to be a plane horizontal stress, at least in most cases. The case that one principal stress axis is not vertical; in all probability the tilting or rotating of blocks are occurred expect some special cases (diapirism, magmatism, accretionary prism, ...). These measured raw natural data must be rotated to the original position. In many cases, the angle of rotation is defined by the dip of bedding. If not this correction, the calculations may lead to incorrect results and the computed reduced stress tensor is imaginary and problematic. The rotation to the original position is necessary from case to case. A very instructive example comes from the High Tatra Mts., where a block tilting occurs. The tilting of blocks resulted from the uplift of the High Tatra Mts. All the older deformation stages were rotated into an incorrect orientation and the original N-S compression has been changed to two deformation stages: N-S compression and N-S tension. The computed imaginary extensional tectonic regime caused reorientation of the inverse faults to normal faults during tilting.

The tilting and block rotation caused problems with true original orientation of principal stress axis that produced deformation. Knowledge of size and magnitude of block tilting and rotating is important for determination of real orientation of stress tensor during actual deformation stage.

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On the Mechanics of Basin Formation in the Pannonian Basin: Inferences from Analogue and Computer Modelling

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We present the results of a thrust fault reactivation analysis that has been carried out using analogue (sandbox) and numerical modelling techniques. The basement of the Pannonian basin is built up of Cretaceous nappe piles (Tari et al., 1993). Reactivation of these compressional structures and connected weakness zones is one of the prime agents governing Miocene formation and Quaternary deformation of the basin system. However, reactivation on thrust fault planes (average dip of ca. 30° with respect to a horizontal plane) in normal or transtensional stress regimes is a problematic process in terms of rock mechanics. The aim of the investigation was to analyse how the different stress regimes (tension or transtension/transpression), and geometrical and mechanical parameters (dip and strike of faults, frictional coefficients) effect the reactivation potential of pre-existing fractures.

Results of analogue modelling predicts that thrust fault reactivation under pure tension is possible for dip angle larger then 45° fault dip with normal friction on the fault plane. By making the fault plane weaker, reactivation is possible down to 35° dip angle. These values are confirmed by numerical modelling. Reactivation in transtensional manner can occur in a broad range of fault dip angle (from 35° to 10°) and strike angle (from 30° to 5° with respect to the direction of compression) when keeping the maximum horizontal stress magnitude at least three times bigger than the vertical or the minimum horizontal stress values.

Our research focussed on two selected study areas in the Pannonian basin system: the Danube basin and the Derecske trough in its western and eastern part, respectively. Their Miocene tectonic evolution as well as their fault reactivation pattern show considerable differences. The dominance of pure extension in the Danube basin (Tari et al., 1994) vs. strike-slip faulting (transtension) in the Derecske trough (Horváth and Rumpler, 1984) are interpreted as a consequence of their different geodynamic position in the evolving Pannonian basin system on one hand. On the other hand, orientation of the pre-existing thrust fault systems with respect to the Early to Middle Miocene paleostress fields (Fodor et al., 1999) also had a major influence on reactivation kinematics. Due to its close proximity to the collapsing Alpine orogen, the area of the Danube basin was characterised by an excess of gravitational potential energy (Bada, 1999) and, thus, high vertical stresses (σ_V) during Early Miocene basin formation. By the time the topography was attenuated (Middle Miocene) and σ_V was reduced, the stress field had rotated and the minimum horizontal stress axes (σ_h) became perpendicular to the main strike of the thrusts. The high topography and the rotation of σ_h could induce nearly pure (dip-slip) extension along the pre-existing low-angle thrusts. On the contrary, the Derecske trough was situated near the Carpathian subduction belt, with lower crustal thickness and no pronounced topography. This resulted in low σ_V values. The proximity of the retreating subduction slab provided lower values of σ_h and the oblique orientation of the paleostress fields with respect to the master faults of the trough led to the dominance of strike-slip faulting in combination with extension and basin subsidence (transtension).

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Geodynamic Interpretation of Anomalies in the Orientation of the Upper Segment of the Nysa Kłodzka River

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Formation of the river pattern of the Sudetes in the current form started in the late Pliocene. This process was connected to a distinct diversification of the Sudetic area into a mountainous part (the Sudetes) and foreland (Fore-Sudetic Block). The boundary between these two areas is defined by the Marginal Sudetic Fault (MSF), which is an important regional morphotectonic structure (Mastalerz and Wojewoda, 1993). A continuous development of the river pattern was connected to the regional drainage toward the N and the NW and later temporarily was modified by the progression of the Scandinavian ice sheets during the Pleistocene (August and others, 1995; Wojewoda and others, 1995).

In the area of the Nysa Kłodzka-Kraliky Trough of the fluvial system developed in a specific way, reflecting the particular tectonic activity of the region. At the beginning, the drainage of a significant part of the trough took place through Morava toward the Black Sea. However, the tectonic uplift at the turn of the Pliocene and the Pleistocene in the area of Międzylesie did force a change of the drainage direction toward the N and start a continuous development of the Nysa Kłodzka Valley up to the recent stage.

The mountainous segment the Nysa Kłodzka Valley reflects several phases of its evolution, among others a phase of its present position, i.e. close and along the western border of the Nysa Kłodzka Trough. There are several sections in the Nysa Kłodzka Valley from the vicinity of Międzylesie in the south to Gorzanów in the north that seem to be evidently influenced by tectonic activity of the basement. They are two ravines: one in the region of Długopole Zdrój and the other of Bystrzyca Kłodzka, which were caused by the uplift of the Nysa Kłodzka Trough bottom. They are also at least 12 sections showing the anomalous geometry of the river valley bend.

To analyse anomalies in the orientation of the Nysa Kłodzka Valley the method of moving mean vector for axis orientation along the valley every 25 m was used. The axis was laid down basing on topographic maps in scale 1:100000 and on measurements taken with laser distance finder. Anomalies of arch bends are noticed only at bends turning toward the west and located in the vicinity of the major fault zones with orientation of 325°-35° (Fig. 1, 2). It turns out that the only geometric way to correct

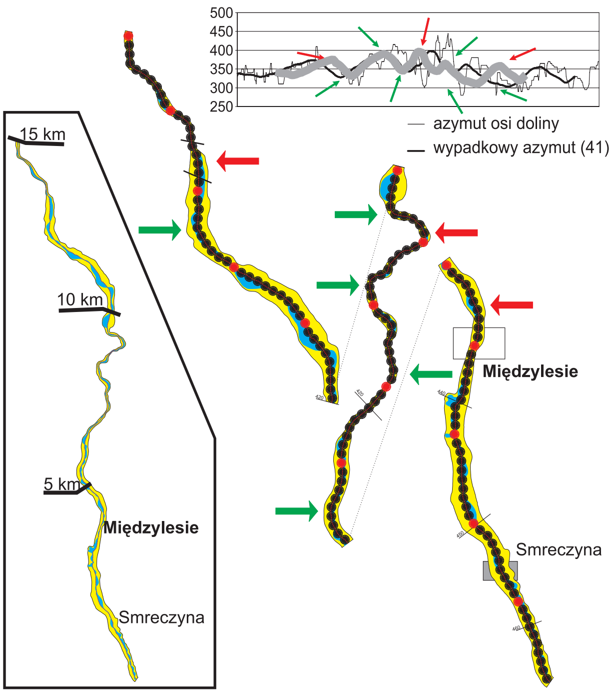

Fig. 1. Anomalies of the Nysa Kłodzka River valley 0–15 km)