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In-situ element analysis of sphalerite from the Lengshuikeng Ag-Pb-Zn deposit, Jiangxi, China: Implications for ore genesis

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The Lengshuikeng Ag-Pb-Zn deposit is located in northeastern Jiangxi Province, South China, which is in the Gan-Hang tectonic belt (GHTB) between the Cathaysia and Yangtze blocks. The deposit comprises veins, veinlets, anddisseminatedmineralization in a granite porphyry (A-Type), and massive sulfide mineralization hosted in volcaniclastic rocks (B-Type). The occurrence, mineral constituents, and the zoning of alteration assemblages of both mineralization typesare markedly different from those of typical porphyry deposits, making the origin of the polymetallic mineralization in Lengshuikeng unclear. Electron microprobe analysesshow that sphalerites from two typesof mineralization have different Fe contents. Iron contents of sphalerites in B-type mineralization range from 2.02 to 7.69 wt %, with a mean of 4.17 wt %, whereas sphalerites in A-type mineralization have a much higher iron content, ranging from 8.02 to 12.42 wt %, with a mean of 9.49 wt %. Although the B-type mineralization occursin the Fe-Mn-rich carbonate strata, sphalerites of such mineralization do not show enrichment of Fe. Further research for minor and trace elementconcentrations of sphalerite from the two types of mineralization wee conducted by in-situ LA-ICP-MS. The results show that A-Type sphalerites have relative enrichments of Fe, Mn, Pb, Ag, Cu, Sb, and Sn, whereas B-Type sphalerites contain aslightly higher Cd content. Different element compositions of sulfides, e.g. sphalerite, within the porphyry system, have been thought to be related to the variable physiochemical conditions (e.g., temperature, pressure, pH, etc.). Although the two type of sphalerites have different Fe contents, both of them contain relatively low low Co (most <10 ppm), Zn/Cd (66-131), and Cd/Fe (0.06-0.31) ratios, and relatively high Sn contents, which are very similar to the sphalerites from volcanogenic massive sulfide deposits.Microscopic observation and time-resolved analytical signals suggest that the enrichments of elements such as Fe, Cd, Ag, Sb, and Tl in solid solution, and Cu, Pb, and Sn occur inmicroscopic inclusions. Thus, Fe and Cd contents could be used to help determine the formation conditions. By using the Cd-fractionation temperaturefor sphalerite-galena geothermometry, we obtained a formation temperature of 238-246 ℃ for B-type mineralization and a relatively lower temperature of 209-224 ℃ forA-type mineralization, despite the relatively high Fe in sphalerite of A-type mineralization. It is noted that minor magnetite is associated with B-type mineralization, but little magnetite occurs in A-type mineralization. Such a difference suggests that high formation temperature and low content of Fe in B-type mineralization might be related to a high oxidation state. In summary, we suggest that the two type of mineralization in the Lengshuikeng depositmight have formed via the same mechanism. The variations of trace elementconcentrations of sphalerites are mainly controlled by changingtemperature and oxygen fugacity during the evolution of the hydrothermal system.