

## **Alternate bar dynamics in response to increases and decreases of sediment supply**

Andrew R. Bankert and Peter A. Nelson

Department of Civil and Environmental Engineering, Colorado State University

**Abstract.** Gravel-bed rivers can accommodate changes in sediment supply by adjusting their bed topography and grain size in both the downstream and cross-stream directions. During aggradational conditions, this can result in heterogeneous stratigraphy, and the morphodynamic influence of heterogeneous stratigraphy during subsequent degradation has not been studied through physical modeling. A flume experiment was conducted where alternate bars were developed in a gravel-sand mixture under constant discharge and sediment supply then two supply increases led to the development of stratigraphy in a set of alternate bars. The supply was then reduced, causing degradation through that self-formed stratigraphy. Migrating alternate bars stabilized during the first equilibrium phase creating bed surface sorting patterns of coarse bar tops and fine pools. During the first supply increase the bars remained stable as the pools aggraded. During the second supply increase the pools aggraded further, causing the boundary shear stress over the bar tops to increase until the bars gained the capacity to migrate and stabilize in new locations. As aggradation occurred, the original sediment sorting patterns were preserved in the subsurface. During degradation, the pools experienced incision and the bars eroded laterally, but this lateral erosion ceased when coarse sediment previously deposited during aggradation became exposed. The results suggest that if a sediment supply increase is capable of filling the pools it can cause stable bars to migrate. These findings also show that heterogeneous stratigraphy can play an important role in determining whether bars persist or disappear after a sediment supply reduction.