NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF ENERGY, MINERALS AND LAND RESOURCES

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NORTH CAROLINA GEOLOGICAL SURVEY

OPEN FILE REPORT 2019-08

Introduction

The Atlantic Coastal Plain of eastern North Carolina (Fig. 1) is poorly understood from scientific, stratigraphic, and mapping perspectives. It is mantled primarily by Pliocene and Pleistocene deposits that have map extents, allostratigraphy, and relationships to global sea level cycles that are mostly undefined. Outcrops are rare, and the new subsurface data necessary to define units and map this region is expensive. Except for recent STATEMAP (SM) deliverables, detailed geologic maps at 1:24,000-scale for the Coastal Plain do not exist. The current geologic map (NCGS, 1985) does not show surficial units for the Coastal Plain, it shows underlying subcrops (Fig. 1A). In recent SM areas (FY10-18), the Pliocene Yorktown Formation is supposedly the principal subcrop (NCGS, 1985); this unit is affiliated with a regional-scale shallow confining unit. Detailed mapping (FY10-18) shows that the Yorktown (Fig. 1A) is thin, absent, or misidentified. Isotopic age dates suggest that basal, clastic carbonate beds that define the base of the Plio-Pleistocene, correlate with the Chowan River Formation, rather than the Yorktown. If this is the case the Yorktown is essentially absent in this area of the NC Coastal Plain. The post-Chowan River section includes several early Pleistocene units in ramp or interfluve settings; younger terraces and alluvium occur in incised valleys.

Location and Geologic Setting

The Coastal Plain, a relict, Plio-Pleistocene landscape (Fig. 1B), consists of a series of progressively younger scarps, or paleoshorelines, and intervening terraces that step down in elevation and age towards the coast (Fig. 2) and into river basins (Fig. 3). This is stairstep topography. Seven river basins dissect the Coastal Plain so that its low-relief, flat, eastward-dipping marine terraces (ramps) are separated by incised valleys with terraced borders. Over the past 5 Ma, glacio-eustatic changes in sea level drove the transgressive-regressive (T-R) cycles that sculpted this landscape. Fluvial, estuarine and marine deposits occur in the incised valleys. The stratigraphy in valley fills differs from that of the ramp or interfluve (Farrell and others, 2003), and forms the "alluvial aquifer system" (Tesoriero and others, 2005).

The Surry Scarp, a Pleistocene paleoshoreline complex, trends north through Fountain quad (Figs. 1, 4A). Regional-scale conceptual models (Mixon and others, 1989; Winker and Howard, 1977; Oaks and DuBar, 1974; Daniels and others, 1966) and NCGS SM data suggest that the Surry shoreline is the highstand position for the main early Pleistocene T-R cyclic event. Stratigraphic relationships near the scarp are complex and include several early Pleistocene units; each contains similar repeating facies, and fossils are rare. In Virginia (Mixon and others, 1989) these are the Moorings Unit and the Bacons Castle, Windsor, and Charles City Formations (Fig. 5). In NC and VA, these correlative units occur within the shoreline complex, and both landward and seaward of it. These are not lithologically distinct bodies of rock that are easily mappable; these are allo-units that are mapped by establishing bounding surfaces, their terminations, and the geologic facies above them. Our goal is to describe facies and establish units in a sequence stratigraphic context, and to determine the stratigraphy's relationship to surficial landforms. Sequence stratigraphy emphasizes facies relationships and stratal architecture within a chronological framework (Catuneanu and others, 2009).

Strategy for Performing the Investigation

Geologic mapping in the NC Coastal Plain requires a non-traditional method, called three-dimensional (3D) subsurface mapping (see Newell and Dejong, 2010; and Hughes, 2010), to define and map surficial geologic units. This method combines a geomorphic interpretation of the relict Quaternary landscape with targeted subsurface analysis along profiles that transect geomorphic features. It is useful because the NC Coastal Plain is notorious for its low relief, few outcrops, lack of defined units and type sections, recurring facies, colluvium on side slopes, and extensive wetlands cover, even on uplands: bedrock mapping methods do not apply.

To produce the map, landforms were interpreted from the highest resolution Light Detecting and Ranging (LiDAR) elevation data (20 cm). LiDAR tiles, as floating point ASCI files were downloaded from the Floodplain Mapping Program's website (www.ncfloodmaps.com). These were transformed from ASCI files to raster grids, mosaiced into 10 X 10 rasters, and reprojected as State Plane Nad 1983 meters. Hillshade, slope, and contour lines (1.0, 0.5, and 0.25 meters) were constructed from the raster grids. Orthoimagery (2012, 2010) from the NCONEMAP was used in conjunction with elevation grid color ramps, contour lines, hillshade and slope to interpret landforms. Farrell and others (2003) summarize the method of comprehensive landscape analysis. A series of landform elements was interpreted and digitized starting with the Holocene depositional system and working backward in time into older landscapes. Key transects cross cutting the Surry paleoshoreline and other features were chosen for subsurface analysis. Geologic cores were acquired in plastic tubes with the Geoprobe drill rig. These are 1.5-inch diameter continuous cores (discrete sampling method) collected in 4-foot increments. Cores were logged using the methods of Farrell and others (2012, 2013). High-resolution photos …

Overview of Geomorphology and Stratigraphy in Falkland Quadrangle, Southeast Quadrant

The project deliverable is … ly north of Falkland … north of Farmville … was conducted by one … appointment) and on … shown are two cross s…

Falkland Quadrangle (1/4): Significant findings from the mapping include:

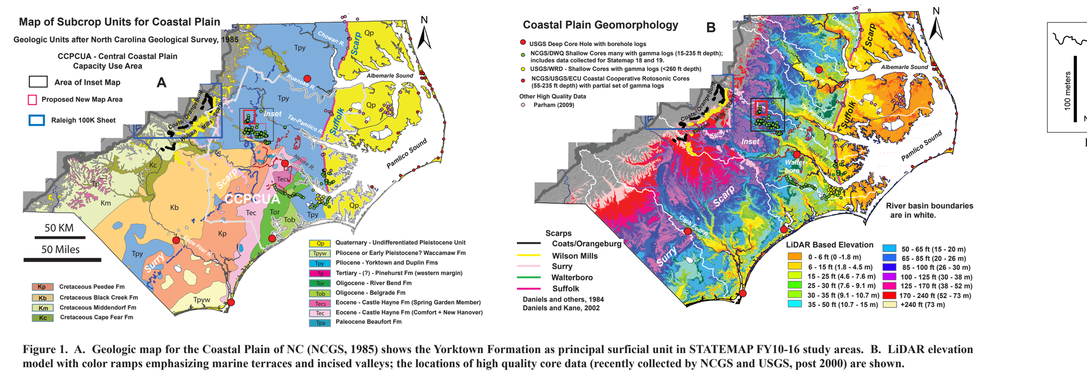


Figure 1. A. Geologic map for the Coastal Plain of NC (NCGS, 1985) shows the Yorktown Formation as principal surficial unit in STATEMAP FY10-16 study areas. B. LiDAR elevation model with color ramps emphasizing marine terraces and incised valleys; the locations of high quality core data (recently collected by NCGS and USGS, post 2005) are shown.

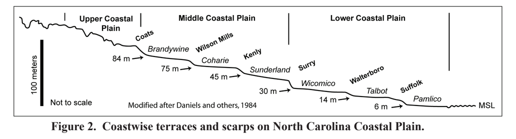


Figure 2. Coastwise terraces and scarps on North Carolina Coastal Plain.

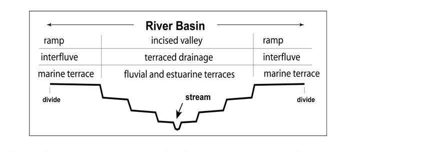
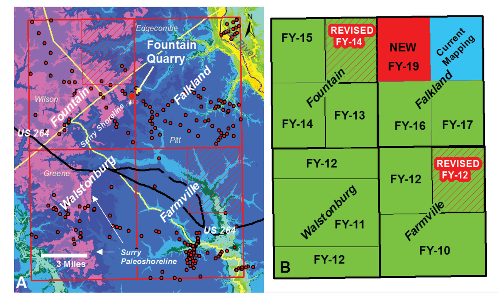


Figure 3. Stairstep topography bordering river basins and terminology.



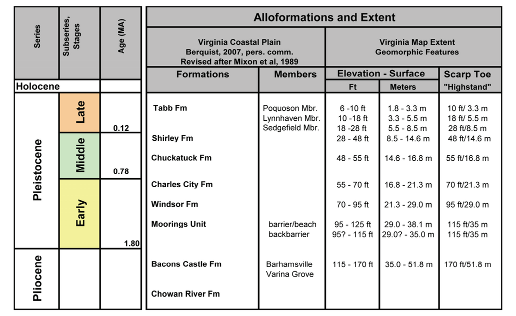
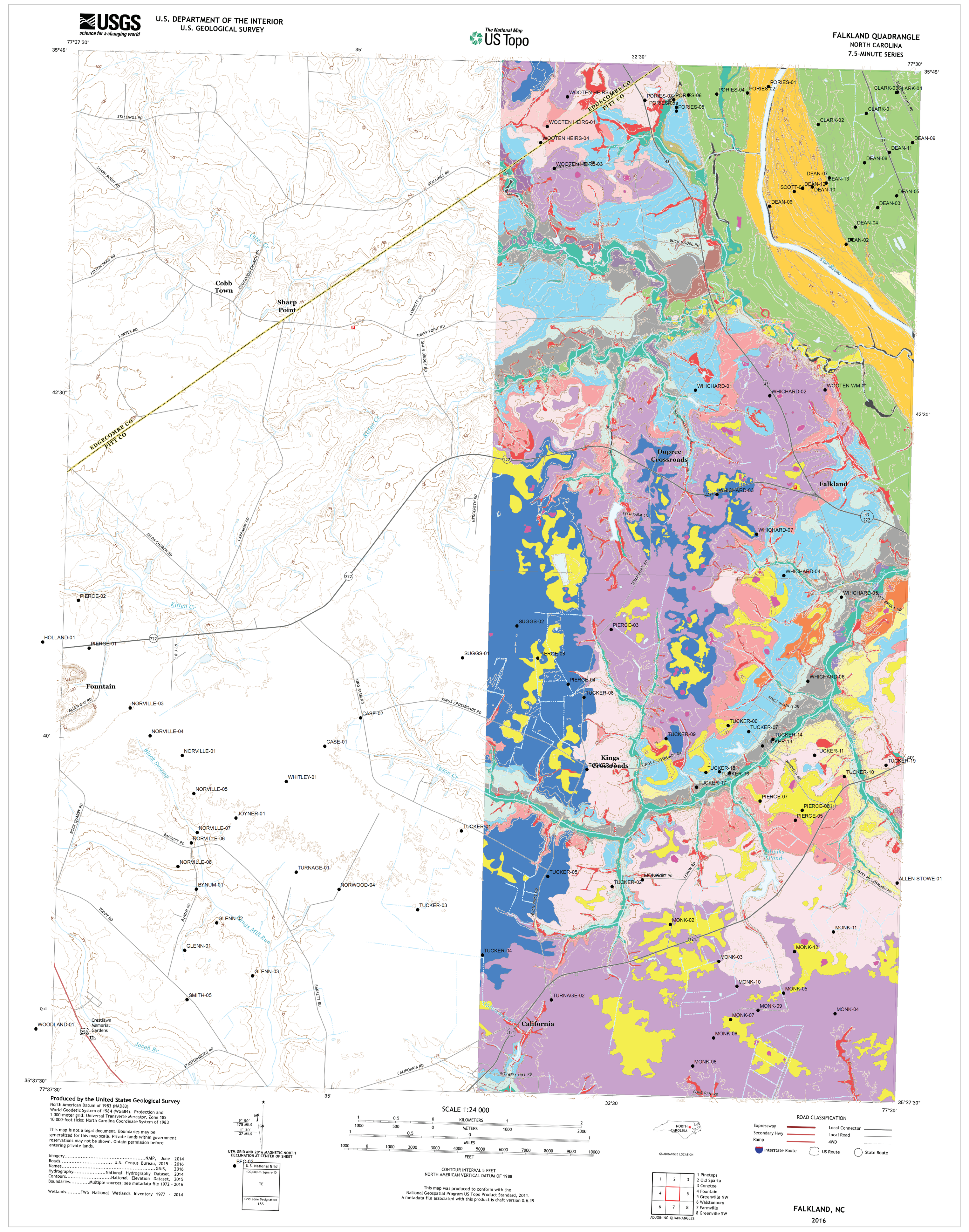
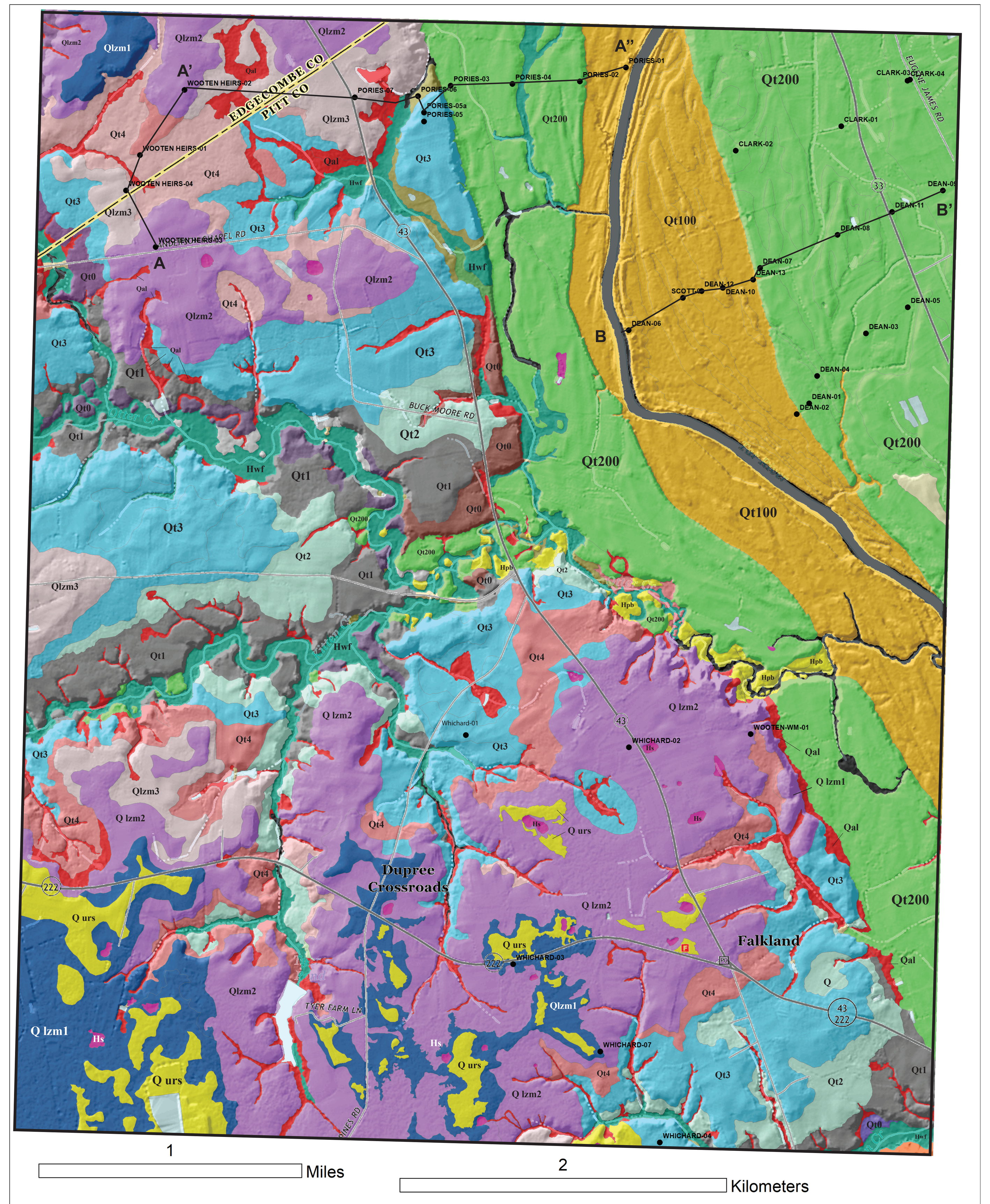
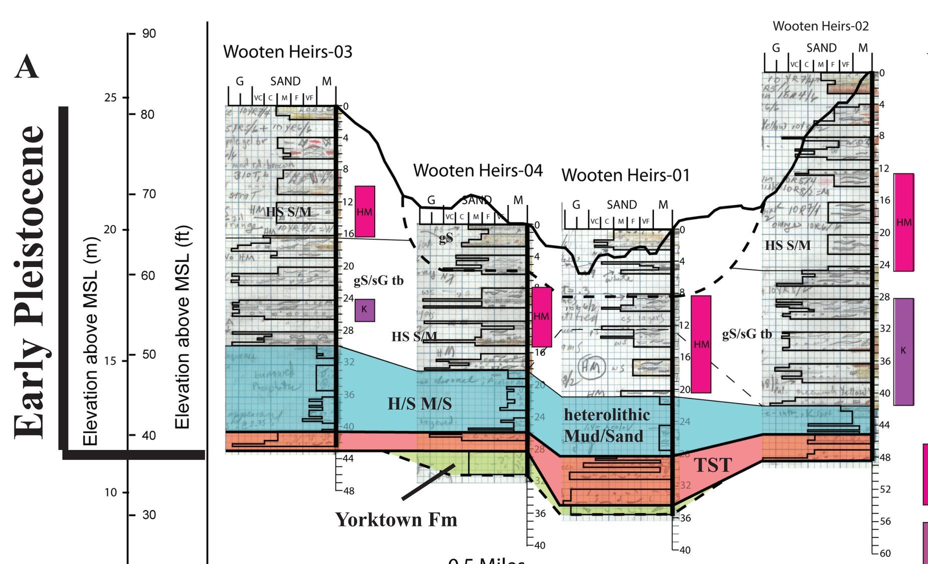


Table 1. Locations of new cores collected in the Southeast Quadrant of Falkland Quadrangle for STATEMAP FY18 data deliverables.

Table 2. Locations of new cores collected in the Northeast Quadrant of Falkland Quadrangle for STATEMAP FY18 data deliverables.







RARE EARTH ELEMENT MINERALS

Feldspar common

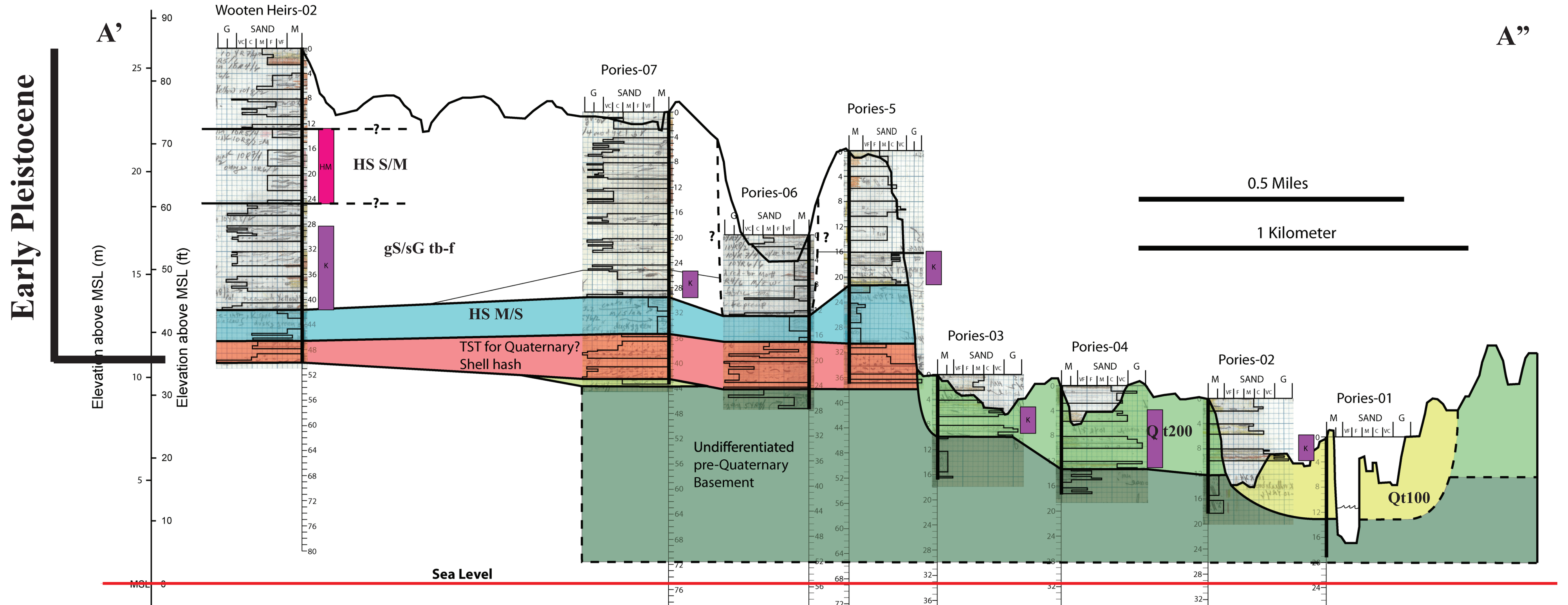
Disclaimer: This Open-File Map is preliminary. It has been reviewed internally for conformity with the North Carolina Geological Survey editorial standards. Further revisions or corrections to this preliminary map may occur.

This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program under StateMap award number G18AC00205, 2018.

GEOLOGIC MAP WITH GEOMORPHIC LANDSCAPE ELEMENTS OF THE FALKLAND 7.5 MINUTE QUADRANGLE, NORTHEAST QUADRANT, NORTH CAROLINA

By
Kathleen M. Farrell and Erik D. Thornton

2019



Legend for Geologic Map Units - Geomorphic Landscape Elements

Holocene

Stream Channel

Man-Made Excavation - Pond or Lagoon, Mining Operations.

Man-Made Earthwork Structures - such as Spoil Piles from Mining and Dredging, Dams, Causeways through Wetlands.

H wf — Wetland Flat (Holocene): Wetland flat at base of incised valleys; commonly with anastomosed channel network activated during flood stage, or a single main channel, which is commonly trenched and straightened by human activity; may exhibit lacustrine conditions. …

H wf2 — Wetland Flat 2 (Holocene - reactivated Pleistocene flat): Wetland flat that merges with the Hwf in upstream reaches of valleys. …

H sc — Side valley colluvium and bar forms within channels.

H s — Sinkhole (Holocene): Incipient ovate depression that is commonly incised into surrounding landscape; may occur in conjunction with depressions in centers of Carolina Bays.

H pb — Point bar deposits (probably Holocene) that are part of lower Otter Creek drainage.

Undifferentiated Quaternary Deposits:

Q urs: Undifferentiated remobilized sands that usually on interfluve flats such as the 24-26 m marine terraces.

Undifferentiated Pleistocene Depositional Systems including Valley Fill and Falling Stage Deposits:

Qt100 Pleistocene Stream Terrace in Tar River incised valley - 4-6 m.

Qt200 Pleistocene Stream Terrace in Tar River incised valley - 10-12 m.

Qal Undifferentiated Quaternary Alluvium - currently active landscape. Includes the Holocene material in side valleys and on alluvial fans and colluvium on side slopes.

Qt0 Pleistocene Stream Terrace @ 8-9 m on Falkland SE, not occurring upstream on Falkland SW.

Qt1 Pleistocene Stream Terrace @ 19-20 m on Falkland SW. Very distinct flat terrace mapped downstream to 11 m on Falkland SE. May be Middle Pleistocene.

Qt2 Pleistocene Stream Terrace @ 20-21 m on Falkland SW. Principally a colluvial deposit affiliated with Qt1. Mapped downstream to 13 m on Falkland SE. Locally widens into flat terrace.

Qt3-10 Pleistocene Stream Terrace @ 22-23 m on Falkland SW where it occurs as an upstream valley fill colluvial deposit. Downstream on Falkland SE, it broadens and flattens into a fully developed terrace at 20 m.

Qt3-20 Pleistocene Stream Terrace @ 19 m on Falkland SE where it occurs as an upstream valley fill colluvial deposit. Downstream on Falkland SE, it broadens and flattens into a fully developed terrace at 20 m.

Qt3 Pleistocene Stream Terrace @ 22-23 m on Falkland SW where it occurs as an upstream valley fill colluvial deposit. Downstream on Falkland SE, it broadens and flattens into a fully developed terrace at 20 m.

Qt4 Pleistocene Stream Terrace @ 23-24 m on Falkland SW where it occurs as an upstream valley fill colluvium associated with falling stage. Downstream on Falkland SE, it forms broad flat areas at 21-23 m, and is associated with deflation surfaces of Carolina Bays.

Qt5 Pleistocene Stream Terrace @ 24-25 m on Falkland SW. This unit is similar to and may correlate with Qt4, but is located in updip areas. It was not identified in Falkland SE.

Qt6 vf Pleistocene Valley Terrace @ 25-26.5 m; merges with marine terrace equivalent that is seaward (east) of ~26 m shoreline (Q lzm). Mapped upstream on Falkland SW; does not occur in downstream areas of Falkland SE.

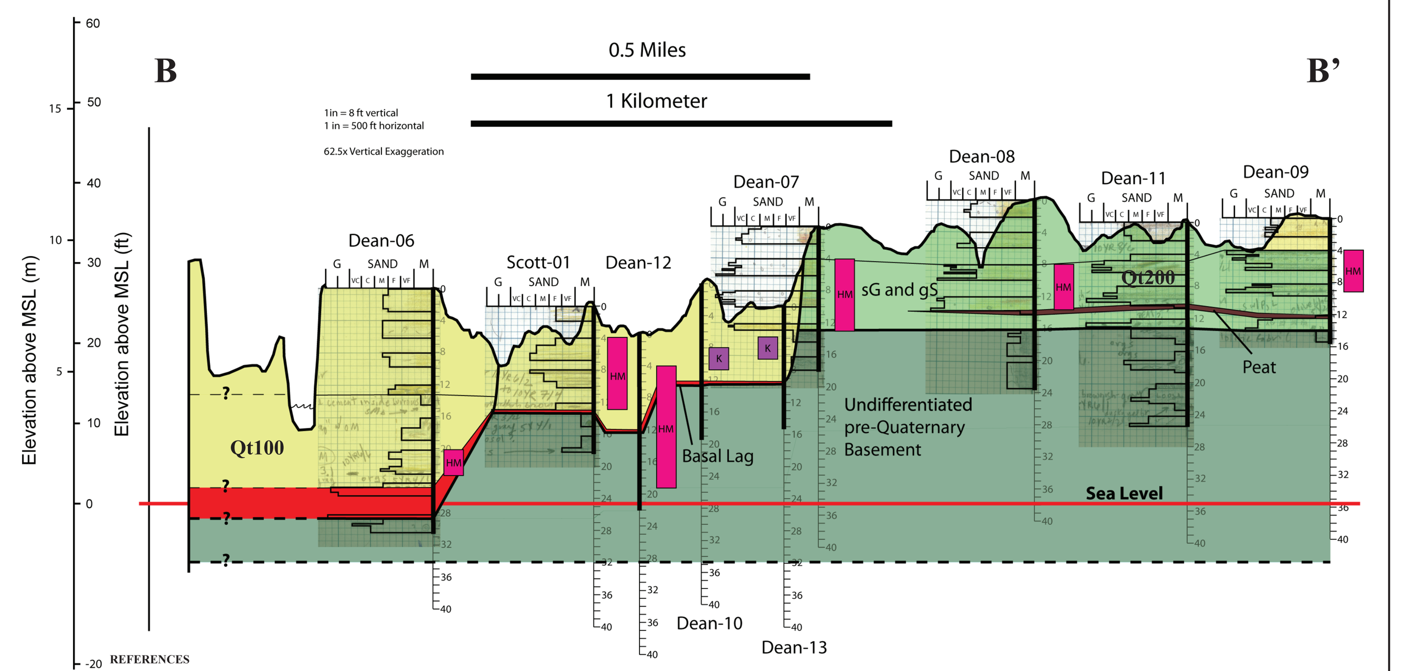
Early Pleistocene Units - Marine Ramps on Interfluves:

Q lzm: Informal Lizzie Formation, downstepping, marine interfluve deposits; occur beneath marine flats east of 26 m shoreline, mapped downdip to 23 m.

Q lzm3: Marine terrace that occurs @ ~23-24 m.

Q lzm2: Marine terrace that occurs @ ~24-25 m, merging gradually (elevation-wise) with lzm1.

Q lzm1: Marine terrace that extends from 26.5 meters to 24.5 m. Boundary between lzm1 and lzm2/3 is ~24.5 m.



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Environmental Quality