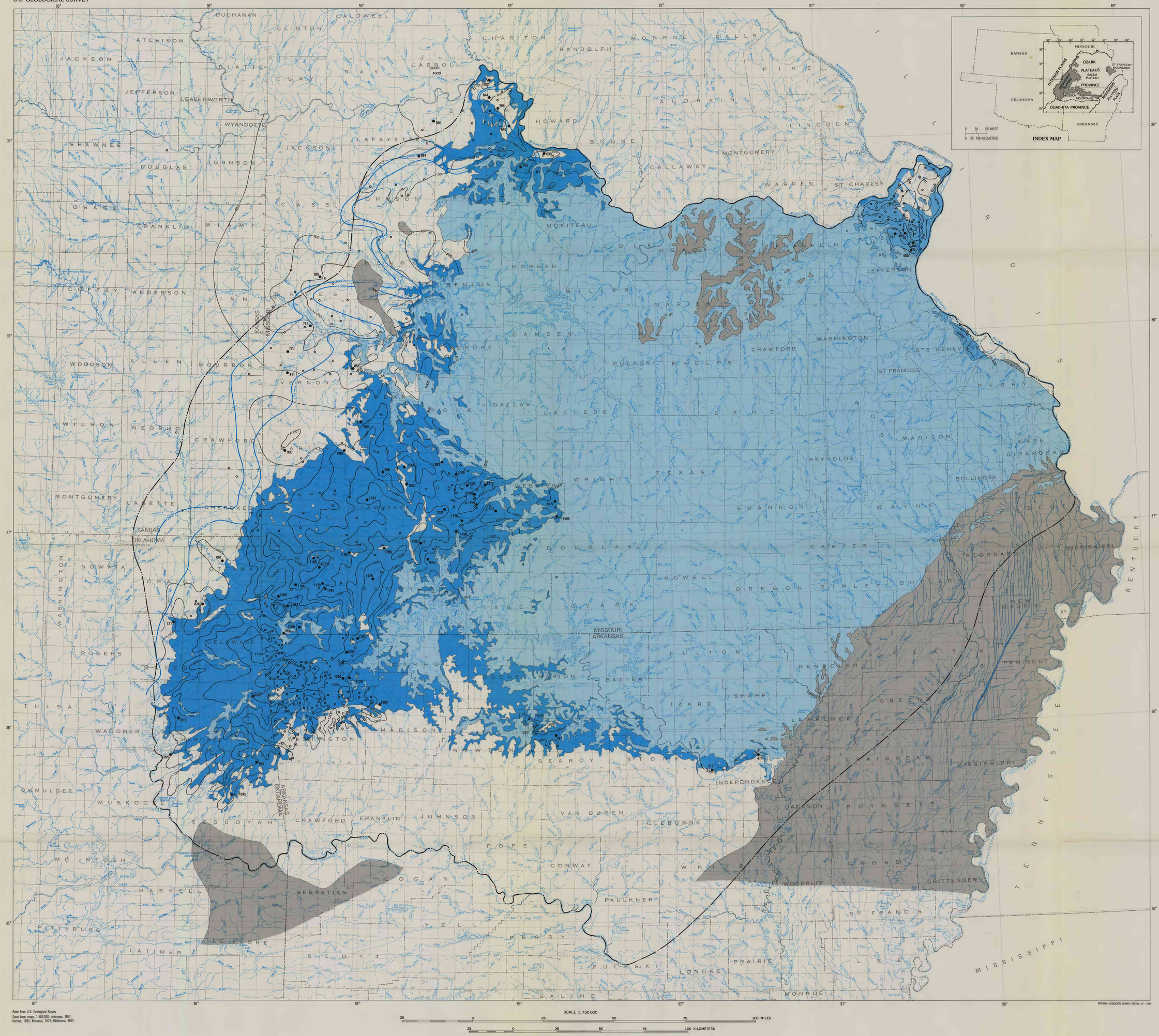
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

HYDROLOGIC INVESTIGATIONS
ATLAS HA–711–G (SHEET 3 OF 3)



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
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INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1990

Predevelopment potentiometric surface of Springfield Plateau aquifer

MAJOR GEOHYDROLOGIC UNITS IN AND ADJACENT TO THE OZARK PLATEAUS PROVINCE, MISSOURI, ARKANSAS, KANSAS, AND OKLAHOMA—SPRINGFIELD PLATEAU AQUIFER

By
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EXPLANATION

- **Outcrop area of Springfield Plateau aquifer**
- **Outcrop area of unnamed geohydrologic units that are stratigraphically equivalent to the Springfield Plateau aquifer (see text)**
- **Outcrop area of rocks comprising geohydrologic units older than Springfield Plateau aquifer**
- **Area where Springfield Plateau aquifer and stratigraphically equivalent units are missing in subsurface**
- Contact
- Approximate boundary of Ozark Plateaus aquifer system
- 1000 — **Potentiometric contour[1]**—Shows altitude at which water levels would have stood in tightly cased wells open to Springfield Plateau aquifer and stratigraphically equivalent units. Contours line in outcrop area drawn consistent with surface topography. Contour interval, in feet, is variable. National Geodetic Vertical Datum of 1929
- 1000 — **Line of equal dissolved-solids concentration[1]**—Data from which lines of equal dissolved-solids concentration are derived are not shown. Interval 1,000 milligrams per liter
- 880 **Control data point[1]**—Part of Central Midwest Regional Aquifer-System Analysis data base. Number is altitude, in feet, of water level. National Geodetic Vertical Datum of 1929
- **Auxiliary control data point[1]**

[1]Contours, lines, and control points beyond the boundary of the Ozark Plateaus aquifer system are for units stratigraphically equivalent to those of the Ozark Plateaus aquifer system

GROUND-WATER MOVEMENT

The potentiometric surface of an aquifer is defined as the altitude to which water would rise in fully penetrating wells cased to the top of the aquifer. The predevelopment potentiometric surface represents that which existed before large-scale withdrawals of water from the aquifer. Assuming isotropic conditions, lateral movement of water within the aquifer is perpendicular to the lines of equal hydraulic head and the rate of flow is proportional to the hydraulic gradient (change in hydraulic head with distance).

Where the Springfield Plateau aquifer crops out and is unconfined, contours generally are drawn such that where a potentiometric contour crosses the trace of a perennial stream, the altitude of the ground-water potentiometric surface is approximately equal to the altitude of the stream.

Along the perimeter of the Ozark Plateaus province, the potentiometric surface of geologic units that comprise the Springfield Plateau aquifer is greatly affected by topography. In west-central Missouri and eastern Kansas, where the Springfield Plateau aquifer crops out in about one-third of the Ozark Plateaus province, the aquifer's freshwater flow system is controlled by a complex interaction with the regional saline-water flow system to the west of the province and by topographic relief. The approximate limit of fresh water to the west of the Ozark Plateaus province is depicted by 1,000 and 2,000 milligrams-per-liter dissolved-solids concentration lines. In common with the underlying Ozark aquifer (Chapter E) the transition zone between fresh water and saline water nearly coincides with the eastern limit of the overlying Western Interior Plains confining system (Chapter H). However, the effect of topography is more noticeable on the transition zone in the shallower Springfield Plateau aquifer as shown by the "finger" pattern of the potentiometric contours and lines of equal dissolved-solids concentration. Generally, three river valleys in this area (Blackwater, Mairas des Cygnes, and South Grand) are discharge areas for the saline water. Fresh water in the Springfield Plateau aquifer moves westward between the river valleys then spreads radially to meet and mix with the saline water before discharging along the river valleys.

The Springfield Plateau aquifer is widely used for domestic- and stock-water supply in southwestern Missouri, northeastern Oklahoma, and northwestern Arkansas where the aquifer crops out and is unconfined. In this area water enters the aquifer from precipitation and moves laterally to discharge into streams or flow radially away from the Ozarks. In the eastern part of this area, ground water also leaks downward into the Ozark aquifer; however, in the western part the situation reverses and ground water moves vertically upward into the Springfield Plateau aquifer where it subsequently discharges into the Spring and Neosho River valleys. Because of the occurrence of large deposits of lead in Mississippian rocks of the tri-State (Missouri, Kansas, and Oklahoma) area, and the attendant water-quality problems associated with mining, the Springfield Plateau aquifer has been studied in some detail in the mining district (Spruill, 1984; and Feder and others, 1969, and references therein). Although the Springfield Plateau aquifer is used throughout the southwestern part of the Ozark Plateaus province, wells designed for large yields usually are open to both the Springfield Plateau aquifer and the underlying Ozark aquifer.

Little hydrologic data are available for the Springfield Plateau aquifer in northern Arkansas. Because the outcrop area occupies only a narrow band that parallels the outcrop area of the Ozark aquifer and because, like the Ozark aquifer, the Springfield Plateau aquifer dips beneath thick deposits of relatively impermeable Pennsylvanian rocks, the general ground-water flow pattern of the Springfield Plateau aquifer in northern Arkansas probably is similar to that of the Ozark aquifer (Chapter E). However, it must be emphasized that no data are available to support this hypothesis.

In Ste. Genevieve County, Missouri, the hydraulic gradient in geohydrologic units stratigraphically equivalent to the Springfield Plateau aquifer is northeast toward the Mississippi River where ground water discharges from the rocks. The rocks also receive water from the underlying Ozark aquifer in this area. In St. Louis and Jefferson Counties, Missouri, ground water moves from a northeast-trending ridge to the Missouri, Mississippi, and Meramec River valleys. A saline-water and fresh-water transition zone extending southeast through St. Louis County (note 1,000 milligram-per-liter dissolved-solids concentration line) indicates the mixing zone between the freshwater flow system in the Ozark Plateaus province and a saline-water flow system to the northeast (Gleason, 1935).

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