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Very high anisotropies of magnetic susceptibility in a shear zone from the Scandinavian Caledonides: A magnetofabric and textural analysis

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Magnetic fabric investigations of mylonitic garnet mica schists of the Seve-slab N and W of Lake Slipsiken (Swedish Caledonides) showed very high anisotropies of the magnetic susceptibility (AMS) with P'-values up to 4.5. The high degree of anisotropy in this shear zone raises questions about its origin and provides a chance to monitor systematic changes of rock magnetic parameters and petrofabrics. Microscopic investigations revealed that metamorphic foliation is defined by muscovite and biotite. Magnetite and ilmenohematite (fine hematite exsolution lamellae in ilmenite hosts) comprise less than 3 per cent by volume of the rock. They are aligned subparallel to the mica fabric, forming flattened and elongated mineral grains of 20 to 250 μm size. Their long axis are aligned in the plane of metamorphic foliation. Because bulk susceptibilities are very high (max. value 65*10^{-3} SI) only magnetite with a T_V of –152°C and T_C of 580°C can be seen in temperature-dependence of magnetic susceptibility. However, IRM acquisition with following thermal demagnetization of the orthogonal IRM, revealed a significant contribution of ilmenohematite on remanence, although NRM demagnetization is dominated by a soft magnetic behaviour (MDF-values < 15 mT). Low- and high-field AMS and AARM axes are nearly coaxial, and k_{max} and k_{int} align in the plane of metamorphic foliation. This observation clearly confirms a syntectonic formation of mica minerals and Fe-Ti oxides during the main stage of shear zone deformation. The shape factor indicates consistent oblate shapes for the susceptibility ellipsoid. We observed a field dependency (up to 10 per cent) of magnetic susceptibility parallel to k_{max}, especially for samples with high P'. We suggest that this field dependence and the high AMS are produced by preferentially oriented exsolution lamellae in ilmenohematite in combination with flattened and elongated magnetite grains.