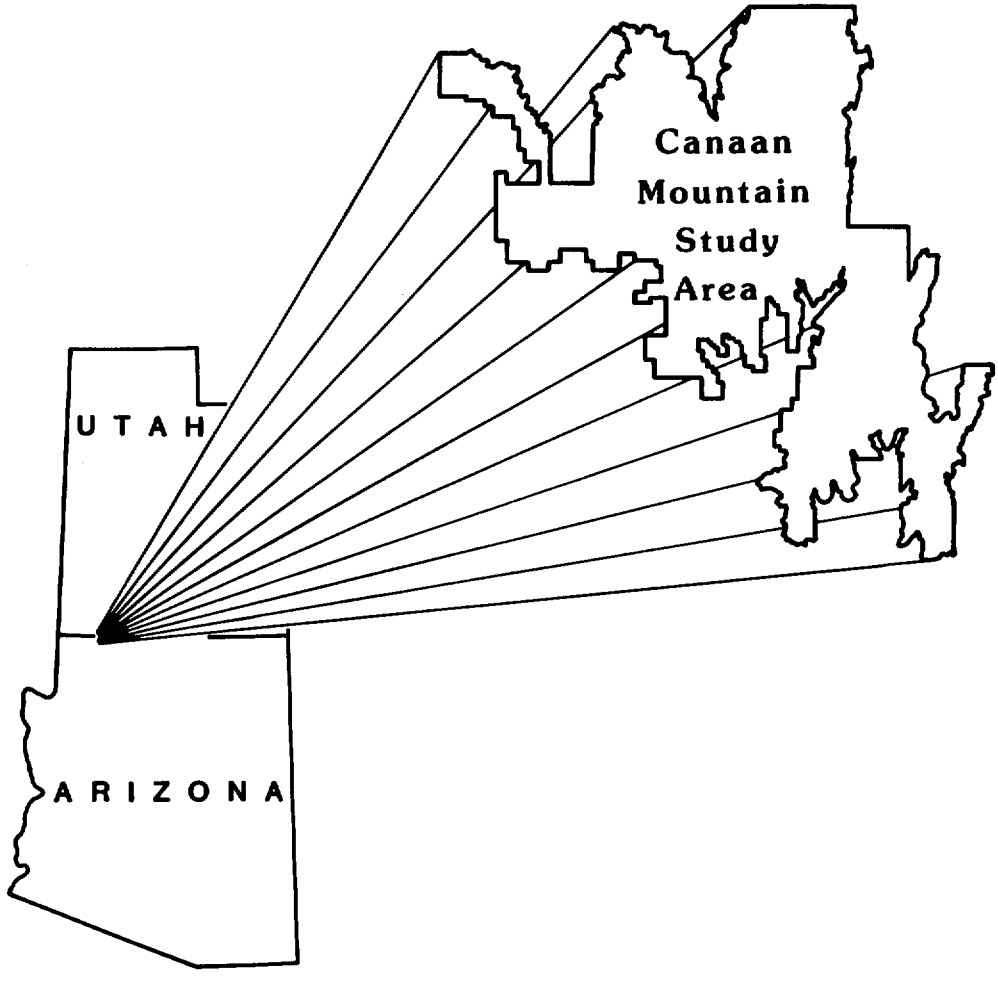
MLA 43-86

Mineral Land Assessment
Open File Report/1986

Mineral Investigation of a Part of the Canaan Mountain Wilderness Study Area, Kane and Washington Counties, Utah (UT-040-143) and Mohave County, Arizona (AZ-010-041)



BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL INVESTIGATION OF A PART OF THE CANAAN MOUNTAIN WILDERNESS STUDY AREA, KANE AND WASHINGTON COUNTIES, UTAH (UT-040-143) AND MOHAVE COUNTY, ARIZONA (AZ-010-041)

by

Terry J. Kreidler

MLA 43-86
1986

Intermountain Field Operations Center, Denver, Colorado

UNITED STATES DEPARTMENT OF THE INTERIOR
Donald P. Hodel, Secretary

BUREAU OF MINES
Robert C. Horton, Director

PREFACE

The Federal Land Policy and Management Act of 1976 (Public Law 94-579) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine the mineral values, if any, that may be present. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of a part of the Canaan Mountain Wilderness Study Area, Kane and Washington Counties, Utah (UT-040-143) and Mohave County, Arizona (AZ-010-041).

This open-file report summarizes the results of a Bureau of Mines wilderness study. The report is preliminary and has not been edited or reviewed for conformity with the Bureau of Mines editorial standards. This study was conducted by personnel from the Branch of Mineral Land Assessment (MLA), Intermountain Field Operations Center, Building 20, Denver Federal Center, Denver, CO 80225.

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ILLUSTRATIONS

TABLES

TABLES--Continued

UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

cps	count per second
ft	foot
mi	mile
oz/st	ounce per short ton
ppm	part per million

MINERAL INVESTIGATION OF A PART OF THE CANAAN MOUNTAIN WILDERNESS STUDY AREA, KANE AND WASHINGTON COUNTIES, UTAH (UT-040-143) AND MOHAVE COUNTY, ARIZONA (AZ-010-041)

By Terry J. Kreidler, Bureau of Mines

SUMMARY

In accordance with the Federal Land Policy and Management Act of 1976 (Public Law 94-579), the Bureau of Mines conducted a mineral survey in June 1985 to appraise the mineral resources in that part of the Canaan Mountain Wilderness Study Area designated preliminarily suitable for inclusion in the National Wilderness Preservation System (38,000 of the original 53,600 acres).

Small amounts of platinum and palladium were detected in outcrop samples taken near the study area, but the grade is too low to be of commercial interest, and development is not economically feasible now or in the foreseeable future.

No uranium occurrences or anomalous radiation were found in either the Chinle or Moenave Formations of Triassic age in or near the study area.

The deposits of sandstone, sand and gravel, and clay in the study area could be used in several industrial applications, but have no unique qualities to make them more valuable than similar deposits in the surrounding area.

The Department of Energy considers the study area to have low potential for the occurrence of oil and gas.

INTRODUCTION

In June 1985, the Bureau of Mines, in a cooperative program with the U.S. Geological Survey (USGS), studied the mineral resources of a part of the Canaan Mountain Wilderness Study Area, Kane and Washington Counties, Utah and Mohave County, Arizona, on lands administered by the Bureau of Land Management

(BLM). The WSA comprises 53,600 acres; the Bureau studied the 38,000 acres designated preliminarily suitable for inclusion in the National Wilderness Preservation System. "Study area" as used in this report refers to only the smaller area. The Bureau surveys and studies mines, prospects, and mineralized areas to appraise reserves and identified subeconomic resources. The USGS assesses the potential for undiscovered mineral resources based on regional geological, geochemical, and geophysical surveys. This report presents the results of the Bureau of Mines study, which was completed prior to the USGS investigation. The USGS will publish the results of their studies. A joint USGS-Bureau report, to be published by the USGS, will integrate and summarize the results of both surveys.

Geographic and geologic setting

The Canaan Mountain study area comprises about 38,000 acres in the High Plateaus section of the Colorado Plateau physiographic province. The study area borders Zion National Park to the north and extends about 3 mi into Arizona to the south (fig. 1). It is about 5 mi south of Springdale, Utah, and about 35 mi northeast of St. George, Utah. Access is provided by unimproved roads from Utah State Highways 9 to the north and 59 (which becomes Arizona State Highway 389) to the south and west.

Canaan Mountain is a high plateau that drops off precipitously into the Virgin River Valley and surrounding plains. Water and wind have incised deep, rugged canyons into the plateau, often carving out fantastic shapes. Elevations in the study area range from about 7,360 ft at the top of the Vermillion Cliffs along the southwest side to about 4,400 ft on the north side where South Creek crosses the northern boundary (pl. 1).

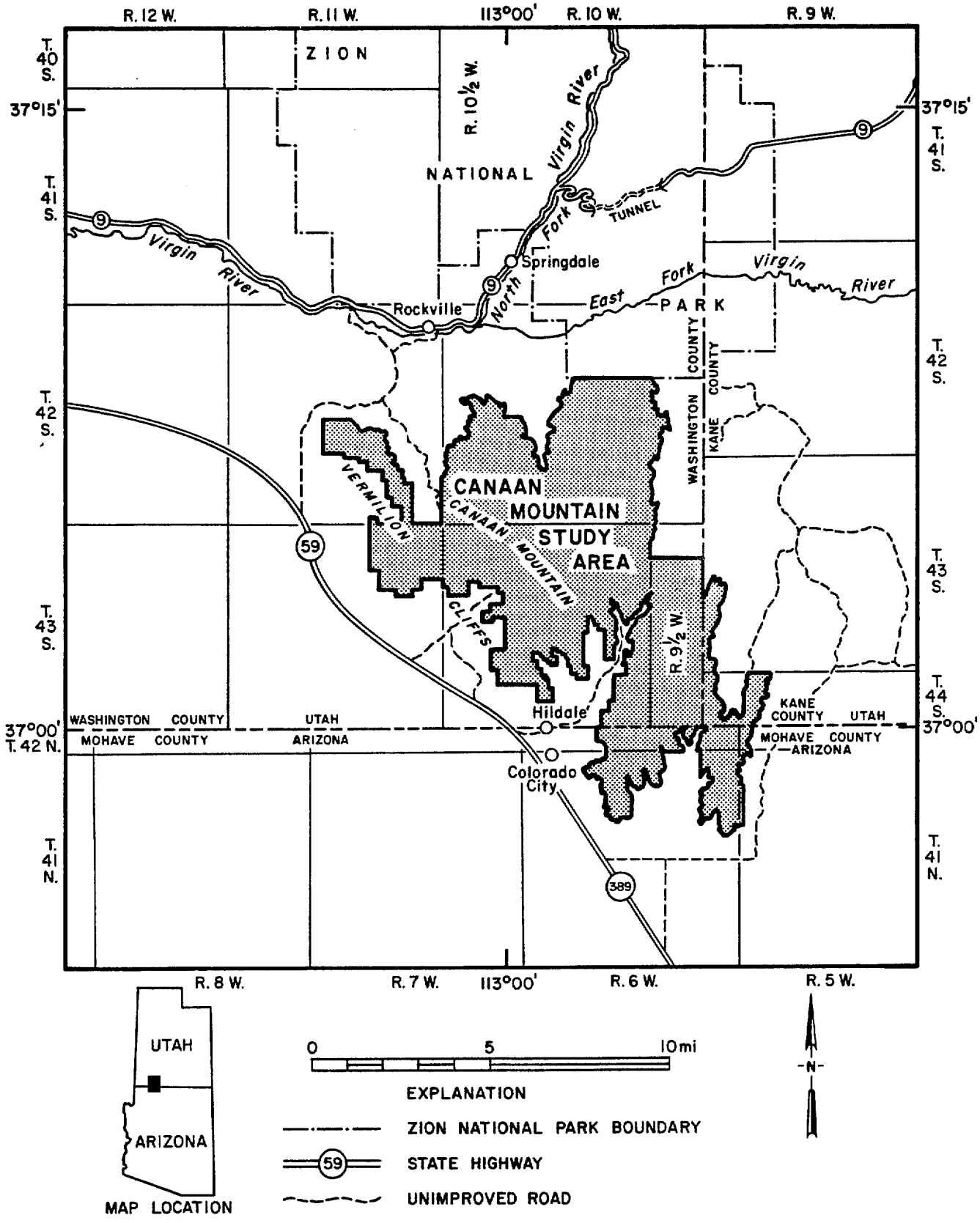

Figure 1.--Index map of the Canaan Mountain study area, Kane and Washington Counties, Utah, and Mohave County, Arizona.

The western part of the High Plateaus Section is a transition zone between the Colorado Plateau, which is little faulted, and the Basin and Range, which is structurally more complex. Canaan Mountain is capped by Navajo Sandstone of Jurassic age, which is underlain by (in descending order) the Jurassic-Triassic Kayenta Formation and the Triassic Moenave and Chinle Formations. The rocks are nearly flat lying, perhaps dipping one or two degrees to the north, and are not known to be faulted in the area.

Previous studies

Gregory (1950) studied the geology of the Zion National Park and surrounding area in detail. He described the stratigraphy, mapped the geology and structure, and discussed the water and mineral resources; no mention was made of any mining activity in the study area. Cook (1960) compiled a geologic map and discussed the geology of all of Washington County. As part of the National Uranium Resource Evaluation (NURE) Program, the Department of Energy has systematically evaluated the uranium resource potential of most areas in the western United States. Baillieul and Zollinger (1982) evaluated the Grand Canyon Quadrangle, which includes the Arizona part of the study area.

Methods of investigation

Bureau personnel reviewed various sources of minerals information including published and unpublished literature, Bureau files, and mining claim and oil and gas lease records at the BLM State Office in Salt Lake City. Discussions on the mineral resources of the study area were held with BLM personnel at the district office in St. George, Utah.

Fieldwork, completed in 18 employee-days in June 1985, consisted of searching for mines and prospects (none were found), examining and sampling unpatented mining claims in and near the study area, and sampling sediments

from streams that drain the Petrified Forest Member of the Chinle Formation. Twenty-one samples were taken; 12 stream sediment, 8 outcrop and 1 panned concentrate. The outcrop, panned-concentrate, and 2 stream-sediment samples were analyzed for gold, silver, platinum, and palladium by fire assay and the panned-concentrate and 11 stream-sediment samples for uranium by the fluorometric method. Additionally, all samples were analyzed for 40 elements by semiquantitative optical emission spectroscopy (appendix).

Mining activity

The only mining activity, as of August 1985, was a uranium prospect in sec. 36, T. 42 S., R. 11 W. reported by Oakes and others (1981, p. 150). In the 1950's, uranium occurrences in the Petrified Forest Member were prospected 6-8 mi south of the study area, and some ore reportedly was shipped (Baillieul and Zollinger, 1982, p. c-90), although no records were found to support this. As of July 1985, there were 54 unpatented mining claims staked in and near the study area for precious metals (pl. 1).

Oil and gas

As of September 1984, 30,200 acres of the study area were under oil and gas lease (fig. 2). As of August 1985, there had been no drilling or other exploration activity on the leases (Gordon Cormier, BLM District Geologist, St. George, UT, oral commun., Aug. 8, 1985).

The Virgin oil field, about 8 mi northwest of the study area, has been an intermittent, low-volume producer since 1907, although production costs generally exceeded profits. The producing zone is the basal member of the Triassic Moenkopi Formation at depths between 424 and 750 ft. A similar environment exists beneath the study area, but nearby exploration wells were dry and are abandoned. The Department of Energy considers the oil and gas

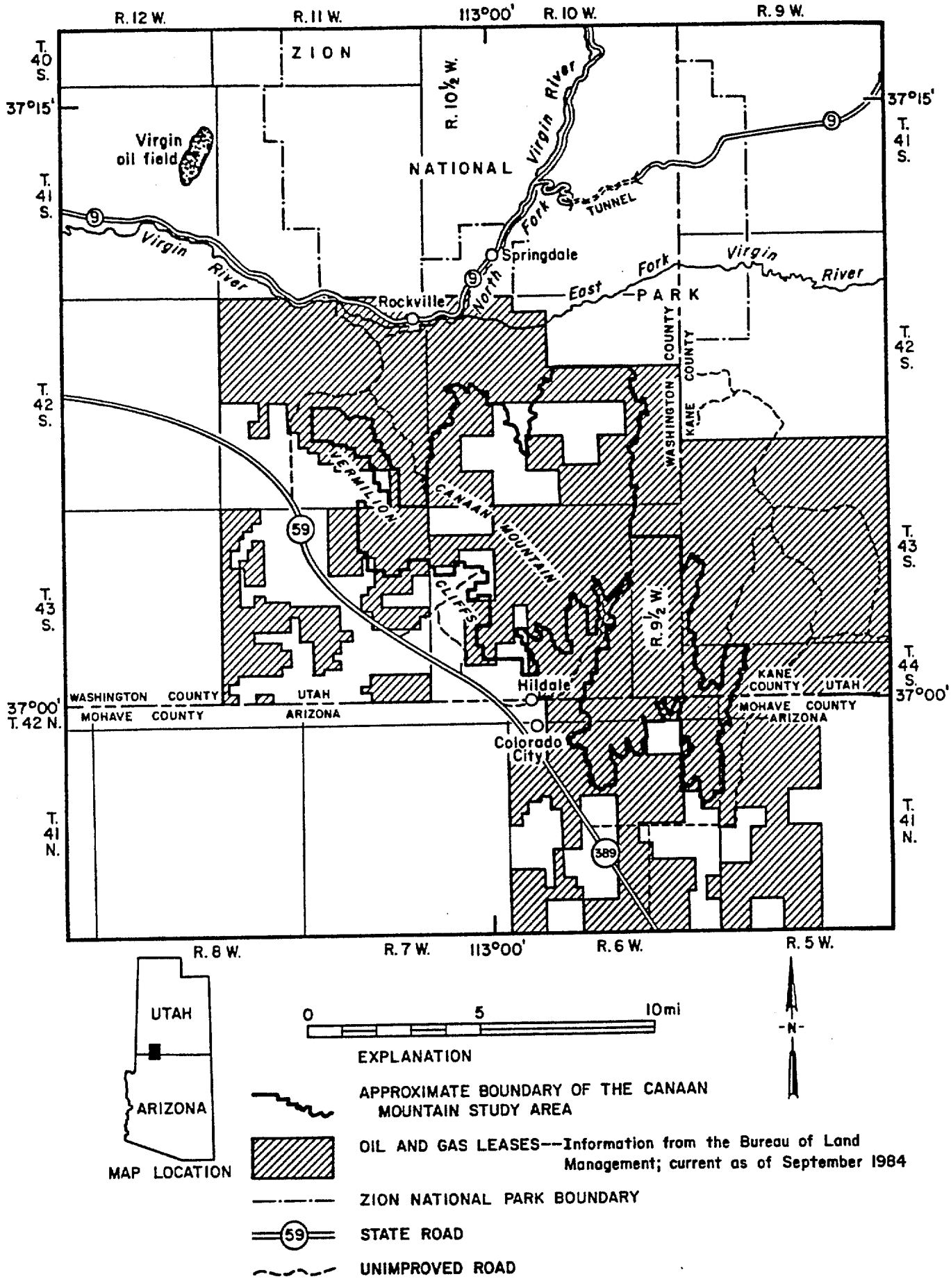

Figure 2.--Oil and gas leases in and near the Canaan Mountain study area.

favorability of the study area to be low. (See Oakes and others, 1981, p. 149.)

RESULTS OF INVESTIGATION

Commodities investigated in this study were precious metals, uranium, and industrial rocks and minerals.

Precious metals

For many years, small amounts of gold and other precious metals have been known to occur in variegated clays of the Chinle Formation, including the Petrified Forest Member. All attempts at economic recovery have met with failure, due to the extremely fine size of the metal particles (Lawson, 1913, p. 447). The source of the metals is not known. The Petrified Forest Member, covered by the block of claims along the northern boundary of the study area, contain, according to the claim holder, recoverable amounts of gold, silver, platinum group minerals, and other rare metals. However, the 11 samples taken by the Bureau from these claims and other outcrops of the Petrified Forest Member did not contain any detectable gold, and only 1 sample contained silver above the detection limit of 0.002 oz/st (table 1, sample 18). Sample 6 contained platinum (0.001 oz/st) and samples 3, 5, 6, and 13 contained palladium (0.001 oz/st) (table 1). Economic recovery of such low grade material is not feasible now or in the foreseeable future.

Uranium

The Colorado Plateau has been one of the major uranium-producing areas in the United States since the late 1940's, with most of the important deposits occurring in the sandstones, conglomerates, and mudstones of the Triassic Chinle and Jurassic Morrison Formations. Minor amounts of uranium have also been mined from rocks of Permian, Cretaceous, and Eocene age. Several miles

south of the study area, uranium occurs in, and reportedly has been produced from, the Petrified Forest Member of the Chinle Formation. On the basis of this information, Baillieul and Zollinger (1982) rated the Petrified Forest Member favorable for uranium deposits.

A uranium prospect (last worked in 1958), reportedly near the study area boundary in sec. 36, T. 42 S., R. 11 W. (Oakes and others, 1981, p. 150), was not found during the Bureau's field investigation. The host rock is believed to be the Moenave, and all outcrops near the reported prospect site were examined with a total-count scintillometer for anomalous radiation, but none was found. Outcrops of the Chinle, particularly the Shinarump and Petrified Forest Members, were also checked for anomalous radiation with the same results. Radiation in the area never exceeded background, which averaged 30 cps.

The average uranium content of the 12 stream sediment samples is 2.6 ppm uranium (range, 0.85-6.9 ppm) (table 2), which falls in the range of average uranium content in sandstones (0.45-3.2 ppm) and is less than the average content in shales (4 ppm) (Levinson, 1980, p. 885-886).

Industrial rocks and minerals

The Navajo Sandstone, which underlies a majority of the study area, can be utilized for several industrial applications such as foundry, fracturing, and abrasive sand. Within the study area, however, the Navajo does not have any unique characteristics that would make it more valuable than similar sandstone deposits that cover much of the Colorado Plateau. Similarly, the deposits of sand and gravel and clay within the study area would have value as local construction materials; however, they can be easily acquired outside the study area.

Table 1.--Data for samples analyzed for gold, silver, platinum, and palladium.

[All samples from outcrops of the Petrified Forest Member of the Triassic Chinle Formation, unless otherwise noted. All determinations by fire assay. Symbols used: ---, not detected; na, not analyzed. Detection limits: Au, 0.005 oz/st; Ag, 0.002 oz/st.]

Sample no.	Au	Ag	Pt	Pd	Description
	oz/st				
3	---	---	---	0.001	Gray clay.
5	---	---	---	.001	Stream sediment, -80 mesh.
6	---	---	0.001	.001	Gray clay, minor interlayered limonite.
7	---	---	---	---	Gray clay, moderately abundant selenite.
13	---	---	---	.001	Red clay.
14	---	---	---	---	Gray clay.
15	---	---	---	na	Panned concentrate.
17	---	---	---	---	Gray clay.
18	---	0.01	---	---	Stream sediment, -80 mesh.
19	---	---	---	---	Gray clay.
20	---	---	---	---	Red clay.

Table 2.--Data for samples analyzed for uranium

[Results in parts per million, sample 15 is a panned concentrate, all other samples are stream sediments sieved in the field to -80 mesh. U_3O_8 determined fluorometrically.]

Sample no.	U_3O_8
1	5.4
2	1.1
4	5.1
8	2.9
9	1.1
10	1.5
11	1.4
12	1.6
15	1.4
16	2.3
18	.85
21	6.9

CONCLUSIONS

Although minor amounts of platinum and palladium were detected in four samples from near the study area, the grades are too low to be of commercial interest, and development is not economically feasible now or in the foreseeable future.

No uranium occurrences were found in the study area in either the Chinle or Moenave Formations of Triassic age

The deposits of sandstone, sand and gravel, and clay in the study area have no unique qualities to make them more valuable than the vast quantities in the surrounding area.

The Department of Energy considers the study area to have low potential for the occurrence of oil and gas.

REFERENCES

Baillieul, T. A., and Zollinger, R. C., 1982, National Uranium Resource Evaluation Grand Canyon Quadrangle, Arizona: prepared by Bendix Field Engineering Corporation for the Department of Energy under contract no. DE-AC07-76GJ01664, PGJ/F-020(82), 36 p.

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Levinson, A. A., 1980, Introduction to exploration geochemistry: Wilmette, Illinois, Applied Publishing Ltd., 924 p.

Oakes, E., Wedow, H., Poling, R. and Voelker, A., 1981, Energy resource evaluation of wilderness study areas, the Bureau of Land Management's Cedar City District, Utah: prepared for the Leasing Policy Development Office, Department of Energy, 317 p.

APPENDIX--Semiquantitative optical emisson spectrographic analysis data and detection limits

Sample numbers

ELEMENTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	CONCENTRATION, PERCENT																				
AG	<.0005	<.0005	<.003	<.003	<.0005	<.0005	<.001	<.001	<.004	<.003	<.009	<.0007	<.005	<.0005	<.002	<.005	<.0005	<.0005	<.002	.005	<.0008
AL	>4.	>4.	>5.	>3.	1.	>4.	>5.	>4.	>4.	>3.	>2.	.5	>5.	>5.	>4.	.3	>4.	.1	>5.	>5.	.04
AS	<.05	<.05	<.04	<.05	<.03	<.02	<.03	<.1	<.08	<.06	<.1	<.05	<.04	<.03	<.07	<.07	<.03	<.01	<.04	<.05	<.009
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.003	<.003	<.002	<.01	<.003	<.002	<.002	<.002	<.003	<.002	<.003	<.002	<.002	<.002
B	.01	.01	.01	.01	.009	<.008	.01	.02	.02	.01	<.006	.01	.01	<.007	.02	.01	<.008	.01	.01	.01	<.003
BA	.07	.1	.04	.2	.3	.04	.009	.3	.4	.1	>10.	.07	.2	.2	.1	.009	.2	<.002	.04	.01	<.002
BE	.0008	.0004	.0006	.0007	.0004	<.0002	.0007	.001	.002	.001	.003	.0008	.0008	<.0002	.001	.001	<.0002	.001	.0006	.0004	<.0001
BI	<.01	<.01	<.02	<.01	<.01	<.01	<.02	<.01	<.02	<.01	<.04	<.01	<.01	<.01	<.02	<.01	<.01	<.01	<.01	<.03	<.01
CA	3.	3.	.4	2.	3.	<.1	.2	3.	2.	2.	<.05	4.	1.	.8	3.	6.	.8	<.08	.2	.1	>10.
CD	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.004	<.001	<.002	<.001	<.002	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0003	<.0003	<.0006	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	.002	.003	<.0003	<.0003	<.0003	.003	<.0003	.004	<.0003	<.0003	<.0003
CU	<.0006	<.0006	.008	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	.004	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
FE	4.	3.	4.	4.	1.	2.	3.	5.	5.	2.	>10.	2.	5.	5.	3.	.9	5.	.3	5.	5.	.05
GA	<.0002	<.0002	<.001	<.0002	<.0002	<.0002	<.0002	<.0004	<.0004	<.0002	<.003	<.0002	<.0008	<.0002	<.001	<.0002	<.0002	<.0002	<.0002	<.0003	<.0002
K	>10.	>10.	8.	>10.	7.	4.	10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	10.	<.9
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.02	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	.008	<.003	.01	<.002	<.002	<.002	<.004	<.002	.006	<.004	<.002	<.002	.006	<.002	.01	<.005	<.002	<.002	<.005	<.003	<.002
MG	1.	1.	1.	2.	1.	1.	2.	1.	1.	1.	.3	1.	2.	2.	1.	1.	2.	.05	1.	2.	>10.
MN	.1	.1	.02	.2	.1	.02	.02	.2	.1	.07	>3.	.07	.2	.2	.2	.09	>3.	.01	.03	.03	.04
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	.001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.5	<.3	1.	<.8	<1.	<.3	<.3	<.3	<.3	<.3	<.3
NB	<.02	<.007	<.009	<.007	<.007	<.007	<.007	<.01	<.03	<.01	<.01	<.007	<.01	<.007	<.02	<.007	<.007	<.007	<.007	<.009	<.05
NI	.001	.0008	.001	.001	<.0003	<.0004	.001	.001	.001	.001	<.003	.001	.001	<.0006	.001	.001	<.0002	<.0004	<.0007	.001	.0008
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.8	2.	<.9	<4.	<1.	<.7	<.7	<.7	<1.	<.7	2.	<.7	<.7	<.7
PB	<.003	<.003	<.002	<.003	<.002	<.002	<.002	<.007	.01	<.003	<.02	.009	<.002	<.002	<.005	.009	<.002	<.004	<.002	<.002	<.005
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0003	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0008	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.008	<.0006	<.0006	<.0006	<.0006	<.0007	<.0006	<.0006	<.0006	<.0007	<.0006
SB	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.5	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.07	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0008	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	4.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.
SN	<.004	<.004	<.002	<.004	<.0007	<.0006	<.0006	<.01	<.02	<.005	<.2	.005	<.004	<.002	<.006	.006	<.002	<.002	<.003	<.003	<.0006
SR	.003	.002	.001	.003	.002	.0002	.0008	.003	.006	.002	.01	.0003	.002	.003	.003	.0003	.002	<.0001	.0008	.0005	.0007
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.03	<.02	<.02	<.02	<.02	<.02	<.02	<.04	<.02	<.02	<.02
TE	.1	<.08	<.04	<.09	<.05	<.04	<.04	.3	.3	.2	<.4	.2	<.04	<.04	.1	.2	<.04	.2	<.04	<.04	<.04
TI	.2	.1	.3	.3	<.05	.1	.2	.2	.5	.1	>10.	<.03	.4	.3	.1	<.03	.2	<.03	.3	.3	<.03
V	<.005	<.005	.01	<.005	<.005	<.005	<.005	<.005	<.005	<.005	.3	<.005	.02	<.008	<.007	<.005	<.005	<.005	<.005	<.006	<.005
Y	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.003	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
ZN	.002	.001	.002	.002	.001	.002	.001	.003	.006	.002	.05	.007	.004	.002	.003	.004	.003	.002	.002	.002	<.0001
ZR	.01	<.003	.007	.1	<.003	<.003	<.003	<.003	.02	.003	.2	<.003	.01	<.003	.006	<.003	<.003	<.003	<.003	.006	<.003

Semiquantitative optical emission spectrographic analysis detection limits, U. S. Bureau of Mines Reno Research Center

Element	Detection limit (percent)	Element	Detection limit (percent)
Ag	0.002	Mo	0.0001
Al	.001	Na	.3
As	.01	Nb	.007
Au	.002	Ni	.0005
B	.003	P	.7
Ba	.002	Pb	.001
Be	.0001	Pd	.0001
Bi	.01	Pt	.0001
Ca	.05	Sb	.06
Cd	.0005	Sc	.0004
Co	.001	Si	.0006
Cr	.0003	Sn	.001
Cu	.0006	Sr	.0001
Fe	.0006	Ta	.02
Ga	.0002	Te	.04
K	2.0	Ti	.03
La	.01	V	.005
Li	.002	Y	.003
Mg	.0001	Zn	.0009
Mn	.001	Zr	.0001

These detection limits represent an ideal situation. In actual analyses, the detection limits vary with the composition of the material analyzed. These numbers are to be used only as a guide.

DEPARTMENT OF THE INTERIOR
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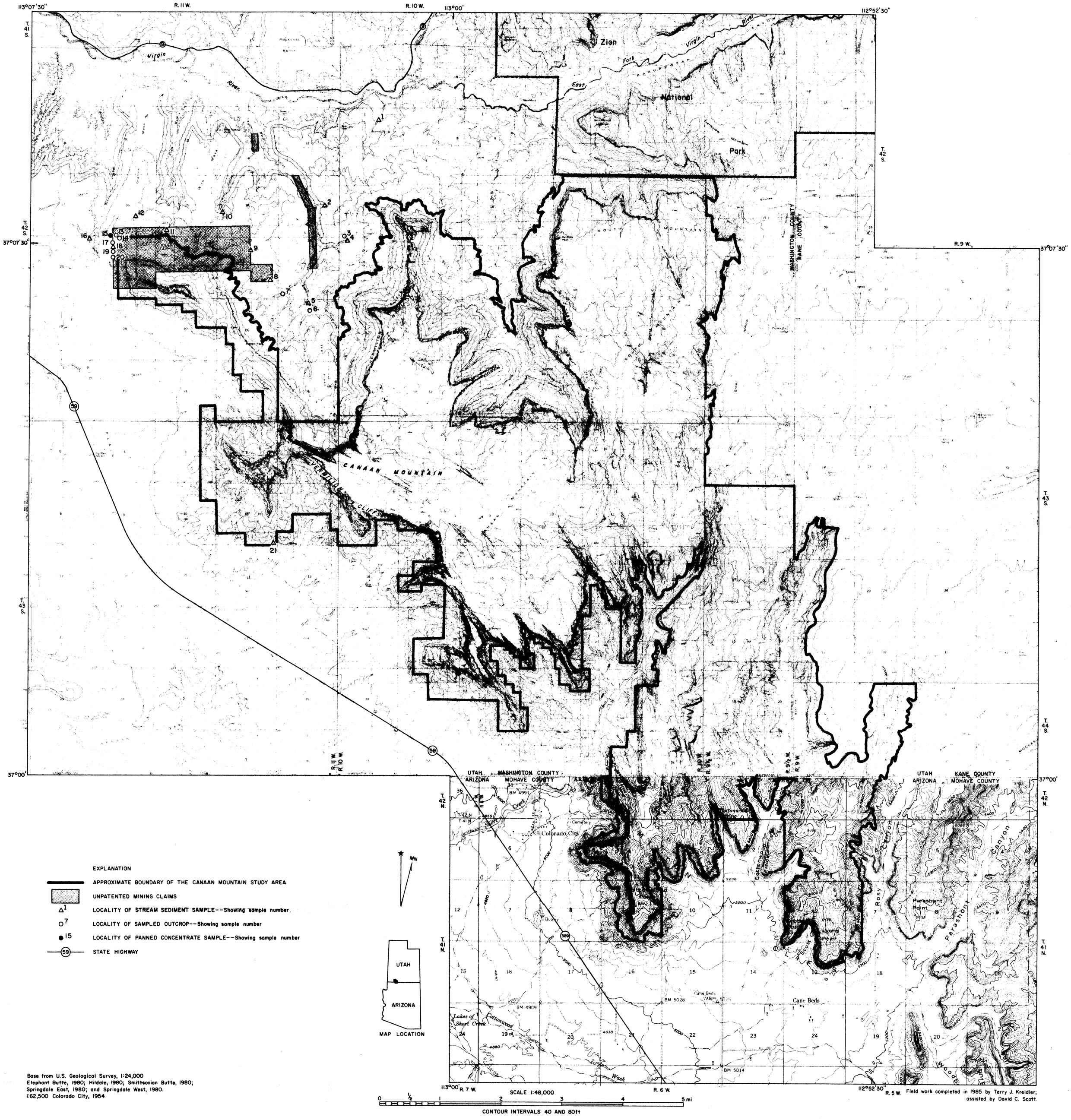
OPEN FILE REPORT
MLA 43-86
PLATE 1



EXPLANATION

- APPROXIMATE BOUNDARY OF THE CANAAN MOUNTAIN STUDY AREA
- UNPATENTED MINING CLAIMS
- Δ^{1} LOCALITY OF STREAM SEDIMENT SAMPLE--Showing sample number.
- $\circ^{7}$ LOCALITY OF SAMPLED OUTCROP--Showing sample number
- $\bullet^{15}$ LOCALITY OF PANNED CONCENTRATE SAMPLE--Showing sample number
- (59) STATE HIGHWAY

MAP LOCATION

Base from U.S. Geological Survey, 1:24,000
Elephant Butte, 1980; Hildale, 1980; Smithsonian Butte, 1980;
Springdale East, 1980; and Springdale West, 1980.
1:62,500 Colorado City, 1954

Field work completed in 1985 by Terry J. Kreidler; assisted by David C. Scott.

SAMPLE LOCALITY AND CLAIM MAP OF THE CANAAN MOUNTAIN STUDY AREA, KANE AND WASHINGTON COUNTIES, UTAH, AND MOHAVE COUNTY, ARIZONA

BY

TERRY J. KREIDLER, U.S. BUREAU OF MINES

1986