# Magnetic Anisotropy of the Šumperk Granodiorite and its Tectonic Implications

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Magnetic properties, mainly the anisotropy of magnetic susceptibility (AMS) of the Šumperk granodiorite were investigated on specimens oriented with respect to the drill cores axis taken from boreholes BMV-10 and BVJ-2, situated near the town of Bludov. This study aimed to check, through investigating the vertical variation of the AMS in granodiorite, the idea of Mísař (1958) that this rock is a tectonite and not post-tectonic plutonite.

The Šumperk Granodiorie Massif crops out in the southern part of Keprník Dome in the Jeseníky Mts., forming two large and many minor occurrences in the vicinities of the towns of Šumperk and Bludov. The contact with the underlying suite of crystalline rocks of the Keprník Dome is sharp. The calc-silica hornfelses, bludovites, derived from carbonate rocks of presumably Devonian age suggest that the massif can be Variscan in age. A large portion of the massif is hidden under Neogene and Quaternary sediments. In the Bludov area, an aeromagnetic anomaly reaching 300 nT was found in the eighties and the subsequent petrophysical research revealed highly variable and insufficiently high susceptibility of the exposed parts of granodiorite to cause the magnetic effect observed. The superficial layers of the granodiorite are only weakly magnetic at many places, often due to deep weathering. The kappa-meter data obtained for the profile of the BVM-10 borehole show very low susceptibility to 85 m, whereas mostly highly elevated values for the fresh rock in the interval 85 - 151.1 m were obtained. The only fresh greyish white rocks of the deeper parts of both boreholes were taken for the anisotropy study.

The mineral composition, as follows from thin section observations, is similar to that described by Mísař (1958). The granodiorite is composed of plagioclase, quartz, K-feldspar and biotite. Among accessory minerals apatite, orthite, zircon, titanite and opaque grains can be found. Secondary minerals are chlorite, sericite, clinozoisite, carbonate, hematite. The plagioclases form euhedral to subhedral prismatic grains (0.5 to 1 mm long) commonly exhibiting normal or oscillatory compositional zoning. The cores and more basic zones are strongly altered. Quartz fills the space between feldspars, resorbing them. A cataclastic mosaic texture is clearly visible at many places, undulatory extinction is frequent. Small amount of quartz is in myrmekite. K-feldspar builds relatively large Carlsbad twins (3 - 10 mm) with irregular rims. They are perthitic or microperhitic and many of them show microcline grid twinning. They enclose an enormous amount of partly resorbed plagioclases and some other small grains. The content of biotite is low, a few vol. percent. Biotite is frequently more or less chloritized. Biotite and chlorite stripes are undulated as if they were squeezed between the grains of light minerals. Minute opaque grains (hundredths of mm} are concentrated in biotote stripes, forming dense impregnations or coatings on grains and fissility planes. The intensity of the signs of rock deformation decreases with depth.

The results of petromagnetic study can be summarized as follows :

1. Magnetic susceptibility of relatively fresh rock varies widely, from $10^{-4}$ to $10^{-2}$ SI. It is controlled by the magnetite content, being probaly unrelated to the degree of chloritization. The presence of magnetite, even in weakly magnetic samples, was revealed by thermomagnetic analysis. The values obtained are high enough for the granodiorite to be considered a source of the above mentioned magnetic anomaly.
2. The AMS is unusually high, the degree of AMS about 1.3 was found in both strongly magnetic and weakly magnetic samples. It very likely reflects stringing-together effect of small magnetite grains within biotite aggregates. Magnetic fabric is clearly linear, with magnetic lineation being approximately horizontal corresponding to the fold axes observed in the surrounding crystalline complex (Hanžl, pers. comm.). This magnetic fabric together with the girdle pattern in quartz c-axes revealed by Mísař indicate that the rock is a tectonite. It may have originated either during tectonic effect on the solidifying magma in the way similar to that described by Parry et al. (1997) for the tonalite of the Staré Město Belt or during late Variscan deformations associated with the formation and advance of the Culm nappes.
3. Leucocratic character of the granodiorite (Mísař 1958) is documented by our density measurements, showing grain density values close to 2.65 $gcm^{-3}$. The re-evaluation of chemical analyses confirmed the rock classification ($CaO$-$Na_2O$-$K_2O$ diagram) as granodiorite, revealed a meta-aluminious rock composition (ASI) and suggested that the Šumperk granodiorite belongs to an I-type. While the Šumperk granodiorite does not differ from the Žulová massif in the major element chemistry, trace element diagrams indicate a difference between the Šumperk granodiorite (BVM-10) and granitic rocks of the Žulová massif as for the plate-tectonic environment. In addition, a difference exists in the REE-distribution; the Šumperk granodiorite shows almost no Eu-anomaly.