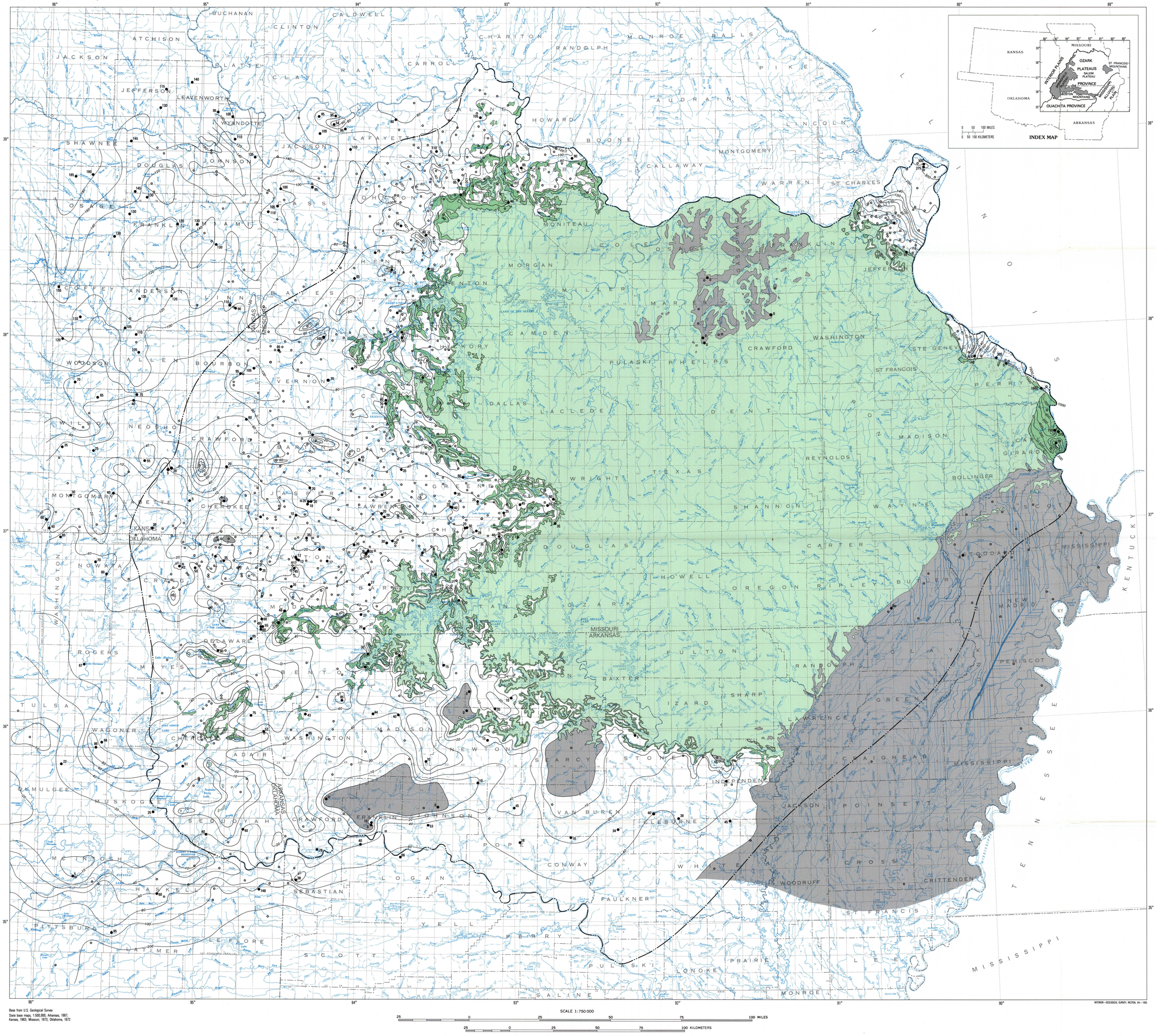
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

HYDROLOGIC INVESTIGATIONS
ATLAS HA–711–F (SHEET 2 OF 3)



EXPLANATION

- Outcrop area of Ozark confining unit
- Outcrop area of rocks comprising geohydrologic units older than Ozark confining unit
- Area where Ozark confining unit and stratigraphically equivalent units are missing in the subsurface
- Contact
- Approximate boundary of Ozark Plateaus aquifer system
- 200 — Line of equal thickness of Ozark confining unit[1] — Lines in areas of few control points are consistent with thickness data calculated from digital representations of altitude of top of Ozark confining unit and altitude of top of underlying Ozark aquifer. Interval, in feet, is variable
- ●105 Control data point[1]—Part of Central Midwest Regional Aquifer-System Analysis data base. Number is thickness, in feet, of Ozark confining unit
- ○ Auxiliary control data point[1]

[1] Lines and control points beyond the approximate boundary of the Ozark Plateaus aquifer system are for units stratigraphically equivalent to those that comprise the Ozark Plateaus aquifer system.

THICKNESS

Geologic well-log data shows that the thickness of the Ozark confining unit generally ranges from 0 to more than 1,500 feet in the Ozark Plateaus province. In most of the province, however, the confining unit is less than 120 feet thick and is, therefore, relatively thin in comparison to other geohydrologic units in the Ozark Plateaus province. The confining unit is thinnest along a narrow belt from Christian County, Missouri, to Montgomery County, Kansas, where wells penetrate less than 10 feet of rocks comprising the Ozark confining unit. To the south of this belt, the confining unit gradually thickens, except at scattered locations in northeastern Oklahoma and southwestern Missouri where the sedimentary rocks thin adjacent to small outcrop areas of older geohydrologic units. In Arkansas, the Ozark confining unit generally thickens to about 50 feet southward from the Salem Plateau. It becomes thinner adjacent to three areas where the confining unit is missing in the subsurface. The Ozark confining unit also is missing because of erosion or nondeposition throughout most of the Salem Plateau. Only at the northeast edge of the Ozark Plateaus province in St. Louis, Perry, and Ste. Genevieve Counties, Missouri, does the confining unit become greater than 300 feet thick.

GEOHYDROLOGIC PROPERTIES

The semipermeable geologic strata of the Ozark confining unit impedes the movement of ground water between the overlying Springfield Plateau aquifer and the underlying Ozark aquifer. This sequence of rocks has been identified and named as a confining unit on the basis of its regional hydrologic properties. However, local lithologic and structural variations can increase the confining unit's hydraulic conductivity and cause the layer to have aquifer-like properties. Thus, locally, water may be more easily transmitted through the confining unit, resulting in a greater hydraulic connection between the Springfield Plateau and the Ozark aquifers.

Where the hydraulic conductivity of a confining unit is considerably smaller than that of the adjacent aquifers, the direction of ground-water movement through the unit is nearly vertical (Neuman and Witherspoon, 1969) and the rate of flow is proportional to the hydraulic gradient across the confining unit and the vertical hydraulic conductivity of the confining unit. The rate at which water flows through the confining unit is determined by its leakage coefficient (L), which is defined as the ratio of the confining unit's vertical hydraulic conductivity (K') to its thickness (b); that is L = K'/b. The vertical hydraulic conductivity is a function of lithologic and structural properties of the geologic formations comprising the confining unit and physical properties of the ground water. Significant factors that affect the tendency of sedimentary rocks to impede the movement of water include the presence of shale (usually having a very low permeability), primary permeability of the rock, and development of secondary permeability, such as post-depositional solution channels, fracture systems, and faults. A thick confining unit with low permeability is a more effective barrier to ground-water flow between adjacent aquifers.

LITHOLOGY

Along the northeast boundary of the Ozark Plateaus province, the Ozark confining unit is lithologically more complex than elsewhere in the province, primarily because it is composed of many geologic formations. Limestone predominates in this rock sequence but shale is well represented and sandstone also is present in minor quantities. The thickness of the major shale formations, the Maquoketa Shale, Orchard Creek Shale, Chattanooga Shale and Hannibal Shale, may total as much as 100 feet. Many of the limestone units contain a significant fraction of argillaceous material. The minor beds of sandstone are mostly confined to a scattered presence in the Grand Tower Limestone and St. Laurent Limestone and to the thin Bushberg Sandstone. At the north and northwest edge of the Ozark Plateaus province, the lithology varies from shale to limestone depending on the presence or absence of three Mississippian-age formations, the Northview Shale, Sedalia Limestone and Compton Limestone. Southward, the Ozark confining unit is represented solely by the Chattanooga Shale, which is predominately shale with occasional minor and areally limited quantities of sandstone.

CONVERSION FACTORS

Multiply inch-pound unit	By	To obtain SI unit
foot	0.3048	meter
mile	1.609	kilometer
foot per mile	0.1894	meter per kilometer

Base from U.S. Geological Survey
State base maps, 1:500,000: Arkansas, 1967; Kansas, 1963; Missouri, 1973; Oklahoma, 1972

SCALE 1:750 000
25 0 25 50 75 100 MILES
25 0 25 50 75 100 KILOMETERS

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Thickness of Ozark confining unit

MAJOR GEOHYDROLOGIC UNITS IN AND ADJACENT TO THE OZARK PLATEAUS PROVINCE, MISSOURI, ARKANSAS, KANSAS, AND OKLAHOMA—OZARK CONFINING UNIT

By
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1990