INTERACTION OF BASALTIC MAGMAS AND ACID GRANITE, EXAMPLES FROM LIBEREC REGION, CZECH REPUBLIC

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This contribution represents first results of detailed investigation of the interactions of basic magma emplacement into granite, on samples collected in the Liberec area in the Czech Republic.

First group of samples represents contact of olivinite melilitite with Liberec granite, and comes from one of the olivine melilititic dykes (approx. 70 cm thick) that outcrops in an abandoned quarry in Liberec granite [1] on the Výšina hill in Liberec. The olivinite melilitite (called polzenite in this region) is a part of dyke swarm in the Krkonoše–Jizera Composite Massif that occurs along NE–SW cross faults showing interconnection with the "Devil Walls" tectonic structures in the Bohemian Cretaceous Basin [2]. Alkaline and ultraalkaline rocks with melilititic association of upper cretaceous up to paleogene age are of mantle origin and represent products of magmatic activity of Eger rift [3]. The dark grey olivinic melilitite with porphyric texture consists of olivine, augite, melilite and biotite, magnetite, perovskite and haüyn. Idiomorphic crystals of olivine (up to 2 mm) are completely serpentinized; pyroxenes are zoned. This melilite dyke is 61.9 ± 3.0 Ma old according to the K–Ar dating [4], and it encloses xenolites of Liberec granite of Variscan age (320 Ma, U–Pb zircon age, [5]). Melilitite emplacement into the granite is recorded by microfracturing and local melting, which is shown by transformation of biotite to magnetite, partial melting of alkali feldspars, and occurrence of glass and mullite. This mineral association may document high temperature at the exocontact and rapid cooling of the rocks.

The deformation in the granite at the contact with melilitite was studied using electron-backscattered diffraction microscopy (EBSD), electron microprobe (EMPA) and scanning electron microscopy (SEM). The contact microstructure, which in the field and hand specimen resembles pseudotachylite, is a combination of hydraulic fracturing, thermal alteration and partial melting effects. It shows internal deformation of quartz and feldspars related to the dyke emplacement. The grain size in melilitite is rather smaller at the contact while differs deeper in the melilitite dyke, the emplacement effects might be observed as far as 1 cm from the contact. Mineral chemistry changes and metasomatic reactions, have been studied in detail (see contribution of Larikova et al.).

Second group of samples represents contact of Contact of the olivine basanite with Jizera Granite is exposed in the abandoned quarry on the southern side of Buková hill near Jiřetín pod Bukovou [1, 2]. Both rocks are welded at the sharp vertical contact boundary. Basalt magma thermal effects on the Jizera Granite are most intense several cm from the contact plane. Thermal shock of the granite is recorded in the transformation of biotite into a fine film of magnetite, and partly K-feldspars into the glass and mullite melt. With respect to the melilitite the microstructure show less damage along the contact and also lower element mobility and less pronounced metasomatic reactions. The basalt texture does not change and the contact region is restricted to the zone of approx.. 1–2 mm. Olivine grains are fresh even at the contact on the contrary to the melilitite.

In the field the thermal effect of magma emplacement might be documented using magnetometer (magnetic survey). In the surrounding of both localities (Výšina and Buková hill) profiles have been measured trending from the contact of the basanite deeper into the granite (basalt Buková hill) and across the melilitite dyke at the Výšina locality.

At Buková hill locality the magnetic susceptibility of the contact granite (13.5×10^{-3} SI) is similar to basanite (12×10^{-3} SI) while magnetic susceptibility of the thermally unaltered ganite is almost $\leq 0.5\times10^{-3}$ SI. Thermal effect of the basanite magma and thus granite heating is traceable in distance about 15 to 20 metres.

Along the melilitite dyke the contact zone in granite is more than one metre wide and the measurement gives us an opportunity to unravel the dyke orientation indirectly.

The occurrence of melilitite represents pre-rift period (79–46 Ma, [6]) of Cenozoic volcanism in the Bohemian massif that was represented by rather rapid emplacement, while the basanite is part of suite emplaced in syn-rift period (42–16 Ma; [6]), both on the NW–SE oriented faults. The difference of observed microstructures is interpreted as a result of different velocities and temperatures of magma emplacement. Moreover the thermal effect as documented by magnetic survey is a good method for detection of contact metamorphism.

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