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Cenozoic Uplift of south Western Australia as constrained by river profiles

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The relative tectonic quiescence of the Australian continent during the Cenozoic makes it an excellent natural laboratory to study recent large-scale variations in surface topography, and processes that influence changes in its elevation. Embedded within this topography is a fluvial network that is sensitive to variations in horizontal and vertical motions. The notion that a river acts as a 'tape recorder' for vertical perturbations suggests that changes in spatial and temporal characteristics of uplift can be deduced through the analysis of longitudinal river profiles. We analyse 20 longitudinal river profiles around the Australian continent. Steady-state concave upward profiles in northeast Australia indicate an absence of recent surface uplift. In contrast, the major knickzones within longitudinal profiles of rivers in southwest Australia suggest recent surface uplift. Given the lack of recent large-scale tectonic activity in that region, this uplift requires an explanation. Applying an inverse algorithm to river profiles of south Western Australia reveals that this uplift started in the Eocene and culminated in the mid-late Neogene. The uplift rates deduced from this river profile analysis generally agree with independent geological observations including thermochronology, and preservation of shallow-marine sediment outcrops across the Eucla Basin and south Western Australia. We show that the interplay between global sea level and long-wavelength dynamic topography associated with south Western Australia's plate motion path over the remnants of an ancient Pacific slab is a plausible mechanism driving this uplift.