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The Bigger, The Better? – Paleomagnetic recording fidelity of weakly interacting clusters of particles, and implications for micro-scale paleomagnetism

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A recent trend in paleomagnetism is the study of samples of ever decreasing sizes, going down to (sub)millimeter scales and even microscopic scales, including single-silicate-crystals and meteorites. Microscopic imaging has shown that some of these micro-scale samples appear to be much closer to ideal single-domain (SD) paleomagnetic recorders than bulk rocks. Small samples with large numbers of SD particles do, however, pose the problem of magnetic interactions affecting their paleomagnetic recording fidelity. We show that clusters of particles are common in micro-scale samples and that these interactions do affect thermoremanent magnetization (TRM) acquisition. We further show through numerical simulations that such interacting clusters may be difficult to detect in traditional experiments (such as FORC diagrams), but may nonetheless lead to over- or underestimates in paleointensities.