From where the tectonic slices of the Cretaceous age could have been transported into the Magura Group of nappes?

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The Magura Group of nappes is the significant regional unit of the Outer Western Carpathians in which flysch sediments from the Lower Cretaceous up to the Oligocene are proved. In the front of the partial Raèa and Bílé Karpaty units tectonic slices of Cretaceous rocks occur that are from lithological and biofacial point of view distinctly different:

Raèa unit, Klippe of Kurovice: Kurovice Limestones are formed by grey micritic limestone of the Oxfordian-Tithonian up to Early Berriasian age. Nannofossils with dominant specimens of genera *Cyclagelosphaera* and *Watznaueria* give evidence of the Tethyan bioprovince.

Tlumaèov Marls (Berriasian-Valanginian) overlaying Kurovice Limestones are characteristic by grey marl and clayey limestone. Nannofossil assemblages with nannoconids and *Conusphaera mexicana* are of the Tethyan character. In the Valanginian (CC3 Zone) was observed rare *Micrantholithus speetonensis* that could indicate a minor influence from the Boreal bioprovince.

The Jurassic and Lower Cretaceous of the Klippe of Kurovice can be lithologically comparable to a degree with northern edge of the Alpine Flysch Zone (Eliáš et al., 1990).

Bílé Karpaty unit, Hluk development: Púchov Marls (Campanian-Maastrichtian) consist of red, highly calcareous claystone and marl. In the Late Campanian and Early Maastrichtian, nannofossils of genera *Ceratolithoides* and *Quadrum* support Tethyan bioprovince by evidence but in the Late Maastrichtian common occurrences of high- and low-latitude species document also some influence from the Boreal area. Sediments correspond to the Púchov Marls of the Pieniny Klippen Belt (Stráník et al., 1995). They could also represent slope sediments comparable with those of the Hauptklippen Zone of the Wienerwald (Bubík, 1995).

Antonínek Formation (Campanian-Maastrichtian) is characterised by turbidite rhythms formed by grey sandy-silty limestone and highly calcareous claystone and marlstone. Unlike Púchov Marls, the Early Maastrichtian nannofossil assemblages are rather of Boreal character documented by *Biscutum coronum* and *Prediscosphaera stoveri*. Equivalents of these sediments are unknown.

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Deformational sequence of a flysch sandstone: examples from Outer Carpathians (Poland)

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Deformation bands are widespread in Lower Eocene flysch sandstone of the Magura nappe (the innermost nappe in the Outer Carpathians in Poland). These structures were studied in detail at Gruszowiec and at Tylmanowa. Microscopic observations were combined with stress analysis. To our knowlege, this is the first attempt to trace and date a process of folding by studying the deformation bends.

At Gruszowiec, steeply dipping beds of the sandstone are cut by water escape sheets, deformation bands and minor brittle faults. The water escape sheets are oriented subpenpendicular to bedding and to the regional fold axis. Some of the water escape sheets pass laterally into the deformation bands. The latter present whole spectrum between the bands with no feldspar cataclasis occurring as (i) a single cross-fold set and (ii) several fold-parallel sets (the latter inclined under shallow angles to the bedding); and the bands with strong feldspar cataclasis forming several fold-parallel sets oriented under high angles to the bedding. The minor brittle faults form several fold-parallel and fold-oblique sets. These faults display cataclasis of feldspar and quartz and cataclasis of calcite cement. Orientation of the water escape sheets and deformation bands was controlled by regional stress field and these structures occurred progressively during regional folding. First, water escape sheets and deformation bands with no feldspar cataclasis were formed. The intensity of cataclasis increased during the folding, and the most recent deformation bands, which were formed close to the completing of the folding, display strong feldspar cataclasis. However, deformation bands display neither quartz cataclasis nor cataclasis of calcite cement. It appears therefore that all deformation bands pre-dated calcite cementation of the host sandstone. Brittle faulting, which involved quartz cataclasis and cataclasis of

calcite cement, started after the regional folding was completed.

At Tylmanowa, two conjugate sets of deformation bands cut subvertically dipping sandstone beds. The linear acute bisector between the sets is horizontal and perpendicular to the regional fold axis. The bands accommodate dip-slip reverse movement. They were formed after regional folding was completed. The bands display feldspar cataclasis but do not display quartz cataclasis. They were formed before complete induration of the sandstone.

Summing up, it appears that the regional folding within the Magura nappe started no-later than during the deposition of the studied Lower Eocene sandstone. The folding was completed before calcite cementation and before complete induration of the sandstone.

The gravity field of the Pancardi Region and its geodynamic implications

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A new, unified Bouguer anomaly map of the Eastern Alps, Carpathian arc, Dinarides and the Pannonian basin has been compiled from previously prepared and recently published gravity maps and data. This map gives a general picture of the gravity field of the studied area and reveals several interesting features that are essential in understanding the geodynamics of the Pannonian basin and the surrounding mountains. In order to constrain the crustal structure and tectonic history of the region 2D gravity models are presented along a Western Carpathians-Pannonian basin-Southern Carpathians transect, and at the Alpine-Pannonian transition zone. These models are based on deep seismic lines, where available, and detailed geological sections. The results confirm that the whole territory of the Pannonian basin can be characterized with a wide rift mode extension, while some deep depressions show the characteristics of the narrow rift mode and the core complex mode extension combined with detachment faulting. Furthermore the modelling results and the Bouguer anomaly map suggest that the different parts of the Carpathian arc are at different stages of their evolution: the subducted oceanic slab under the Western Carpathians has already been detached and assimilated to the astehenosphere, while a lithospheric root is still present under the Eastern and Southern Carpathians. These findings are compatible with the observation that the last major phase of crustal shortening terminated at the early Middle Miocene in the Western Carpathians, but continued throughout the Pliocene in the Eastern and Southern Carpathians. In order to give an explanation we utilized the idea of strain partitioning which results from the oblique convergence and transpression between the European lithosphere and the different terranes that formed the Pannonian basin and the Carpathian arc.

Alpine tectonics in the East Carpathian/Pannonian transitional zone (Hungary/Romania)

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Based on the style of Miocene faulting observed on industry seismic reflection profiles and the characteristically retrograde metamorphism of the pre-Tertiary basement, a metamorphic core complex origin was predicted for some of the basement highs in the SE Pannonian basin. Indeed, recent apatite/zircon fission-track age-dating of amphibolite to greenschist facies basement rocks in this critical region verified this earlier speculation.

Similarly to the NW Pannonian Basin, the Middle Miocene syn-rift extension can be subdivided into an Karpatian metamorphic core complex style extension followed by a Badenian(?) wide rift style one. The earlier, ENE-WSW oriented extension is largely responsible for the formation of a regional detachment system which displays a distinctly down-to-the-ENE polarity. The probable breakaway zone for this system is located around Kelebia and the metamorphic core complex in lower plate position is represented by the Algyo basement high of Hungary. Outcropping basement highs in the Apuseni Mts. of Romania, such as the Codru-Moma, Padurea Craiului and Plopis ranges are bounded by antithetic, down-to-the-WSW normal faults and thus they are interpreted as large fault-block ranges in upper plate position.

The still continuing but diminishing continental extension during the Late Miocene could not advance to the localization of extension into a narrow rift zone in the Pannonian region, except some subbasins such as the Mako and Bekes