Cretaceous Research 31 (2010) 27–60

Contents lists available at ScienceDirect

Cretaceous Research

journal homepage: www.elsevier.com/locate/CretRes

Early Maastrichtian ammonites and nautiloids from Hrebenne, southeast Poland, and phenotypic plasticity of *Acanthoscaphites tridens* (Kner, 1848)

Adrian Kin

Geoscience Friends Association 'Phacops', ul. Targowa 29, PL-90 550 Łódź, Poland

ARTICLE INFO

Article history:
Received 30 July 2008
Accepted in revised form 3 September 2009
Available online 30 September 2009

Keywords:
Ammonites
Dimorphism
Nautiloids
Phenotypic and ecophenotypic plasticity
Polymorphism
Poland

ABSTRACT

Marly siliceous limestones (opokas) of late early Maastrichtian (*Belemnella sumensis* Zone) age exposed temporarily at Hrebenne (southeast Poland) have recently yielded seven species of ammonite and four nautiloid taxa, namely *Hauericeras sulcatum* (Kner, 1848), *Diplomoceras cylindraceum* (Defrance, 1816), *Baculites vertebralis* de Lamarck, 1801, *Baculites knorrianus* Desmarest, 1817, *Baculites* sp., *Acanthoscaphites tridens* (Kner, 1848) s. str., *Hoploscaphites constrictus* (Sowerby, 1817), *Cymatoceras loricatum* (Schlüter, 1876), *Cymatoceras patens* (Kner, 1848), *Eutrephoceras* aff. *darupense* (Schlüter, 1876), and *Eutrephoceras* sp. nov. A. Of these, four heteromorphs (*B. knorrianus*, *B.* sp., *B. vertebralis*, and *A. tridens* s. str.) predominate in these rich assemblages, while *Eutrephoceras* aff. *darupense* is the most common nautiloid. The wide range of variation in both size and ornament seen in *Acanthoscaphites tridens* s. str. (= formae *trispinosus*, *innodosus*, *trinodosus*; ranging from the uppermost *Belemnella obtusa* Zone into the *Bn. sumensis* Zone), is held to be intimately linked to phenotypic plasticity of that species, rather than to the previously widely accepted concept of marked sexual dimorphism or an expression of hypothetical polymorphism. The presence of small representatives (< 200 mm in diameter) of *Cymatoceras loricatum* at Hrebenne shows that this species cannot be considered endemic to northern Germany. The Hrebenne locality is the first in Poland to provide a rich and diverse macrofauna, inclusive of cephalopods, of *Bn. sumensis* Zone age. The ammonites from Hrebenne comprise typically early Maastrichtian forms; their specific composition is similar to that recorded from both western (e.g., Kronsmoor and Rügen, northern Germany, Limburg and Liège provinces, Belgium; southern Limburg, the Netherlands; Møns Klint, Denmark), and eastern Europe (e.g., Nagoryanÿ, the Ukraine; Russian Platform).

1. Introduction

The first studies of Maastrichtian strata in the eastern part of Lublin Upland (central and southern portions of the Roztocze area; Fig. 1B), renowned for their rich macrofaunas, were conducted in the early nineteenth century and later at the start of the twentieth century (Staszic, 1815; Pusch, 1837; Łopuski, 1911, 1912). Various macrofossil groups collected from numerous exposures in the Polish portion of the Roztocze area have not yet been studied and described in detail, and all previous records of the specific faunal composition were included solely in stratigraphic analyses (Pożaryski, 1956; Areń, 1959; Nowiński, 1967; Żelichowski, 1967, 1975; Cieśliński and Wyrwicka, 1970; Krassowska, 1975, 1976; Cieśliński, 1995). To date, in Poland faunal assemblages of *Belemnella sumensis* Zone age (*sensu* Schulz, 1979), a zone partially equivalent to the *Trochoceramus radiosus* inoceramid Zone (see Fig. 2; the range of *T. radiosus* being middle to late *Bn. sumensis* Zone; Ireneusz Walaszczyk, pers. comm., May 2006) still are poorly known, which can be explained by a near-total lack of outcrops representing this interval in the widely outcropping Cretaceous rocks along the Middle Vistula River, in the Nida Trough and in the Włoszczowa area. So far, only Walaszczyk et al. (1996) have demonstrated the occurrence of the index species, *T. radiosus* (Quaas, 1902), in the Nida Trough. However, the exact provenance of these specimens (housed in the Polish Geological Institute, Warsaw) is unknown.

Abundant well-preserved ammonoid and nautiloid cephalopods from Hrebenne, a locality no longer accessible (Fig. 1C), provide an excellent opportunity to study these assemblages in detail. In particular, numerous specimens of the common scaphitid, *Acanthoscaphites tridens*, permit a comprehensive documentation of its range of variation; the species is widely distributed in Europe, inclusive of the Ukraine and Russian Platform (Kennedy and Summesberger, 1987; Jagt et al., 1999; Niebuhr, 2003). Various types of ornament and final shell diameter as previously demonstrated in morphotypes of *A. tridens* (formae *trispinosus-innodosus-trinodosus* and *bispinosus-quadrispinosus*; *sensu* Niebuhr, 2003), have so far been attributed exclusively to a marked sexual dimorphism

E-mail address: amonit79@tlen.pl

0195-6671/$ – see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.cretres.2009.09.003

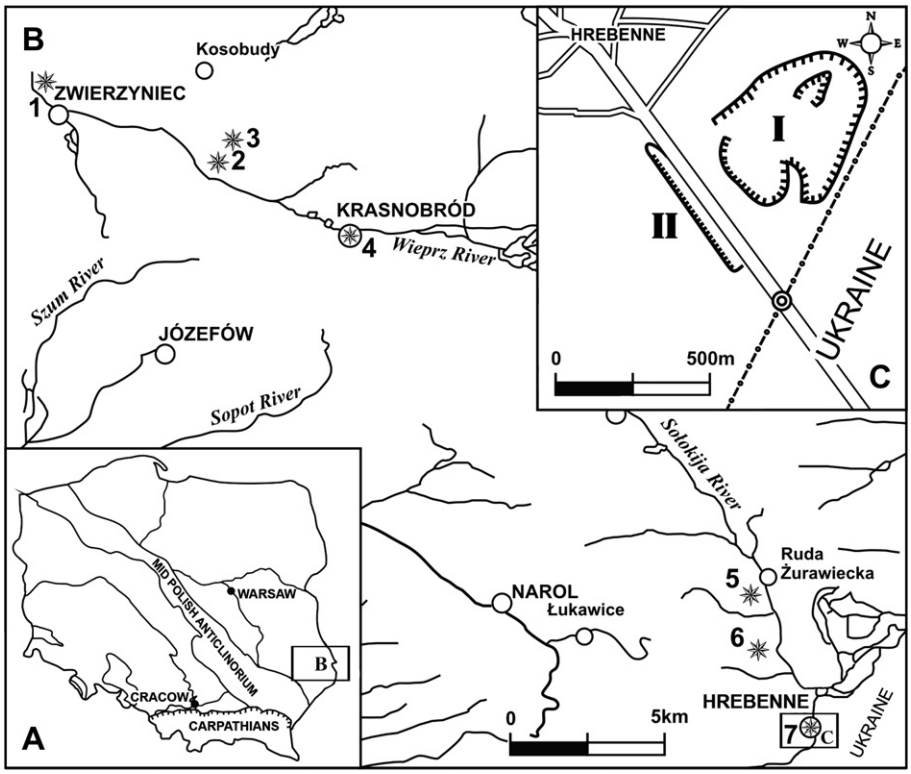

Fig. 1. A, Map of Poland, showing the extent of Upper Cretaceous deposits (in grey); B, Detailed map of the central-southern portion of the Roztocze area, showing outcrops studied (1–7) (see text for details); C. Map of extensive temporary outcrops (I, II) in the Hrebenne area (*Belemnella sumensis* Zone).

(Kennedy and Summesberger, 1987) as identified in certain of members of the family Scaphitidae Gill, 1871 (Makowski, 1962; Wiedmann, 1965; Cobban, 1969; Riccardi, 1983; van der Tuuk, 1987; Landman and Waage, 1993; Davis et al., 1996; Monks, 2000; Machalski and Odin, 2001; Landman et al., 2003). Morphometric data on numerous specimens of *A. tridens* from Hrebenne, and from elsewhere in Poland, plus an analysis of literature sources have allowed me to present here an alternative interpretation, namely that of phenotypic plasticity of representatives of *A. tridens* s. str. (= formae *trispinosus-innodosus-trinodosus*, range: uppermost *Bn. obtusa* and *Bn. sumensis* zones). The present material was collected during fieldwork at Hrebenne in 2004 and 2005, by Zbigniew Remin and myself; associated belemnites will subsequently be described by Remin. Inoceramid bivalves from this locality, including specimens of *T. radiosus*, are now with Ireneusz Walaszczyk. Associated biota, e.g. irregular echinoids, gastropods, sponges and brachiopods, are in the collection of the Geoscience Friends Association '*Phacops*', registered Hr/2004-5/276, as are all ammonites and nautiloids (Hr/CAA187 and Hr/CAN 77).

Stage & substage			Belemnite zones	Inoceramid zones	Calcareous nannofossils
Maastrichtian	lower Maastrichtian	U	*Bn. fastigata*	"*Inoceramus*" *morgani*	UC 19
			Bn. cimbrica		
			Bn. sumensis	*T. radiosus*	UC 18 ★
		L	*Bn. obtusa*	*E. typica*	UC 17 ☆ ☆
			Bn. pseudobtusa	"*Inoceramus*" *redbirdensis*	UC 16
			Bn. lanceolata	"*Inoceramus*" *costaecus*	

Fig. 2. Biostratigraphy of the lower Maastrichtian in northern Europe on the basis of micro- and macrofossils (belemnite zones after Schulz, 1979; Schulz and Schmid, 1983; inoceramid zones after I. Walaszczyk (pers. comm., May 2008); calcareous nannofossil zones after Burnett (1998) and M. Kędzierski (pers. comm., September 2006). Abbreviations: L - lower; U - upper; *Bn. - Belemnella*; *T. - Trochoceramus*; *E. - Endocostea*; ☆ stratigraphic position of sample from Bełżec (M. Kędzierski, pers. comm., September 2006); ☆ stratigraphic position of sample from Lubycza Królewska (M. Kędzierski, pers. comm., September 2006);★ stratigraphic position of hBH at Hrebenne (M. Kędzierski, pers. comm., September 2006).

2. Geological setting and stratigraphy

The Roztocze area comprises a distinct geographic unit, made up of a range of hills, some 185 km long and up to 28 km wide, which extends from Kraśnik in the Lublin Upland (southeast Poland) to Lviv in the Ukraine. The area is situated in the central portion of the Lubelsko-Wołyńska Upland (southeast Poland and western Ukraine; Fig. 1A, B) and along the northeasterly border of the Pre-Carpathian depression. The marginal portion of the eastern European Precambrian and Epivariscan platforms, as well as Palaeozoic and Mesozoic rocks constitute its substratum (Oszczypko, 1996, 1997). The central and southern part of the Roztocze area comprises Upper Cretaceous carbonate rocks: opokas (i.e., intermediate calcareous and siliceous sedimentary rocks, rich in silica of organic origin), marly opokas and calcareous gaizes (i.e., siliceous sedimentary rock with carbonate ingredients) (Pożaryski, 1956) of Campanian and Maastrichtian age. Maastrichtian strata may be over 500 m in thickness (Cieśliński, 1995). The cover consists of Cenozoic and Quaternary formations of varying thickness, e.g. sands and gravels, calcareous sandstones and organo-detrital limestones (Pożaryski, 1956; Kulczycka, 1975; Superson, 1983;