Geophysical Research Abstracts
Vol. 16, EGU2014-6656, 2014
EGU General Assembly 2014

Landscape development in Southern Peninsular India from 10Be denudation rates in river sands

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The persistence of high elevation and topography observed along many passive margins remains one of the outstanding problems in landscape evolution. In Southern Peninsular India, this question revolves around the understanding of whether the observed high relief and pronounced topography results from equilibrium with contemporaneous external forcing or whether the relief was acquired during the late Cenozoic and conserved over several tens of millions years. Modern denudation rates dictating the current landscape evolution are ruled by the interactions between climate, tectonics and rock strength. We used detrital cosmogenic 10Be from 43 drainage basins ranging in size from 4 to 68768 km2, to infer millennial averaged denudation rates along and across the Western Ghat Mountains in Southern India and to understand if the present landscape is still actively evolving or not.

The Western Ghat is characterized by a W-E gradient in relief and rainfall with only minor variations in lithology allowing to isolate the relationship between erosion rates and topographic indices. Cosmogenic-derived erosion rates are spatially variable, ranging from $\sim$8 to 77 mm/ka on the western side and 8 to 51 mm/ka on the eastern side. The rugged topography of Western Ghats and Nilgiri Mountains exhibit pronounced topography in conjunction with low denudation rates. This represents an exception to the often-cited general coupling of topography and denudation rates and suggests that steep slopes and high relief in passive margin settings are not associated to high denudation. Nevertheless, locally the differences in denudation rates along and across the Western Ghats are well correlated with local relief, which suggests that the inherited topography still controls current denudation rates. Even though the catchments in Western Ghats receive a mean annual precipitation $\sim$ 5 m, due to the SW Indian monsoon, precipitation shows only a minor control on denudation rates. This suggests that in the absence of significant tectonic forcing, climate is not an active driver of landscape evolution in passive margins such as the Western Ghats.