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A new ceratite record from Upper Silesia (Poland)

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A new ceratite locality from Gołuchowice (Upper Silesia, Poland) is described. Ceratites from the *spinosus* group found there include *Ceratites* (*Acanthoceratites*) cf. *praespinosus,* found for the first time in Upper Silesia. Five ceratite zones are proposed for that region: *pulcher*, *robustus*, *compressus, evolutus* and *spinosus*. The taxonomic compositions of individual ceratite zones from Upper Silesia are almost identical to those of corresponding zones from the Holy Cross Mountains. However, ceratite zones in Poland show lower taxonomic diversity than their equivalents in Germany.

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Key words: Upper Silesia, Triassic, Muschelkalk, ceratites.

INTRODUCTION

Recent investigations have aimed to compare ceratites from the Upper Muschelkalk of Upper Silesia with those known from the Holy Cross Mountains and from Germany. This paper describes a new ceratite finding from Gołuchowice near Siewierz, and discusses curated specimens and published data concerning Upper Silesian ceratites.

PREVIOUS WORK

Ceratites have been rarely recorded in Upper Silesian deposits and most known specimens were collected before 1945. Roemer (1870) described one fragment of ceratite phragmocone from Upper Silesian Muschelkalk, including an illustration of *Ceratites* (*Ceratites*) *nodosus* (Bruguičre, 1792) (specimen lost). Eck (1865) also mentioned the occurrence of *C.* (*C.*) *nodosus* at several locations in Upper Silesia within the outcrop of the "Rybnaer Kalksteins", which could have been equivalent to the entire Upper Muschelkalk. Tietze (1888) described *C.* (*C.*) *nodosus* from the Chrzanów district but failed to record the exact locality; he assumed, without any foundation, that this specimen had been collected from the "Rybnaer Kalksteins". Gürich (1887) recorded *C.* (*C.*) *nodosus* from the Boruszowice Beds at Boruszowice. None of these papers contained descriptions or illustrations of ceratites. *C.* (*Opheoceratites*) *compressus* Philippi, 1901 was mentioned from the Wilkowice Conglomerate by Michael (1913). Much later Assmann (1937) described the following ceratites: *Paraceratites* (*Progonoceratites*) *discus* (Riedel, 1916), *P.* (*P.*) *sequens* (Riedel, 1916), *P.* (*P.*) *philippii* (Riedel, 1916), *C.* (*Doloceratites*) *robustus* Riedel, 1916, *C. compressus*, *C.* (*O.*) *evolutus* Philippi, 1901, *C.* (*Acanthoceratites*) *spinosus* Philippi, 1901 from the Wilkowice Conglomerate and *C.* (*A.*) *spinosus* from the Boruszowice Beds. After 1945 *Ceratites* sp. and *C.* sp. cf. *spinosus* were collected by Siedlecki (1949, 1952) from the Boruszowice Beds around Chrzanów. Other specimens have been mentioned: *Ceratites* (*A.*) *spinosus* from the Boruszowice Beds at Laryszów near Tarnowskie Góry (Kotlicki, 1974; Szulc, 1991; one specimen of *C.* (*A.*) *spinosus* has been determined by H. Hagdorn and is housed in Muschelkalk museum in Ingelfingen: Szulc, pers. comm.) and a fragment of *C.* (*A.*) *spinosus* from the Lubliniec borehole

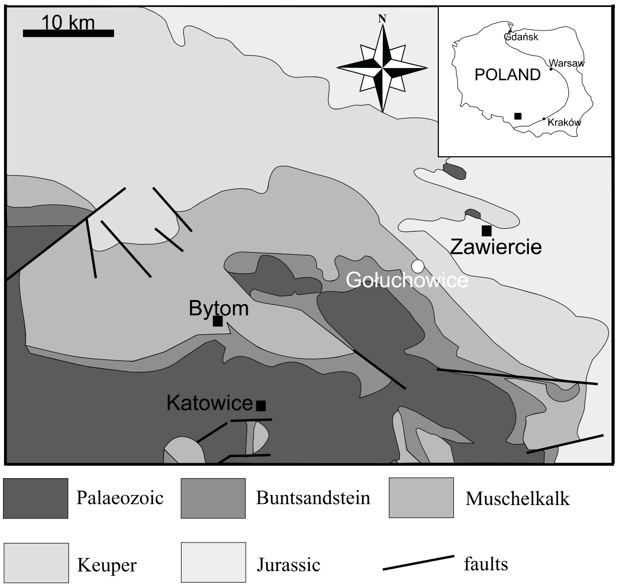

Fig. 1. Schematic geological map of Upper Silesia (according to Senkowiczowa, 1973, modified)

(Kotlicki and Siewniak-Madej, 1982). Most of these records lack descriptions, illustrations or museum locations.

REMARKS ON TAXONOMY

Almost all of the species and subspecies of *Paraceratites* and *Ceratites* occurring in the Upper Muschelkalk were erected by German scientists (i.e. Riedel, 1916; Wenger, 1957; Urlichs and Mundlos, 1980, 1987). Some have been recognised in Poland (e.g. Assmann, 1937; Senkowiczowa, 1991; Niedźwiedzki *et al*., 2001). Many of these subspecies, though, are neither geographical nor temporal subspecies. Quite often several subspecies of the same species occur in a single layer restricted to a small area or one exposure (*cf.* e.g. Urlichs and Mundlos, 1990; Urlichs, 1993). Wenger (1957) defined many previous species as subspecies (e. g. *C.* (*D.*) *humilis* Philippi, 1901 was determined as *C.* (*A.*) *armatus humilis* Philippi, 1901) and created many new subspecies. Some of these should probably be classified as species while others should be treated as morphotypes. Therefore, according to Riedel (1916), the forms *C.* (*A.*) *spinosus* and *C.* (*A.*) *postspinosus* Riedel, 1916 are treated in this paper as two distinct species, and not as subsecies *sensu* Wenger (1957). It remains to be determined which of these ceratite taxa are true species or subspecies, and which represent different ontogenic stages or sexual morphs of the same biological species (e.g. Rein, 2001). Rein (1999) suggested that *C.* (*A.*) *armatus* and *C.* (*D.*) *muensteri* represent juvenile stages of *C.* (*A.*) *spinosus*. Subgenera mentioned in this paper, were proposed by Haan (1825) and Schrammen (1928) — *fide* Urlichs and Mundlos (1987).

The current ceratite zonation of the Upper Muschelkalk was created by Riedel (1916) and further modified by Wenger (1957), Urlichs and Mundlos (1980, 1987), Hagdorn and Simon (1985) and Rein (2001). In Poland, it has been used by Trammer (1975), Senkowiczowa (1991), Salamon (1998) and Niedźwiedzki *et al.* (2001) for the Holy Cross Mountains.

GEOLOGICAL SETTING

The standard division of the Silesian Upper Muschelkalk is known from the western part of the Upper Silesia (Opole Silesia). It comprises the Upper Tarnowice Beds composed mainly of dolomites, the Wilkowice Conglomerate, the Wilkowice Beds composed of limestones and the uppermost part comprises the Boruszowice Beds composed of clay and marly mudstone with limestone and dolomite intercalations (Assmann, 1944). However, in the eastern part of Upper Silesia, strong dolomitization obliterates the primary rock fabrics (Siedlecki, 1949, 1952), making, it difficult to distinguish the Wilkowice Conglomerate and the Wilkowice Beds from the Upper Tarnowice Beds.

In the Gołuchowice region (Fig. 1), where all of the ceratite specimens have been found, Śliwiński (1964) described a profile through mainly platy marls and marly dolomites and rarely dolomitic, oolitic limestone. The rocks, containing a poor, fossil fauna of low diversity (bivalves, gastropods and ostracods), have been correlated with the Tarnowice Beds. Neither Śliwiński (1964) nor Kotlicki (1968) found higher parts of the Upper Muschelkalk in the area investigated. However, Śliwiński (1964) discovered transported blocks of organodetritic limestone, richly fossiliferous limestone breccia and weathered crinoid-bearing limestone blocks, representing undetermined deposits of the Upper Muschelkalk. In other blocks from Gołuchowice, Salamon (2002) found the crinoid *Encrinus* cf. *liliiformis* Lamarck, 1801. The specimens of *Ceratites* sp., *C.* (*A.*) cf. *praespinosus* and *C.* (*A.*) cf. *spinosus* described here were also found in these weathered limestone blocks. The blocks found by Śliwiński (1964), Salamon (2002) and by us do not resemble the Tarnowice Beds. They comprise ooid-free bioclastic limestone. Shells are very common, together with organodetritic brecciated limestone clasts and crinoid columnals. Furthermore, *E. liliiformis* is known only in the Upper Muschelkalk of the Holy Cross Mountains (Salamon, 2002), and has never been found in the Lower and Middle Muschelkalk of Poland (Hagdorn and Głuchowski, 1993; Niedźwiedzki, 2002). This suggests that the limestone blocks found at Gołuchowice represent the Wilkowice Conglomerate and the Wilkowice Beds. The Boruszowice Beds have not yet been found in the Gołuchowice region. The specimens of *C.* (*A.*) cf. *spinosus* described here suggest the presence of younger rocks than the Wilkowice Conglomerate, as this species appeared in Germany in the middle part of the *media* conodont Zone (zone 3; Hagdorn, 1991), which corresponds to Wilkowice Beds (Zawidzka, 1975). In the Holy Cross Mountains, this taxon appears by the end of the zone 3 (*cf.* Kowalczewski, 1926; Waksmundzki, 1982) and occurs throughout the *N. haslachenis* conodont Zone (zone 4) (Senkowiczowa, 1991), which corresponds to the Wilkowice Beds and Boruszowice Beds of Upper Silesia.

One specimen described in this paper (*C.* (*O.*) *compressus*) was found in Gąsiorowice before World War II and is curated at the Geological Museum of Wrocław University. The uppermost part of the Upper Tarnowice Beds and the Wilkowice Conglomerate are visible at Gąsiorowice (Zawidzka, 1975).

MATERIAL

Five specimens from Gołuchowice (GIUS–7-1879/1-5) and one from the vicinity of Gąsiorowice (MGUWr 2380s) are described. All specimens are moulds.

TAXONOMIC DESCRIPTION

Family **Ceratitidae** Mojsisovics, 1879
Genus ***Ceratites*** De Haan, 1825
Subgenus ***Opheoceratites*** Schrammen, 1928
Ceratites (*Opheoceratites*) *compressus* Philippi, 1901
(Fig. 2)

1901 *Ceratites compressus* Philippi; E. Philippi, p. 54, pl. 38, fig. 1 (lectotype).
1916 *Ceratites compressus* (Sandb.) Philippi; A. Riedel, p. 38, pl. 9, figs. 5, 6.
1937 *Ceratites compressus* Philippi emend. Riedel; P. Assmann, p. 106.
1957 *Ceratites* (*Acanthoceratites*) *compressus compressus* Philippi; R. Wenger, p. 82.
1991 *Ceratites* (*Acanthoceratites*) *compressus compressus* Philippi; H. Senkowiczowa, p. 121, pl. 3, fig. 4; pl. 4, figs. 4, 5; pl. 10, fig. 4; pl. 12, fig. 1.

M a t e r i a l . One almost complete internal mould (MGUWr 2380s).

D e s c r i p t i o n . The entire phragmocone and a significant part (40% of the last whorl) of the body chamber is preserved. The mould is evolute (the beginning of the third whorl is visible). The whorl section is oval, the venter is tabulate, smooth, and narrow. Whorl flanks are slightly arched. The width of the venter increases very slightly towards the aperture. The ribs are single and straight. There are no nodes on the body chamber, and the ribs are highest on the central part, diminishing towards the ventral and the dorsal side. Two or three ribs on the adapertural part of the phragmocone are similarly developed. On the further part of the phragmocone, the ribs do not reach the ventral edge, where indistinct nodes occur. On the border of the last and penultimate whorl the ribs become very short and indistinct and reach to half of the whorl height, ending with a lateral node. A complete ceratitic suture on one of the sides is visible. It is composed of five narrow lateral lobes and wider saddles between them. The ventral lobe is wide with a faintly marked accessory saddle. The phragmocone chambers are filled with calcite cement. D = 80 mm, H = 32.5 mm, W = 24 mm, U = 24.5 mm, U/D = 0.306, H/D = 0.406, W/H = 0.738 (D — diameter of mould, U — diameter of umbilicus, H — height of whorl, W — width of whorl).

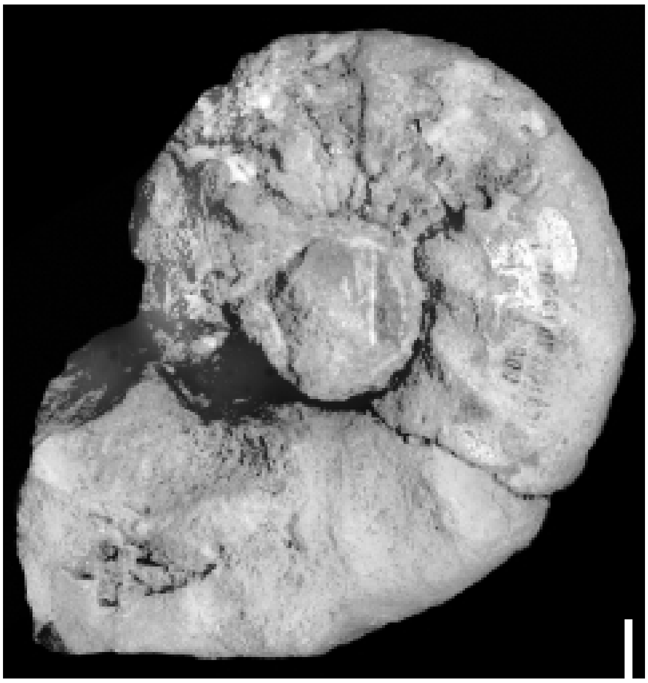

Fig. 2. *Ceratites (Opheoceratites) compressus* Philippi, 1901

MGUWr 2380s, Gąsiorowice, scale bar 10 mm

Fig. 3. *Ceratites (Acanthoceratites)* cf. *Praespinosus* Riedel, 1916

GIUS–7-1879/1, Gołuchowice, scale bar 10 mm

O c c u r r e n c e . *C.* (*O.*) *compressus* is noted from Germany in the *compressus* Zone (Wenger, 1957). It occurs in Poland in Upper Silesia and in the Holy Cross Mountains (Assmann, 1937; Senkowiczowa, 1991).

Subgenus ***Acanthoceratites*** Schrammen, 1928
Ceratites (*Acanthoceratites*) cf. *praespinosus* Riedel, 1916
(Fig. 3)

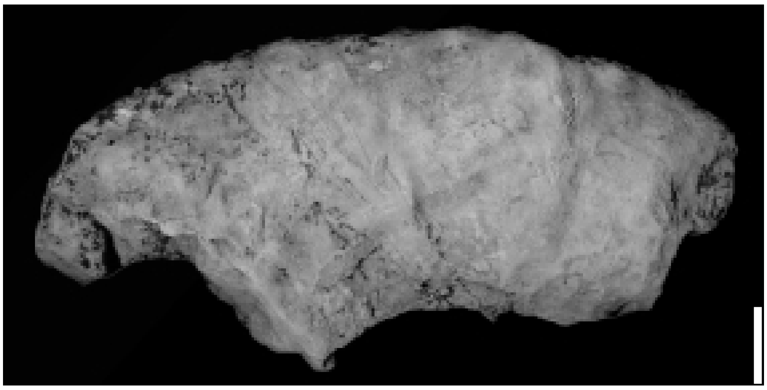

Fig. 4. *Ceratites (Acanthoceratites)* cf. *spinosus* Philippi, 1901

GIUS–7-1879/2, Gołuchowice, scale bar 10 mm

1916 *Ceratites praespinosus* Riedel; A. Riedel, p. 54–55, pl. 12, figs. 5–6; pl. 13, fig. 1.
1957 *Ceratites* (*Acanthoceratites*) *spinosus praespinosus* Riedel; R. Wenger, p. 87, pl. 13, figs. 1, 2.
1990 *Ceratites* (*Acanthoceratites*) *spinosus praespinosus* Riedel; M. Von Urlichs and R. Mundlos, pl. 1, fig. 1.

M a t e r i a l . One almost complete internal mould (GIUS–7-1879/1).

D e s c r i p t i o n . The entire phragmocone and the rear part of the body chamber of the specimen are preserved. The ventral side is wide and flat. There is one straight and single rib separated from a large ventrolateral spine (5 mm high) by a hollow. Short single ribs, reaching $^1/_2$ of the whorl height and separated from small ventrolateral nodes by hollows, are visible on the proximal part of the phragmocone. From the first half whorl there are only two rows of small, slightly elongated ventrolateral and lateral nodes, located half-way of the whorl height. The ventrolateral nodes reach at least the end of the whorl and the lateral ones disappear at the end of the last whorl. As the entire mould is strongly deformed, it is impossible to give its measurements. The diameter of the specimen is 7 cm, but this value has been increased by deformation. The lobe line covers four lateral lobes and saddles and also a wide ventral lobe with an accessory saddle in the central part. The first lateral lobe and saddle are wide.

R e m a r k s . Due to occurrence of single ribs and large spines in the rear part of the body chamber the specimen is allied to the *spinosus* group. Fine ribs visible only on the proximal part of the phragmocone and small diameters suggest the specimen belongs to *Ceratites (A.) praespinosus*.

O c c u r r e n c e . The species *Ceratites* (*A.*) *praespinosus* is noted from Germany (Wenger, 1957) and from the Holy Cross Mountains in Poland (*Ceratites* (*A.*) *spinosus* cf. *praespinosus*, Senkowiczowa, 1991) in the *spinosus* Zone. It has not yet been recorded from Upper Silesia.

Ceratites (*Acanthoceratites*) cf. *spinosus* Philippi, 1901
(Fig. 4)

1901 *Ceratites spinosus* Philippi; E. Philippi, p. 60, pl. 41, fig. 1.
1916 *Ceratites spinosus* Philippi; A. Riedel, p. 55–58, pl. 13, fig. 4; pl. 14, figs. 1, 3; pl. 18, fig. 2.
1937 *Ceratites spinosus* Philippi; P. Assmann, p. 107.
1957 *Ceratites* (*Acanthoceratites*) *spinosus spinosus* Philippi; R. Wenger, p. 87, pl. 13, figs. 3–5.
1991 *Ceratites* (*Acanthoceratites*) *spinosus spinosus* Philippi; H. Senkowiczowa, p. 124, pl. 6, fig. 3; pl. 7, figs. 1–3.

M a t e r i a l . One specimen (GIUS–7-1879/2).

D e s c r i p t i o n . The specimen is a mould representing a large part of a whorl (chord 113 mm) including a body chamber. The ventral part of the whorl is wide, smooth and slightly convex. The surface of the mould is partly eroded, and so the ornamentation is visible only on one side. Slightly eroded single, straight ribs extend radially from the umbilicus and terminate with traces of large, ventrolateral spines, which are partly preserved. H = 50 mm, W = 47 mm, W/H = 94.

R e m a r k s . The large size of the mould and traces of large ventrolateral spines prove the specimen belongs to a form from the *spinosus* group. The large value of W/H excludes identify with *C.* (*A.*) *penndorfi* Rothe, 1955, and the radial ribs suggest the specimen should be allied to *C.* (*A.*) *spinosus*. However, due to its incompleteness, the specimen has been left in open nomenclature.

O c c u r r e n c e . *Ceratites* (*A.*) *spinosus* is noted from Germany in the *spinosus* Zone (Wenger, 1957). It occurs in Poland in Upper Silesia and in the Holy Cross Mountains (Assmann, 1937; Senkowiczowa, 1991) forming together with *C.* (*A.*) *postspinosus* a *spinosus/postspinosus* Zone (Niedźwiedzki *et al*., 2001).

Ceratites sp.

M a t e r i a l . Three fragments of ceratites moulds (GIUS–7-1879/3-5).

D e s c r i p t i o n . Specimen 3 (H = 35 mm, W = 28 mm, W/H = 80) represents a small fragment of a mould of a body chamber (chord = 49 mm). The whorl section is rectangular, the ventral side is flat, smooth and wide with a slightly curved surface. The lateral sides are flat. There is one visible single rib. There are also traces of large ventrolateral spines. Specimen 4 is a small (chord 43 mm, H = 25 mm, W = 16.7 mm, W/H = 66.8) fragment of an eroded mould. It cannot be determined whether it is a phragmocone or a body chamber.

Fine ventrolateral nodes and very poorly preserved ribs are visible. The ventral side is flat and narrow, strongly curved. Specimen 5 is a mould and represents a large part of a whorl (almost half of a whorl, chord = 68 mm). The ventral side is flat and wide. Both lateral sides of the whorl are eroded and no ribs can be seen. Ventrolateral spines are easily visible.

R e m a r k s . It has not been possible to identify these incomplete specimens to species level. Specimens 3 and 5 have large ventrolateral spines, which suggest they belong to indicate affinity with the *spinosus* group.

DISCUSSION

Paraceratites (*P.*) *discus* and *P.* (*P.*) *sequens* found by Assmann (1937) are typical representatives of the *pulcher* Zone, and *P.* (*P.*) *philippii* occurs both in the *pulcher* Zone and in the *robustus* Zone (Riedel, 1916; Urlichs and Mundlos, 1980). Other ceratites found by Assmann (1937), Kotlicki (1974), and the material described in this paper distinction of the *robustus*, *compressus, evolutus* and *spinosus* zones (Fig. 5). The specimens of *C. (C.) nodosus* mentioned by Eck (1865), Tietze (1888) and Gürich (1887) are not described or illustrated, so the determinations cannot be assessed. There is an illustration of an incomplete *Ceratites* (*Ceratites*) *nodosus* in Roemer (1870), but Niedźwiedzki *et al*. (2001) stated that features of this specimen are not sufficient for species identification. Deposition of the marine Upper Muschelkalk in Poland terminated in the earliest Longobardian (Zawidzka, 1975; Niedźwiedzki and Salamon, 2002), well before the occurrence of the *C.* (*C.*) *nodosus* species. According to magnetostratigraphy data from the Holy Cross Mountains (Nawrocki and Szulc, 2000), the end of the Upper Muschelkalk sedimentation took place in the later part of the early Fassanian. Hence, all recorded occurrences of *C.* (*C.*) *nodosus* in Poland are most likely misidentifications of *C.* (*A.*) *spinosus, C.* (*A.*) *postspinosus* or *C.* (*A.*) *penndorfi*. Therefore, the oldest *atavus* Zone and seven younger zones, from the *postspinosus* Zone, which occur in the Upper Muschelkalk, and are known from Germany (Urlichs and Mundlos, 1987), are present neither in Upper Silesia, nor in the Holy Cross Mountains (Senkowiczowa, 1991; Niedźwiedzki *et al.*, 2001). The lack of the uppermost part of the Upper Muschelkalk was the result of a much earlier retreat of the sea in the eastern part of the Germanic Basin. This is supported by the lack of the youngest conodont zones (5–7), distinguished by Kozur (1968, 1974) in Germany, as observed by Trammer (1975), Zawidzka (1975) and Narkiewicz (1999). However, the occurrence of such conodonts as *Neogondolella haslachensis* and *Celsigondolella watznaueri praecursor* in the Holy Cross Mountains (Trammer, 1975, fig. 6, p. 201; Romanek, 1981, p. 110) and Upper Silesia (Zawidzka, 1975, pl. 37, figs. 1, 8) suggest the possible existence of the lower part of zone 5 (*sensu* Kozur, 1974). The lack of zones 6 and 7 is apparent. Ceratites of the *atavus* Zone have not been found in Poland, despite the occurrence of conodonts from zone 1 (*sensu* Kozur, 1968, 1974), which co-occur in Germany with ceratites. Although the fauna, during deposition of the Upper Muschelkalk, transgressed mainly from the west, the lack of ammonoids may result from the fact, that as nektobenthos (Wang and Westermann, 1993) or vaginal benthos (Rein, 1998), associated with shallow coastal water (Shevyriev, 1986; Wang and Westermann, 1993), they migrated slower than conodont-bearing animals. On the other hand, there has been less research into ceratites much lower in Poland than in Germany. Hence, ceratites from the older zones have been found quite rarely and the lack of the *atavus* Zone in the Upper Muschelkalk zonation may be the result of insufficient research. Comparing the groups of ceratites from the Holy Cross Mountains and Upper Silesia it may be stated that in both cases their taxonomic variations are small (six and seven species plus two *conformis* species in the Holy Cross Mountains). However, apart from that, numerous subspecies could be distinguished in the Holy Cross Mountains. The difference is small and probably results from the small number of specimens collected and the incomplete investigation of ceratites in Upper Silesia. Those groups are less varied than in Germany, where all ceratite species occurred. Due to their low mobility only few species of ceratites migrated outside the Germanic Basin — they are very few not only in the eastern part of the Germanic Basin, but also in the western Tethys (Urlichs, 1997), despite connections with the Tethys and the Germanic Basin in the Fassanian and the Longobardian.

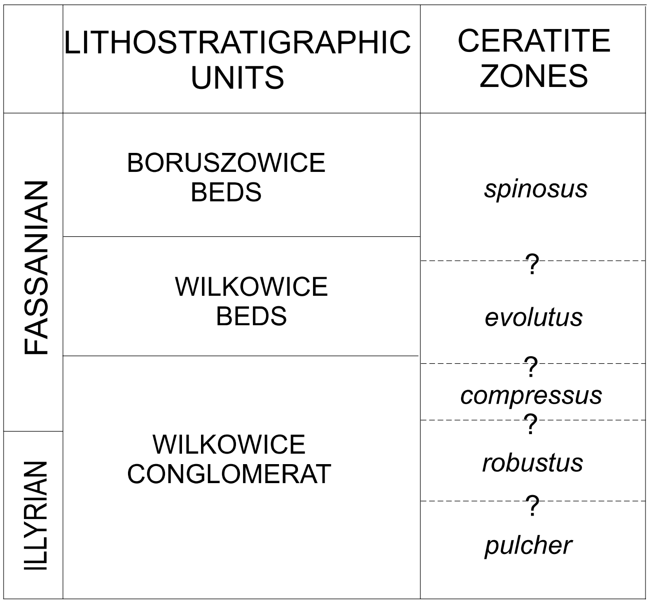

Fig. 5. Upper Silesian ceratite zones

Ceratite data after Assmann, 1937; Kotlicki, 1974 and Niedźwiedzki *et al*., 2001; correlation of the lithostratigraphic units with chronostratigraphic units after Zawidzka, 1975

CONCLUSIONS

The following zones can be documented in Upper Silesia: *pulcher*, *robustus*, *compressus, evolutus* and *spinosus*.

For the first time *Ceratites* (*A.*) cf. *praespinosus* from Upper Silesia has been described.

The ceratite *C.* (*C.*) *nodosus* described 19th century publications was misidentified, as marine sedimentation had ended in the area of Upper Silesia before the species evolved.

The lack of the *atavus* Zone in Upper Silesia may be the result of poor investigation of ceratites from the older zones of the Upper Muschelkalk in Poland, but the fact that ceratites from Germany did not reach the eastern part of the German Basin cannot be excluded either. The taxonomic composition of corresponding ceratite zones in the Holy Cross Mountains and Upper Silesia is almost identical and slight differences might be the result of the scarce ceratites specimens collected in those areas. Those zones display lower taxonomic diversity than the ones in Germany.

Abbreviations of cited repositories: GIUS — Geological Institute of the University of Silesia, Sosnowiec, Poland. MGUWr — Geological Museum of the Institute of Geological Sciences of Wrocław University, Poland.

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