

Distribution and mobility of Niobium in European soils

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The EuroGeoSurvey's Geochemical Mapping of Agricultural and Grazing Land Soil (GEMAS) project and its 32 participating organisations mapped European soils at a density of 1 site per 2,500 km² providing geochemical data for over 50 elements (EGS, 2008). At each site, two types of soils were collected, one "Ap" sample from the ploughing layer of arable fields at 0-20 cm and one "Gr" sample from permanent grazing land at 0-10 cm below surface. Analyses of the < 2 mm fraction of 2024 Gr and 2108 Ap samples were carried out by a) inductively coupled plasma atomic emission spectrometer (ICP-AES) and inductively coupled plasma emission mass spectrometer (ICP-MS) following *aqua regia* extraction as well as b) X-ray fluorescence spectrometry (XRFS) on Gr samples only. Whilst the latter method gives the total concentration, *aqua regia* gives only the chemically extractable fraction.

The refractory element Niobium (Nb) is of growing interest because of its application and use as an alloying element in high-grade structural steel, as well as in electronic components. However, there is very little published information on Nb concentration levels in the environment and its potential health effects. GEMAS data for Nb is presented with the aim to establish and enhance our understanding of the baseline distribution and typical mobility within European soils.

The median baseline concentration of Nb in Gr soils of Europe is 12 mg/kg (XRFS), which is more than a magnitude greater than the median of 0.52 mg/kg following *aqua regia* extraction and ICP analyses. This shows that a large proportion (>95%) of Nb in soils is highly immobile. Comparing the chemically mobile concentration, determined by ICP following *aqua regia* extraction in Gr and Ap (collected from the same sampling cells), shows that the median concentration in Gr soils is 0.07 mg/kg (13%) higher than in Ap soils. This relative depletion of *aqua regia*-soluble Nb in Ap soils may be a result of physical agricultural practises, such as tillage.

Across Europe, elevated concentrations of chemically mobile Nb are closely related to the occurrence of Caledonian granitic and plutonic rocks in Scandinavia and northern Britain, Hercynian granites across the European continent (e.g. Massif Central and Bohemian Massif) as well as carbonate rocks of southern Italy. The larger resistant and immobile portion of Nb in soils however, is more spatially dispersed and not only confined to areas of plutonic outcrop. Elevated concentrations (>15 mg/kg) also occur across areas of known aeolian sediments, such as loess of central Europe, and residual soils related to karstified carbonate rocks across Croatia and Slovenia.

References:

EGS, 2008. EuroGeoSurveys geochemical mapping of agricultural and grazing land in Europe (GEMAS) – Field manual. NGU report 2008.038, Trondheim, Norway, 46p.