Geophysical Research Abstracts
Vol. 17, EGU2015-8106, 2015
EGU General Assembly 2015

Correlations between soil magnetic susceptibility and the content of particular elements as a reflection of pollution level, land use and parent rocks

Marzena Rachwał (1), Tadeusz Magiera (1), Oliver Bens (2), and Kati Kardel (3)

(1) Institute of Environmental Engineering, Polish Academy of Sciences, 34 Sklodowska-Curie Str., 41-819 Zabrze, Poland (marzena.rachwal@ipis.zabrze.pl; tadeusz.magiera@ipis.zabrze.pl), (2) Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences, Telegrafenberg, D-14473 Potsdam, Germany (bens@gfz-potsdam.de), (3) Saxon State Office for the Environment, Agriculture and Geology, Halsbrücker Str. 31a, 09599 Freiberg, Germany (Kati.Kardel@smul.sachsen.de)

Magnetic susceptibility is a worldwide used measure of (ferri)magnetic minerals occurring in soils, sediments and dusts. In soils, these minerals are of various origin: air-derived particulate pollutions, parent rocks or pedogenesis. Human activity causes different changes in the content of magnetic minerals as well as their spatial and vertical distribution in soil profiles. Magnetic minerals are characterized by an affinity for other elements occurring in the soil, so positive correlations between magnetic susceptibility and particular elements like macrocomponents or heavy metals often occurs.

The archival soil samples collected from different soil horizons in the territory of the Free State of Saxony (Germany) were subjected to the magnetic susceptibility measurements using Bartington MS2B. Additionally, samples were chemically analyzed by the S Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences in Potsdam. Values of magnetic susceptibility varied from 9.3 to 1382 $\times$10-8 m3/kg in organic soil horizon and from 0.1 to 2105 $\times$10-8 m3/kg in dipper layers. Calculated correlation coefficients between magnetic susceptibility and some elements indicate significant relationships characteristic for different factors influenced soil properties (pollution level, land use and parent rocks).

The northern part of Saxony is divided by the Elbe into two parts: east part with loose sedimentary rocks and the west one with more solid loess bedrock enriched by spectrum of elements from the Ore Mountains. Correlations between magnetic susceptibility and Ca, Fe, Mn, and Zn were stated in the eastern, while soil magnetic susceptibility of the western part revealed a correlation with Fe, P, Cd, Cu, Pb, Zn, Mo, U, V, and W. Taking into account influences of industry and urbanization, soil magnetic susceptibility is enhanced in the areas with higher population density comparing with rural sites. In the area of Hoyerswerda and Weisswasser with low magnetic natural background (sand) the load of (ferri)magnetic minerals explained by high magnetic susceptibility values as a result of high pollution level, shows the considerable correlations with Na, Ca, Fe, Mn, Zn, B, Be, V.

What is more, the soil magnetic susceptibility, developed on different geological bedrocks, correlates with their natural geochemistry bound in the rock and connected with their ferromagnetic minerals (such magnetite and titanomagnetite present in slate, phyllite, mica schist). In that case the magnetic susceptibility correlates with such elements as: Fe, Mn, Ni, B and V. The soils in the south-eastern Saxony close to the border tri-point of Germany, Poland and the Czech Republic, reveal a correlation of magnetic susceptibility with Cd and As content. It can also be caused by power industry in Zittau, however they are developed on basalts and phonolithes in background that produce also strong magnetic signal of geogenic origin. All the statements made above are usually not so clear, since geogenic processes and anthropogenic influences often overlay in the soil.