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Can magnetic anisotropy improve relative paleointensity estimates from sediments?

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Recalling that the magnetic moment lies in the long axis direction of magnetite grains, then the maximum axis of the magnetic remanence anisotropy ellipsoid should parallel the paleomagnetic direction if the magnetization reflects a true depositional remanence acquired via torque. Although the aligning process during sedimentation is highly inefficient, one should expect that the remanence anisotropy to change in proportional to magnetic field strength. Because higher external fields increase NRM by tightening the alignment of the grains, magnetic anisotropy should become increasingly prolate proportional to field strength. We show this to be indeed true through a series of redeposition experiments in controlled magnetic fields using natural sediments that contain single domain magnetite. Anisotropy of anhysteretic remanent magnetization (AARM) indices (directions and eigenvalues) vary in proportion to magnetic field strength. Anisotropy of magnetic susceptibility (AMS) shows a much more subdued relationship with magnetic field strength, as it is overwhelmed by the paramagnetic fraction dominated by a sedimentary fabric. Our numerical models can account for the AARM, AMS and “paleomagnetic” experimental results. AARM thus holds promise to improve relative paleointensity estimates from sediments.