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Influence of regional factors on the Late Eocene - Early Oligocene palaeogeography of the Northern Carpathians

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Abstract. Distribution of the Late Eocene – Early Oligocene deposits in the Northern Carpathians and their facies indicate presence of three distinctive sedimentary realms in the region. The Moldavide flysch basins were located in tectonically relatively stable area. Eustasy and climate were there the chief sedimentation controls. In contrast, growth and northward migration of accretionary prism were the chief sedimentation controls in the Magura basin. The Central Carpathians, particularly their northern part underwent growing subsidence. The development of the Magura basin and the Central Carpathians was driven by a rollback of the earlier subduced oceanic slab. The rollback started to intensify at the beginning of Late Eocene.

Key words: Carpathians, Poland, Paleogene, palaeogeography, sedimentation controls

Introduction

Distribution of the Late Eocene - Early Oligocene deposits in the Northern Carpathians and their facies indicate notable differentiation of sedimentary conditions and palaeogeography in the depositional area. Factors responsible for the differentiation are here interpreted.

Sediment distribution and facies

In the Moldavide tecto-facial units (i.e. the Fore-Magura Group, Silesian, Sub-Silesian and Skole nappes, see Sandulescu, 1988), a complete succession of the Upper Eocene - Lower Oligocene deposits occurs in the entire area (Figs. 1, 2). Background, deep-water deposits constitute significant part of the succession. Up to several tens of metres thick unit dominated by green noncalcareous shales with some admixture of sandstones locally (chaotic deposits occur in NE part the Skole Nappe) is characteristic of its lower part (lower - middle Upper Eocene). These deposits are overlain by a several metres thick package commonly dominated by cream-yellow and/or yellowish-green marls and calcareous shales rich in globigerina (upper Upper Eocene - lowermost Oligocene). This package passes upwards into a several tens to several hundreds meters thick unit called the Menilite Beds (basically Lower Oligocene). The predominance of dark-coloured fine-grained deposits and occurrence of cherts are the most characteristic features of this unit. Thin- to thick-bedded sandstones occur there locally in notable proportion.

In the Magura Nappe, a continuous succession of the Upper Eocene – Lower Oligocene deposits is being known first of all from the outermost part of the nappe, called the Siary Unit. This succession consists basically of sandy and muddy turbidites and attains up to 2000 m in thickness (see Bromowicz, 1992). It represents the Magura Beds. Precise upper chronostratigraphic range of this unit is poorly known. Green noncalcareous shales represent there usually the background deposits. They occur principally in several millimetres thick laminae underlying the turbidite beds. The sandstones display characteristic enrichment in glauconite.

In other parts of the Magura Nappe, the Upper Eocene only is widely distributed. It is represented by the top part of the Magura Formation dominated by thick-bedded turbidite sandstones. These sandstones differ from those of the Siary Unit by distinctive enrichment in muscovite. The sequence attains greatest thickness in the Rača Unit, located south of the Siary Unit (see Bromowicz, 1992). The topmost part of the Upper Eocene and the Lower Oligocene are known only from several places. These deposits display some similarities to their chronostratigraphic equivalent in the Moldavide units. In the Krynica Unit, this succession rests unconformably on older rocks.

In the Central Carpathians, the Upper Eocene – Lower Oligocene deposits form a transgressive succession more than a 1000 metres thick (see Kępińska, 1997). It starts with a sequence of carbonate ramp deposits that continue from the Bartonian and embrace the lower and middle part of Priabonian. These rocks pass upward into basinal siliciclastic deposits dominated by turbidites (Uppermost Priabonian - Oligocene). Together with the underlying Bartonian alluvial fan deposits this succession rests unconformably on older, chiefly Mesozoic rocks.

Sedimentation development

In the early Priabonian, most intense sedimentation occurred in the middle part of the Magura Basin. In its

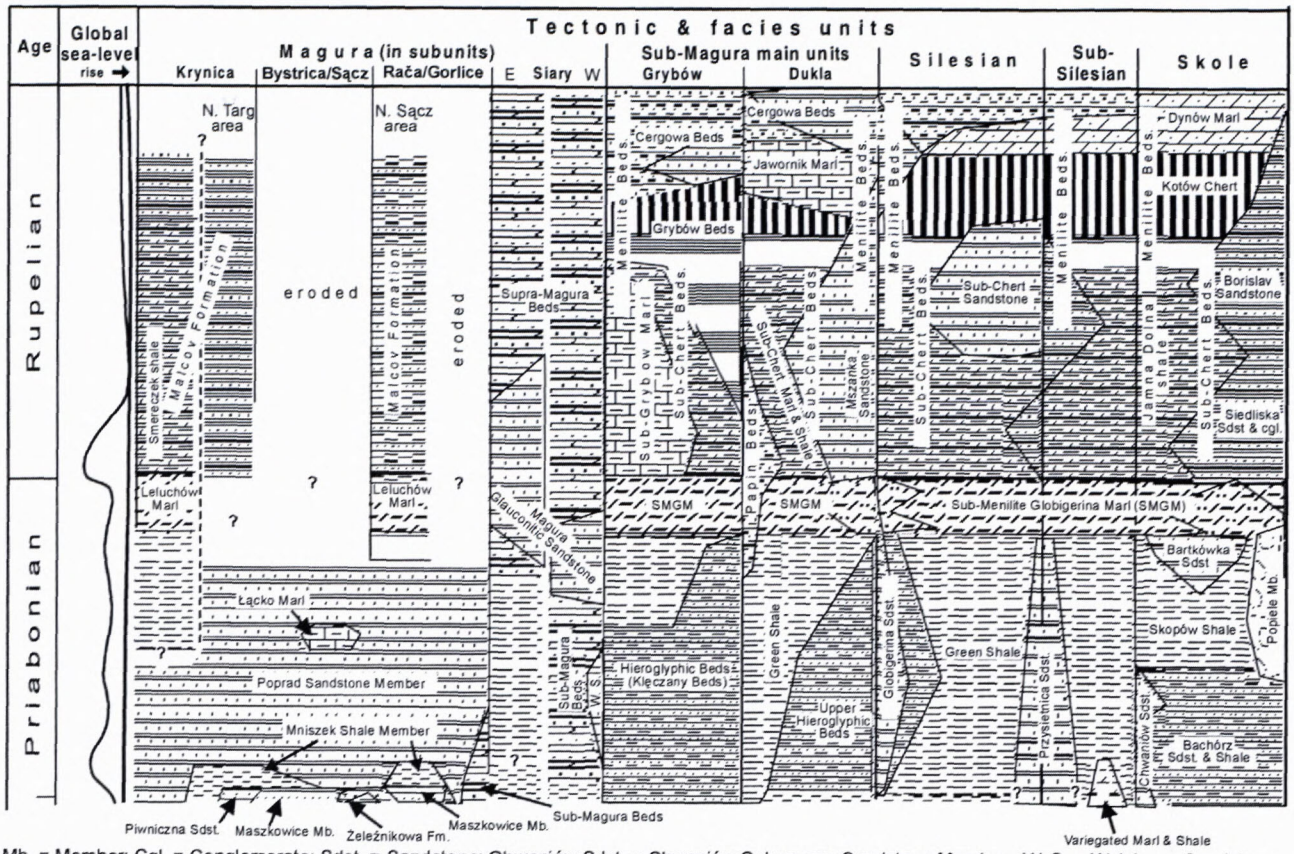

Fig. 1. Simplified litho- and chronotratigraphy of the Upper Eocene - Lower Oligocene (without topmost part of Lower Oligocene) of the Polish Outer Carpathians. Unit names given in simplified form. Compiled by the author from different sources.

innermost part, this was a period of sedimentation decrease crease up to the prevalence of erosion locally. The material was supplied from sources located on southern margin of the basin.

In the outer part of the basin, i.e. the Siary Zone, the early Priabonian was a time of sedimentation increase. The sedimentary material was supplied from northern basin margins (the Silesian cordillera). In the area in which the rocks of the Moldavide units were deposited, the early Priabonian was a time of extensive green shale sedimentation.

In the late Priabonian, significantly lowered sedimentation and extensive deposition of globigerina marl occured in the Moldavide basins. In the Magura basin, this was time of intense sedimentation in the Siary Zone, whereas in the inner part of the basin, sedimentation decrease occured. Locally, sedimentation was similar to that in the Moldavide basins.

The Early Rupelian was a time of a widespread sedimentation of dark-coloured fine-grained deposits in the Moldavide basins. To a lesser extent, such sedimentation occurred in the inner part of the Magura basin and the basin of the Central Carpathian Paleogene. Coarse-clastic material was deposited in the Moldavide basins and the inner parts of the Magura basin only subordinately. Two phases of intensified coarse-clastics sedimentation divided by an episode of extensive sedimentation of cherts are there recorded. In the Siary Zone of the Magura basin, the Early Rupelian was a period of gradual sedimentation decrease.

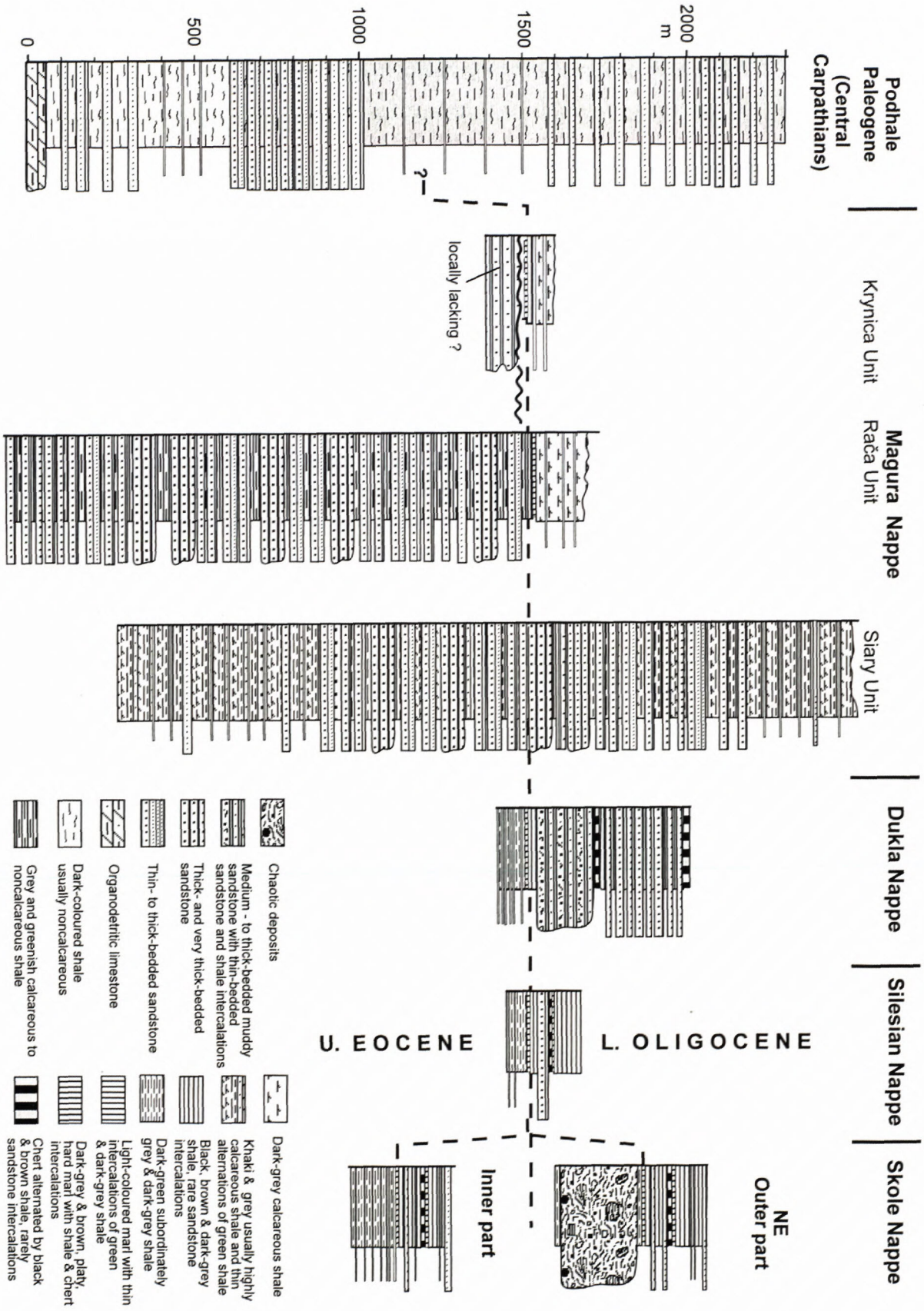

Fig. 2. Generalized facies and thickness logs of the Upper Eocene - Lower Oligocene deposits in selected tecto-facial units of the Polish Outer Carpathians.

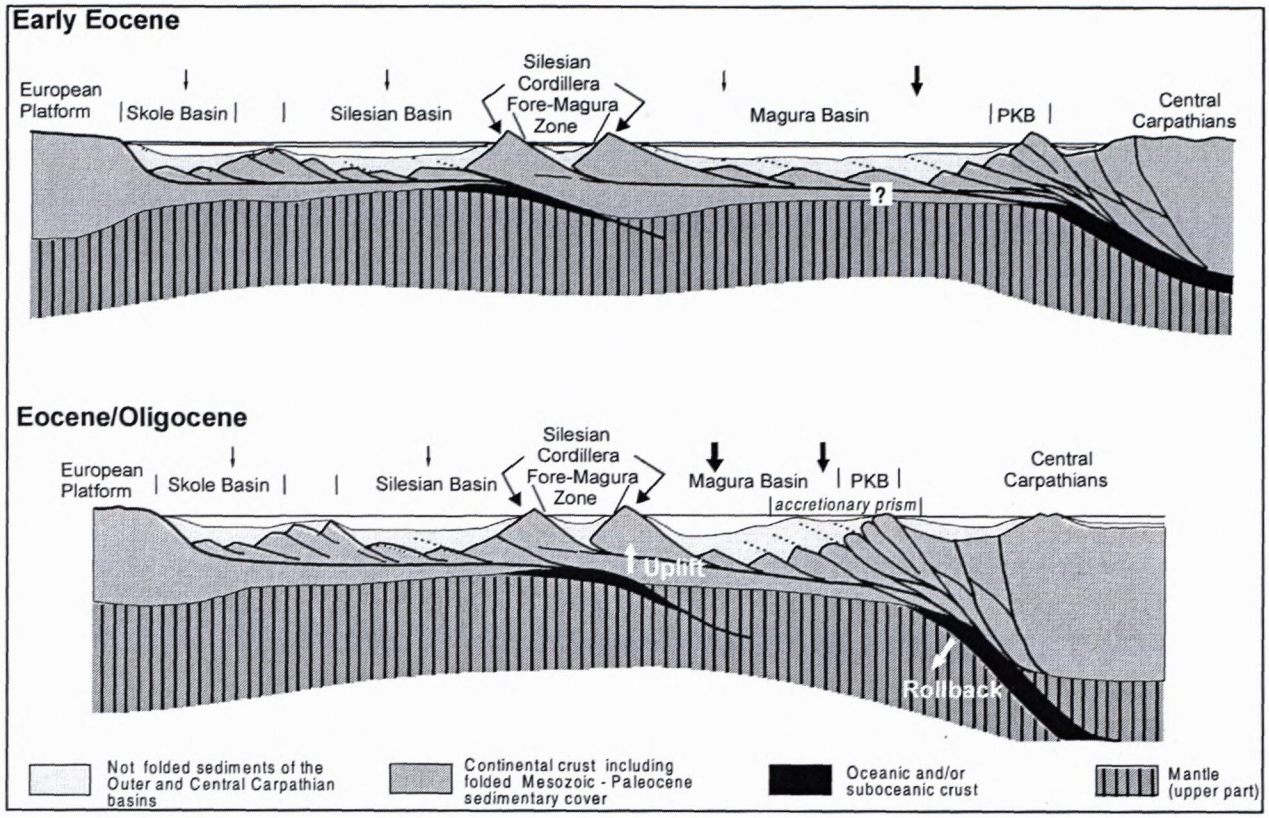

Fig. 3. Comparative palinspastic cross-sections through the Northern Carpathians in Eocene. Arrows above cross-sections denote relative subsidence

Discussion and conlusions

Distribution of the Late Eocene - Early Oligocene deposits in the Northern Carpathians and their facies indicate the presence of three distinctive sedimentary realms in the region. The realms differed in tectonic activity and sedimentation controls.

The Moldavide flysch basins were located in tectonically relatively stable area. This area underwent slow subsidence balanced by sedimentation. Eustasy and climate were there the chief sedimentation controls. In contrast, the Magura basin and the Central Carpathians represented a tectonically active area. The very high sedimentation rate, the facies and their succession indicate a fast subsidence in the Late Eocene to Early Oligocene in notable part of the Central Carpathians.

The development of the Magura basin was much more complicated. The deposits indicate gradual northward shifting of depocentres and appearance of deformation in the innermost part of the basin. Such circumstances suggest that growth and northward migration of accretionary prism were the chief sedimentation controls (cf. Oszczypko, 1999). Furthermore, such development of the Magura basin together with rapid subsidence in the Central Carpathians suggest that the development of both areas was driven by a rollback of the earlier subduced oceanic slab (Fig. 3). The entire succession of the Carpathian Paleogene indicates that the rollback started to intensify at the beginning of Late Eocene. Moreover, sedimentation development suggests that at the turn of Eocene - Oligocene, the inner parts of the Magura basin changed to a kind of a trench-slope basins, whereas the basin of the Central Carpathian Paleogene turned to a forearc basin (Plašienka & Kováč, 1999).

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