

Zitteliana	A50	71 - 88	4 Pls, 4 Textfigs	München, 30.06.2010	ISSN 1612 - 412X
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Rare Middle Jurassic ammonites of the families Erycitidae, Otoitidae and Stephanoceratidae from southern Germany

By

Volker Dietze^{1*}, Günter Schweigert², Gerd Dietl², Wolfgang Auer³, Wolfgang Dangelmaier⁴, Roger Furze⁵, Stefan Gräbenstein⁶, Michael Kutz⁷, Elmar Neisser⁸, Erich Schneider⁹ & Dietmar Schreiber¹⁰

¹Benzstrasse 9, 73469 Riesbürg

²Staatliches Museum für Naturkunde, Rosenstein 1, 70191 Stuttgart

³Schillerstrasse 15, 68804 Altlussheim

⁴Abornweg 1, 73111 Nellingen

⁵Lebenhof 2, 88693 Deggenhäusertal

⁶Landhausstrasse 20, 72411 Bodelshausen

⁷8 rue haute, F-67390 Mackenheim

⁸Untere Ringstrasse 23, 79859 Schluchsee

⁹Bezgenrieterstrasse 33, 73092 Heiningen

¹⁰Hauptstrasse 48, 78589 Dürbheim

Manuscript received December 8, 2009; revised manuscript accepted February 24, 2010

Abstract

We present insufficiently or previously unknown ammonites of the families Erycitidae SPATH, 1928, Otoitidae MASCKE, 1907 and Stephanoceratidae NEUMAYR, 1875 from the Upper Aalenian and early Lower Bajocian (Middle Jurassic) of southern Germany. The newly recorded taxa of the Erycitidae are: *Abbasites gardincola* (DE GREGORIO), *Abbasites* aff. *abbas* BUCKMAN and *Spinammatoceras* aff. *sagax* (VACEK); of the Otoitidae: *Docidoceras zemistephanoides* GÉCZY, *D.* cf. *wysogorskii* (PRINZ), *Docidoceras* sp., *Parsemileites liebi* (MAUBEUGE), *Otoites tumulosus* WESTERMANN, *O. douvillei* PARSONS, *Emileia contrahens* BUCKMAN and *E. dundriensis* CALLOMON & CHANDLER, and a new species, *Docidoceras chandleri* DIETZE, DIETL & SCHWEIGERT. The latter taxon is also recorded from southern England. The stephanoceratid genus *Mollistephanus* is recorded for the first time from southern Germany by a single specimen of *M.* aff. *kondai* GALÁ CZ.

Key words: Erycitidae, Otoitidae, Stephanoceratidae, southern Germany, Aalenian, Bajocian.

Zusammenfassung

Einige aus dem Ober-Aalenium und dem frühen Unter-Bajocium (Mitteljura) Süddeutschlands nur unzureichend oder überhaupt noch nicht bekannte Ammonitenarten der Familien Erycitidae SPATH, 1928, Otoitidae MASCKE, 1907 und Stephanoceratidae NEUMAYR, 1875 werden hier vorgestellt und diskutiert. Von den Erycitidae sind dies: *Abbasites*

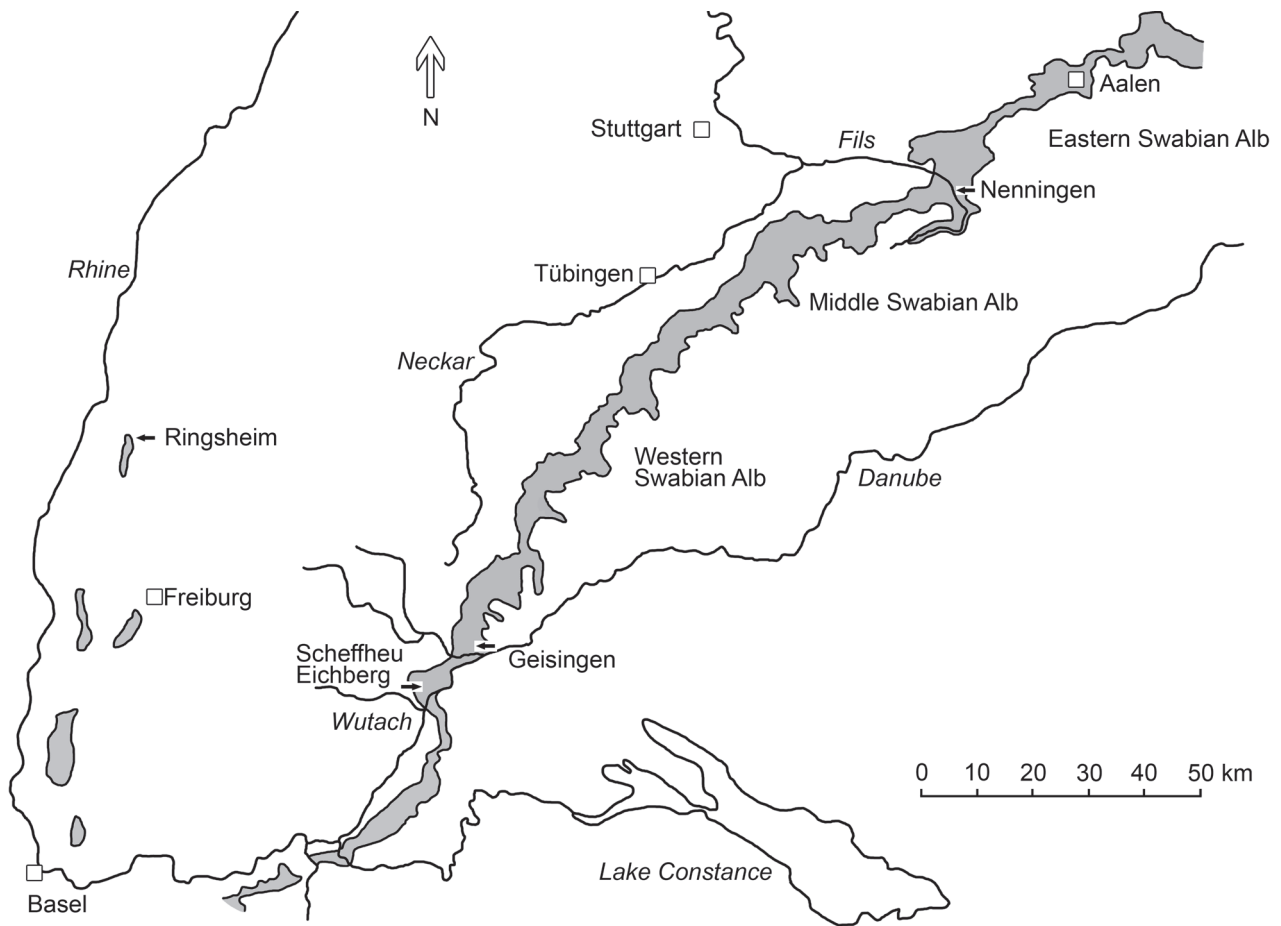
gardincola (DE GREGORIO), *Abbasites* aff. *abbas* BUCKMAN und *Spinammatoceras* aff. *sagax* (VACEK); von den Otoitidae: *Docidoceras zemistephanoides* GÉCZY, *D.* cf. *wysogorskii* (PRINZ), *Docidoceras* sp., *Parsemileites liebi* (MAUBEUGE), *Otoites tumulosus* WESTERMANN, *O. douvillei* PARSONS, *Emileia contrahens* BUCKMAN und *E. dundriensis* CALLOMON & CHANDLER sowie eine neue Art der Gattung *Docidoceras*, *D. chandleri* DIETZE, DIETL & SCHWEIGERT n. sp. Von den Stephanoceratidae wird die Gattung *Mollistephanus* mit einem einzigen Exemplar der Art *M.* aff. *kondai* GALÁ CZ erstmals in Süddeutschland nachgewiesen.

Schlüsselwörter: Erycitidae, Otoitidae, Stephanoceratidae, *Docidoceras chandleri* n. sp., Süddeutschland, Aalenium, Bajocium.

1. Introduction

Southern Germany is, together with France and southern England, one of the “classical” places for the study of Middle Jurassic ammonites and biostratigraphy. Numerous publications over the last 180 years deal with these fossils. Due to this long period of research the ammonite faunas from the Upper Aalenian and Lower Bajocian of southern Germany are often regarded as exhaustively studied and relatively well known. Nevertheless, intensive collecting activities by enthusiastic amateurs often bring to light very rare or new taxa. The bulk of material included in this paper comes from such amateur collections. Most of the specimens were kindly donated to the collection of the State Museum of Natural History in Stuttgart.

*Author for correspondence and reprint requests; E-mail: v.dietze@enmail.de



Textfigure 1: Locations of the ammonites described in this paper from the Middle Jurassic of SW Germany (modified from DIETZE et al. 2008).

Here we present new records of the closely related ammonite families Erycitidae SPATH, 1928, Otoitidae MASCKE, 1907, and Stephanoceratidae NEUMAYR, 1875 from the Swabian Middle Jurassic and the Middle Jurassic of the Upper Rhine Valley (Textfig. 1). Since most of the recorded taxa are represented by only one or a few specimens, statistical analysis of intraspecific variability were not possible; determinations are based on published morphospecies.

Institutional abbreviations: LGRB = Landesamt für Geologie, Rohstoffe und Bergbau im Regierungspräsidium Freiburg im Breisgau, Germany; SMNS = Staatliches Museum für Naturkunde Stuttgart, Germany.

2. Description of rare ammonites from southern Germany

Family Erycitidae SPATH, 1928
 Subfamily Erycitinae SPATH, 1928
 Genus *Spinammatoceras* SCHINDEWOLF, 1964

Type species: *Hammatoceras pugnax* VACEK, 1886

Spinammatoceras aff. *sagax* (VACEK)
 Textfig. 2a–d

- * 1886 *Hammatoceras sagax* n. sp. – VACEK, p. 95, pl. 15, figs 15–18.
- 1996 *S. sagax* (Vacek). – SADKI, fig. 46.
- 1996 *S. sagax* (VAC.). – SADKI, p. 133.
- 2009 *Spinammatoceras sagax* (VACEK). – RULLEAU, pl. 85, fig. 10 [reproduction of specimen illustrated by VACEK 1886: pl. 15, fig. 15].

Syntypes: 10 specimens, 3 of which were figured by VACEK (1886: pl. 15, figs 15–18). To our knowledge a lectotype has never been selected.

Type locality: Capo San Vigilio, Lake Garda, Italy.

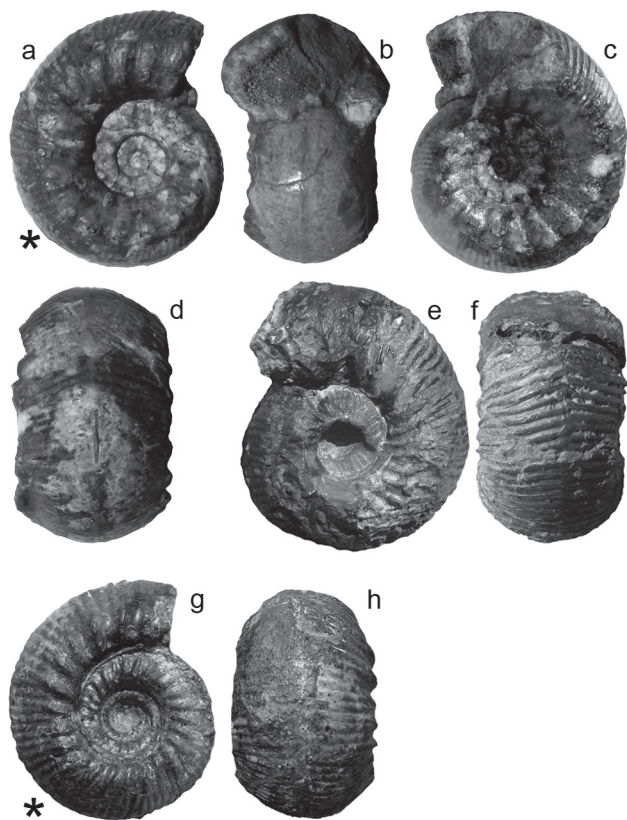
Type horizon: Upper Aalenian, probably from the Murchisonae Zone, or slightly younger (see CALLOMON et al. 1994).

Stratigraphical Range: Upper Aalenian (Murchisonae and Bradfordensis zones).

Description: The specimen represents an incomplete phragmocone, 34 mm in diameter, partly preserved with a calcitic shell. The whorl section is coronate in all stages. The umbilical wall is almost vertical. Except for the innermost whorls a row of blunt nodes appears at the umbilical edge. Subsequently with the inner row of nodes radiating primary

ribs are developed. Another lateral row represented by rather long spines is developed already in the juvenile stage. In the inner whorls these spines are attached to the wall of the following whorl. Ventromarginally, each spine gives rise to two or three finer secondaries. In addition, intercalatory ribs occur. Both rows of nodes weaken towards the end of the phragmocone. On the rounded venter the straight secondaries are slightly prorsiradiate. They meet in the middle of the venter at a blunt angle, separated by a slightly elevated keel-like band. The suture line is hardly discernible.

The present specimen differs from *S. tenax* (VACEK) by its coronate cross section and the straight secondaries. *S. sagax* is very close morphologically, but exhibits a higher and less broad whorl section at comparable diameters (cf. VACEK: pl. 15, fig. 15a). Moreover, in *S. sagax* the bundled secondaries are curved at base, unlike in our specimen. In contrast to LINARES & SANDOVAL (1986) we prefer a taxonomic separation of *S. tenax* and *S. sagax* because of the differences with regard to the whorl sections.



Textfigure 2: (a–d) *Spinammatoceras* aff. *sagax* (VACEK), Opferdingen near Achdorf, Wutach area, SW Germany, Achdorf Formation, Sinon-Bank, Aalenian, Murchisonae Zone, Haugi Subzone, SMNS no. 67547 (leg. S. GRÄBENSTEIN). (e, f) *Abbasites gardincola* (DE GREGORIO); Wartenberg near Geisingen an der Donau, SW Germany, Achdorf Formation, nodular bed below the “Haupt-Bank”, Aalenian, Bradfordensis Zone, Bradfordensis/Gigantea subzonal boundary, SMNS no. 67546 (leg. D. SCHREIBER). (g, h) *Abbasites* aff. *abbas* BUCKMAN; Geisingen an der Donau, SW Germany, Achdorf Formation, “Haupt-Bank”, Aalenian, Bradfordensis Zone, Gigantea Subzone, SMNS no. 67545 (leg. M. RIETER). – x1. Asterisk marks beginning of body chamber.

Remarks: The here described specimen comes from the “Sinon-Bank” of the Achdorf Formation exposed in an outcrop near Opferdingen (Wutach area). RIEBER (1977) mentioned a single specimen of *Erycites* sp. from the “Sinon-Subzone” of Achdorf (Wutach area); this is exactly the same level from which the fossil described here was recovered. Unfortunately we were unable to trace the collection where the latter specimen is stored. *Spinammatoceras* aff. *sagax*, *Erycites* sp. and a still unpublished specimen of *Tmetoceras regleyi* (ex coll. KUTZ, SMNS no. 67528) from the Sinon-Bank of the Eichberg section represent Tethyan immigrants from the early Murchisonae Zone. *Spinammatoceras* is recorded for the southern Alps, the Apennines, Spain, Portugal, and Morocco. The present specimen is the first record of this genus from outside the Tethyan Realm.

Genus *Abbasites* BUCKMAN, 1921

Type species: *Abbasites abbas* BUCKMAN, 1921.

Abbasites gardincola (DE GREGORIO, 1886) Textfig. 2e–f

- * 1886 *Stephanoceras gardincola* mut. *tulcus* GREG. – DE GREGORIO, p. 16, pl. 10, figs 5 [lectotype], 6, 10.
- 1960 *Ambersites gardincola* GREGORIO ? – LELIÈVRE, p. 42, pl. 7, figs 18–21.
- 2001 *Abbasites* (*Ambersites*) *gardincola* (DE GREGORIO). – RULLEAU et al., p. 16, pl. 10, fig. 5.
- 2009 *Abbasites* (*Ambersites*) *gardincola* (DE GREGORIO). – RULLEAU, pl. 85, fig. 1.

Lectotype: *Stephanoceras gardincola* mut. *tulcus* DE GREGORIO (1886: p. 16, pl. 10, fig. 5); designated by LELIÈVRE (1960: 43).

Type locality: Capo San Vigilio, Italy.

Type horizon: Probably Upper Aalenian (?Bradfordensis Zone).

Stratigraphical range: Aalenian, Bradfordensis Zone.

Description: The specimen represents an almost complete body chamber with parts of the next inner whorl. Due to its preservation with a calcitic shell the exact beginning of the phragmocone is not discernible. The whorl section of the preserved inner whorl is coronate, whereas that of the body chamber is broad-oval. The ribbing of the body chamber is strongly prorsiradiate. The primary ribs diverge without forming nodes or spines.

A. cestiferum (BRASIL) is finer ribbed than our specimen. *A. abbas* BUCKMAN exhibits a much stronger egression of the body chamber; the whorl section is more rounded, and the ribbing is much less curved. *A. aegrotus* (BUCKMAN) differs from *A. gardincola* only in a slightly broader whorl section at the end of the phragmocone. The holotype of *A. lelievrei* ELMI & RULLEAU is distinctly larger than that of *A. gardincola*, and the ribbing is less curved. *A. platystomus* WESTERMANN or *A. sparsicostatus* IMLAY do not have closer morphological affinities.

Remarks: The two genera *Abbasites* BUCKMAN, 1921 and *Ambersites* BUCKMAN, 1921, both based on single and closely related specimens, are in urgent need of a taxonomic revision. The various morphospecies hitherto assigned to these genera seem to overlap in their variation, and thus the two genera most likely are synonymous. The few specimens recorded from southern Germany do not contribute to resolving this problem. Nevertheless, they extend the known biogeographic range of this “micromorphic” erycitid to SW Germany.

The present specimen (Textfig. 2e–f) comes from a ca. 15–25 cm thick, nodular bed at the Wartenberg hill near Geisingen a. d. Donau, which occurs below the 45–60 cm thick, chamosite-oolitic “Hauptbank”. From the same bed *Brasilia platychora*, *B. rustica* and *B. similis* were recorded (det. R. B. CHANDLER). The age of this bed therefore lies around the boundary of the Bradfordensis-/Gigantea subzones of the Bradfordensis Zone. *Staufenia staufensis*, which is indicative for the older parts of the Bradfordensis Subzone, has already disappeared at this level.

Abbasites aff. *abbas* BUCKMAN, 1921
Textfig. 2g–h

- ? 1895 *Erycites cestiferum* n. sp. – BRASIL, p. 40, pl. 3, figs 12, 13.
*aff. 1921 *Abbasites abbas*. – BUCKMAN, pl. 236, figs 1, 2.
1960 *Abbasites abbas* S. BUCKMAN. – LELIÈVRE, p. 38, pl. 7, figs 9–11.
1960 *Abbasites* cf. *abbas* S. BUCKMAN. – LELIÈVRE, p. 39, pl. 7, figs 6–8.
2001 *Abbasites (Abbasites) abbas* BUCKMAN. – RULLEAU et al., p. 44, pl. 29, figs 1, 5.
2006 *Abbasites (Abbasites) abbas* BUCKMAN. – RULLEAU, p. 110, pl. 85, fig. 7.

Holotype: Specimen figured by BUCKMAN 1921, pl. 236, figs 1, 2.

Type locality: Bradford Abbas (Dorset, S England).

Type horizon: Paving Bed; comprising condensed Murchisonae and Bradfordensis zones (see CALLOMON & CHANDLER 1990; CHANDLER & SOLE 1996).

Stratigraphical range: Aalenian (Bradfordensis Zone).

Description: Our specimen of *Abbasites* aff. *abbas* (Fig. 2a–b) differs from the holotype of the species by a more coronate whorl section, which is due to the more pronounced primaries at the umbilical edge. The sculpture of the last preserved third of the whorl is affected by pathology. Therefore, the coronate stage continues longer on this flank than on the worse-preserved opposite flank. On the ill preserved and un-

prepared back side the specimen is more complete and shows an uncoiling of the body chamber. LELIÈVRE (1960: pl. 7, figs 6–11) illustrated several specimens from the Bradfordensis Zone of Morocco that are well comparable with regard to the early and medium ontogenetic stages, and RULLEAU et al. (2001: pl. 27, fig. 3) illustrate another specimen from equivalent beds in the Lyonnais (E France).

Remarks: The specimen was collected in the section of the clay-pit near Geisingen a. d. Donau. Based on preservation and the characteristic rock matrix, it must come from the basis of the 40–60 cm thick “Hauptbank” bed. Most ammonites recorded for this locality come from the lowermost 10 cm of this bed. Based on the co-occurrence of the very abundant and easily recognizable *Brasilia decipiens* the faunal horizon is assigned to the Bradfordensis Zone, more precisely to the upper part of the Gigantea Subzone (CALLOMON & CHANDLER 1990; CHANDLER 1997; RIOULT et al. 1997). In this level the genus *Graphoceras* is already present, but the ammonite fauna is still dominated by the genus *Brasilia* (CALLOMON & CHANDLER 1990). *Graphoceras concavum*, the index species of the overlying Concavum Zone, is extremely rare. Therefore, a condensation or mixing of several distinct horizons around the Gigantea Subzone and Concavum Zone cannot be ruled out for this bed.

Family Otoitidae MASCKE, 1907

Genus *Docidoceras* BUCKMAN, 1919

Type species: *Docidoceras cylindroides* BUCKMAN, 1919.

Docidoceras zemistephanoides GÉCZY, 1967
Pl. 1, Figs 1–4.

- * 1967 *Docidoceras zemistephanoides* n. sp. – GÉCZY, p. 233, fig. 244, pl. 12, fig. 1.
? 1985 *Docidoceras zemistephanoides* GÉCZY. – FÉRNANDEZ-LÓPEZ, p. 342, pl. 36, fig. 8.
1988 *D. zemistephanoides* GÉCZY. – CRESTA, p. 218.
1989 *Docidoceras (Docidoceras) zemistephanoides* GÉCZY. – BENSILHI, p. 176, pl. 21, fig. 9.
1990 *Docidoceras zemistephanoides* GÉCZY. – CRESTA & GALÁCZ, pl. 12, fig. 1.
1990 *Docidoceras (Docidoceras) zemistephanoides* GÉCZY. – BENSILHI, p. 17, pl. 1, fig. 7.
1996 *Docidoceras zemistephanoides*. – CRESTA et al., p. 10.
2002 *Docidoceras zemistephanoides* GÉCZY. – CRESTA et al., p. 231.

Lectotype: Specimen figured by GÉCZY (1967: pl. 58, fig. 2), housed in the Hungarian Geological Institute, no. 7260.

Plate 1:

(1, 2) *Docidoceras zemistephanoides* GÉCZY; Eichberg near Achdorf, Wutach area, SW Germany, Wedelsandstein Formation, Sowerbyi-Oolith, Bajocian, Discites Zone, SMNS no. 67548 (leg. W. AUER). (3, 4) *D. zemistephanoides* GÉCZY; Ringsheim, Upper Rhine Valley, SW Germany, Wedelsandstein Formation, Oberes Erzband (upper part), Bajocian, Ovale Zone, SMNS no. 67549 (leg. M. KUTZ). (5–7) *D. cf. wysogorskii* (PRINZ); Scheffheu near Achdorf, Wutach area, SW Germany, Wedelsandstein Formation, Sowerbyi-Oolith, Bed I in DIETZE et al. (2001), Bajocian, Discites Zone, SMNS no. 67550 (leg. FABREWITZ). (8–11) *Docidoceras* sp.; Ringsheim, Upper Rhine Valley, SW Germany, Wedelsandstein Formation, base of “Bunte Mergel” Member, Bajocian, Discites Zone, LGRB no. B 142 (leg. R. MATTES). – x1. Asterisk marks beginning of body chamber.



Type locality: Csernye, Hungary.

Type horizon: Bajocien inferieur (probably from the Discites Zone, but see CRESTA & GALÁ CZ 1990: 170).

Stratigraphical range: Discites and ?Ovale zones.

Description: In this specimen of *D. zemistephanoides* a part of the body chamber and the last part of the phragmocone are preserved as moulds. The last whorl is slightly compressed, so that its coronate character remains hidden. The coarse primaries appear to be located higher on the flanks than in the uncompressed condition. Regardless of this deformation we assign the specimen to *D. zemistephanoides*. The lectotype of this taxon is also preserved as a mould. At the proximal end of the phragmocone and adjacent body chamber a long-persisting shallow sulcus occurs on the umbilical wall. This structure may be interpreted either as an attachment bar for the retractor muscles, or simply as a pathological deformation. In consequence the primary ribs develop weak nodules – similar to those in the genus *Zemistephanus*. At the end of the body chamber the primary ribs appear elongate, like in the specimen from the Wutach area. Our specimen exhibits more distant primaries than the lectotype, but it still lies within the otherwise observed intraspecific variation of *D. zemistephanoides*.

D. cylindroides BUCKMAN possesses a less coronate whorl section than *D. zemistephanoides*, especially concerning the body chamber. *D. wysogorskii* (PRINZ) and *D. chocsinskyi* (HANTKEN in PRINZ) have more slender whorl sections than *D. zemistephanoides*.

A small and slightly compressed nucleus of *D. zemistephanoides* (Pl. 1, Figs 3, 4) comes from the upper part of the “Oberes Erzband” of Ringsheim. This bed belongs to the Ovale Zone (DIETZE et al. 2009). BOSCH (2006) illustrated a phragmocone of *Docidoceras* sp. from the lower part of this bed, which still belongs to the Discites Zone.

Remarks: *D. zemistephanoides* has hitherto been recorded from Spain, the Apennines and from the Middle Atlas of Morocco, alongside the Hungarian type locality.

The specimen illustrated in Pl. 1, Figs 1 and 2 was collected by W. AUER from the northern edge of the Eichberg landslide near Achdorf (Wutach area). It comes from Bed IV in the section of OHMERT (1988: fig. 2) and BAYER (1969: fig. 1) where it was found in association with *Sonninia modesta*, *S. acanthodes*, *S. marginata*, *Hyperlioceras discites*, *H. subsectum*, and *H. liodiscites* (see BAYER 1969). This fauna represents the youngest faunal horizon of the Discites Zone in the Wutach area. Immediately on top of this bed follows a marly layer (“Gryphaeen-Bank”), which is the type horizon of *Fissiloboceras ovale*, the index fossil of the Ovale Zone. *D. zemistephanoides* has also been reported from Normandy (Eterville near Caen, SMNS 67618, ex coll. AUER) and southern England (Cockroad Farm, coll. DIETZE), both from around the Discites/Ovale zonal boundary.

The specimens described in this paper expand the known stratigraphical distribution to southern Germany, northern France, and southern England, and allow a review of their precise stratigraphical range. *D. zemistephanoides*, which is recorded from the Discites to the Ovale zones of the Lower

Bajocian, was also reported from the Laeviuscula Zone of Morocco, but the co-occurring ammonites are typical for the Ovale Zone (BENSHILI 1989: 169, 176; pl. 21, fig. 9). The records from Spain and Italy come from the Discites Zone. In the Apennines *D. zemistephanoides* is used as an index species for the oldest faunal horizon of the Discites Zone (CRESTA et al. 1996).

Docidoceras cf. *wysogorskii* (PRINZ, 1904)

Pl. 1, Figs 5–7

- * 1904 *Coeloceras* (*Stephanoceras*) *Wysogorskii* NOV. SP. – PRINZ, p. 102, pl. 19, fig. 3.
- 1967 *Docidoceras wysogorskii* (PRINZ, 1904). – GÉ CZY, p. 229, pl. 58, figs. 3 [lectotype], 4, pl. 59, fig. 2.
- 1988 *D. wysogorskii* (HANTKEN in PRINZ). – CRESTA, p. 218.
- 1994A *Docidoceras wysogorskii*. – SADKI, Text-fig. 2.
- 1994B *Docidoceras wysogorskii*. – SADKI, Text-fig. 3.

Lectotype: Specimen figured by PRINZ (1904: pl. 19, fig. 3); lectotype designation as “type” and first photographic illustration by GÉ CZY (1967); housed in the Hungarian Geological Institute, no. 689.

Type locality: Csernye, Hungary.

Type horizon: “Dogger inférieur” (probably Discites Zone).

Stratigraphical range: Discites Zone.

Description: The specimen consists of the phragmocone and almost half a whorl of the body chamber, and is mostly preserved with its shell. The body chamber originally comprised ca. one whorl. The whorl section is almost coronate on the phragmocone and changes to broad-elliptic in the transition to the body chamber. This broad-elliptic stage of the cross section is a characteristic feature of *Docidoceras*. In *Stephanoceras* the whorl section at comparable diameters is always much more rounded. A broad-oval whorl section only occurs in the inner whorls; the transition to the planulate stage occurs at latest on the middle whorls. Species of the genus *Stephanoceras* are never sphaerocone. Moreover, the uncoiling of the body chamber of stephanoceratids from the late Aalenian and earliest Bajocian is much weaker than in *Docidoceras*. Inner whorls of *Pseudotoites* are hardly distinguishable from those of *Docidoceras*. In *Pseudotoites* the body chamber is much more planulate than in *Docidoceras*, and the primary ribs are more widely spaced.

The lectotype of *D. wysogorskii* exhibits a taller whorl section than our specimen, which therefore only tentatively is assigned to this species. *D. chocsinskyi* (HANTKEN in PRINZ) differs by a much taller, almost constant section of the outer whorls. The closely related *D. zemistephanoides* GÉ CZY is considerably larger and more compressed in section view. *D. biforme* BUCKMAN shows a ventrally less rounded, more broad-elliptic section. In the latter species the ribs are slightly prorsiradiate and finer. *D. cylindroides* BUCKMAN grows to a much larger size. The body chamber is remarkably uncoiled in *D. cylindroides*.

Remarks: The distinction of various nominal morphos-

pecies within the genus *Docidoceras* may obscure the variation within single palaeobiospecies. However, we do not have enough precisely collected material for a documentation of the shifts in variation within the genus *Docidoceras* from the beginning of the Discites Zone to the Ovale or even basal Laeviuscula zones (“*Emileia*” crater BUCKMAN). The specimen from the Scheffheu section comes from Bed I of the Sowerby-Oolith Member. It can be assigned to the lower part of the Discites Zone (see OHMERT 1988; DIETZE et al. 2001).

Docidoceras sp.
Pl. 1, Figs 8–11

Remarks: This incomplete and partly compressed specimen was collected from the so-called “Bunte Mergel” Member of the abandoned iron opencast mine of Ringsheim (Upper Rhine Valley). This lithological member belongs to the early Discites Zone (DIETZE et al. 2009). The broad-oval section of the inner whorls of this specimen suggests affinities with the genus *Docidoceras*. In contrast, the outer whorl is much more rounded, but less high than in stephanoceratids of comparable size. Also arguing against assignment to *Stephanoceras* is the fact that the furcating points of the ribs are positioned so high on the flank that they are covered by the succeeding whorls. The closest resemblance is with *D. chocsinkyi* (HANTKEN in PRINZ), although in the latter form the primary ribs are more widely spaced, and the whorl section is much taller. As a result, a specific determination of this ill-preserved specimen is impossible.

Genus *Parsemileites* DIETZE & CHANDLER, 2008

Type species: *Docidoceras liebi* MAUBEUGE, 1955.

Parsemileites liebi (MAUBEUGE, 1955)
Pl. 2, Figs 3–6

- v * pars 1955 *Docidoceras liebi* n. sp. – MAUBEUGE, p. 42, pl. 9, fig. 1 [holotype], non pl. 9, fig. 2 [= phragmocone of *Emileites* sp.].
- v non 1968 *Docidoceras* cf. *liebi* MAUBEUGE. – BAYER, p. 1, pl. 1 [= *Emileites* sp.].
- v 2008 *Parsemileites* n. gen. *liebi* (MAUBEUGE, 1955) [M] – DIETZE & CHANDLER., p. 171, figs 1e–f, 3a–p [with extended synonymy].

Holotype: Specimen figured by MAUBEUGE (1955: p. 42, pl. 9, fig. 1), Musée de Bâle, J 673.

Type locality: Sur Soutce sur Envelier, Jura bernois, Switzerland.

Type horizon: „Couches à *sowerbyi*; Zone à *Sowerbyi*” (= Ovale Zone or Laeviuscula Zone, Trigonalis Subzone).

Stratigraphical range: Ovale and Laeviuscula zones (Trigonalis Subzone).

Description: The specimen represents a juvenile macroconch. The body chamber is preserved with the calcitic shell (Pl. 2, Figs 5, 6), whereas the phragmocone is completely miss-

ing. The specimen comes from the Scheffheu section (Wutach area), ca. 1 meter below the top of the Unterer Wedelsandstein Member (Bed XI in DIETZE et al. 2001). This bed probably belongs to the younger part of the Ovale Zone (DIETZE et al. 2001, 2005). The second specimen is a reworked fragment of a body chamber (Pl. 2, Figs 3, 4) from the same locality, but from the lowermost bed (Bed VI in DIETZE et al. 2001) of the Unterer Wedelsandstein Member. This bed yields rather abundant *Fissiloboceras ovale* and therefore is assigned to the Ovale Zone. Another, strongly crushed specimen determined as *Parsemileites* sp. (Pl. 2, Fig. 7), comes from the upper third of the Unterer Wedelsandstein Member of the Eichberg section, and thus from around the boundary between the Ovale and Laeviuscula zones.

Remarks: The genus *Parsemileites* was introduced for a lineage within the Otoitidae comprising remarkably small-sized representatives with maximum diameters of approximately 50 mm. For the diagnosis and details on the morphological differences when compared with other genera of Otoitidae see DIETZE & CHANDLER (2008). In southern England the genus *Parsemileites* has its acme in the Ovale Zone, but ranges up into the Trigonalis Subzone of the Laeviuscula Zone. *Parsemileites* has also been recorded from southern England, southern France, Spain, Portugal, and southern Germany (DIETZE & CHANDLER 2008). Morphologically *Parsemileites* and the Pacific genus *Pseudotoites* are very similar, which suggests that they have derived from a common ancestor.

Genus *Otoites* MASCKE, 1907

Type species: *Ammonites sauzei* D’ORBIGNY, 1845

Otoites tumulosus WESTERMANN, 1954 [m]
Pl. 3, Figs 3, 4

- * 1954 *Otoites tumulosus* n. sp. – WESTERMANN, p. 119, pl. 5, fig. 1 [holotype]–2.
- v 2007 *Otoites tumulosus* WESTERMANN [m]. – DIETZE et al., p. 18, pl. 10, fig. 3.
- v 2008 *Otoites tumulosus* WESTERMANN [m]. – DIETZE et al., p. 144, pl. 2, fig. 1.

Holotype: Specimen figured by WESTERMANN (1954: p. 119, pl. 5, fig. 1), Bristol City Museum Cb 3626.

Type locality: Dundry Hill (Somerset), England.

Type horizon: Inferior Oolite Formation, Elton Farm Limestone, from beds of the Laeviuscula or Sauzei zones (C. PARSONS †, pers. comm. 2006).

Stratigraphical range: Ovale to Sauzei zones (Early Bajocian).

Description: The studied specimen is a mould that consists of a body chamber; the phragmocone is not preserved. The specimen exhibits a striking coronate whorl section that becomes narrower towards the aperture. The radiate primaries diverge into two or three secondaries, forming spines at

the furcation point. In addition, a few intercalatory ribs are irregularly scattered. Lappets are not preserved.

Remarks: The single specimen was discovered from a bed slightly less than 1 m below the top of the Unterer Wedelsandstein Member in the Eichberg section near Achdorf (= Bed XI in DIETZE et al. 2001). This is exactly the same level from which the above described *Parsemileites liebi* comes; it belongs to the Ovale Zone. The specimen represents the first record of the genus *Otoites* for the upper Ovale Zone of southern Germany. This is in accordance with S England where *Otoites* and its dimorphic partner *Emileia* very rarely occur also in the Ovale Zone (DIETZE & CHANDLER 2008).

Otoites dowvillei PARSONS, 1977

Pl. 3, Figs 5, 6

- * 1977 *Emileia (Otoites) dowvillei* sp. nov. – PARSONS, p. 103, pl. 17, figs 6, 7, 9 [with synonymy].
 1985 *Otoites dowvillei* PARSONS. – FERNÁNDEZ-LÓPEZ, p. 366, pl. 39, fig. 9.
 non 2006 *Otoites* or *Trilobiticeras dowvillei* PARSONS. – CHANDLER et al., pl. 7, fig. 4 [= *Parsemileites cricki* (PARSONS)].

Holotype: *Emileia (Otoites) dowvillei* PARSONS (1977: p. 103, pl. 17, fig. 6).

Type locality: Dundry Hill (Avon, S England).

Type horizon: *Ovalis* bed; Ovale zone (see DIETZE et al. 2007).

Stratigraphical range: Lower Bajocian (Ovale zone and Trigonalis subzone).

Description: In this specimen only the body chamber is preserved, and bears a short apophysis at its aperture. The specimen is assigned to *Otoites* because of the presence of a typical ribbing style, the lack of lateral spines, and a body chamber that becomes taller towards the aperture (PARSONS 1977; DIETZE et al. 2008).

Remarks: The specimen comes from the Eschach landslide and was discovered from one of the lowest beds of the Unterer Wedelsandstein Member (= Bed VIII in OHMERT 1988), which belongs to the Ovale Zone. The small size and overall habit of this specimen strikingly resemble that seen in certain species of the genus *Trilobiticeras* from the Discites Zone. The genus *Trilobiticeras* is regarded as a possible forerunner of *Otoites*.

Genus *Emileia* BUCKMAN, 1898

Type species: *Ammonites brocchii* J. SOWERBY, 1818

Emileia contrahens BUCKMAN, 1927 [M]

Pl. 3, Figs 1, 2

- v* 1927 *Emileia contrahens* nov. – BUCKMAN, pl. 744 [holotype].
 1983 *Emileia (Emileia) contrahens* BUCKMAN, 1927. – SANDOVAL, p.188, pl. 7, fig. 1.

Holotype: BUCKMAN (1927: pl. 744), housed in the collection of the British Geological Survey, no. GSM 49323.

Type locality: Sandford Lane Quarry, Sherborne, England.

Type horizon: Upper part of Bed 6b (PARSONS 1974); Laeviuscula Zone, Trigonalis Subzone).

Stratigraphical range: Ovale and Laeviuscula zones.

Description: The specimen has a maximum diameter of 210 mm, and is completely preserved up to the aperture, which is slightly restored in its ventral part. The body chamber consists of ca. 1 1/5 whorls. Our specimen fits quite well with the holotype of this species with regard to size, ribbing and coiling pattern. In the body chamber and parts of the adjacent phragmocone, compaction obstructs reconstruction of the true whorl section. Due to the compaction the whorls appear to be higher than in the uncompressed state. In any case the whorl section was taller than in the specimen of *E. dundriensis* from the Winzingen-Gefällholz site described below. A sub-coronate stage is weakly developed, at least prior to the end of the phragmocone.

Remarks: The specimen of *E. contrahens* was collected by R. FURZE from Bed X (in OHMERT 1988) of the Unterer Wedelsandstein Member in the Scheffheu section (Wutach area). The same bed has also yielded *Witchellia pseudoromanoides* and *Pseudoshirbuirmia* cf. *oechslei*. Therefore, we assign this bed to the Ovale Zone. Hence, this specimen represents the stratigraphically oldest record of the genus *Emileia* in Germany and one of the oldest records worldwide (DIETZE et al. 2008). It is interesting to note that both this specimen and the very rare findings from the Ovale Zone of southern England are remarkably evolutive.

Emileia dundriensis CALLOMON & CHANDLER, 2006 [M]

Pl. 2, Figs 1, 2

Plate 2:

(1, 2) *Emileia dundriensis* CALLOMON & CHANDLER; Lauterstein-Winzingen, Gefällholz, eastern Swabian Alb, SW Germany, Wedelsandstein Formation, Sowerbyi-Bank, Bed 2d of DIETZE et al. (2005), Bajocian, Laeviuscula Zone, Slg. W. DANGELMAIER (plaster cast in SMNS). (3, 4) *Parsemileites liebi* (MAUBEUGE); Eichberg near Achdorf, Wutach area, SW Germany; Wedelsandstein Formation, Unterer Wedelsandstein Member, Bed VI of DIETZE et al. (2001), Bajocian, Ovale Zone, SMNS no. 67551 (leg. E. NEISSER). (5, 6) *Parsemileites liebi* (MAUBEUGE); Eichberg near Achdorf, Wutach area, SW Germany; Wedelsandstein Formation, Unterer Wedelsandstein, Bed XI in DIETZE et al. (2001), Bajocian, Ovale Zone, SMNS no. 67552 (leg. E. NEISSER). (7) *Parsemileites* sp., Eichberg near Achdorf, Wutach area, SW Germany; Wedelsandstein Formation, upper third of Unterer Wedelsandstein Member, Bajocian, boundary of Ovale/Laeviuscula zones, SMNS no. 67609. – x1. Asterisk marks beginning of body chamber.



- * 1867 *Ammonites Brocchi* SOWERBY. – WAAGEN, p. 601, pl. 24, fig. 3.
- v 2006 *Emileia dundriensis* sp. nov. CALLOMON & CHANDLER. – CALLOMON & CHANDLER, p. 371, figs 6.3, 7.1 [holotype], 7.2.
- v 2007 *Emileia (Emileia) aff. dundriensis* CALLOMON & CHANDLER [M]. – DIETZE et al., p. 17, pl. 10, fig. 1, pl. 11, fig. 2.
- v 2007 *Emileia (Emileia) dundriensis* CALLOMON & CHANDLER [M]. – DIETZE et al., p. 17, pl. 11, fig. 1.

Holotype: Specimen figured by CALLOMON & CHANDLER (2006: p. 371, fig. 7.1), Sedgwick Museum Cambridge no. X29100.

Type locality: South Main Road Quarry, Dundry Hill, England.

Type horizon: Base of Bed 9a in CHANDLER et al. (2006); faunal horizon of *Euhoplaceras nodatipingue* (Bj-8a; Trigonalis Subzone, Laeviuscula Zone).

Stratigraphical range: Laeviuscula Zone (Trigonalis Subzone).

Description: The specimen represents a phragmocone with one half whorl of the body chamber. The estimated original diameter was >200 mm. The whorl section is slightly broader than in the illustrated type specimens of *E. dundriensis* (cf. CHANDLER et al. 2006). Meanwhile, we found specimens with a similarly broad whorl section in beds of the Trigonalis Subzone in the Sandford Lane Quarry near Sherborne (coll. CHANDLER & DIETZE). The phragmocone exhibits a sub-coronate section that becomes round towards the end of the phragmocone. In all growth stages the umbilicus is widely open. At the umbilical shoulder the elongate and widely spaced primaries form nodes. These nodes give rise to dense, fine secondaries, which cross the rounded venter without an interruption. At the transition between phragmocon and body chamber the whorls turn to a planulate coiling stage. The shoulder becomes even more rounded. The end of the body chamber has the same width as one whorl before. On the body chamber the nodes disappear. The radiate to prorsiradiate primaries become weaker, but are still well discernible. The weakening of the ribbing in the adult stage is much less prominent than in the specimens figured by CHANDLER et al. (2006), but continues to the end of the body chamber, as in the specimen figured by DIETZE et al. (2007: pl. 10, fig. 1; pl. 11, fig. 2 – in this specimen, the first half of the body chamber is restored and therefore appears smooth). The phragmocone of the specimen from Lauterstein-Winzigen (near Nenningen, see Textfig. 1) and the phragmocone of *E. dundriensis* illustrated by DIETZE et al. (2007: pl. 11, fig. 1) are very similar. The phragmocone of the specimen from Swabia

still resembles the assumed forerunner genus *Docidoceras* with regard to whorl section, umbilicus width, and ribbing style. On the body chamber, however, the coiling becomes planulate. In younger representatives of this genus, during the Sauzei Zone, this onset of the planulate coiling stage begins continuously earlier during ontogeny.

WAAGEN (1867: pl. 24, fig. 3) illustrated a specimen of “*Ammonites Brocchi*” from the “Zone of *Ammonites Sowerbyi*”. This *Emileia*, which could not be traced yet in any collection, exhibits denser primaries than our new specimen. Both specimens surely came from the same stratigraphical level. WAAGEN’s specimen displays a subcoronate whorl section, which is typical for *Emileia dundriensis*, and is therefore assigned to this taxon. The exact provenance remains unclear because WAAGEN (1867: 601) notes Gingen/Fils, while the legend of the plate indicates a different locality (i.e. Altenstadt near Geislingen an der Steige) within the same area

Emileia contrabens BUCKMAN represents the planulate “variety” of this genus in the Ovale Zone and Trigonalis Subzone (DIETZE et al. 2007). In comparison with *E. dundriensis*, *E. brocchi* (SOWERBY) exhibits a more rounded whorl section and a narrower umbilicus. *E. brocchi* appears in the Laeviuscula Subzone (DIETZE et al. 2007). “*Emileia crater* BUCKMAN, another species from the Trigonalis Subzone, maintains a subcoronate whorl section until its mouth border, and the primary ribs bear nodes up to the final stage. We therefore assign the latter species to the genus *Docidoceras*.

Remarks: The studied specimen of *E. dundriensis* comes from the site Gefällholz near Lauterstein-Winzigen (Eastern Swabia). It was recovered from Bed 2d of the “Sowerby-Bank” (Laeviuscula Zone, Trigonalis Subzone, *Sonninia adicra* β horizon; see DIETZE et al. 2005). The specimen is kept in the private collection of one of the co-authors (W. D.), and a plaster cast is stored in the collection of the SMNS. The specimen from the Swabian Jurassic is both stratigraphically and morphologically close to the genus *Docidoceras*. With regard to the planulate body chamber and sphaerocone coiling stage, we retain *E. dundriensis* CALLOMON & CHANDLER in the genus *Emileia* without hesitation.

Family Stephanoceratidae NEUMAYR, 1875

Genus *Mollistephanus* BUCKMAN, 1921

Type species: *Mollistephanus mollis* BUCKMAN, 1922.

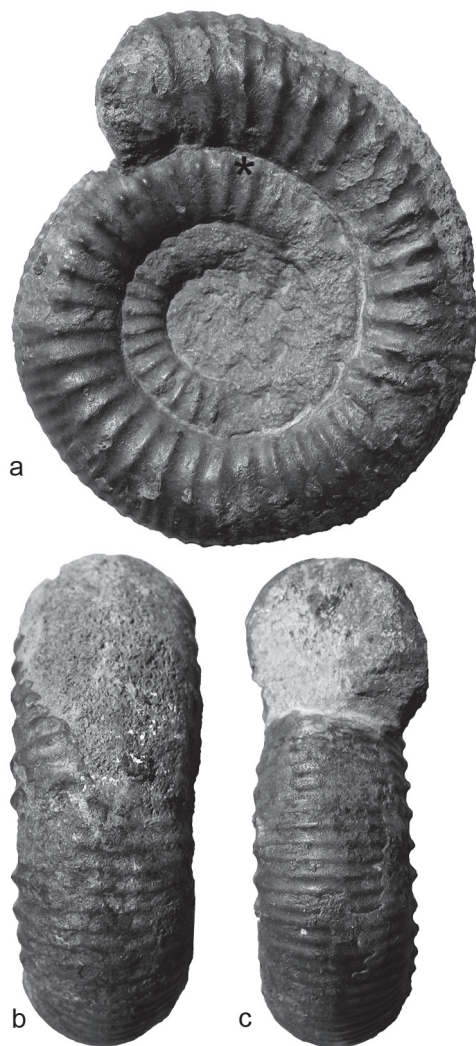
Mollistephanus aff. kondai GALÁCZ, 1986 [M]
Textfig. 3a–c

* aff. 1986 *Mollistephanus (Mollistephanus) kondai* n. sp. – GALÁCZ,

Plate 3:

(1, 2) *Emileia contrabens* BUCKMAN, dorsal part of mouth border slightly restored. Scheffheu near Eschach, Wutach area, SW Germany, Wedelsandstein Formation, Unterer Wedelsandstein Member, Bed X in OHMERT (1988), Lower Bajocian, Ovale Zone, SMNS no. 67602 (leg. R. FURZE). (3, 4) *Otoites tumulosus* WESTERMANN, Eichberg near Achdorf, Wutach area, SW Germany, Wedelsandstein Formation, Unterer Wedelsandstein Member, Bed XI in DIETZE et al. (2001), Bajocian, Ovale Zone, SMNS no. 67553 (leg. E. NEISSER). (5, 6) *Otoites douvillei* PARSONS, 1977, Scheffheu near Eschach, Wutach area, SW Germany, Wedelsandstein Formation, Unterer Wedelsandstein Member, Bed XIII in OHMERT (1988), Bajocian, Ovale Zone, SMNS no. 67610. – x1. Asterisk marks beginning of body chamber.





Textfigure 3: (a–c) *Mollistephanus* aff. *kondai* GALÁ CZ; Lauterstein-Nenningen, Christental, eastern Swabian Alb, SW Germany, Wedelsandstein Formation, Sandmergel bed, Lower Bajocian, Laevisucula Zone, Trigonalis Subzone, *stephani* Horizon, SMNS no. 67554 (leg. E. SCHNEIDER). – x1. Asterisk marks beginning of body chamber

p. 121, pl. 1, fig. 1 [holotype]–3.

Holotype: Specimen figured by GALÁ CZ (1986: pl. 1, fig. 1).

Type locality: Lókút Hill (Bakony Mountains, Hungary).

Type horizon: Exact level unknown, after its lithology probably coming from beds of the basal Sauzei Zone.

Stratigraphical range: Early Bajocian (Laevisucula Zone, Trigonalis Subzone to Sauzei Zone).

Description: The specimen consists of the body chamber that is more than one whorl long, and one third of the next whorl, which belongs to the phragmocone. The whorl section becomes round towards the end of the body chamber. Before this latest stage, it is subcircular and broader than high. The mostly radiate, moderately wide-spaced primaries subdivide into two or, more rarely, three secondaries at the broadest position of the whorl section. At the divergence point a short but significant spine occurs and is visible even on the mould. The suture line is not visible.

Remarks: The single specimen from Swabia comes from the Sandmergel Member in the Christental section at Lauterstein-Nenningen (Bed 3, Trigonalis Subzone, *stephani* horizon, see DIETZE et al. 2005). The specific determination of this specimen is difficult. It represents a transitional form linking between various named morphospecies. *Mollistephanus mollis* BUCKMAN exhibits a much taller and more rounded whorl section (see illustrations in CHANDLER & DIETZE 2004). In contrast to many topotypes of *M. mollis* the holotype of this species shows relatively well developed spines at the diverging point of the ribs, but they are still less prominent than in our new specimen. In a slightly younger level within the Laevisucula Zone of South England specimens of *Mollistephanus* rarely occur that exhibit a similarly wide but more rounded whorl section than our fossil. In these specimens (e.g., CHANDLER & DIETZE 2004: fig. 2.2) the lateral spines are much weaker than in our specimen. *M. hispaniensis* FERNÁNDEZ-LÓPEZ is smaller and has a taller whorl section. *Phaulostephanus diniensis* PAVIA differs in a more rounded whorl section and less developed spines. PAVIA (1983: pl. 23, fig. 5) figured a *Phaulostephanus* aff. *paululus* from the Humphriesianum Zone of southeastern France that is very similar to our specimen. The genus *Phaulostephanus* is a subjective junior synonym of *Mollistephanus*, which is used for small-sized but macroconchiate stephanoceratids from the Humphriesianum Zone. The closest resemblance, however, is with *M. kondai* GALÁ CZ from the basal Sauzei Zone of northern Hungary. The specimens illustrated by GALÁ CZ (1986: pl. 1) possess also sub-circular or round whorl sections, and the divergence point of the ribs is positioned relatively high on the flanks, at a comparable diameter. However, the spines are less well-developed in these specimens. The more widely spaced ribbing on the body chamber of the holotype of *M. kondai* results from its larger size. Our specimen did not reach this coiling stage, and thus we prefer usage of an open nomenclature for determination. It may belong to a new species, but we refrain from erecting a new species based only on one specimen.

Plate 4:

Docidoceras chandleri n. sp. (1–3) Holotype, Scheffheu near Eschach, Wutach area, SW Germany, Wedelsandstein Formation, Sowerbyi-Oolith, Bed I in DIETZE et al. (2001), Lower Bajocian, Discites Zone, SMNS no. 67556. (4, 5) Paratype, Mapperton Farm, Mapperton near Beaminster, Dorset, S England, Inferior Oolite Formation, Bed 3c, boundary Discites/Ovale Zone, SMNS no. 67557. – x1.

1



2



3



4



5



At present, we separate the small-sized stephanoceratids on genus level and do not include them in one of the “normal-sized” genera *Stephanoceras* or *Skirroceras* (for a discussion see CHANDLER & DIETZE 2004: 232). However, a “developmental polymorphism” sensu MATYJA (1986) would represent another possible explanation for the striking co-occurrence of small- and large-sized stephanoceratids.

3. Description of a new species of *Docidoceras* (V. DIETZE, G. DIETL & G. SCHWEIGERT)

Docidoceras chandleri n. sp. [M]

Pl. 4, Figs 1–5

aff. 1904 *Coeloceras* (*Stephanoceras*) *Chocsinskyi* HANTK. msc. nov. sp. – PRINZ, p. 102 (pars), pl. 15, fig. 2.

aff. 1967 *Docidoceras chocsinskyi* (HANTKEN in PRINZ, 1904) – GÉCZY, p. 230, pl. 59, fig. 5.

Holotype: Specimen illustrated in Pl. 4, Figs 1–3 (SMNS no. 67555).

Paratype: Specimen illustrated in Pl. 4, Figs 4, 5 (SMNS no. 67556).

Type locality: Scheffheu near Blumberg-Achdorf (Wutach area, SW Germany).

Type horizon: Wedelsandstein Formation, Bed I in section of OHMERT (1988) and DIETZE et al. (2001); lower part of Discites Zone.

Stratigraphical range: Discites Zone.

Etymology: In honour of our friend Robert Baron CHANDLER, a profound researcher and specialist of the British Inferior Oolite and its ammonite faunas.

Records: SW Germany, S England.

Diagnosis: Large-sized and remarkably planulate species of *Docidoceras*.

Description: The holotype of *D. chandleri* n. sp. is a mould preserved with the body chamber including the mouth border and the last whorl of the phragmocone. The inner whorls are not preserved. The whorl section of the phragmocone is broad-elliptic-cornate and becomes rounded towards the end of the body chamber. The phragmocone and adjacent half of the body chamber bear coarse, radiate primaries. On the point of furcation they bear a spine, which disappears at the beginning of the body chamber. On the outer half of the body chamber the primaries are equally strong than the secondaries; the latter cross the venter without interruption. From this coiling stage onwards the ribbing style is prorsiradiate. The whorl section becomes wider until the end of the first quarter of the body chamber. Further on, the section narrows slightly, which leads to a sphaeroconic appearance in ventral view (Pl. 4, Fig. 1), like in the holotype of *D. cylindroides* BUCKMAN. At the

end of the body chamber the whorl section widens again. The body chamber is strongly uncoiled. In lateral view the specimen appears to have a planulate aspect, whereas in ventral view, towards the aperture, it more resembles the genus *Emileia*. But due to the broad-elliptic section of the inner and median whorls and the sphaerocone stage its assignment to *Docidoceras* is beyond any doubt. The suture line looks relatively simple. The aperture bears a collar, which is well preserved at the only incompletely prepared back side of the specimen.

The paratype of *Docidoceras chandleri* n. sp. comes from the boundary Discites/Ovale Zone (Bed 3c, CHANDLER & CALLOMON 2009) of Mapperton Farm (Mapperton near Beaminster, Dorset, S England). It is preserved with its shell and exhibits a slightly more rounded umbilical shoulder than in the holotype. The ribbing and the lateral spines are more accentuated due to the different preservation. On the body chamber the ribbing style is still rectiradiate. Otherwise both type specimens are very similar to each other.

Comparisons: The new species differs from *D. chocsinskyi* (HANTKEN in PRINZ) mainly in a much larger adult size and more rounded whorl section of the body chamber. In *D. chocsinskyi* the whorl section is broad-oval. *D. zemistephanoides* GÉCZY and *D. wysogorskii* (PRINZ) differ from *D. chandleri* n. sp. in their broad-oval and coronate whorl sections of the outer whorls. A planulate stage on the body chamber is not developed in any of these species. *D. bifforme* BUCKMAN is much smaller and lacks a planulate body chamber. In *D. cylindroides* BUCKMAN the sphaerocone character is more expressed than in *D. chandleri* n. sp., but its section in the body chamber is much more depressed, and the planulate stage is not present. *Stephanoceras telegdirothi* GÉCZY differs from *D. chandleri* n. sp. in a much less elliptic whorl section of the inner and median whorls. Moreover, in the latter species, the coiling is more evolute.

Measurements:

	Diameter	Whorl width	Whorl height	Width of umbilicus	Primary ribs per last whorl	Secondary ribs per last whorl
Holotype (Scheffheu)	121 ~92 ~77	37 34 38	29 26 23	65 46 36	40 33 30	95 ? ?
Paratype (Mapperton)	111 ~72	38 ~35	26 ~22	65 34	? 31	? ?

4. Discussion and conclusions

None of the ammonite families studied here had their center of diversification in South Germany. Erycitidae, subfamily Erycitinae, is an important, sometimes even predominant faunal element of the western Tethys (KOVÁCS & GÉCZY 2008). In the Pacific Realm Erycitidae are represented by the subfamily Podagrosiceratinae, which has not been recorded for Germany for palaeobiogeographical reasons. Both *Erycites* and *Abbasites* only sporadically migrated to southern Germany. From there, other representatives of the Erycitidae have been recorded for

Substage	Zone	Subzone	Described taxa	Stratigraphy (Locality)
Lower Bajocian (pars)	Witchellia laeviuscula	Witchellia laeviuscula		
		Shirbuirnia trigonalis	<i>Mollistephanus</i> aff. <i>kondai</i> <i>Emileia dundriensis</i>	<i>stephani</i> horizon (Nenningen) <i>adicra</i> β horizon (Winzingen)
	Fissiloboceras ovale		<i>Parsemileites liebi</i> <i>Otoites tumulosus</i> <i>Emileia contrabens</i> <i>O. dowvillei</i> <i>Parsemileites liebi</i>	Bed XI OHMERT 1988 (Scheffheu) Bed XI OHMERT 1988 (Eichberg) Bed X OHMERT 1988 (Scheffheu) Bed VIII OHMERT 1988 (Scheffheu) Bed VI OHMERT 1988 (Scheffheu)
			<i>Docidoceras zemistephanoides</i>	Top of Oberes Erzband (Ringsheim)
Hyperlioceras discites		<i>Docidoceras zemistephanoides</i> <i>Docidoceras</i> sp. <i>D. chandleri</i> n. sp. <i>D. cf. wysogorskii</i>	Bed IV OHMERT 1988 (Eichberg) Bunte Mergel (Ringsheim) Bed I OHMERT 1988 (Scheffheu) Bed I OHMERT 1988 (Scheffheu)	
Upper Aalenian	Graphoceras concavum	Graphoceras formosum		
		Graphoceras concavum		
	Brasilia bradfordensis	Brasilia gigantea	<i>A. aff. abbas</i> <i>Abbasites gardincola</i>	lower part "Hauptbank" (Geisingen) bed below "Hauptbank" (Geisingen)
		Brasilia bradfordensis		
	Ludwigia nurchisonae	Ludwigia nurchisonae		
		Ludwigia haugi	<i>Spinammatoceras</i> aff. <i>sagax</i>	„Sinon-Bank“ (Opferdingen)

Textfigure 4: Compilation of the source levels of the ammonites described in this study.

around the Toarcian/Aalenian boundary (SCHWEIGERT 1996). The systematic position of *Erycites* GEMMELLARO, 1886 and *Abbasites* BUCKMAN, 1892 remains a matter of debate. They were included in the families Erycitidae, Hammatoceratidae, Otoitidae or Phymatoceratidae (see KOVÁČ & GÉCZY 2008). Based on the ventral interruption of the ribbing that occurs in both genera, we assign them to the subfamily Erycitinae SPATH, 1928 within Erycitidae SPATH, 1928. *Spinammatoceras* SCHINDEWOLF, 1964 also is placed in Erycitinae. The group of *S. tenax/sagax* continued in the Bradfordensis Zone with *Malladaites pertinax* (VACEK) and probably evolved to *Haplopleuroceras* in the Concavum Zone (LINARES & SANDOVAL 1986, 1996). Moreover, the Erycitidae gave rise to the families Otoitidae and Stephanoceratidae.

The Otoitidae, in this study represented by the genera *Docidoceras*, *Parsemileites*, *Emileia* and *Otoites*, are descendants of *Abbasites*. The latter genus derived from sphaeroconic species of *Erycites* such as *E. fallifax* ARKELL in the Murchisonae zone (CALLOMON & CHANDLER 1994). On the other hand, the Stephanoceratidae probably evolved from planulate species of *Erycites* such as *E. gonionotus* in the Murchisonae Zone (CALLOMON & CHANDLER 1994). A possible transient is the genus *Abbasitoides* WESTERMANN, 1995. Among Stephanoceratidae the micromorphic genus *Mollistephanus* is recorded here for the first time from southern Germany. In that area Otoitidae are much more frequent from the transition between the Laeviuscula and Sauzei zones upwards and in the Sauzei Zone itself. From older beds only very few specimens have been recorded, which we regard as sporadic immigrants. Thus, the discoveries presented in this study significantly broaden our knowledge about Otoitidae in this area. *Docidoceras* is much more abundant in some parts of the western Tethys (Hungary, Apennines) and in southern England (Dorset, Somerset). The genus *Parsemileites* most frequently occurs in southern England. *Emileia* and its dimorphic partner *Otoites* are quite common in the Laeviuscula Zone of southern England, but extremely rare in older beds. The evolutionary transition from *Docidoceras* to *Emileia* must have occurred in another area, which however has not yet been identified.

DIETZE et al. (2001) recently reported on some rare findings of stephanoceratids in the lower part of the Bajocian of southern Germany. However, the center of diversification of Stephanoceratidae was located in the Tethyan Realm, and especially in the Lusitanian Basin. The sole record of *Mollistephanus* aff. *kondai* from Germany represents either another short immigration event, or may be interpreted as a postmortally drifted shell. In southern Germany stephanoceratids become more abundant from the transition Laeviuscula/Sauzei zones upwards, with the two genera *Kumatostephanus* and *Skirroceras*. In the Humphriesianum Zone and later, stephanoceratids form an important and very frequent faunal element in southern Germany.

Several immigration events from the Tethys to southern Germany, also reaching southern France and southern England, have been observed. In the Haugi Subzone, *Erycites* sp., *Spinammatoceras* aff. *sagax* and *Tmetoceras regleyi* suddenly appear. Another Tethyan influx is recognized in the upper part of the Gigantea Subzone: Together with rare *Abbasites*, *Lytoceras* and *Phylloceras*, numerous Hammatoceratidae occur in the Hauptbank of Geisingen and in the underlying nodular bed. In

the lower part of the Discites Zone rather evolute specimens of *Docidoceras* rarely occur, whereas in the top of the Discites Zone and in the lowermost Ovale Zone *D. zemistephanoides* occasionally reached southern Germany, Normandy and southern England. In the upper part of the Ovale Zone the genera *Parsemileites*, *Otoites* and *Emileia* represent rare accessory faunal elements. The faunal immigrations from the Tethys seem to have continued until the lower part of the Laeviuscula Zone. *Emileia*, *Skirroceras* and *Mollistephanus* are abundant in many areas along the north-western Tethyan shelf and in the Tethys Realm itself. For an overview, we have summarized the stratigraphical occurrences of the above described ammonites in Textfigure 4.

Acknowledgements

We thank J. H. CALLOMON (†), R. B. CHANDLER (Whyteleaf, England), M. FRANZ (Freiburg im Breisgau, Germany), R. MATTES (†), C. PARSONS (†), M. RIETER (Stuttgart), L. RULLEAU (Chasselay, Frankreich), W. SCHOTT (†) and D. SOLE (Axminster) for fruitful discussions, comparative material, or for providing literature. M. KAPITZKE (Stuttgart) helped with the preparation of specimens, and M. RIETER (Stuttgart) prepared some plaster casts. M. HOWE, P. SHEPHERD and L. NEEP (Nottingham, England) kindly loaned type specimens from the BUCKMAN collection for comparisons. A. GALÁČZ (Budapest, Hungary) provided plaster casts of type specimens from the Jurassic of Hungary. The journal's referees are thanked for their suggestions and valuable advice.

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