Geophysical Research Abstracts
Vol. 15, EGU2013-4164, 2013
EGU General Assembly 2013

AMS in basalts: is there a need for a-priori demagnetization?

Stefan Schoebel (1), Helga de Wall (1), and Christian Rolf (2)

(1) GeoZentrum Nordbayern, Universität Erlangen-Nürnberg, Schlossgarten 5, 91054 Erlangen, Germany., (2) Leibniz Institute for Applied Geophysics (LIAG), Stilleweg 2, 30655 Hannover, Germany.

One of the most prominent applications of anisotropy of magnetic susceptibility (AMS) measurements is the evaluation of flow fabrics in basalts. Basalts often contain Fe-Ti oxides with variations in grain/domain size fractions due to their variable cooling history. The origin of AMS in such rock types is of complex nature. Crystal shape, magneto-crystalline anisotropy and magnetic interactions are considered as the most influential parameters. It is still under debate if a remanent magnetization, commonly strong in such basalts, can influence the low-field AMS measurements and therefore bias the magnetic fabric interpretation.
For this key study lava flows from the Malwa Plateau, the northern part of the Deccan Large Igneous Province in India have been investigated. Specimens were demagnetized using a static 3-axial and a tumbling device (peak fields of 100 mT). The AMS was measured before and after the respective demagnetizing experiment.
Scalar AMS parameters and orientation of the principle axes change during the experiments: Mean susceptibility rises due to demagnetization, the shape factor T and the corrected magnetic anisotropy P' show systematic change. This behavior points to a significant influence of remanence vector on AMS. In multi-domain (MD) and pseudo-single-domain (PSD)-grains, axial-demagnetization will align the domain walls according to the applied field. Especially specimens showing a normal magnetic fabric react very sensitive to changes in the domain structure. κmax will get aligned parallel to the last applied field and the other principle magnetic axes will follow the orthogonal geometry of the field. Specimens with an inverse magnetic fabric can also be affected by the demagnetization. However, inverse specimens with an apparent high fraction of single-domain (SD)-particles show no redistribution of their principle axes. Demagnetization with a tumbling device will not impress a direction on the AMS but will remove the magnetic remanence in MD/PSD-grains. This change of the domain structure can lead to aberrations of the principle magnetic axes from their initial position.
This new orientation will give a better approximation of the crystal fabric. It is therefore advisable to demagnetize specimens showing a strong magnetic remanence with a tumbling demagnetizer before any AMS experiments. However AMS can still be deflected by the remanent magnetization of SD-particles and magnetic interactions of nearby ferrimagnetic grains. This study shows how changes in the alignment of the domain walls in MD/PSD-ferrimagnetic minerals can have a leading influence on the AMS.