Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.14029

Zircon texture and chemistry reveal multi-stage metasomatic Zr mineralization in the world-class Baerzhe REE-Nb-Zr-Be deposit

DR. MINGQIAN WU, PHD[1,2], KUN-FENG QIU[1] AND IAIN SAMSON[2]

[1]China University of Geosciences (Beijing)
[2]University of Windsor
Presenting Author: aria.wu1990@gmail.com

China's Baerzhe deposit contains large endowments of rare metal mineralization hosted in an alkaline granitic pluton. This pluton comprises an unaltered miaskitic granite porphyry, a variably hematized miaskitic granite, and an agpaitic granite that underwent Na metasomatism and hematization. REE-Nb-Be mineralization is present in both the altered miaskitic and agpaitic granites, whereas high-grade Zr mineralization (≥ 2.5 wt% of ZrO_2) occurs only in the agpaitic granite. Metasomatic zircon in the agpaitic granite was suggested to have formed prior to REE-Nb-Be mineralization. Raman analyses and back-scattered imaging suggest that all the metasomatic zircon from the agpaitic granite is not metamict and unaltered, such that they will have retained their original chemistry. Some zircon occurs as inclusions in snowball quartz. These zircon inclusions display oscillatory zoning under cathodoluminescence (CL), and exhibit chondrite-normalized REE patterns with positive slopes and a large increase of concentrations from Gd to Lu. Zircon also occurs as replacement of elpidite, which is rare, in abundant quartz-zircon pseudomorphs. Both of these types exhibit comparable, irregular zoning in CL images, and show relatively flat chondrite-normalized patterns with concave-down HREE portions. Such features confirm that the pseudomorphs represent replacement of elpidite. A fourth zircon type occurs as replacement of magmatic amphibole, is unzoned in CL, and has similar, flat chondrite-normalized patterns to the elpidite-replacement and pseudomorph zircon but has much higher REE concentrations. In addition, the amphibole-replacement type contains high Be concentrations (ca. 200 ppm), more than four times higher than the other types. The data indicate that the inclusion and amphibole-replacement zircon crystallized from two different fluids; the pseudomorph and elpidite-replacement zircon could have crystallized from either of the two fluids. Deuteric and altered magmatic zircon from the altered miaskitic granite exhibits different chemistry to zircon from the agpaitic granite described above. This suggests that the fluid responsible for zircon alteration and crystallization in the altered miaskitic granite was neither of the two zircon-forming fluids that affected the agpaitic granite. The data reveal that Zr-rich alkaline rocks can have been affected by multi-stage metasomatic zircon-forming events. This could be one of the reasons that these rocks contain high Zr concentrations.