Lithological and Morphological Framework of Pleistocene Barrier Islands and Underlying Strata from Surface and Borehole Geophysics and Airborne Lidar in the Matagorda Embayment

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ABSTRACT

Barrier-island deposits from the last Pleistocene interglacial (oxygen isotope stage 5) are an attractive target for surface and borehole geophysical investigations on the Texas coastal plain. We are combining frequency- and time-domain electromagnetic measurements with high-resolution elevation data acquired during recent airborne lidar surveys to distinguish low-relief Pleistocene barrier and strandplain strata, which are generally sand-rich and poorly conductive, from underlying and adjacent clay-rich estuarine, deltaic, and fluvial deposits. Lidar data reveal subtle topographic expressions that enable major depositional features to be discriminated, frequency-domain conductivity measurements allow sand content in the shallow subsurface to be estimated, and time-domain electromagnetic soundings permit sand-body thicknesses and major vertical lithologic boundaries to be determined. Borehole geophysical measurements of conductivity and gamma activity complement surface geophysical measurements by verifying major lithologic types and boundary depths and identifying intraformational variations in sand content and depositional environment. On the central Texas coast between Matagorda Bay and Copano Bay, airborne lidar and geophysical measurements indicate that the Pleistocene Ingleside barrier island reaches thicknesses greater than 10 m and was deposited in at least three distinct episodes that may correlate to sea-level highstands associated with oxygen isotope stage 5 during the last interglacial at about 100 ka. Within the Matagorda embayment between the Brazos/Colorado and Guadalupe/San Antonio alluvial fans, geophysical log data suggest that Ingleside strata overlie a nearly complete transgressive sequence more than 80-m thick that includes (1) stacked fining-upward fluvial strata (point bar and floodplain), (2) a coarsening-upward deltaic unit, and (3) marine-influenced estuarine and barrier-island deposits.

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