

Belemnella (Pachybelemnella) inflata (ARKHANGELSKY) from Nagoryan̄, USSR

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by

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Abstract

A small belemnite fauna from Nagoryan̄ (USSR, formerly Austro-Hungarian empire) is referred to *Belemnella (Pachybelemnella) inflata* (ARKHANGELSKY, 1912) on the basis of biometric analysis. This species occurs in the basal Maastrichtian *Belemnella lanceolata* and *Belemnella pseudobtusa* Zones.

Zusammenfassung

Aus Nagoriani (USSR, früher Österreich–Ungarn) wird eine kleine Belemnitenfauna beschrieben. Einziges Taxon ist *Belemnella (Pachybelemnella) inflata* (ARKHANGELSKY; 1912), identifiziert auf der Basis biometrischer Untersuchung. Die Art tritt im unteren Untermaastricht in der *Belemnella lanceolata*- und *Belemnella pseudobtusa*-Zone auf.

Introduction

Belemnites have been shown to be of fundamental importance in biostratigraphy and correlation in the Upper Cretaceous of Europe, especially during the Coniacian through Maastrichtian Stages. The purpose of the present paper is to describe a small belemnite fauna from Nagoryan̄ in Galicia (USSR, formerly Poland) and place the locality within the international stratigraphic framework.

NOWAK (1913) and NAIDIN (1952) described and figured *Belemnella lanceolata* (SCHLOTHEIM) from Nagoryany. SCHULZ (1979) studied the genus *Belemnella* NOWAK from the Lower Maastrichtian of NW-Europe in great detail and introduced a set of parameters for determining species of *Belemnella*; this method is used herein.

All the belemnites from Nagoryan̄ belong to *Belemnella*, and they are assigned to *B. (P.) inflata*, which occurs in the basal Maastrichtian.

Provenance of material. – The study is based upon belemnites housed in the Geological Museum, Copenhagen (prefix MGUH) (9 specimens) and Naturhistorisches Museum, Vienna (prefix NHMW) (6 specimens).

Terms and methods. – The Schatzky distance (SD) is defined as the distance from the anterior part of the protoconch to the beginning of the ventral fissure measured along the axis of the guard (Fig. 1). The fissure

angle (FA) is the angle between the wall of the alveolus and the straight line connecting the intersection points of the bottom of the ventral fissure on the wall of the alveolus and the outer margin of the guard. The alveolar angle (AA) is the angle between the walls of the alveolus measured in the median plane. The alveolar angle is measured in the anterior part of the alveolus.

SCHULZ (1979) stressed the importance of the shape of the guard in ventral view compared to the length from apex to protoconch (length of rostrum solidum (Ls) sensu SCHULZ). In order to compare specimens of different size he introduced the term standardized length from apex to protoconch (Lsn) (see below). The shape of the guard in ventral view was defined by an index (AV) (see below). The late ontogenetic growth quotient (WQs) (see

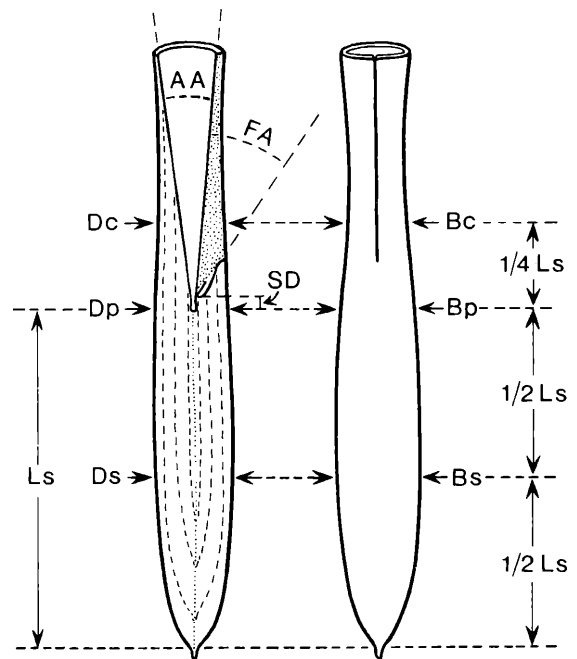


Fig. 1. Diagram showing morphological elements of the guard. AA = alveolar angle. FA = fissure angle. SD = Schatzky distance. Ls = length from apex to protoconch (= length of rostrum solidum sensu SCHULZ). D = Dorso-ventral diameter. B = Lateral diameter. The diameters are measured in three places: (1) at the protoconch (Dp and Bp); (2) in the posterior part of the guard halfway between apex and the protoconch (Ds and Bs); and (3) in the guard, anterior to the protoconch, at a distance corresponding to one quarter of the length from apex to protoconch (Dc and Bc). Modified after SCHULZ (1979:20; Fig. 4).

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below) is calculated on the basis of measurements obtained from growth stages of single specimens. For a further discussion of these derived variables, see SCHULZ (1979: 15–20). He also gave a graphic key for Lower Maastrichtian species of *Belemnella* based on AV and Lsn (SCHULZ 1979, fig. 53), which was used successfully in later works (SCHMID & SCHULZ 1979; SCHULZ & SCHMID 1983). The graphic key is used here (Figs. 2), and the derived variables are defined in the following way (see also Fig. 1):

$$(1) \text{Lsn} = \text{Ls} + \text{WQs} (13.5 - \text{Dp}) \text{ mm}; (2) \text{AV} = \frac{(\text{Bs} - \text{Bc}) 100}{\text{Bp}} \%;$$

$$(3) \text{WQs} = \frac{\text{Ls}_2 - \text{Ls}_1}{\text{Dp}_2 - \text{Dp}_1}; (\text{Dp}_2 > \text{Dp}_1 > 6 \text{ mm}).$$

The late ontogenetic growth quotient in three split specimens gave the following values: 1.65, 1.05, and 1.22. The mean value is 1.3, which is used in the calculations. According to SCHULZ (1979:30) the mean value of WQs for Lower Lower Maastrichtian species of *Belemnella* is 1.8. I have also calculated the standardized length from apex to protoconch using WQs = 1.8, and the result is almost identical to the result using WQs = 1.3.

Systematic description

Genus *Belemnella* NOWAK, 1913

Type species. — *Belemnites lanceolatus* SCHLOT-HEIM, 1813.

Remarks. — The genus *Belemnella* is particularly characterized by its long and slender juvenile guard, small Schatzky distance (generally less than 4 mm), undulating dorso-lateral double furrows, and the vascular imprints which branch off the dorso-lateral furrows posteriorly at an angle exceeding 30° .

The following subgenera of *Belemnella* have been established: *B. (Belemnella)*, and *B. (Pachybelemnella)* SCHULZ from the Lower Maastrichtian, in addition to *B. (Neobelemnella)* NAIDIN from the Upper Maastrichtian (see SCHULZ 1979:95).

Subgenus *Pachybelemnella* SCHULZ, 1979

Type species. — *Belemnella (Pachybelemnella) obtusa* SCHULZ, 1979.

Remarks. — Species of *Pachybelemnella* are distinguished from species of the nominate subgenus by their stouter guards.

Belemnella (P.) inflata (ARKHANGELSKY, 1912)

Pl. 1, Figs. 1–6, ?7

Remarks. — Synonyms were given by SCHULZ (1979: 107–110), who also fully described the species on the basis of material from West Germany, Denmark and England.

Short description. — A *Belemnella* with a large, stout

guard which is markedly lanceolate in lateral and ventral views and strongly flattened ventrally. Vascular imprints are distinct and branch off the undulating dorso-lateral furrows at a high angle (up to 70°). The apical angle generally is obtuse and a well-defined mucro is present. The Schatzky distance and alveolar angle are small (see below).

Biometry. — The mean values of important characters of the Nagoryany specimens are reported below, and the values of Lsn and AV are plotted in Fig. 2.

Character	N	\bar{X}	OR
Lsn	9	65.2	56.9–73.7 (in mm)
AV	9	21.4	10.4–25.9 (in %)
SD	5	0.8	0.6–1.2 (in mm)
FA	5	26.2	21.0–42.0 (in degrees)
AA	7	14.9	14.0–16.0 (in degrees)

N is the number of specimens; \bar{X} is the mean value; and OR is the observed range.

Discussion. — Most of the specimens from Nagoryany plot in the *B. (P.) inflata* area in Fig. 2, as does the mean value. Two specimens have AV-values less than 20%. One specimen has a AV-value of 16.8% which is within the range of *B. (P.) inflata* (see SCHULZ 1979:56–57; Figs. 13, 15). The other specimen is discussed below. The Schatzky distance, alveolar angle, and WQs of the Nagoryany specimens are small as in *B. (P.) inflata* from West Germany. The Nagoryany specimens are consequently referred to *B. (P.) inflata*.

B. (P.) inflata, *B. (P.) desnensis* (JELETZKY), *B. (P.) lanceolata*, and *B. (P.) longissima* SCHULZ are distinguished from other species of *Belemnella* by having guards, which are markedly lanceolata in ventral view (AV is generally larger than 20%; see Fig. 2). *B. (P.) inflata* differs

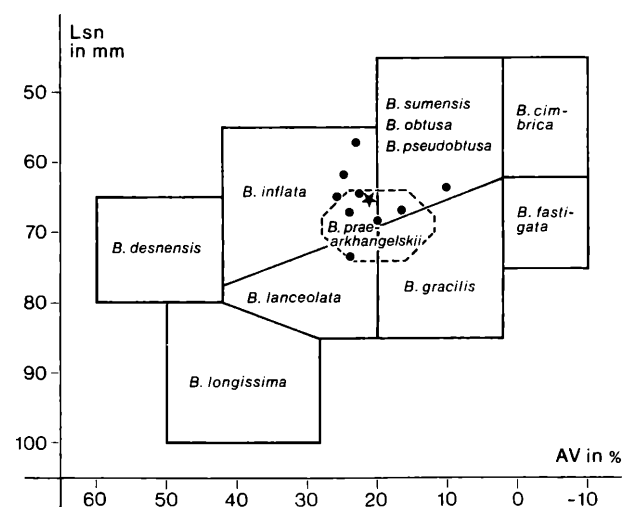


Fig. 2. Graphic key for Lower Maastrichtian species of *Belemnella* based on mean values of Lsn and AV. The diagram is valid only for samples of *Belemnella*, and does not permit identification of individual specimens with certainty. After SCHULZ (1979:94; Fig. 53). ● = specimens from Nagoryany; ★ = mean value.

from *B. (P.) desnensis* in being less lanceolate in ventral view and from *B. (B.) lanceolata* and *B. (B.) longissima* by being stouter. *B. (P.) inflata* differs from *B. (?B.) praearkhangelskii* NAIDIN in being more lanceolate in ventral view, having an obtuse apical angle, and a smaller alveolar angle and WQs.

The specimen plotted farthest to the right in Fig. 2 is less lanceolate in ventral view and has a larger fissure angle (42°) than the other specimens from Nagoryana. It is uncertain if this specimen should be regarded as an extreme variant of *B. (P.) inflata* or be referred to another species. More material is necessary in order to solve this problem.

Stratigraphy. — The base of the Maastrichtian is commonly defined by the first occurrence of *B. (B.) lanceolata*. This definition was first proposed by JELETZKY (1951) and has since received general recognition, at least in Europe (see SCHULZ 1978, 1979; SCHULZ, ERNST, ERNST & SCHMID 1984; SURLYK 1982, 1984; BIRKELUND, HANCOCK, HART, RAWSON, REMANE, ROBASZYNSKI, SCHMID & SURLYK 1984).

The genus *Belemnella* is only recorded from the Maastrichtian (SCHULZ 1979). Some authors, including JELETZKY (1958) and NAIDIN (1964), have reported assumed primitive representatives of *Belemnella*, *B. (P.) licharewi* (JELETZKY) and *B. (P.) desnensis* (JELETZKY), from the highest Campanian. According to SCHULZ (1979:43, 48), however, *B. (P.) licharewi* is a synonym of *B. (P.) desnensis*, and *B. (P.) desnensis* occurs in the *B. lanceolata* Zone 6–7 m above the base of the Maastrichtian in the Kronsmoor quarry in West Germany. Therefore, the highest Campanian of JELETZKY and NAIDIN may be correlated with the middle part of the *B. lanceolata* Zone of NW-Europa (SCHULZ 1979:48).

SCHULZ (1979) subdivided the Lower Maastrichtian into six range or concurrent range zones on the basis of species of *Belemnella*, in ascending order: *lanceolata*, *pseudobtusa*, *obtusa*, *sumensis*, *cimbrica*, and *fastigata* Zones. It should be stressed, however, that the *lanceolata*, *sumensis*, and *cimbrica* Zones sensu SCHULZ are defined in another way than the *lanceolata*, *sumensis*, and *cimbrica* Zones used in earlier literature (e.g. BIRKELUND 1957).

B. (P.) inflata occurs in the *B. lanceolata* and *B. pseudobtusa* Zones of the basal Maastrichtian.

Paleobiogeography. — *B. (P.) inflata* occurs from England (Norfolk), across West Germany, Denmark, and Poland to the Russian Platform.

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Plate 1

Photographed specimens are coated with ammonium chloride. All figures are x 0,8.

Figs. 1–6. *Belemnella (Pachybelemnella) inflata* (ARKHANGELSKY) from Nagoryan̄y.

Fig. 1. A large adult specimen. A: Ventral view. B: Lateral view. MGUH 18304.

Fig. 2. Adult specimen with an acute apical end. Ventral view. MGUH 18305.

Fig. 3. Adult specimen with an obtuse apical end. Ventral view. MGUH 18306.

Fig. 4. Adult specimen with vascular markings. A: Ventral view. B: Lateral view. C: View of

the split anterior end showing inner characters. NHMW 1848/8221b.

Fig. 5. Adult specimen with pronounced vascular markings. A: Ventral view. B: Lateral view. NHMW 1862/8222b.

Fig. 6. View of the split anterior end showing inner characters. MGUH 18307.

Fig. 7. *Belemnella (Pachybelemnella)* sp. A: Ventral view. B: View of split anterior end showing inner characters. This specimen is less lanceolata and has a larger fissure angle than the other specimens studied from Nagoryany. It is uncertain if it is an extreme variant of *B. (P.) inflata* or belongs to another species. MGUH 18308.

