GLACIAL-DEPOSIT AQUIFERS—
Continued

The distribution of the numerous sand and gravel beds that make up the glacial-deposit aquifers and the clay and silt confining units that are interbedded with them is extremely complex. The multiple advances of lobes of continental ice originated from different directions and different materials were eroded, transported, and deposited by the ice, depending on the predominant rock types in its path. When the ice melted, coarse-grained sand and gravel outwash was deposited near the ice front, and the meltwater streams deposited successively finer material farther and farther downstream. During the next ice advance, heterogenous deposits of poorly permeable till might be laid down atop the sand and gravel outwash. Small ice patches or terminal moraines dammed some of the meltwater streams, causing large lakes to form. Thick deposits of clay, silt, and fine sand accumulated in some of the lakes and these deposits form confining units where they overlie sand and gravel beds. The glacial-deposit aquifers are either localized in bedrock valleys or are in sheetlike deposits on outwash plains.

The valley-fill glacial-deposit aquifers (**fig. 12*A***) might be buried beneath till, glacial-lake deposits, or shallower sand and gravel aquifers. Where the bedrock valleys are completely filled, the locations of the ancestral channels and the coarse-grained sediments they contain may not be evident at the land surface. In the example shown in **figure 12*A***, two glacial-deposit aquifers are separated by a clay and silt confining unit that restricts the flow of water between them. The shallower aquifer receives direct recharge from precipitation, and water moves along short flow paths in the aquifer to discharge at local streams. Some water percolates downward through the fine-grained confining unit to recharge the deeper, buried aquifer and moves along more lengthy flow paths before discharging to larger streams. Valley-fill glacial-deposit aquifers in bedrock valleys are much more common than glacial-deposit aquifers in outwash plains.

Aquifers in the sand and gravel of glacial outwash plains (**fig. 12*B***) commonly are exposed at the land surface and receive direct recharge from precipitation. Water in the upper parts of these aquifers discharges to local streams, lakes, or wetlands. Water in the deeper parts of the aquifers, however, flows beneath the local surface-water bodies and discharges to large rivers that are regional drains. Lenslike beds of clay and silt are interspersed with the permeable sand and gravel, and locally create confined conditions in the aquifers. Large yields are common from wells completed in aquifers composed of glacial outwash.

Local movement of water in the glacial valley-fill aquifers generally is from the valley walls toward streams (**fig. 13**); regional movement of water is down the valley in the direction of stream flow. Where these aquifers occupy channels in permeable bedrock, they generally receive much of their recharge from the bedrock, but locally discharge some water to it.

Yields of wells completed in the glacial-deposit aquifers formed by continental glaciers are as much as 3,000 gallons per minute where the aquifers consist of thick sand and gravel. Locally, yields of 5,000 gallons per minute have been obtained from wells completed in glacial-deposit aquifers that are located near rivers and can obtain recharge from the rivers. Aquifers that were formed by mountain glaciers yield as much as 3,500 gallons per minute in Idaho and Montana, and wells completed in mountain-glacier deposits in the Puget Sound area yield as much as 10,000 gallons per minute.

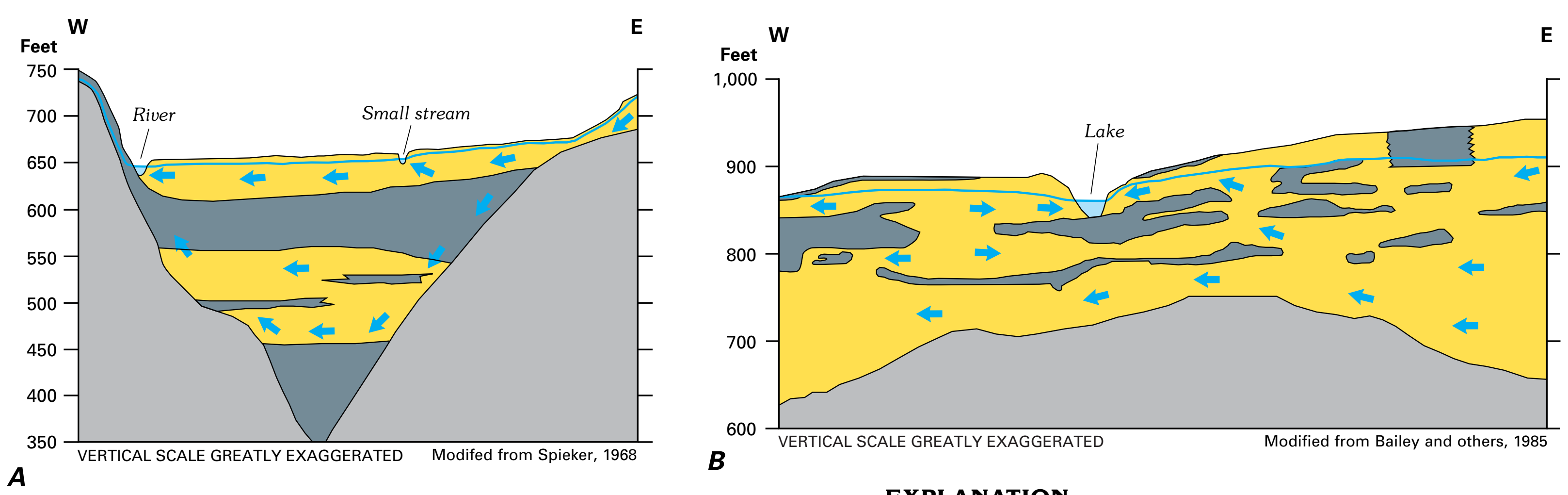


Figure 12. *Most glacial-deposit aquifers are in bedrock valleys (A) and might be hydraulically separated from deeper aquifers by clay and silt confining units. Sand and gravel in glacial outwash plains (B) receive recharge directly from precipitation, and the thick sequences of sand and gravel yield large volumes of water to wells.*

EXPLANATION

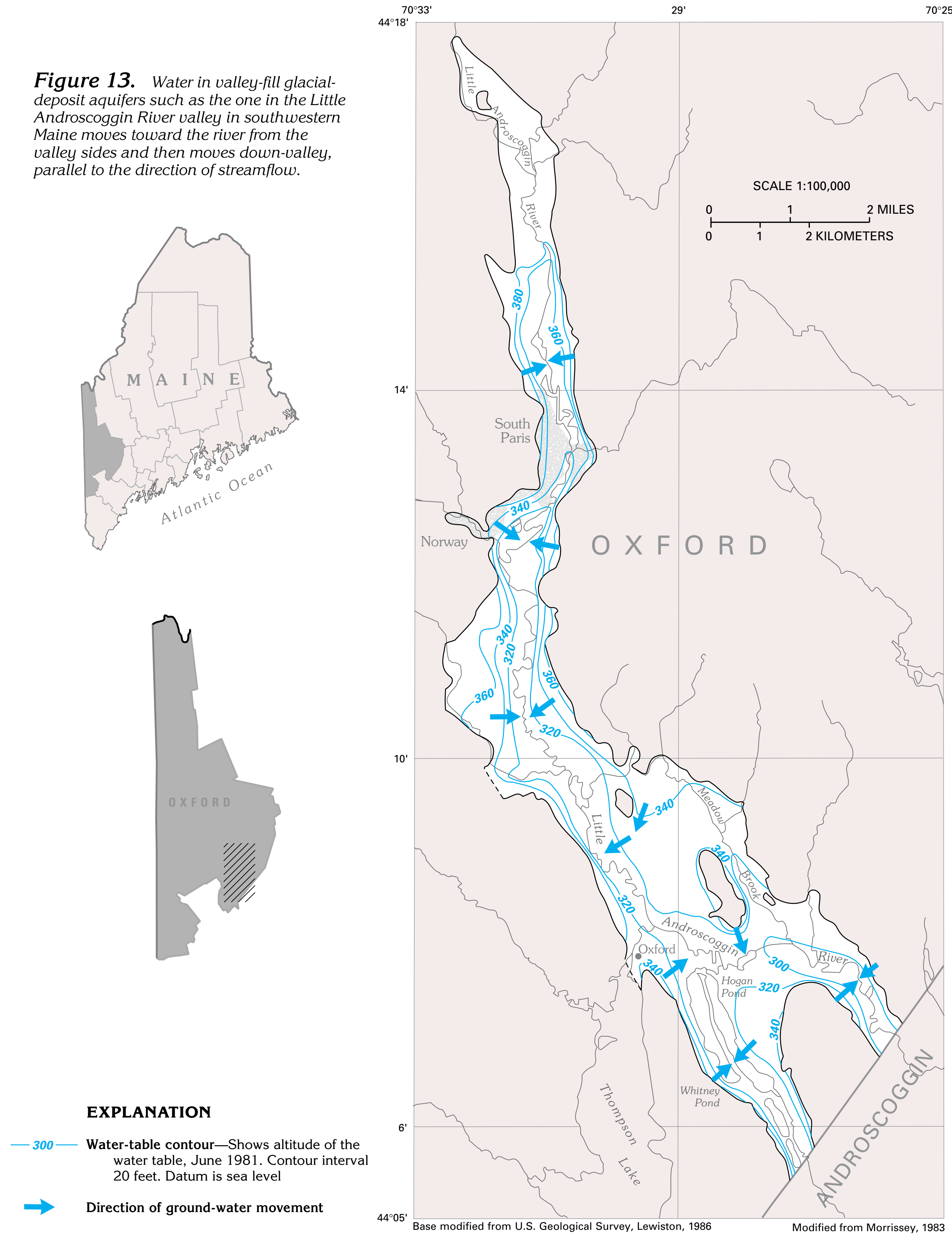
Sand and gravel aquifers

Generally clay and silt

Bedrock

Direction of ground-water movement

Figure 13. *Water in valley-fill glacial-deposit aquifers such as the one in the Little Androscoggin River valley in southwestern Maine moves toward the river from the valley sides and then moves down-valley, parallel to the direction of streamflow.*



Semiconsolidated sand aquifers

SEMICONSOLIDATED SAND AQUIFERS

Sediments that primarily consist of semiconsolidated sand, silt, and clay, interbedded with some carbonate rocks, underlie the Coastal Plains that border the Atlantic Ocean and the Gulf of Mexico. The sediments extend from Long Island, New York, southwestward to the Rio Grande, and generally form a thick wedge of strata that dips and thickens seaward from a featheredge at its updip limit. Coastal Plain sediments are water-laid and were deposited during a series of transgressions and regressions of the sea. Depositional environments ranged from fluvial to deltaic to shallow marine, and the exact location of each environment depends upon the relative position of land masses, shorelines, and streams at a given point in geologic time. Complex interbedding and variations in lithology result from the constantly-changing depositional environments. Some beds are thick and continuous for tens to hundreds of miles, whereas others are traceable only for short distances. Consequently, the position, shape, and number of the bodies of sand and gravel that form aquifers in these sediments varies greatly from place to place.

The semiconsolidated sand aquifers have been grouped into five aquifer systems (**fig. 4**) which interfinger with and grade into each other. Within each aquifer system, the numerous local aquifers have been grouped into regional aquifers that are separated by regional confining units consisting primarily of silt and clay, but locally are beds of shale or chalk. The rocks that comprise these aquifer systems are of Cretaceous and Tertiary age. In general, the older rocks crop out farthest inland, and successively younger rocks are exposed coastward.

The Southeastern Coastal Plain aquifer system in Atlas Segments 5 and 6 (**fig. 14**) is a representative example of a complex aquifer system in semiconsolidated sediments. The predominantly clastic sediments that comprise the aquifer system crop out or are buried at shallow depths in large parts of Mississippi and Alabama, and in smaller areas of Georgia and South Carolina; toward the coast, the aquifer system is covered either by shallower aquifers or confining units. Some of the aquifers and confining units of the Southeastern Coastal Plain aquifer system grade laterally into adjacent clastic aquifer systems in North Carolina, Tennessee, and Mississippi and adjacent States to the west; some also grade vertically and laterally southeastward into carbonate rocks of the Floridan aquifer system.

Numerous geologic formations have been identified in the complexly interbedded rocks of the Southeastern Coastal Plain aquifer system. Likewise, many local aquifers and confining units are present in the area underlain by the aquifer system. Based on similarities in their hydraulic characteristics and water levels, sequences of local aquifers can be grouped into regional aquifers; sequences of local confining units can be grouped into regional confining units in the same manner.

The sediments of the Southeastern Coastal Plain aquifer system have been grouped into four regional aquifers separated by three regional confining units. The principal geologic formations that comprise these regional hydrogeologic units are shown in **figure 15**. The regional aquifers chiefly consist of coarse to fine sand, but some locally include beds of gravel and limestone. In each aquifer, the coarser-grained material, such as gravel and coarse sand, generally is farthest inland near sediment source areas; the amount of silt and clay increases coastward. The regional confining units are mostly clay and mudstone with local shale beds except for a thick sequence of chalk in Alabama and Mississippi (the Selma Group) which forms an effective confining unit. Each of the regional aquifers is named for a major river along which the sediments that comprise the aquifer are well exposed. From shallowest to deepest, the regional aquifers are the Chickasawhay River aquifer, the Pearl River aquifer, the Chattahoochee River aquifer, and the Black Warrior River aquifer (**fig. 15**). Each regional confining unit bears a name similar to that of the aquifer it overlies; for example, the Pearl River confining unit overlies the Pearl River aquifer and separates it from the shallower Chickasawhay River aquifer (**fig. 15**). All the regional hydrogeologic units are not present everywhere in the coastal plain. For example, the Chickasawhay River aquifer occurs only in southern Mississippi and southwestern Alabama; the Chattahoochee River aquifer is absent in a large area in western Alabama and southeastern Mississippi, and so on.

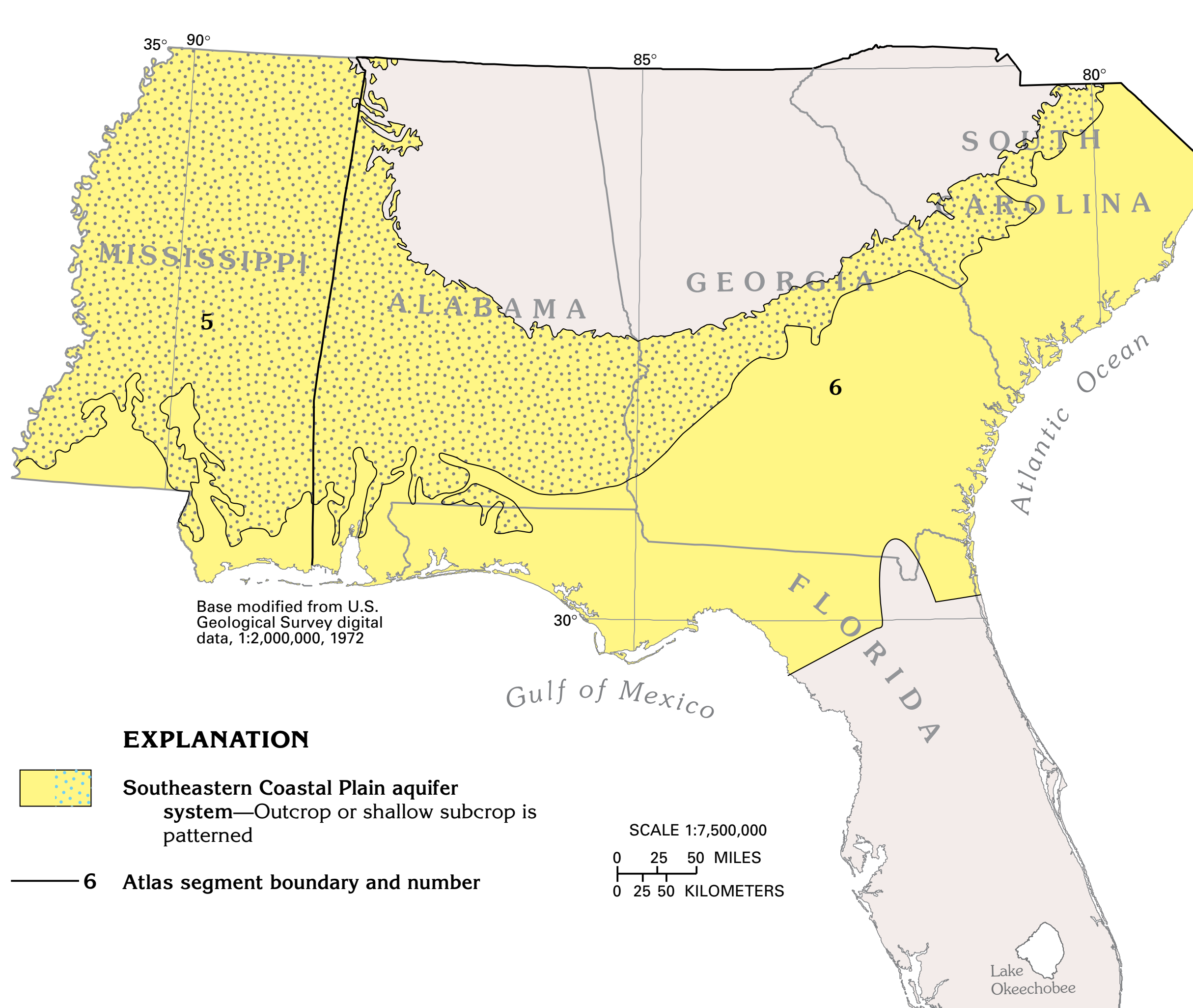


Figure 14. *The Southeastern Coastal Plain aquifer system underlies the coastal plains of Mississippi, Alabama, Georgia, and South Carolina, and is in parts of Atlas Segments 5 and 6.*

Modified from Miller, 1992; and Barker and Pernik, 1994

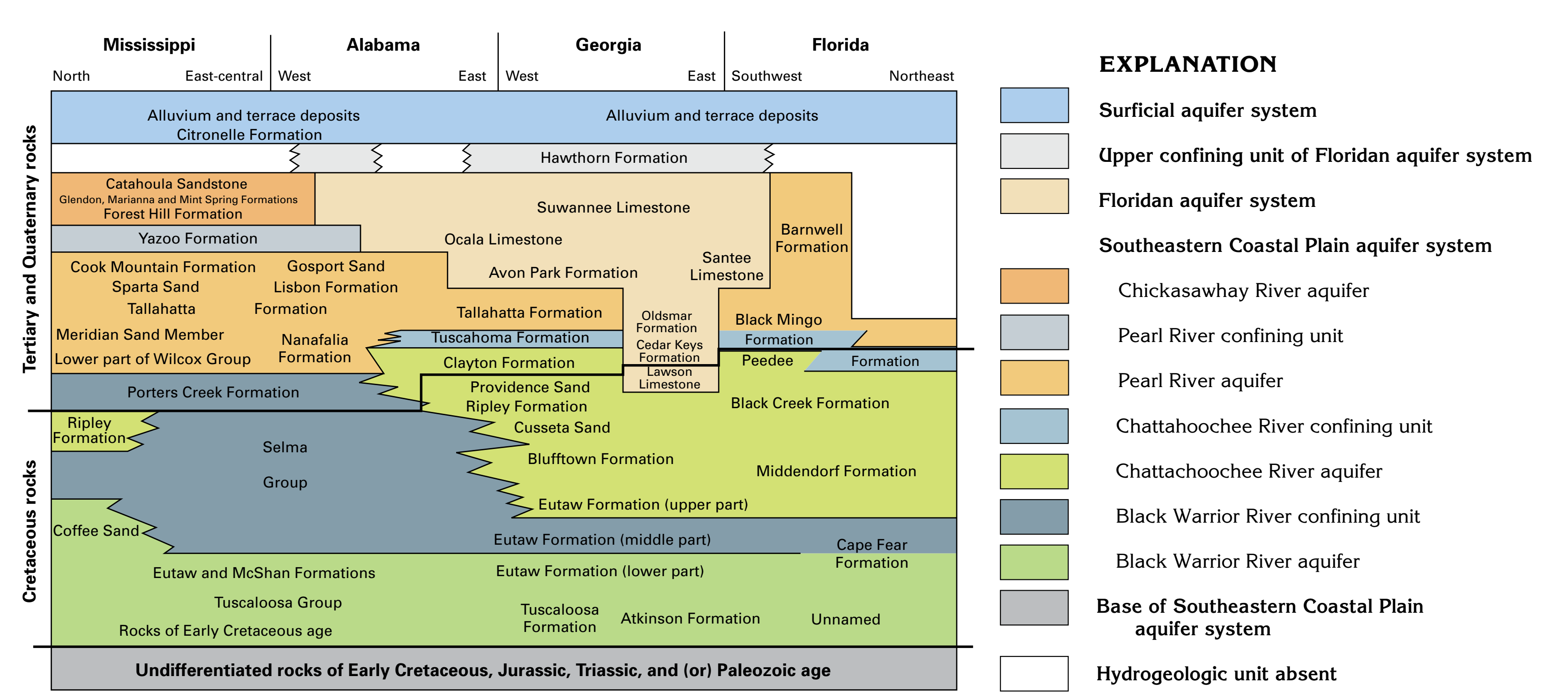


Figure 15. *The large number of geologic formations that comprise the Southeastern Coastal Plain aquifer system can be grouped into four regional aquifers, each named for a major river that crosses the aquifer outcrop area, and three regional confining units. The chart does not show exact correlations of the geologic units.*