CHEMICAL AND PHYSICAL PROPERTIES

The areal distributions 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 permeable zone E. 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 offshore because of a lack of data.

Dissolved-Solids Concentrations

The concentration of dissolved solids in water from permeable zone E, based on median values of all samples in each 100-square-mile area, ranges from 20 mg/L in the outcrop area to 221,300 mg/L in a downdip area in southern 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 downdip, 500 to 35,000 mg/L, in about 10 mi, occurs east of the Mississippi River (fig. 5).

From the Sabine arch eastward to the western edge of Florida the concentration of dissolved solids in the outcrop area generally ranges from 20 to 500 mg/L. An exception is a small area west of the Mississippi River (near the Ouachita River) where the concentration ranges from 500 to 1,000 mg/L. From the outcrop to about middip in the area east of the Mississippi River the concentration generally is less than 500 mg/L; at middip the concentration increases in a downdip direction from 500 to 35,000 mg/L and continues to increase in a downdip direction to about 70,000 mg/L in southeastern Louisiana. From the Mississippi River westward to the Sabine arch the concentration increases from less than 500 to about 70,000 mg/L in the area from the outcrop to middip and to as much as 221,300 mg/L in a downdip area in southern Louisiana.

From the Sabine arch southwestward to the Rio Grande the concentration of dissolved solids in the outcrop area increases from 500 mg/L in the area between the Sabine arch and the San Marcos arch to 10,000 mg/L near the Rio Grande. From the outcrop southward to middip the concentration increases to about 35,000 mg/L and from middip to the coastline of Texas the concentration increases to more than 70,000 mg/L. The increase in the concentration of dissolved solids from updip to downdip is attributed to mineral-water interaction and specifically to the dissolution of evaporites comprising salt domes in the deeper part of permeable zone E (fig. 4).

Temperature

The temperature of water from permeable zone E, based on combined depth-averaged values and the median values of all samples in each 100-square-mile area, ranges from about 13 degrees Celsius in the outcrop area to about 91 degrees Celsius in the downdip area of southern Louisiana (table 1). Generally where the concentration of dissolved solids is less than 3,000 mg/L the temperature is generally less than 30 degrees Celsius (fig. 5). In areas where the concentration of dissolved solids increases from 3,000 to as much as 221,300 mg/L the temperature of the ground water increases from 30 degrees to about 91 degrees Celsius. About one-fourth of the area of permeable zone E contains water with a temperature of less than 30 degrees Celsius.

Primary Water Type

The primary water types in permeable zone E, which are based on the most frequently observed type (mode) in each 100-square-mile area, are calcium bicarbonate, sodium bicarbonate, and sodium chloride (fig. 6). Calcium bicarbonate is the primary water type in most of the outcrop area between the Sabine arch and the San Marcos arch, sodium bicarbonate is the primary water type in the outcrop and middip areas east of the Sabine arch, and sodium chloride is the primary water type in the area southwest of the San Marcos arch and in the downdip area east of the San Marcos arch.

pH

The pH of water from permeable zone E, based on median values of all samples in each 100-square-mile area, ranges from 4.5 in the outcrop area east of the Mississippi River to 11.7 in an area between the outcrop and middip in central Louisiana (table 1). The indicated trend from the Sabine arch eastward to the western edge of Florida is one of increasing pH from outcrop to middip and one of decreasing pH from middip to the downdip limit of the data (fig. 7). The indicated trend from the Sabine arch southwestward to the Rio Grande is one of decreasing pH from outcrop to middip and one of increasing pH from middip to the downdip limit of the permeable zone.

The pH in the outcrop area east of the Mississippi River generally ranges from 6 to 7, from outcrop to middip the pH ranges from 7 to 8, and downdip extending from southeastern Louisiana to southwestern Alabama the pH ranges from 8 to 9. From the Mississippi River westward to the Sabine arch the pH ranges between 6 and 8 in the outcrop area, from 7 to more than 8 in the middip area, and 6 to 7 in the downdip area of the permeable zone.

From the Sabine arch southwestward to the Rio Grande the pH in the outcrop area ranges from less than 7 between the Sabine arch and the San Marcos arch to more than 8 near the Rio Grande. From the outcrop to the downdip limit of the permeable zone the pH is about 8 at the outcrop, ranges between 6 and 7 at middip, and than increases to about 8 at the downdip limit of the permeable zone.

CHEMICAL CONSTITUENTS

The areal distributions of eight constituents in ground water are shown on maps and discussed below. These constituents are the major chemical components in ground water of the Gulf Coastal Plain. The extent of the areal distribution is limited to onshore areas of permeable zone E because chemical data generally are not available for the Continental Shelf area.

Calcium

The concentration of dissolved calcium in water from permeable zone E, based on median values of all samples in each 100-square-mile area, ranges from 0.3 mg/L in middip areas east of the Sabine arch to 19,600 mg/L in a middip area of southern Texas (table 1). The concentration generally increases in a downdip direction in the area from the vicinity of the Trinity River in Texas, eastward to the western edge of Florida (fig. 8). From the vicinity of the Trinity River southwestward to the Rio Grande the concentration increases to about middip and decreases to the downdip limit of the permeable zone.

From the Sabine arch eastward to the western edge of Florida the concentration of dissolved calcium generally is less than 10 mg/L along the outcrop to about middip areas. An exception is two areas, one in the vicinity of the Mississippi River and one in the vicinity of the Red River where the concentration is about 50 mg/L in the outcrop. Beginning near middip the concentration increases from 10 to 1,000 mg/L in as little as 20 mi and increases to more than 2,000 mg/L in the downdip area of southern Louisiana. The area downdip having the greatest concentration of dissolved calcium generally is coincident with the deeper part of permeable zone E and with the location of salt domes (fig. 4).

From the Sabine arch southwestward to the Rio Grande the concentration of dissolved calcium in the outcrop ranges from about 20 mg/L at the Sabine arch to more than 200 mg/L near the Rio Grande in southern Texas. From the outcrop southward to middip the concentration increases to about 1,000 mg/L and then decreases to about 1,000 mg/L at the downdip limit of the data.

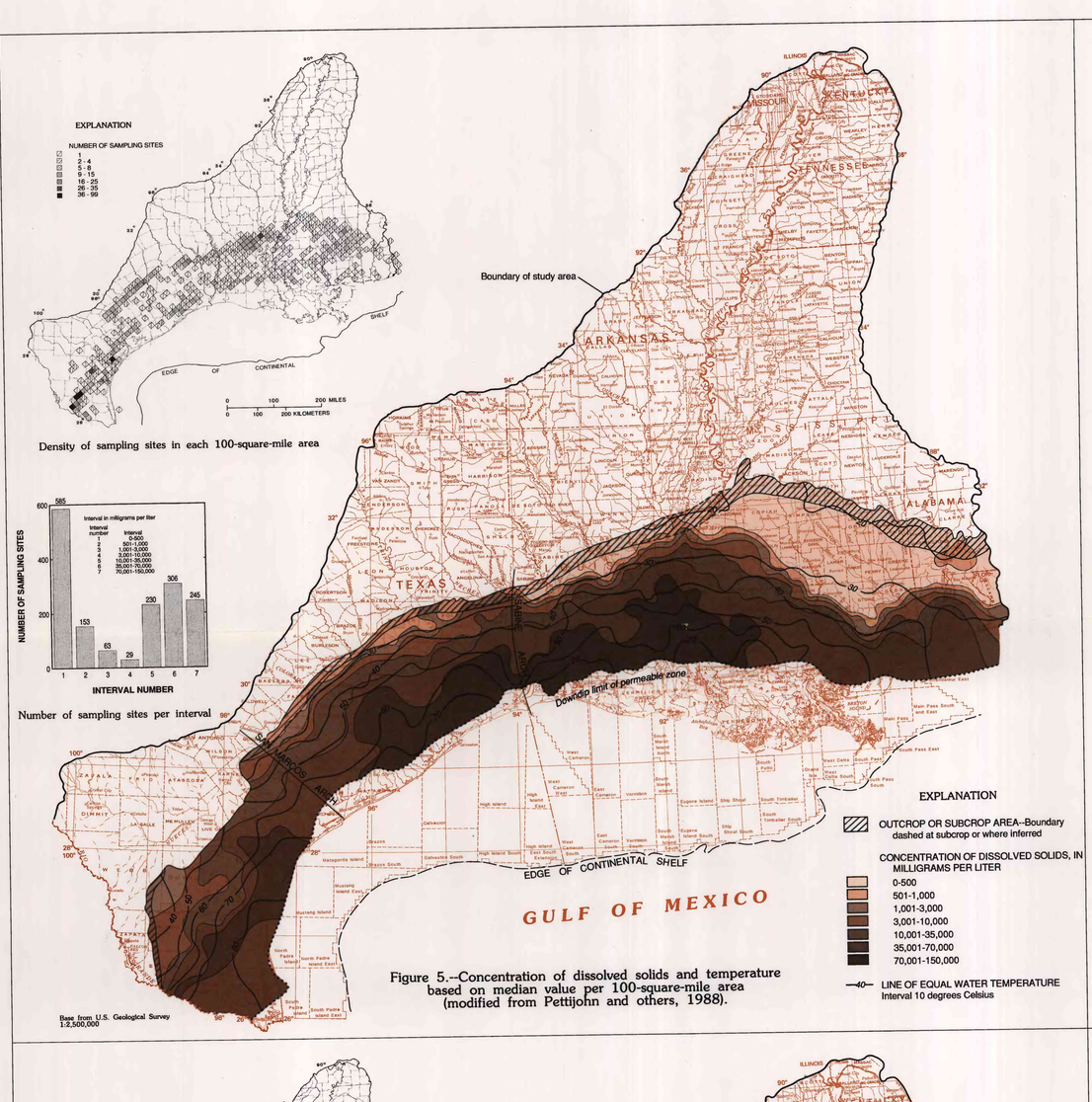

Figure 5.--Concentration of dissolved solids and temperature based on median value per 100-square-mile area (modified from Pettijohn and others, 1988).

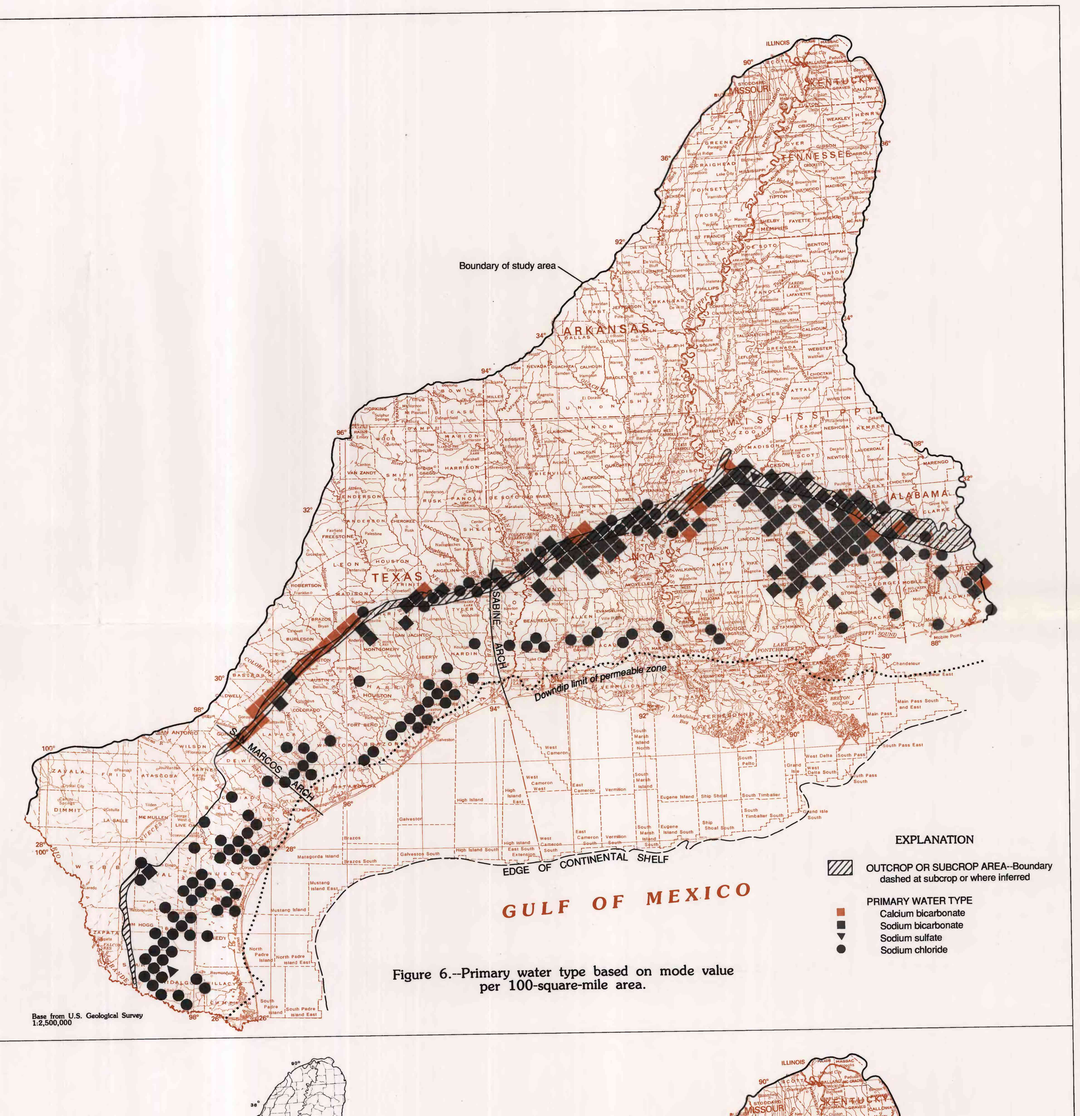

Figure 6.--Primary water type based on mode value per 100-square-mile area.

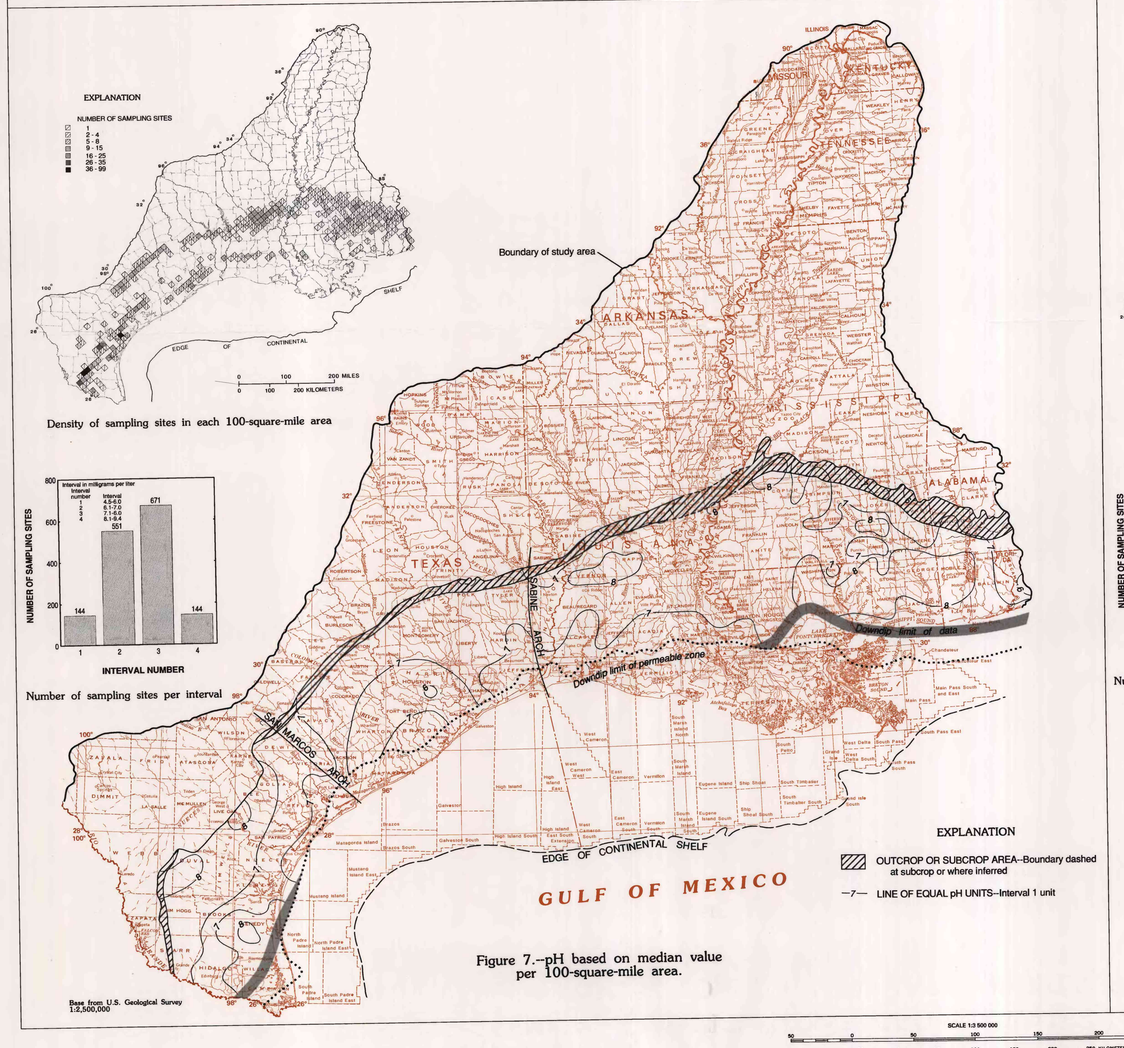

Figure 7.--pH based on median value per 100-square-mile area.

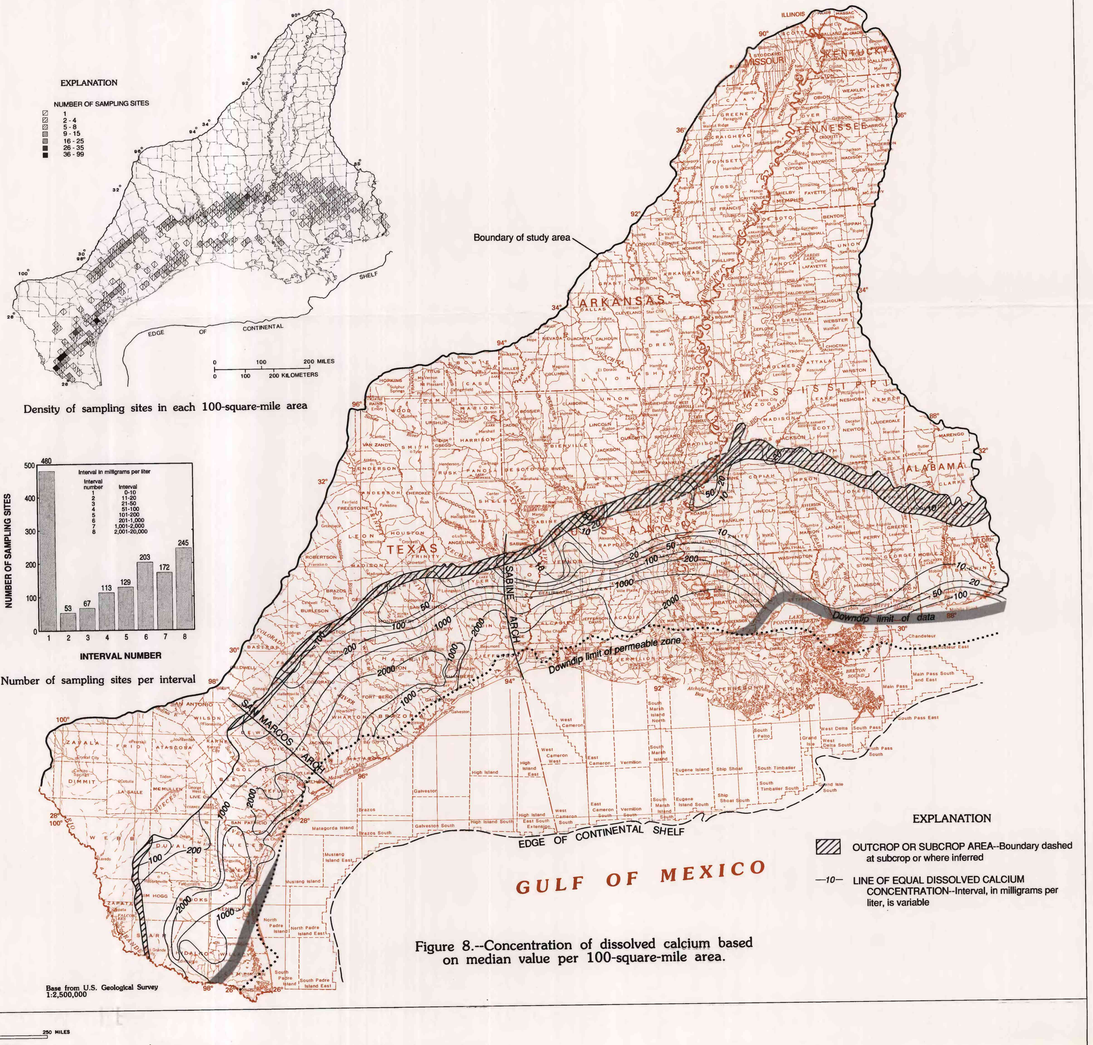

Figure 8.--Concentration of dissolved calcium based on median value per 100-square-mile area.

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PROPERTIES AND CHEMICAL CONSTITUENTS IN GROUND WATER FROM PERMEABLE ZONE E (LOWER MIOCENE-UPPER OLIGOCENE DEPOSITS), COASTAL LOWLANDS AQUIFER SYSTEM, SOUTH-CENTRAL UNITED STATES

by

ROBERT A. PETTIJOHN, JOHN F. BUSBY, AND THOMAS B. LAYMAN

1993