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Spatial and statistical analyses of parameters influencing arsenic geochemical distribution in the lowland Drava River area, northeastern Croatia

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Soils with an elevated arsenic content are widespread in the Pannonian Basin, Croatia. However, little is known about their distribution and occurrence. The subject of this study is the geochemical distribution of arsenic in Gleysol developed on an agricultural field in the Podravina region, Croatia. The main goal was to determine which soil parameter has the greatest influence on the overall distribution of arsenic in the area. Mineralogical, geochemical, and physico-chemical characteristics of 56 topsoil samples were analysed, while statistical analyses and spatial distribution of the most important soil parameters were performed and presented. Mineralogical analysis revealed the presence of quartz, plagioclase, clays, micas and Fe-oxyhydroxide goethite. Granulometric analysis revealed silt to be the predominant soil texture. A moderately acidic environment was recognized in the study area, probably the result of extensive agricultural activity, such conditions being known to promote mobilisation of material adsorbed on soil particles. Geochemical analysis revealed elevated contents of iron (max. 23.37 mass. %) and arsenic (max. 824 mg/kg). The spatial distribution of eight parameters indicates an overlap in the distribution of iron and arsenic, influenced by the topography of the area. Statistical analysis revealed a significant positive correlation between Fe and As, with a correlation factor of r = 0.90, confirming the relationship between the two. The hierarchical cluster analysis resulted in two main groups: Fe-rich samples (Group 1) and Si-rich samples (Group 2). The Si-rich group of samples has lower arsenic contents, while the Fe-rich group has elevated arsenic contents. This indicates that iron content is the parameter that has the largest influence on the overall distribution of As. Although Fe-oxides can be dissolved under reductive conditions, the predominant presence of well-crystallised goethite implies that As is not mobilized under reductive conditions and remains adsorbed on the goethite mineral phase.