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# Quantification of magnetofossils using first-order reversal curves

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Non-interacting single-domain (SD) magnetic particles are ubiquitous in sediments and sedimentary rocks. Newell [2005] calculated the FORC diagram from an assemblage of such particles oriented randomly and demonstrated that it is typified by a continuous contribution in the $H_u < 0$ half-plane, and a central ridge on the $H_c$ axis. The latter contribution has almost never been observed in natural samples, even though the presence of non-interacting SD particles are often inferred from other rock magnetic parameters such as the ARM ratio. We show that the absence of the central ridge from published FORC diagrams may be related to inadequate measuring parameters, which excessively broadens and smears the central ridge. We propose a measurement protocol that allows intrinsic FORC features to come through clearly. Using this protocol we present an example based on a sediment sample from Lake Ely (Pennsylvania) that contains abundant magnetofossils. We identified essential features of non-interacting SD particles in accordance with Newell's prediction. Moreover, by performing coercivity analysis on the central ridge, we found three magnetic components corresponding strictly to non-interacting SD particles. The two components with higher coercivity are identical to magnetofossil components found in coercivity analysis of ARM and IRM demagnetization curves measured from sediments and bacterial cultures. We propose coercivity analysis on the FORC diagram central ridge as an ideal and robust method to quantify the abundance of intact, isolated magnetofossil chains in natural sediments.

Newell, A.J. (2005), A high-precision model of first-order reversal curve (FORC) functions for single-domain ferromagnets with uniaxial anisotropy, Gechem. Geophys. Geosyst., 6, Q05010, doi:10.1029/2004GC00877.