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## **Spatial variation of erosion rates and passive margin escarpment embayment from New England, NSW and Bellenden Ker, Queensland, Australia: an analysis using GIS and in-situ $^{10}\text{Be}$ basin-wide cosmogenic nuclides**

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The eastern seaboard of Australia is characterized by a passive margin and a continental divide that separates the inland-draining rivers from those that drain to the Coral and Tasman seas. Seaward of this divide lies the Great Escarpment (GE) of Australia that separates a moderate relief coastal plain from a low relief, high elevation plateau. Quantifying the spatial variation of erosion rates from temperate New England (NE), NSW and tropical Bellenden Ker (BK), Queensland, two regions with distinctly different climates and escarpment embayment, could help constrain erosional controls that contribute to escarpment form. In this study, we compared forty detrital  $^{10}\text{Be}$  samples collected from sediments in the main trunk and tributaries of five major rivers: the Macleay, Bellinger, and Clarence in NE and the Russel-Mulgrave and North Johnstone in BK. We then traced the escarpment position in ARCGIS and calculated a sinuosity ratio to better compare the degree of embayment in each region. Across both datasets we found that for NE, which has deep gorges cutting into the plateau, the degree of embayment was twice that of BK, where the escarpment position is significantly less embayed and erosion rates significantly more variable (ratio of .18 vs .38). Erosion rates in low slope areas, such as on the plateau, were universally low with no other significant controlling factors. There was no correlation between erosion rates and catchment area, and that our data echo previous studies that find that once mean rainfall passes an approximate threshold (around 2000mm/yr) basin characteristics that are known to control erosion rates, such as slope and lithology, are subdued.

In temperate NE, where rainfall ranges from approximately 800-1200mm/yr, there was a moderate linear correlation with mean catchment rainfall and erosion rates ( $R^2$  .50), which is likely due to a strong orographic effect due to the escarpment. Erosion rates from tributaries below the plateau were highly variable and ranged from 5m/Ma up to 60m/Ma and correlated strongly with mean catchment slope ( $R^2$  .86). In addition, there were moderate inverse linear correlations between erosion rate and the catchment total percent granite and sedimentary rock ( $R^2$  .53 and .63 respectively) and a moderate correlation between erosion rate and catchment total percent metamorphic rock ( $R^2$  .57). Similar to previous studies, these data suggest that in temperate

climates with moderate amounts of annual rainfall, individual basin characteristics play a significant role in controlling basin wide erosion rates.

In contrast, data from tropical BK, where mean rainfall amounts are in excess of 2000mm/yr, erosion rates from tributaries below the plateau were significantly less variable than NE. Rates had a mean of 37m/Ma  $\pm$  9 (standard deviation 5m/Ma, N=10) and were not significantly correlated with mean catchment slope nor catchment lithology. The mean erosion rate of BK is similar to that of other studies in the region, though with slightly less variability, and possibly reinforces the hypothesis from other researchers that in tropical climates with significant mean rainfall, soil depth effectively armors hillslopes and prevents bedrock erosion from occurring.