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Charactering mineralization related geo-processes by Fractal/multifractal analysis

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Nowadays, numerous case studies have indicated that research on mineral resources rely greatly on knowledge from multidiscipline, including geochemistry, geophysics, remote sensing, etc. Extracting geo-information associated with hydrothermal systems from multisource data is significant to geological exploration, especially to the detection of prospective areas in the reconnaissance stage. With the development of computer sciences and constructions of geo-database all over the world multidisciplinary approaches nowadays are flourishing. Geosciences as the beneficiary have been greatly progressed in geo-information integration for datasets from multi-source and at multi-scale. The Malipo area as an important part of the southeastern Yunnan polymetallic belt, China has become a heat point of Sn-Zn mineral exploration. After a long time effort, numbers of exploratory datasets has been collected and knowledge regarding metallogeny is greatly improved. Different from systematical studies conducted in other parts of the southeastern Yunnan polymetallic belt, studies in the Malipo area mainly focusing on several discovered and typical deposits. Consequently, geo-information including association between granitic intrusions and mineralization, controlling effects of tectonics, and ore-bearing strata are not well achieved, especially in a spatial scenario. Former studies employed a series of fractal/multifractal-based spatial analysis methods to investigate controlling factors of polymetallic mineralization in the southeastern mineral district. In the Malipo area, 1:200,000 and 1:50,000 scales stream sedimentary geochemical sampling data, 1:200,000 scale gravity and 1:100,000 scale aeromagnetic data are available for mineral exploration. In current study, multi-statistical and fractal/multifractal-based methods including principal component analysis (PCA), Spectrum-Area (S-A) model and singularity theory will be applied to characterize the geological features indicative to mineralization. First of all, geo-anomalies are extracted from background. By PCA, geo-information of individual geo-variables including gravity, aeromagnetic and geochemical elements are integrated to characterize their associated geological features. Secondly, S-A model is applied to evaluate the spatial distributions of geo-anomalies. Consequently, the complexity of geo-processes associated with these geo-anomalies can be investigated. According to this study, knowledge regarding controlling effects of mineralization associated geological factors, especially the effects of faults on anisotropic properties of ore-forming elements can be achieved that will be great supplementary to mineral exploration in the Malipo area, southeastern Yunnan, China.