Magnetic technoparticles in soil as a record of Anthropocene

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Soil samples from 10 sites in the Lesser Poland were studied (from depths of 0.0-0.1m and 0.2-0.4m on each site). Mineral and chemical composition were determined together with magnetization vs. applied magnetic field curves and Mössbauer spectra. Magnetic particles were extracted form soils and analyzed using SEM-EDS method.

The Pollution Load Index (PLI) values were calculated taking into account the content of Cd, Cr, Cu, Pb, Zn, Co, Ni, and As in the soil samples, and in the upper continental crust as background. The highest values were obtained for samples situated ca 20 and 65 km from the largest industrial plants in the region. The PLI values for samples from direct vicinity of industrial plants were lower. Magnetization measurements show excellent correlation with Fe content except for two samples, this result being in a good agrrement with Mössbauer spectroscopy results.

Anthropogenic spherical particles are common in magnetic fraction. Particles with complex internal structures composed of Fe, slightly oxidixed Fe, Fe oxides or containing aluminosilicate glass are abundant in magnetic fraction. Massive metallic spherules devoid of any internal structures and small slag fragments containing Fe also occur.

The magnetic fractions also contain irregular isometric, or tabular particles. Their origin is disputable. The anthropogenic origin is clear for particles of unusual chemical composition for soil or rocks. The content of the magnetic technoparticles is higher in samples from sites near industrial plants, but is not correlated with the Fe content or with a PLI value. The easily distinguishable airborne magnetic technoparticles in soils are a useful marker of the post-Second World War rapid industrialisation, referred to as the “Great Acceleration” and often considered as the beginning of the Anthropocene.