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Quaternary depositional patterns and sea-level fluctuations, northeastern North Carolina

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Abstract

A detailed record of late Quaternary sea-level oscillations is preserved within the upper 45 m of deposits along an eight km transect across Croatan Sound, a drowned tributary of the Roanoke/Albemarle drainage system, northeastern North Carolina. Drill-hole and seismic data reveal nine relatively complete sequences filling an antecedent valley comprised of discontinuous middle and early Pleistocene deposits. On interfluves, lithologically similar marine deposits of different sequences occur stacked in vertical succession and separated by ravinement surfaces. Within the paleo-drainage, marine deposits are separated by fluvial and/or estuarine sediments deposited during periods of lowered sea level. Foraminiferal and molluscan fossil assemblages indicate that marine facies were deposited in a shallow-marine embayment with open connection to shelf waters. Each sequence modifies or truncates portions of the preceding sequence or sequences. Sequence boundaries are the product of a combination of fluvial, estuarine, and marine erosional processes. Stratigraphic and age analyses constrain the ages of sequences to late Marine Isotope Stage (MIS) 6 and younger (~140 ka to present), indicating multiple sea-level oscillations during this interval. Elevations of highstand deposits associated with late MIS 5 and MIS 3 imply that sea level was either similar to present during those times, or that the region may have been influenced by glacio-isostatic uplift and subsidence.

Keywords: Late Quaternary; Sea-level record; Northeastern North Carolina; Stratigraphy; Antecedent topography

Introduction

The Mesozoic and Cenozoic deposits of northeastern North Carolina consist of eastward-dipping, seaward-thickening sequences of sediments that form a sedimentary wedge 1.5 to 2.0 km thick (Popenoe, 1985; Klitgord et al., 1988; Riggs et al., 1992). The upper 55 to 60 m of these sediments are Quaternary in age and rest unconformably on the Pliocene Yorktown Formation (Brown et al., 1972; Mallinson et al., 2005). Between the Cape Lookout High to the south and the Norfolk Arch to the north, Quaternary deposits fill a regional depositional basin called the Albemarle Embayment (Ward and Strickland, 1985; Riggs et al., 1995; Foyle and Oertel, 1997) (Fig. 1). The Quaternary section preserved within the Albemarle Embayment is unusually thick for the region. To the north, Quaternary deposits in the Salisbury Embayment of Virginia average 30–35 m in thickness (Foyle and Oertel, 1997). To the south, Quaternary deposits on the Carolina Platform High (Fig. 1) are only preserved as a thin, discontinuous sand prism (Hine and Snyder, 1985). Dissecting the Albemarle Embayment are a series of Quaternary fluvial valleys filled with younger coastal and shelf sediments separated laterally by older stratigraphic units that compose the interfluves (Riggs et al., 1995).

Located within the modern coastal system of northeastern North Carolina, Croatan Sound and Roanoke Sound (Fig. 1) represent two drowned lateral tributaries that flowed northwards to the paleo-Roanoke River (now Albemarle Sound) (Riggs et al., 1992). Roanoke Island is a remnant of the

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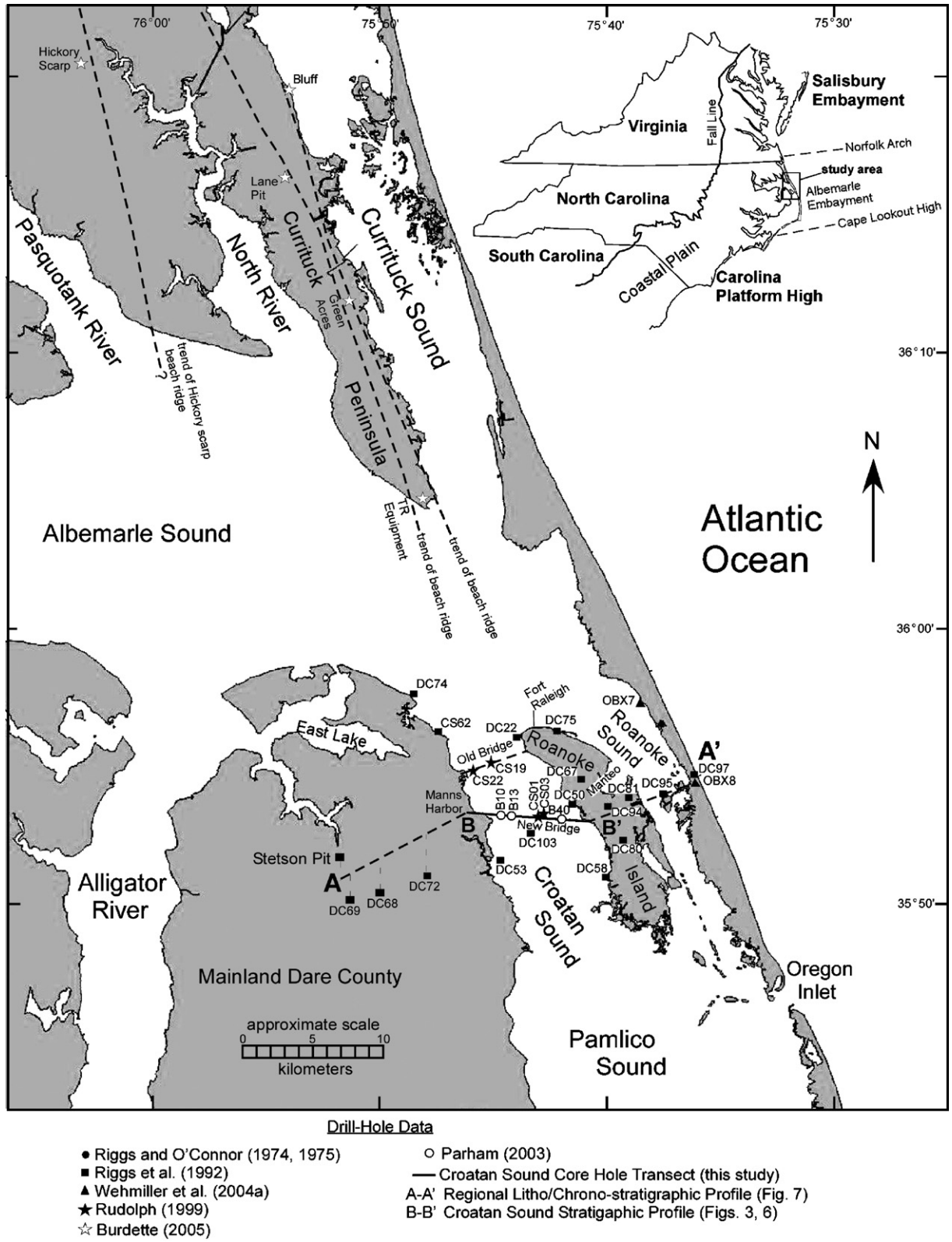

Figure 1. Map of the Croatan Sound study area, northeastern North Carolina, shows the drill hole and outcrop locations containing age data used in this study, the trends of Currituck beach ridges, the location of the Croatan Sound drill hole transect B–B′ (Fig. 2), and the location of regional litho- and chronostratigraphic cross sections A–A′ (Figs. 8 and 9).

interstream divide that separated these two drainages. Croatan Sound is the major outlet to Pamlico Sound and the Atlantic Ocean for the Roanoke/Albemarle drainage system. It ranges in width from 4.2 km to 8 km and averages 5 m in depth, with depths up to 7.5 m in the NW–SE trending channel (Eames, 1983; Riggs et al., 1992).