DEVELOPMENT AND BIOSTRATIGRAPHY OF THE PALEOGENE GORZEŃ BEDS, SUBSILESIAN UNIT, OUTER CARPATHIANS, POLAND

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Abstract: Gorzeń beds represent the sedimentary succession of the Subsilesian Unit. The Gorzeń beds developed as thin- up to medium-bedded sandstones intercalated with grey clayey shales occur in a few tectonic windows of the Lanckorona – Żegocina zone. Palaeocene age of these flysch deposits has been determined on the base of investigations of foramniferal assemblages predominated by agglutinated forms. These assemblages indicate *Rzehakina fissistomata* Zone.

Key words: Subsilesian Unit, Gorzeń beds, lithology, biostratigraphy, foraminifera

Introduction:

Sedimentary facies of the Silesian and Subsilesian nappes have been deposed in adjacent sedimentary areas and together represent continuos succession of deposits of the age interval from Late Jurassic and Early Cretaceous to Early Miocene time. Up to the beginning of Late Cretaceous the sedimentation in both areas was similar, but later differentiated and during Late Cretaceous - Paleogene age interval the Subsilesian succession has got individual development. During Senonian more shallow water (above CCD) carbonate sedimentation of marls and occasionally limestone dominated there. In the Paleogene it was replaced by the flysch facies with dominant sedimentation of fine material.

Unique development of the sedimentary succession makes the Subsilesian Unit very interesting. Though investigations have been leaded (e.g. Książkiewicz 1951 a, b; 1972; Skoczylas-Ciszewska 1960; Geroch *et al.*, 1967) there from more than fifty years, last examinations (e.g. Cieszkowski *et al.* 2000; Leśniak & Waśkowska-Oliwa, 2001) supplied many new details.

Authors of this paper concerned on Paleogene deposits of the Subsilesian Unit and turned a special attention to the Palaeocene flysch facies of the Gorzeń beds, which had been described by Książkiewicz (1951a, b) as glauconitic Gorzeń sandstons. Lithological and micropaleontological examination took place in type section area.

Geological setting:

Gorzeń beds that represent deposits of the sedimentary succession of the Subsilesian Unit have got their type section area south of Wadowice in Gorzeń village and its surroundings. Here, the Subsilesian Unit occurs in the one of tectonic windows of the Lanckorona – Żegocina zone. The Lanckorona – Żegcina tectonic zone is an anticlinal structure of the Silesian Nappe, extending in the Polish sector of the Outer Carpathians between Skawa and Dunajec rivers. It forms the Silesian Nappe overthrust onto the Subsilesian Nappe and refolded togather with it. Latter erosion cut part of the Silesian Nappe strata and uncovered strongly tectonized rocks of the Subsilesian Nappe in numerous tectonic windows located along the axes of the Lanckorona – Żegocina structure.

The sedimentary sequence of the Subsilesian Unit south of Wadowice consists of the Late Cretaceous marly facies and the Paleogene flysch. The Palaeocene Gorzeń beds are known only from the tectonic windows between Wadowice and Lanckorona. They overlie here the organodetritic Szydłowiec Sandstone (Książkiewicz 1951a, b).

The lithostratigraphic position of the Gorzeń beds is adequate to the Palaeocene deposits from other areas of the Subsilesian Unit, which are represented by the Czerwin beds, glauconitic sandstones and partly the variegated and green shales.

Lithology:

The Gorzeń beds represent flysch facies that consists of thin- to medium-bedded sandstones with intercalations of shales. Occasionally thick-bedded sandstone layers occur too. The sandstones are siliceous, graded, fine- or rarely medium-grained with parallel and/or cross lamination. Occasionally on the bottom of sandstone layers flute marks and/or trace fossils occur. In some cases ichnofossils are frequent also at top of sandstone layers. Shales are usually calyey, grey and grey-greenish in colour, more or less bioturbated. The turbidites mainly represent T_{bcde} and T_{cde} Bouma's sequences, but rare T_{abcde} occur too.

Biostratigraphy:

The age of the considered deposits has been established thanks to assemblages of benthic foraminifers. Samples were taken from shaly intervals of Gorzeń beds in Gorzeń village. Foraminiferal associations consist mainly of deep water agglutinated benthos. Very good preserved fossil foraminifers represent more than twenty genera. (see appendix). *Nothia* is the most frequent group and tubular forms belonging to *Rhabdammia* and *Rhizamnmina* genus as well. There have been found quite a lot of representatives of *Recurvoides* div. sp., *Bolivinopsis spectabilis* (Grzybowski), *Hormosina velascoensis* (Cushman), *Caudammina ovuloides* (Grzybowski) and *Kalamopsis grzybowskii* (Dylążanka). Characteristic species with the biostratigraphical importance such as *Dorothia crassa* (Marsson), *Glomospira diffundens* Cushamn et Renz, *Haplophragmoides walteri (Grzybowski), Haplophragmoides mjatliukae* (Maslakowa), *Remesella varians* (Glaessner), *Rzehakina fissistomata* (Grzybowski), *Rzehakina epigona* (Rzehak) and *Spiroplectammina dentata* (Alth) have been recognized among studied microfauna. Moreover, a few poorly preserved planktonic specimens, probably *Subbotina* have been found only in one sample. The common occurrence of mentioned above genera is typical for the Palaeocene age of the sediments and indicates the *Rzehakina fissistomata* zone (zone after Olszewska, 1997).

The presence of foraminiferal associations within the Gorzeń beds, especially predominant agglutinated forms with organic cement (there have been found only single taxa with calcareous cement e.g. *Dorothia* and *Remesella*) is characteristic of the depth below but close the CCD. The occasional occurrence of a few badly preserved planktonic foraminifers and the scarcity of benthos with the calcareous cement, found only in few samples, could have been caused by little fluctuation of the CCD-level.

Appendix – Species list

Bathysiphon sp.
Nothia div. sp. (mainly *Nothia excelsa* (Grzybowski))
Rhabdammina cylindrica Glaessner
Rhabdammina discreta Brady
Rhizammina idivisa Brady
Saccammina placenta (Grzybowski)
Saccammina scabrosa Mjatliuk
Ammodiscus cretaceus (Reuss)
Ammodiscus incertus (d'Orbigny)
Ammodiscus peruvianus Berry
Ammodiscus planus Loeblich
Ammodiscus tenuissimus Grzybowski
Glomospira charoides (Jones et Parker)
Glomospira diffundens Cushman et Renz
Glomospira gordialis (Jones et Parker)
Glomospira glomerata (Grzybowski)
Glomospira serpens (Grzybowski)
Glomospirella grzybowskii (Jurkiewicz)
Psamminopelta gradsteini Kaminski et Geroch
Rzehakina epigona (Rzehak)
Rzehakina fissistomata (Grzybowski)
Aschemocella carpathica Neagu
Kalamopsis grzybowskii (Dylążanka)

Caudammina ovuloides (Grzybowski)
Caudammina ovulum (Grzybowski)
Hormosina velascoensis (Cushman)
Haplophragmoides mjatliukae (Masłakowa)
Haplophragmoides walteri (Grzybowski)
Paratrochamminoides contortus (Grzybowski)
Paratrochamminoides irregularis (White)
Paratrochamminoides heteromorphus (Grzybowski)
Paratrochamminoides multilobus (Dylążanka)
Paratrochamminoides olszewskii (Grzybowski)
Ammosphaeroidina pseudopauciloculata (Mjatliuk)
Recurvoides div. sp.
Thalmannammina subturbinata (Grzybowski)
Spiroplectammina dentata (Alth)
Bolivinopsis spectabilis (Grzybowski)
Trochammina globigeriniformis (Parker et Jones)
Gerochammina conversa (Grzybowski)
Karrerulina coniformis (Grzybowski)
Remesella varians (Glaessner)
Dorothia crassa (Marsson)
? Subbotina sp.

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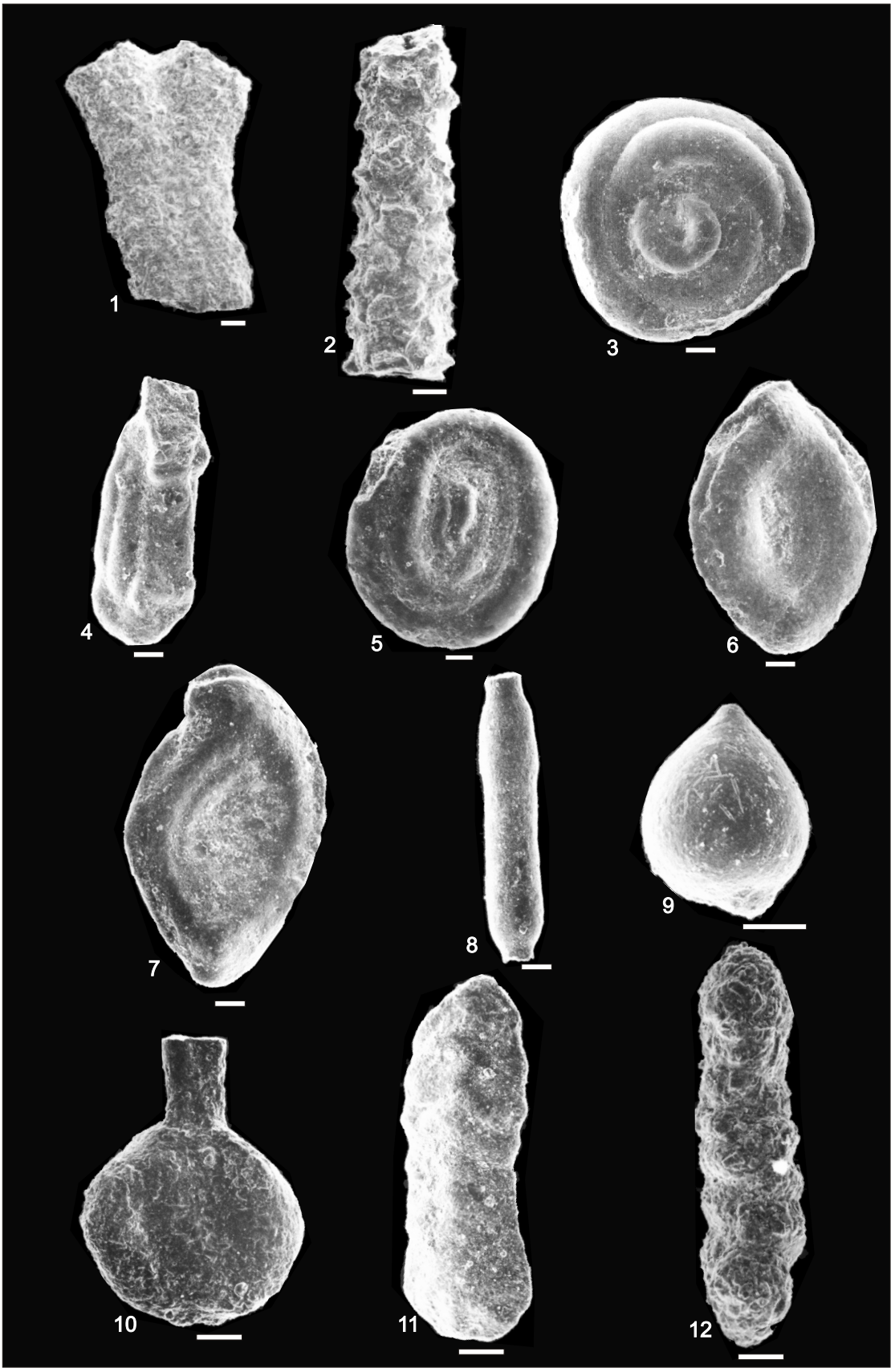
Plate 1. Agglutinated foraminifera from the Gorzeń beds.

Plate 1
Agglutinated foraminifera from Gorzeń beds.



Scale bar = 100mm

1 - *Nothia excelsa* (Grzybowski), 2 - *Rhabdammina cylindrica* Glaessner, 3 - *Glomospira diffundens* Cushman et Renz, 4 - *Glomospira glomerata* (Grzybowski), 5 - *Glomospirella grzybowskii* (Jurkiewicz), 6 - *Rzehakina epigona* (Rzehak), 7 - *Rzehakina fissistomata* (Grzybowski), 8 - *Kalamopsis grzybowskii* (Dylążanka), 9 -*Caudammina ovulum* (Grzybowski), 10 - *Hormosina* sp., 11 - *Bolivinopsis spectabilis* (Grzybowski), 12 - *Gerochammina conversa* (Grzybowski). .