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Assessment of trace elements distribution in French agricultural soils

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Although trace element distribution and mobility have been investigated in agricultural soils, precise information about the extent to which anthropogenic activities influence soil quality remains limited. This study quantified trace element distribution (As, Bi, Cd, Cu, Ni, Pb, Pd, Sb, Zn) in agricultural and grazing land soils in metropolitan France based on the results from the GEMAS project [1]. The dataset is composed of 214 samples from agricultural soils (Ap) and 218 samples from grazing land soils (Gr) for total and mobile fractions. The geological substrates have been divided into five main classes to correlate with geology: (i) shales, (ii) sandstones and sands, (iii) carbonate rocks, (iv) metamorphic rocks, and (v) intrusive and igneous rocks. These nine metal elements were selected using the enrichment factor higher than 40 in most of the five rock classes, specifically As and Cd. Arsenic had a median of 9.04 mg/kg and 9.5 mg/kg for Ap and Gr, respectively, on all kind of bedrocks. These values are similar, and this is also the case for Cd : 0.215 mg/kg and 0.249 mg/kg for Ap and Gr, soils respectively. Kriging interpolation was used to analyze the spatial distribution of the both elements in French soils. A correlation between geology and mining was observed for the distribution of As in France, for example southern part of Massif Central [2]. However, Cd shows a different pattern. The highest concentrations are situated in the sedimentary basin (Aquitaine and Parisien), as well as in the South Massif Central and South Vosges. This could be related to anthropogenic activities [3]. If the high concentration level of As is not due to anthropisation, its distribution could be used as a reference for pollution in France. The concentrations differ depending on the bedrock. On the contrary, Cd concentrations are not correlated to geology, but high Cd concentrations are linked with cultural practices. The lowest level Cd concentration could only be used for a reference.

[1] Reinman et al. (2014) Chemistry of Europe's agricultural soils [2] Birke et al. (2017) J Geochem Explor 173, 13-30 [3] Tarvainen et al. (2013) Appl Geochem 28, 2-10.