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Determining post-breakup evolution of elevated passive margins

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The Western Ghats of Indian has been cited as a type example of a downwarped, elevated passive continental margins. However, published low temperature thermochronometry suggests downwearing or parallel escarpment retreat as alternative models of margin evolution. We present the results of new onshore apatite fission track and apatite (U-Th)/He thermochronometry coupled with a sediment mass balance study for Western India to further constrain the temporal and spatial evolution of the margin since break-up at 65 Ma. Both Apatite fission track (AFT) and apatite (U-Th)/He (AHe) thermochronometry monitor the cooling of rocks in the upper 4.5 km of the crust and can be used to quantify denudation, provided there are adequate constraints on the palaeogethermal gradient. AFT ages increase from c.65 Ma at the coast to $<$250 Ma at the escarpment, a pattern consistent with downwearing or parallel escarpment retreat initiated in the Palaeocene. AFT and AHe ages of 65 Ma suggest an unroofing of at least 4km at the coast since break-up. AFT ages further inland suggest more modest amounts of unroofing of between 1.5km and 2.5km. Inverse modelling of AFT data provides thermal histories that require an accelerated cooling event at the beginning of the Palaeocene. The Konkan-Kerala basin is the major recipient of sediment from the central and southern West Indian margin and provides a valuable record of the timing and rate of denudation throughout the Cenozoic. Total decompacted clastic sediment volumes are equivalent to an onshore rock volume of 109,000 km3, almost double that which would have been generated by escarpment retreat into a downwarped margin. Both the low temperature thermochronometry and the sediment mass balance support the alternative hypothesis of downwearing or parallel escarp-

ment retreat accompanied by flexural rebound. The sedimentary record also indicates two rapid phases of increased denudation. The first phase is pre-Eocene, contemporaneous with rifting and also recorded in the AFT and AHe thermochronometry. The second phase is post-Miocene, previously unidentified and not recorded in the thermochronometry. The onshore thermochronometric data at present are not sensitive enough to constrain the post-Miocene increase in sedimentation that is recorded offshore.