^{4}HE SOLUBILITY IN APATITE IS LOW

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$$t = \frac{1}{\lambda}\ln\left(1 + \frac{D_m - D_o}{P}\right)$$

The age equation used in dating rocks includes a term for that portion of the daughter product that is present in the sample at the time of its formation (or closure to diffusive loss). In U-Th/He dating, it is assumed that this component is negligible because of the great mobility of He and because making a correction would be extremely difficult and imprecise. However there are geological environments in which excess ^{4}He might be introduced into samples due to helium overpressures, but an assessment of this issue requires knowledge of the solubility of helium in minerals, and essentially no relevant solubility data exist.

As a side benefit of our efforts to study radiation-damage trapping of ^{4}He in fission tracks, our attempts to saturate apatite crystals with helium have allowed us to put a quantitative constraint on helium solubility in apatite. We find this solubility to be extremely low, as we measured ^{4}He concentrations of treated samples to only very slightly above laboratory blanks (see figure at right). As shown by Plot B, measured signals correspond to amounts that cause only a negligible increase in age, and we think that the slight excess helium we see represents an adsorbed component not relevant to natural samples. This validates the routine assumption that initial or "trapped" ^{4}He can be safely ignored for samples from typical crustal environments.