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How Magnetic Susceptibility Reflects the Distribution of Major and Trace Elements in Forest Andosols in the French Massif Central

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A b s t r a c t

Mineral magnetic properties are sensitive indicators for evaluation of mechanisms influencing soil formation. The interpretation of magnetic contribution focuses on discrimination between the lithogenic, pedogenic and anthropogenic origin of minerals. In case of Andosols the interpretation is limited because the lithogenic magnetic signals are masking the anthropogenic and pedogenic magnetic contributions. The main aims of this study are: (i) to assess the link between the distribution of 21 elements on the one side, and mass-specific magnetic susceptibility (χ) and frequency-dependent magnetic susceptibility (χ_{FD}%) on the other side, along soil depth profiles; (ii) to analyse the relationship between soil organic carbon (Cox) and the χ_{FD} and χ_{FD}% with respect to particle-size distribution. We studied 9 profiles (81 soil samples) of Alu-andic Andosols from the French Massif Central, developed on highly magnetic basaltic parent rock (Grison *et al*. 2017). The statistical evaluation was performed by the principal component analysis and linear regression.

The results showed that while anthropogenic elements, such as Pb, As and S, showed meaningful correlation with χ_{FD}%, the concentration of lithological elements, such as Fe, Ti, Cr and V, was associated with χ. The content of Cox was associated with the fine sand (0.05–2 mm) and fine silt (0.002–0.02 mm) fractions. Furthermore, the Cox correlates positively with χ_{FD}% and negatively with χ. Our findings suggest that the development of Andosols, formed on basaltic parent material in climatic conditions of the French Massif Central, can be studied using magnetic parameters reflecting the concentration and grain-size of iron-oxides in combination with geochemistry.

Keywords: iron oxides, pedogenesis, basalts.

References

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