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# REE contents in agricultural soil of Sweden (GEMAS): Comparison of weak MMI® extraction with near total concentrations

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Within the GEMAS project agricultural soil samples were analyzed for 52 elements by aqua regia extraction, 41 elements by XRF (total concentration), for 57 elements in a mobile metal ion (MMI®) extraction. In addition, 174 samples from Swedish agricultural soil were analyzed by ICP-AES and ICP-MS using sodium peroxide fusion (SPF).

The aim of this study is to compare the content of Rare Earth Elements (REEs) and their extractability using the MMI® extraction and the sodium peroxide fusion (SPF) methods. The statistical comparison of both methods reveal that the median extractability for most of the REEs obtained by the MMI® method is less than 1%, with an extractability of 0.5% for Ce and La, and 0.9% for Nd. The median value of Ce by MMI extraction is 0.31 mg/kg while the median by SPF is 59.5 mg/kg. For La the median value by MMI extraction is 0.14 mg/kg and 29.4 mg/kg by SPF, and for Nd the median is 0.23 mg/kg and 26.5 mg/kg , by the MMI and SPF methods respectively. All data from the Swedish samples lie over the detection limit, except for Ce (13 sample) and Tb (5 sample).
The graphs of cumulative proportions of REEs by the MMI® extraction and SPF methods show that the trend of REEs is likely to be similar in both methods. The only difference is that the MMI method shows higher proportions of Y compared to the SPF method, while there are higher proportions of Ce and La in the SPF method compared to MMI® .

The elemental distribution maps for both methods indicate that the distinct distribution patterns are influenced by not only underlying parent material or lithologies but that there is also an effect from the geochemical behaviour of individual elements, their extractability, and by the content of clay-size fractions in soil.