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Frequency spectrum of AC magnetic susceptibility: A new rock magnetic method to estimate grain size distribution

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A new measurement system has been developed for detecting frequency spectrum of low-field alternating current (AC) magnetic susceptibility for rock and mineral magnetic studies. The measurement method is principally the same as that of the previous system developed for obtaining frequency dependence of natural samples (Kodama, G-cubed, 11, 2010, Q11002), but the new system has been improved so as to measure AC susceptibility at frequencies in the range of 10 kHz to 100 kHz. The wide range of operating frequency, along with the capability of measuring both in-phase and out-of-phase components of AC susceptibility, permits to estimate the grain size distribution of superparamagnetic particles. Preliminary measurements were made on natural materials, including volcanic rocks containing SD/MD particles, Chinese loess/paleosol samples, as well as several synthetic materials. The result from the Chinese loess/paleosols, for example, shows a stronger frequency dependence for the paleosol than for the loess, over the frequency range considerably broader than ever reported. This result suggests that the measurement of wide band frequency spectrum of AC susceptibility can be useful, especially in environmental magnetism, as a new rock magnetic experimental method to help quantify the distribution of superparamagnetic nano-particles in a variety of soils and sediments.

Keywords: AC magnetic susceptibility, frequency spectrum, grain size distribution, superparamagnetism