

FORMATION OF THE MISSISSIPPI CANYON

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ABSTRACT

The most prominent submarine physiographic trough in the northern Gulf of Mexico is the Mississippi Canyon. This submarine trough has an average width of 8 km., length of 120 km., and bathymetric relief of 300m. Its origin has generally been attributed to channel entrenchment of the Mississippi River during low stands of sea level and erosion of the more distal parts by turbidity currents or submarine gravity flows. In the last two years, a dense, high-resolution seismic and side-scan sonar grid (305 m.), together with deep borings utilized to obtain samples for C-14 dating, has been used to establish a time-stratigraphic framework and origin for this feature. Nine horizons, chosen from borings and dated by C-14 and paleontologic methods, have been traced laterally on the seismic lines. These horizons range in age from Illinoian (~ 400,000 years B.P.) to late Holocene (3,500 years B.P.). During the interval from Illinoian to late Pleistocene (25,000-27,000 years B.P.), the Mississippi River deposited a series of fluvial and deltaic deposits of approximately 1,000 m. There is no evidence that a submarine canyon existed in the vicinity of the present feature during this time interval. Approximately 25,000 years ago, a C-14-dated horizon was truncated by the initial formation of the submarine canyon. Samples dated by C-14, obtained near the base of the canyon fill, show that by 20,000 years B.P., canyon fill had commenced. Thus, this major submarine trough had, at most, 7,000 years in which to remove 1,500 to 2,000 km.³ of material. It is highly probable, therefore, that the canyon originated from massive shelf-edge slope failure on an unstable continental margin. A series of successive failures, each one creating an upslope instability that triggered the next failure, caused an elongate trough to form that excavated the canyon to a depth of 1,220 m. below present sea level. Once the canyon has formed, its steep side walls continued to be unstable and sediments slumped into the canyon axis, forming the initial canyon fill. This phase is well documented: the lowermost sediment fill is composed of displaced material similar to that now found on the canyon rim. Large scars from side-wall failures can also be easily mapped on the seismic data. From 20,000 years to approximately 5,000 years B.P., a series of late Wisconsin and Holocene delta lobes formed and were responsible for the remainder of the fill of the canyon. During the past 5,000 years only a thin deep-water pelagic drape has been deposited within the canyon. Maps have been constructed that depict the various horizons, and the geometry of these horizons verify this mode of formation.

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