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Application of in-phase and out of phase AMS to provide new insights into the structure of the Austurhorn Intrusive Complex, SE Iceland

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Anisotropy of magnetic susceptibility (AMS) is an essential tool in elucidating the structure of subvolcanic magmatic systems, but thus far only in-phase AMS has been applied in this geological context. Here we present novel out of phase (OP) AMS data alongside traditional in-phase (IP) AMS and field observations to assess the architecture of the magma mixing zone at the base of the Austurhorn Intrusive Complex in SE Iceland.

A 1:2000 scale geological map and an extensive outcrop scale field bulk susceptibility data set were compiled from the Austurhorn Intrusive Complex to provide context for detailed petrographic and magnetic analysis. A total of 15 sites were sampled for AMS and rock magnetic experiments. IP AMS results compliment field observations and describe a coherent structure to the magma mixing zone, interpreted to represent the deflection of magma around a competent layered gabbro body in the west of the complex during pluton construction.

OP AMS tensor axes typically align closely with corresponding in-phase tensor axes and field data. However, in some examples there is an appreciable offset, and in two sample sites the OP AMS tensor axes are rotated at approximately 90° to corresponding in-phase AMS data. Confidence ellipses are very well constrained in all cases. We consider several hypotheses to explain these results, including: the presence of multiple fabrics delineated by different minerals or domain types; the influence of minor phases with a strong OP response such as pyrrhotite; and the relative abundance of single-domain magnetite. These possibilities have exciting implications for OP AMS as a new addition to the geologist's toolkit.