

Reappraisal of geochronology of the Itsaq Gneisses in the Isua area

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The Earth is the active planet, characterized by biological and geological activity, including earthquake and volcanism due to plate tectonics. And, it is considered that the emergence of the life and beginning of the plate tectonics go back to the Early Archean and Hadean. However, the evidence is still controversial because the Eoarchean terranes are few: Acasta Gneiss Complex, Canada, Itsaq Gneiss Complex, southern West Greenland, Saglek Block, Labrador, Canada and Nuvvuagittuq Belt, Canada. Especially, previous works reported a line of evidence for the life and plate tectonics from the Itsaq Gneiss Complex in the Eoarchean so that the geochronology of the terranes is quite important.

Recent geochronological studies of U-Pb dating of zircons from orthogneisses in the Isua area showed the northern part is dominated by 3700 Ma orthogneiss whereas the southern part by 3800 Ma orthogneiss. Nutman et al. (2009) proposed that the Isua area was formed through collision and amalgamation of two distinct terranes based on the different ages. They also interpreted that the suture zone occurs along a chert layer in the Isua supracrustal belt. In addition, they emphasized that there are no older, >3700 Ma, materials in the northern part, distinct from the southern part with an older age. On the other hand, previous works considered recycling of continental materials insignificant, contrast to recent studies of age distribution of detrital zircons in sandstone and river sands (e.g. Komiya, 2011). In addition, co-occurring rocks with different ages does not necessarily need amalgamation of different terranes because granitic rocks are discontinuously and sporadically intruded into accretionary complexes in the subduction zones.

We studied Cathodoluminescence observation and U-Pb dating of zircons separated from three orthogneisses in the northern part and two in the southern part. Two of them in the northern part and the samples in the southern part were collected from the contact areas neighboring the supracrustal belt, and the other was collected from the central area of the orthogneiss. One of them in the southern part contains few zircons. We conducted the Cathodoluminescence observation at the Tokyo Institute of Technology and U-Pb dating of the zircons with the LA-ICPMS at the Kyoto University. The zircons from orthogneisses in both the northern and southern parts display oscillatory zoning and clear difference between the cores and rims on the Cathodoluminescence images. Especially, the zircons in the northern parts have relatively dark emission of the cathodoluminescence. The zircons in the northern part range from ca. 3660 to 3750 Ma in Pb-Pb ages; the average and oldest age are 3720 and 3759±56 Ma, respectively. On the other hand, the zircons in the southern part range from ca. 3750 to 3800 Ma in Pb-Pb ages; the average is 3770 Ma.

In summary, the obtained ages in northern and southern parts are consistent with those determined by previous works. However, the combination of U-Pb dating with Cathodoluminescence observation obviously shows that despite of clear boundary between them, the cores and rims of zircons have almost the same ages, which may need the reappraisal of geochronology of the ages in the northern and southern parts because of resetting of ages of zircons.

Keywords: Early Archean, Isua Supracrustal Belt, Cathodoluminescence