Geophysical Research Abstracts
Vol. 19, EGU2017-15340, 2017
EGU General Assembly 2017

Distribution of lithium in agricultural and grazing land soils at European continental scale (GEMAS project)

Philippe Negrel (1), Clemens Reimann (2), Anna Ladenberger (3), and Manfred Birke (4)

(1) BRGM, Orleans, France , (2) Geological Survey of Norway, Trondheim, Norway, (3) Geological Survey of Sweden, Uppsala, Sweden, (4) Bundesanstalt für Geowissenschaften und Rohstoffe, Stillweg 2, 30655 Hannover, Germany

The environmental chemistry of Li has received attention because Li has been shown to have numerous and important implications for human health and agriculture and the stable isotope composition of lithium is a powerful geochemical tool that provides quantitative information about Earth processes such as sediment recycling, global chemical weathering and its role in the carbon cycle, hydrothermal alteration, and groundwater evolution. However, the role of bedrock sources, weathering and climate changes in the repartition of Li at the continental scale has been scarcely investigated. 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 a 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 Li in European soil were determined by ICP-MS after a hot aqua regia extraction, and their spatial distribution patterns generated by means of a GIS software.
Due to the partial nature of the aqua regia extraction, the mean concentration of Li in the European agricultural soil (ca 11.4 mg/kg in Ap and Gr soils) is about four times lower than in the Earth's upper continental crust (UCC = 41 mg/kg).
The combined plot histogram - density trace one- dimensional scattergram - boxplot of the aqua regia data displays the univariate data distribution of Li. The one-dimensional scattergram and boxplot highlight the existence of many outliers at the lower end of the Li distribution and very few at the upper end. Though the density trace, histogram and boxplot suggest a slight skew, the data distributions are still rather symmetrical in the log-scale. The median values of the Ap and Gr samples do overlap, demonstrating they are not statistically different at the 5 % significance level.
The maps of Li in the aqua regia extraction show a distinct difference between northern Europe with predominantly low concentrations (median 6.4 mg/kg) and southern Europe with significantly higher values (median 15 mg/kg). The maximum extent of the last glaciation is visible as a discrete concentration break on the maps. The principal Li anomalies occur spatially associated with the granitic rocks and Li-pegmatites and their weathering products throughout Europe, e.g. in central Sweden (Central Scandinavian Clay Belt) and in the western part of the Alpine Region (higher Li concentrations). Even the new Li-deposit near Wolfsberg, Austria is marked by a clear anomaly. In southern Europe, high Li values occurring over limestone areas can be attributed to secondary Li enrichment during weathering controlled by climate (temperature and precipitation).