UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

MINERAL-RESOURCE POTENTIAL OF THE GRAND GULCH INSTANT STUDY AREA, SAN JUAN COUNTY, UTAH

by

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1981

Open-File Report 81-748

1981

Mineral Surveys

Wilderness Studies Related to Bureau of Land Management

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U. S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine their mineral resource potential. 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 the Grand Gulch Instant Study Area, San Juan County, Utah.

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SUMMARY STATEMENT

Geologic mapping, geochemical sampling, radiometric surveying, and a search for mineralized terranes have been conducted to determine the mineral resource potential of the Grand Gulch Instant Study Area, San Juan County, Utah. The area encompasses about 250 sq mi (650 sq km) of canyon and mesa country. Rocks of Pennsylvanian and Permian age and thin deposits of Quaternary age crop out in the study area. The dominant structure is a gently dipping homocline on the west flank of the Monument Upwarp.

The mineral resource potential of the Grand Gulch Instant Study Area is considered to be low for resources other than oil and gas. Spectrographic analyses of stream sediments and rocks collected in the area by the U.S. Geological Survey and the U.S. Bureau of Mines do not suggest derivation from mineralized terranes. Triassic rocks which are hosts for uranium and copper deposits in adjacent areas are not present in this area. Traces of gold detected in some pan concentrates are too low to encourage prospecting. The oil and gas potential is low to moderate. The study area and adjacent lands have no record of production. As most obvious structural traps have been tested, future exploration in the region must concentrate on the search for stratigraphic traps.

INTRODUCTION

During 1978 and 1979, the U. S. Geological Survey and the U. S. Bureau of Mines conducted field investigations to evaluate the mineral resource potential of the Grand Gulch Instant Study Area, San Juan County, Utah. Field studies included geological mapping and reconnaissance (Weir, 1981), geochemical sampling and radiometric surveying, and a search for mineralized areas. The area was judged to have low to moderate potential for oil and gas deposits and low potential for other resources.

The Grand Gulch Wilderness Area includes about 250 sq mi (650 sq km) of canyon and mesa country in southern San Juan County, southeastern Utah (fig. 1). The area is bounded approximately on the north and in large part on the east and west by paved highways. On the southeast an unimproved road leading to Muley Point branches from the highway on southern Cedar Mesa. On the southwest an unimproved road leading to the Clay Hills Crossing of the San Juan River branches off the highway a few miles east of the Clay Hills Divide. Several unimproved roads, generally suitable only for four-wheel drive vehicles, exist within the area. The road most traveled leads to a trailhead near Collins Spring. Other generally passable roads lead to various pastures and drill sites. Most of the travel within the area is by foot. The principal trails are along the Grand Gulch and its tributaries.

Geologic setting

The Grand Gulch Instant Study Area is within the Canyonlands section of the Colorado Plateau province (Fenneman, 1931, p. 306-312). This section is characterized by bare rock surfaces, plateaus, and steep-walled canyons. Sedimentary rocks of late Paleozoic and Mesozoic age form the principal outcrops. The strata in this part of the Plateau are generally flat or dip gently on the flanks of broad folds.

Mining Activity

The Grand Gulch Instant Study Area does not lie within an organized mining district. No mining claims are known to have been located within the study area.

Uranium occurs in the Shinarump Member of the Chinle Formation at several locations near the head of Fry Canyon in T. 37 S., Rs. 16 and 17 E., approximately 3 mi (5 km) west of the study area (Thaden and others, 1964). The only known production came from the Fry No. 4 mine in sec. 24, T. 37 S.,

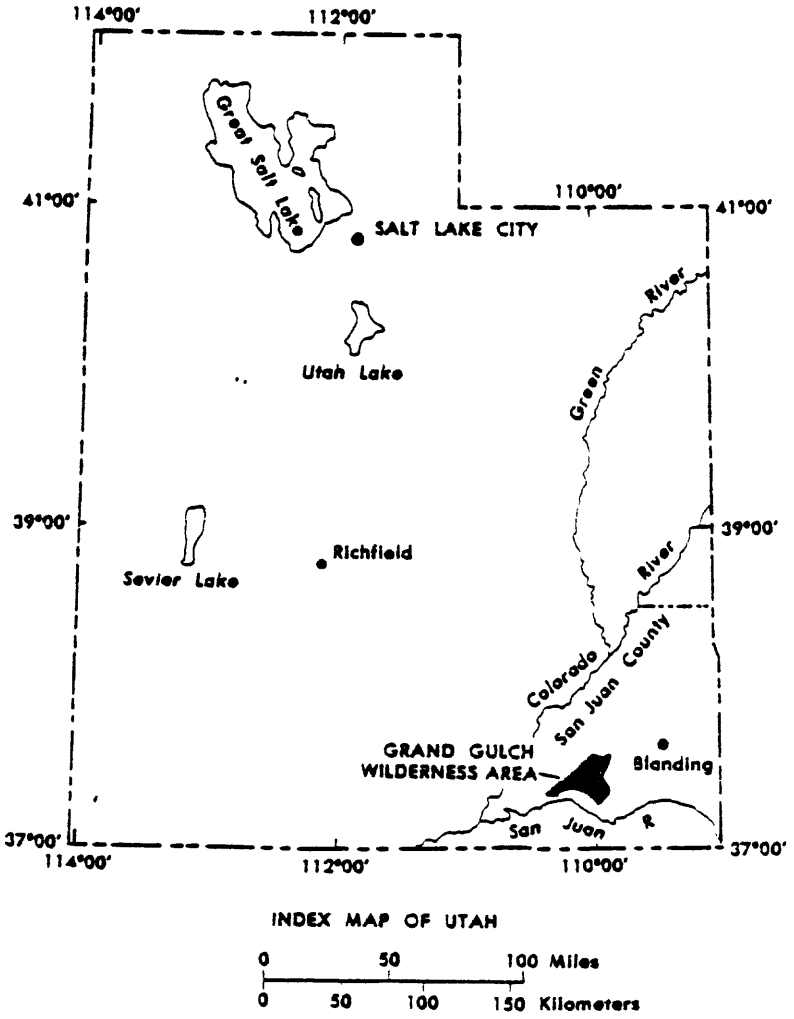


Figure 1.--Index map of Utah showing location of Grand Gulch Instant Study Area.

R. 17 E. Within the study area the Shinarump does not occur, and therefore there is no potential for similar deposits.

Oil and gas exploration

Shows of oil and gas were encountered in Permian, Pennsylvanian, Mississippian, and Devonian strata. However, none of these wells was productive, and all the wells were plugged and abandoned.

GEOLOGY

by

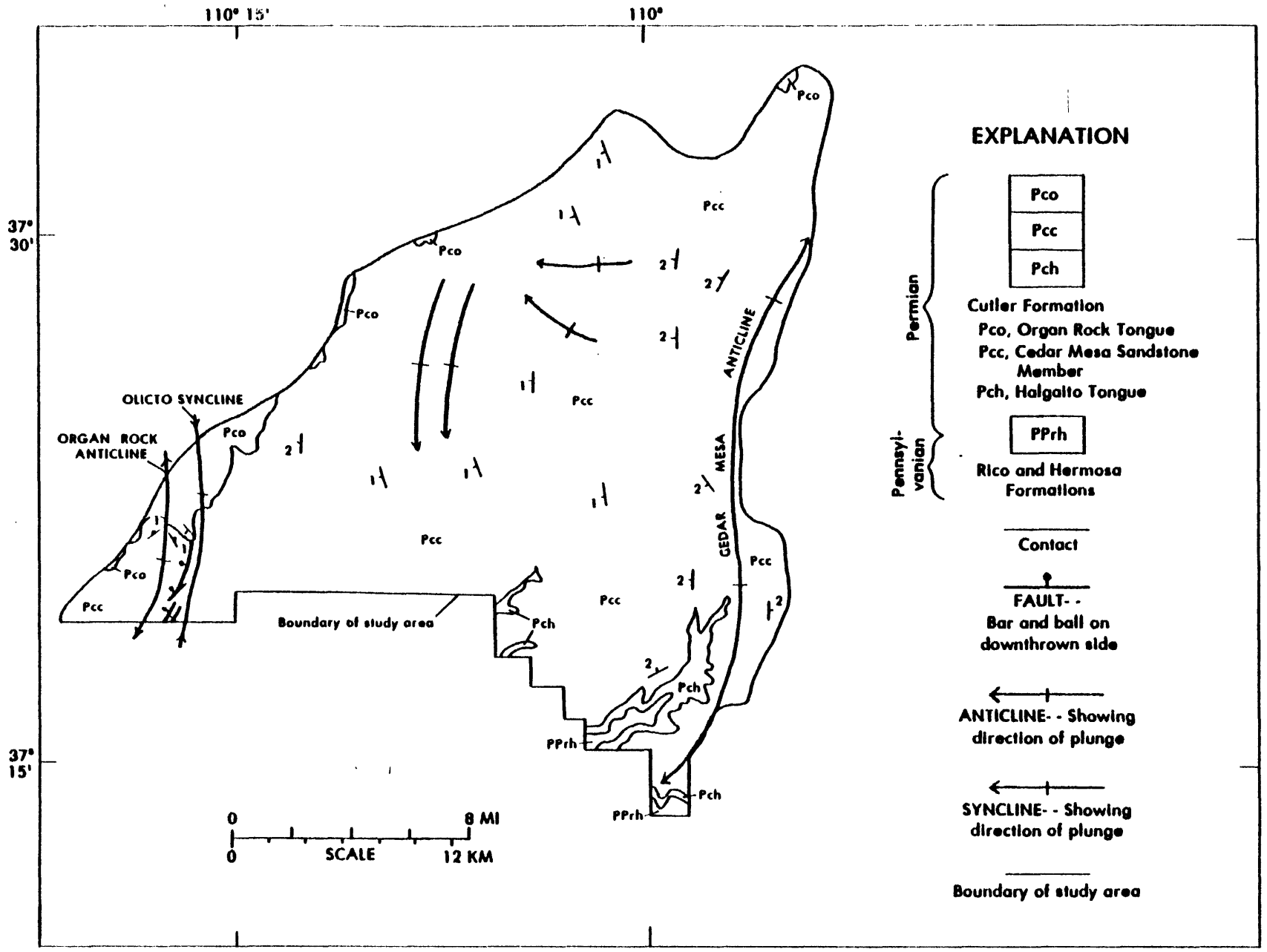
Gordon W. Weir

Rocks of Pennsylvanian and Permian age, totaling about 2,000 ft (600 m) in thickness, and thin deposits of Quaternary age crop out in the Grand Gulch Instant Study Area. Characteristics of the rocks units are listed in table 1. Most of the area is underlain by the Cedar Mesa Sandstone Member of the Cutler Formation of Permian age (fig. 2). Older units are exposed mainly in canyons in the southern part of the area. Younger rocks crop out near the northern and western edges. Quaternary deposits, chiefly eolian and alluvial sand and silt, are widespread but are commonly thin and patchy (Weir, 1981).

The study area is on the west flank of the Monument Upwarp, an elongate dome that extends from near Kayenta, Ariz., to near the junction of the Colorado and Green Rivers in southeastern Utah. The dominant structure in the area is a gently westward-dipping homocline. Because persistent beds are lacking in the Cedar Mesa Sandstone Member of the Cutler Formation, details of structure in much of the area are obscure, but as shown on figure 2, several small folds are present. The only faults within the area are normal faults on the east flank of the Organ Rock anticline. Displacements on these faults are commonly only a few feet but locally are as much as 100 ft (30 m).

Table 1.--Characteristics of rocks exposed in the Grand Gulch Instant Study Area, Utah

System	Formation	Member	Thickness		Description
			Feet	Meters	
Quaternary			0-50	0-15	Alluvium; windblown silt and sand; fanglomerate.
	Unconformity				
		Organ Rock Tongue	150+	45+	Reddish-brown, thin-bedded siltstone, interlayered with thin-bedded, fine-grained sandstone.
Permian	Cutler Formation	Cedar Mesa Sandstone Member.	700-800	210-240	Thick persistent beds of gray to reddish-orange, very fine to medium-grained, crossbedded sandstone; interlayered with minor discontinuous beds of reddish-brown siltstone.
		Halgaito Tongue	400	120	Reddish-brown, very thin bedded siltstone; irregularly interbedded with very fine grained sandstone.
	Rico Formation		370	115	Light- to medium-gray, thin to thick beds of fossiliferous, cherty, sandy limestone; medium to thick interbeds of very light gray and reddish-brown, very fine to fine-grained calcitic sandstone; and interbeds of reddish-brown siltstone.
Pennsylvanian	Hermosa Formation		330+	100+	Gray, fossiliferous, cherty, very fine to fine-grained, thick-bedded limestone; minor thin interbeds of gray, greenish-gray, and purple shale and siltstone. Base not exposed; total thickness of Hermosa about 1,500 ft (450 m) (O'Sullivan, 1965, p. 21).



Quaternary units are not shown. Bedrock geology modified from Weir (1981). Structural elements drawn from Mullens (1960), Haynes and others (1972), and Hackman and Wyant (1973).

Figure 2.--Generalized geologic map of the Grand Gulch Instant Study area, Utah.

GEOCHEMISTRY

Sampling and analytical techniques

A total of 94 samples from within and near the Grand Gulch Instant Study Area were collected by J. C. Antweiler, L. S. Beard, and G. W. Weir. Seventy stream-sediment samples, chiefly collected along Grand Gulch and its tributaries and other canyons draining southward to the San Juan River, make up the majority of the samples. Seven panned concentrates of stream sediments were made by J. C. Antweiler. Seven samples of surficial material on mesa tops and ten samples of bedrock units were collected to check the general background of the area. Semiquantitative spectrographic analyses of the stream sediments and rocks were made by R. T. Hopkins and C. J. Moisier using the six-step method for 30 elements (Au, Ag, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, La, Mg, Mn, Mo, Nb, Ni, Pb, Sb, Sc, Sn, Sr, Ti, V, W, Y, Zn, and Zr). The spectrographic data were reported to the nearest number in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, and so on, which represent approximate midpoints of group data on a geometric scale. The panned concentrates of heavy minerals were analyzed for gold by W. L. Campbell using atomic-absorption techniques. The data for the samples are stored in the Rock Analysis and Storage System files.

Radioactivity, which is a guide in searching for uranium deposits, was measured with a scintillometer by L. S. Beard and G. W. Weir along the bordering highways and principal access roads of the study area, and in Bullet and Johns Canyon, in the upper part of Slickhorn Canyon, and from near Collins Springs to about 5 mi (8 km) above the mouth of Grand Gulch.

Evaluation of analytical data

The analyses of the samples of stream sediments and rocks do not suggest derivation from mineralized terranes. They appear characteristic of the

country rock, mostly sandstone of Permian age (Weir, 1981). A few analytical values seem anomomalous because they are high relative to the whole set of analyses (table 2). Some relatively high values in stream sediments may result from contamination by fine debris derived from volcanic rocks that crop out north of the study area. The gold values detected in the panned concentrates are very low. None of the anomalies are more than an order of magnitude higher than the lower limit of detection, and they do not form a pattern requiring more sampling.

The radioactivity survey detected no anomalies.

MINING DISTRICTS AND MINERALIZED AREAS

by

Thomas D. Light

The Grand Gulch Instant Study Area does not lie within an organized mining district. Mining claim records were examined at the office of the San Juan County Recorder in Monticello, Utah. No mining claims are known to have been located within the study area.

The U. S. Bureau of Mines collected 38 stream-sediment and outcrop samples from within the study area. Each sample was analyzed spectrographically for 40 elements.[1]

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[1]Assay data for samples analyzed by the U.S. Bureau of Mines are available from the Intermountain Field Operations Center, Mineral Land Assessment Section, Building 20, Denver Federal Center, Denver, Colorado 80225.

Table 2.--Anomalous values shown by analyses of stream sediments and rocks in and near the Grand Gulch Instant Study Area, Utah

[Samples 115-160 collected by J. C. Antweiler, samples 777-783 collected by L. Sue Beard and G. W. Weir. Gold values determined by W. L. Campbell using atomic-absorption techniques. Other elements from semiquantitative spectrographic analyses by R. T. Hopkins (samples 115-160) and C. J. Moister (samples 777-783) using the six-step method for 30 elements. Values reported in parts per million (ppm). L, detected but below limit of determination shown; leaders (---) indicate no data]

	Element (Lower limit of detection) Anomaly minimum							
Sample No.	Au (.05) L.05	Cr (10) 100	Cu (5) 100	La (20) 100	Mo (5) 50	Sr (100) 500	V (10) 100	Remarks
				Stream sediments				
115	---	200	---	---	---	---	---	Canyon SE. of Collins Spring.
117	---	150	---	---	---	---	---	Grand Gulch, E. of Collins Spring.
120	---	100	---	---	---	---	---	Canyon SE. of Collins Spring.
121	---	300	---	---	---	---	---	Do.
122	---	100	---	---	---	---	---	Do.
	---			Panned concentrates of stream sediments				
156	L.05		150	---	---	---	---	Unnamed canyon, 2.5 mi (4 km) S. of Collins Spring.
157	1.0	300	---	100	---	---	150	Grand Gulch, E. of Collins Spring.
158	.45		---	---	---	---	100	Do.
159	L.05	100	---	---	---	---	150	Canyon SE. of Collins Spring.
160	.28	100	---	---	---	---	---	Do.
				Rocks				
133	---		---	---	50	---	---	Residual chert pebbles.
777	---		---	---	---	---	150	Limestone, Halgaito Tongue, Cutler Fm.
782	---		---	---	---	1,000	---	Siltstone, Halgaito Tongue, Cutler Fm.
783	---		---	---	---	500	200	Limestone, Halgaito Tongue, Cutler Fm.

The records from the Conservation Division of the U.S. Geological Survey show 61 oil and gas wells have been drilled in and near the area. Shows of oil and gas were encountered in Permian, Pennsylvanian, Mississippian, and Devonian strata. However, none of these wells was productive, and all the wells were plugged and abandoned.

Uranium occurs in the Shinarump Member of the Chinle Formation at several locations near the head of Fry Canyon in T.37 S., Rs. 16 and 17 E., approximately 3 mi (5 km) west of the study area (Thaden and others, 1964). The only known production came from the Fry No. 4 mine in sec. 24, T. 37 S., R. 17 E. Within the study area the Shinarump does not occur, and therefore there is no potential for similar deposits.

MINERAL-RESOURCE POTENTIAL

The mineral resource potential of the Grand Gulch Instant Study Area is very low except for and oil and gas. No metallic mineral occurrences are known within the area. The spectrographic analyses of stream sediments and rocks collected in the area by the U. S. Geological Survey (Weir and Light, 1981, table 1) and the U. S. Bureau of Mines do not suggest derivation from mineralized terranes. Scintillometer traverses along the principal roads and trails detected no anomalous radioactivity. Triassic rocks, which are hosts for uranium and copper deposits in adjacent areas (Lewis and Campbell, 1965; Thaden and others, 1964; Witkind and Thaden, 1963), are not present in this area. Traces of gold were detected in panned concentrates of stream sediments (Weir and Light, 1981, table 1), but the reported values (not more than 1 ppm) are too low to encourage prospecting. Sand and gravel in Quaternary deposits, and limestone in formations of Pennsylvanian and Permian age in the area are of little potential value because of their remote location and the presence of readily accessible, adequate supplies of such material elsewhere in the

region.

The oil and gas potential is low to moderate. Although the wilderness area and adjacent lands have no record of production, shows of oil and gas in some wells (Weir and Light, 1981, table 3), suggest the possibility that oil and gas may be present in Permian, Pennsylvanian, Mississippian, and Devonian rocks. The area probably lies outside the saline facies of the Hermosa Formation (Pennsylvanian) that contains the major oilfields in the Four Corners region (Wengerd and Strickland, 1954, fig. 2). Morever, much of the Hermosa correlative with productive zones is breached by the San Juan River near the study area, so that oil formerly present may have drained away. Nevertheless, structural and stratigraphic traps in the Pennsylvanian rocks may be sealed by impermeable facies from reservoir drainage into the canyon of the San Juan (Wengerd, 1973, p. 125). Mississippian and Devonian strata, which have yielded significant amounts of oil and gas in and near the region, have been inadequately tested in southeastern Utah (O'Sullivan, 1965; Spencer, 1975). As most obvious structural traps have been tested, future exploration must concentrate on the search for stratigraphic traps.

Table 3.--Record of wells drilled in and near the Grand Gulch Instant Area, Utah

[Wells drilled are as of 1979. All wells are abandoned. Sources of data: Hansen and Scoville (1955), Heylnun and others (1965), O'Sullivan (1965), and records of the Conservation Division, U. S. Geological Survey]

Reference letter	Section	Operator	Well	Total depth (ft)	Year completed	Oldest formation or age of rocks penetrated	Remarks
			T. 37 S., R. 17 E. (Unsurveyed)				
A	16	Phillips Petroleum Co.--------	1720 Federal----------	3,539	1960	Mississippian----------	None.
			T. 37 S., R. 18 E. (Unsurveyed)				
B	1	Don Danvers----------	1 Federal------	3,950	1957	Mississippian----------	Show of gas in Pennsylvanian rocks.
C	13	Mountain Fuel Supply Co.------	1 Morman Flat Government	4,637	1958	Devonian----------	Shows of oil in Permian and Devonian rocks; shows of gas in Pennsylvanian and Devonian rocks.
			T. 37 S., R. 19 E. (Unsurveyed)				
D	7	William B. Kidd----------	1 Federal 7----------	4,405	1971	Mississippian----------	Show of gas in Rico Fm.
E	23	Edward J. Kubat----------	1 Government----------	3,501	1958	do----------	None.
			T. 38 S., R. 15 E. (Unsurveyed)				
F	11	Tenoessee Gas Transmission Co.	1-B Organ Rock----------	2,800	1960	Hermosa Fm.----------	None.
			T. 38 S., R. 16 E. (Unsurveyed)				
G	22	Sinclair Oil and Gas Co.------	1 Federal-Southern Union	3,885	1958	Devonian----------	Show of oil in Pennsylvanian rocks.
H	29	Houston Oil and Minerals Corp.	23-29 Federal----------	3,440	1976	Mississippian----------	None.
			T. 38 S., R. 18 E. (Unsurveyed)				
I	7	Sinclair Oil and Gas Co.------	1 Federal-Fehr----------	3,866	1958	Mississippian----------	Show of oil in Pennsylvanian rocks.
J	14	Carter Oil Co.----------	1 J. H. Ryan----------	3,394	1956	Molas Fm.----------	Show of gas in Pennsylvanian rocks.
K	34	St. Louis Car Co.----------	1 Utah Government-------	2,705	1959	Hermosa Fm.----------	None.
			T. 38 S., R. 19 E. (Unsurveyed)				
L	22	Atlantic Refining Co.---------	1 Monsanto-Government---	2,357	1962	Paradox Mbr., Hermosa Fm.	None.
			T. 39 S., R. 13 E. (Unsurveyed)				
M	24	Pan American Petroleum Co.----	1 USA-Osterhoudt--------	5,231	1960	Molas Fm.----------	None.
			T. 39 S., R. 14 E. (Unsurveyed)				
N	6	Houston Oil and Minerals Corp.	11-6 Federal----------	6,243	1976	Cambrian----------	None.
			T. 39 S., R. 15 E. (Unsurveyed)				
O	2	Tennessee Gas Transmission Co.-	1-A Organ Rock----------	2,767	1959	Molas Fm.----------	None.
P	7	Pan American Petroleum Co.----	1 Grand Gulch----------	4,000	1961	Mississippian----------	None.
Q	31	Forest Oil Corp.----------	31-1 Government---------	4,100	1956	Cambrian----------	Show of gas in Rico Fm.

Table 3.--Record of wells drilled in and near the Grand Gulch Instant Area, Utah--Continued

Reference letter	Section	Operator	Well	Total depth (ft)	Year completed	Oldest formation or age of rocks penetrated	Remarks
			T. 39 S., R. 16 E. (Unsurveyed)				
R	15	Sinclair Oil and Gas Co.-------	1 Grand Gulch----------	3,404	1959	Mississippian----------	Show of oil and gas in Pennsylvanian rocks.
			T. 39 S., R. 17 E. (Unsurveyed)				
S	26	Carter Oil Co.----------	1 Government Hancock----	3,585	1959	Devonian----------	Shows of oil in Pennsylvanian rocks.
			T. 39 S., R. 18 E.				
T	4	British-American Oil Co.------	1 Danvers----------	3,150	1959	Molas Fm.----------	Shows of oil and gas in Pennsylvanian rocks.
U	15	Carter Oil Co.----------	1 Cedar Mesa----------	5,000	1959	Cambrian----------	None.
V	33	W. F. Stricklin----------	1 Norma-Federal----------	3,295	1963	Misaissippian----------	Shows of oil in Pennsylvanian rocks.
			T. 39 S., R. 19 E.				
W	11	Atlantic Refining Co.----------	1 Murphy-Federal--------	3,283	1961	Mississippian----------	Show of oil in Pennsylvanian rocks.
			T. 40 S., R. 16 E.				
X	15	Don Danvers----------	1 Jack Harris----------	695	1956	Permian----------	None.
Y	15	Don Danvers----------	1-X Jack Harris----------	1,810	1956	Mississippian----------	None
Z	15	Unknown----------	Slick Horn Gulch--------	310	1909(?)	Hermosa Fm.----------	Probably produced some oil.
			T. 40 S., R. 17 E.				
AA	25	Norwood Oil Co.----------	Galloway 1----------	1,938	1911	Hermosa Fm.----------	Shows of oil and gas in Rico and Hermosa Fms.
			T. 40 S., R. 18 E.				
BB	7	Mutual Oil Co.----------	Galloway 2----------	210	1912	Rico Fm.----------	Show of oil in Rico Fm.
CC	24	(Unknown)----------	(Unknown)----------	150	Pre-1920	do----------	None.
DD	28	Utah Southern Oil Co.----------	J. E. Noble 1----------	3,633	1927	Precambrian----------	Show of gas in Pennsylvanian rocks.
EE	33	(Unknown)----------	Finley 2----------	40	Pre-1920	Rico Fm.----------	None.
FF	33	Barney Cockburn----------	Halbersteben 1----------	560	1946	Hermosa Fm.----------	None.
GG	33	(Unknown)----------	Finley 3----------	50	Pre-1920	Rico Fm.----------	None.
HH	34	(Unknown)----------	Finley 1----------	50	Pre-1920	do.----------	None.
II	35	California Co.----------	Red Butte----------	60	1909	do.----------	None.
JJ	36	(Unknown)----------	(Unknown)----------	300	1909	do.----------	None.
			T. 41 S., R. 17 E.				
KK	36	Utah Petroleum Corp.----------	1 Francis Clark---------	1,707	1927	Hermosa Fm.----------	None.

Table 3.--Record of wells drilled in and near the Grand Gulch Instant Area, Utah--Continued

Reference letter	Section	Operator	Well	Total depth (ft)	Year completed	Oldest formation or age of rocks penetrated	Remarks
			T. 41 S., R. 18 E.				
LL	1	(Unknown)	(Unknown) 1	300	1909	Rico Fm.	None.
MM	1	Service Oil Co.	1 Columbus-Rexall	3,005	1957	Cambrian	Show of oil in Pennsylvanian rocks.
NN	1	(Unknown)	(Unknown) 1	50	1910(?)	Rico Fm.	None.
OO	2	Pinnacle Oil Co.	(Unknown) 10	520	1909	do.	None.
PP	2	(Unknown)	(Unknown)	20	Pre-1920	do.	None.
QQ	3	(Unknown)	(Unknown)	10	Pre-1920	do.	None.
RR	4	(Unknown)	1 Olympic	150	1909(?)	do.	None.
SS	4	(Unknown)	(Unknown)	10	Pre-1920	do.	None.
TT	6	Texaco, Inc.	1 Johns Canyon	4,469	1962	Precambrian	None.
UU	9	Fulton, McKim, and Hadlock	1 Government	143	1949	Cutler Formation	None.
VV	9	Fulton, McKim, and Hadlock	1A Government	1,646	1950	Hermosa Fm.	Show of oil in Hermosa.
WW	9	Basin Fuels, Inc.	1 Federal	1,175	1974	do	None.
XX	11	Marathon Oil Co.	5 Mexican Hat	295	1964	do.	None.
YY	12	London-San Juan Oil Co.	(Unknown) 1	520	1909	Pennsylvanian	None.
ZZ	12	London-San Juan Oil Co.	(Unknown) 2	450	1910	Rico Fm.	None.
			T. 41 S., R. 18 E.				
AAA	12	Pacific-San Juan Oil Co.	(Unknown) 1	60	1911(?)	Rico Fm.	None.
BBB	13	London-San Juan Oil Co.	(Unknown) 4	10+	1923(?)	do	None.
CCC	13	Marathon Oil Co.	4 Mexican Hat	298	1964	Hermosa Fm.	None.
DDD	13	Marathon Oil Co.	3 Mexican Hat	289	1964	do	None.
EEE	15	Aztec Oil Co.	(Unknown) 1	1,350	1912	do	None.
FFF	16	(Unknown)	(Unknown)	30	1910(?)	Rico Fm.	None
GGG	16	(Unknown)	(Unknown)	150(?)	1908(?)	do	None.
HHH	17	(Unknown)	(Unknown)	150(?)	1909(?)	Rico Fm.	None.

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