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Origin and magnetic properties of soil profiles developed on different geological bedrock

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Soil magnetic susceptibility anomaly is a result of accumulation in soil profile magnetic minerals (mostly iron oxides and hydroxides) of both natural and anthropogenic origin. The proper interpretation of magnetic susceptibility distribution in soil profile needs the information about magnetic properties of particles present in, respectively geological bedrock, subsoil horizons and topsoils horizons. The study was aimed on characterization mineralogical composition as well as physicochemical properties of mineral soil horizons. The essence of these research is to show, with the application of magnetic measurements, the character and diversification of selected rocks types and its influence on magnetic properties in soil profiles, in the local scale. The collected rock material included some sedimentary, igneous rocks (i.e. plutonic and volcanic) and metamorphic rocks, occurring in Poland. Magnetic properties of bedrock and soil samples were determined according to the measurements of mass magnetic susceptibility (χ) and thermomagnetic curves. Technogenic character and nature of research sites of magnetic susceptibility anomalies, was distinctly observed only in the uppermost part of soil profiles. Except the anthropogenic peak of magnetic susceptibility observed in organic soil horizons, the vertical distribution of χ in the whole soil profiles developed on sedimentary rocks is relatively low values ranging from $\sim$0.5 to 75 $\times 10^{-8} m^3 kg^{-1}$. In some studied profiles noticeable χ value increment is observed in subsoil horizons, revealing pedogenic character of magnetic susceptibility (influence of soil forming process – presence of superparamagnetic particles). Analyses of thermomagnetic curves support the presence of pedogenic iron minerals in subsoil horizons. The strong geogenic character with increasing χ values downward the soil profile was observed in soils developed on basalt, serpentinite, gabbro and andesite rocks. Here the χ value measured in the bedrock was between 500 $\times 10^{-8} m^3 kg^{-1}$ (in gabbro) and 2000 $\times 10^{-8} m^3 kg^{-1}$ (in basalt and serpentinite). The results will allow for verification and correct interpretation of mentioned anomalies (in the local scale), which are an effect of a number of coexisting factors: pedogenic, geogenic and technogenic.