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Basin-wide denudation rates of claystone lithologies in Taiwan from meteoric ^{10}Be/^{9}Be ratios

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Small mountainous rivers (SMRs) in southern Asia and Oceania contribute ∼1/3 of the suspended load[1], and thus act as a critical part of global source-to-sink systems and an especially significant role in the material cycling of the Earth's surface. Because of active tectonics and a high typhoon frequency, SMRs in Taiwan Island is characterized by extremely high erosion rates (several mm/yr) and rapid mass wasting[2].

In order to quantitatively determine denudation rates averaged over centennial-millennial time scales, denudation rates from *in situ* ^{10}Be (D_{insitu}) are commonly the first choice. However, claystone lithologies in the headwaters of many Taiwan rivers limit the reliability of this method to quarz-bearing units. Hence, we apply a promising new denudation rate tool, the meteoric ^{10}Be/^{9}Be ratio[3,4]. This new proxy combines an atmospheric tracer of known flux, meteoric cosmogenic ^{10}Be, with stable ^{9}Be released from rocks by weathering, and can be measured on small sample amounts and quartz-free lithologies[5].

^{10}Be and ^{9}Be concentrations were analyzed in the 30-63 μm fraction of bedload sediments along the Choshui River, whose headwaters drain a region dominated by claystone lithologies, the so-called Slate Belt. To first assess ^{10}Be steady state conditions that are a prerequisite for the application of this meteoric proxy, ^{10}Be fluxes exported from the basin by river transport must equal their production by deposition. We determined the exported meteoric ^{10}Be flux by multiplying ^{10}Be concentrations with an independent erosion rate estimate from *in situ* ^{10}Be[6], and compared it with the depositional ^{10}Be flux derived from global atmospheric circulation models[7]. The ratios of exported to produced ^{10}Be flux scatter around 1 in the Choshui River, indicating their balance, and thus we proceed to calculate meteoric ^{10}Be/^{9}Be-derived denudation rates (D_{met}). Downstream of the Slate Belt, our D_{met} agree with published D^{6}_{insitu}, where both methods yield rates on the order of 1-2 mm/yr. In comparison, D_{met} in the slate-dominated upstream are significantly higher, similar with higher modern uplift rates in the Central Range[8]. We conclude that the ^{10}Be/^{9}Be ratio is a promising tool to derive denudation rates characterized by rapid erosion and claystone lithologies.

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