Magma flow and anisotropy of magnetic susceptibility in aplite dykes in the Nasavrky Plutonic Complex (Bohemian Massif)

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Formation and propagation of dykes is one of the important mechanisms of the mass transport from the lower parts of the Earth's crust (or even from the mantle) to the upper ones. Details of this mechanism can be advantageously studied using anisotropy of magnetic susceptibility (AMS) which is a rapid and efficient geophysical (petrophysical) method for investigation of the preferred orientation of magnetic minerals (magnetic fabric) in a rock (Tarling and Hrouda 1993).

The Nasavrky Plutonic Complex is located in the E part of the Bohemian Massif, in the central and southern regions of the Železné hory Mts. It comprises multiphase intrusions of rocks of calc-alkaline series from granodiorite to tonalite, gabbroic rocks and leucocratic biotite granites. The granitoids are often penetrated by dykes of aplitic to pegmatitic composition.

Magnetic fabric in five aplitic dykes in the Nasavrky Plutonic Complex was investigated (Táborská 1997). Magnetic fabric in dykes shows a different orientation than that in the host granodiorite and is therefore of magmatic origin. In four dykes, magnetic foliations are roughly parallel to the dyke plane and the magnetic lineations show bi-modal orientation (nearly horizontal and nearly vertical). This magnetic fabric originated through magma flow. In one dyke, magnetic foliations are in no case parallel to the dyke plane. Mostly, they are almost perpendicular. This orientation originated through compaction of the static magma column.

The relationship between the magnetic fabrics in the dyke and in granodiorite is important from the point of view of the fabric origin of both the rock types. Namely, if the orientations of the magnetic fabrics are the same, they indicate an effect of post-intrusive tectonic ductile deformation that affected both the granodiorite and dyke and overprinted their originally different magnetic fabrics (Tarling and Hrouda 1993). On the other hand, if the magnetic fabrics in the dyke and in granodiorite are different and magnetic foliations and lineations in the dyke are closely related to the dyke shapes, the magnetic fabric in the dyke can be regarded intrusive in origin. Magnetic fabrics in all our dykes are oriented very differently from those in the surrounding granodiorite. Consequently, the magnetic fabric in the dykes can be regarded as originated through magma flow in the dykes.

References

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