Application of magnetic susceptibility as a function of temperature, field and frequency

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Magnetic susceptibility is a very sensitive indicator of magnetic minerals present in rock or environmental samples because any slight variation in magnetic mineralogy is usually reflected by a profound change of susceptibility. This short course will be focused on the geological application of the low-field AC susceptibility measured as a function of temperature, field amplitude and operating frequency.

Temperature variation of magnetic susceptibility is very useful namely in i) identifying of the type and chemical composition of ferromagnetic (s. l.) minerals based on their characteristic temperatures (e.g. Curie temperature, Verwey transition) or paramagnetic minerals based on their hyperbolic course of the thermomagnetic curve and possibly characteristic alteration products in increased temperatures; ii) semi-quantitative resolution of ferromagnetic vs. paramagnetic contribution to magnetic susceptibility; iii) numerical assessment of rock alteration during thermal metamorphism; iv) paleotemperature estimation based on the repeated heating/cooling cycles. Variation of magnetic susceptibility as a function of AC field amplitude can be used for i) identification of ferromagnetic minerals, or ii) chemical composition of titanomagnetites. Dependence of magnetic susceptibility on the operating frequency is indicative of the presence of ultrafine magnetic particles in rocks and soils which, in turn, may be interpreted in terms of rock genesis or environmental changes.

The application of each method will be demonstrated on the examples of real sample measurements and a sort introduction to data processing software will be given. As with any analytical method, a combination of various approached is usually necessary to get an unambiguous interpretation of the results. To conclude the course, several practical examples will be given to demonstrate how a combined susceptibility approach can be a rather powerful tool in reliable interpretation of various magnetic data of igneous and sedimentary rocks and soils.