Mapping Bay-Head Deltas Within Incised Valleys as an Aid for Predicting the Occurrence of Barrier Shoreline Sands: An Example From the Trinity/Sabine Incised Valley

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Examination of the landward retreat history of bay-head deltas during transgressions will help predict the occurrence and location of barrier shorelines associated with incised valleys. During the last transgression (18,000 yr. BP to present) the Trinity/Sabine incised valley back-filled with continuous fluvial and bay-head delta facies and discontinuous middle-bay and coastal (tidal delta complex and barrier facies) deposits (Thomas and Anderson, 1994; Fig. 1A). Thomas and Anderson (1994) identified four packages of sediments bounded by flooding surfaces separating proximal coastal environments (bay-head delta and fluvial environments) from overlying distal coastal environments (middle bay, tidal delta, and barrier environments) within the incised valley. In places on the inner shelf banks (Sabine, Heald, Shepard, and Thomas banks) lie adjacent to and over the incised valley (Fig. 1A). These banks represent submerged paleoshorelines composed of three facies (from bottom to top): (1) a back barrier estuarine facies characterized by landward-dipping seismic reflectors and consisting of an interbedded sand and mud unit; (2) a fore-barrier, lower shoreface/ebb-tidal delta facies characterized by seaward-prograding to chaotic seismic reflectors and consisting of a muddy sand unit; and (3) a storm-reworked facies characterized by a chaotic to acoustically reverberating seismic reflection pattern consisting of an interbedded shell hash and sand unit (Rodriguez et al., 1999; Fig. 1B). The contact between the storm-reworked unit and the fore-barrier unit is the transgressive ravinement surface and represents shoreline submergence and reworking (Fig. 1B).

The modern Galveston Bay complex formed above the Trinity incised valley during the most recent stage of marine incursion, and because of its protected waters, it is an ideal area to examine incised valley fill in detail. The top of the bay-head delta surface has been mapped regionally within Galveston Bay and is characterized by a series of flat steps and inclined risers (Fig. 2). The flat steps represent landward translation of the bay-head delta environment. These flooding surfaces formed at the same time as the ravinement surfaces located within the offshore banks and indicate rapid landward translation of a bay complex as the result of sea-level rise. The risers represent periods of bay-head delta aggradation. This aggradation correlates with deposition of middle bay and barrier island sediments indicating formation of a new bay complex. Bay-head deltas are extremely sensitive to fluctuations in climate and sea-level. Landward translation of bay-head delta facies and barrier island submergence events occur simultaneously; therefore, recognition of bay-head delta steps within incised valley fill may aid in predicting the location of barrier sands stranded offshore as banks.

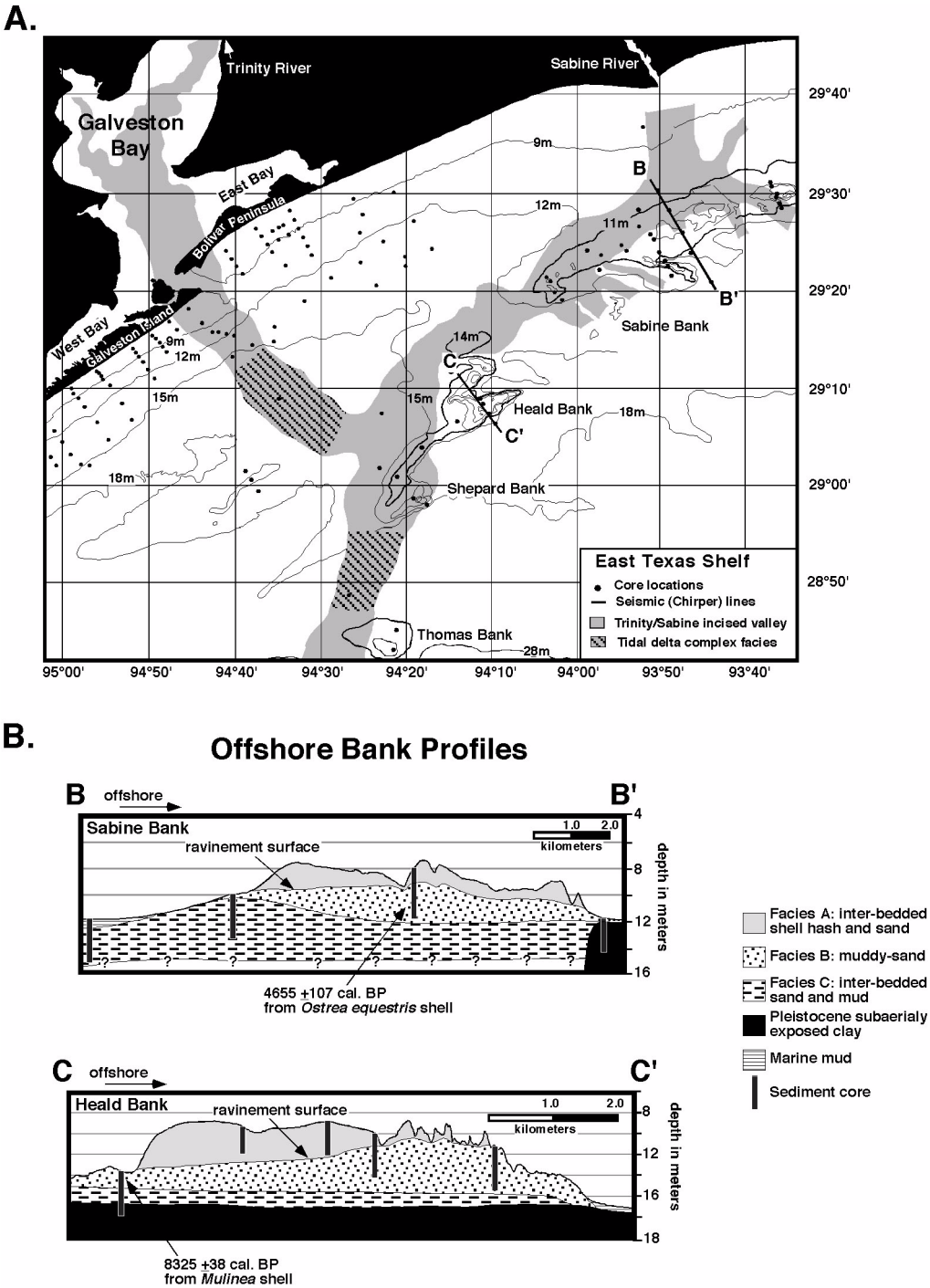

Figure 1. Map of the east Texas shelf (A) showing the location of the Trinity/Sabine incised river valley (in gray; after Thomas and Anderson, 1994) and tidal delta complex deposits (striped; after Rodriguez et al., 1998) preserved within it. Cross-section B-B' through Sabine Bank and C-C' through Heald Bank (B) illustrate bank facies architecture (after Rodriguez et al., 1999).

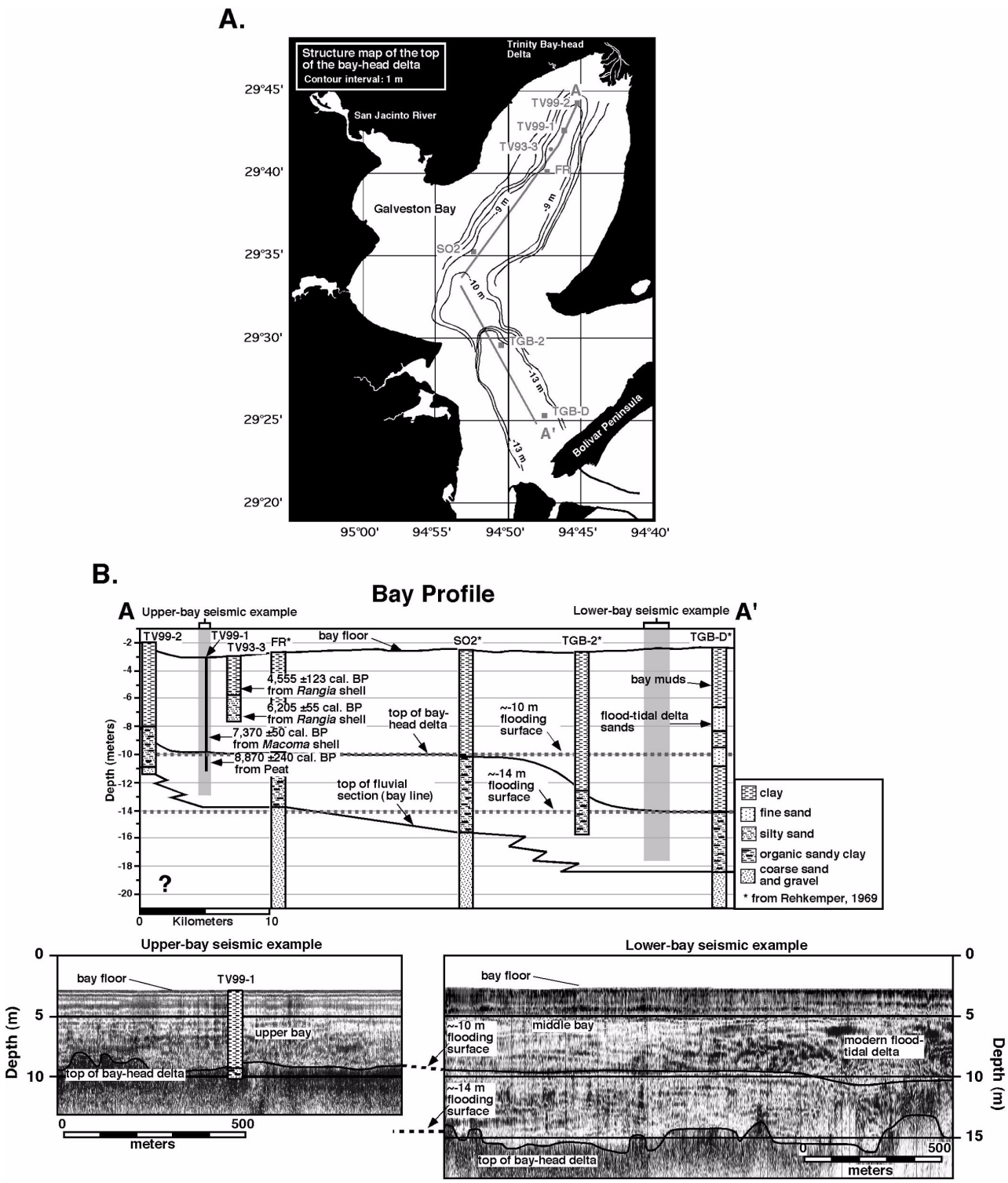

Figure 2. Structure map of the top of the bay-head delta flooding surface within Galveston Bay (A) showing the location of the inclined riser. Cross-section A-A' through Galveston Bay (B) is based on seismic and lithologic data. Locations of two seismic examples are indicated in gray on the cross-section. Flooding surfaces are outlined on the representative seismic examples.

References

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