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Evolution of mineral compositions during eclogitization of subducting basaltic crust

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ABSTRACT

Experiments performed on the basalt + H_2O system at 2.2 to 3.4 GPa and 625 to 750 °C demonstrate the importance of amphibole, zoisite/clinozoisite, and lawsonite as H_2O carriers in subducting oceanic crust. Amphiboles are sodic-calcic (barroisite) at low pressures (2.2 and 2.4 GPa) but become sodic (glaucophane-ferroglaucophane) with increasing pressure. Zoisite/clinozoisite and lawsonite vary little in composition over this *P-T* range. Garnet and clinopyroxene compositions respond to the progressive disappearance of amphibole and zoisite with increasing pressure.

H_2O contents of eclogitic assemblages based on modal abundances calculated from electron microprobe analyses were combined with recent results from thermal modeling of subduction zones to discuss fluid release from the slab. The results indicate that, for cold subduction zones, the basaltic crust does not dehydrate, and lawsonite transports H_2O to depths greater than 250 km. For intermediate temperature paths, the destabilization of lawsonite will trigger the release of 0.9 wt% H_2O at ~110 km, within the sub-arc region. The remaining 0.1 wt% H_2O is transported by phengite to depths greater than 300 km. In hot subduction zones, the H_2O-saturated basalt solidus is crossed, and partial melting of the crust leads to the generation of "adakite" type melts.