Bayesian thermal history modelling of detrital thermochronometric data

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We have developed a Bayesian inversion approach to modeling both detrital and bedrock thermochronometric data. Following the approach presented in Gallagher (2012), we use Markov chain Monte Carlo to sample many candidate thermal histories models. We use the present day hypsometric curve in a drainage basin as a starting point to sample age-elevation profiles predicted for each candidate thermal history. From these we can then predict the detrital age distribution for a detrital sample representative of the catchment. In principle, discrepancies between the predictions and the observed data may allow us to refine the sampling of the age-elevation profile and infer a detrital sampling distribution different to that implied from the hypsometric curve. The methodology can be applied to the profile data alone, combined profile-detrital data, or just the detrital data alone. The results do not differ too much, implying that detrital thermochronological data can be used directly to reconstruct thermal histories of a catchment. We give examples of the method applied to apatite fission track data (AFT) data from small (< 900 km2) river catchments from the Santa Marta Sierra Nevada in northern Colombia with elevations up to 5.8 km. The resultsreveal spatially variable, episodic exhumation with a major peak in middle to late-Miocene (30-15).

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