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P-T Conditions and an Extent of the First Alpine Deformation Event Recorded in the Vepor Unit, West Carpathians

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The Vepor unit composed of Variscan basement and Late Palaeozoic to Mesozoic cover sequences is one of the major crustal segments incorporated into the Alpine structure of the Central West Carpathians. Two Alpine deformation events are recorded in this unit. The first one is characterized by the presence of sub-horizontal mylonitic fabric with E-W trending stretching lineation related to formation of vast mid-crustal shear zone. The second one, responsible for kinking and folding of earlier fabrics in the weaker lithologies preferentially, resulted from subsequent oblique convergence with the Gemer unit in the south.

Based on our recent field and petrological studies of migmatites and gneisses from the Kralova Hola massif in the north of the Vepor unit, three metamorpic events can be distinguished. The first event, characterised by the presence of garnet and staurolite, is regional metamorphic event, most probably of Variscan age. The second event led to the formation of garnet and andalusite and could relate to Variscan granite formation. There is a sharp compositional change in garnet between Ca-rich core formed during regional metamorphism and relatively Ca-poor rim related to contact metamorphism. The last event, characterised by the presence of garnet and chloritoid, is believed to represent regional Alpine metamorphism that was coincident with the first Alpine deformation event. The Alpine garnet is again rich in grossulare content. Thermodynamic modelling in the Vertex program was used to estimate P-T conditions of the Alpine metamorphism for the gneiss from the Kralova Hola massif. The results of this method indicated P-T conditions 0.5–0.6 GPa and 450–500 °C. Similar P-T conditions were obtained for the metasediments of the Slatvina formation in the south of the Vepor unit (0.6 GPa and 500 °C, using Vertex) and for the orthogeneisses form the central part of the Vepor unit (0.5–0.7 GPa and 450–500 °C, using THERMOCALC). Detailed investigation of quartz microstructure carried out on orthogneisses of the entire Vepor unit includes recrystallized grain size measurements and the CPO (crystal preferred orientation) measurements. The recrystallized quartz grain size determination was performed automatically from a set of micrographs using the Lazy Grain Boundary macro in the Scion program. This analysis covering most of the Vepor unit area revealed only small variations in the mean grain size with slight increase towards the west. The quartz CPO measurements produced by using the EBSD (electron back-scatter diffraction) and the CIP (computer-integrated polarization microscopy) methods indicated operation of basal <a>, rhomb and prism <a> slip systems.

The results of microstructural analyses correspond well with our temperature estimates and therefore can be used as complementary method for evaluation of regional extent of the metamorphic conditions during the first Alpine deformation. We argue that the first Alpine deformation recorded in basement of the Vepor unit occurred in similar metamorphic conditions during vertical shortening of buoyant Veporic crust. The last stages of exhumation of the Vepor unit as well as differences in pressure estimates in the interior of the Vepor unit could be explained by subsequent convergence with the Gemer unit in the south and the Fatric unit in the north.