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UNITED STATES GEOLOGICAL SURVEY

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MINERAL RESOURCE POTENTIAL AND GEOLOGY OF THE BELL STAR EAST AND WEST ROADLESS AREAS, SEBASTIAN AND SCOTT COUNTIES, ARKANSAS

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STUDIES RELATED TO WILDERNESS

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and related acts, the U.S. Geological Survey and the U.S. Bureau of Mines have been conducting mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness," "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System, and some of them are presently being studied. The act provided that areas under consideration for wilderness designation should be studied for suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. The act directs that the results of such surveys are to be made available to the public and be submitted to the President and the Congress. This report discusses the results of a geologic and mineral survey of Bell Star East (08088) and Bell Star West (08089) Roadless Areas, Ouachita National Forest, Sebastian and Scott Counties, Arkansas. Bell Star East and West Roadless Areas were classified as further planning areas during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

MINERAL RESOURCE POTENTIAL SUMMARY STATEMENT

The U.S. Geological Survey and U.S. Bureau of Mines conducted a mineral and geological survey of the Bell Star East and West Roadless Areas in 1981-82. The roadless areas cover about 5,900 acres for Bell Star East and 5,560 acres for Bell Star West in the Ouachita National Forest, Sebastian and Scott Counties, west-central Arkansas. Belle Starr Cave Wilderness Study Area separates the two roadless areas. The roadless areas are in the southern part of the Arkansas Valley section of the Ouachita physiographic province.

Rocks that crop out in the two roadless areas and in the wilderness study area between them are the Savanna and McAlester Formations of Pennsylvanian age. The McAlester Formation, which underlies the Savanna, contains the Lower Hartshorne coal bed that has been mined both north and south of the roadless areas. This low- to medium-volatile bituminous coal bed probably underlies both the roadless areas and the wilderness study area and represents a high potential for the occurrence of coal in the roadless areas. Inferred resources of 47.5 million short tons of coal are thought to underlie the roadless areas.

Natural gas has been produced from the Hartford anticline north of the roadless areas and from the Waldron syncline southeast of the areas. No natural gas or crude oil has been found in the roadless areas. Gas wells in the Mansfield field, Sebastian County, Ark., are still producing, but no gas production was reported from Scott County, Ark., in 1981. Fields in Sebastian County produce small quantities of gas from the Atoka and Hale Formations of Pennsylvanian age from depths of as much as 6,000 ft. These formations are pesent at depth beneath Bell Star East and West Roadless Areas. Exploratory drilling would be necessary to determine the occurrence of gas in Bell Star East and West Roadless Areas. Reinemund and Danilchik (1957) and Haley (1966) believe there is potential for small amounts of gas in the wilderness and roadless areas. The potential for coal-bed gas from the Lower Hartshorne coal bed is low.

INTRODUCTION

Bell Star East and West Roadless Areas cover 11,460 acres in the Ouachita National Forest in Sebastian and Scott Counties, west-central Arkansas (fig. 1). The roadless areas are about 30 mi south of Fort Smith, Ark. About 98 percent of the surface rights are owned by the Federal Government; the remainder is privately owned. Most mineral rights, except for oil and gas leases, are held by the Federal Government, but mineral rights on 129 acres are privately owned. About 70 percent of the roadless areas is leased for oil and gas.

Elevation in the roadless areas ranges from 740 ft at the northern boundary of Bell Star East to 2,570 ft on the western boundary of Bell Star West. Terrain is mainly steep, rock-covered slopes with a relatively flat hilltop.

Access to the southern part of the roadless areas is by U.S. Forest Service Road 158; access to the northern part of the area is by dirt and primitive roads, several of which are private roads cutting

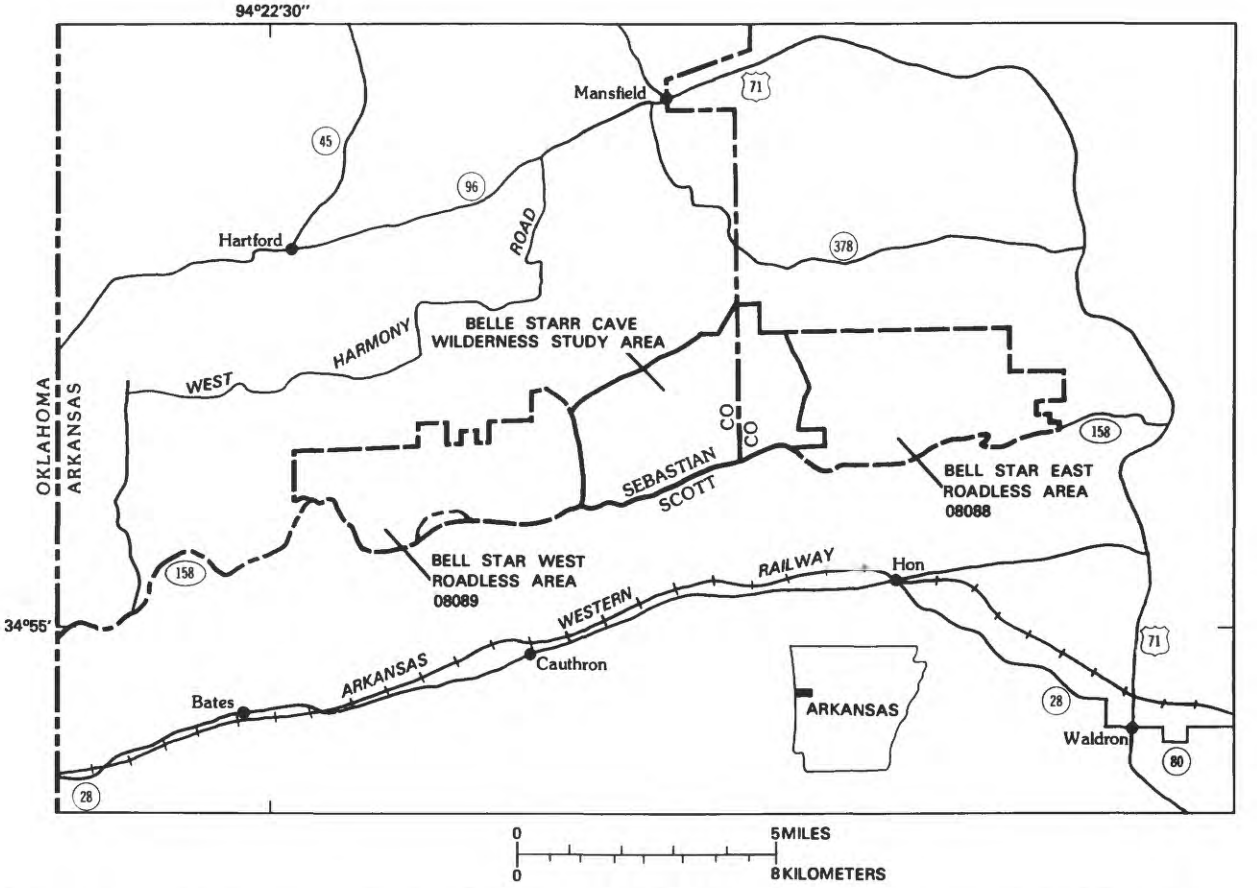

Figure 1.--Index map of Bell Star East and West Roadless Areas and Belle Starr Cave Wilderness Area, Sebastian and Scott Counties, Ark.

across privately owned land. The roadless areas are moderately timbered. Drainages in the area are West, James Fork, Alum Fork, Posey, Rock, Kings, Old Freedom, and Clear Creeks.

The mineral resource potential map (fig. 2) covers Bell Star East and West Roadless Areas and Belle Starr Cave Wilderness Study Area. Sample localities shown on the map are in the wilderness study area and the roadless areas.

GEOLOGY

The oldest formation exposed in the vicinity of Bell Star East and West Roadless Areas is the Pennsylvanian Atoka Formation (fig. 2). According to Reinemund and Danilchik (1957), the Atoka Formation in this region may be as much as 19,000 ft thick; it is made up of fissile shale, siltstone, and sandstone. Shale forms more than 90 percent of the formation. Sandstone in the Atoka is mostly fine grained to very fine grained and grades into siltstone; it is medium to dark gray, weathering to light gray or brownish gray. Most sandstone units are approximately 15–20 ft thick, but a few are more than 100 ft thick (Reinemund and Danilchik, 1957).

Rocks mapped by Reinemund and Danilchik (1957) as Hartshorne Sandstone rest conformably on the Atoka Formation. In this area the Hartshorne is about 270 ft thick. The Hartshorne Sandstone consists of lenticular beds of sandstone interbedded with shale and siltstone. The basal sandstone, 3–6 ft thick, is fine grained, light gray, yellowish gray, or pinkish gray. Other sandstone and siltstone beds, generally less than a foot thick, are light olive to yellowish gray and weather to a yellowish brown. Shale beds in the Hartshorne are as much as 60 ft thick (Reinemund and Danilchik, 1957).

The McAlester Formation above the Hartshorne Sandstone, ranges in thickness from 1,820 ft in the southwest part of the Fort Smith district, which covers parts of Sebastian, Franklin, and Scott Counties, Ark. (Hendricks and Parks, 1950) to 2,750 ft in north-central Scott County (Reinemund and Danilchik, 1957). The McAlester, the oldest formation that crops out in the roadless and wilderness areas, is made up of interbedded shale, siltstone, and sandstone; shale makes up about 80 percent of the formation. The sandstone is fine to very fine grained, light olive gray, olive gray, or dark gray in fresh exposures and weathers to mottled brownish gray or grayish brown. Two distinctive ridge-forming sandstone units in the middle of the McAlester are medium grained and weather to light gray, yellowish gray, pink, or white. These sandstone units contain abundant plant fossils. The shale units, commonly a few feet thick, are dark gray, olive gray, or olive black and weather to light gray, light olive gray, and yellowish or grayish brown. Some layers contain abundant fossil plant fragments. The lowest bed of the McAlester Formation is the Lower Hartshorne coal bed. Although eight coal beds are reported in the McAlester Formation in the Arkansas Valley (Hendricks and Parks, 1950), only one is exposed extensively in the vicinity of the roadless areas (Reinemund and Danilchik, 1957). The Lower Hartshorne coal bed is not exposed in the roadless areas or the wilderness study area, but it probably extends under all these areas. It has been mined both north and south of the wilderness study area and contiguous roadless areas (Haley and others, 1980). The upper part of the McAlester Formation is exposed on upper Pack Saddle Creek in the eastern part of Bell Star East Roadless Area. Cross sections of the roadless areas and the Belle Starr Cave Wilderness Study Area show the Lower Hartshorne coal bed beneath the Poteau syncline (Reinemund and Danilchik, 1957).

Most rocks exposed in the roadless areas and in the wilderness study area are of the Savanna Formation which is about 1,580 ft thick. It consists of interbedded shale, siltstone, and sandstone; about 80 percent of this formation is shale. Sandstone and siltstone units exhibit channeling and lateral changes in composition and texture. Sandstone units near the top of the Savanna Formation are medium grained; sandstone units lower in the formation are fine to very fine grained and have a high silt content. Unevenly bedded and cross-laminated sandstone and siltstone commonly weather to yellowish gray. Shale in the Savanna Formation is generally light olive gray to olive or dark gray, fissile to thin bedded, and silty or sandy; the shale includes a few discontinuous beds of carbonaceous shale and coal (Reinemund and Danilchik, 1957).

Alluvial and colluvial deposits in the Bell Star Roadless Areas include Pleistocene terrace deposits, Holocene unconsolidated cobbles and boulders in talus and landslide deposits, and Holocene clay, silt, sand, and gravel on the flood plains and valley floors (Reinemund and Danilchik, 1957; Haley and others, 1980).

STRUCTURE

Bell Star East and West Roadless Areas and Belle Starr Cave Wilderness Study Area are on the east-west-trending Poteau syncline in western Arkansas. Dips along the south limb of the syncline are slightly steeper than those on the north limb. Dips within the roadless areas are 20° or less (Reinemund and Danilchik, 1957). One fault parallel to the trend of the syncline has been mapped across secs. 31, 32, and 33, T. 4 N., R. 30 W., near the southern boundary of the Bell Star East Roadless Area. Anticlines bound the areas on the north and south.

GEOCHEMISTRY

Sixteen stream-sediment and eight rock samples were collected from Bell Star East and West Roadless Areas. Sixteen stream-sediment and 14 rock samples were collected by Haley and others (1980) from Belle Starr Cave Wilderness Study Area. Eight coal samples were collected from nearby mines and prospects (Harris, 1981). All samples were analyzed for 30–40 elements by semiquantitative spectrographic methods. Analytical data show that no samples from either the roadless areas or the wilderness study area contain significant amounts of metallic elements. Eight of the stream-sediment samples from the roadless areas and one coal sample from north of the study area were analyzed by atomic-absorption methods for zinc, cadmium, bismuth, antimony, and arsenic. These samples contained no anomalous concentrations of metals. Analytical data (Harris, 1981) of coals sampled from nearby coal mines indicate the coal is low- to medium-volatile bituminous.

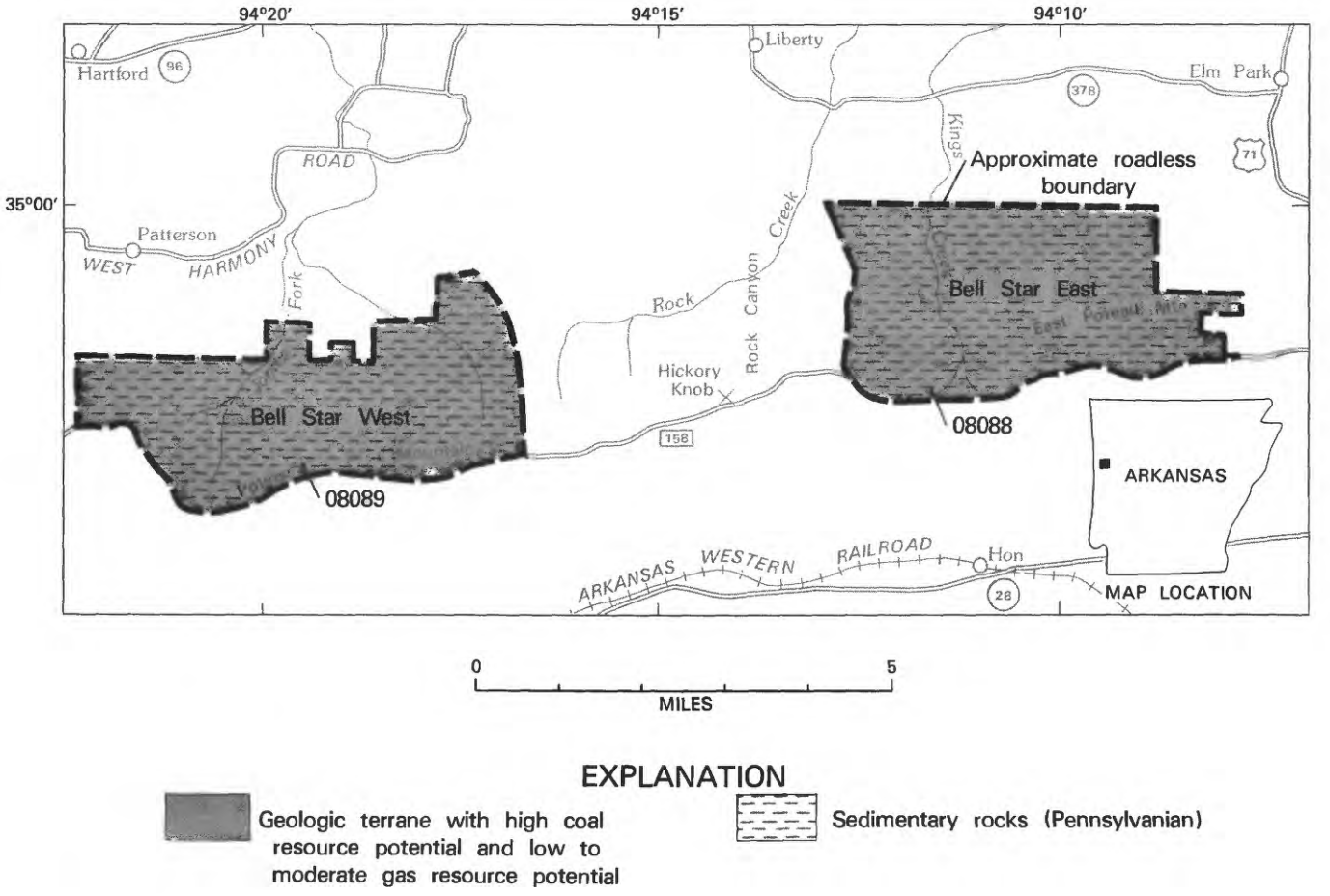

Figure 2.--Map showing mineral resource potential and generalized geology of the Bell Star East and West Roadless Areas.

GEOPHYSICS

No detailed magnetic or gravimetric surveys have been made of Bell Star East and West Roadless Areas or Belle Starr Cave Wilderness Study Area. A Bouguer gravity map of Arkansas (Hendricks and others, 1981) shows no gravity anomaly within the roadless or wilderness areas.

MINING DISTRICTS AND MINERALIZED AREAS

No gas or oil has been produced from the Bell Star East and West Roadless Areas, but natural gas has been produced in the Mansfield field, about 3 mi north (Stroud and others, 1969). At least 13 wells drilled since 1965 are gas producers. These wells produce from the Atoka Formation at depths of as much as 6,000 ft (Haley and others, 1980), although many of the producing wells are less than 3,000 ft deep (W. M. Caplan, Arkansas Geological Commission, oral commun., 1982). A small quantity of gas has been produced in the Waldron syncline, about 4.5 mi south of Bell Star East Roadless Area (Reinemund and Danilchik, 1957). There is a low to moderate potential for accumulation of small quantities of natural gas in the roadless areas (Reinemund and Danilchik, 1956; Haley and others, 1980).

Bell Star East and West Roadless Areas are in the western region of the Interior coal province. In this region, commercially important coal beds occur in the McAlester and Savanna Formations. Thin coals also occur in the Hartshorne Sandstone and Atoka Formations. Coal mining began in the mid-19th century. Two coal beds in the Savanna Formation have been mined 20 mi north of the roadless areas: the Charleston, ranging in thickness from 9 to 30 in., and the Paris, ranging in thickness from 6 to 32 in. A 4-inch exposure of a slightly weathered Savanna Formation coal bed was found in West Creek in Bell Star West Roadless Area. This coal probably was used for blacksmithing in the late 1800's (Winslow, 1888). This coal, probably in the Charleston coal bed of the Savanna Formation, is thin and discontinuous in this region. It has little or no potential for commercial production (Winslow, 1888; Stroud and others, 1969; Haley and others, 1980). North of the study area, the coal occurs in one to five beds, with the lower bed being most continuous (Haley, 1966). Net coal thickness varies from 14 in. in the east to 50 in. in the west. Clay and shale partings in the vicinity on the roadless areas appear to thicken and become more numerous toward the east. South of the study area, coal exposures exhibit similar east to west variations in thickness and partings. Coal has been produced from mines about 2 1/4 mi north and about 1 mi south of the roadless areas. Most large mines nearby have not produced coal since the early or middle 1960's. The Lower Hartshorne coal bed from which these mines produced probably underlies the roadless areas and the Belle Starr Cave Wilderness Study Area and constitutes the coal resource for these areas. Because of the synclinal structure of the rocks, the coal bed lies at depths of 2,000 ft or more beneath the roadless areas and the wilderness study area. The Lower Hartshorne coal bed in Bell Star East and West Roadless Areas is estimated to contain 47.5 million short tons of coal (Reinemund and Danilchik, 1957; Haley and others, 1980; Harris 1981).

Clay, shale, and sandstone within the roadless areas are similar to those regionally abundant and are unlikely to be mined or quarried. There are no known occurrences of metallic minerals in or near the roadless areas.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

The Lower Hartshorne coal bed of the Pennsylvanian McAlester Formation underlies the roadless areas; thus, the areas have high potential for the occurrence of coal. Within the roadless areas and the wilderness study area, however, the Lower Hartshorne coal bed is 2,000 ft or more below the surface.

Inferred resources of coal projected in the subsurface of Bell Star East are about 12.5 million short tons, and in Bell Star West are estimated to be about 35 million short tons (Haley and others, 1980). An average of 1,800 short tons per acre-foot of coal was used in the calculations.

Although all producing gas wells in the Mansfield field are north of the roadless areas, there is a low to moderate potential for accumulation of minor amounts of gas in the Pennsylvanian Atoka Formation and a low potential for accumulation of gas in the Lower Hartshorne coal bed.

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