LATE PLEISTOCENE-HOLOCENE SEQUENCE STRATIGRAPHY OF THE MISSISSIPPI-ALABAMA SHELF, NORTHEASTERN GULF OF MEXICO: IMPLICATIONS FOR GLOBAL CHANGE

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ABSTRACT

Sequence stratigraphy is the study of rock relationships within a framework of repetitive, unconformity-bounded depositional sequences and provides a methodology by which to study and understand stratigraphic, lithofacies, and paleogeographic relationships among the strata within a depositional basin. The primary premise of sequence stratigraphy is that stratal stacking patterns and lithofacies distributions are related to cycles of transgression and regression that result from cyclical changes in relative sea level; relative sea level changes, in turn, result from the combined effects of eustatic sea level changes, basin subsidence, sediment yield, and climatic conditions. While the concepts of sequence analysis have been applied in numerous studies of the ancient rock record, research into the applicability of this approach to the modern record is generally lacking. An understanding of the sequence stratigraphic setting and history of modern depositional systems, when combined with data from ancient analogs to which sequence analysis has been applied, may have predictive value in determining possible scenarios for change in modern coastal and offshore areas and the rates of such change.

A major late Pleistocene sea level fall that exposed the continental shelf in the northern Gulf of Mexico area is well documented. During this lowstand, the exposed continental shelf was subjected to erosion and stream valley entrenchment, which resulted in an incised, type 1 unconformity surface. This surface forms the base of the late Pleistocene-Holocene sequence in the study area. Sediment bypassed the exposed shelf through these valley systems and accumulated as slope and basin lowstand systems tract deposits. In the northern central Gulf, studies have shown that the Mississippi Canyon and Fan formed during this sea level phase by these processes. On the Mississippi-Alabama shelf, incised valleys formed on the type 1 surface are much smaller than the Mississippi Canyon to the west, but are numerous and readily delineated on seismic reflection records. Preliminary data show that these features are filled with generally coarse-grained siliciclastics that were deposited as incised valley fill associated with renewed transgression. Progressive marine transgression during the Holocene eventually flooded the entire continental shelf, depositing backstepping sets of transgressive systems tract parasequences. Rapid deepening led to sediment starvation on the shelf as active depositional loci were translated landward. Submarine hardbottoms consisting of surficial rock and shell rubble are common in the offshore in the northeastern Gulf of Mexico. The thickness of the Holocene section in this area and the presence of these hardbottoms indicate that the Mississippi-Alabama shelf has been sediment starved throughout most of its Holocene history. Preliminary assessment of these hardbottom features indicates that they represent, in part, condensed section associated with the transgressive phase of the late Pleistocene-Holocene sea level cycle. This condensed section is probably correlative to that reported by Boyd et al. (1989) in the north-central Gulf area. Subsequent to maximum transgression, relative sea level has been falling in the north-central Gulf, and the Mississippi delta system has been prograding into the basin as a highstand systems tract. Sediment yield from rivers in the northeastern Gulf is not as great as that of the Mississippi River.

Sequence stratigraphic analysis of late Pleistocene-Holocene strata of the Mississippi-Alabama shelf can be used as a tool for establishing the anticipated naturally-controlled lithostratigraphic succession, sea level position and rate of change, and distribution of modern geomorphic features. The recognition of deviations from the anticipated sequence stratigraphic framework may allow for the determination of physical environmental changes which may be attributed to anthropogenic events.