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Annealing experiments on induced fission tracks in apatite: Measurements of horizontal-confined track lengths and track densities in basal sections and randomly oriented grains

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ABSTRACT

To improve kinetic models for apatite fission-track annealing, we present new experimental annealing data that complement previously published data. To determine the degree of annealing of induced tracks, surface density (ρ), and mean horizontal-confined track lengths (l), were measured, both for basal and randomly oriented faces. Our annealing data were obtained by submitting an apatite sample collected in Itambé, Bahia, Brazil, to 46 different isothermal treatments where temperature ranged from 150 to 600 °C (duration of 1, 10, 100, and 1000 h). To compare the behavior of Itambé to Durango apatite, the latter was also annealed for 1 h in 9 isothermal experiments at temperatures between 240 and 380 °C. Our results show that the l/l_0 values in Durango are systematically smaller than those in Itambé sample, both in basal and random faces. The curves depicting relative track density reduction, ρ/ρ_0, and relative mean confined track length reduction, l/l_0, as a function of time and temperature, are similar for $\rho/\rho_0 > \sim 0.5$, but different for $\rho/\rho_0 < \sim 0.5$. In this interval, ρ/ρ_0 can be measured but the measurement of l/l_0 is very difficult because the confined tracks become undetectable. Measurements of ρ/ρ_0 and l/l_0 for tracks revealed in basal surfaces are systematically lower (but this difference is <3%) than those in randomly oriented ones.

Keywords: Apatite, confined tracks, fission track dating, crystallographic orientation