



Sediment Controls on Bedrock Channel Morphology

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Lateral erosion of bedrock rivers is an important control on the cross-sectional channel shape, and the coupling of channels and hillslopes. At the Lushui station on the Liwu River, Taiwan, lateral incision is driven by large floods, while vertical incision is driven by small and medium flows (Hartshorn et al., *Science*, 2002). Similar links between the variability of discharge and lateral cutting have been observed in other, sinuous mountain channels (Barbour and Stark, AGU Fall Meeting, 2005) and in numerical models (Stark, 2006). Using suspended sediment data and field observations, we show that at Lushui Station, Liwu River, Taiwan, the partitioning between thalweg lowering and bank erosion is controlled by a competition between the cover and the tools effect: at high sediment loads the thalweg is covered and protected from erosion. Erosion rates are highest at the top of the cover, where most tools are available for incision. At low sediment loads tools concentrate around the thalweg and there the erosion rates are highest.

We argue that the same mechanism controls channel form in other Taiwanese bedrock rivers by analysing at-the-station hydraulic geometry. The width-discharge relationship can be described by a power law. A low exponent in this relationship indicates steep channel banks, while a high exponent indicates gently rising banks. The measured exponent is positively correlated with the mean sediment concentration in the river. Low sediment concentrations are observed when the river carries a small sediment load. According to the mechanism described above thalweg erosion will be more frequent and the river cuts a deep gorge with steep walls. At high sediment loads the river cuts laterally more frequently and the banks will rise gently.