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MISCELLANEOUS FIELD STUDIES
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PAMPHLET

MINERAL RESOURCE POTENTIAL AND GEOLOGY OF THE UPPER BUFFALO WILDERNESS AND THE BUFFALO ADDITION ROADLESS AREAS, NEWTON COUNTY, 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 mineral survey of the Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas, Ozark National Forest, Newton County, Ark. The Upper Buffalo Wilderness was established by Public Law 93-622, January 3, 1975. The Buffalo Addition Roadless Areas (08003) were recommended for wilderness designation during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

MINERAL RESOURCE POTENTIAL SUMMARY STATEMENT

There is no indication of metallic mineral resource potential in the Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas except zinc and lead. Zinc and lead have been mined from deposits about 3 mi outside the study area near Boxley and Ponca, Ark., but are not known to occur within the study area. These deposits are in fractures and minor faults in the Mississippian Boone Formation. The potential for zinc and lead in the study area is very low. Although black shales in the study area contain minor amounts of uranium, these concentrations do not constitute a resource. Oil and other hydrocarbons occur in minor amounts in Pennsylvanian shales in the region; however, the oil and gas potential is low in the Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas. Limestone and sandstone in the study area probably are suitable for construction purposes. Although probably suitable for building brick, it is unlikely that shales from the study area would be used. Shale, limestone, and sandstone are readily available elsewhere in Newton County.

INTRODUCTION

The Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas cover 10,590 and 1,504 acres, respectively, in the Ozark National Forest, Newton County, Ark. The wilderness and roadless areas are collectively referred to in this report as "the study area." The study area (see fig. 1) is about 38 mi southwest of Harrison and about 22 mi north of Clarksville, Ark.

The study area is accessible via State Highways 21 and 16 and U.S. Forest Service roads and trails. Off-trail hiking in the interior is difficult because of 40- to 80-foot bluffs at about 1,900 ft elevation.

The Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas are in the Boston Mountain section of the Ozark Plateaus province. Elevation ranges from 1,240 ft on the Buffalo River at the northern boundary to 2,463 ft on Turner Ward Knob. The deeply incised Buffalo River bisects the study area.

Most of the surface and mineral rights in the Upper Buffalo Wilderness Area and all surface and mineral rights in the Buffalo Addition Roadless Areas are federally owned. Surface and mineral rights for 3.5 percent of the wilderness are in private ownership, and mineral rights for 4.2 percent of the federally owned surface are privately owned. Oil and gas rights are reserved until the year 2033 for about 1.5 percent of the Upper Buffalo Wilderness (Armstrong and Dunn, 1982, fig. 4).

A geologic map of the study area was prepared by E. E. Glick in 1976. A reconnaissance of the study area was made in 1979 by M. K. Armstrong and M. L. Dunn. M. H. Miller and M. C. Smith conducted a geological and mineral survey of the study area in

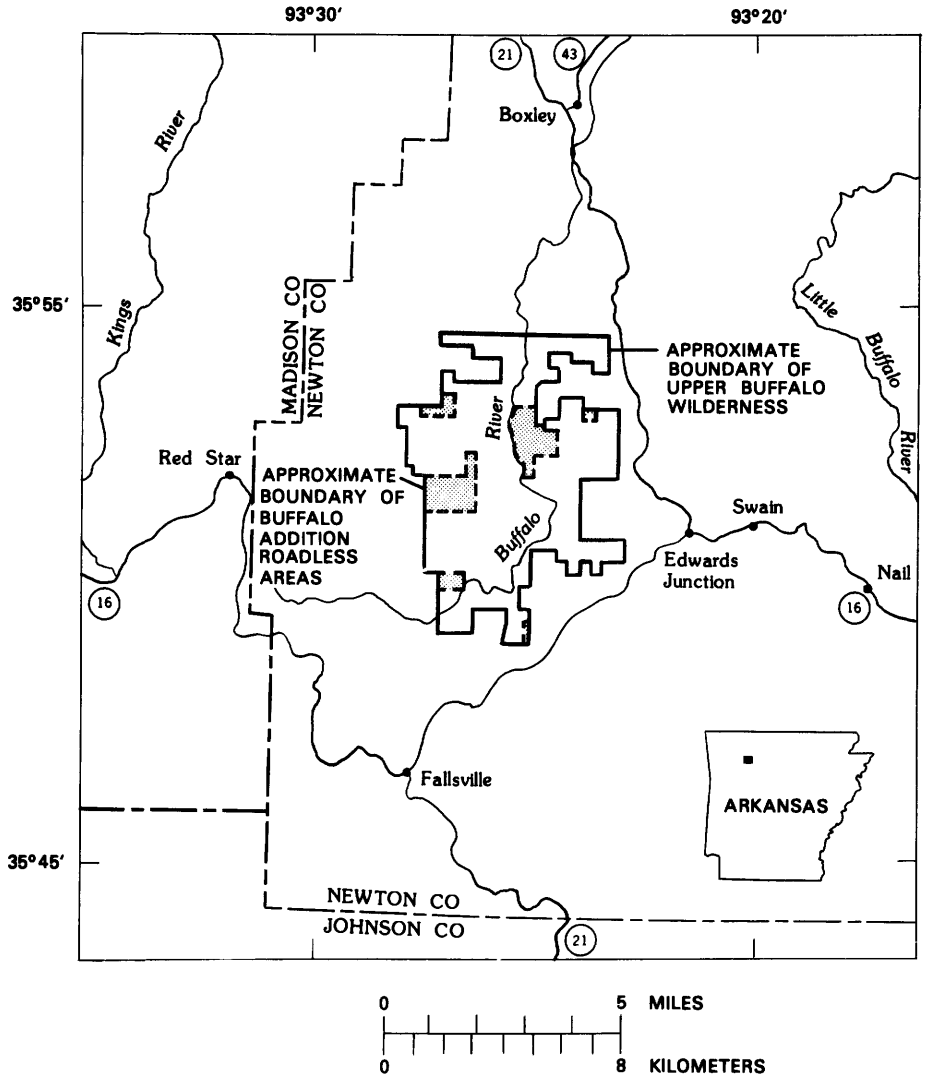

Figure 1.--Index map showing location of the Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas (stippled) (08003), Newton County, Ark.

1982. The reconnaissance and mineral survey concentrated principally on assessing potential for zinc-lead mineralization and oil-bearing shale.

U.S. Bureau of Mines personnel collected 20 samples of limestone, sandstone, and shale, which were analyzed for 40 elements by semiquantitative spectroscopy at the Bureau of Mines Reno Research Center, Reno, Nev. The Research Center also performed radiometric determinations of U_3O_8 content for select samples. Ceramic properties of all shale samples were evaluated by the U.S. Bureau of Mines Tuscaloosa Research Center, Tuscaloosa, Ala. Oil content of select samples was determined by Fischer assay by the U.S. Department of Energy Laramie Energy Technology Center, Laramie, Wyo. Smith and Miller collected 1 rock and 13 stream-sediment samples, which were analyzed for 31 elements by semiquantitative spectrographic methods.

Appreciation is expressed to personnel of the U.S. Forest Service in Russellville and Jasper, Ark., and to R. H. Konig, Department of Geology, University of Arkansas, Fayetteville, for helpful information about the region. A special thanks is extended to Sandy Swayne and Anne Holmes of the Circle Seven Riding Stable, Inc., Jasper, Ark., for providing horses for access to the study area as well as for considerable moral support.

GEOLOGY

Stratigraphy

Strata in the Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas dip southward about 50 ft per mi. The lowermost formation exposed in the study area is the Boone Formation of Early and Late Mississippian age (fig. 2). The Boone is made up mostly of medium-bedded to massive limestone that contains brachiopods and crinoids. About 80 ft below the top of the Boone, a zone of limestone about 55 ft thick contains closely spaced lenses of chert nodules. Sparse chert is present in the lower and upper parts of the formation. In this region the Boone Formation ranges from 220 to nearly 400 ft in thickness.

The Boone of the study area is overlain unconformably by the Batesville Sandstone, which consists of beds of fine- to medium-grained sandstone and interfingering layers of limestone (Hindsville Limestone Member). In places the sandstone is crossbedded. In outcrop just north of the study area the Batesville Sandstone ranges in thickness from 10 to 25 ft.

The Mississippian Fayetteville Shale conformably overlies the Batesville Sandstone; it is made up of shale, siltstone, and minor amounts of sandstone (the Wedington Sandstone Member). The shale generally is black and fissile and locally contains large amounts of silt. The lower shale beds contain limonite-stained concretions as much as 2 ft in diameter. Some lower shales have a petroliferous odor when broken. In this region the Fayetteville ranges in thickness from 80 ft to slightly less than 200 ft.

Conformably overlying the Fayetteville Shale is the Mississippian Pitkin Limestone. It is made up of massive beds of compact, light-gray, commonly oolitic limestone. It contains abundant crinoids, brachiopods, and the bryozoan Archimedes. In some outcrops in this region the Pitkin Limestone is slightly more than 100 ft thick; it thins northward beneath the pre-Pennsylvanian unconformity.

The Hale Formation, Pennsylvanian in age and unconformably overlying the Pitkin, includes only the Cane Hill Member in the study area. It consists of interlayered, thin- to medium-bedded, fine-grained sandstone, siltstone, and shale. Shales are dark gray; sandstones and siltstones are light to medium gray or grayish brown. In some places these rocks are crossbedded and ripple marked. The thickness of the Cane Hill is slightly more than 100 ft in the northern part of the study area and at least 150 ft in the southern part.

Unconformably overlying the Cane Hill Member is the Pennsylvanian middle Morrowan unit. This unit is made up of medium-bedded to massive, medium- to coarse-grained sandstone, medium-bedded, light-gray, medium- to coarse-grained limestone, and beds of siltstone and shale. The lower sandstone and gray limestone beds grade upward into light-gray limestone, which in turn grades into siltstone and sandy shale layers in the upper part of this unit. The middle Morrowan unit contains abundant fragments of crinoids, brachiopods, cephalopods, gastropods, and trilobites. The thickness of the middle Morrowan unit is about 180 ft (Morrison, 1971).

The rocks in this area now assigned to the upper Morrowan were mapped as lower Atokan prior to publication of the "Geologic Map of Arkansas" (Zachry and Haley, 1975; Haley and others, 1976). These rocks unconformably overlie the middle Morrowan sequence and are made up principally of medium- to coarse-grained, thin-bedded to very thick-bedded tan sandstone containing minor amounts of siltstone and shale. The thickness of the upper unit is about 250 ft. One of its striking features is its massive, cliff-forming basal sandstone, which here is the dominant rimrock of the upper walls of the deep valleys.

In the study area the Pennsylvanian Atoka Formation consists mainly of medium- to coarse-grained tan sandstone and thin- to medium-bedded, light-gray silty shale. Probably it rests conformably on the Morrowan sequence; the contact is poorly exposed. Sandstone beds near the top of the Atoka are crossbedded and ripple marked. The maximum thickness of the Atoka Formation in this area is about 320 ft (Morrison, 1971).

Structure

No faults have been mapped in the Upper Buffalo Wilderness or the Buffalo Addition Roadless Areas. Interpretation by Smith (1978) of lineaments shown on ERTS (Earth Resources Technology Satellite) imagery indicates that zinc-lead deposits in the Ponca-Boxley mining district coincide with a northeast-trending lineament (fig. 3), which is about 1 mi northwest of the study area. It is thought that this and similar lineaments reflect major fractures or shear zones in the Earth's crust that in certain areas functioned as channelways for fluid migration (Konig, 1974). Possibly another lineament crosses the wilderness coincident to part of the upper Buffalo River (Kirk and Walters, 1968). This lineament is not verified by geochemical anomalies or geophysical data.

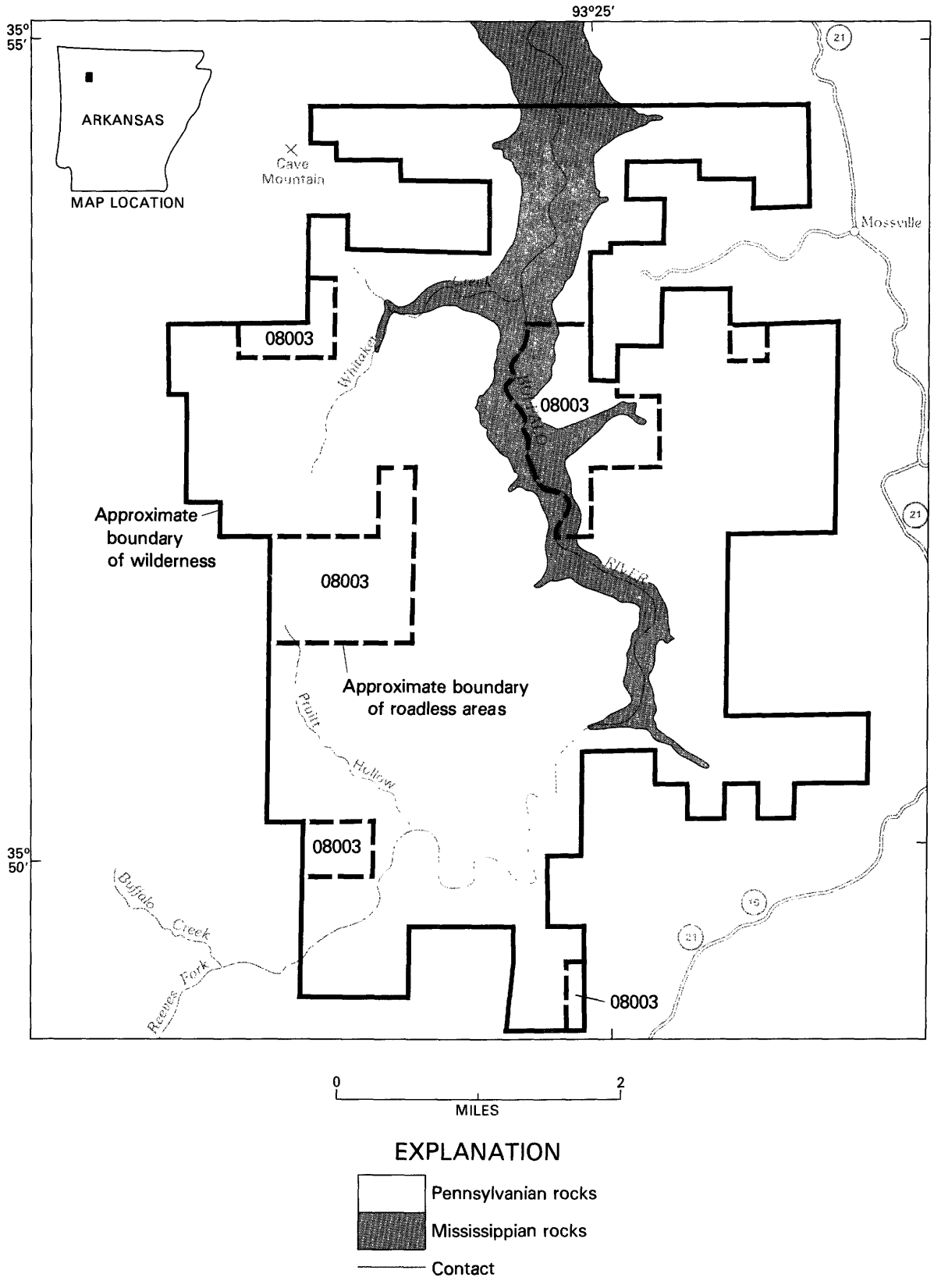

Figure 2.--Mineral resource potential and generalized geologic map of the Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas (08003), Newton County, Ark.

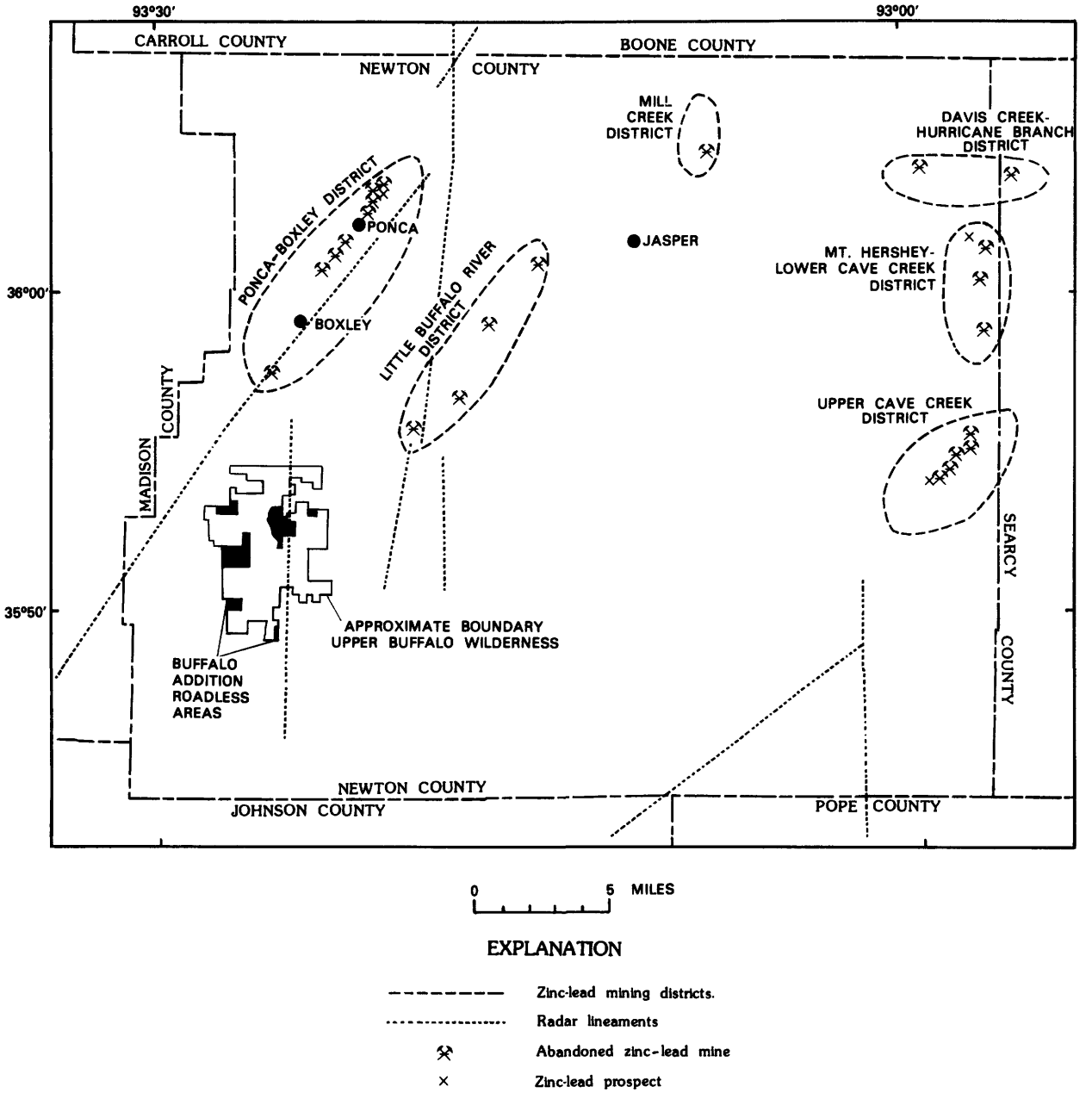

Figure 3.--Zinc-lead mining districts and radar lineaments in Newton County, Ark. (adapted from McKnight, 1935; Kirk and Walters, 1968; and Stroud and others, 1969).

GEOCHEMISTRY

For this study, 21 rock samples and 13 stream-sediment samples were collected from the Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas. The rock samples were analyzed by semiquantitative spectrographic methods for 40 elements (Armstrong and Dunn, 1982). The stream-sediment samples were sieved, and the minus-50-mesh fraction from each was analyzed for 31 elements by a six-step, semiquantitative spectrographic method (Grimes and Marranzino, 1968) and by atomic-absorption methods for gold, zinc, cadmium, bismuth, antimony, and arsenic. Selected rock samples were radiometrically analyzed for U_3O_8; minor amounts of uranium are present in some shale samples, but amounts, less than 0.002 percent U_3O_8, are not anomalous (Armstrong and Dunn, 1982). A Fischer assay of a sample of Fayetteville Shale yielded small amounts of oil (1.9 gal/ton).

One stream-sediment sample and 20 rock samples contained zinc (10-1,000 ppm), and all but one stream-sediment sample contained very small amounts of lead (10-30 ppm). Although the zinc content of six samples is somewhat higher than the background value (200 ppm), the zinc content is not considered significant.

Analyses of rock and stream-sediment samples indicate that there are no major areas of metallic mineralized rock at the surface in the Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas.

GEOPHYSICS

No detailed ground magnetic or gravimetric surveys have been made of the study area. Smith (1978) conducted a ground magnetic survey and a gravity traverse of the Ponca lineament, which crosses the region about 1 mi northwest of the study area (fig. 3). Smith's data show a magnetic low west of the lineament and higher values east of the lineament. His interpretation is that the lineament is controlled by the Precambrian rocks, but that there is no appreciable vertical displacement of them. The gravity traverse shows a low across the Ponca lineament; Smith interprets these data to indicate a first-order magnitude fracture or shear zone cutting the Earth's crust parallel or coincident to the lineament. A Bouguer gravity map of Arkansas (Hendricks and others, 1981) shows a gravity low just southwest of the study area. Widely spaced gravity stations effectively mask minor highs and lows; thus, no anomaly appears to coincide with either the Ponca lineament or the lineament that parallels part of the Buffalo River in the wilderness (fig. 3).

MINING DISTRICTS AND MINERALIZED AREAS

There are no patented mining claims, and no mines or prospects were found in the Upper Buffalo Wilderness or the Buffalo Addition Roadless Areas. The nearest mining districts are the now-inactive Ponca-Boxley and Little Buffalo zinc-lead districts, 3 mi north and northeast of the study area. Ores in these districts, mainly zinc carbonate and galena, occur principally in fractures and minor faults in the Mississippian Boone Formation (McKnight, 1935). About half of these fractures and faults trend northeast, parallel to the Ponca lineament, and half trend northwest. Production from the Ponca-Boxley mining district probably totalled about 4,600 tons of zinc and lead concentrates. The Little Buffalo mining district produced about 3,300 tons of zinc and lead concentrates. The production from these districts is small compared to other zinc-lead districts in northern Arkansas. In some other districts of northern Arkansas, zinc and lead deposits occur in the Ordovician Everton Formation (McKnight, 1935; Stroud and others, 1969).

The Mississippian Boone Formation crops out along the upper Buffalo River near the northern boundary of the Upper Buffalo Wilderness and underlies the entire study area. The Ordovician Everton Formation crops out near Ponca and probably is present in the subsurface in the study area. The Boone and Everton Formations in the study area may possibly contain zinc and lead minerals.

The Arkoma basin, about 20 mi southwest of the the Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas, has produced dry gas from the upper Paleozoic formations for more than 75 years. Only a few holes have been drilled in the Boston Mountains, and two holes drilled near the study area were dry (fig. 2). Interest of oil and gas companies at present is minimal and probably will continue to be so (Arkansas Oil and Gas Commission, oral commun., 1979).

Formations that yield dry gas in the Arkoma basin are exposed and lack favorable structure in the region near the study area, indicating a low probability for structurally trapped oil and gas. Oil seeps and other hydrocarbon indicators in the region have been noted in formations also present in the study area (Croneis, 1930). Several exposures of Pitkin Limestone and Fayetteville Shale gave off a strong petroliferous odor when struck with a hammer, suggesting that where favorable stratigraphic traps exist these formations may be potential reservoir or source rocks. These conditions may exist in the Boston Mountains near the study area. Accumulations in the study area probably would be small because the distance between drainages where formations are exposed seldom exceeds 1 mi. The study area has low potential for oil and gas.

Black shales in the study area contain minor amounts of uranium (less than 0.002 percent U_3O_8), but the amounts are not significant (Armstrong and Dunn, 1982). Several rock formations present in the study area are suitable for aggregate or building stone, and shales may be suitable for use as building brick. Formations having similar qualities occur elsewhere in Newton County and are more accessible to local markets.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

The Boone Formation, present in the Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas, contains zinc and lead deposits in other areas of Newton County, in other northern Arkansas counties, and in the Tri-State mining district, southwest Missouri. Zinc and lead minerals in the Ponca-Boxley and Little Buffalo mining districts, about 3 mi north and northeast of the study area, are in fractures and minor faults, mainly in the Boone Formation. No

faults were mapped in the study area, and the possibility of locating major deposits of zinc and lead seems unlikely. The potential for zinc and lead in the Upper Buffalo Wilderness and the Buffalo Addition Roadless Areas is very low.

Although oil and hydrocarbons are present in minor amounts in the Pitkin Limestone and the Fayetteville Shale, the potential for oil and gas in the study area is low.

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