MULTIFRACTAL MODELING OF HYDROTHERMAL MINERALIZATION AND MINERAL DEPOSITS

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York University, Toronto, Ontario, Canada, M3J 1P3Spatial distributions of element concentration values in rocks and ore deposits in a mineral district or in a mineral province resulted from hydrothermal activities often reflect multi-phase or multi-episode processes with aggregation, continuation and superimposition properties. These properties might be due to both the nature of the genesis of hydrothermal systems such as multi-episode igneous activities or metamorphism and the properties of continuation and superimposition of structural activities controlling the transportation and deposition of hydrothermal solutions. Under this assumption, the current paper has proposed a multinomial multifractal model to characterize the distributions of the enrichment of element concentration values in rocks or other media and mineral deposits as the consequence of mineralization of hydrothermal systems. Both closed and open mineralization systems have been considered as conservative and non-conservative multifractals, respectively. This newly proposed model can be used not only to characterize hydrothermal mineralization processes but also to study various statistical regularities of the consequences of mineralization processes such as the power-law relationships between: the number and the sizes of deposits; the numbers and sizes of geochemical anomalies; and the areas of anomalies and their minimum concentration values. In addition, the discretelization of mineralization with respect to spatial and spectral scaling have also been addressed from a multifractal point of view. The model was demonstrated with the three datasets: the gold deposits from Nevada, USA, and gold deposits from the Northern China Platform, China, and gold-associated geochemical data in soils from the Mudik area, Indonesia.