followed by reverse and strike-slip faulting that finally shaped the klippen tectonic style of the area.

In the most external position in the Chmeľová region, a narrow strip of the Kysuca Unit was discerned. It involves deep-water pelagic Jurassic strata (predominantly marlstones and radiolarites), but the Lower Cretaceous sediments are of special type with allodapic biodetrital limestones (Horná Lysá Fm – Mišík et al. 1994). The position of the Kysuca Unit is not clear; it is likely in an original tectonic superposition above the Czorsztyn-related units. To the NW, the Kysuca Unit is juxtaposed to the Maastrichtian – Paleocene flysch sediments of the Biele Karpaty Unit of the Carpathian Flysch Belt. This contact is most probably followed by a large wrench fault that forms the northern boundary of the PKB.

The PKB was formed during multistage ductile-brittle and brittle tectonic evolution that occurred in several deformation stages producing variable fold and fault structures. Probably the oldest event was thrusting of the presently most external Kysuca Unit over the Czorsztyn and Niedzica-Pruské Units. Then macroscopic folding due to orthogonal layer-parallel shortening affected especially the Chmeľová region with well-bedded Niedzica-Pruské succession, while the thick competent Vršatec-Javorník slab was steepened and partly overturned to the SE. Folding occurred at comparatively greater depths (but still beyond intracrystalline ductile deformation mechanisms) with development of cleavage formed by pressure solution. This strong compressional stage was followed by transpression, which is recorded by several generations of striated, mostly steeply dipping faults. Numerous reverse and strike-slip faults truncated the stiff limestones sandwiched between incompetent strata and produced klippen of two distinct morphostructural types: 1. the Vršatec type formed by vertical strata obliquely cut by faults into variously large, lozenge-shaped blocks arranged in one straight row; 2. the Chmeľová type with a more random arrangement of variously shaped klippen, dependent on which parts of pre-existing macrofolds (cores, limbs) were separated into klippen that slightly moved with respect to each other afterwards. Finally, the klippen style was affected also by slope movements and some independent blocky klippen are obviously loose blocks transported downslope by landslides.

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Tectonic Deformations in the Orava Basin Margins in the Western Carpathians, Based on the DEM Analysis and Geological Research

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The tectonic structure is the main issue of the Orava Basin geology but the Quaternary deposits make difficult presentation of the depression architecture. For the recognition of the linear morphological features which could depict the basement dislocations of the Orava Basin the digital elevation model (DEM) was made. Morpholineaments were drawn along straight segments of rivers and morphological edges. It allows distinguishing two groups of morpholineament – directions: the morpholineaments which form the margins of the Orava Basin and the morpholineaments which are perpendicular to the first group of lineaments and disturb them. Morpholineaments in the contour map, shaded relief map, and the DEM refer to fault lines buried beneath deposit

cover which fill the Orava Basin (Chrustek and Golonka 2005). Moreover, the DEM allows determining the present image of the Orava Basin, relationship between ambient elevations and the Orava depression and effects of southern fringes uplift and northern fringes subsidence.

The geological research is in preliminary phase and hasn't been done yet in the whole investigated area. The tectonic deformations are represented by ductile and brittle faults which appear with breccias and also mixed faults in the north and south margins of the Orava Basin. The mentioned dislocations are longitiudinal and obligue faults. Moreover, most of them have strike-slip character. The field research allows determining places where the largest deformations are located as well. They are situated along south-east in the neighbourhood of the Pieniny Klippen Belt and north margin of the Orava Basin. The south-east fringe forms a steep scarp made up of Neogene gravels containing fractured clasts. The orientation of fracture sets observed in several outcrops from Domański Wierch to Stare Bystre in this area determines NE and NNE stress direction. According to Tokarski and Zuchiewicz (1998) these outcrops reflect dislocations in the basement. Probably these dislocations are active nowadays because along south-east fringe of the Orava Basin runs active zone called Myjava lineament (Bac-Moszaszwili 1993) or the Orava transforming fault (Baumgart-Kotarba *et al*. 2004). Besides, there are known earthquakes which had compressional character according to Baumgart-Kotarba (2001). In the northern part of the Orava Basin occur local overthrusts. In the border of thrust are reverse faults with overturned strata of the Magura series. These faults must have formed during compressional regime.

Directions of morpholineaments and faults founded in the investigated area are similar. It means that the faults situated on the surface are reflected by the morpholineaments distinguished on the basis of the DEM analysis.

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Olistostroms as Indicator of the Geodynamic Process (Northern Carpathians)

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Existence and transformation of the accretionary wedge in the southern in the Northern Carpathians are documented by occurrence of olistostroms. During the detail mapping and lithofacies investigations of deposits in a few main tectonic units of the Outer (Flysch) Carpathians the olistostroms has been identified. In Poland, Czech and Slovak Republic the olistostroms are known from the Cretaceous, Paleocene, Eocene, Oligocene and Miocene flysch deposits of a few main tectonic units. Those units are the Skole, Subsilesian, Silesian, Dukla and Magura nappes as well as Pieniny Klippen Belt.

The term olistostrome is derived from the ancient Greek and means «slide-layer» (Cieszkowski and Golonka 2005). An olistostostrome is a sedimentary deposit consisting of blocks of diverse origin that are immersed in a matrix. The Northern Carpathians this matrix consist of clay, mud, sand or their mixture forming turbidity package. The blocks in olistostrome are named olistolites. The size of olistolites varies, from centimeters to kilometers. Very large blocks could slide independently into the basin with no easily distinguishable matrix. The matrix in this case is the flysch sequence or even entire sedimentary-tectonic