

Stratigraphic Architecture and Key Stratigraphic Surfaces Formed by Punctuated Flow Events - An Experiment on Fluviodeltaic Responses

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A tank experiment was conducted to gain understanding of the stratigraphic architecture and surface morphologies related to punctuated flow events involving high sediment yield. The experimental setup consisted of two 10 minute intervals with high sediment and water supply, each succeeded by a 50 minute, low supply phase. Base level was held constant throughout the experiment.

Early during the first high-supply pulse most of the sediment is stored in a large fan on the proximal delta plain close to the source. Most striking during this phase is the initiation of two incised valleys cutting into the proximal fan once the fan is established, limiting autogenic channel avulsion. During the first low-supply phase these valleys are further incised and the upper delta plain is essentially a zone of sediment bypass. These incised valleys also remain conduits for flow during the second high-supply pulse, although the valleys are partially filled early during this phase. Sediment deposition is most prevalent on the distal delta plain. During the second low-supply phase the valleys are again deeply incised, continuing to capture the flow in the upstream part of the delta plain. Although flow is confined to the same valley systems throughout most of the experiment, sediment transport to the marine portion of the experimental basin is very low and almost all of the sediment is stored on the delta plain.

The most recognizable stratigraphic surface is a complex compound erosional surface formed by the alternate cycles of incision and partial filling of the valleys in the most proximal portions of the experiment. Most importantly, the deepest incisions along this surface are related to the flows during the low supply phase. Although this complex incision surface is controlled only by changes in supply, in the stratigraphic record it could be easily misinterpreted as a sequence boundary controlled by base-level fluctuations. In contrast to incised valleys formed by base-level cycles, almost no sediment was delivered to the deep receiving basin.

These phases of alternating high and low supply, with the consequent formation of complex incised valleys in the proximal areas, would not be recognized by analyzing the stratigraphic record only in the more distal receiving basin.