THEME 5: THE DEEPER EARTH

Session 5.3: Subduction processes and the subcontinental lithosphere

CONVENED BY:

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At subduction zones, rocks get pushed, or maybe pulled, down into the Earth. Regardless of whether they are pushed or pulled, things happen to the rocks as they get deeper. This session invites papers that examine those things as well as what might happen in the surrounding rocks as a consequence. We look forward to lively discussions that shed more light on some of the most controversial issues in the field.

5.3.11

Trace element distribution between antigorite and fluid near the dehydration conditions

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We are currently conducting a set of experiments to characterize trace element distribution between antigorite and fluid at conditions relevant to subduction zone tectonic setting (3 to 5 GPa and 500 to 700 ˚C), because antigorite is one of key minerals contributing the fluid release from subducting slab to mantle wedge below the arc. The partitioning data help construct the quantitative geochemical model accounted for fluid release and element segregation, which are ultimately constrained by observations of arc lavas and subducting slab compositions.

The synthesis experiments were conducted with anhydrous mineral-oxide mixture. The fluid form of water was introduced into the capsule with quantity ranging from 10 to 60 weight percent of samples, which are up to 6 mg in total. The synthesis conditions were maintained by a belt-type apparatus at Univ. C. B. Lyon 1. The pressure was calibrated against room temperature metal transition (Ce, Hg, Bi, and Tl) and high temperature coesite synthesis. Temperature is monitored by chromel-alumel thermocouples. When thermocouples failed, a power-temperature calibration curve is used to determine the run temperature. The press has shown excellent stability up to 100 hours at the conditions, 3 to 4 GPa at 550˚C. The stability over long duration enabled us to synthesize relatively large crystals of antigorite (10 to 50 microns). Presence of free fluid during experiments is confirmed by direct observation of fluid release from the sealed capsule upon puncturing. Formation of antigorite is confirmed by x-ray diffraction and Raman spectroscopy.

We have tested “bulk” analysis method to reconstruct the fluid composition at high-pressure temperature conditions. Elements dissolved in fluid during experiments were recovered by leaching pre-dried samples using diluted acid and base. The remaining leached samples were then dissolved in acid for analysis. Concentrations of elements in these solutions were measured by ICPMS. Our preliminary results show a systematic trace element distribution at conditions 3.3 and 3.9 GPa at 550˚C. The partition coefficients between antigorite and fluid are: (Tl)~0.005 > (Li, Pb, Sr)~0.05 > (Ba, Zn)~0.5 and Ni, Cu, Al, Co, Fe, Cr, Mn, Ga, and In are compatible to antigorite.