Magnetic mineral separation using low temperature magnetism

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Résumé

One timeless challenge in rock magnetic studies, inclusive of paleomagnetism and environmental magnetism, is decomposing a sample's bulk magnetic behaviour into its individual magnetic mineral components. We present a method permitting to decompose the magnetic behavior of a bulk sample experimentally and at low temperature avoiding any ambiguities in data interpretation due to heating induced alteration. A single instrument is used to measure the temperature dependence of the remanent magnetization and to apply different steps of AF demagnetizations and thermal demagnetization. The experimental method is validated on synthetic mixtures of magnetite, hematite, goethite as well as on natural loess samples where the contributions of magnetite, goethite, hematite and maghemite are successfully isolated. The experimental protocol can be adapted to target other iron bearing minerals relevant to the rock or sediment under study. One limitation rests on the fact that the method is based on remanent magnetization. Consequently, a quantitative decomposition of absolute concentration of individual components remains unachievable without assumptions. Nonetheless, semi-quantitative magnetic mineral concentrations were determined on synthetic and natural loess/paleosol samples in order to validate and test the method as a semi-quantitative tool in environmental magnetism studies.

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