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Climatic and Sea-Level Variation - Controls on Fluvial Incision and Aggradation: A Study of the Latest Pleistocene Brazos River Valley (TX)

The Late Pleistocene incised valley of the Brazos River (TX) was formed by punctuated eustatic fall preceding the Last Glacial Maximum. The 120 m fall excavated a 14 km wide and 100 km long valley that was partially filled during three high frequency episodes of climatically induced sediment flux. Data, including radiocarbon and thermoluminescence dating, derived from a coring program reconstruct the liberation, transport, and deposition of sediment within the latest Pleistocene Brazos River system.

Three nested terraces record the dispersal system's response to an increased El Nino-like weather pattern and sea level fall during OIS 3. Mean bankful paleodischarge was five times the modern 100-year flood value. Increased discharge and punctuated eustatic falls incised and filled the valley three times during falling stage. Incision footprints migrated laterally and basinward in response to base level lowering and vigorous coastal stream pirating. The resulting fluvial incision surface is a diachronous composite of three cut-and-fill episodes. A sediment partitioning analysis of one high frequency cycle shows that 90% of the sediment is subequally distributed between the delta and basin.

This source-to-sink study integrates onshore and offshore datasets and yields insight into the response of coupled fluvial and marine environments to climatically induced changes, and to the timing and nature of sequence boundary formation in incised valleys. Results challenge the classic valley fill model and the nature and the significance of sequence boundaries in a fluvial system -- valley fill is heterogeneous, sediment flux is rapid, and an isochronous sequence boundary is unobtainable.