

Porous fission fragment tracks in fluorapatite

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Fission tracks caused by the spontaneous fission of ^{238}U in minerals, as revealed by chemical etching, are extensively used to determine the age and thermal history of Earth's crust. Details of the structure and annealing of tracks at the atomic scale have remained elusive, as the original track is destroyed during chemical etching. By combining transmission electron microscopy with *in situ* heating, we demonstrate that fission tracks in fluorapatite are actually porous tubes, instead of having an amorphous core, as generally assumed. Direct observation shows thermally induced track fragmentation in fluorapatite, in clear contrast to the amorphous tracks in zircon, which gradually "fade" without fragmentation. Rayleigh instability and the thermal emission of vacancies control the annealing of porous fission tracks in fluorapatite.