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(U-Th)/He Dating and Thermotectonic Re-Evaluation of Red Sea Rift Development in Yemen

We present new apatite (U-Th)/He data from the Red Sea margin in Yemen that demonstrate a need to re-evaluate accepted hypotheses of rift development for this region. 8 samples from a selection of apatite separates previously analysed by the fission track (FT) method were found to have high-quality euhedral apatite suitable for the rigorous requirements of (U-Th)/He dating. Thermal histories calculated for these samples using the FT annealing model of Laslett et al. (1987) have previously been used to argue that tectonic denudation along the margin of the southern Red Sea was rapid and peaked in a single episode early in the rifting process, between 25 and 19 Ma, in the vicinity of the developing rift. Taken together with the corresponding fission track ages, our new data favour relatively consistent cooling (which we infer to reflect similarly steady exhumation and tectonic activity) from Miocene to Recent time.

Critically, this alternative was explicitly tested and rejected in previous modelling studies of the fission track length distributions for these samples. Taken at face value, these (U-Th)/He results question the veracity of existing track length annealing models at very low temperatures. It is hoped that further application of the combined fission track and (U-Th)/He analytical approach to the Red Sea margin will provide an important natural example of the inter-relationships of FT annealing and helium diffusion in apatite, complementing laboratory experiments underway into this topic in the London Thermochronology Research Group.