THE RELATIONSHIP BETWEEN CHEMISTRY, TEXTURE AND ANISOTROPY OF MAGNETIC SUSCEPTIBILITY FOR A SET OF CALCITE MYLONITES

BJARNE S.G. ALMQVIST 1, Marco Herwegh 2, Volkmar Schmidt 3, Thomas Pettke 2, Ann M. Hirt 1

1 Institute of Geophysics, ETH Zürich, Sonneggstrasse 5, 8092 Zürich, Switzerland
2 Institute of Geological Sciences, Universität Bern, Baltzerstrasse 1+3, 3012 Bern, Switzerland
3 Kali-Umwelttechnik GmbH, D-99706 Sondershausen, Germany

Magnetic susceptibility and its anisotropy (AMS) are sensitive indicators for trace amounts of paramagnetic impurities and second-phase minerals in rocks that display diamagnetic bulk susceptibility. To illustrate this relationship a set of highly strained calcite mylonites has been collected from the overturned limb (shear zone) of the Morcles Nappe (Helvetic Alps, southwestern Switzerland). The sample set consists of white and gray fine-grained calcite mylonites (Upper and Lower Urgonian) with less than 10 vol% of secondary phase content and varying amounts of paramagnetic Fe and Mn impurities. The AMS of these specimens are studied using a combination of low- and high-field magnetic susceptibility measurements. In addition, high-field AMS measurements are performed at 77 K. The use of these methods illustrates a strong relationship between the magnetic susceptibility, the development of crystallographic preferred orientation (CPO) of calcite and the Fe plus Mn impurity content. The bulk magnetic susceptibility and AMS varies systematically according to the amount of Fe and Mn. At room-temperature the AMS results from a combination of the diamagnetic and paramagnetic sub-fabrics, whereas at 77 K the paramagnetic sub-fabric is dominant. The k_1 and k_3 axes invert positions when comparing the AMS at room temperature and 77 K. The degree of anisotropy is shown to be related to bulk susceptibility, which in itself is directly dependent on the amount of Fe incorporated into the calcite's lattice, and the strength of the calcite's CPO. Our results indicate that AMS can be used as a sensitive tool for studying the relationship between trace element chemistry and deformation.

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Bjarne S.G. Almqvist, Institute of Geophysics, ETH Zuerich, Sonneggstrasse 5, 8092 Zuerich, Switzerland; tel: +41446332626; e-mail: bjarne.almqvist@mag.ig.erdw.ethz.ch