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Gliding Box method applied to trace element distribution of a geochemical data set

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The application of fractal theory to process geochemical prospecting data can provide useful information for evaluating mineralization potential. A geochemical survey was carried out in the west area of Coruña province (NW Spain). Major elements and trace elements were determined by standard analytical techniques. It is well known that there are specific elements or arrays of elements, which are associated with specific types of mineralization. Arsenic has been used to evaluate the metallogenetic importance of the studied zone. Moreover, as can be considered as a pathfinder of Au, as these two elements are genetically associated. The main objective of this study was to use multifractal analysis to characterize the distribution of three trace elements, namely Au, As, and Sb. Concerning the local geology, the study area comprises predominantly acid rocks, mainly alkaline and calcalkaline granites, gneiss and migmatites. The most significant structural feature of this zone is the presence of a mylonitic band, with an approximate NE-SW orientation. The data set used in this study comprises 323 samples collected, with standard geochemical criteria, preferentially in the B horizon of the soil. Occasionally where this horizon was not present, samples were collected from the C horizon. Samples were taken in a rectilinear grid. The sampling lines were perpendicular to the NE-SW tectonic structures. Frequency distributions of the studied elements departed from normal. Coefficients of variation ranked as follows: Sb < As < Au. Significant correlation coefficients between Au, Sb, and As were found, even if these were low. The so-called ‘gliding box’ algorithm (GB) proposed originally for lacunarity analysis has been extended to multifractal modelling and provides an alternative to the ‘box-counting’ method for implementing multifractal analysis. The partitioning method applied in GB algorithm constructs samples by gliding a box of certain size (a) over the grid map in all possible directions. An “up-scaling” partitioning process will begin with a minimum size or area box (amin) up to a certain size less than the total area A. An advantage of the GB method is the large sample size that usually leads to better statistical results on Dq values, particularly for negative values of q. Because this partitioning overlaps, the measure defined on these boxes is not statistically independent and the definition of the measure in the gliding boxes is different. In order to show the advantages of the GB method, spatial distributions of As, Sb, and Au in the studied area were analyzed. We discussed the usefulness of this method to achieve the numerical characterization of anomalies and its differentiation from the background from the available data of the geochemistry survey.