Summary Depositional History of the Mississippi

The Mississippi fan is the deepwater sink for the Mississippi River, preserving ~8,000 ft (2,440 m) of Pleistocene sediment eroded from a glacially dynamic catchment. The fan was mapped over 29 3D seismic surveys during a project BOEM undertook investigating the distribution of shallow water flows on the Mississippi fan. The depositional history of the fan is traced through Pleistocene sequence boundaries (SB) recognized in BOEM's revised chronostratigraphic chart. The revised chart orders 3rd order sequence boundaries (PLL = Lower Pleistocene; PLM = Middle Pleistocene; and PLU = Upper Pleistocene). "Nth" order sequences are recognized within each. A 3-minute video was prepared as an outfall of this project (click here).

Depocenters of the fan migrated from southwest-to-northeast during the Early to Middle Pleistocene, and then partially retraced this route back southwest during the Late Pleistocene. Northwest-southeast transfer fault-bounded structural corridors identified by Stephens (2001; 2010) suggestively guide the spatial distribution of Pleistocene SWFs, while their temporal distribution on the Mississippi fan make them proxies for high sedimentation rates related to the drainage of glacial lakes.

Sedimentation rates in the Gulf of Mexico increased greatly following the 700 Ka sequence boundary (SB) and a ~400 ft (125 m) drop in sea level. Lake Tight, an ice-dammed Middle Pleistocene proglacial lake drained at some point close to the 700 Ka SB, dumping 2.5x the volume of Lake Erie into the upper Mississippi valley and inundating the GOM with outwash. Duration for the draining of Lake Tight is a key unknown. It could have drained suddenly; evidence for which has not been preserved or recognized. It could have drained over ~10^4 years, or it could have drained over a more extended period of ~10^5 years; both durations are permissible given the available age control. Sediment loading of the shelf margin contributed to, or caused, its collapse and very thick mass transport deposits were deposited in ultra-deepwater between ~700 to 460 Ka SB.

High rates of sediment influx during the Late Pleistocene (130 Ka to Holocene) were influenced by unification of the Missouri and Mississippi River catchments ~77 Ka that greatly increased the size of the watershed. Late in the Pleistocene outwash reached the GOM from the failure of the ground moraines impounding proglacial Lake Kankakee (~19 Ka) dumping 0.23x the volume of Lake Erie into the Illinois River. The upper Mississippi River valley received a large amount of outwash between 13.5 and 9 Ka while episodically connected to enormous proglacial Lake Agassiz in Canada. After the connection to Lake Agassiz was shut down <10 Ka the lobes of the modern delta were deposited as sea level rose and the Wisconsinian ice sheet disintegrated.

Stephens, B.P. 2010. Basement controls on subsurface geologic patterns and near-surface geology across the northern Gulf of Mexico: a deeper perspective on coastal Louisiana. American Association of Petroleum Geologists, Annual Conference and Exhibition, New Orleans, LA. Search and Discovery Article. No. 25129. http://www.searchanddiscovery.com/pdfz/documents/2010/25129stephens/ndx_stephens.pdf.html

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