PhD Dissertation Defense

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Title: Morphostratigraphy, Dynamics, And Reconstruction Of Former Tidal Inlets Along Assateague Island, Maryland-Virginia: Impacts On Barrier-Island Evolution

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ABSTRACT

A multi-technique approach, including analysis of historical nautical charts and maps, LIDAR datasets, true-color and infrared aerial imagery, ground-penetrating radar (GPR) surveys, and analysis of sediment cores, was pursued to reveal the dynamic nature of former tidal inlets along Assateague Island, MD-VA. An updated inlet chronology of the barrier island revealed that 11 former tidal inlets and breach zones were active within the historical period. In total, 34% of Assateague Island is estimated to be comprised of tidal-inlet fill. A five stage, life-cycle model of Green Run Inlet was constructed utilizing the multi-technique method. GPR data revealed that the former Green Run Inlet migrated 680 m to the south and had a final channel position 100 m wide and 3.75 m deep resulting in a spring tidal prism of 2.79 X 10^6 m^3. During the waning and shoaling stage of Green Run Inlet, the channel rotated 30° counterclockwise before infilling. The former Sinepuxent Inlet was subjected to a more complex history and sediment cores yielded a three-stage evolutionary inlet model. Sediment cores and historical aerial photography suggest multiple breaching events occurred at Sinepuxent Inlet. Sediment cores also underscore the importance that energy pulses (i.e., higher flow velocities associated with increased tidal prism during storms, spring high tides, and perigean spring high tides) play in inlet-fill stratigraphy. Reconstruction of the tidal prism of the former Sinepuxent Inlet yielded a value of 8.71 X 10^6 m^3 when the inlet was open. A regional overview of wave-dominated tidal inlets yielded a generalized life-cycle model based on the rotational nature of tidal inlets when they were active. Wave-dominated tidal inlets may form by landward- or seaward-directed breaching and are classified into three categories based on channel rotation direction: clockwise rotation, counterclockwise rotation, or non-rotation. Counterclockwise rotating tidal inlets appear to be more common than clockwise rotating or non-rotating tidal inlets. Clockwise rotation appears to occur in areas where external forces (i.e., salt marsh obstruction, pre-existing backbarrier channels, and flood-tidal delta breaching) influenced the rotation.