Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)
©2011. Japan Geoscience Union. All Rights Reserved.

SGL041-P03 会場:コンベンションホール 時間:5 月 25 日 14:00-16:30

原子間力顕微鏡 (AFM) によるジルコン中のフィッショントラックの観察
Observation of fission-tracks in zircon by Atomic Force Microscope (AFM)

大石 新之介 [1*]
Shinnosuke Ohishi[1*]

[1] 金沢大学大学院自然科学研究科
[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.