U-Pb and Lu-Hf isotopic study of detrital zircons from the Paleoproterozoic Murmac Bay Group in the Rae craton

HIKARU SAWADA[1*], YUKIO ISOZAKI[2], YUKIYASU TSUTSUMI[3], TSUYOSHI IIZUKA[4]

[1] Department of Earth and Planetary Sciences, Tokyo Institute of Technology / sawada.h.aa@m.titech.ac.jp
[2] Department of Earth Science and Astronomy, the University of Tokyo / isozaki@ea.c.u-tokyo.ac.jp
[3] National Museum of Nature and Science, Tsukuba / ytsutsu@kahaku.go.jp
[4] Department of Earth and Planetary Science, the University of Tokyo / iizuka@eps.s.u-tokyo.ac.jp

The ca. 2.3-2.1 Ga Murmac Bay Group (MBG) represents one of the best sedimentary records that preserve Eoarchean geologic information [1]. We performed U-Pb and Lu-Hf isotopic analyses of detrital zircons from the MBG orthoquartzites using LA-ICP-MS and LA-MC-ICP-MS. Our data clarified the episodic crust-formation during the Archean. ^{206}Pb-^{207}Pb age spectra show a major age cluster at ca. 2.5-3.3 Ga and a subordinately older one at c. 3.5-3.9 Ga. It is noteworthy that a distinct interval around 3.4 Ga exists in the ^{206}Pb-^{207}Pb age spectra. The εHf values of the detrital zircons range from +6 to -23. Hafnium model ages (T_{DM}) suggest three distinct episodes of juvenile crust generation at 2.6-3.2 Ga, 3.2-3.6 Ga, and 3.6-4.2 Ga. The zircons with Hf model ages of ca. 3.4 Ga have ^{206}Pb-^{207}Pb ages between 3.3 and 2.5 Ga. This suggests that juvenile crust was formed extensively at ca. 3.4 Ga and subsequently reworked by tectono-igneous events between 3.3-2.5 Ga. Our results further indicate that pre-existing Hadean/early Archean rocks were likely reworked into the late Archean vigorous continental crust. The absence of ca. 3.4 Ga zircon is not unique to the Rae craton but is common in the Proterozoic sedimenary rocks and the current basement of the Archean cratons in the rest of the world. On the other hand, clear peaks at ca. 3.4 Ga detrital zircon ^{206}Pb-^{207}Pb ages are reported by studies of sedimentary units older than 3 Ga. Our data, together with these observations, imply that 3.4 Ga granitic continental crust was once formed and later suffered by heavy reworking associated with the 3.3-2.5 Ga crust formation.

REFERENCES

[1] Ashton et al. (2013), Precam. Res. 232, 70-88.