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Geology and geochronology of the Saglek Block, northern Labrador, Canada

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The Saglek-Hebron area is located in the northeastern part of the Labrador Peninsula, northeast Canada, and belongs to a coastal, central part of the early Archean terrane, called Saglek Block. The block is the west end of the North Atlantic Craton from the Scotland through the southern part of Greenland to the Labrador. The block contains well-preserved Early to Late Archean suites including the Nulliak supracrustal assemblage (>3.73 Ga), *ca.* 3.73 Ga Uivak TTG gneisses, 3.24 Ga Lister gneiss and *ca.* 2.5 Ga granite. In addition, Collerson (1984) and Collerson and Regelous (1995) found >3.9 Ga zircon cores, and suggested pre-3.8 Ga Nanok Fe-rich monzodioritic gneiss. However, the origin of the >3.9 Ga zircon cores is still obscure: inherited or directly crystallized from the host magma (Schiotte et al., 1989: Krogh and Kamo, 2006). The orthogneisses and supracrustals underwent high-grade metamorphism, locally reaching granulite facies at 2.8-2.7 Ga. In the area, the orthogneisses are predominant, and account for about 80 %. It is considered that the Nulliak supracrustal assemblage and Uivak TTG gneisses are equivalent to the Akilia association and Amitsoq gneiss complex in southern West Greenland, respectively. However, the detailed geology within the supracrustal belts, and the relationship between the supracrustal belts and surrounding orthogneiss complex is still unclear. Additionally, detailed geochronological works, including comprehensive dating with LA-ICPMS and cathodoluminescence for igneous and detrital zircons, still lack. Thus, we made detailed geological maps at 9 areas, including relatively low metamorphic grade areas, amphibolite facies condition in order to reveal the Nanok Gneiss, and find the oldest rocks in this area. Especially, we made detailed sketch maps to describe cross-cutting relationships among orthogneisses and determine the oldest suite in each outcrop. In addition, we conducted LA-ICPMS U-Pb dating of zircons from the orthogneisses.

We classified the orthogneisses into eight groups based on the cross-cutting relationships in each outcrop and the distribution of zircon ages: ˜3.90 Ga, 3.83 Ga, 3.73-3.65 Ga, 3.60 Ga, 3.35 Ga, 2.84 Ga, 2.73 Ga and 2.56 Ga, respectively. The presence of >3.9 Ga zircons provides very important constraint on the formation of felsic continental crust because of the second oldest ages in the world. Collerson (1983) named the pre-3.8 Ga orthogneiss the Nanok Gneiss, but they could not obtain compelling evidence that the >3.8 Ga zircon grains are not inherited/xenocrystic grains. However, the age distribution of oscillatory-zoned zircon grains in the oldest group of the orthogneisses shows presence of older zircons than 3.8 Ga, with the maximum age of 3,956 Ma in $^{207}Pb/^{206}Pb$ age, and apparent lack of 3.7 to 2.7 Ga zircons. In addition, field observation clearly differentiates two orthogneiss suites in an outcrop, and shows the gneiss containing >3.90 Ga zircons is cut by a 3.83 Ga gneiss. The age distribution of the zircons and field occurrence indicates that the old grains, >3.9 Ga, are not inherited or xenocrystic zircons in young (3.7 to 3.8 Ga) orthogneiss but the host orthogneiss were formed at >3.9 Ga. As a result, our geochronological and geological study provides line of evidence of the >3.9 Ga Nanok Gneiss in the Nain Complex.

The Nanok gneiss is the second oldest rock to the Acasta gneiss in the world. The geological relationship that the Nulliak supracrustal rocks are intruded by the orthogneisses implies that the supracrustal rocks also have >3.9 Ga ages, and they are the oldest supracrustal rocks in the world.

Keywords: U-Pb dating, Early Archean, zircon, orthogneiss, supracrustals