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GROUNDWATER CHARACTERIZATION IN SOUTHWESTERN ROMANIA USING FUZZY HIERARCHICAL CROSS CLUSTERING

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Abstract

A simultaneous hierarchical classification of groundwater in the Banat Plain-southwestern Romania and associated characteristics such as As(III), As(V), total As, trace metals (Al, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Zn), pH and redox potential using Fuzzy Hierarchical Cross Clustering Algorithm was carried out. In samples containing more than 10 µg/L total As (13.9 – 77.3 µg/L), the As(V) species represented 57±20% and 73±18% in the others. Arsenic speciation pattern was in agreement with basic pH (8.31 – 8.49) and oxidizing conditions (369.0 – 409.1 mV) in aquifer. The contents of metals were below the threshold values excepting Mn. The Fuzzy Hierarchical Cross Clustering Algorithm emphasized pH and redox potential as main parameters responsible for water samples grouping. Part of water samples containing > 10 µg/L As have as associated parameters the content of Pb, Cr, Zn and Fe, and pH plays a key role in natural occurrence of these elements by desorption from Fe minerals/oxyhydroxides. The other water samples with > 10 µg/L As were grouped based on redox potential, As (III), As (V), total As, Cd, Ni, Cu, Al and Mn concentrations. The source of these elements was attributed to desorption processes from Al minerals/oxyhydroxides and Mn oxyhydroxides governed by the redox potential. The Fuzzy Hierarchical Cross Clustering emphasized the importance of trace metals quantification for classification of groundwater with naturally enriched As content.

Key words: arsenic speciation, Banat Plain, fuzzy hierarchical cross clustering, groundwater exploration, trace metal

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