

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science Directorate
Geologic Resources Division



Congaree National Park

GRI Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory (GRI) Digital Geologic
Data for Congaree National Park

cong_geology.pdf

Version: 1/27/2014

Geologic Resources Inventory Map Document for Congaree National Park

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Geologic Resources Inventory Map Document



Congaree National Park, South Carolina

Document to Accompany Digital Geologic-GIS Data

[cong_geology.pdf](#)

Version: 1/27/2014

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Congaree National Park, South Carolina (CONG).

Attempts have been made to reproduce all aspects of the original source products, including the geologic units and their descriptions, geologic cross sections, the geologic report, references and all other pertinent images and information contained in the original publication.

National Park Service (NPS) Geologic Resources Inventory (GRI) Program staff have assembled the digital geologic-GIS data that accompanies this document.

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About the NPS Geologic Resources Inventory Program

Background

Recognizing the interrelationships between the physical (geology, air, and water) and biological (plants and animals) components of the Earth is vital to understanding, managing, and protecting natural resources. The Geologic Resources Inventory (GRI) helps make this connection by providing information on the role of geology and geologic resource management in parks.

Geologic resources for management consideration include both the processes that act upon the Earth and the features formed as a result of these processes. Geologic processes include: erosion and sedimentation; seismic, volcanic, and geothermal activity; glaciation, rockfalls, landslides, and shoreline change. Geologic features include mountains, canyons, natural arches and bridges, minerals, rocks, fossils, cave and karst systems, beaches, dunes, glaciers, volcanoes, and faults.

The Geologic Resources Inventory aims to raise awareness of geology and the role it plays in the environment, and to provide natural resource managers and staff, park planners, interpreters, researchers, and other NPS personnel with information that can help them make informed management decisions.

The GRI team, working closely with the Colorado State University (CSU) Department of Geosciences and a variety of other partners, provides more than 270 parks with a geologic scoping meeting, digital geologic-GIS map data, and a park-specific geologic report.

Products

Scoping Meetings: These park-specific meetings bring together local geologic experts and park staff to inventory and review available geologic data and discuss geologic resource management issues. A summary document is prepared for each meeting that identifies a plan to provide digital map data for the park.

Digital Geologic Maps: Digital geologic maps reproduce all aspects of traditional paper maps, including notes, legend, and cross sections. Bedrock, surficial, and special purpose maps such as coastal or geologic hazard maps may be used by the GRI to create digital Geographic Information Systems (GIS) data and meet park needs. These digital GIS data allow geologic information to be easily viewed and analyzed in conjunction with a wide range of other resource management information data.

For detailed information regarding GIS parameters such as data attribute field definitions, attribute field codes, value definitions, and rules that govern relationships found in the data, refer to the NPS Geology-GIS Data Model document available at: <http://science.nature.nps.gov/im/inventory/geology/GeologyGISDataModel.cfm>

Geologic Reports: Park-specific geologic reports identify geologic resource management issues as well as features and processes that are important to park ecosystems. In addition, these reports present a brief geologic history of the park and address specific properties of geologic units present in the park.

For a complete listing of Geologic Resource Inventory products and direct links to the download site visit the GRI publications webpage http://www.nature.nps.gov/geology/inventory/gre_publications.cfm

GRI geologic-GIS data is also available online at the NPS Data Store Search Application: <http://irma.nps.gov/App/Reference/Search>. To find GRI data for a specific park or parks select the appropriate park

(s), enter "GRI" as a Search Text term, and then select the Search Button.

For more information about the Geologic Resources Inventory Program visit the GRI webpage: <http://www.nature.nps.gov/geology/inventory>, or contact:

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The Geologic Resources Inventory (GRI) program is funded by the National Park Service (NPS) Inventory and Monitoring (I&M) Division.

GRI Digital Map and Source Map Citations

The GRI digital geologic-GIS map for Congaree National Park, South Carolina (CONG):

GRI Digital Geologic Map of Congaree National Park and Vicinity, South Carolina (GRI MapCode CONG)

South Carolina Geological Survey source maps and digital data.

Meitzen, K.M., Howard, C.S. and Nystrom, P.G., 2009, Geologic Map of the Poinsett State Park 7.5-Minute quadrangle, South Carolina, South Carolina Geological Survey, Geologic Quadrangle Map GQM-46, 1:24000 scale. (*GRI Source Map ID 75216*).

Nystrom, P., 2009, Geologic Map of the Wedgefield 7.5-Minute quadrangle, South Carolina, South Carolina Geological Survey, Geologic Quadrangle Map GQM-47, 1:24000 scale. (*GRI Source Map ID 75215*).

Shelley, D.C., 2007, Geologic Map of the Congaree 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-31, 1:24,000 scale (*GRI Source Map ID 7333*).

Shelley, D.C., 2007, Geologic Map of the Eastover 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-30, 1:24,000 scale. (*GRI Source Map ID 7334*).

Shelley, D.C., 2007, Geologic Map of the Gadsden 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-37, 1:24,000 scale. (*GRI Source Map ID 74893*).

Shelley, D.C., 2007, Geologic Map of the Saylor's Lake 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-38, 1:24,000 scale. (*GRI Source Map ID 74894*).

Shelley, D.C., 2007, Geologic Map of the Wateree 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-36, 1:24,000 scale. (*GRI Source Map ID 74892*).

Willoughby, R.H., 2004, Geologic Map of the Lone Star 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-15, 1:24,000 scale. (*GRI Source Map ID 7336*).

Willoughby, R.H., 2003, Geologic Map of the Ellore 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-27, 1:24,000 scale. (*GRI Source Map ID 7335*).

Willoughby, R.H., 2003, Geologic Map of the Fort Motte 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-10, 1:24,000 scale. (*GRI Source Map ID 5778*).

Additional information pertaining to each source map is also presented in the GRI Source Map Information (CONGMAP) table included with the GRI geology-GIS data.

Map Unit List

The geologic units present on digital geologic-GIS data produced for Congaree National Park, South Carolina (CONG) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Qal - Alluvium). Units are listed from youngest to oldest. No description for water is provided. Information about each geologic unit is also presented in the Geologic Unit Information (CONGUNIT) table included with the GRI geology-GIS data.

Cenozoic Era

Quaternary Period

Holocene

Qme - Moved earth ([Qme](#))

Qfw - Freshwater marsh and swamp deposits ([Qfw](#))

Holocene - upper Pleistocene

Qslk - Sandhills lakebed deposits ([Qslk](#))

Qcb - Carolina bay deposits ([Qcb](#))

Qe - Eolian sand ([Qe](#))

Qeeb - Eolian sand of East Bethel ([Qeeb](#))

Qem - Eolian sand of Manchester State Forest ([Qem](#))

Holocene - Pleistocene

Qacf - Quaternary alluvium, Congaree River flood plain ([Qacf](#))

Qasf - Quaternary alluvium, Santee River flood plain ([Qasf](#))

Qawf - Quaternary alluvium, Wateree River flood plain ([Qawf](#))

Qatv - Quaternary alluvium, tributary valleys ([Qatv](#))

Qatt - Quaternary alluvium, tributary valley microterraces ([Qatt](#))

Qaf - Quaternary alluvial fan deposits ([Qaf](#))

Qaf1 - Quaternary alluvial fan deposits: fan deposits 1 ([Qaf1](#))

Qaf2 - Quaternary alluvial fan deposits: fan deposits 2 ([Qaf2](#))

upper Pleistocene

Qd - Dune complexes ([Qd](#))

Qpl - Packs Landing beds ([Qpl](#))

Pleistocene

Qtw1-Qtw2 - Wateree River valley terrace complex: terrace 1 ([Qtw](#))

Qt1-Qt11b - Congaree River Valley terrace complex: terraces 1-11b ([Qt](#))

lower Pleistocene

Qwtb - Wicomico Toney Bay Member ([Qwtb](#))

Qhs - Fluvial terrace deposits of Halfway Swamp ([Qhs](#))

Qlf - Terrace sediments of Low Falls Landing ([Qlf](#))

Qm - Marietta unit ([Qm](#))

Tertiary Period

Pliocene

Tt12 - Tt13 - Congaree River Valley terrace complex: terrace 12, 13 ([Qt](#))

Td - Duplin Formation ([Td](#))

Tdu - Duplin Formation, upper part

lower Pliocene

Tdl - Duplin Formation, lower part ([Tdl](#))

middle Miocene

Tal - Altamaha Formation ([Tal](#))

upper Eocene

Ttr - Tobacco Road Sand ([Ttr](#))

Tdb - Dry Branch Formation ([Tdb](#))

upper middle Eocene

Todb - Orangeburg District bed ([Todb](#))

middle Eocene

Ts - Santee Limestone ([Ts](#))

Twh - Warley Hill Formation ([Twh](#))

Eocene

Tc - Congaree Formation ([Tc](#))

upper Paleocene

Tls - Lang Syne Formation ([Tls](#))

Mesozoic Era

Cretaceous Period

Upper Cretaceous

Ksl - Sawdust Landing Formation ([Ksl](#))

Kus - Upper Cretaceous, undifferentiated ([Kus](#))

Map Unit Descriptions

Descriptions of all geologic map units, generally listed from youngest to oldest, are presented below.

Qme - Moved earth (Holocene)

me - Moved earth (Holocene) – This unit includes artificially emplaced earthen material including dams, causeways, embankments, dikes, roads, railroads, and other construction fill. Delineation is largely restricted to obvious moved earth on top of alluvium or otherwise very significant features; moved earth is not marked everywhere. *GRI Source Map IDs* 7333 ([Congaree Quadrangle](#)), 7334 ([Eastover Quadrangle](#)), 74893 ([Gadsden Quadrangle](#)), 74894 ([Sailors Lake Quadrangle](#)), 74892 ([Wateree Quadrangle](#)).

me - Moved earth (Holocene) – The moved-earth map unit consists of earthen material moved by humans. Most of the moved earth that was mapped in this quadrangle represents earthen dams along some of the tributaries draining into the Wateree River flood plain; roadfill, where dirt roads cross over culverts placed in the creeks of tributary valleys and raised railroad beds crossing the Wateree flood plain. It is possible that many of the dirt roads that traverse the quadrangle contain moved earth; however, this network is too dense to map, and thus only areas of moved earth thicker than 3 feet were mapped. *GRI Source Map IDs* 75216 ([Poinsett State Park Quadrangle](#)), 75215 ([Wedgfield Quadrangle](#)).

me - Moved earth (Holocene) – Earthen material in roads and dams. *GRI Source Map IDs* 7335 ([Ellore Quadrangle](#)), 5778 ([Fort Motte Quadrangle](#)), 7336 ([Lone Star Quadrangle](#)).

Qfw - Freshwater marsh and swamp deposits (Holocene)

QHfw - Freshwater marsh and swamp deposits (Holocene) – Black (N1), silty clay and peat deposited in low-ordered stream valleys. Deposits are identified by the organic material content, sediment type, and ecozones. Also included in this unit are silty, clayey, and organic-rich deposits accumulating in man-made drainage ditches. These ditches are found on level drainage divides and are used to drain excess water from farming fields. Drainage ditches are recognized by their rectangular patterns. *GRI Source Map IDs* 7335 ([Ellore Quadrangle](#)), 5778 ([Fort Motte Quadrangle](#)), 7336 ([Lone Star Quadrangle](#)).

Qslk - Sandhills lakebed deposits (Holocene to upper Pleistocene)

Qslk - Sandhills lakebed deposits (Holocene to Pleistocene?) – Quartz sand and gray to black, clayey quartz sand in lakebeds or savannahs. Deposits are surrounded by eolian sand. *GRI Source Map ID* 7335 ([Ellore Quadrangle](#)),

Qslk - Sandhills lakebed deposits (Holocene to Pleistocene?) – Quartz sand and gray to black, clayey quartz sand in lakebed or savannah in southeast corner of Fort Motte quadrangle. Deposits are surrounded by eolian sand. *GRI Source Map ID* 5778 ([Fort Motte Quadrangle](#)).

Qslk - Sandhills lakebed deposits (Holocene to upper Pleistocene) – White to light-gray quartz sand and gray to black, clayey quartz sand in lakebeds or savannahs in southwest and northeast corners of Fort Motte quadrangle. Deposits surrounded by eolian sand of East Bethel and of Manchester State Forest. *GRI Source Map ID* 7336 ([Lone Star Quadrangle](#)).

Qcb - Carolina bay deposits (Holocene to upper Pleistocene)

Qcb - Carolina bays (Pleistocene) – Undisturbed Carolina bays are elliptical depressions containing 3-5 feet of variably gray to black sandy clay to clayey quartz sand and surrounded by an eolian sand rim. Bays, which commonly have the primary (long) axis oriented north-northwest, are periglacial features formed over time by the action of dominant southwesterly winds on ponded water and dry land under conditions of fluctuating ground water (Kaczorowski, 1976, 1977; Soller and Mills, 1991; Brooks and others, 1996). Most bays are a minimum of Wisconsinian in age, though an Illinoian age (100-200 ka) for onset of bay formation is consistent with regional stratigraphic occurrence (Soller and Mills, 1991). A few rare cases of overlapping bays on the Congaree River Valley terrace complex indicate multiple periods of formation; lateral contacts and relative ages in these areas have not been confidently determined. Bays have been modified by climate changes in the Holocene and, today are important seasonal depressional wetlands (Brooks and others, 1996; Sharitz, 2003). The vast majority of bays have been plowed, ditched, or filled in during land development, such that many have been virtually erased. Because of this, most bays have been remotely mapped by using a combination of DOQQs, LIDAR data (MD Atlantic Technologies, 2002a,b), and observations of artificial drainage networks. The few (<5%) that have been ground-truthed are commonly expressed as wetter areas with distinctly darker soils and differences in vegetation type. *GRI Source Map IDs* 7333 ([Congaree Quadrangle](#)), 7334 ([Eastover Quadrangle](#)), 74894 ([Saylor's Lake Quadrangle](#)), 74892 ([Waterlee Quadrangle](#)).

Qcb - Carolina bay deposits (Holocene to upper Pleistocene) – Light-gray to black, quartzose clay to clayey quartz and quartzose sand in lake beds; and quartzose sand in eolian rims of bays. Carolina bays formed by the action of dominant southwesterly winds on ponded water and dry land under conditions of fluctuating ground water (Kaczorowski, 1976, 1977). Maximum ages are poorly constrained, but carbonaceous sediment in a bay in Sumter County is older than the range of reliable radiocarbon dates (approximately 25,000 to 30,000 years; after Brooks and others, 2001). Outlines of Carolina bay deposits were determined by inspection and from topographic maps, aerial photographs, and soil maps (Gerald and Stuckey, 1976; Lawrence, 1963; DeFrancisco, 1988). *GRI Source Map ID* 7335 ([Ellore Quadrangle](#)).

Qcb - Carolina bay deposits (Holocene to upper Pleistocene) – Light gray to black, quartzose clay to clayey quartz sand; quartzose sand in lakebeds; and quartzose sand in eolian rims of bays. Carolina bays form(ed) by the action of dominant southwesterly winds on ponded water and dry land under conditions of fluctuating ground water (Kaczorowski, 1976, 1977). Maximum ages are poorly constrained, but carbonaceous sediment in a bay in Sumter County is older than the range of reliable radiocarbon dates (approximately 25,000 - 30,000 years, Brooks and others, 2001). Not labeled everywhere. *GRI Source Map ID* 5778 ([Fort Motte Quadrangle](#)).

Qcb - Carolina bays (Pleistocene) – Undisturbed Carolina bays are elliptical depressions containing 3 to 5 feet of variably gray to black sandy clay to clayey quartz sand and surrounded by an eolian sand rim. Bays, which commonly have the primary (long) axis oriented north-northwest, are periglacial features formed over time by the action of dominant southwesterly winds on ponded water and dry land under conditions of fluctuating ground water (Kaczorowski, 1976, 1977; Soller and Mills, 1991; Brooks and others, 1996). Most bays are a minimum of Wisconsinian in age, though an Illinoian age (100-200 ka) for onset of bay formation is consistent with regional stratigraphic occurrence (Soller and Mills, 1991). A few rare cases of overlapping bays on the Congaree River Valley terrace complex indicate multiple periods of formation; lateral contacts and relative ages in these areas have not been confidently determined. Bays have been modified by climate changes in the Holocene and, today are important seasonal depressional wetlands (Brooks and others, 1996; Sharitz, 2003). The vast majority of bays have been plowed, ditched, or filled in during land development, such that many have been virtually erased. Because of this, most bays have been remotely mapped by using a combination of DOQQs, LIDAR data (MD Atlantic Technologies, 2002a,b), and observations of artificial drainage networks. The few (<5%) that have been ground-truthed are commonly expressed as wetter areas with distinctly darker

soils and differences in vegetation type. Remote sensing data indicate one bay within the modern Cedar Creek tributary valley (Qatv). Aerial photographs clearly show hydrologic deflections around a topographically-positive, oval-shaped feature with a long axis oriented north-northwest. This feature is interpreted to be an old Carolina bay that has been overprinted by tributary valley development. *GRI Source Map ID 74893 ([Gadsden Quadrangle](#))*,

Qcb - Carolina bay sediments (Holocene to upper Pleistocene) – Light-gray to black, quartzose clay to clayey quartz sand in lake beds; and quartzose sand in eolian rims of bays. Carolina bays formed by the action of dominant, southwesterly winds on ponded water and dry land under conditions of fluctuating ground water (Kaczorowski, 1976, 1977). Maximum ages are poorly constrained, but carbonaceous sediment in a bay in Sumter County is older than the range of reliable radiocarbon dates (older than approximately 25,000 to 30,000 years; after Brooks and others, 2001). Carolina bays on the Duplin Formation may have begun to form before the bays that overlie the fluvial sediments of Low Falls Landing. *GRI Source Map ID 7336 ([Lone Star Quadrangle](#))*.

Qcb - Carolina bay sediments (upper Pleistocene to Holocene) – Carolina bays contain light-gray to black, clayey quartz sand and organic-rich peat deposits in the lake beds and coarser quartz sand and granules in the eolian rims of bays. Carolina bays were formed by the action of prevailing southwesterly winds that scoured blowout-like deflations on the topographic surface of the regional landscape. Carolina bays occur on the Atlantic Coastal Plain from New Jersey to Florida but are most abundant between Georgia and North Carolina (Soller and Mills, 1991). Although the shape and orientation of Carolina bays can vary, the majority are ellipsoidal depressions, with the long axis oriented southeast and the elevated rim of the bay along the northwest margin of the depression. The eolian-dominated process that formed Carolina bays, probably occurred under various moisture regimes, whereby the Carolina bays seasonally and annually ranged between ponded and dry conditions dependent on fluctuating ground-water levels (Kaczorowski, 1976, 1977). The wetter conditions facilitated peat formation, and the drier periods are evidenced by charcoal fragments from episodic fires. Deposition of the elevated sand rim is likely to have resulted from the combination of two processes, waves lapping against the northwest margin and eolian dune formation. The Carolina bays in the Poinsett State Park Quadrangle have been masked by agriculture, but their form is still recognizable by their topographic depression, orientation, and soil-moisture conditions. Maximum ages are estimates from regional correlations, but carbonaceous sediment in a bay in Sumter County is older than the range of reliable radiocarbon dates (older than approximately 25,000 to 30,000 years; after Brooks and others, 2001). In the Poinsett State Park Quadrangle map the Carolina bays were formed on the surface of the Pliocene-age Duplin Formation. *GRI Source Map ID 75216 ([Poinsett State Park Quadrangle](#))*.

Qe - Eolian sand (Holocene to upper Pleistocene)

Qe - Eolian sand (upper Pleistocene or lower Holocene or both) – Incohesive, white to light tan, moderately sorted, fine- to very coarse-grained and mostly medium-grained quartz sand, to minor quartz granules; with negligible clay. Adjoins a Carolina bay in central Fort Motte quadrangle. *GRI Source Map IDs 7335 ([Ellore Quadrangle](#)), 5778 ([Fort Motte Quadrangle](#))*.

Qeeb - Eolian sand of East Bethel (Holocene to upper Pleistocene)

Qeeb - Eolian sand of East Bethel (Holocene?; upper Pleistocene?) – Incohesive, white to light-tan, moderately sorted, fine to very coarse quartz sand to minor quartz granules; with negligible clay. Occurs on interfluvium north of Halfway Swamp in northwest Ellore 7.5-minute quadrangle. Occurs on interfluvium of Warley Creek and Halfway Swamp in southwestern Lone Star quadrangle. The eolian sand of East Bethel overlies the Duplin Formation. *GRI Source Map IDs 7335 ([Ellore Quadrangle](#)), 7336 ([Lone Star Quadrangle](#))*.

Qeeb - Eolian sand of East Bethel (upper Pleistocene?) – Incohesive, white to light-tan, moderately sorted, fine to very coarse and mostly medium quartz sand, to minor quartz granules; with negligible clay. Occupies interfluvium of Warley Creek and Halfway Swamp in southeastern Fort Motte quadrangle and in the adjacent corners of Cameron, Ellore, and Lone Star 7.5-minute quadrangles. As much as 20 feet thick. The eolian sand of East Bethel is named for East Bethel Church on the southeast side of Sherlock Road (Calhoun County road 9-157) at the intersection with Jones Road in southeastern Fort Motte quadrangle. *GRI Source Map ID 5778* ([Fort Motte Quadrangle](#)).

Qem - Eolian sand of East Bethel (Holocene to upper Pleistocene)

Qem - Eolian sand of Manchester State Forest (upper Pleistocene?) – Incohesive, white to light tan, moderately sorted, fine to very coarse quartz sand to minor quartz granules; with negligible clay. Occurs on highland at Manchester State Forest in northeastern Lone Star quadrangle and in corners of the adjoining quadrangle. As thick as 35 feet in drill hole 43-135. The eolian sand of Manchester State Forest overlies the Duplin Formation, and it is overlain by modern alluvium and swamp deposits. *GRI Source Map ID 7336* ([Lone Star Quadrangle](#)).

Qem - Eolian sand of Manchester State Forest (Pleistocene) – The Eolian Sand of Manchester State Forest forms a blanket of incohesive, white to light-tan, moderately well-sorted, fine to very coarse quartz sand to minor quartz granules with negligible clay. This sand occurs on highland surfaces at Manchester State Forest in southeastern Poinsett State Park Quadrangle and extends southeastward into adjoining quadrangles. The thickness of eolian sand in Poinsett State Park Quadrangle ranges between 10 and 20 feet, and it is 35 feet thick in drill hole 43-135, located in the Lone Star Quadrangle south of Poinsett State Park Quadrangle. The eolian sand forms Lakeland and Kershaw soils, and thus they are readily identifiable from the SSURGO soils maps. The eolian sand of Manchester State Forest overlies the Duplin Formation and drapes over Carolina bay deposits in the adjacent quadrangle to the east, Privateer. Eolian sand has been eroded by tributaries draining into the Wateree River flood plain. *GRI Source Map ID 75216* ([Poinsett State Park Quadrangle](#)).

Qacf - Quaternary alluvium, Congaree River flood plain (Holocene to Pleistocene)

Qacf - Quaternary alluvium, Congaree River flood plain (Pleistocene to Holocene) – The Congaree River flood plain alluvium in the confluence area is similar in composition and texture to the Wateree and Santee Rivers flood-plain alluvium, and includes fine- to very coarse-grained, light-tan to dark-brown sand, silt, clay, and organic-rich peat deposits. The geomorphology of the flood plain is simplified to a single unit for this map scale, but it is important to note that it contains a mosaic of fluvial features including infilled abandoned channels, flood-plain streams, natural levee deposits, and back swamps. Collectively, many of these features represent a complex of polymorphic landforms indicative of varied environmental conditions from the late Pleistocene to the present. *GRI Source Map IDs 5778* ([Fort Motte Quadrangle](#)), *7336* ([Lone Star Quadrangle](#)).

Qacf - Quaternary alluvium, Congaree River floodplain (Pleistocene to Holocene) – This unit includes a variety of sand, clay, and peat deposited in the Congaree River floodplain; a complex array of post-Late Pleistocene intra-floodplain terraces, meanderbelts, alluvial fans, dune fields, and rimswamps are recognized (Shelley and others, 2004; Shelley and Meitzen, 2005; Shelley and Cohen, 2007). *GRI Source Map IDs 74893* ([Gadsden Quadrangle](#)), *74894* ([Sailors Lake Quadrangle](#)), *74892* ([Wateree Quadrangle](#)).

Qacf - Quaternary alluvium, Congaree River flood plain (Pleistocene to Holocene) – The Congaree River flood plain alluvium in the confluence area is similar in composition and texture to the Wateree River flood plain alluvium, and includes fine- to very coarse-grained, light-tan to dark-brown

sand, silt, clay, and organic-rich peat deposits. The geomorphology of the flood plain is simplified to a single unit for this map scale, but it is important to note that it contains a mosaic of fluvial features including infilled abandoned channels, flood-plain streams, natural levee deposits, and back swamps. Collectively, many of these features represent a complex of polymorphic landforms indicative of varied environmental conditions from the late Pleistocene to the present. The Congaree River flood plain may also contain additional alloformations such as flood-plain terraces, meander belts, and a variety of other active and relict depositional landforms (e.g. Shelley and others, 2004; Meitzen and Shelley, 2005; Shelley and Cohen, 2007). Detailed geologic and geomorphic mapping would be necessary to identify and delineate the boundaries of these older flood-plain features. *GRI Source Map ID 75216* ([Poinsett State Park Quadrangle](#)).

Qasf - Quaternary alluvium, Santee River flood plain (Holocene to Pleistocene)

Qasf - Quaternary alluvium, Santee River flood plain (Pleistocene to Holocene) – The Santee River flood-plain alluvium in the confluence area is similar in composition and texture to the Wateree and Congaree Rivers flood-plain alluvium, and includes fine- to very coarse-grained, light-tan to dark-brown sand, silt, clay, and organic-rich peat deposits. The Santee River flood plain begins at the confluence of the Congaree and Wateree Rivers; however, the demarcation between these flood plains is approximated and shifts from one flooding event to another. *GRI Source Map IDs 7335* ([Ellore Quadrangle](#)), 5778 ([Fort Motte Quadrangle](#)), 7336 ([Lone Star Quadrangle](#)).

Qawf - Quaternary alluvium, Wateree River flood plain (Holocene to Pleistocene)

Qawf - Quaternary alluvium, Wateree River floodplain (Pleistocene to Holocene) – This unit includes a variety of sand, clay, and peat deposited in the Wateree River floodplain. DOQQs indicates a number of abandoned channels that likely reflect a similar complex of post-late Pleistocene intra-floodplain terraces, meanderbelts similar to those in the Congaree River Valley (e.g. Shelley and others, 2004; Shelley and Meitzen, 2005; Shelley and Cohen, 2007). Additional alluvial fans, dunes, and rimswamps may be present as well. *GRI Source Map IDs 7334* ([Eastover Quadrangle](#)), 74892 ([Wateree Quadrangle](#)).

Qawf - Quaternary alluvium, Wateree River flood plain (Pleistocene to Holocene) – The Wateree River flood plain alluvium includes fine- to very coarse-grained, light-tan to dark-brown sand, silt, clay, and organic-rich peat deposits in the Wateree River flood plain. The geomorphology of the flood plain is simplified to a single unit for this map scale, but it is important to note that it contains a mosaic of fluvial features including abandoned channels, crevasse channels, numerous flood-plain streams, natural levee deposits, alluvial fans, back swamps, and ground-water rim swamps. Collectively, many of these features probably represent a complex of polymorphic landforms indicative of varied environmental conditions from the late Pleistocene to the present. *GRI Source Map ID 7336* ([Lone Star Quadrangle](#)).

Qawf - Quaternary alluvium, Wateree River flood plain (Pleistocene to Holocene) – This unit includes fine- to very coarse-grained, light-tan to dark-brown sand, silt, clay, and organic-rich peat deposits in the Wateree River flood plain. The flood-plain alluvium is 66 feet thick at drill hole 43-167 and overlies a stiff gray Cretaceous clay. The geomorphology of the flood plain is simplified to a single unit for this map scale, but it is important to note that it contains a mosaic of fluvial features including abandoned channels, crevasse channels, numerous flood-plain streams, natural levee deposits, alluvial fans, back swamps, and ground-water rim swamps. Collectively, many of these features probably represent a complex of polymorphic landforms indicative of varied environmental conditions from the late Pleistocene to the present. Although detailed geologic mapping was limited to the uplands, the Wateree River flood plain may also contain additional alloformations such as flood-plain terraces and meander belts, and a variety of other active and relict depositional landforms similar to those in the Congaree River

Valley (e.g. Shelley and others, 2004; Meitzen and Shelley, 2005; Shelley and Cohen, 2007). Detailed geologic and geomorphic mapping of the Wateree River Valley is also necessary to identify and delineate the boundaries of these older flood-plain features. A few of the major flood-plain drainages and well-preserved oxbow lakes are included as bodies of water digitized from the 2006 DOQQ's. Although not included on the map, a moderately preserved alluvial fan extends from Fuller's Earth Creek into the flood plain on the eastern margin of the Wateree River flood plain. It is hypothesized that this alluvial fan may have formed as a geomorphic adjustment to the fault located along the Fuller's Earth Creek drainage. *GRI Source Map ID 75216* ([Poinsett State Park Quadrangle](#)).

Qawf - Quaternary alluvium, Wateree River flood plain (Pleistocene to Holocene) – This unit includes fine to very coarse-grained, light-tan to dark-brown sand, silt, clay and organic-rich peat deposits in the Wateree River flood plain. The flood-plain alluvium is 66 feet thick at drill hole 43-167 and overlays a stiff gray Cretaceous clay unit. The geomorphology of the flood plain is simplified to a single unit for this map-scale, but it is important to note that it contains a mosaic of fluvial features including abandoned channels, yazoo streams, natural levee deposits, alluvial fans, back swamps and possibly ground-water rim swamps. Some of these features may reflect a similar complex of post-late Pleistocene flood-plain terraces and meander belts similar to those in the Congaree River Valley (e.g. Shelley and others, 2004; Shelley and Meitzen, 2005; Shelley and Cohen, 2007). A few remnants of former flood-plain drainages and well-preserved oxbow lakes are included as bodies of water digitized from the 1999 DOQQ's. *GRI Source Map ID 75215* ([Wedgfield Quadrangle](#)).

Qatv - Quaternary alluvium, tributary valleys (Holocene to Pleistocene)

Qatv - Quaternary alluvium, tributary valleys (Pleistocene to Holocene) – Small stream valleys containing saturated brown to red to black sand and clay deposited by Holocene to modern streams. Most of these tributaries empty into the Congaree River Valley. In Richland County, stream valleys were mapped by matching online 2-foot contours (MD Atlantic Technologies, 2002a, b) against aerial photography; these data are allowed to supersede 10-foot contours from older U.S. Geological Survey (USGS) quadrangle maps. In Calhoun County, streams were mapped from a combination of aerial photography and 10-foot contours. Nystrom (1992) reported several late Pleistocene dates for similar tributaries in the Savannah River Valley, and these minimum ages are assumed to apply in the Congaree River Valley as well. *GRI Source Map IDs 7333* ([Congaree Quadrangle](#)), *7334* ([Eastover Quadrangle](#)), *74893* ([Gadsden Quadrangle](#)), *74894* ([Saylor's Lake Quadrangle](#)), *74892* ([Wateree Quadrangle](#)).

Qatv - Quaternary alluvium, tributary valleys (Pleistocene to Holocene) – Tributary stream valleys drain into larger flood plains and consist of saturated tan, brownish-red and black sand and clay. The active stream bed contains fine to very coarse, poorly sorted sand, gravel, and cobbles. Most of these tributary valleys contain a series of two or three moderately preserved fluvial terraces, with the active tributary stream incised into the valley floor. The terrace deposits consist of layers of moderately sorted, subrounded, and medium-to coarse-grained sand with abundant granules and cobbles. Most tributary valleys are uneven with regard to terrace preservation, and in some cases younger colluvial deposits, slumping from the hillside, mask the terrace morphology. *GRI Source Map IDs 7335* ([Elloree Quadrangle](#)), *5778* ([Fort Motte Quadrangle](#)), *7336* ([Lone Star Quadrangle](#)).

Qatv - Quaternary alluvium, tributary valleys (Pleistocene to Holocene) – The tributary stream valleys draining from the bluffs into the Wateree River flood plain contain saturated tan, brownish-red and black sand and clay deposited by Pleistocene to modern stream processes. The active stream beds contain fine to very coarse, poorly sorted sand, gravel, and cobbles. Most of these tributary valleys contain a series of two or three moderately preserved fluvial terraces, with the active tributary stream incised into the valley floor. The terrace deposits consist of layers of moderately sorted, subrounded, and medium-to coarse-grained sand with abundant granules and cobbles. Most tributary valleys are uneven with regard to terrace preservation, and in some cases younger colluvial deposits, slumping from the

hillside, mask the terrace morphology. In Sumter County the quaternary alluvium was mapped by using field observations, aerial photographs, and 10-foot contours. In Richland County, the terraced stream valleys were mapped by matching online 2-foot LIDAR-derived contours against aerial photography (Shelley, 2007b). *GRI Source Map ID 75216* ([Poinsett State Park Quadrangle](#)).

Qatv - Quaternary alluvium, tributary valleys (Pleistocene to Holocene) – Small stream valleys containing saturated brown to red to black sand and clay deposited by Pleistocene to modern streams. The active stream beds contain fine to very coarse sand, gravel and cobbles. Most of these tributary valleys contain a series of 2 to 3 moderately preserved fluvial micro-terraces, with the active tributary stream incised into the valley floor. The terrace deposits consist of stratified layers of moderately-sorted, sub-rounded, and sand to cobble sized sediments. Most tributary valleys are asymmetrical with regard to terrace preservation, and in some cases younger colluvial deposits mask the terrace morphology. In Sumter County the quaternary alluvium was mapped using field observations, aerial photographs, and 10 foot contours. In Richland County, the terraced stream valleys were mapped by matching online 2-foot contours (MD Atlantic Technologies, 2002a, b) against aerial photography. Nystrom (1992) reported several late Pleistocene dates for similar tributaries in the Savannah River Valley, and these minimum ages are assumed to apply in the Congaree River Valley as well. *GRI Source Map ID 75215* ([Wedgfield Quadrangle](#)).

Qatt - Quaternary alluvium, tributary valley microterraces (Holocene to Pleistocene)

Qatt - Quaternary alluvium, tributary valley microterraces (Pleistocene to Holocene) – 2-foot contours (MD Atlantic Technologies, Inc., 2002a, b), aerial photographs, and USGS topographic maps indicate small, scattered, fragmentary steps between the active, swampy tributary valleys and the true upland terrace surface. Hand augering indicates at least one of these features contains several feet of blonde to red-brown, loose, quartz sand with abundant heavy minerals. These features may reflect incision due to post-18th century changes in hydrology and sediment supply due to land use (clearing, ditching, agriculture) in the valley. Alternatively, they may be much older and reflect Holocene climate changes related to deposition of small alluvial fans in the floodplain (Shelley and Cohen, 2007). The presence of some Cretaceous subcrop in these tributary valleys well to the north of the current map area (e.g. Kite, 1988) suggests that some of these features could be abandoned, erosional benches of rather than constructional terraces. *GRI Source Map IDs 7333* ([Congaree Quadrangle](#)), 7334 ([Eastover Quadrangle](#)), 74893 ([Gadsden Quadrangle](#)), 74892 ([Wateree Quadrangle](#)).

Qaf - Quaternary alluvial fan deposits (Holocene to Pleistocene)

Qaf - Quaternary alluvial fan deposits (Pleistocene to Holocene) – Topographic maps and aerial photographs indicate a large alluvial fan where Sandy Run crosses the southern bluffs and enters the Congaree River Valley proper. SCGS drill hole log 09-247, the only hole on this feature, indicates up to 17 feet of orange to buff, poorly sorted, subangular to well-rounded fine to very coarse, blonde, black, and orange speckled, relatively immature sand with local red, micaceous, gritty clay lenses. At least two fining upward sequences are present, suggesting some lobe switching. A similar underlying sequence, which extend down to 36-foot depth and coarsen downward to include blocky, subrounded gravel less than one cm, could be basal alluvial fan sediments or part of a fluvial sequence at the top of the terrace. The steep slopes and loose Eocene sand in the Sandy Run watershed a very mechanism for moving sediments, and may help account for the large size of this deposit. The size and character of this fan are consistent with observations in the Lower Mississippi River Valley, where the most robust fans (up to 40-feet thick) are formed in association with perennial or semiperennial streams that drain older Cretaceous and Tertiary uplands and enter the valley at a distinct, high order bluff (Saucier, 1994). Other alluvial fans and tributary avulsions (suggesting alluvial fan processes) have been mentioned in the Savannah River Valley (Stevenson, 1982; Brooks and Sassaman, 1990). Several other fans are present along the

opposite rim of the Congaree River Valley to the east, but correlation, timing, and triggering mechanisms are not well constrained at the present time. *GRI Source Map ID 74894* ([Saylors Lake Quadrangle](#)).

Qaf1-Qaf2 - Quaternary alluvial fan deposits (Holocene to Pleistocene)

Quaternary alluvium fan deposits (Pleistocene to Holocene) – Topographic maps, LIDAR, and aerial photographs indicate several alluvial fans associated with Griffin's Creek and McKenzie Creek. Two upper fans on each creek appear to be locally coalesced into an alluvial apron. Drill hole log 40-141 indicates up to 4-feet of orange with dark orange and light streaked sand with abundant interstitial clay; the underlying terrace is relatively thin, suggesting it was eroded prior to fan development. Another fan, which is very well defined by LIDAR data (MD Atlantic Technologies, 2001a), is present on Griffins Creek below Congaree River Valley terrace complex 2 to the southeast. Drill hole logs 40-146 and 40-147 in this fan indicate light yellow to orange sand with abundant interstitial clay sediments are thin or similar enough to terrace deposits to be indistinguishable from the surficial soil zone. Other alluvial fans and tributary avulsions (suggesting alluvial fan processes) have been mentioned in the Savannah River Valley (Stevenson, 1982; Brooks and Sassaman, 1990). Multiple fan sequences in this area likely indicate multiple late Pleistocene climate (wetting?) events driving incision of the valley and sediment discharge in the creeks. Several other fans are present in the valley, especially at Sandy Run to the west, but correlation, timing, and triggering mechanisms are not well constrained at the present time. *GRI Source Map ID 74892* ([Wateree Quadrangle](#)).

The following Quaternary alluvial fan deposits are mapped: Qaf1 (fan deposits 1), Qaf2 (fan deposits 2)

Qd - Dune complexes (Holocene to Pleistocene)

Qd - Dune complexes (Pleistocene to Holocene) – Three sand dune complexes, which are locally known as Green Hill Mound, Muller's Barn Ridge, and Solomon Island, are recognized within the Congaree River floodplain. Although technically part of the Quaternary alluvium, Congaree River floodplain unit, these deposits are unique enough that they have been recognized as distinct features. Dune deposits are large, vegetated mounds of sand (less than 30-feet high) locally towering above the swampy floodplain. The sediments, which are very pale brown to reddish brown in color, are loose, well-sorted sand with locally abundant heavy minerals and very little interstitial clay. These features are tentatively correlated with sand dunes on the Coastal Plain of Georgia as described by Ivester and others (2001) and Ivester and Leigh (2003). Dunes probably reflect deposition in partially vegetated areas under glacial conditions 15,000 to 30,000 years ago (though some could be as old as 80,000 years), with minor reworking during the middle Holocene (e.g. Ivester and others, 2001; Ivester and Leigh, 2003). *GRI Source Map IDs 74894* ([Saylors Lake Quadrangle](#)), *74892* ([Wateree Quadrangle](#)).

Qpl - Packs Landing beds (upper Pleistocene)

Qpl - Packs Landing beds (upper Pleistocene) – Dominantly incohesive to lightly cohesive, tannish-orange to light-gray, medium quartz sand to common quartz pebbles to 10 mm; locally with scattered white feldspar grains to 17 mm; with scattered dark, heavy minerals and locally with minor muscovite flakes. Subordinately cohesive to very cohesive, stiffly plastic to very stiff, silty to micaceous, orangish-brown, medium-brown, or medium-gray clay matrix, with abundant very fine quartz sand to very abundant medium to very coarse quartz sand; locally with wood fragments. A stem or root from abundant plant matter in this sediment at 34 to 35 feet depth (47 to 48 feet elevation) in SCGS drill hole 43-129 at Packs Landing, Sumter County, in Lone Star quadrangle, yielded a radiocarbon C-14 date of 25,960 ± 3,790/-2,570 years BP, C-13 corrected (29,720 to 23,390 years BP; from Geochron Laboratories). The Packs Landing beds are 37 feet thick in drill hole 43-129. The unit is interpreted as 16 feet thick in USGS drill hole LM-2A (after Prowell, 1990) in Lone Star quadrangle. It occurs at the surface below about 82 feet elevation in southwestern Lone Star quadrangle. In Lone Star quadrangle the Packs

Landing beds unconformably overlie the upper Cretaceous Sawdust Landing Formation and the upper Paleocene Lang Syne Formation, and they are partially covered by modern alluvium and by Lake Marion. Alluvium of an ancient Santee River terrace. *GRI Source Map ID 7336* ([Lone Star Quadrangle](#)).

Qtw1-Qtw2 - Wateree River Valley terrace complex (Pleistocene)

Wateree River valley terrace complex (Plio-Pleistocene) – At least two apparent, fragmentary terraces are recognized within Wateree River valley that do not readily correlate with elevations or gradients mapped in the Congaree River Valley. Field investigations of these terraces during the current mapping were not undertaken, but previously existing auger data suggest that the general character and architecture of individual terrace deposits are similar to those in the Congaree River Valley. These terrace fragments, which have been uniquely designated with numbers in order of decreasing age, could simply be artifacts of existing topographic models or eroded terraces correlative with those in the Congaree River Valley terrace complex. Alternatively, they could represent deposits of an ancestral Wateree River adjusted to a different hydrologic and sedimentologic variables controlled by subtly differing climate, tectonics, and geology in the watershed. This latter case is most likely for the large fragment just north of the confluence between Colonels Creek and the Wateree River. *GRI Source Map ID 7334* ([Eastover Quadrangle](#)).

The following terraces are mapped for the Wateree River valley terrace complex: Qtw1 (terrace 1), Qtw2 (terrace 2)

Qt1-Tt13 - Congaree River Valley terrace complex (Pleistocene - Pliocene)

The following descriptions are for Qt1-Tt13:

Congaree River Valley terrace complex (Plio-Pleistocene) – The Congaree River Valley terrace complex is a series of estuarine to fluvial deposits that are Pliocene to recent in age (e.g., Shelley, 2007a-e). Where complete, these deposits are graded sequences of massive, white to pink, poorly to moderately sorted medium to very coarse sand with varying interstitial clay grading upward into red clay and sandy clay. Multiple graded sequences are locally present. Dense geotechnical data indicate up to 15-feet of local relief on the suballuvial surface. Gravel lags are often present at or near the base, and the lower portion is effectively an amalgamated sand sheet. The overlying topstratum is exceedingly variable in character and thickness. Intervening scarps range from well-expressed topographic breaks up to 15-feet high to effectively concealed. Terrace surfaces and scarps have been significantly modified by alluvial, colluvial, eolian and groundwater processes.

Although terrace deposits and bounding surfaces are often operationally equivocated, the two are conceptually distinct for mapping purposes and can be organized into hierarchies at many scales of spatial and temporal resolution (e.g., Miall, 1996; Shelley, 2007). Observations of the floodplain, for example, clearly demonstrate the architectural complexity of one relatively continuous “terrace” (e.g., Shelley and Cohen, 2007).

Colquhoun (1965) originally recognized four terraces in the valley and correlated them with regional marine terraces of Cooke (1936). In light of new data and updated paradigms, however, such simplistic correlations are problematic. Based on correlations of topographic features, drill hole data, and major breaks in the suballuvial surface, a total 14 terrace surfaces have been identified in the terrace complex (Shelley, 2007 a-e). The floodplain is considered terrace 0, and the progressively older surfaces have been named in order of age (1 = youngest, 2 = older, etc.). Numbers are split ‘a’ and ‘b’ if the relative age cannot be determined. Scarps have largely been generalized at the present scale of observation and are not drafted to reflect local micro-topography. Terrace delineation has been biased towards splitting out separate surfaces in questionable areas. Further drilling and analysis may condense some of these

terraces.

The oldest deposits in the Congaree River Valley terrace complex are correlative with the Pliocene Duplin Formation. Some of the subjacent terraces are also likely Pliocene in age, but the position of the base of the Pleistocene is based on speculation and SSURGO soil distributions at this point. As younger terraces are separated by increasing distance from time-correlative marine deposits of the Middle and Lower Coastal Plains, these deposits grade rapidly to a pure fluvial character. Progressively younger terraces are increasingly subtle and complex. Many of the younger terraces are concentrated in the lowermost valley and delineated by cross-referencing online 2-foot contour data (MD Atlantic Technologies, 2002a, b) with existing aerial photography and GIS layers. *GRI Source Map IDs* 7333 ([Congaree Quadrangle](#)), 7334 ([Eastover Quadrangle](#)), 74893 ([Gadsden Quadrangle](#)), 74894 ([Saylors Lake Quadrangle](#)), 74892 ([Wateree Quadrangle](#)).

Congaree River Valley terrace complex (Plio-Pleistocene) – The Congaree River Valley terrace complex is a series of estuarine to fluvial deposits that are Pliocene to Recent in age (e.g., Shelley, 2007a-e). These terrace complexes were mapped by Shelley (2007b) for the adjacent Eastover Quadrangle and then extrapolated into the Poinsett State Park Quadrangle along elevation contours, and thus the unit descriptions closely follow Shelley (2007b). Where the terrace deposits are complete, they are characterized by graded sequences of thick, white, pink, poorly to moderately sorted, medium to very coarse sand with varying amounts of interstitial clay grading upward into red clay, sand, and sandy clay. Multiple fining-upward sequences are locally present. Geotechnical drill-hole data from the Eastover quadrangle map (Shelley, 2007b) indicate as much as 15 feet of local relief on the suballuvial surface. Gravel lags are often present at or near the base, and the lower portion is a thick and highly variable sand deposit. The overlying top stratum is variable in character and thickness. Intervening scarps range from well-expressed topographic breaks as great as 15 feet to concealed. Terrace surfaces and scarps have been significantly modified by alluvial, colluvial, eolian, and ground-water processes. Although terrace deposits and bounding-surface contacts are often eroded and difficult to identify, the adjacent units are conceptually distinct for mapping purposes and can be organized by the suggested scheme used here (e.g., Miall, 1996; Shelley, 2007a-e).

The terrace hierarchy mapped for the Congaree River Valley contains a hypothesized sequence of 14 terrace units recognized by Shelley (2007a-e) and is derived from multiple data sources. Although the Poinsett State Park map contains only four of the suggested terraces, it is important to understand their position relative to the greater hierarchical sequence. Colquhoun (1965) originally recognized four terraces in the valley and correlated them with regional marine terraces of Cooke (1936). In light of new data sources and methods, a greater number of terraces can be recognized. On the basis of correlation to topographic features, drill-hole data, and major breaks in the suballuvial surface, a total of 14 terrace surfaces have been identified in the terrace complex (Shelley, 2007a-e). The flood plain is considered terrace 0, and the progressively older surfaces have been named in order of age (1 = youngest, 2 = older, etc.). Numbers are split 'a' and 'b' if the relative age cannot be determined. Scarps have largely been generalized at the present scale of observation and are not drafted to reflect local microtopography. Terrace delineation has been biased towards splitting out separate surfaces in questionable areas. Further drilling and analysis may condense some of these terraces.

The oldest deposits in the Congaree River Valley terrace complex are correlative with the Pliocene Duplin Formation. Some of the subjacent terraces are also likely to be Pliocene in age, but the position of the base of the Pleistocene is based on speculation and SSURGO soil distributions at this point. As younger terraces are separated by increasing distance from time-correlative marine deposits of the Middle and Lower Coastal Plains, these deposits grade rapidly to a pure fluvial character. Progressively younger terraces are increasingly subtle and complex. Many of the younger terraces are concentrated in the lowermost valley and delineated by cross-referencing online 2-foot contour data (MD Atlantic Technologies, 2002a, b) with existing aerial photography and GIS layers. *GRI Source Map ID* 75216 (

[Poinsett State Park Quadrangle](#)).

- Qt1** - Congaree River Valley terrace complex: terrace 1 (Pleistocene) - Found on: *GRI Source Map ID* 74892 ([Wateree Quadrangle](#))
- Qt2** - Congaree River Valley terrace complex: terrace 2 (Pleistocene) - Found on: *GRI Source Map IDs* 75216 ([Poinsett State Park Quadrangle](#)), 74892 ([Wateree Quadrangle](#))
- Qt3** - Congaree River Valley terrace complex: terrace 3 (Pleistocene) - Found on: *GRI Source Map ID* 74893 ([Gadsden Quadrangle](#))
- Qt4** - Congaree River Valley terrace complex: terrace 4 (Pleistocene) - Found on: *GRI Source Map ID* 74892 ([Wateree Quadrangle](#))
- Qt5** - Congaree River Valley terrace complex: terrace 5 (Pleistocene) - Found on: *GRI Source Map ID* 74892 ([Wateree Quadrangle](#))
- Qt6** - Congaree River Valley terrace complex: terrace 6 (Pleistocene) - Found on: *GRI Source Map IDs* 74893 ([Gadsden Quadrangle](#)), 74894 ([Saylor's Lake Quadrangle](#)), 74892 ([Wateree Quadrangle](#))
- Qt7a** - Congaree River Valley terrace complex: terrace 7 (Pleistocene) - Found on: *GRI Source Map IDs* 74893 ([Gadsden Quadrangle](#)), 74892 ([Wateree Quadrangle](#))
- Qt7b** - Congaree River Valley terrace complex: terrace 7b (Pleistocene) - Found on: *GRI Source Map IDs* 75216 ([Poinsett State Park Quadrangle](#)), 74892 ([Wateree Quadrangle](#))
- Qt8** - Congaree River Valley terrace complex: terrace 8 (Pleistocene) - Found on: *GRI Source Map IDs* 7333 ([Congaree Quadrangle](#)), 74893 ([Gadsden Quadrangle](#)), 75216 ([Poinsett State Park Quadrangle](#)), 74894 ([Saylor's Lake Quadrangle](#)), 74892 ([Wateree Quadrangle](#))
- Qt9** - Congaree River Valley terrace complex: terrace 9 (Pleistocene) - Found on: *GRI Source Map IDs* 7333 ([Congaree Quadrangle](#)), 74893 ([Gadsden Quadrangle](#))
- Qt10** - Congaree River Valley terrace complex: terrace 10 (Pleistocene) - Found on: *GRI Source Map IDs* 7333 ([Congaree Quadrangle](#)), 7334 ([Eastover Quadrangle](#)), 74893 ([Gadsden Quadrangle](#)), 75216 ([Poinsett State Park Quadrangle](#)), 74892 ([Wateree Quadrangle](#))
- Qt11a** - Congaree River Valley terrace complex: terrace 11a (Pleistocene) - Found on: *GRI Source Map IDs* 7333 ([Congaree Quadrangle](#)), 74893 ([Gadsden Quadrangle](#))
- Qt11b** - Congaree River Valley terrace complex: terrace 11b (Pleistocene) - Found on: *GRI Source Map IDs* 7334 ([Eastover Quadrangle](#)), 74892 ([Wateree Quadrangle](#))
- Tt12** - Congaree River Valley terrace complex: terrace 12 (Pliocene) - Found on: *GRI Source Map IDs* 7333 ([Congaree Quadrangle](#)), 7334 ([Eastover Quadrangle](#)), 74892 ([Wateree Quadrangle](#))
- Tt13** - Congaree River Valley terrace complex: terrace 13 (Pliocene) - Found on: *GRI Source Map IDs* 7333 ([Congaree Quadrangle](#)), 7334 ([Eastover Quadrangle](#)), 74892 ([Wateree Quadrangle](#))

Qwtb - Wicomico Toney Bay Member (lower Pleistocene)

QPwtb - Wicomico Toney Bay Member (lower Pleistocene) – Gray, orange, red (2.5YR 4/6 to 10R 4/6), reddish-brown, and yellowish-red (5YR 5/8), locally mottled, partly laminated, silty to clayey, angular, to subrounded, medium to coarse quartz sand; light-gray (5YR 7/1), pinkish-gray (5YR 7/2), red (2.5YR 5/6), light reddish-brown, and light-red (2.5YR 6/4 to 6/6), mottled, clayey silt to clay matrix with interspersed, medium to very coarse quartz sand. The basal lag is coarse quartz sand to small quartz pebbles (to 11 mm). A narrow band of the “Wicomico” or Waccamaw(?) occurs in the northeast valley of Santee River below approximately 108 feet (33 meters) in southeastern Lone Star quadrangle. The existence of these beds here is inferred from mapping in adjacent Pinewood quadrangle (Willoughby, 2000a) and from geomorphology; no drill holes penetrated the “Wicomico” or Waccamaw(?) in Lone Star quadrangle. The unit unconformably overlies the Lang Syne Formation in drill holes in Pineville quadrangle. In Lone Star quadrangle the unit abuts and unconformably terminates the Marietta unit, it is abutted and unconformably terminated by the Packs Landing beds, and it unconformably underlies modern alluvium and swamp deposits. Equivalent to the Wicomico Formation of Colquhoun and Duncan (1964, 1966) and the Waccamaw(?) Formation of Weems and others (1997). *GRI Source Map ID* 7336 ([Lone Star Quadrangle](#)).

Qhs - Fluvial terrace deposits of Halfway Swamp (lower Pleistocene)

Note: period changed from Tertiary to Quaternary by SCGS due to changes in stratigraphic nomenclature, not actual age

Ths - Fluvial terrace deposits of Halfway Swamp (lower Pleistocene?; upper Pliocene?) –

Interbedded quartzose sand, sandy conglomerate, and minor sandy clay matrix. Quartzose sand is buff-white to buff, orange, light-yellow, light-brown to reddish-brown, tan or khaki, slightly clayey, poorly to moderately sorted, subangular to subrounded, and medium to very coarse; includes minor to interstitial silt and clay; and includes minor heavy minerals. Minor beds are well sorted fine to medium quartz sand with lesser coarse quartz sand to quartz granules. Quartz granules and small quartz pebbles to 7 mm occur locally and at the base of the sand. Conglomerate is reddish-orange, orange, tan, and khaki; includes small quartz pebbles in matrix of poorly sorted, subangular, fine quartz sand to quartz granules; includes minor clay and is locally kaolinitic. Conglomerate occurs at or near the base of the deposits. Clay matrix is medium- to reddish-brown, light-gray, or tan and includes poorly sorted, subangular to rounded, locally bimodal, medium to coarse quartz sand. Subrounded to rounded small quartz pebbles or clay pebbles, or a textural change to underlying sediments, mark the base of the deposits. The fluvial terrace deposits of Halfway Swamp occur lower than approximately 125 feet (38.0 m) elevation on the north bank of the Halfway Swamp Creek valley in Elloree quadrangle. The fluvial terrace deposits of Halfway Swamp were intersected in drill holes 9-175 through 9-178 (western series), 9-191, 9-193, 9-194 (eastern series), and 9-195. Maximum known thickness is 28 feet in drill hole 9-175. The deposits unconformably overlie the Warley Hill Formation and Congaree Formations and are truncated by modern alluvium. The deposits apparently grade into the white, feldspathic, fluvial sediments of the Low Falls Landing (Qlf). GRI Source Map ID 7335 ([Elloree Quadrangle](#)).

Qlf - Terrace sediments of Low Falls Landing (lower Pleistocene)

Note: period changed from Tertiary to Quaternary by SCGS due to changes in stratigraphic nomenclature, not actual age

Tlf - Fluvial sediments of Low Falls Landing (lower Pleistocene?; upper Pliocene?) –

Buff-white, gray, orange, yellow, brown, and tan quartz-pebble conglomerate, quartz sand, and minor clay matrix. Conglomerate is subrounded quartz pebbles in poorly to moderately sorted, coarse quartz sand with minor clay. Quartz sand is moderately to well sorted, angular to subrounded, coarse to very coarse, and includes minor to interstitial clay. Well sorted, subangular, medium to coarse quartz sand occurs locally. Quartz granules occur in quartz sand at the base in drill hole 9-165, where the unit is 37 feet thick. Buff-white to orange clay matrix includes abundant, well-sorted, subangular, coarse to very coarse quartz sand.

Alluvial sediments in terrace lower than approximately 120 feet (36.6 m) elevation, to water's edge of Lake Marion in northern Elloree and southern Lone Star quadrangles. Exposed at Low Falls Landing in southern Lone Star quadrangle. Presumed gradational with the fluvial terrace deposits of Halfway Swamp (Qhs). Correlative with or slightly older than the "Wicomico Formation" of Colquhoun and Duncan (1966). GRI Source Map ID 7335 ([Elloree Quadrangle](#)).

Tlf - Terrace sediments of Low Falls Landing (lower Pleistocene?; upper Pliocene?) – Lightly to well cohesive, white, gray, cream, orange, yellow, and brown quartz sand, mixed quartz sand and clay, quartz-pebble to feldspar-pebble conglomerate, and minor stiff clay with minor quartz sand. Sand and pebble beds are poorly to moderately sorted, locally well-sorted, fine to coarse quartz sand to common quartz granules and commonly to quartz-pebble or quartz-and-feldspar conglomerate with pebbles to as much as 27 mm, especially at the base. Locally, quartz grains are stained orange. Feldspar sand,

granules, and pebbles are white and crumbly. Muscovite is minor to common locally.

The Low Falls terrace occurs in south-central Lone Star quadrangle and north-central Ellore 7.5-minute quadrangle on the west side of Santee River or Lake Marion. The terrace sediments are more than 10 feet thick by the parking lot at Low Falls Landing and are 33 feet and 54 feet thick in drill holes 9-138 and 9-139 in Lone Star quadrangle. The terrace sediments unconformably overlie the Lang Syne Formation; they abut and unconformably terminate the Duplin Formation; and they are overlain locally and unconformably by modern alluvium and swamp deposits. The highest elevation of the terrace is approximately 120 feet (36.6 meters). The terrace is considered separate from the "Wicomico Formation" or Waccamaw(?) Formation. The Low Falls terrace is a fluvial terrace deposited by Santee River. This informal unit was not previously recognized except in an earlier version of this map. *GRI Source Map ID 7336 ([Lone Star Quadrangle](#))*.

Qm - Marietta unit (lower Pleistocene)

Note: period changed from Tertiary to Quaternary by SCGS due to changes in stratigraphic nomenclature, not actual age

Tm - Marietta unit (upper Pliocene?) – Sediments mapped as the Marietta unit are buff white, rose, rusty red, tannish brown, or brown, poorly to moderately sorted, subangular to subrounded, locally bimodal, medium to very coarse quartz sand; with minor heavy minerals; and with minor interstitial clay to clay matrix. Quartz granules and small quartz pebbles to 10 mm occur at the base. Laminated beds, partly mottled by weathering, were noted in drill hole 9-187.

The Marietta unit was mapped on the promontory between Lake Marion (Santee River) and Halfway Swamp and as a high terrace on the north bank of the valley of Halfway Swamp valley. Drill holes 9-163, 9-173, and 9-177 penetrated the sediments assigned to the Marietta unit in the valley of Halfway Swamp. Drill hole 9-187 penetrated the sediments assigned to the Marietta unit(?) in the outlier between Lake Marion and Halfway Swamp.

The Marietta terrace-unit was deposited during a late Pliocene marine highstand that attained approximately 135-140 feet (41-43 m) in current elevation. That elevation is the toe of the Parler Scarp (Colquhoun and Duncan, 1964, 1966). The Parler Scarp, and the local, informal "beds of Rock Hill Road" bounded landward by it, were recognized by Willoughby (1997a, 1997b) and by Willoughby and Clendenin (1998).

The Marietta unit abuts the Duplin Formation, and it overlies the Warley Hill Formation. In the valley of Halfway Creek, the fluvial terrace deposits of Halfway Swamp abut and overlie the Marietta unit. The maximum known thickness of the Marietta unit in Halfway Swamp is 17 feet, in drill hole 9-187.

DuBar (1971) established the Marietta unit and recognized that it is bounded landward by the toe of the Mechanicsville Scarp, at approximately 135 feet in southern North Carolina and northeastern South Carolina. The Marietta unit is equivalent with or correlates with the Okefenokee Formation of Colquhoun and Duncan (1964, 1966), with the "Bear Bluff Formation" (not the stratotype) of Owens (1989), and with the "beds of Rock Hill Road" (Willoughby, 1997a). According to M. Campbell and L. Campbell, (1995) and M. Campbell (1997, personal communication), the type section of the Bear Bluff Formation correlates biostratigraphically with the lower Pliocene Goose Creek Limestone and not with most of the strata Owens (1989) assigned to his Bear Bluff Formation. *GRI Source Map ID 7335 ([Ellore Quadrangle](#))*.

Tm - Marietta unit (upper Pliocene?) – Stiff to loose, white, light-gray, pink, red, yellow, brown, and, rarely, dark-gray, locally variegated, clayey quartz sand to 25-mm quartz pebbles. Quartz pebbles are

common at the base but occur throughout. Lesser, silty, micaceous clay beds, to 7 feet thick, include interspersed quartz silt to very fine quartz sand, to locally small quartz pebbles to 6 mm, and traces of dark, heavy minerals. The Marietta unit is 54 feet and 15 feet thick in drill holes 9-139 and 14-97 in Lone Star quadrangle. The Marietta unit is at the surface in a narrow terrace in southeastern Lone Star quadrangle. In drill holes in Lone Star quadrangle, the unit overlies the Lang Syne Formation. At the surface in Lone Star quadrangle the unit abuts and unconformably terminates (and overlies) the Duplin Formation, and the unit apparently is overlain and abutted by an even narrower remnant of the "Wicomico Formation" or Waccamaw(?).

The informal Marietta unit (DuBar, 1971; Willoughby, 2002a, 2002b; Willoughby and Clendenin, 2002) is equivalent to the "Okefenokee Formation" of Colquhoun and Duncan (1964, 1966) and to the "Bear Bluff Formation" of DuBar and others (1974) and Owens (1990). *GRI Source Map ID 7336* ([Lone Star Quadrangle](#)).

Td - Duplin Formation (Pliocene)

Td - Duplin Formation (Pliocene) – Similarities between the position, stratigraphy and sedimentology, and geomorphology of the uppermost terrace in the Congaree River Valley terrace complex and the Duplin Formation in the nearby Fort Motte 7.5-minute quadrangle indicate that the two are directly correlated (Willoughby, 2003; Ralph Willoughby, oral communication). The Duplin Formation, which ranges in color from red to orange to brown to yellow, is characterized by moderately to poorly sorted medium quartz sand to quartz granules with local interstitial clay. Sand beds are locally laminated and include dispersed to bedded quartz gravel of less than 2.5-cm. Thin beds of sandy clay and white clay are also locally present. The Duplin Formation is generally interpreted as a shallow to marginal marine deposit on the basis of paleontological evidence and facies analysis, and it appears to represent multiple phases of deposition (Colquhoun, 1965; Ward and others, 1991). The formation, which was deposited after a late Miocene to early Pliocene regional hiatus, is variably considered middle Pliocene by Campbell (1998) and upper Pliocene by Weems and Lewis (2002) and is correlative with the Yorktown Formation north of the Neuse River and the Raysor Formation in the Charleston Embayment (Riggs and Belknap, 1988; Ward and others, 1991). Although the Duplin Formation regionally trends northeast-southwest, parallel to the modern shoreline, the Congaree River Valley it trends northwest. This reflects deposition in an estuary or sound oriented at an oblique angle to the regional shoreline.

The Duplin Formation is bounded upsection by the Orangeburg Scarp. The Orangeburg Scarp, also known as the Citronelle Escarpment, is a regionally extensive scarp that represents one of the best-preserved scarps in the Coastal Plain as well as the inland limit of the Middle Coastal Plain (Winker and Howard, 1977; Cronin, 1981; Dowsett and Cronin, 1990; Soller and Mills, 1991). Although the scarp is usually a northeast-southwest trending wave-cut feature, its presence up the Congaree and Wateree River Valleys indicates that these valleys were physiographic features by Pliocene time. These valleys were probably expressed as sounds, and the scarp in these areas is, technically, an estuarine feature. The significant rise in sea level associated with the Orangeburg Scarp marks a distinct event following a regional late Miocene to early Pliocene hiatus, as well as the onset of significant glacioeustatic cycling that significantly affected stratigraphy, geomorphology, and paleoecology throughout North America (Riggs and Belknap, 1988). *GRI Source Map IDs 7333* ([Congaree Quadrangle](#)), *7334* ([Eastover Quadrangle](#)).

Td - Duplin Formation (Pliocene) – Locally clayey, moderately sorted, locally poorly sorted, dominantly medium quartz sand to quartz granules; to quartz pebbles to 25 mm locally to commonly concentrated as pebble beds (gravel); and with scattered, white clay beds as much as a few inches thick. Occurs at the surface in Elloree quadrangle except in the valleys of Santee River and its tributaries. The Duplin Formation was considered to be lower Pliocene by M. R. Campbell (1992) and M. R. Campbell and L. D. Campbell (1995) and was considered to be upper Pliocene by Weems and Lewis

(2002). *GRI Source Map ID 7335* ([Elloree Quadrangle](#))

Td - Duplin Formation (Pliocene) – Locally clayey, moderately sorted to locally poorly sorted, dominantly medium quartz sand to quartz granules; to quartz pebbles to 25 mm locally to commonly concentrated as pebble beds (gravel); and with white clay beds to a few inches thick. Occurs in eastern and southeastern Fort Motte quadrangle. The inland limit of the Duplin Formation on the interfluvies is the base or toe of the Orangeburg Scarp. The Duplin Formation was considered approximately middle Pliocene by M. R. Campbell (1998) and was considered upper Pliocene by Weems and Lewis (2002). *GRI Source Map ID 5778* ([Fort Motte Quadrangle](#)).

Td - Duplin Formation (Pliocene) – Very lightly cohesive to well cohesive or plastic, white, cream, gray, pink, orange, yellow, ocher, and brown, quartz sand to sandy quartz conglomerate, mixed sand and clay, and minor clay matrix. Sandy beds are very well-sorted, very fine to fine quartz sand, to well-sorted, very fine to medium quartz sand, or poorly to well-sorted, very fine quartz sand, granules and pebbles; locally with scattered quartz granules to subrounded quartz pebbles to 25 mm and at base with quartz pebbles to 34 mm; with minor dark heavy minerals; with minor to locally very abundant interstitial clay; locally with minor muscovite; locally with distinct laminae and thin beds of clayey quartz sand. Gritty conglomerate with quartz granules and subrounded quartz pebbles to 39 mm occurs locally. Mixed quartz sand and clay includes well-sorted, very fine to medium quartz sand, lesser silt and mica, and minor dark heavy minerals. The mixed sediment locally includes quartz-pebble conglomerate with quartz pebbles to 18 mm, and it varies locally to clay matrix. Clay beds include fine to medium quartz sand, minor dark heavy minerals, and locally common silt or muscovite. Some silty or sandy laminae occur. Clay beds are as much as 15 cm thick. Uncommon, soft white feldspar sand occurs at the base of the Duplin Formation in drill hole 43-134. Moderately cohesive, dark gray-green, fossiliferous, moderately calcareous clay with abundant shell fragments occurs at the base of the Duplin in drill hole 43-7.

The Duplin Formation is at the surface in the highlands in eastern and western Lone Star quadrangle. In drill holes in Lone Star quadrangle, the Duplin overlies the Lang Syne Formation (most drill holes), the Warley Hill Formation (drill holes 9-143, 144, 9-148, and 9-149), or the Orangeburg District bed (drill hole 9-149). The inland margin or termination of the Duplin Formation does not occur in Lone Star quadrangle. Eolian sand, modern alluvium and swamp deposits, or Carolina bay sediments locally overlie the Duplin in this quadrangle. The Marietta unit abuts and terminates the Duplin in eastern Lone Star quadrangle, and the terrace sediments of Low Falls Landing abut and terminate the Duplin in western Lone Star quadrangle. M. R. Campbell (1992) and M. R. Campbell and L. D. Campbell (1995) considered the Duplin Formation to be lower Pliocene, and Weems and Lewis (2002) considered the Duplin to be upper Pliocene. *GRI Source Map ID 7336* ([Lone Star Quadrangle](#)).

Td - Duplin Formation (Pliocene) – Similarities between the position, stratigraphy, and sedimentology, and geomorphology of the uppermost terrace in the Congaree River Valley terrace complex and the Duplin Formation in the nearby Fort Motte quadrangle indicate that the two are directly correlated (Willoughby, 2003; Ralph Willoughby, oral communication). The Duplin Formation, which ranges in color from red to orange to brown to yellow, is characterized by moderately to poorly sorted medium quartz sand to quartz granules with local interstitial clay. Sand beds are locally laminated and include dispersed to bedded quartz gravel of less than 2.5 cm. Thin beds of sandy clay and white clay are also locally present. The Duplin Formation is generally interpreted as a shallow to marginal marine deposit on the basis of paleontological evidence and facies analysis, and it appears to represent multiple phases of deposition (Colquhoun, 1965; Ward and others, 1991). The formation, which was deposited after a late Miocene to early Pliocene regional hiatus, is variably considered middle Pliocene by Campbell (1998) and upper Pliocene by Weems and Lewis (2002) and is correlative with the Yorktown Formation north of the Neuse River and the Raysor Formation in the Charleston Embayment (Riggs and Belknap, 1988; Ward and others, 1991). Although the Duplin Formation regionally trends northeast-southwest, parallel to the modern shoreline, in the Congaree River Valley it trends northwest. This

reflects deposition in an estuary or sound oriented at an oblique angle to the regional shoreline. *GRI Source Map ID 74892* ([Wateree Quadrangle](#))

Td - Duplin Formation (Pliocene) – In western Sumter County the Duplin Formation is mainly composed of poorly sorted, medium- to very coarse-grained clayey quartz sand with abundant granules, and stringers of quartz pebbles. Locally there are cross-bedded, loose, medium-grained sands. The Duplin Formation occurs at the base of and southeastward of the Orangeburg Scarp. *GRI Source Map ID 75215* ([Wedgefield Quadrangle](#)).

Tdu - Duplin Formation, upper part (Pliocene)

Note: Td is divided into Tdu and Tdl east of rivers per SCGS staff

Td - Duplin Formation (Pliocene) – Very lightly cohesive to well cohesive or plastic, white, cream, gray, pink, orange, yellow, ocher, and brown, quartz sand to sandy quartz conglomerate, mixed sand and clay, and minor clay matrix. Sandy beds are very well-sorted, very fine to fine quartz sand, to well-sorted, very fine to medium quartz sand, or poorly to well-sorted, very fine quartz sand, granules and pebbles; locally with scattered quartz granules to subrounded quartz pebbles to 25 mm and at base with quartz pebbles to 34 mm; with minor dark heavy minerals; with minor to locally very abundant interstitial clay; locally with minor muscovite; locally with distinct laminae and thin beds of clayey quartz sand. Gritty conglomerate with quartz granules and subrounded quartz pebbles to 39 mm occurs locally. Mixed quartz sand and clay includes well-sorted, very fine to medium quartz sand, lesser silt and mica, and minor dark heavy minerals. The mixed sediment locally includes quartz-pebble conglomerate with quartz pebbles to 18 mm, and it varies locally to clay matrix. Clay beds include fine to medium quartz sand, minor dark heavy minerals, and locally common silt or muscovite. Some silty or sandy laminae occur. Clay beds are as much as 15 cm thick. Uncommon, soft white feldspar sand occurs at the base of the Duplin Formation in drill hole 43-134. Moderately cohesive, dark gray-green, fossiliferous, moderately calcareous clay with abundant shell fragments occurs at the base of the Duplin in drill hole 43-7.

The Duplin Formation is at the surface in the highlands in eastern and western Lone Star quadrangle. In drill holes in Lone Star quadrangle, the Duplin overlies the Lang Syne Formation (most drill holes), the Warley Hill Formation (drill holes 9-143, 144, 9-148, and 9-149), or the Orangeburg District bed (drill hole 9-149). The inland margin or termination of the Duplin Formation does not occur in Lone Star quadrangle. Eolian sand, modern alluvium and swamp deposits, or Carolina bay sediments locally overlie the Duplin in this quadrangle. The Marietta unit abuts and terminates the Duplin in eastern Lone Star quadrangle, and the terrace sediments of Low Falls Landing abut and terminate the Duplin in western Lone Star quadrangle. M. R. Campbell (1992) and M. R. Campbell and L. D. Campbell (1995) considered the Duplin Formation to be lower Pliocene, and Weems and Lewis (2002) considered the Duplin to be upper Pliocene. *GRI Source Map ID 7336* ([Lone Star Quadrangle](#)).

Td - Duplin Formation (Pliocene) – In western Sumter County the Duplin Formation is mainly composed of poorly sorted, medium- to very coarse-grained clayey quartz sand with abundant granules and stringers of quartz pebbles. Locally there is cross-bedded, loose, medium-grained sand. Weathered outcrops of the Duplin Formation are often tannish-brown to medium brown. The Duplin Formation occurs at the base of and southeastward of the Orangeburg Scarp (DuBar and others, 1974; Owens 1990). *GRI Source Map ID 75216* ([Poinsett State Park Quadrangle](#)).

Tdl - Duplin Formation, lower part (lower Pliocene)

Tdl - Duplin Formation (lower part, lower Pliocene) – At base, clay and clayey, quartzose, in part shelly, sands. In remaining lower part, locally calcareous (with interstitial lime mud) to richly shelly or

locally clayey, well-sorted, dominantly very fine- to fine-grained quartz sand, and with uncommon bluish gray clay beds to 2 feet thick. Contact with the immediately underlying beds of the lower Duplin Formation is gradational. Upper contact is abrupt. Transgressive to offshore marine facies. *GRI Source Map ID 7336* ([Lone Star Quadrangle](#)).

Tal - Altamaha Formation (middle Miocene)

Tal - Altamaha Formation (Middle Miocene) – The Altamaha Formation (formally the upland unit), which varies from red to orange in color, is characterized by weathered, heterogeneous, poorly sorted, angular, coarse to very coarse sand and gravel with abundant interstitial clay and local quartz cobbles. Sand-sized white clay clasts are common and locally give this unit a speckled appearance (Kite, 1988). The Altamaha Formation is irregularly scattered on the highest hilltops in the region. This distribution indicates some post-depositional topographic inversion (Kite, 1988). These deposits are interpreted to represent a regional, pre-late Miocene sheet of fluvial conglomerates deposited by braided systems on the Coastal Plain. Regional fluvial deposition is potentially related to cessation of thermal subsidence and peripheral uplift of the southeastern North American margin (Clendenin and others, 1999). The Altamaha Formation is equivalent to the updip Hawthorn Formation of Georgia, the Beacon Hill gravel of New Jersey, the Tyson's Corner gravel of Northern Virginia, and the Bon Air gravel of southeastern Virginia (Nystrom and others, 1991). *GRI Source Map IDs 7333* ([Congaree Quadrangle](#)), *7334* ([Eastover Quadrangle](#)), *74894* ([Saylors Lake Quadrangle](#)).

Ttr - Tobacco Road Sand (upper Eocene)

Ttr - Tobacco Road Sand (Upper Eocene) – The Tobacco Road Sand, which is red to orange to brown in color, is characterized by moderately to poorly sorted, subangular to well-rounded fine to medium sand with uncommon (though locally moderately abundant) interstitial sand. Sand is dominantly quartz, with local mica in the upper portion (Kite, 1984a,b) and local, rare blue quartz in the study area. Gravel less than 1.4 centimeters is commonly found at the base. The unit is considered a near shore to littoral marine depositional environment (Nystrom and others, 1991). The upper portion of this unit is often encountered at the surface in the study area, and is often overprinted with soil features. The maximum thickness of the Tobacco Road Sand in the area is approximately 16-feet. *GRI Source Map ID 74894* ([Saylors Lake Quadrangle](#)).

Tdb - Dry Branch Formation (upper Eocene)

Tdb - Dry Branch Formation (Upper Eocene) – The Dry Branch Formation, which varies from orange to red to brown in color, is characterized by moderately well-sorted, subangular to subrounded, locally bimodal fine to coarse quartz sand (Kite, 1984a,b). Rare blue quartz and garnet are noted in the study area. Interstitial clay varies from rare to abundant. The lower contact, characterized by very coarse sand to granules with small gravel, is only recorded in 32-347. This contact is often pebbly throughout the updip portions of the region, but becomes increasingly obscured downdip (Kite, 1984a,b). The Dry Branch Formation is interpreted as a transgressive and near shore shelf deposit (Nystrom and others, 1991). The maximum thickness of the Dry Branch Formation in the study area is approximately 16-feet; the formation thickens to 52-feet to the west in Georgia (Nystrom and others, 1991). *GRI Source Map ID 74894* ([Saylors Lake Quadrangle](#)).

Todb - Orangeburg District bed (upper middle Eocene)

Todb - Orangeburg District bed (upper middle Eocene) – Varies from loose to lightly cohesive, clay-poor, slightly clayey quartz sand to stiff, mixed quartz sand and clay to stiff, locally laminated, clay matrix with interspersed quartz sand in Fort Motte quadrangle. Clay-poor sediment is loose or lightly

cohesive. Mixed quartz sand and clay beds and clay matrix are stiff. Shades of red, orange, and yellow dominate the colors; white plus tan, olive, and brown are lesser. Various clayey, well-sorted, very fine to medium quartz sand is a common and characteristic lithology; quartz grains in other clayey sand beds are poorly sorted with common quartz granules and scattered quartz pebbles (to 15 mm). Very fine to fine dark heavy minerals are minor to common. Muscovite flakes impart a sheen to the smeared sediment. Quartz granules to quartz pebbles (to 20 mm) occur at the base of the unit. Silica-replaced molluscan fossils occur locally in the Orangeburg District bed (Nystrom and others, 1990, 1992; Dockery and Nystrom, 1990, 1992a, 1992b). The last three references recognized the informal Orangeburg District bed, reported silica-replaced molluscan fossils from it locally, and reported its age as late middle Eocene. *GRI Source Map ID 5778* ([Fort Motte Quadrangle](#)).

Todb - Orangeburg District bed (Upper Middle Eocene) – The Orangeburg District bed, which is variably orange to red to yellow to brown in color, varies from loose, clay-poor quartz sand with minor to common heavy minerals to stiff, moderately cohesive sand with abundant interstitial clay and mica to laminated, clay matrix with interspersed quartz sand to well-sorted, very fine to medium quartz sand with variable interstitial clay. Quartz granules and scattered quartz pebbles less than two centimeters are scattered through the unit and common (though not always present) at the base. Silica-replaced molluscan fossils of late middle Eocene age occur locally in the Orangeburg District bed (Nystrom and others, 1991; Dockery and Nystrom, 1992a; Dockery and Nystrom, 1992b; Nystrom and others, 1992). The Orangeburg District bed is considered to be a shallow marine deposit, and is correlative with the Piney Point Formation of Virginia, the upper Lisbon Formation of Alabama and Georgia, the Cook Mountain Formation of Mississippi, Louisiana, and Texas, and the Upper New Hanover member of the Castle Hayne limestone of North Carolina (Nystrom and others, 1991; Dockery and Nystrom, 1992b). *GRI Source Map IDs 74893* ([Gadsden Quadrangle](#)), *74894* ([Saylor's Lake Quadrangle](#)), *74892* ([Wateree Quadrangle](#)), .

Ts - Santee Limestone (middle Eocene)

Ts - Santee Limestone (middle Eocene) – Moderately indurated, sectile, cream to light tan, microfossiliferous lime mudstone to slightly shelly wackestone and moderately to well indurated, shelly, lime wackestone to packstone. The fossil oyster *Cubitostrea sellaeformis* and associated fossils occur in the lime mudstone. The Santee Limestone is exposed to a few feet above water level on the southwest shore of Lake Marion in eastern Elloree quadrangle. The Santee Limestone occurs in the subsurface of much of Elloree quadrangle. *GRI Source Map ID 7335* ([Elloree Quadrangle](#)).

TwH - Warley Hill Formation (middle Eocene)

TwH - Warley Hill Formation (middle Eocene) – Stiff, olive-green (fresh) to light-orange, medium-orange, pale-green, brownish-red to dark-brown (weathered), clayey, fine to medium glauconite sand and fine to coarse quartz sand. The Warley Hill Formation includes very dark olive-green, subrounded, fine to coarse glauconite pellets; has subordinate, angular to subangular, medium to coarse quartz sand; includes minor to abundant interstitial clay; and includes some clay beds. Black, phosphatic, shark teeth occur rarely. *GRI Source Map ID 7335* ([Elloree Quadrangle](#)).

TwH - Warley Hill Formation (middle Eocene) – Stiff, olive-green (fresh) to light-orange, medium-orange, pale-green, brownish-red to dark-brown (weathered), clayey, glauconitic, fine to coarse glauconite and quartz sand. The Warley Hill Formation includes very dark olive green, subrounded, fine to coarse glauconite pellets; has subordinate, angular to subangular, medium to coarse quartz sand; includes minor to abundant interstitial clay; and includes some clay beds. Minor, green, thin beds (to 15 cm) of clay occur at the surface. Beds of chocolate-brown clay matrix, with included fine quartz sand to quartz granules and with rounded to subrounded, fine to coarse glauconite pellets were seen in drill holes 9-124 and 9-130. Black, phosphatic shark teeth were noted rarely. The Warley Hill Formation

occurs throughout Fort Motte quadrangle. In natural exposures and in older artificial exposures in Fort Motte quadrangle, the Warley Hill is light-orange, medium-orange, pale-green, or dark-brown. In fresh drill-hole cuttings from below the surface, the Warley Hill Formation in Fort Motte quadrangle is olive-green. The major differences in color are due to the weathering of glauconite. The Warley Hill Formation is 29 feet thick in drill hole 9-133 and 27 feet thick in drill hole 9-77. In 21 holes that penetrated the complete thickness of the Warley Hill in Fort Motte quadrangle, the formation averages 13 feet in thickness. *GRI Source Map ID 5778* ([Fort Motte Quadrangle](#)).

TwH - Warley Hill Formation (middle Eocene) – The Warley Hill Formation in Lone Star quadrangle is slightly clayey glauconite and quartz sand to mixed sediment of clay, glauconite and quartz sand to clay matrix. The sandy to mixed beds are lightly to well cohesive, locally softly plastic to stiff, locally dry and powdery glauconite-pellet and quartz sand to mixed glauconite, quartz sand, and clay; with common to very abundant, elongate, rounded, fine to medium glauconite pellets; with mainly well-sorted fine to medium quartz sand to locally quartz granules; at base, with subrounded quartz pebbles to 15 mm; with minor interstitial to matrix-forming clay and with minor clay laminae; with slight to scattered muscovite flakes; with minor dark heavy minerals; with slight to scattered muscovite flakes; locally with shark teeth; and locally with black wood fragment to as much as 12 mm. Clay beds in the Warley Hill Formation in Lone Star quadrangle are very cohesive, include slight to abundant green silt (presumed to be glauconite); are slightly micaceous; include minor to common quartz sand that is dominantly very fine to fine or locally medium to coarse; include moderate to abundant very fine to fine, deep-olive glauconite pellets; and locally have minor cream to light green laminae. The Warley Hill Formation in Lone Star quadrangle is green, olive-green or bluish-green to tan, orange, greenish-gray, or dark brown, depending on whether the glauconite is fresh or weathered. Sand-size glauconite grains are elongate, rounded pellets; much of the silt and clay is probably glauconite as well. Carbonate was not noted. Richly clayey beds and clay matrix adhere to metal and can be peeled off the auger rods in stiff, intact coils. Horizontal and vertical burrows were seen in 10 feet of section above the site of drill hole 9-147.

The Warley Hill Formation occurs at the surface and in the subsurface in western Lone Star quadrangle but is absent in eastern Lone Star quadrangle. The Warley Hill Formation is 24 to 26 feet thick in drill holes 9-143, 9-144, and 9-146. Drill holes 9-147, 9-148 and 9-149 encountered incomplete thicknesses of 9 to 16? feet. The Warley Hill Formation is exposed and has its type section (Sloan, 1907a, 1907b, 1908) in the valley of Warley Creek in western Lone Star quadrangle. The Warley Hill has been projected to the surface in areas near Warley Creek. In drill holes in western Lone Star quadrangle, the Warley Hill unconformably overlies the Congaree Formation or Lang Syne Formation, and it unconformably underlies the Orangeburg District bed or the Duplin Formation. The Congaree Formation and Orangeburg District bed (middle Eocene) do not occur at the surface in Lone Star quadrangle. *GRI Source Map ID 7336* ([Lone Star Quadrangle](#)).

Tc - Congaree Formation (Eocene)

Tc - Congaree Formation (Upper Middle Eocene) – The Congaree Formation, which is variably buff to orange to pink to gold in color, consists of bedded, loose to moderately cohesive, well-sorted, sub- to well-rounded fine to medium quartz sand with local heavy minerals and blue quartz. Lenses of poorly to moderately sorted medium quartz sand to quartz granules, thin beds of pale-green very fine sand, glauconitic sand, local zones of moderate to abundant interstitial clay, and poorly indurated beds with SiO₂ cement are locally present. Quartz granules, subrounded to rounded quartz pebbles (to 1 cm), and iron-oxide cement often occur at or near the base, as do locally concentrated kaolin rip-up clasts; in most places the lower contact with the waxy black clay of the subjacent Lang Syne Formation is perhaps the most obvious lithologic contact in the area. A few road cuts near Garners Ferry Road and Good Hope Church in Richland County contain very poorly preserved, scattered silicified shell hash and shell impressions (Cooke, 1936). Local exposures in the Staley Crossroads 7.5-minute quadrangle nearby indicate channels several meters deep containing poorly indurated, laminated sand and clay and

small (2-3 mm) poorly preserved bivalves. Locally massive, burrowed to laminated green claystone is found in the lower portion of the unit in the Fort Motte 7.5-minute quadrangle nearby (Willoughby, 2003). Although no fossils are identifiable near the study area, the large molluscan bivalve *Anodontia augustana* occurs in the sandy claystone of the Congaree Formation parts of Calhoun County, South Carolina, as well as in Alabama (Gardner, 1951; Toulmin, 1977). The Congaree Formation is interpreted as a shallow marine deposit and is correlative with the Huber Formation in western South Carolina and with the Tallahatta Formation in southern Alabama and Mississippi, where it is also sometimes called the Basic City shale (Toulmin, 1977). *GRI Source Map IDs* 7333 ([Congaree Quadrangle](#)), 7334 ([Eastover Quadrangle](#)), 74893 ([Gadsden Quadrangle](#)), 74894 ([Saylor's Lake Quadrangle](#)), 74892 ([Wateree Quadrangle](#)).

Tc - Congaree Formation (lower to middle Eocene?) – Quartz sand in the Congaree Formation is lightly to moderately cohesive, varicolored (pink, red, yellow, orange, tan, golden-brown, and yellowish-brown), well-sorted, very fine to fine quartz sand and poorly to moderately sorted, medium quartz sand to quartz granules; includes scattered, dark, heavy minerals; locally includes minor pale-green, very fine glauconite sand; and includes minor to moderate interstitial clay and local clay laminae. Some beds of well-sorted, coarse quartz sand to quartz granules occur. Quartz granules and subrounded to rounded quartz pebbles (to 1 cm) occur at or near the base. Glauconite sand in the Congaree is scattered, inconspicuous, pale-green, and very fine, in contrast with the ubiquitous, abundant, olive-green, very fine to medium grained glauconite in the Warley Hill Formation. Minor green clay granules occur locally and near the base. Kaolin granules to pebbles occur in outcrops in the steep valley west-southwest of Wiles Crossroads. The kaolin clasts resemble those in the correlative Huber Formation (Nystrom and others, 1991).

Clay matrix in the Congaree Formation in Fort Motte quadrangle is stiff, green, tan, or gray; includes scattered muscovite flakes; includes minor quartz silt to fine quartz sand; and is locally laminated. Indurated, silica-cemented laminae to thick beds of dominantly well sorted, very fine to fine quartz sand and clay, varying from clayey quartz sandstone to sandy claystone, form prominent outcrops in the southwest valley walls of Halfway Swamp and Lyons Creek. Horizontal burrows (to 5 cm thick or wide) are prominent in this rock. This lithology also occurs in the correlative Tallahatta Formation in southern Alabama, where it is called the Basic City Shale (Toulmin, 1977). The large molluscan bivalve *Anodontia augustana* Gardner occurs in the sandy claystone of the Congaree Formation elsewhere in Calhoun County, S. C. as well as in Alabama (Gardner, 1951; Toulmin, 1977). *GRI Source Map ID* 5778 ([Fort Motte Quadrangle](#)).

Tc - Congaree Formation (lower to middle Eocene) – The Congaree Formation was identified in drill holes 9-143, 9-144, and 9-147 in eastern Calhoun County. In those holes the Congaree is silty clay matrix and quartz sand. Silty clay matrix in the Congaree in 9-143 and 9-144 is dark or olive greenish-gray or olive-green and is plastic to stiff; includes common to abundant, interspersed, very fine quartz sand throughout; includes scattered thin beds of very fine quartz sand to quartz granules; includes moderate interstitial clay; and includes minor, very fine glauconite and muscovite. Quartz sand in the Congaree in 9-147 is loose to lightly cohesive, light orange to medium yellowish-orange, well-sorted, dominantly fine to medium and minor coarse sand; includes minor dark heavy minerals; and includes interstitial clay to thin clay beds. In the three auger holes, the base of the Congaree Formation includes common medium quartz sand to subrounded quartz pebbles to 18 mm. In the holes the Congaree overlies the Lang Syne Formation and underlies the Warley Hill Formation. Exposures outside the quadrangle show that the contacts are unconformable. The formation in the three auger holes is 4 to 9 feet thick.

The Congaree Formation correlates with the Huber Formation in South Carolina and with the Tallahatta Formation in Alabama and Mississippi (Gardner, 1951; see Smith, 1958; Toulmin, 1977; see Nystrom and others, 1991). The Congaree Formation is early Lutetian, early middle Eocene in age (see Weems and others, 2004). *GRI Source Map ID* 7336 ([Lone Star Quadrangle](#)).

Tc - Congaree Formation (Eocene) – The Congaree Formation mapped in Poinsett State Park quadrangle occurs in a relatively small local deposit along a high-elevation ridge (270 to 290 feet) in the north-central portion of the Quadrangle. Here, the Congaree Formation consists of tan, loose, poorly sorted, fine- to coarse-grained quartz sand with clay coating the coarser grains. Some white kaolin laminations and kaolin balls are also abundant throughout the deposit. The kaolin is mostly found in discontinuous very thin clay beds and laminae. Fine- to medium-grained dark heavy minerals are relatively abundant through much of the formation. The upper part of the Congaree is coarser grained than the lower part of the unit, and thus explains the abundance of finer grains and clay found in Poinsett State Park Quadrangle. Distinctive indurated light-green claystone, siltstone, or sandstone occurs at several localities in Calhoun and Sumter Counties and, in some areas, yields the distinctive large clam *Anodontia augustana* Gardner (Nystrom and others, 1992). Although no clam fossils were found in the present quadrangle, the siltstone-sandstone beds of the Congaree Formation crop out along the base of dirt roads where this unit is exposed in the north-central portion of the quadrangle. The exposed beds are highly oxidized and have a dark, rusty, brownish-red color. The siltstone and sandstone are thin-bedded and occur in intervals about 3 feet thick and are interlayered with thick to very thick beds of medium- to very coarse-grained quartz sand with quartz granules. Cross-bedding is evident in some of these layers. These clay-sandstone cemented fine-coarse grained beds are lithologically and chronologically similar and have been compared to the Tallahatta Formation of Alabama by Cooke and MacNeil (1952). *GRI Source Map ID 75216* ([Poinsett State Park Quadrangle](#)).

Tc - Congaree Formation (Eocene) – The Congaree Formation is composed mainly of tan to pale yellow, loose, poorly sorted, fine- to very coarse-grained quartz sand with some white kaolin grains and kaolin balls. Fine- to medium-grained, dark heavy minerals are relatively abundant. Green, thin-bedded clay layers occur in the lower part of the Congaree to the southwest in Calhoun County. There are kaolin pebbles, discontinuous, thin clay beds and laminae. Clay-lined burrows occur in some outcrops of the Congaree Formation, but burrows usually are not prominent. The upper part of the Congaree includes sand of coarser grain size than the lower part of the unit. In Fort Motte quadrangle in Calhoun County, the Congaree Formation locally includes fine- to medium-grained glauconite.

Distinctive, indurated, light-green claystone or siltstone occurs at several localities in Calhoun County and yields the distinctive large clam *Anodontia augustana* Gardner. Cooke and MacNeil (1952) compared the claystone or siltstone beds lithologically (and chronologically) with the Tallahatta Formation of Alabama. The claystone or siltstone beds are thin-bedded and comprise intervals, three feet or so in thickness, that are inter-layered with thick to very thick beds of medium to very coarse-grained quartz sand with quartz granules. Cross-bedding is evident in some of these thick sand layers. *GRI Source Map ID 75215* ([Wedgefield Quadrangle](#)).

Tls - Lang Syne Formation (upper Paleocene)

Tls - Lang Syne Formation (Upper Paleocene) – The Lang Syne Formation is extremely variable in color, ranging from black to red to orange to gray to white to buff to brown. Lithologic variation is also extreme, ranging from thinly bedded, well-sorted clay to fine to medium sand with local clay-lined burrows to massive, variably sandy clay to iron oxide cemented sandstone and claystone to silicified claystone to Fuller's Earth (Padgett, 1980). In updip areas the deposit tends to be sandier, while in downdip areas it tends to be more clayey. The base of the formation is often dominated by a subtle coarsening, though it is not always gravelly. Silicified shell hash containing abundant bivalves and turritellid gastropods is also locally present in the Gadsden, Wateree, and Eastover 7.5-minute quadrangles. This lithology is locally known as Buyck's (pronounced 'Bikes') Bluff chert or Black Mingo chert. It was used for projectile points by prehistoric people, even though it tends to be porous and of generally poor quality for knapping. Shell impressions are also sometimes found in the Fuller's earth beds. The clay, claystone, sandstone, and chert often form distinctive outcrops in road cuts, creek valleys, and river bluffs. Deposits of the Lang Syne Formation typically grade upwards into an extremely

cohesive, plastic, waxy, black, locally silty, lignitic, and micaceous clay with minor well-sorted, fine to medium sand in light-colored laminae. This top stratum, referred to as the "Tavern Creek bed," makes a sharp contact with the loose sands of the overlying Congaree Formation and represents perhaps the best regional marker bed. Palynological analysis of black clay samples obtained from SCGS drill hole logs 40-94 and 40-104 indicated a late Paleocene (Thanetian) age and an early Paleocene (Danian) age, respectively (Willoughby, 2003). The Lang Syne Formation, which has been interpreted as a lower delta plain succession, is correlative with the Ellenton Formation on the Savannah River site, mixed carbonate-clastic sediment of the Rhems Formation in the subsurface of the Middle and Lower Coastal Plain of South Carolina, and the Aquia Formation of Virginia (Padgett, 1980; Nystrom and others, 1991). *GRI Source Map ID 7333* ([Congaree Quadrangle](#)).

Tls - Lang Syne Formation (Upper Paleocene) – The top of the Lang Syne Formation is typified by an extremely cohesive, plastic, waxy, black, locally silty, lignitic, and micaceous clay with minor well-sorted, fine to medium sand in light-colored laminae. This bed, referred to as the "Tavern Creek bed," makes a sharp contact with the loose sand of the overlying Congaree Formation and grades downward into more variable deposits ranging from thinly bedded, well-sorted clay, fine to medium sand with local clay-lined burrows to massive, variably sandy, gray, orange, or white clay to iron oxide cemented sandstone and claystone to silicified claystone (Fuller's earth) (Padgett, 1980). In updip areas the lower portion is sandier, while in downdip areas it tends to be more clayey. The base of the formation is often dominated by a subtle coarsening (though not always gravelly). Silicified shell hash containing abundant bivalves and turritellid gastropods is also locally present in the Gadsden, Wateree, and Eastover 7.5-minute quadrangles. This lithology is locally referred to as Buyck's Bluff (pronounced 'Bikes Bluff') chert (named for Buyck's Creek in the Gadsden 7.5-minute quadrangle) or Black Mingo chert and was used for projectile points by prehistoric people, even though it tends to be porous and of generally poor quality for knapping. Shell impressions are also sometimes found in the Fuller's earth beds. The clay, claystone, sandstone, and chert often form distinctive outcrops in road cuts, creek valleys, and river bluffs. Palynological analysis of black clay samples obtained from SCGS drill hole logs 40-94 and 40-104 indicated a late Paleocene (Thanetian) age and an early Paleocene (Danian) age, respectively (Willoughby, 2003). The Lang Syne Formation, which has been interpreted as a lower delta plain succession, is correlative with the Ellenton Formation on the Savannah River site, mixed carbonate-clastic sediment of the Rhems Formation in the subsurface of the Middle and Lower Coastal Plain of South Carolina, and the Aquia Formation of Virginia (Padgett, 1980; Nystrom and others, 1991). *GRI Source Map IDs 7334* ([Eastover Quadrangle](#)), *74893* ([Gadsden Quadrangle](#)), *74894* ([Sailors Lake Quadrangle](#)), *74892* ([Wateree Quadrangle](#)).

Tls - Lang Syne Formation (upper Paleocene) – Gray to black, silty, micaceous, locally quartzose clay matrix and very fine to fine quartz sand to clayey, glauconitic, pebbly quartz sand and quartz granules. Clay matrix locally includes interspersed, very fine to fine quartz sand; and contains numerous laminae of white, very well sorted, very fine to medium quartz sand that are devoid of interstitial clay. Black clay is a characteristic lithology of the Lang Syne Formation. Black clay occurs throughout the formation but is common at the top of the formation. Quartz sand beds are loose to lightly cohesive, yellowish brown or yellowish orange, subangular to subrounded, medium to coarse quartz sand to subrounded and rounded quartz granules; include moderate interstitial clay; and include glauconite pellets, especially near the base. Crumbly, black lignite occurs locally in both clay matrix and clayey sand beds. *GRI Source Map ID 7335* ([Elloree Quadrangle](#)).

Tls - Lang Syne Formation (upper Paleocene) – Gray to black, silty, micaceous, locally quartzose clay matrix and very fine to fine quartz sand to clayey, glauconitic, pebbly quartz sand and quartz granules; and lime mud sediment. Clay matrix locally includes interspersed, very fine to fine quartz sand; and it contains numerous laminae of white, very well sorted, very fine to medium quartz sand that are devoid of interstitial clay. Black clay is a characteristic lithology of the Lang Syne Formation. Black clay occurs throughout the formation but is common at the top of the formation.

Quartz sand beds are loose to lightly cohesive, yellowish-brown or yellowish-orange, subangular to subrounded, medium to coarse quartz sand to subrounded to rounded quartz granules; include moderate interstitial clay; and include glauconite pellets, especially near the base. Crumbly, black lignite occurs locally in both clay matrix and clayey sand beds.

White to cream lime mud (micrite) beds, at least 4 feet thick and with rare to scattered impressions of turrillid gastropods, crop out on the walls of a deeply incised tributary of Congaree River in northwestern Fort Motte quadrangle. This outcrop probably is the farthest inland exposure of lime sediment in the Lang Syne Formation. *GRI Source Map ID 5778* ([Fort Motte Quadrangle](#)).

Tls - Lang Syne Formation (middle to upper Paleocene) – The Lang Syne Formation in Lone Star quadrangle is largely silty clay, clayey silt, and clayey or well sorted quartz sand. Silty clay matrix and minor clayey silt is very cohesive, softly plastic to hard, black, dark-gray, grayish-green to minor greenish-gray, and light tan; includes minor to moderate interspersed, well-sorted, very fine to fine quartz sand; includes minor interspersed, medium to coarse quartz sand; locally includes scattered, discrete, white laminae of very fine to fine quartz sand; commonly is micaceous; and locally includes black wood fragments, some of which have disseminated pyrite. Quartz sand is black, dark greenish-gray, gray, strong brown to light tannish-yellow, loose to very cohesive, and very fine to coarse; locally includes minor, scattered small quartz pebbles to 6 mm; locally includes moderate to abundant clay; locally is micaceous; locally includes scattered to abundant, green glauconite pellets; includes scattered dark heavy mineral grains; includes scattered laminae of well-sorted, very fine to fine quartz sand; includes minor to abundant interstitial clay; and includes minor greenish-gray clay laminae or thin beds; and varies locally to black clay matrix. Above the base of the Lang Syne in Lone Star quadrangle, quartz sand commonly is moderately to well sorted and very fine to medium. Black and dark brown, commonly pyritic lignite is common in drill holes in the Lang Syne Formation. Very cohesive, stiff, black clay locally grades to black quartz sand. Clay or sandy clay in the Lang Syne Formation weathers to a strong brown or burnt-orange color.

The Lang Syne Formation underlies all of Lone Star quadrangle except possibly the inland (northern) valley of Santee River, where the Lang Syne may have been removed by erosion. Nearly all auger holes in the quadrangle encountered some Lang Syne Formation. The greatest thickness of unit encountered in Lone Star quadrangle is 49 feet in drill hole 43-132. No drill holes in the quadrangle penetrated the complete stratigraphic thickness of the Lang Syne. In Lone Star quadrangle the Lang Syne Formation overlies the Sawdust Landing Formation, and abundant outcrops updip show that the relationship is unconformable. In Lone Star quadrangle the Lang Syne Formation unconformably underlies the Congaree Formation, the Warley Hill formation, the Orangeburg District bed, the Duplin Formation, the Marietta unit, the terrace unit of Low Falls Landing, eolian sand, or modern alluvium. The Lang Syne Formation correlates downdip with the Williamsburg Formation (Willoughby and others, 1999), which is Selandian and Thanetian (middle to upper Paleocene) in age (Weems and others, 2004). *GRI Source Map ID 7336* ([Lone Star Quadrangle](#)).

Tls - Lang Syne Formation (Paleocene) – The upper part of the Lang Syne Formation consists of thin and laterally continuous beds of yellowish, tan to brown, fine-medium-coarse grained micaceous quartz sand interlayered with beds of black clay that vary in thickness from 2 to 50 feet. The thin to very thick beds of black clay are Fuller's Earth deposits that commonly occur near the top to middle of the formation and constitute entire exposures at some localities. Fuller's Earth was historically mined from the Lang Syne Formation in this area; however, there are presently no active quarries. Multiple fining-upward sequences are common throughout the Lang Syne and are typically in sequences 10 to 20 feet thick. The Lang Syne Formation also contains beds of silicified shell hash and mudstone, which occur in numerous localities throughout Poinsett State Park. Exposures of these silicified shell hash beds occur at variable elevations and locations, and in most cases the outcrops are fragmented and likely to be influenced by mass wasting and other hill slope processes. Some of the silicified shell hash beds contain abundant chert deposits, which are dark and glassy and relatively gray to translucent. Chert

cobbles are also present near the Lang Syne and Sawdust Landing contact on the weathered hill slopes in the vicinity of Poinsett State Park. Weakly silica-enriched and somewhat indurated claystone is a prominent part of the formation locally (Tavern Creek, Stop 3 in Nystrom and Willoughby, 1992). The Lang Syne Formation overlies the feldspathic clayey sand and sandy clay of the upper Cretaceous Sawdust Landing Formation. A prominent layer of well-rounded pebbles $\frac{3}{4}$ to 3 inches in diameter occurs near this basal contact. In some exposures the pebbles in the basal bed are less abundant, and instead thin- to medium-bedded quartz sand occurs with scattered sand-size glauconite grains and thin beds of greenish-black marsh clay and locally, solitary corals. *GRI Source Map ID 75216* ([Poinsett State Park Quadrangle](#)).

Tls - Lang Syne Formation (Paleocene) – Abruptly overlying the feldspathic, clayey sands and sandy clays of the Sawdust Landing Formation, a prominent layer of well-rounded pebbles occurs at places in the base of the Lang Syne Formation. In some exposures the pebbles in the basal bed are less abundant and thin to medium-bedded quartz sand occurs, with scattered to common sand-size glauconite grains, thin interbeds of black clay and, locally, solitary corals. Poorly sorted, medium- to very coarse-grained quartz sand with interspersed, locally abundant, fine- to coarse-grained glauconite overlies the pebble bed in numerous exposures. Above the basal meter or so, thin- to thick-bedded, locally clayey, quartzose sands with sand-size glauconite grains characterize the lower part of the Lang Syne Formation. The upper part of the Lang Syne Formation is comprised of characteristically thin and laterally continuous beds of micaceous, medium-grained quartz sand inter-layered with laminae or thin beds of black clay. Burrows are common in the sandy beds of the Lang Syne and in places have obliterated most of the original bedding. Some exposures include numerous impressions of mollusks.

Stacked, thin beds to massive beds of black clay or Fuller's earth occur locally, commonly near the top of the formation, and constitute entire exposures at some localities. Weakly silica-enriched and somewhat indurated claystone is a prominent part of the formation locally (cf. Nystrom and Willoughby, 1992, Stop 3) and probably is related to replacement by secondary opal (Heron and others, 1965; Weaver and Wise, 1978; Prowell, 1990). *GRI Source Map ID 75215* ([Wedgefield Quadrangle](#)).

Ksl - Sawdust Landing Formation (upper Cretaceous)

Ksl - Sawdust Landing Formation (Upper Cretaceous) – The Sawdust Landing Formation is composed of gray to cream to orange interbedded sand and clay that grades up into extremely stiff, extremely cohesive, variably steel-blue gray to cream (in fresh exposures) to red to white to orange to purple (in weathered exposures) clay with abundant, angular to subangular, medium to very coarse quartz, smoky quartz, rose quartz, and feldspar sand with minor heavy minerals, mica, lignite, and quartz and feldspar granules. This top stratum of tight, sandy, gritty clay is a very distinctive lithology and a good marker throughout much of the area. Although across the Santee River Valley to the east the base of the unit is often a lag deposit with a dark-green clay matrix (Prowell, 1990), the lower contact is more subtle in the study area and very similar to the underlying Upper Cretaceous deposits (e.g. Willoughby, 2003). The Sawdust Landing Formation, which was originally designated as the Sawdust Landing member of the Rhems Formation at a type locality at Sawdust Landing (also known as Trezvant's Landing) on the Santee River nearby, is interpreted as an Upper Delta Plain deposit (Muthig and Colquhoun, 1988; Nystrom and others, 1991). Though previously thought to be Paleocene in age, more recent data indicate that the Sawdust Landing Formation is late Cretaceous in age (Christopher and others, 1999). *GRI Source Map ID 7333* ([Congaree Quadrangle](#)).

Ksl - Sawdust Landing Formation (Upper Cretaceous) – The top of the Sawdust Landing Formation, which is variably steel-blue gray to cream colored in fresh exposures and red to white to orange to purple in weathered exposures, is typified by extremely stiff, cohesive clay with abundant, angular to subangular, medium to very coarse quartz, smoky quartz, rose quartz, and feldspar sand with minor heavy minerals, mica, lignite, and quartz/feldspar granules. This sandy, gritty clay grades downward

(and locally laterally) to interbedded sand and clay. Although across the Santee River Valley to the east the base of the unit is often a lag deposit with a dark-green clay matrix (Prowell, 1990), the lower contact is more subtle in the study area and very similar to the underlying upper Cretaceous deposits (e.g. Willoughby, 2003). The Sawdust Landing Formation, which was originally designated as the Sawdust Landing member of the Rhems Formation at a type locality at Sawdust Landing (also known as Trezvant's Landing) on the Santee River nearby, is interpreted as an Upper Delta Plain deposit (Muthig and Colquhoun, 1988; Nystrom and others, 1991). Though previously thought to be Paleocene in age, more recent data indicate that the Sawdust Landing Formation is late Cretaceous in age (Christopher and others, 1999). *GRI Source Map IDs* 7334 ([Eastover Quadrangle](#)), 74893 ([Gadsden Quadrangle](#)), 74894 ([Saylor's Lake Quadrangle](#)), 74892 ([Wateree Quadrangle](#))

Ksl - Sawdust Landing Formation (upper Cretaceous) – Moderately cohesive to stiff, cream, white, light- to medium-gray, bluish-gray to purplish-gray, light-orange, or medium-brown, medium quartz sand to quartz granules; with scattered, weathered, white feldspar grains; with scattered muscovite flakes; locally with very fine to fine dark heavy minerals; commonly with abundant interstitial to matrix-forming white clay. Where clay is minor, the sediment is loose and incohesive. The Sawdust Landing Formation is considered to be late Cretaceous in age (Christopher and Prowell, 2002). *GRI Source Map ID* 5778 ([Fort Motte Quadrangle](#)).

Ksl - Sawdust Landing Formation (Maastrichtian, Upper Cretaceous) – The Sawdust Landing Formation was tentatively identified by the writer in auger holes 9-11 and 9-21 in Lone Star quadrangle, and the formation was recognized in cores by Prowell (1990) in holes LM-1A, LM-2A, MAN-1A, Rimini-1A, and Railway 1A in Lone Star and Pinewood 7.5-minute quadrangles. In auger holes 9-11 and 9-21 in Lone Star quadrangle, sediments interpreted by the writer as Sawdust Landing Formation is white, light-gray, or light-tan, sandy clay, with fine to coarse quartz sand, locally with sparse pyrite or traces of carbonaceous material, and is lesser grayish-green, stiff to hard, silty clay. In outcrops updip from Lone Star quadrangle, the Sawdust Landing Formation is dominantly stiff, cohesive, light-gray to light greenish-gray, thick-bedded, massive to weakly cross-bedded, feldspathic, micaceous, clayey, quartzose sand with common quartz granules and quartz pebbles, to lesser light-gray sandy clay, micaceous clay, and cross-bedded, fine to very coarse quartz sand with white clay sand grains to pebbles and with laminae of heavy minerals (Nystrom and Willoughby, 1992). The Sawdust Landing Formation in core MAN-1A is characteristically dense, hard, massive to weakly crossbedded, thick beds of clayey, feldspathic, poorly sorted, angular, fine to coarse quartz sand to granules, and a variety of heavy minerals (Prowell, 1990). Christopher and Prowell (2003) considered the basal boundary of the Sawdust Landing Formation to be an unconformity. Fredriksen and others (2000) and (Christopher and Prowell, 2003) recently assigned a Maastrichtian, Late Cretaceous age to the Sawdust Landing Formation on the basis of sparse, included pollen grains. Previously the Sawdust Landing was interpreted to be of early Paleocene age. *GRI Source Map ID* 7336 ([Lone Star Quadrangle](#)).

Ksl - Sawdust Landing Formation (Upper Cretaceous) – The Sawdust Landing Formation consists primarily of light whitish-tan to gray to greenish gray, thick-bedded, massive to weakly cross-bedded, feldspathic, micaceous, clayey, fine to very coarse-grained quartz sand with common quartz granules and quartz pebbles. Other common lithologies include light-gray sandy micaceous clay, which is characteristically thick-bedded or may show no layering at all. Kaolin balls, kaolin clay coating, and abundant dark, fine- to coarse-grained heavy minerals are typically found scattered throughout the Sawdust Landing in the Poinsett State Park Quadrangle. The quartz-sand grains are generally angular, medium gray, and translucent to transparent. Red quartz is minor but noticeable. White to pink angular feldspar grains are common in most exposures and are up to an inch in length. Some sand beds have abundant coarse flakes of mica. Better exposures may exhibit more than one sequence of clayey sand fining upward to sandy kaolinitic clay. Clay beds are generally light-gray but commonly display purple, pink, tan, or yellow mottles. On the basis of X-ray analyses, Prowell (1990) reported that the matrix clay of the unit is pale-green illite and smectite and gray to white kaolin. The illite and smectite clay is mainly confined to the upper part of the unit. Accessory minerals recognized include ilmenite, siderite, garnet,

leucoxene, zircon, pyrite, rutile, sillimanite, biotite, tourmaline, monazite, rutiled quartz, cristobalite, and other opaque heavy minerals (Prowell, 1990). *GRI Source Map ID 75216* ([Poinsett State Park Quadrangle](#)).

Ksl - Sawdust Landing Formation (Upper Cretaceous) – The Sawdust Landing Formation primarily consists of light gray to light greenish gray, thick-bedded, massive to weakly cross-bedded, feldspathic, micaceous, clayey, quartzose sand with common quartz granules and quartz pebbles. Other common lithologies include light gray sandy clay and micaceous clay, which are characteristically thick-bedded or may show no layering at all. A less common lithology is prominently cross-bedded, fine- to very coarse-grained quartzose sand with white clay grains, clay balls and with very thin streaks of dark heavy minerals. The quartz sand grains in the unit are generally angular, medium-gray, and translucent to transparent. Red quartz is minor but noticeable. White to pink, angular feldspar grains are common in most exposures and are up to an inch in length. Some sand beds have abundant, coarse mica. Better exposures may exhibit more than one sequence of clayey sands fining upward to sandy kaolinitic clay. Clay beds are generally light gray but commonly display purple, tan or yellow mottles.

The Sawdust Landing Formation is stiff, cohesive, and difficult to penetrate with a power auger. The dense, thick-bedded, clayey sand, sandy clay and clay of the unit along with the characteristic feldspars distinguish the Sawdust Landing Formation from other units in the section.

On the basis of X-ray analyses, Prowell (1990) reported that the matrix clays of the unit are pale green illite/smectite and gray to white kaolin, and that the illite/smectite clays are mainly confined to the upper part of the unit. He also found small amounts of cristobalite in the matrix. Accessory minerals recognized include ilmenite, siderite, garnet, leucoxene, zircon, pyrite, rutile, sillimanite, biotite, tourmaline, monazite, rutiled quartz, and opaque heavy minerals. *GRI Source Map ID 75215* ([Wedgfield Quadrangle](#)).

Kus - Upper Cretaceous, undifferentiated (upper Cretaceous)

UKs - Upper Cretaceous, undifferentiated (Upper Cretaceous) – Undifferentiated Upper Cretaceous sediments, which range from white to purple to red in color, include a wide range of highly weathered clay, sandy clay, clayey sand, and sand deposits. Lithologies are often biased towards poorly sorted, angular to subangular, coarse to very coarse sand with abundant mica, interstitial kaolin, and kaolin rip-ups, but exceptions are common. Local Upper Cretaceous outcrops on the south bluffs of the Congaree River show primary sedimentary structures including ripples, cross beds, and parallel laminations. Some areas show thinly bedded, laterally continuous strata, whereas other exposures hint at distinct channels that sometimes have a distinct muscovite sand (greater than 50 percent) fill. Iron oxide cemented sandstone is locally common and exceptionally well developed along the base of the bluffs in the Congaree River Valley, where it is associated with iron oxide “pipes” around springs at water level and attributed to recent groundwater/surface water interactions. Drill hole data suggest several graded sequences several tens of feet thick, but exact correlation of these sequences with (in) other formations is tentative at best without more detailed work owing to deep weathering, subtle changes in sedimentology, abundant hiatus, local thinning near the Fall Line, possible local faulting, and a general lack of dateable materials (except palynomorphs where preserved; e.g. Christopher and Prowell, 2002; Prowell and others, 2003). Grouping Cretaceous deposits is not inconsistent with other authors, who have recognized the difficulty in differentiating Cretaceous deposits at a regional scale (e.g. Kite, 1984a, b; Kite, 1985; Willoughby, 2003; Wyatt and Harris, 2004). Kaolin has been mined in the northeastern Messers Pond, northern Leesburg and central Congaree 7.5-minute quadrangles nearby. The deposits immediately below the Sawdust Landing Formation are probably Pee Dee Formation (especially to the southeast), but could also locally include correlatives of the Cape Fear Formation (Coniacian) and other Black Creek Group strata (Santonian to Maastrichtian) as they thin towards the Fall Line just a few miles to the northwest (Prowell, 1990; Sohl and Owens, 1991; Christopher and Prowell, 2002; Prowell

and others, 2003). Palynological analysis of black clay from South Carolina Geological Survey drill hole 28-53 (northwest quarter Leesburg) indicated that no age-diagnostic taxa were present (Willoughby, 2003). *GRI Source Map ID 7333* ([Congaree Quadrangle](#)).

UKs - Upper Cretaceous, undifferentiated (Upper Cretaceous) – Undifferentiated Upper Cretaceous sediments, which range from white to purple to red in color, include a wide range of highly weathered clay, sandy clay, clayey sand, and sand deposits. Exceptions are common, but lithologies are often biased towards poorly sorted, angular to subangular, coarse to very coarse sand with abundant mica, interstitial kaolin, and kaolin rip-ups. Iron oxide cemented sandstone is locally common and exceptionally well developed along the base of the bluffs in the Congaree River Valley. Local outcrops on the south bluffs of the Congaree River show primary sedimentary structures including ripples, crossbeds, and parallel laminations. Some areas show thinly bedded sequences, whereas other exposures hint at distinct channels. Drill hole data suggest several graded sequences several tens of feet thick, but exact correlation of these sequences with (in) other formations is tentative at best without more detailed work owing to deep weathering, subtle changes in sedimentology, abundant hiatus, local thinning near the Fall Line, possible local faulting, and a general lack of dateable materials (except palynomorphs where preserved; e.g. Christopher and Prowell, 2002; Prowell and others, 2003). Grouping Cretaceous deposits is not inconsistent with other authors, who have recognized the difficulty in differentiating Cretaceous deposits at a regional scale (e.g. Kite, 1984a, b; Kite, 1985; Willoughby, 2003; Wyatt and Harris, 2004). Kaolin is actively being mined in the northeastern Messers Pond 7.5-minute quadrangle nearby and has been mined in both the northern Leesburg 7.5-minute quadrangle and the central Congaree 7.5-minute quadrangle. The deposits immediately below the Sawdust Landing Formation are probably Pee Dee Formation (especially to the southeast), but could also locally include correlatives of the Cape Fear Formation (Coniacian) and other Black Creek Group strata (Santonian to Maastrichtian) as they thin towards the Fall Line just a few miles to the northwest (Prowell, 1990; Sohl and Owens, 1991; Christopher and Prowell, 2002; Prowell and others, 2003). Palynological analysis of black clay from South Carolina Geological Survey drill hole 28-53 (northwest quarter Leesburg) indicated that no age-diagnostic taxa were present (Willoughby, 2003). *GRI Source Map IDs 7334* ([Eastover Quadrangle](#)), *74893* ([Gadsden Quadrangle](#)), *74894* ([Saylors Lake Quadrangle](#)), *74892* ([Wateree Quadrangle](#)).

UKs - Upper Cretaceous, undifferentiated (Upper Cretaceous) – Undifferentiated Upper Cretaceous sediments, which range from white to purple to red in color, include a wide range of highly weathered clay, sandy clay, clayey sand, and sand deposits. Exceptions are common, but lithologies are often biased towards poorly sorted, angular to subangular, coarse to very coarse sand with abundant mica, interstitial kaolin, and kaolin rip-ups. *GRI Source Map ID 5778* ([Fort Motte Quadrangle](#)).

UKs - Upper Cretaceous undifferentiated sediments (Upper Cretaceous) – The Upper Cretaceous sediments are compositionally variable but locally include massively bedded, light-gray, micaceous, poorly sorted, fine- to coarse-grained clayey sand with purple mottles. Massive beds like that just described occur in contact with orange, well-layered, poorly sorted, fine- to very coarse-grained clayey sand with white kaolin balls. Crossbedded, orange, very poorly sorted, very coarse-grained sand with granules, some quartz pebbles, white kaolin grains, and kaolin balls are present. Well-stratified fine-grained sand with streaks of dark heavy minerals, and with small white burrows, also occurs. Kaolinitic clay coats the sand grains and often forms a dense clay-matrix for the poorly sorted sand, granules, and rounded pebbles. Thick beds of micaceous silty clay or silty-sandy clay are also found throughout the Upper Cretaceous sediments. Bedding is characteristically laterally and vertically discontinuous. Trough crossbedding and tabular crossbedding are defined by variations in grain size and by stringers of clay. *GRI Source Map ID 75216* ([Poinsett State Park Quadrangle](#)).

UKs - Upper Cretaceous Undifferentiated Sediments (Upper Cretaceous) – The Upper Cretaceous sediments consist of a variety of lithologies including massively bedded, light gray, micaceous, poorly sorted, fine- to coarse-grained, clayey sand with purple mottles. Massive beds like that just described

occur in abrupt contact with orange, well-layered, poorly sorted, fine- to very coarse-grained, clayey sand with white kaolin balls. There is also cross-bedded, orange, very poorly sorted, very coarse-grained sand with granules and some quartz pebbles, white kaolin grains and kaolin balls. Well-stratified, fine-grained sand with streaks of dark heavy minerals, and with small white burrows, also occur. Kaolinitic clay occurs as clay coating on sand grains, as matrix between sand grains, as distinct white sand grains and rounded pebbles, and as thick beds of micaceous, silty clay or silty-sandy clay. Bedding characteristically is laterally and vertically discontinuous. Trough cross-bedding and tabular cross-bedding are defined by graded beds, by stringers of kaolin balls or quartz pebbles, by thin clayey laminae, and by thin streaks of dark heavy minerals. *GRI Source Map ID 75215* ([Wedgefield Quadrangle](#)).

GRI Source Map Citations

The GRI digital geologic-GIS map for Congaree National Park, South Carolina (CONG) was compiled from the following sources:

Meitzen, K.M., Howard, C.S. and Nystrom, P.G., 2009, Geologic Map of the Poinsett State Park 7.5-Minute quadrangle, South Carolina, South Carolina Geological Survey, Geologic Quadrangle Map GQM-46, 1:24000 scale. (*GRI Source Map ID 75216*).

Nystrom, P., 2009, Geologic Map of the Wedgefield 7.5-Minute quadrangle, South Carolina, South Carolina Geological Survey, Geologic Quadrangle Map GQM-47, 1:24000 scale. (*GRI Source Map ID 75215*).

Shelley, D.C., 2007, Geologic Map of the Congaree 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-31, 1:24,000 scale (*GRI Source Map ID 7333*).

Shelley, D.C., 2007, Geologic Map of the Eastover 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-30, 1:24,000 scale. (*GRI Source Map ID 7334*).

Shelley, D.C., 2007, Geologic Map of the Gadsden 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-37, 1:24,000 scale. (*GRI Source Map ID 74893*).

Shelley, D.C., 2007, Geologic Map of the Saylor's Lake 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-38, 1:24,000 scale. (*GRI Source Map ID 74894*).

Shelley, D.C., 2007, Geologic Map of the Wateree 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-36, 1:24,000 scale. (*GRI Source Map ID 74892*).

Willoughby, R.H., 2004, Geologic Map of the Lone Star 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-15, 1:24,000 scale. (*GRI Source Map ID 7336*).

Willoughby, R.H., 2003, Geologic Map of the Ellore 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-27, 1:24,000 scale. (*GRI Source Map ID 7335*).

Willoughby, R.H., 2003, Geologic Map of the Fort Motte 7.5-Minute Quadrangle, South Carolina Geological Survey, Geologic Quadrangle Map GQM-10, 1:24,000 scale. (*GRI Source Map ID 5778*).

Copies of the original map PDF files (including correlation of units and cross sections) can be ordered from the South Carolina Geological Survey at: <http://www.dnr.sc.gov/geology/publications.htm>.

Source digital GIS data for the quadrangles can be downloaded from the South Carolina Geological Survey at: <http://www.dnr.sc.gov/geology/DigitalMapping.htm>.

Additional information pertaining to each source map is also presented in the Source Map Information (CONGMAP) table included with the GRI geology-GIS data.

GRI Digital Data Credits

This document was developed and completed by John Gilbert (Colorado State University) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory(GRI) Program, with quality control performed by Heather Stanton (Colorado State University).

The information contained here was compiled to accompany the digital geologic-GIS map(s) and other digital data for Congaree National Park, South Carolina (CONG) developed by Heather Stanton and Dave Green (Colorado State University).

GRI finalization by Heather Stanton (Colorado State University). Format migration and Google Earth product by Stephanie O'Meara (Colorado State University).

GRI program coordination and scoping provided by Bruce Heise and Tim Connors (NPS GRD, Lakewood, Colorado).