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Identification of iron minerals in soils by thermomagnetic measurements

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Thermomagnetic measurements, especially measurements of the Curie temperature, are often used to identify magnetic minerals in rocks or sediments. In many soil samples it is impossible to determine the Curie temperature as mineral changes occur during heating. Soil iron (hydr)oxides are transformed to ferrimagnetic iron oxides. In this study we analysed the thermomagnetic behaviour of some natural and synthetic iron minerals: goethite, hematite, ferrihydrite, lepdocrocite and siderite. The change of saturation magnetization (Ms) with temperature was determined with a magnetic translation balance. The sample is heated in air to a maximum temperature of 700 °C and subsequently cooled back to room temperature. By adding organic carbon to synthetic samples and by destroying it in natural samples, the influence of organic substance on the reactions was determined. Goethite, ferrihydrite and hematite transform to a strongly magnetic phase only if organic carbon is present. Lepidocrocite and siderite transform without organic carbon, the reaction of siderite is even weakened if organic matter is added. Therefore siderite is probably not the cause of the strong reactions of soil samples during heating. The temperature, at which the transformation starts, depends not only on crystallinity, ion substitution and heating rate but also on the amount of organic carbon in the sample. Each of these influences would have to be varied independently if we wanted to give exact temperatures for the onset of the transformation. But generally we can say that the transformation starts clearly below 400 °C for ferrihydrite and lepidocrocite and around 450 °C for goethite. We can conclude that, although these reactions impede the identification of the ferrimagnetic oxides in the soil, they can be used to distinguish between the most common soil iron

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