

Geological and geochemical characteristics of UHT metamorphic rocks from the Amundsen Bay region in the Napier Complex, East Antarctica

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The Tonagh and Bunt Islands locate in the southern-end of Amundsen Bay, northern Enderby Land, which belongs to the central Napier Complex and shows a part of the highest-grade metamorphic region in the Napier Complex. The islands are mostly underlain by various kinds of ultrahigh-temperature (UHT) metamorphic rocks. UHT-metamorphic rocks from the Tonagh Island are subdivided into five lithologic units (Units I to V) owing to their lithologies and geological structures from north to south bounded by thrust-shear zones, accompanying with remarkable anhydrous mylonite and later pseudotachylite-cataclasite.

A geological perspective of the metamorphic rocks from the Tonagh and Bunt Islands is generally classified into 8 types on the regional map scale such as (1) Opx-bearing quartzofeldspathic charnockitic gneiss, (2) Grt-bearing quartzofeldspathic gneiss, (3) Opx-Cpx-bearing mafic granulite, (4) Grt-Opx gneiss and granulite, (5) Mt-Qz gneiss, (6) metamorphosed ultramafic rocks, (7) layered gneiss 1 (composed mainly of mafic gneiss and Opx-bearing quartzofeldspathic gneiss), (8) layered gneiss 2 (composed mainly of mafic gneiss and Grt-bearing quartzofeldspathic gneiss) with subordinate meta-impure quartzite, Spr-bearing aluminous restitic granulite, and calc-silicate granulite. Types-(1) and -(2) are main constituents of the Tonagh Island and Osm- and Spr-bearing aluminous granulite is characteristically found in Bunt Island.

Especially the Unit I of the Tonagh Island has a peculiarity of predominance of layered gneisses showing thin alternation (centimeter to several meters in thickness) of various kinds of UHT metamorphic rocks (mafic, intermediate and felsic in bulk chemical compositions) and metamorphosed ultramafic rocks (pyroxenite and Iherzolite). All these metamorphic rocks show a simple variation trend from the komatiite field to the rhyolite field and have bimodal chemical clusters of ultramafic-mafic and highly quartzofeldspathic in compositions. Spr- and Osm-bearing granulite as a typical UHT metamorphic rock have silica-undersaturated and aluminous chemical compositions, which would have formed as the restite and/or metasomatic reaction product under the UHT condition. The Spr- and Qz-bearing granulites have also derived from partial melting of metamorphic rocks having pelitic composition. In any case, most of the metamorphic rocks from the Tonagh and Bunt Islands got the anhydrous mineral assemblages excepting later retrograde hydration with forming micas and amphiboles during the highest-grade metamorphism of 2480-2550 Ma.

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