西グリーンランド南部アクレックテレーンに産するクロミタイトの成因
Origin of chromitites in the Akulleq terrane, southern West Greenland

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The studies dealing with the Hadean-Archaean geologic samples are recently expanding. Research on Hadean-Archaean terranes is an important part in reconstructing the geologic past of the Earth which is thought to have differences from the present conditions. Southern West Greenland preserves a wide exposure of ancient geologic materials and structures. This study focuses on chromitites and peridotites from the Ujaragssuit nunāt area in southern West Greenland. The Ujaragssuit nunāt area is about 20 km south from the 3.8 Ga Isua Supracrustal Belt (Moorbath et al., 1977). In Ujaragssuit nunāt, ultramafic rocks occur as lenses of several meters to several hundred meters hosted in silicic gneiss (Chadwick and Crewe, 1986). It is important to understand the origin and processes related to the formation of the peridotites and chromitites in Ujaragssuit nunāt as a contribution to the Archaean magmatic processes and tectonics of the early Earth.

Chromitites are rocks with significant amount of chromites (>20 vol.%) (Arai and Miura, 2016). The unaltered composition of spinel is regarded as a useful petrological indicator (Irvine, 1967). However, chromite composition could be modified as a result of chemical re-equilibration, metamorphism, hydrothermal alteration. The impacts of these processes are evaluated in this study. In Ujaragssuit nunāt, chromitites, dunites and amphibole harzburgites are widely exposed. In some areas, the chromitites occur as layers with thickness ranging from several centimeters to a meter. Massive chromitites (2 m thick) are also exposed. The lithologies present in the area were also described in detail in previous works such as of Rollinson et al. (2002).

Chromites are subhedral and account for about 50-70% of the Ujaragssuit nunāt chromitites. Interstitial grains are mainly phlogopite and minor chlorite and talc. The dunite host consists mainly of olivine (~80%) and accessory spinel and phlogopite. Some spinel grains in the host dunite exhibit zonation as evidenced by darker cores and lighter rims under reflected light microscope and scanning electron microscope observations. The zonation observed is associated with compositional variation from core to rim (Fe enrichment towards the rim). The amphibole harzburgites are mainly composed of amphibole, orthopyroxene, spinel, phlogopite. Orthopyroxenes occur both around olivine and in some parts as inclusions inside olivine grains. Talc replacement of orthopyroxenes is also common. Spinel are surrounded by phlogopite and edenitic amphibole.

Spinel in the host peridotites has a higher Fe^{3+}content. The spinel Fe^{3+} content is higher in samples with higher phlogopite and spinel ratio. This suggests that phlogopite was formed by the reaction of spinel (+olivine) with an alkaline element-rich fluid. Spinel serves as a source of the Al_2O_3 in the phlogopite formation. It is considered that the chemical composition change of spinel is caused by the formation of

phlogopite. Furthermore, phlogopite in the sample containing amphiboles has lower K/(K+Na) ratio than samples without amphibole. Amphiboles are also found around the spinel. The K/(K+Na) ratio in the fluid decreases as the alkaline element-rich fluid forms phlogopite and amphibole was formed by the reaction between this differentiated fluid and spinel (+olivine). The abundance of orthopyroxene is higher in the sample containing amphiboles. The Cr_2O_3- and Al_2O_3- poor characteristic of the orthopyroxenes suggests a secondary origin. The differentiated fluid is also abundant in silica component and reacts with olivine to react to form the secondary orthopyroxenes. Although the possibility of crystal differentiation cannot be completely ruled out, it is thought that these peridotites were originally dunites and chromitites and the chemical composition was modified by alkali alteration.

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