Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SGL041-P01 Room:Convention Hall Time:May 25 14:00-16:30

U-Pb geochronology in western part of the Rayner Complex, East Antarctica

Kenji Horie[1*], Tomokazu Hokada[1], Yoichi Motoyoshi[1], Kazuyuki Shiraishi[1], Yoshikuni Hiroi[2]

[1]National Institute of Polar Research, [2]Chiba University

The Rayner Complex in East Antarctica was initially defined by Kamenev (1972) to include coastal outcrops and minor inland nunataks in western Enderby Land and Kemp Land adjacent to the Napier Complex and further east into MacRobertson Land where amphibolite-granulite-facies metamorphism occurred at ˜900 Ma (e.g., Sheraton et al., 1987). Shiraishi et al. (1997) and Motoyoshi et al. (2006) reported that western coastal region of this Complex contains younger zircons (537-522 Ma) and monazites (˜500Ma) than inland region (˜1320-760 Ma), and this western coastal region is later defined as Western Rayner Complex (Shiraishi et al., 2008). However, the boundary and the mutual relationship between the main Rayner Complex and the Western Rayner Complex is still remained ambiguity.

U-Pb isotopic analyses of zircon were performed for Mt. Yuzhnaya, Condon Hills, and Mt. Lira using a Sensitive High Resolution Ion Microprobe (SHRIMP II) at National Institute of Polar Research. The studied samples were collected during the field work at the 2004-2005 Japanese Antarctic Research Expedition. 3 garnet-biotite gneisses were collected from Mt. Yuzhnaya and Mt. Lira, respectively. 2 garnet-biotite gneisses and quartzite were collected from Condon Hills.

U-Pb age data of three gneiss samples from Mt. Yuzhnaya are scattered from 572 to 2462 Ma. The gneiss samples show continuous age population ranging from 860-1030 Ma and older inheritances centered at ca. 1940 Ma and ca. 2181 Ma. Two gneiss samples are characterized by young age population at around 580 Ma and lower Th/U ratios. The other gneiss sample does not contain zircons of ca. 580 Ma, and shows the youngest age peak of 890 Ma. Three gneiss samples from Condon Hills contain inheritance older than 2500 Ma. The oldest zircon ages are over 3600 Ma. Main age population of Condon Hills samples are centered at ca. 2073 Ma, ca. 1934 Ma, and ca. 1878 Ma. Overgrowth rim with low Th/U ratio yields a weighted mean $^{206}Pb/^{238}U$ age of 894 +/- 2Ma (95% confidence).

Based on these newly obtained zircon data, we could suggest the following points:

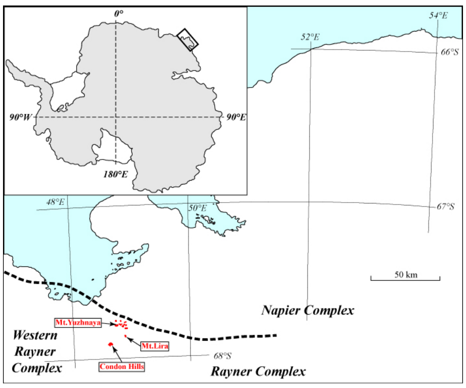
(1) The ca.1000˜860 Ma Rayner metamorphic event is commonly recorded in these areas.

(2) The presence of common magmatic 2200-1940 Ma zircons in all analyzed samples suggests that the area share the common history after the supply of sediments with these age materials.

(3) Neoproterozoic ˜580 Ma age event, which is relatively older than the previously reported 530-520 Ma ages, is obtained only in two samples from Mt. Yuzhnaya and is typically lacked in Condon Hills samples.

(4) Archean inherited (>2500 Ma) zircon is only found from Condon Hills.

These lines of geochronological evidences combined with the petrographical data can constrain the geologic evolution of Proterozoic-Cambrian boundary region of this part of Antarctica.



Keywords: East Antarctica, Rayner Complex, Western Rayner Complex, zircon, U-Pb geochronology

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Paleomagnetic direction of the Pliocene PM tephra, Himi area (Toyama Prefecture), central Japan

Hiroyuki Hoshi[1]*

[1]Aichi University of Education

The PM tephra, a prominent felsic tephra bed in the Pliocene sedimentary sequence in Himi, has been sampled for deciphering its rock magnetic and paleomagnetic properties. 10 oriented cores were taken from the uppermost fine-grained vitric ash layer at one locality, and detailed alternating-field and thermal demagnetization experiments were performed for 20 cylindrical samples cut from the cores in order to isolate remanent magnetization components. More than half of the samples had a single magnetic component with a northerly and down direction close to the present geomagnetic field direction (i.e. normal polarity). However, six samples which also provided a normal polarity linear component displayed a directional change along a great circle during stepwise demagnetization, indicating the presence of another higher coercivity/unblocking temperature component. Application of the great circle method disclosed that component which possesses a SSW and up direction (i.e. reversed polarity). A previous study has reported that the PM tephra is normally magnetized; however, I interpret that the normal polarity direction is most likely a viscous remanent magnetization and the primary magnetization is of reversed polarity. This interpretation is concordant with tephrostratigraphic investigations suggesting that the PM is correlated to the reversely magnetized tephras in several areas of central Japan collectively referred to as the Znp-Ohta tephra, a widespread tephra at about 4 Ma (upper Gilbert Chron).

Keywords: paleomagnetism, Pliocene, PM tephra, Znp-Ohta tephra, Himi

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Observation of fission-tracks in zircon by Atomic Force Microscope (AFM)

Shinnosuke Ohishi[1*]

[1]Kanazawa Unive. Natural Sci. & Tech.

Fission track (FT) method is a dating technique based on the observation of damages (tracks) by spontaneous fission of 238U left in a mineral. The date is calculated from the track density and the uranium concentration in the mineral because the number of tracks is a function of the uranium concentration and time. Usually the number of tracks is counted under an optical microscope after etching (chemical expansion of a track). However, as the density of FT rises, it becomes difficult to count the number of tracks because FTs overlap each other unable to distinguish. Therefore, the measureable density is limited to some extent due to etching process and the resolution of the microscope. To expand FT methods to date minerals with high FT densities, preventing the tracks from lying on top of each other by shortening the etching time, and observation with the higher magnification and resolution microscope than the optical microscope should be effective. Atomic force microscope (AFM) possesses high resolution with nano order, so that has the potential to count FTs with higher density. This research examines FT dating of zircon by using AFM.

AFM, which is a kind of the scanning probe microscope, observes a sample surface by scanning with the in-depth probe. Unlike electron microscope is able to observe without special pretreatment such as carbon coating, and tracks never disappear because it does not give energy. Moreover, high resolution and three dimensional information on sample surface can be easily obtained in the atmosphere so that it is not necessary to put a sample under the vacuum.

Zircons with track densities of about 4*106cm-2 and about 11*106cm-2 are observed. To obtain the AFM image for a sample prepared for FT dating, it is very important to remove the static electricity of the sample and to have flat surface wider than about 30 micro meter. Polishing with fine grained compound is essential. Two scanning methods, the AC(Tapping) mode (Scanning with the in-depth probe vibrating at a constant cycle) and the Contact mode (Scanning with the in-depth probe always approached), were tested to result that the Contact mode shows clearer image. To confirm how tracks can be identified under the AFM image, the image was compared with the image obtained with the optical microscope. When change in track shape and number is observed through step-wise etching, the track expands as the etching time increases, and the etching rate was smaller for tracks with a large size than those of small in size. Moreover the track that was not able to be seen with the optical microscope because the etching is insufficient can already be observed by AFM at same etching stage. As a result, the possibility of FT dating with high track densities using AFM was shown.