

## Observation of radiation damage in zircon by atomic force microscope and its application to geochronology

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Fission track (FT) method is a dating technique based on the observation of damage (tracks) by spontaneous fission of <sup>238</sup>U left in a mineral. The number of tracks is counted under an optical microscope after etching (chemical expansion of a track). However, as FT density per unit area rises, it becomes difficult to count the number of tracks. This is due to the fact that FTs overlap one another and are unable to be readily distinguished. This research examines the potential of atomic force microscope (AFM) for FT dating using zircons after a short time etching.

Zircons with track densities of about 4, 6.5, 10, and 20 ( $10^6/\text{cm}^2$ ) are observed. The clearer image for a short time etching is obtained after polishing with colloidal silica solution. Several tracks were found connected through step-etching. Thus, to measure the exact track density, correction in number of tracks is necessary by comparing the images before and after etching. FT ages were calculated using the corrected track densities, and agreed with the ages obtained by conventional methods.

In addition to fission tracks, there were numerous topographic lows in an AFM image. Due to these topographic lows, the cross sections shows cyclic waves. Number of these lows are estimated from the wavelength of the cyclic waves under the assumption that these topographic lows distribute on the surface evenly. As the result, the value obtained from wavelength of 0.10 micron was matched in the order to the expected number of alpha recoil tracks.

Keywords: atomic force microscope, fission track, alpha recoil track