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Cooling rate dependence of the TRM of SD, PSD and MD particles

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The dependence of thermoremanence (TRM) on cooling rate was investigated experimentally on six thermally stabilized synthetic magnetites that are sealed in quartz glass tubes and range in grain size from below 1 μm (single domain, SD) to 12.1 μm (multi domain, MD). Earlier theoretical and experimental studies suggest that TRM dependence on cooling rate varies with grain size: For non-interacting SD grains slower cooling was found to lead to larger TRMs, for MD assemblages lower TRM acquisition after slow cooling has been suggested and for PSD grains studies have given various results (similar to SD behavior, no cooling rate dependence at all, opposite to SD behavior). Here, we present cooling rate experiments with well defined cooling rates over the whole blocking spectrum that were repeated several times to obtain uncertainty estimates. Rock magnetic measurements before and after the cooling rate experiments are done to check for alteration. During heating and cooling of the samples a magnetic field of 50 μT was applied parallel to the y-axis. The samples were cooled using five different cooling rates (0.1 to 15K/min; at least 3 repeat measurements). Additionally four samples were cooled with a very slow cooling rate of 0.05K/min (two repeat measurements). After each cooling the horizontal component of the magnetization was measured using a 2G Cryogenic magnetometer. The theoretically predicted log-linear behavior for SD grains is verified though the magnitude of the effect is smaller than in the predictions. The same is observed for two samples with pseudo-single domain (PSD) grains. For two of the MD samples no effect is found while the third one shows some increase of TRM with slower cooling rate like the SD and PSD samples.