



Genesis of the Bangbule Pb-Zn-Cu polymetallic deposit in Tibet, western China: Evidence from zircon U-Pb geochronology and S-Pb isotopes

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The Bangbule Pb-Zn-Cu skarn deposit is located in the Longger-Gongbujiangda volcanic magma arc in the Gangdese-Nyainqentanglha Plate. It is the only lead-zinc polymetallic deposit discovered in the westernmost Nyainqentanglha metallogenic belt. The measured and indicated resources include 0.9 Mt of Pb+Zn (4.77% Pb and 4.74% Zn, respectively), 6499 t of Cu, and 178 t of Ag (18.75g/t Ag).

The orebodies mainly occur as lenses, veins and irregular shapes in the contact zone between the quartz-porphyry and limestone of the Upper Permian Xiala Formation, or in the boundaries between limestone and sandstone. Pb-Zn-Cu mineralization in the Bangbule deposit is closely associated with skarns. The ore minerals are dominated by galena, sphalerite, chalcopyrite, bornite, and magnetite, with subordinate pyrite, malachite, and azurite. The gangue minerals are mainly garnet, actinolite, diopside, quartz, and calcite.

The ore-related quartz-porphyry displays LA-ICP-MS zircon U-Pb age of 77.31 ± 0.74 Ma. The $\delta^{34}\text{S}$ values of sulfides define a narrow range of -0.8 to 4.7‰ indicating a magmatic source for the ore-forming materials. Lead isotopic systematics yield $^{206}\text{Pb}/^{204}\text{Pb}$ of 18.698 to 18.752, $^{207}\text{Pb}/^{204}\text{Pb}$ of 15.696 to 15.760, and $^{208}\text{Pb}/^{204}\text{Pb}$ of 39.097 to 39.320. The data points are constrained around the growth curves of upper crust and orogenic belt according to the tectonic discrimination diagrams. The calculated $\Delta\beta - \Delta\gamma$ values plot within the magmatic field according to the discrimination diagram of Zhu et al. (1995).

The S-Pb isotopic data suggest that Bangbule is a typical skarn deposit, and the Pb-Zn-Cu mineralization is genetically related to the quartz-porphyry in the mining district. The discovery of the Bangbule deposit indicates that there is metallogenic potential in the westernmost Nyainqentanglha belt, which is of great importance for the exploration work in this area.