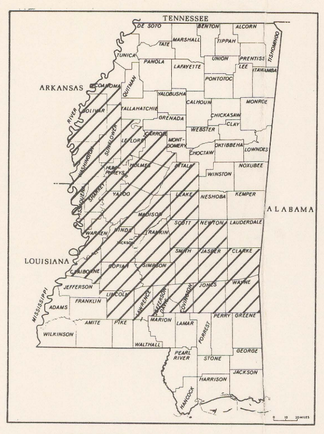
Department of the Interior
United States Geological Survey

Prepared in cooperation with the
Mississippi Department of Natural Resources
Bureau of Land and Water Resources

WATER-RESOURCES INVESTIGATIONS
OPEN-FILE REPORT 81-1053



LOCATION OF STUDY AREA
IN MISSISSIPPI

EXPLANATION

AREA OF OUTCROP OF COCKFIELD FORMATION--Generalized after Spiers (1977) from Belt and others (1945).

AREA OF SUBCROP OF COCKFIELD FORMATION BENEATH THE MISSISSIPPI RIVER VALLEY ALLUVIUM--Generalized after Spiers (1977).

200 POTENTIOMETRIC CONTOUR-- Shows altitude at which water level would stand in tightly cased wells. Dashed where approximately located. Contour interval is 20 feet. Datum is National Geodetic Vertical Datum of 1929. Based on measurements of water-level altitudes in wells and on water-surface altitudes of streams in and near outcrop area.

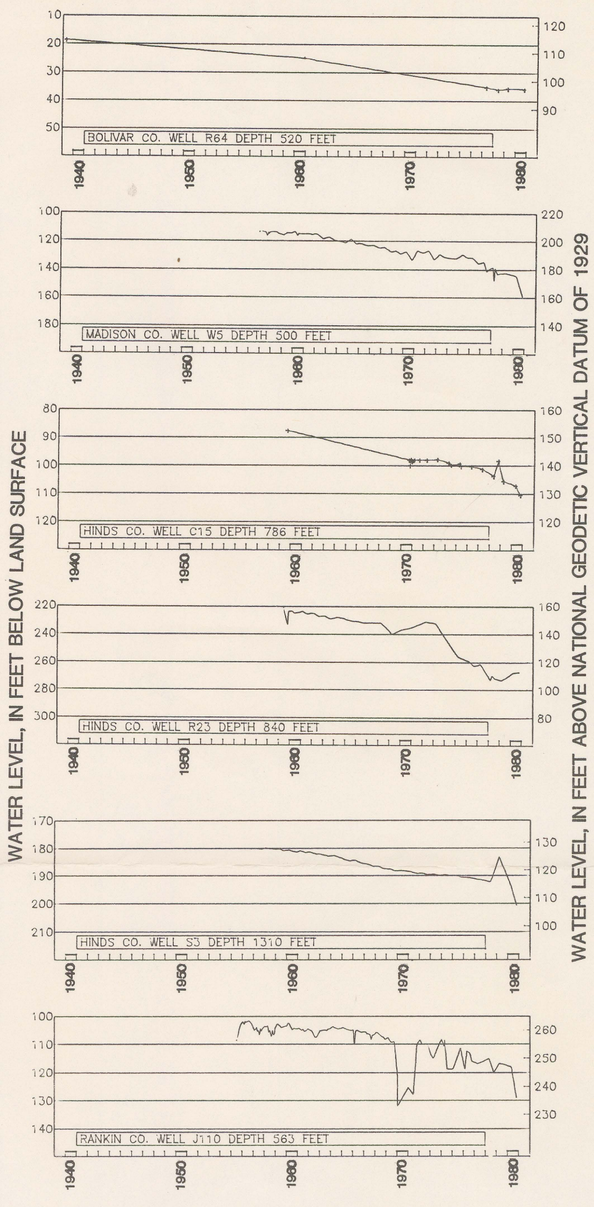
L15/252 OBSERVATION WELL--Upper number is well number which is alpha-numerical by county. Lower number is altitude of water surface in feet.

R23/113 OBSERVATION WELL FOR WHICH HYDROGRAPH IS SHOWN.

△280 POINT AT WHICH ALTITUDE OF WATER SURFACE IN STREAM DURING THE FALL WAS USED TO DEFINE THE POTENTIOMETRIC SURFACE OF AQUIFER. Number is approximate altitude of water surface in feet.

EAST EDGE OF MISSISSIPPI RIVER ALLUVIAL PLAIN-- That part of plain north of Vicksburg is known as the Yazoo basin and locally as "the Delta".

DOWNDIP LIMIT OF THE FRESHWATER IN THE COCKFIELD (SPIERS, 1971)



HYDROGRAPHS OF SELECTED WELLS
IN THE COCKFIELD AQUIFER
(See map for locations. Note that vertical scales vary. Straight lines coonnect data points. Data points represent periodic water-level measurements, generally made with steel tape.)

10 0 10 MILES

Base map modified from
U.S. Geological Survey
Map of Mississippi, 1972

POTENTIOMETRIC MAP OF THE COCKFIELD AQUIFER IN MISSISSIPPI, FALL 1980

The potentiometric map of the Cockfield aquifer is the eleventh in a series of maps, prepared by the U. S. Geological Survey in cooperation with the Mississippi Department of Natural Resources, Bureau of Land and Water Resources, delineating the potentiometric surfaces of the major aquifers in Mississippi. This map is based on (1) water-level measurements made in Mississippi in 105 wells during the fall of 1980, (2) measurements in 6 observation wells directly across the state line in Arkansas, and (3) water-surface altitudes determined at points on streams in or near the outcrop areas of the aquifer.

The base of the Cockfield Formation of Eocene age dips 20 to 50 feet per mile generally to the southwest away from the outcrop area (see map). In addition to the normal belt of outcrop, the formation is exposed in a small area over the Jackson Dome structure at Jackson. The Cockfield Formation increases in thickness from a feather edge in the outcrop area to about 600 feet in Warren and Washington Counties. Sand layers that form the Cockfield aquifer commonly make up about 50 percent of the thickness of the Cockfield Formation. A structure contour map and more geologic detail are given in Spiers (1977). Primary recharge to the aquifer is from precipitation in the outcrop areas. Mineralization of the water increases downdip. The downdip limit of freshwater (less than 1,000 milligrams per liter of dissolved solids) commonly is 50 to 70 miles southwest of the outcrop area, but freshwater extends less than 15 miles from the outcrop area at the Mississippi-Alabama state line.

Thick clay layers normally retard vertical movement of water into or out of the Cockfield aquifer. The Yazoo Clay, which lies above the Cockfield, is commonly several hundred feet thick south of Yazoo and Madison Counties. Also, a significant thickness of Yazoo Clay overlies the Cockfield aquifer and separates it from the Mississippi River Valley alluvial aquifer in Washington County and southwestern Bolivar County. (See area west of subcrop on map.) In areas where the alluvial aquifer is not separated from the Cockfield aquifer by a clay layer the water levels in the two aquifers are about equal.

The Cook Mountain Formation separates the Cockfield aquifer from the Sparta aquifer system below. The Cook Mountain south of Yazoo County consists of about 170 feet of predominantly clayey material, but northward the formation is sandier and may not effectively prevent flow between the two aquifers.

Depths of wells completed in the Cockfield aquifer range from less than 100 feet in the outcrop area to about 1,300 feet near the downdip limit of freshwater. Properly designed and constructed wells commonly produce about 300 gallons per minute; however, some wells in the Greenville area produce about 1,500 gallons per minute. The Cockfield is an important source or potential source of water in about 30 percent of Mississippi.

In the outcrop area of the Cockfield, the potentiometric surface is strongly affected by topography, drainage of the aquifer by streams, and recharge from precipitation. The potentiometric surface slopes generally to the west away from the outcrop area and is strongly influenced by large groundwater withdrawals in the Jackson and Greenville areas.

In the small outcrop area of the Cockfield over the Jackson Dome at Jackson there is good recharge potential from precipitation and from the Pearl River. There is little pumpage from the small outcrop area at Jackson, but in the larger metropolitan area pumpage is about 5 million gallons per day (Spiers, 1977). This pumpage has caused significant depression and distortion of the potentiometric surface in the area around Jackson.

Pumpage of about 16 million gallons per day from the Cockfield aquifer in the Greenville area has caused a 60-foot depression in the potentiometric surface in Greenville. In this area, the Cockfield aquifer is separated from the Mississippi River Valley alluvial aquifer by the Yazoo Clay, and the water level in the Cockfield is as much as 90 feet lower than that in the alluvium. In much of the Mississippi River alluvial plain in Northwestern Mississippi the Cockfield subcrops under the alluvial aquifer (see map), and therefore, in this area, the potentiometric surfaces of the two aquifers have much the same shape and altitude. (See Wasson, 1980h, for alluvial potentiometric map.)

Whereas water levels in or near the outcrop of the Cockfield aquifer have shown little long-term change, heavy withdrawals have caused long-term water-level declines of 1 to 2 feet per year in much of the confined part of the aquifer (see hydrographs). Water-level declines of 2 feet per year have occurred in much of the area surrounding Jackson. Some of these hydrographs also show effects of variable pumpage in nearby wells. Potentiometric maps of large parts of the Cockfield aquifer have been made by Brown (1947), Harvey and others (1964), and Spiers and Dalsin (1979).

Other reports containing information on the geohydrology of the Cockfield aquifer and nine other potentiometric maps in this series are included in the selected references.

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_____ 1980h, Water-level map of the Mississippi Delta alluvium in northwestern Mississippi, September 1980: Mississippi Department of Natural Resources, Bureau of Land and Water Resources, Water Resources Map 80-1, 1 sheet.

POTENTIOMETRIC MAP OF THE COCKFIELD AQUIFER IN MISSISSIPPI, FALL 1980

B. E. WASSON

1981