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The Application of AMS for Deciphering Structural and Sedimentary Evolution of the Orava Basin (Slovakia)

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Abstract

The Neogene infilling of the Orava Basin constitutes a sedimentary record postdating the formation of thrust-and-fold belt of Outer Carpathians and its contact with Inner Carpathians. After the main underlying structural units (Magura Nappe, Pieniny Klippen Belt, and Podhale Synclinorium) were formed, the area underwent uplift and erosion. The considerable horizontal movements including strike-slip tectonics were noted since Lower/Middle Miocene resulting in origin of local depressions. The sedimentary succession and deformation history of the Orava Basin provide an excellent data for the understanding the neoalpine evolution of the Orava and Podhale regions.

This study (Łoziński *et al*. 2017) combined a sedimentological study, structural measurements and an analysis of large AMS dataset (1930 specimens from 85 locations). The AMS measurements provided data on the presence and directions of tectonic deformation and unravelled the orientation of bedding within massive deposits.

The mineralogy of minerals was obtained from XRD analysis (Łoziński *et al*. 2016) followed by stepwise magnetization and thermal demagnetization of magnetic minerals. The mineral content was dominated by quartz, clay minerals (mixture of illite, chlorite and smectites) and subordinately organic matter. This set of minerals was reflected by magnetic susceptibility falling mostly (>95% specimens) in range 100–500 [$\times 10^{-6}$ SI]. For this group of specimens we assumed the AMS being determined by clay particles orientation.

The majority of 20 specimens examined for magnetic minerals saturated in fields up to 0.3 T. Subsequently, they were almost completely demagnetized in a Lowrie test at temperature between 325 (soft fraction) and 370 °C (medium and hard fraction). The main ferromagnetic minerals (s.l.) were interpreted as greigite and pyrrhotite. The other specimens saturated in fields 1.5–2 T and demagnetized in 575°C and 650°C pointing to the minor content of magnetite and hematite.

The spatial analysis of AMS results revealed that the basin was deformed mostly in its southern part and locally at the margins. Directions of AMS ellipsoid were interpreted as tectonically induced, however the vulnerability for gaining tectonic lineation was higher for

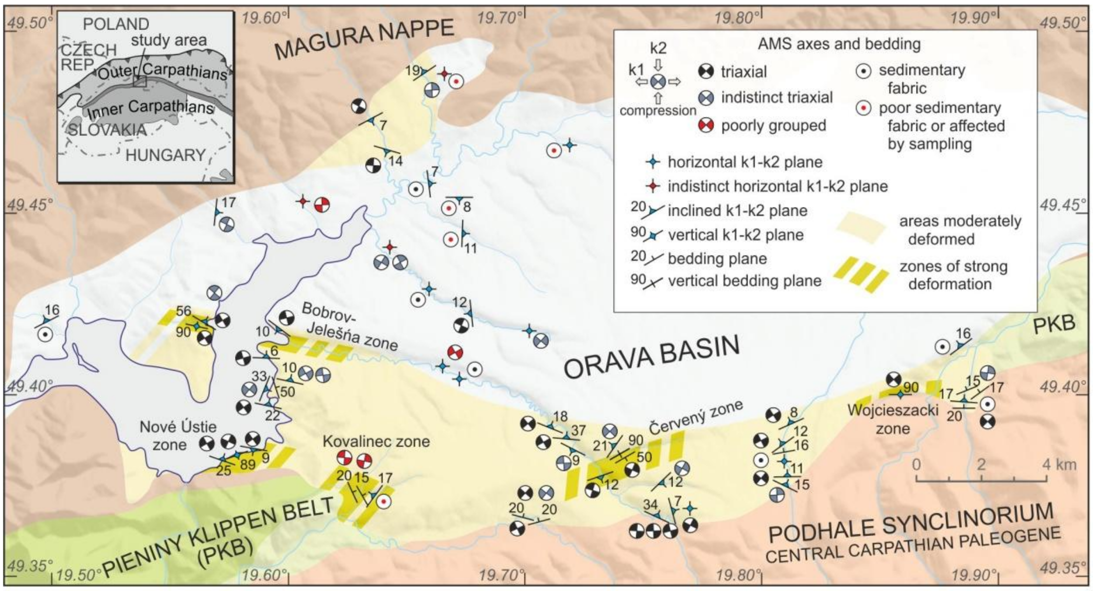

Fig. 1. The AMS fabrics and ellipsoid directions in structural analysis of the Orava Basin (after Łoziński *et al*. 2017, modified).

massive clayey siltstones (floodplain deposits) than for laminated claystones and heterolithic deposits (lacustrine).

The prevailing trend of k1 directions was WNW-ESE. Along with W-E trending bounding faults in the south, it suggested contractional character of deformation in this part of the basin, related presumably with the basin inversion. The NNE-trending contraction agreed with the present-day compression noted in the uppermost part of the lithosphere. Local zones of deformation within the basin confirmed the neo-alpine deformation of the basement, especially along the Pieniny Klippen Belt.

Keywords: anisotropy of magnetic susceptibility, basin inversion, Orava Basin, fine-clastic facies.

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