東南極ナピア岩体西部地域におけるジルコン酸素同位体の予察報告

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Preliminary report of zircon oxygen isotope record in western part of the Napier Complex, East Antarctica

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The oxygen isotopic composition of zircon is a powerful tool to characterize parental magma, complementing trace element data. Recently technical improvements of a secondary ion mass-spectrometer allow us to obtain highly accurate and precise oxygen isotope data of zircon from thin sections or grain resin mounts. Numerous studies show that non-metamicted zircons can preserve their oxygen isotopic ratios ($\delta^{18}O$) from the time of crystallization, even though high-grade metamorphism and anatexis. The zircon oxygen isotope record is generally preserved despite other minerals that have been disturbed by high-grade metamorphism or intense hydrothermal alteration due to slower diffusion rate.

The Napier Complex in East Antarctica has attracted considerable interest from a viewpoint of long Archaean crustal history from 3800 Ma to 2500 Ma and >1000˚C ultrahigh-temperature (UHT) metamorphism in a regional scale. There are many petrological, geochronological, and geochemical reports, but the zircon oxygen isotope data completely lack. In this study, we tried to analyze the zircon oxygen isotopes in garnet-bearing quartzo-feldspathic gneiss (YH05021606A) collected from Fyfe Hills in the Napier Complex.

The quartzo-feldspathic gneiss, YH05021606A, was collected by Y.H. during the field work at the 2004-2005 Japanese Antarctic Research Expedition. The zircon U–Pb ages of the YH05021606A sample are already reported in Horie et al. (2012) and shows multiple age peaks centered at ca. 3025, 2943, 2883, 2818, 2759, 2674, 2518, and 2437 Ma. Horie et al. (2013) picked zircon grains afresh and analyzed U–Pb ages, Th/U ratios, and rare earth elements (REE) compositions. The oxygen isotope analyses were performed on same resin disc as Horie et al. (2013). The zircon oxygen isotope analyses were carried out by a sensitive high-resolution ion microprobe (SHRIMP II) with the 5-head advanced multi-collector (AMC) at the National Institute of Polar Research, Japan. ^{16}O, ^{17}O, and ^{18}O were detected by the Faraday cups at low mass (LM), Axial, and high mass (HM), respectively, and were measured on 10^{11} Ω resistors in current mode. The surface of the grain mounts was coated by aluminum prior to the analysis.

The U–Pb analysis of zircon yielded similar age population to Horie et al. (2012) and revealed younger ages of ca. 2273, 2195, 2106, and 1980 Ma. C1-chondrite-normalized REE abundance patterns of the YH05021606A zircons were characterized by a large fractionation between light REE (LREE: La, Pr, and Nd) and heavy REE (HREE: Tm, Yb, and Lu), positive Ce anomalies, and negative Eu anomalies. The inherited zircons shows highly fractionated patterns between LREE and HREE. The zircons of ca. 2505 Ma and ca. 2490 Ma are characterized by weakly fractionation between middle REE (MREE: Gd, Tb, and Dy) and HREE. The HREE of ca. 2490 Ma zircons are more depleted than those of ca. 2505 Ma zircons, which indicates that growth of garnet had continued from ca. 2505 Ma to ca. 2490 Ma. The REE patterns of the younger age zircons are characterized by a large fractionation between MREE and HREE. Although the YH05021606A zircons have various U–Pb ages and trace element composition, the oxygen isotope analyses yielded homogeneous $\delta^{18}O$ ratios among zircon grains with various ages (5.68 ± 0.30 ‰). The $\delta^{18}O$ values of the YH05021606A zircons are consistent with those of zircon in equilibrium with the mantle (5.3 ± 0.6 ‰: Valley et al., 1994). In this presentation, the homogeneous $\delta^{18}O$ ratios in the Fyfe Hills zircons will be discussed.

References

Horie, K., Hokada, T., Hiroi, Y., Motoyoshi, Y. and Shiraishi, K. Contrasting Archaean crustal records in western part of the Napier Complex, East Antarctica: New constraints from SHRIMP geochronology, Gondwana Research, 21, 829–837, 2012.

Horie, K., Hokada, T., Hiroi, Y., Motoyoshi, Y. and Shiraishi, K. Characterization of Proterozoic ages in western part of the Napier Complex, East Antarctica, 4th Symposium on Polar Science, 2013.

Valley, JW., Chiarenzelli, JR. and McLelland, JM. Oxygen isotope geochemistry of zircon, Earth and Planetary Science Letters, 126, 187–206, 1994.