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Characterization of primary geochemical haloes associated with Sn-Zn mineralization at the Dulong deposit, China

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The Dulong district, located at the western margin of the Cathaysia Block, is characterized by widespread Cretaceous granitic rocks and accompanying Sn-Zn polymetallic ore deposit (~20 Mt of Zn, ~30 Mt of Sn). It is one of the most important polymetallic tin ore districts in China. Two predominant mineralization types as skarn and quartz vein have been recognized. Hydrothermal alteration mainly consists of greisenization, chloritization, skarnization. The purpose of this study is to identify primary geochemical haloes for exploring undiscovered mineral resources at the Dulong deposit, Yunnan, China. Sampling of unweathered rock have been analyzed for 18 elements (Au, Ag, Sn, As, Sb, Bi, Hg, W, Mo, Co, Ni, Cu, Ga, Cd, In, Mn, Pb and Zn) from altered rocks and mineralized altered rocks. The assay data are employed by a centered logratio (clr) transformation to address the closure effect of compositional data for factor analysis (FA). Results of FA analyses show that, in the Dulong deposit, Sn-Zn mineralization is characterized by a Sn-Zn-Cu association, supra- and/or near-ore primary haloes in mineralized altered rocks by an As-Sb-Bi-Ag-Au-In association, sub-ore primary haloes around mineralization by a Mo-Bi-Sn-W association, and host metamorphic wall rock by a Ni-Co-Mn association. The analyses of vertical primary haloes indicate that Sn-Zn mineralization exhibit a clear zoning sequence as Bi-In-As-Hg-Cu-Cd-Ag-Mn-Sb-Sn-Au-Mo-Ga-W-Zn-Pb-Ba-Be-Co from high to low lever, which is similar to the standard zonation of hydrothermal deposits. Based on the geochemical halo zoning sequence, an indexes as (As*Ag*Hg）/（Sn*Cd*Zn） was constructed as a criterion for evaluating the ore potential in depth. A potential zone extending ca. 100 m below the known ore body was delineated. Therefore, by applications of statistical procedures for geochemical data analysis, the analysis of primary geochemical haloes linked with Sn-Zn mineralization enhances its effectiveness as an exploration tool for revealing the presence of the undiscovered ores at depths.