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Mineral Resources of the Richland Creek Wilderness Study Area, Newton and Searcy Counties, Arkansas

By

U.S. Geological Survey
and
U.S. Bureau of Mines

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Summary

The results of a mineral evaluation survey of the Richland Creek Wilderness study area, which covers about 3,375 acres (1,366 ha) in Newton and Searcy Counties in Arkansas, indicate that the area has a fair potential for gas and a low potential for other mineral commodities. The investigations consisted of geological and geochemical studies, and a record and literature search of past exploration and mining activities in and near the area.

The area is in the southern part of the Ozark Dome, and the rocks are predominantly limestone, sandstone, siltstone, and shale of Pennsylvanian and Mississippian ages. The strata are gently dipping and no faults or major folds are evident from geologic mapping; a normal fault with an apparent displacement of 280 ft (85 m) is outside the area near the southern boundary.

The only mineral production near the area is from 5 mi (8 km) north of the north boundary where about 3,500 tons (3,175 t) of zinc concentrates and 1,200 tons (1,089 t) of lead concentrates were mined during World War I. The deposits were mined from faulted and fractured parts of the Boone Formation. Although the Boone is present at shallow depth in the study area, faults and fractures are apparently lacking, and it seems unlikely that similar deposits occur within the area.

The analytical results of 43 rock, 16 stream sediment, and 3 soil samples suggest that the area has little to no potential for shallow buried metallic mineral deposits. A few samples from the lower part of the Bloyd Shale contain weakly anomalous amounts of zinc, but the values are too low to be of economic significance.

Hydrocarbon analyses of 13 shale, siltstone, and limestone samples suggest that rocks in or near the area may have generated natural gas, and some of the rock units underlying the area are potential petroleum reservoir

rocks. However, a gas test well less than one-half mile from the boundary did not contain shows of natural gas, and the potential for this commodity in the study area is considered to be only fair.

The area contains deposits of sandstone and limestone that could be used for aggregate and building stone; the limestone also could be used for agricultural purposes. However, deposits of equal or better quality are widespread in more accessible parts of northern Arkansas. As a result the deposits in the study area have little to no economic potential.

Mineral Resources of the Richland Creek Wilderness Study Area, Newton and Searcy Counties, Arkansas

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By Boyd R. Haley, U.S. Geological Survey, Little Rock, Arkansas

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Chapter A

Geologic evaluation of the Richland Creek Wilderness study area, Newton and Searcy Counties, Arkansas

By

Boyd R. Haley

U.S. Geological Survey

Prepared in cooperation with the Arkansas Geological Commission.

Introduction

This report is a part of a study to determine the suitability of the area for inclusion in the National Wilderness Preservation system. The Richland Creek Wilderness study area covers about 3,375 acres (1,366 ha) in Newton and Searcy Counties, Ark. (fig. 1). It is just northeast of lat 35°45′ N. and long 93°00′ W. in the Ozark National Forest.

Elevations in the area range from about 2,085 ft (635.5 m) on Stump Mountain in the central part of the area (pl. 1) to about 1,020 ft (310.9 m) at the junction of Falling Water and Richland Creeks, in a distance of about 1 mi (1.6 km). The valleys are v-shaped, and the hillsides are a series of slopes and bluffs. The bluffs are as much as 100 ft (30 m) high, and they are formed on resistant units of sandstone or limestone.

Access to the eastern part of the area is provided by a U.S. Forest Service road, and to the western part of the area by a privately maintained road. The southern part of the area is accessible by a jeep trail (pl. 1).

Falling Water Creek is the principal stream in the area, and it is dry during the late summer months or during times of drought. Parts of Richland Creek flow underground through fissures in the Pitkin Limestone; Richland Creek has surface flow only during time of flooding.

The Richland Creek Wilderness study area is in the southwestern part of the Snowball, Ark., 15-minute quadrangle.

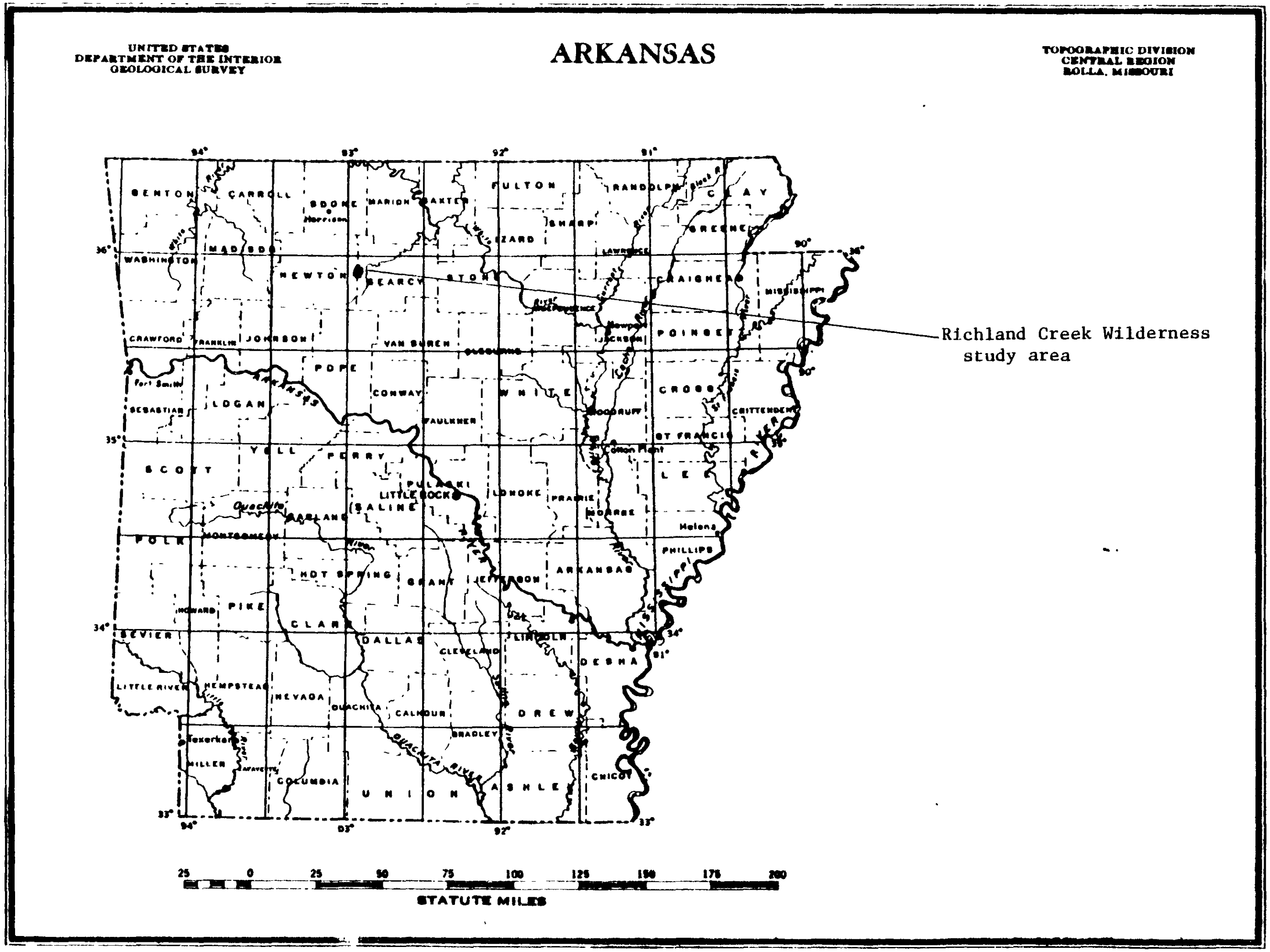

Figure 1.--Index map of Arkansas showing the location of the Richland Creek Wilderness study area.

Previous and present investigations

The geology of the Richland Creek study area is included in Glick and Frezon (1965). The geology shown on plate 1 of this report is from their map. They measured the surface section shown in plate 1, and E. E. Glick examined and logged the samples from the well section shown in plate 1.

The present mineral resource investigation is based on field checking of the geologic map, geochemical sampling, and mineral commodity studies.

Geology

Geologic setting

The exposed rocks in the Richland Creek Wilderness study area range in age from Late Mississippian to Early Pennsylvanian. They consist of limestone, sandstone, siltstone, and shale, all of which are thought to have been deposited in a shallow-water environment.

Stratigraphy

The surface and subsurface rocks in the study area are shown graphically on plate 1. Many of the following lithologic descriptions are excerpts from those given by Glick and Frezon (1965) and modified where necessary.

Ordovician

St. Peter Sandstone

The St. Peter Sandstone consists of white to very light gray, rounded, fine- to medium-grained sandstone, interbedded with greenish-gray shale and dolomite.

Plattin Limestone

The Plattin Limestone, 30 ft (9.1 m) thick, is dominantly dense olive-gray limestone that contains white calcite crystals and veinlets. Some beds grade laterally into medium-gray finely crystalline dolomite. A trace of fine- to coarse-grained quartz sand and a few fossils, especially ostracodes and brachiopods, are in the limestone.

Fernvale Limestone

The Fernvale Limestone, 23 ft (7 m) thick, is light-gray to pinkish-gray, medium-crystalline fossiliferous limestone.

Cason Shale

The Cason Shale, 13 ft (3.9 m) thick, is greenish-gray to dark-gray dolomitic or limy shale of which the lower part is phosphatic and fossiliferous.

Silurian

Lafferty, St. Clair, and Brassfield Limestones

A sequence of limestone, 167 ft (51.2 m) thick, is present in the study area but cannot be separated with certainty into separate formations. The limestone is light to medium gray, granular to finely crystalline, and dolomitic.

Mississippian

Boone Formation

The Boone Formation, 378 ft (115.2 m) thick, consists of three distinct lithologic units. The basal unit, ranging in thickness from 6 in to 10 ft (15.2 cm to 3 m), consists of well-rounded fine to coarse sand, phosphatic pebbles, glauconite, pyrite, and conodonts. The St. Joe Limestone Member, 8 ft (2.4 m) thick, is a pinkish- to brownish-gray, clayey, very finely crystalline limestone containing crinoid fragments and other fossils. The upper and thickest unit consists of interbedded, light-gray, medium-crystalline fossiliferous limestone and medium-gray to brownish-gray chert. The chert is most abundant and least limy in the lower 30 ft (9.1 m) of the unit.

Moorefield Formation, Ruddle Shale, and Batesville Sandstone

These three formations are represented by an interval 31 ft (9.4 m) thick of light- to medium-gray, silty, fossiliferous limestone containing oolites, very fine grained sand, and thin beds of dark-gray and brownish-gray shale and

Table 1.—Hydrocarbon content of rocks near the Richland Creek Wilderness study area

[Organic carbon was analyzed by Rinehart Laboratories, Arvada, Colorado. All other analyses were by J. P. Basinger, U.S. Geological Survey]

Sample No.	Formation	Type of rock sampled	Organic carbon wt.%	Pyrolitic hydrocarbon yield wt.%	Volatile hydrocarbon content ppm	Pyrol. HC / Org. C %	*TPII°C
H-1	Cane Hill Member of Hale Formation	Siltstone and shale	0.52	0.013	14	2.6	550
H-2		Siltstone and shale	0.73	0.017	25	2.4	550
H-3		Siltstone and shale	0.71	0.016	19	2.3	550
H-4		Shale	1.07	0.031	37	2.9	570
H-5		Limestone	0.22	0.009	9	4.3	550
H-6	Fayetteville Shale	Shale	1.82	0.28	1,110	15.5	500
H-7		Shale	1.85	0.38	1,570	20.4	505
H-8		Limestone	0.65	0.10	430	16.5	510
H-9	Moorefield Formation	Silty limestone	0.41	0.044	117	10.8	506
H-10		Siltstone and shale	0.63	0.093	290	14.9	510
H-11		Siltstone and shale	0.87	0.11	320	12.7	506
H-12		Slickensided shale	1.59	0.12	320	7.8	510
H-13		Shale	0.85	0.17	500	20.4	510

Samples H-1 through H-8 are located on figure 2.

Samples H-9 through H-13 were collected in the SW 1/4 SW 1/4 sec. 15, T. 14 N., R. 18 W.

*TPII°C - Temperature peak II in degrees centigrade.

dark-gray siltstone near the base. Samples of rock in the lower part of this unit were analyzed for hydrocarbon content, and the results are listed in table 1.

Fayetteville Shale

The Fayetteville Shale, 173 ft (52.7 m) thick, consists of about 90 percent dark-gray shale and 10 percent dark-gray microcrystalline petroliferous limestone. Most of the limestone is in the upper part of the formation. The hydrocarbon content of rock samples collected from the upper 12 ft (3.6 m) of the formation is listed in table 1.

Pitkin Limestone

The Pitkin Limestone, 195 ft (59.4 m) thick, consists of medium-gray limestone and a few thin beds of dark-gray shale. Oolites are common and are particularly abundant in the middle and upper parts. Other fossils are abundant and a few lenses and nodules of dark-gray chert are present.

Pennsylvanian

Cane Hill Member of the Hale Formation

The Cane Hill Member, 0-150 ft (0-45.7 m) thick, was removed by post-Cane Hill pre-Prairie Grove erosion in the extreme southwestern part of the study area. Where the Cane Hill is present, it consists of a widespread basal conglomerate that contains pebbles and cobbles of Pitkin Limestone, and the channel fills in the conglomerate contain carbonaceous shale, coal lenses, and 2 ft (0.6 m) of oolitic phosphorite containing pebbles and cobbles of Pitkin. The rest of the Cane Hill consists of dark-gray shale with some thin beds of limestone and ironstone concretions, and medium-gray siltstone. The hydrocarbon content of some of the rocks in the Cane Hill is listed in table 1.

Prairie Grove Member of the Hale Formation and the lower part of the Bloyd Shale

These two units were mapped as Witt Springs Formation by Glick and Frezon (1965) because they could not be separately mapped. The Witt Springs is overlain by a thick sandstone which prior to 1965 was thought to be the base of the Atoka Formation. Later mapping has shown that the sandstone is the caprock of the Baldwin coal in the middle part of the Bloyd Shale. The rocks that they mapped as part of the Atoka are included with the Bloyd Shale in this report.

The basal part of the Prairie Grove and Bloyd Shale is a persistent coarse-grained sandstone, about 50 ft (15.24 m) thick, generally containing white quartz and quartzite pebbles. However, in the channel in the southwestern part of the study area the unit is 175 ft (53.3 m) thick and consists of conglomerate, conglomeratic sandstone, sandstone, siltstone, and shale. The rest of the unit, about 700 ft (213.3 m), consists of dark-gray shale, medium-gray sandy limestone, limy sandstone (some of which is glauconite), and sandstone. Some of the sandstone units are more than 100 ft (30.4 m) thick.

Quaternary

Terrace deposits of Pleistocene age and alluvium of Holocene age are present along the streams. These consist of clay, silt, sand, and pebble-to-boulder-size fragments of rocks that are exposed elsewhere in the area.

Structure

The report area is on the south side of the Ozark Dome, and the rocks have a gentle southward dip of about 100 ft (30.4 m) per mile. Glick and Frezon did not map any faults in the study area, but they did map one just outside the south edge. The down-to-the-south normal fault has a maximum displacement of about 280 ft (85.3 m) (pl. 1).

Hydrocarbon content

Some of the older rocks from outside the study area were sampled and analyzed for hydrocarbon content (table 1). George Claypool of the U.S. Geological Survey stated (oral commun., 1976) that the hydrocarbon in the samples from the Cane Hill Member "appears to have been subjected to deeper burial and higher temperatures than that in the rest of the samples."

The Cane Hill Member is the youngest and therefore the shallowest rock sampled, but it was the only rock unit sampled in the vicinity of a fault. Perhaps a fault-related increase in pressure and temperature would account for the more mature stage of hydrocarbon generation.

Claypool has also stated that (1) the hydrocarbon generation stage in rock samples H-6, H-7, H-12, and H-13 is mature to early postmature; (2) the samples have good organic richness; and (3) the rocks could be a possible oil source, but more likely a possible gas source.

The hydrocarbon potential of the area is discussed in Chapter B of this report.

Chapter B

Assessment of the mineral resources in the Richland Creek Wilderness study area, Newton and Searcy Counties, Arkansas

By

Raymond B. Stroud

U.S. Bureau of Mines

Bedrocks underlying the proposed Richland Creek Study Area provide a minuscule representation of geologic formations prevalent in much of the interior highlands section of northern Arkansas. Alternating beds of sandstone, siltstone, shale, and limestone dominate with much lesser thicknesses of conglomerate and phosphorite. The sandstone and limestone, for the most part, could be used for aggregate and building stone, and the limestone also could be used selectively for agricultural purposes; but these rocks are widespread in more accessible parts of northern Arkansas.

Phosphorites, particularly in the Fayetteville Shale underlying the study area, are generally less than 2 ft (0.6 m) thick and are therefore too thin for commercial development. Stroud (1969) reported that greater thicknesses of phosphorites occur in northern Arkansas but outside the study area.

Six-inch- (15.2 cm) thick lenses of coal crop out at scattered points outside the study area and may be present at depth within the study area, but these are not considered of commercial significance.

Croneis (1930) suggested that the Fayetteville Shale and Bloyd Shale may be sources of shale oil because of their petroliferous character. An analysis given in the Croneis report (p. 88) indicates that the Bloyd Shale in some areas of north Arkansas contains significant oil on distillation. For these reasons, slightly weathered samples of Fayetteville Shale, Shale of the Moorefield Formation, and shale from the Cane Hill Member of the Hale Formation were taken as part of the present investigation in areas adjacent to the study area. Outcrops of Bloyd Shale were deemed too highly weathered to warrant sampling. The locality and analytical results of the samples are listed in table 2.

Table 2.--Fischer assay report of shale samples from near the Richland Creek Wilderness study area, Searcy County, Arkansas

[Analytical data supplied by Laramie Energy Research Center, Laramie, Wyoming, U.S. Energy Research and Development Administration]

Sample No., Unit, and Locality	Percent yield				Gal per ton (Liters per tonne)	
	Oil	Water	Spent Shale	Gas+loss	Oil[1/]	Water
RBS-77-4, Moorefield Formation shale NW 1/4 NW1/4 sec. 15, T. 14 N.,	0.0	2.8	96.9	0.3 (1.3)	Trace	6.7 (28.3)
R. 18 W., 14-inch channel	.0	2.4	97.2	.4 (1.7)	Trace	5.8 (24.6)
RBS-77-5, Fayetteville Shale NW 1/4 SE 1/4, sec. 5, T. 13 N.,	.2	2.4	97.0	.4 (1.7)	.4a (1.7)	5.8 (24.6)
R. 18 W., Upper 3-foot channel	.2	2.0	96.8	1.0 (4.2)	.5a (2.1)	4.8 (20.4)
RBS-77-6, Fayetteville Shale NW 1/4 SE 1/4 sec. 5, T. 13 N.,	.2	1.7	97.6	.5 (2.1)	.4a (1.7)	4.1 (17.4)
R. 18 W., Lower 3-foot channel	.1	1.8	97.5	.6 (2.5)	.4a (1.7)	4.3 (18.3)
RBS-77-7, Shale of Cane Hill Member, Hale Formation	.0	4.5	94.4	1.1 (4.7)	Trace	10.9 (46.2)
NE 1/4 NE 1/4 sec. 19, T. 13 N., R. 18 W., 4-foot channel	.0	4.0	95.0	1.0 (4.2)	Trace	9.7 (41.1)

1/ "a"--indicates specific gravity estimated as 0.92.

Analytical results given in table 2 are not indicative of commercial oil concentrations. Analyses of drill core samples or fresh outcrop samples, if available at some future time, may suggest a different economic potential. However, extensive shale deposits exist outside the study area in northern Arkansas and the need to develop shale deposits as shale oil sources inside the study area is not justifiable based on current knowledge.

Of the 3,375 acres (1,366.9 ha) comprising the study area, all but 270 acres (109.4 ha) has been leased out by the U.S. Bureau of Land Management for oil and gas exploration. Croneis (1930) and R. A. Dumas (oral commun., 1977), Director of the Arkansas Oil and Gas Commission, have considered the Moorefield Formation, Batesville Sandstone, Fayetteville Shale, Pitkin Limestone, Hale Formation, and Bloyd Shale as targets for possible reservoirs of natural gas. The hydrocarbon analyses of samples collected by Haley (Chapt. A) indicate that shales near the study area have good organic richness and could be a source of natural gas, or less likely, of oil. An exploration well for natural gas was completed in 1964 by Pan American Petroleum Corp. about one-half mile (0.8 km) southeast of the study area in the NE 1/4 sec. 18, T. 13 N., R. 18 W. According to the USGS log of this hole, there were no shows of natural gas and the hole bottomed at 1,108 ft (337.9 m) in the St. Peter Sandstone or the upper part of the Everton Formation. Until additional exploration wells are drilled in or near the study area, the oil and gas potential can only be considered fair.

The Boone Formation and some of the underlying formations in the study area possibly contain zinc and lead minerals. Deposits of zinc and lead associated with northeast-trending faulting and fractures, have been developed about 5 mi (8.1 km) north of the Richland Creek study area. McKnight (1935) mentions that these deposits were mined mainly during World War I with about

3,500 tons (3,175.2 t) of zinc concentrates and 1,200 tons (1,088.6 t) of lead concentrates produced during those war years.

Chapter C

Geochemical evaluation of the mineral resources of the Richland Creek Wilderness study area, Newton and Searcy Counties, Arkansas

By

Robert L. Earhart

U.S. Geological Survey

Introduction

The geochemical evaluation of the mineral resources in the Richland Creek Wilderness study area covers metallic mineral deposits. Hydrocarbons are evaluated by Haley (Chapt. A, this report) and by Stroud (Chapt. B), who also evaluated other commodities.

The estimate of the potential for metallic mineral deposits is based on the analytical results of samples of 43 rocks, 16 stream sediments, and 3 soils. Thirteen of the rock samples were randomly collected during the study and are representative of the various rock types that crop out in the area. Thirty of the rock samples were collected prior to the present studies from a measured section of the lower part of the Bloyd Shale, and the Prairie Grove and Cane Hill Members of the Hale Formation, by E. E. Glick (1965). In the course of sampling, outcrops were examined for visible indications of mineralization; none were found. Stream sediments were collected from the principal streams and their tributaries. The samples consisted of the finest grained material available in active parts of the streams. The sediments were sieved in the laboratory, and the minus 80 mesh fractions were analyzed. Three soil samples were collected in the western part of the area because of the scarcity of outcrops in that part. Sample localities and numbers are shown on the geologic map (pl. 1).

All samples were analyzed for 30 elements by a semiquantitative emission spectrographic technique, and for zinc by an atomic absorption method. Sample localities and analytical results are shown on figure 2 and table 3, respectively. Anomalous values of potentially valuable metallic elements were arbitrarily estimated in rocks and in stream sediments by doubling the median value of the element in each of the sample types. This method of estimation seems valid in that less than 10 percent, and in most cases less than 5 percent, of the samples fall into an anomalous category. None of the samples are highly anomalous in metals.

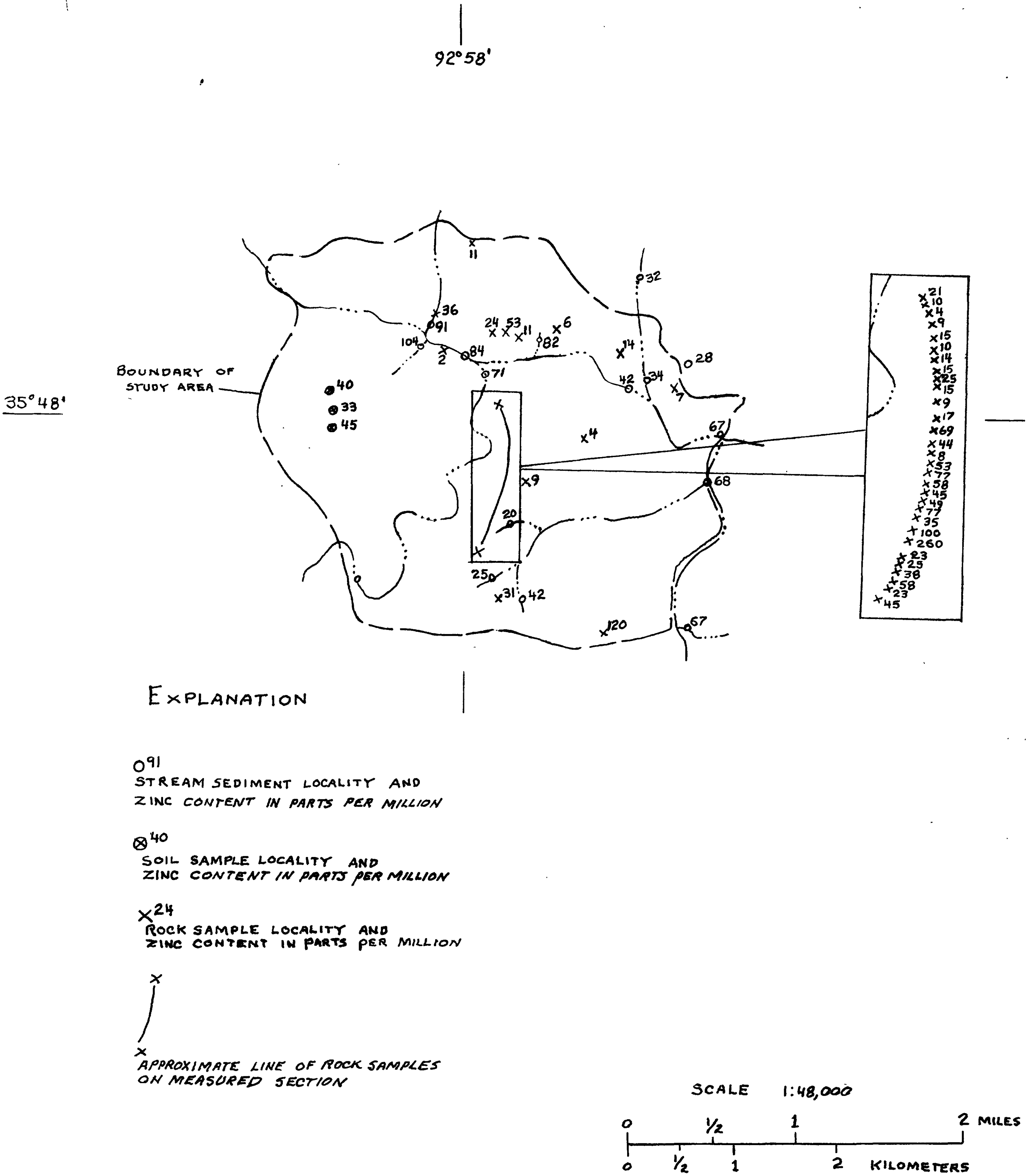

Figure 2.--Distribution of zinc in stream sediments, soils, and rocks in the Richland Creek area.

Table 3.--Analytical results of stream sediments, soils, and rocks from the Richland Creek area

[All values 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; 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 Ag (.05 ppm limit of detection), As (200 ppm), Au (10 ppm), Bi (10 ppm), Cd (10 ppm), Sb (100 ppm), Sn (10 ppm), and W (50 ppm). All samples contained 2 ppm or less Be, all samples contained undetected (N) amounts of Mo except R-200--5 ppm and R-6--L, and all contained undetected (N) or less than the lower limit of detection (L) of Nb (20 ppm) except R-202--20 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																			
R-1	3	0.5	0.3	0.3	1,500	50	200	20	100	30	50	70	20	7	L	150	20	67	300
R-2	2	.5	.1	.5	300	20	300	20	150	20	30	70	15	7	N	70	30	68	500
R-3	2	.3	.15	.5	500	20	150	20	30	30	30	20	10	5	N	70	20	28	200
R-4	2	.3	.3	.1	700	20	150	20	30	20	20	50	15	5	N	50	20	42	70
R-5	2	.2	.1	.1	1,000	50	150	20	30	20	20	30	15	7	N	50	30	34	70
R-6	3	.7	.2	.5	1,000	50	150	30	30	30	50	50	20	10	L	70	50	82	100
R-7	5	.7	.5	.3	1,000	50	300	20	100	30	70	100	20	10	150	70	50	71	700
R-8	5	.7	.5	.2	1,500	50	300	20	100	30	30	50	20	7	100	100	50	84	300
R-9	2	.5	.15	.2	500	15	100	20	100	10	20	30	N	7	N	70	20	104	100
R-10	3	.7	.5	.3	1,500	50	300	30	100	20	70	50	20	10	100	70	50	91	200
R-11	2	.2	.1	.2	1,500	50	200	20	30	10	20	20	10	5	N	50	30	32	150
R-12	2	.7	.15	.5	2,000	50	500	30	100	30	50	70	20	10	100	70	50	67	200
R-13	1.5	.3	.1	1	2,000	50	500	30	70	30	50	50	20	5	100	50	50	42	500
R-14	1	.2	.07	.3	2,000	30	300	30	70	15	50	30	20	7	L	50	50	25	300
R-15	.5	.2	.05	.7	100	30	200	10	70	15	50	10	20	7	N	50	30	20	300
R-16	2	.1	.05	.15	1,000	20	150	20	30	10	30	20	10	5	N	30	15	35	100
Soils																			
R-200	2	.1	.3	1	3,000	20	500	5	100	50	50	7	30	7	L	100	20	40	1,000
R-201	2	.5	.3	1	2,000	20	300	5	500	30	50	7	30	7	100	100	20	33	1,000
R-202	3	1	.5	1	5,000	50	300	5	100	50	70	20	30	7	100	100	30	45	1,000

Table 3.--Analytical results of stream sediments, soils, and rocks from the Richland 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																			
R-100	1	.1	.15	.1	100	15	200	N	50	20	L	L	10	L	L	10	20	7	200
R-101	1	.1	.2	.15	100	10	70	N	100	L	L	L	L	L	L	10	10	14	100
R-102	.7	.07	.2	.1	500	10	200	N	70	5	L	L	L	L	L	10	15	6	300
R-103	.5	.7	G(20)	.015	150	N	100	N	20	N	20	L	10	N	500	20	50	11	10
R-104	2	.1	G(20)	.02	700	L	150	N	50	5	30	7	20	5	1,000	30	100	53	10
R-105	1	.1	.5	.2	300	L	100	N	70	5	30	5	15	5	150	30	10	24	50
R-106	.15	.5	G(20)	.01	100	N	30	10	15	L	N	L	L	N	1,000	15	L	2	10
R-107	3	.1	20	.5	200	20	150	5	150	15	50	20	20	10	700	70	50	36	70
R-108	2	.1	1	.3	150	L	700	N	70	10	20	10	L	5	150	50	20	11	300
R-109	1	1	.7	.2	300	L	150	5	30	L	20	L	N	L	N	10	10	4	70
R-110	2	.1	.2	.1	70	10	70	30	30	10	20	5	10	5	L	10	L	9	50
R-111	.15	.1	.1	.15	700	10	150	5	50	7	50	L	L	7	N	30	15	31	100
R-112	3	.1	.5	.2	5,000	20	500	20	150	20	30	100	50	10	200	100	30	120	200
UR-1	1.5	2	G(20)	.05	1,500	10	2,000	N	20	5	N	5	L	N	500	30	30	21	10
UR-2	1.5	.5	3	.2	1,000	15	150	10	50	10	N	N	L	N	L	20	10	10	700
UR-3	1.5	.5	1.5	.2	2,000	10	150	N	50	15	N	20	L	N	N	20	N	4	500
UR-5	1.5	.2	1	.2	1,000	10	100	5	150	15	N	7	N	N	N	20	N	9	500
UR-7	3	.5	.3	.2	300	10	100	10	70	20	20	30	N	N	N	30	10	15	1,000
UR-9	2	.7	.3	.5	300	20	100	5	300	L	20	N	L	N	N	30	15	10	G(1,000)
UR-10	2	.2	.15	.5	200	15	150	5	50	20	N	7	L	N	N	10	N	14	1,000
UR-12	1	.15	.15	.1	200	10	100	N	15	7	N	5	L	N	N	L	N	15	100
UR-13	2	.2	.1	.3	300	10	150	10	100	15	N	20	L	N	N	15	N	25	200
UR-14	1.5	.2	.1	.3	150	10	100	N	30	15	N	N	10	N	N	10	N	15	200
UR-17	5	.2	.05	.2	200	10	100	N	15	15	N	5	N	N	N	10	N	9	100
UR-20	1.5	.3	.5	.07	500	10	150	N	15	30	N	7	N	N	N	L	N	17	100
UR-21	5	.7	.2	.7	300	50	200	10	100	20	20	50	10	7	L	100	20	69	700
UR-23	3	.5	.15	.7	500	15	150	15	70	20	20	30	10	5	L	70	15	44	700
UR-24	2	.2	.05	.1	200	10	100	5	15	20	N	15	L	N	N	15	N	8	200
UR-25	3	.3	.3	.3	200	15	100	10	300	20	N	30	L	5	N	70	15	53	300
UR-26	2	.2	.5	.3	500	15	100	10	500	20	N	30	15	5	N	70	20	77	300

Table 3.--Analytical results of stream sediments, soils, and rocks from the Richland 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																			
UR-28	2	.5	10	.2	2,000	15	150	10	100	20	20	30	10	5	100	70	20	58	150
UR-29	5	.5	.2	.3	150	20	200	7	150	30	20	50	L	7	N	100	20	45	700
UR-30	2	.5	G(20)	.05	G(5,000)	N	50	5	70	L	30	10	20	5	200	100	100	49	70
UR-31	5	1	1	1	300	100	1,000	20	500	20	100	70	30	20	100	500	70	77	300
UR-32	2	.7	20	.1	G(5,000)	10	50	N	70	L	30	20	20	5	150	70	70	35	200
UR-35	5	1	.3	.7	300	50	500	15	200	20	50	70	20	10	N	150	30	100	500
UR-37	2	.5	10	.07	G(5,000)	L	50	5	50	15	N	30	20	N	200	100	20	260	15
UR-42	2	.3	15	.05	G(5,000)	10	50	10	50	5	20	20	30	5	150	100	70	23	30
UR-43	1	.2	.7	.1	700	10	70	5	50	10	N	15	N	L	N	30	10	25	200
UR-44	5	.5	.2	.5	150	20	150	10	100	20	20	30	15	7	N	100	20	38	500
UR-46	5	.05	.1	.1	500	L	50	5	30	L	N	15	15	L	N	70	15	58	200
UR-47	10	.03	.1	.05	1,000	10	50	10	50	7	N	30	L	5	N	150	30	23	70
UR-51	5	.5	.1	1	100	50	500	10	200	20	50	30	30	10	100	150	50	45	G(1,000)

Stroud, in Chapter B of this report, has noted that lead and zinc were mined from northeasterly-trending fractures in the Boone Formation of Mississippian age about 5 mi (8 km) north of the area. The Boone is also a host to lead-zinc deposits elsewhere in northwest Arkansas (McKnight, 1935). Sphalerite and galena are the only metallic minerals of possible economic importance in the surrounding region. As a result, only the distribution of zinc and lead are shown on the element distribution maps (figs. 2 and 3). The Boone Formation does not crop out in the study area, but underlies the area at a minimum depth of about 325 ft (99 m). Any mineralized bodies in the Boone underlying the study area, if they exist, would go undetected by the surface sampling techniques employed in this study, and this potential can only be assessed by drilling. The geology of the area, as described and compiled by Haley (Chapt. A; fig. 2), suggests that the area lacks faults and fracture systems, which are an apparent control for the localization of zinc and lead deposits to the north. Therefore, drilling is probably not justified in the study area.

Zinc

All of the samples collected in the study area were analyzed for zinc by an atomic absorption method. The average zinc content of randomly collected rocks ('R' prefix) is 25 ppm, and the average is 41 ppm in rocks from the measured section ('UR' prefix); in stream sediments the average is 52 ppm. The analytical results do not indicate any economically significant anomalies of zinc, although 4 rock samples (R-104, R-112, UR-35, and UR-37) contained weakly anomalous amounts. R-104 is an oolitic phosphorite from the Cane Hill Member of the Hale Formation; the other anomalous samples are from gritstone and sandstone units in the lower part of the Bloyd Shale. One stream sediment (R-9), in the northwestern part of the area, contained a weakly anomalous amount of zinc, and other stream sediments in the surrounding area contain zinc values that are well above the median value of zinc in all stream sediments. The streams with the highest zinc content drain the lower part of the Bloyd Shale, the source of most of the anomalous rock samples. The results suggest that sandy units in the lower part of the Bloyd Shale are the principal source of zinc anomalies in the area, but the zinc content of these rocks is too low to be of economic importance.

Shales rich in organic carbon commonly contain high concentrations of metals, including zinc, relative to other types of sedimentary rocks. Exposures of shale are rare in the study area, and the 2 shale samples collected (R-103 and R-107) were calcareous and low in organic carbon. As expected, these samples contained lesser amounts of zinc and other heavy metals than the average amounts in carbonaceous shales elsewhere in northern Arkansas (Vine and Tourtelot, 1969).

In conclusion, none of the formations exposed in the study area appear to contain economically important amounts of zinc. Older rocks in the subsurface could be host to zinc deposits, but the apparent lack of faults or fractures suggests that the potential is low for buried zinc deposits in the study area.

Lead

Lead is commonly associated with zinc, and much of the previous discussion on the potential for zinc deposits in the area applies also to lead. Only one of the samples collected in the area contained an anomalous amount (50 ppm) of lead (fig. 3). This is a rock sample (R-112) from a gritstone unit in the lower part of the Bloyd Shale that also contained an anomalous amount (120 ppm) of zinc (figs. 2 and 3). The lead content in stream sediments ranged from not detected to 20 ppm, and in rocks from less than 10 ppm to 50 ppm. The geochemical data suggest that the rock units

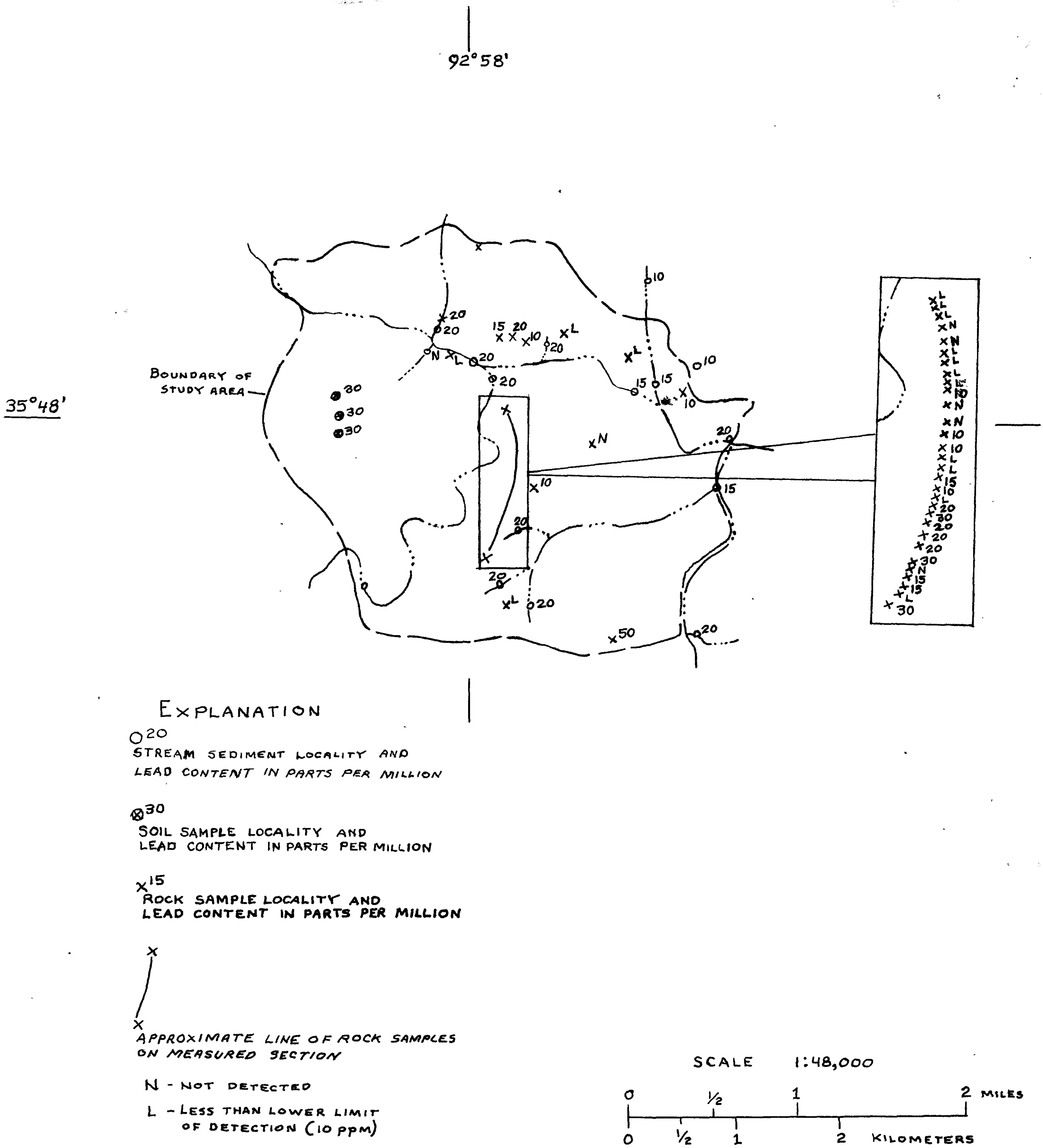

Figure 3.--Distribution of lead in stream sediments, soils, and rocks in the Richland Creek area.

exposed in the area have little or no potential for lead deposits, and the area is considered to have a low potential for buried deposits.

Conclusions

The results from geochemical studies of the outcropping rocks and stream sediments in the Richland Creek Wilderness study area indicate that the exposed formations have little to no potential for deposits of zinc or lead. A few samples are very weakly anomalous in other metals, such as manganese and niobium, but the values are too low and widely scattered to be of any economic significance.

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