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GEMAS: Geochemical Distribution of Thallium in European Soil

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Thallium concentrations are reported for the <2 mm fraction of soil samples from agricultural (Ap horizon, 0–20 cm; N=2108) and grazing land (Gr, 0–10 cm; N=2024), covering 33 European countries and 5.6 million km2 at a sample density of 1 site/2500 km2. The median concentration of Tl in an aqua regia extraction is 0.116 mg/kg in the Ap and 0.115 mg/kg in the Gr samples. The maps of Tl in the aqua regia extraction show the southern limit of the last glaciation as a distinct concentration break; Tl concentrations are generally somewhat higher in southern (median Ap & Gr 0.14 mg/kg;) than in northern (median Ap 0.086 mg/kg; Gr 0.082 mg/kg) European soil. A well-defined anomaly marks the Central Scandinavian Clay Belt, and highlights the tendency of Tl to accumulate in clay-rich soil. In Sweden, the high Tl concentrations may be correlated with sulphide mineralisation (e.g., Bergslagen mining district), and also in the Balkans (e.g., Allchar, Krstov Dol, Bujanovac). The principal Tl anomalies are spatially associated with the alkaline igneous rocks in Italy, and terra rossa soil developed on karst in Slovenia, Croatia, Bosnia and Herzegovina and Montenegro. The latter may actually also be influenced by ash input from former eruptions of the Italian volcanoes (Vesuvius, Campi Felgrei and Mount Vulture); similar anomalous patterns are shown by Be, Pd and Pt. Most granitic intrusions are also marked by high Tl values (e.g., northern Portugal, Massif Central in France, and Bohemian Massif in Czechia).

The median Tl concentration of Ap soil samples in the mobile metal ion (MMI®) partial extraction is 0.0006 mg/kg, and almost 50% of all samples report concentrations below detection. There is no pronounced difference between northern and southern Europe anymore, and the ice age limit of the last glaciation remains invisible. The main anomaly is related to the alkaline volcanic rocks in Italy. Many granitic intrusions are indicated by somewhat enhanced Tl concentrations (e.g., northern Portugal, north-western Spain, Massif Central in France, south-west England, and Bohemian Massif in Czechia). An interesting NE to SW anomalous pattern occurs in Scotland, partly following the Great Glen fault, and occurrences of granitic intrusions. Almost all of central Europe is marked by enhanced Tl values, and one wonders whether agriculture might have had an impact on this unusual pattern.

Finally, the GEMAS data set defines the geochemical background variation of Tl in aqua regia and MMI® extraction for European agricultural and grazing land soil at the 2008 timeline.