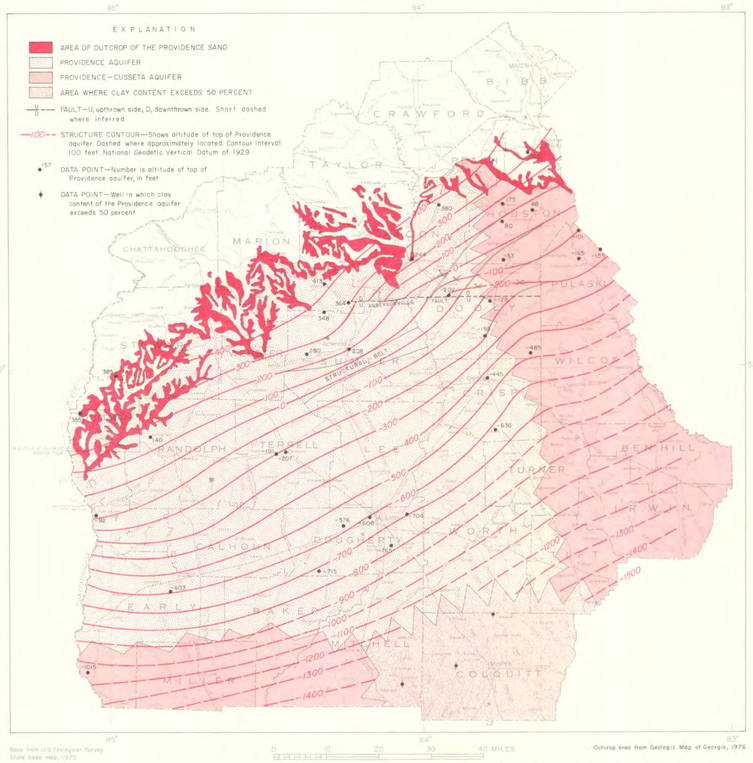

Figure 3.—Structural features, outcrop area, and approximate altitude of the top of the Providence aquifer.

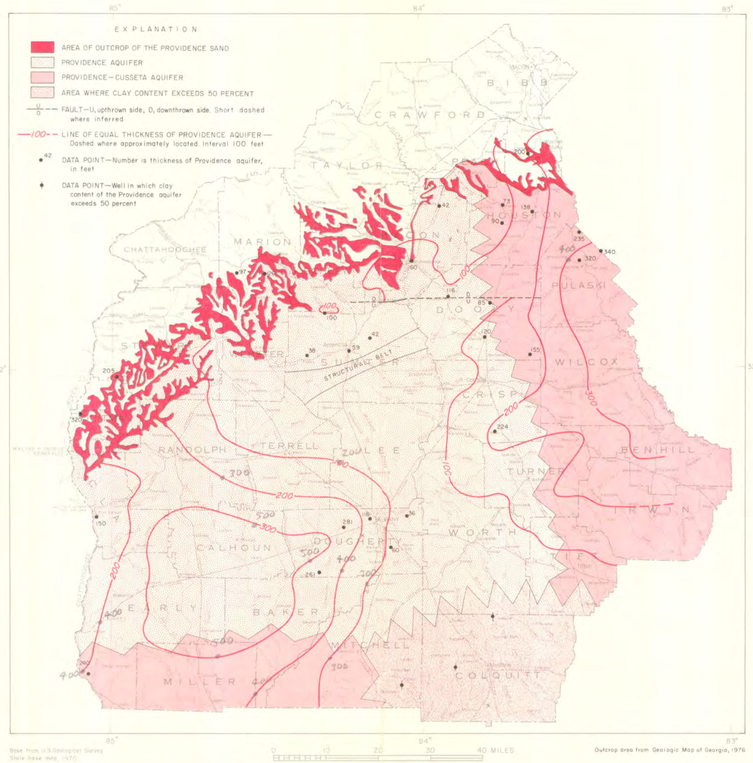

Figure 4.—Thickness of the Providence aquifer.

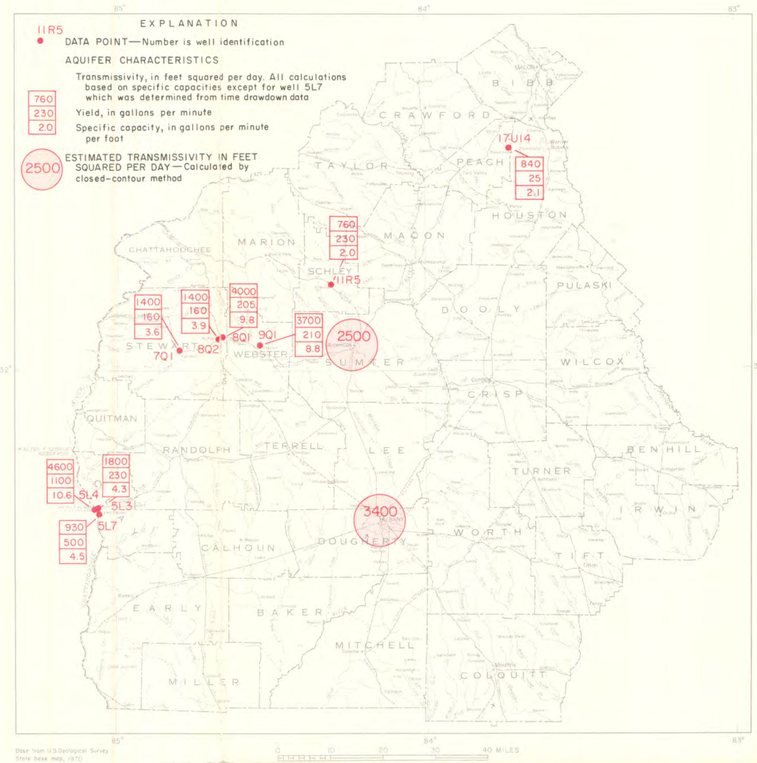

Figure 5.—Aquifer transmissivity, yield, and specific capacity of wells tapping the Providence aquifer.

STRUCTURE

The altitude of the top of the Providence aquifer is shown in figure 3. This map was constructed by using geophysical and lithologic logs from 37 wells throughout the study area. Depths to the top of the aquifer may be estimated from figure 3 by subtracting the altitude of the aquifer from the altitude of land surface. An average dip of 29 ft/mi to the southeast was computed for the top of the Providence aquifer.

The northeast trending structural belt of Sumter County (Owen, 1963, p. 38) and east-west trending Andersonville fault (Zapp, 1943) are major features that affect the geology of the Providence Sand (fig. 3). Within the Sumter County structural belt, the dip of the top of the Providence aquifer steepens. Owen (1963, p. 38) found that within this belt, the regional dip of Upper Cretaceous sediments, the lower Paleocene Midway Group, and the upper Paleocene Tuscahoma Sand is about twice as great as elsewhere and may be due to a monoclinal flexure, a fault, or a series of faults. In the vicinity of the Andersonville fault, structure contours of the top of the Providence aquifer are offset, indicating a maximum vertical displacement of about 200 ft along the fault. Owen (1963, p. 38) found that the top of the overlying Midway Group was offset 100 ft by the fault. It is, therefore, likely that the top of the Providence aquifer also is displaced 100 ft or more. In Dooly County, the low altitude of the top of the Providence aquifer at Byromville and high altitude at Pinehurst probably indicate that the Andersonville fault extends farther east than is shown on the Geologic Map of Georgia (1976), and that Byromville is on the downthrown side of the fault.

AQUIFER THICKNESS

The thickness of the Providence aquifer was determined from geophysical and lithologic logs of 32 wells distributed throughout the study area (fig. 4). The aquifer ranges in thickness from 38 ft in Sumter County and 36 ft in Dougherty County, to 386 ft in Pulaski County. Figure 4 shows two large areas where the thickness of the aquifer exceeds 300 ft: one to the southwest in Early, Calhoun, Baker, and Dougherty Counties and the other to the east in Pulaski and Wilcox Counties. The thickness of the Providence aquifer is less than 50 ft in parts of Sumter County and may be the result of faulting in the vicinity of the structural belt.

AQUIFER PROPERTIES

Aquifer transmissivity, well yields, and specific capacities of wells tapping the Providence aquifer are shown in figure 5. The specific capacity of a well is defined as the rate of yield per unit of drawdown, generally expressed in gallons per minute per foot [(gal/min)/ft]. Values for the Providence aquifer range from 2.0 (gal/min/ft) at well 11R5 in Schley County to 10.6 (gal/min)/ft at well 5L4 in Clay County.

The transmissivity of an aquifer is defined as the rate at which water will flow through a unit width of the aquifer under a unit hydraulic gradient (Lohman, 1972, p. 6). It is, thus, a measure of the aquifer's ability to transmit water, generally expressed in feet squared per day (ft^2/d). Transmissivities may be estimated from time-drawdown or specific-capacity data, and by the closed contour method. With the exception of values at Albany, Americus, and well 5L7 at Fort Gaines, transmissivities in this report were computed by applying Jacob's modified nonequilibrium formula to specific-capacity data (Ferris and others, 1962, p. 99). Unpublished data indicate that transmissivities estimated by this method are generally 2-4 times lower than values calculated from time-drawdown data for the same well. In order to account for this difference, values computed by this method were increased by about 50 percent to account for the effect of estimated energy losses near the well on measured drawdown. Transmissivities of 3,400 ft^2/d at Albany and 2,500 ft^2/d at Americus are probably most accurate and were estimated by using the closed contour method described by Lohman (1972, p. 46-47). The transmissivity for well 5L7 was computed from time-drawdown data. Computed transmissivities ranged from 760 ft^2/d at well 11R5 in Schley County to 4,600 ft^2/d at well 5L4 in Clay County.

Cartography by Willis G. Hester

HYDROGEOLOGY OF THE PROVIDENCE AQUIFER OF SOUTHWEST GEORGIA.

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