Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.31314

Fission track etching in apatite – practical implications

FLORIAN TRILSCH[1], HONGYANG FU[1,2], CAROLIN ASLANIAN[1], RAYMOND JONCKHEERE[1] AND THORSTEN NAGEL[3]

[1]TU Bergakademie Freiberg, Germany
[2]Key Laboratory of Tectonics and Petroleum Resources, Ministry of Education, China University of Geosciences, China
[3]Institut für Geologie, TU Bergakademie Freiberg, Germany

Apatite fission track thermal modelling rests on counting and measuring the length of etched surface and confined fission-tracks. Track labs use a small number of protocols for etching tracks and measuring their lengths. Problems in reproducing length measurements remain. There were, however, few attempts to understand the process of etching fission tracks in apatite in detail. Our new radial etch model is capable of explaining the geometry of etched tracks better than previous simplified v_T-v_B models. The anisotropic radial etch rate v_R was determined for apatites with different chemical compositions by remeasuring tracks after two or several consecutive etch steps. This allows calculating effective etch times of individual confined tracks in geological samples by measuring their widths. This has several practical consequences. It removes the need for fixed etch protocols and instead allows to adjust immersion times for individual geological samples depending on their properties. E.g., all apatites could be etched to the same Dpar, i.e. to the same state. Fast etching apatites could be etched for a shorter time than slow etching apatites. Selecting tracks within a certain range of effective etch times will improve the reproducibility of length measurements. Together with deep ion irradiation the use of longer immersion times enables to increase the number of well-etched confined tracks by an order of magnitude. Additionally, naturally annealed fossil confined tracks in geological samples often appear to be under-etched compared to induced tracks used for deriving the annealing equations used for T-t inverse modelling. This can be detected by a remaining length anisotropy after ***c***-axis projection. The latter has been proved to cause model artefacts and can be eliminated by using a second etch step with an increased immersion time.