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沈み込み物質内超高圧交代変成作用による大陸物質深部沈み込みの流体制御ーコクチェタフ超高圧変成岩によるモデリング
Fluid control of deeply subducted continental materials and diamond formation by Intraslab UHP metasomatism

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Deep continental subductions are an input for material cycling from surface to deep mantle. UHPM rocks mean the part of the direct evidence of this process. The Kokchetav UHPM rocks are the best samples and evidence to understand chemical processes in the subducting materials in global material cycling. During subductions, volatiles are carried into deep mantle together with major components and control the chemical reactions in subducting materials. Transportation of H_2O and CO_2, is the most important role of the deep continental subduction. Silicate rocks are H_2O reservoirs as hydrate minerals and carbonate and calc-silicate rocks are CO_2 reservoirs during subduction. The timings of dehydration in silicate rocks and decarbonation in carbonate and calc-silicate rocks are different. Dehydrations precede decarbonations by different P-T-V relations of CO_2 and H_2O, and H_2O play as a trigger to occur decarbonations in carbonate and calc-silicate rocks. Decarbonations are a CO_2 extraction from carbonate and calc-silicate rocks and are difficult to occur under dry conditions in P-T range of UHP metamorphism. The amount of H_2O infiltrating in carbonate and calc-silicate rocks controls the amount of CO_2 carried into the mantle. Poor H_2O supply means abundant CO_2 transportation into the mantle.

H_2O-bearing fluid plays an important role for diamond formation during subduction of continental materials. Diamonds form and dissolve in subducting materials through H_2O fluid. In UHP dolomite marble, diamonds formed at two different stages and 2^{nd} stage growth was from H_2O fluid. The diamond at 2^{nd} stage growth has light carbon isotope compositions, -17 to -27 ‰, whereas 1st stage diamond has -8 to -15 ‰. The light carbon of 2^{nd} stage could be organic carbon in gneisses carried by fluid; dissolution of diamond in gneisses had occurred. H_2O fluid infiltration into dolomite marble caused the change of carbon solubility in fluid itself to precipitate abundant fine-grained (10-20 μm) diamonds quickly. Recently discovered sp^2 graphitic carbon inclusions in 2^{nd} stage diamond suggest the fluid participation in diamond growth from H_2O fluid. Very large cubic diamond (max. 200 μm) in garnet-clinopyroxene rocks could be different fluid conditions; low oversaturation degree of carbon in fluid and slow crystallization, and led to low abundance of diamond.

In deeply subducting carbonate rocks, the abundant carbonate remains after decarbonations and are carried to the mantle. H_2O is stored in NAMs, which become new water carriers to the mantle. The amount of H_2O in carbonate rocks carried to the mantle is smaller than calc-silicate rocks because of small modal compositions of silicate minerals. In the case of calc-silicate rocks, for example garnet-clinopyroxene rocks of the Kokchetav, the modal compositions of carbonate is small; therefore, even a small amount of H_2O can decompose all amount of carbonate to form garnet and clinopyroxene. These NAMs contain several hundreds to 1,000 ppm order of water (OH and H_2O) as new water reservoirs and carriers. The modal compositions of H_2O-bearing NAMs control the potential of water transportation. UHP metasomatism with skarn mineral formation brings the swapping of H_2O carrier from hydrate minerals in silicate rocks to NAMs in calc-silicate rocks to expand the life of H_2O transportation into mantle much longer.

We can regard deep continental subduction as the transportation mechanism of H_2O and CO_2. CO_2 transportation is controlled by H_2O behavior in deeply subducted materials and poor amount of H_2O expands the volume of CO_2 transportation into the deep mantle as carbonate. Summarizing these, *Intraslab UHP metasomatism* was proposed and will be available for volatile transportation into the mantle. All these ideas were occurred from the research on the Kokchetav UHPM rocks. The author thanks Prof. Shige Maruyama. who gave me a great opportunity to study exciting materials, Kokchetav UHPM rocks and diamonds.

Keywords: UHP metamorphism, Intraslab UHP metasomatism, metamorphic diamond, fluid, Kokchetav Massif, deep continental subduction