Processes Affecting Preservation Potential of Coastal Lithosomes Along the Central Texas Coast

Michelle L. Fassell and John B. Anderson

Department of Geology, Rice University, Houston, TX 77251-1892

Preservation potential of shoreface sediments along the central Texas shelf is variable. From Matagorda Bay to North Padre Island, 105 cores were collected along offshore transects to understand the depositional processes controlling shoreface sedimentation along the coast. There is a high preservation potential of sand-prone shoreface sediments deposited during the last glacial eustatic highstand. On the shelf, older preserved highstand sequences contain a similar sand-prone facies. The modern shoreface profiles exhibit low gradients, are currently prograding, and vary in thickness between one and three meters. The key processes affecting the preservation and variability of modern highstand systems tract (HST) and transgressive systems tract (TST) deposits above the Pleistocene surface are sediment input, storm reworking, longshore current transport, rates of transgression, and irregularity in depth of the stage 2 sequence boundary.

Critical to the preservation potential of transgressive and highstand sediments is the variable depth of the Pleistocene surface accross the study area. In areas where the Pleistocene surface is deeper than the depth of core penetration, thick Holocene sequences, in excess of 3 meters, are preserved (eg. Matagorda Peninsula shoreface profile transect 1; Fig. 1). On the other hand, a shallower Pleistocene surface provides less accomodation space and is associated with thinner (one meter) Holocene sequences (eg. San Jose shoreface profile transect 10; Fig. 2).

Currently, there are two models that can account for the sedimentary sequences above the Pleistocene surface. The preferred model is a fining upwards sequence of silty to clayey sands grading up into clays or silty clays resting on the stage 2 sequence boundary and amalgamated transgressive surface. These transgressive systems tract deposits typically contain high percentages of sand in the upper shoreface. Above the transgressive systems tract, the maximum flooding surface is overlain by a modern prograding Highstand shoreface unit that coarsens upward. Typically, the proximal upper shoreface contains fine sand that grade into distal lower shoreface interbeds of very fine sand and clay (Figs. 1 and 2). This model has broad implications for understanding the variable nature of deposition along the Texas coast. East of this study area, in the vicinity of Galveston Island, shoreface profiles typically contain upper and lower shoreface sediments up to a depth of the storm wave base (about 8 m). Further seaward, thin marine muds rest directly on the stage 2 sequence boundary (Siringan and Anderson, 1994). Hence, preservation of shoreface deposits is minimal. In central Texas, lower shoreface sediments extend far seaward of storm wave base (Figs. 1 and 2). This implies that sediment supply is much greater in this area, possibly due to longshore current transport of sediment into the area as well as a greater effec-

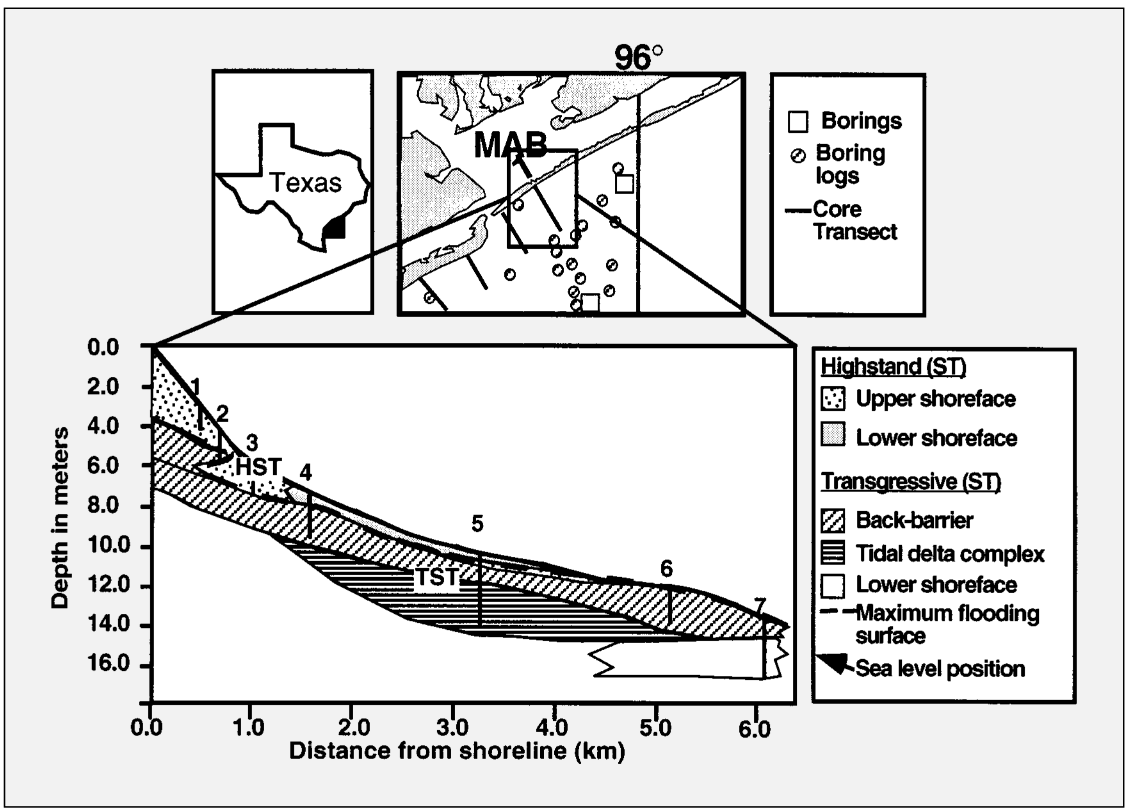

Figure 1. Matagorda Peninsula shoreface profile 1. MAB is Matagorda Bay for scale. The facies boundary is denoted by the maximum flooding surface. The transgressive systems tract consists of an overall fining upward sequence from tidally-influenced sands and silts grading up into organic-rich silts and clays of the back-barrier environment. The maximum flooding surface divides the transgressive deposits from the highstand systems tract deposits. The proximal cores contain lower fine sand grading into very fine sand of the distal lower shoreface.

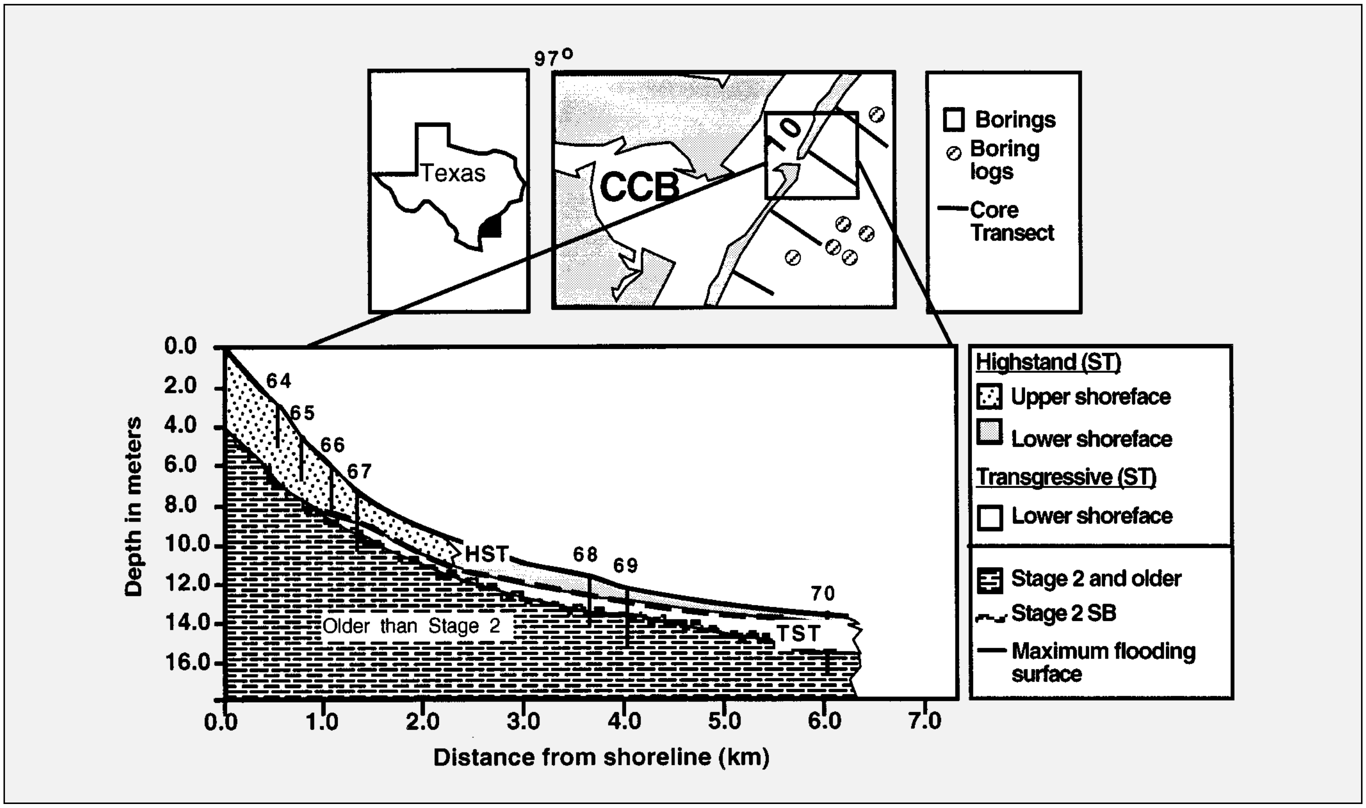

Figure 2. San Jose Island shoreface profile 10. CCB is Corpus Christi bay for scale. The lower sequence has been exposed and consists of indurated Pleistocene clays and oyster reefs which are consistently oxidized, and often contain carbonate nodules. These sediments are interpreted as older than stage 2 (>18,000 years old). The top of the unit is the Stage 2 sequence boundary. The transgressive systems tract overlies the sequence boundary, and consists dominantly of fining upwards lower shoreface sands with interbedded clays and silts. The maximum flooding surface caps the transgressive deposits and amalgamates with the sequence boundary updip. Highstand systems tract deposits prograde across this boundary. Proximal cores consist of lower fine sand grading into very fine sand of the distal lower shoreface.

tiveness of storm transport of sands out onto the shelf. Thus, the preservation potential of sediments on the Central Texas shelf is greater than on the East Texas shelf.

An alternative model suggests that all of the sediments above the stage 2 sequence boundary, excluding only the most proximal upper shoreface cores, represent transgressive systems tract deposits. The maximum flooding surface observed in Figures 1 and 2 would be a flooding surface representing a rapid increase in the rate of sea level rise during the transgression. Subsequent deposition above this flooding surface represents shoreface progradation during a relative sea level stillstand. This model implies that sedimentation rates were very high throughout the transgression.

The correct model can be determined if the timing can be constrained using radiometric ^{14}C-dating on shell material located at key stratigraphic surfaces. Furthermore, the surfaces constrained using the core transects can be confirmed based on future high resolution Chirper seismic acquisition. Ongoing research is aimed at gathering these data.

REFERENCES

Siringan, F.P., and J.B. Anderson, 1994, Modern shoreface and inner-shelf storm deposits off the East Texas coast, Gulf of Mexico: Journal of Sedimentary Research, v. B64, p. 99-110.