U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
U. S. DEPARTMENT OF ENERGY

MISCELLANEOUS FIELD STUDIES
MAP MF–2300
Explanatory pamphlet accompanies map

CORRELATION OF MAP UNITS

Qal1, Qal2	Holocene	Quaternary
Td	Pliocene(?)	Tertiary
Tu	Miocene(?)	
Ttr	Oligocene(?) and Eocene	
Tdb		
Tc		
Tm	Eocene	
Thc		
Tltu	Eocene and Paleocene	

DESCRIPTION OF MAP UNITS

Qal1, Qal2 **Alluvium (Holocene)**—Qal 1 is fine to very coarse quartz sand in a sparse clay matrix. Sand is typically angular and poorly sorted, and contains small amounts of mica, feldspar, and dark heavy minerals such as rutile, garnet, magnetite, and staurolite. Well-rounded gravels of milky, yellow, and dark-red (rutilated?) quartz derived from quartz veins in the adjacent metamorphic terranes are also present. Crossbedding and infilling of small to large crosscutting channels are common. Qal 2 lithology is very similar to that of younger Qal 1, but Qal 2 strata are slightly more compact and lithified. Secondary iron mineralization, oxidation due to weathering, and primitive soil-profile development are also present

Td **Dune sand (Pliocene?)**—Medium, angular, moderately sorted tan quartz sand with minor amounts of mica and specks of carbonaceous debris left by decaying roots from modern plants. Deposits are devoid of matrix clays and dark heavy minerals that characterize other units in the study area. Bedding is generally absent, but at a few localities west of the study area, the sand shows well-defined crossbedding and graded bedding

Tu **Upland unit (Miocene?)**—Unit is characterized by three predominant lithofacies: (1) beds of crossbedded gravel and poorly sorted sand, (2) beds of crossbedded, fine to very coarse sand containing clay clasts and in-situ-weathered feldspar grains, and (3) beds of brightly colored, massive sandy clay. Coarsest phase is characterized by gravels of polycrystalline vein quartz ranging in diameter from 0.5 to 4 in.). Gravels are surrounded by a matrix of fine to very coarse clayey quartz sand with abundant mica and white clay balls. The gravel beds outline the shapes of old fluvial channels, with the larger size fraction nearer the channel base.

The second and most common lithofacies is pervasively crossbedded, fine to very coarse sand and grit containing large (0.16 in.) micas and weathered feldspar grains. Sand is angular to subangular quartz generally found in a matrix of kaolinitic clay. White kaolinitic clay balls are common and range from coarse sand to cobble size. The sand also contains ferrous heavy minerals that have oxidized to give strata a distinctive red and white mottled appearance. Lithology is best characterized by unusual "spotted" appearance from small (0.2 in.) square to rhombohedral, white clay clasts formed by the in-situ alteration of feldspars.

The massive sandy clay lithofacies is typically found filling channels. The clay shows very little bedding or lithologic variation. The small percentage of sand is coarse, angular quartz, evenly dispersed throughout the surrounding clay. Very fine, dark heavy minerals have oxidized and stained the clay intense shades of red, orange, yellow, and purple. Beds have a characteristic hackly fracture probably due to cyclic hydration and desiccation

Barnwell Group (Oligocene? and Eocene)—Consists of Tobacco Road Sand, Dry Branch Formation, and Clinchfield Formation, described below

Ttr **Tobacco Road Sand (Oligocene? and Eocene)**—Poorly to moderately sorted, angular to subangular, fine to very coarse quartz sand with mica and heavy-mineral suite dominated by brown ilmenite and sillimanite. Other heavy minerals include zircon, rutile, brown hornblende, and staurolite. Matrix of kaolinitic clay gives internal cohesion to sand. Coarser grained beds are slightly to moderately burrowed whereas finer, better sorted beds are heavily bioturbated. Crossbedding, white kaolin clasts, and thin wisps of white clay characterize the formation. Basal contact is commonly marked by one or more thin layers of ovoid-shaped quartz gravel

Tdb **Dry Branch Formation (Eocene)**—Beds of calcareous clay, clay, thinly interbedded sand and clay, and sand in a coarsening-upward sequence. Basal lithofacies is massive to thickly bedded, well-sorted clayey sand with a calcareous matrix. Thin beds of calcareous laminated clay, and thin beds of limestone, chert, and silica-cemented sand are locally present. Lithofacies is locally characterized by beds or bioherms of large oyster shells (*Crassostrea gigantissima*). Thinly laminated clay beds, commonly separated by very thin layers of fine sand and silt, are present above the basal calcareous beds. The clay fraction is kaolinite in outcrop but may contain montmorillonite in the subsurface. Clay in most outcrops typically appears tan to orange-brown or less commonly pale-green with no trace of organic debris; however, in some outcrops and in subsurface samples, clay can be carbonaceous and typically light- to dark-green to gray. Unweathered samples may contain molds of leaves and bivalve shells. Beds of fine to medium, angular to subangular, moderately to well-sorted sand characterize the top of the formation. The sand is largely quartz with mica and dark heavy minerals such as brown ilmenite, zircon, brown hornblende/biotite, staurolite, sillimanite, kyanite, and magnetite. Small-scale crossbedding and flaser bedding are common. Evidence of burrowing organisms or fossil remnants is rare

Tc **Clinchfield Formation (Eocene)(subsurface only)**—Sandy, fossiliferous limestone to calcareous clayey sand that typically contains glauconite and fine dark heavy minerals. Some subsurface beds contain enough clay to be classified as marl

Tm **McBean Formation (Eocene)**—Basal part of formation contains white to buff, fossiliferous sandy limestone and calcareous sand, and dark-olive-green marl. Well-preserved shells of gastropods and pelecypods are common. Above these basal beds, the sediments are moderately to well sorted, rounded to subrounded, fine to medium quartz sand with fine gravel, well-laminated beds of green montmorillonitic clay, and crudely stratified beds of white to pale-green fine sand. White mica, glauconite, phosphate, polished blue quartz grains, and fine dark heavy minerals are common in the sandier beds. The heavy mineral suite includes ilmenite/brown ilmenite, leucoxene, zircon, sillimanite, kyanite, monazite, and magnetite. The most updip beds are thinly laminated green clays and poorly sorted, fine to coarse, angular to subangular quartz in a medium-green to orange illite/smectite clay matrix. Larger quartz grains (clear and blue) tend to be polished and well-rounded. Large (0.12 in.) mica flakes, glauconite, and shell ghosts are locally present. Outcropping sand and clay beds are characterized by dark-brown to black spots of manganese probably concentrated during weathering. Basal contact in outcrop areas is commonly bored by marine organisms

Thc **Huber and Congaree Formations, undivided (Eocene)**

Huber Formation—Fine to very coarse, poorly sorted, angular quartz sand in a matrix of white kaolin. Accessory minerals include white mica, lignite, and dark heavy minerals such as sillimanite, ilmenite, staurolite, rutile, garnet, and magnetite. Beds containing kaolin clay balls and very coarse crossbedded sand are common. Sparse clay-lined burrows are locally present in the finer sand beds. Top of formation is characterized by thick, massive, white kaolin beds, locally of commercial value. The clay is typically compact and brittle with sharp, conchoidal fractures. Well-laminated, medium- to dark-gray carbonaceous lenses occur locally in kaolin deposits and contain well-preserved microfloras

Congaree Formation—Moderately to well-sorted, fine to coarse, subangular to subrounded quartz sand in a buff to light-gray clay matrix with small quantities of very fine, dark heavy minerals and white mica. The heavy mineral assemblage is characterized by sillimanite, ilmenite, staurolite, rutile, garnet, and magnetite. Detrital mica varies in size from small (< 0.04 in.) to quite large (0.16 in.) and is generally more prevalent in the clay-rich intervals. Most of this sand is enclosed in a sparse clay matrix of off-white kaolin, and bedding is generally flat to weakly crossbedded. Clays may be light-gray due to finely disseminated carbonaceous matter or less commonly stained pale orange from oxidation of iron-bearing heavy minerals. Thin (0.25 in.), clay-enriched silty laminae are present in this formation, as are faint clay-coated walls of burrows of marine organisms

Tltu **Lower Tertiary sediments, undivided (Eocene and Paleocene)(subsurface only)**—Composed of thick beds of medium to coarse subangular quartz sand in a light-gray to off-white clay matrix, alternating with thick beds of white to pale-gray, sandy to silty, micaceous kaolinitic clay. Light-gray to blue-gray quartz constitutes the majority of the sand fraction and gives the formation a characteristic pale-gray color along with finely disseminated carbonaceous debris and fragments of lignite. Some thin, well-laminated clay and clayey silt beds (typically less than 5 ft thick) are highly carbonaceous and are dark-gray to black with notable low density. Locally, some sandy beds contain fragments of lignite in the coarse-sand fraction. Accessory minerals include muscovite, feldspar, sillimanite, iron-bearing minerals (typically pyrite, marcasite, and siderite), garnet, rutilated quartz, cristobalite (in clay fraction), and various unidentified dark heavy minerals. In the absence of carbonaceous material, strata are typically off-white, light-green, or pale yellow-green

EXPLANATION OF MAP SYMBOLS

Contact—Dotted where concealed

Fault—Dashed where questionable; arrows show direction of movement
Shown only in cross section *A–A'*

Outcrop

- Single exposure
- Series of exposures

Drill-hole locality and identification number
FC4A

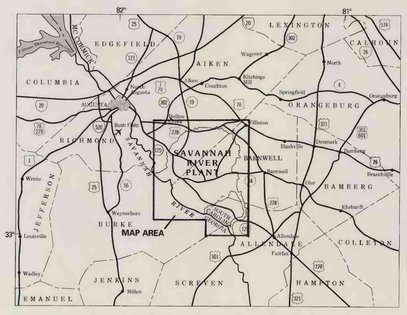
Base from U.S. Geological Survey
in cooperation with the U.S. Department of Energy
Compiled from USGS 1:24,000 -scale topographic maps dated 1964–1981. Planimetry revised from aerial photographs taken 1981 and 1986, and other source data. Revised information not field checked
Projection and 10,000-foot grid ticks: South Carolina coordinate system, south zone, and Georgia coordinate system, east zone
5,000-meter Universal Transverse Mercator grid ticks, zone 17
20,000-foot grid based on U.S. Department of Energy local coordinate system
1927 North American Datum

SCALE 1:48 000

CONTOUR INTERVAL 10 FEET
SUPPLEMENTARY CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF MAP

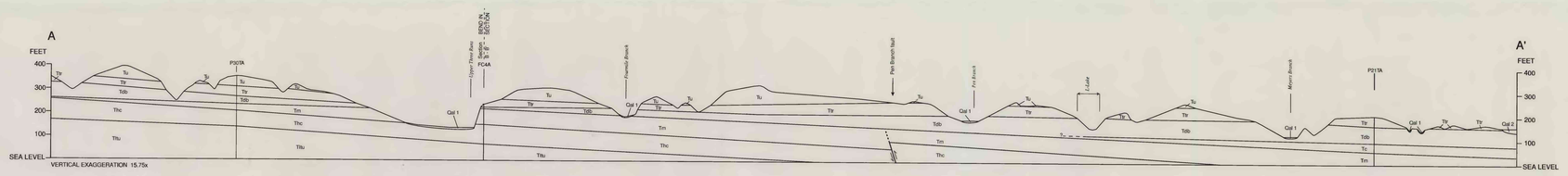
GRID DECLINATIONS

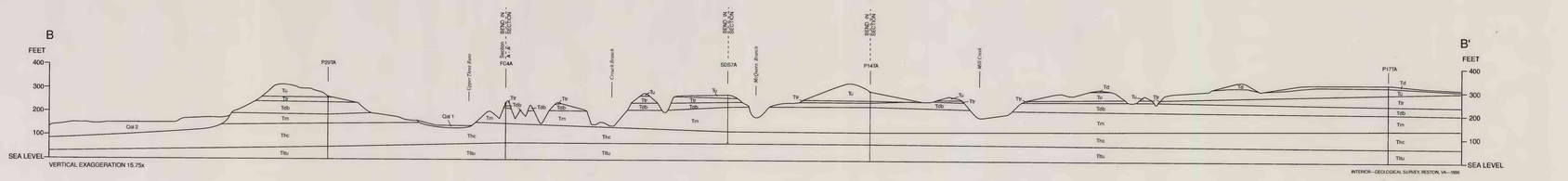


Location diagram showing map area and outline of Savannah River Site

Period or Series	European Stage	Provincial Stage	Alabama	Western Georgia	Eastern Georgia	This report	South Carolina	North Carolina
Quaternary	Undivided	Undivided	Unnamed	Unnamed	Unnamed	Unnamed alluvium	Unnamed	Unnamed
Pliocene	Undivided	Undivided			Cypresshead Formation	Unnamed dune sand	Bear Bluff Formation; Finchurst Formation, Raysor Formation	Bear Bluff Formation; Finchurst Formation, Yorktown Formation
MIOCENE	Undivided	Undivided			Hawthorn Formation	Upland unit	Upland unit; Coosawhatchie, Marks Head, and Edisto Formations	Undivided
OLIGOCENE	Chattian	Chickasawhayan	Paynes Hammock Formation; Chickasawhay Formation		Suwannee Limestone		Chandler Bridge Formation; Ashley Formation; Cooper Group	River Bend Formation
	?							
	Rupelian	Vicksburgian	Byram Formation; Marianna Limestone; Red Bluff Clay and Bumpnose Formation					
EOCENE	Priabonian	Jacksonian	Yazoo Clay; Ocala Limestone	Ocala Limestone	Barnwell Group	Barnwell Group: Tobacco Road Sand, Dry Branch Formation, Clinchfield Formation	Barnwell Group: Parkers Ferry and Snapp Formations; Cooper Group	
	Bartonian		Nanafalia Formation; Lisbon Sand					
	Lutetian	Claibornian	Lisbon Formation; Tallahatta Formation	Lisbon Formation; Tallahatta Formation	Lisbon Formation	McBean Formation; Huber and Congaree Formations, undivided	McBean Formation; Warley Hill Marl; Santee Limestone; Congaree Formation	Castle Hayne Formation
	Ypresian		Hatchetigbee and Bashi Formation; Tuscahoma Formation	Hatchetigbee and Bashi Formation; Tuscahoma Formation	Huber Formation			
PALEOCENE	Thanetian	Sabinian	Naheola and Bashi 100 Formation; Naheola Formation	Naheola and Bashi 100 Formation		Lower Tertiary Undivided	Williamsburg Formation; Black Mingo Group	Williamsburg Formation
	Selandian	Midwayan	Porters Creek Formation	Porters Creek Formation			Ellenton Formation; Rhems Formation	Beaufort Formation
	Danian		Clayton Formation	Clayton Formation				

Figure 1. Correlation chart of geologic units.





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GEOLOGIC MAP OF THE SAVANNAH RIVER SITE, AIKEN, ALLENDALE, AND BARNWELL COUNTIES, SOUTH CAROLINA

By

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1996

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