CHEMICAL AND PHYSICAL PROPERTIES

The areal distribution of dissolved-solids concentrations, temperature, primary water type, and pH are shown on maps and discussed in the following sections. The dissolved-solids concentrations and temperature are shown to the downdip limit of the aquifer. The abundance of geophysical well logs (Grubb, 1986, and Wilson and Hosman, 1988), both onshore and offshore, make it possible to estimate both dissolved-solids concentrations and temperature throughout a large area where data from water samples are not available. Primary water type and pH generally are not shown in the deeper part of the Mississippi embayment aquifer system area because of a lack of data.

Dissolved-Solids Concentrations

The concentration of dissolved solids in water from the lower Claiborne-upper Wilcox aquifer, based on the median values of all samples in each 100-square-mile area, ranges from 25 mg/L in the outcrop area to 122,300 mg/L in a downdip area of Louisiana (table 1). Concentrations larger than 10,000 mg/L are depth-averaged values as described by Pettijohn and others (1988). The trend noted above indicates that the concentration of dissolved solids increases in a downdip direction. The largest increase occurs in an area adjoining the southern edge of the Sabine uplift near the Sabine River (fig. 5).

From the Sabine uplift eastward to southwestern Alabama the concentration of dissolved solids ranges from about 25 to 500 mg/L in the outcrop area and in most of the northern and eastern part of the Mississippi embayment aquifer system area. In the area east of the Sabine uplift and mostly west of the Mississippi River the concentration increases from 500 mg/L in east-central Arkansas to more than 70,000 mg/L along the downdip limit of the aquifer in central Louisiana. The largest increase in concentration, 1,000 to 70,000 mg/L, occurs in about 25 mi in the area adjoining the southern edge of the Sabine uplift near the Sabine River.

From the Sabine uplift southwestward to the San Marcos arch the concentration of dissolved solids ranges from less than 500 to 1,000 mg/L in both the outcrop and most of the area from the outcrop to the downdip limit of the aquifer. The exception is the area around the San Marcos arch where the concentration increases from about 1,000 mg/L near the outcrop to more than 10,000 mg/L near the downdip limit of the aquifer. From the San Marcos arch southwestward to the Rio Grande the concentration also ranges from less than 500 to 1,000 mg/L in the outcrop and increases to more than 3,000 mg/L along the downdip limit of the aquifer. The increase in concentration of dissolved solids from updip limit to downdip limit is attributed to mineral-water interaction such as dissolution of silicates in outcrop areas and the dissolution of evaporites comprising salt domes in the deeper downdip parts of the aquifer (fig. 4).

Temperature

The temperature of water from the lower Claiborne-upper Wilcox aquifer, based on combined depth-averaged values and the median values of all samples in each 100-square-mile area, ranges from 13 degrees Celsius in the outcrop area to 74 degrees Celsius in a downdip area of southern Texas (table 1). The temperature generally increases from the outcrop to the downdip limit of the aquifer (fig. 5).

From the Sabine uplift eastward to southwestern Alabama the temperature generally increases from 20 to 30 degrees Celsius where the concentration of dissolved solids ranges from 500 to 10,000 mg/L. In areas where the concentration ranges from 10,000 to more than 70,000 mg/L the temperature increases to more than 50 degrees Celsius. From the Sabine uplift southwestward to the Rio Grande the temperature increases from 20 to 30 degrees Celsius where the concentration of dissolved solids ranges from about 500 to 1,000 mg/L. The temperature increases to more than 70 degrees Celsius in southern Texas where the concentration of dissolved solids ranges from 1,000 to more than 10,000 mg/L. Ground water in more than one-half the aquifer area has temperatures of less than 30 degrees Celsius.

Primary Water Type

The primary water types in the lower Claiborne-upper Wilcox aquifer, which are based on the most frequently observed type (mode) in each 100-square-mile area, are calcium bicarbonate and sodium bicarbonate (fig. 6). Calcium bicarbonate is the primary water type in northeastern Arkansas, western Tennessee, southeastern Missouri, and in most of the outcrop area. Sodium bicarbonate is the primary water type in Texas, Louisiana, Mississippi, and western Kentucky. The primary water type in the downdip area, which is generally sodium chloride in most other aquifers of the gulf coast aquifer systems, is not shown due to the lack of data.

pH

The pH of water from the lower Claiborne-upper Wilcox aquifer, based on the median values of all samples in each 100-square-mile area, ranges from 5.1 in the outcrop area of eastern Texas to 8.8 near the downdip limit of the data in southwestern Alabama (table 1). The pH in the outcrop area ranges from more than 5 but less than 8 (fig. 7). From the outcrop to the downdip limit of the data the pH ranges from about 7.0 to less than 9.0. The pH generally increases from the outcrop area southward to the downdip limit of the data. No trend in pH is indicated from east to west in the aquifer.

CHEMICAL CONSTITUENT

The areal distributions of eight constituents in ground water from the lower Claiborne-upper Wilcox aquifer are shown on maps and discussed below. The constituents mapped are the major chemical components in ground water of the Gulf Coastal Plain. Lines of equal concentration of constituents generally are absent between the Sabine uplift and the Mississippi River in a large area extending from central Arkansas southward to central Louisiana and in areas near the downdip limit of the aquifer that extends from Alabama westward to the Rio Grande due to the lack of data.

Calcium

The concentration of dissolved calcium in water from the lower Claiborne-upper Wilcox aquifer, based on the median values of all samples in each 100-square-mile area, ranges from 0.10 mg/L in northwestern Mississippi to 1,075 mg/L in east-central Louisiana near the downdip limit of the aquifer (table 1). However, lines of equal concentration were not extended into the area of the upper range of the concentration because it was the only data point in a very large area of the aquifer. The concentration of dissolved calcium in the aquifer appears to decrease from the outcrop to the downdip limit of the data in west-central Mississippi and in the area extending from the Trinity River southwestward to the Rio Grande (fig. 8).

From the Sabine uplift eastward to southwestern Alabama the concentration of dissolved calcium ranges from about 1 to less than 50 mg/L except for an area in east-central Arkansas where it exceeds 50 mg/L and another area adjoining the southeastern edge of the Sabine uplift in Louisiana where it exceeds 100 mg/L. East of the Mississippi River in central Mississippi the concentration decreases from about 10 mg/L along the outcrop to about of 5 mg/L near the downdip limit of the data. Elsewhere east of the Sabine uplift the change in concentration appears to have no areal trend.

From the Sabine uplift southwestward to the San Marcos arch the concentration of dissolved calcium generally ranges from 5 to 50 mg/L in the outcrop area and from 5 to 10 mg/L in the area from the outcrop to the downdip limit of the data except for a small area downdip between the Trinity and Neches Rivers where the concentration exceeds 100 mg/L. From the San Marcos arch southwestward to the Rio Grande the concentration ranges from about 10 to more than 100 mg/L in both the outcrop area and the area between the outcrop and updip and generally decreases to 5 mg/L along the downdip limit of the data in southern Texas.

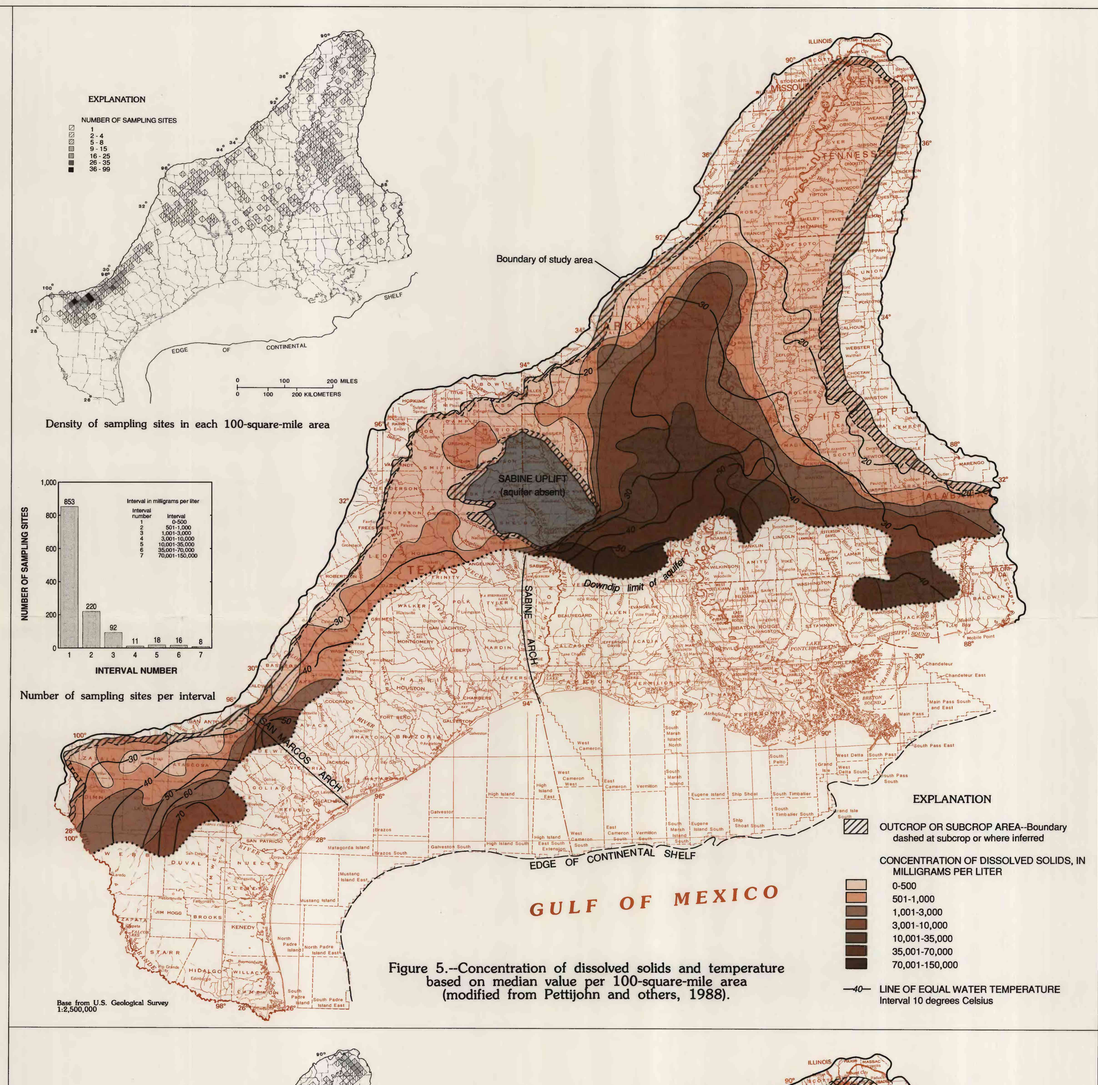

Figure 5.--Concentration of dissolved solids and temperature based on median value per 100-square-mile area (modified from Pettijohn and others, 1988).

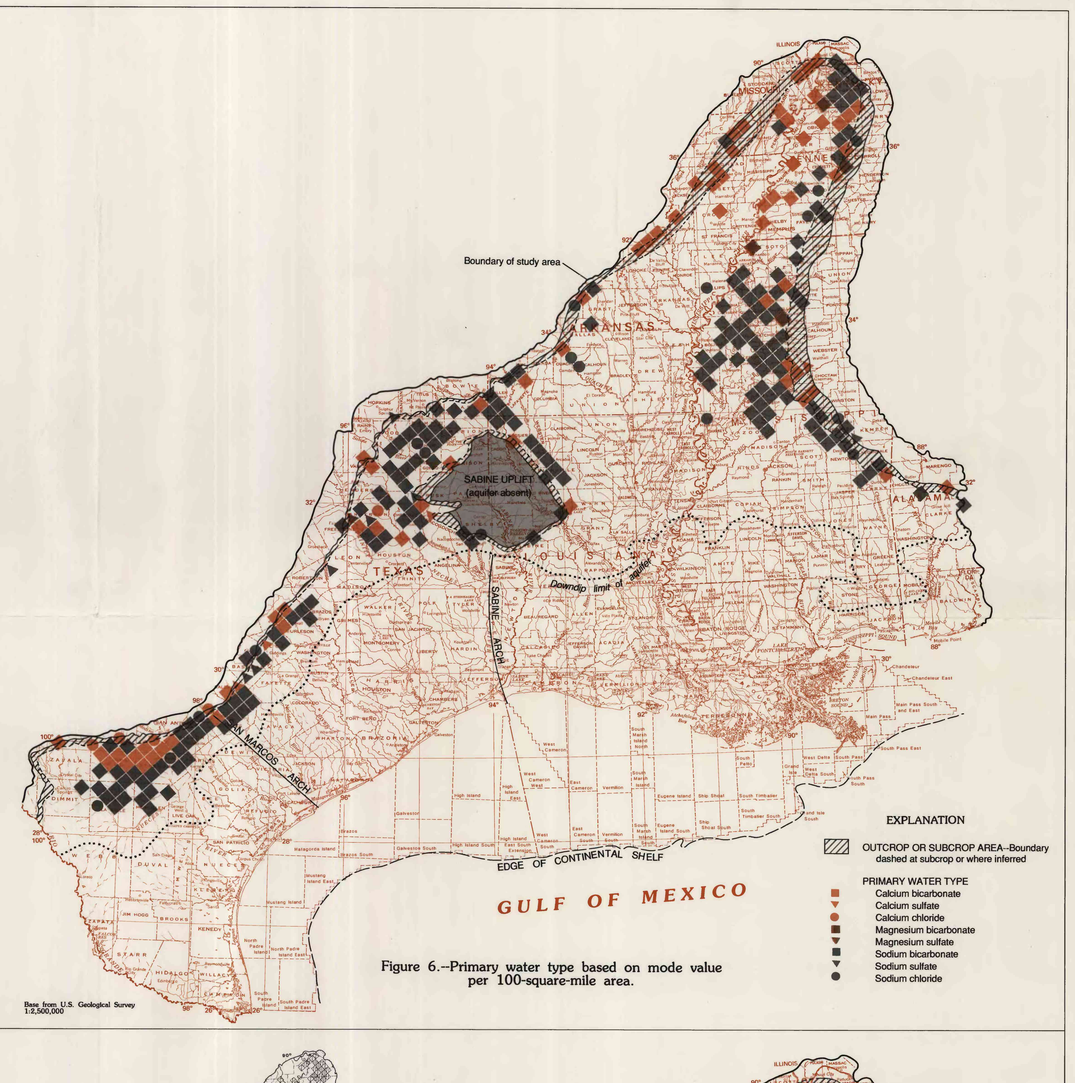

Figure 6.--Primary water type based on mode value per 100-square-mile area.

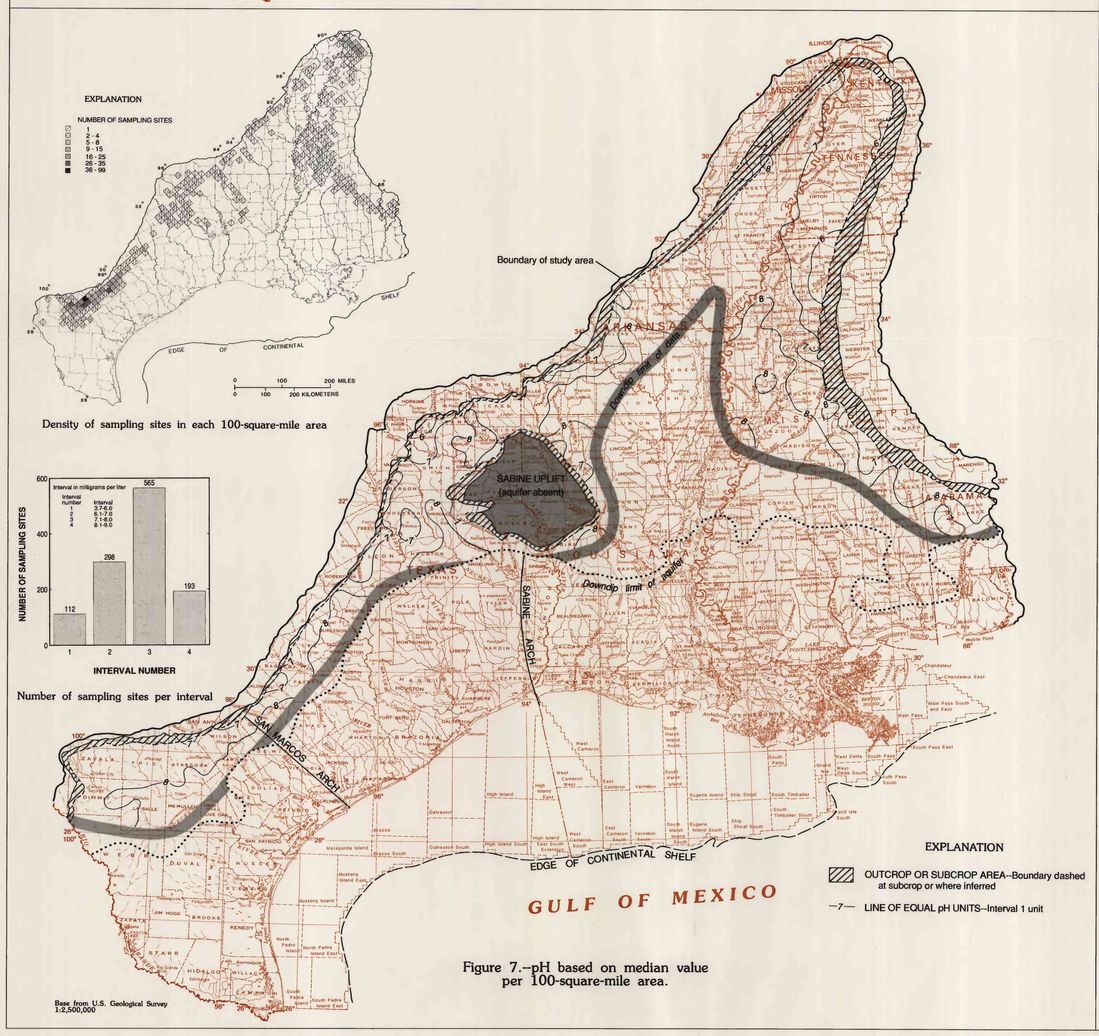

Figure 7.--pH based on median value per 100-square-mile area.

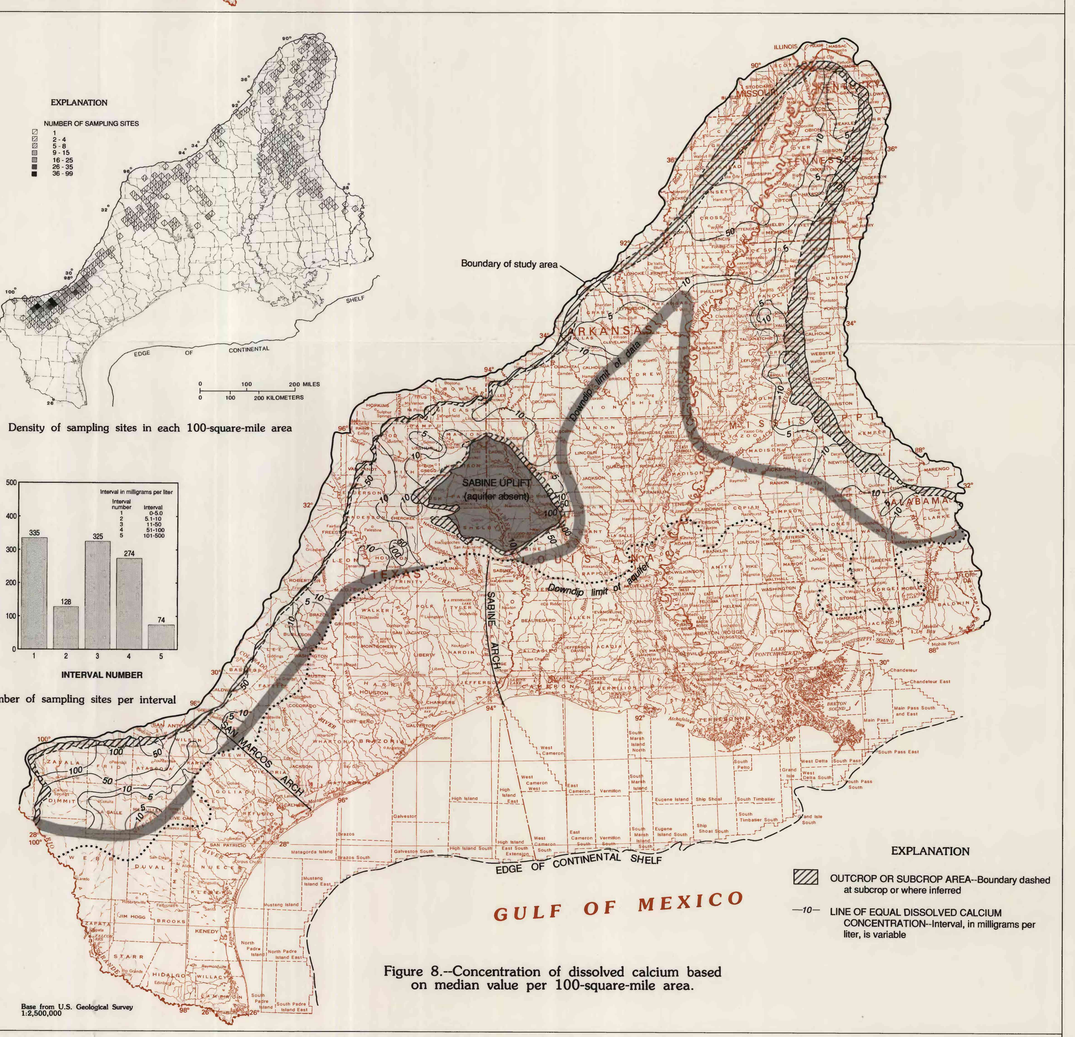

Figure 8.--Concentration of dissolved calcium based on median value per 100-square-mile area.

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PROPERTIES AND CHEMICAL CONSTITUENTS IN GROUND WATER FROM THE LOWER CLAIBORNE-UPPER WILCOX AQUIFER, GULF COAST REGIONAL AQUIFER SYSTEMS, SOUTH-CENTRAL UNITED STATES

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