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Spatial pattern of denudation in a lithologically controlled sub-tropical flat landscape: Insights from the Kimberley region, NW Australia.

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The Kimberley region, northwest Australia, is well known for its expansive and diverse collection of prehistorical aboriginal rock art that potentially dates back to 40,000 years ago. The region is characterized by a tropical, semi-arid climate with a monsoonal rainfall distribution and a flat landscape interrupted by massive sandstone mesas and deeply incised bedrock river gorges. In order to constrain the chronology of the rock art it is necessary to quantify the spatial and temporal dimensions of landscape evolution.

We report cosmogenic ^{10}Be and ^{26}Al concentrations in modern fluvial sediment collected from 27 catchments with areas spanning several orders of magnitude (13.6 – 13,900 km^2). All catchments are characterized by a very low topographic gradient (average basin slopes < 3°) and subdued local relief of at most 200m. Assuming negligible sediment storage times and rapid sediment transport driven by the annual monsoonal washout, we calculate ^{10}Be based catchment-wide denudation rates ranging between 1.87 $\pm$ 0.23 and 9.48 $\pm$ 1.05 m.Myr^{-1}. These low rates are among the slowest recorded in the world, despite the strong climatic seasonality of the region. Our measured denudation rates exhibit a strong correlation with topographic gradient, which in the overall flat landscapes of the Kimberley, is controlled by the prevailing sandstone bedrock lithology and the presence of numerous escarpments adjacent to the river channels. We present a modelling approach that makes use of the ^{26}Al/^{10}Be ratio in the fluvial sediments as a source tracer (ie escarpment cliffs, river channels, plateau bedrocks), and use this to explore the control and retreat rate of the eroding escarpment cliffs in order to provide information on the spatial distribution of denudation in the landscape.

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