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Geochronology and Petrogeochemistry of arc-volcanic rocks from Meiriqiecuo Group in the Duolong porphyry-epithermal copper (gold) deposit, western Tibet

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The duolong porphyry-epithermal copper (gold) deposit whose mineralization is related to the northward subduction of Neo-Tethys oceans, is located approximately at 100 km northwest of Gerze county in western Tibet. It is located to the northwest of Bangong–Nujiang suture zone and within the southern Qiangtang Terrane. This deposit widely distributes plenty of Meiriqiecuo Group effusive volcanic rocks including basaltic andesite, andesite, dacite and rhyolite rocks.

The lavas show relatively intensive Na₂O (3.13~3.80 wt.%), varying K₂O (2.14–5.53 wt.%) and K₂O/Na₂O (0.61–1.65) with a wide range SiO₂ (49.41–72.0 wt.%) and belong to the high-K calc-alkaline to calc-alkaline series. They have low Mg[#] (23.8–43.9) with variable TFe₂O₃ (1.79–8.78 wt.%), MgO (0.28–3.34 wt.%), Al₂O₃ (14.70–16.38 wt.%) and TiO₂ (0.38–1.01 wt.%). Besides, these samples exhibit a wide compositional range from basaltic andesite to rhyolite in the diagram of Zr/TiO₂ versus Nb/Y, and show metaluminous to peraluminous characteristics with A/CNK values of 0.60–1.28. The lavas also show light rare earth element enrichments and heavy rare earth element depletions, with right deviation form in the rare earth element chondrite-normalized patterns. Moreover, they display medium to small negative Eu anomalies (Eu/Eu* = 0.63–0.93) and fractionate REE patterns characterized by (La/Yb)_N ratios of 9.67–11.05. In primitive mantle-normalized spidergram, all of the samples generally show strong enrichments in large ion lithophile elements relative to high-field-strength elements, pronounced enrichments of Rb Th K Pb and Sr, distinct depletions of Nb, Ta, and Ti, which is similar to geochemical characteristics of arc-type magmas worldwide. Zircons from the lavas are mostly euhedral to subhedral with elongated to short prismatic forms, crystal sizes of 50–300 μm and length-to-width ratios of 1:1 to 3:1. They exhibit typical oscillatory zoning, unzoned or uniform internal textures, which imply a high-temperature crystallization environment. Most zircons in the study display low Th (80–490 ppm) and U (133–795 ppm) with Th/U ratios of 0.29–1.12. Th/U ratios higher than 0.1, together with homogeneous internal structure, are characteristic of igneous zircons whose zircon U–Pb ages could be interpreted as representing the crystallization age of the host rocks. After rejecting discordant ages, zircons from three samples yield ²⁰⁶Pb/²³⁸U weighted mean ages of 110.2±0.7Ma, 109.3±2.2Ma and 108.2±2.6Ma. Generally, the fact that subduction was still ongoing during approximately 108~110Ma suggests closure of the Bangong-Nujiang Ocean occurred after the Early Cretaceous, which is different with the early recognition of closure time of late Jurassic to early Cretaceous^[1~2].

References

[1] Kapp P et al.,(2005). Geological Society of America Bulletin,117:865-878.

[2] Yin, A., Harrison, T.M., (2000). Annual Review of Earth and Planetary Sciences,28, 211–280.

