

PRELIMINARY REPORT ON NEAR-SURFACE  
LIGNITE OCCURRENCES, CLEVELAND COUNTY, ARKANSAS

By

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature

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## Abstract

Four cross sections were constructed from lithologic descriptions of 43 drill holes in Cleveland County, Ark., in order to illustrate the occurrence of lignite and to relate the lignite beds to the regional stratigraphic framework. Of 43 holes drilled, 8 contained beds of lignite, but only two had beds greater than 30 in. thick. These beds are apparently lenticular and are restricted to the upper 60 ft. of the Cockfield Formation of the Claiborne Group of Middle Eocene age. The Cockfield Formation is at or near the surface west of the Saline River.

## Introduction

Lignite occurs in Paleocene and Eocene strata throughout the Gulf Coastal Plain in Arkansas. In 1975, the Arkansas Geological Commission began a program of drilling and coring in the lignite-bearing regions of the state to determine the occurrence and resource potential of lignite. Holes generally 150 ft deep were drilled about 1 mile apart along highway rights-of-way in 16 counties in Arkansas. The information gathered was published as lithologic descriptions of drill cuttings (Clardy, 1979; Holbrook, 1980) and as chemical analyses of samples of lignite cored in offset holes (Hildebrand and others, 1981). This report, based on information on Cleveland County found in those publications, uses cross sections to illustrate the occurrence of lignite in Cleveland County and to relate the lignite beds to the regional stratigraphic framework.

## Geology

Unconsolidated sand, silt, and clay of the Claiborne and Jackson Groups of Middle and Upper Eocene age and terrace and alluvial sediments of Quaternary age make up the sedimentary deposits exposed in Cleveland County, Ark. (fig. 1). Found in the subsurface are unconsolidated to poorly consolidated sediments of Cretaceous, Paleocene, and Eocene age. The Jackson Group and Quaternary deposits are found at the surface throughout most of the county, whereas the Claiborne Group is at the surface only near the western edge (fig. 2).

The Claiborne Group contains the only near-surface lignite beds in Cleveland County. It is at or near the surface west of the Saline River and reaches a maximum depth of 500 ft in the subsurface in the northeastern part of the county (estimated from Terry and others, 1979). Only the uppermost formation of the Claiborne Group, the Cockfield Formation, was penetrated in the drilling program, and it averages 200 ft thick in the subsurface (estimated from Terry and others, 1979). It is composed of nonmarine sand, silt, and clay; carbonaceous and lignitic zones; and lenticular beds of lignite. The Cockfield Formation is underlain by the Cook Mountain Formation, which consists of glauconitic sediments of marine origin (Spooner, 1935).

The White Bluff Formation of the Jackson Group, the only formation of this group found in Cleveland County, overlies the Claiborne Group and

contains two members in Cleveland County, both of marine origin: The Caney Point Member at the base, and the overlying Rison Member. The Caney Point Member averages 11 ft thick and is composed of calcareous, glauconitic, and fossiliferous clay and sand that commonly contain ironstone nodules. The Caney Point Member grades upward into the Rison Member which is composed chiefly of silt and clay (see Wilbert, 1953).

The Jackson-Claiborne contact is well marked by the fossiliferous, calcareous greensand and clay of the Caney Point Member that overlie the carbonaceous and lignitic sediments of the Cockfield Formation (Wilbert, 1953). That contact is an especially useful datum for drillers because lignite beds are found most frequently near the top of the Cockfield Formation.

Quaternary alluvium in flood plains and terrace deposits cover a large portion of Cleveland County. Those sediments range from 0 to 40 ft in thickness (Plebuch and Hines, 1969) and are found in lowlands along the Saline River, Moro Creek, Derriousseaux Creek, Big Creek, and Hudgin Creek.

In most of Cleveland County, structural strike is oriented northwest-southeast, or approximately parallel to the Saline River, and strata dip to the northeast. Strike is oriented north-south and the strata dip to the east in the northwest part of Cleveland County.

#### Cross Sections

Four cross sections were constructed from the lithologic descriptions of 43 drill holes and the boundary between the Cockfield Formation and the White Bluff Formation was identified on the basis of lithologic changes found in those descriptions.

Cross section A-A' (plate 2) is composed of drill holes that penetrated only the Cockfield Formation. The cross section, oriented north-south along U.S. Route 167, is approximately parallel to structural strike. Lignitic zones were found in 5 of the 7 drill holes, but only DH 527 contained a lignite bed. The thickness of that bed is 66 in.

Cross section B-B' (plate 3), located along U.S. Route 79 from the east-central to the north-central part of Cleveland County, is in general oriented perpendicular to structural strike. DH 373 and DH 388 - DH 391, which show glauconitic sand and clay underlain by strata containing lignitic clay and beds of lignite, clearly identify the position of the Jackson-Claiborne contact. Lignite occurs in all 7 of the drill holes that partially penetrated the Cockfield Formation. A lignite bed, as thick as 36 in. in DH 390 may be continuous with thinner lignite beds in drill holes to the west. To the east, the lignite bed thins and becomes clayey. North of DH 373, the drill holes penetrated only the White Bluff Formation and no beds of lignite were found.

Cross section C-C' (plate 4), located in southwestern Cleveland County, is oriented northwest-southeast and is approximately parallel to structural strike. The drill holes penetrated sediments of both the White Bluff and Cockfield Formations. The boundary between these formations is well marked in DH 491 and DH 492 where ironstone and fossiliferous greensand

SERIES	GROUP	FORMATION	
UPPER EOCENE	JACKSON	REDFIELD FM.	
		RISON MBR. ----- CANEY POINT MBR.	WHITE BLUFF FM.
		COCKFIELD FM. ----- COOK MOUNTAIN FM. ----- SPARTA SAND ----- CANE RIVER FM. ----- GARRIZO SAND	
MIDDLE EOCENE	CLAIBORNE		

Figure 1.--Chart showing stratigraphic nomenclature of Middle and Upper Eocene strata of Arkansas (from Hackman and Meissner, 1962).

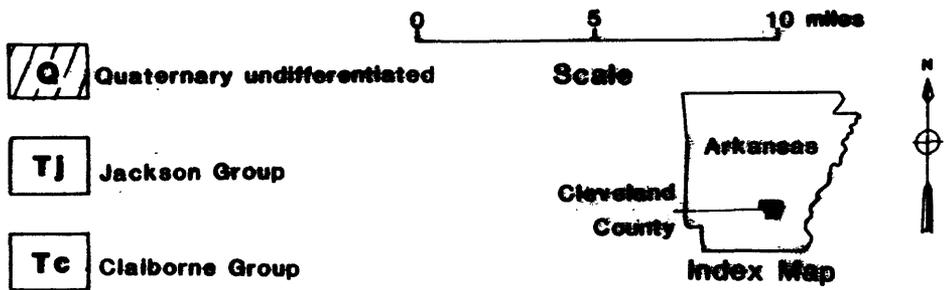
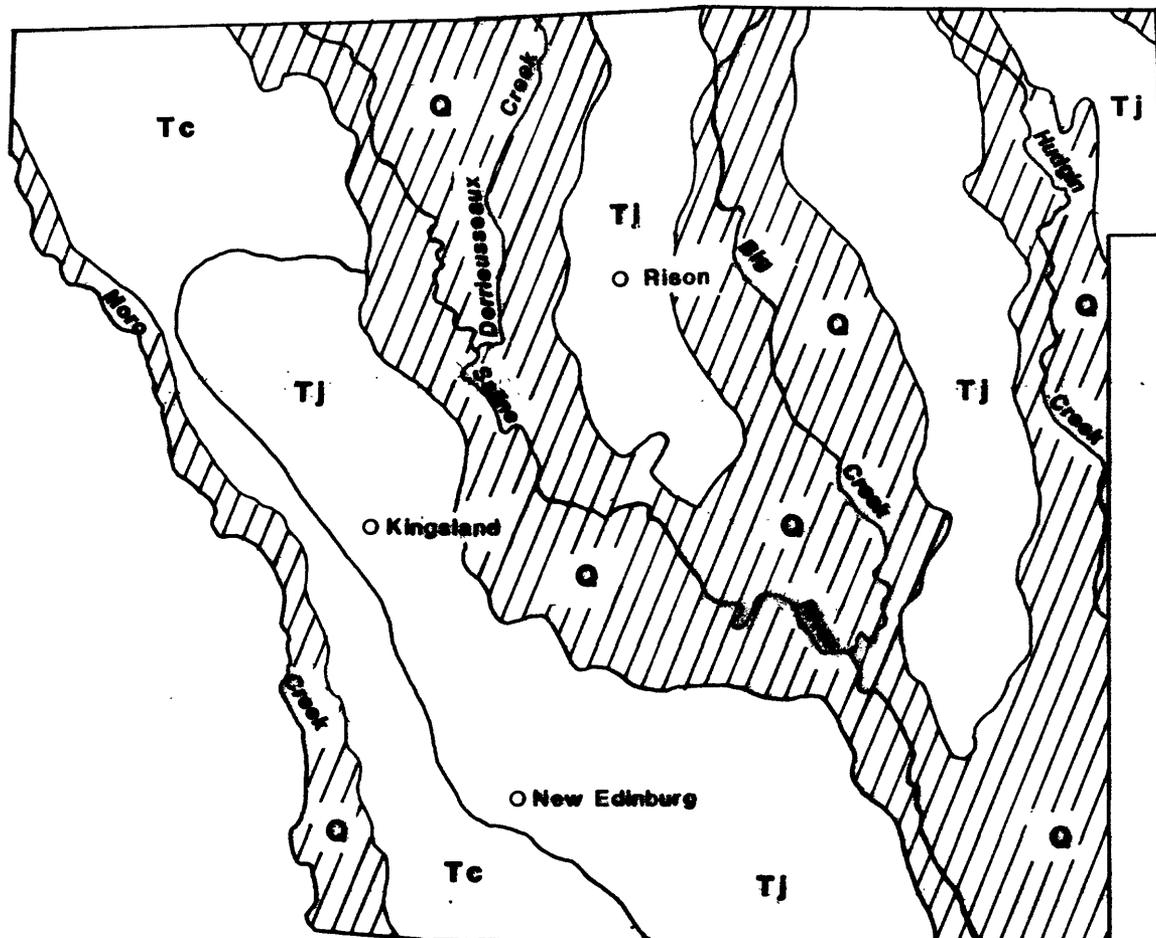


Figure 2.--Geologic map of Cleveland County, Arkansas (modified from Plebuch, 1969).

of the Caney Point Member of the White Bluff Formation overlies carbonaceous sand of the Cockfield Formation. Southeast of DH 492, where fossiliferous greensand and clay of the Caney Point Member are absent or were unreported, the boundary between the White Bluff and Cockfield Formations is poorly defined. A bed of lignite twenty-four in. thick was found in DH 493 and a bed of lignite 12 in. thick was found in DH 496.

Cross section D-D' (plate 5), located east of the Saline River in the north-central part of Cleveland County, is oriented northwest-southeast and is approximately parallel to structural strike. All of the holes were spudded in the White Bluff Formation, but only three reached the Cockfield Formation. None of these holes were found to contain beds of lignite.

### Lignite Occurrences

The U.S. Geological Survey defines as resources, beds of lignite at least 30 in. thick. Of the 43 drill holes placed in Cleveland County, 26 partially penetrated the Cockfield Formation. Eight of these encountered beds of lignite, but only 2 contained lignite beds of resource thickness.

The lignite beds occur in the upper part of the Cockfield Formation. The beds are restricted to a zone extending from the top of the Cockfield Formation, as is illustrated in DH 390 of plate 3, to approximately 60 ft below the top of the Cockfield as is illustrated in DH 493 of plate 4. Within this zone the beds are apparently lensoidal and occur at different stratigraphic horizons. Drill hole data suggest that only traces of lignite occur in the older parts of the Cockfield Formation in Cleveland County. The White Bluff Formation is mostly of marine origin and contains only traces of lignite.

Further exploratory drilling into the Cockfield Formation is needed to develop a clearer knowledge of the continuity of the lignite beds. It is suggested that future drilling be concentrated west of the Saline River north of Kingsland and west of Route 79 south of Kingsland where the lignite-bearing Cockfield Formation is found at or near the surface.

Samples of lignite from DH 390 and DH 527 were analyzed by the Coal Analysis Section of the Department of Energy for chemical composition and the results were published by Hildebrand and others (1981). The proximate and ultimate analyses, the heat-of-combustion, and the forms of sulfur are shown in table 1 for samples analyzed on an as-received, moisture-free, and moisture- and ash-free basis.

### Summary

Lignite beds thicker than 30 in. were found in 2 of the 43 holes drilled in Cleveland County. The beds are lenticular and are at different stratigraphic horizons within the upper 60 ft. of the Cockfield Formation. The White Bluff Formation contains no known lignite beds.

Table 1.--Ultimate and proximate analyses for 2 lignite samples from the Cockfield Formation of the Claiborne Group, Cleveland County, Arkansas (Results in percent except heating values. (a) as received; (b) moisture free; (c) ash and moisture free. Analyses by the Coal Analysis Section, Department of Energy, Pittsburgh, Pa. Data from Hildebrand and others, 1981.)

Drill hole and sample number	Sample type	Proximate Analysis			Ultimate Analysis			Heating Value Btu/lb	Sulfur Form					
		moisture	volatile fixed matter	carbon ash	hydrogen	carbon	nitrogen		oxygen	sulfur	sulfate	pyritic	organic	
DH 390 D205169	a	31.5	29.8	20.6	18.1	6.4	36.0	0.8	38.2	0.5	6,250	0.01L <sup>1</sup>	0.13	0.40
	b	---	43.5	30.1	26.4	4.2	52.6	1.2	14.9	0.7	9,130	0.01L	0.19	0.58
	c	---	59.1	40.9	---	5.8	71.4	1.6	20.2	1.0	12,410	0.01L	0.26	0.79
DH 527 D211821	a	45.8	27.2	20.1	6.9	8.1	34.5	0.6	49.5	0.4	6,080	0.01L	0.05	0.32
	b	---	50.2	37.1	12.7	5.6	63.7	1.1	16.2	0.7	11,210	0.01L	0.09	0.59
	c	---	57.5	42.5	---	6.4	72.9	1.3	18.6	0.8	12,850	0.01L	0.11	0.68

<sup>1</sup>L means less than the value shown.

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