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Age and Geochemistry of Granitoids from the Sijiaoyang-Niukutou and Kaerqueka Skarn Deposits, Qiman Tagh Area, East Kunlun Orogen: Implications for Devonian Magmatism and Mineralization

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The East Kunlun Orogeny (EKO), located in the northern part of the Tibetan Plateau, is one of the most important igneous and metallogenic provinces in China that has undergone Neoproterozoic to Early Devonian and Carboniferous to Late Triassic orogenic processes. The Qiman Tahg area of Qinghai Province (QTQP), located within the western margin of the EKO, is characterized by the development of numerous important skarn Cu-Mo-Fe-Pb-Zn deposits. Many geologists argue that these deposits are associated with Triassic granitoids formed under a post-collisional setting (e.g., Feng et al., 2012). However, recent research indicates that some deposits (e.g., Yemaquan and Wulanwuzhuer) are also related to Early and Middle Devonian magmatism (e.g., Gao et al., 2014), but Early and Middle Devonian mineralizations in the QTQP are still poorly understood. The Sijiaoyang-Niukutou and the Kaerqueka deposits are the largest skarn Pb-Zn deposit and skarn Cu deposit, respectively, within the QTQP. However, it is currently controversial whether they are genetically related with Devonian or Triassic granitoids.

In this study, we obtain new LA-ICP-MS zircon U-Pb ages for the granitoids associated with the Sijiaoyang-Niukutou deposit and the Kaerqueka deposit, which show that the crystallization ages of the Sijiaoyang-Niukutou granodiorite and the Kaerqueka biotite monzogranite are 394.0 ± 1.3 Ma and 406.4 ± 4.2 Ma, respectively. These ages are consistent with those of granitic intrusions associated with the Yemaquan, Kaerqueka, and Wulanwuzhuer deposits (410–386 Ma; e.g., Guo et al., 2011; Gao et al., 2014) within the QTQP, indicating that Early and Middle Devonian are an important period for magmatism and mineralization in the QTQP. Geochemical results show that the Sijiaoyang-Niukutou granodiorite belongs to high-K calc-alkaline, I-type granitoids, with enrichment of LREE and weak negative Eu anomalies. The trace elements compositions of the rock are enriched in Rb, Th, U, La, Ce, and Hf, and poor in Ba, Ta, Nb, P, and Ti. The biotite monzogranite belong to weakly peraluminous granitic rocks, with enrichment of Si, Na_2O+K_2O and REE contents. In addition, the rocks have obvious LREE and HREE fractionation, significant negative Eu anomaly, and enrichment of HFSEs (e.g., Ce, Zr, and Y). This indicates that the Kaerqueka biotite monzogranites have features of A-type granitoids (Eby, 1992). Based on geochronological and geochemical data published previously and reported in this study, we proposed that Early and Middle Devonian magmatism and related polymetallic mineralization occurred in a post-collision tectonic setting, and Early and Middle Devonian may be another significantly metallogenic period for the QTQP.