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GEOLOGICAL SURVEY

Mineral resources of the Dry Creek Wilderness study area, Logan, Yell, and Scott Counties, Arkansas

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The results of mineral evaluation studies in the Dry Creek Wilderness study area indicate the area has a moderate potential for occurrences of natural gas and a low potential for other mineral commodities. The area covers about 6,479 acres (2,623 ha) of the Ouachita National Forest in western Arkansas.

The study area is in the Arkansas Valley section of the Ouachita Mountains province and contains gently dipping sandstone, siltstone, and shale of the Atoka Formation and Hartshorne Sandstone, both of Pennsylvanian age. The axis of the Poteau syncline is in the eastern part; no faults are known in the area.

The closest gas field is about 4 mi (6.4 km) north of the area near Sugar Grove in Logan County. Two holes drilled south of the gas field and one drilled about 8 mi (12.9 km) southeast of the study area were dry. The area has a moderate potential for small accumulations of natural gas in the Atoka Formation. In addition, formations underlying the Atoka at depths greater than 12,000 ft (3,660 m) may contain natural gas.

Metal contents of carbonaceous shales in the area are anomalous relative to that in the other rock types; however, the amounts are too low to be of economic significance. The area contains resources of aggregate and building stone, but an abundance of these materials is available nearer to markets in more accessible parts of western Arkansas.

Introduction

The Dry Creek Wilderness study area covers about 6,479 acres (2,623 ha) just north of lat 35°00′ N. and long 92°45′ W. in the Ouachita National Forest (fig. 1). The area comprises the drainage basin of the upper part of Dry Creek. Elevations range from about 2,439 ft (743 m) to about 660 ft (201 m) above sea level. The area is surrounded by U.S. Forest Service, county, or private roads. The area is covered by the southeastern part of the Booneville and southwestern part of the Blue Mountain Dam topographic quadrangles. The base map for figure 2 is a mosaic of these parts.

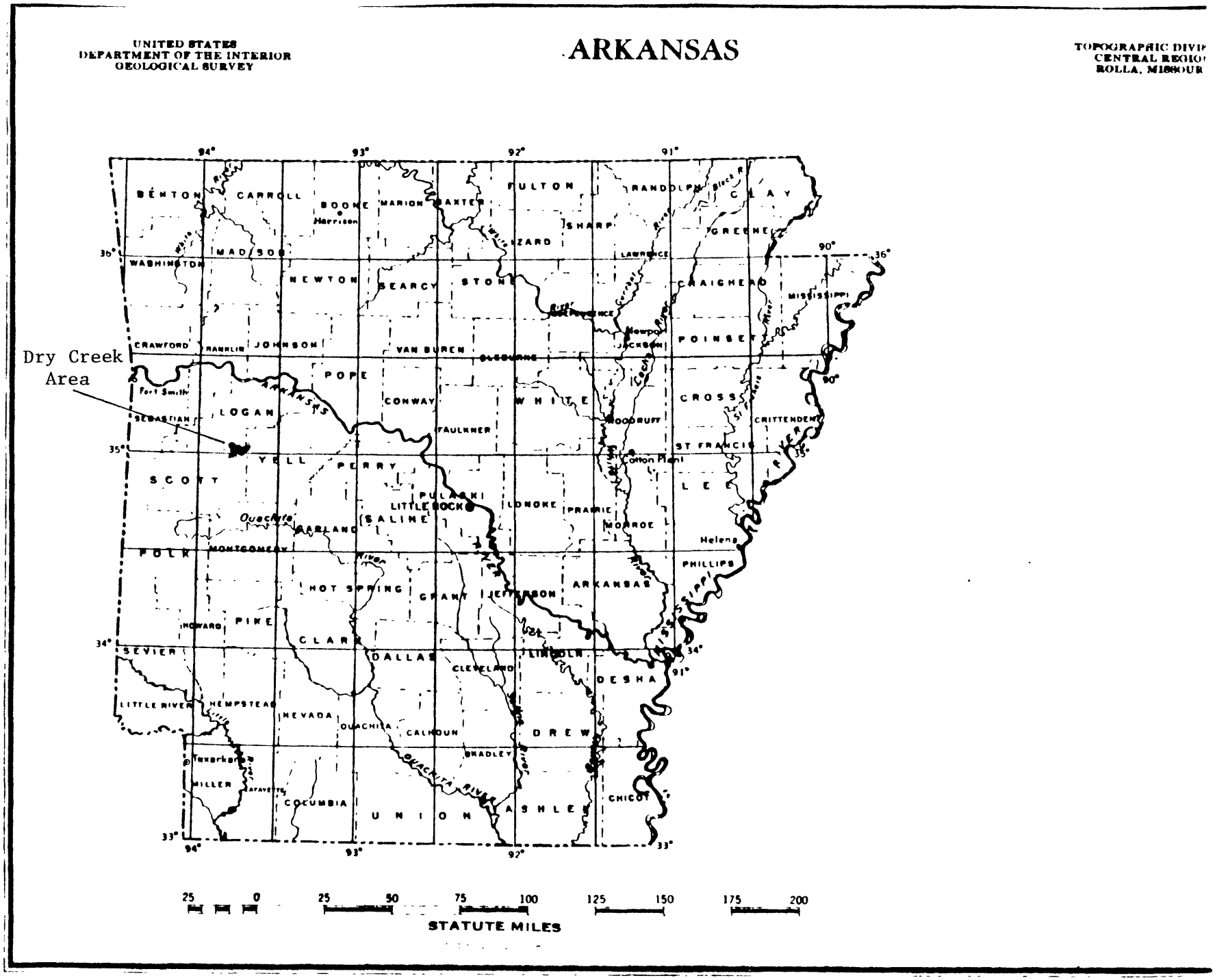

Figure 1.--Index map of Arkansas showing the location of the Dry Creek Wilderness study area.

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page 5 follows

Previous and present studies

Geologic reports describing the rocks in the report area have not been published. The geologic map (fig. 2) is taken from maps used in the compilation of the geologic map of Arkansas (Haley, 1976).

Geophysical data pertaining to the study area consist of a large scale gravity map. The area is not covered by an aeromagnetic survey or by other types of geophysical surveys.

A mineral and petroleum assessment of the area was made by the U.S. Bureau of Mines, and a geochemical survey was conducted by the U.S. Geological Survey to investigate the occurrence of previously unknown mineral deposits.

Geology

Geologic setting

The Dry Creek Wilderness study area is in the southern part of the Arkansas Valley section of the Ouachita Mountains province. The exposed rocks consist of alluvium along Dry Creek and sandstone, siltstone, and shale of Pennsylvanian age. Older rocks of Pennsylvanian age are exposed north and south of the study area and have been penetrated by wells drilled for natural gas 4 mi (6.4 km) to the north.

Stratigraphy

The oldest rocks exposed in the study area are assigned to the upper part of the Atoka Formation of Pennsylvanian age; they are about 600 ft (183 m) thick. This part of the Atoka consists of about equal parts of sandstone, siltstone, and shale. Thin beds of coal are present in this part of the Atoka elsewhere in Arkansas, but none are known to be present in the study area. Little is known about the rocks older than Atoka underneath the study area.

The Hartshorne Sandstone of Pennsylvanian age overlies the Atoka and consists mostly of sandstone with a small amount of siltstone. About 100 ft (30 m) of the lower part of the Hartshorne is under Petit Jean Mountain in the eastern part of the study area and about 50 ft (15 m) is present on a ridge in the southern part of the area.

Alluvium of Holocene age, consisting of boulders, cobbles, pebbles, sand, silt, and clay, all of local origin, is present along Dry Creek.

Structure

The eastern part of the study area spans the axis of the Poteau syncline. The rocks have dips less than 20^{o}. No faults are known in the study area.

Assessment of mineral resources

Surface exposures and bedrock to considerable depths in the Dry Creek study area are almost entirely Atoka Formation of Pennsylvanian age. Relatively small tracts in the eastern and southern parts of the area are underlain by Hartshorne Sandstone. Alternating beds of sandstone and shale would be sources of aggregate and building stone; however, ample resources of these materials outside the area are nearer to potential markets.

Approximately 39 percent of the 5,560 acres (2,251.8 ha) in the study area has been leased by the U.S. Bureau of Land Management for oil and gas exploration. The axis of the Poteau syncline trends easterly through the southeast part of the study area, and it is parallel to the axis of the Ranger anticline about 4 mi (6.4 km) north of the area.

The closest gas field is about 4 mi (6.4 km) north of the study area near Sugar Grove in Logan County. The discovery well was drilled in 1966 in sec. 17, T. 5 N., R. 26 W., to a depth of 8,291 ft (2,528.8 m) with the producing zone being from 5,109 to 5,122 ft (1,558.2 to 1,562.2 m) in the Atoka Formation; initial production was reported as 775 MCF (21.9 M^3) of gas per day. Another well in sec. 18, T. 5 N., R. 26 W., had an estimated flow of 300 MCF (8.5 M^3) of gas per day. As of 1977, this gas field was classified as temporarily abandoned by the Arkansas Oil and Gas Commission. Two holes drilled south of the gas field were dry; one is in section 20 and the other in section 29. A hole drilled about 8 mi (12.9 km) southeast and another about 10 mi (16.1 km) southwest of the study area were dry.

W. M. Caplan (oral commun., 1977) of the Arkansas Geological Commission and R. A. Dumas (oral commun., 1977), Director of the Arkansas Oil and Gas Commission, believed that any discoveries of natural gas in the Atoka Formation in the study area would be in relatively small gas pools. Natural

gas may exist in the study area at considerable depth in formations underlying the Atoka. According to W. A. Caplan, drilling depth to possible targets would exceed 12,000 ft (3,660 m).

Geochemical evaluation of metallic mineral resources

The geochemical evaluation of the metallic mineral resources in the Dry Creek Wilderness study area is interpreted from the analytical results of 13 stream sediments and 19 rock samples. Hydrocarbons are evaluated by Stroud (this report), who also evaluated other commodities.

Grab samples of rocks from all of the lithologic types that crop out in the area were randomly collected. During the course of sampling, outcrops were examined for indications of mineralization. Except for sample D-115, which is from a weakly pyritic sandstone, none of the rocks appeared to be mineralized. Stream sediments were sampled from Dry Creek and its tributaries. About 2 kg of the finest material available in the most active parts of the stream were collected. The stream sediments were sieved in the laboratory and the minus 80 mesh fraction was analyzed. All samples were analyzed for 30 elements by a semiquantitative spectrographic technique and for zinc by an atomic absorption method. Sample localities are shown on figure 2 and the analytical results are given in table 1. Anomalous values of metallic elements were estimated in stream sediments and in rocks by doubling the median value of an element in each of the sample types.

The outcropping rocks in the study area are sandstones, siltstones, and shales of the Atoka Formation and Hartshorne Sandstone, both of Pennsylvanian age. No metallic mineral occurrences of possible economic importance are known in these rocks in the area or in the surrounding region. The only indication of mineralization observed in the rocks was a minor amount of pyrite in an impure, fine-grained sandstone of the Atoka Formation. Spectrographic analysis of this sample (D-115) did not indicate unusual amounts of valuable metals.

Table 1.--Analytical results of stream sediments and rocks from the Dry Creek area

[All values are in parts per million except Fe, Mg, Ca, and Ti, which are given in percent. Zinc analyses are by an atomic absorption method. All other analyses are by a semiquantitative emission spectrographic method. Spectrographic analyses are by M. Erickson, and atomic absorption by B. Plasse. Lower limit of detection shown above elements. N, not detected; L, detected below measurable limit; and G, greater than. Elements analyzed for but not shown in the table include Ag, As, Au, Be, Bi, Cd, Mo, Nb, Sb, Sn, and W. All samples contained undetected (N) amounts of As (200 ppm), Au (10 ppm), Bi (10 ppm), Cd (10 ppm), Nb (20 ppm), Sb (100 ppm), Sn (10 ppm), and W (50 ppm). All samples contained undetected (N) amounts of Ag except D-110--.7 ppm, and D-114--L (.05 ppm). All samples contained 3 ppm or less Be, and all samples contained undetected (N) amounts of Mo except D-13--L (5) and D-117--5 ppm]

Sample No.	(.05) Fe	(.02) Mg	(.05) Ca	(.002) Ti	(10) Mn	(10) B	(20) Ba	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Ni	(10) Pb	(5) Sc	(100) Sr	(10) V	(10) Y	(1) Zn	(10) Zr
Stream sediments																			
D-1	2	.3	.07	.2	300	50	500	30	50	30	30	20	20	7	L	50	30	44	300
D-2	2	.7	.1	.2	700	50	500	30	70	50	30	50	20	7	L	50	20	87	300
D-3	2	.7	.05	.5	700	50	500	30	100	50	30	50	20	10	100	50	50	73	300
D-4	3	.7	.07	.7	700	50	700	30	100	50	50	30	15	15	100	50	30	75	500
D-5	2	.7	.07	.7	1000	50	700	50	200	50	70	100	15	10	L	70	50	72	150
D-6	2	.7	.1	.7	1500	50	500	30	200	30	70	50	20	10	100	70	50	68	500
D-7	3	.5	.1	.5	1500	50	700	50	150	50	70	30	15	10	L	70	30	65	500
D-8	3	.3	.1	.5	2000	30	500	30	50	30	30	70	20	15	L	30	50	52	1000
D-9	1	.7	.07	.5	300	50	500	30	200	50	50	100	20	10	100	70	50	60	500
D-10	2	.5	.07	.5	500	50	500	30	100	30	50	50	20	10	L	100	50	61	500
D-11	2	.5	.07	.5	500	50	500	30	70	30	50	30	20	10	L	150	30	62	500
D-12	2	.5	.15	.5	700	50	700	30	150	30	50	30	20	10	L	70	50	64	500
D-13	3	.5	.1	.1	500	50	700	50	500	50	50	70	30	10	100	100	70	68	500
D-14	5	.5	.07	.7	300	50	500	30	100	30	50	50	20	10	L	100	30	32	500
Rocks																			
D-100	.5	.15	.1	.2	100	50	150	N	30	5	L	N	10	L	L	20	15	2	20
D-101	.5	.2	.1	.2	100	10	100	N	30	5	L	N	10	L	L	20	30	2	500
D-102	3	.5	.15	.5	150	10	200	15	50	15	50	N	15	5	L	50	5	34	500
D-103	3	.1	L	.15	20	L	70	N	15	L	L	20	N	7	L	10	10	N	70
D-104	2	.1	L	.2	20	N	70	N	15	5	N	5	N	L	N	20	10	1	300

Table 1.--Analytical results of stream sediments and rocks from the Dry Creek area--Continued

Sample No.	(.05) Fe	(.02) Mg	(.05) Ca	(.002) Ti	(10) Mn	(10) B	(20) Ba	(5) Co	(10) Cr	(5) Cu	(20) La	(5) Ni	(10) Pb	(5) Sc	(100) Sr	(10) V	(10) Y	(1) Zn	(10) Zr
								Rocks--Continued											
D-105	2	.7	.07	.5	500	10	200	20	70	10	L	50	10	L	N	50	10	34	700
D-106	2	.15	.05	.5	30	10	50	N	30	5	L	5	L	7	L	50	20	2	200
D-107	2	.15	L	.5	150	10	70	N	50	L	L	5	10	5	L	50	10	5	500
D-108	.7	.1	L	.1	20	L	70	N	10	L	L	5	L	N	L	10	15	2	100
D-109	1	.1	.07	.2	30	L	50	N	30	L	L	5	N	N	N	15	10	2	150
D-110	2	.2	.1	.3	200	L	150	N	20	5	L	5	L	L	N	15	15	6	700
D-111	3	.7	.2	1	300	30	300	20	100	30	50	30	30	10	N	100	50	69	700
D-112	3	.7	.2	1	300	20	500	20	100	30	50	30	20	10	100	150	50	95	1000
D-113	2	.7	.2	1	300	30	500	20	100	20	70	30	20	10	N	150	100	55	1000
D-114	3	.7	.2	.7	300	20	300	10	50	20	30	20	20	7	N	70	10	36	1000
D-115	3	1	.2	1	150	15	500	10	50	15	20	20	20	10	L	100	30	43	1000
D-116	5	1.5	.2	.7	700	50	700	20	100	50	70	30	30	20	100	500	50	91	500
D-117	5	1	.07	1	150	70	1000	10	150	50	100	20	30	30	100	700	30	34	100
D-118	7	1	.5	G(1)	1000	50	500	50	100	50	100	50	20	20	L	500	70	98	700

None of the stream sediments from the Dry Creek area contain anomalous amounts of metals. Zinc values range from 44 to 87 ppm, lead values from 15 to 30 ppm, and copper from 30 to 50 ppm (table 1). In rock samples, zinc ranges from less than 1 ppm to 98 ppm, lead from less than 10 ppm to 30 ppm, and copper from less than 5 ppm to 50 ppm. Four of the rock samples contained weakly anomalous amounts of zinc, and 3 of these samples also had weakly anomalous amounts of copper. All of the rock samples with weakly anomalous amounts of base metals are carbonaceous shale. Although base metals in the shales are weakly anomalous when compared to other rock types of the area, the amounts are about normal for black shales collected from Pennsylvanian rocks elsewhere in west-central Arkansas (Vine and Tourtelot, 1969). The average manganese, barium, and titanium values in shales from the Dry Creek area are slightly higher than the average for black shales elsewhere in west-central Arkansas; however, none of these elements are in sufficient concentration to be of economic interest. One sample (D-110) of fine-grained sandstone contained 0.7 ppm silver; all other samples contained less than the lower limit of detection (0.5 ppm).

In conclusion, the geochemical data suggest that the Dry Creek Wilderness study area has a very low potential for deposits of metallic mineral resources.

References

Arkansas Oil and Gas Commission, 1966, Annual oil and gas report, 56 p.

Croneis, Cary, 1930, Geology of the Arkansas Paleozoic area with a special reference to oil and gas possibilities: Arkansas Geological Survey Bulletin 3, 477 p.

Haley, B. R., 1976, Geologic map of Arkansas: U.S. Geological Survey Geologic map of Arkansas.

Vine, J. D., and Tourtelot, E. B., 1969, Geochemical investigations of some black shales and associated rocks: U.S. Geological Survey Bulletin 1314-A, 43 p.

80-355

93°50'

93°45'

35°05'

35°00'

Sugar Grove

Brown Sch

Sugar

Ground Mtn

Jack

Creek

Buck

Ridge

Hogan Mountain

Boundary of study area

PETIT JEAN

QUACHITA

NATIONAL FOR

SYNCLINE

HUNT

Qal

Pa

Phs

D-14

D-115

EXPLANATION

Qal

ALLUVIUM

Phs

HARTSHORNE SANDSTONE

Pa

ATOKA FORMATION

SYNCLINE

○ D-14

STREAM SEDIMENT SAMPLE LOCALITY AND NUMBER

× D-115

ROCK SAMPLE LOCALITY AND NUMBER

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1975 1470000 FEET

R.26 W. 93°45'

Base from U.S. Geological Survey 1:62,500 Booneville (1934) and 1:24,000 Blue Mountain Dam (1966)

0 1 MILE

0 1 KILOMETER

UTM GRID AND 1966 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Figure 2 GEOLOGIC MAP OF DRY CREEK WILDERNESS STUDY AREA, YELL, LOGAN AND SCOTT COUNTIES, ARKANSAS