Modeling of anisotropy of magnetic susceptibility: example from serpentinized peridotite

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Abstract: Numerical modeling of the AMS from rock microstructure can help gain insight into the factors that contribute to the observed magnetic fabrics and the mechanism responsible for AMS formation. This viewpoint is very important for the quantitative comparison and evaluation of mineral fabric and magnetic fabric. Mathematical calculations can be used to figuring the respective contribution of individual minerals (and corresponding fabric) to the bulk magnetic susceptibility and AMS, also in the case where individual microstructures in polymineralic rocks are noncoaxial. Further, through parametric study more observation on properties of magnetic fabric can be made.

An attempt is made to model magnetic fabric from serpentinized Mohelno spinel to garnet peridotite (Bohemian Massif) and evaluate its link to the olivine and pyroxene microstructure. Serpentinization altering 50% to 100% of the studied peridotite is mostly expressed by presence of the lizardite and iron oxides (thermomagnetic curves revealed mainly magnetite accompanied with both high and low temperature variety of maghemite and in some specimens also by a mineral from magnetite – chromite or magnetite – spinel series.)

Model is developed based on the lattice preferred orientation (LPO) of olivine and orthopyroxene obtained by electron back-scattered diffraction (EBSD) and of serpentine whose orientation data was estimated from topotactic relationships between olivine and antigorite. From LPO of the mafic silicates and literary data of their grain AMS (due to new magnetite created within silicate crystals), we can calculate the overall magnetic properties (paramagnetic and ferromagnetic AMS) and compare it with the measured fabric.

Keywords: LPO, AMS, numerical model, peridotite, serpentinite