



Alluvial deposition at the Skeleton Coast, northern Namibia: chronology and spatial patterns

Joel Mohren^{1,2}, Janek Walk^{1,3}, Dominik Brill⁴, Julian Krieger¹, Wolfgang Römer¹, Alicia Medialdea^{4,5}, Anna Nguno⁶, and Frank Lehmkuhl¹

¹Department of Geography, RWTH Aachen, Germany

²Institute of Geology and Mineralogy, University of Cologne, Germany

³Department of Geography and Regional Research, University of Vienna, Austria

⁴Institute of Geography, University of Cologne, Germany

⁵National Research Centre on Human Evolution (CENIEH), Burgos, Spain

⁶Geological Survey of Namibia, Windhoek, Namibia

Quaternary topography sculpting along the Skeleton Coast of northern Namibia has predominantly been governed by long-term (hyper-)aridity and a rather absence of tectonic activity. The long-term prevalence of such environmental conditions has been favoured by the overall geographical setting, as the Skeleton Coast is situated at the western passive continental margin of the African continent, close to the southern tropic. As a consequence, the main episode of denudation and relief building in this region is usually believed to have taken place during the Cretaceous. However, Quaternary sediment successions and modern records on flash floods hold proof for a highly active environment post-dating the Mesozoic. Given the important role climate and its variability are presumed to play for sediment redistribution during the Quaternary, alluvial deposits found along this coast-parallel stretch may be regarded as valuable paleoclimate archives, potentially reflecting indications for climate-controlled pulses of sediment aggradation. The present-day environmental conditions limit the decay of such landforms, while promoting the persistence of a long-stretched, coast-parallel dune belt obstructing fluvial sediment conveyance towards the Pacific. The dune belt, termed Skeleton Coast erg, represents aeolian, coast-parallel sediment transport, and covers older alluvial surfaces. Altogether, this special setting bears the potential to investigate linkages between pulses of wetter episodes, the different modes of erosion, and spatiotemporal patterns of alluvial deposition.

We seek to identify these patterns on a regional scale and hence apply a combined, spatially extensive approach including geochronological and (hydro-)morphometric analyses of mapped alluvial fans ($n = 52$) along the Skeleton Coast and catchments draining the hinterland ($n = 67$). The drainage is mostly confined by the Great Escarpment to the east, providing similar (modern) rainfall regimes of less than $\sim 150 \text{ mm yr}^{-1}$ on average. Preliminary results obtained from the morphometric analyses indicate that typical power-law correlations between catchment and fan metrics exist, providing evidence for intact source-sink communication pathways for climate signals from the feeding catchments towards the coast. However, significant spatial fan

confinement, e.g. caused by the coastal erg, is very likely to affect the morphometric relationships and landscape reconstruction efforts based on these data. Hence, establishing a regional geochronological framework integrating over timescales relevant for major episodes of alluvial deposition is crucial for our study aims. First results obtained from optically stimulated luminescence (OSL) dating provide indications for significant Holocene and Late Pleistocene sediment conveyance, as previously reported for other study areas across Namibia. Additionally, preliminary ^{10}Be exposure dating yields Middle Pleistocene ages for alluvial surfaces in the vicinity of the Skeleton Coast erg. Such old ages could reflect the impact of orbital forcing on fan activity and may imply that landscape formation processes temporally integrating over timescales relevant for our analyses are archived in both the fan and catchment morphology. Investigating polyphase fans will help to further increase the spatiotemporal resolution of alluvial deposition patterns to unravel Quaternary climatic conditions and climate variability along the Skeleton Coast of Namibia.