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Comparing REE distribution in GEMAS agricultural soils and FOREGS topsoils-subsoils in Italy and Sweden

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Scientific interest on Rare Earth Elements (REEs)-bearing media is increasing as a consequence of the rapidly growing demand of these important chemical resources, which are currently used in a large number of technical applications. In this study, Italian and Swedish REE data from the FOREGS database on topsoil and subsoils samples have been compared to the distribution of REEs in the GEMAS samples of agricultural soil (Ap), pertaining to regularly ploughed land to a depth of 20 cm. Principal Component Analysis (PCA) was carried out to identify patterns within both data sets. Investigation of the spatial distribution of REEs in FOREGS topsoil-subsoil and GEMAS Ap media for both countries revealed the prominent role of the geogenic component in the general REE geochemical pattern of the three solid media. Despite a similar REE content in the underlying parent material or bedrocks (alkaline igneous rocks, both intrusive and effusive in Italy, alkaline granites and pegmatites in Sweden), several distinct differences emerged between the two countries driven by climate, topography, age of the rock units and sediments, presence of mineralisations, type of soils and presence of glacial deposits. GEMAS agricultural soils form both countries show higher REEs contents than the corresponding subsoils and topsoils, which could be ascribed to the analytical method specifically set for REEs and the last generation ICP-MS instrument used by SGS Lab to analyze REEs in Ap soils. The REE content in Italian topsoil and subsoil is similar and there is a good agreement between the topsoils and Ap soils, which were collected from similar depth. Swedish subsoil is on the contrary more enriched in REEs with respect to topsoil, and Ap soils even display REE contents higher than subsoils. This anomalous REE concentrations in agricultural soil may originate from the fact that most of the arable land in Sweden has been located on glacial and postglacial deposits, rich in clay which has tendency to accumulate secondary REEs. We concluded that the fingerprints of anthropic activity due to agricultural activities does not influence the geogenic signal. Both in Italy and Sweden, in fact, REE trends in GEMAS agricultural soils are well comparable with those obtained for FOREGS soils sampled from unoccupied and undisturbed regions.