



Controls on the distribution and geometry of postglacial bedrock channels

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In postglacial rivers of the northwest Scottish Highlands, reach-scale channel slopes remain strongly controlled by glacially-conditioned valley-floor slopes 14.0-11.7 kyr after deglaciation. The inherited slopes, together with glacially-conditioned sediment flux, control the distribution of bedrock channels, and therefore fluvial erosion, in these rivers. Declining paraglacial sediment flux lowers the critical slope for the alluvial to bedrock channel transition resulting in a long-term increase in the proportion of bedrock channels.

Bedrock channel cross-sectional geometry is strongly hydraulically scaled despite variable bedrock lithologies, but differences in scaling relationships for coarse-grained alluvial and bedrock channels suggest that transport-limited and detachment-limited erosion processes produce characteristic differences in channel form. The development of hydraulically-scaled channel geometry indicates that most bedrock channels in the northwest Scottish Highlands have achieved a stable cross-section configuration (i.e. w/d ratio), and that this stability is achieved where postglacial bedrock incision has progressed to ~ 1.5 times the bankfull equivalent flow depth.

The findings indicate that in post-orogenic, postglacial terrains bedrock channel cross-sections adjust on timescales of 10^4 years whereas full adjustment of channel slope takes considerably longer.