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Genesis of the charnockite from Mt. Cronus in the Napier Complex, East Antarctica

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One of the themes that important of the Earth's history is the Archean -Proterozoic crustal formation and evolution. The felsic gneiss of igneous origin and granitic rocks, of Archean to Proterozoic age, are widely distributed in the Napier Complex, East antarctica, that a suitable field to study the formation and the evolution of the initial continental crust. The aim of this study has been clarify the origin of the charnockite and suggest the evolution model of the continental crust when the Archean to early Proterozoic.

Mt. Cronus is located in the center of the Napier Complex, and is in the area of the ultra high temperature (UHT) metamorphism. The dominant rock in the Mt. Cronus is charnockite that have a weakly gneissose structure, and metagabbro cuts structure of the charnockite. In addition, the sapphirine(Spr)-bearing granulite was confirmed.

Charnockite is composed of Qtz, Pl, Opx, Bt, Grt, and mesoperthite. Bulk compositions are plotted to the area of post-Archean TTG and within-plate granite. The Rb-Sr whole rock isochron age of 2323+/-191 Ma with an initial $^{87}Sr/^{86}Sr$ ratio of 0.71903+/-0.01299, and the Sm-Nd whole rock isochron age of 2294+/-73 Ma with an initial $^{143}Nd/^{144}Nd$ ratio of 0.50945+/-0.00007 are obtained from charnockite. On the other hand, an initial $^{87}Sr/^{86}Sr$ ratio of the metagabbro is considerably low with 0.7029. As a result of having used plagioclase- alkali feldspar thermometer about mesoperthite in the charnockite, it was estimated at about 1,000-1,100?C. In addition, Spr-Grt-Opx-Sil-Qtz-bearing granulite contains evidence for the early stability of Spr+Qtz. This assemblage is later replaced by Opx+Grt+Sil.

Based on the above-mentioned result, I examined the continental crust formation and the evolution model of the Archean to the early Proterozoic in the Mt.Cronus. Asami et al.(1998, 2002) reported the zircon ages, of the quartzofelspathic gneiss in the Mt.Cronus, are as follows; 3.65Ga, 3.0Ga, 2.7Ga, and 2.4Ga. The Rb-Sr whole rock isochron age of 2323+/-191 Ma in this study that is similar to zircon ages, as a formation age of charnockite. On the other hand, 3.3-3.7Ga of Nd model ages same as 3.65Ga from zircon. Therefore, it is thought to indicate the protolith age. High epsilon Sr and low epsilon Nd values of charnockite show that the original rocks derived from continental material.

The pressure condition as UHT metamorphism of Spr-bearing granulite is estimated at 1GPa degree, and afterwards isobaric cooling. The heat source satisfying such a condition, it is easy to explain that the heat derived from the mantle. The heated crust was partially melting, and granitic crust grows up by its magma. The basaltic magma of the heat source intruded in the crust and would make gabbro as low initial Sr isotope ratio.

In the Nd model ages of the feldspathic gneiss, a result of Mt. Bergin:2.3-2.7 Ga, Geffrey Hills:2.7-2.8 Ga, Fyfe Hills:2.8-3.4 Ga, and Mt. Cronus:3.3-3.7 Ga, were provided from West to central area of Napier Complex. Mt.Cronus, the near to the center of Napier Complex, is the oldest model age, and the outward is younger model age. It show that the growth process of the Napier Complex as a continent crust, if there is a meaning of a difference ages and the place.

<References>

Asami et al., 1998, Polar Geosci., 11, 172-199.
Asami et al., 2002, Precamb. Res., 114, 249-275.

Keywords: Napier Complex, charnockite, Sr, Nd isotope, continental crust, Archean, Proterozoic