THE AGE OF THE YOUNGEST DEPOSITS OF THE MSZANA DOLNA AND SZCZAWA TECTONIC WINDOWS (MAGURA NAPPE, WESTERN CARPATHIANS, POLAND)

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Abstract: The youngest deposits of the Mszana Dolna Tectonic Window belong to the NP24 and NP22-23 calcareous nannoplankton zones in the Dukla and Grybów units respectively. In the Grybów Unit of the Szczawa Tectonic Window the NP22 Zone was determine in the Grybów beds, whereas the Cergowa beds belong to NP 23 and NP 24 zones. These ages are very well co relatable with that from the southern part of the Silesian, and Dukla units.

Key words: Outer Carpathians, Magura Nappe, tectonic window, Oligocene, calcareous nannoplankton

Introduction

In the middle part of the Polish sector of the Magura Nappe eleven tectonic windows were recognized (Książkiewicz, 1972). The majority of these windows are situated between the Skawa River on the west and the Polish/ Slovak frontier in the east. These windows belong to the Fore-Magura Group (FMG) of units, which occupied the intermediate position between the Silesian and Magura nappes. In the tectonic windows the Obidowa and Grybów units occur and are regarded as the western and southern prolongation of the Dukla Unit, respectively. These units are composed of predominantly Late Eocene-Oligocene deposits. There is a common understanding (Bieda et al., 1963, Olszewska, 1981), that the FMG of units contain transitional lithofacies which link the Silesian and Magura basins. According to these opinions the Upper Cretaceous-Middle Eocene deposits of MGF reveal a similarity to the facies of the Magura Nappe, whereas the Late Eocene -Oligocene deposits are the same to those of the Silesian Unit. The similarities between these facies suggest the proximity of the Silesian and Magura basins. This opinion concurs with a fact, that during the Late Cretaceous to Eocene, the interaction between these basins was controlled by

the vertical movements of the Silesian Cordillera, which separated the western part of the Magura basin from the Silesian basin (Książkiewicz, 1972). The aim of this preliminary study was to recognize position and age of the Menilite-Krosno succession of the Mszana Dolna and Szczawa Tectonic Windows.

Geological setting

Mszana Dolna Tectonic Window

The characteristic feature of the middle part of the Magura Nappe, in the Polish Outer Carpathians, is the occurrence of the Mszana Dolna Tectonic Window (MDW). The central and most uplifted part of this window is dominated by the Oligocene Krosno Formation of the Dukla Unit (Obidowa Słopnice Unit), whereas the narrow, marginal part is occupied by Cretaceous-Oligocene deposits of the Grybów Unit (Fig. 1, Burtan et al., 1976, Mastella, 1988). The Mszana Dolna Tectonic Window is a large duplex structure, which developed during the Middle Miocene thrusting of the Magura Nappe against its foreland. Between the floor and roof thrusts the imbricated horses of the Grybów Unit developed. The southern margin of MDW is built up of Cretaceous-Paleogene deposits of the Bystrica and Raca subunits (Fig. 2).

Dukla (Obidowa-Słopnice) Unit. The Upper Cretaceous-Paleocene and Eocene deposits of the Dukla Unit are only known from the Poręba 1, Poręba IG-1 and Niedźwiedź 1 boreholes (Burtan et al., 1992, Połtowicz, 1985). These deposits are represented by: the Senonian-Paleocene Jaworzynka beds, Variegated shales (Paleocene-Middle Eocene), Hieroglyphic beds (Middle/Upper Eocene), “Black Upper Eocene” and Menilite (Grybów) beds with hornstone intercalations (Oligocene). The Oligocene Krosno Fm. is very well known from the surface exposures. The lower part of this formation is composed of grey, calcareous, thick-bedded sandstones of the Cergowa type with intercalations of dark-grey, marly shales. The upper portion of the Krosno Fm. belongs to the dark-grey marly mudstones with sporadic intercalations of the thick to medium-bedded, muscovite, calcareous sandstones.

The Grybów Unit of the MDW occurs as erosional outliers at the top of the elevated part of the Dukla Unit as well as a narrow thrust sheet edged between the Dukla and Magura units along the southern margin of the tectonic window. The tectonically reduced succession of the Grybów Unit (MDW) is composed of Lower Cretaceous to Oligocene deposits. In the Koninki and Poręba Górna sections which are located along the front of the Magura Nappe, the oldest deposits of the Grybów Unit belong to Jaworzynka beds (Paleocene). Higher up in the section occur strongly deformed

dark shales and micaceous mudstones with intercalations of thin to medium-bedded sandstones and sporadic intercalations of siderites. This part of the sequence can be probably correlated with Paleocene shales and sandstones with siderites. These deposits are tectonically bounded by a repetition of dark and grey, laminated, marly mudstones, intercalated by a thin and medium bedded, fine-grained, calcareous sandstones and thin-bedded siderite (see: “black Eocene”, Burtan et al., 1992). In the Poręba Górna section these deposits are overlain by Grybów shales, which developed as thick-bedded dark, calcareous mudstones with lenses of siderites.

Szczawa Tectonic Window

The Szczawa Tectonic Window is exposed 15 km SE of the Mszana Dolna Tectonic Window (Fig.1). This small, triangular-shaped, tectonic window (ca. 1 sq km) reveals Oligocene deposits of the Grybów Unit, which are bounded by the Upper Cretaceous-Paleocene strata of the Magura Nappe (Chrząstowski, 1971, Oszczypko et al., 1991). The Grybów Unit is composed of the Grybów and Cergowa beds. The Grybów beds, up to 60 m thick, are exposed in the Głębieniec stream. This section reveals black shales, partly calcareous, with intercalations of thin- to medium-bedded quartzitic sandstones and subordinate intercalations of hornstones. In the Kamienica river section, dark-grey marls with intercalations of black Grybów shales and medium-bedded sandstones represent the lowest part of the Cergowa beds. Higher up, the section is dominated by thick-bedded marls and Cergowa type sandstones. The thickness of the Cergowa beds is at least 150 m.

Biostratigraphy

The vast majority of the examined samples yield very poor and badly-preserved nannofossil assemblages. The scarcity of the index species makes the age determination very difficult. However, in some cases the assemblages were rich enough, enabling the following zonal assignment:

Helicosphaera reticulata Zone (NP22)

This zone was identified in the lowest part of Grybów Beds in the Głębieniec section (Szczawa) as well as in Koninki section. The zone assignment is based on a continuous range of *Reticulofenestra umbilica* (Levin) following the disappearance of *Ericsonia Formosa* (Kamptner). At the same time the species of *Reticulofenestra ornata* Műller and *Transversopontis fibula* Gheta were not found.

Sphenolithus predistentus Zone (NP23)

This zone was identified in the basal part of the Cergowa Beds in the Kamienica section (Szczawa Tectonic Window) as well as in Grybów Beds of the Grybów Unit (Poręba Górna, Mszana Dolna Tectonic Window). The zone assignment is due to the presence of abundant *Reticulofenestra ornata* following the disappearance of *Reticulofenestra umbilica.*

Sphenolithus distentus Zone (NP24)

This zone was identified in the Cergowa Beds of the Grybów Unit in the Szczawa Tectonic Window (Głębieniec and Kamienica sections), as well as in shaley lithofacies from the Krosno beds of the Dukla (Słopnice-Obidowa) Unit in the Mszana Dolna Tectonic Window (Niedźwiedź, Poręba). The zone assignment is based on the FO of *Cyclicargolithus abisectus* (Műller). The FO of *Cyclicargolithus abisectus* is usually found close to the FO of *Sphenolithus ciperoensis* (zonal marker for the lower boundary of NP24 zone) and thus can be used to approximate the NP23 and NP24 boundary (Martini & Műller, 1986). In addition, *Sphenolithus dissimilis* Bukry & Percival was also observed. The FO of these species is characteristic for zone NP24 (see Perch-Nielsen, 1985).

Conclusions

The youngest deposits of the Mszana Dolna Tectonic Window belong to the shaley facies of the Krosno (Dukla Unit) and Grybów beds in the Grybów Unit. The Krosno beds were assigned to NP24, whereas the Grybów beds belong to the NP 22 and 23 zones. In the Grybów Unit succession of the Szczawa Tectonic Window, the Grybów beds belong to NP22 Zone, whereas the Cergowa beds belong to NP23 as well to NP 24 zones. The ages of the youngest deposits of the Mszana Dolna and Szczawa Tectonic Windows very well correlate with that from the southern part of the Silesian, and Dukla units (Koszarski et al., 1995) as well as from the northern part of the Magura Nappe (Oszczypko-Clowes, 2001). These data confirm the Late Oligocene overthrust of the Magura Nappe onto their foreland. At the same time, recently discovered, folded Late Oligocene/ Early Miocene deposits in the middle part of the Magura Nappe (Oszczypko et al., 1999, Oszczypko-Clowes, 2001) documented the presence of the Magura piggy-back basin.

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References

Bieda F., Geroch S., Koszarski L., Książkiewicz M. & Żytko K., 1963: Stratigraphie des Carpathes Externes Polonaises. *Biul. Inst. Geol*., 181: 5-174. Warszawa.

Burtan J., Paul Z., Watycha L., 1976: Szczegółowa Mapa Geologiczna Polski, arkusz Mszana Dolna. Wydawnictwa Geologiczne, Warszawa.

Burtan J., Cieszkowski M., Mastella L. & Paul Z., 1992: Niedźwiedź-Konina-Okno tektoniczne Mszany Dolnej**.** In; Zuchiewicz W. & Oszczypko N.-*Przewodnik LXIII Zjazdu Polskiego Towarzystwa Geologicznego, Koninki*, 17- 19 września 1992. Wydaw. ING PAN, Kraków, 76-88.

Chrząstowski J., 1971: Wody mineralne Szczawy na tle budowy geologicznej. Kom. *Zagospod. Ziem Górskich* PAN. *Problemy Zagospodarowania Ziem Górskich*, 9: 99- 136.

Koszarski A., Koszarski L., Ślęzak J. & Iwaniec M., 1995: Calcareous nannoplankton from the terminal deposits of the Silesian Nappe, Polish Flysch Carpathians: stratigraphic implications. In: Flores J. A. & Sierro F. J. (Eds.): 5th INA Conferenze in Salamanca Proceedings: 115-123.

Książkiewicz M. 1972: Budowa geologiczna Polski, t. IV Tektonika, cz. 3 Karpaty. Wyd. Geol., Warszawa 288 p.

Mastella L., 1988: Budowa i ewolucja strukturalna okna tektonicznego Mszany Dolnej, polskie Karpaty zewnętrzne. *Ann. Soc. Geol. Polon*., 58, 53-173.

Martini, E. & Műller, C., 1986: Current Tertiary and Quaternary calcareous nannoplankton stratigraphy and correlations. *Newsletter on Stratigraphy*, 16 (2): 99-112.

Olszewska B., 1981: O niektórych zespołach małych otwornic serii okiennej z Sopotni Małej, Mszany Dolnej, Szczawy i Klęczan. *Biul. Inst. Geol*., 331: 141-163. Warszawa.

Oszczypko N., Cieszkowskiego M, & Zuchiewicz W. 1991: Variable orientation of folds within Upper Cretaceous – Paleocene rocks near Szczawa, Bystrica Subunit, Magura nappe, West Carpathians. *Bull. Poll. Acat. Sc., Earth Sc*., 39: 67-84

Oszczypko N., Andreyeva-Grigorovich A., Malata E., & Oszczypko-Clowes M. 1999a: The Lower Miocene deposits of the Rača Subunit near Nowy Sącz (Magura Nappe, Polish Outer Carpathians). *Geol. Carpath.* 50 (6): 419-433.

Oszczypko N., Malata E. & Oszczypko-Clowes M., 1999 b: Revised position and age of the northern slope of the Gorce Range (Bystrica Subunit, Magura Nappe, Polish Western Carpathians. *Slovak Geol. Magazine*, 5, 4, Bratislava, s. 1-20.

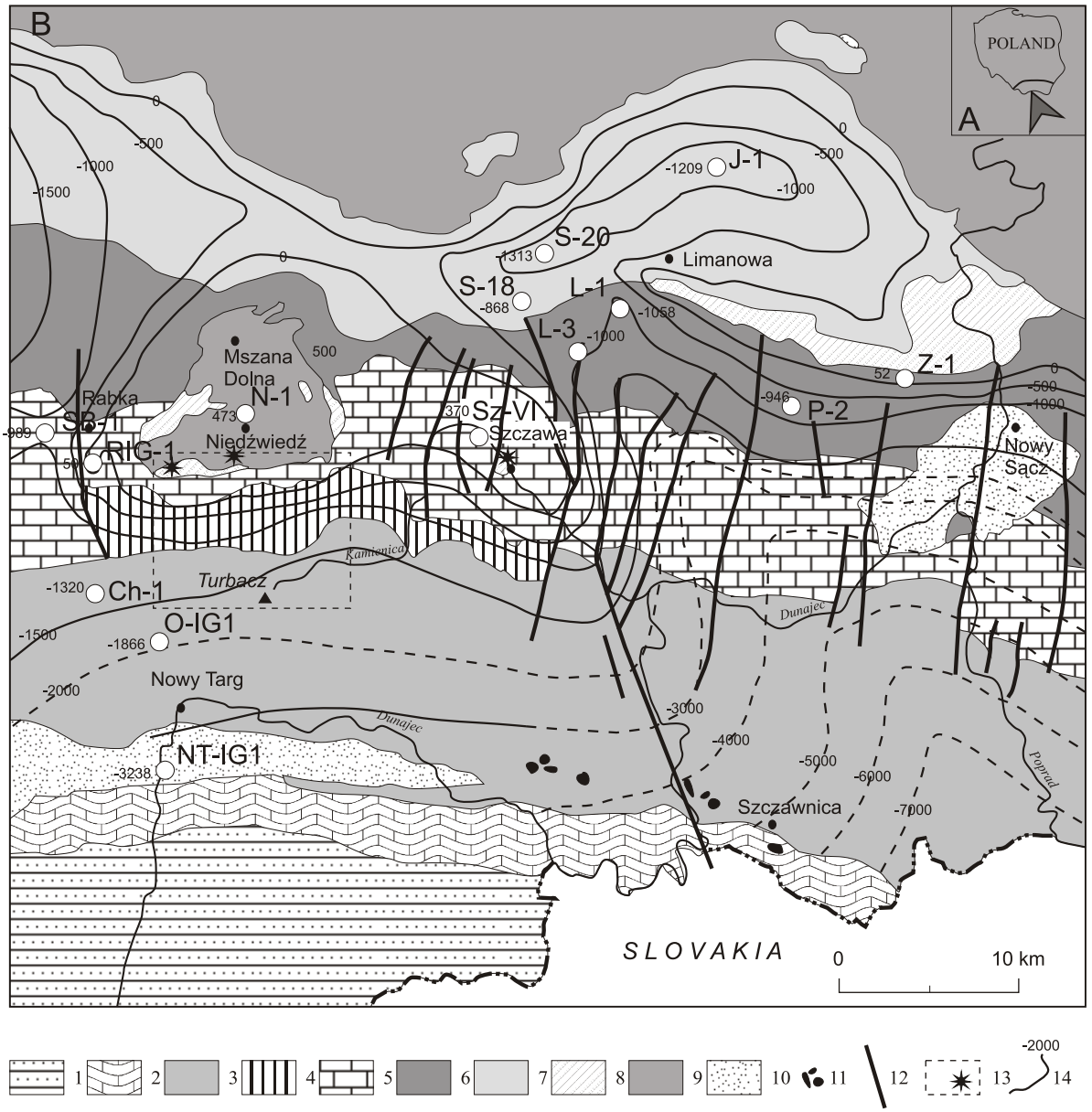
Oszczypko-Clowes M., 2001: The nannofossil biostratigraphy of the youngest deposits of the Magura Nappe (East the Skawa River, Polish Flysch Carpathians) and their paleoenveromental conditions. *Ann. Societ. Geol. Polon*., 73, 139-188.

Perch-Nielsen, K., 1985: Cenozoic calcareous nannofossils. In: Bolli H., Saunders J. S. and Perch-Nielsen K. (eds), *Plankton Stratigraphy*. Cambridge University Press 11: 427-554.

Połtowicz S., 1985**.** Jednostka grybowska na południe od Limanowej. *Ann. Soc. Geol. Polon*., 55: 77-104.

Fig. 1. A- Position of the middle part of the Polish Carpathians (after Oszczypko et al., 1999b, supplemented). 1-Podhale Flysch, 2-Pieniny Klippen Belt; Magura Nappe: 3-Krynica Subunit, 4-Tobołów-Turbaczyk thrust sheet, 5-Bystrica Subunit, 6-Rača Subunit, 7-Siary Subunit, 8-Grybów Unit, 9-Dukla Unit, Silesian & Sub-Silesian units, 10-Miocene onto the Carpathians, 11-Miocene andesites, 12-faults, 13- sampled area, 14-isobathe of Magura Nappe overthrust.

Fig. 2. Geological map of the Magura Nappe on the southern margin of Mszana Dolna Tectonic Window (after Oszczypko et al., 1999b, supplemented). 1-Oligocene Krosno beds of Dukla Unit, 2-Grybów Unit, (3-9) Magura Nappe - Bystrica Subunit: 3-Albian-Cenomanian deposits, 4-Cenomanian-Paleocene; Eocene: 5-Łabowa Fm., 6-Zarzecze Fm., a-variegated shales, 7-Beloveza Fm., 8- Bystrica and Żeleźnikowa fms., 9-Maszkowice Mb. of the Magura Fm., 10-Krynica Subunit, 11-Grybów overthrust, 12-Magura overthrust, 13-Bystrica Subunit internal overthrusts, 14-Krynica overthrust, 15-faults, 16-samples localites.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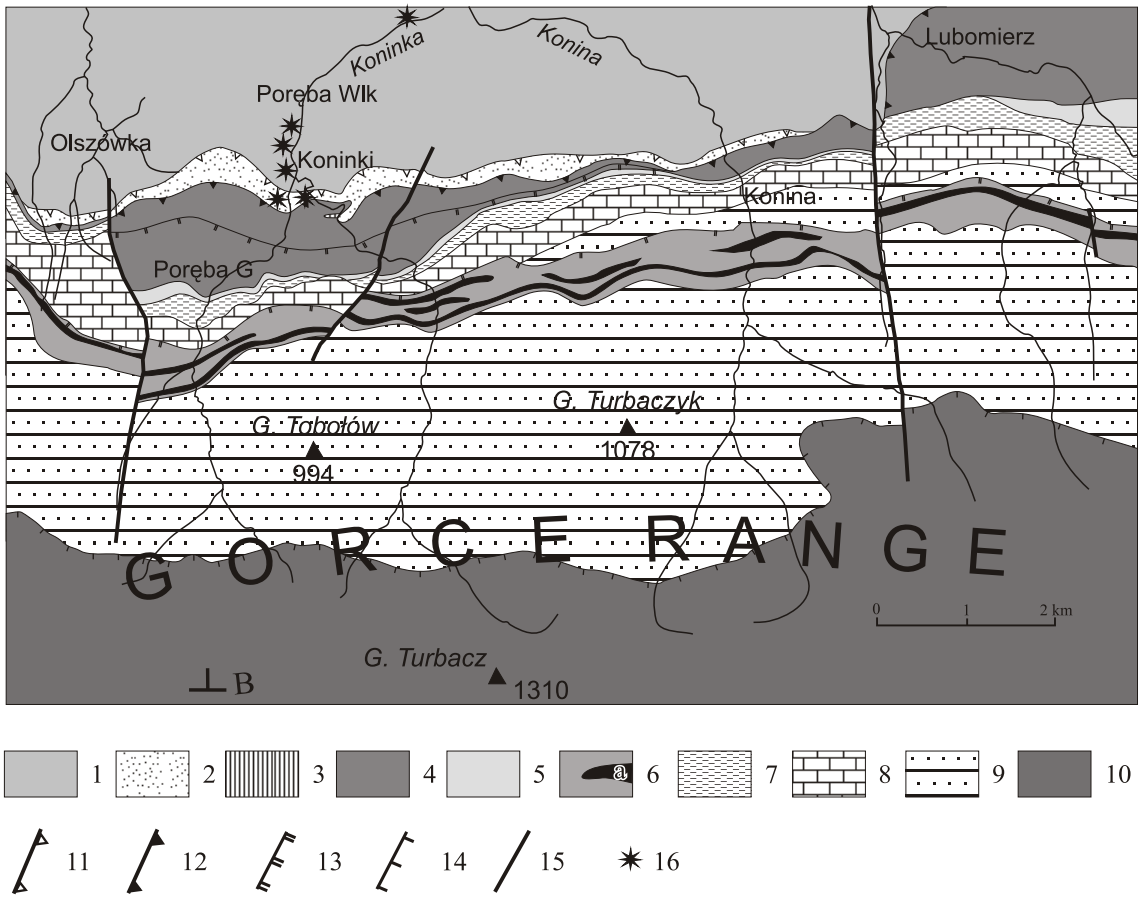
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