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Some geometrical properties of fission-track-surface intersections in apatite

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Abstract

Parallel fission-track-surface intersections identify the grains in an etched apatite mount that have been polished parallel to their prism faces and mark the orientations of their ***c***-axes. Their lengths (D_{par}) are a practical kinetic parameter that is indicative of the track annealing rate of apatite. Little is known, however, about their geometrical properties in non-prism faces. We present a model calculation of the frequency distributions of the orientations, lengths, and widths of track-surface intersections in non-prism faces. The current model does not include the effects of surface etching or measurement imprecision. However, as far as it goes, it is consistent with measurements in apatite surfaces up to 30° to the ***c***-axis. Regardless of the model, we submit that the statistical properties of the fission-track-surface intersections have practical uses. The distribution of their orientations is characteristic of the orientation of the etched surface relative to the ***c***-axis. The distribution of their lengths presents a possible tool for investigating track etching, in particular for evaluating the tracks added and lost through surface etching. The distribution of their widths is a potential kinetic parameter independent of surface orientation and less susceptible to the factors, such as the sampling method and surface etch rate, that produce conflicting D_{par} values.

Keywords: Apatite, fission track, etching, D_{par}, D_{per}, statistics