GEORGIA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION
GEORGIA GEOLOGIC SURVEY

Prepared in cooperation with the
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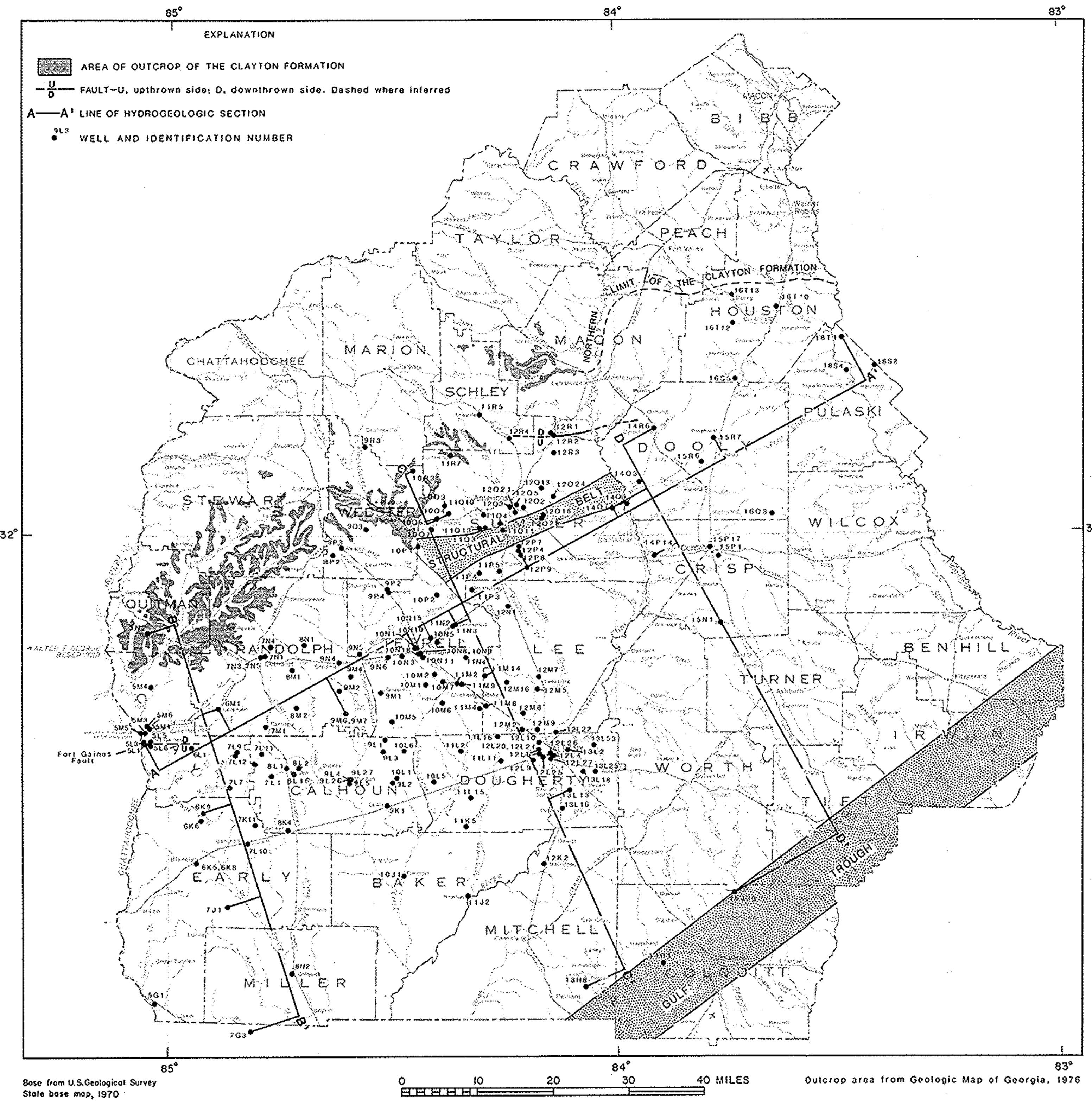

Figure 7.—Structural features, outcrop area, and locations of wells and hydrogeologic sections.

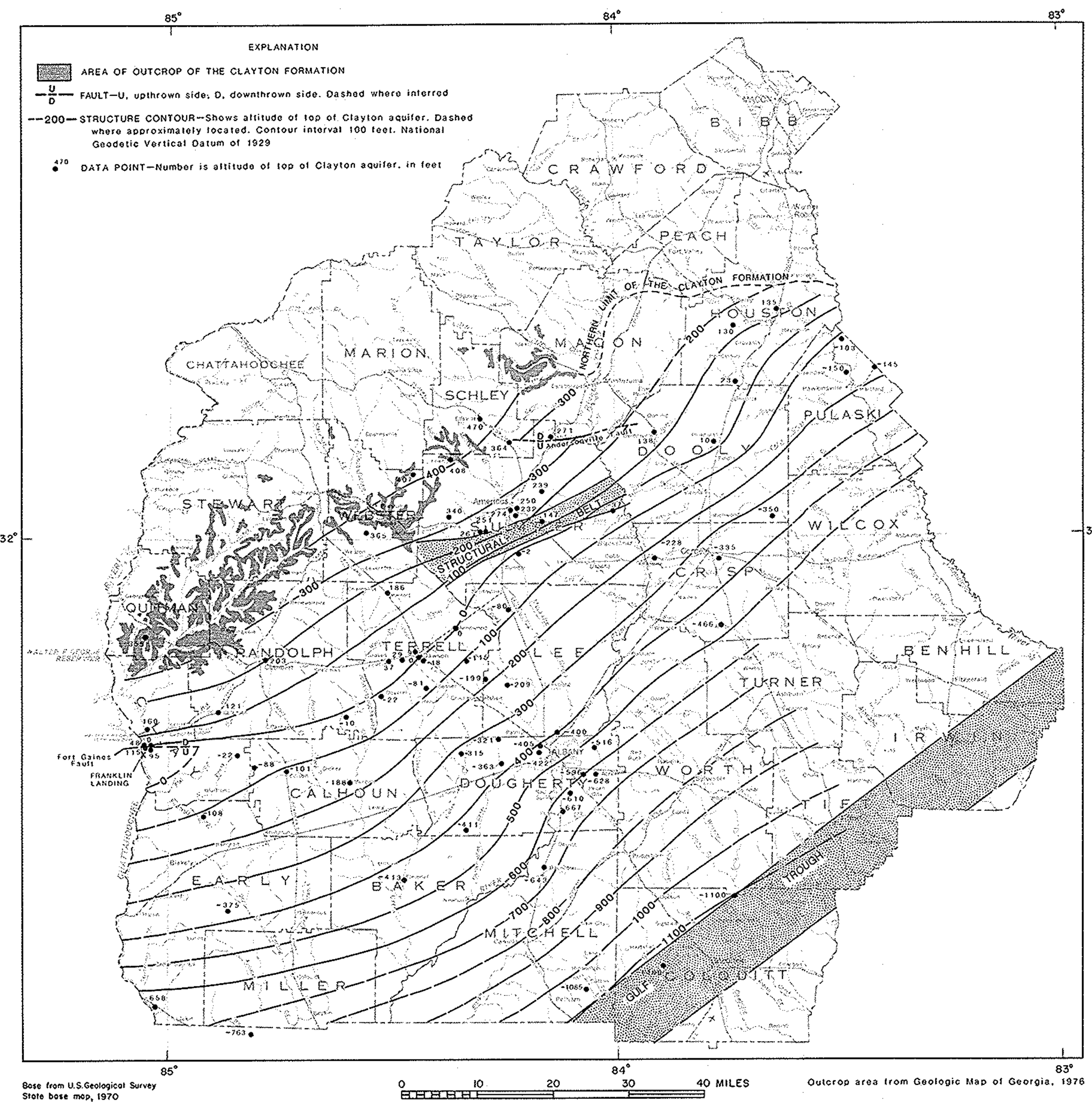

Figure 8.—Structural features, outcrop area, and altitude of the top of the Clayton aquifer.

STRUCTURE OF THE CLAYTON FORMATION

In the study area, the top of the Clayton formation trends northeastward and dips to the southeast at about 20 ft/mi. Irregularities in the top of the Clayton formation in some areas may be due to solution of the limestone. Major structural features (fig. 8) that affect the Clayton formation in the study area include: (1) the Structural Belt of Owen (1963) in Sumter County; (2) the Andersonville Fault (Zapp, 1943) in Schley, Sumter, Macon, and Dooly Counties; (3) an inferred fault near Fort Gaines in Clay County; and (4) the Gulf Trough (Herrick and Vorhis, 1963) in Mitchell, Colquitt, Tift, Irwin, and Ben Hill Counties.

Within the northeast-trending Structural Belt, Owen (1963, p. 38) reported that the regional dip of Upper Cretaceous sediments, the lower Paleocene Clayton formation, and the upper Paleocene Tuscahoma Formation is about twice as great as elsewhere and concluded that the steepened dip may be due to a monoclinal flexure, a fault, or a series of faults. The contours in figure 8 of the top of the aquifer also reflect structure in the Clayton and indicate that at the midpoint of the belt, the dip of the top of the limestone unit of the Clayton formation steepens from about 18 ft/mi north of the belt to about 66 ft/mi within the belt. The increase is less pronounced at the ends of the belt, where the dip diminishes from about 66 ft/mi to about 33 ft/mi.

The Andersonville Fault (fig. 8) is an east-west-trending fault that is upthrown on the south side. Zapp (1965) shows the fault as nearly vertical and reports a maximum vertical displacement of 100 ft at the top of the Clayton formation.

At Fort Gaines, Clay County (fig. 8), the altitude of the top of the middle limestone unit of the Clayton formation shows a difference of 95 ft between the Clay County School (formerly Speight School) well (altitude of 0 ft) and Fort Gaines city well 2 (altitude of 95 ft). Because the wells are less than 2,000 ft apart, Herrick (1961, p. 115) postulated a fault between them, with the Clay County School well on the downthrown side. Although solution of limestone may account for some of this difference, the authors agree with Herrick's postulation of a fault. It is likely the same fault caused a 67-ft offset between city wells 4 (altitude of 115 ft) and 3 (altitude of 48 ft), which are less than 1,500 ft apart. This fault, herein named the Fort Gaines Fault (fig. 8), has the same general east-west orientation as the Andersonville Fault, and, like the Andersonville Fault, is upthrown on the south side.

The northeast-trending Gulf Trough (fig. 8) crosses the southeastern part of the study area in Mitchell, Colquitt, Tift, Irwin, and Ben Hill Counties. Several different opinions as to the nature and origin of the Gulf Trough have been expressed by previous investigators. Patterson and Herrick (1971, p. 11-12) presented a summary of these differing views:

(1) that the feature represents a buried submarine valley or strait,
(2) that it is a graben,
(3) that it is a syncline, or
(4) that it is a buried solution valley.

The authors prefer the second hypothesis. Further study will be required to definitively assess the nature and origin of the Gulf Trough. The Gulf Trough has an adverse effect on the ground-water-flow system, as evidenced by low well yields, low transmissivity, high dissolved-solids concentrations, and steepened potentiometric gradients in the principal artesian aquifer (Zimmerman, 1977).

AQUIFER GEOMETRY

AQUIFER TOP

The altitude of the top of the Clayton aquifer was estimated from geophysical and lithologic logs of 76 wells in the study area (fig. 8). Depths to the top of the aquifer may be estimated by subtracting the altitude of the top of the aquifer (fig. 8) from the altitude of land surface (available on U.S. Geological Survey 7.5-minute topographic quadrangle maps).

AQUIFER THICKNESS

The thickness of the Clayton aquifer was estimated from geophysical and lithologic logs of 51 wells (fig. 9) and by comparing maps of the altitude of the top of the Clayton aquifer with the altitude of the top of the Clayton-Providence confining zone, which forms the base of the Clayton aquifer (table 1).

The Clayton aquifer ranges in thickness from less than 50 ft in most of the clastic and transition provinces (fig. 2) to more than 265 ft in the southern part of the carbonate province. In the clastic province in Pulaski County, the aquifer reaches a maximum thickness of 120 ft.

In the carbonate province, the thickness of the Clayton aquifer may be reduced locally by sinkholes in the top of the limestone that are filled with fine-grained sediments. For example, a sinkhole at Franklin Landing, Ala. (fig. 9), is filled with fine sand and clay of the overlying Nanafalia Formation (Reinhardt and Gibson, 1980, p. 450), thus reducing the effective thickness of the aquifer by about 12 ft.

AQUIFER PROPERTIES

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 Clayton aquifer range from 1.7 (gal/min)/ft at well 13L2 in Dougherty County to 40 (gal/min)/ft at well 7N1 in Randolph County (Appendix A).

The transmissivity of an aquifer is defined as the rate at which water will flow through a unit width of 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). Transmissivity may be estimated from time-drawdown, time-recovery, and specific-capacity data. Estimates of transmissivity from specific-capacity data, due to well losses, are generally lower than values calculated from time-drawdown data at the same well. With the exception of values at wells 9M2, 9M4, 5M5, and 12M9, transmissivities in this report were computed by applying Jacob's modified nonequilibrium formula to specific-capacity data (Ferris and others, 1962, p. 99). Transmissivities for wells 9M2, 9M4, 5M5, and 12M9 were computed from time-drawdown or time-recovery data.

The Clayton aquifer shows variations in transmissivity largely due to changes in lithology (fig. 10). Transmissivities are generally greatest in the carbonate province and lowest in the transition province (fig. 2).

In the carbonate province, transmissivities range from 1,400 ft^2/d at well 9P2 in northern Terrell County to more than 5,000 ft^2/d in two large areas—one in Randolph and Clay Counties; the other in Terrell and Lee Counties (fig. 10). In these two areas, aquifer sediments are relatively free of clay and silt and reported yields range from 350 to 2,150 gal/min. East of Albany, Dougherty County, the percentage of clay and silt in the aquifer increases and transmissivities are less than 1,000 ft^2/d (well 13L2). Although aquifer-test data in the transition province (fig. 2) are lacking, the high percentage of clay and silt suggests that transmissivities are less than 1,000 ft^2/d.

Figure 9.—Structural features, outcrop area, and thickness of the Clayton aquifer.

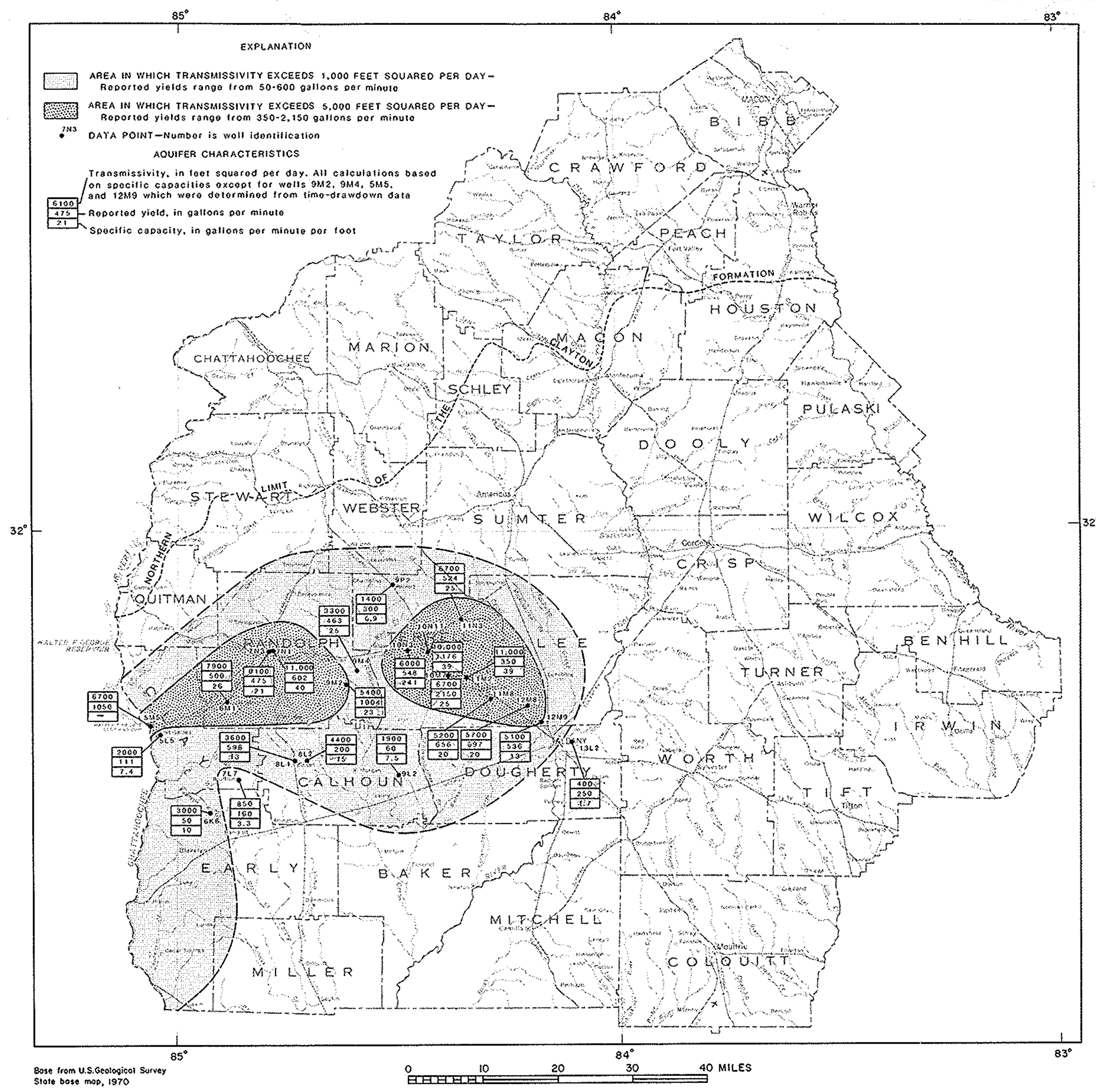

Figure 10.—Aquifer transmissivity, reported yield, and specific capacity of wells tapping the Clayton aquifer.

Cartography by Willis G. Hester

HYDROGEOLOGY OF THE CLAYTON AQUIFER OF SOUTHWEST GEORGIA.

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1984