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High-pressure transitions of subducted continental crust at around 660-km discontinuity

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It has been suggested that subducted slabs carry crust materials to the deep interior of the earth, and give a variety of influences on mantle dynamics. The slab mateials are composed of oceanic crust, harzburgite and peridotite. But it is suggested that continental crust and terrigenous and pelagic sediments may be subducted to the deep mantle with the slab. High-pressure phase relations of upper continental crust (UCC) have been studied from the uppermost mantle to the upper part of lower mantle (Irifune et al., 1994, Wu et al., 2009), but phase relations at around 660-km discontinuity of the interior of the earth have not been researched in detail yet. In this study, we have examined high-pressure phase relations of UCC at around 660-km conditions.

UCC sample was prepared by mixing SiO_2(66.07), TiO_2(0.50), Al_2O_3(15.21), K_2O(3.40), FeO(4.50), MgO(2.20), CaO(4.20) and Na_2O(3.90), where numbers in parentheses are contents in wt%. High-pressure experiments were made at 20.1-28.0 GPa and 1200-1800C with a Kawai-type 6-8 multianvil high-pressure apparatus. UCC and pressure marker (one of Mg_2SiO_4, $MgSiO_3$ and $MgAl_2O_4$) were packed in two holes in a Re capsule, kept simultaneously at desired pressure-temperature conditions for 2-3 hours, quenched and recovered after the run. Phase identification of each sample was made with a microfocus X-ray diffractometer, and compositional analyses of them were made with a SEM-EDS.

The asemblege of garnet (Gt) + clinopyroxene (Cpx) + $KAlSi_3O_8$-hollandite (Hol) + stishovite (St) + CAS phase (CAS) is stable to 21 GPa at temperatures higher than 1400C, and the assemblege of calcium ferrite (CF) + St + Gt + Ca-rich perovskite (Cpv) + CAS is stable in a range of 21-24 GPa. Gt and CAS decompose completely and CF + Hol + St + Cpv is stable at pressures higher than about 24 GPa. At 1200C, CAS does not exsit. At pressures higher than 23-24 GPa, recovered samples were easyly crushable. The fact indicates that Hol (II) probably transforms to Hol (I) during decompression. We will conduct mass-balance calculations from the compositions, compare a density with pyrolite mantle and discuss the influence on movement of the materials in the mantle.

Keywords: continental crust, 660km discontinuity, slab, high pressure experiment, pyrolite