Stratigraphic Variations of Incised-Valley Fill Controlled by Rates of Sea-Level Change

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The Mobile River incised-valley system located in the northern Gulf of Mexico occupies an area from southern Alabama through Mobile Bay to the outer Mississippi–Alabama continental shelf. During the Wisconsinan regression, this incised-valley system was fluvial and extended across the exposed shelf to a shelf-margin delta complex. After the Wisconsinan regression, the Holocene transgression drowned the entrenched alluvial valleys and reworked the alluvial fill and estuarine deposits to form shoals on the middle shelf. As the postglacial transgression slowed, Mobile Bay was formed.

The late Wisconsinan maximum regression was ~120 m lower than present; the Mobile River incised-valley was a conduit for drainage from the catchment to the shelf margin. The sediment carried by the fluvial system during lowstand passed through the valley incised by the Mobile River and across the exposed shelf and was deposited on the shelf margin as deltaic lobes. Rapid sea-level rise forced coastal-plain shorelines landward across the present mid-continental shelf. As the Holocene sea-level rise slowed, the incised Mobile River valley became an estuarine depocenter. In the alluvial valley, lowstand deposits are overlain by estuarine sediments deposited during both the initial flooding and the subsequent formation of Mobile Bay.

The Holocene incised-valley fill (estuarine facies) underlying Mobile Bay conforms to the conceptual facies model of a microtidal wave-dominated estuary. The rapidly transgressed shelf part of the incised valley does not conform to this model. The downdip section lacks a clearly identifiable (from seismic profiles) estuarine facies; the valley fill is primarily fluvial and is overlain by marine shoals. In the Mobile River incised valley, the distal part of the valley was rapidly drowned, allowing the thin estuarine facies to be reworked. The proximal part was drowned more slowly, leaving the estuarine facies intact. Thus, the single incised valley contains two very different types of fill.

Morphology and Stratigraphy of Middle to Late Pleistocene Shelf Submarine Canyons, Central Offshore Louisiana

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Five submarine canyons exist in the Pleistocene section of central offshore Louisiana. These large features have depths of as much as 800 m and widths between 5 and 17 km and were important sediment pathways to the Gulf basin. This study covers the shelf portion of the canyons and spans approximately 100 × 70 km, from the ancestral shelf margin to an onshore location in southern Louisiana. More than 3,000 line km of 2-D seismic data were interpreted for this study, as were data from 25 exploration wells consisting of digital well logs and information on lithology, biostratigraphy, and velocity. Canyon morphology was determined on the basis of unconformities between the canyon fill and the surrounding strata and was mapped in time and depth. The stratigraphic position of the canyons indicates that they become younger progressively eastward, toward the present-day Mississippi Canyon. The canyons represent a hybrid type of submarine canyon with a complex origin referred to as delta-front troughs. Modern analogs can be found associated with the Mississippi, Indus, and Ganges-Brahmaputra deltas. The Miocene Markley Canyon of northern California and the Paleocene Yoakum Canyon of South Texas are also similar in morphology and paleogeographic setting. Data in the study area support the theory that canyon initiation may take place on the slope, followed by headward erosion onto the shelf and the focusing of turbidity and longshore currents through the canyon. It appears likely that canyon filling did not start until well into the transgressive systems tract.