Application of absolute paleointensity methods on aged thermoremanent magnetization and implications for fragile curvature in paleointensity plots

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Absolute paleointensity (API) of the geomagnetic field can be estimated from volcanic rocks by comparing the natural remanent magnetization (NRM) to a laboratory-induced thermoremanent magnetization (Lab-TRM). Plots of NRM unblocking vs Lab-TRM blocking from API experiments, so-called Arai plots, often exhibit non-ideal curvature which can result in biased estimates. We have targeted on specimens gave a ‘fresh’ Lab-TRMs in a 70 μT field and then aged for a few years. Tauxe et al. (2021) showed that curvature can increase with age, however, the CCRIT selection criteria designed to eliminate such behavior (Cromwell et al., 2015; Tauxe et al., 2016) yielded accurate API estimates by the IZZI Thellier method (Yu et al., 2004) for two-year aged specimens (70.3 ±3.8 μT; N = 96 specimens out of 120 experiments). API can also be estimated in coercivity space, and the Tsunakawa-Shaw method yielded accurate API results (68.5 ±4.5 μT; N=17 specimens out of 20 experiments) for four-year aged specimens by its selection criteria. In thermal API experiments, curvature is related to internal structure with more single-domain like behavior having the least curvature. Here we show that the fraction of anhysteretic remanent magnetization demagnetized by low-temperature treatment was larger for samples with larger thermal curvatures suggesting a magnetocrystalline anisotropy source. We also tested experimental remedies that have been proposed to improve the accuracy of paleointensity estimates. In particular we test the efficacy of the multi-specimen approach and a strategy pre-treating specimens with low field alternating field demag netization prior to the paleointensity experiment. Neither yielded accurate results.

