



## **Magnetic mineral separation: a timeless challenge for an experimental rock magnetist**

France Lagroix (1), Yohan Guyodo (2), Jessica L. Till (2), and Live Nova Naess (2)

(1) IPGP, Sorbonne Paris Cité, Univ Paris Diderot, UMR CNRS 7154, Paris, France (lagroix@ipgp.fr), (2) IMPMC, Sorbonne Universités, UPMC Univ Paris 06, UMR CNRS 7590, Paris, France

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. One approach consists of physically separating the bulk into its components prior to magnetic characterization. Both dry magnetic based or wet magnetic or gravity based techniques are routinely used. A second approach consists of chemical separation where certain components may be preferentially dissolved. Component characterization is achieved by comparing before and after magnetic data. Both physical and chemical approaches have shortcomings biasing the separation towards a physical behavior which may encompass more than one mineral species. A third approach calls for numerical unmixing of magnetic data such as hysteresis loops and remanence (e.g. ARM, IRM) acquisition of demagnetization curves. Here the main drawback is that a priori knowledge of the expected behavior of each mineral component is required. When considering how dependent the magnetic behavior of a mineral is on, for example, grain size, stoichiometry, concentration (i.e. magnetic interactions); the a priori bases functions required become a significant limitation of numerical unmixing techniques.

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.