

U-Pb age of the zircons in gneisses from Mt. Riiser-Larsen in the Napier Complex, East Antarctica

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The Napier Complex in East Antarctica consists predominantly of ultra high temperature (UHT) metamorphic rocks. Many geological and geochronological investigations have been conducted in order to reveal the timing of UHT metamorphism in this area.

We dated U-Pb ages of zircons in three different types of gneisses: (1) osumilite-bearing garnet orthopyroxene quartzofeldspathic gneiss, (2) garnet felsic gneiss, and (3) orthopyroxene quartzofeldspathic gneiss, by using laser abrasion inductivity coupled plasma mass spectrometry (LA-ICP-MS) at Tokyo Institute of Technology. Internal texture of zircon was assessed using backscattered electron image (BSE) prior to the analysis.

Zircons in the osumilite-bearing garnet orthopyroxene quartzofeldspathic gneiss have an average diameter of 150 μm . Patchy structure appeared in the majority of zircon grains. U-Pb ages of the zircons are spread from 2400 to 2900 Ma and a peak of 2728 Ma is appeared in the histogram. Older (2760 Ma) ages are thought to be inherited ages, since these ages are obtained from the euhedral zircon core. Based on the observation of BSE images of the analyzed zircon grains, ages ranged from 2450 to 2760 Ma seem to be mixture ages between euhedral and metamorphic zircons. Ages from 2439 to 2475 Ma were obtained from metamorphic part of zircon grains. These ages reflect complete or partly reset of the U-Pb system in these zircons.

Zircons in the garnet felsic gneiss have an average diameter of 100 μm . Oscillatory-zoned structure appeared in the majority of these zircons. U-Pb ages of the zircons are spread from 2400 to 2800 Ma and a peak of 2558 Ma is appeared in the histogram. Older (2700 Ma) ages are thought to be inherited ages, since these ages are obtained from the euhedrally-zoned zircon cores. Since Th/U ratio and uranium concentration of zircons in the osumilite-bearing garnet orthopyroxene quartzofeldspathic gneiss differs from those in garnet felsic gneiss, origin of these inherited zircons are thought to be different. Ages from 2550 to 2680 Ma and 2450 to 2500 Ma were obtained from distinct metamorphic part of zircon grains.

Zircons in the garnet orthopyroxene quartzofeldspathic gneiss have an average diameter of 70 μm . Zoned structure appeared in the majority of these zircon grains. U-Pb ages range from 2200 to 2550 Ma and a peak of 2370 Ma is appeared in the histogram. Ages of zircons are divided into two groups; zircons with high Th/U ratio and low U concentration (about 200 ppm) yielded 2430-2500 Ma ages, and others have U concentration ranging 200-1600 ppm and Th/U ratio of 0.01-3 that yielded 2300-2430 Ma age.

Zircon morphology and internal zoning suggest that one metamorphic event occurred during 2430-2500 Ma. Another metamorphic event started at c. 2370 Ma and continued to 2300 Ma.

Our U-Pb dating results imply presence of at least three metamorphic events in the Mt. Riiser Larsen area, at 2.37 Ga, 2.4-2.5 Ga, 2.55-2.68 Ga. Ages older than 2.7 Ga may represent the inherited protolith ages.