Helium trapping in apatite damage: insights from overly dispersed (U-Th-Sm)/He dates.

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Over the past 10 years, the effects of radiation damage on helium diffusion kinetics were discovered and led to significant improvements of the (U-Th-Sm)/He thermochronomeric system. Nevertheless, helium retention rate and closure temperature in apatite are still debated, mostly because the physical nature of these defects, and their ability to trap helium are still unknown. Based on recent experimental analyses and quantum calculation, Gerin et al. (2017) predict helium diffusion properties in damaged apatite. In this contribution, we present a new dataset of apatite He and AFT ages, from a 300 Ma pluton (French Brittany). Using the new model, we quantify trapping behaviour in terms of energy. The AHe date dispersion for single grain with similar eU content may be explained by a variation in the trapping ability. We additionally propose that damage connect and cluster for high damage content leading to a decrease of retention.

Gerin et al., 2017. Influence of vacancy damage on He diffusion in apatite, investigated at atomic to mineralogical scales. Geochim. Cosmochim. Acta. 197, 87-103