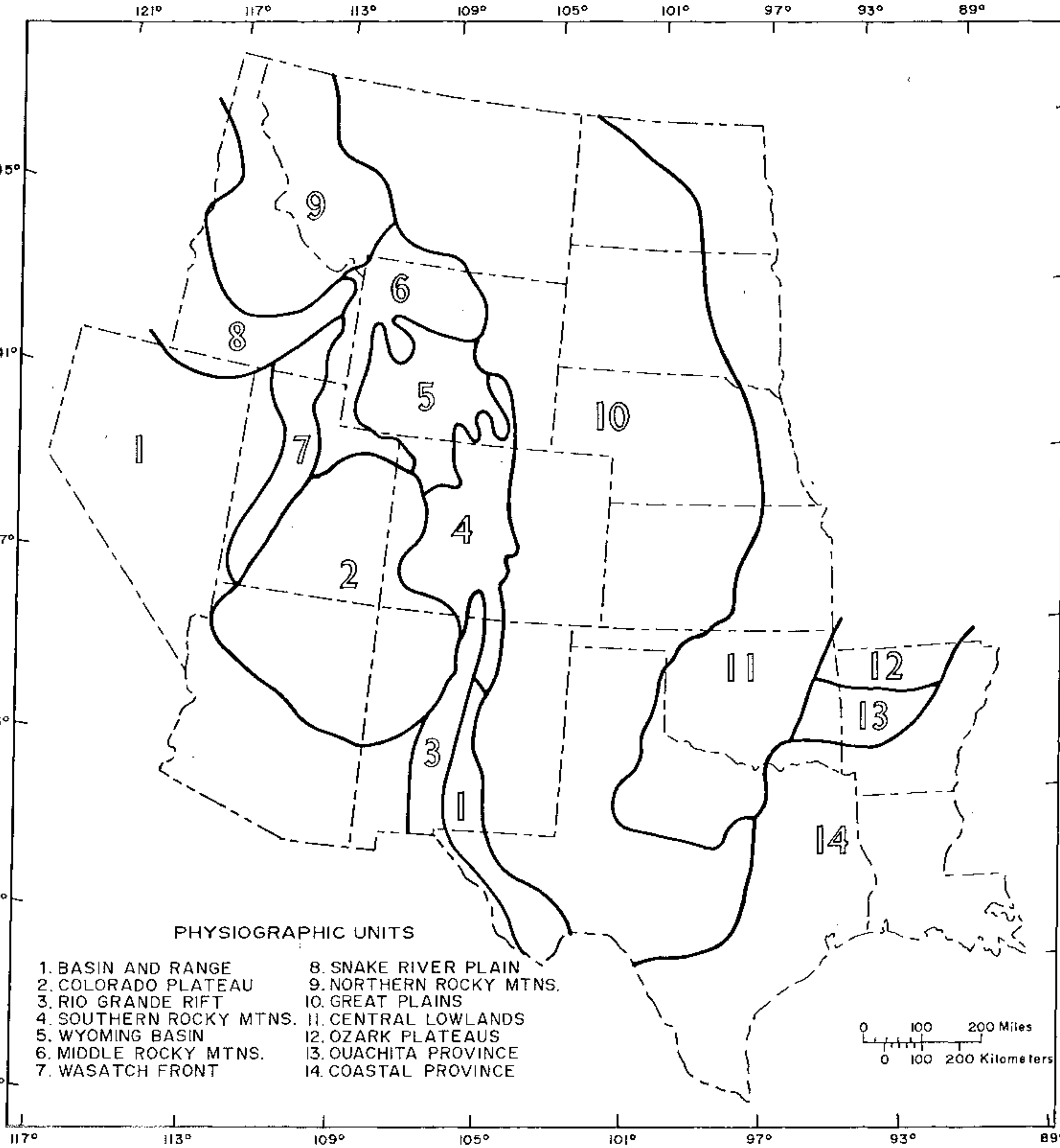

PHYSIOGRAPHIC PROVINCES

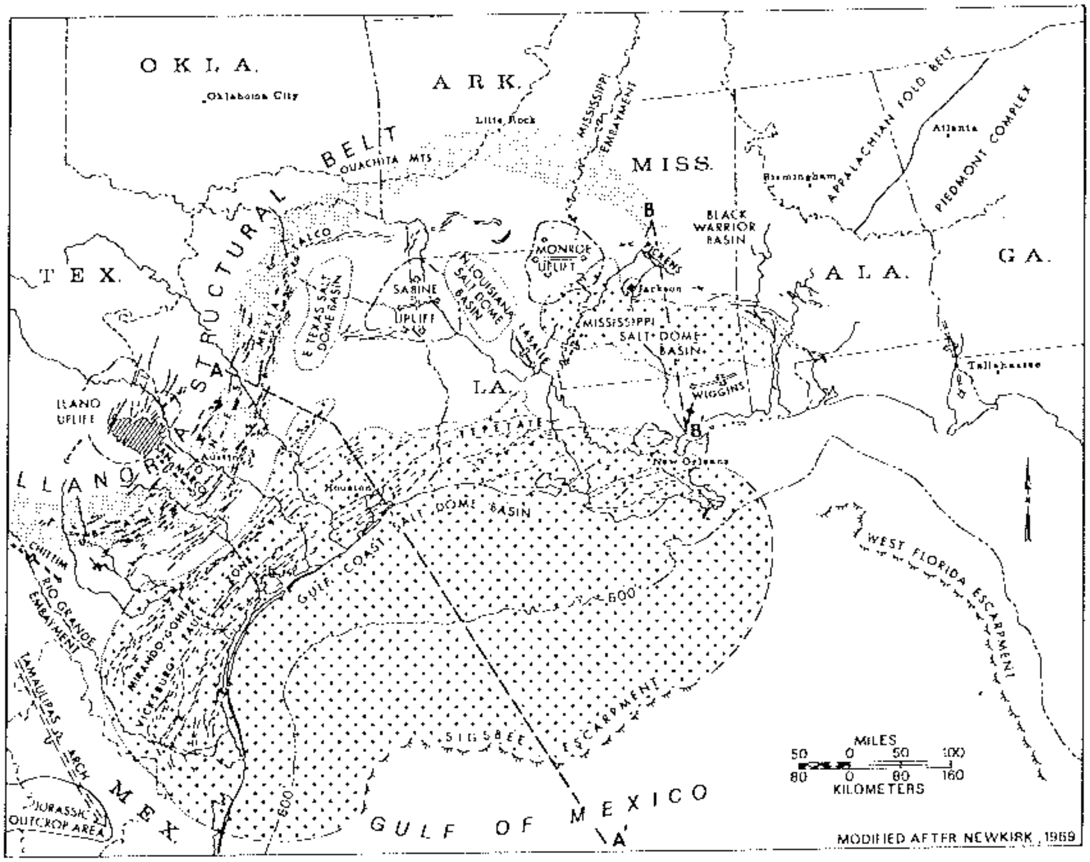

FIGURE 1. Tectonic map of South-Central United States showing locations of geologic profiles A-A' and B-B'.

INTRODUCTION

No commercial development of geothermal energy for process heat or power generation has yet been made in the South-Central United States, and prior to the past decade (Hottman, 1966) few earth scientists believed significant geothermal resources—in terms of national energy requirements—might be present in this region. Only in the vicinity of Hot Springs, Arkansas (Waring, 1965), and perhaps in a few other lesser-known places, is there any surface indication of geothermal heat flow at rates that might warrant prospecting for this type of energy source.

Following Hottman's suggestions, a regional study of temperatures and pressures in the northen Gulf of Mexico Basin was made by the author (Jones, 1970, pp. 14-26). The study identified a very large (150,000 mi² or 375,000 km²) geopressured geothermal reservoir system, reported by White and Williams (1975, p. 154) to have a geothermal energy potential "deliverable at the wellhead in the assessed onshore part of the Gulf Coast . . . likely to range from 9,000 to 35,000 megawatt centuries." This is ten times larger than the estimated total potential of all high-temperature convection systems associated with igneous rocks in the western United States,

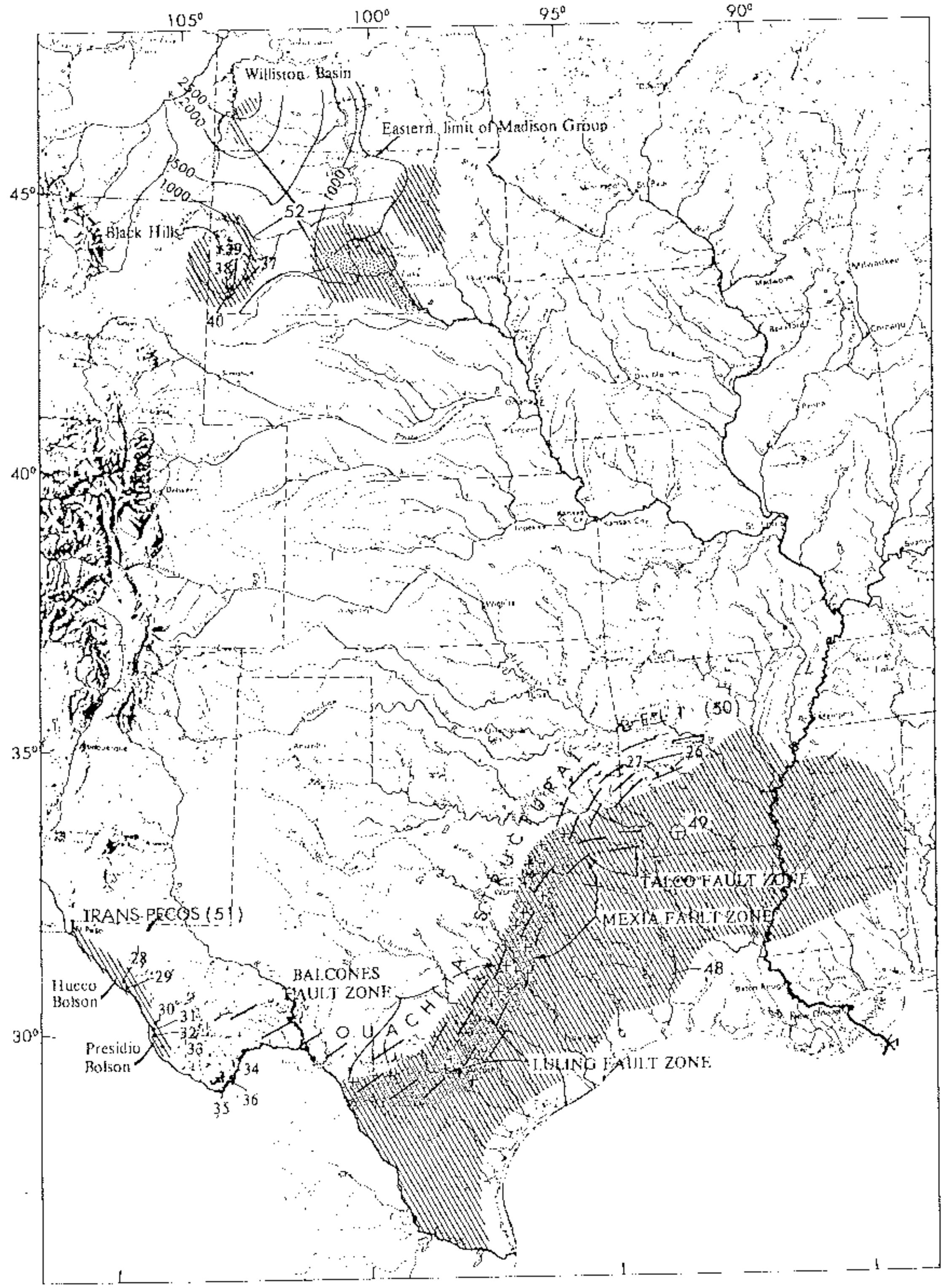

Figure 16.--Locations of known and inferred low-temperature geothermal waters in the Central United States.

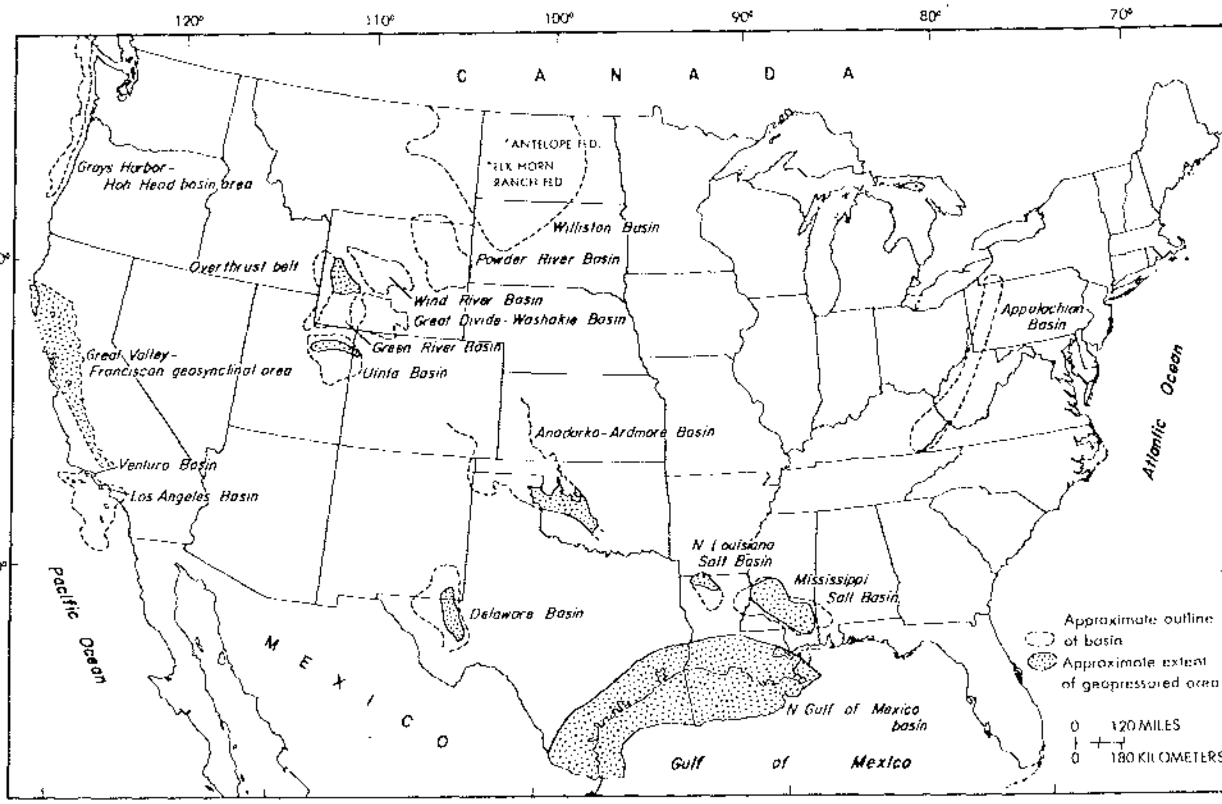

Figure 26.--Geopressured basins of the United States.

as the sandstone-shale divider. When the SP curve was deflected across the midline to the left, sandstone was recorded until it again deflected across the midline to the right, indicating shale.

This procedure worked well except when sandstone beds of low porosity or low salinity were encountered. In such cases, the SP curve becomes very subdued, disappears completely or reverses, and cannot be used to determine sandstone accurately. The resistivity curve usually was used in these instances to distinguish sandstone from shale because the sandstone exhibited higher resistivity. Sandstone thickness was then determined by accumulating the definite peaks on the resistivity log.

In some instances, especially in very deep wells and in wells penetrating Cretaceous sedimentary rocks, a gamma ray-resistivity log was run in place of the SP-resistivity log for the deeper runs. If the gamma ray log showed suitable variation in intensity, indicating clear distinction of sandstone and shale, the gamma ray curve was used to estimate sandstone content. If, as was many times the case, the gamma ray log was noisy or otherwise nondistinctive, the resistivity curves were again used to estimate sandstone content.

After the selected wells were "sand counted" and the net sandstone value per 500-ft (152-m) interval coded, the data were converted by computer into the 1500-ft (457-m) intervals for use in the assessment. Vertical extrapolations of sandstone content below the total depths of wells were not attempted. For wells not penetrating a complete 500-ft (152-m) interval, only the amount of sandstone recorded to total depth from the beginning of the last 500-ft (152-m) interval was used. No extrapolation or proportioning was carried out to estimate total sandstone in the last segment as if it were a complete 500-ft (152-m) interval. The amount of sandstone below the depths reached by these wells in the assessment model was controlled by horizontal extrapolation using trend-surface analysis based on available control within each depth interval.

Porosity

Sandstone

Decrease of porosity with depth was determined individually for each major embayment in the study area. For the Rio Grande and Houston embayments a wide range of porosity determinations from side-wall cores, conventional cores, and well test data were used. For the Mississippi embayment, porosity information from the Federal Power Commission's (FPC) (now Federal Energy Regulatory Commission) files (form 15), which contain average porosities of gas reservoirs, was used. A linear relation of por-

ARKANSAS

A. GEOLOGIC SETTING

There are three physiographic provinces in Arkansas: the Coastal Province, the Ouachita Province and the Ozark Plateau Province. ~~At present~~, Known occurrences of potential geothermal resources are restricted to the Coastal Province and the Ouachita Province.

¶ Numerous wells and test holes in the southern half of the Arkansas Coastal Province have abnormally high thermal gradients and produce thermal waters from depths less than 1 km. In southwestern Arkansas, in the Hope-El Dorado area, many wells have gradients ranging from 33° to 40° C/km. Some of these wells produce thermal brines from Jurassic and Cretaceous aquifers lying at depths of 3.0 to 2.5 [illegible]. The maximum temperature [illegible] produced from the deepest zones is 140°C. This thermal brine field may extend over a large portion of southwestern Arkansas, and possibly into Northern Louisiana.

The Ouachita Province is dominated by the Ouachita Structural Belt, a zone of thrust faulting that extends from Texas northeast into Oklahoma and Arkansas. The two known hot springs in Arkansas, Hot Springs and Caddo Hot Springs occur in this area of thrust faulting. Deep circulation of water along faults. probably controls these hot springs.

There may be a limited area with potential geopressured-geothermal resources in southern Arkansas. The extreme southern portion of the North Louisiana Salt Dome Basin may extend into Arkansas. In Louisiana, geopressured geothermal wells in this basin produce 93° to 149°C saline fluids from depths of 10,900' (3322 m) to 13,000' (3962 m).

B. High Temperature Reservoirs (>150°C)

Confirmed Reservoirs: None

Prospects: None

C. Low to Moderate Temperature Reservoirs (<150°C)

Confirmed Reservoirs: None

Prospects:

The thermal brine fields of southwestern Arkansas, zones of elevated thermal gradient in southern Arkansas, the Ouachita Thrust Fault Belt including Hot Springs and Caddo Gap Springs, and possibly the Northern Louisiana Salt Dome Basin in southern Arkansas

D. Comments

Current knowledge of the geothermal resource potential of Arkansas is limited. More work is needed before it can be accurately assessed.