Objective selection of elemental association related to mineralization

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Geochemical exploration plays a significant role in mineral exploration because it helps to discovery various mineral deposits. For a geochemical exploration project, a number of elements are usually synchronously determined. It is known that few elements are pathfinder elements which can guide geoscientists to discovery mineralization, and other elements may reflect other geological processes or events. How to choose the elemental association related to mineralization from both a geological and a spatial statistic point is addressed in this study. On the basis of studies on ore geological characteristics, a hybrid of method that combines multifractal spectrum and the receiver operating characteristic (ROC) was applied to select the elemental association for a specific mineral deposit type. The spatial distribution characteristics of elements were firstly explored through multifractal analysis, which can determine the enriched elements with the asymmetry index R greater than 1. These enriched elements were further analyzed by ROC, which can evaluate the spatial correlation between these enriched elements and known mineral deposits. The elements with the area under curve (AUC) and Z_{AUC} values obtained by ROC are greater than 0.5 and 1.96, respectively, representing a strong spatial relationship with mineralization, are favorable elemental association for detecting mineralization. The hybrid method provided an objective selection of elemental association from a spatial statistic point. The geological environment for the formation of mineralization should be considered jointed with the proposed approach.