Relative Sea Level Versus Climate Forcing of the Lower Mississippi River During the Last Two Glacial-Interglacial Cycles

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The late Quaternary Lower Mississippi River has experienced dramatic external perturbations driven by orbitally controlled glacio-eustatic cycles and severe fluctuations in water and sediment discharge from the hinterland. Fluvial terraces in the Lower Mississippi Valley (LMV) record responses of this continental-scale river to these external forcings by means of incision and aggradation, commonly on the order of tens of meters. This presentation addresses the relative role of sea-level change vs. climate change in the formation of the exceptionally well preserved late Pleistocene terraces and associated strata known as the Prairie Complex, by a detailed investigation of their chronology with the aid of optically-stimulated luminescence (OSL) dating.

A total of 26 OSL ages was obtained for most of the allostratigraphic units of the Prairie Complex in the LMV and the majority of them show good stratigraphic consistency and are in agreement with regional stratigraphic correlations. The OSL chronology indicates that the Prairie Complex consists of multiple chronostratigraphic units that formed mainly during Marine Isotope Stages (MIS) 7, 5e, and 5a. Thus, the aggradation of Prairie Complex strata is strongly correlated with the relative sea-level highstands of the last two glacial-interglacial cycles, which is consistent with relict fluvial geomorphic and sedimentologic characteristics. Fluvial incision during the relative sea-level fall associated with the MIS5a/4 transition occurred as far inland as ~600 km from the present-day shoreline, testifying to the dominant downstream (eustatic) control of fluvial stratigraphic architecture in the LMV over a 100 ka timescale. In addition, the short response time of the Lower Mississippi River (within the resolving power of OSL dating, on the order of <10 ka) is consistent with recent findings for large fluvial systems elsewhere, but may be at odds with model results that have suggested much slower response times to external forcing for such large fluvial systems.