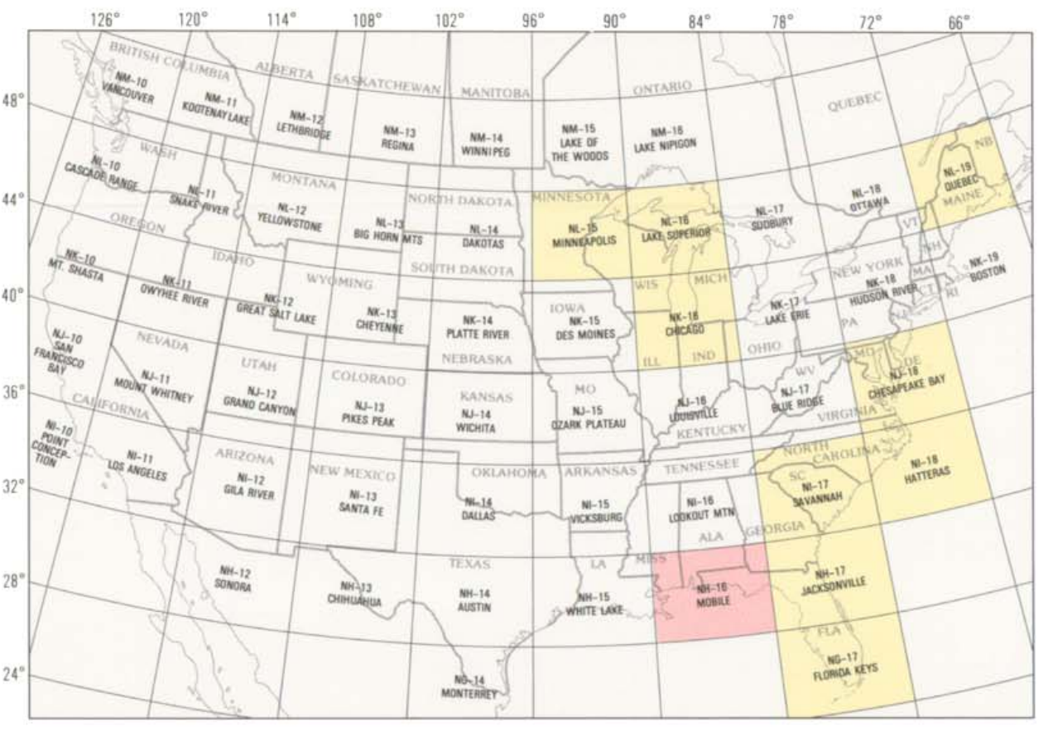
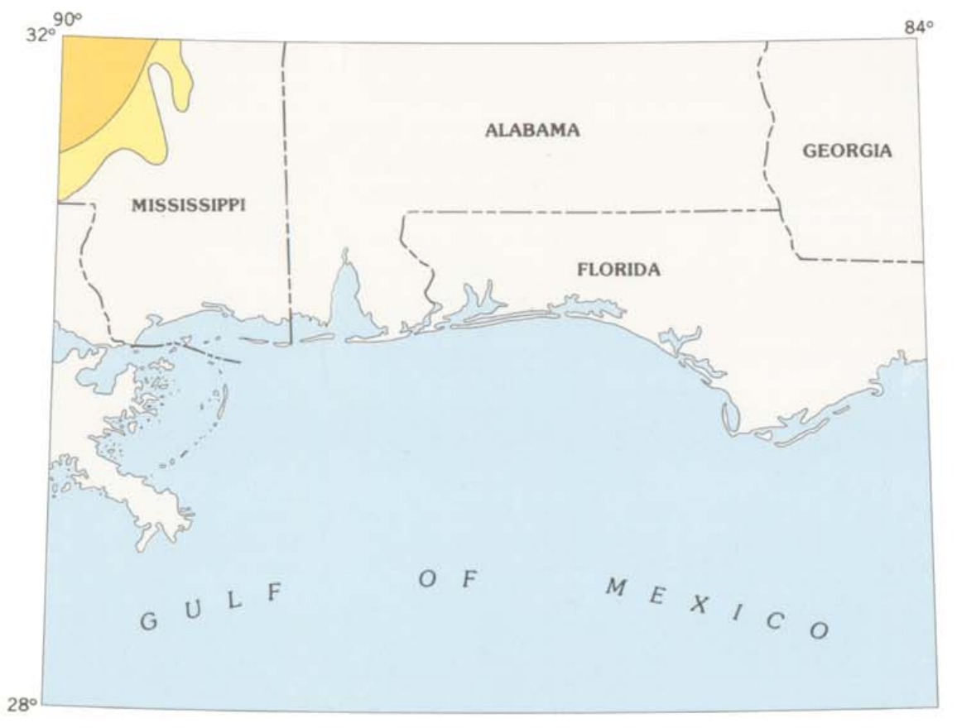
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



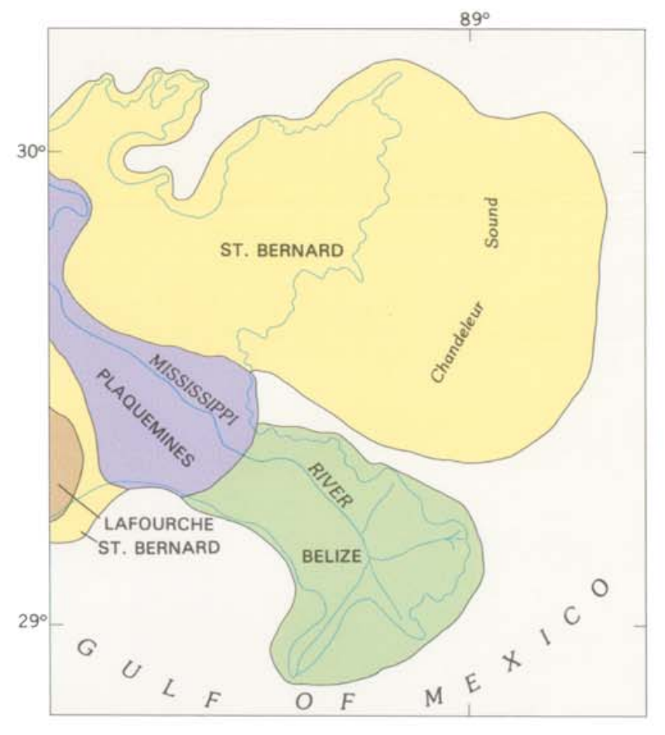
INDEX TO INTERNATIONAL MAP OF THE WORLD 1:1,000,000 TOPOGRAPHIC SERIES

Showing location of the Quaternary Geologic Map of the Mobile 4° × 6° Quadrangle in red [U.S. Geological Survey, Miscellaneous Investigations Series, Map I-1420 (NH-16)] and other published maps in the Quaternary Geologic Atlas of the United States in yellow.



LOESS DISTRIBUTION AND THICKNESS, IN METERS

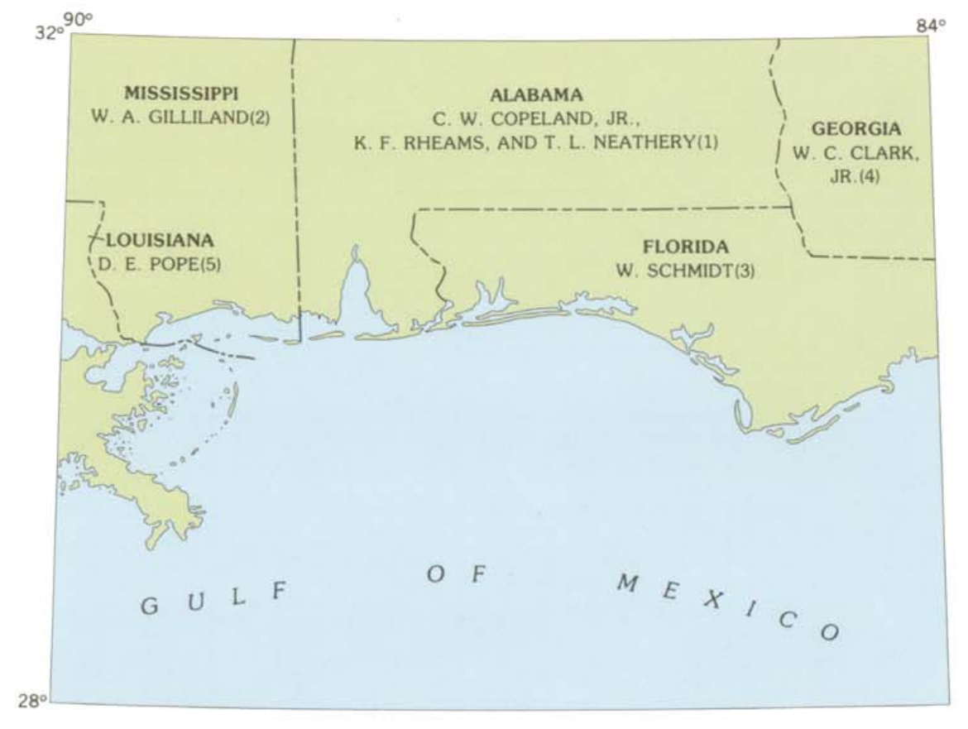
🟨	<0.5 m
🟧	0.5-1.0 m



LOCATION AND AGE OF ANCESTRAL DELTAS OF THE MISSISSIPPI RIVER

From Kolb and Van Lopik (1958), and Frasier (1967)

BELIZE 0-500 years B.P. (before present)
PLAQUEMINES 450-1100 years B.P.
LAFOURCHE 750-1900 years B.P.
ST. BERNARD 1700-2900 years B.P.



RESPONSIBILITY FOR STATE COMPILATIONS

(1) ALABAMA GEOLOGICAL SURVEY
(2) MISSISSIPPI GEOLOGICAL SURVEY
(3) FLORIDA BUREAU OF GEOLOGY
(4) GEORGIA GEOLOGIC SURVEY
(5) LOUISIANA GEOLOGICAL SURVEY

QUATERNARY GEOLOGIC MAP OF THE MOBILE 4° × 6° QUADRANGLE, UNITED STATES

State compilations by
Charles W. Copeland, Jr., Katherine F. Rheams, Thornton L. Neathery, William A. Gilliland,
Walter Schmidt, William C. Clark, Jr., and David E. Pope

Edited and integrated by
Gerald M. Richmond, David S. Fullerton, and David L. Weide
1988

QUATERNARY GEOLOGIC ATLAS OF THE UNITED STATES

PREPARED IN COOPERATION WITH THE
ALABAMA GEOLOGICAL SURVEY
MISSISSIPPI GEOLOGICAL SURVEY
FLORIDA BUREAU OF GEOLOGY
GEORGIA GEOLOGIC SURVEY
LOUISIANA GEOLOGICAL SURVEY

LIST OF MAP UNITS

HOLOCENE

asa	ALLUVIAL GRAVELLY SAND
asl	ALLUVIAL SAND AND SILT
aca	ALLUVIAL CLAY
fl	NATURAL LEVEE SILT
hs	SWAMP DEPOSIT
hpc	FRESHWATER-MARSH PEAT AND CLAY
hps	SALINE-MARSH DEPOSIT
he	SWAMP DEPOSIT AND DUNE SAND
be	BEACH AND DUNE SAND
ba	BEACH SAND
bb	BEACH SAND AND SHELL SAND
bc	BEACH SHELL-FRAGMENT AND SHELL SAND
bd	BEACH MUD

HOLOCENE AND LATE WISCONSIN

ald	ALLUVIAL DELTA LOAM

LATE WISCONSIN

acb	ALLUVIAL CLAY AND SILT

HOLOCENE TO MIDDLE WISCONSIN

bda	BEACH AND DUNE SAND, AND DELTA DEPOSIT

LATE PLEISTOCENE

da	DELTA DEPOSIT

LATE PLEISTOCENE TO EARLY PLEISTOCENE

aga	ALLUVIAL QUARTZ-PEBBLE GRAVEL AND SAND

EARLY PLEISTOCENE(?) TO MIDDLE PLIOCENE

agc	ALLUVIAL PEBBLE GRAVEL AND SAND

QUATERNARY AND TERTIARY

zsa	LIMONITIC SANDY DECOMPOSITION RESIDUUM
zsc	SAND AND CLAY DECOMPOSITION RESIDUUM
zse	CLAYEY FINE TO MEDIUM SAND AND SANDY CLAY DECOMPOSITION RESIDUUM
zsf	MEDIUM TO COARSE SAND AND SANDY CLAY DECOMPOSITION RESIDUUM
zsg	SANDY CLAY AND FERRUGINOUS COARSE SAND DECOMPOSITION RESIDUUM
zsh	SILTY FINE SAND AND SANDY SILT DECOMPOSITION RESIDUUM
zsm	CLAYEY SILT AND VERY FINE SAND DECOMPOSITION RESIDUUM
zca	SANDY CLAY DECOMPOSITION RESIDUUM
zcb	SMECTITIC CLAY DECOMPOSITION RESIDUUM
zcd	SILICEOUS CLAY DECOMPOSITION RESIDUUM
zce	MASSIVE CLAY DECOMPOSITION RESIDUUM
rse	CALCAREOUS SANDY CLAY SOLUTION RESIDUUM
rsf	CLAYEY SAND SOLUTION RESIDUUM WITH CHERT BLOCKS
rsh	CLAYEY SAND SOLUTION RESIDUUM
rcg	DARK-GRAY CLAY SOLUTION RESIDUUM

───	CONTACT
───	BEACH RIDGES—Occur along most of mainland coast and on barrier islands

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 indicated on the inset diagram, Responsibility for State Compilations. Second, these maps were combined, integrated, locally supplemented, and related to a uniform map symbol classification. 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. 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.

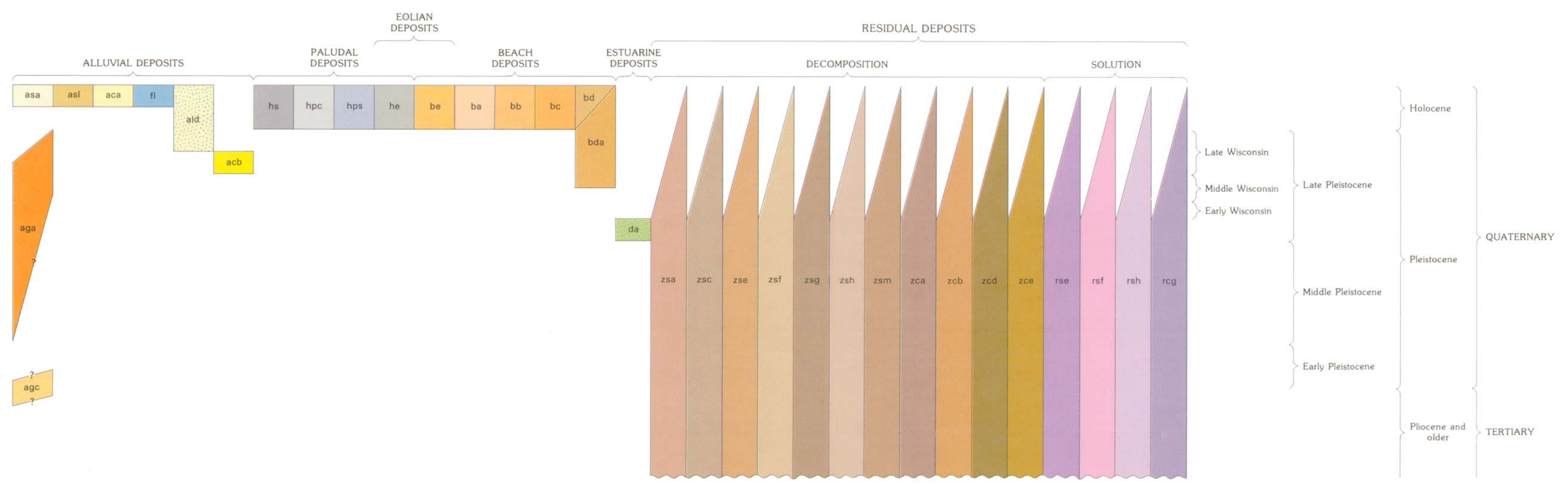
Less than forty percent of the surficial deposits of the United States have been mapped and described. Traditionally, mapping of surficial deposits has been focused on glacial, alluvial, eolian, lacustrine, marine, and landslide deposits. Slope and upland deposits have been mapped in detail only in restricted 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. Some geomorphic features, such as end moraines, are distinguished as map units. Erosional features, such as stream terraces, are not distinguished, 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 that scale, but areas in which landslides are present are distinguished as map units.

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 and 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.

QUATERNARY GEOLOGIC ATLAS OF THE UNITED STATES
MOBILE 4° × 6° QUADRANGLE
MISCELLANEOUS INVESTIGATIONS SERIES
MAP I-1420 (NH-16)

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

HOLOCENE

asa ALLUVIAL GRAVELLY SAND—Light-gray, brownish-gray, yellowish-red, or orange-red, coarse to fine sand and subangular to well-rounded pebble gravel; poorly to well sorted, poorly to well stratified. Gravel component sparse in Louisana and Mississippi. Deposit includes interbedded or admixed silt and clay, chiefly kaolinite, especially along lower parts of regional drainages. Clay balls locally present in deposits in Georgia. Gravel in Louisiana, Mississippi and western Alabama is chiefly chert with minor amounts of quartz. Gravel in central and eastern Alabama, northwestern Florida, and Georgia is chiefly quartz. Mapped areas include local organic muck and swamp deposits (**hs**) on flood plains, and colluvium along margins of valley floors. Thickness 5-10 m

asl ALLUVIAL SILT AND SAND—Grayish-tan to brown silt and fine to very fine sand, locally clayey. Poorly to well sorted, poorly to well stratified. Sand mostly quartz. Chert-pebble gravel intermixed with deposit in some headwater areas. Silt and clay are derived secondarily from local residual deposits. Mapped areas include organic muck and swamp deposits (**hs**) of flood plains. Thickness 3-8 m

aca ALLUVIAL CLAY—Light-gray, yellowish-gray, or brownish-gray clay and silty clay. Contains minor amounts of medium to fine quartz sand and, locally, fine chert-pebble gravel. Deposit underlies flood plain and low terraces of Pearl River and its tributaries in Louisiana and overbank areas distal to natural levees of Mississippi River. Mapped areas include swamp and woody and herbaceous deposits (**hs**) and deposits of woody and herbaceous peat. Thickness 8-10 m

fl NATURAL LEVEE SILT—Light- to medium-gray silt and silty clay. Contains small amounts of fine quartz sand. Forms levees as high as 4 m and 0.5-1 km wide that border present and former channels of Mississippi River and its distributaries. Thickness of silt 1-5 m

hs SWAMP DEPOSIT—Dark-brown to black muck, mucky peat, and organic residue mixed with fine to very fine quartz sand, silt, and kaolinitic clay. Contains lenses of mottled clay. Commonly thinly laminated but extensively bioturbated. Deposits mostly drained for agriculture, but some in depressions are covered intermittently by 0.5-1 m of standing water. Adjacent slightly higher terrain commonly is underlain by light- to dark-brown, unconsolidated, medium to fine quartz sand. Thickness 3-10 m

hpc FRESHWATER-MARSH PEAT AND CLAY—Gray to black herbaceous peat and clay, intermixed and interbedded; color darkens as content of organic matter increases. Includes interbedded freshwater and brackish-water deposits. Mapped in part from distribution of freshwater vegetation. Thickness 1-3 m

hps SALINE-MARSH DEPOSIT—Gray to black herbaceous peat and clay, intermixed and interbedded; color darkens as content of organic matter increases. Includes interbedded saltwater and brackish-water deposits. Mapped in part from distribution of salt-tolerant vegetation. Thickness 1-3 m

he SWAMP DEPOSIT AND DUNE SAND—Swamp deposit consists of dark-gray to orange, mottled, silty, smectitic clay with abundant organic debris. Present in parallel, linear, interdune depressions. Dune sand is white, unconsolidated, and fine- to medium-grained, composed of quartz and moderate amounts of shell debris. Deposits form linear dune ridges and swampy swales parallel to shore. Dunes chiefly stabilized by vegetation but active locally. Thickness of swamp deposits, 3-5 m; of dune sand, 5-15 m

be BEACH AND DUNE SAND—White, gray, or yellowish-gray, subangular to round, fine to medium sand. Well sorted, massive to crossbedded; mostly quartz and traces of heavy minerals. Locally contains clay, shell fragments, and organic debris. Dunes, both active and stabilized, occur along coast above modern beach. In Mississippi and western Alabama along the northern part of Mississippi Sound, beach and dune sand as thick as 2 m partly mantles pink to orange mottled beach and dune deposits (unmapped) of late Wisconsin age. Beach-sand thickness 1-15 m; dune-sand thickness 1-6 m

ba BEACH SAND—White to light-gray sand. Well-sorted, medium to fine grained, chiefly quartz. Occurs on the islands in Breton Sound and in Chandeleur Sound west of Chandeleur Islands; also present as a thin layer on coastal saline-marsh deposits (**hps**) in these areas. Mapped only in Louisiana. Thickness 2-7 m

bb BEACH SAND AND SHELL SAND—White to gray quartz sand and shell fragments in about equal proportions. Well sorted, medium to fine grained. Mapped only in Louisiana. Occurs chiefly on seaward side of Chandeleur Islands. Mangrove swamp and saline marsh deposits (not mapped) present on Chandeleur Sound side. Thickness 1-3 m

bc BEACH SHELL-FRAGMENT AND SHELL SAND—White to light-gray shell-fragment and shell sand, including minor amounts of fine-grained quartz sand, silt, and clay. Mapped only in Lake Borgne and Chandeleur Sound areas of Louisiana. Thickness 1-5 m

bd BEACH MUD—Gray to black silt and clay; contains shell fragments and very fine grained organic matter. Color darkens as content of organic matter increases. Underlies beaches in the Lake Pontchartrain and Lake Borgne areas. Thickness less than 1 m

HOLOCENE AND LATE WISCONSIN

ald ALLUVIAL DELTA LOAM—Yellowish-gray to brownish-gray, poorly sorted to well sorted, coarse to fine sand, silt, and clay; intermixed and interbedded. Forms delta deposits at mouths of major rivers. Mapped areas include organic muck, discontinuous lenses of peat, freshwater-marsh deposits (**hpc**) and saline-marsh deposits (**hps**). The deposit at the mouth of the Mobile River rises from sea level upstream to an altitude of 3 m and extends to depths of as much as 43 m below sea level. Thickness elsewhere is unknown

LATE WISCONSIN

acb ALLUVIAL CLAY AND SILT (Deposits of Deweyville terrace of Bernard, 1950)—Light- to medium-gray clay and silty clay. Poorly sorted to well sorted, poorly bedded to well bedded. Locally includes some admixed or interbedded fine quartz sand. Mapped only along Pearl River in Louisiana. Thickness 8-10 m

HOLOCENE TO MIDDLE WISCONSIN

bda BEACH AND DUNE SAND, AND DELTA DEPOSIT—Beach and dune gray sand, kaolinitic clayey sand, and sandy clay; crossbedded; sand medium grained and chiefly quartz. Delta deposit of fine to medium quartz sand grading down into coarse sand and containing beds of silt, stringers of pea-size gravel, and lenses of silty clay, rich in organic matter. Between Cape San Blas and Alligator Harbor, Florida, wood from the deltaic sand and associated shallow marine deposits (not shown on map) yielded ^{14}C ages between 24,000 and 45,000 years B.P., indicating a middle Wisconsin high sea level (Schnable and Goodell, 1968) and suggesting correlation with the Silver Bluff Formation and part of the Wando Formation of the Atlantic Coastal Plain. Deposit disconformably overlies a lower undated clayey to silty fine sand, containing beds of silt and silty clay, lenses of marine shells, burrows, and a few wood fragments, that grades down into a basal coarse sand containing angular quartzite gravel. Correlation of lower unit with the Princess Anne Formation and part of the Wando Formation of the Atlantic Coastal Plain is suggested. Thickness of beach and dune sand 3-9 m. Thickness of delta and associated marine deposits 3-20 m; thickness of lower unit 5-18 m

LATE PLEISTOCENE

da DELTA DEPOSIT (Prairie Formation of Fisk, (1938, 1940) in Louisiana; unnamed elsewhere)—Light-gray, yellowish-gray, and brownish-gray clay, silt, and sand, intermixed and interbedded. Deposit poorly sorted to well sorted, weakly bedded; locally includes thin stringers of well-rounded quartz granule gravel, discontinuous lenses of peat and scattered shell debris. Mapped areas include small, younger alluvial, colluvial, and swamp deposits of Holocene age. In coastal zone west and east of Pearl River in Mississippi and Louisiana, deposit is 1-3 m above sea level. Thickness 70-150 m in Louisiana and Mississippi, 3-10 m elsewhere

LATE PLEISTOCENE TO EARLY PLEISTOCENE

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, massive to weakly bedded, locally crossbedded; gravel is chiefly quartz and well rounded. Deposit underlies terraces 10-150 m above major streams. Mapped only in Alabama. Thickness less than 15 m

EARLY PLEISTOCENE(?) TO MIDDLE PLIOCENE

agc ALLUVIAL PEBBLE GRAVEL AND SAND (Citronelle Formation)—Yellow, orange, or reddish-orange, gravelly coarse to fine quartz sand containing lenses of dark-red sandy clay. Clasts are subangular to subround and range from granules to medium-size pebbles; mostly chert but some quartz in Mississippi and Alabama; mostly quartz but some chert in Florida. Mapped areas include some locally derived alluvial gravelly sand (**asa**) and colluvium. The Citronelle Formation is considered middle Pliocene to possible early Pleistocene age based on fossil leaves (Berry, 1916; Stringfield and LaMoureaux, 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). Thickness as much as 60 m

QUATERNARY AND TERTIARY

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

zsc SAND AND CLAY DECOMPOSITION RESIDUUM[1]—White, light-yellow, grayish-orange, or grayish-red, commonly mottled fine quartz sand and local zones of clay. Poorly sorted. Locally contains small areas of silt or very fine gravel. Present only in Georgia and Florida. Mapped areas include some bedrock outcrops and locally derived colluvium and alluvium. Thickness less than 1 to 3 m

zse CLAYEY FINE TO MEDIUM SAND AND SANDY CLAY DECOMPOSITION RESIDUUM[1]—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 are chiefly quartz. Mapped areas include some locally derived colluvium, alluvium, and bedrock outcrops. Thickness less than 1 to about 3 m

zsf MEDIUM TO COARSE SAND AND SANDY CLAY DECOMPOSITION RESIDUUM[1]—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. Present in Alabama and Georgia. Mapped areas include some bedrock outcrops and deposits of alluvium and locally derived colluvium. Thickness 1-7 m

zsg SANDY CLAY AND FERRUGINOUS COARSE SAND DECOMPOSITION RESIDUUM[1]—Mottled dark-orange-red to yellowish-orange, clayey, coarse sand and sandy clay. Contains abundant limonitic pebbles, locally constituting commercial-grade iron ore. Includes areas of light-greenish-yellow waxy clay that probably is derived from limestone, but the residuum is chiefly derived from weakly cemented calcareous sandstone. Thickness 1-2.5 m

zsh SILTY FINE SAND AND SANDY SILT DECOMPOSITION RESIDUUM[1]—Yellowish-gray to brownish-red, micaceous medium to fine sand; mixed with silt and smectitic clay. Shrinks and swells with changes in moisture content. Mapped areas include some bedrock outcrops and locally derived colluvium and alluvium. Thickness 0.5-2 m

zsm CLAYEY SILT AND VERY FINE SAND DECOMPOSITION RESIDUUM[1]—Light-gray to buff silty clay to clayey silt and silty very fine sand. Grades down into soft sandstone. Mapped areas include some locally derived colluvium and alluvium, and the parent rock exposures. Thickness 0.5-3 m

zca SANDY CLAY DECOMPOSITION RESIDUUM[1]—Pale-yellow, orange, reddish-orange, or greenish-gray mottled, poorly sorted, fine sandy clay. Locally includes clayey fine sand or clay and, in places, medium to coarse sand containing quartz pebbles. Mapped areas include some locally derived colluvium and outcrops of the parent rock. Thickness generally less than 1 m, locally 3 m

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

zcd SILICEOUS CLAY DECOMPOSITION RESIDUUM[1]—Very pale orange to pale-greenish-yellow siliceous clay or clayey silt. Grades down into compact clay bedrock. Occurs only in Alabama. Mapped areas include some locally derived colluvium and parent rock exposures. Thickness commonly less than 1 m

zce MASSIVE CLAY DECOMPOSITION RESIDUUM[1]—Yellowish-gray, brownish-gray, or brownish-black, massive, plastic clay, shrinks and swells greatly with changes in moisture content. Characterized by limonitic nodules and platelets, and includes small areas of ferruginous very fine to coarse quartz sand. The residuum grades down into dark-gray clay or, locally, soft sandstone. Present only in western and south-central Alabama. Mapped areas include some locally derived colluvium and the parent-rock exposures. Thickness less than 1 to 2 m

rse CALCAREOUS SANDY CLAY SOLUTION RESIDUUM[2]—Yellowish-gray to grayish-pink calcareous, sandy clay and clay. Clay locally gypsiferous. Unit grades down into soft limestone, calcareous sandstone, and massive marine clay. Karst features, including sink holes, common. Mapped areas include some locally derived colluvium and parent-rock outcrops. Present only in Alabama. Thickness 1-5 m

rsf CLAYEY SAND SOLUTION RESIDUUM[2] WITH CHERT BLOCKS—Mottled orange-red, light-pink, or reddish-brown sand. Fine- to medium-grained, ferruginous, clayey. Locally contains subround to subangular pebble- to boulder-size blocks of chert and limestone. Residuum is developed on sandy limestone. Its lower part contains distorted and disarranged masses of shale and poorly compacted limonitic sandstone that collapsed from formerly overlying beds of soft sandstone and shale as solution of the limestone occurred (MacNeil, 1946, 1947). Locally the residuum contains a few pebbles and small cobbles of quartz and quartzite collapsed from formerly overlying alluvial deposits. Karst features common. Deposit described as residuum by MacNeil (1946, 1947); present in southeastern Alabama, southwestern Georgia and northern Florida. In Florida, unit grades southward into clayey sand solution residuum (**rsh**). Mapped areas include some locally derived colluvium, alluvium, and parent-rock exposures. Thickness commonly 1.5-4 m, locally as much as 10 m in karst depressions

rsh CLAYEY SAND SOLUTION RESIDUUM[2]—Yellowish-gray to grayish-white quartz sand. Locally clayey, in places contains a few scattered, pea-size chert pebbles. Residuum is developed on soft sandy limestone. Karst features, including sinkholes, common. Mapped areas include some locally derived colluvium and parent-rock exposures. Present only in northern Florida; grades northward into clayey sand solution residuum with chert blocks (**rsf**). Thickness 1-3 m

rcg DARK-GRAY CLAY SOLUTION RESIDUUM[2]—Yellowish-gray to dark-gray clay loam to clay, locally sandy clay loam. Contains scattered, very light gray, powdery calcium carbonate nodules and marcasite concretions. The residuum is highly plastic; it is present in areas of low relief and rests in abrupt contact on underlying limestone bedrock. Mapped areas include some locally derived colluvium and parent-rock exposures, chiefly in areas of high relief. Present only in Alabama. Thickness less than 1 m

[1] DECOMPOSITION 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.

[2] SOLUTION 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.

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