NOTE: This map is the product of collaboration of State geological surveys, universities, and the U.S. Geological Survey, and is designed for both scientific and practical purposes. It was prepared in two stages. First, separate maps and map explanations of the parts of States included in the quadrangle were prepared by the State compilers. Second, these maps were combined, integrated, locally supplemented, and related to a uniform map symbol classification by the editors. The map unit descriptions also were combined, supplemented, and coordinated with those of other maps of this series so that individual unit descriptions are applicable throughout both this map and all other maps of the series. The footnote on saprolite was prepared by E. T. Cleaves, Maryland Geological Survey, and R. B. Daniels, North Carolina State University. Diagrams accompanying the map were prepared by the editors.

Differences in mapping or interpretation in different areas were resolved by correspondence to the extent possible. Most simply reflect differences in available information or differences in philosophies of mapping. Such differences serve to encourage further investigation.

Less than forty percent of the surficial deposits of the United States have been mapped and described. Traditionally, mapping of surficial deposits has been focused on glacial, alluvial, eolian, lacustrine, marine, and landslide deposits. Slope and upland deposits have been mapped in detail only in restricted areas. However, an enormous amount of engineering construction and many important problems of land use and land management are associated with regions that have extensive slope and upland deposits (colluvium, residuum, and saprolite, for example). These materials have many different physical characteristics. Therefore, an effort has been made to classify, map, and describe these deposits, based in large part on unpublished interpretations of individuals, published and unpublished subsoil data, and the distribution of bedrock parent materials. The classification is crude, but represents a first step toward a more refined and useful product.

For scientific purposes, the map differentiates Quaternary surficial deposits on the basis of a combination of
criteria, such as lithology, texture, genesis, stratigraphic relationships, and age, as shown on the correlation
diagram and indicated in the map unit descriptions. Geomorphic features, such as stream terraces, are not
distinguished, as map units, and differentiation of sequences of alluvial deposits of different ages is rarely
possible at a scale of 1:1,000,000. Most landslide deposits also are too small to be shown at this scale.

For practical purposes, the map is a surficial materials map, on which materials are distinguished on the
basis of texture, composition, and local specific characteristics, such as swelling clay. It is not a map of soils as
soils are recognized and classified in pedology or agronomy. Rather it is a generalized map of soils as
recognized in engineering geology, or of subsoils or parent materials from which pedologic or agronomic
soils are formed. As a materials map it serves as a base from which a wide variety of derivative maps for use in
planning engineering, land use, or land management projects can be compiled.

The map contains the following illustrations:

- An index map to the International Map of the World 1:100,000 topographic series showing the Quaternary
  geologic map of the Lookout Mountain 4°x 6° quadrangle and other published maps of the
  Miscellaneous Investigations Series (I–1420).
- An illustration showing the responsibility for state compilations.
- An illustration showing the correlation of map units.
- An illustration showing loess thickness and distribution in the map area

LIST OF MAP UNITS

HOLOCENE

asa ALLUVIAL GRAVELLY SAND
asl ALLUVIAL SILT AND SAND

HOLOCENE AND LATE WISCONSIN

as ALLUVIAL SILTY FINE SAND
ac ALLUVIAL CLAY

HOLOCENE AND WISCONSIN

cba BOULDERY COLLUVIUM
csb COLLUVIUM WITH HUGE BLOCKS
csh SANDY SHALY COLLUVIUM
cla SANDSTONE- AND SHALE-CLAST LOAMY COLLUVIUM

WISCONSIN AND ILLINOIAN

ela COLLUVIAL AND ALLUVIAL LOESS

LATE PLEISTOCENE TO LATE PLIOCENE

aga ALLUVIAL QUARTZ-PEBBLE GRAVEL AND SAND
agb ALLUVIAL CHERT-PEBBLE GRAVEL AND SAND

EARLY PLEISTOCENE(?) TO MIDDLE PLIOCENE

agc ALLUVIAL PEBBLE GRAVEL AND SAND (CITRONELLE FORMATION)

PLEISTOCENE, PLIOCENE, AND MIOCENE(?)

agh UPLAND CHERT-PEBBLE GRAVEL AND SAND

QUATERNARY AND OLDER CENOZOIC

zsa LIMONITIC SANDY DECOMPOSITION RESIDUUM
zsd SANDY DECOMPOSITION RESIDUUM
zee CLAYEY FINE TO MEDIUM SAND DECOMPOSITION RESIDUUM
zsf MEDIUM TO COARSE SAND AND SANDY CLAY DECOMPOSITION RESIDUUM
SANDY CLAY AND FERRUGINOUS CLAYEY COARSE SAND DECOMPOSITION RESIDUUM

SILTY MEDIUM TO FINE SAND AND SANDY CLAY DECOMPOSITION RESIDUUM

CLAYEY FINE SAND DECOMPOSITION RESIDUUM

CHERT GRAVEL AND SAND DECOMPOSITION RESIDUUM

FERRUGINOUS SANDY DECOMPOSITION RESIDUUM

MEDIUM TO COARSE SAND DECOMPOSITION RESIDUUM

CLAYEY SILT AND VERY FINE SAND DECOMPOSITION RESIDUUM

SANDY SHALY DECOMPOSITION RESIDUUM

SANDY CLAY DECOMPOSITION RESIDUUM

SMECTITIC CLAY DECOMPOSITION RESIDUUM

SILICEOUS CLAY DECOMPOSITION RESIDUUM

MASSIVE CLAY DECOMPOSITION RESIDUUM

SILTY SANDY DECOMPOSITION RESIDUUM AND CHERTY CLAY SOLUTION RESIDUUM, UNDIFFERENTIATED

CHERTY CLAY SOLUTION RESIDUUM, SANDY CLAY DECOMPOSITION RESIDUUM, AND SILTY CLAY DECOMPOSITION RESIDUUM, UNDIFFERENTIATED

CHERT FRAGMENT SOLUTION RESIDUUM

PHOSPHATIC SANDY SOLUTION RESIDUUM

CLAYEY SAND SOLUTION RESIDUUM WITH CHERT CLASTS

CHERTY CLAY SOLUTION RESIDUUM

THIN CLAYEY SOLUTION RESIDUUM

CHERTY SILTY CLAY, LOCALLY PHOSPHATIC, SOLUTION RESIDUUM

DARK-GRAY CLAY SOLUTION RESIDUUM

RED-CLAY SOLUTION RESIDUUM

CLAYEY SAND TO SANDY CLAY SOLUTION RESIDUUM

CHERTY SILTY CLAY SOLUTION RESIDUUM

PLASTIC-CLAY SOLUTION RESIDUUM WITH COLLUVIAL CHERT

Silty to clayey sandy saprolite, rock tors, and joint-block boulders

Silty to clayey sandy saprolite, undifferentiated

MICACEOUS, CLAYEY, AND SANDY SAPROLITE, UNDIFFERENTIATED

QUARTZ-RICH SAPROLITE

ARGILLACEOUS SAPROLITE

MICACEOUS SAPROLITE

LIST OF MAP SYMBOLS

CONTACT

MARGIN OF FLOOD PLAIN OF MISSISSIPPI RIVER

DESCRIPTION OF MAP UNITS

HOLOCENE

ALLUVIAL GRAVELLY SAND—Light-gray, yellowish-gray, or brownish-gray, coarse to fine sand and subangular to well-rounded pebble to cobble gravel; reddish-orange to reddish-brown in parts of Tennessee, Georgia, and Alabama. Poorly to well-sorted, poorly to well-stratified, locally clayey. Interbedded lenses of gravel along Tennessee River in Tennessee. Gravel component sparse in Mississippi. Deposits include varying amounts of interbedded or admixed silt and clay, especially in flood plains along lower parts of regional drainage in Georgia and Alabama and along Tennessee River in Tennessee. Gravel in Tennessee, Mississippi, and western Alabama is chiefly chert and
minor amounts of quartz. Gravel in central and eastern Alabama and in Georgia is chiefly quartz. Clay balls and lenses, commonly kaolinitic, occur locally in deposits in Georgia. Mapped areas include organic muck and swamp deposits on flood plains, and local colluvium along margins or valley floors. Thickness generally 5–10 m

**ALLUVIAL SILT AND SAND**—Grayish-tan to brown, locally clayey, silt and fine to very fine quartz sand; poorly sorted, irregularly bedded. Some interbedded or intermixed chert-pebble gravel, especially in eastern headwaters. In Tennessee and northern Mississippi, silt derived mainly from older colluvium and alluvium composed chiefly of loess. In eastern Mississippi, deposit derived from local residuum and is more clayey. Mapped areas include organic muck and swamp deposits of flood plains. Thickness 3–8 m

**HOLOCENE AND LATE WISCONSIN**

**ALLUVIAL SILTY FINE SAND**—Gray to brown, silty fine sand intermixed and interbedded with silt and clay. Poorly to well sorted, poorly to well stratified. Represents meander and, locally, overbank deposits of Mississippi River. Mapped areas include swamp deposits, muck of oxbow lakes, and some areas of dark-brown to black organic clay on floodplain. Overlies older alluvium consisting of intermixed and interbedded gravel, sand, silt, and clay that become coarser with depth and is 10 to more than 60 m thick. Thickness of alluvial silty fine sand commonly 1–2 m

**ALLUVIAL CLAY**—Gray to reddish-brown, poorly to well-bedded clay; contains some intermixed and interbedded fine sand and silt and, locally, layers and lenses of dark-brown to black organic clay. Unit is an overbank deposit of Mississippi River. Mapped areas include swamp deposits and muck of floodplain oxbow lakes. Overlies older alluvium consisting of intermixed and interbedded gravel, sand, silt, and clay that becomes coarser with depth and is 10 m to more than 60 m thick. Thickness commonly 1–2 m

**HOLOCENE AND WISCONSIN**

**BOULDERY COLLUVIUM**—Grayish-yellow, bluish-yellow, or buff, poorly sorted, silty sandy loam to sandy clay; contains numerous well-rounded cobble- to boulder-size clasts of hard conglomerate composed chiefly of quartz and feldspar pebbles. Occurs on mountain slopes. Mapped areas include some rock outcrops, local areas of saprolite (ssa), and bouldery alluvial-fan deposits in valleys at edge of mountains. Chiefly the product of debris avalanche, mudflow, landslide, creep, and possibly solifluction. In places it overlies unmapped terrace deposits of alluvial cobble gravel. Thickness ranges from about 2 m to as much as 30 m, the latter at base of slopes

**COLLUVIUM WITH HUGE BLOCKS**—Light-gray to pale-yellowish-brown poorly sorted, sandy, silty clay loam; contains chips of siltstone and shale and angular slabby blocks of sandstone ranging from a few cm to 10–15 m in diameter. Occurs on steep slopes at margins of flat to gently sloping plateau uplands in Tennessee and locally in northern Alabama. As mapped, includes local small areas of cherty clay solution residuum (rec). Thickness commonly 3–15 m, but may be as thick as 30 m

**SANDY SHALY COLLUVIUM**—Gray, bluish-gray, or greenish-gray, unsorted, sandy loam, locally clayey or silty; contains abundant chips of shale, particles of clay, and small fragments of sandstone. Boulders lacking. Sand mostly quartz. Present only locally on northwest slopes of foothills in Tennessee in northeast part of map area. Thickness generally less than 15 m

**SANDSTONE- AND SHALE-CLAST LOAMY COLLUVIUM**—Light-gray, brownish-gray, or yellowish-brown, poorly sorted, sandy loam to clay loam; contains angular to subrounded, commonly slabby, pebble- to boulder-size clasts of sandstone and chips of shale. Present in mountainous northeastern part of map area in Tennessee. Locally overlies older residuum (zsd). Deposit tends to be unstable on steep slopes and where clayey. Thickness less than 2 m to 7 m

**WISCONSIN AND ILLINOIAN**

**COLLUVIAL AND ALLUVIAL LOESS** (In part stratigraphically equivalent to the Peoria Loess and Roxana Silt of Illinois and, in places, to the Loveland Loess in Iowa)—Grayish-brown to yellowish-brown, locally light reddish brown silt loam; massive to bedded. Unmapped loess extends east of map unit limit as thin, patchy deposits commonly mixed with locally derived colluvial, residual, or alluvial deposits. Thickness ranges from 3 m at eastern limit of map unit to maximum of 30 m along Mississippi River
**LATE PLEISTOCENE TO LATE PlioCENE**

**aga** ALLUVIAL QUARTZ-PEBBLE GRAVEL AND SAND—Yellowish-gray to reddish-orange, very fine to coarse sand and quartz-pebble gravel, intermixed and interbedded. Sand is poorly sorted, loose to compact, and massive to weakly bedded, locally crossbedded; gravel is chiefly quartz and well rounded. Deposit underlies terraces 10–150 m above major streams. Thickness less than 15 m

**agb** ALLUVIAL CHERT-PEBBLE GRAVEL AND SAND—Reddish-brown, slightly iron stained, well-rounded to angular, blocky chert-pebble gravel, in fine sand matrix; poorly sorted, weakly bedded. Includes some quartz pebbles derived locally from Upper Cretaceous Tuscaloosa Formation. Deposit underlies terraces 5–180 m above Tennessee River and locally is present at level of its floodplain. Thickness as much as 25 m

**EARLY PLEISTOCENE (?) TO MIDDLE PLIOCENE**

**age** ALLUVIAL PEBBLE GRAVEL AND SAND (Citronelle Formation)—Yellow, orange, or reddish-orange, gravelly, coarse to fine quartz sand containing lenses of red to dark-red, sandy clay. Clasts are subangular to subround, and range from granules to medium size pebbles, mostly chert, but some quartz. Deposit contains some admixed loess in places. Mapped areas include some alluvial gravelly sand (asa) and colluvium. The Citronelle Formation is considered of middle Pliocene to possible early Pleistocene age based on fossil leaves found in Alabama (Berry, 1916; Stringfield and LaMoreaux, 1957; Doering, 1958). A vertebrate fauna, collected from dark-gray clay beneath oxidized sand typical of the Citronelle Formation, has been assigned a Hemphillian (middle Pliocene) age by F. C. Whitmore (Isphording and Lamb, 1971). Includes some locally derived gravelly sand colluvium. Thickness 20–40 m

**PLEISTOCENE, PLIOCENE, AND MIocene (?)**

**agh** UPLAND CHERT-PEBBLE GRAVEL AND SAND ("Lafayette Gravel" or "Lafayette Formation" of some authors)—Light-tan, yellowish-orange, or reddish-brown, well-rounded, chiefly chert-pebble gravel in, abundant fine sand and silt clay matrix. Poorly sorted, massive to weakly bedded. Includes an upper unit and a lower unit which are not distinguished on map. The lower unit comprises most of the deposit and forms buried valley fill as much as 30 m thick. Though commonly un cemented, it contains iron-oxide- or manganese-oxide-cemented zones, especially in lower part. Pollen assemblages from a single locality suggest that lower unit is no older than Miocene and no younger than Pliocene (Olive, 1980). The upper unit, lithologically similar to the lower unit but more sandy, contains clasts of iron-cemented gravel and sand derived from the lower unit, and forms a sheet-like deposit only a few meters thick that disconformably overlies the lower unit in upland areas. However, below 400 ft altitude along major drainages, deposit may be as thick as 30 m. Pollen assemblages from a single locality suggest that the upper unit is Pleistocene in age. Deposit covered in most places by 2–8 m of loessial colluvium and alluvium. Total thickness at any given locality 5–30 m

**QUATERNARY AND OLDER CENOZOIC**

**zsa** LIMONITIC SANDY DECOMPOSITION RESIDUUM—Yellowish-orange, reddish-orange, red or dark-red, slightly clayey, fine to coarse quartz sand. Contains irregular masses of limonite-cemented sandstone. Chiefly in Mississippi. Mapped areas include some bedrock outcrops and locally derived colluvium and alluvium. Thickness less than 1 m to about 5 m

**zsd** SANDY DECOMPOSITION RESIDUUM—Light-gray, tan, pinkish-tan, or light-brown, coarse to fine sand to clayey sand, locally sandy clay. Developed chiefly on flat to gently sloping plateau uplands and broad ridge crests. Deposit grades down irregularly into sandstone or shale; lower part commonly includes angular slabs of rotted sandstone or chips of shale. Material is subject to subsidence where it overlies underground mines. Mapped areas include locally derived colluvium on valley slopes and floors, and numerous bedrock outcrops. The colluvium where clayey, is commonly unstable, and, in Alabama, has high shrink-swell potential. Thickness commonly less than 1.5 m but may be as much as 7 m in places

**zse** CLAYEY FINE TO MEDIUM SAND DECOMPOSITION RESIDUUM—Mottled very pale orange,
yellowish-orange, reddish-orange, or brick-red, clayey fine to medium sand; locally contains some
subrounded fine gravel, and very fine to fine sandy, silty clay. Sand and gravel chiefly quartz.
Mapped areas include some locally derived colluvium, alluvium, and bedrock outcrops. Thickness
less than 1 m to about 3 m

zs f MEDIUM TO COARSE SAND AND SANDY CLAY DECOMPOSITION RESIDUUM2—Light-
gray, yellowish-gray, very pale orange, or light-reddish-brown, micaceous medium to coarse sand;
contains local zones of kaolinitic sandy clay or clay, leached and partly decomposed oyster-shell
fragments, and subrounded fine quartz-pebble gravel. Mapped areas include some bedrock outcrops
and small deposits of alluvium and locally derived colluvium. Thickness less than 2 m to as much as 7
m

zs g SANDY CLAY AND FERRUGINOUS CLAYEY COARSE SAND DECOMPOSITION RESIDUUM2—
Mottled dark-orange-red to yellowish-orange, clayey coarse sand. Contains abundant limonite
pebbles, locally constituting commercial-grade iron ore. Includes some light-greenish-yellow waxy
clay, probably derived from limestone, but the residuum is derived chiefly from weakly cemented
calcareous sandstone. Thickness 1–2.5 m

z s h SILTY MEDIUM TO FINE SAND AND SANDY CLAY DECOMPOSITION RESIDUUM2—Gray,
buff, or light-yellowish-orange, silty, medium to fine sand and sandy clay, in Alabama and western
Georgia; extends eastward into micaceous, slightly clayey, medium to coarse sand at southeastern part
of map area in Georgia. Clay is locally intensely mottled, smectitic and shrinks and swells with
changes in moisture content. Deposit grades down into parent rock, chiefly sandstone, locally
claystone or siltstone. Mapped areas include some locally derived colluvium, alluvium, and
bedrock outcrops. Thickness 1–3 m

z s i CLAYEY FINE SAND DECOMPOSITION RESIDUUM2—White, buff, or gray, clayey fine sand, fine
sandy clay, and fine sand; poorly sorted. Clay content decreases northward. Locally contains some
admixed loess. Deposit grades down into bedrock. Mapped areas include some locally derived
colluvium and bedrock outcrops. Thickness less than 1–2 m

z s j CHERT GRAVEL AND SAND DECOMPOSITION RESIDUUM2—Light-gray, yellowish-orange,
yellowish-brown, or reddish-brown, gravelly sand to sandy gravel, locally including pebbles and
cobbles. Clasts rounded to subrounded, chiefly chert, but some quartz in Mississippi, Tennessee, and
western Alabama. Clasts of plutonic and hard metamorphic rocks also occur in deposits in eastern
Alabama. Matrix consists of poorly sorted, very coarse to fine quartz sand, locally somewhat clayey.
Lenses of clay occur in deposit in places. In some areas of Mississippi, deposit contains irregular
masses of sand and gravel cemented with limonite. In Tennessee, Mississippi, and northwestern
Alabama, it may locally contain admixed loessial silt. Deposit grades down into its source bedrock.
Mapped areas include some locally derived colluvium and bedrock outcrops. Thickness commonly
2–5 m, but may be as much as 15 m

z s k FERRUGINOUS SAND DECOMPOSITION RESIDUUM2—Yellowish- to reddish-brown, ferruginous,
fine quartz sand, well sorted. Local iron oxide cement forms highly irregular tubules, boxwork
structures, and corrugated masses. In places sand is slightly clayey; upper part may contain some
admixed loess. Mapped areas include some locally derived colluvium and bedrock outcrops.
Residuum is irregularly gradational into ferruginous uncedmented source rock. Thickness
indeterminate

z s l MEDIUM TO COARSE SAND DECOMPOSITION RESIDUUM2—Yellowish-gray, yellowish-brown,
yellowish-orange, reddish-orange, dark-red, or dark-brown, slightly micaceous, slightly
clayey, medium to coarse quartz sand. Deposit locally contains cemented platelets, concretions, and
irregular masses of limonite. Locally, small areas consist of yellowish-brown sandy clay, micaceous
clay, or plastic clay, commonly poorly drained and unstable. In Tennessee, the residuum
contains admixed loessial silt. Mapped areas include some locally derived colluvium and bedrock
outcrops. Residuum grades downward into weakly consolidated sandstone. Thickness generally
less than 1.5 m

z s m CLAYEY SILT AND VERY FINE SAND DECOMPOSITION RESIDUUM2—Light-gray to buff silty
smectitic clay, clayey silt, and silty very fine sand. Grades down into soft sandstone. Mapped areas
include some locally derived colluvium, alluvium, and source-rock outcrops. Thickness 0.5–3 m

z s n SANDY SHALY DECOMPOSITION RESIDUUM2—Grayish-brown, yellowish-brown, or reddish-brown
sandy loam to clay loam. Lower part contains shale chips or sandstone fragments. Mapped areas
include some thin, stony loam colluvium on steep slopes and bedrock outcrops along ridge crests.
Deposit present only in northeastern part of map area in Georgia and Tennessee. Thickness mostly less than 3 m but may be as much as 6 m in Tennessee.

**zc**  SANDY CLAY DECOMPOSITION RESIDUUM—Pale-yellow, orange, reddish-orange, or greenish-gray, mottled fine sandy clay. Locally includes clayey fine sand or clay and, in places, very fine to fine sand containing quartz pebbles. Mapped areas include some locally derived colluvium and outcrops of the unconsolidated source rock. Thickness generally less than 1 m, locally 2 m.

**zc**  SMECTITIC CLAY DECOMPOSITION RESIDUUM—Yellowish-gray, greenish-gray, light-gray, or gray clay and sand. Locally contains calcareous nodules. Clay is smectitic and shrinks and swells greatly with changes in moisture content. Deposit grades down into marine clay, marl, calcareous sandstone, and limestone. Mapped areas include some locally derived colluvium and source-rock outcrops. Thickness commonly less than 1 m, locally 2 m.

**zc**  SILICEOUS CLAY DECOMPOSITION RESIDUUM—Very pale orange to pale-greenish-yellow siliceous clay or clayey silt. Grades down into compact clay bedrock. Mapped areas include some locally derived colluvium and source-rock outcrops. Thickness commonly less than 1 m.

**zc**  MASSIVE CLAY DECOMPOSITION RESIDUUM—Yellowish-gray, brownish-gray, or brownish-black, massive, plastic, smectitic clay; shrinks and swells greatly with changes in moisture content. In northern third of Mississippi and western and south-central Alabama, unit contains limonitic nodules and platelets, and includes small zones of ferruginous very fine to coarse quartz sand. In Tennessee, unit includes some areas of light-gray or buff fine sandy clay or fine sand. In northwest part of quadrangle, it commonly contains some admixed loess. The residuum grades down into dark-gray clay or, locally, soft clayey fine sandstone. Mapped areas include some locally derived colluvium and source-rock outcrops. Thickness less than 1 m to 2 m.

**zc**  SILTY SANDY DECOMPOSITION RESIDUUM AND CHERTY CLAY SOLUTION RESIDUUM, UNDIFFERENTIATED—Includes two residua that cannot be shown separately at scale 1:1,000,000. One is reddish-brown cherty clay solution residuum developed on carbonate rocks. The second is yellowish-gray, silty, sandy decomposition residuum, that contains abundant angular to subrounded slabs to chunky fragments of sandstone and is developed on sandstone. Occurs along northwest edge of Valley and Ridge Province in north-central Alabama. Mapped areas include locally derived colluvium on lower part of steep slopes and bedrock exposures on steep slopes and ridge crests. Thickness less than 1 m on steep uppermost slopes to as much as 15 m along base of slopes.

**zc**  CHERTY CLAY SOLUTION RESIDUUM, SANDY CLAY DECOMPOSITION RESIDUUM, AND SILTCLAY DECOMPOSITION RESIDUUM, UNDIFFERENTIATED—Comprises three residua that cannot be shown separately at scale 1:1,000,000. One is yellowish-brown to dark-redbrown cherty clay solution residuum developed on limestone. The second is yellowish-brown sandy clay decomposition residuum that is porous and ferruginous or calccareous. It includes slabby sandstone fragments and is developed on sandstone. In Georgia, it locally contains limonitic boxwork and commercial-grade iron ore. The third is pale-yellowish-brown to grayish-brown clay or silty clay decomposition residuum containing shale chips and local hematitic zones. It is developed on shale. Mapped areas include bedrock outcrops and some locally derived colluvium, as much as 8 m thick, on steep slopes in Tennessee. In Alabama, deposits tend to be unstable on slopes greater than 30° and subject to subsidence where they overlie shallow underground mines. Thickness generally less than 5 m in Tennessee but as much as 7 m in Alabama. In Georgia, thickness is commonly greater, locally as much as 20 m.

**zc**  CHERT-FRAGMENT SOLUTION RESIDUUM—Yellowish-orange, yellowish-gray, and yellowish-brown in Tennessee, becoming reddish-orange to reddish-brown southward in Alabama; residuum consists of clay and minor amounts of sand and silt; clasts chiefly iron-stained chalcedonic chert fragments and shale chips. Base is sharp, highly irregular contact with underlying limestone bedrock, into which deposit extends along fractures. The residuum, in part, may be colluvially transported and may contain some admixed loess. Mapped areas include locally derived sheetwash colluvium on steeper slopes, and bedrock outcrops along ridge crests. Thickness commonly 3-10 m, locally as much as 40 m where material fills solution fractures in bedrock.

**zc**  PHOSPHATIC SANDY SOLUTION RESIDUUM—Reddish-brown to grayish-brown, clayey, silty sand to sandy clay loam. Deposit is phosphatic in western half of central basin of Tennessee. Lower part tends to be more sandy and silty than upper part, contains shale chips, and grades down into arenaceous limestone containing shale interbeds. The residuum, in part, may be colluvially...
transported. Mapped areas locally include a mantle of stony clay colluvium and bedrock outcrops. Thickness commonly less than 5 m but locally as much as 15 m where material fills solution fissures in bedrock.

**rsf CLAYEY SAND SOLUTION RESIDUUM** — Mottled yellow, yellowish-orange, orange-red, light-pink, or reddish-brown, clayey, fine to medium sand. Locally contains subround pebbles and, in places, cobble- and boulder-size blocks, chiefly chert, but a few of limestone. East of the Flint River, in Georgia, the sand is coarse and locally limonite cemented. Deposit is residual on sandy cherty limestone. Mapped areas include some bedrock outcrops and locally derived colluvium and alluvium. Present only in Georgia. Thickness commonly 1.5–4 m, locally as much as 10 m.

**rcce CHERTY CLAY SOLUTION RESIDUUM** — Moderate-orange to moderate-brown, or tan to reddish-orange, commonly mottled, cherty clay to cherty sandy or silty clay. Chert is gray, yellowish brown, or yellowish orange, locally light green or black, and occurs as angular to subround chunks and boulders. Deposit contains slabs of sandstone, siltstone, and locally limestone or dolomite, at or near the surface. Such slabs suggest that the material may be, in part, a colluvially transported residuum. Contact with underlying bedrock is abrupt and pinnacled. In west-central Tennessee the residuum probably contains considerable admixed loess. Mapped areas include some bedrock outcrops and deposits of locally derived colluvium. Where colluvium overlies the residuum on steep slopes, both deposits tend to be unstable. Thickness varies greatly; averages about 15 m in Tennessee, but is as much as 50 m thick in Alabama and as much as 100 m thick locally in Georgia.

**rce THIN CLAYEY SOLUTION RESIDUUM** — Brown to reddish-brown, clayey residuum commonly containing small amounts of chert and normally in abrupt contact with underlying bedrock. Deposit characterizes limestone areas called "glades" in Tennessee. Mapped areas include some locally derived colluvium and extensive flat to gently sloping limestone surfaces. Thickness of residuum generally less than 1.5 m but may be as much as 3 m.

**rcf CHERTY SILTY CLAY, LOCALLY PHOSPHATIC, SOLUTION RESIDUUM** — Yellowish-brown, orange-red, or reddish-brown, silty clay, containing variable quantities of chert fragments. Base of deposit is chiefly an irregular, sharp solution contact on limestone but locally is gradational through zone of weathered argillaceous limestone and shale chips into bedrock. Deposit underlies steeper slopes in central western Tennessee where it may contain considerable admixed loess. Some deposits in western part of this area are phosphatic. Mapped areas at periphery of central basin of Tennessee and on higher outlying hills and ridges, include locally derived cherty colluvium as much as 8 m thick and numerous bedrock outcrops. Thickness of residuum commonly less than 3 m but locally as much as 15 m.

**rcl CHERTY SILTY CLAY SOLUTION RESIDUUM** — Varicolored, moderate-yellowish-brown to moderate-red, silty clay residuum containing scattered chert fragments. Locally includes small areas
of sandy residuum. Base of deposit is smooth, sharp, irregular contact on underlying, predominantly limestone bedrock. Solution and collapse features common in areas underlain by flat-lying rock. Mapped areas include small areas of locally derived colluvium and bedrock outcrops. Present only in southeastern part of Valley and Ridge Province in Alabama. Thickness less than 1 to 15 m.

**PLASTIC-CLAY SOLUTION RESIDUUM** with colluvial chert—Moderate-red to very pale orange clay containing colluvial chert and fragments of carbonate rock. Deposit has low to moderate permeability and moderate shrink-swelling potential. Clay is plastic when wet and tends to be unstable on slopes greater than 30°. Base of deposit is smooth, irregular solution contact on predominantly limestone bedrock, and solution and collapse features are common. Much of deposit may be colluvium derived from residuum. Mapped areas include some bedrock outcrops. Thickness less than 1 m to as much as 30 m.

**SILTY TO CLAYEY SANDY SAPROLITE, ROCK TORS, AND JOINT-BLOCK BOULDERS**—Dark-red, reddish-brown, reddish-yellow, or white, slightly micaceous, sandy clay to silty or clayey medium sand developed in massive granite and granite gneiss. Quartz abundant. Clay is predominantly kaolinite in upper part, but gibbsite may equal or exceed kaolinite in lower part. Illite and vermiculite are also present as lesser components. Partly weathered feldspar is the predominant weatherable mineral in lower part; muscovite or its pseudomorphs predominate in upper part. The saprolite is permeable and strongly acid. It grades into bedrock through zone of partly decomposed joint-core boulders. Abundant joint-block boulders are associated with bedrock knobs or tors that protrude through the saprolite in mountain and hill areas. Pavement outcrop, as much as 10 hectares in extent, is common on the Piedmont. Mapped areas of saprolite include deposits of locally derived colluvium containing numerous boulders, especially at base of steep slopes. Fragments of vein-quartz locally are abundant in such deposits. Thickness of saprolite commonly less than 2 m but may be as much as 5 m in well-drained uplands.

**SILTY TO CLAYEY SANDY SAPROLITE**—Dark-red, reddish-brown, reddish-yellow, or white sandy clay to slightly clayey sand. Developed in strongly gneissic granite, felsic schist interlayered with gneiss, and other foliated granitic rocks. Clay predominantly kaolinite in upper part of saprolite, but gibbsite may equal or exceed kaolinite in lower part. Illite and vermiculite are minor components. Partly weathered feldspar is predominant weatherable mineral in lower part, but muscovite or its pseudomorphs predominate in upper part. Unit is permeable and strongly acid. It grades down into underlying bedrock through an irregular zone of partly weathered slabby fragments in matrix of micaceous silt to clayey sand. Mapped areas include bedrock exposures, commonly as micaceous rock ribs, and locally derived slubby to bouldery colluvium, especially at base of steep slopes; the colluvium commonly contains numerous vein-quartz fragments. Thickness of saprolite commonly less than 2 m but may exceed 6 m on well-drained uplands.

**MICACEOUS, CLAYEY, AND SANDY SAPROLITE, UNDIFFERENTIATED**—Grayish-red to moderate-reddish-brown micaceous clay, sandy clay, or clayey sand in areas too small to show at scale of map. Deposit down into underlying bedrock through zone of relict thick, slabby boulders. Deposit is developed on metagraywacke, feldspathic sandstone, conglomerate, fine-grained biotite gneiss, other gneisses, marble, mylonite, and felsic metavolcanic rocks. It is graphitic where underlain by carbonaceous metamorphic rocks. Mapped areas include bedrock outcrops and thin mantle of locally derived colluvium. Mapped only in Georgia. Thickness less than 1 m to as much as 15 m.

**QUARTZ-RICH SAPROLITE**—Gray, pale-yellow, pale-brown, or pale-yellowish-red, locally micaceous, slightly clayey or silty, very sandy saprolite. Clay is predominantly kaolinite. Angular or irregularly shaped, partly disintegrated chunks or slabs of rock common in lower part. Deposit developed on quartzite, quartz-rich metasedimentary rocks, or quartz-mica schist. Mapped areas include rock exposures on steep slopes or crests, and areas of locally derived sandy, stony colluvium, especially at bases of slopes. Thickness ranges from less than 0.5 m on steep slopes to about 3 m on gentle slopes.

**ARGILLACEOUS SAPROLITE**—Greenish-gray, pale-yellowish-orange, moderate-yellow, or dark-red, slightly micaceous to micaceous, clayey sand to sandy clay or clayey silt. Developed in mafic metamorphic, mafic metavolcanic and ultramafic rocks. Clay component is mixed smectite and kaolinite with minor vermiculite. Shrink-swell potential ranges from low to high. Smectite is particularly common in poorly drained areas. Sand component is chiefly calcic feldspar, biotite, vermiculite, hornblende, and a little quartz. The saprolite is relatively impermeable. It grades down into underlying
bedrock through zone of partly saprolitized slabs and blocks. Map unit includes a cover, 1–1.5 m thick, of locally derived colluvium and widely scattered bedrock exposures. The colluvium contains boulders of partly weathered bedrock and fragments of vein-quartz. Thickness less than 1 m to more than 30 m

slb  MICACEOUS SAPROLITE 4—Red, reddish-brown, strong-brown, yellowish-red, or gray, micaceous to very micaceous, sandy clayey silt. Developed in felsic micaceous schist, phyllitic rock, aluminous schist, and, where graphic, in graphic schist. Color depends on drainage and abundance of mafic minerals in parent rock. Clay is chiefly kaolinite and illite with minor amounts of vermiculite and gibbsite. Shrink-swell potential generally low. Sand is chiefly feldspar and mica. Locally, the saprolite is graphic and dark gray to dark greenish gray. Mapped areas include mantle of locally derived colluvium, that is bouldery on steep slopes and bedrock exposures. Thickness less than 1 m on steep slopes to as much as 30 m on well-drained uplands

1COLLUVIVUM is a general term applied for purposes of this map to material transported and deposited by mass-wasting processes. For map units cba and csh, these are chiefly creep, solifluction, mudflow, frost heave, and locally landslide; for map unit csh, chiefly talus, mudflow, frost heave, and creep; for map unit cha, chiefly frost heave, creep, and landslide.

2DECOMPOSITION RESIDUUM, for purposes of this map, is defined as material derived primarily by in-place chemical decay of clastic rock with no appreciable subsequent lateral transport.

3SOLUTION RESIDUUM, for purposes of this map, is defined as material derived by in-place solution of carbonate rock or carbonate-cemented rock with no appreciable subsequent lateral transport.

4SAPROLITE is the product of extensive chemical weathering of crystalline rocks. The color of saprolite depends on the abundance of dark minerals in the parent rock and on the drainage. Bright reds and yellows are produced above the water table; grays, whitish-grays, and greenish-blues are produced below. Saprolites grade down through partly weathered rock into fresh parent rock. The structure and texture of the bedrock are characteristically preserved in saprolite. However, in places, structureless saprolite may occur between structured material below and colluvium or modern soil above. Replication of bedrock features in saprolite results from isovolumetric chemical alteration of weatherable minerals. In weathering, the aluminosilicate minerals alter to clay minerals, density decreases by as much as 50 percent, and porosity increases greatly. Saprolite texture ranges from sandy to clayey depending upon the abundance of minerals that are resistant to weathering, such as quartz, in the parent rock. Quartz veins are commonly preserved in place in saprolite.

The clay mineralogy of saprolites depends on the kind of rock-forming aluminosilicate minerals in the parent rock and the drainage regimen. For example, the clay minerals in saprolite developed on mafic rocks, in which hornblende and plagioclase are the primary minerals, are chiefly smectite and kaolinite in poorly drained areas, kaolinite in well-drained areas, and kaolinite and gibbsite in very well drained areas. In contrast, the clay minerals in saprolite developed on felsic rocks are chiefly kaolinite and illite in both poorly and well drained areas; gibbsite develops as a persistent minor component only where internal drainage is excellent.

Saprolite thickness is directly related to slope angle and to the lithology and permeability of the parent rock, including the abundance of fractures. For example, the thickness of saprolite developed on felsic gneiss or schist on gently sloping uplands commonly exceeds 6 m (and locally may exceed 30 m); on slopes of 6–12° the thickness commonly ranges from 2 to 6 m; on slopes exceeding 12° it is generally less than 2 m. In contrast, saprolite developed in quartzite and serpentinite is commonly less than 2 m thick regardless of slope angle.

Saprolite has been mapped in terms of variety only in very limited areas. For purposes of this map, it is mapped in accordance with the distribution of different kinds of bedrock from which differing varieties of saprolites are derived. Differences due to slope angle could not be effectively shown at the scale of this map. Information on rock permeability suitable for mapping varieties of saprolite is not regionally available.

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MISSISSIPPI


NORTH CAROLINA

TENNESSEE

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