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Research article

# Application of geochemical structural methods to determine lead-contaminated areas related to mining activities

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**S-A Fractal model**

***English Extended Abstract***

**Summary**

In this study, the determination of lead –contaminated areas around the Pb-Zn Irankooh mine located in Iran has been investigated using S-A and C-A fractal models and U statistical method. The S-A fractal method is a new method in the field of environmental studies that detects the frequency communities of the polluting element. The results of C-A fractal modeling showed that there is a range of pollution in the agricultural region and residential area. The U-spatial statistics method correctly determined the contaminated communities in the extraction area and the tailings dam location.

**Introduction**

Distinguishing between anomalous and background communities and determining the threshold of geochemical communities are usually done by structural and non-structural methods. The U spatial statistical method is one of the structural methods for geochemical anomaly separation, which is known for its high capabilities in determining geochemical anomalous areas in mineral exploration. In this investigation, U statistics, S-A, and C-A fractal methods have been used for modeling Pb-contaminated areas**.**

**Methodology and Approaches**

The geochemical distribution maps have fractal dimensions. Fractal dimensions of the anomaly and the background will be different from each other, which are used to separate the anomaly from the background. The S-A fractal method has been performed on the geochemical data in the frequency domain. The geochemical log-log diagram of the power spectrum values and cumulative areas is delineated, and straight lines are fitted on the diagram to show the trends of fractal populations. The U-spatial statistics method is a kind of moving averaging method that changes the dimensions of the window in which the averaging takes place at any specific point. Therefore, for each particular point, several U statistic values are calculated using the surrounding points, thus the spatial relationship of the samples is completely considered.

**Results and Conclusions**

In this study, the Pb contaminations resulting from the distribution of this element in the surrounding areas of the Irankuh mine have been investigated. The C-A, S-A fractal, and U statistics methods were performed for pollution anomaly mapping. Four geochemical communities with different dimensions were obtained using C-A fractal method. The higher fractal dimensions are associated with Pb contamination of mining activities or human impacts and are known as anomalous communities. The communities with lower fractal dimensions are considered as background. The results of the fractal method show that the source of contamination has originated from the mine area and dispersed in the surrounding areas. The S-A fractal method separated the frequency signals in 4 geochemical communities. The population 2 including medium to low-frequency signals properly determined the contamination locations. The geochemical community with high concentrations correctly determined the contamination districts around the mining activities and tailings dam using U modeling. The middle community showed the agricultural and residential lands have a smaller contamination halo than other methods.

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