Tectonic control on changes in older Quaternary sediment supply in the Körös sub-basin, and neotectonic movements in the eastern part of Great Hungarian Plain — relatoinship of the plate tectonics and environmental change

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The formation of the Pannonian Basin started in the Early-Middle Miocene by back-arc style rifting, coeval with the late stages of thrusting of the Carpathian belt. Following the Middle Miocene rifting characterized by two independent extensional phases, a post-rift thermal subsidence occured during the Late Miocene-Pliocene (Horváth 1993). The latest phase of the multistorey development of the Pannonian Basin comprises a still active basin inversion, characterized by NW-SE and N-S compression, which resulted in significant uplift of the marginal parts and local subsidence of the basin centre during the Quaternary. The crustal deformation of the Pannonian Basin, which is controlled by the counterclockwise rotation of Adria with respest to Europe around a pole at the 45^{O} latitude and $6\text{-}10^{O}$ E longitudes resulted the change of plate-tectonic environments in the Alp-Carpathian terrain (Csontos et al, 1992; Sanders 1998).

As a result of this varied morphology, the main rivers transported sediments from the northwest, north, northeast and east mountain regions toward the central part of the Pannonian Basin. The uninterrupted subsidence of the Körös subbasin, which has been investigated here, was one of the largest subsiding areas, represented by a 400-500 m thick continuous Pleistocene fluvial record. Variations in transport direction, determined on the basis of detrital micromineral composition as revealed by cluster analysis, were caused by changes in sediment supply, sorce areas and drainage pattern reorganization. These changes have been shown to be comparable to transport directions predicted on the basis of a theoretical tectono-morfological model, based on sedimentological observations and tectonic data, as well as analogues for basin evolution with similar stress fields.

The tectonic model implies two phases of uplift of the Apusen Mountains source area during the Late Neogene and Quternary, which was strongly controlled by the evolution of the subduction zone along Eastern Carpathians. During the Pliocene and Early Pleistocene, due to continent-continent collision, a compressional stress field was operating in the East Carpathians region that resulted in thrust-driven uplift of the Apusen Mountains (Fig.1.) and formation syn-sedimentary trap at the western margin ofthe mountain chain. For this phase transverse drainage is envisaged, characteristic for actively uplifting orogens, whose sediments have been captured in the thrust fault bounded syn-sedimentary trap, parallel to the mountain front. In addition to capturing the sediments of the transverse rivers, this trap favoured the deveiopment of axial drainage, and sediments were transported from northeast to study area, also inferred from micro-mineralogical data of detrital heavy minerals. The second phase of uplift of the Apusen Mountains was characterized by an erosion-driven, isostatic uplift (Fig.2.) due to the relief of the compressional stress field resulting from the waning collision. As a result the trap ceased to be active and was filled up rapidly by the sediments of the transverse rivers, and also allowed the spread of alluvial fans over the basin to the west. This is indicated by the occurence of SE transport directions in the boreholes at about 1,95 Ma ago, which also gives the timing for the tectonic processes.

The other studied area is situated east from the Great Hungarian Plain and northwest from the Transylvanian (Apuseni) Mountains, close to the source region of Ér- and Berettyó-rivers. These rivers carry sediments into the Körös subbasin, which river network evolution was investigated earlier by sedimentological, morphological, and tectonical methods complemented with OSL dating and heavy mineral analysis. These investigations were extended to northeast, into the valleys of Ér- and Berettyó-rivers.

Our micro- and morphotectonic measurements show that there are two phases of deformations. The older was generated by a NE-SW compression, which caused left lateral strike slips. The younger was generated by WNW-ESE compression and caused right lateral transpressions, which seems to be active till now. The network of the tectonical lines is very similar to those, analysed from seismic sections of the Körös subbasin.

Based on new OSL age data the older neotectonic movement in the study area took place till 40 ka, while the younger movements started after 40 ka BP. We concluded that these tectonic movements had important allogenic control on the developement of river dynamics of the Great Hungarian Plain.

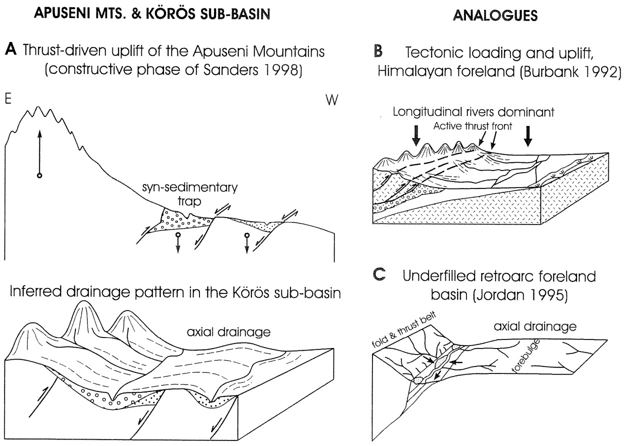

Fig.1. Geotectonic model for the thrust-driven uplift of the Apusen Mountains (after Thamó-Bozsó et al. 2002).

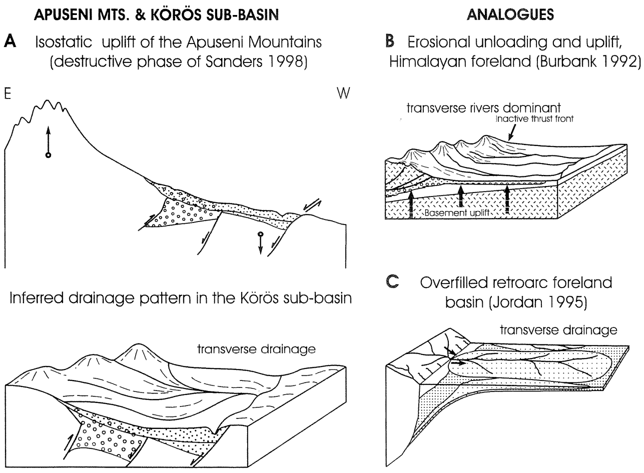

Fig.2. Geotectonic model for the isostatic uplift of the Apusen Mountains and reactivated strike-slip faults on the eastern part of the Great Hungarian Plain (after Thamó-Bozsó et al. 2002).

References

Csontos L., Nagymarosy A., Horváth F. & Kovac M. 1992: Tertiary evolution of the Intra-Carpathian area: a model. — Tectonophysics, 208, pp. 221–241.

Sanders C. 1998: Tectonics and erosion. Competitive forces in a compressive orogene — A fission track study of the Romanian Carpathians. — PhD thesis, Vrije Universitiet, Amsterdam.

Horváth F. 1993: Towards a mechanical model for the formation of the Pannonian Basin.— Tectonophysics 226, pp. 337–357.

Thamó-Bozsó E., Kercsmár Zs. & Nádor A. 2002: Tectonic control on changes in sediment supply: Quaternary alluvial systems, Körös sub-basin, SE Hungary. — In: Jones S.J. & Frostick L.E. (eds) 2002, Sediment flux to basins: Causes, controls and consequences. Geol. Soc. London Spec. Publ. 191, pp. 37–53.

Thamó-Bozsó E., Magyari Á., Nagy A., Unger Z. & Kercsmár Zs. 2007: OSL dates and heavy mineral analysis of upper Quaternary sediments from the valleys of the Ér-, and Berettyó rivers. — *Geochronometry* 28.