Evaluating a New Mechanism for Bay-Head Delta Back-Stepping Events

PI: Antonio B. Rodriguez, UNC-Chapel Hill
Co-PI: Brent A. McKee, UNC-Chapel Hill

Bay-head deltas (BHD) are located at the head of drowned river-mouth estuaries and encompass the ecologically important tidal freshwater zone. The Holocene sedimentary record shows that BHDs shifted landward rapidly (back-stepped) during a period of time when sea level was rising at a rate similar to what is predicted by the year 2100. Tributary junctions may be an important, but previously overlooked threshold in BHD evolution. The objective of this study is to examine the impact of tributary isolation as a result of sea-level rise on the BHD depositional environment.

As tributaries are inundated, their drainage basins are isolated from the main trunk valley. This causes an abrupt decrease in discharge to the BHD, bisection of the BHD, and BHD inundation and rapid landward retreat. Hypotheses to be tested include: 1. Tributary isolation as a result of sea-level rise is a mechanism for Holocene BHD back-stepping and 2. Tributary isolation is likely to occur in many areas within the next 50 to 100 years and will accelerate BHD retreat rates.

The modern Roanoke and Chowan BHDs and a Holocene BHD preserved in Albemarle Sound, NC will be used to test the hypotheses. Tributaries discharge directly into the modern BHDs at elevations < 50 cm, which is within the range of year 2100 predicted sea-level. Additionally, previous studies indicate a Holocene BHD accreted in the middle of Albemarle Sound and back-stepped during its evolution.

Holocene BHD back-stepping will be evaluated from high-resolution seismic data, cores, and radiocarbon dates acquired in the sound and modern delta-plain environments. The impact of future sea-level rise and associated tributary isolation on modern BHD back-stepping will be assessed by measuring BHD accretion rates in cores using radiochemical techniques and digital-elevation models.

Tributary isolation as a mechanism for BHD back-stepping has not previously been recognized but is likely very important and imminent. This study will produce a new, widely applicable conceptual model for BHD evolution in response to sea-level rise. Thresholds in the rate of accretion and accommodation-space creation will be quantified. Results will be published in peer-reviewed journals, and the project will contribute to graduate/undergraduate education.