Gb-017 Room: IM Time: June 8 16:15-16:30

Thermal climax and its P-T conditions of the UHT gneisses from the high-grade region in the Napier Complex, East Antarctica

Tomokazu Hokada [1], Masahiro Ishikawa [2], Hideo Ishizuka [3], Yasuhito Osanai [4], Satoko Suzuki [1]

[1] Grad. Univ. Advanced Studies / NIPR, [2] Dept of Environmental Sci, Yokohama National Univ, [3] Dept. Geol., Kochi Univ., [4] Earth Sci., Okayama Univ.

Phase relations and alkali feldspar (mesoperthite) compositions of the ultrahigh-temperature metamorphic rocks from Mt. Riiser-Larsen and Tonagh Island, which are located on the high-grade region in the Napier Complex, are examined. Mineral compositions of alkali feldspar from both localities indicate the equilibrium temperature of > 1100 C. This suggests that the high-grade region in the Napier Complex has been regionally achieved such extra-high temperature condition. Pressure differences between the subareas, which are divided by shear zone, within the Mt. Riiser-Larsen area are estimated from phase relations, suggesting that the pressure condition may not increase monotonously southward in the high-grade part of the Napier Complex as is previously proposed.

Ultrahigh-temperature (UHT) metamorphism, which is defined as a crustal metamorphism at peak conditions of greater than 900 C (e.g., Harley, 1998), is characterized by the occurrences of sapphirine + quartz paragenesis, osumilite and metamorphic pigeonite. This study discusses the thermal climax and its P-T conditions of the ultrahigh-temperature metamorphic rocks from the high-grade region in the Napier Complex, East Antarctica, based on phase relations and alkali feldspar (mesoperthite) compositions.

Mt. Riiser-Larsen and Tonagh Island are located on the high-grade region in the Napier Complex, and they are about 40 km away from each other. Felsic gneisses and mafic granulite constitute the main part of the areas, and garnet gneiss, garnet-sillimanite gneiss, siliceous gneiss, magnetite-orthopyroxene-quartz gneiss, aluminous gneisses and ultramafic rocks are minorly intercalated within the above layers. Sapphirine and osumilite are generally contained in Mg-rich felsic, siliceous and aluminous gneisses.

The Mt. Riiser-Larsen area is divided into the central and the western parts by mylonite- and pseudotachylite-bearing shear zone of ca. 200 m wide (Riiser-Larsen Main Shear Zone). In the central area, sapphirine + orthopyroxene + quartz, garnet + osumilite and sapphirine + garnet + quartz parageneses in felsic, siliceous or aluminous gneisses constrain the peak conditions of > 1030 C and 0.6 - 0.9 GPa. Mineral compositions of alkali feldspar (mesoperthite) in felsic, garnet-sillimanite and aluminous gneisses indicate equilibrium temperature of > 1100 C based on ternary feldspar solvus. On the other hand, in the western area, the occurrences of sapphirine + orthopyroxene + quartz paragenesis and osumilite without coexisting with garnet suggest the peak conditions of similar P-T or slightly lower-T / higher-P than the central area.

Among the sapphirine + quartz parageneses described above, thin retrograde reaction film is occasionally observed between sapphirine and quartz. Reaction products are cordierite or garnet in the central area, whereas orthopyroxene + sillimanite in the western area. They are formed by the following FMAS divariant reactions.

The central area:

Mg-rich Spr + Mg-rich Opx + Qtz = Fe-rich Spr + Fe-rich Opx + Crd (1)

Fe-rich Spr + Fe-rich Opx + Qtz = Mg-rich Spr + Mg-rich Opx + Grt (2)

The western area:

Fe-rich Spr + Qtz = Mg-rich Spr + Opx + Sil (3)

These reactions occur slightly below the peak conditions (ca. 1000 C), and the reactions (1) and (2) are stable at lower-pressure than the reaction (3). These suggest that the western area represents deeper structural level than the central area and that they have juxtaposed due to the shear zone activity.

Phase relations of the metamorphic rocks in Tonagh Island are difficult to analyze because of quartz-free mineral parageneses. Element partitioning between garnet and orthopyroxene indicates equilibrium temperature of less than 1000 C. Mineral compositions of alkali feldspar (mesoperthite) in aluminous gneisses from the island indicate equilibrium temperature of > 1100 C, which is equivalent to those from the Mt. Riiser-Larsen area.

Above estimations suggest that the culminant temperature of over 1100 C is achieved regionally in the high-grade region of the Napier Complex, and give a significant constraint on the heat source and tectonic process of the complex. A variety of reaction textures after sapphirine + quartz are reported various localities in the high-grade part of the Napier Complex. Harley (1998) summarized that cordierite and garnet are produced after sapphirine + quartz in the northern part representing lower-pressure than orthopyroxene + sillimanite in the southern part. However, the above observation suggests that pressure condition within the high-grade region in the Napier Complex may not increase monotonously southward as is summarized in

Harley and Hensen (1990).