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Early Late Campanian ammonite fauna from Busko Zdrój (Nida Trough, southern Poland)

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ABSTRACT:

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Sixteen ammonite taxa are recorded from four temporary exposures of lower Upper Campanian deposits in the town of Busko Zdrój, NE limb of the Nida Trough, southern Poland. These are: *Phylloceras* (*Neophylloceras*) cf. *bodei*, *Tetragonites obscurus*, *Desmophyllites* sp., *Pachydiscus* (*Pachydiscus*) *subrobustus*, *P.* (*P.*) cf. *subrobustus*, *Hoplitoplacenticeras* (*Hoplitoplacenticeras*) *dolbergense*, *H.* (*H.*) sp., *H.* (*Lemfoerdiceras*) *lemfoerdense*, *Glyptoxoceras* cf. *retrorsum*, *G.* sp., *Lewyites elegans*, *Pseudoxybeloceras* (*Pseudoxybeloceras*) *riosi*, *Ps.* (*Ps.*) sp. juv., *Baculites* sp., *Scaphites gibbus*, and *Trachyscaphites spiniger spiniger*. Many specimens lack precise provenance data, but co-occurrence of *T. obscurus*, *P.* (*P.*) *subrobustus*, *H.* (*H.*) *dolbergense*, *H.* (*L.*) *lemfoerdense*, *Ps.* (*Ps.*) *riosi*, *Baculites* sp., *S. gibbus*, and *T. s. spiniger* is documented from a single opoka bed in one of the exposures. The ammonites allow correlation with standard sections in northern Germany: the ammonite-bearing sequence of Busko Zdrój corresponds to a part of the interval from the *basiplana*/*spiniger* to *roemeri* zones in Lägerdorf and Kronsmoor (Schleswig-Holstein), and from the *stobaei*/*basiplana* to *vulgaris*/*stolleyi* zones in the Lehrte West Syncline (Lower Saxony). It can also be correlated with the lower part of the *Neancyloceras phaleratum* Zone in Vistula valley, central Poland.

Key words: Upper Cretaceous, Campanian, Ammonites, Stratigraphy, Correlation, Nida Trough, Vistula section, Northern Germany.

INTRODUCTION

Ammonites are not uncommon in Campanian deposits of extra-Carpathian Poland. However, only those from the Vistula section, central Poland (Text-fig. 1B), were monographed by BŁASZKIEWICZ (1980). In contrast, our current knowledge of Campanian ammonite faunas from other parts of Poland is based mostly on taxonomic lists in stratigraphic papers, and thus remains unsatisfactory. This concerns also the ammonite faunas from the Nida Trough, southern Poland (Text-fig. 1B), quoted e.g. by SENKOWICZ (1959), RUTKOWSKI (1965), POŻARYSKI (1966), and BŁASZKIEWICZ (1969). Only recently have JAGT & *al.* (2004) described and illustrated some stratigraphically important taxa from the Campanian of the Wolbrom-Miechów area (SW limb of the Nida Trough).

In the present paper we describe and illustrate an interesting early Late Campanian ammonite fauna from the Nida Trough. It was collected in 1994-1998 by one of us (A. KIN) from Busko Zdrój, NE limb of the Nida Trough (Text-fig. 1A-C). We discuss this fauna in terms of its correlation with the standard zonation of the Campanian in northern Germany, worked out by

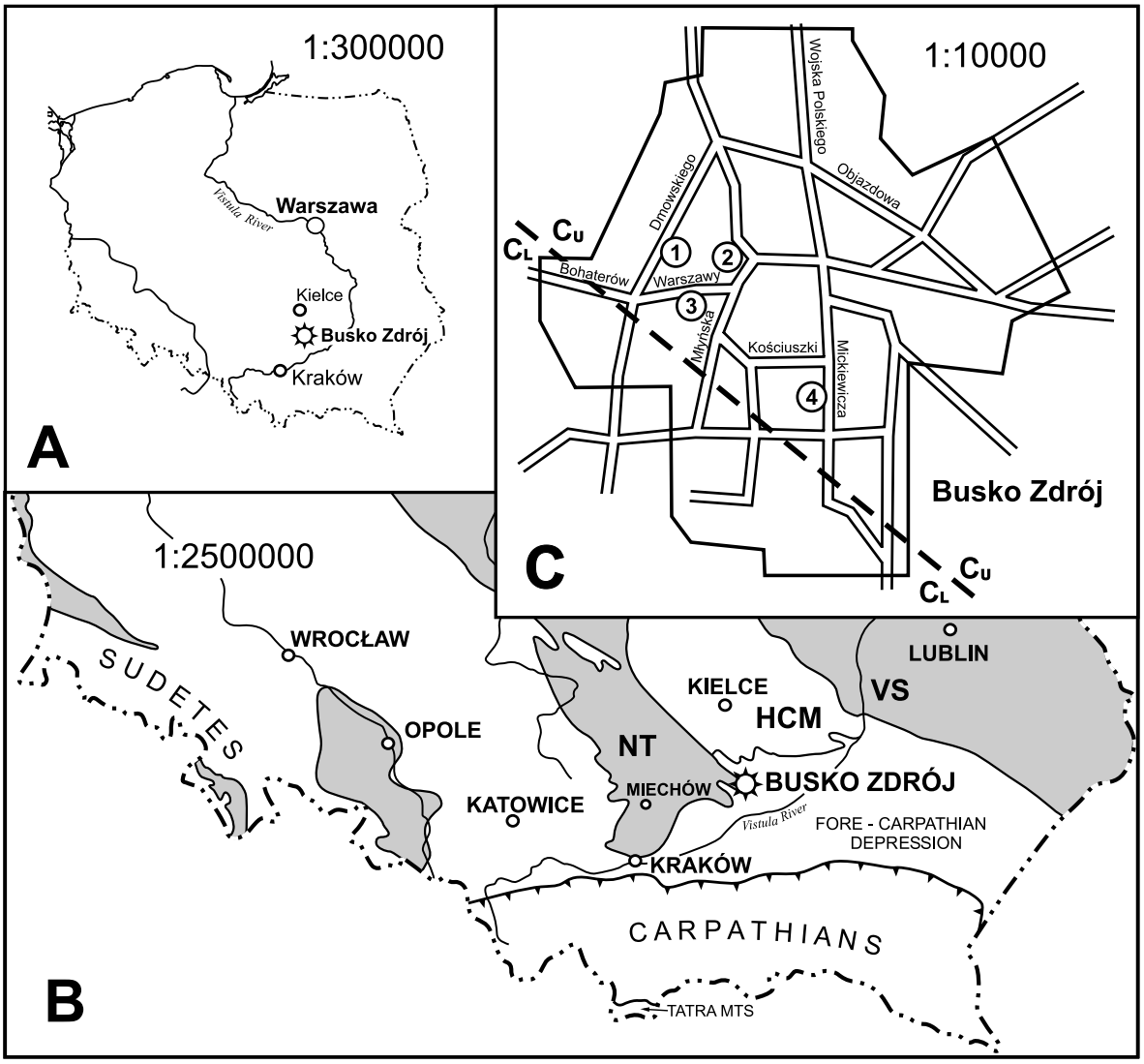

Fig. 1. Location and regional geology of the Busko Zdrój area. A – Map of Poland. B – Simplified geological map of southern Poland; areas of Cretaceous deposits exposed at the surface or under a Quaternary and continental Paleogene or Neogene cover are gray-coloured; NT – Nida Trough, HCM – Holy Cross Mountains (Palaeozoic core plus Triassic and Jurassic margins); VS – Vistula sections (modified from MARCINOWSKI & RADWAŃSKI 1983, fig. 1). C – Location of ammonite-bearing outcrops (1-4) in Busko Zdrój; C_L – Lower Campanian, C_u – Upper Campanian (based on the Geological Map of Poland, file Busko Zdrój)

the late Gundolf ERNST, his students and co-workers (ERNST 1963 a, b, 1968; ERNST & *al.* 1979; NIEBUHR & ERNST 1991; NIEBUHR 1995, 1996; NIEBUHR & *al.* 1997; SCHULZ 1978, 1985; SCHULZ & *al.* 1984; SCHÖNFELD & *al.* 1996; SCHÖNFELD 2000). A correlation with Vistula (Wisła) section in Poland (POŻARYSKI 1938; BŁASZKIEWICZ 1980) is also attempted.

W.J. KENNEDY and M. MACHALSKI are responsible for the taxonomic part of this paper; A. KIN collected the material studied and is responsible for the field observations. The introductory and stratigraphical chapters were written by M. MACHALSKI, who also prepared the final version of the manuscript.

GEOLOGICAL SETTING

The town of Busko Zdrój is situated in southern Poland, in the NE limb of the Nida Trough (Text-fig. 1A-C). The Nida Trough forms the SE segment of the Szczecin-Łódź-Miechów Synclinorium, which belongs to the Alpine (Laramide) tectonic units of extra-Carpathian Poland (see POŻARYSKI 1977; KUTEK & GŁAZEK 1972; MARCINOWSKI & RADWAŃSKI 1983; WALASZCZYK 1992). To the south, Cretaceous deposits of the Nida Trough are covered by Miocene strata of the Fore-Carpathian Depression (POŻARYSKI 1977; Text-fig. 1B).

The Campanian/Lower Maastrichtian sedimentary succession of the NE limb of the Nida Trough is represented by opokas (= siliceous limestone) and marls with sandy intercalations in the Maastrichtian part of the succession (CIEŚLIŃSKI 1973). In contrast to the south-western and central parts of the trough, the Campanian/Maastrichtian succession is continuous in the NE limb, without hardgrounds and condensed deposits; the maximum thickness of the Campanian/Maastrichtian here is 450 metres, the Campanian being 300 metres thick (see CIEŚLIŃSKI 1973, table 44).

SENKOWICZ (1959) and RUTKOWSKI (1976) reported the occurrence of sandy organodetrital limestones of Late Cretaceous age from the NE limb of the Nida Trough. They are best known at Motkowice (RUTKOWSKI 1976) and are regarded to be either of Maastrichtian or Late Campanian age (SENKOWICZ 1959; CIEŚLIŃSKI 1973, p. 579; RUTKOWSKI 1976). These sandy organo-detrital limestones contain poorly preserved inoceramids, pectinids, pycnodont oysters, and belemnite rostra (SENKOWICZ 1959). However, the remains of lithothamnian thalli – typical of marine Miocene deposits of the southern Poland and unknown from the Polish Cretaceous – were also reported from the matrix of the limestones (RUTKOWSKI 1976). Moreover, the sandy organo-detrital limestone lithosome appears to follow discordantly on both Campanian and Maastrichtian deposits (ŁYCZEWSKA in RUTKOWSKI 1976). An opoka infilling was observed by one of us (M. MACHALSKI) in a shell of the Late Cretaceous oyster *Pycnodonte vesicularis* from Motkowice, otherwise embedded in sandy detrital limestone (Institute of Geology collection, University of Warsaw). All this suggests that the Cretaceous fossils preserved in the sandy organo-detrital limestones from Motkowice are reworked, and that this unit is of Miocene or even later age (the lithothamnia may also be derived). If this interpretation is correct, all previous conclusions based on the sandy limestones from Motkowice concerning the palaeography and tectonics of the area in the Late Cretaceous (e.g. RUTKOWSKI 1976; ŚWIDROWSKA & HAKENBERG 1999), should be revised.

The ammonite collection studied comprises 74 specimens. They all come from four temporary exposures of Campanian opoka in Busko Zdrój (localities 1-4 in Text-fig. 1C). The exposures were situated close to the Lower/Upper Campanian boundary and roughly along the strike of the strata (Text-fig. 1C). Thus, all the strata studied appear to represent stratigraphic levels close to each other and not far from the Lower/Upper Campanian boundary.

Exposures 1-3 were situated in temporary municipal trenches, whereas no. 4 was a building site where several opoka layers were exposed over a larger area. Sections 1-3 each consisted of a few metres of medium- and thin-bedded opoka.

Only part of the ammonite material studied was collected *in situ* (Tables 1, 2). A significant part of the collection comes from a single opoka layer, 80 cm thick, near the bottom of the section exposed at locality 3 (Table 3). Other specimens were found loose near the exposures or acquired from local collectors, with no information on their precise provenance. Moreover, no correlation between the outcrops was attempted and, consequently, the ammonite succession in the area cannot be established.

Sponges, bivalves, belemnites, nautiloids and irregular echinoids were also noted or collected from the outcrops studied; these fossils, however, are not included in the present study.

Taxon	Specimen	Locality
Phylloceras (*Neophylloceras*) cf. *bodei* MÜLLER & WOLLEMANN, 1906	6	3
Tetragonites obscurus (SCHLÜTER, 1872)	1, 2, 3, 4, 5, 9	3, ?
Desmophyllites sp.	7 , 8	2, ?
Pachydiscus (*Pachydiscus*) *subrobustus* SEUNES, 1892	10, 11, 12, 13, 14, 15, 44, 45	3, ?
Pachydiscus (*Pachydiscus*) cf. *subrobustus* SEUNES, 1892	16, 17	1
Hoplitoplacenticeras (*Hoplitoplacenticeras*) *dolbergense* (SCHLÜTER, 1876)	48	3
Hoplitoplacenticeras (*Hoplitoplacenticeras*) sp.	18	2
Hoplitoplacenticeras (*Lemfoerdiceras*) *lemfoerdense* (SCHLÜTER, 1872)	19, 20, 21, 22, 23, 46, 47, 49	3, ?
Glyptoxoceras sp. cf. *retrorsum* (SCHLÜTER, 1872)	25	?
Glyptoxoceras sp.	52	?
Lewyites elegans (MOBERG, 1885)	72, 73, 74, 75	4
Pseudoxybeloceras (*Pseudoxybeloceras*) *riosi* (WIEDMANN, 1962)	26, 27, 28, 29, 53, 54, 55, 56, 57, 58, 59	2, 3, ?
Pseudoxybeloceras (*Pseudoxybeloceras*) sp. juv.	24	3
Baculites sp.	50, 51	3
Scaphites gibbus SCHLÜTER, 1872	30, 31, 32, 33, 40, 60, 61, 62, 63	1, 3, ?
Trachyscaphites spiniger spiniger (SCHLÜTER, 1872)	34, 35, 36, 37, 38, 39, 41, 42, 43, 64, 65, 66, 67, 68, 69, 70, 71	1, 2, 3, ?

Tab. 1. The lower Upper Campanian ammonite fauna of Busko Zdrój. Specimen numbers in the table are last digits of complete acronym, wich is as follows: ZPAL Am. 19/

CORRELATIONS

It was agreed during the Second International Symposium on Cretaceous Stage Boundaries, held at Brussels in 1995, that the Campanian Stage should be subdivided into three sub-stages (HANCOCK & GALE 1996). However, no formal definition of these substages has been accepted yet (the tripartite subdivision of Campanian presented by NIEBUHR 2003, text-fig. 2, is informal). Consequently, we adhere to the traditional two-fold subdivision of the Campanian (Text-fig. 2). In terms of the standard belemnite stratigraphy, the boundary between Lower and Upper Campanian corresponds to the extinction level of the genus *Gonioteuthis* (SCHULZ & *al.* 1984; CHRISTENSEN 2000).

Northern Germany

The biostratigraphic zonation of the Campanian in northern Germany (Text-fig. 2) is based on belemnites, echinoids, and ammonites (ERNST 1963 a, b, 1968; ERNST & *al*. 1979; NIEBUHR & ERNST 1991; NIEBUHR 1995, 1996; NIEBUHR & *al.* 1997; SCHULZ 1978, 1985; SCHULZ & *al*. 1984; SCHÖNFELD & *al*. 1996; CHRISTENSEN 2000). It was worked out in two areas: 1) in the white-chalk succession at Lägerdorf and Kronsmoor in southwestern Schleswig-Holstein (e.g. SCHÖNFELD & *al*. 1996); 2) in the marl/limestone/spiculitic opoka succession of the Misburg-Höver area in the Lehrte West Syncline (Lehrter Westmulde), east of Hannover, Lower Saxony (e.g. NIEBUHR 1995, NIEBUHR & *al*. 1997).

The zonations of the Lower Campanian in Lägerdorf and Misburg-Höver area are the same for the most part, but there are differences for the upper part of the Lower Campanian and the Upper Campanian (Text-fig. 2). The zones established in these two areas are used in other areas of northern Germany as "standard zones". The Lägerdorf and Kronsmoor scheme was applied to the Stemweder Berg, Dammer Oberkreide Mulde (KENNEDY & KAPLAN 1997) and for the northwest Münsterland (WIPPICH 1995) while that for the Lehrte West Syncline was applied to the southeast Münsterland (KAPLAN & *al*. 1996) and in the Beienrode Basin (NIEBUHR & ERNST 1991).

A total of sixteen ammonite taxa were identified in the material studied (Tables 1, 2). Among these, ten taxa were identified to species level: three with the qualification *cf*. and seven without. The total vertical ranges of the latter group in northern Germany are plotted against the biostratigraphic schemes for Lägerdorf and Kronsmoor and for the Lehrte West Syncline (Text-fig. 2).

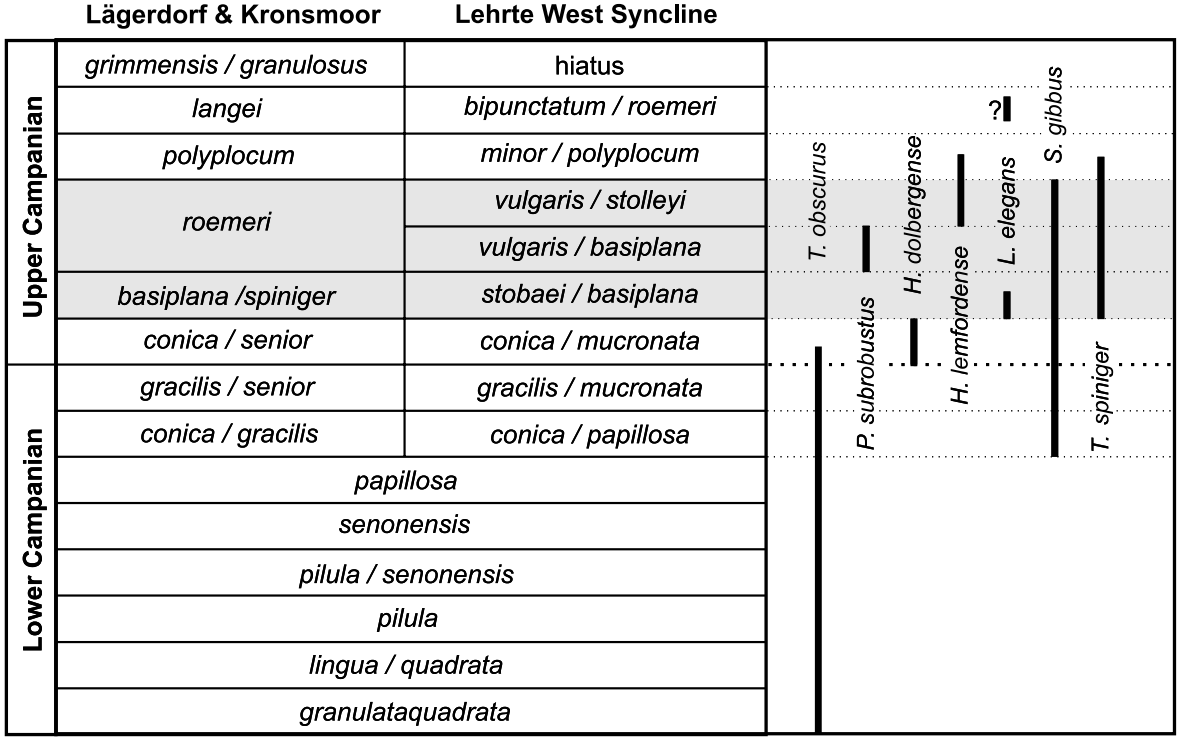

Fig. 2. Vertical ranges in northern Germany of selected ammonite species identified in the Busko Zdrój fauna (based on: SCHMID & ERNST 1975; NIEBUHR & ERNST 1991; WIPPICH 1995; KAPLAN & *al*. 1996; NIEBUHR 1995, 1996; NIEBUHR & *al*. 1997; KENNEDY & KAPLAN 1997; SCHULZ 1985; SCHULZ & *al*. 1984; SCHÖNFELD & *al*. 1996; CHRISTENSEN 2000; KAPLAN & *al*. in press). The stratigraphic interval in northern Germany that correlates with the ammonite-bearing sequence of Busko Zdrój is gray-coloured

Locality 1	*Pachydiscus* (*Pachydiscus*) cf. *subrobustus* SEUNES, 1892 *Scaphites gibbus* SCHLÜTER, 1872 *Trachyscaphites spiniger spiniger* (SCHLÜTER, 1872)
Locality 2	*Desmophyllites* sp. *Pachydiscus* (*Pachydiscus*) *subrobustus* SEUNES, 1892 *Hoplitoplacenticeras* (*Hoplitoplacenticeras*) sp. *Pseudoxybeloceras* (*Pseudoxybeloceras*) *riosi* (WIEDMANN, 1962) *Trachyscaphites spiniger spiniger* (SCHLÜTER, 1872)
Locality 3	*Phylloceras* (*Neophylloceras*) cf. *bodei* MÜLLER & WOLLEMANN, 1906 *Tetragonites obscurus* (SCHLÜTER, 1872) *Pachydiscus* (*Pachydiscus*) *subrobustus* SEUNES, 1892 *Hoplitoplacenticeras* (*Hoplitoplacenticeras*) *dolbergense* (SCHLÜTER, 1876) *Hoplitoplacenticeras* (*Lemfoerdiceras*) *lemfoerdense* (SCHLÜTER, 1872) *Pseudoxybeloceras* (*Pseudoxybeloceras*) *riosi* (WIEDMANN, 1962) *Pseudoxybeloceras* (*Pseudoxybeloceras*) sp. juv. *Baculites* sp. *Scaphites gibbus* SCHLÜTER, 1872 *Trachyscaphites spiniger spiniger* (SCHLÜTER, 1872)
Locality 4	*Lewyites elegans* (MOBERG, 1885)

Tab. 2. Distribution of the lower Upper Campanian ammonite taxa within the Busko Zdrój localities

The scaphitids *Scaphites gibbus* SCHLÜTER, 1872, and *Trachyscaphites spiniger spiniger* (SCHLÜTER, 1872) are probably the most precise biostratigraphic tools for the correlation between northern Germany and the Busko Zdrój area. These species are common in the material from Busko Zdrój (Table 1) and co-occur in a single opoka bed at locality 3 (Table 3). Secondly, their vertical ranges in northern Germany, summarised in Text-fig. 2, are well documented (SCHMID & ERNST 1975; WIPPICH 1995; KAPLAN & *al*. 1996; KENNEDY & KAPLAN 1997; NIEBUHR 1996).

The entry level of *Trachyscaphites s. spiniger* in northern Germany is near the base of the *basiplana*/*spiniger* Zone in the Lägerdorf and Kronsmoor zonation, and in the *stobaei*/*basiplana* Zone in the biostratigraphic scheme for the Lehrte West Syncline; the last occurrence of the species is in the middle of the *polyplocum* Zone in the Lägerdorf and Kronsmoor zonation and in the *minor*/*polyplocum* Zone in the scheme for the Lehrte West Syncline (Text-fig. 2; SCHMID & ERNST 1975; KENNEDY & KAPLAN 1997; NIEBUHR 1996; NIEBUHR & *al*. 1997). In the Campanian deposits of the latter area NIEBUHR (1996) distinguished a *spiniger* Zone, based on the vertical range of this species.

In northern Germany, *Scaphites gibbus* enters in the *conica*/*gracilis* Zone in the Lägerdorf and Kronsmoor scheme and in the equivalent *conica*/*papillosa* Zone in the Lehrte West Syncline scheme; the last occurrence of the species is in the top of the *roemeri* Zone in the Lägerdorf and Kronsmoor scheme and in the *vulgaris*/*stolleyi* Zone in the Lehrte West Syncline zonation (Text-fig. 2; SCHMID & ERNST 1975; WIPPICH 1995; KAPLAN & *al*. 1996; NIEBUHR 1996; NIEBUHR & *al*. 1997).

Vertical ranges of both species thus overlap in northern Germany in the interval from the *basiplana*/*spiniger* to

Taxon	Specimen
Tetragonites obscurus (SCHLÜTER, 1872)	1, 2, 3, 4, 5
Pachydiscus (*Pachydiscus*) *subrobustus* SEUNES, 1892	10
Hoplitoplacenticeras (*Hoplitoplacenticeras*) *dolbergense* (SCHLÜTER, 1876)	48
Hoplitoplacenticeras (*Lemfoerdiceras*) *lemfoerdense* (SCHLÜTER, 1872)	20, 21, 22, 23
Pseudoxybeloceras (*Pseudoxybeloceras*) *riosi* (WIEDMANN, 1962)	29, 54, 55, 56, 57
Baculites sp.	50, 51
Scaphites gibbus SCHLÜTER, 1872	30, 31, 32, 33
Trachyscaphites spiniger spiniger (SCHLÜTER, 1872)	34, 36, 37, 68, 69

Tab. 3. The ammonite fauna of an opoka layer at the bottom of exposure 3 in Busko Zdrój; Specimen numbers in the table are last digits of complete acronym, wich is as follows: ZPAL Am. 19/

roemeri zones in the Lägerdorf and Kronsmoor scheme and from the *stobaei*/*basiplana* to *vulgaris*/*stolleyi* zones in the Lehrte West Syncline zonation (Text-fig. 2). The ammonite-bearing strata of Busko Zdrój are accordingly correlatable with a part of this interval. They thus belong to the lower, but not lowermost Upper Campanian in the standard subdivision of this stage (Text-fig. 1). In view of the lack of contradictory evidence we assume this stratigraphic position for all studied fauna and sections from Busko Zdrój.

This correlation is confirmed by the absence at Busko Zdrój of scaphitids typical of both lower and higher stratigraphic levels in northern Germany. These are *Scaphites cobbani* BIRKELUND, 1965 and *Scaphites hippocrepis* (DE KAY, 1827), typical of the Lower Campanian in northern Germany (e.g. SCHMID & ERNST 1975; WIPPICH 1995), and *Hoploscaphites greenlandicus* (DONOVAN, 1953), *Jeletzkytes compressus* (ROEMER, 1841), as well as *Trachyscaphites pulcherrimus* (ROEMER, 1841), typical of the upper Upper Campanian in northern Germany (e.g. NIEBUHR 1996; NIEBUHR & *al*. 1997; KENNEDY & KAPLAN 1997). In other words, the *hippocrepis*, *gibbus* and *compressus* zones of NIEBUHR (1996) are not recognised in Busko Zdrój. It should be noted that *Scaphites hippocrepis* III *sensu* COBBAN, 1969 has recently been reported for the first time from Poland by JAGT & *al*. (2004), from the Wolbrom-Miechów area.

Non-scaphitid ammonites common to northern Germany and Busko Zdrój seem to be less useful for correlation. This is certainly true for *Pachydiscus* (*Pachydiscus*) *subrobustus* SEUNES, 1892, *Hoplitoplacenticeras* (*Hoplitoplacenticeras*) *dolbergense* (SCHLÜTER, 1876), and *H.* (*Lemfoerdiceras*) *lemfoerdense* (SCHLÜTER, 1872). Their vertical ranges in northern Germany do not overlap (Text-fig. 2) which would suggest that the Busko Zdrój fauna is stratigraphically heterogenous. However, the German ranges of these species are intuitively too short in terms of time-duration of an average ammonite species. The co-occurrence of these species in a single opoka bed in locality 3 (Table 3) clearly confirms the partial nature of their North German record. *Tetragonites obscurus* (SCHLÜTER, 1872) is a long-ranging species (Text-fig. 2) and thus of little biostratigraphic significance. The only unquestionable record of *Lewyites elegans* (MOBERG, 1885) in northern Germany is from the lower part of the *spiniger*/*basiplana* Zone (KENNEDY & KAPLAN 1997) (Text-fig. 2). This is in accordance with the scaphitid correlation presented above.

Vistula section

In the Vistula section, *Scaphites gibbus* and *Trachyscaphites spiniger spiniger* co-occur in the *Neancyloceras phaleratum* Zone of BŁASZKIEWICZ (1980). In fact, BŁASZKIEWICZ himself described only a single specimen of *Scaphites gibbus* in his monograph (as *Trachyscaphites* (?) *gibbus*, see BŁASZKIEWICZ 1980, p. 32, pl. 13, figs 6, 8). However, POŻARYSKI (1938, p. 12) reported numerous "*Acanthoscaphites gibbus* and *Acanthoscaphites spiniger*" in his local horizon **k** from this area. The horizon **k** was included by BŁASZKIEWICZ (1980) in his *Neancyloceras phaleratum* Zone (compare POŻARYSKI 1938, fig. 1 and BŁASZKIEWICZ 1980, fig. 1; table 1 in BŁASZKIEWICZ 1980 is erroneous). The ammonite-bearing interval at Busko Zdrój can thus be correlated with the *Neancyloceras phaleratum* Zone of BŁASZKIEWICZ (1980).

The index species of the *Neancyloceras phaleratum* Zone is absent in the lower part of this zone in the Vistula sections (BŁASZKIEWICZ 1980) (in the view of KLINGER 1982, p. 237, *Hamites phaleratus* GRIEPENKERL, 1889 may actually belong to *Pseudoxybeloceras* (*Parasolenoceras*)). It is also absent in the material studied from Busko Zdrój, although the species was reported from the Miechów region by BŁASZKIEWICZ (1969). This would suggest correlation of the Busko Zdrój ammonite-bearing succesion with the lower part of the *Neancyloceras phaleratum* Zone of the Vistula section.

SYSTEMATIC PALAEONTOLOGY

The following abbreviations are used to indicate the repositories of specimens mentioned in the text:

ZPAL – Institute of Paleobiology, Polish Academy of Sciences, Warszawa, Poland.
PIB – Paläontologisches Institut, Rheinische Friedrich-Wilhelms-Universität, Bonn, Germany.
LO – Geological Institute, University of Lund, Sweden.

All dimensions are given in millimetres: D=diameter, Wb=whorl breadth, Wh=whorl height, and U=umbilical diameter. Figures in parentheses are dimensions as a percentage of diameter. The term rib index, as applied to heteromorphs, is the number of ribs in a distance equal to the whorl height at the mid-point of the interval counted.

Ammonoidea VON ZITTEL, 1884
Suborder Phylloceratina ARKELL, 1950
Superfamily Phylloceratacea VON ZITTEL, 1884
Family Phylloceratidae VON ZITTEL, 1884
Subfamily Phylloceratinae VON ZITTEL, 1884
Genus *Phylloceras* SUESS, 1866

TYPE SPECIES: *Ammonites heterophyllus* J. SOWERBY, 1820, p. 119, pl. 226; by monotypy.

Subgenus *Neophylloceras* SHIMIZU, 1934

TYPE SPECIES: *Ammonites* (*Scaphites*?) *ramosus* MEEK, 1857, p. 45, by original designation.

Phylloceras (*Neophylloceras*) cf. *bodei* MÜLLER & WOLLEMANN, 1906
(Pl. 1, Figs 1, 7)

compare:

1906. *Schlüteria bodei* MÜLLER & WOLLEMANN, p. 13, pl. 8, figs 1, 2.
1925. *Phylloceras bodei* MÜLLER & WOLLEMANN; DIENER, p. 41.
1964. *Phylloceras velledaeformis* (SCHLÜT); GIERS (*non* SCHLÜTER), p. 255.
1995. *Phylloceras* (*Hypophylloceras*) *rousseli* (DE GROSSOUVRE, 1894); LOMMERZHEIM, p. 44, text-fig. 13c, pl. 7, fig. 2.
1995. *Phylloceras* (*Hypophylloceras*) cf. *velledaeformis* (SCHLÜTER, 1871); LOMMERZHEIM, p. 44, pl. 7, fig. 1.
1996. *Phylloceras* (*Neophylloceras*) *bodei* (MÜLLER & WOLLEMANN, 1906); KAPLAN & *al.* p. 26, pl. 1, figs 15-21.

TYPES: Lectotype, by the subsequent designation of KAPLAN & *al.* (1996, p. 26), is the original of MÜLLER & WOLLEMANN (1906, pl. 8, fig. 1) from Broitzem; a figured paralectotype (MÜLLER & WOLLEMANN 1906, pl. 8, fig. 2) is from 'Aktienziegelei bei Braunschweig'.

MATERIAL: Single specimen, ZPAL Am. 19/6.

DESCRIPTION: A 25 mm long fragment of venter and flank, not preserving the umbilical region has the fine, even lirae of a *Phylloceras* (*Neophylloceras*), and can best be compared with *P.* (*N.*) *bodei* specimens from the Lower Campanian of the Münster Basin, Germany (KAPLAN & *al*. 1996, p. 26, pl. 1, figs 15-21).

OCCURRENCE: Lower Upper Campanian of Busko Zdrój, locality 3.

Suborder Lytoceratina HYATT, 1889
Superfamily Tetragonitaceae HYATT, 1900
Family Tetragonitidae HYATT, 1900
Genus *Tetragonites* KOSSMAT, 1895
(= *Epigoniceras* SPATH, 1925; *Carinites* WIEDMANN, 1973)

TYPE SPECIES: *Ammonites timotheanus* PICTET, 1847, p. 295, pl. 2, fig. 6; pl. 3, figs 1, 2; by original designation.

Tetragonites obscurus (SCHLÜTER, 1872)
(Pl. 1, Figs 2, 4-6, 9-17)

1872. *Ammonites obscurus* SCHLÜTER, p. 70, pl. 22, fig. 9, 10.
1984. *Tetragonites* cf. *obscurus* (SCHLÜTER, 1872); KENNEDY & SUMMESBERGER, p. 153, pl. 2, figs 10-12.
1994. *Tetragonites obscurus* (SCHLÜTER); HAUSCHKE, p. 6, figs 6, 8.
1995. *Tetragonites obscurus* (SCHLÜTER, 1872); KENNEDY & KAPLAN, p. 17.
1995. *Tetragonites obscurus* (SCHLÜTER, 1872); WIPPICH, p. 50, text-figs 4, 5; pl. 1, figs 3, 4, 5-6, 7-8, 9-12.
1995. *Tetragonites obscurus* (SCHLÜTER, 1872); LOMMERZHEIM, p. 46, text-fig. 13e; pl. 3, figs 5-7.
1996. *Tetragonites obscurus* (SCHLÜTER, 1872a); KAPLAN & *al*., p. 26, pl. 1, figs 1-5, 7-15.

TYPES: Lectotype, by the subsequent designation of KAPLAN & *al*. (1996, p. 26), is the original of SCHLÜTER (1872, pl. 22, fig. 9, 10) from the Upper Campanian of Coesfeld, Westphalia. PIB 55b is a paralectotype, from the Campanian of Duvenbeck. The specimens were reillustrated by WIPPICH (1995, text-figs 5a-f) and KAPLAN & *al.* (1996, pl. 1, figs 1, 3; 10-12).

MATERIAL: Six specimens, ZPAL Am. 19/1-5, 9.

DESCRIPTION: Specimens range from 15-50 mm in diameter. All are distorted to varying degrees due to *post-mortem* crushing. Coiling is moderately evolute. The umbilicus comprises approximately 33% of the diameter, with a flattened, outward-inclined wall, and narrowly rounded umbilical shoulder. Specimen ZPAL Am. 19/9 (Pl. 1, Figs 12-14) may retain the original whorl section. The whorl breadth to height ratio is 1.4, the inner flanks broadly rounded, outer flanks convergent, ventrolateral shoulders broadly rounded, the venter broad, and very feebly convex. Under oblique light, a low, rounded siphonal ridge, plus one or two weaker ridges on the ventrolateral shoulders can be detected in some specimens. Specimen ZPAL Am. 19/4 (Pl. 1, Figs 15-17) is a complete adult, the aperture marked by a prorsiradiate constriction. There is no other ornament.

DISCUSSION: As noted by KAPLAN & *al.* (1996, p. 26), COLLIGNON (1961, p. 95) suggested that SCHLÜTER's *Ammonites obscurus* might be a *Damesites* of the Desmoceratidae, but proportions and suture suggest Tetragonitidae. The rather slender whorls and ventral ridges recall *Saghalinites* WRIGHT & MATSUMOTO, 1954, but this has very evolute coiling, trapezoidal whorls and numerous strong prorsiradiate constrictions (KENNEDY & KLINGER 1977; KENNEDY & HENDERSON 1992; BIRKELUND 1993).

OCCURRENCE: Lower Lower Campanian to lower Upper Campanian (*granulataquadrata* to *conica*/*senior* zones) of Münsterland, Westphalia, Germany (WIPPICH

1995, KAPLAN & *al*. 1996; KAPLAN & *al*. in press); possibly from the Upper Campanian of the Gschliefgraben, Austria. In Poland, lower Upper Campanian of Busko Zdrój, locality 3 (specimens ZPAL Am. 19/1-5); specimen ZPAL Am. 19/9 lacks precise provenance data.

Suborder Ammonitina HYATT, 1889
Superfamily Desmoceratacеae VON ZITTEL, 1895
Family Desmoceratidae VON ZITTEL, 1895
Genus *Desmophyllites* SPATH, 1929

TYPE SPECIES: *Desmoceras larteti* SEUNES, 1891, p. 19, pl. 12 (2), fig. 2; pl. 13 (3), figs 2, 3.

Desmophyllites sp.
(Pl. 1, Figs 3, 8)

MATERIAL: Two specimens, ZPAL Am. 19/7 and 8.

DESCRIPTION: The two specimens are very crushed laterally. The better preserved ZPAL Am. 19/8 is 16.8 mm in diameter. Coiling is very involute, with a minute umbilicus. The original proportions and whorl section cannot be established with certainty, although the inner to mid-flank region appears to have been flattened, with rounded ventrolateral shoulders and venter. There is no ornament.

DISCUSSION: Of contemporary genera, only *Desmophyllites* combines the distinctive involute, high-whorled shell form with lack of ornament, as shown by these specimens.

OCCURRENCE: Lower Upper Campanian of Busko Zdrój, locality 2 (specimen ZPAL Am. 19/7); specimen ZPAL Am. 19/8 is without precise location.

Family Pachydiscidae SPATH, 1922
Genus and subgenus *Pachydiscus* VON ZITTEL, 1884

TYPE SPECIES: *Ammonites neubergicus* VON HAUER, 1858, p. 12, pl. 2, figs 1-3; pl. 3, figs 1, 2, by the subsequent designation of DE GROSSOUVRE, 1894, p. 177.

Pachydiscus (*Pachydiscus*) *subrobustus* SEUNES, 1892
(Pl. 1, Figs 18, 19; Pl. 2, Figs 1-7; Pl. 3, Figs 1-3; Pl. 4, Fig. 7; Pl. 5, Fig. 5)

1892. *Pachydiscus subrobustus* SEUNES, p. 15, pl. 13(4), fig. 1.
1894. *Pachydiscus subrobustus* SEUNES; DE GROSSOUVRE, p. 200, pl. 36, fig. 2.
1910. *Pachydiscus subrobustus* SEUNES; FRECH, p. 4, pl. 1, fig. 1; text-figs 2, 3.
1913. *Pachydiscus subrobustus* SEUNES; NOWAK, p. 357, pl. 41, fig. 15.
1925. *Pachydiscus subrobustus* SEUNES; DIENER, p. 108.
non 1951. *Pachydiscus subrobustus* SEUNES; MIKHAILOV, p. 70, pl. 9, figs 43, 44.
1952. *Pachydiscus subrobustus* SEUNES; COLLIGNON, p. 92.
1952. *Pachydiscus subrobustus* SEUNES; COLLIGNON, p. 83.
1964. *Pachydiscus subrobustus* SEUNES; GIERS, p. 265, pl. 5, fig. 3 (pars).
non 1971. *Pachydiscus subrobustus* SEUNES; COLLIGNON, p. 34, pl. 454, fig. 2411.
1974. *Pachydiscus subrobustus* SEUNES; NAIDIN, p. 185, pl. 65, fig. 1; text-fig. 33.
1984. *Pachydiscus* cf. *subrobustus* SEUNES, 1891; KENNEDY & SUMMESBERGER, p. 161, pl. 8, fig. 4.
1993. *Pachydiscus* (*Pachydiscus*) cf. *subrobustus* SEUNES, 1892; HANCOCK & KENNEDY, p. 161; pl. 3, figs 2, 3.
1995. *Pachydiscus* (*Pachydiscus*) *subrobustus* SEUNES, 1892; JAGT & *al*., p. 55, pl. 1, figs 1-3; pl. 2, fig. 6.
1996. *Pachydiscus* (*Pachydiscus*) *subrobustus* SEUNES, 1892; KAPLAN & *al*., p. 28, pl. 2, figs 1, 2; pl. 3, figs 1-4; pl. 4, figs 1, 2.
2001. *Pachydiscus subrobustus* SEUNES, 1892; COURVILLE & ODIN, p. 534, pl. 4, fig. 30, 31.

TYPE: Lectotype, by the subsequent designation of KENNEDY & SUMMESBERGER (1984, p. 161), is the original of SEUNES (1892, pl. 13(4), fig. 1), from the Upper Campanian of Tercis, Landes, France. The specimen has not been traced.

MATERIAL: Eight specimens, ZPAL Am. 19/10-15, 44, 45.

DESCRIPTION: All specimens have suffered *post-mortem* crushing. Coiling is moderately involute, with over 70% of the previous whorl covered. The umbilicus comprises around 20% of the diameter, is of moderate depth, with a feebly convex wall, and more narrowly rounded umbilical shoulder. The least-deformed specimen, ZPAL Am. 19/15 (Pl. 3) has a whorl breadth to height ratio of 0.89, with broadly rounded flanks, converging to a rounded venter. Specimens ZPAL Am. 19/10 and ZPAL Am. 19/11 (Pl. 2, Fig. 3; Pl. 5, Fig. 5) show the ornament at diameters of 55-75 mm. Primary ribs arise at the umbilical seam and strengthen across the umbilical wall and shoulder, developing into widely separated, incipiently bullate primary ribs. These are straight and prorsiradiate on the inner flank, where they commonly bifurcate. Additional long ribs arise on the umbilical shoulder but initially are very weak, while shorter ribs intercalate on the outer flank. The ribs flex back and are

concave on the middle and outer flanks, strengthening, and projecting forwards across the ventrolateral shoulder, to cross the venter in a broad convexity. Specimen ZPAL Am. 19/10 has a total of 42-46 ribs at the ventrolateral shoulder at a diameter of 75 mm. Larger specimens (Pl. 2, Figs 5-7; Pl. 3, Figs 1-3; Pl. 4, Fig 7) range up to 130 mm diameter. Specimen ZPAL Am. 19/15 has a total of approximately 40 ribs at this diameter, of which 21 are primary and well-developed on the umbilical shoulder, the branching pattern essentially the same as in the juveniles. Specimen ZPAL Am. 19/13 (Pl. 2, Figs 5-7) has crowded, subdued ornament (in part a *post-mortem* effect). Specimen ZPAL Am. 19/14 (Pl. 4, Fig. 4) has suffered artificial modelling of the earliest whorls, but the actual ornament is well preserved on the outer whorl. The branching pattern is well displayed on the adapical half of the outer whorl; there is a total of 44-46 ribs per whorl at the ventrolateral shoulder.

What appears to be the microconch of the species is represented by specimen ZPAL Am. 19/12 (Pl. 2, Figs 1, 2). A 240° section of crushed outer whorl is preserved, deformed into an ellipse with a maximum diameter of 45 mm. Six primary ribs arise at the umbilical seam on the last half whorl, and strengthen across the umbilical wall and shoulder, developing into an incipient bulla. The ribs bifurcate low on the flank at the smallest diameter preserved, but for most of the specimen, primary ribs are separated by a long intercalated rib. All ribs bear a ventral tubercle, comma-shaped at the smallest preserved diameter, but enlarging progressively and becoming conical. Tubercles are linked across the venter by a coarse, incipiently looped transverse rib, with occasional single weak ventral ribs between the tuberculate ones.

DISCUSSION: *P.* (*P.*) *subrobustus* is a Late Campanian species. However, records by MIKHAILOV (1951, pp. 70-71) are from the Maastrichtian. He reported two specimens of the species. One is from "the Maastrichtian of Caucasus" (MIKHAILOV 1951, pl. 9, figs 43, 44). The other specimen (not illustrated) is from the "Upper Maastrichtian of Crimea", where it was found together with "*P. neubergicus* HAUER, *Discoscaphites constrictus* and *Belemnitella americana* Arkh. (non Mort.)" (MIKHAILOV 1951, p. 71). The latter taxon is actually *Belemnella kazimiroviensis*, the upper Upper Maastrichtian belemnite zonal marker. The illustrated specimen does not resemble Campanian material, having straight ribs, rather than concave on outer flanks and convex over the venter. It may be allied to *Pachydiscus* (*P.*) *noetlingi* KENNEDY, 1999, known up to date only from the Upper Maastrichtian deposits of Balochistan, Pakistan, and of the Maastricht area, the Netherlands (see FATMI & KENNEDY 1999; JAGT & KENNEDY 2003).

Additionally, the specimen referred to as *P. neubergicus* from the Upper Maastrichtian of Crimea by MIKHAILOV (1951, pl. 7, fig. 36) seems to be only distantly related to the "type population" of the species from Neuberg, Steiermark, Austria, as described by KENNEDY & SUMMESBERGER (1986) and may be also a close ally of *Pachydiscus* (*P.*) *noetlingi* KENNEDY, 1999. The same may hold true for other specimens identified as *Pachydiscus neubergicus* (VON HAUER, 1858) from the upper Upper Maastrichtian of Crimea, described and illustrated by ARKADIEV & *al*. (2000, p. 112, pl. 14, figs 1, 2).

OCCURRENCE: The type material of *P.* (*P.*) *subrobustus* is from the Upper Campanian of Tercis (Landes, France), and there are also records from the Gschliefgraben in Upper Austria, southern Limburg in the Netherlands, and Pontus in Turkey. In Germany, the species occurs in the upper part of the lower Upper Campanian Vorhelmer Schichten of Münsterland (*vulgaris/basiplana* Zone, see KAPLAN & *al*. 1996). In Poland, the species was formerly recorded from the upper Lower Campanian of Wierzchowisko near Wolbrom, Nida Trough (see NOWAK 1913, and RUTKOWSKI 1965, fig. 1, for location and stratigraphy). The present specimens are from the lower Upper Campanian of Busko Zdrój. Specimens ZPAL Am. 19/10 and ZPAL Am. 19/44 are from locality 3; the remainder of the material is without precise locality data.

Pachydiscus (*Pachydiscus*) cf. *subrobustus* SEUNES, 1892
(not figured)

MATERIAL: Two specimens, ZPAL Am. 19/16-17.

DESCRIPTION AND DISCUSSION: The maximum diameter of specimen ZPAL Am. 19/17 is 205 mm, and that of ZPAL Am. 19/16 is 264 mm. Both specimens are wholly septate and most of their surface is heavily worn. The shell proportions and the details of the ornament preserved are consistent with those of *P.* (*P.*) *subrobustus*.

OCCURRENCE: Lower Upper Campanian of Busko Zdrój, locality 1.

Superfamily Hoplitaceae H. DOUVILLÉ, 1890
Family Placenticeratidae MEEK, 1876
Genus and Subgenus *Hoplitoplacenticeras* PAULCKE, 1907
(ICZ Name no. 1345)
(= *Dechenoceras* KAYSER, 1924, p. 175)

TYPE SPECIES: *Hoplites-Placenticeras plasticus* PAULCKE, 1907, p. 186: ICZN Opinion 555, name no. 1629.

DISCUSSION: See KENNEDY (1986, p. 63) for diagnosis and discussion of *Hoplitoplacenticeras* and its subgenera, and KAPLAN & *al.* (1996) for a comprehensive description and discussion of *H.* (*H.*) *vari* (SCHLÜTER, 1872), *H.* (*H.*) *costulosum* (SCHLÜTER, 1867); *H.* (*H.*) *coesfeldiense* (SCHLÜTER, 1867) and *H. dolbergense* (SCHLÜTER, 1876).

Hoplitoplacenticeras (*Hoplitoplacenticeras*) *dolbergense*
(SCHLÜTER, 1876)
(Pl. 4, Fig. 1)

1867. *Ammonites Coesfeldiensis* SCHLÜTER, p. 14, pl. 1, fig. 5 only.
1872. *Ammonites Coesfeldiensis* SCHLÜTER; SCHLÜTER, p. 56 (pars), pl. 17, figs 1-3.
1876. *Ammonites Dolbergensis* SCHLÜTER, p. 159, pl. 44, figs 1-4.
1894. *Hoplites dolbergensis* SCHLÜTER; DE GROSSOUVRE, p. 119.
1938. *Hoplitoplacenticeras dolbergense* SCHLÜTER; ROMAN, p. 506.
1938. *Hoplitoplacenticeras Coesfeldiense* SCHLÜTER; ROMAN, p. 506, pl. 53, figs 492, 492a; 492 on p. 508.
1951. *Hoplitoplacenticeras coesfeldiense* SCHLÜTER var. *schlüteri*; MIKHAILOV, p. 82, pl. 15, figs 60-61.
1959. *Hoplitoplacenticeras coesfeldiense* (SCHLÜTER) var. *schlüteri* MIKHAILOV; NAIDIN & SHIMANSKIJ, p. 193, pl. 15, fig. 2.
1964. *Hoplitoplacenticeras dolbergense* (SCHLÜT.); GIERS, p. 271, pl. 6, figs 2-7; pl. 7, fig. 1; text-fig. 7.
1973. *Hoplitoplacenticeras* cf. *H. coesfeldiense* var. *schlüteri* MIKHAILOV; COBBAN, p. C60, fig. 76.1.
1974. *Hoplitoplacenticeras coesfeldiense coesfeldiense* (SCHLÜTER, 1867); NAIDIN, p. 187 (pars), pl. 69, fig. 3 only.
1975. *Hoplitoplacenticeras dolbergense* (SCHLÜTER, 1876); SCHMID & ERNST, p. 346.
1986. *Hoplitoplacenticeras dolbergense* (SCHLÜTER, 1876); KENNEDY, p. 76, pl. 11, figs 1, 2.
1996. *Hoplitoplacenticeras* (*Hoplitoplacenticeras*) *dolbergense* (SCHLÜTER, 1876); KAPLAN & *al*., p. 39, pl. 25, figs 3, 4; pl. 26, fig. 5; pl. 27, figs 3, 4; pl. 28, figs 1-5; pl. 29, figs 1-4; pl. 30, figs 1-5; pl. 31, figs 1-9; pl. 32, figs 4, 5.

TYPES: Lectotype, by the subsequent designation of KENNEDY (1986, p. 64), is PIB 90b, the original of SCHLÜTER (1876, pl. 44, figs 2, 3, ?4) from Ahlen-Dolberg, Westphalia. Paralectotype PIB 90 is the original of SCHLÜTER (1876, pl. 44, fig. 1) from Darup, Westphalia.

MATERIAL: A single specimen, ZPAL Am. 19/48.

DESCRIPTION: Specimen ZPAL Am. 19/48 is an incomplete juvenile with an original estimated diameter of 30 mm. Primary ribs arise from small, sharp umbilical bullae, and are narrow, distant, straight, prorsiradiate, and wiry on the flanks. They increase by branching low on the flank, so that there are three times as many ribs at the ventrolateral shoulder as at the umbilical margin. The ribs are flexuous on the outer flank, projecting forwards and concave across the ventrolateral shoulder. Some, but not all, develop small inner ventrolateral clavi, and pairs of ribs link at much coarser outer ventrolateral clavi.

DISCUSSION: This small specimen differs from the other *Hoplitoplacenticeras* from Busko Zdrój in lacking the additional ventral rows of tubercles. It closely resembles the smallest specimen from Coesfeld figured by SCHLÜTER (1872, pl. 17, fig. 3).

OCCURRENCE: Lower Upper Campanian Beckum-Schichten of the Münster Basin (*conica*/*mucronata* Zone), and lower Upper Campanian of Coesfeld in Westphalia, Germany (see KAPLAN & *al.* 1996). Lower Upper Campanian (*conica*/ *mucronata* Zone) of Lehrte West Syncline, Lower Saxony, Germany (SCHMID & ERNST 1975). Aquitaine Basin in France, Zeven Wegen Chalk of Limburg, the Netherlands, and the Ukraine (Donbass). The present specimen is from the lower Upper Campanian of Busko Zdrój, locality 3.

Hoplitoplacenticeras (*Hoplitoplacenticeras*) sp.
(Pl. 4, Fig. 6)

MATERIAL: A single specimen, ZPAL Am 19/18.

DESCRIPTION: This specimen is a laterally heavily crushed composite mould, with an original maximum diameter of 100-110 mm. Coiling is involute, the umbilicus comprising an estimated 18% of the diameter. The original whorl section cannot be determined. Ornament is of low, relatively broad primary ribs that arise on the umbilical shoulder. There are no obvious umbilical bullae, but this may be due to mechanical cleaning of the umbilicus. In some cases ribs appear to arise in pairs at the umbilical shoulder, while intercalated ribs arise around mid-flank. The ribs are prorsiradiate and straight, broadening across the flanks, becoming concave and flexing forwards on the outermost flank and ventrolateral shoulder. There are equivocal suggestions of inner and outer ventrolateral tubercles. Apart from these ribs, the limonitic film that coats the specimen picks out a pattern of delicate lirae and striae, parallel to the ribs. These are only preserved in patches, and are not associated with any relief on the surface of the mould, being invisible when the specimen is coated with ammonium chloride.

DISCUSSION: Proportions, and ornament, so far as this is preserved, suggest a *Hoplitoplacenticeras* (*Hoplitoplacenticeras*). If the delicate ornament of lirae and striae is an original feature, the group of *H.* (*H.*) *vari* (SCHLÜTER, 1867) – *H.* (*H.*) *costulosum* (SCHLÜTER,

1867) is indicated. The specimen is, however, specifically indeterminate.

OCCURRENCE: Lower Upper Campanian of Busko Zdrój, locality 2.

Subgenus *Hoplitoplacenticeras* (*Lemfoerdiceras*) KENNEDY, 1986

TYPE SPECIES: *Ammonites lemfoerdensis* SCHLÜTER, 1872, p. 92, by original designation by KENNEDY (1986, p. 66).

Hoplitoplacenticeras (*Lemfoerdiceras*) *lemfoerdense* (SCHLÜTER, 1872)
(Pl. 4, Figs 2-4; Pl. 5, Figs 1-4)

1872. *Ammonites scaphitoides* SCHLÜTER, p. 63, pl. 19, figs 1, 2.
1872. *Ammonites lemfoerdensis* SCHLÜTER, p. 92.
1876. *Ammonites lemfoerdensis* SCHLÜTER; SCHLÜTER, p. 160, pl. 44, figs 8, 9.
1964. *Hoplitoplacenticeras lemfoerdense* (SCHLÜTER); GIERS, p. 281, pl. 8, fig. 2.
1986. *Hoplitoplacenticeras* (*Lemfoerdiceras*) *lemfoerdense* (SCHLÜTER, 1872b); KENNEDY, p. 66, text-fig. 29a, b.
1997. *Hoplitoplacenticeras* (*Lemfoerdiceras*) *lemfoerdense* (SCHLÜTER, 1872b); KENNEDY & KAPLAN, p. 51, pl. 38, figs 1,2,4.

TYPE: The holotype is PIB 50a, the original of SCHLÜTER, 1872, pl. 19, figs 1, 2, from Haldem, figured here as Text-fig. 3 A-C.

MATERIAL: Eight specimens, ZPAL Am. 19/19-23, 46, 47, 49.

DESCRIPTION: The holotype (Text-fig. 3A-C) is somewhat distorted composite mould (SCHLÜTER's figure is highly restored). Coiling is moderately evolute. The umbilicus comprises 22% of the diameter, shallow, with an outward-inclined, low wall. The whorl section is compressed, with a whorl breadth to height ratio of 0.58, the greatest breadth low on the flanks. The inner flanks are feebly convex, the outer flanks flattened and convergent, the ventrolateral shoulders broadly rounded, the venter flattened. Ornament consists of dense, narrow, crowded ribs. These arise at the umbilical seam and are feebly concave across the umbilical shoulder, straight and prorsira-

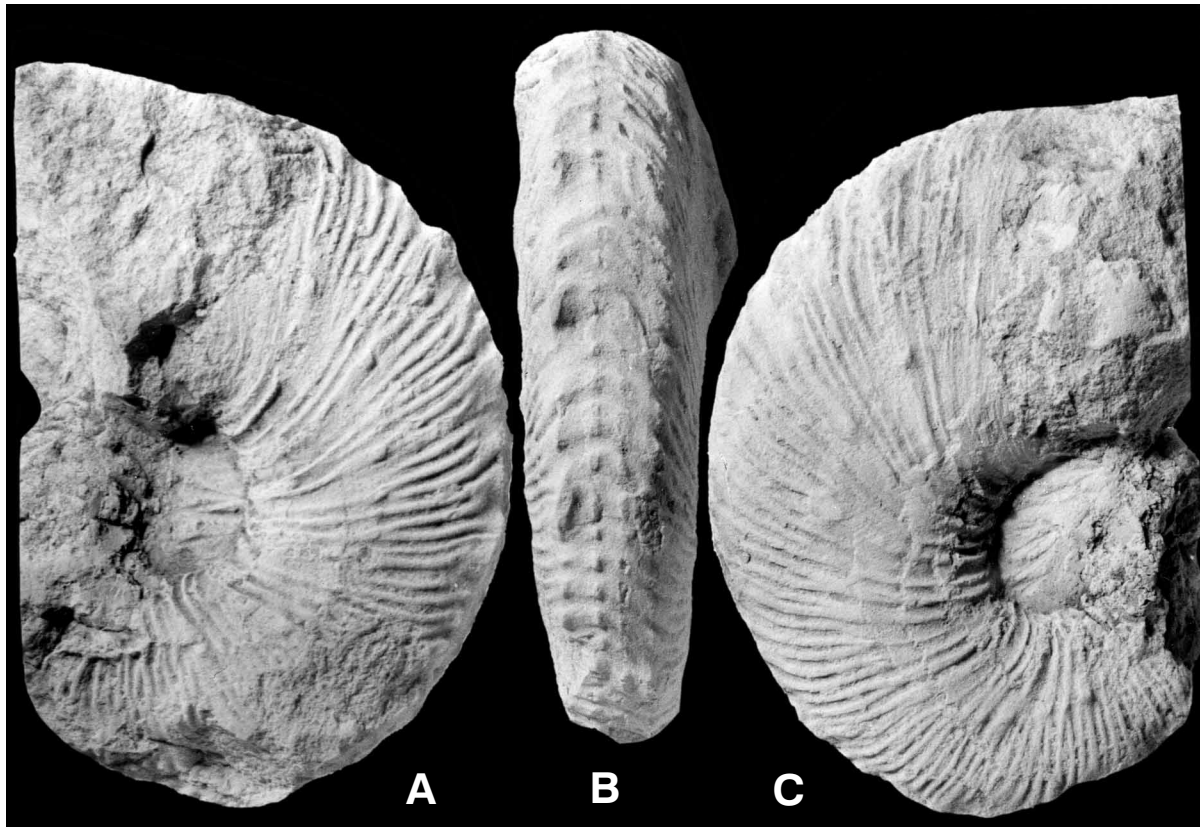

Fig. 3. A-C. *Hoplitoplacenticeras* (*Lemfoerdiceras*) *lemfoerdense* (SCHLÜTER, 1872), the holotype PIB 50a, the original of SCHLÜTER (1872, pl. 19, figs 1, 2), from Haldem, Westphalia, Germany; nat. size

diate on the inner and middle flanks, projected forwards and feebly concave on the outermost flank. At the smallest diameter visible, all ribs bear a feeble lateral tubercle from which most bi-, or, rarely, trifurcate, while there are also additional intercalated ribs. There are thus many more ribs on the outer flank than the inner. Almost all ribs bear small inner ventrolateral tubercles. Single ribs link to small outer ventrolateral tubercles, while two or three ribs link to much larger clavi; large and small outer ventrolateral tubercles alternate irregularly on the venter. Delicate ribs extend across the venter to a row of small equal ventral tubercles on either side of the midventral line. As size increases, the lateral tubercles migrate outwards and decline in number, with up to four nontuberculate ribs separating successive tuberculate ones. Ribs continue to bi- and trifurcate from these tubercles; the ribs between branch both high and low on the flank and intercalate. A marked decline in tubercles and rib strength at the adapertural end of the side not figured by SCHLÜTER (Text-fig. 3c) indicates the specimen to be a near-complete adult. A few ribs on the outer whorl bear a feeble inner lateral tubercle; a few ribs and additional outer lateral tubercle close to the ventrolateral shoulder.

Specimen ZPAL Am. 19/23 (Pl. 4, Fig. 2), although somewhat battered and worn, shows exactly the same pattern of crowded wiry ribbing as the holotype, with a small lateral tubercle from which ribs bi- and trifurcate, small inner ventrolateral tubercles, which give rise to single ribs that link either singly to small outer ventrolateral tubercles, or in groups to much larger outer ventrolateral clavi, so that the tubercles in the outer ventrolateral row are of disparate sizes, large clavi separated by several much smaller tubercles. Delicate ribs link to two rows of small equal ventral clavi, well seen at the smallest preserved diameter. Specimen ZPAL Am. 19/19 (Pl. 5, Fig. 2) preserves what may be the adult aperture, showing a decline and loss of ventral and ventrolateral tuberculation, the venter now crossed by wiry, convex ribs. ZPAL Am. 19/47 (Pl. 4, Fig. 4) is a somewhat more finely ribbed than the material described above, and is preserved to a diameter of 45 mm, with greatly reduced lateral and inner ventrolateral tubercles, but characteristic outer ventrolateral plus ventral rows. ZPAL Am. 19/22 is still more finely ribbed (Pl. 4, Fig. 3), with minute or no lateral and inner ventrolateral tubercles, but the same characteristic outer ventrolateral and ventral rows, which also permit assignation of juveniles (Pl. 5, Figs 1, 3, 4) to the species. ZPAL Am. 19/20 (Pl. 5, Fig. 1) has well-developed long spines on the larger outer ventrolateral tubercles.

OCCURRENCE: Upper Upper Campanian of Stemweder Berg, Westphalia, Germany (high in the *roemeri* Zone and low in the *polyplocum* Zone, see KENNEDY & KAPLAN 1997; *Hoplitoplacenticeras* (*Lemfoerdiceras*) aff. *lemfoerdense* is recorded from the basal *spiniger/basiplana* Zone, *ibidem*). In Poland, lower Upper Campanian of Busko Zdrój. The specimens ZPAL Am. 19/19-23 are from locality 3; the remainder of the material is without precise locality data.

Suborder Ancyloceratina WIEDMANN, 1966
Superfamily Turrilitaceae GILL, 1871
Family Diplomoceratidae SPATH, 1926
Subfamily Diplomoceratinae SPATH, 1926
Genus *Glyptoxoceras* SPATH, 1925

TYPE SPECIES: *Hamites rugatus* FORBES, 1846, p. 117, pl. 11, fig. 2, by original designation by SPATH (1925, p. 30).

Glyptoxoceras cf. *retrorsum* (SCHLÜTER, 1872)
(Pl. 6, Fig. 5)

1872. *Ancyloceras retrorsum* SCHLÜTER, p. 97, pl. 30, figs 5-10.
1889. *Ancyloceras retrorsum* SCHLÜTER; GRIEPENKERL, p. 105.
1905. *Ancyloceras retrorsum* SCHLÜTER; WEGNER, p. 210.
non 1913. *Ancyloceras retrorsum* SCHLÜTER; NOWAK, p. 383, pl. 40, figs 1, 5.
1925. *Ancyloceras retrorsum* SCHLÜTER; DIENER, p. 194.
1925. *Glyptoxoceras retrorsum* SCHLÜTER; SPATH, p. 31.
1951. *Ancyloceras retrorsum* SCHLÜTER; MIKHAILOV, p. 87, pl. 5, fig. 32; pl. 13, fig. 56.
1959. *Neancyloceras retrorsum* (SCHLÜTER); NAIDIN & SHIMANSKIJ, p. 182, pl. 3, fig. 7.
1976. *Glyptoxoceras retrorsum* (SCHLÜTER); ATABEKIAN & KHAKHIMOV, p. 61, pl. 10, fig. 3; pl. 11, fig. 1.
1980. *Glyptoxoceras retrorsum* (SCHLÜTER, 1872); BŁASZKIEWICZ, p. 28, pl. 55, figs 3-5.
1984. *Neoglyptoxoceras*? cf. *retrorsum* (SCHLÜTER, 1872); KENNEDY & SUMMESBERGER, p. 168, pl. 6, fig. 1.
1986. *Neoglyptoxoceras* (?) *retrorsum* (SCHLÜTER, 1872a); KENNEDY, p. 106, pl. 16, figs 1-4, 6, 7; pl. 17, figs 1, 2; text-fig. 38.
1988. *Neoglyptoxoceras retrorsum* (SCHLÜTER); THOMEL, p. 21, pl. 1, fig. 2, pl. 4, fig. 4, pl. 21, fig. 2, text-figs 7-10.
1993. *Glyptoxoceras retrorsum* (SCHLÜTER, 1872); KENNEDY, p. 108, pl. 4, figs 1-9, 11-19; 25, 26.
1995. *Glyptoxoceras retrorsum* (SCHLÜTER, 1872); WIPPICH, p. 58, pl. 7, figs 1-9; pl. 8, fig. 8; pl. 9, figs 1, 2.
1996. *Glyptoxoceras* cf. *retrorsum* (SCHLÜTER, 1872); KAPLAN & *al*., p. 42, pl. 33, figs 1-4; pl. 38, fig. 4.
1997. *Glyptoxoceras* cf. *retrorsum* (SCHLÜTER, 1872a); KENNEDY & KAPLAN, p. 59, pl. 5, fig. 3.
1999. *Glyptoxoceras* ex. gr. *retrorsum* (SCHLÜTER); HAUSCHKE & *al*., pl. 4, fig. 3.

TYPES: Lectotype, by the subsequent designation of SPATH (1925, p. 31, footnote), is PIB 67, the original of SCHLÜTER (1872, pl. 30, figs 5-7) from the Upper Campanian of Coesfeld, Westphalia, Germany. The smaller figured paralectotype of SCHLÜTER (1872, pl. 30, fig. 8) is PIB 67b from the same horizon and locality (see KENNEDY 1986, text-fig. 38).

MATERIAL: A single specimen, ZPAL Am. 19/25.

DESCRIPTION: A very crushed, curved fragment is 52 mm long, with a whorl height of c. 10 mm. The ribs are weakened and feebly convex on the dorsum, strengthen on the dorsolateral margin, and are markedly rursiradiate on the flank.

DISCUSSION: The fragment compares well with the juvenile paralectotype of the species (KAPLAN & *al.* 1996, pl. 33, fig. 1).

Glyptoxoceras retrorsum (SCHLÜTER, 1872) is a Campanian species. However, a juvenile specimen referred to as *Anisoceras retrorsum* by NOWAK (1913, pl. 40, fig. 1) comes from "obersten Mukronatenkreide von Lemberg" and thus, from the lower Upper Maastrichtian (*Belemnitella junior* Zone). Another specimen of NOWAK (1913, pl. 40, fig. 5) comes from Nagórzany (Nagoriany or Nagoryany of authors, lower Lower Maastrichtian in belemnite terms). Both specimens of NOWAK (1913) should be probably referred to *Glyptoxoceras rugatum* (FORBES, 1846), as revised by KENNEDY & HENDERSON (1992), although we are unable to confirm this without having seen the original material.

OCCURRENCE: The species occurs widely in the Lower Campanian of the Münster Basin, and there are also records from Lower and Upper Campanian of Lower Saxony, Germany, the Lower Campanian of northern Spain, and the Upper Campanian of the Mons Basin in Belgium, the Gschliefgraben in Austria; Aquitaine and Alpes-Maritimes in France, European Russia, Armenia, Caucasus and Turkmenia. In Poland, the species was formerly reported from the lower Lower Campanian *Gonioteuthis quadrata* Zone, Vistula sections (BŁASZKIEWICZ 1980). Lower Upper Campanian of Busko Zdrój, without precise locality data.

Glyptoxoceras sp.
(not figured)

MATERIAL: A single specimen ZPAL Am. 19/52

DESCRIPTION: A badly crushed curved fragment, 21 mm long, with a maximum preserved whorl height of 11 mm. There are 12 irregularly spaced, almost rectiradiate ribs.

OCCURRENCE: Lower Upper Campanian of Busko Zdrój, without precise locality data.

Genus *Lewyites* MATSUMOTO & MIYAUCHI, 1984

TYPE SPECIES: *Idiohamites* (?) *oronensis* LEWY, 1969, p. 127, pl. 3, figs 10, 11, by original designation by MATSUMOTO & MIYAUCHI (1984, p. 64).

Lewyites elegans (MOBERG, 1885)
(Pl. 5, Figs 6, 7; Pl. 6, Figs 1-3; Pl. 8, Fig. 15)

1885. *Scaphites* ? MOBERG, p. 30, pl. 3, fig. 11.
1885. *Ancyloceras* ? *elegans* MOBERG, p. 30, pl. 3, fig. 10.
1885. *Helicoceras* ? sp. MOBERG, p. 33.
1913. (?) *Anisoceras elegans* MOBERG sp.; NOWAK, p. 384, pl. 40, fig. 7.
1986. *Neocrioceras* (*Schlueterella*)? *elegans* (MOBERG, 1885); KENNEDY, p. 102, pl. 17, figs 3-6.
1997. *Lewyites elegans* (MOBERG, 1885); KENNEDY & CHRISTENSEN, p. 106, figs 22-23.
1997. *Lewyites elegans* (MOBERG, 1885); KENNEDY & KAPLAN, p. 57, pl. 58, figs 1-5; pl. 59, figs 1, 2; pl. 60, figs 1-5.
?1997. *Lewyites elegans* (MOBERG, 1885); NIEBUHR & *al*., p. 220, pl. 3, fig. 3.
2004. *Lewyites elegans* (MOBERG, 1885); JAGT & *al*., p. 576, pl. 1, fig. 8.

TYPE: Holotype by monotypy, is the original of MOBERG (1885, pl. 3, fig. 10) in the Collections of Lund University, no. LO731T (KENNEDY & CHRISTENSEN 1997, fig. 22a, b; KENNEDY & KAPLAN 1997, pl. 58, figs 3, 4) from the lower Upper Campanian of Köpinge, Sweden.

MATERIAL: Four specimens, ZPAL Am. 19/ 72-75.

DESCRIPTION: All specimens are moulds that have suffered significant lateral crushing. Specimen ZPAL Am. 19/74 (Pl. 6, Figs 1-3) is a curved fragment 100 mm long, with a maximum preserved whorl height of 22.5 mm. The whorl section is compressed oval, the compression accentuated by *post-mortem* crushing. The rib index is 9. The ribs are rounded and relatively coarse, well-developed and transverse on the dorsum, recti- to feebly rursiradiate on the flanks, and very feebly convex. Ribs link in pairs at very coarse, rounded-clavate ventral tubercles, and these in turn are linked across the venter by a pair of looped ribs, borne on a low swelling. The pairs of tuberculate ribs are separated by one or two nontuberculate ribs that weaken markedly on the outer flank, ventrolateral shoulders and venter.

Specimen ZPAL Am. 19/75 (Pl. 8, Fig. 15) is also slightly curved, 91 mm long, with a maximum preserved whorl height of 26 mm. Ribs are even on the flank of the adapical part of the fragment, with a rib index of 7. The ribs link in pairs at coarse ventral tubercles, with one or two nontuberculate ribs between the tuberculate groups. On the adapertural part of the fragment, the ribbing differentiates, with periodic coarser ribs linked to the tubercles, and weaker nontuberculate ribs between.

Specimen ZPAL Am. 19/73 (Pl. 5, Fig. 7) is an external mould of a curved fragment 170 mm long. It has markedly rursiradiate ribs at the adapical end, with tuberculate ribs coarser than the nontuberculate ones, and this persists to the greatest preserved diameter. Traces of long spines, preserved at the adapertural end, suggests the specimen may be part of the body chamber.

Specimen ZPAL Am. 19/72 (Pl. 5, Fig. 6) is a 70 mm long fragment of body chamber with a maximum preserved whorl height of 40 mm. The rib index is approximately 8. There are coarse ventrolateral tubercles linking pairs of ribs of variable strength, with single nontuberculate ribs between. Well-developed spines are preserved at the adapertural end.

DISCUSSION: The present material shows many similarities to the type material, and that from Dielinger Klei in Westphalia, Germany, described by KENNEDY & KAPLAN (1997). There is some variation in the rib index, but it is all treated as belonging to a single species. *Lewyites oronensis* (LEWY, 1969, p. 127, p. 3, fgs 10, 11) from the Upper Campanian Mishash Formation of Israel is a close ally, with ribs joined in pairs at ventral tubercles but only a single nontuberculate rib between. *Lewyites circularis* (LEWY, 1969, p. 128, p. 3, fg. 9; p. 4, fg. 3 only) also from the Upper Campanian Mishash formation of Israel, has a circular whorl section, similar flank ornament, but ribs that weaken or disappear on the venter. *Lewyites clinensis* (ADKINS, 1929, p. 208, p. 6, figs 10, 11) from the Upper Campanian Anacacho Limestone near Cline (Uvalde County, Texas) has a nearly circular intercostal section, a rib index of 7, flank ribs linked in pairs at ventral tubercles, and tubercles linked across the venter by pairs of weakened ribs, the adapical one of which supports a low siphonal node. A single nontuberculate rib separates tuberculate ribs. *Lewyites taylorensis* (ADKINS, 1929, p. 209, pl. 6, figs 12, 13) from the Upper Campanian Pecan Gap Chalk of northeast Texas, is known from poor phosphatic fragments only with pairs of strong ribs linked at ventral tubercles with two weaker, annular, nontuberculate ribs between. It remains inadequately known.

NIEBUHR & *al.* (1997, p. 220, pl. 3, fig. 3) record *Lewyites elegans* (MOBERG, 1885) from the upper Upper Campanian of Lehrte West Syncline, Lower Saxony (from the *bipunctatum*/*roemeri* Zone), but the fragmentary preservation of their specimen precludes firm identification.

In Poland, the species was recorded from Waganowice, Jeżówka and Rzeżuśnia, all localities in the Nida Trough, by NOWAK (1913, p. 384, pl. 40, fig. 7) and JAGT & *al*. (2004, p. 576, pl. 1, fig. 8). It was also recorded from Popów, Vistula valley, by NOWAK (1917, p. 141). The latter record is from the lower Upper Campanian *Neancyloceras phaleratum* Zone of BŁASZKIEWICZ (1980, fig. 1). It may equally represent *Pseudoxybeloceras phaleratum* (GRIEPENKERL, 1889) as the MOBERG's species was otherwise not recorded from the Vistula sections.

OCCURRENCE: Lower Upper Campanian of Dielinger Klei, Stemweder Berg, Westphalia (low in the *spiniger*/*basiplana* Zone, see KAPLAN & KENNEDY 1997), Germany. Possibly the upper Upper Campanian of Lehrte West Syncline, Lower Saxony (*bipunctatum*/*roemeri* Zone, see NIEBUHR & *al.* 1997). Upper Campanian of Köpinge and Tosterup, Sweden, northern Aquitaine, France and NE Belgium (JAGT, pers. comm.). In Poland, the species was formerly recorded from the Upper Campanian of Waganowice, Nida Trough (NOWAK 1913, 1917). The present specimens come from the lower Upper Campanian of Busko Zdrój, locality 4 (the sole ammonite taxon from that locality).

Genus and subgenus *Pseudoxybeloceras* WRIGHT & MATSUMOTO, 1954

TYPE SPECIES: *Hamites quadrinodosus* JIMBO, 1894, p. 185 (39), pl. 23(7), figs 3, 4, by the original designation of WRIGHT & MATSUMOTO (1954, p. 119).

Pseudoxybeloceras (*Pseudoxybeloceras*) *riosi* (WIEDMANN, 1962)

(Pl. 6, Figs 4, 6; Pl. 7, Figs 4, 8; Pl. 8, Fig. 13)

1962. *Neocrioceras* (*Schlueterella*) *riosi* WIEDMANN, p. 205, pl. 12, fig. 7; text-fig. 50.

1963. *Ancyloceras* sp. TĂTĂRIM, p. 62, pl. 3, figs 2-4.

1974. *Pseudoxybeloceras quadrinodosum* (JIMBO); SZÁSZ, p. 193 (*pars*), pl. 2, figs 1-3 only.

1982. *Pseudoxybeloceras riosi* (WIEDMANN); SZÁSZ, p. 51, pl. 2, fig. 1; pl. 3, figs 1, 2; pl. 4, fig. 1.

1994. *Neocrioceras* (*Schlueterella*) *riosi* WIEDMANN; WIEDMANN in GISCHLER & *al.*, p. 232, pl. 43, figs 3, 4.

TYPE: The holotype by original designation, is the original of WIEDMANN (1962, pl. 12, fig. 7, text-fig. 50), a specimen in the J.M. RIOS Collection, from Peña Vallegrul, west of Villamerdones, Burgos, Spain.

MATERIAL: Eleven specimens, ZPAL Am. 19/ 26-29, 53-59.

DESCRIPTION: The most complete specimen, ZPAL Am. 19/29 (Pl. 6, Fig. 6) is a very crushed composite mould of two shafts, linked by a curved sector. The adapical shaft is 250 mm long. The whorl height is 18 mm at the adapical end, increasing to 20 mm at the adapertural end: the expansion rate is thus very low. A narrowly curved sector joins the two shafts. The adapertural shaft is 180 mm long and incomplete, due to damage. The whorl height is 24 mm at the adapical end, and 28 mm at the adapertural end. Whereas the adapical shaft is straight, the adapertural one is slightly curved, with a feebly concave line to the venter in profile. The separation of the two limbs is 17.6 mm close to the linking curved sector, increasing to a maximum of 27.5 mm. The rib index is 4-5, the ribs straight, recti- to feebly prorsiradiate on the adapical shaft, becoming rursiradiate around the curved sector, and feebly prorsiradiate on the adapertural shaft. The ribs are narrower than the interspaces and bear a small clavus on the outer flank, and a large clavus on the ventrolateral shoulder/venter. In places, there are traces of short, laterally compressed septate spines on the latter. Towards the adapertural end of the larger shaft, the tubercles approximate, and occupy what could reasonably be termed outer lateral/inner ventrolateral and outer ventrolateral positions. The flank tubercles vary in strength on the adapical shaft, and may be very small indeed, ribs with stronger and weaker tubercles alternating more or less regularly in places. The lateral/inner ventrolateral tuberculation becomes much more even on the larger shaft.

Specimen ZPAL Am. 19/27 (Pl. 8, Fig. 13) has suffered substantial dorsoventral crushing, and has a maximum whorl height of 27.5 mm, and a maximum preserved length of 59 mm. The ribs are low, coarse, and concave on the dorsum, but strengthen markedly on flanks and venter. All bear well-developed rounded-clavate inner and outer ventral tubercles, the latter linked across the venter by a broad, straight, transverse rib. In places, the ribs linking tubercles show minor differentiation, with strengthened edges, giving a distinctive 'button and loop' appearance.

Specimen ZPAL Am. 19/26 (Pl. 7, Figs 4, 8) includes the initial part of a curved sector, and shows a tendency for ribs to be alternately weaker and stronger, with corresponding variation in tubercle strength. Specimen ZPAL Am. 19/28 (Pl. 6, Fig. 4) is a J-shaped fragment, with a maximum preserved whorl height of 42 mm. Ornament of the type described above is well-preserved on the adapical part of the fragment; that on the adapertural part is atypical and irregular, perhaps the result of non-lethal damage in life.

DISCUSSION: *Pseudoxybeloceras* (*Pseudoxybeloceras*) *riosi* differs from the type species *P.* (*P.*) *quadrinodosum* (JIMBO, 1894) (see revision in MATSUMOTO 1977, p. 345, pl. 57, fig. 2; pl. 61, fig. 4) in having coarser ribs and a much lower rib density (rib index 4-5, versus up to 15-16 in larger specimens of a comparable size).

OCCURRENCE: Campanian of northern Spain, and the southern Carpathians in Romania. In Poland, lower Upper Campanian of Busko Zdrój, locality 2 (specimen ZPAL Am. 19/28) and locality 3 (specimens ZPAL Am. 19/29, 53-57); specimens ZPAL Am. 19/26, 27, 57, 58 are without precise locality data.

Pseudoxybeloceras (*Pseudoxybeloceras*) sp. juv.
(Pl. 4, Fig. 5)

MATERIAL: A single specimen, ZPAL Am. 19/24.

DESCRIPTION: The specimen is a 66 mm long, very crushed composite mould, with a maximum preserved whorl height of 7.6 mm. The rib index is 7-8, the ribs narrow, crowded, feebly prorsiradiate and feebly convex. All bear closely spaced, subequal, feebly clavate inner and outer ventrolateral tubercles.

DISCUSSION: Being so much smaller than the other *Pseudoxybeloceras* (*Pseudoxybeloceras*) sp. juv. fragments in the collection, we are unable to determine if the specimen is merely a juvenile *P.* (*P.*) *riosi*, or some other species.

OCCURRENCE: Lower Upper Campanian of Busko Zdrój, locality 3.

Family Baculitidae GILL, 1871
Genus *Baculites* LAMARCK, 1799

TYPE SPECIES: *Baculites vertebralis* LAMARCK, 1801, p. 103, by subsequent designation by MEEK (1876, p. 391).

Baculites sp.
(not figured)

MATERIAL: Two specimens, ZPAL Am. 19/50-51.

DESCRIPTION and DISCUSSION: Both specimens are fragmentary moulds of smooth baculitids, indeterminable at the specific level.

OCCURRENCE: Lower Upper Campanian of Busko

Zdrój, locality 3. *Baculites* sp. is probably the commonest ammonite in the Busko Zdrój area, being significantly underrepresented in the present collection, possibly due to their morphology: not an attractive object for collectors.

Superfamily Scaphitaceae GILL, 1871
Family Scaphitidae GILL, 1871
Subfamily Scaphitinae GILL, 1871
Genus *Scaphites* PARKINSON, 1811

TYPE SPECIES: *Scaphites equalis* J. SOWERBY, 1813, p. 53, pl. 18, figs 1-3, by subsequent designation of MEEK, 1876, p. 413.

Scaphites gibbus SCHLÜTER, 1872
(Pl. 7, Figs 1-3, 5-7, 9, 10)

1872a. *Scaphites gibbus* SCHLÜTER, p. 87, pl. 26, figs 6-9.
1889. *Scaphites gibbus* SCHLÜTER; GRIEPENKERL, p. 404(102).
1894. *Scaphites gibbus* SCHLÜTER; DE GROSSOUVRE, p. 251, pl. 32, fig. 10.
1911. ?*Acanthoscaphites gibbus* SCHLÜTER; NOWAK, p. 565.
1916. *Hoploscaphites gibbus* SCHLÜTER; NOWAK, p. 66.
1925. *Discoscaphites gibbus* SCHLÜTER; DIENER, p. 211.
1928. *Discoscaphites gibbus* (SCHLÜTER); REESIDE, p. 30.
1951. *Discoscaphites gibbus* (SCHLÜTER); MIKHAILOV, p. 94, pl. 18, figs 86, 87.
1959. *Discoscaphites gibbus* (SCHLÜTER); NAIDIN & SHIMANSKIJ, p. 197, pl. 6, figs 9-11.
1964. *Hoploscaphites gibbus* (SCHLÜTER): GIERS, p. 283, pl. 8, fig. 3; text-fig. 10.
1964. *Hoploscaphites monasterensis* (SCHLÜT.); GIERS, p. 284.
1964. *Acanthoscaphites roemeri* (D'ORB.); GIERS, p. 285.
1974. *Trachyscaphites* (?) *gibbus* (SCHLÜTER, 1872); NAIDIN, p. 172, pl. 58, figs 2-4.
1975. *Scaphites gibbus* SCHLÜTER, 1872; SCHMID & ERNST, p. 327, pl. 1, figs 3-6.
1976. ?*Trachyscaphites gibbus* (SCHLÜTER); ATABEKIAN & KHAKHIMOV, p. 71, pl. 8, figs 4-6 (with additional synonymy).
1980. *Trachyscaphites* (?) *gibbus* (SCHLÜTER); BŁASZKIEWICZ, p. 32, pl. 13, figs 6, 8.
1986. *Scaphites* (*Scaphites*) *gibbus* SCHLÜTER, 1872a; KENNEDY, p. 125, pl. 22, figs 1, 2, 5-8, text-fig. 41.
1993. *Scaphites* (*Scaphites*) *gibbus* SCHLÜTER, 1872; KENNEDY, p. 142, pl. 6, figs 1-4; pl. 7, figs 12, 17.
1995. *Scaphites* (*Scaphites*) *gibbus* SCHLÜTER, 1872; WIPPICH, p. 62, pl. 1, figs 13-15; pl. 11, figs 10-12.
1995. *Scaphites* (*Scaphites*) *gibbus* SCHLÜTER, 1872; JAGT & *al*., p. 56, pl. 3, figs 4-10.
1996. *Scaphites* (*Scaphites*) *gibbus* SCHLÜTER, 1872a; KAPLAN & *al*., p. 44, pl. 34, figs 1-3; pl. 35, figs 1, 2; pl. 36, figs 1-5; pl. 37, figs 1-4; pl. 38, figs 1-3, 5-11; pl. 39, figs 1-7; pl. 40, figs 1-6.
1997. *Scaphites* (*Scaphites*) *gibbus* SCHLÜTER, 1872a; KENNEDY & KAPLAN, p. 62, pl. 67, figs 1-13.
2004. *Scaphites* (*S.*) *gibbus* SCHLÜTER, 1872; JAGT & *al*., p. 577, pl. 1, fig. 6.

TYPES: Lectotype, by the subsequent designation of BŁASZKIEWICZ (1980, p. 32), is the macroconch specimen PIB SCHLÜTER-collection 63 (the original of SCHLÜTER 1872, pl. 26, figs 7-9; refigured by KAPLAN & *al.* 1996, pl.

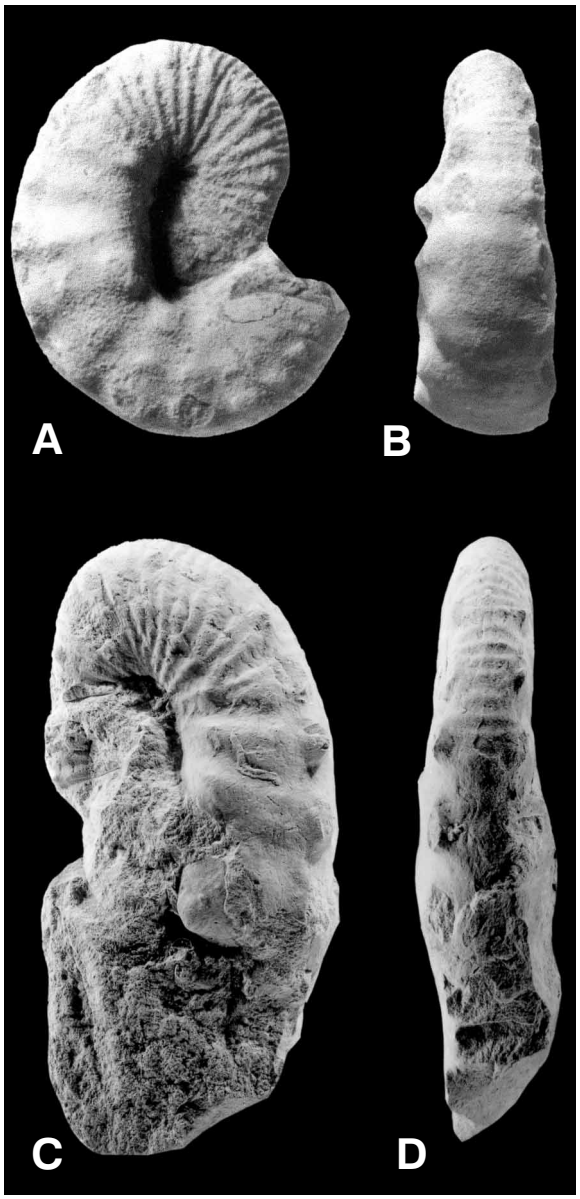

Fig. 4. Microconchs of *Scaphites gibbus* SCHLÜTER, 1872. A-B. Paralectotype PIB SCHLÜTER-collection, unregistered, from Darup, Westphalia, Germany; C-D. Specimen ZPAL Am. 19/60 from the lower Upper Campanian of Busko Zdrój, locality 3; nat. size

34, figs 1-3), from the lower Upper Campanian of Baumberge between Coesfeld und Billerbeck, Westphalia (see KAPLAN & *al.* 1996). Paralectotype is the microconch specimen PIB SCHLÜTER-collection, unregistered, from Darup, Westphalia (see SCHLÜTER 1872, pl. 26, fig. 6; refigured by KAPLAN & *al*. 1996, pl. 38, figs 6, 7, and herein as Text-fig. 4 C, D).

MATERIAL: Nine specimens, ZPAL Am. 19/ 30-33, 40, 60-63.

DESCRIPTION: Specimen ZPAL Am. 19/32 (Pl. 7, Fig. 3) is a complete, very crushed specimen 35 mm long, most probably a small macroconch as suggested by a relatively high whorl of the shaft, a typical macroconch feature in many scaphitid species (e.g. MAKOWSKI 1962; KENNEDY 1989; MACHALSKI 1996). The finely ribbed spire is succeeded by a body chamber shaft with three coarse umbilical bullae, which give rise to one or two low, broad prorsiradiate ribs that link to well developed ventrolateral clavi. On the final curved sector (hook) there is a single well developed umbilical tubercle, strongly elongated parallel to the umbilical shoulder, and five progressively weakening lateral and ventral tubercles. The latter give rise to delicate prorsiradiate ribs which pass over the venter, with additional ribs intercalated between. The strongly prorsiradiate apertural margin is marked by a strong constriction.

Specimens ZPAL Am. 19/30, 31, 33 and 40 are larger macroconchs (Pl. 7, Figs 1, 2, 5-7, 9, 10). The two complete individuals are 64 and 88 mm long. On the spire, crowded wiry prorsiradiate ribs arise either singly or in pairs on the umbilical shoulder, and increase by branching and intercalation, as is well seen in specimen 40 (Pl. 7, Fig. 5). The shaft of the adult body chamber has a convex wall, a straight course when seen in lateral view, and a variably developed bulge that partially conceals the umbilicus of the spire. Ornament is poorly preserved, but a few umbilical bullae are present, giving rise to low, flat, broad ribs that link to coarse ventral clavi. The umbilical bullae efface on the final curved sector, the ventrolateral clavi weaken and change shape, becoming bullate, and linked over the venter by groups of two or three progressively weakening ribs, with additional nontuberculate ribs intercalating between. A third row of rounded to bullate lateral tubercles appear at the junction of shaft and curved sector, strengthen, then decline, and disappear before the adult aperture is reached. This is prorsiradiate and marked by a pronounced constriction.

Specimen ZPAL Am. 19/60 (Text-fig. 4C, D) is a crushed spire and part of the shaft. It is the only unquestionable microconch in the present material, as indicated by the relatively low whorl of the shaft. The specimen is rather large for a microconch. The spire is coarsely ribbed with four ventrolateral tubercles. The shaft has three preserved umbilical bullae which give rise to low, broad prorsiradiate ribs that link to well-developed ventrolateral clavi. This specimen compares well with the paralectotype of the species, also a microconch (SCHLÜTER 1872, pl. 26, fig. 6, refigured by KAPLAN & *al*. 1996, pl. 38, figs 6, 7, and herein as Text-fig. 4A, B). The remainder of the material is represented by fragmentary or heavily crushed specimens which cannot be assigned either to micro- or to macroconchs.

DISCUSSION: KAPLAN & *al*. (1996) gave an extensive account of this species. As they noted, specimens referred to *Acanthoscaphites roemeri* by GIERS (1964) are no more than phragmocones of *S*. (*S*.) *gibbus*, as is GIERS' (1964) *Hoploscaphites monasterensis*. *Scaphites* (*S*.) *gibbus* is a highly distinctive species, the coarse ribs of the shaft of the body chamber and development of rows of lateral tubercles immediately separating it from *S*. (*S*.) *binodosus* ROEMER, 1841 (SCHLÜTER 1872, pl. 24, figs 1-6; KENNEDY & KAPLAN 1995, p. 32, pl. 21, fig. 13; pl. 22, figs 1-10; pl. 23, figs 1-9; pl. 24, figs 1-4; pl. 25, figs 1-4; pl. 26, figs 1-7; pl. 27, figs 1-4; pl. 28, figs 1-4), and the smaller *S*. (*S*.) *fischeri* RIEDEL, 1931 (p. 704, pl. 79, figs 5, 6; see KENNEDY & KAPLAN 2000, p. 116, pl. 39, figs 1, 2, 6, 10-18; pl. 40, figs 1, 2, 4-7). The most closely related species is *S*. (*S*.) *haugi* DE GROSSOUVRE, 1894 (p. 244, pl. 31, fig. 5; KENNEDY 1986, p. 116, pl. 21, figs 12, 16), which has a spire with coarse single flank ribs that terminate in conical ventrolateral tubercles linked over the venter by secondaries and a shaft with coarse umbilical and ventrolateral tubercles only.

Scaphites hippocrepis (DE KAY) IV, described by KÜCHLER (2000a, figs 4, 5) from the uppermost Lower Campanian and lowermost Upper Campanian of northern Spain seems to be more closely related to *Scaphites* (*Scaphites*) *gibbus* than to *Scaphites hippocrepis* (DE KAY) III which precedes it (COBBAN 1969).

OCCURRENCE: In Germany, the species was recorded from high in the Lower Campanian to low in the Upper Campanian. In Westphalia it occurs low in the *spiniger*/*basiplana* Zone of Stemweder Berg (KENNEDY & KAPLAN 1997), from *conica*/*gracilis* to *roemeri* zones in northwest Münsterland (WIPPICH 1995), from the Lower Campanian "Quadraten Schichten" to "*vulgaris*"/*basiplana* Zone in southeast Münsterland (KAPLAN & *al.* 1996; according to KAPLAN & *al.* in press from *conica*/*gracilis* Zone to *conica*/*mucronata* Zone of this area). In Lower Saxony *Scaphites* (*S*.) *gibbus* occurs from *conica*/*papillosa* to *gracilis*/*mucronata* zones of Lehrte West Syncline (SCHMID & ERNST 1975). It was also recorded from the Mons Basin and Liège province in Belgium, southern Limburg in the Netherlands, northern Aquitaine in France, Donbass in

Ukraine, and from Kazakhstan. In Poland, the species occurs in the lower Upper Campanian *Neancyloceras phaleratum* Zone of the Vistula sections (BŁASZKIEWICZ 1980, p. 32, pl. 13, figs 6, 8, see also POŻARYSKI 1938, p. 13) and from the lower Upper Campanian at Rzeżuśnia, Nida Trough (JAGT & *al*. 2004). The present specimens are from the lower Upper Campanian of Busko Zdrój, locality 1 (specimens ZPAL Am. 19/40, 60-62), locality 3 (specimens ZPAL Am. 19/30-33); specimen ZPAL Am. 19/63 is without precise locality data.

Genus *Trachyscaphites* COBBAN & SCOTT, 1964

TYPE SPECIES: *Trachyscaphites redbirdensis* COBBAN & SCOTT, 1964, p. E7, pl. 1, figs 1-7; text-fig. 3, by original designation.

Trachyscaphites spiniger spiniger (SCHLÜTER, 1872) (Pl. 8, Figs 1-12, 14, 16, 17)

1841. *Scaphites pulcherrimus* ROEMER, p. 91 (*pars*), pl. 14, fig. 4.
1872. *Scaphites spiniger* SCHLÜTER, p. 82, pl. 25, figs 1-7.
1885. *Scaphites spiniger* SCHLÜTER; MOBERG, p. 28, pl. 3, figs 6-8.
1889. *Scaphites spiniger* SCHLÜTER; GRIEPENKERL, p. 405.
1894. *Scaphites spiniger* SCHLÜTER; DE GROSSOUVRE, p. 252.
non 1908. *Scaphites* cf. *spiniger* SCHLÜTER; DE GROSSOUVRE, p. 38, pl. 10, fig. 6; text-fig. 13 (= *Hoploscaphites constrictus* (J. SOWERBY, 1817)).
1915. *Scaphites spiniger* SCHLÜTER; FRECH, p. 564, text-fig. 13.
1916. *Acanthoscaphites spiniger* SCHLÜT.; NOWAK, p. 67, figure facing p. 66.
1925. *Scaphites* (*Acanthoscaphites*) *spiniger* SCHLÜTER; DIENER, p. 207.
1928. *Acanthoscaphites spiniger* (SCHLÜTER); REESIDE, p. 34.
1951. *Acanthoscaphites spiniger* (SCHLÜTER); MIKHAILOV, p. 100, pl. 19, fig. 92.
1952. *Scaphites spiniger* SCHLÜTER; BASSE, p. 612.
1954. *Scaphites* (*Acanthoscaphites*) *spiniger* SCHLÜTER; HÄGG, p. 58.
1954. *Scaphites* sp. 2 HÄGG, p. 58, pl. 9, fig. 97.
1964. *Trachyscaphites spiniger* (SCHLÜTER); COBBAN & SCOTT, p. E8.
1974. *Trachyscaphites spiniger* (SCHLÜTER); NAIDIN, p. 171, pl. 59, fig. 2.
1975. *Scaphites spiniger* SCHLÜTER; SCHMID & ERNST, p. 330, pl. 2, figs 1-4; pl. 3, fig. 3.
1976. *Trachyscaphites spiniger spiniger* (SCHLÜTER); ATABEKIAN & KHAKHIMOV, p. 66, pl. 9, figs 1-4; pl. 12, figs 2, 4.
1980. *Trachyscaphites spiniger spiniger* (SCHLÜTER); BŁASZKIEWICZ, p. 30, pl. 13, figs 1-3, 5-7.
?1980. *Trachyscaphites spiniger posterior* BŁASZKIEWICZ, p. 31, pl. 13, fig. 4, pl. 14, figs 1-7; pl. 15, figs 2, 3; pl. 30, fig. 2.
1986. *Trachyscaphites spiniger* (SCHLÜTER, 1972a); KENNEDY, p. 130, pl. 22, fig. 4; text-fig. 42.
1991. *Scaphites spiniger* SCHLÜTER; NIEBUHR & ERNST, pl. 2, fig. 4.
1992. *Trachyscaphites spiniger spiniger* (SCHLÜTER, 1872a); COBBAN & KENNEDY, p. 86, pl. 1, figs 2, 3; pl. 7, figs 1, 2, 5, 9; pl. 8, figs 1-9; text-fig. 4a.
1993. *Trachyscaphites* cf. *spiniger* (SCHLÜTER, 1872); KENNEDY, p. 113, pl. 7, Fig. 13.
?1996. *Trachyscaphites spiniger posterior* BŁASZKIEWICZ; NIEBUHR, p. 276, pl. 4, fig. 7.
1997. *Trachyscaphites spiniger spiniger* (SCHLÜTER, 1872); KENNEDY & CHRISTENSEN, p. 116, text-figs 33-37.
1997. *Trachyscaphites spiniger spiniger* (SCHLÜTER, 1872a); KENNEDY & KAPLAN, p. 63, pl. 10, fig. 3; pl. 59, fig. 2; pl. 68, figs 1-6; pl. 69, figs 2-5; pl. 70, figs 1-9; pl. 71, figs 1-10; pl. 72, figs 1-7; pl. 73, figs 1-9; pl. 74, figs 4-6; pl. 75, figs 1-5; pl. 77, fig. 6.
2000a. *Trachyscaphites spiniger* (SCHLÜTER); KÜCHLER, pl. 11, figs 1-2, 5-6.
? 2000b. *Trachyscaphites* cf. *spiniger*; KÜCHLER, pl. 11, figs 7-8, 9.
2004. *Trachyscaphites s. spiniger* (SCHLÜTER, 1872); JAGT & *al*. 2004, p. 577, pl. 1, fig. 7.

TYPES: Lectotype, by the subsequent designation of BŁASZKIEWICZ (1980, p. 31), is the original of SCHLÜTER (1872, pl. 25, figs 1-3), a macroconch, from the Upper Campanian of Darup, Westphalia, an unregistered PIB specimen, refigured by KENNEDY & KAPLAN (1997, pl. 67, figs 4-6). Paralectotypes are PIB 61a, the original of SCHLÜTER (1872, pl. 25, fig. 4), from the Hügelgruppe of Haldem, an adult microconch refigured by KENNEDY & KAPLAN (1997, pl. 67, figs 1-3), and PIB 61b, from the same horizon and locality, the original of SCHLÜTER (1872, pl. 25, fig. 6, refigured by KENNEDY & KAPLAN (1997, pl. 68, figs 3, 4).

MATERIAL: Seventeen specimens, ZPAL Am. 19/34-39, 41-43, 64-71.

DESCRIPTION: All of the material is rather fragmentary, and distorted. Specimens ZPAL Am. 19/34 (Pl. 8, Figs 6, 10, 11) and ZPAL Am. 19/39 (Pl. 8, Figs 1-3) are nuclei of phragmocones, with ornament well-preserved to a diameter of 23 mm. Primary ribs arise at the umbilical seam, strengthen across umbilical wall and shoulder, are distant, straight, prorsiradiate, and increase in strength progressively across the flanks. These primary ribs bear well-developed outer lateral, inner and outer ventrolateral tubercles. Intercalated ribs arise at various points on the flank, and the primary ribs may branch low or high on the flank, so that there are many more

ribs at the ventrolateral shoulder than on the umbilical wall.

Specimens ZPAL Am. 19/38, and ZPAL Am. 19/41-43 (Pl. 8, Figs 4, 5, 9, 14, 16) are much larger phragmocones, up to 40 mm in diameter. They show a progressively more complex pattern of ornament, with the appearance of a fourth, inner lateral row of tubercles (Pl. 8, Figs 9, 16), the whole of the surface of the shell covered in crowded wiry ribs that arise at the umbilicus, branch low and high on the flank, link in groups to, and loop between tubercles, as well as intercalating between the tuberculate groups on flanks, ventrolateral shoulders, and venter.

Specimens ZPAL Am. 19/35, 36 and 37 are all fragmentary adults, probably microconchs as judged from relatively low whorls of the shaft and rather robust ribbing and tuberculation (macroconchs are usually more finely sculptured, see e.g. SCHMID & ERNST 1975). The most complete is ZPAL Am. 19/37, which is an estimated 78 mm long. The umbilical wall of the shaft is concave, with a concave course in side view. There are coarse umbilical bullae on the shaft, which elongate parallel to the umbilical margin on the succeeding curved sector (hook), weakening progressively as the adult aperture is approached. There are coarse outer lateral tubercles, and inner and outer ventrolateral clavi. The surface of the shell between tubercles is covered in complexly branching and intercalating ribs which link in groups to the tubercles, as well as intercalating between. All rows of tubercles weaken on the final sector before the adult aperture (Pl. 8, Figs 12, 17), which is prorsiradiate, with a marked constriction.

The remainder of the material, not figured herein, is composed of fragmentary and crushed phragmocones (ZPAL Am. 19/64, 65, 68-71) and two poorly preserved macroconch body chambers (ZPAL Am. 19/ 66, 67).

DISCUSSION: Although fragmentary, the ornament of the present material is well preserved, and shows it to belong to the nominate subspecies. The macroconch lectotype from Darup, Westphalia, Germany, is 110 mm long, the spire 60 mm approximately in diameter (the position of the last septum is unclear). SCHLÜTER's original figure is reversed and restored. There is no longer any evidence for the dorsal rostrum shown in SCHLÜTER's figures. The coiling of the spire is very involute. The original whorl proportions cannot be established, due to *post-mortem* crushing. Delicate crowded ribs arise at the umbilical shoulder. They are straight and prorsiradiate on the flank, and increase by branching and intercalation at the umbilical shoulder as well as low and high on the flank. There are occasional small lateral tubercles, five per half whorl, at which the ribs commonly bifurcate, larger conical outer lateral tubercles, 9-10 per half whorl, where ribs again branch, and much larger, initially conical, thereafter feebly clavate inner ventrolateral tubercles, equal in number to the outer lateral but stronger. Groups of 2 or 3 ribs link to strong outer ventrolateral tubercles, displaced adapertural of the corresponding inner ventrolateral row. The outer ventrolateral tubercles are linked over the venter by 2 or 3 nontuberculate wiry ribs, with a similar number of ribs intercalating between the ventrolateral tubercles. The shaft of the body chamber is high-whorled, the umbilical wall convex, straight in profile, and partially concealing the umbilicus of the phragmocone. Ornament is of crowded wiry ribs that increase by branching and intercalation, linking the tubercles in groups and intercalating between. The inner lateral tubercles coarsen markedly, migrate out to a mid-lateral position and become feebly clavate, as do the outer lateral row, which are larger and slightly more numerous than the inner lateral row. They correspond approximately with the larger inner ventrolateral clavi, which alternate in position with the larger outer ventrolateral clavi which are alternate in position, rather than opposite across the venter. All rows of tubercles crowd, become progressively smaller and less markedly clavate around the curved sector of the final hook. The aperture subtends a slightly acute angle with the line of the umbilical wall of the body chamber and is contracted, with a marked apertural constriction on the mould.

Paralectotype PIB 61b from Haldem, Westphalia, is the original of SCHLÜTER (1872, pl. 25, figs 5-7). It is the adapertural part of the body chamber of a macroconch, strongly deformed, but with the same style of ornament as the lectotype. A well preserved aptychus (parataxon *Striaptychus spinigeri* TRAUTH, 1928), preserved at the junction of shaft and hook retain traces of the original calcareous layers, some of which have been lost since SCHLÜTER's (reversed) illustrations were published. The growth rugae are less regular than in the figure. The aptychys has a maximum length of 26 mm.

Paralectotype PIB 61a is the original of SCHLÜTER, 1872, pl. 25, fig. 4, from Haldem, Westphalia, a crushed composite mould of a microconch 70 mm long. SCHLÜTER's figure is restored and reversed. The phragmocone is an estimated 39 mm in diameter, and ornament is as in the macroconch but with the inner lateral tubercles somewhat weaker. The body chamber has a much lower whorl section than that of the macroconch, slender, with a concave umbilical wall. The course of the umbilical wall is concave in profile, and the umbilicus of the phragmocone is not occluded. The inner lateral tubercles strengthen markedly along the body chamber, are clavate, and migrate progressively to the umbilical shoulder by the final curved sector. They are equal to or larger than the outer lateral tubercles, which are also smaller than the prominent subequal inner and outer ventrolateral clavi. The delicate wiry ribs are prominent on the phragmocone, but less so on the body chamber, possibly an artefact or preservation.

BŁASZKIEWICZ (1980) described two chrono-subspecies of *Trachyscaphites spiniger* from the Vistula sections, the nominate subspecies, and *Trachyscaphites spiniger posterior* BŁASZKIEWICZ, 1980 (p. 31, pl. 13, fig. 4; pl. 14, figs 1-7; pl. 15, figs 2-3; pl. 30, fig. 2; see KENNEDY & KAPLAN 1997, pl. 73, figs 1, 2, 4-6; pl. 74, figs 4, 5). The latter was differentiated from the nominate subspecies because of the "smaller number of ribs running between the tubercles of the same row on the exposed part of normal spiral and the presence of lateroumbilical tuberculation on earlier sectors of the exposed, normal spiral. It also differs on the whole in a smaller degree of freeing the shaft from phragmocone and in a frequent lack of ribs between the tubercles on the same row or shaft." However, the illustrations by BŁASZKIEWICZ (1980) suggest it may be just a synonym of *T. spiniger spiniger*. Moreover, according to data presented by BŁASZKIEWICZ (1980, table 1, p. 13) *Trachyscaphites spiniger posterior* seems to co-occur with *Trachyscaphites spiniger spiniger* in the upper part of the *Neancyloceras phaleratum* Zone, a situation incompatible with the concept of successive chronotaxa.

Trachyscaphites spiniger porchi (ADKINS, 1929) (see ADKINS 1929, p. 205, pl. 5, figs 1-3), of which *Scaphites aricki* (ADKINS, 1929) (p. 206, pl. 5, figs 7-8) is a synonym (see COBBAN & SCOTT 1964, p. E10, pl. 2, figs 1-23; pl. 3, figs 1-11; fig. 4; COBBAN & KENNEDY 1994, p. D7, pl. 4, figs 1-4; pl. 5, figs 1-16; text-fig. 8), differs from the nominate subspecies in having fewer tubercles in all rows on the body chamber and generally lacking dense ribbing. *Trachyscaphites spiniger levantinensis* LEWY, 1969 (p. 132, pl. 4, fig. 1), from the upper Campanian of Israel, is a microconch of *T. s. porchi*.

Trachyscaphites pulcherrimus (ROEMER, 1841) (see revision in KENNEDY & SUMMESBERGER 1984, p. 171, pl. 11, figs 1-2, 10-22, pl. 13, figs 2-6; KENNEDY & KAPLAN 1997, p. 65, pl. 69, fig. 1; pl. 77, figs 1-5, 7-10) differs from *T. spiniger* by the presence of five rows of flank tubercles as well as a siphonal row in some individuals.

OCCURRENCE: In Germany, Upper Campanian of Westphalia (low in *basiplana*/*spiniger* Zone to within the *roemeri* Zone of Stemweder Berg and southeastern Münsterland, see KAPLAN & KENNEDY 1997), Lower Saxony (from *stobaei*/*basiplana* Zone to middle of the *vulgaris* Zone of Lehrte West Syncline, see SCHMID & ERNST 1975, and from *vulgaris*/*stolleyi* Zone to *minor*/*polyplocum* Zone of the same area, see NIEBUHR & *al.* 1997; also from the *spiniger*/*stobeai* Zone of the Beienrode Basin which corresponds to the *stobaei*/*basiplana* Zone of Lehrte West Syncline, see NIEBUHR & ERNST 1991) and of Schleswig-Holstein (a single specimen from the lower part of *stobaei*/*basiplana* Zone at Lägerdorf, see SCHULZ & *al.* 1984). The Netherlands, NE and ?southern Belgium; Köpinge, Tosterup and Fredriksberg in Sweden, the Ukraine, Armenia, Turkmenia; lower Upper Campanian where precisely dated. In the United States it is best known from the Ozan Formation in Fannin County, Texas. In Poland, the species was formerly recorded from the lower Upper Campanian *Neancyloceras phaleratum* Zone, Vistula sections and from the Nida Trough (see BŁASZKIEWICZ 1980). It was also recorded from the lower Upper Campanian of Rzeżuśnia, Nida Trough by JAGT & *al.* (2004). The present specimens are from the lower Upper Campanian of Busko Zdrój, locality 1 (ZPAL Am. 19/39, 65), locality 2 (ZPAL Am. 19/35, 38, 69, 71), locality 3 (ZPAL Am. 19/34, 36, 37); specimens ZPAL Am. 19/ 41-43, 64, 66, 67, 70 are without precise locality data.

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