GEOMORPHOLOGY AND MORPHOLOGIC DEVELOPMENT OF AN EBB-DOMINATED TIDAL INLET ON THE MICROTIDAL, WAVE-DOMINATED TEXAS COAST

Andrew D. Eyer[1]

ABSTRACT

Few geological studies have been made of tidal inlets on the Texas coast and the total picture of inlet dynamics in that region remains poorly understood. Previous generalizations of inlet geomorphology characterized Texas inlets as wave-dominated, with large, well-developed, flood-tidal deltas and small, poorly-developed, ebb-tidal deltas. On the basis of this study, this appears not to be the case.

The geomorphology of Bolivar Roads Inlet, located between Galveston Island and Bolivar Peninsula on the Texas coast, was studied through the examination and comparison of aerial photographs, historic maps and charts, and written accounts of historic changes, as well as the analysis of hydraulic, bathymetric, and meteorological data compiled by various sources. Depositional environments and process-morphologic response relationships were determined and compared to models presented for East Coast and Gulf Coast tidal inlets. In addition, examination of the historical development of the inlet between 1721 and 1876 determined long-term changes and trends in tidal inlet hydrodynamics and morphology.

In its natural state (pre-1890), Bolivar Roads Inlet was geometrically stable and behaved like present-day mesotidal, mixed energy (tide-dominated) tidal inlets, even though it was (and is) in a microtidal, wave-dominated environment. An atypically large and well-developed ebb-tidal delta was maintained by: a) wind tides and ebb flow enhancement associated with "northers;" b) a large sediment supply; c) an ebb dominance and time-velocity asymmetry of tidal currents resulting from a diurnal inequality of the tides and tidal phase lags in Galveston Bay.

Historical documentation of the inlet indicates that the asymmetric flood-tidal delta migrated in a southerly direction, apparently because of "norther"-generated wave and tidal current action. Major changes in the ebb-tidal delta were associated with repetitive cycles of "channel abandonment by-passing" similar to that documented on the South Carolina coast. The present-day morphology of Bolivar Roads Inlet is the result of a complex interaction between tidal currents, wind waves, and longshore currents, all of which have been disrupted as a result of extensive modification of the inlet.

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[1] Pennzoil Company, P.O. Box 2967, Houston, Texas 77252-2967