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SPECIAL COLLECTION: APATITE: A COMMON MINERAL, UNCOMMONLY VERSATILE

Single-track length measurements of step-etched fission tracks in Durango apatite: "*Vorsprung durch Technik*"

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ABSTRACT

Fossil and induced confined fission-tracks in the Durango apatite do not etch to their full etchable lengths with the current protocols. Their mean lengths continue to increase at a diminished rate past the break in slope in a length vs. etch-time plot. The mean length of the fossil tracks increases from 14.5(1) to 16.2(1) μm and that of the induced tracks from 15.7(1) to 17.9(1) μm between 20 and 60 s etching (5.5 M HNO_3; 21 °C); both are projected to converge toward ~18 μm after ~180 s. This increase is due to track etching, not bulk etching. The irregular length increments of individual tracks reveal a discontinuous track structure in the investigated length intervals. The mean lengths of the fossil and induced tracks for the standard etch time (20 s) for the (5.5 M HNO_3; 21 °C) etch are thus not the result of a shortening of the latent fission tracks but instead of a lowering of the effective track-etch rate v_T. The rate of length increase of individual fossil confined tracks correlates with their length: older tracks are shorter because they etch slower. Step etching thus makes it possible to some extent to distinguish between older and younger fossil fission tracks. Along-track v_T measurements could reveal further useful paleo-temperature information. Because the etched length of a track at standard etch conditions is not its full etchable length, geometrical statistics based on continuous line segments of fixed length are less secure than hitherto held.

Keywords: Durango apatite, fission track, step etching, confined-track length