GIS-SUPPORTED MODELING OF STREAM-SEDIMENT GEOCHEMISTRY: HANDLING OF FUZZY DATA IN GEOCHEMICAL APPLICATIONS

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Uncertainty is a fundamental property of geological data (e.g. Mann, 1993). In this contribution, stochasticity, which is inherent in geochemical data of stream-sediments, is expressed by means of fuzzy sets. The complex system which produces the geochemical data in the sediment is reduced to a conceptual model consisting of the components lithology-erosion-transport-accumulation. This system is investigated using the geochemical data base of Austrian stream-sediments (Thalmann et al., 1989) within the "Nockgebiet" of Carinthia and applying multivariate statistical techniques in combination with a geographical information system (GIS).

In a first approach the lithological induced background concentrations inherent in geochemical data are used to construct a lithological map of the study area. The comparison of different techniques (multivariate regression, Bayes modeling, fuzzy modeling) demonstrates a relationship between the classification quality and the geochemical contrast of distinct lithotypes. Using only geochemical data of stream-sediments the relationship between lithology and geochemical signature in the sediment is seen from the relationship between observed and predicted lithology within a training area.

Geochemical anomalies modifying the background concentrations are identified and quantified by applying limited fuzzy clustering (Kramar, 1995). They are seperated from the geochemical background by the assessment of cluster assignment errors, which can be interpreted as concentrations exceeding the lithological induced concentrations. In the study area there is no spatial relationship between mineral deposits and geochemical anomalies.

In this study it is demonstrated that modeling of uncertainty which is inherent in geological data is a way to come to better geological predictions.

References:

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