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Anisotropy of Remanent Magnetization: What Works Best

Ann Hirt
ETH Zurich, Institute of Geophysics, Zurich, Switzerland (ann.hirt@erdw.ethz.ch)

Interest in the anisotropy of magnetic remanence has continued since the early days of paleomagnetism as a means to assess whether sedimentary or tectonic compaction deflects the original natural remanent magnetization (NRM). Remanent anisotropy is determined by examining the directional dependence of an artificial remanence imparted in at least six different directions, relative to the sample. The induced remanence either exploits coercivity, using an isothermal (IRM) or anhysteretic remanent magnetization (ARM), or blocking temperature, i.e. thermal remanent magnetization (TRM), of the ferromagnetic minerals carrying the NRM. Each method has its advantages and disadvantages, which will be illustrated and discussed. The anisotropy of ARM (AARM) is often used when low coercivity phases carry the NRM, because it is easy to impart and subsequently remove. It also has the advantage that an ARM can be induced in the specific coercivity range, which carries a component of magnetization. In the case of different generations of ferrimagnetic minerals, the direction and/or degree of anisotropy can differ. The disadvantage of AARM is that one is generally limited in the maximum applicable AC field, such that high coercivity phases are not magnetized. In this case anisotropy of IRM has been used, in which high fields can be imparted to magnetize all ferromagnetic minerals in a rock. Ideally the induced magnetization should be randomized or removed after each direction. Although if may be possible to reduce the IRM by applying a back-field on the order of the remanent coercivity, this is not the same as starting from a demagnetized state. Examples are given to show that inducing a saturation IRM repeatedly in the same direction, may still lead to variations in intensity on the order of several percent, i.e. on the order of the anisotropy. The anisotropy of TRM is an alternative method, which has been shown to work well, when hematite carries the NRM. Similar to using heating methods for paleointensity determinations, the ferromagnetic mineralogy should not alter with repeated heating.