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Identification of Element Association Anomaly and Extraction of its Ore-forming information of Southeastern Yunnan Ore Concentration Area by Using PCA combined with SVD

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Southeastern Yunnan Ore Concentration Area (SYOCA), located in the intersection region of the western Pacific metallogenic domain and the eastern Tethys metallogenic domain, is one of the most important Sn-W and Pb-Zn-Ag polymetallic mineralization area in China. In order to extract the ore-forming information of W-Sn and Pb-Zn-Ag in the study area, Principal Component Analysis (PCA)¹ and Singular Value Decomposition (SVD)² were applied in handling the stream sediment geochemical data at the scale of 1:200,000. Firstly, the identification of the element groups of regional metallogenic background was made out by PCA: $[\text{SiO}_2\text{-K}_2\text{O}]$ — $[\text{Fe}_2\text{O}_3\text{-Co-Ni-V-Cr-Nb-Cu}]$, which reflects a relationship of the granitic magma in the study area that SiO_2 - K_2O group is inversely proportional to $\text{Fe}_2\text{O}_3\text{-Co-Ni-V-Cr-Nb-Cu}$ group, that is, with the gradually increasing in acid and alkali components, the mafic components were gradually reducing in the magma system during the process of granitic magma crystallization and evolution. The ore-forming element groups were established by PCA: (a) The W-Bi-Sn-Be group, which may show a typical W-Sn polymetallic mineralization with the features of the Nanyangtian ore deposit associated with the emplaced event of the late Cretaceous two-mica granite of the Laojunshan intrusive complex. (b) The Zn-As-Cu group, which may show the element association that the Dulong Zn (In) - Cu polymetallic deposits associated with alkaline granite porphyry of the Laojunshan intrusive complex. (c) The Pb-Ag-Sb group, which may illustrate a typical element association that the Bainiuchang Ag-Pb polymetallic deposits associated with the porphyritic biotite monzogranite of the Bozhushan intrusive complex. The regional and local ore-forming information was extracted from the ore-forming element groups mentioned before by using SVD. Finally, ore-finding targets of the various types of mineralization were delineated with the help of the ore-finding information. In conclusion, the combination of the linear PCA and nonlinear SVD based on stream sediment geochemical data could effectively uncover intrinsic characteristics of different types of element associations of both the regional metallogenic background and the local ore-forming anomalies which contribute to mineral exploration.

References

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