Emplacement of the Altenberg Granite Porphyry: AMS Data Constraints

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Vertical variations in magnetic fabric and paragenesis of the ferrimagnetic minerals for virtually upright dyke of the Altenberg syenogranite pophyry were investigated using profile data of the borehole E-16 to the depths of 922.7 m (Eastern Krušné hory pluton). As other syenogranite porphyry to granodiorite porphyrite dykes of the Altenberg-Teplice caldera, which is a large volcano-tectonic depression of Late Westphalian age (Sattran 1960, Fiala 1960, Jiránek et al. 1987, Breiter and Seltmann 1995, Breiter 1997), the dyke under consideration represents the middle member in magmatic sequence after rhyolitic ignimbrite and before Late Variscan, two-sequence granites of the Krupka subpluton (Štemprok et al. 1994). Timing of dyke emplacement (307-309 Ma - Seltmann, pers. comm.) and extensional tectonic regime are pertinent to understand the emplacement interactions.

The NNW-SSE-trending and 15 km long dyke was drilled near the contact with the NW part of the Krupka hidden pluton (Malásek et al. 1987). It shows no signs of ductile-brittle deformation.

Modal composition of the dyke mostly corresponds to porphyritic biotite-amphibole syenogranite. The large, up to 30 mm long phenocrysts are represented by pink-coloured perthitic K-feldspar and oligoclase, and rarely by quartz. The matrix consists of K-feldspar, oligoclase, quartz, amphibole, biotite and in some places of clinopyroxene relics. Among secondary minerals, sericite, epidote (clinozoisite), chlorite, locally hematite, siderite, and calcite are present. Opaque minerals (magnetite, ilmenite with magnetite lamellae, and hemoilmenite) accompanying accessory apatite, zircon and leucoxene are common but tranformed in strongly altered zones. Fluorite, siderophyllite, topaz, orthite, REE-carbonate and ferri-rutile belong among rare minerals.

The Altenberg syenogranite porphyry exhibits distinctly anomalous magnetic properties, with bulk susceptibility ranging from 10^{-4} to 10^{-2} [SI]. These may indicate large variability in the quality and content of ferrimagnetic minerals. The upper portion of the dyke (to depth of 400 m) contains relatively large grains and aggregates of magnetite (mostly 0.1-0.2 mm, exceptionally up to 1 mm). In addition, ilmenite with magnetite lamellae (0.1-0.8 mm) occurs more frequently than that without visible lamellation. Ilmenite intergrowths with amphibole, biotite, and disintegrated clinopyroxene are rare. Due to slight alteration, some of the ilmenite grains may be rimmed by sphene and/or leucoxene. In contrast, lower portion of the dyke contains spherical opaque grains of hemoilmenite (0.3-1 mm) without visible magnetite lamellae, sometimes with leucoxene rims. Ilmenite containing magnetite lamellae is rare. Joint-controlled alteration leads to partial martitization of magnetite grains as that in upper part. Strongly altered zones indicated by low susceptibility (below 1,000 x 10^{-6} SI) contain martitized magnetite, hematite, sphene after ilmenite, and leucoxene. Hematite impregnations of feldspars are typical throughout the borehole profile.

Magnetic minerals were also investigated by temperature variation of susceptibility. Thermomagnetic heating curves of all specimens investigated are similar to those of magnetite (with Curie temperature of 570°C to 580°C). The cooling curves are of two types. In samples from upper portion, the cooling curve resembles that of pure magnetite, being however much lower than the rock-heating curve; a part of magnetite was transformed into a less magnetic mineral. In the lower portion, the cooling curve is in turn much higher than the heating one, therefore, some strongly magnetic mineral was created during heating.

Magnetic foliation is mostly steep corresponding to that in dykes originated through nearly free magma flow. Magnetic lineations of most of the specimens show flat plunges probably indicating a sub-horizontal magma flow. On the contrary, at the base of the upper dyke portion (in the depth interval of 200 - 400 m), magnetic foliation and magnetic lineation are subhorizontal. This can be explained by vertical compaction of partly solidified upper part magma due to the pressure of the ascending lower part magma. Magnetic minerals were re-orientated with their larger planes perpendicular to the pressure.

Generalization of these data must take into consideration that the mechanism of magma ascent of acidic dyke is complex and comprises all types of preferred magnetic orientations known in more basic rocks.