

Characteristics and formation of corundum within syenite in the Yushishan rare metal deposits in the northeastern Tibetan Plateau

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ABSTRACT

Corundum is rarely found in situ within alkali syenites. A corundum-bearing syenite was found in the Yushishan rare metal deposits of the eastern section of the Altyn Tagh fault in the northeastern Tibetan Plateau, but the characteristics and formation of corundum remain unknown. We describe a corundum-bearing syenite dike emplaced in biotite plagioclase gneiss that suffered overprinted deformation with characteristics of mylonitization. The corundum crystals have variable grain sizes, and the largest ones are megacrystic with growth zoning. The corundum crystals contain a variety of mineral inclusions that are divided into primary and secondary. The primary mineral inclusions within the corundum include variable contents of Fe-Ti oxide needles, ilmenite, zircon, monazite-(Ce), potassium feldspar, pyrochlore, columbite-(Fe), magnetite, samarskite-(Y), and pyrite that indicate corundum crystallized in peraluminous Zr-rich and Si-poor alkali rock with variable TiO₂ contents. Secondary mineral inclusions include Zn-rich hercynite, ilmenite, magnetite, annite, fluorapatite, and intergrowths of ilmenite with columbite-(Fe) and goethite that reveal late-stage influx of Zn-, Ti-, Fe-, and F-bearing fluids into corundum that caused metasomatism and element migration and mineral precipitation. The trace element analysis of corundum shows high-Fe and -Ga contents and low-Mg and -Cr contents that are consistent with the characteristics of corundum of magmatic origin. The trace element characteristics and the oxygen isotopes (6.2–8.2‰) results indicate that corundum crystallized in melts with the involvement of Al-rich and Si-poor crustal material.

Keywords: Syenite, corundum, mineral inclusions, trace element, oxygen isotopes