Exsolution origin for zircon rims around hemo-ilmenite in magmatic Fe-Ti oxide deposits

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Secondary accessory zircon rims that form around hemo-ilmenite grains may be a common feature in Fe-Ti oxide ores. Detailed scanning electron microprobe backscatter imaging of Fe-Ti oxide ores related to the Saint-Urbain and Havre Saint-Pierre anorthosites (Grenville Province, Québec) reveals fine zircon rims (8 to 60 μm) around hemo-ilmenite grains (0.2 to 5 mm). The zircon rims are characterized by extremely low abundances in U (~1 ppm; isotope dilution). Zircon derived from basaltic melt compositions typically have much higher U contents (>40 ppm) and those found in anorthosite contain on average 100 ppm U. Zircon rimming hemo-ilmenite has been identified resulting from purely metamorphic reactions, however we preclude this as a mechanism for the formation of zircon in the unmetamorphosed Saint-Urbain and Havre Saint-Pierre anorthosites. Instead, we favour exsolution and sub-solidus reactions during slow cooling. This is consistent with previously published work suggesting hemo-ilmenite as the source of Zr in the formation of zircon rims. Existing experimental partition coefficient results shows that Zr is a moderately incompatible element in ilmenite in basaltic systems (D_{Zr} 0.28-0.38). Based on published Zr contents of ilmenite from the Skaergaard intrusion relative to estimated parental magma compositions, it appears that partition coefficients for Zr in ilmenite could be in the range of 2-3 [1]. Whole rock analyses of cumulate rocks from the studied ore deposits show that Zr is positively correlated with TiO_2; variations in TiO_2 are directly related to the amount of hemo-ilmenite. Based on both cation charge and ionic radii, substitution of Ti^{4+} (0.61 Å) by Zr^{+4} (0.72 Å) in ilmenite is possible. The results of this study indicate that Zr is compatible in ilmenite in Fe-rich basaltic systems and that slow cooling allows for an exsolution origin of zircons rim around hemo-ilmenite in Fe-Ti oxide ores.

Reference

[1] Jang Y.D. & Naslund H.R. (2003). *Chem Geol* 109-25

Discovery of pyrrhotite-chalcopyrite bearing amphibole megacrysts in Tongling Area, Anhui Province

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Some pyrrhotite-chalcopyrite-bearing amphibole megacrysts (including pyroxene megacrysts) were discovered in Mesozoic pyroxene diorite-porphyrite at Caoshan in Tongling area, Anhui province. The amphibole megacrysts, belonging mainly to pargasite and magnesiohastingsite, are characteristic of the amphibole composition derived from mantle and crystallized in lower crust. In general, the aggregates of pyrrhotite-chalcopyrite take the shape of cylinder and sphere. Three occurrences have been recognized in the amphibole megacrysts: parallel linear, bunchy and scattered. The unique cylinder-like shape of the aggregates and remarkable Ni-poor sulfides in Caoshan are distinctively different from the spherical Ni-rich sulfides in pyroxene megacrysts and any other kinds of megacrysts. In terms of composition, the amphibole megacrysts and their sulfides in Caoshan are similar to those in the pyroxenite xenoliths in Qilin, Guangdong Province. In terms of origin, the pyrrhotite-chalcopyrite as exsolution products were resulted from the subsolidus re-equilibration of sulfide solid solution within amphibole megacrysts. This discovery is important for the study of regional magma evolution and its associated mineralizations and ore sources as well.