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GEMAS: Source, distribution patterns and geochemical behaviour of Ge in agricultural and grazing land soils at European continental scale

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Agricultural soil (Ap-horizon, 0-20 cm) and grazing land soil (Gr-horizon, 0-10 cm) samples were collected from a large part of Europe (33 countries, 5.6 million km²) as part of the GEMAS (Geochemical Mapping of Agricultural and grazing land Soil) soil mapping project. GEMAS soil data have been used to provide a general view of element mobility and source rocks at the continental scale, either by reference to average crustal abundances or to normalized patterns of element mobility during weathering processes. The survey area includes a diverse group of soil parent materials with varying geological history, a wide range of climate zones, and landscapes. The concentrations of Ge in European soil were determined by ICP-MS after an aqua extraction, and their spatial distribution patterns generated by means of a GIS software. The median values of Ge and its spatial distribution in Ap and Gr soils are almost the same (0.037 vs. 0.034 mg/kg, respectively). The majority of Ge anomalies is related to the type of soil parent material, namely lithology of the bedrock and minor influence of soil parameters such as pH, TOC and clay content. Metallogenic belts with sulphide mineralisation provide the primary source of Ge in soil in several regions in Europe, e.g. in Scandinavia, Germany, France, Spain and Balkan countries. Comparison with total Ge concentrations obtained from the Baltic Soil Survey shows that aqua regia is a very selective method with rather low-efficiency and cannot provide a complete explanation for Ge geochemical behaviour in soil. Additionally, large differences in Ge distribution are to be expected when different soil depth horizons are analysed.