Geochemistry and geochronology of the orthopyroxene felsic gneisses with TTG composition in the Napier Complex, East Antarctica

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Tonalite-trondhjemite-granodiorite, the so-called TTG suite, compose most of the preserved Archaean crust in Precambrian shield. The Napier Complex, East Antarctica, is composed mainly of granulite facies gneisses. The Mt. Riiser-Larsen area in this complex consists of various kinds of metamorphic rocks, which are classified into the layered gneiss series (LGS) in the central to western part and the massive gneiss series (MGS) in the southern to southeastern part. The MGS is dominated by orthopyroxene (Opx) felsic gneiss. The LGS and MGS may correspond to greenstone belt and granitoid belt in the greenstone-granitoid terrains, respectively.

The Opx FG in MGS consists of orthopyroxene - mesoperthite - quartz with minor clinopyroxene - magnetite - ilmenite - apatite - zircon - monazite. The geochemical features of Opx FG is demonstrated as follows: 1) SiO_2 contents of 62 to 71wt%, 2) a non-alkaline rock on the (Na_2O + K_2O) - SiO_2 diagram, 3) a calc-alkaline affinity on the AFM diagram, 4) tonalitic to granodioritic compositions on the normative An-Ab-Or diagram, 5) negative anomalies in Ta, Nb, P and Ti on the spiderdiagram normalized to primitive mantle, and 6) low YbN on the chondrite normalized (La/Yb)N - YbN relations. These chemical data of the Opx FG suggest that they are similar to Archaean TTG or Gray gneiss of the Archaean terrane over the world.

In this area, the geochemical affinities (mineral composition, concentration of minor elements, Sm-Nd isotopic investigations, and electron microprobe U-Th-Pb chemical age) classify the Opx FG into two groups.

Type-1: XMg of orthopyroxene to be approximately 0.6, REE patterns showing the gradually depleted HREE and no Eu anomaly, $^{147}Sm/^{144}Nd$ being 0.08 to 0.10, the broad range of zircon age of ca 2.5 Ga to over 2.5 Ga by electron microprobe U-Th-Pb chemical analyses.

Type-2: XMg of orthopyroxene to be approximately 0.5, REE patterns showing the more depleted MREE and HREE than type-1 and the positive Eu anomaly with increasing SiO_2 content, $^{147}Sm/^{144}Nd$ being 0.11 to 0.12, and the zircon age defined at ca 2.5 Ga.

The reference data of Sm-Nd whole-rock isochron imply that type-1 was formed at ca 3.0 Ga. On the other hand, type-2 may have been generated at ca 2.5 Ga and suffered the auto-metamorphism continuously.