Geophysical Research Abstracts
Vol. 17, EGU2015-7911, 2015
EGU General Assembly 2015

Identification and Separation of Geochemical Distribution Patterns using Fractal/Multifractal Methods

Yue Liu and Qiuming Cheng
Faculty of Earth Resources, China University of Geosciences, Wuhan, China(liuxy314@163.com)

Abstract: Identification and separation of anomalies from background for mineral exploration or environmental assessment is a fundamental issue in the field of exploration geochemistry. Traditionally, geochemical data are usually considered to follow normal or lognormal distributions, this scenario might lead to the extreme values cannot be detected by ordinary statistic methods, because the data of interest cannot meet the prerequisites of some typical statistic methods, and usually it is hard to separate geochemical anomalies from background, especially when weak anomalies are hidden in high background or the difference between anomaly and background is feeble. Cheng (2000) demonstrated that background values of geochemical data typically followed normal or lognormal distributions, and and anomalous values usually followed fractal/multifractal distributions. West and Shlesinger (1990) investigated the relationships of normal/lognormal distributions with Pareto distributions, the results indicated that the natural system was gradually tend to complexity from normal distributions to lognormal distributions, and then to Pareto distributions. Pareto distributions describe the most complex natural system, showing stronger fractal/multifractal characteristics. From the perspective of ore-forming processes, ore formation is the result of complex physical and chemical processes, there are considerable overlaps between igneous and hydrothermal and between sedimentary and hydrothermal, as a result, complex ore-forming processes might result in fractal/multifractal pattern. In the present study, a case study of anomaly identification of REE mineralization-related La and Y concentration values from 1617 stream sediment samples in the Nanling belt, South China, is used to demonstrate the application of two fractal/multifractal methods, singularity analysis and concentration-area (C-A) fractal method. First, singularity analysis is used to identify weak anomalies hidden within geochemical background for the prediction of the present of REE mineralization. And then, the C-A fractal method is applied to determine threshold values of singularity indices for separating anomalies from background. The results indicate that nonlinear models and methods related to fractal/multifractal (Singularity analysis and C-A method) can provide powerful tools for the quantification of geochemical anomaly characteristics, and hybrid frequency distribution patterns can be identified by combining singularity analysis and C-A method due to different distribution patterns of background and anomaly of geochemical data.