Morphotectonics of the Orava Basin, Western Carpathians

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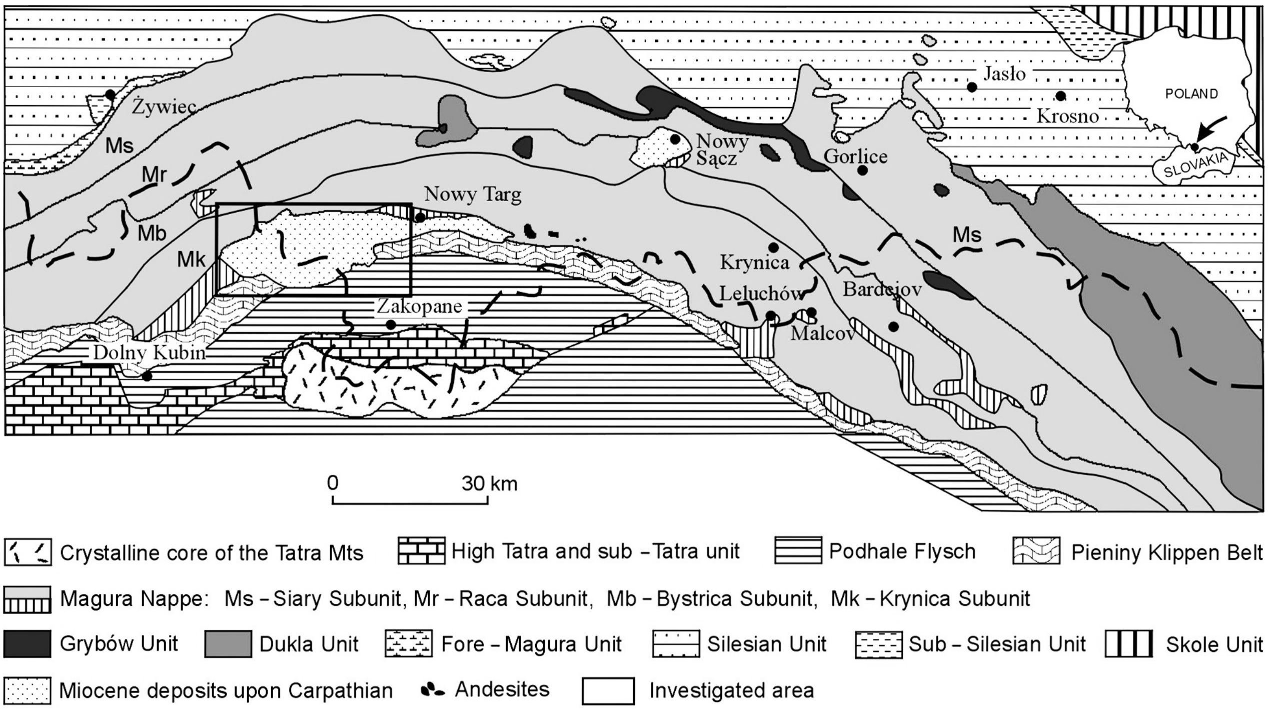
Orava Basin it is intramontane depression filled by Neogene and Quaternary deposits (Birkenmajer 1978), which spread out on Polish and Slovakian territory (Fig. 1). Orava Basin is situated between different tectonic – facies units that belong to Inner and Outer Carpathians. The ground of depression and its surrounding is built of central flysch called in Slovakia Podtatranská Group (Gross et al. 1993) and Podhale Flysch in Poland. The other units are Pieniny Klippen Belt and Magura Nappe represented by Oravská Magura unit (Potfaj 2003) in Slovakia and Krynica unit in Poland. Tectonics structure was always the main issue of the Orava Basin geology. The Quaternary deposits make the architecture of depression display impossible. Data about tectonic structure are presently known mainly from geophysical research. Interpretation of geoelectrical and gravimetrical data by Pomianowski (1995, 2003) showed that fringes of the depression have longitudinal and dip-slip faults character. Those faults separate deposits of the base from filling of the Orava Basin deposits. Mentioned faults are cut and displaced by system of oblique faults which was distinguished on the base of strike line shifts of longitudinal, adjacent faults (Pomianowski 2003). Oblique faults of the southern fringe of the Orava Basin have NNW-SSE orientation and are youngest than main dislocation (Pomianowski 2003). Probably the oblique faults described by Pomianowski (1995, 2003) are entering the periphery of the Orava Valley. The preliminary results of digital elevation model and shaded relief map analysis have shown abrupt depressions and steep dipping slopes have linear arrangement. This situation is clearly visible in southern part of the Orava Basin. The steep slopes of the Oravská Magura and Skorušina Mountains are the evidences of displacement in southern fringe of the Orava Valley. The region in the front of the Oravská Magura and Skorušina Mountains is strongly depressed and it seems to be the fault block, which is downtrown along the normal faults (Chrustek and Golonka 2004). The rectilinear densities of isohypses allow marking several linear structures on the contour map. Lineaments distinguished on the basis of digital data have W-E, SW-NE system and NNW-SSE, SSW-NNE system. Morpholineamets on the contour map, shaded relief map and 3D model refer to fault lines buried beneath deposit cover, which fills Orava Basin. Discontinuous structures located in the geological base of Orava Basin are recognisable on the geomorphological image. Determined lineaments are the reflections of mentioned structures on the topographical profile.



■ **Fig. 1.** Location of the Orava Basin in a geological map of the Carpathians (after Żytko et al., suplemented by Oszcypko and Oszcypko-Clowes 2002).

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Palaeo-Position and Tectonic Neighborhood of Bükk Mts, N. Hungary

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The anchimetamorphic, south-vergent Bükk Mts is an "exotic" block in the framework of the generally non-metamorphic, north vergent West Carpathians. Since a long time (Schréter 1943, Balogh 1964) it is considered as a displaced part of the Dinarides. In fact, many formations including Carboniferous turbiditic shales, Upper Permian Bellerophon Limestone, Lower Triassic oolithic limestone, Middle Triassic calkoalkaline magmatism interfingering with pelagic facies and voluminous Upper Jurassic shales/mélange and ophiolitic basalts can find their direct counterparts in the Inner Dinarides (Kázmér and Kovács 1984, Balla 1987, Csontos 1999, 2000, Protić et al. 2000, Filipović et al. 2003). A buried tectonic zone between the Periadriatic-Balaton and the Zagreb-Zemplin (Mid-Hungarian) faults constitutes the natural link between the Bükk exposures and the Inner Dinarides (Wein 1969). This link suggests that the original position of Bükk Mts. can be reconstructed near Zagreb. Major problems arise, however, because the Medvednica Mts have a clear NW vergence, while the Ivanscica Mts is north-vergent. Both show clear stratigraphic-structural similarities to the Bükk Mts units. The continuation of these anchimetamorphic units in north Bosnia and central-east Serbia are clearly SW vergent (Dimitrijević 1997, Csontos et al. submitted).

A growing number of palaeomagnetic measurements suggests that the present disposal of different units in the Carpathian-Dinaric realm is the result of different, often very big rotations in different times (Márton 1990, Márton and Márton 1989, Márton et al. 1999, Csontos et al 2002, Tomljenović et al. 2003). These studies help to outline the positions of different units in the Late Cretaceous. With the help of this reconstruction, all the anchimetamorphic units of different structural directions and vergencies belonging to the once (Late Cretaceous) Internal Dinarides become subparallel and aligned along a single belt.

Dinaric studies (Dimitrijević 1997, Csontos et al., 2003) suggest that these anchimetamorphic units once formed the margin of the Dinaric microplate and are all in a lower plate position with respect to voluminous obducted Jurassic (Triassic) ophiolites. All these units suffered anchimetamorphic transformation at 120 Ma (Árkai et al. 1995; Belak et al. 1995, Milovanović 1984, Milovanović et al. 1995). This age (Hauterivian-Barremian) is interpreted as a cooling age after earliest Cretaceous peak metamorphic conditions (Árkai et al. 1995, Koroknai 2005). Ductile deformation, including the main, originally west-vergent syncleavage folding occurred during peak metamorphic conditions (i.e. latest Jurassic-earliest Cretaceous).

In most anchimetamorphic units a deformation earlier than syn-cleavage folding is observed (Csontos 1999, Tomljenović 2002, Csontos et al2003, Koroknai 2005). This structural event created strong flattening along bedding and a stretching lineaion occasionally with shear markers. The observed shear directions (Fórián-Szabó, this volume, Tomljenović 2002, Csontos et al. submitted) scatter in present positions, but become subparallel to the once Dinaric margin when reconstructed. This shear possibly related to ophiolite emplacement and/or flattening due to Early Cretaceous collision was hence subparallel to the Dinaric margin. The oblique event was followed by a more head-on major shortening, perpendicular to the Dinaric margin. Originally northwards displacement of the ophiolite sheet bears some consequences for the West Carpathian units located more to the north.