



Anisotropy of magnetic susceptibility and paleomagnetic data bearing on magma ascent and emplacement of the Western Granite, Isle of Rum, NW Scotland

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The Isle of Rum Central Complex, NW Scotland, consists of silicic to ultrabasic intrusive and extrusive rocks emplaced into sandstones of the Neoproterozoic Torridon Group during at least three distinct phases of magmatism in the early Paleocene. Phase one (~ 61 Ma), characterized by silicic intrusive and extrusive magmas and the development of an arcuate ring fault system, is the focus of this study; specifically the emplacement of the Western Granite that was intruded late during phase one and is well-exposed along the western side of the island.

Twenty-eight AMS stations were established over the ~ 6 km² exposed part of the intrusion with all stations yielding interpretable results. The high average bulk magnetic susceptibility (28.21E^{-3} SI) together with low temperature susceptibility experiments indicate that magnetite controls the magnetic anisotropy. AMS fabric shapes are generally triaxial; magnetic lineations are N-NW trending in the north and SE trending in the western and southern part of the intrusion with bimodal plunges. Magnetic foliations commonly strike parallel to the margins of the intrusion and dip steeply toward the contact. For over 90 percent of the data, the magnetic lineations trend parallel to the strike of the magnetic foliation.

Eight to ten oriented samples from 8 of 28 paleomagnetic sites in the Western Granite have been fully demagnetized and yield characteristic remanent magnetizations that

are discordant to the expected field direction. These results give predominately single-component, well-grouped magnetizations of high coercivity (median destructive fields between 20 and 50 mT), which we interpret as a primary thermoremanent magnetization that decay along a roughly univectoral path to the origin with less than ten percent of the NRM intensity remaining after treatment in 80 mT to 120 mT fields. The eight sites yield *in-situ* reverse polarity results of S-SW declination and moderate to steep inclinations that are well-grouped (average $\alpha_{95} < 5.0^\circ$) at the site level and provide an overall group mean $D = 210.8^\circ$, $I = -68.3^\circ$, $\alpha_{95} = 7.9^\circ$ that is discordant to an early Paleocene expected field $D = 183.7^\circ$, $I = -65.6^\circ$.

We interpret the paleomagnetic data to reflect at least 15° of west side down tilting of the intrusion, and, possibly, the entire Rum Central Complex. Restoring the discordant paleomagnetic data to the expected field direction defines a horizontal tilt axis trending N20E. Correcting for the inferred 15° of west-side down tilting of the intrusion, AMS fabric elements are restored to their original orientation. Considering these fabrics as magma flow indicators, we propose that the steeply dipping magnetic foliations and N-S trending magnetic lineations represent a N-S trending magma source area or conduit in the east of the intrusion, perhaps the Long Loch fault or associated splay. Intrusion of magma along this conduit was followed by emplacement to the west, as indicated by the shallower magnetic foliations and the E-W trending magnetic lineations.