New geochronological report of tonalitic gneisses at Harvey Nunatak and Mt. Reed in western part of Napier Complex, East Antarctica

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The Napier Complex in East Antarctica is well known as a region which has both of evidence of ultrahigh-temperature (UHT) metamorphism (e.g., Sheraton et al., 1987; Harley & Hensen 1990) and long Archaean crustal history from 3800 Ma to 2500 Ma (e.g., Harley & Black 1997). In particular, Mt. Sones and Gage Ridge regions are famous as evidence of Hadean to Eoarchean (Black et al., 1986; Harley & Black 1997). For other regions, previous workers also reported possibility of the early Archean crust. For example, the Fyfe Hills and Mt. Cronus regions in the western part of the Napier Complex are the areas where ancient >3800-3600 Ma zircon ages have been obtained (Compston and Williams, 1982; Asami et al., 2002). On the other hand, 3000 Ma or younger protolith ages were also reported from the Fyfe Hills and Mt. Cronus regions (Horie et al., 2012), which is quite important to confirm the reported early Archaean crustal ages in order to promote a discussion about the Archean crustal history in the Napier Complex. Moreover, the timing of ultrahigh-temperature metamorphism is still in argument either >2550 Ma or <2480 Ma (Kelly and Harley, 2005).

We first focused and analyzed tonalitic gneisses (23-2A-09 and 23-1A-06) using a sensitive high resolution ion-microprobe (SHRIMP IIe) at the National Institute of Polar Research, Japan. The samples, 23-2A-09 and 23-1A-06, were collected at the Harvey Nunatak and Mt. Reed, respectively, which are located close to Mt. Sones, during the field work at the 2016-2017 Japanese Antarctic Research Expedition (JARE). The geochronological data from the Harvey Nunatak and Mt. Reed had never been reported. The samples were crushed by a high-voltage pulse power fragmentation device (Selfrag Lab) to preserve the external morphology of zircons and prevent contamination (Takehara et al., 2018). After pulverizing, the zircon grains were concentrated using conventional mineral separation techniques, including heavy liquid separation with methylene iodide and magnetic separation.

Zircon grains collected from a tonalitic gneiss (23-2A-09) at the Harvey Nunatak have mostly fractures but slightly inclusion based on the observation of transmitted light images by optical microscope. BSE images show that some zircon grains have darker BSE-response domains, which suggests depletion of contents of Zr and Si during hydrothermal alteration of zircon even in the ultrahigh-temperature metamorphic region. In the darker BSE-response domains in zircons, small inclusions (~3 mm) of galena (PbS) are observed. U–Pb data of the zircons show mostly concordant data and discordance (Disc.(%) = 1 –(^{206}Pb/^{238}U age)/(^{207}Pb/^{206}Pb age)} ×100 (e.g, Song et al., 1996)) ranges from -5 to +9%. Preliminary weighted mean of ^{207}Pb/^{206}Pb age is 2485.1±3.4 Ma (95% confidence) and MSWD is 1.6. However, the zircons show typically high U contents (average is ~2500 ppm). When U-Pb ages of zircons showing high U contents (particulary, >2500 ppm) are determined by SHRIMP, it is necessary to consider the correction of the matrix effect derived from the high U contents (Williams & Hergt, 2000; White & Ireland, 2012).

Zircon grains collected from a tonalitic gneiss (23-1A-06) at Mt. Reed have rounded habits and are typically <250 mm in size. CL images of the zircons revealed that bright CL-response domains surround

dark CL-response domains. The dark CL-response domains contain mineral inclusions such as quartz, K-feldspar, plagioclase, ilmenite, and rutile, whereas the minerals inclusions are absence in the bright CL-response domains. U–Pb data (n =129) of the zircons are scattered from 2858 to 2344 Ma and show several age peaks centered at 2798, 2712, 2660, 2478, and 2449 Ma. The components of the youngest age peak were obtained from the bright CL-response domains with crystal face, which suggests that the last crystal growth occurred at ca. 2449 Ma. Detailed observation by using Gatan ChromaCL2 installed with a field emission SEM (FE-SEM; JEOL JSM-7100F) revealed that the dark CL-response domains have patchy texture forming during regional metamorphism and suggests that it is necessary to pay attention to discuss about geochronological data.
In presentation, we will discuss geochronological interpretaion of the zircons based on more detail geochemical information.

