



High pressure effects on fission-track formation in apatite

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In nature, fission tracks are formed by spontaneous fissioning of ^{238}U nuclei in various minerals under natural pressure and temperature conditions. These tracks are used for thermochronological dating. For such studies, the number of tracks and the etchable track length are the crucial parameters. Theoretical models, ion-irradiation experiments, and neutron irradiations at ambient conditions are used to understand the formation process and to deduce a theoretical concept for the time-temperature and pressure stability of fission tracks. Those experiments are compared with fission-track data from natural minerals. Recently, the influence of pressure on the stability of fission-tracks in apatite is discussed controversially. Wendt et al. (2002) observed with increasing pressure (up to 2 GPa), a decrease of the critical track-annealing temperature. In contrast, Donelick et al. (2003) found no influence of pressure (up to 0.1 GPa) on fission-track annealing in apatite. Irradiation with heavy ions of apatite at high pressure did not show any change in formation of tracks. Therefore, and to further extent the data base for the pressure behaviour of apatite we determine the geometric lattice properties of Durango apatite oriented crystal sections up to 0.64 GPa and compared those data with the unit-cell volume data (< 19.9 GPa) of Brunet et al. (1999) of synthetic apatite powder at ambient temperature. Subtle differences of changes of the cell parameters have been observed and will be discussed.

Brunet, F., Allan, D.R., Redfern, S.A.T., Angel, R.J., Miletich, R., Reichmann, H.J., Sergent, J., Hanfland, M., 1999. Compressibility and thermal expansivity of synthetic apatites, $\text{Ca}_5(\text{PO}_4)_3\text{X}$ with $\text{X} = \text{OH}, \text{F}$ and Cl . *Eur. J. Miner.* 11, 1023-1035.

Donelick, R., Farley, K., O'Sullivan, P., Asimow, P. 2003. Experimental evidence concerning the pressure dependence of He diffusion and fission-track annealing kinetics in apatite. *On Track* 26, 19-21.

Wendt, A.S., Vidal, O., Chadderton, L.T., 2002. Experimental evidence for the pressure dependence of fission track annealing in apatite. *EPSL* 201, 593-607.