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Gemas: issues from the comparison of aqua regia and X-ray fluorescence results

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The comparison of analytical results from aqua regia (AR) and X-ray fluorescence spectroscopy (XRF) can provide information on soil processes controlling the element distribution. The GEMAS (GEochemical Mapping of Agricultural and grazing land Soils) agricultural soil database is used for this comparison. Analyses for the same suite of elements and parameters were carried out in the same laboratory under strict quality control procedures. Sample preparation has been conducted at the laboratory of the The comparison of analytical results from aqua regia (AR) and X-ray fluorescence spectroscopy (XRF) can provide information on soil processes controlling the element distribution in soil. The GEMAS (GEochemical Mapping of Agricultural and grazing land Soils) agricultural soil database, consisting of 2 x ca. 2100 samples spread evenly over 33 European countries, is used for this comparison. Analyses for the same suite of elements and parameters were carried out in the same laboratory under strict quality control procedures. Sample preparation has been conducted at the laboratory of the Geological Survey of the Slovak Republic, AR analyses were carried out at ACME Labs, and XRF analyses at the Federal Institute for Geosciences and Natural Resources, Germany

Element recovery by AR is very different, ranging from <1% (e.g. Na, Zr) to > 80% (e.g. Mn, P, Co). Recovery is controlled by mineralogy of the parent material, but geographic and climatic factors and the weathering history of the soils are also important. Nonetheless, even the very low recovery elements show wide ranges of variation and spatial patterns that are affected by other factors than soil parent material. For many elements soil pH have a clear influence on AR extractability: under acidic soil conditions almost all elements tend to be leached and their extractability is generally low. It progressively increases with increasing pH and is highest in the pH range 7-8. Critical is the clay content of the soil that almost for all elements correspond to higher extractability with increasing clay abundance. Also other factors such as organic matter content of soil, Fe and Mn occurrence are important for certain elements or in selected areas.

This work illustrates that there are significant differences in the extractability of elements from soils and addresses important influencing factors related to soil properties, geology, climate.