Burial and Exhumation of Eclogites in Continental Accretionary Wedge: An Indentation Model of Eclogite Formation in Variscan Collisional Zone

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Numerous eclogite boudins surrounded by tonalitic gneisses, metavolcanics and metapelites form a unit separating a Neoproterozoic foreland from the Variscan orogenic root at the NE margin of the Bohemian Massif. Eclogites record peak conditions of 15 kbar and 700 °C (indicating burial to 55 km) and near-isothermal exhumation to 40 km, whereas the enclosing metapelites show an almost complete P-T loop with peak pressure conditions at 11 kbar and 640 °C. These different paths suggest differential burial and exhumation of rocks with tectonic amalgamation at mid-crustal levels. Structural features show viscous pure shear-dominated deformation of gneiss-eclogite blocks at deep crustal levels and essentially non-coaxial partitioned deformation of these blocks and their volcano-sedimentary matrix at shallower levels. Based on U/Pb zircon ages (561–633 Ma, 2000 Ma), calc-alkaline intrusive rocks associated with the eclogites are interpreted as a part of the lower crust of the Neoproterozoic Brunian continent. The eclogite protolith ages, field geothermal gradients and geological structures are compared with coherent eclogite-bearing crustal units of the subducted Saxothuringian lithosphere and thickened Variscan (Moldanubian) orogenic root. Based on this comparison, a new model suggests the development of HP rocks at the tip of Brunian lithospheric indentor which penetrated a weak orogenic root in the west with Cambro-Ordovician protolith ages. Subsequent exhumation of HP blocks enclosed in a weak metasedimentary matrix was controlled by ongoing indentation and is similar to that of block-matrix flow in sedimentary or serpentinite wedges. The block-matrix relationship is a characteristic feature of the eclogite micaschist wedge along the entire eastern margin of the Variscan collisional front.

Structural and Metamorphic Record of Thickening and Exhumation of the Moldanubian Lower Crust (NE Moldanubian Domain, Bohemian Massif)

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We document a succession of tectonic events associated with burial and exhumation of the lower crustal rocks at the NE margin of the Moldanubian domain (Bohemian massif) by combining new structural, petrological and geochronological data from plutonic and metamorphic rocks exposed along NE margin of the lower crustal Strážek Complex. This unit has been thrust over middle crustal Svratka Complex during tectonic processes associated with Moldanubian orogenic root formation.

Structural study of granulites, surrounding gneisses and migmatites has demonstrated the presence of an early sub-vertical, mostly N-S trending fabric (S_1) reworked by flat shear zones or newly developed penetrative foliation (S_2). S_2 fabric is generally dipping to the SSE to SW under moderate angles, and becomes progressively steeper towards the contact with the underlying Svratka Complex. Well developed L_2 stretching lineation is mostly subhorizontal or slightly plunging to the S. Durbachitic intrusion emplaced along the boundary between the Strážek and Svratka complexes show strong subsolidus deformation along the western edge of the main durbachite body parallel with the S_2 foliation in surrounding migmatites. On the other hand, only non-deformed magmatic fabrics were observed in the eastern part of the body but aligned xenocrysts of K-feldspar define magmatic foliation which is also parallel with the S_2 foliation of country rocks. Steep igneous fabric is locally developed in small sill-like bodies intruding mechanically resistant granulites with vertical D_1 anisotropy. The character and timing of the intrusion can also be deduced from the magnetic foliations and lineations, which are comparable to the D_2 structures developed in the surrounding rocks.

Steep S_1 foliation in granulites is associated with high-pressure (16–18 kbar at 750–800 °C) mineral assemblage and is interpreted to represent an early fabric developed during or shortly after the period of maximum thickening of the Moldanubian orogenic root. This event has been dated at ~340 Ma on two samples from the granulite body withihn the Strážek Complex (Kröner, unpublished data). D_2 fabric in granulites and surrounding gneisses is associated with low-pressure mineral assemblages (3–4 kbar at 650–720 °C) and interpreted to reflect exhumation and thrusting of the lower crustal Strážek Complex over the middle crustal Svratka Complex. Concordant D_2 fabrics in granulites and surrounding gneisses with magmatic fabric developed in the durbachite body suggest the emplacement