Mechanical Collapse of Vertically Extruded Orogenic Root System: SW Moldanubian Zone

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We investigated the structure and PT evolution of two contrastingly crystalline levels within the internal part of the Moldanubian orogenic root which are separated by the N-dipping normal fault. The E-W cross-section S of the Kravsko fault comprises from the W to the E: middle – crustal rocks of the Monotonous group, the lower –crustal Gföhl and Raabs units, the Drosendorf window (composed of the middle–crustal Varied unit, paragneisses and amphibolite complex in the E) and the lower –crustal granulitic complex adjacent to the Moravian zone. The cross-section N of the Kravsko fault is traced from the Monotonous unit through the Raabs unit containing eclogites and granulites to N of the Kravsko fault. N of this prominent fault, the flat S2 foliation is missing, in the Raabs unit is subhorizontal and pervasive. The S2 foliation is heterogeneous and dips to the SE, in the Gföhl gneiss it is developed, which is equivalent to association found in amphibolites. For the granulites and paragneisses characteristic the M2 assemblage sil-grt-bt-pl is characteristic. The conditions of M2 metamorphism were in all the lithologies calculated at 700–850 °C / 9–13 kbar. In the Monotonous, group the sil-grt-pl-bt-ksf assemblage in paragneisses and the cpx-amp-pl assemblages in amphibolites give evidence of the HT stage. Near the contact with the Moldanubian pluton, the sillimanite becomes unstable and cordierite originates through a reaction si + bt = crd + ms which is a result of decompression under 6 kbar at T > 650 °C. In the Drosendorf window, the sil-grt-pl-bt assemblage is stable in paragneisses and amp-grt-pl in the amphibolites yielding the PT conditions of ~700–800 °C / 8–10 kbar.

The distribution of the lower and middle crustal complexes and steep S2 fabrics of the Kravsko fault are interpreted in terms of successive extrusion of the lower crust over the base- ment to the E and over the middle crust in the central part of the root. The E-W shortening of the root produced vertical N-S trending fabrics in all structural levels (lower granulitic crust and middle crust) producing a positive flower structure within the Gföhl unit which extruded symmetrically over the western Monotonous unit and the easterly-lying Varied unit. The second extrusion occurred at along the boundary of the Moravian complex where the root was thrust over the Moravian basement. This extrusion brings to middle crustal levels rocks from the base of the orogenic root (16–18 kbar / 800 °C, O Brien 2000) through relatively narrow vertical channels. The S2 fabrics represent a mechanical collapse of vertical fabrics of the extruded lower and middle crustal material. The highest extruded and rheologically weakest lower crustal rocks of the Raabs and Gföhl complexes show almost entire flat reworking. The PT conditions of the horizontal flow in the extruded lower-crustal rocks correspond to 9–10 kbar / ~800 °C. The underlying middle crustal rocks show similar pressure range and temperatures between 700–800 °C. However, these rocks show evidence of only partial vertical shortening and reworking. We suggest that the collapse of vertical “syn-extrusion” fabrics should not be exclusively gravitational but may be associated with a subhorizontal shearing due to lateral flow of the weak crustal material.