river reaches have been deflected by anticlines formed above en echelon segments of the TaTZ (#5 and #6 on Fig. 1). Eastwards the morphologic expression of the TaTZ decreases because of the smaller amplitude of the structures and the proximity of the subsiding Jászság Basin.

Typically minor amplitude of surface undulations respective to the amplitude of folding of the uppermost Miocene layers indicates that several episodes of Plio-Quaternary erosion smoothed the deforming topography. Characteristic NW winds and local variation of wind power led to the development of the typical NW-SE striking landforms. Accordingly the Valkó and Úri Ridges of the Gödöllő Hills form large scale yardangs separated by a wind channel (Isaszeg Channel). In the Isaszeg Channel the surface expression of the structures is further weakened by the strong areal denudation of the wind. The central and SE part of the ridges evolved in a wind-shielded position where climate oscillations led to various phases of loess deposition and fluvial erosion. Here surface dissection is significant yet overall lowering was smaller (see slope distribution on Fig. 1).

According to the seismic reflection profiles structural inversion is younger than ~4 Ma. Chronostratigraphy of the outcropping loess-paleosoil sequences suggest that surface expression of the neotectonic deformation – i.e. valley sections developed in consequence of river deflections in front of growing anticlines – is at least 400–600 ky old. The significant lag between the onset of the structural deformation and the appearance of its surface expression may be explained by two reasons. Firstly, the denudation processes were stronger during Pliocene – early Pleistocene times, thus they obliterated the surface deformations. Secondly, the deformation in the first period of the neotectonic phase was slower and the vertical motions have been accelerating towards present.

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Lower Crustal Channel Flow in Hot Orogens in Space and Time Exemplified by the Variscan Eastern Margin

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Recent considerations of detailed petrological, geochronological, geophysical and structural data allow us to make progress in understanding mechanisms of crustal-scale exhumation of orogenic lower crust associated with lithospheric indentation. Current numerical models (e.g. Beaumont group) suggest an emplacement of “hot-nappes” in subsurface channel-flow powered either by gravity potential or by an indentation of a weak hot root with a lower crustal rigid promontory attached to the subducting plate. Geological examples of channel-flow are based on localized occurrence of high-grade rocks along the S. Himalayan front resulting from ductile extrusion driven by gravitational collapse and focused erosion.

We present an example of several thousand square kilometres of flat-lying orogenic lower crust underlain by a basement promontory located at the retroside of the Variscan orogen along a 300 km long collisional front (Poland, Czechia and Austria).

Gravity surveys show that the limit of basement promontory extend about 100 kilometres towards the internal part of the orogenic root from todays exposure of the orogenic front. Combined structural and petrological studies revealed that the orogenic lower crust (high-pressure granulites and mafic eclogites) was vertically extruded from depths of about 70 kilometres parallel to the western steep margin (ramp) of the basement promontory. The observed transition from steep to flat fabrics occurs in different depths from 35 to 15 kilometres and is marked by different P-T-t paths of exhumed lower crustal blocks. The vertically extruded rocks are reworked by flat fabrics reflecting the flow of hot material into some horizontal channel developed between the upper boundary (flat) of the basement promontory and the overlying orogenic lid. The flow kinematics in this horizontal channel are controlled by plate movements as documented by structural and paleomagnetic investigations. A simple 2D thermokinematic model is used to show that the differences in P-T-t paths are controlled by three major parameters: thickness of the indenter, plate velocity and thermal structure of the orogenic root. We suggest that the exhumation of orogenic lower crust in large hot orogens is an extremely heterogeneous process controlled by local parameters, essentially driven by indentation. Orogenic flat fabrics commonly reported in hot orogens result neither from lower crustal flow nor gravity driven collapse of an orogenic system but rather reflect the deformation fronts and geometries of crustal indentors.

Extraction of Morphotectonic Features from High-Resolution Photogrammetric DEM (Mecsek Mts., Hungary)

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Photogrammetric digital elevation models (DEMs) belong to the 2nd generation of DEMs. Compared to the preceding generation usually achieved by interpolation between contour lines, these are produced from aerial orthophotos. Under optimal conditions, they provide higher resolution and are devoid of some interpolation errors typical of the first generation.

A methodology developed earlier for tectonic feature extraction from traditional DEMs (Jordan et al., 2003, 2005; Sebe 2005) is applied on the photogrammetric DEM of Mecsek Mts. (SW Hungary). Mecsek Mts. and their foreland are characterized by the dominance of strike-slip fault systems and the presence of neotectonic (latest Miocene – Pliocene – Quaternary(?)) activity including young vertical movements. The area has already been studied from the aspect of tectonic geomorphology using DEM, traditional geomorphology and geology, and new concepts about young evolution history have been outlined (Sebe et al. 2006). The objective of the present study is to further improve our understanding on the tectonics of the area and to compare the two DEM types (contour-based and photogrammetric) in terms of morphotectonic interpretation.

Anthropogenic features such as roads and bridges were first removed from the photogrammetric DEM by means of mathematical morphology image processing methods. Detailed digital terrain analysis applied smoothing filters to the DEMs using a sequence of kernel sizes in order to detect morphotectonic features on various scales ranging from local to regional. For each re-scaled DEM several morphometric parameters of tectonic significance, such as aspect, slope, curvatures, directional derivatives and local relief were calculated and displayed as maps. These maps were analysed visually and statisctically to locate geomorphic features of tectonic origin. Tectonic study was enhanced by the examination of drainage network extracted from the DEM (for methods see Jordan et al. 2003).

Results show that the new photogrammetric DEM with a resolution higher than that of the traditional contour-based type provides important additional information, in particular along major morphotectonic features such as fault scarps and linear valleys, although it also has its characteristic error types that can hinder tectonic interpretation to a certain extent. In the photogrammetric DEM more fault lines and other tectonic features could be located, many of which are not indicated in geological maps. The new DEM seems to be especially useful in areas of low relief.

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