

Geological comparison between three Eoarchean supracrustal complexes: the Isua Supracrustal Belt, southern West Greenland, Nulliak supracrustal rocks, Labrador, and Nuvvuagittuq supracrustal belt, northern Quebec

*Tsuyoshi Komiya¹, Shinji Yamamoto², Shogo Aoki³, Hiroki Uehara¹, Yoshida Satoshi¹

1. Department of Earth Science & Astronomy Graduate School of Arts and Sciences The University of Tokyo, 2. Graduate School of Environment and Information Sciences, Yohohama National University, 3. Faculty of Biosphere-Geosphere Science, Okayama University of Science

The early Earth is one of the most interesting issues and unsolved themes in the history of the Earth. Especially, the tectonics, surface environment and life on the early Earth are attractive to not only geologists but also biologists and planetary physicists. Although the oldest crust, whose age is up to 4.03 Ga, is preserved in the Acasta Gneiss Complex, it comprises only granitic gneiss with little amount of metabasite. Therefore, only three Eoarchean geologic terrains of the Isua Supracrustal Belt (ISB), southern West Greenland, Nulliak supracrustal rocks (NSR), Labrador, and Nuvvuagittuq supracrustal belt (NSB), northern Quebec may provide the information of the tectonics, surface environment and life on the early Earth. We will present geological and geochemical review of the three geologic complexes, and comparison among them.

The ISB is one of the best places for studying the environment and life in the Eoarchean because the supracrustal rocks underwent relatively low-grade metamorphisms from the upper greenschist to amphibolite facies condition, and weak deformation. Komiya et al. (1999) showed the northeastern part of the belt comprises fourteen subunits bounded by layer-parallel faults, which have similar lithostratigraphy from basaltic rock through chert to mafic clastic sedimentary rock in ascending order to each other. Its geological and lithostratigraphic similarity to modern accretionary complexes allowed us to suggest the ISB originates from ancient accretionary complex, and imply that plate tectonics was in operation even in the Eoarchean. However, Nutman and colleagues proposed that the ISB comprises three units with different tectonothermal histories, and also suggested that carbonate rock and chert were formed in shallow-water environment because of occurrence of stromatolite. Last year, we updated our geological map to solve the inconsistency between the groups. The results seem to be still consistent with our interpretation.

The NSB contains ultramafic rocks, mafic rocks, banded iron formation (BIF), chert, conglomerate, gabbroic and felsic intrusions. Previous work subdivided the mafic and ultramafic rocks into three groups of High-Ti, depleted Low-Ti and enriched Low-Ti Ujaraaluk units based on their TiO_2 contents and REE patterns, and considered that they are conformably piled up in ascending order. In addition, the ultramafic rocks were considered as sills. Recent our geological survey suggests that the belt contains many fine-grained felsic and pegmatitic intrusions in addition to those rocks, and that the ultramafic rocks originate from volcanic rock because they conformably underlie the BIF. The geochemical difference was derived from later alteration due to the intrusions. The conglomerate may originate from the deformed felsic intrusions.

The NSR contains ultramafic rock, mafic volcanic rock, chemical sedimentary rocks of BIF, chert and carbonate rock, and clastic sedimentary rocks of pelitic rock and conglomerate, and were intruded by

over 3.9 Ga orthogneiss (Iqaluk Gneiss). Some Nulliak supracrustal belts comprise fault-bounded subunits of mafic/ultramafic rocks, chemical sedimentary rocks and clastic sedimentary rocks in ascending order, similar to the lithostratigraphy and geological structure in modern accretionary complexes. Ophiolite sequence from ultramafic rock through layered gabbroic rock to fine-grained amphibolite and sedimentary rock is present in the Shuldham Island. The geological structures suggest that it was also an Eoarchean accretionary complex.

Geological and lithostratigraphic difference among the three geologic terrains suggests that they were formed in different tectonic settings. The combination of three areas allows us to more comprehensively understand the tectonics, surface environment and organisms in the early Earth.

Keywords: Eoarchean, Isua supracrustal belt, Saglek block, Nulliak supracrustal rocks, Nuvvuagittuq supracrustal belt