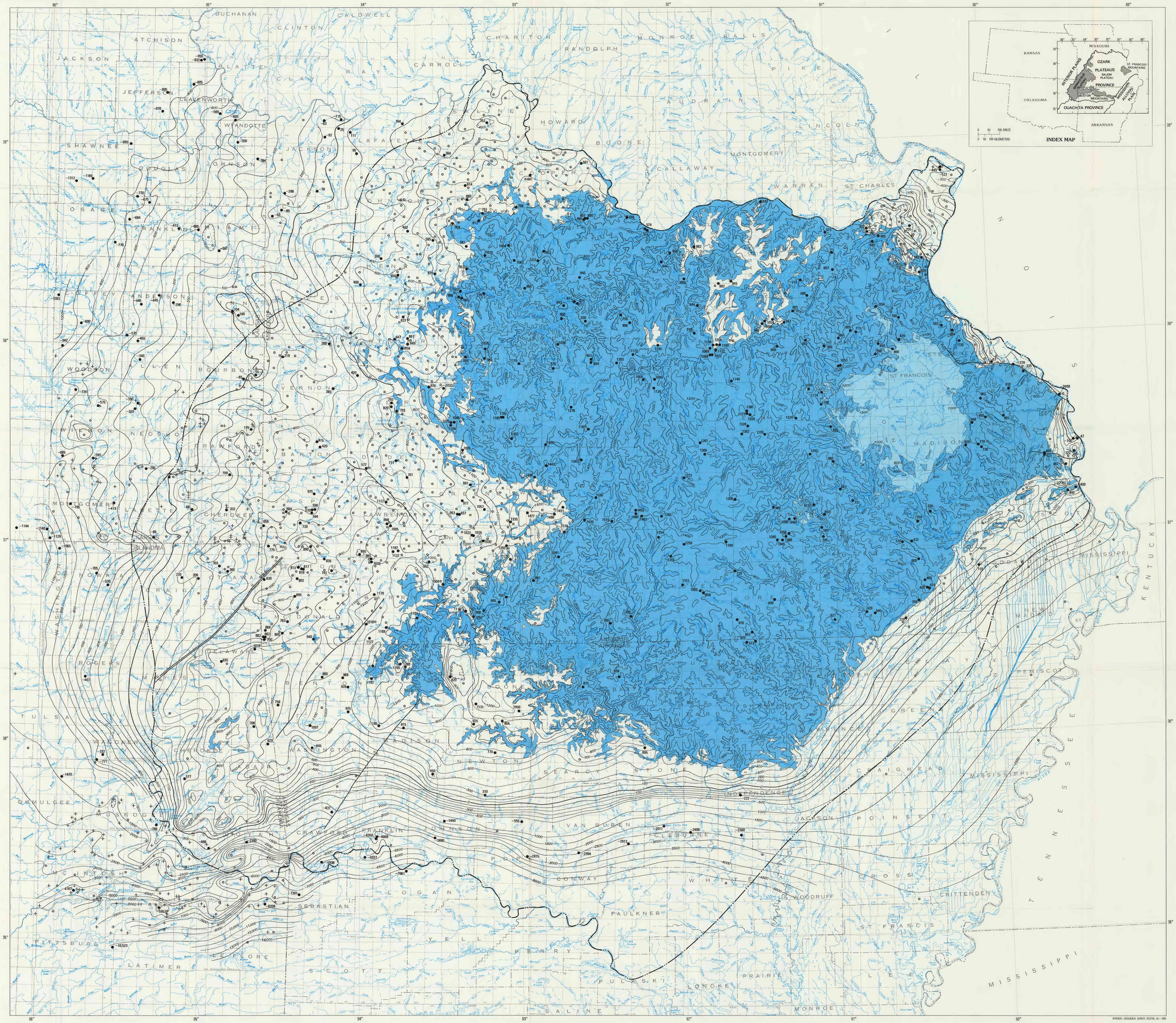
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

HYDROLOGIC INVESTIGATIONS
ATLAS HA–711–E (SHEET 1 OF 3)



Base from U.S. Geological Survey
State base maps, 1:500,000: Arkansas, 1967; Kansas, 1983; Missouri, 1973; Oklahoma, 1972

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1990

Altitude of top of Ozark aquifer

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

By
Jeffrey L. Imes

1990

EXPLANATION

- **Outcrop area of the Ozark aquifer**
- **Outcrop area of rocks comprising geohydrologic units older than the Ozark aquifer**
- **Contact**
- **Approximate boundary of Ozark Plateaus aquifer system**
- **Fault**—U, upthrown side; D, downthrown side
- **Structure contour**[1]—Shows altitude of top of Ozark aquifer. Contours in areas of few control points are consistent with control points and contours on maps of overlying and underlying geohydrologic units. Contours in outcrop area are modified from 1:500,000 scale, Missouri, Arkansas, and Oklahoma State base maps. Hachures indicate depression. Contour interval, in feet, is variable. National Geodetic Vertical Datum of 1929
- **Control data point**[1]—Part of Central Midwest Regional Aquifer-System Analysis data base. Number is altitude, in feet, of the top of Ozark aquifer. National Geodetic Vertical Datum of 1929
- **Auxiliary control data point**[1]
- **Supplementary control point**[1]—Control points from published map of top of Hunton Group in eastern Oklahoma by Amsden (1980), and published maps of the tops of Hunton and Arbuckle rocks in Kansas, by Merriam (1960) and Merriam and Smith (1961).

[1] Contours 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.

INTRODUCTION

An investigation of the geohydrologic system in the Ozark Plateaus province (Index map and Fenneman, 1938) has been made as part of the Central Midwest Regional Aquifer-System Analysis (Jorgenson and Signor, 1981), a major study that encompasses parts of 10 States. The study is one of several by the U.S. Geological Survey that are designed to increase knowledge of the flow regime and geohydrologic properties of regional aquifer systems in the United States. Because a large quantity of fresh ground water is available in aquifers underlying the Ozark Plateaus province, a subregional project has been established to study the geohydrologic units of this area in more detail than is practical in the regional study. The stratigraphic relationship among the primary geohydrologic units in the Ozark Plateaus province is discussed in Chapter A of this Hydrologic Investigations Atlas series. This chapter focuses on the Ozark aquifer, a geohydrologic unit within the Ozark Plateaus aquifer system underlying the Ozark Plateaus province.

THE OZARK AQUIFER

DEFINITION

The Ozark aquifer, the largest and most widely used aquifer in the Ozark Plateaus aquifer system, is composed of a sequence of geologic formations ranging in age from Late Cambrian to Middle Devonian that vary considerable in water-yielding capability, but collectively function as a regional aquifer. Stratigraphically, the aquifer's basal formation is the Potosi Dolomite. In eastern Missouri the upper boundary of the aquifer is coincident with the base of the Upper Ordovician Maquoketa Shale. This shale usually is underlain by the Kimmswick Formation, but the Cape Limestone may be locally present. West and south of the extensive outcrop area of the Ozark aquifer, the base of the Upper Devonian Chattanooga Shale stratigraphically represents the upper boundary of the aquifer.

STRUCTURAL FEATURES

Gradual uplift of the Ozark dome beginning in early Middle Ordovician time and erosion of younger rocks has exposed the Ozark aquifer in a large area throughout the Ozark Plateaus province. The aquifer's basal Cambrian rocks crop out along major river valleys in Camden and Morgan Counties, Missouri, and around the fringe of the St. Francois Mountains. The Ozark aquifer has been removed entirely from the core of the St. Francois Mountains, exposing older geohydrologic units. Ordovician rocks comprise the largest part of the aquifer's nearly circular outcrop area, which is circumscribed by a thin ring of younger Devonian rocks along most of the outcrop's outer circumference. The intermittent, gradual, and long-term rise of the Ozark dome has led to the formation of deeply dissected, rugged topographic features as surface drainage systems developed. The aquifer is broken by numerous faults and fracture systems, especially near the St. Francois Mountains (McCracken, 1966). Only the major faults are shown on this map.

Where the aquifer dips into the subsurface, it generally is overlain by Upper Devonian rocks; however, in the northern part of the province (Gasconade County, Missouri, and vicinity) the aquifer is in direct contact with as much as 200 feet of younger Pennsylvanian shale. To the southeast, in the Mississippi Alluvial Plain, the younger rocks of the aquifer have been removed by erosion and, subsequently, overlaid by thick deposits of Cretaceous, Tertiary, and Quaternary sediments. Small patches of the Ozark aquifer crop out along the northwest edge of the Mississippi Alluvial Plain.

In Kansas and western Missouri the aquifer dips to the west about 14 feet per mile with no significant change in the slope apparent along the boundary of the Ozark Plateaus province. The altitude of the top of the Ozark aquifer is about 150 feet at the west edge of the Ozark Plateaus aquifer system. A ridge of the Ozark aquifer extends southwest into Oklahoma and can be recognized on the land surface by a chain of island-like outcrops extending from Barry County, Missouri, to Sequoyah County, Oklahoma. This ridge approximately coincides with part of the area in northeastern Oklahoma where deeper geohydrologic units, the St. Francois confining layer and St. Francois aquifer, are missing in the subsurface along a southwest extension of the Ozark uplift. Uplift in this region probably began later and has not been as large as that in the St. Francois Mountains. The rate of dip of the aquifer increases at the southwest and south boundary of the Ozark Plateaus province. In Arkansas, the regional dip is about 26 feet per mile southward within the Ozark Plateaus province, increasing to 175 feet per mile or more near the province boundary. Beneath the Mississippi Alluvial Plain, the dip is about 45 feet per mile.

GENERALIZED STRATIGRAPHIC COLUMN SHOWING GEOLOGIC UNITS THAT COMPRISE THE OZARK AQUIFER

ERATHEM	SYSTEM		SOUTHEASTERN MISSOURI	SOUTHWESTERN MISSOURI	SOUTHEASTERN KANSAS	NORTHEASTERN OKLAHOMA	NORTHERN ARKANSAS	GEOHYDROLOGIC UNIT
PALEOZOIC	DEVONIAN			Chattanooga Shale	Chattanooga Shale	Chattanooga Shale	Chattanooga Shale	
				Callaway Formation		Sallisaw Formation	Clifty Limestone	
				Fortune Formation[1]		Frisco Limestone	Pentago Chert	
	SILURIAN						Lafferty Limestone	
						St. Clair Limestone	St. Clair Limestone	
							Brassfield Limestone	
	ORDOVICIAN		Maquoketa Shale			Sylvan Shale	Cason Shale	
			Cape Limestone[1]			Fernvale Limestone	Fernvale Limestone	
			Kimmswick Limestone	Kimmswick Limestone		Viola Limestone	Kimmswick Limestone	
			Decorah Formation					
			Platten Limestone	Plattin Limestone		Fite Limestone	Plattin Limestone	
			Brick Lewis Formation[1]					
			Joachim Dolomite	Joachim Dolomite		Tyner Formation	Joachim Dolomite	
			Dutchtown Formation[1]					
			St. Peter Sandstone	St. Peter Sandstone		Burgen Sandstone	St. Peter Sandstone	
			Everton Sandstone	Everton Sandstone			Everton Sandstone	
			Smithville Formation	Smithville Formation		Smithville Equivalent	Smithville Formation	
			Powell Dolomite	Powell Dolomite		Powell Dolomite	Powell Dolomite	
			Cotter Dolomite	Cotter Dolomite	Cotter Dolomite	Cotter Dolomite	Cotter Dolomite	
			Jefferson City Dolomite	Jefferson City Dolomite	Jefferson City Dolomite	Jefferson City Dolomite	Jefferson City Dolomite	
			Roubidoux Formation	Roubidoux Formation	Roubidoux Formation	Roubidoux Formation	Roubidoux Formation	
			Gasconade Dolomite	Gasconade Dolomite	Gasconade Dolomite	Gasconade Dolomite	Gasconade Dolomite	
			Van Buren Formation		Van Buren Formation	Van Buren Formation	Van Buren Formation	
			Eminence Dolomite	Eminence Dolomite	Eminence Dolomite	Eminence Dolomite	Eminence Dolomite	
			Potosi Dolomite	Potosi Dolomite	Potosi Dolomite	Potosi Dolomite	Potosi Dolomite	
			Doe Run Dolomite	Doe Run Dolomite	Doe Run Dolomite	Doe Run Dolomite	Doe Run Dolomite	

Ozark aquifer

[1] Unit follows usage of the Missouri Division of Geology and Land Survey.

For sale by U.S. Geological Survey Map Distribution
Box 25286, Federal Center, Denver, CO 80225