The Beiya gold-polymetallic deposit is located near the eastern end of the Tethyan orogenic belt in western Yunnan Province, China. It is one of the largest gold deposits in China, and contains significant amounts of silver and base metals (Cu, Fe and Pb). This study aims to resolve the problems relating with geodynamic setting, origin and petrogenesis of magmatic rocks, ore-forming processes and to suggest a metallogenetic model in the Beiya deposit.

1 Systematic LA-ICP-MS U-Pb zircon dating results indicate that all the intrusive rocks in Beiya district are coeval, ranging from 34 Ma to 37 Ma.

2 The results show that felsic porphyries in the Beiya area are shoshonitic rocks with high K2O/Na2O, and enrich in LREE and lack pronounced Eu negative anomalies. Besides, they have high contents of Sr, and enrichment in LILE, but depletion in Yb, Y and HFSE. All characteristics mentioned above indicate that the alkali-rich porphyries from Beiya are similar to adakites geochemically. This study presents the lamprophyres were derived from EMII enriched mantle in terms of their isotopic characteristics and regional tectonic evolution history. This lithospheric thinning caused by the collision between Indian and Eurasian plate could have resulted in the upwelling of the asthenosphere beneath western Yunnan, inducing partial melting of the residual metasomatized lithospheric mantle.

3 Re-Os dating of molybdenite indicates the age of 36.82±0.48 Ma, suggesting the mineralization in the Beiya gold-polymetallic deposit genetically associated to the porphyry.

4 According to our study, the Beiya deposit is a composite deposit, within which skarn-type Cu-Au-Fe deposit is predominant, and associated with porphyry-type Au-Cu, and hydrothermal vein-type Fe-Au-Pb-Zn mineralization. It is clearly zoned in element assemblage consistent to temperature decreasing from the porphyry to the wallrock. The garnet is andradite-rich, whereas pyroxene is relatively rich in diopside. This mineral assemblage indicates oxidization in the Beiyaskarn system.

5 The ore-forming fluids evolved from high temperature and high salinity conditions to low temperature and low salinity conditions, and experienced extraction of magma, phase separation of supercritical fluid, decompression and boiling, the filling or metasomatism between magmatic hydrothermal-volatile and carbonate wall rocks. In the processes of water-rock interaction, magmatic hydrothermal and meteoric water was boiled and mixed. Boiling and mixing could be a significant mechanism of the formation of mineralization. The ore-forming fluids were derived from magma mixing with precipitated water in the later period, while the mineralization elements were mainly from magma.