The influence of frost weathering on the release of readily available ions from granite surfaces

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Hundreds of research studies concerning frost weathering of minerals were conducted during the last century. Regardless of a long history of inquiries, the quantitative insights of frost weathering products are still elusive. Frost weathering is mainly attributed to the increase of surface area without any chemical changes. This study represents the first attempt to evaluate readily available ions released by frost weathering with the use of capillary electrophoresis (CE) and a capacitively coupled contactless conductivity detection (C^4D) detector. An new easy-to-handle sampling technique called "Drop-on-Stone" (DoS) was used to sample rock surface areas. Aare Granite samples undergoing different amounts of freeze-thaw cycles were analyzed for a continuous increase of cations and anions. Particular attention was given to the first weathering steps. Complementary SEM pictures of the sampled areas were taken during the weathering experiments. The results illustrate the initial release of ions during the first few freeze-thaw cycles. This indicates that frost weathering is able to raise surface concentrations of readily soluble cations and anions. These ions serve as the primary nutrient source for organisms and are essential for initial soil formation in arctic and high altitude areas.

Geochemical atlas of Italian soils

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The geochemical Italian Atlas was carried out as part of GEMAS project whose objective was to characterize soils of rural areas of the whole Europe. Soil samples were collected at an average sampling density of 1 site per 2500 km^2. Two different sample types were collected: (1) 121 agricultural soils on regularly ploughed land to a depth of 20 cm and (2) 121 grazing land soils (land under permanent grass cover) to a depth of 10 cm. All soil samples were air dried, sieved to <2 mm, homogenised and finally split into 10 sub-samples. Both sample types (Ap and Gr) were analysed at the BGR in Berlin for a suite of 41 elements by WD-XRFS. The same samples were also analysed after AR and MMI extractions by a combination of ICP-AES and ICP-MS for 53 elements. In addition, other parameters were determined: pH, TOC, total carbon and total sulphur, LOI, CEC, Sr-isotopes, Pb-isotopes, MIR-spectra. By means of a GIS software, georeferenced data of the Italian territory were used to produce the geochemical maps of all the analysed elements for both agricultural and grazing land soils. Specifically, for each element and sampling media a map reporting interpolated data and graduated dots was produced; univariate statistics and graphs were also associated to each map. The Atlas also contain: 5 maps for regional variability of factor scores of elemental associations resulting from R-mode factor analysis and 15 land use maps for some selected elements (As, Be, Cd, Co, Cr, Cu, Hg, Ni, Pb, Sb, Se, Sn, Tl, V, Zn) following the intervention criteria established by Italian Law (D.L. 152/06).

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