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Multifractal analysis of the strength of Cu-Au paragenetic relationships, a case study in eastern Tianshan mineral district, China

Zhao, J.[1], Wang, W.[2] and Cheng, Q.[1,3]

[1]China University of Geosciences, Beijing, 29 Xueyuan Rd., Beijing, China, jiezhao2014@163.com
[2] Institute of Geomechanics, Chinese Academy of Geological Sciences, 11 Minzudaxue South Rd., Beijing, China
[3]York University, 4700 Keele Street, Toronto, ON, Canada

The ductile shear zone in the middle of the eastern Tianshan district is an important Cu-Au mineralization zone in China. Complicated deforming and metamorphic processes produced an favorable environment for the formation of Cu-Au mineral deposits. Geochemically, Cu and Au in this area present strong strength of paragenetic relationships. As a singular event, Cu-Au mineralization happens occasionally. Because of intrinsic characteristics, different elements of paragenetic association may also be generated. As a result, the respective material sources could be shifted from the original locations, and the strength of paragenetic association of elements could be declined. Therefore, the strength of paragenetic relationship between elements presents variations in space, and these variations could be helpful in locating the Cu-Au mineralization. To examine the strength of paragenetic association of elements on polymetallic mineralization, the current research proposes a data processing procedure. In this model, two steps including non-linear regression and multifractal analysis of the resulting regression coefficients are included. In the first step, geographically weighted regression (GWR) [1] is used to examine the relationship between Cu and Au concentrations. This model allows non-linear regression between variables, the results of which could assist more reasonable explanation in mineral exploration. By this model, coefficients for Cu and Au concentrations at every individual location can be calculated. Therefore, the variation of the strength of Cu-Au paragenetic association across the study area can be derived. Secondly, a multifractal method, spectrum-area (S-A) [2] analysis is further applied to the regression coefficients in order to separate the background and anomalies of the strength of Cu-Au paragenetic association. The background is believed to reflect the general tendency of strong or weak Cu-Au paragenetic relationships in the whole area, while the anomalies indicates very strong paragenetic association locations which could be corresponding to Cu-Au mineralization. Based on the proposed data processing procedure, analytical results could be useful in mineral exploration for Cu-Au polymetallic mineralization.

References:

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