



The importance of lithology and throw rate on bedrock river behaviour and evolution in the Gediz (Alaşehir) Graben, Turkey.

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The Gediz (Alaşehir) Graben is located in the highly tectonically active and seismogenic region of Western Turkey, which has been experiencing high-angle normal faulting since ~ 2 Ma. Rivers upstream of the normal fault-bounded graben each contain a lithologic knickpoint related to the change in bedrock geology (from soft sediments to hard metamorphic rocks) and a non-lithologic knickpoint, caused by an increase in fault slip rate at ~ 0.8 Ma. Therefore, this system represents an ideal natural laboratory to investigate the relative roles of bedrock lithology / rock strength and rates of faulting on the behaviour and evolution of bedrock river systems. Our results show that metamorphic rocks in the catchments are 2-3 times harder than the sedimentary rocks. Stream power increases downstream reaching local maxima upstream of the fault within the metamorphic bedrock but declines rapidly once softer sedimentary rocks are encountered. We also demonstrate a positive correlation between throw rate and stream power in the metamorphic rocks characteristic of rivers obeying a detachment-limited model of erosion. In sedimentary rocks stream powers are invariant with throw rate but do scale with the river's sediment transport capacity. We also present new Be¹⁰ denudation rates that show correlations with calculated stream power and fault throw rates. This study demonstrates that the strength of underlying bedrock is a major influence on river evolution and that the nature of the underlying lithology profoundly influences the way in which the river behaves.

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