

Geology of the Eoarchean (>3.95 Ga) Nulliak supracrustal belt, Labrador, Canada: The oldest evidence for plate tectonics

KOMIYA, Tsuyoshi^{1*}

¹Department of Astronomy & Earth Sciences, The University of Tokyo, Komaba

The earth is a unique planet, which has been highly evolved, diversified and complicated through geologic time, and underwent many key events, including giant impact, magma ocean, core formation, large-scale mantle differentiation and late heavy bombardment, especially in the dawn. But, our knowledge of early earth is limited due to the lack of the Hadean supracrustal rocks. The supracrustal rocks with the Eoarchean ages provide key evidence for early evolution of the earth, but few supracrustal rocks have been comprehensively investigated. Therefore, we mapped in seven areas of the Saglek Block, northern Labrador, where ancient supracrustal sequences are interleaved with a diverse assemblage of orthogneisses. Early studies suggested that some of them have the Mesoarchean ages because of lack of the Mesoarchean Saglek dyke, but we found the Saglek dykes in the areas to recognize the Eoarchean Nulliak supracrustal rocks and Uivak Gneiss in all the areas. Recent reassessment of U-Pb dating and cathodoluminescence observation of zircons from the oldest suites of the Uivak Gneiss showed that the Uivak Gneiss has the Eoarchean age, >3.95 Ga, and forms the Ittusaq-Uivak Gneiss series. Because our geological survey clearly showed that the Ittusaq-Uivak Gneisses were intruded into the Nulliak supracrustal belts, the Nulliak supracrustal rocks are the oldest supracrustal rock in the world. The supracrustal belts consist of piles of faults-bounded blocks, which are composed of the ultramafic rocks, mafic rocks and sedimentary rocks in ascending order, similar to modern ocean plate stratigraphy (OPS). In addition, small-scale duplex structures are found in all the areas. The presence of duplex structure and OPS indicates that the >3.95 Ga Nulliak supracrustal belts originate from an accretionary complex. The presence of the accretionary complex, ophiolite and granitic continental crust provides the oldest evidence for the plate tectonics on the early earth.

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