Magnetic fabric in ilmenite-rich norites of the Bjerkreimer-Sokndal Layered Intrusion, Norway *Poster*

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Introduction

The Bjerkreim-Sokndal (BKS) is a layered intrusion, located in the Mid-Proterozoic Egersund anorthosite-norite province within the Sveconorwegian province of the Baltic Shield, south Norway. The layered intrusion formed by influxes of more primitive magma into more evolved magma to produce six Megacyclic units (MCU), each of which can be divided into up to six subunits. From bottom to top in each megacycle the rocks consist of early plagioclase-rich norites, intermediate hemo-ilmenite-rich norites and later magnetite-rich norites. Aeromagnetic maps over the intrusion show large negative and positive anomalies. A negative anomaly with amplitude to -13000 nT at 60 m above ground is associated with hemo-ilmenite-rich norite layer MCU Ive. This layer IVe contains plagioclase, orthopyroxene, hemo-ilmenite, magnetite, and minor clinopyroxene, biotite, apatite and sulfides. Multi-domain (MD) magnetite makes up 2–3% of the rock.

The negative magnetic anomaly associated with MCU IVe reaches its most negative value on the east limb of the Bjerkreim Lobe near Heskestad. The anomaly at Heskestad is part of a longer negative anomaly, which follows MCU IVe for more than 20 km around a large syncline. The average NRM intensity decreases from $25\,\mathrm{A\,M^{-1}}$ along the east fold limb to $10\,\mathrm{A\,M^{-1}}$ towards the hinge area to $7\,\mathrm{A\,M^{-1}}$ at the hinge. The BKS has a penetrative deformation fabric within the syncline with the weakest deformation found in the hinge area and the strongest on the east limb. Electron backscatter diffraction (EBSD) was used to determine the lattice-preferred orientation (LPO) of orthopyroxene and ilmenite. The (100)-planes of the orthopyroxenes are found to lie parallel to a foliation in the rock, which is sub-parallel to the cumulate layering. Orthopyroxene c-axes form the steep lineation within the foliation plane.

The anisotropy of magnetic susceptibility (AMS) was measured for samples that were taken at five locations from the eastern limb to the hinge area of the syncline to investigate if the change in NRM intensity could be related to magnetic fabric.

Magnetic Fabric

The AMS of the norite samples was measured in low fields with an AGICO KLY-2 susceptibility bridge at room temperature (293 K) and liquid nitrogen temperature (77 K). At room temperature the AMS ellipsoid is triaxial with a grouping of maximum axes down-dip in the foliation plane and minimum axes sub-parallel to the pole to foliation. The degree of anisotropy is lower in the hinge area compared to localities on the limb of the syncline. The average, low-field susceptibility increases by a factor of 2.2 to 3.2 at low temperature, which indicates that both ferromagnetic and paramagnetic minerals are responsi-

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ble for the low-field susceptibility. This grouping becomes less distinct at low temperature; the shape remains triaxial although the degree of anisotropy increases. There is also a slight change in the orientation of the ellipsoid at 77 K, which may be related to the increased contribution of the paramagnetic phases to the magnetic susceptibility at low temperature, and this will be discussed in conjunction with the mineral fabric.

To understand better which mineral fraction is controlling the AMS at the two temperatures, i.e., the ferromagnetic or paramagnetic, the AMS was measured subsequently in high-fields with a torque magnetometer at 293 K and 77 K on selected samples. The torque is dominated by the ferromagnetic phases at both temperatures. The orientation of the ferromagnetic ellipsoid is at 293 K is in agreement with the orientation of the low-field AMS. The paramagnetic AMS is similar is tilted slightly with respect to the ferromagnetic AMS, but both are triaxial in shape. At 77 K the orientation of the ferromagnetic subfabric rotated clockwise with respect to its orientation at 293 K. Magnetite is the dominant carrier of the susceptibility anisotropy. It must be noted that magnetite undergoes a transition in its crystallographic structure from cubic to lower symmetry below the Verwey transition at approximately 120 K. Above the Verwey transition magnetite is dominated by shape anisotropy, i.e., shape of the magnetite grains, whereas below the Verwey transition, magnetite is dominated by a strong crystalline anisotropy. The change in magnetic fabric will be discussed in the context of the mineral fabric of orthopyroxene and ilmenite.