The Contrast Between Metamorphic and Structural Evolution of the Vír Granulite and Surrounding Metapelites of the Polička Crystalline Unit

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Structural and petrological studies have been concentrated on solution of tectonothermal relations of the granulite body, which is concordant to apparently lower grade metapelites. The granulite body is composed of leucocratic granulites, sillimanite-biotite migmatites and migmatitic paragneisses. The granulite body cover is formed by metagabbros and metabasic edge. The intrusional relations between the marginal gabbros and the granulite body itself there can be observed. The whole granulite-metagabbro enclave is enclosed by kyanite-staurolite micaschists in the foot wall and staurolite-sillimanite mica schists in the hanging wall. The covering micaschists in hanging wall comprise porphyritic orthogneisses and deformed migmatites.

The granulite body is concordant to structures of the Polička crystalline unit and Moravian micaschists in the foot wall. In the north and central parts, the foliation planes are oriented in a NW-SE direction and bent NE in every lithology, the subvertical foliation planes can be observed only in the central parts of the granulite body. Near Vír, the foliation planes change their orientation to a NNW-SSE direction and reach nearly a vertical slope. The trend NNW-SSE of the foliation plane direction extends to the south with the WSW dipping of the planes. The orientation of the stretching lineation is NW-SE with mostly flat (20°) NW plunging. An exception is the internal part of the granulite body where the lineations are subvertical.

In the covering metapelites, there were distinguished three events of deformation. During the D_1, the main metamorphic cleavage S_1 and the mineral lineation, defined by Barrovian mineral paragenesis, were developed. The transtensional dextral shear zones, showing kinematics with the top to the SE, were attained through the D_2. Through the D_3, the whole complex was folded and a huge megafold with a steep NE dipping fold axis was developed. The fold is characterised mesoscopically by evolution of the flat NW bending transpressional shear zones in the south part of the antiform. The shear zones show kinematics with the top to the SSW.

The granulites show the structural evolution concordant to the surrounding metagabbros and are locally folded together. However, the granulites mostly represent budins in the intrusional gabbros. The deformation of the gabbros is sometimes formed in a solid state and HT mylonites are developed. Subhorizontal open folds and budins, which have the axes parallel to the NW-SE stretching lineation, were developed in the granulites during the postmetamorphic event.

The mineral associations, observed in individual lithologies, were recorded in AFM, ACF+M and ANF+M triangles. The temperatures were estimated by grt - bt and hbl - plg thermometry. The mineral associations of grt - bt - ky, grt - ky or grt - bt represent granulites. The grt - bt thermometry in granulites offer 650 - 720°C at pressures of 8 - 12 kbars. Three different mineral associations express the various composition of the protolith but the identical metamorphic conditions. The retrograde granulites contain grt - bt - sill mineral association. Temperature of 550 - 620°C and pressures of 8 - 12 kbars are the metamorphic conditions, which were attained in grt - bt thermometry. In the western surrounding metapelites, the typical mineral associations are represented by grt - st - ky and grt - bt - sill, the surrounding metapelites of the Moravian mica schists zone contains grt - st - ky mineral association. In the both types of metapelites, the couples grt - bt offer temperatures of 550 - 620°C at pressures of 8 - 11 kbars. Moreover, the dominant mineral paragenesis grt - bt - sill in the western metapelites documents a significant overprint of the older mineral associations with kyanite under higher temperatures and/or lower pressures. Temperature and pressure estimates correspond to a depth of 35 km and agree with the metamorphic conditions of the retrograde granulites. Amphibolites contain hbl-tsch.hbl - ep - chl and hbl - plg (olig-andez) - chl mineral associations. The hbl - plg thermometry gives the temperatures of 650 - 800°C at pressures of 7-11 kbars.

It is possible to explain the structural and thermal evolution of the granulite lens by a combination of the thermal induction from the gabbroic intrusion and transport of the developed granulite together with gabbros into the middle crust. The temperature estimates of 650 - 720°C under the pressures 8 - 12 kbars are values that can be achieved in the depth of 35 - 40 km only due to an external heat source, e.g. due to magmatic advection. The proof of that is the presence of metagabbros as a cover, which is in a close structural contact with the granulite body. In the contact between gabbros and granulites, we can be observe a narrow zone of detracted pieces and budins of granulite, which were dragged into the original gabbroic magma, mingled together with gabbro and they testify to the syntectonic gabbroic intrusion. The granulites were exhumed by the gabbroic magma due to an oblique transpression and probably buoyancy from the lower crust. At a depth of 35 km, the transported lens was cooled in contact with the metapelites that provided the amount of water, essential for melting of the granulites which underwent anatexis through the decompressional uplift. The cooling of the whole body started at a depth of about 30 km under pressures of 8 kbars and temperatures of 550°C which are the metamorphic conditions of the weak retrogression of the metapelites and granulites. In the middle crust, the whole complex was folded, which was enabled by considerably high temperatures during the uplift of the granulites.