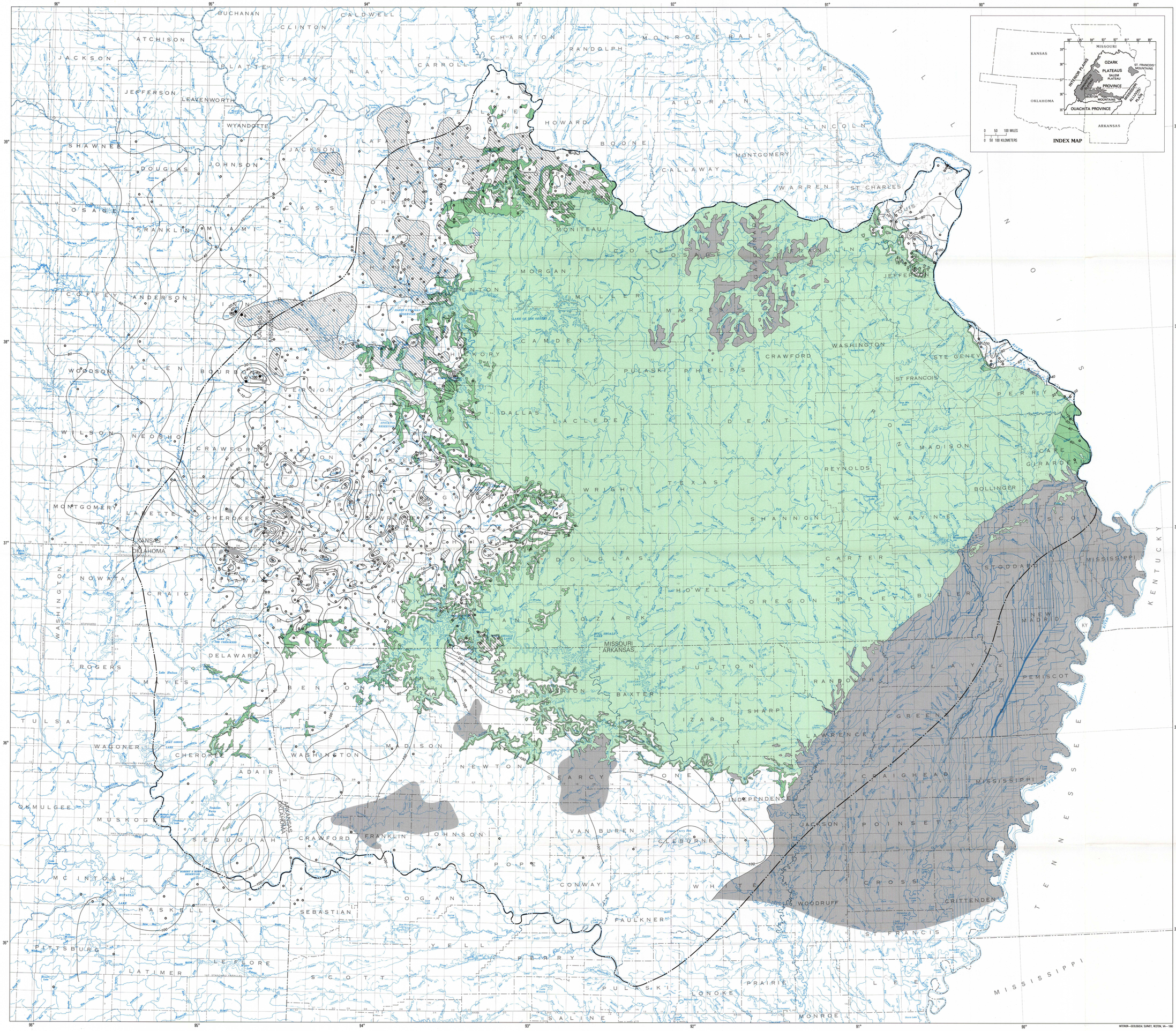
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

HYDROLOGIC INVESTIGATIONS
ATLAS HA–711–F (SHEET 3 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
- 20 — Line of equal percentage shale in Ozark confining unit[1]—Area of zero percentage shale is hachured. Interval, in percentage of total thickness, is variable
- 40 Control data point[1]—Part of Central Midwest Regional Aquifer. System analysis data base. Number is percentage of shale content in 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

## SHALE CONTENT

The shale content of a geologic formation may be used as an indicator of its effectiveness as a confining unit. Although the shale content usually is a good measure of confining ability due to the relatively impermeable nature of shale, other factors such as the degree of cementation of the parent rock, the development of post-depositional solution cavities and the presence and extent of fracture zones and faults may considerably increase the permeability of a geologic formation that contains shale.

The percentage-of-shale content of the Ozark confining unit ranges from 0 to 100 percent. Generally, shale constitutes a smaller percentage of rock type in the north and becomes more predominant in the south. In the north, the Chattanooga Shale is absent and the Northview Shale is the primary source of shale. Several isolated patches along the north and northwest edge of the Ozark Plateaus province are devoid of shale because of the discontinuous areal distribution of the Northview. West of the Missouri-Kansas State line the percentage of shale in stratigraphically equivalent units increases uniformly to the west, as opposed to southwestern Missouri where the percentage of shale in the confining unit varies markedly within short distances. In the southwestern and southern part of the Ozark Plateaus province the confining unit is represented almost exclusively by the Chattanooga Shale. In much of this region, shale constitutes 100 percent of the confining unit.

The percentage-of-shale data primarily were derived from results of insoluble residue analyses on file at the Missouri Division of Geology and Land Survey. In this technique, well-cutting samples in each 5-foot interval of drillhole are placed in hydrochloric acid, which dissolves the carbonate matrix, leaving a residue of insoluble clastics and fossil remains. Thus, no distinction is made as to whether the shale is present in a single layer or uniformly distributed within the carbonate matrix.

The percentage-of-shale map portrays the distribution of shale as a percentage of the total thickness of rock comprising the Ozark confining unit, but it also is useful to utilize the percentage-of-shale map in conjunction with the thickness map of the confining unit. The net thickness of shale within the confining unit is a measure of the unit's confining ability. The net thickness of shale at a given location can be determined as the product of the percentage-of-shale content and the total thickness of the unit at that location divided by 100. For example, in northern St. Louis County, Missouri, where the shale content of the 275-foot thick unit is about 40 percent, the equivalent thickness of shale is 110 feet (275 ft × 40/100 = 110 ft). In eastern Delaware County, Oklahoma, the 65 foot thick confining unit has a shale content of 100 percent and therefore has an equivalent thickness of 65 feet of shale.

The lack of shale in isolated locations bordering the northwestern edge of the Ozark Plateaus province does not, in itself, necessarily indicate the presence of permeable materials in the Ozark confining unit. Although it is likely that the confining unit is more permeable in this area than in areas containing larger quantities of shale, the 50 to 100 feet of limestone that is present can form an effective barrier to water movement if no significant secondary permeability has developed. However, water-level measurements in the underlying Ozark aquifer (see Chapter E) and overlying Springfield Plateau aquifer (see Chapter G) show a relatively small hydraulic-head difference across the confining unit. This may indicate that the Ozark confining unit is more permeable in this area.

## REFERENCES


Fenneman, N. M., 1938, Physiography of eastern United States: New York, McGraw-Hill, 714 p.

Jorgensen, D. G., and Signor, D. C., 1981, Plan of study for the Central Midwest Regional Aquifer-System Analysis in parts of Arkansas, Colorado, Kansas, Missouri, Nebraska, New Mexico, Oklahoma, South Dakota, and Texas: U.S. Geological Survey Water-Resources Investigations Open-File Report 81–296, 28 p.

Neuman, S. P. and Witherspoon, P. A., 1969, Transient flow of ground water to wells in multiple-aquifer systems: Berkeley University of California, Geotechnical Engineering No. 69–1, 182 p.


Base from U.S. Geological Survey
State base maps, 1:500,000; Arkansas, 1967; Kansas, 1983; 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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Percentage of shale in confining unit

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


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