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From sink to source: extracting onshore erosion signals preserved in offshore thermochronometric data

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Products of onshore passive continental margin erosion are preserved in offshore sedimentary basins. Therefore, these basins potentially hold a recoverable record of onshore erosion. We present a suite of apatite fission track (AFT) data for 13 borehole samples from the southern Walvis basin, offshore Namibia. All of the samples show AFT central ages older or similar to their respective stratigraphic ages, and many single grain ages are older. These data show that none of the samples has been totally annealed post-deposition. Furthermore, the large dispersion in single grains ages in some samples suggests multiple age components. A lack of obvious correlation to compositional proxies implies this dispersion is related to different source regions. Using Bayesian mixture modelling we classify single grain ages from a given sample to particular age components to create 'subsamples'. Subsequently, we jointly invert the entire dataset of subsamples to obtain a consistent thermal history for the well location. For each sample, the post-depositional thermal history is required to be the same for all age components, but each component has an independent pre-depositional thermal history. With this approach we can resolve pre- and post-depositional thermal events and identify potential changes in sediment provenance over time. In the example we present from offshore Namibia, we constrain the erosional evolution of the continental margin over a longer timescale than has been possible using onshore AFT thermochronological data and or offshore sediment volumes.