

The timing of polyphase Miocene tectonics in Northern Romania

Vortrag

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This study addresses the polyphase Miocene tectonic evolution in the Maramures area (northern Romania, Fig. 1) by combining field observations, stratigraphic arguments and fission-track analysis (Tischler et al. in press). Fission-track analysis has been carried out on basement samples from the Rodna horst, situated in the East Carpathians (Bucovinian nappes). This area was affected by Cretaceous medium- to low-grade metamorphism, followed by post-collisional exhumation and renewed moderate thermal overprint due to the deposition of Eocene to Early Miocene sediments.

Based on paleostress analyses of meso-scale structures, three main tectonic phases can be distinguished in the study area, all of which are post-date the earliest Miocene (Aquitainian, 20.5 Ma, Fig. 2). In late Early Miocene (Burdigalian) the Pienide nappes, non-metamorphic flysch series, were emplaced onto the Paleogene to Early Miocene sedimentary cover of the Bucovinian nappes. Emplacement of the Pienides is consistently SE-directed and dominated by brittle thrusting while folding is of subordinate importance only. The curved map appearance of the thrust contact is due to lateral ramps and tear-off faults, accentuated by later

folding. This early Miocene thrust contact was sinistrally offset later on along the Bogdan-Voda fault (Fig. 1).

Activity along the Bogdan-Voda fault started in Middle Miocene times as a sinistral transpressive fault related to the formation of open NW-SE trending folds in the sedimentary units. In a next stage (late Middle Miocene to Late Miocene) kinematics along the coevally active Bogdan-Voda fault and its eastern prolongation, the Dragos-Voda fault, formed one through going fault, characterised by sinistral transtension. Towards the east the left lateral offset along the main fault is continuously reduced by coevally active SW-NE trending normal faults (e.g. Greben fault, Fig. 1), thus terminating the Dragos-Voda fault in an extensional horsetail splay. The main activity along the Bogdan-Voda fault ends at about 10 Ma, as is indicated by almost unaffected Neogene volcanics. In the western part of the study area, along the Bogdan-Voda fault, sedimentary and volcanic rocks provide timing constraints for the deformation. In the Eastern part of the study area, along the Dragos Voda fault, only basement units and Paleogene sediments crop out. Therefore the fault activity is indirectly dated and inferred from the cooling history of the syn-kinematically exhumed Rodna horst. A vertical profile covering about 1000 m of altitude difference has been sampled for apatite fission-track analysis. Burial by Eocene to Oligocene sediments led to full annealing of apatite in the Rodna Horst, and all samples yielded Middle to Late Miocene cooling ages (8.6–11.6 Ma, see also Sanders 1998, Fig. 3). The altitude *vs.* age relationship indicates enhanced exhumation between 12–11 Ma with exhumation

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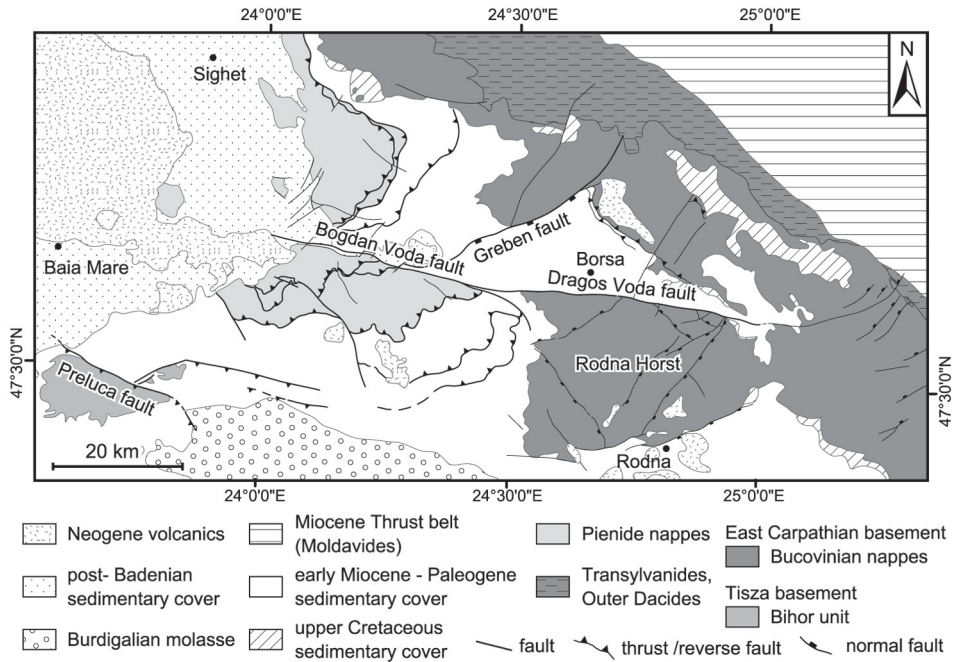


Figure 1: Tectonic map of the study area.

tion rates of at least 1 mm^{-1} , while a fast decrease in the rate of exhumation to around 0.1 mm a^{-1} is observed after 10 Ma (Fig. 3).

Our fission-track data suggest enhanced exhumation of the Rodna horst between 12–10 Ma, i.e. during the stratigraphically dated transtensional sinistral strike-slip phase.

Literatur

Sanders C (1998) Tectonics and erosion: competitive forces in a compressive orogen. A fission track study of the Romanian Carpathians. Ph.D. thesis, Free University of Amsterdam, 204 p.

Tischler M, Gröger HR, Fügenschuh B & Schmid SM (in press) Miocene tectonics in the Maramures area (Northern Romania)-implications for the Mid-Hungarian fault zone. *Journal of international Earth Sciences*.

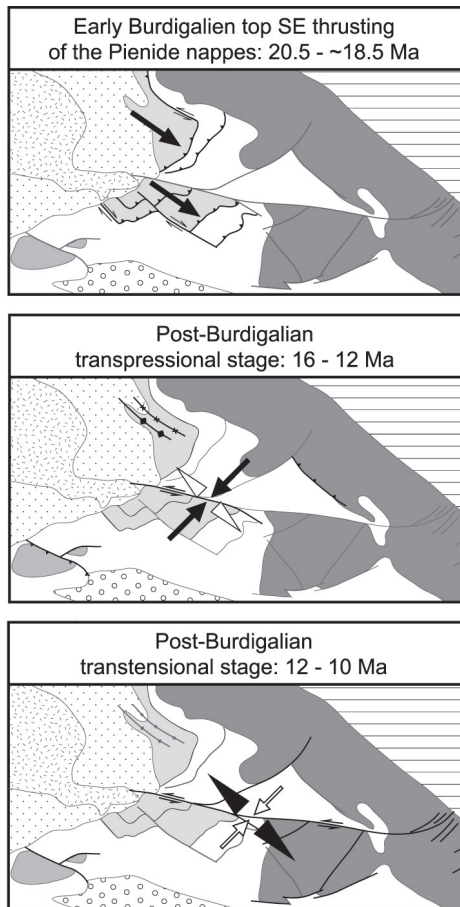


Figure 2: The three main Miocene tectonic phases observed in the study area.

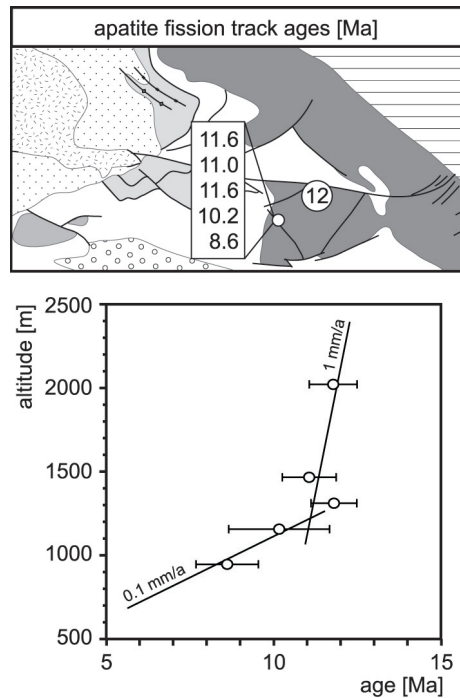


Figure 3: Apatite fission track data from the Rodna horst (encircled datum point from Sanders 1998) together with altitude vs. age diagram.