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Constraining aggradation and degradation phases of alluvial fans in the sedimentary record: a case study from the Namib Desert, NW Namibia

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Along the Southern African margin it remains unclear whether the topography is the result of one or more Neogene uplift phases possibly related to mantle-driven dynamic topography, or a remnant of uplift due to pre-South Atlantic rifting and breakup during the Mesozoic. Whereas offshore seismic profiles and raised marine terraces onshore suggest phases of accelerated Neogene uplift, cosmogenic nuclide dating of river sediments and thermochronological data indicate constant uplift since post-Gondwana breakup. In this contribution we report present day erosion rate estimates from a fan-delta outboard the rift shoulder of the passive margin (i.e. the Great Escarpment), located in an area where erosion rate estimates on different timescales exist. Additionally, this fan-delta preserves elevated marine terraces on its surface, providing a unique time stratigraphic framework. It thus allows for direct comparison of erosion and uplift rate data as well as offshore-onshore correlation of sedimentary records. We constrain present day erosion rates of the system using quantitative sedimentology, and compare these results with published estimates of millennial and million year timescales. At present, erosion rates are 1.33E -06 mm/a, which is more than one order of magnitude lower than rates derived from cosmogenic nuclides, and several magnitudes lower than rates derived from thermochronological data. This shows that erosion rates constantly declined since the uplift pulse related to passive margin break-up. Subsequent erosional phases have not been effective enough to perturb this overall long-term trend. This is not in conflict with uplift rates inferred from raised beaches along the passive margin, if corrected for timescale dependent bias. With this study we are able to reconcile the confounding results from different data sets.