Background and baseline values for thallium and antimony in soils from Murcia Region (SE, Spain) and their relationship with mineralogical composition

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Thallium minerals are very rare and are formed exclusively during the epithermal stage of hydrothermal activity or under supergene conditions. Examples of these minerals include lorandite ($TlAsS_2$), picotpaulite ($TlFe_2S_3$) and vrbaite ($Hg_3Tl_4As_8Sb_2S_{20}$). Thallium is extremely toxic, but little studied, affecting the central nervous system.

Antimony is a low-abundance chalcophile element forming several rather rare minerals including stibnite (Sb2S3), valentinite (Sb2O3) and kermesite (Sb2S2O), but is more usually present at trace levels in minerals such as il-menite, Mg-olivine, galena, sphalerite and pyrite. Antimony has no known function in living organisms and high concentrations of Sb are highly toxic.

The objective of this study was to determine the thallium and selenium background and baseline levels in soils from the Region of Murcia (Southeast, Spain) and to study the possible relationship between mineralogical composition, soil properties and antimony and thallium concentration.

Sampling sites corresponded to areas subjected to high and similar agricultural activity or soils with natural veg-etation, which correspond to abandoned agricultural areas. A total of 490 samples were collected, and the miner-alogical composition and thallium and antimony content were determined. Samples were analysed for antimony content by atomic fluorescence spectrometry (AFS) and by inductively coupled plasma spectrometry (ICP-MS) for thallium content.

The results showed that the concentration of target metals was correlated with the mineralogical composition. Thus, thallium and antimony level was positively correlated with the phylosilicate content and with amphibole, quartz and calcite content. In addition, both metals were positively correlated. In summary, the background level for thallium and antimony, showed as the median, was 0.20 mg kg^{-1} and 1.06 mg kg^{-1} respectively. Baseline level, showed as mean+ 2*Std. deviation, was 0.64 mg kg^{-1} for thallium and 3.12 mg kg^{-1} for antimony. Given that heavy metal concentrations in the study area were similar to those analysed in other areas of similar lithological characteristics, it follows that the background and baselines values established could be comparable to background and baselines values in other areas with a similar geological substrate.