SUPPLEMENTARY MATERIAL

Geological Setting

This study focused on the coastal plain of South Carolina Atlantic seaboard (Fig. 1 SM). The original source data used in the paper are all from marine Pleistocene-aged deposits and their regional authors are listed in Figure 1. We now assign the Marietta unit (informal) to the Pleistocene and therefore it is the oldest Pleistocene unit identified at the surface (Fig. 3g of paper). The Marietta unit of South Carolina (DuBar et al., 1974) was formerly assigned to the Pliocene. The Pliocene age was based on the correlation with the Bear Bluff Formation age of 1.8-2.4 Ma (McCartan et al., 1982). The change of the Marietta unit’s age assignment results from the proposed change in the base of the Pleistocene from 1.8 Ma to 2.558 Ma by the International Commission on Stratigraphy in 2009 (Gibbard and Head, 2009), and from age dates from Weems, Lewis, and Crider (2011) which revised the Marietta unit’s age to 1.6 Ma.

Mapping Compilation

There is a well-established body of work related to these formations and features in South Carolina and their correlations to other states in the southeastern United States (Tables 1 and 2 SM).The geological formations established from mapping and their associated features, escarpments (scarp), terrace, unconformities, are used to establish that the toe elevation of the scarp is our indicator for former relative sea level elevation (terms defined in Table 4 SM). The sea level indicators used in this paper are derived from geological mapping (Fig. 1 of paper; Tables 2 and 3 SM). We assume elevation errors are small since many measurements were made across a substantially large area of study (~ 8000 km2), as were measurements in comparable areas of map coverage in other studies while other studies have larger error ranges (confidence intervals) for possible elevations. For example, Waelbroeck et al. (2002) have estimated confidence intervals of ± 10 m. Our mapping, with elevations derived from USGS 7.5-minute 1:24,000 scale topographic maps, has a much smaller elevation error range.

Regional Stratigraphic Correlation

In southeastern North America the naming of many Pleistocene stratigraphic units are named after their associated geomorphic features (i.e. Shattuck 1901a; 1901b; 1906; Clark et al., 1912), and predate the now-standard North America Stratigraphic Code (North American Commission on Stratigraphic Nomenclature, 2005). For example, a terrace and its genetically related subsurface sedimentary deposits often share the same name, as in the Pamlico terrace and Pamlico Formation (Clark et al., 1912).

Correlatable formations, and geomorphic features, are critical to interpreting relative sea-level history. Locally there are difficulties correlating some of the stratigraphy and geochronology this has resulted in some inconsistent stratigraphic assignments. These differences in stratigraphy can confuse the correlation of formations with Marine Oxygen Isotope Stages and modeling isostatic corrections. We provide a summary of the evolution of the stratigraphy for reference.

During the 1960’s and 1970’s, Colquhoun (1974) and DuBar et al. (1974) both proposed stratigraphies for the Pleistocene of South Carolina. Colquhoun (1974) proposed a stratigraphy based on Cooke (1936) in the Charleston, SC area (Fig. 2 SM). DuBar et al. (1974) produced a generalized geological map of Neogene formations in NE South Carolina and SE North Carolina (Fig. 3 SM), creating a different stratigraphy from Cooke and Colquhoun. The resulting competing stratigraphies (Cooke vs. DuBar) for the same-aged sediments have produced complications for later workers. For example, based on remapping currently underway by the South Carolina Geological Survey (Doar, 2012), we feel that the samples attributed to the Canepatch (DuBar et al., 1974) were derived from three separate depositional episodes that may correlate to the Ten Mile Hill, Pamlico, and Princess Anne Formations (Fig. 4 SM) just as the Talbot terrace of Colquhoun (1974) is divided by the Bethera scarp and composed of two depositional episodes- the Ladson and Mile Hill formations.

Quaternary geochronologic data for the area are available from numerous studies (e.g., Colquhoun, 1962; Wehmiller and Belknap, 1982; McCartan et al., 1984; Szabo, 1985; Wehmiller et al., 2004; Mallinson et al., 2008; Wehmiller et al., 2010) and all of the geochronological data used herein, except for our 14C data (on file at the South Carolina Geological Survey), is sourced from existing publications.

Our mapping (Table 3 SM), and the mapping noted in Supplementary Tables 1 and 2 (e.g. Hoyt and Hails, Colquhoun, Healy, Weems and multiple workers, Berquist and multiple workers), all use a directly correlatable stratigraphy (Table 2 SM). Doar (2012) mapped three highstands adjacent to the Santee River near Georgetown, S.C. as Ten Mile Hill, Pamlico, and Princess Anne Formations yet DuBar et al. (1974) mapped the same area as the Canepatch or Socastee Formations (Fig. 3). Wehmiller and Belknap’s (1982) explanations were complicated by this same stratigraphic confusion, particularly when attempting to date the Pamlico deposits correlated to samples from the Canepatch of DuBar et al. (1974) and the Wando of McCartan et al. (1980). The dates range from 74 ka to 180 ka. In the Charleston, S.C. area, Wehmiller and Belknap (1982) mention that four coral Uranium-series dates were 90-120 ka. Cronin et al. (1981) report dates from the Wando Fm of 139-87 ka. We feel that these samples are from two separate depositional episodes; the ~ 139-120 ka dates are from the Pamlico Formation and the 90-87 ka dates are from the Princess Anne Formation. We support this interpretation with two additional data sets. Between Charleston and Georgetown, Willis (2006) reports Optically Stimulated Luminescence (OSL) dates of ~100 ka (± 18.15 ka) (Table 1 of paper) for mapped Princess Anne deposits. Also, York et al. (2001) report a Uranium-series date of 80 ka from mapped Princess Anne deposits south of Charleston and Wehmiller et al. (2004) also report Uranium-series coral dates from Charleston-area Princess Anne deposits of 75.5+/- 9.8 ka and 85.5+/- 10.8 ka. Additionally, since it was established as a formation, the Canepatch Fm has been restricted by various workers (Cronin, 1980; Soller and Mills, 1991) and no longer encompasses the entire stratigraphic and chronological ranges. The restrictions to the Canepatch places the interpretations of the Socastee Formation into question. Any previous models based off of the Canepatch or Socastee Formation’s data may have issues related to the lack of detail as to which Marine Isotope Stage the samples were collected from (5e, 5c, or 5a). The Wando Formation used by the USGS encompasses 2 sets of highstand deposits (MIS 5e and 5a). Any models based on data from this formation may not be as accurate as models based on the ages and elevations of the separately-mapped highstands.

The 100 ka age for the Silver Bluff reported by Zayac (2003) from the Beaufort, S.C. area is suspect since it has been related to the stratigraphic context of the Princess Anne Formation landward of the sample site (Doar, 2003 g). Possible explanations for this older than expected age are: the sample area may have been incorrectly identified during our mapping; or the cores used may have crossed an unconformity and sampled from the underlying unit. The work of Zayac (2003) was focused only on the restricted area of Hunting Island State Park in South Carolina, whereas the Silver Bluff Formation mapped as stratigraphically higher than the Princess Anne Formation in more than 12 quadrangles (Table 8). Our samples for carbon dating have all given ages of >48,000 14C BP (GX-33442 and GX 33448). Based on these data, the possibility exists that samples, which yielded 14C ages of ~ 34 ka (Weems and Lemon, 1993) could have been contaminated with modern materials and represent composite dates of older deposits. Conservatively, we interpret that the Silver Bluff deposits are older than Holocene and younger than 100 ka.

Glacio-isostatic Adjustment Data

Several sets of workers have produced models to calculate the glacio-isostatic effects along the Atlantic coast of North America resulting from the last glacial maximum (LGM). The interpreted glacio-isostatic adjustment (GIA) from those models provides insight into the post-depositional elevations changes to mapped shorelines along the coast (Peltier, 1994; Potter and Lambeck, 2003). A note of caution should be made here- if these GIA models use onshore observations as calibration points, then refinements in the stratigraphy and geochronology should be addressed. For example, the issues with age-dates in South Carolina for the MIS 5 deposits noted in the Stratigraphic Correlation section above can add significant errors to any calculations of elevation. The range of ages for the Canepatch Formation (DuBar et al., 1974), Wando Formation noted in Cronin et al. (1981), and the Charleston area samples from Wehmiller and Belknap (1982) encompass MIS 5 e through MIS 5a. MIS 5 e and MIS 5a were mapped as highstands in the area- the Pamlico Formation (+ 6.7 m MSL) and the Princess Anne Formation (+ 5.18 m MSL). Colquhoun (1974), Hoyt and Hails (1974), Healy (1975), and Doar (2012) all map those separate highstands. The age of the Pamlico deposits is ~ 120 ka and the age of the Princess Anne deposits is 100 to 78 ka.

Hydro-isostatic Adjustment Data

Hydro-isostatic down-warping and rebound can alter relative shoreline elevations during and after deposition independent of GIA. Along a continental margin where the water does not depress the entire crustal mass, the process is very similar to glacial isostasy. The added weight of water as it transgresses during interglacials can depress the crust beneath the continental shelf and coastal plains. This can lever the crust downward with the center of the continent acting as a fulcrum, or it can create a fore-bulge some distance shoreward of the continental shelf edge with the fulcrum seaward of the shoreline (Fig. 5 SM). When the water is removed from the shelf the crust reverses direction. The rate and magnitude of crustal deflection is determined by weight of the added water column, the crust thickness, and mantle density. Table 5 contain the results of a 2D model (OSXFlex2D software; Cardozo, 2008) for calculating the instantaneous hydro-isostatic effect of water depth change from off the shelf edge inland to the mapped shorelines. We based the differences in water depths for each formation for the modeling on our mapping. The Young Modulus used was 70 Gpa. The Poisson Ratio was 0.25. The elastic thickness of the crust is 60 km and is based on the elastic thickness of viscosity model VM5a in Peltier and Drummond (2008). The mantle density used was 3,300 kg/m3 with the density contrast being 3,300-1.025 kg/m3 (the average density of sea water) = 3,298.98 kg/m3. The water depth changes used were the equivalent to modern bathymetric depths. The total distance onshore and offshore is noted in Table 5 with 0.00 as that highstand’s shoreline position. In the table, the value of “x” is the distance in km from the shoreline (negative numbers are km inland from shoreline), while “t” is the new topographic elevation in meters at each distance, and “u” is the net elevations change in meters (negative values indicate uplift). The model iterations were run assuming the bathymetric depths at each distance offshore at the start. The water was removed and the rebound magnitude (u) and the new elevation of the profile compared to its starting RSL elevation (t) was calculated from 30 km inland of that shoreline to the modern continental shelf edge. The 30 km distance inland captures the isostatic rebound effects on the next one or two inland scarps except for the MIS 3 deposits reported on the shelf by Harris et al. (2013). The distance inland use for the MIS 3 shelf deposits is 120 km in order to calculate the effects on the Pamlico and Princess Anne deposits.

The post HIA rebound topographic deflection is no more than +10.5 m for the Pamlico deposits. If ESL was +5.5-7 m MSL as predicted by other studies (Kopp et al., 2009; Kopp et al., 2013), then the HIA adds that 10.5 m to its elevation during MIS 5d. That resulting elevation is +16-17.5 m MSL.

The +4.9 m calculated HIA rebound effect on the Pamlico deposits for the predicted MIS 5a ESL of -20m of the Princess Anne highstand is the amount that highstand depressed the Pamlico deposits. Removing that 4.9 m from the calculated post-MIS 5e rebound elevation of the Pamlico deposits (+16-17.5 m) results in a HIA-corrected predicted MSL elevation for the Pamlico of +11.1-12.6 m MSL. Currently the difference in mapped elevations of the Pamlico and Princess Anne shorelines is 1.5 m. The ~ 10 m of remaining elevation may be resolved with GIA or other processes.

The + 5.4 m calculated HIA rebound effect on the Pamlico deposits and the +6 m calculated HIA rebound effect on the Princess Anne deposits, resulting from the +3 m MSL for the Silver Bluff highstand are the magnitude this highstand depressed those shorelines. If the predicted MIS 3 ESL of at least -40 m MSL (possibly -80 m) is correct, then the current difference in mapped elevations of 3.7 m and 2.2 m (respectively) versus the predicted MIS 3 elevation is not resolved by the 5-6 m HIA.

A final note to consider is that the 5e (Pamlico) and modern shorelines have experienced similar glacioisostatic conditions, and the elevations should remain consistent relative to each other, as they do. With Kopp et al. (2009) assigning a 95% probability to the MIS 5e sea level having an elevation of at least +6.6 m MSL, these consistent elevations being closer together than predicted by the generally accepted sea level curves offer the potential for further research into this problem.

Supplemental Information References Cited

Bard, E., Hamelin, B., Fairbanks, R.G., 1990. U-Th ages obtained by mass spectrometry in corals from Barbados: Sea level during the past 130,000 Years. Nature 345, 405-410.

Bender, M.L., Fairbanks, R.G., Taylor, F.W., Matthews, R.K., Goddard, J.G., Broecker, W.S., 1979. Uranium-series dating of the Pleistocene reef tracts of Barbados, West Indies. Geological Society of America Bulletin 90, 577-594.

Cardozo, N., 2012. designer, OSXflex version 2.3freeware software for OSX for Macintosh, downloadable from http://homepage.mac.com/nfcd/work/programs.html.

Chappell, J., 1974. Geology of coral terraces, Huon Peninsula, New Guinea: Study of Quaternary tectonic movements and sea-level changes. Geological Society of America Bulletin 85, 553-570.

Clark, W.B., Miller, B.L., Stephenson, L.W., 1912. The physiography and geology of the Coastal Plain of North Carolina. North Carolina Geology and Economic Survey 3, 41-73.

Colquhoun, D.J., 1962. On Surficial Sediments in Central South Carolina – a progress

 report. Division of Geology, South Carolina State Development Board, Geologic Notes 6, 63-80

Colquhoun, D.J., 1965. Terrace sediment complexes in central South Carolina. Atlantic Coastal Plain Geological Association, 6th Annual Field Conference, 1965, Guidebook, 62 p.

Colquhoun, D.J., 1974. Cyclic surficial stratigraphic units of the Middle and Lower Coastal Plains, central South Carolina. In: Oaks Jr., R.Q., DuBar, J.R. (Eds.), Post Miocene stratigraphy, Central and Southern Atlantic Coastal Plain. Utah State University Press, Logan, UT, pp. 170-190.

Colquhoun, D.J., Johnson, G.H., Peebles, P.C., Huddlestun, P.F., Scott, T., 1991. Quaternary geology of the Atlantic Coastal Plain. In: Morrison, R.B. (Ed.), Quaternary nonglacial geology; Conterminous U.S. Boulder, Colorado, Geological Society of America, The Geology of North America K-2, 629-650.

Cooke, C.W., 1936. Geology of the coastal plain of South Carolina. U. S. Geological Survey Bulletin 867, 196 p.

Cronin, T.M., 1980. Biostratigraphic correlation of Pleistocene marine deposits and sea levels, Atlantic coastal plain of the southeastern United States. Quaternary Research 13 (2), 213-229.

Cronin, T.M., 1988. Evolution of marine climates of the U.S. Atlantic Coast during the past four million years. Philosophical Transactions of the Royal Society of London 318, 667-668.

Cronin, T.M., Szabo, T.M., Ager, T.A., Hazel, J.E., Owens, J.P., 1981. Quaternary climates and sea levels of the U.S. Atlantic Coastal Plain. Science 211 (4479), 233- 240.

Dall, W.H., Harris, G.D., 1892. Correlation papers: Neocene. U.S. Geological Survey Professional Bulletin 84, 349 p.

Doar III, W.R., 1999. Geologic maps of the Edisto Island, Edisto Beach and northeastern St. Helena Sound 7.5-minute quadrangles, Charleston and Colleton Counties, South Carolina. S.C. Geological Survey Open-File Report 119, map with text.

Doar III, W.R., 2000. Surface Geology maps of the Frogmore, eastern Parris Island, Fripp Inlet and St. Phillips Island 7.5-minute quadrangles, Beaufort County, South Carolina. S.C. Geological Survey Open-File Report 126, map and text.

Doar III, W.R., 2001 a. Geologic map of the Jasper 7.5-minute quadrangle, Beaufort County, South Carolina. S.C. Geological Survey Open-File Report 137, map and text.

Doar III, W.R., 2001 b. Geologic map of the Bluffton 7.5-minute quadrangle, Beaufort County, South Carolina. S.C. Geological Survey Open-File Report 138, map and text.

Doar III, W.R., 2001 c. Geologic map of the Parris Island 7.5-minute quadrangle, Beaufort County, South Carolina. S.C. Geological Survey Open-File Report 139, map and text.

Doar III, W.R., 2001 d. Geologic map of the Spring Island 7.5-minute quadrangle, Beaufort County, South Carolina. S.C. Geological Survey Open-File Report 140, map and text.

Doar III, W.R., 2002 a. Geologic map of the Pritchardville 7.5-minute quadrangle, Beaufort and Jasper Counties, South Carolina. S.C. Geological Survey Geologic Quadrangle Map 1, map and text.

Doar III, W.R., 2002 b. Geologic map of the Hilton Head 7.5-minute quadrangle, Beaufort County, South Carolina. S.C. Geological Survey Geologic Quadrangle Map 2, 1 map and text.

Doar III, W.R., 2002 c. Geologic map of the Savannah 7.5-minute quadrangle, Jasper County, South Carolina, and Chatham County, Georgia. S.C. Geological Survey Geologic Quadrangle Map 3, map and text.

Doar III, W.R., 2002 d. Geologic map of the Tybee Island North 7.5-minute quadrangle, Beaufort County, South Carolina, and Chatham County, Georgia. S.C. Geologic Quadrangle Map 4, map and text.

Doar III, W.R., 2002 e. Geologic map of the Fort Pulaski 7.5-minute quadrangle, Beaufort and Jasper Counties, South Carolina, and Chatham County, Georgia. S.C. Geological Survey Geologic Quadrangle Map 5, map and text.

Doar III, W.R., 2003 a. Geologic Map of the Dale 7.5-minute quadrangle, Beaufort and Colleton Counties, South Carolina. S. C. Geological Survey Geologic Quadrangle Map 17, map and text.

Doar III, W.R., 2003 b. Geologic Map of the Wiggins 7.5-minute quadrangle, Beaufort and Colleton Counties, South Carolina. S.C. Geological Survey Geologic Quadrangle Map 18, map and text.

Doar III, W.R., 2003 c. Geologic Map of the Bennett’s Point 7.5-minute quadrangle, Charleston and Colleton Counties, South Carolina. S.C. Geological Survey Geologic Quadrangle Map 19, map and text.

Doar III, W.R., 2003 d. Geologic Map of the Edisto Island 7.5-minute quadrangle, Charleston and Colleton Counties, South Carolina. S.C. Geological Survey Geologic Quadrangle Map 20, map and text.

Doar III, W.R., 2003 e. Geologic Map of the Edisto Beach 7.5-minute quadrangle, Charleston and Colleton Counties, South Carolina. S.C. Geological Survey Geologic Quadrangle Map 21, map and text.

Doar III, W.R., 2003 f. Geologic Map of the Beaufort 7.5-minute quadrangle, Beaufort County, South Carolina. S.C. Geological Survey Geologic Quadrangle Map 22, map and text.

Doar III, W.R., 2003 g. Geologic Map of the St. Helena Sound 7.5-minute quadrangle, Beaufort and Colleton Counties, South Carolina. S.C. Geological Survey Geologic Quadrangle Map 23, map and text.

Doar III, W.R., 2003 h. Geologic Map of the Frogmore 7.5-minute quadrangle, Beaufort County, South Carolina. S.C. Geological Survey Geologic Quadrangle Map 24, map and text.

Doar III, W.R., 2004 a. Geologic Map of the Limehouse and Port Wentworth 7.5-minute quadrangles, Jasper County, South Carolina. S.C. Geological Survey Open-file Report 151, map and text.

Doar III, W.R., 2004 b. Geologic Map of the Hardeeville and Ricon 7.5-minute quadrangles, Jasper County, South Carolina. S.C. Geological Survey Open-file Report 152, map and text.

Doar III, W.R., 2012. A cross section illustrating Cenozoic relationships from the Orangeburg Scarp to Winyah Bay, South Carolina. Geological Society of America Abstracts with Programs 44 (1), p. 591.

Doar III, W.R., Berquist Jr., C.R., 2009. The Late Pliocene and Pleistocene marine stratigraphies of South Carolina and southeastern Virginia. Geological Society of America Abstracts with Programs 41 (1), A53.

Doar III, W.R., Kendall, C.G., 2008. Late Pleistocene to Holocene coastal marine terraces and sea level curves derived from 18O proxies: Is the 125 ka high-stand the only higher-than-present event?. 33rd International Geological Congress Abstracts with Programs, HPS07423.

Doar III, W.R., Willoughby, R.H., 2006. Prevision of the Pleistocene Dorchester and Summerville scarps: The inland limits of the Penholoway terrace, central South Carolina. Geological Society of America Abstracts with Programs 38 (3), A18.

Dodge, R.E., Fairbanks, R.G., Benninger, L.K., Maurrasse, F., 1983. Pleistocene Sea Levels from Raised Coral Reefs of Haiti. Science 219, 1423-1425.

DuBar, J.R., Johnson Jr., H.S., Thom, B., Hatchell, W.O., 1974. Neogene stratigraphy and morphology, south flank of the Cape Fear Arch, North and South Carolina. In: Oaks Jr., R.Q., DuBar, J.R. (Eds.). Post Miocene stratigraphy, Central and Southern Atlantic Coastal Plain, Utah State University Press, Logan, Utah, pp. 139-173.

Flint, R.F., 1940. Pleistocene Features of the Atlantic Coastal Plain. American Journal of Science 288 (11), 757-787.

Gibbard, P.L., Head, M.L., 2009. IUGS ratification of the Quaternary system/period and the Pleistocene series/epoch with a base at 2.58 Ma. Quaternaire 20 (4), 411-412.

Graybill, E.A., Harris, W.B., Kelly, P., Dietl, G., Visaggi, C.C., 2009. Age of the Duplin and Waccamaw formations, Cape Fear River Basin, North Carolina. Geological Society of America Abstracts with Programs, 71 (1), p. 45.

Harris, M.S., 2000. Influence of a complex geological framework on Quaternary coastal evolution: An example from Charleston, South Carolina. Journal of Coastal Research 21 (1), 49-64.

Harris, M.S., Sautter, L.R., Johnson, K.L., Luciano, K.E., Sedberry, G.R., Wright, E.E., Siuda, A.N.S., 2013. Continental shelf landscapes of the southeastern United States since the last interglacial. Geomorphology in press (2013), 19p. http//dx.doi.org/10.1016/j.geomorph.2012.02.014

Healy, H.G., 1975. Terraces and Shorelines of Florida. Tallahassee, Florida Department of Natural Resources Map Series 71, 2 sheets.

Hoyt, J.H., Hails, J.R., 1974. Pleistocene stratigraphy of southeastern Georgia. In: Oaks Jr., R.Q., DuBar, J.R. (Eds.). Post Miocene stratigraphy, Central and Southern Atlantic Coastal Plain, Utah State University Press, Logan, Utah, pp. 191-205.

Imbrie, J., Hayes, J.D., Martinson, D.G., McIntyre, A., Mix, A.C., Morely, J.J., Pisias, N.G., Prell, W.L. Shackleton, N.J., 1984. The orbital theory of Pleistocene climate: Support from a revised chronology of the marine δ18O record. In: W.H. Berger et al., (Eds.), Milankovitch and Climate, part 1, 269-305.

Johnson, G.H., Berquist Jr., C.R., 1989. Geology and mineral resources of the Brandon and Norge quadrangles, Virginia. Virginia Division of Mineral Resources, Publication 87, 1-28.

Kopp, R.E., Simons, F.J., Mitrovica, J.X., Maloof, A.C., Oppenheimer, M., 2009. Probabilistic assessment of sea level during the last interglacial stage. Nature 462 (7275), 863-867.

Kopp, R.E., Simons, F.J., Mitrovica, J.X., Maloof, A.C., Oppenheimer, M., 2013. A probabilistic assessment of sea level variations within the last interglacial stage. Geophysical journal International 193, 711-716.

Linsley, B.K., 1996. Oxygen-isotope record of sea level and climatic variations in the Sulu Sea over the past 150,000 Years. Nature 380, 234-237.

Lisiecki, L.E., Raymo, M.E., 2005. A Pliocene-Pleistocene stack of 57 globally distributed benthic δ18O records. Paleoceanography 20, 17 p.

Ludwig, K.R., Muhs, D.R., Simmons, K.R., Halley, R.B., Shinn. E.A., 1996. Sea-level records at ~80 ka from tectonically stable platforms: Florida and Bermuda. Geology 24 (3), 211-214.

Malde, H.E., 1959. Geology of the Charleston phosphate area, South Carolina. U.S. Geological Survey Bulletin 1079, 105 p.

Mallinson, D.J., Burdett, K., Mahan, S., Brook, G., 2008. Optically stimulated luminescence age controls on late Pleistocene and Holocene coastal lithosomes, North Carolina, USA. Quaternary Research 69, 97-109.

McCartan, L. Weems, R.E., Lemon Jr., E.M., 1980. The Wando Formation (upper Pleistocene) in the Charleston, South Carolina area. In: Sohl, N.F., Wright, W.B., (Eds.), Changes in stratigraphic nomenclature by the U.S. Geological Survey, 1979. U.S. Geological Survey Bulletin 1502-A, pp. A110-A116.

McCartan, L., Owens, J.P., Blackwelder, B.W., Szabo, B.J., Belknap, D.F., Kriausakul, N., Mitterer, R.M., Wehmiller, J.F., 1982. Comparison of amino acid racemization geochronology with lithostratigraphy, biostratigraphy, uranium-series coral dating, and magnetostratigraphy in the Atlantic Coastal Plain of the southeastern United States. Quaternary Research 18 (3), 337-359.

McCartan, L., Lemon Jr., E.M., Weems, R.E., 1984. Geologic map of the area between Charleston and Orangeburg, South Carolina. U.S. Geological Survey Miscellaneous Investigation Series MAP I-1472, 2 sheets.

Neuendorf, K.K.E., Mehl, J.P., Jr., Jackson, J.A., 2005. Glossary of Geology, Fifth

 Edition, American Geological Institute, Alexandria, Virginia, USA, 779 p.

North American Commission on Stratigraphic Nomenclature, 2005. North American Stratigraphic Code, American Association of Petroleum Geologists Bulletin 89 (11), 1547-1591.

Newton, C.R., Belknap, D.F., Lynts, G.W., 1978. Early Pleistocene (Calabrian) age of the Waccamaw Formation at Walkers Bluff, Elizabethtown, N.C. Geological Society of America, Abstracts with Programs, 10 (4), p. 194.

Ota, Y., Pillans, B., Berryman, K., Beu, A., Fujimori, T., Miyauchi, T., Berger, G., Beu, A.G, Climo, F.M., 1996. Pleistocene coastal terraces of Kaikoura Peninsula and the Marlborough Coast, South Island, New Zealand. New Zealand Journal of Geology and Geophysics 39, 51-73.

Owens, J. P., 1990. Geologic Map of the Cape Fear region, Florence 1x2 degree Quadrangle and northern half of the Georgetown 1x2 degree Quadrangle, North Carolina and South Carolina. U.S. Geological Survey, Miscellaneous Investigation Series MAP I-1948, 2 sheets.

Parham, P.R., Riggs, S.R., Culver, S.J., Mallinson, D.J., Wehmiller, J.F., 2007. Quaternary depositional patterns and sea-level fluctuations, northeastern North Carolina, Quaternary Research 67, 83-99.

Peltier, W.R., 1994. Ice age paleotopography. Science 265 (5169), 195-201.

Peltier, W.R., Drummond, R., 2008. Rheological stratification of the lithosphere: a direct inference based upon the geodetically observed pattern of glacial isostatic adjustment of the North American continent. Geophysical Research Letter 35 (16), L16314.

Potter, E., Lambeck, K., 2003. Reconciliation of sea-level observations in the western North Atlantic during the last glacial cycle. Earth and Planetary Science Letters 217, 171-181.

Richards, H.G., 1950. Geology of the coastal plain of North Carolina. Transactions of

 the American Philosophical Society, New Series 40 (1), 1-83.

Shackleton, N.J., 1987. The carbon isotope record of the Cenozoic: History of organic carbon burial and of oxygen in the ocean and atmosphere. In: Brooks, J., Fleet, A. J. (Eds.), Marine Petroleum source rocks. Geological Society of London, Special Publication 26, 423-434.

Shattuck, G.B., 1901a. The Pleistocene problem of the north Atlantic Coastal Plain. Johns Hopkins University Circular 20 (152), p. 73.

Shattuck, G.B., 1901 b. The Pleistocene problem of the north Atlantic Coastal Plain. American Geologist 28, 87-107.

Shattuck, G.B., 1906. Pliocene and Pleistocene. In: Clark, W.B, Mathews, E.B., Shattuck,

 G.B., and Miller, B.L, (Eds.), Pliocene and Pleistocene. Maryland Geological Survey, Johns Hopkins University Press, Baltimore, Md., 292 p.

Schultz, A., Doar III, W.R., Swezey, C.S., Pierce, H.A., Mahan, S.A., Markewich, H.W., Buell, G.R., Garrity, C.P., 2011. Geologic mapping using LiDAR, Tillman Sand Ridge Heritage Preserve, Jasper County, South Carolina. Geological Society of America Abstracts with Programs 43 (2), p. 32.

Skene, K.I., Piper, J.W., Aksu, A.E., Syvitski, J.P.M., 1998. Evaluation of the global oxygen isotope curve as a proxy for Quaternary sea level by modeling of delta progradation. Journal of Sedimentary Research 68 (6), 1077-1092.

Soller, D.R., Mills, H.H., 1991. Surficial geology and geomorphology. In: Horton Jr, J.W., Zullo, V.A., (Eds.), Geology of the Carolinas 6, University of Tennessee Press, Knoxville, Tenn., pp. 290-308.

Stearns, H.T., 1974. Correlation of Pleistocene shorelines in Gippsland, Australia, and Oahu, Hawaii: Discussion. Geological Society of America Bulletin 85, p. 1189.

Szabo, B.J., 1985. Uranium-series dating of fossil corals from marine sediments of southeastern United States Atlantic Coastal Plain. Geological Society of America Bulletin 96, 398-406.

Tuomey, M., 1848. Report on the geology of South Carolina. Printed by A,S, Johnston, Columbia, S.C., 293 p.

Waelbroeck, C., Labeyrie, L., Michel, E., Duplessy, J.C., McManus, J.F., Lambeck, K., Balbon, E., Labracherie, M., 2002. Sea-level and deep water temperature changes derived from benthic foraminifera isotopic records. Quaternary Science Reviews 21, 295-305.

Ward, W.T., 1975. Geology of coral terraces, Huon Peninsula, New Guinea: A study of Quaternary tectonic movements and sea-level changes: Discussion and Reply. Geological Society of America Bulletin 86, 1482-1486.

Weems, R.E., Lemon Jr., E.M., 1984 a. Geologic map of the Mount Holly quadrangle, Berkeley and Charleston Counties, South Carolina. U.S. Geological Survey Map GQ-1579, map sheet and text.

Weems, R.E., Lemon Jr., E.M., 1984 b. Geologic map of the Stallsville quadrangle, Charleston and Dorchester counties, South Carolina, with text. U.S. Geological Survey Map GQ-1581, map sheet and text.

Weems, R.E., Lemon Jr., E.M., 1985. Detailed sections from auger holes and outcrops in the Cainhoy, Charleston, and Fort Moultrie quadrangles, South Carolina. U.S. Geological Survey Open-file Report 85-378, 71 p.

Weems, R. E., Lemon Jr., E.M., 1989. Geology of the Bethera, Cordesville, Huger,

 and Kittredge quadrangles, Berkeley and County, South Carolina, with text. U.S.

 Geological Survey Miscellaneous Investigation Series MAP I-1854, map sheet with text.

Weems, R.E., Lemon Jr., E.M., 1993. Geology of the Cainhoy, Charleston, Fort Moultrie, and North Charleston Quadrangles, Charleston and Berkeley Counties, South Carolina. U.S. Geological Survey Miscellaneous Investigation Series MAP I-1935, map sheet with text.

Weems, R.E., Lemon Jr., E.M., Cron, E.D., 1985. Detailed sections from auger holes and outcrops in the Bethera, Cordesville, Huger, and Kittredge quadrangles, South Carolina. U.S. Geological Survey Open-file Report 85-439. 85 p.

Weems, R.E., Lemon Jr., E.M., Gohn, G.S., Houser, B.B., 1987 a. Detailed sections from auger holes and outcrops in the Clubhouse Crossroads, Johns Island, Osborn, and Ravenel quadrangles, South Carolina. U.S. Geological Survey Open-file Report 87-661, 159 p.

Weems, R.E., Lemon Jr., E.M., Nelson, M.S., Gohn, G.S., Houser, B.B., 1987 b. Detailed sections from auger holes and outcrops in the Pringletown, Ridgeville, Summerville Northwest, and Summerville quadrangles, South Carolina. U.S. Geological Survey Open-file Report 87-524, 97 p.

Weems, R.E., Lemon Jr., E.M., McCartan, L., 1985. Shallow subsurface geology of the North Charleston 7.5 minute quadrangle, South Carolina. U.S. Geological Survey Open-file Report 85-274, 62 p., 1 plate.

Weems, R.E., Lemon Jr., E.M., Nelson, M.S., 1997. Geology of the Pringletown, Ridgeville, Summerville, and Summerville Northwest 7.5 minute quadrangles, Berkeley, Charleston, and Dorchester Counties, South Carolina. U.S. Geological Survey Miscellaneous Investigation Series MAP I-2502, 2 sheets.

Weems, R.E., Lewis, W.C., 1997. Detailed sections from auger holes in northeast Charleston County, South Carolina, east of 79 degrees 45 minutes west Longitude. U.S. Geological Survey Open-file Report 97-712, 82 p.

Weems, R.E., Lewis, W.C., 2002. Structural and tectonic setting of the Charleston, South Carolina, region: Evidence from the Tertiary stratigraphic record. Geological Society of America Bulletin 114 (1), 24-42.

Weems, R.E., Lewis, W.C., Crider, E.A., 2011. Surficial geologic map of the Elizabethtown 30’ by 60’ quadrangle, North Carolina. U.S. Geological Survey Open-file Report 2011-1121, 1 map sheet and text.

Weems, R.E., Lewis, W.C., Murray, J., Queen, D., Gray, J.B., DeJong, B.D., 2011. Detailed sections from auger holes in the Elizabethtown 1:100,000 map sheet. U.S. Geological Survey Open-file Report 2011-1115, 1-286.

Wehmiller , J.F., Belknap, J.D., 1982. Amino Acid age estimates, Quaternary Atlantic Coastal Plain: Comparison with U-series dates, biostratigraphy, and paleomagnetic control. Quaternary Research 18, 311-336.

Wehmiller, J.F., Simmons, K.R., Cheng, H., Edwards, R.L., Martin-McNaughton, J., York, L.L., Krantz, D.E., Chun-Chou, S., 2004. Uranium-series coral ages from the US Atlantic Coastal Plain- the “80 ka problem” revisited. Quaternary International, 120 (1), 3-14.

Wehmiller, J.F., Thieler, E.R., Miller, D., Pellerito, V., Bakeman Keeney, V., Riggs, S.R., Culver, S.J., Mallinson, D.J., Farrell, K.M., York, L.L., Pierson, J., Parham, P.R., 2010. Aminostratigraphy of surface and subsurface Quaternary sediments, North Carolina coastal plain, USA. Quaternary Geochronology 5, 459-492.

Willis, R.A., 2006. Genetic stratigraphy and geochronology of last interglacial shorelines of the central coast of South Carolina [M.S. thesis]. Baton Rouge, Louisiana State University, 126 p.

York, L.L., Doar, W.R., III, Wehmiller, J.F., 2001. Late Quaternary aminostratigraphy and geochronology of the St. Helena Island area, South Carolina Coastal Plain. Geological Society of America Abstracts with Programs 33 (2), A36.

Zayac, T.A., 2003. Late-Quaternary sea levels in the southeastern United States: Evidence from geomorphic indicators and optically-stimulated luminescence dating, St. Helena, South Carolina [M.S. thesis]. Lincoln, University of Nebraska, 201 p.