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The Bairendaba and Weilasituo Polymetallic Sulfide Ore System of Inner Mongolia, China: the Role of Metal Fractionation in the Genesis of Zonation

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The Weilasituo and Bairendaba Zn- Pb- Ag- Cu sulfide deposits are located in south Great Xing'an Range, Inner Mongolia, China. They occur as zoned veins within fractures cutting the older Xilinhote metamorphic complex. Weilasituo lies on the west sector. Bairendaba lies 4 km to the east of Weilasituo.

The main alteration assemblage in both deposits is quartz-sericite-fluorite, and this is controlled by fractures in the vicinity of sulfide veins. The sulfide ores in these two deposits are massive, and consist mainly of pyrrhotite and dark Fe-rich sphalerite, with an assemblage comprising variable proportions of chalcopyrite, galena, and minor Ag-bearing minerals. Two predominant sulfide mineralization stages are recognized. During the early stage, sub-economic intermediate-sulfidation state euhedral pyrite and arsenopyrite were deposited. This was followed by the main stage of ore genesis which was characterized by low-sulfidation state fluids depositing pyrrhotite, Fe-rich sphalerite, chalcopyrite, galena and minor Ag-bearing minerals.

The Weilasituo and Bairendaba deposits have metal zonation which follows the strike of the veins. The western part of the Weilasituo deposit is more copper-rich and the eastern part is more zinc-rich. The central zone of the Bairendaba deposit comprises Cu-bearing zinc sulfide and this deposit is zoned outwards to Zn-rich ores which

are devoid of Cu, and then into zinc-lead-silver ores which dominate the outer part. There are three major veins in the Weilasituo and Bairendaba deposits, namely the #1 Zn-Cu vein at Weilasituo, the #3 Zn-Pb-Ag vein at west Bairendaba and the #1 Zn-Pb-Ag vein at east Bairendaba; together, these veins contain more than 50 wt.% of the metals contained in these two deposits. The metal tonnage, metal grade and metal ratios of these three major veins display systematic and gradual metal zonation pattern from west of Weilasituo to east Bairendaba.

The metal zonation data indicates that these two deposits were formed from the same hydrothermal ore forming system, and represent two upstream and downstream end-members respectively, where the ore-forming fluid laterally flowed from west to east. The quantitative metal zonation patterns are consistent with metal-bearing fluid entering the system to precipitate chalcopyrite in proximal setting and sphalerite and Ag-bearing minerals in more distal settings. There is no evidence to suggest that the metal zonation pattern of the two deposits resulted from superimposition of different hydrothermal activities; rather, the zonation results from metal deposition accompanying the evolution of a metal-bearing fluid along the strike of the vein. The temperature gradient between the inflow zone and the outflow zone may be a key factor controlling this process.

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