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ENVIRONMENTAL POLLUTION STUDY IN THE ARIEŞ VALLEY (APUSENI MOUNTAINS, ROMANIA) USING FACTOR ANALYSIS

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The chemical systems of river water are complex ones in which groups of chemical species are reacting and become correlated whereas others behave in an independent manner. In order to investigate and identify such inter-element alignments, the analytical results have to be checked for correlations. This is best done by factor analysis which, as a statistical technique, tries to explain the observed variations in terms of a smaller, unobserved number of statistical associations or factors. Such factors can then be interpreted in terms of processes or reactions, i.e. one searches for a geochemical control over data variations. The most common type of factor analysis is the R-mode analysis, which is based on the relationships between variables (RUIZ et al., 1990; JAYAKUMAR & SIRAZ, 1997). Fourteen variables and samples from fourteen sampling sites were selected for R-mode factor analysis.

The analytical data used were transformed values, in order to obtain near normal distributions (GUPTA & SUBRAMANIAN, 1998). The factor analysis was performed using SPSS software.

An evaluation of the results showed that about 88% of the internal variance of the data set could be explained by the re-arrangement of the data into factors. The interpretation of the factors allowed an identification of several groups of ionic species and parameters, which were connected by internal correlation.

The high factor loadings for Ca^{2+}, Sr^{2+}, K^{+}, Na^{+}, Mg^{2+} and EC values in Factor 1 are interpreted as large-scale water–rock interactions, i.e. the influence of the rock types exposed locally. Since the cations grouped under this factor contribute the most to the conductivity of the water, their correlation to the EC values is expected.

Factor 2 contains the variables pH, Cu^{2+}, Zn^{2+} and Mn^{2+} and it can be interpreted as the fingerprint of mining activities and related pollution.

Factor 3 is characterized by high loadings for NO_3^-, Cl^-, and SO_4^{2-} and is interpreted as the interaction of river water with settling pond effluents and also as the continuous interaction of river water with Neogene sediments.

Factor 4 could be interpreted as representative for domestic effluents.

Factor 1 explains 39.2% of data variance and points to the importance of water–rock interaction processes in the control of the composition of the river water. The high percentage represented by the sum of Factors 2, 3 and 4 (48.3%) supports the interpretation of a high pollution of the Arieş river system as a result of mining and other human activities within the region under study.

References

JAYAKUMAR, R. & SIRAZ, L. (1997). Environ. Geol., **31**: 174–177.
RUIZ, F., GOMIS, V. & BLASCO, P. (1990). J. Hydrol., **119**: 169–177.
GUPTA, L.P. & SUBRAMANIAN, V. (1998). Environ Geol., **36**: 102–108.