A Geochronological Framework for Early Mesozoic Magmatism Associated with Cu-Mo-Fe-Pb-Zn Skarn Deposits in the Qiman Tahg Area, Qinghai Province, East Kunlun Orogen, Western China

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The East Kunlun Orogen, located in the northern part of the Tibetan Plateau, is one of the most important metallogenic provinces in China, and has undergone Neoproterozoic to Early Devonian and Early Carboniferous to Late Triassic tectonism. Most ore deposits in the region are associated with the early Mesozoic orogenic processes. The Qiman Tahg area of Qinghai Province, located within the western margin of the orogen, is characterized by numerous important skarn deposits. These skarn deposits are related to Triassic granitic rocks and can be mineralogically classified into Fe polymetallic (e.g., Galinge, Yemaquan, Kendekeke, and Tawenchahan), Cu (Mo) polymetallic (e.g., Kaerqueka), and Pb-Zn polymetallic (e.g., Hutouya) deposits. However, the geochronological framework of Triassic magmatism associated with skarn mineralization is still unclear. We review the petrography and published data for igneous rocks associated with Triassic Cu-Mo-Fe-Pb-Zn skarn mineralization and attempt to better understand the Triassic intrusion and ore-forming process that occurred within the Qiman Tahg area.

Based on detailed field investigations and published geochemical data and zircon in-situ U-Pb and mineral Ar-Ar and Re-Os ages, two discrete suites of early Mesozoic intrusions related to polymetallic skarn mineralization within the area are recognized: 1) ~240 Ma granodiorites together with associated 241-238 Ma porphyry-skarn Cu, Mo, and polymetallic deposits and 2) 235-224 Ma monzonites, granodiorites, monzogranites, and granites, together with related Fe skarn and Pb-Zn polymetallic deposits. The intrusions of suites 1 and 2 are petrologically and geochemically different. The rocks of suite 1 are intermediate to felsic and characterized by numerous mafic micro-granular enclaves (MMEs). These intrusions have low SiO_2 and (Na_2O+K_2O) contents and high A/NK values, and belong to the high-K, calc-alkaline, I-type granites. They have high Sr content, and $(La/Yb)_N$ and Sr/Y ratios but relatively low Yb content, with weakly negative Eu anomalies. Compared with the suite 1 rocks, the intrusions of suite 2 occur extensively throughout the Qiman Tahg area and lack MMEs. They are felsic and consist of high-K, calc-alkaline, I-type and alkaline A-type granitoids, with higher SiO_2 and (Na_2O+K_2O) contents, and lower A/NK values than the suite 1 rocks. These rocks are characterized by strong negative Eu anomalies, relatively low $(La/Yb)_N$ and Sr/Y ratios and Sr content, and relatively high Yb content. In addition, the intrusions of the two suites also have different Sr-Nd-Hf isotopic compositions. All these features indicate that the intrusions of suite 1 and suite 2 have diverse origins and formed under different tectonic settings.