THE HYDROGEOLOGIC FRAMEWORK FOR THE SOUTHEASTERN COASTAL PLAIN AQUIFER SYSTEM OF THE UNITED STATES

By Robert A. Renken

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CONVERSION FACTORS

For use of readers who prefer to use metric units, conversion factors for terms used in this report are listed below:

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)

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ABSTRACT

Tertiary and Cretaceous age sand aquifers of the Southeastern United States Coastal Plain constitute a distinct multistate hydrogeologic regime informally defined as the Southeastern Coastal Plain aquifer system. Seven regional hydrogeologic units are defined; four regional aquifer units and three regional confining beds. Sand aquifers of this system consist of quartzose, feldspathic, and coarse to fine sand and sandstone and minor limestone; confining beds are composed of clay, shale, chalk, and marl. Three hydrogeologic units of Cretaceous to Holocene age overlie the sand system: the surficial aquifer, upper confining unit, and Floridan aquifer system. These three units are not part of the Southeastern Coastal Plain aquifer system, but are an integral element of the total hydrogeologic system, and some act as a source of recharge to, or discharge from the underlying clastic sediments. Low-permeability strata of Paleozoic to early Mesozoic age form the base of the total system.

INTRODUCTION

Clastic sediments of Cretaceous and Tertiary age in South Carolina, Georgia, Alabama, Mississippi, and adjacent areas of northern Florida and southwestern North Carolina are an important source of ground water. The clastic sediments described in this report comprise a major aquifer system in the Southeastern United States Coastal Plain that is informally called the Southeastern Coastal Plain aquifer system. This aquifer system can be traced from the southwestern flank of the Cape Fear Arch in North Carolina into the Mississippi Embayment in northern Mississippi.

The Southeastern Coastal Plain aquifer system is being studied as part of the U.S. Geological Survey's Regional Aquifer-System Analysis program, a series of investigations that present a systematic, unified regional overview and assessment of the hydrogeologic and geochemical conditions of unique, multistate aquifer systems. A major objective of these studies is to examine the pattern of ground-water flow within the network of regional aquifers whose physical boundaries extend beyond political subdivisions, and to develop a digital computer simulation of such systems.

A regional hydrogeologic system, or aquifer system, can be described as a body of strata having a wide areal distribution, and containing an extensive set of aquifers and confining units. The aquifers are hydraulically connected in varying degrees, and can be regionally treated as a single system. A hydrogeologic framework is comprised of cross sections, structure contour, or isopach maps that are used to graphically illustrate the spatial arrangement, distribution, and physical attributes of the individual aquifers and confining beds that are part of the regional ground-water flow system.

The purpose of this report is to define the hydrogeologic framework of the Southeastern Coastal Plain aquifer system; specifically, to describe the configuration and overall character of the sand and clay bodies which form regionally extensive aquifers and confining beds within that system. The hydrogeologic framework presented in this article represents part of a comprehensive regional outline adopted to study clastic aquifers throughout the entire Southeastern United States Coastal Plain.

Eighty-eight wells are contained in one strike-oriented and five dip-oriented hydrogeologic sections presented in this report and are used to illustrate the hydrogeologic framework for the Southeastern Coastal Plain aquifer system. Gulf Coast chronostratigraphic units (Murray, 1961) and regional hydrogeologic units are denoted on the cross sections to illustrate the relation between stratigraphy and changes in permeability of rock units in the Southeastern Coastal Plain.

Location and Geographic Setting

The Southeastern United States Coastal Plain encompasses more than 120,000 mi^2 in South Carolina, Georgia, Alabama, Mississippi, and adjacent counties in North Carolina and northern Florida (fig. 1) and is drained by streams flowing to the Gulf of Mexico and the Atlantic Ocean. The Cape Fear River in North Carolina and the Mississippi River are the easternmost and westernmost streams that drain the study area. The Coastal Plain of the Southeastern United States includes the Sea Island, East Gulf Coastal, and a small part of the Mississippi Alluvial Plain sections of the Coastal Plain physiographic province (Fenneman and Johnson, 1946). The Southeastern United States Coastal Plain extends southward to the Atlantic Ocean and the Gulf of Mexico from the Fall Line, a physiographic boundary that marks its inner margin; it is bounded to the north by the Piedmont, Valley and Ridge, Applalachian Plateau, and Interior Low Plateau physiographic provinces. The Florida peninsula comprises part of the Coastal Plain but is not included in the study area (fig. 1).

Geologic and Hydrogeologic Setting

Coastal Plain rocks in the southeastern United States form a thick wedge of unconsolidated to poorly consolidated clastic and carbonate rocks that generally dip gently seaward from the Fall Line. Coastal Plain rocks are underlain in places by metamorphic, igneous, and sedimentary rocks of Paleozoic and early Mesozoic age that are, in part, a southeastern extension of the Piedmont Province and in places by sedimentary rocks of Paleozoic age which are a southwestern extension of the Applachian Mountains. These rocks, taken together, are herein referred to as the Coastal Plain floor.

Coastal Plain rocks are the product of the cyclic invasion and retreat of ancient seas and were deposited from Jurassic to Holocene time under marine, marginal marine, and nonmarine conditions. Deeply buried sedimentary rocks of Jurassic age found in parts of Georgia, Alabama, Mississippi, and Florida, however, are not considered to be part of the regional hydrogeologic framework. These rocks were excluded from examination as they are not known to contain waters with a dissolved-solids content of less than 10,000 mg/L (milligrams per liter); therefore, they are included as part of the Coastal Plain floor.

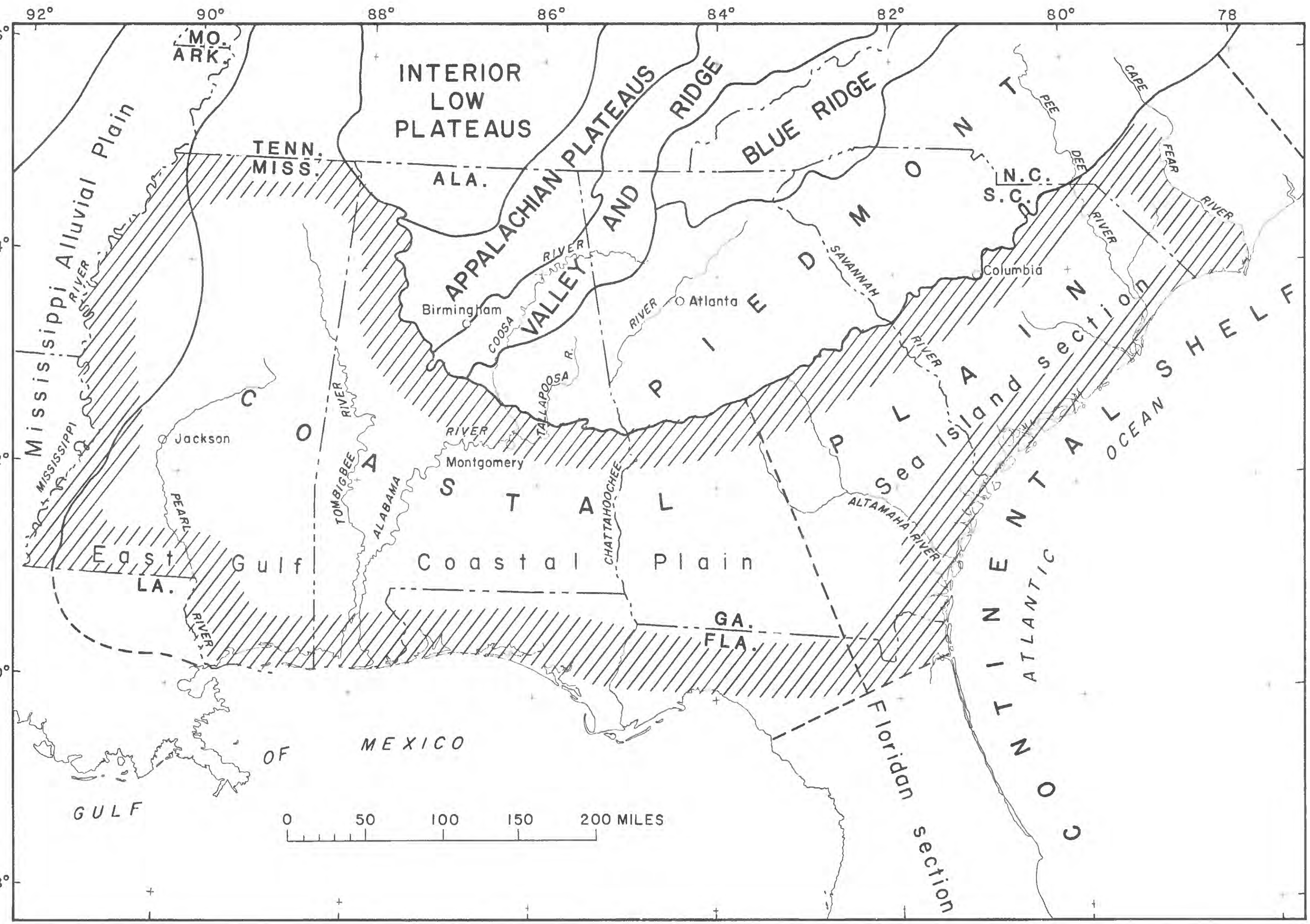


Figure 1.— Location of project area and major physiographic provinces (From Fenneman and Johnson, 1946).

Differential movement within the rocks that comprise the Coastal Plain and its floor has resulted in a number of major to minor structural features. The principal geologic structures of the Southeastern Coastal Plain are shown in figure 2. Three large sedimentary embayments resulting from subsidence are present in the area of investigation: the Southeast Georgia embayment, Southwest Georgia embayment, and Mississippi embayment. Prominent structurally high features include the Cape Fear arch, Peninsular arch, Ocala uplift, Wiggins anticline, and the Jackson dome. The Gulf trough is an elongate feature that has a marked structural affect on Tertiary and younger sediments and was apparently caused by faulting. This feature extends northeastward across the south Georgia Coastal Plain. The Pickens-Gilbertown fault system forms a prominent series of grabens that have displaced Alabama and Mississippi Coastal Plain sediments downward in varying degrees. The Suwannee strait is a structurally low area in north Florida and southeast Georgia that may have resulted from differential erosion during post-Cretaceous time.

Coastal Plain strata of the Southeastern United States can be divided into two major hydrogeologic, or regional aquifer systems (fig. 3). Clastic Tertiary and Cretaceous aquifers are the focus of this investigation; however, carbonate rock present in Florida, southern Georgia and Alabama, and southwest South Carolina comprise a highly productve aquifer system referred to as the Floridan aquifer system (Miller, in press). In these states, the Southeastern United States Coastal Plain aquifer system is mostly overlain by, and hydraulically connected to, the Floridan aquifer system. The limestone units that comprise the Floridan generally grade to or interfinger with the clastic rock of the Southeastern Coastal Plain aquifer system in the direction of the Fall Line to the north. These carbonate rocks are considered to be an integral part of the total hydrogeologic framework, but are not described in detail in this report.

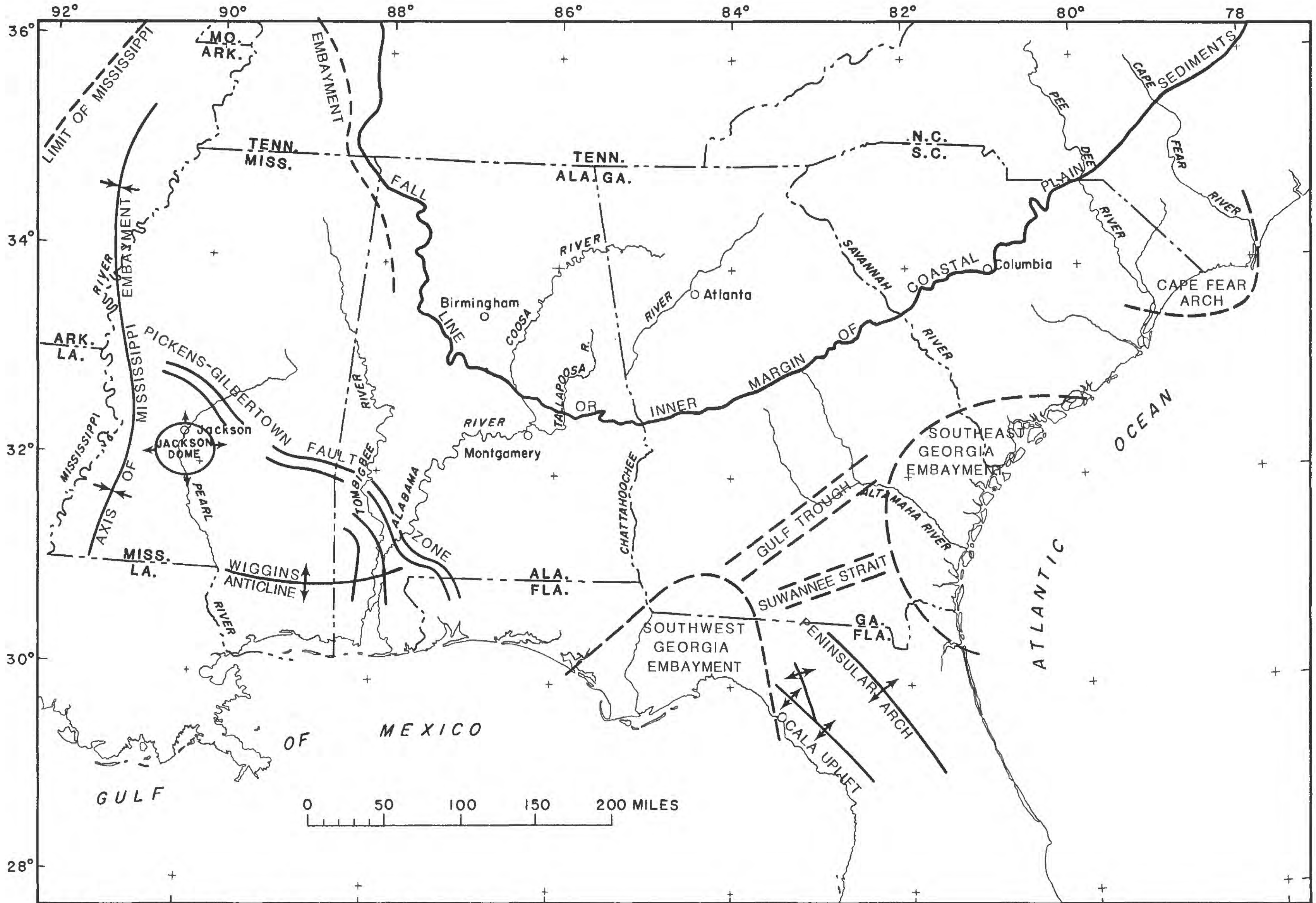
Previous Studies

Numerous workers have contributed to understanding the stratigraphy of the Southeastern Coastal Plain of the United States. Regional and subregional geologic studies which are particularly helpful include reports by Cooke (1936, 1943), Applin and Applin (1944, 1947, 1965, 1967), Applin (1951), Applin (1955), Eargle (1955), Herrick (1961), Murray (1961), Herrick and Vorhis (1963), Maher (1965), Maher and Applin (1968), Copeland and others (1976), Gohn, Bybell, Smith, and Owens (1978), Gohn, Christopher, Smith, and Owens (1978), Gohn and others (1980), Christopher (1982a), and Valentine (1982).

Regional hydrogeologic studies include reports by Boswell (1963, 1976a, 1976b, 1978a, 1978b), Boswell and others (1965), Stringfield (1966), Hosman and others (1968), Cushing and others (1970), Brown and others (1972), Newcome (1975, 1976), Brown and others (1979), Spiers (1977a, 1977b), Cederstrom and others (1979), Pollard and Vorhis (1980), and Miller (1982a, b, 1984).

METHOD OF STUDY

The hydrogeologic framework presented in this report is based on detailed study of geophysical, lithologic, and paleontologic data from over 250 oil and ground-water test holes. Selected oil test and other deep well data were examined from the entire Southeastern Coastal Plain between the Mississippi River



From Applin and Applin 1967; Vernon and Puri, 1956; Copeland, 1966; Williams, 1969; Cederstrom and others, 1979; Gelbaum and Howell, 1982; Miller, 1982

Figure 2.— Principal structural features of the Southeastern Coastal Plain of the United States.

and the Cape Fear River in North Carolina (fig. 3) to insure a unified regional overview. Data used in this report were obtained from a variety of sources. Geophysical logs from oil and gas wells were collected primarily from commercial geophysical log service companies. State government and U.S. Geological Survey well record files were the primary source of water well data. Published well data found in many reports also provided information. Drill cuttings were studied from selected water and oil wells to obtain additional lithologic and paleontologic data.

A common approach to describing the regional character of rock in a sedimentary basin is to describe their spatial arrangement, geometry, and lithic variation within a specific rock-stratigraphic and or time-stratigraphic interval. Although the vertical limits of an aquifer may locally parallel those defined by lithology, or the time or mode of deposition, a body of hydraulically connected permeable strata does not always fall within these boundaries. This report is directed to the evaluation of rock permeability and is therefore unlike sedimentary basin studies that usually center on the study of primary rock characteristics that have paleoenvironmental significance. Consequently, Coastal Plain sediments were classified on the basis of their relative permeability as: (1) aquifers, water-saturated geologic units permeable enough to yield water to wells at a sufficient rate for a source of supply, or (2) confining units; water-saturated geologic units having very low permeability. Coastal Plain aquifers are comprised of sand, gravel, porous limestone, or dolomite; confining beds that bound and separate the aquifers are composed of shale, clay, chalk, and evaporite.

To simplify the regional hydrogeologic framework of the Southeastern Coastal Plain aquifer system into a sequence of aquifers and confining units suited to a digital ground-water flow model study, the complex stratigraphic and hydrologic nature of the rocks comprising the Southeastern Coastal Plain must be greatly idealized and generalized.

A regional hydrogeologic unit, as described in this report, may consist of a series of sand or clay beds, each previously treated as discrete aquifer or confining units at the state or local level; when taken together, however, they are considered to behave as a single hydrologic unit. Strata that comprise a regional hydrogeologic unit is combined according to: (1) the degree of interconnection, (2) uniformity and continuity of the potentiometric surface, and (3) the overall spatial distribution of sediments. The relative difference in the potentiometric head between discrete sand horizons within a regional aquifer unit is generally less than the difference in potentiometric head between two adjacent regional aquifer units.

Regional aquifer units are areally extensive and are generally separated by zones of contrasting lithology or permeability. However, two regional aquifer units can be in direct contact if the regional confining unit that separates them is missing. Similarly, two regional confining units can be in direct contact if the intervening aquifer is missing.

As suggested above, the relation between an aquifer's permeability and lithology is an important criteria to delineating the boundaries of water-bearing units. For example, the highly permeable Floridan aquifer system overlies, and is interconnected with, the less permeable Southeastern Coastal Plain aquifer system. In large part, both aquifers are not separated by an intervening

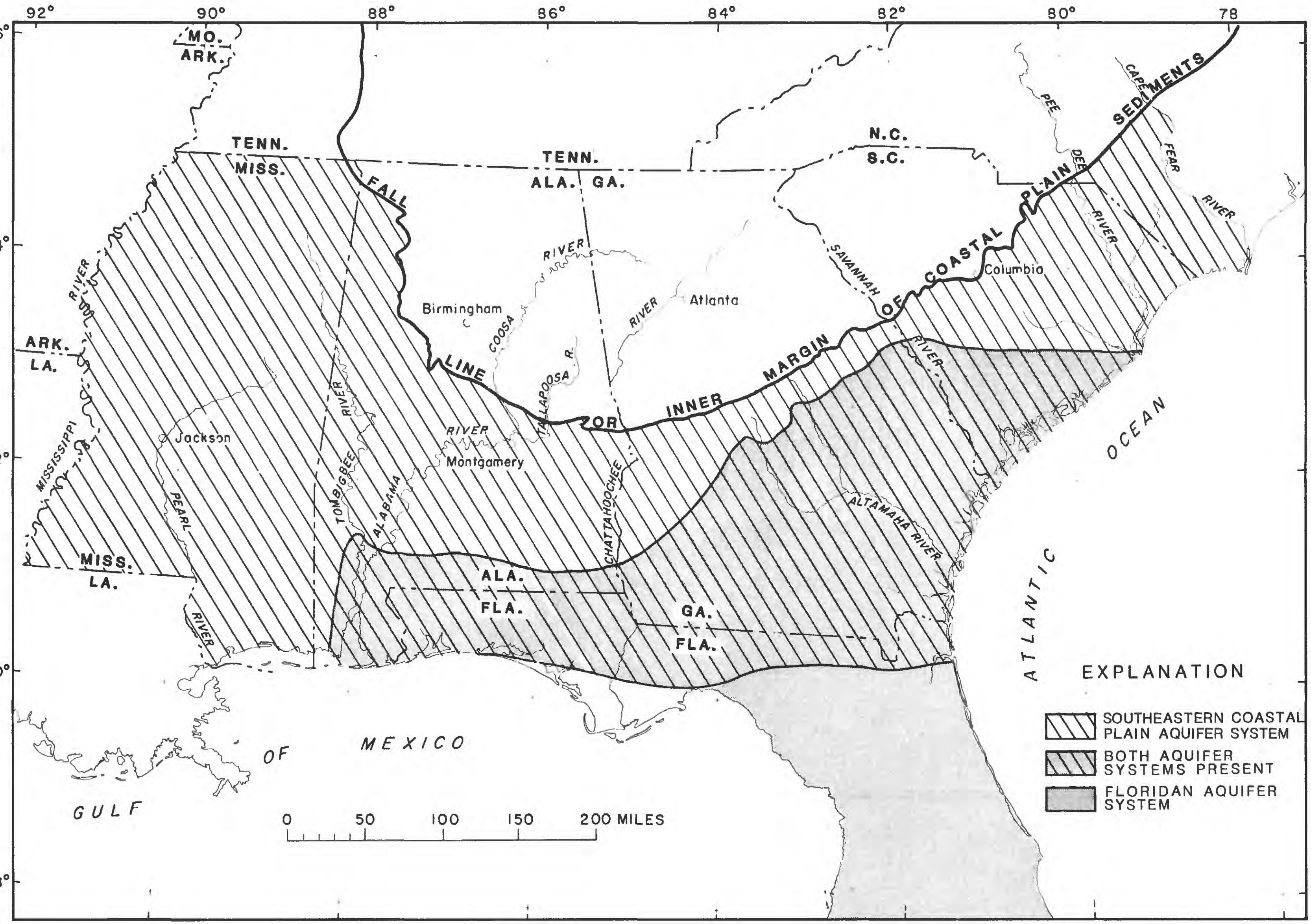


Figure 3.— Areal extent of regional aquifer systems in the Southeastern Coastal Plain of the United States.

confining bed. The boundary between the two aquifer systems is a lithologic boundary, but, more importantly, this boundary also represents a contrast in permeability.

The number of regionally extensive hydrogeologic units was minimized partly in order to reduce the complexity of the digital model and partly because definitive geologic and hydrologic data are lacking in much of the Southeastern Coastal Plain, particularly where the different hydrogeologic units lie at great depths. The hydrogeologic framework was differentiated with existing data. Additional information would be required to provide a more detailed definition of subregional aquifer units or to test the validity of a more detailed digital model. By generalizing the lithic and hydraulic character of larger regional units, it is easier to extrapolate the regional units to areas having limited data.

Because of the regional extent of the different hydrogeologic units, they cannot accurately be designated by existing time- or rock-stratigraphic nomenclature. The lithologic character of rock that are stratigraphically equivalent generally change from place to place; stratigraphically equivalent rock may be an aquifer in one location and a confining unit in another area. Therefore, aquifer units have been designated by the letter A and confining units by the letter C. A sequential number also is assigned to indicate their relative position in the hydrogeologic column. In Mississipppi, for example, regional hydrogeologic unit A1 is the uppermost aquifer unit of the clastic system. The underlying confining bed is called C1; the aquifer immediately beneath this confining unit is designated A2, and so on.

During the course of the study, twelve hydrogeologic sections parallel to regional dip and three hydrogeologic sections parallel to regional strike were constructed to illustrate the relation between regional hydrogeologic units and Gulf Coast chronostratigraphic units. For this report, one strike-oriented and five dip-oriented sections were selected as being representative of the entire region (plates 2-8). A map showing the location of the sections and the 88 wells used to construct them is presented on plate 1. On each cross section, wells are identified by state, county, and a sequential project number. Due to space limitations, abbreviations of state and county names were used and a list of these is given on table 1. Each cross-section well-heading cites the operator or driller, the lease or well name, and the datum elevation. For example, a well presented on section C-C' (plate 2), that was the third well from which data was obtained in Dorchester County, S.C., has been assigned the project identification number SC-DOR-03. The operator is cited as the U.S. Geological Survey and the well name is the St. George Test Hole. The datum altitude is given as 80 feet (NGVD of 1929).

Serving as a benchmark to aid in the identification of continuous regional hydrogeologic units, Gulf Coast chronostratigraphic units proved a suitable method for extending regional correlations in the Southeastern Coastal Plain. Correlation of outcropping rock-stratigraphic units is often difficult as their recognition is based on local outcrop descriptions that may not be representative elsewhere, especially in the subsurface. A summary of the difficulties encountered when extending regional correlations is provided by Brown and others (1972, p. 31-33).

Table 1.--State and county abbreviations used on hydrogeologic sections to identify project wells

Alabama	ALA	Mississippi	MIS
Bullock	BUL	Atala	ATA
Choctaw	CHO	Bolivar	BOL
Clarke	CLA	Calhoun	CAL
Coffee	COF	Clarke	CLR
Conecuh	CON	Choctaw	CHO
Covington	COV	Greene	GRE
Dale	DAL	Hancock	HAN
Greene	GRE	Itawamba	ITA
Geneva	GEN	Lafayette	LAF
Henry	HEN	Lauderdale	LAU
Houston	HOU	Lee	LEE
Macon	MAC	Neshoba	NES
Marengo	MAR	Pearl River	PEA
Monroe	MON	Perry	PER
Pike	PIK	Pontotoc	PON
Perry	PER	Stone	STO
Sumter	SUM	Sunflower	SUN
Tuscaloosa	TUS	Tallahatchie	TAL
		Tippah	TIP
Florida	FLA	Union	UNI
Jefferson	JEF	Wayne	WAY
Walton	WAL	Webster	WEB
		Yalobusha	YAL
Georgia	GA		
		North Carolina	NC
Bibb	BIB		
Brooks	BRO	Columbus	COL
Calhoun	CAL		
Crisp	CRP	South Carolina	SC
Coffee	COF		
		Berkeley	BRK
Colquitt	COQ	Charleston	CHN
Dooley	DOO	Colleton	COL
Dougherty	DOU	Dorchester	DOR
Early	EAR	Hampton	HAM
Pulaski	PUL		
		Horry	HOR
Screven	SCR	Marion	MRN
Telfair	TEL	Orangeburg	ORG
Thomas	THO	Williamsburg	WIL
Toombs	TOO		
Wilcox	WIX		
Worth	WOR		

HYDROGEOLOGIC FRAMEWORK

Gulf Coast chronostratigraphic, rock-stratigraphic subdivisions, and regional hydrogeologic designations are shown on table 2 to help illustrate the relation between rocks defined by their lithologic, chronologic, and hydrologic character. The relation between rock-stratigraphic units and their classification within the regional framework is summarized in figure 4.

Several regional hydrogeologic units overlie the Southeastern Coastal Plain aquifer system. These units are not considered to be part of the Southeastern Coastal Plain aquifer system but constitute an important part of the total hydrogeologic framework, and some of them act as a source of recharge to, or discharge from, the underlying sand aquifers. The uppermost hydrogeologic unit in the study area is a surficial aquifer that is composed mostly of unconsolidated sand and gravel of Pliocene to Holocene age and contains water under unconfined conditions. The surficial aquifer is underlain in the central part of the study area by low-permeability rocks of Oligocene to Pliocene age that make up the upper confining unit of the Floridan aquifer system (table 2, figure 4). In southern and western Mississippi and east South Carolina, however, the surficial aquifer is underlain by, and hydraulically connected to strata that are part of the Southeastern Coastal Plain aquifer system (plates 2, 6, 8).

A thick sequence of carbonate rocks in northern Florida and in much of South Carolina, Georgia, and Alabama comprise a major part of the rocks known as the Floridan aquifer system (Miller, 1984). This highly permeable carbonate lithofacies consists of unconsolidated to poorly consolidated fossiliferous limestone and dolomite that are at places chalky, interbedded with sand and clay, and may be glauconitic and phosphatic at places. The base of the Floridan aquifer system represents a transitional lithologic or facies boundary separating predominantly carbonate rocks from the underlying clastic rocks. Along with the contrasting lithology, the Floridan has a markedly greater permeability of one or more orders of magnitude higher than the sands that underlie it. The relation between the Floridan and overlying and underlying units is shown on several hydrogeologic sections (plate 2, 3, 7, 8).

The Southeastern Coastal Plain aquifer system can be divided into seven hydrogeologic units; four regional aquifer units separated by three regional confining units. In southwest Alabama and southern Mississippi, the carbonate lithology of the Floridan aquifer system grades laterally into the uppermost hydrogeologic unit of the Southeastern Coastal Plain aquifer system, A1. The A1 aquifer unit is a predominantly arenaceous sequence of Miocene to Oligocene age that contains interbedded fossiliferous limestone, marl, and calcareous clay. A regional confining unit (C1) comprised of marine, calcareous, occassionally fossiliferous, ferruginous and glauconitic clay and marl of late Eocene age (Yazoo Formation and Moodys Branch Formation) to early Oligocene age (Red Bluff Formation) separates the A1 aquifer from underlying aquifers (plate 5).

In southwestern South Carolina, southern Georgia and southeastern Alabama, and northern Florida, neither the A1 aquifer unit nor the C1 confining unit is present. Here, the Floridan aquifer system grades into the underlying clastic hydrogeologic unit A2 (plates 2, 3, 8). In these areas, the Floridan represents the downdip stratigraphic equivalent of the Southeastern Coastal Plain aquifer system. The A2 hydrogeologic unit is comprised of massive to thinly laminated, very fine to coarse, glauconitic, calcareous quartz sand of late Eocene

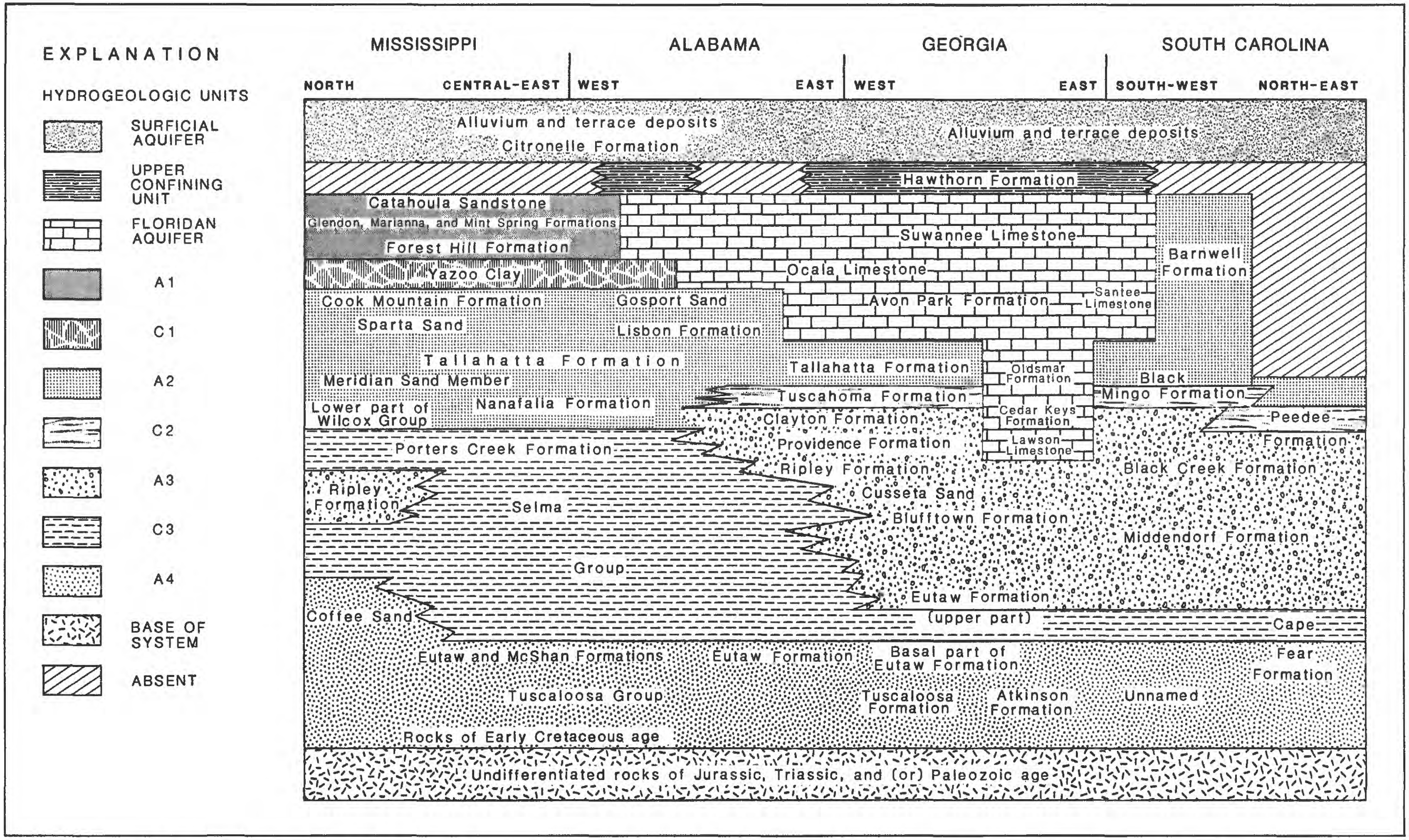


Figure 4.—Schematic diagram of regional hydrogeologic units and selected rock-stratigraphic units in the Southeastern U.S. Coastal Plain.

(Jacksonian) to middle Paleocene (Midwayan) age; it contains interbedded carbonaceous, calcareous, micaceous, fossiliferous clay, and marl that form local confining beds.

A persistent zone of low permeability separates the regional hydrogeologic unit A2 from underlying aquifers. Although this confining zone is not a single stratigraphic unit, it is considered as the regional confining unit C2. The spatial relation of this confining zone is shown on the regional strike sections P-P' and P'-P" (plates 7 and 8). In easternmost South Carolina, sandy marls equivalent to part of the Peedee Formation (Navarroan) separate Tertiary sands (A2) from deeper permeable horizons (A3) of Cretaceous age (plate 8). In the region between central South Carolina and central Alabama (between ALA-COV-05, section P-P', plate 7, and SC-DOR-03, section P'-P", plate 8), the A2 aquifer is underlain by a confining zone of middle Eocene to late Paleocene age (Claibornian to Midwayan) that is part of the C2 confining unit. The boundaries of the C2 confining unit in this area closely parallel the upper and lower contacts of the Tuscahoma Formation of Alabama and Georgia, and the unit contains clays that are partly equivalent to clay of the Black Mingo Formation, and Ellenton Formation of South Carolina and Georgia. In this central part of the study area, confining unit C2 consists of dark, carbonaceous, micaceous, glauconitic clay, and mudstone. To the west in western Alabama and in northern Mississippi, confining unit C2 is not present (plate 7).

A series of lenticular to wedge-shaped sand aquifer zones, interbedded with low-permeability zones, together comprise the A3 regional hydrogeologic unit that range in age from Paleocene (Sabinian) to Late Cretaceous (Austinian) (table 2). Although the individual sand bodies that comprise the A3 unit often act as a series of discrete subregional aquifers, they are interconnected in varying degrees in many places, and generally have a common distribution. In the eastern half of the study area, regional hydrogeologic unit A3 consists of alluvial, deltaic, and marginal marine to marine deposits of fine to coarse quartz sand that is commonly fossiliferous, glauconitic, micaceous, phosphatic, and feldspathic. Sand horizons within the A3 hydrogeologic unit are typically interbedded with dark, calcareous, carbonaceous, chalky shale, clay, and mudstone. The sandy limestone and calcareous sand of the Clayton Formation in eastern Alabama and western Georgia are interconnected with permeable, predominantly clastic horizons of the A3 hydrogeologic unit, and are therefore included as part of this regional unit, even though the Clayton consists largely of carbonate rocks. In a large part of the western half of the study area, aquifer unit A3 is nonexistent, particularly in central and western Alabama and east-central Mississippi. However, this aquifer is present in northern Mississippi as marine, glauconitic, fine to coarse, calcareous, fossiliferous sand assignable to the Ripley Formation (plate 7).

The extent and thickness of the A3 aquifer unit is a direct function of the gradational changes in lithology and permeability. For example, in Georgia and Alabama, the A3 hydrogeologic unit grades downdip into chalky limestone, dolomite and sandy chalk of Navarroan to Austinian age (plates 3 and 4). As a result, the permeable parts of A3 thin greatly in these downdip regions. Similarly, from central Alabama to eastern Mississippi, hydrogeologic unit A3 grades into low-permeability chalk, shale, and clay of the Prairie Bluff, Demopolis, and Mooreville Chalks (Selma Group) of Navarroan to Austinian age, and the Porters Creek Formation of Midwayan age (plates 7 and 8). In southeast Georgia, however, the unit A3 grades into permeable limestone (Lawson Limestone) of Cretaceous age that is part of the Floridan aquifer system.

Dark, massive marine clays of the Porters Creek Formation (Midwayan) and calcareous to noncalcareous shale, chalky limestone, chalk, and carbonaceous clay of the Selma Group form the effective C3 confining unit in Mississippi and Alabama. Fissile, carbonaceous clay and shale considered to be part of the Eutaw Formation of eastern Alabama and Georgia, varicolored clay of the upper part of the Cape Fear Formation, and carbonaceous clays of Austin age found in the subsurface of southeast South Carolina, combine with the Selma Group and Porters Creek Formation to form the extensive regional confining unit (C3) (table 2, plates 2 to 8).

The basal hydrogeologic unit A4 of the southeastern sand aquifer ranges in age from middle Late Cretaceous (Austinian) to Early Cretaceous (Washitan-Fredericksburgian) and is composed of medium to coarse, massively to thinly bedded, angular to subangular, quartzose, glauconitic, feldspathic, calcareous to noncalcareous, hematitic to limonitic sandstone and sand of fluvio-deltaic, near-shore marine, and marine origin. Interbedded, varicolored and mottled clay, shale, and siltstone form confining beds within this hydrogeologic unit. For example, a massive marine shale that is part of the Tuscaloosa Group of early Late Cretaceous age (Eaglefordian to Woodbinian) (Mancini and others, 1980) divides the A4 aquifer into upper and lower permeable zones in downdip areas of southern Mississippi, Alabama, northern Florida, and in southwest and south-central Georgia (plates 7 and 8).

Relatively impermeable sediments of Jurassic to Paleozoic age, along with various kinds of crystalline rocks, form the base of the southeastern sand aquifer. Several rock types comprise the aquifer system's base: shale, sandstone, limestone, and minor salt of Jurassic age; fanglomerate, claystone, siltstone, sandstone, and conglomerate of Triassic age interbedded with flows, sills, and dikes of basic igneous rock; gneiss, schist, and felsic intrusive rocks of Paleozoic age; and alternating sequences of Paleozoic sandstone, limestone, and shale.

SUMMARY

This report outlines the hydrogeologic framework to be used in a regionwide study of Tertiary and Cretaceous sand aquifers of the Southeastern United States Coastal Plain. Six hydrogeologic sections are presented to illustrate the relation between regional hydrogeologic and stratigraphic units and to show the distribution, arrangement, and lithic character of sand and clay bodies that comprise the water-bearing and confining units of the Southeastern Coastal Plain aquifer system.

Coastal Plain strata from Mississippi to South Carolina and adjacent areas were studied to insure a uniform treatment of the regional permeability units that are herein placed in a hydrogeologic framework suitable for a digital computer model study. The complex stratigraphic and hydrogeologic nature of the rocks comprising the southeastern Coastal Plain was greatly idealized and generalized in order to minimize the number of regional hydrogeologic units, so as to reduce the complexity of the digital model, as well as to allow data to be more easily extrapolated into areas of sparse control.

Because aquifers do not necessarily conform to time- or rock-stratigraphic boundaries, a separate rationale was used to delineate regionally extensive hydrogeologic units. Coastal Plain strata were classified as regional aquifer or confining units on the basis of relative permeability. Regionally extensive permeable strata having a wide distribution and a large degree of interconnection, similar lithology, and similar hydraulic characteristics were considered to function as a single aquifer unit on a regional scale. Because regional hydrogeologic units contain all or parts of several geologic units, an alphanumeric system of aquifer and confining bed terminology was used.

Several hydrogeologic units overlie the Southeastern Coastal Plain aquifer system; although they are not considered to be part of the sand system, some serve as a source of recharge to or discharge from the underlying strata. The uppermost surficial aquifer is comprised of unconsolidated sand and gravel and contains water under unconfined conditions and is present in much of the study area. In Georgia, northern Florida, and southwestern Alabama, it is underlain by low-permeability strata of the upper confining unit. Carbonate rocks of the Floridan aquifer system form a major water-bearing unit in the southeastern Coastal Plain and consist of poorly consolidated to unconsolidated, fossiliferous limestone and dolomite; in large part this system overlies, and is hydraulically connected to, the Southeastern Coastal Plain aquifer system.

Seven hydrogeologic units, four regional aquifers separated by three regional confining units, constitute the Southeastern Coastal Plain aquifer system. The uppermost aquifer A1 is comprised of arenaceous strata interbedded with interbedded limestone, marl, and clay of Oligocene to Miocene age. Present in southern Mississippi and southwest Alabama, the A1 aquifer is separated from underlying clastic aquifers by the marine, calcareous clays of late Eocene to early Oligocene age. The regional aquifer A2 is composed of very fine to coarse, glauconitic, quartz sand interbedded with carbonaceous, calcareous clay and shale of Cretaceous to Eocene age that form local confining beds. The A2 hydrogeologic unit largely represents the updip clastic equivalent of the Floridan aquifer system in Alabama, Georgia, and South Carolina. The A2 unit is separated from deeper sand aquifers by several distinct stratigraphic horizons of low permeability composed of clay, marl, and mudstone that are treated together as regional confining unit C2. The underlying A3 aquifer unit consists of a series of lenticular to wedge-shaped glauconitic, quartzose sand bodies of Cretaceous to Paleocene age interbedded with local carbonaceous clay and shale confining beds. The A3 aquifer unit grades to the west and in downdip areas of eastern Alabama and western Georgia into chalk, clay, and shale of the Selma Group and Porters Creek Formation. In southeast Georgia, the A3 hydrogeologic unit grades into permeable limestone of the Floridan aquifer system; the unit is present in northern Mississippi only as a patchy sand body of limited extent. Chalk, marl, varicolored clay, and carbonaceous shale act as an effective confining bed (C3) underlying the A3 unit and separating it from a deeper aquifer unit (A4). The basal A4 aquifer unit consists of massive to thinly bedded, fine to coarse, quartzose, glauconitic, feldspathic sand bodies interbedded with shale, clay, and siltstone of middle Late Cretaceous to Early Cretaceous age. Low-permeability crystalline rocks and sediments of Jurassic to Paleozoic age form the base of the Southeastern Coastal Plain aquifer system.

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