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Variability of apatite fission-track annealing kinetics: II. Crystallographic orientation effects

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ABSTRACT

A method is presented that permits the length of any horizontal, confined fission-track inclined at a specified angle to the crystallographic *c* axis in apatite to be converted to an equivalent track length parallel to the crystallographic *c* axis. The model is based on the results of annealing experiments for six selected apatites (five calcian fluorapatites and Durango apatite) representing a subset of the 15 total apatite specimens studied. An iterative process of calculation is required to project fission-track lengths onto the *c* axis and computer source code implementing the solution to this problem is presented.

This method of projecting apatite fission-track lengths onto the crystallographic *c* axis is shown to remove effectively fission-track length variation within single fission-track populations due to anisotropic track-length reduction for all 15 apatites studied. In addition, a model is developed that offers predictions that closely reproduce published experimental data concerning the relationship between fission-track density (etched fission tracks per unit area of apatite surface) and the arithmetic mean fission-track length. Finally, it is shown that natural fission-track populations exhibit fission-track length anisotropy similar to that of fission-track populations created and annealed in the laboratory. This observation implies that the same process by which apatite fission tracks anneal in the laboratory is responsible for annealing of apatite fission tracks in the geological environment.