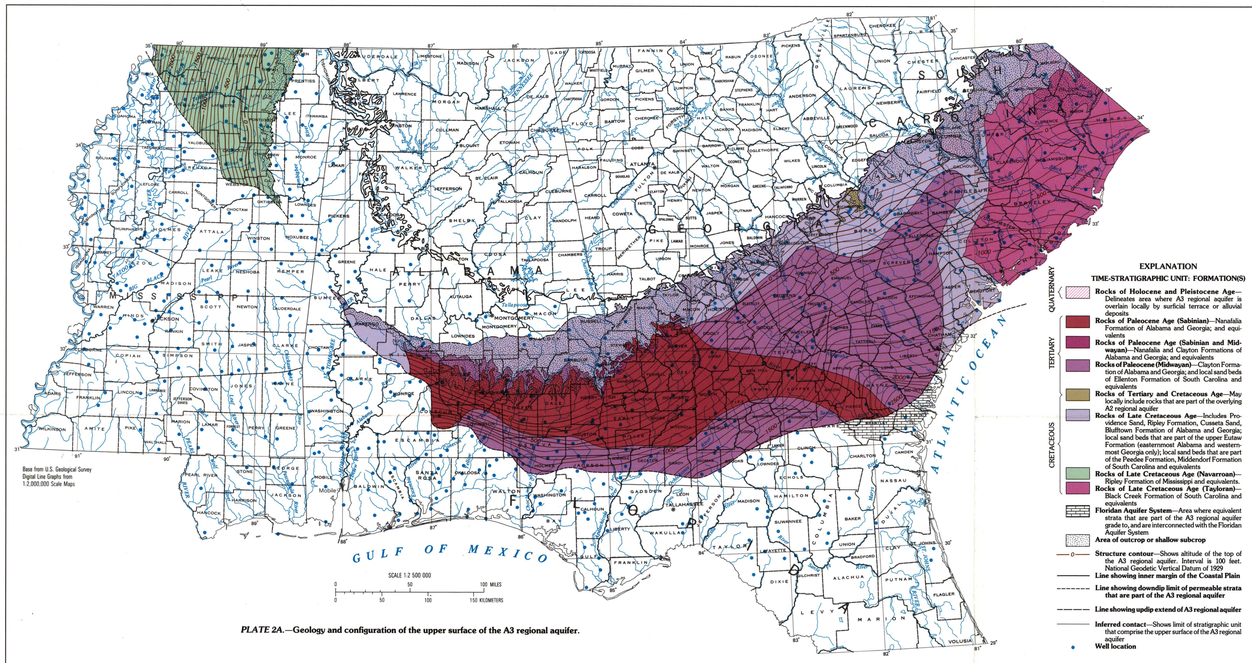

PLATE 2A.—Geology and configuration of the upper surface of the A3 regional aquifer.

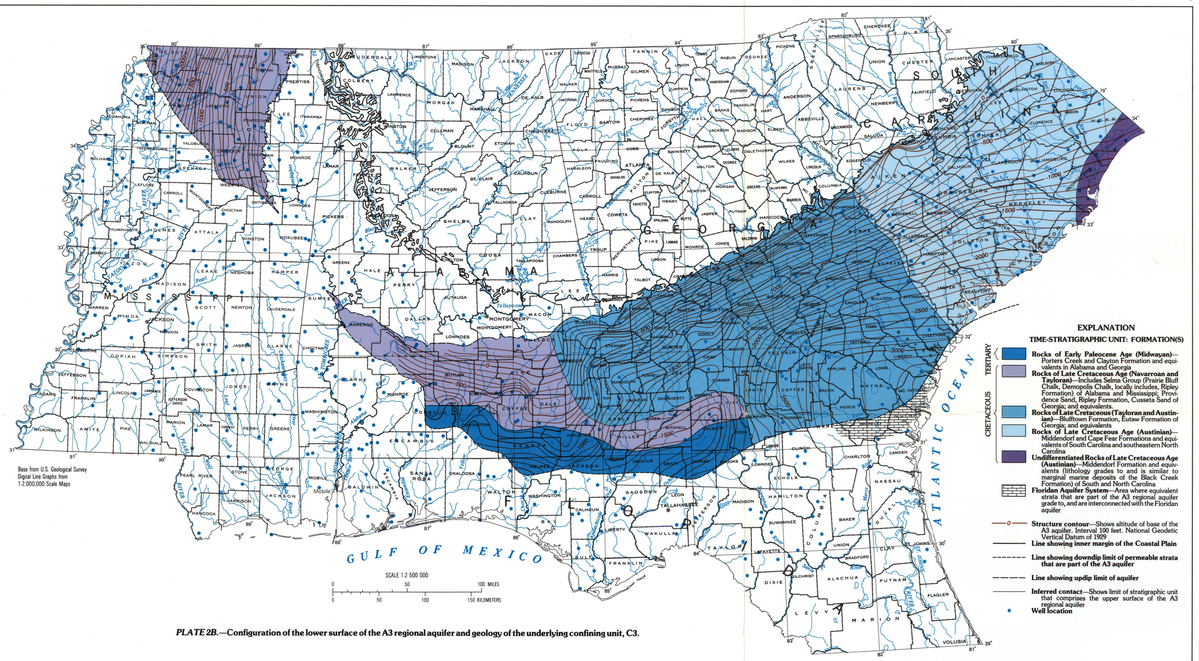

PLATE 2B.—Configuration of the lower surface of the A3 regional aquifer and geology of the underlying confining unit, C3.

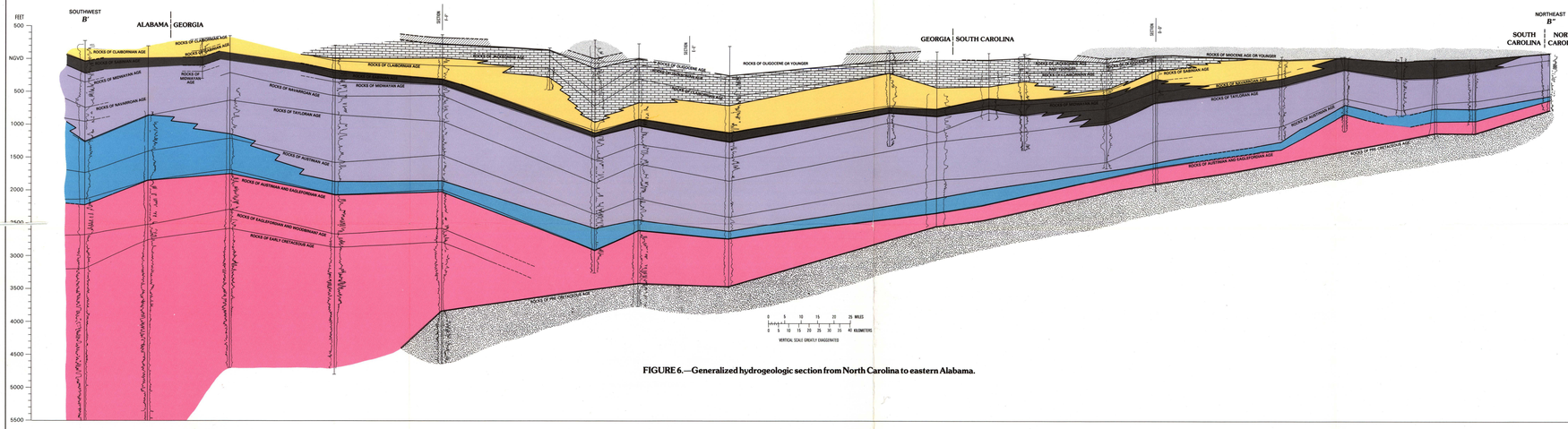

FIGURE 6.—Generalized hydrogeologic section from North Carolina to eastern Alabama.

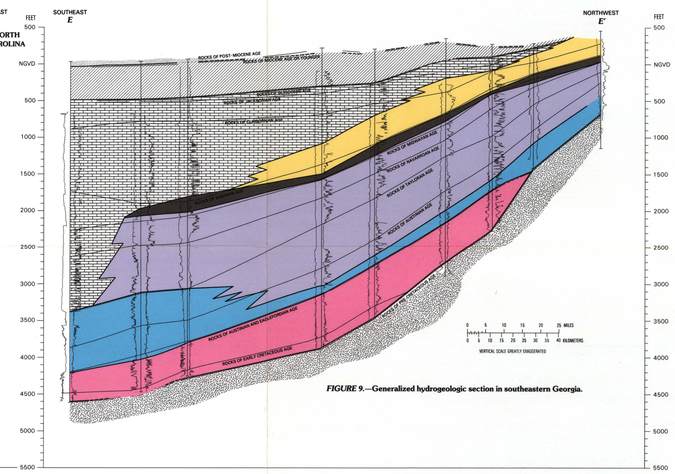

FIGURE 9.—Generalized hydrogeologic section in southeastern Georgia.

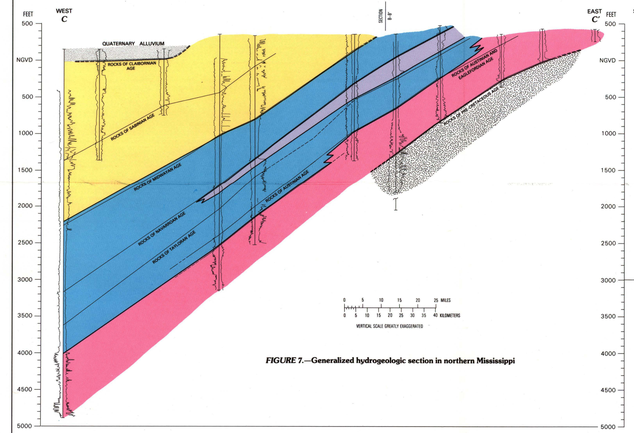

FIGURE 7.—Generalized hydrogeologic section in northern Mississippi

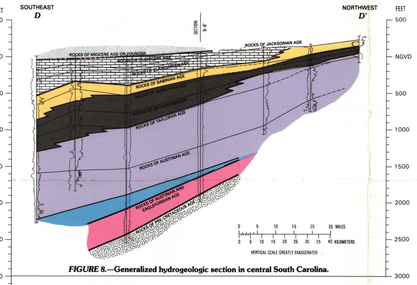

FIGURE 8.—Generalized hydrogeologic section in central South Carolina.

EXPLANATION FOR FIGURES 6, 7, 8, 9 and 10

- SURFICIAL AQUIFER
- UPPER CONFINING UNIT
- FLORIDAN AQUIFER SYSTEM
- SOUTHEASTERN COASTAL PLAIN AQUIFER SYSTEM
  - A2, aquifer unit
  - C2, confining unit
  - A3, aquifer unit
  - C3, confining unit
  - A4, aquifer unit
- BASE OF SYSTEM
- AQUIFER-CONFINED BED BOUNDARY—Dashed where uncertain
- TIME-STRATIGRAPHIC BOUNDARY—Dashed where uncertain

A3 REGIONAL AQUIFER

Sand, sandstone, gravel and minor limestone beds that are locally interbedded and interlaminated with clay, shale, marl, mudstone and chalk together comprise the A3 regional aquifer unit (plate 2A). Rocks of the A3 aquifer were deposited under marine to nonmarine conditions during Late Cretaceous (Austinian Stage) to Paleocene (Sabinian Stage) time (table 1). The bedding character, texture, and lithology of this aquifer is highly varied as a result of these diverse depositional conditions. Water-bearing zones within the A3 aquifer consist largely of fine to coarse grained quartz sand that is glauconitic and feldspathic in places, and occurs in massive to thin beds that are generally lenticular to wedgeshaped. In addition, many of these water-bearing zones tend to be fossiliferous, calcareous, carbonaceous, and micaceous. Sandy, glauconitic, highly permeable limestone beds of local extent are also part of the A3 aquifer in some areas.

The A3 aquifer extends as a continuous unit from North Carolina to central Alabama. In western Alabama and east-central Mississippi, however, the aquifer is absent; a correlative sand aquifer, albeit not hydraulically interconnected, is present in northern Mississippi (shown on map) and extends northward and northwestward to Tennessee, Kentucky, Illinois, Missouri, and Arkansas where it is part of the Gulf Coast aquifer system (Grubb, 1984). The A3 aquifer crops out in three areas: a 25- to 60-mile wide band that extends southwestward from North Carolina into South Carolina; a narrower band about 15 to 40 miles wide that extends westward into Alabama from central Georgia; and a thin band about 2 to 15 miles wide that extends southward from northern Mississippi. In western South Carolina and eastern Georgia, the A3 aquifer is covered by younger overlapping rocks and consequently crops out in a discontinuous pattern.

The landward limit of the A3 aquifer is westward and coastward of the inner Coastal Plain margin in Mississippi and Alabama, respectively; in Georgia, South Carolina, and southwestern North Carolina, the landward limit of the aquifer occurs at or near the Fall Line. The upper surface of the aquifer slopes gently toward the coast at a gradient of 15 to 20 feet per mile in South Carolina, Georgia, and Alabama. As is true of the overlying A2 aquifer and intervening confining units, the upper surface of the A3 aquifer dips to the west in northern Mississippi at a steeper gradient of 30 to 40 feet per mile. The hydraulic conductivity of the water-bearing zones within the A3 aquifer diminishes at depth as the sandy strata of this unit grade into calcareous shale and chalk; the permeable parts of the A3 aquifer thin greatly seaward as a result (figs. 10, 11, and 12). This is not true everywhere. For example, the A3 aquifer grades into permeable limestone that is part of the Floridan aquifer system in southeast Georgia (fig. 9).

Outcropping rocks of the A3 aquifer consist largely of sand, sandstone and gravel of Late Cretaceous age (Austinian to Navarroan Stages). Younger sand and limestone beds of Paleocene age form the upper surface of the A3 aquifer in a narrow band that extends from central Alabama to central Georgia and marks the southern limit of the outcropping parts of the A3 aquifer. Paleocene strata also form the top of the aquifer where it extends coastward into the subsurface and eastward into South Carolina. Fossiliferous, glauconitic quartz sand equivalent to the outcropping Nanafalia Formation of Paleocene age (Sabinian Stage) found in the middip areas of Alabama and western Georgia comprises the youngest sediments that are part of the A3 aquifer. These sand beds grade into calcareous shale to the south. Consequently, underlying Paleocene limestone of the Clayton Formation (Midwayan Stage) marks the top of the aquifer in downdip areas of southwestern Georgia and southeastern Alabama. These strata consist largely of coarsely glauconitic, fossiliferous, crystalline and sandy limestone, but also include calcareous, glauconitic quartz sand. The limestone beds are hydraulically interconnected with underlying permeable clastic beds of Tertiary and Cretaceous age but are separated from the Floridan aquifer system (also a limestone) by sand and clay of the overlying A2 regional aquifer and C2 regional confining beds. Therefore, the Paleocene limestone is included as part of the A3 regional aquifer, even though it consists largely of highly permeable carbonate rock. In central and eastern Georgia, these limestone beds grade into an arenaceous facies that consists of calcareous, fine to coarse grained, fossiliferous quartz sand.

Rocks of Late Cretaceous age that are part of the A3 aquifer where it crops out in northeastern Mississippi, eastern Alabama, and western Georgia consist mostly of marine to shallow marine, fine to coarse grained quartz sand that is highly glauconitic, commonly fossiliferous, and typically massively bedded. The A3 aquifer includes the outcropping marine, glauconitic, quartz sand of the Ripley Formation present in northwestern Mississippi; conversely, the lithic character of equivalent Cretaceous rocks is more variable in eastern Alabama and in western and central Georgia. In those latter areas, the aquifer consists of shallow marine to nonmarine, feldspathic and locally glauconitic quartz sand and gravel that is in places interbedded with ferruginous, kaolinitic, and carbonaceous clay. Rock-stratigraphic units that are part of the A3 aquifer in these areas include the Providence Sand, Ripley Formation, Cusseta Sand, Blufftown Formation, and local beds that are considered to be equivalent to the upper part of the Eutaw Formation. In outcrop and shallow subsurface areas of southeastern South Carolina, the A3 aquifer consists of massively bedded, fluvial-deltaic quartz sand of the Middendorf Formation that grades seaward to a marginal marine sequence of lenticular water-bearing zones that are interbedded and interlaminated with carbonaceous, silty clay of the Black Creek Formation.

C3 REGIONAL CONFINING UNIT

The configuration of the upper surface of the C3 confining unit, which is the same as the basal surface of the A3 regional aquifer, is shown on plate 2B. A thick sequence of low-permeability rocks that comprise this confining unit are associated with five stratigraphic units which effectively separate the A3 aquifer from deeper permeable strata. The C3 confining unit consists of highly oxidized, nonmarine, sandy and silty clay in shallow updip areas of South Carolina and northeastern Georgia, but in other areas grades into marginal marine and marine calcareous clay, shale, mudstone, marl, and chalk.

In middip areas of South Carolina, and in adjacent counties of North Carolina, an extensive clay horizon that forms the C3 confining unit is considered, in part, equivalent to the outcropping Middendorf or Cape Fear Formations. Here, the confining unit is made up of nonmarine (fluvial-deltaic), noncalcareous, sparsely fossiliferous, mottled reddish brown to greenish gray, sandy to silty clay that is interlaminated with fine micaceous sand; minor constituents include hematite, limonite, and siderite. In downdip sections of South Carolina and southeastern North Carolina, the C3 confining unit consists of a moderately thick succession of marginal marine to nearshore marine, sandy clay beds that are lithologically similar to the Black Creek Formation. Here, the confining unit embodies gray clay that is interlaminated with fine grained micaceous sand and lignite; pyrite, shell material, foraminifera, and ostracoda are common.

In much of Georgia, the low-permeability beds that form the C3 confining unit are considered equivalent to the clay of the Eutaw Formation or the lower part of the Blufftown Formation of Late Cretaceous age (Austinian and Tayloran Stages) as shown on figure 10. The lithic character of the C3 confining unit here is chalky, micaceous, calcareous, carbonaceous clay that is silty and sandy in places. Minor amounts of glauconite, phosphate, and chlorite are locally present.

Chalk, shale, and clay of the Selma Group make up the C3 confining unit in the eastern Alabama Coastal Plain and in downdip sections of southwestern Georgia (fig. 10). Here, the confining unit includes gray to brown marl, chalk, and marine clay of Late Cretaceous age (Austinian and Navarroan Stages) that is locally micaceous, fossiliferous, and sandy. Similar marine deposits of fossiliferous and calcareous shale, chalky marl, and chalk that are part of the Selma Group comprise the C3 confining unit in northern Mississippi.

Marine, micaceous, calcareous to carbonaceous clay and shale that is locally interbedded with minor limestone and fine glauconitic sand comprise the C3 confining unit in the extreme southwestern Georgia and southeastern Alabama Coastal Plain. These rocks are considered to be stratigraphically equivalent to the lowest parts of the Porters Creek Formation and Clayton Formation of early Paleocene age (Midwayan Stage) as shown on figure 11.

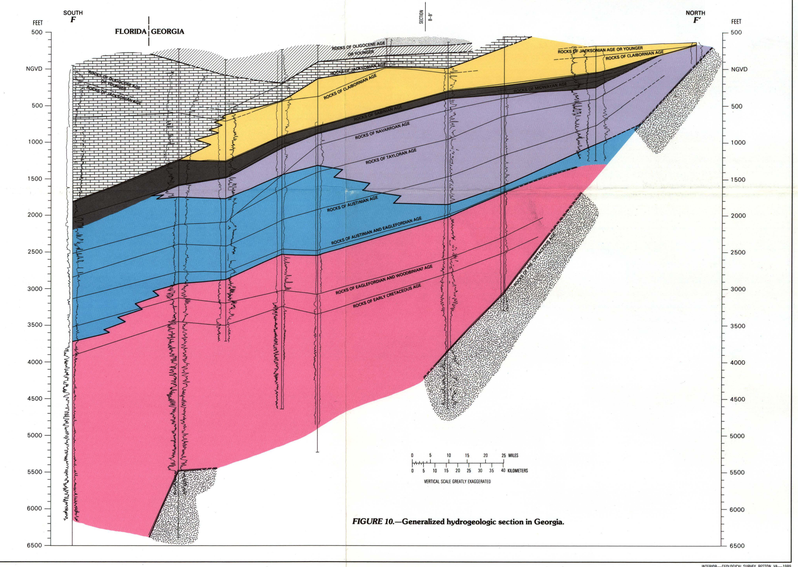

FIGURE 10.—Generalized hydrogeologic section in Georgia.

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1989

HYDROGEOLOGY OF CLASTIC TERTIARY AND CRETACEOUS REGIONAL AQUIFERS AND CONFINING UNITS IN THE SOUTHEASTERN COASTAL PLAIN AQUIFER SYSTEM OF THE UNITED STATES

By
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