
Mössbauer Studies of Small Particles of Iron Oxides in Soil

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Abstract: A soil of Attica (Greece) has been studied by Mössbauer spectroscopy and magnetization measurements in order to ascertain the nature and form of iron oxides present in it. The room temperature spectra consist of a paramagnetic doublet and a small magnetic sextet. At liquid nitrogen temperature the magnetic component increases considerably at the cost of the paramagnetic component. This behavior is typical of superparamagnetism exhibited by ultrafine magnetic particles. From the values of hyperfine parameters extracted by computer fits of the spectra, the particles can be identified mainly as α -Fe₂O₃. The theory of superparamagnetism, in conjunction with Mössbauer and magnetization data, is discussed in detail. Application of this theory to the data for the clay fraction of the soil leads to the conclusion that the oxide particles have a size distribution with a mean particle diameter of 131 Å and a width of 14 Å.

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