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Different view to the paleomagnetic results from the Pohorje Mountains, northern Slovenia

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Igneous rocks of the Pohorje Mountains, northern Slovenia, represent from paleomagnetic point of view very unique occurrence. Pallet of paleomagnetic results is so diverse that it seems illogical on first glance. The measurements were made with the aim to determine rotations of separate parts of the investigated area and their regional and/or local significance. We expected the results to support one of two different statements, namely, that dacite is younger from granodiorite and the magmatic activity is connected with Periadriatic lineament, what was valid up to now (e.g. Mioč, 1978; Mioč & Žnidarčič, 1989), or that the intrusion is most probably peri-Pannonian (Trajanova et al. 2005, 2008, Trajanova & Pécskay 2006, Fodor et al. 2008), and granodiorite and dacite represent one common intrusion (Trajanova et al. 2005, 2008, Trajanova & Pécskay 2006). In this context, paleomagnetic results published by Marton et al. (2006) are re-evaluated and reinterpreted. It is shown that rotation as basic discrimination criteria for succession of the Pohorje Mountains magmatism is not suitable. Therefore, magnetic polarity is used instead representing regional parameter without fear to be locally affected. This change enabled explanation of extremely inhomogeneous paleomagnetic results.

Paleomagnetic measurements were carried out on granodiorite with transition to porphyric granodiorite and dacite, co-genetic varieties lamprophyre and rhyodacite, and gabbroid inclusion in granodiorite called cizlakite. In granodiorite body, paleomagnetic signal is governed by ferromagnetic minerals, predominantly by magnetite. Paramagnetic minerals (predominantly hornblende and biotite) determine mostly magnetic properties of cizlakite and surrounding metamorphic rocks. Relatively frequent secondary magnetite formed locally on the account of paramagnetic minerals by deuteric processes.

As shown by petrographic and structural data magma crystallized in a dynamic conditions producing mushy flow of a partly crystallized magma. The influence of synmagmatic and postmagmatic ductile and brittle deformations in shallow parts of the crust influenced paleomagnetic record of the intrusion more than its direction of emplacement. Later reduction of grain size in mylonitized zones and reorientation of grains within shear zones affected stronger wider central and eastern part of the Pohorje Mountains, therefore the influence of emplacement direction on the paleomagnetic fabric was destroyed. Magnetic anisotropy is on average higher in central to eastern part and weaker in western part of the massif. Later right rotation affected only southern to south-eastern part of the area.

Polarity measurements indicate that magmatism on the Pohorje Mountains was active in the period of magnetic reversion. Such an example is known from western Antarctica (Behrendt et al. 2007). The time of eruption there is estimated to be older than 15 Ma and magnetic anomalies occur only in volcanic exposures older than 10 Ma, what in broad coincides with the time of emplacement and cooling of the Pohorje Mountains batholith (between around 18.7 to 15Ma). Both, granodiorite and dacite have normal polarity, which fits to their common emplacement. Lamprophyre and rhyodacite, together with separate mafic inclusions in granodiorite have reverse polarity, which confirms their younger age. Together with the rocks dating it is quite clear that pole reversal occurred after emplacement and cooling of the granodiorite body under the Currie point, but before lamprophyre (age about 16.7 Ma) was cooled under about 560oC.