

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 downwind limit of the aquifer. The abundance of geological well logs (Grubb, 1986; Wilson and Hosman, 1988), through both the central and lower part of the lower Wilcox aquifer area, make it possible to estimate both dissolved-solids concentrations and temperature throughout a large area where data from water samples are not available. The primary water type and pH generally are not shown in the central and lower part of the aquifer area because of the absence of chemical data.

Dissolved-Solids Concentrations

The concentration of dissolved solids in water from the lower Wilcox aquifer, based on the median value of all samples in each 100-square-mile area, ranges from 15 mg/L near the outcrop in western Tennessee to 122,000 mg/L in a downwind area in southern Mississippi (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 downwind direction (fig. 5). The largest increase downwind over the shortest distance occurs east of the Mississippi River in south-central Mississippi. About one-third of the aquifer area has concentrations of dissolved solids that are less than 500 mg/L.

Ground water from the outcrop and areas near the upwind limit of the aquifer area have concentrations of dissolved solids ranging from 15 to 500 mg/L, except in southern Arkansas and southwestern Alabama where concentrations are as large as 1,000 mg/L. An area in northwestern Louisiana also has concentrations that are less than 1,000 mg/L.

The concentration of dissolved solids in ground water increases sharply from 500 mg/L to 50,000 mg/L in less than 50 mi in the downwind direction in south-central Mississippi. Concentrations that exceed 10,000 mg/L begin at about midday in Mississippi and between the outcrop and midday in Arkansas and increase in a downwind direction to 70,000 mg/L in Louisiana and Mississippi. Concentrations of dissolved solids that exceed 70,000 mg/L occur in two areas in southern Mississippi. The increase in concentration of dissolved solids from upwind limit to downwind limit is attributed to mineral-water interaction such as dissolution of sulfates in the outcrop area and the dissolution of evaporites comprising salt domes in the deeper downwind parts of the aquifer (fig. 4).

Temperature

The temperature of water from the lower Wilcox aquifer, based on depth-averaged values and the median values of all samples in each 100-square-mile area, ranges from 14 degrees Celsius in the outcrop area to 100 degrees Celsius in a downwind area of southern Louisiana (table 1). Generally the temperature ranges from 20 to 30 degrees Celsius where the concentration of dissolved solids increases from 500 to 10,000 mg/L (fig. 5). In areas where the concentration of dissolved solids increases from 10,000 mg/L to more than 70,000 mg/L, the temperature of the ground water ranges from 30 degrees to more than 80 degrees Celsius. Ground water in most of the outcrop area has temperatures of less than 20 degrees Celsius except in southeastern Mississippi and southwestern Alabama where it ranges from 20 to 30 degrees Celsius.

Primary Water Type

The primary water types in the lower 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 the outcrop. Sodium bicarbonate is the primary water type in all other areas of the aquifer. The presence of sodium chloride water type, which generally is the primary water type in downwind areas of other aquifers of the Gulf Coast aquifer system, is not indicated due to the absence of data in the downwind area.

pH

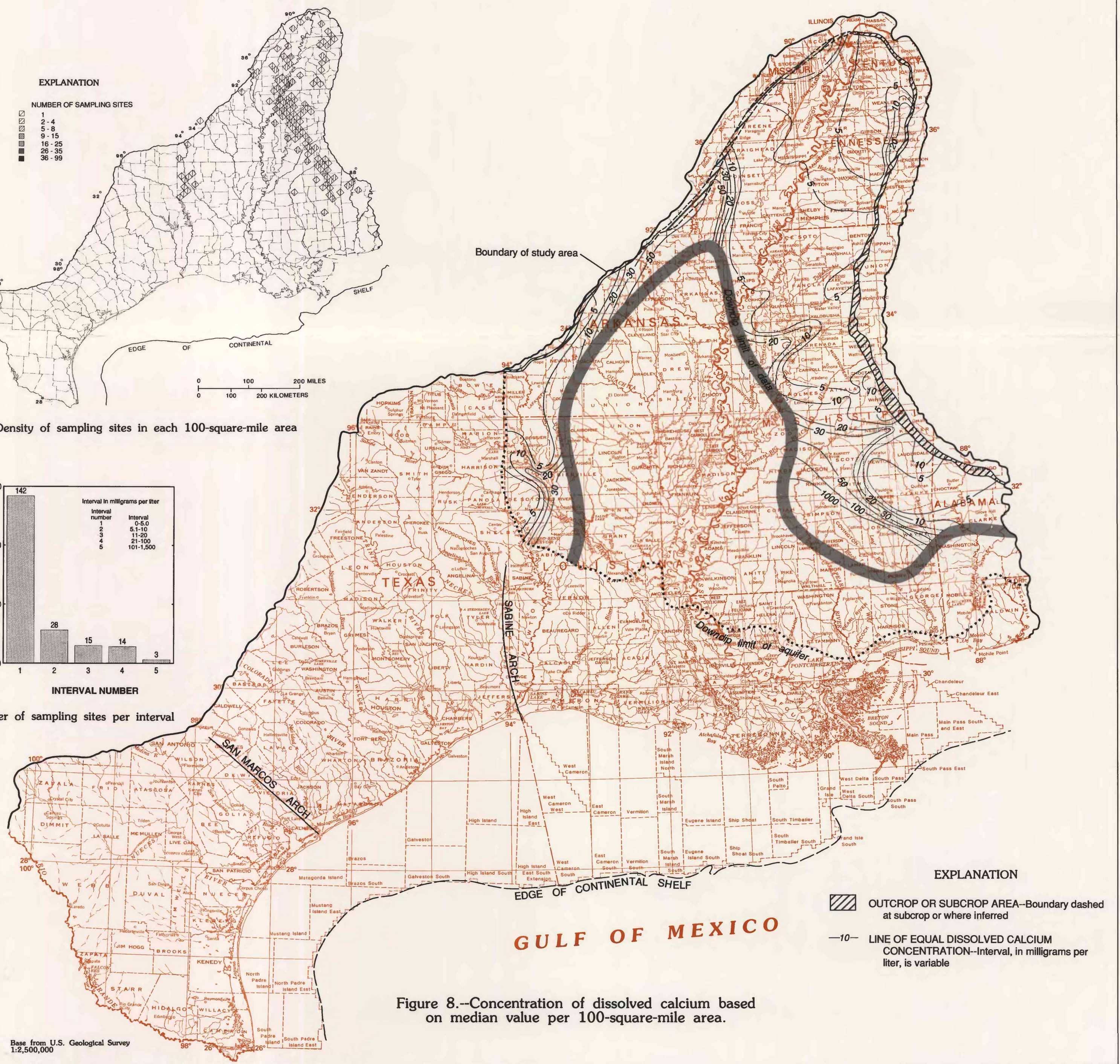
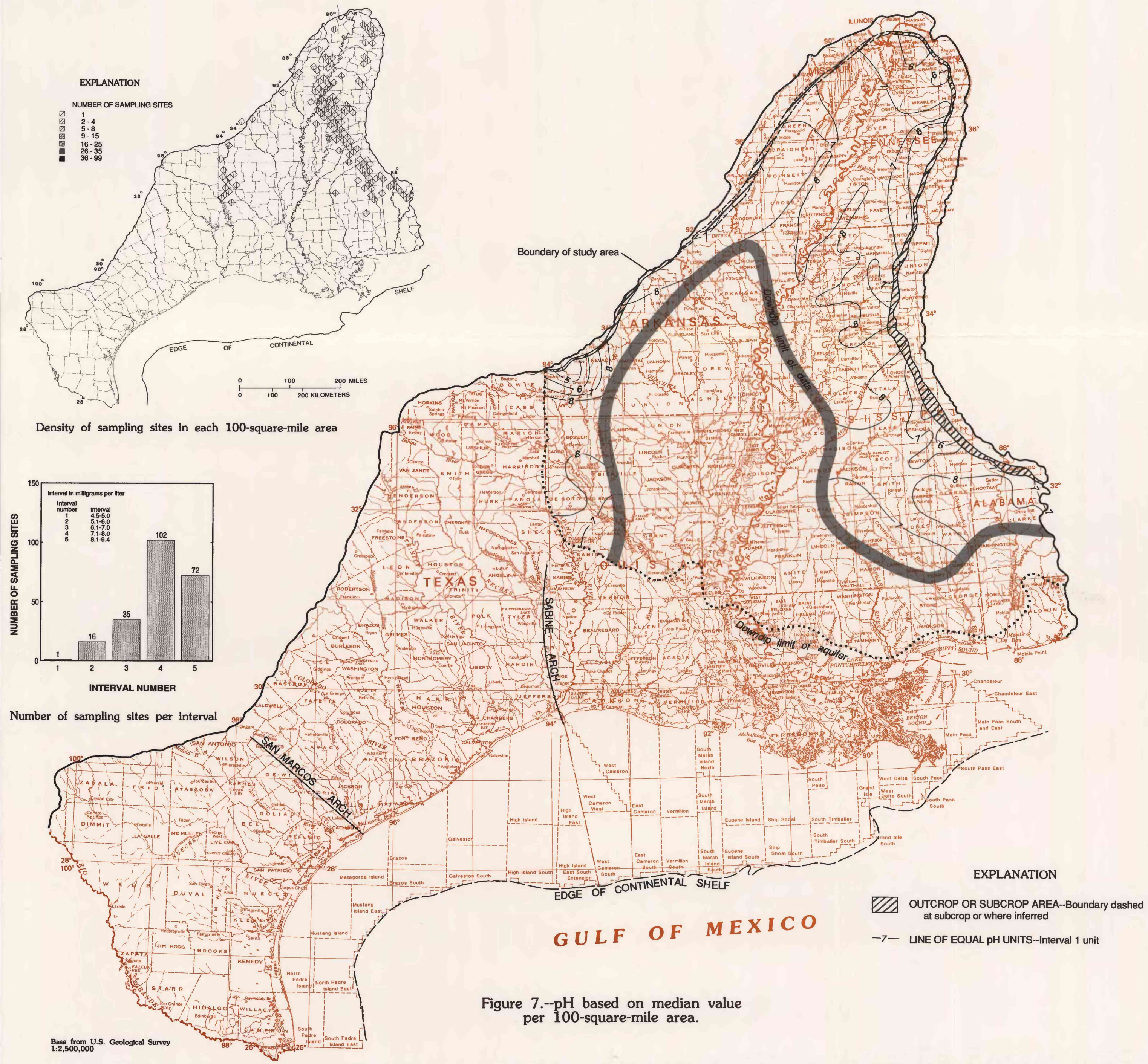
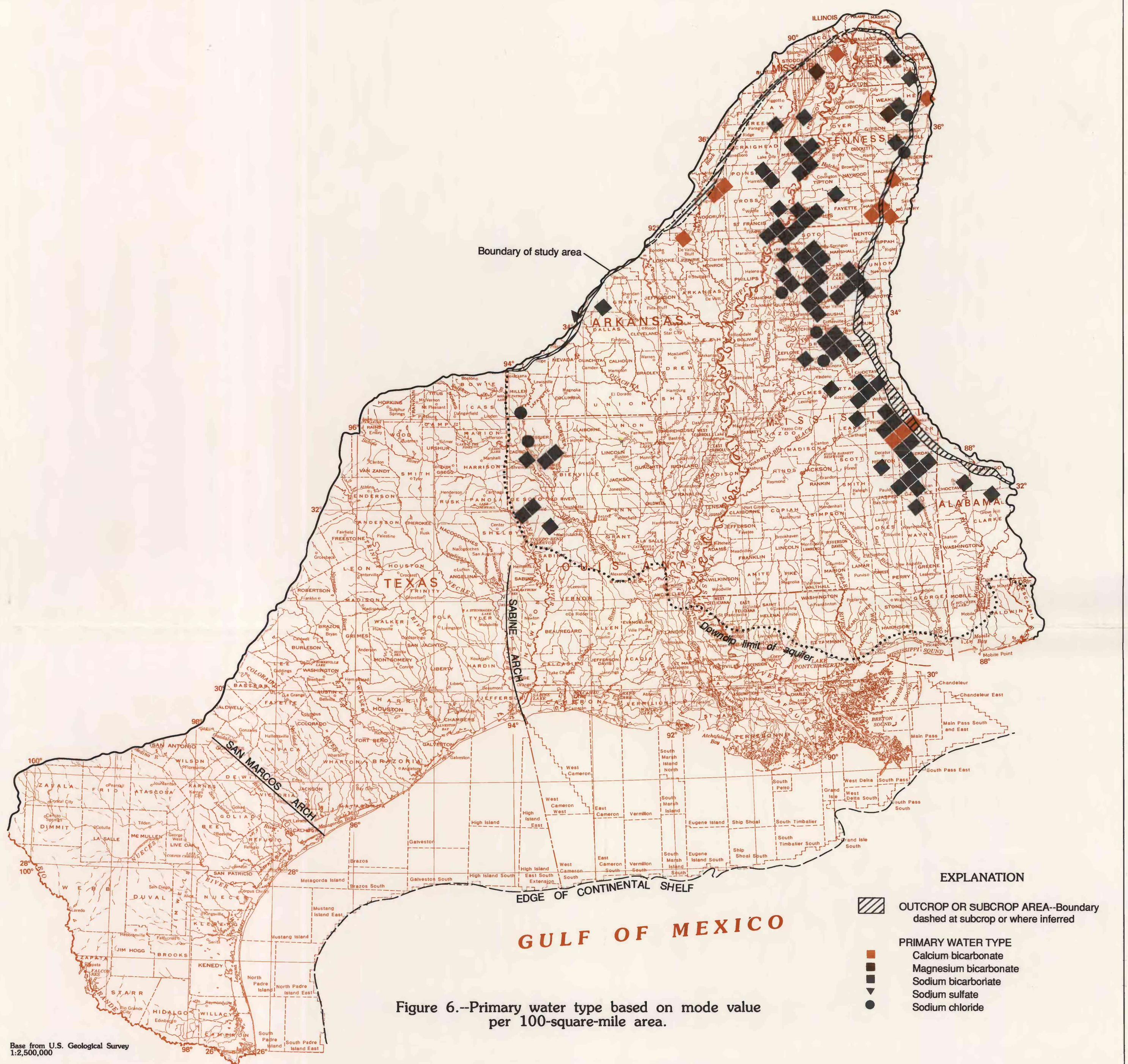
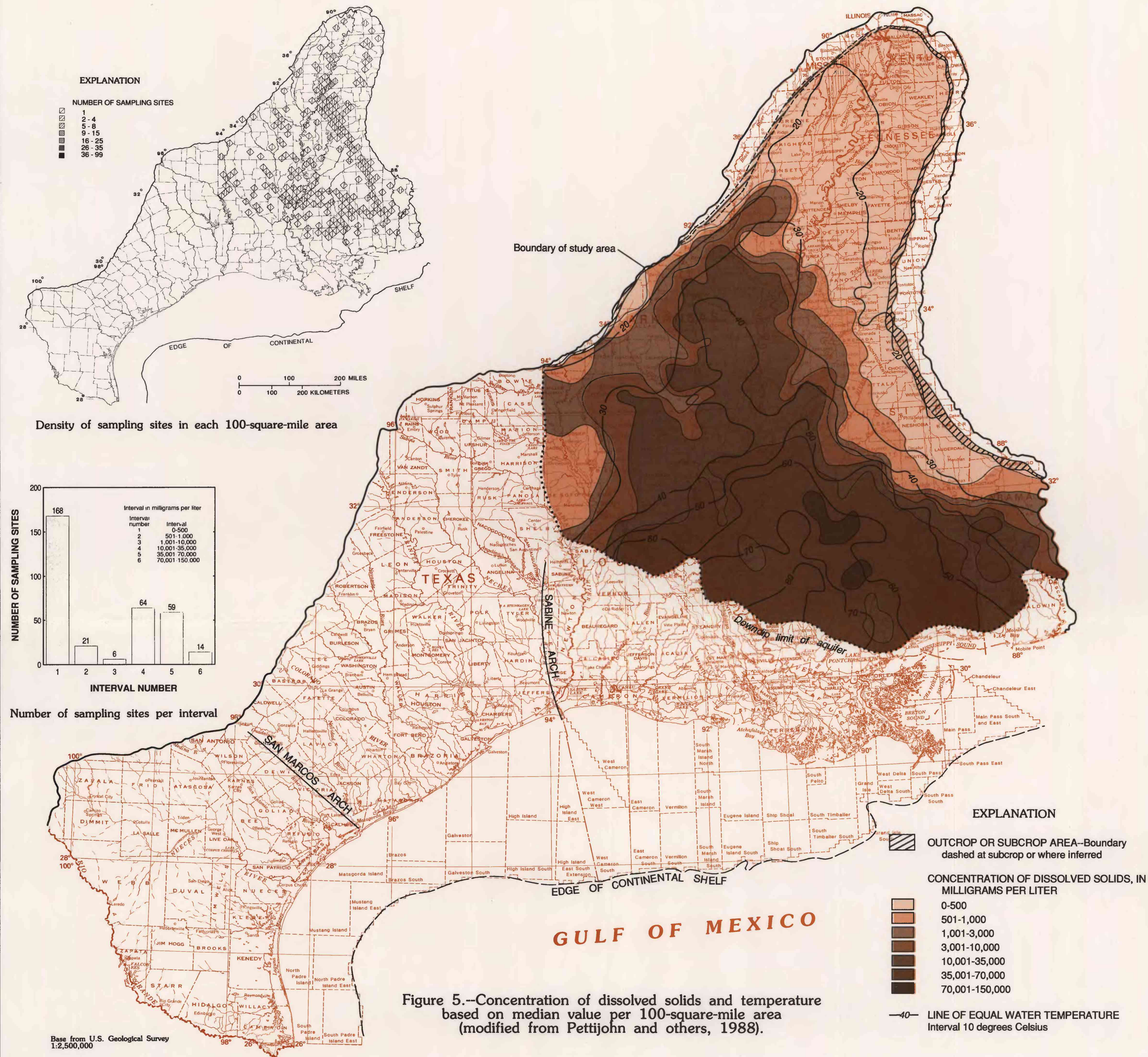
The pH of water from the lower Wilcox aquifer, based on the median values of all samples in each 100-square-mile area, ranges from 4.5 in southwestern Arkansas to 9.3 in southwestern Alabama (table 1). The pH in most of the outcrop area and in the area from outcrop to midday ranges from 5 to 8. From midday to the downwind limit of the data the pH ranges from 8 to 9 except in southern Mississippi where it ranges from 6 to 8 (fig. 7).

CHEMICAL CONSTITUENTS

The areal distribution of eight constituents in ground water from the lower 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 throughout the central and southern parts of the aquifer area due to the absence of data.

Calcium

The concentration of dissolved calcium in water from the lower Wilcox aquifer, based on the median values of all samples in each 100-square-mile area, ranges from 0.3 mg/L in eastern Arkansas to 1,500 mg/L in a downwind area in southern Mississippi (table 1). In the outcrop area the concentration ranges from about 2 to 30 mg/L but shows no apparent trend (fig. 8). In the southern part of the aquifer area the concentration generally ranges from 5 to 30 mg/L with no apparent pattern from outcrop to the downwind limit of the data whereas in the southern part of the area the concentration ranges from about 5 mg/L in the outcrop area to more than 1,000 mg/L downwind in southern Mississippi.



PROPERTIES AND CHEMICAL CONSTITUENTS IN GROUND WATER FROM THE LOWER WILCOX AQUIFER,
MISSISSIPPI EMBAYMENT AQUIFER SYSTEM, SOUTH-CENTRAL UNITED STATES

by

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