | D | Wb | Wh | Wb/Wh | U |
|---|---|---|---|---|---|
| SaK5517 | 53.0 (100) | – | 27.5 (51.8) | – | 15.3 (28.8) |

*Description*. – Specimen SaK5517 is only comparatively poorly preserved and shows moderately evolute coiling (U = 29%). The umbilicus is shallow, characterized by a weakly convex umbilical wall and a narrowly rounded umbilical shoulder. Whorls are compressed with a rectangular cross-section (Fig. 8B). The flanks are flat and ornamented by strong, broad and distant ribs. Prorsiradiate primary ribs arise at the umbilical seam and carry strong bullae at the umbilical shoulder. They irregularly alternate with short intercalated ribs. All ribs end at small inner ventrolateral clavi at the ventrolateral shoulders. The venter is narrow and markedly concave between strong and sharp outer ventrolateral clavi. Sutures are poorly preserved.

*Remarks*. – Detailed descriptions of *Watinoceras coloradoense* and its intraspecific variations have been given by Cobban & Scott (1972) and Cobban (1988). Wright & Kennedy (1981) introduced the subspecies *W. coloradoense coloradoense* (Henderson, 1908) for the coarsely ribbed forms with low whorl section and narrow venter. In addition, they erected a new subspecies (*W. coloradoense praecursor*) to comprise more evolute forms with broad venter and higher whorl section that maintain fine ribs also in later stages of ontogeny. The differences between *Watinoceras coloradoense* and other species of the genus have been discussed by Cobban (1988). Our single specimen is close to the nominate subspecies of Henderson (1908), but we refrain from a subspecific assignment.

*Occurrence*. – *Watinoceras coloradoense* is the index species of the early Early Turonian *Watinoceras coloradoense/Watinoceras devonense* Zone (Kennedy 1984, Hancock 1991). It has been recorded from Canada (Alberta, British Columbia), the United States (Colorado, Kansas, New Mexico), Mexico, Brazil, the Czech Republic, Turkestan, Uzbekistan and Tunisia. *W. coloradoense* is not well-known from Germany (there is a non-illustrated record by Skupin 1989 from the Münsterland Cretaceous Basin). This is the first record of the species from the Saxonian Cretaceous of Germany and the direct ammonite evidence of the presence of the *W. coloradoense* Zone.

## Genus *Calycoceras* Hyatt, 1900

*Type species*. – *Ammonites navicularis* Mantell, 1822, p. 198, pl. 22, fig. 5; by original designation.

## Subgenus *Calycoceras* (*Calycoceras*) Hyatt, 1900

*Type species*. – *Ammonites navicularis* Mantell, 1822, p. 198, pl. 22, fig. 5; by original designation.

### *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822)

Figures 9, 10

*1822 *Ammonites navicularis*; Mantell, p. 198, pl. 22, fig. 5.

**Figure 7.** A, B – *Placenticeras memoriaschloenbachi*? Laube & Bruder, 1887. • A – ventral view, B – lateral view. MMG: SaK2177. Upper Cenomanian Dölzschen Formation, Dresden-Plauen, × 0.6. • C, D, E – *Neocardioceras juddii barroisi* Wright & Kennedy, 1981. C, E – lateral views, D – ventral view. MMG: SaK1409 (original of Geinitz 1875, pl. 62, fig. 4). Upper Cenomanian Dölzschen Formation, Plauen'scher Grund in Dresden-Plauen, × 2. • F – *Watinoceras coloradoense* (Henderson, 1908). Lateral view. MMG: SaK5517 (original of Petrascheck 1902, pl. 9, fig. 3). Lower Turonian Brießnitz Formation, Dresden-Cotta. × 1.5.


A
B
C
D
E
F

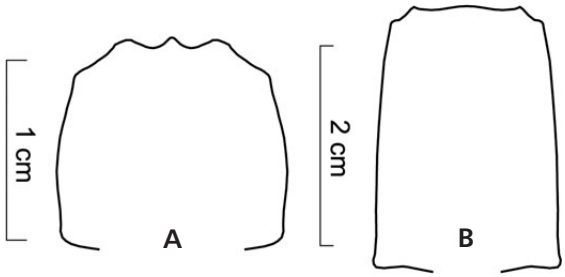


**Figure 8.** A – whorl section of *Neocardioceras juddii barroisi* Wright & Kennedy, 1981. MMG: SaK1409. Upper Cenomanian Dölzschen Formation, Plauen'scher Grund in Dresden-Plauen. • B – whorl section of *Watinoceras coloradoense* (Henderson, 1908). MMG: SaK5517. Lower Turonian Brießnitz Formation, Dresden-Cotta.

1875 *Ammonites Mantelli* Sow. – Geinitz, p. 279, pl. 62, figs 1, 2.
1909 *Douvilléiceras mantelli* Sowerby sp. – Wanderer, p. 63, pl. 11, fig. 1.
1971 *Calycoceras naviculare* (Mantell). – Kennedy, p. 71, pl. 33, fig. 1a, b; pl. 34, fig. 1a, b; pl. 35, figs 1, 2; pl. 36, figs 1–4; pl. 37, figs 1–3; pl. 47, figs 1, 3, 5.
1981 *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822). – Kennedy & Juignet, p. 29, fig. 6b, c.
1981 *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822). – Wright & Kennedy, p. 34, pl. 4; pl. 5, figs 1–3; text-figs 13, 14c–e (with full synonymy).
1989 *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822). – Cobban *et al*., p. 24, fig. 70A–T.
1990 *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822). – Wright & Kennedy, p. 236, pl. 61, fig. 1; pl. 62, figs 1–6; pl. 63, figs 1–3; text-figs 88E, I, 89D, 110C.
1998 *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822). – Kaplan *et al*., p. 152, pl. 53.
2004 *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822). – Barroso-Barcenilla, p. 89, pl. 1, fig. 2.

*Material*. – Five specimens (SaK4021, 4415, 4515, 4652, 5650) from the Oberhäslich Formation of Welschhufe near Bannewitz, south of Dresden, and two specimens (SaK4706, 4705) from the Dölzschen Formation of the Oberau railway tunnel near Meißen. All specimens are from the Upper Cenomanian.

*Measurements*. –

| Specimen | D | Wb | Wh | Wb/Wh | U |
|---|---|---|---|---|---|
| SaK4706 | 64.9 (100) | 29.1 (44.8) | 25.4 (39.1) | 1.14 | 18.0 (27.7) |
| SaK5650 | 176.1 (100) | 79.0 (44.8) | 71.3 (40.4) | 1.10 | 46.1 (26.1) |

*Description*. – The specimens are characterized by moderately evolute coiling. The depressed whorl section has its greatest whorl breadth on the lower flank (Fig. 9). The umbilicus is deep, with rounded, slightly overhanging wall. Strong primary ribs arise at the umbilical wall and carry

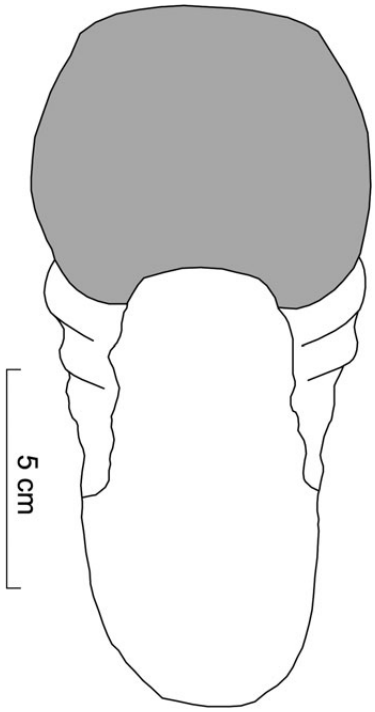


**Figure 9.** Whorl section of *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822). MMG: SaK5650 (original of Geinitz 1875, pl. 62, figs 1, 2). Upper Cenomanian Oberhäslich Formation, Welschhufe near Bannewitz (south of Dresden).

rounded umbilical bullae. Short and likewise strong secondary ribs are intercalated. All ribs are rectiradiate and number about 30 per whorl at D = 176 mm in SaK5650, separated by intercostal spaces of similar width. Flanks are short, convex and smoothly connected to the wide and arched venter by means of weak ventrolateral shoulders. None of the specimens shows sutures.

*Remarks*. – Specimen SaK5650 is the original of Geinitz (1875, pl. 62, figs 1a, b) and has been misidentified as "*Ammonites mantelli* Sow.". However, *Mantelliceras mantelli* (J. Sowerby, 1814) is an index species of the Lower Cenomanian and characterized by completely different ribbing and tuberculation patterns (*e.g*., Wright & Kennedy 1984, but note that *Ammonites mantelli* Sow. of Geinitz has there been placed in the synonymy of *M. mantelli*). Barroso-Barcenilla (2004) noted that mainly due to the poor quality of Mantell's (1822) original illustration and the lack of a precise description of the holotype, the definition of *Calycoceras* (*Calycoceras*) *naviculare* has led to different interpretations, mainly during the nineteenth century and first half of the twentieth century. Consequently, numerous specimens assigned to the species have been shown to belong to different taxa. This confusing situation has also caused considerable variations in the synonymy from author to author. Therefore, the specific differences that distinguish *Calycoceras* (*Calycoceras*) *naviculare* from other species of the (sub-)genus have been discussed in


**Figure 10.** *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822). • A – lateral view, B – apertural view. MMG: SaK5650 (original of Geinitz 1875, pl. 62, figs 1, 2). Upper Cenomanian Oberhäslich Formation, Welschhufe near Bannewitz (south of Dresden). × 1.

detail by Wright & Kennedy (1981, 1990). The few specimens from Saxony match well to the descriptions and illustrations provided in these revisions.

*Occurrence*. – *Calycoceras* (*Calycoceras*) *naviculare* is a widespread index species for the early Late Cenomanian *Calycoceras* (*C.*) *naviculare* Zone [or its equivalent *Calycoceras* (*Proeucalycoceras*) *guerangeri* Zone; see Kennedy 1984; Wright *et al. in* Wright & Kennedy 1984; Hancock 1991]. The five specimens from Welschhufe document this zone for the Oberhäslich Formation (where they are associated with typical low-Upper Cenomanian representatives of the *Inoceramus pictus* group). However, the species ranges into the overlying *M. geslinianum* Zone (Wright & Kennedy 1981) and the two specimens from the Dölzschen Formation of the Oberau railway tunnel are from this stratigraphically higher level. *Calycoceras* (*C.*) *naviculare* occurs in Germany, England, France, Spain, Portugal, northern Africa, the United States (Colorado, Kansas, New Mexico, Texas and California), Japan, India, Iran, Angola, and Madagascar (Wright & Kennedy 1981, 1990).

Subfamily Euomphaloceratinae Cooper, 1978

**Genus *Euomphaloceras* Spath, 1923**

*Type species*. – *Ammonites euomphalus* Sharpe, 1855, p. 31, pl. 13, fig. 4; by monotypy.

***Euomphaloceras septemseriatum* (Cragin, 1893)**
Figure 12C

*1893 *Scaphites septem-seriatus*; Cragin, p. 240.
1978 *Euomphaloceras* (*Kanabiceras*) *septem-seriatum* (Cragin, 1893). – Cooper, p. 106, figs 4N–O, 10A–E, 12E–H, 18G–H, 19G–L, 26A–B, 28.
1981 *Euomphaloceras septemseriatum* (Cragin, 1893). – Kennedy & Juignet, p. 38, fig. 9b–d.
1981 *Euomphaloceras septemseriatum* (Cragin, 1893). – Wright & Kennedy, p. 55, pl. 12, figs 1–8; pl. 13, figs 1–6; pl. 14, figs 5–9 (with full synonymy).
1988 *Euomphaloceras septemseriatum* (Cragin, 1893). – Kennedy, p. 53, pl. 8, figs 1–6, 9; pl. 9, figs 1–3, 5–7,

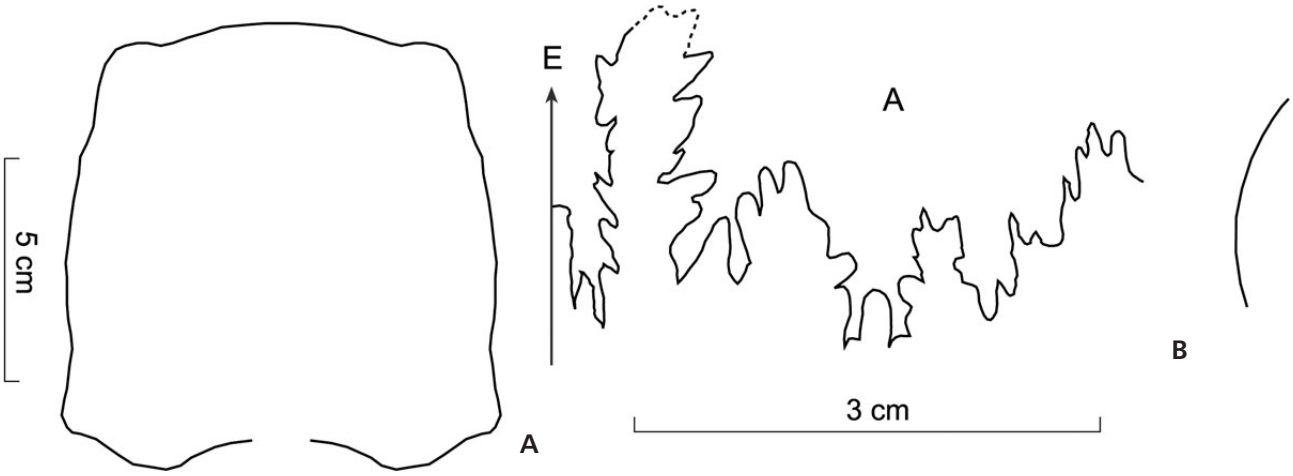


**Figure 11.** *Pseudaspidoceras footeanum* (Stoliczka, 1864). • A – whorl section, B – external suture line. MMG: SaK4799. Lower Turonian Brießnitz Formation, Dresden-Gorbitz.

9–12; pl. 22, fig. 3; text-figs 10E, 11D (with full synonymy).

1989 *Euomphaloceras septemseriatum* (Cragin). – Cobban *et al*., p. 35, figs 35, 76Q–T, Z–FF, HH–PP.

2003 *Euomphaloceras septemseriatum* (Cragin, 1893). – Kennedy *et al*., p. 10, pl. 2, figs 9, 10, 13, 15, 18–23.

2010 *Euomphaloceras septemseriatum* (Cragin, 1893). – Nagm *et al*., p. 479, figs 5I–K, 7C.

*Material*. – One fragmentarily preserved specimen (SaK7849) from the Dölzschen Formation of the Ratssteinbruch in Dresden-Plauen.

*Description*. – Even in fragmentary preservation, specimen SaK7849 shows the main characters of the species, represented by fine ribs arising at the umbilical margin and persisting on the flanks up to the wide, flat venter. Each rib carries small umbilical bullae, strong inner ventrolateral tubercles, oblique outer ventrolateral bullae, and small, rounded siphonal tubercles. The outer ventrolateral bullae and the siphonal tubercles are very close. Thus, ventrally there is a characteristic central band of three rows of tubercles.

*Remarks*. – Several authors have described the species in detail (*e.g*., Cooper 1978, Wright & Kennedy 1981, Kennedy 1988), and already Kennedy *et al*. (1981) noted that *Euomphaloceras septemseriatum* shows considerable morphological variation. New data on *E. septemseriatum* provided by Kennedy (1988) based on material from Texas show that this is a markedly dimorphic species. The very conspicuous ventral morphology allows a safe assignment of our single specimen to *E. septemseriatum*.

*Occurrence*. – *Euomphaloceras septemseriatum* is widespread in the Late Cenomanian *Metoicoceras geslinianum* Zone (Kennedy 1984; Wright *et al. in* Wright & Kennedy 1984; Hancock 1991) and has records in Germany, England, France, United States (Texas, New Mexico, Arizona, Colorado, Kansas, Montana, Utah, California), Brazil, Japan, Egypt, Nigeria and Angola. The occurrence in the Dölzschen Formation of the Ratssteinbruch in Dresden-Plauen represents the first record of the species from Saxony.

## Genus *Pseudaspidoceras* Hyatt, 1903

*Type species*. – *Ammonites footeanus* Stoliczka, 1864, p. 101, pl. 52, figs 1, 1a–c, 2, 2a; by original designation.

### *Pseudaspidoceras footeanum* (Stoliczka, 1864)

Figures 11, 12A–B

*1864 *Ammonites Footeanus*; Stoliczka, p. 101; pl. 52, figs 1–2.

1902 *Mammites Footeanus* Stol. spec. – Petrascheck, p. 144, pl. 9, fig. 1a, b.

1982 *Pseudaspidoceras footeanum* (Stoliczka). – Chancellor, p. 92, figs 2A, 24, 25.

**Figure 12.** A, B – *Pseudaspidoceras footeanum* (Stoliczka, 1864). • A – lateral view, B – ventral view. MMG: SaK4799 (original of Petrascheck 1902, pl. 9, fig. 1). Lower Turonian Brießnitz Formation, Dresden-Gorbitz. × 0.65. • C – *Euomphaloceras septemseriatum* (Cragin, 1893). Lateral view. MMG: SaK7849. Upper Cenomanian Dölzschen Formation, Dresden-Plauen, × 1. • D, E – *Metoicoceras geslinianum* (d'Orbigny, 1850); D – lateral view, E – ventral view. MMG: SaK4045. Upper Cenomanian Dölzschen Formation, Dresden-Ockerwitz. × 1.


A
B
C
D
E

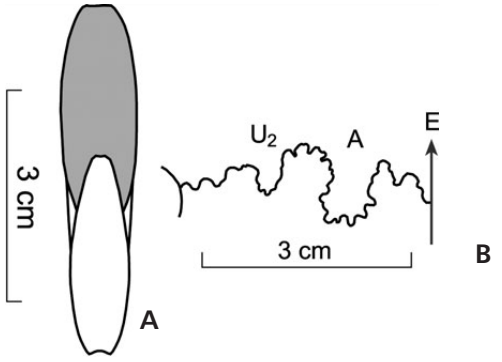


**Figure 13.** *Metoicoceras geslinianum* (d'Orbigny, 1850). • A – whorl section, B – external suture line. MMG: SaK4045 (original of Petrascheck 1902, pl. 7, fig. 4). Upper Cenomanian Dölzschen Formation, Dresden-Ockerwitz.

1985 *Pseudaspidoceras footeanum* (Stoliczka). – Howarth, p. 98, figs 30–33.
1995 *Pseudaspidoceras footeanum* (Stoliczka, 1864). – Zaborski, p. 59, figs 6, 7, 9, 10.
2009 *Pseudaspidoceras footeanum* (Stoliczka, 1864). – Lehmann & Herbig, p. 67, pl. 1, figs P–Q; text-fig. 7B.

*Material*. – Three specimens (SaK4799, 5526, 5465) from the Lower Turonian Brießnitz Formation in Dresden-Gorbitz, Dresden-Omsewitz and Dresden-Cotta.

*Measurements*. –

| Specimen | D | Wb | Wh | Wb/Wh | U |
|---|---|---|---|---|---|
| SaK4799 | 245.5 (100) | 48.6 (19.7) | 53.3 (21.7) | 0.91 | 89.9 (36.6) |
| SaK5526 | 130.2 (100) | 32.4 (24.8) | 48.1 (36.9) | 0.67 | 51.1 (39.2) |

*Description*. – The large specimens are characterized by evolute coiling with a wide, deep umbilicus and a concave umbilical wall. The whorls are sub-quadratic (Fig. 11A), with the greatest breadth at the umbilical tubercles. Very low, weak and wide ribs ornament the flat flanks. These ribs arising at the umbilical seam and strengthen into strong tubercles on the umbilical shoulder. Inner ventrolateral tubercles, with the same number and size of the umbilical ones, mark the ventrolateral shoulder. The venter is rounded and bound with small outer ventrolateral tubercles. The suture line (Fig. 11B) is characterized by a very wide adventive lobe and a high and narrow external saddle.

*Remarks*. – The similarities and differences between *Pseudaspidoceras footeanum* and other species of the genus (*e.g*. *P. flexuosum*, *P. paganum*, *P. ressidei*, *P. barberi* have been thoroughly discussed in several papers (Wright & Kennedy 1981, Zaborski 1995, Lehmann & Herbig 2009). In terms of morphological characters (*e.g*., whorl section, umbilical width, ribbing), the specimens from the Saxonian Cretaceous can be unequivocally assigned to *P. footeanum*. Specimen SaK4799 has already been described and illustrated by Petrascheck (1902). It differs from the specimen described and illustrated as *P.* cf. *footeanum* by Wright & Kennedy (1981, pl. 21, fig. 3a, b) by means of its stronger compression, degree of involution and less pronounced tuberculation.

*Occurrence*. – *Pseudaspidoceras footeanum* occurs in the Lower Turonian of Germany, England, Brazil, Mexico, India, Israel, Angola, Nigeria and Morocco (*e.g*., Zaborski 1995, Lehmann & Herbig 2009).

Subfamily Mammitinae Hyatt, 1900

**Genus *Metoicoceras* Hyatt, 1903**

*Type species*. – *Ammonites swallovi* Shumard, 1860, p. 591; by subsequent designation (Shimer & Shrock 1944, p. 591).

***Metoicoceras geslinianum* (d'Orbigny, 1850)**
Figures 12D, E, 13, 14

*1850 *Ammonites Geslinianus*; d'Orbigny, p. 146.
1875 *Ammonites Geslianus* [sic] d'Orb. – Geinitz, p. 280, pl. 62, fig. 3.
1902 *Pulchellia Gesliniana* d'Orb. spec. – Petrascheck, p. 140, pl. 7, figs 3a, b, 4a, b, 5a, b.
1909 *Pulchellia Gesliana* [sic] d'Orbigny sp. – Wanderer, p. 63, pl. 9, fig. 5.
1981 *Metoicoceras geslinianum* (d'Orbigny). – Kennedy *et al*., p. 60, pl. 3, figs 6–8; pl. 9, figs 1, 2; pl. 10, figs 5, 6; pls 11–13; pl. 14, figs 1–3; pl. 15, figs 1–3; pl. 16; pl. 17, figs 1–3; text-figs 13–17 (with full synonymy).
1981 *Metoicoceras geslinianum* (d'Orbigny, 1850). – Wright & Kennedy, p. 62, pl. 17, fig. 2; pl. 18, figs 1, 2; pl. 19, figs 1, 2; pl. 20, figs 1–3; pl. 21, figs 1, 2; text-figs 19C–E, 20, 21A–D.
1981 *Metoicoceras geslinianum* (d'Orbigny, 1850). – Kennedy & Juignet, p. 39, figs 7d, e, 8a–c, 9a, e, 10a.

**Figure 14.** *Metoicoceras geslinianum* (d'Orbigny, 1850). • A – ventral view, B – lateral view. MMG: SaK641 (original of Geinitz 1875, pl. 62, fig. 3). Upper Cenomanian Dölzschen Formation, Welschhufe near Bannewitz (south of Dresden). • C – lateral view, D – ventral view. MMG: SaK4040 (original of Petrascheck 1902, pl. 7, fig. 5). Upper Cenomanian Dölzschen Formation, Dresden-Ockerwitz. • E, G – lateral views, F – ventral view. MMG: SaK4041 (original of Petrascheck 1902, pl. 7, fig. 3). Upper Cenomanian Dölzschen Formation, Dresden-Ockerwitz. • H – lateral view. MMG: SaK4045 (original of Petrascheck 1902, pl. 7, fig. 4). Upper Cenomanian Dölzschen Formation, Dresden-Ockerwitz. × 1.


A
D
B
H
E
F
G
C

1988 *Metoicoceras geslinianum* (d'Orbigny, 1850). – Kennedy, p. 58, pl. 9, fig. 8; pl. 11, figs 25–27; pl. 22, figs 16, 17; text-figs 20–23.
1989 *Metoicoceras geslinianum* (d'Orbigny). – Cobban *et al*., p. 42, figs 84A–W, AA.
1989 *Metoicoceras geslinianum* (d'Orbigny, 1850). – Vašíček, p. 73, pl. 6, figs 2, 3.
1998 *Metoicoceras geslinianum* (d'Orbigny, 1850). – Kaplan *et al*., p. 172, pl. 13, figs 19, 20.
1998 *Metoicoceras geslinianum* (d'Orbigny, 1850). – Lehmann, p. 28, pl. 3, fig. 3.
2003 *Metoicoceras geslinianum* (d'Orbigny, 1850). – Kennedy *et al*., p. 11, pl. 3, figs 1–9; pl. 5, figs 4–9.
2005 *Metoicoceras geslinianum* (d'Orbigny). – Meister & Abdallah, p. 128, pl. 8, fig. 1.
2009 *Metoicoceras geslinianum* (d'Orbigny, 1850). – Lehmann & Herbig, p. 69, pl. 1, figs T, U.
2010 *Metoicoceras geslinianum* (d'Orbigny, 1850). – Nagm *et al*., p. 481, figs 7F, 8A–C.

*Material*. – Five specimens (see measurements) from the Dölzschen Formation in Dresden-Ockerwitz and Dresden-Plauen, and two specimens (SaK640, 641) from the sandy Dölzschen Formation of Welschhufe near Bannewitz. All specimens are from the Upper Cenomanian.

*Measurements*. –

| Specimen | D | Wb | Wh | Wb/Wh | U |
|---|---|---|---|---|---|
| SaK4041 | 49.8 (100) | 15.2 (30.5) | 27.5 (55.2) | 0.55 | 5.8 (11.6) |
| SaK4040 | 70.1 (100) | 17.5 (24.9) | 40.5 (57.7) | 0.43 | 6.5 (9.2) |
| SaK4045 | 73.5 (100) | 20.0 (27.2) | 35.4 (48.1) | 0.56 | 12.7 (17.2) |
| SaK5433 | 92.4 (100) | 27.2 (29.4) | 46.1 (49.8) | 0.59 | 17.2 (18.6) |
| SaK2179 | 110.0 (100) | 15.1 (13.7) | 59.7 (54.2) | 0.25 | 14.3 (13.0) |
| SaK640 | 135.4 (100) | 35.2 (25.9) | 64.1 (47.3) | 0.54 | 28.8 (21.2) |
| SaK641 | 160.0 (100) | 41.8 (26.1) | 69.0 (43.1) | 0.60 | 32.8 (20.5) |

*Description*. – All investigated specimens are involutely coiled; only the two large specimens have U above 20%. The umbilical wall is low with a rounded shoulder. Whorl sections are compressed (Fig. 13A), with greatest breadth on the inner flanks. The flanks are only weakly convex to flat and converge to a more-or-less sharp ventrolateral shoulder. The venter is narrow and slightly sulcate on early whorls and tends to become wider and weakly rounded during ontogeny. The ornamentation consists of broad primary ribs alternating with one or two short intercalated ribs. The primaries start at weak bullate swellings at the umbilical shoulder while the intercalatories appear on the inner or mid-flanks. All ribs are slightly prorsiradiate and end at the ventrolateral shoulder with a strong clavus on the early whorls, becoming weaker later in ontogeny. The suture line (Fig. 13B) has simple outlines and is characterized by a moderately deep and wide adventive lobe.

*Remarks*. – *Metoicoceras geslinianum* shows a considerable morphological variability and this has led some authors to describe several new species that subsequently have been considered as different forms of *M. geslinianum* (Kennedy & Juignet 1981, Kennedy *et al*. 1981, Wright & Kennedy 1981, Kennedy 1988). Kennedy *et al*. (1981) have discussed these forms in detail and observed transitional morphologies among many of these varieties. Furthermore, Kennedy (1988) discussed the variability of the well-preserved material described by de Grossouvre (1912) from France as it shows the same wide range of intraspecific variation and dimorphism. Based on the limited material from the Saxonian Cretaceous, we cannot comment on the reported morphological variations. However, all specimens can be safely assigned to *M. geslinianum*.

*Occurrence*. – *Metoicoceras geslinianum* is the index fossil of the middle Late Cenomanian *Metoicoceras geslinianum* Zone (Kennedy 1984; Wright *et al. in* Wright & Kennedy 1984; Hancock 1991) and has records from Europe (Germany, Czech Republic, England, France, Spain), United States (Texas and western interior), Southern America (Mexico, Brazil, Colombia), and Africa (Morocco, Tunisia, Egypt, Nigeria, Angola) (*e.g*., Kennedy & Juignet 1981, Wright & Kennedy 1981).

## Genus *Spathites* Kummel & Decker, 1954

*Type species*. – *Spathites chispaensis* Kummel & Decker, 1954, p. 311, pl. 30, figs 1, 2; pl. 31, figs 1–15; text-fig. 1; by original designation.

## Subgenus *Spathites* (*Jeanrogericeras*) Wiedmann, 1960

*Type species*. – *Ammonites reveliereanus* Courtiller, 1860, p. 249, pl. 2, figs 5–8; by original designation.

### *Spathites* (*Jeanrogericeras*) *reveliereanus* (Courtiller, 1860)

Figures 15, 16, 17A–F

*1860 *Ammonites reveliereanus*; Courtiller, p. 249, pl. 2, figs 5–8.
1867 *Ammonites reveliereanus* (spec. nov.). – Courtiller, p. 4, pl. 3, figs 1–4.
1902 *Mammites binicostatus* nov. spec.; Petrascheck, p. 145, pl. 7, fig. 6a, b; pl. 8, figs 1a, b, 3a, b.
1909 *Mammites binicostatus* Petrascheck. – Wanderer, p. 64, pl. 10, fig. 2.
1980 *Spathites* (*Jeanrogericeras*) *reveliereanus* (Courtiller). – Kennedy *et al*., p. 826, pl. 105, 1–12; pl. 106, figs 1, 2; text-figs 3, 5, 6 (with synonymy).

1981 *Spathites* (*Jeanrogericeras*) *reveliereanus* (Courtiller, 1860). – Wright & Kennedy, text-fig. 22.
1992 *Spathites* (*Jeanrogericeras*) *reveliereanus* (Courtiller), 1860. – Thomel, p. 223, pl. 118, figs 3, 4; pl. 119, fig. 1.
2007 *Spathites* (*Jeanrogericeras*) *reveliereanus* (Courtiller, 1860). – Barroso-Barcenilla, p. 138, pl. 4, fig. G; pl. 5, figs A–D; text-figs 6A, B (with additional synonymy).
2009 *Spathites* (*Jeanrogericeras*) *reveliereanus* (Courtiller, 1860). – Lehmann & Herbig, p. 70, pl. 1, figs C–E.

*Material*. – In total 40 specimens from the Lower Turonian Brießnitz Formation, 29 specimens from Dresden-Leubnitz and 11 specimens from Dresden-Lockwitz (see Wilmsen *et al.* 2011 for details on the latter locality). 24 specimens have been measured (see below) while 16 specimens are crushed and not complete (SaK5169, 5218, 5219, 5254, 5257, 5262, 5271, 5274, 5368, 5369, 5371, 5375, 5377, 5383, 12104, 53233).

*Measurements*. –
(c. = costal, i. = intercostal)

| Specimen | D | Wb | Wh | Wb/Wh | U |
|---|---|---|---|---|---|
| SaK5558 c | 52.9 (100) | 30.2 (57.0) | 26.1 (49.3) | 1.15 | 0.95 (17.9) |
| SaK5558 i | 51.0 (100) | 23.4 (45.8) | 25.3 (49.6) | 0.92 | 0.95 (18.6) |
| SaK5269 c | 60.5 (100) | 31.5 (52.0) | 33.1 (54.7) | 0.95 | 12.6 (20.8) |
| SaK5269 i | 57.4 (100) | 25.7 (44.7) | 30.5 (53.1) | 0.84 | 12.6 (21.9) |
| SaK5261 c | 70.1 (100) | 35.1 (50.0) | 33.6 (47.9) | 1.04 | 19.4 (27.6) |
| SaK5261 i | 69.7 (100) | 31.7 (45.4) | 33.3 (47.7) | 0.95 | 19.4 (27.8) |
| SaK5256 c | 72.2 (100) | 32.4 (44.8) | 36.3 (50.2) | 0.89 | 15.6 (21.6) |
| SaK5256 i | 67.4 (100) | 27.2 (40.3) | 33.9 (50.2) | 0.80 | 15.6 (23.1) |
| SaK5253 c | 84.3 (100) | 57.4 (68.0) | 41.5 (49.2) | 1.38 | 18.2 (21.5) |
| SaK5253 i | 80.2 (100) | 44.0 (54.8) | 38.6 (48.1) | 1.13 | 18.2 (22.6) |
| SaK12254 c | 86.5 (100) | 48.2 (55.7) | 42.5 (49.1) | 1.13 | 21.1 (24.3) |
| SaK12254 i | 81.1 (100) | 44.3 (54.6) | 37.9 (46.7) | 1.16 | 21.1 (26.0) |
| SaK5242 c | 92.4 (100) | 32.6 (35.2) | 45.9 (49.6) | 0.71 | 22.0 (23.8) |
| SaK5242 i | 89.6 (100) | 28.8 (32.1) | 43.2 (48.2) | 0.66 | 22.0 (24.5) |
| SaK12276 c | 98.4 (100) | 60.1 (61.0) | 45.9 (46.6) | 1.30 | 28.1 (28.5) |
| SaK12276 i | 95.1 (100) | 51.5 (54.1) | 43.6 (45.8) | 1.18 | 28.1 (29.5) |
| SaK5178 c | 100.7 (100) | 43.2 (42.8) | 48.6 (48.2) | 0.88 | 35.1 (34.8) |
| SaK5178 i | 97.2 (100) | 36.0 (37.0) | 46.7 (48.0) | 0.77 | 35.1 (36.1) |
| SaK12277 c | 102.3 (100) | 56.1 (54.8) | 46.3 (45.2) | 1.21 | 23.5 (22.9) |
| SaK12277 i | 99.3 (100) | 51.4 (51.7) | 46.0 (46.3) | 1.11 | 23.5 (23.6) |
| SaK5230 c | 110.1 (100) | 50.0 (45.4) | 43.2 (39.2) | 1.15 | 37.8 (34.3) |
| SaK5230 i | 105.7 (100) | 47.7 (45.1) | 43.1 (40.7) | 1.10 | 37.8 (35.7) |
| average c | 84.58 | 43.34 | 40.27 | 1.07 | 21.30 |
| average i | 81.24 | 37.42 | 38.37 | 0.96 | 21.30 |
| SaK12268 | 57.1 (100) | 27.8 (48.6) | 28.0 (49.0) | 0.99 | 14.6 (25.5) |
| SaK5276 | 57.2 (100) | 31.8 (55.5) | 34.5 (60.3) | 0.92 | 10.3 (18.0) |
| SaK5272 | 72.3 (100) | 44.8 (61.9) | 34.9 (48.2) | 1.28 | 19.8 (27.3) |
| SaK5380 | 75.2 (100) | 46.2 (61.4) | 35.9 (47.7) | 1.28 | 16.0 (21.2) |
| SaK5179 | 82.5 (100) | 35.9 (43.5) | 45.6 (55.2) | 0.78 | 18.0 (21.8) |
| SaK12205 | 83.9 (100) | 27.9 (33.2) | 45.5 (54.2) | 0.61 | 16.5 (19.6) |
| SaK5264 | 91.2 (100) | 33.5 (36.7) | 41.4 (45.3) | 0.80 | 21.0 (23.0) |
| SaK5252 | 91.6 (100) | 44.8 (48.9) | 41.1 (44.8) | 1.09 | 20.8 (22.7) |
| SaK5388 | 96.9 (100) | 31.2 (32.1) | 45.4 (46.8) | 0.68 | 24.2 (24.9) |
| SaK5255 | 98.1 (100) | 33.5 (34.1) | 45.9 (46.7) | 0.72 | 31.5 (32.1) |
| SaK12157 | 100.7 (100) | 31.6 (31.1) | 44.3 (43.9) | 0.71 | 26.3 (26.1) |
| SaK12253 | 114.8 (100) | 56.3 (49.0) | 46.4 (40.4) | 1.21 | 36.7 (31.9) |
| SaK12124 | 116.9 (100) | 33.6 (28.7) | 47.9 (40.9) | 0.70 | 35.5 (30.3) |
| average | 87.65 | 36.83 | 41.29 | 0.82 | 22.40 |

*Description*. – Coiling is involute to moderately evolute, with U representing < 20% in smaller and > 30% in larger specimens. Whorl sections are variable (Fig. 15), ranging from depressed in early stages to compressed with trapezoidal section in larger specimens. The umbilicus is deep with subvertical walls, rounded shoulders and bordered by up to eight prominent umbilical tubercles. The flanks are convex in early stages. Later in ontogeny, only the inner flanks are convex and the outer ones are straight and converge towards the narrow and sulcate venter (Fig. 15). The flank ornamentation consists of strong, broad recti- to slightly retroradiate ribs arising in pairs from the umbilical tubercles. Intercalatories starting at mid-flank may also be developed. Each rib bears faint inner and well-developed outer tubercles at the ventrolateral shoulders. Sutures are not preserved.

*Remarks*. – Some of the investigated material has already been studied by Petrascheck (1902). Based on these specimens, he erected *Mammites binicostatus* as a new species. Wiedmann (1960, 1964) distinguished it from *Spathites* (*Jeanrogericeras*) *reveliereanus* on the basis of the absence of intercalated ribs, eight rather than four umbilical tubercles, sharper ventrolateral shoulder, sulcate venter, larger umbilicus and less asymmetric lobes of the suture line. Kennedy *et al*. (1980) argued that none of these criteria discussed by Wiedmann are sufficient to justify a separation of the two taxa, especially in the view of the fact that the lectotype of *S. reveliereanus* has at least seven umbilical tubercles, and other specimens have eight or nine. In addition, the sharp ventrolateral shoulder is a matter of preservation (lateral compaction). Recently, Barroso-Barcenilla (2007) described both, *S. reveliereanus* and *M. binicostatus*, from time-equivalent Lower Turonian strata in Spain and likewise considered Petrascheck's taxon as a synonym of Courtiller's species. Starting from Courtiller (1860), many papers discussed the considerable intraspecific variation in *S.* (*J.*) *reveliereanus* and, therefore, some authors (*e.g*., Karrenberg 1935) used different forms within the species to accommodate this variability. However, a comparison of the biometric data presented above (using costal and inter-costal measurements separately) show that there is a very good correlation of D and U (r = 0.92, n = 24) as well as D and Wh (r = ~0.90), while D and Wb are less

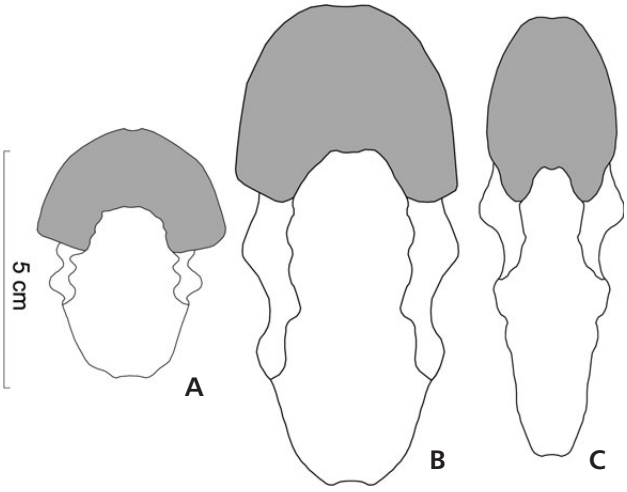


**Figure 15.** Whorl sections of *Spathites* (*Jeanrogericeras*) *reveliereanus* (Courtiller, 1860). • A – MMG: SaK5558, B – MMG: SaK5230, C – MMG: SaK5242. Lower Turonian Brießnitz Formation, Dresden-Leubnitz.

well correlated (r = 0.28–0.78). Due to the predominant bedding-parallel (= sub-horizontal) burial of ammonite shells, Wb and flank ornament (tubercles, ribs) are much more prone to alteration by compaction compared to the other parameters such as Wh and U. Thus, taphonomic processes may explain much of the inferred intraspecific variability observed in *S. reveliereanus*. Differences between the species related to the genus and subgenus have been carefully discussed for example by Kennedy *et al*. (1980), Barroso-Barcenilla (2007) and Lehmann & Herbig (2009).

*Occurrence*. – *S.* (*J.*) *reveliereanus* occurs in the Early Turonian *Mammites nodosoides* Zone and the Middle Turonian *Collignoniceras woollgari* Zone of Germany, Spain, France, Romania, India and Morocco (see Barroso-Barcenilla 2007 and Lehmann & Herbig 2009 for further details).

### Genus *Mammites* Laube & Bruder, 1887

*Type species*. – *Ammonites nodosoides* Schlüter, 1871, p. 19, pl. 8, figs 1–4; by monotypy.

#### *Mammites nodosoides* (Schlüter, 1871)
Figures 17G–H, 18A–B

*1871 *Ammonites nodosoides*; Schlüter, p. 19, pl. 8, figs 1–4.
1902 *Mammites michelobensis* Laube u. Bruder. – Petrascheck, p. 142, pl. 8, fig. 2; pl. 9, fig. 2; pl. 10, fig. 1.
1909 *Mammites michelobensis* Laube u. Bruder. – Wanderer, p. 63, pl. 10, fig. 1.
1981 *Mammites nodosoides* (Schlüter, 1871). – Wright & Kennedy, p. 75, pl. 17, fig. 3; pl. 19, fig. 3; pl. 20, fig. 4; pl. 22, fig. 4; pl. 23, figs 1?, 2, 3; pl. 24, figs 2, 3; text-figs 19B, 23, 24 (with full synonymy).
2009 *Mammites nodosoides* (Schlüter, 1871). – Lehmann & Herbig, p. 71, pl. 1, figs J, K, R, S.

*Remarks*. – A large number (more than 150 specimens) of this important Early Turonian index species has been collected from the study area. A systematic description of the species, with complete discussion of its taxonomic problems as well as biometric, biostratigraphic and palaeobiogeographic remarks will be given in a separate paper (Nagm, in prep.). There seem to be two basic morphotypes, *i.e*., a small, strongly ornamented and involute form (Fig. 17G, H) and a larger, more evolute and less strongly ornamented form (Fig. 18A, B). The same forms can be recognized in the two paralectotypes illustrated by Schlüter (1971, pl. 8, figs 1–4). Specimen SaK5200 has already been figured by Petrascheck (1902, pl. 10, fig. 1).

*Occurrence*. – *Mammites nodosoides* is the index species of the eponymous upper Lower Turonian standard ammonite zone (Kennedy 1986, Hancock 1991). It occurs in a variety of European countries, northern Africa, Madagascar, the Middle East as well as North and South America (Wright & Kennedy 1981).

Superfamily Turrilitoidea Gill, 1871
Family Baculitidae Gill, 1871

### Genus *Sciponoceras* Hyatt, 1894

*Type species*. – *Hamites baculoide* Mantell, 1822, p. 123, pl. 23, figs 6, 7; by original designation.

#### *Sciponoceras gracile* (Shumard, 1860)
Figure 18C, D

*1860 *Baculites gracilis*; Shumard, p. 596.
1875 *Baculites subbaculoides*; Gein., p. 281, pl. 63, fig. 1.

**Figure 16.** *Spathites* (*Jeanrogericeras*) *reveliereanus* (Courtiller, 1860). • A – lateral view, B – ventral view, C – apertural view. MMG: SaK5230. Lower Turonian Brießnitz Formation, Dresden-Leubnitz. • D – lateral view, E – ventral view. MMG: SaK5256. Lower Turonian Brießnitz Formation, Dresden-Leubnitz. • F, G – lateral views, H – ventral view. MMG: SaK5558 (original of Petrascheck 1902, pl. 7, fig. 6). Lower Turonian Brießnitz Formation, Dresden-Leubnitz. × 1.


B
D
C
E
A
H
F
G

1972 *Sciponoceras gracile* (Shumard). – Cobban & Scott, p. 47, pl. 17, figs 9–29; text-fig. 18.
1981 *Sciponoceras gracile* (Shumard, 1860). – Wright & Kennedy, p. 112, pl. 31, figs 1–3; pl. 32, figs 8, 11; text-figs 38A–Q.
1988 *Sciponoceras gracile* (Shumard, 1860). – Kennedy, p. 108, pl. 20, figs 1–14, 17–20; text-fig. 38.
1989 *Sciponoceras gracile* (Shumard). – Cobban *et al*., p. 61, fig. 96D.
2003 *Sciponoceras gracile* (Shumard, 1860). – Kennedy *et al*., p. 14, pl. 6, figs 1–19.

*Material*. – Two specimens (SaK4645, 4708) from the Upper Cenomanian Dölzschen Formation in Rippien near Bannewitz and Oberau near Meißen.

*Description*. – Very slender baculitid with oval to subcircular, slightly compressed whorl section. Ornamentation consists of feeble prorsiradiate and regularly spaced ribs on the inner flanks that strengthen on the outer flank and cross the venter in a broad convexity. Sutures are not preserved.

*Remarks*. – Cobban & Scott (1972) redescribed *Sciponoceras gracile* and have provided a fundamental account of the species. The studied specimens have been identified by Geinitz (1875) as *Baculites subbaculoides*. Wright & Kennedy (1981) considered the figured specimens of Geinitz as typical *S. gracile*, and we agree in this respect. In addition, Wright & Kennedy (1981) have discussed the differences between *S. gracile* and other species of the genus (*S. baculoides*, *S. bohemicum*, *S. glaessneri* and *S. kossmati*).

*Occurrence*. – *Sciponoceras gracile* occurs in the Late Cenomanian *Metoicoceras geslinianum* Zone of Germany, England, France, United States (Texas, Arizona, New Mexico, Colorado, Kansas, Wyoming, Montana, Utah, California), Mexico, and possibly Angola (Wright & Kennedy 1981).

Superfamily Scaphitoidea Gill, 1871
Family Scaphitidae Gill, 1871
Subfamily Scaphitinae Gill, 1871

**Genus *Scaphites* Parkinson, 1811**

*Type species*. – *Scaphites equalis* Sowerby, 1813, p. 53, pl. 18, figs 1–3; by the subsequent designation of Meek (1876, p. 413).

***Scaphites equalis* Sowerby, 1813**
Figures 18E–G

*1813 *Scaphites equalis*; Sowerby, p. 53, pl. 18, figs 1–3.
1975 *Scaphites obliquus* Brongniart. – Geinitz, p. 280.
1872 *Scaphites aequalis* Sow. – Fritsch, p. 41, pl. 13, fig. 6.
1996 *Scaphites equalis* J. Sowerby, 1813. – Wright & Kennedy, p. 394, pl. 116, figs 1–5, 7–11; pl. 117, figs 1–11; pl. 118, figs 1–13; text-figs 154C, D (with full synonymy).

*Material*. – Two specimens (SaK1408, 2175) from the Dölzschen Formation of the Plauen'scher Grund (Ratssteinbruch) in Dresden-Plauen as well as an additional specimen (MF_Sak214) from the same locality and stratigraphic level of the private collection of Markus Fengler (Dresden). This specimen will be transferred into the MMG collection at a later date.

*Description*. – The specimens are characterized by slightly depressed whorl sections and small and deep umbilici. Venters are broadly rounded with short, arched flanks. Both flanks carry distant, short and shallow primaries that start at mid-flank and end at the ventrolateral shoulder with distinct tubercles. Between these tubercles, fine densely spaced single or double ribs cross the venter, some arise at the tubercles. Sutures are not preserved.

*Remarks*. – The studied specimens can be included in *S. equalis* without any doubt as they closely match the description and illustrations given in the revision of Cenomanian Scaphitidae by Wright & Kennedy (1996). The antecedents of *Scaphites equalis* and differences between it and *Scaphites obliquus* the have also been thoroughly discussed by Wright & Kennedy (1996). They also noted the great intraspecific variation in *Scaphites equalis* (size, compression and inflation, strength and number of secondary ribs on the venter of the shaft). The occurrence of scaphitids from the Dölzschen Formation at Dresden-Plauen has already been noted by Geinitz (1875) and Tröger (1956), but this is the first properly documented record of *S. equalis*. The record of *S. equalis* by Geinitz, (1846, p. 301, pl. 12, fig. 1) from the lower Upper Turonian Strehlen Limestone of the Strehlen Formation is probably related to *S. geinitzi* d'Orbigny.

*Occurrence*. – *Scaphites equalis* occurs in the Middle and Upper Cenomanian of England, Germany, France, Czech

**Figure 17.** A–F – *Spathites* (*Jeanrogericeras*) *reveliereanus* (Courtiller, 1860). • A – apertural view, B – lateral view, C – ventral view. MMG: SaK5242 (original of Petrascheck 1902, pl. 8, fig. 3). Lower Turonian Brießnitz Formation, Dresden-Leubnitz. × 1. • D – apertural view, E – lateral view, F – ventral view. MMG: SaK12254. Lower Turonian Brießnitz Formation, Dresden-Lockwitz. × 1. • G, H – *Mammites nodosoides* (Schlüter, 1871). G – lateral view, H – apertural view. MMG: SaK5240. Lower Turonian Brießnitz Formation, Dresden-Leubnitz. × 1.


Min. Mus.
Dresden
SaK5242
A
B
C
D
E
F
G
H


**Figure 18.** A, B – *Mammites nodosoides* (Schlüter, 1871). A – lateral view, B – apertural view. MMG: SaK5200 (original of Petrascheck 1902, pl. 10, fig. 1). Lower Turonian Brießnitz Formation, Dresden-Leubnitz. × 1. • C, D – *Sciponoceras gracile* (Shumard, 1860), flanks views. C – MMG: SaK4708 (original of Geinitz 1875, pl. 63, fig. 1), Upper Cenomanian Dölzschen Formation, Oberau near Meißen, D – MMG: SaK4645. Upper Cenomanian Dölzschen Formation, Rippien near Bannewitz (south of Dresden). × 1. • E, F, G – *Scaphites equalis* Sowerby; E – ventral view. MMG: SaK2175, F – ventral view, G – lateral view. M. Fengler collection: SaK214. Upper Cenomanian Dölzschen Formation, Plauen'scher Grund in Dresden-Plauen. × 1.

Republic, Poland, Ukraine, the Caucasus, Turkmenia, Iran, Algeria, Tunisia and southern India (Wright & Kennedy 1996).

## Concluding remarks

The Upper Cenomanian to Lower Turonian ammonoid fauna of the Saxonian Cretaceous (Elbtal Group) has been revised based on the study of 270 specimens hosted in the collection of the Museum für Mineralogie und Geologie of the Senckenberg Naturhistorische Sammlungen Dresden (Germany). Several of the specimens are historical originals that have already been treated and illustrated in the monographic works of Geinitz (1839–1843, 1849, 1871–1875, 1872–1875), Petrascheck (1902) and Wanderer (1909). However, these important works date back over a century and numerous taxonomic modifications have been necessary. In total, 12 species have been recognized and, based on this revision, a number of ammonoids are now reported and/or illustrated for the first time from the Elbtal Group: *Euomphaloceras septemseriatum, Neocardioceras juddii barroisi, Watinoceras coloradoense, Spathites* (*Jeanrogericeras*) *reveliereanus, Sciponoceras gracile* and *Scaphites equalis*. The study demonstrated the presence of all Upper Cenomanian and Lower Turonian standard ammonite biozones (*cf.* Kennedy 1984, 1986; Wright *et al. in* Wright & Kennedy 1984; Hancock 1991) for the lithostratigraphic succession of the lower Elbtal Group: the lower Upper Cenomanian *Calycoceras naviculare* Zone, represented by the Oberhäslich Formation, the mid- and upper Upper Cenomanian *Metoicoceras geslinianum* and *Neocardioceras juddii* zones, represented by the Dölzschen Formation, and the Lower Turonian *Watinoceras coloradoense* and *Mammites nodosoides* zones, represented by the Brießnitz Formation of the Dresden area

(in the Elbsandsteingebirge, these zones are represented by the Schmilka Formation).

Concerning taxonomical corrections, the most important changes relate to *N. juddii barroisi* from the Dölzschen Formation of Dresden-Plauen, which has been identified as *Ammonites neptuni* Gein. by Geinitz (1872–1875; *Subprionocyclus neptuni* is the index of the lower Upper Turonian) and *W. coloradoense* which has been identified as *Schlönbachia* [sic] *gracillima* Kossmat by Petrascheck (1902). Furthermore, *Mammites binicostatus* Petrascheck, 1902, a species name widely used in Saxony, is a subjective junior synonym of *Spathites* (*J.*) *reveliereanus* (Courtiller, 1860), as already suggested by Kennedy *et al.* (1980).

In comparison to contemporaneous faunas from Egypt (Nagm *et al.* 2010, Nagm & Wilmsen 2012), the ammonoids from the Saxonian Cretaceous are strongly ornamented and mainly related to widely distributed Acanthoceratidae. The strongly Tethyan-influenced Upper Cenomanian–Lower Turonian ammonites of Egypt are predominatly smooth-shelled forms with a dominance of Vascoceratidae. Species that occur in both areas are rare, only represented by the Late Cenomanian *Euomphaloceras septemseriatum* and *Metoicoceras geslinianum* (d'Orbigny, 1850). During the Early Turonian, the ammonite faunas are completely different with a predominance of Pseudotissotiinae in Egypt and Mammitinae in Saxony. This observation is in accord with increasing biogeographic differentiation at that time reported from many regions in the world (*e.g.*, Wiedmann 1988, Lehmann & Herbig 2009).

## Acknowledgements

We are indebted to R. Hoffmann (Bochum) and Z. Vašíček (Ostrava) for constructive reviews as well as Š. Doležalová (Prague) for the professional editorial handling. Furthermore, we express gratitude to W.J. Kennedy (Oxford) for the discussion of some taxonomic problems. Thanks also to R. Winkler (Senckenberg Dresden) for his photographic work and M. Fengler (Dresden) for the loan of *S. equalis*. The financial support of the German Academic Exchange Service (DAAD) for the stay of Emad Nagm in Germany is greatly acknowledgement. This paper is also a contribution to project WI 1743/6-1 granted to MW by the German Research Foundation (DFG).

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