AGU 100 FALL MEETING
Washington, D.C. | 10–14 Dec 2018

V33C-0248: Trace element redistribution during rehydration of eclogite via sulfide-silicate reactions

Wednesday, 12 December 2018
13:40 - 18:00
Walter E Washington Convention Center - Hall A-C (Poster Hall)

Sulfide breakdown during subduction releases oxidizing fluids that transport chalcophile and siderophile elements (CSE) such as Ni ,Co, and As. These fluids are reincorporated into high-pressure rocks such as eclogites during exhumation and rehydration along the slab-mantle interface. Evidence for these rehydration reactions takes the form of large sulfide (pyrite, pyrrhotite, chalcopyrite) grains (up to 5 mm) associated with hydrous Fe^{3+}-bearing minerals. Here we present results of trace element determination by LA-ICP-MS coupled with mass balance calculations for sulfide-silicate reactions in rehydrated eclogites from the Mariánské Lázně Complex and Moldanubian Zone, Bohemian Massif, Czech Republic.

One key texture observed in these rocks is the breakdown of garnet + omphacite in the presence of fluid to produce hornblende + diopside + plagioclase + pyrite. This rehydration reaction involves the oxidation of Fe^{2+} in garnet to Fe^{3+} in hornblende. In order to oxidize the iron from the garnet, we propose that sulfate is brought into the rock by an infiltrating fluid, where it is reduced to form pyrite, consistent with the observed textures.

Trace element analyses reveal the Co distribution within rehydrated eclogite: Co is measurable in garnet (~50 µg/g), omphacite (~26 µg/g), hornblende (~80 µg/g), and pyrite (~5000 µg/g). Mass balance calculations suggest that of the total amount of Co present in the rehydration products, only ~35 % can be supplied by the breakdown of garnet and omphacite, leaving ~65 % of the Co to be supplied by another source. Average concentrations of Ni are: in garnet (1–4 µg/g), omphacite (~57 µg/g), hornblende (~90 µg/g), and pyrite (~2500 µg/g). Mass balance calculations suggest that of the total amount of Ni present in the rehydration products, ~70 % comes from the breakdown of garnet + omphacite, with the other 30 % supplied external to this reaction. Arsenic is not present in the silicate minerals, but is in the 10s of µg/g range in pyrite, and must be supplied externally to the rock, likely from a fluid.

We conclude that the fluids released from subducting slabs carry sulfate and CSEs, which infiltrate the slab-mantle interface and eventually make their way into the sub-arc mantle, where they can be incorporated into the arc magmatic system.

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