Does Uranium influence fission track annealing in apatite?

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Hendriks and Redfield (2005) suggested that elevated concentrations of U in apatite influence fission track annealing. Their model of radiation-enhanced annealing was quickly contested by the community and therefore mostly abandoned. The relatively recent introduction of in-situ U concentration measurements into the apatite fission track (AFT) age-equation (e.g. Hasebe et al., 2004; Vermeesch, 2017), provides large quantities of precise U concentration estimates, spurring a re-evaluation of the influence of U on fission track annealing.

AFT studies conducted on granitoids from various studies will be presented, including from northern Ghana, far-eastern Russia, and Central Asia. The AFT results for those studies reveal typical open-jaw displays of single-grain AFT ages in radial plots. For apatites from those studies, higher U concentrations correlate with younger age estimates and vice versa. This relationship suggests that the older, low U grains are more retentive to annealing than the younger, high U grains. For some studies, the different populations seem to (partially) preserve different discrete thermal events.

We compare our results with the more accepted use of Cl as chemical discriminator and present AFT length histograms associated with different AFT age populations, suggesting that elevated U concentrations may indeed affect AFT annealing. Our results further indicate that AFT annealing is yet to be fully understood and that a more rigorous characterisation of the apatite chemistry may be required prior to thermochronological modelling.

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Vermeesch, P., 2017. Apatite fission-track chronometry using laser ablation ICP-MS. Chemical Geology, in press.