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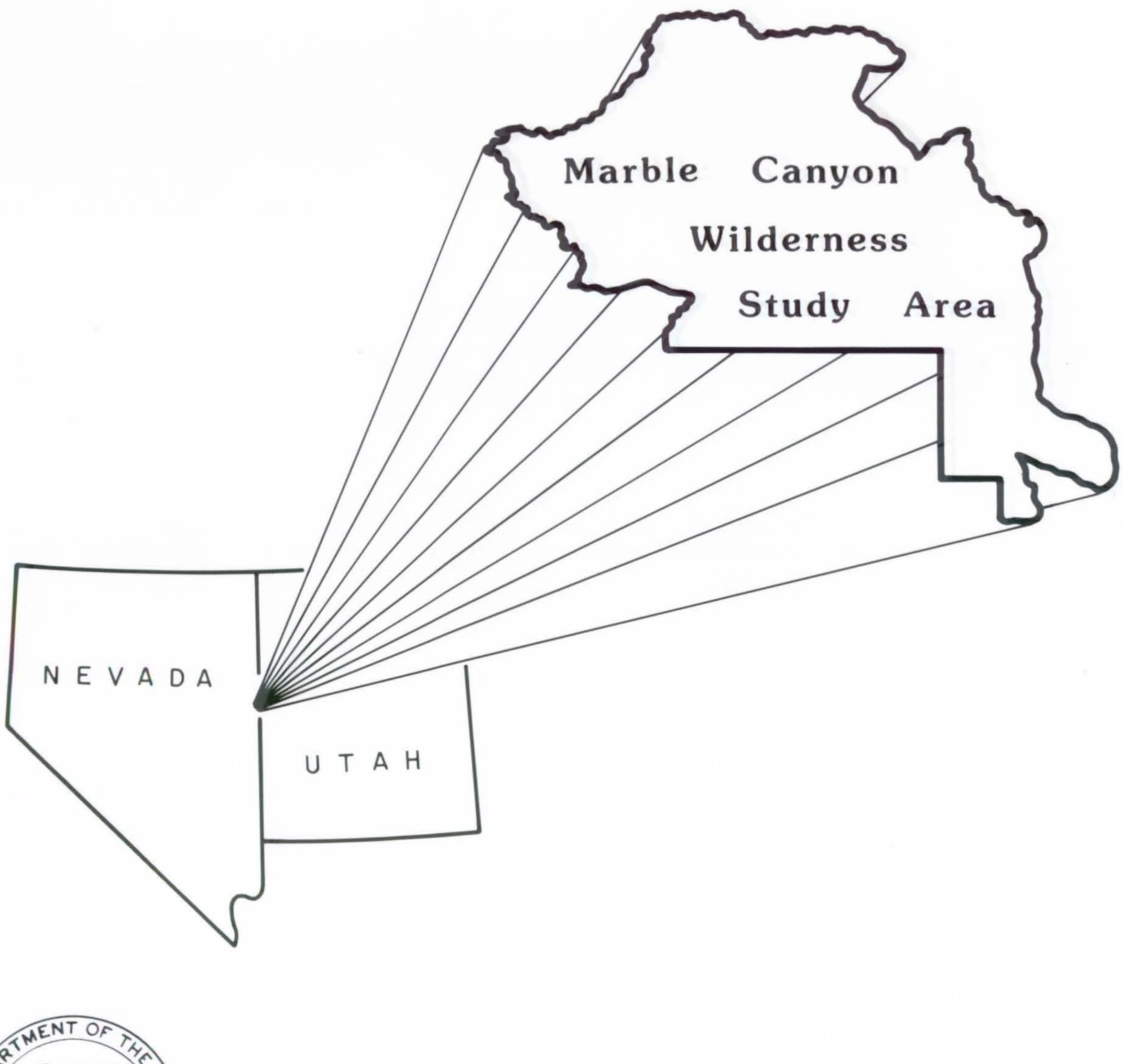
Mineral Investigation of the Marble Canyon Wilderness Study Area (NV-040-086), White Pine County, Nevada, and Millard County, Utah



BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL INVESTIGATION OF THE MARBLE CANYON WILDERNESS STUDY AREA (NV-040-086), WHITE PINE COUNTY, NEVADA, AND MILLARD COUNTY, UTAH

by

Richard F. Kness

MLA 17-89
1989

Intermountain Field Operations Center
Denver, Colorado

UNITED STATES DEPARTMENT OF THE INTERIOR
Manuel Lujan, Jr., Secretary

BUREAU OF MINES
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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 the Marble Canyon Wilderness Study Area (NV-040-086), White Pine County, Nevada, and Millard County, Utah.

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 Resource Evaluation Branch, Intermountain Field Operations Center, P.O. Box 25086, Denver Federal Center, Denver, CO 80225.

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UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

°	degree
ft	foot
in	inch
mi	mile
ppb	part per billion
ppm	part per million
%	percent
lb	pound
oz	troy ounce

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Richard F. Kness, Bureau of Mines

SUMMARY

In July 1987, the Bureau of Mines conducted a mineral investigation of the Marble Canyon Wilderness Study Area, White Pine County, Nevada, and Millard County, Utah, on 19,150 acres of land, administered by the Bureau of Land Management, as authorized by the Federal Land Policy and Management Act of 1976 (Public Law 94-579).

Prospecting and limestone quarrying have taken place in and near the study area. Large inferred subeconomic limestone and marble resources inside the study area are without special or unique properties. The carbonate rocks are suitable for use in aggregate, but there are no nearby markets, and similar quality resources are present elsewhere.

The exposed northern Snake Range decollement or detachment fault within the study area is not mineralized, based on lack of surface indications and stream sediment data. Samples taken from fault-breccia zones in unmetamorphosed carbonate rocks above the northern Snake Range decollement, however, contained some pathfinder elements typical of detachment-related deposits.

INTRODUCTION

In July 1987, the Bureau of Mines, in a cooperative program with the U.S. Geological Survey (USGS), conducted a mineral investigation of the Marble Canyon Wilderness Study Area (WSA), White Pine County, Nevada, and Millard County, Utah, on lands administered by the Bureau of Land Management (BLM), Ely District Office. The WSA comprises 19,150 acres. The Bureau surveys and studies mines, prospects, and mineralized areas to appraise mineral reserves and identified resources. The USGS assesses the potential for undiscovered mineral resources based on regional geological, geochemical, and geophysical surveys. 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. This report presents the results of the Bureau study.

Geographic setting

The Marble Canyon WSA is principally in eastern Nevada, about 37 air-mi northeast of Ely. A gravel road that bears northward in Snake Valley, near the junction of U.S. Highway 6 and 50 and State Highway 487, generally parallels the Snake Range (fig. 1). From this road, unimproved roads provide access into Smith Creek and Marble Wash.

The WSA is in the Great Basin section of the Basin and Range Physiographic Province, which is characterized by subparallel mountain ranges separated by broad alluvium-filled valleys. In the northern part of the Snake Range, the WSA is bounded on the east by Snake Valley and on the west by Spring Valley. The southern and southeastern boundaries border the Mt. Moriah division of the Humboldt National Forest.

Topography within the WSA is rugged. Thunder Mountain (9,331 ft) is the highest peak. Bars Canyon, the largest canyon, is 400-600 ft deep, and drains northeasterly into Marble Wash. Profiles of canyons near the eastern boundary change abruptly from deep v-shaped to broad or shallow, braided drainages as range front-gravel pediment surfaces are encountered.

Previous investigations

Darton (1908) conducted a reconnaissance of marble occurrences in Marble Wash. Hose and others (1976) published a report on the geology and mineral

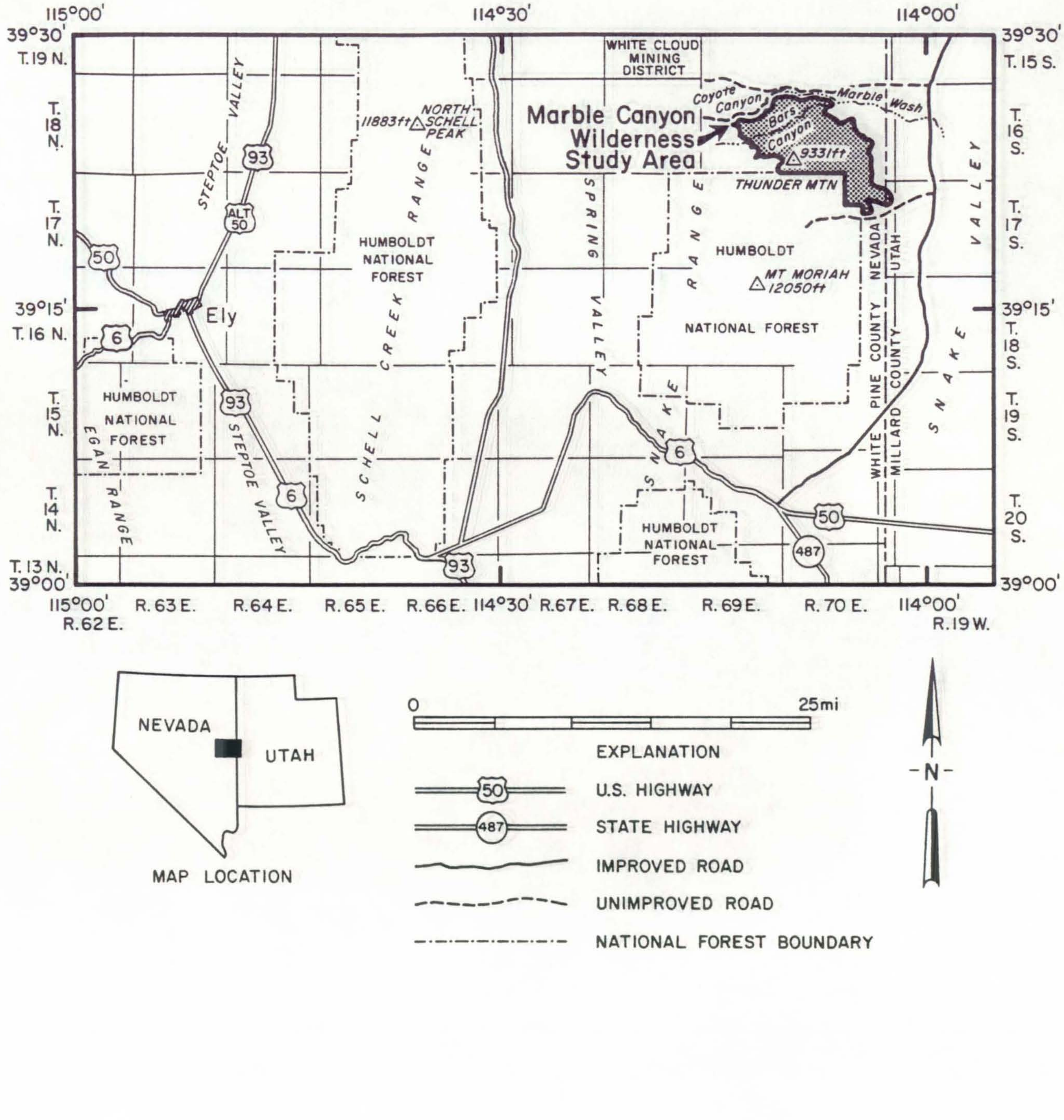


Figure 1.--Index map of the Marble Canyon Wilderness Study Area, White Pine County, Nevada, and Millard County, Utah.

resources of White Pine County, Nevada. This report included a county geologic map.

Unpublished Ph.D. dissertations cover parts of the WSA. Nelson (1959) studied the stratigraphy and structure of the northern Snake Range, Kern Mountains, and southern Deep Creek Range. Lee (1989) mapped the geology in Marble Wash and vicinity.

Outside the southern boundary in the Mt. Moriah division of the Humboldt National Forest, Wood (1983) made a mineral investigation, Hose (1981) mapped the geology, and Carlson and others (1984) appraised the mineral resources. An energy and mineral resources evaluation of the Granite Spring Resource Area, which includes the Marble Canyon study area, was done by Great Basin GEM Joint Venture (1983).

Published references detailing structural geology which include the northern Snake Range, are by Nelson (1966), and Nelson (1969) prepared a reconnaissance geologic map and a geologic section of lower plate marbles in Marble Wash. Numerous papers describing the northern Snake Range decollement are by Coney (1974), Gans and Miller (1983), and Miller and others (1983). Cretaceous magmatic and metamorphic and Tertiary decollement faulting events in the northern Snake Range are detailed by Lee and Fischer (1985).

The Stanford University geology department conducts a summer geology field camp in the northern Snake Range. Unpublished geologic maps in and near the study area resulting from these student investigations include: Christiansen and others (1987), Lee (1987), and Lee and others (1987).

Method of investigation

A detailed literature search was made for geologic and mining information pertinent to the study area and BLM records were examined for information on mining claims and oil and gas leases. Two Bureau geologists spent 6 days on the field study which included ground reconnaissance and an examination of prospects within and near the study area.

Twenty-one rock and 19 stream-sediment samples were collected. Sampled localities are shown on plate 1. Samples were analyzed either by inductively coupled plasma-atomic emission spectroscopy or fire assay-atomic absorption methods by Chemex Labs Inc., Sparks, Nevada. Detection limits and methods used are presented in tables 1 and 2 showing the analytical results. Results of analyses not included in this report are available for public inspection at the Bureau of Mines, Intermountain Field Operations Center, Building 20, Denver Federal Center, Denver, CO.

GEOLOGIC SETTING

Geologic mapping by Hose and others (1976, pl. 1) shows mostly middle and upper Cambrian-, upper Ordovician-, and Silurian-age rocks exposed within the WSA. Near Pete's Knoll, inside the eastern boundary, Devonian- and Pennsylvanian-age sedimentary and Tertiary-age extrusive rocks crop out.

Paleozoic limestone and marble crop out in and adjacent to the study area. Marble is in three middle-Cambrian carbonate formations which are exposed along Marble Wash and Bars Canyon (Lee and others, 1987). According to Darton (1908, p. 377), the marble is about 150 ft thick. Nelson (1969, p. 319) defined seven calcitic or dolomitic marble units varying from 20-55 ft thick with a composite thickness of about 200 ft.

Schistosity and compositional banding are the dominant features in the marble units. Within the marble, foliation is the most conspicuous metamorphic planar feature formed by alternating calcite and dolomite laminae and in schistose marble by alternating mica-rich beds. Some marble units are contorted, folded, and contain discontinuous mica schist beds, quartz veins and pods, and lamprophyre sills. Folds show evidence of flowage. Brecciation and mylonitization are widespread in the upper marble unit forming zones of granulated and mylonitized carbonate rocks that can be traced long distances and are deeply weathered. (See Nelson, 1966, p. 939; Nelson, 1969, p. 316.) Lamprophyre sills are restricted to the metamorphosed upper middle-Cambrian Raiff Limestone (Lee and others, 1987).

Structural relations in the northern Snake Range and within the study area are complex. A metamorphic core complex has been identified in the Snake Range and within the study area. Metamorphic core complexes are composed of a lower structural level, or plate, of igneous and metamorphic rocks, and an unmetamorphosed upper level, or plate, separated by a major low-angle normal fault, called a detachment fault. The Northern Snake Range decollement (NSRD) is a detachment fault exposed in the WSA. The NSRD formed at a depth of 3.5-4.5 mi, and lower plate deformation was synchronous with upper plate faulting. (See Gans and Miller, 1983, p. 107.)

The lower plate is characterized by metamorphosed strata of Precambrian (?) and lower-middle Cambrian age. Quartzite, marble, and schist are exposed in and near Marble Wash (Nelson, 1969, p. 317, 319). Lower plate rocks in the northern Snake Range were metamorphosed to amphibole grade (Gans and Miller, 1983, p. 133). Rock contacts and foliation are structurally concordant to the gently arched NSRD which generally follows the top of the Cambrian Pioche Shale. Upper plate rocks are unmetamorphosed but are structurally complex due to extensive listric normal faults that terminate at the NSRD. (See Miller and others, 1983, p. 242, 250.)

Mineral occurrences that may be associated with core complexes and detachment faults are copper, gold, iron, lead, manganese, silver, uranium, and zinc. Mineralization is related to fluid migration along the detachment fault and faults in upper plate rocks. (See Spencer and others, 1987, p. 2-3.) Disseminated gold is sometimes found in low-angle detachment fault breccias related to metamorphic core complexes (Bouley, 1986, p. 251).

Carlson and others (1984, p. 3, 5, 7) found that mineral resources in the Mount Moriah division of the Humboldt National Forest are in lower or upper plate rocks. Building stone from the Cambrian Prospect Mountain Quartzite and garnets in mica schists are confined to metamorphosed lower plate rocks. Most of the copper, lead, silver, and zinc occurrences in veins or replacements are associated with high-angle faults in unmetamorphosed upper plate rocks.

MINING ACTIVITY

No mining has occurred, but prospecting and limestone quarrying have taken place in the study area. Unpatented mining claims on marble are in and near the northern boundary of the study area. The following information on nearby mining districts and a mining area is summarized from Hose and others (1976).

The Marble Canyon mining district near the northern boundary encompasses the Marble Wash area. Marble claims were first located in 1891. No production records are available, but small quantities of marble were quarried for grave headstones and transported to Garrison, Utah. Darton (1908) investigated the marble as a building stone source. Pink-colored marble was tested for crushed stone from 1966 to 1969. No results of these tests were located during this investigation.

The White Cloud mining district in T. 19 N. R. 68 E. (fig. 1) borders the western boundary of the Marble Canyon district. The only mine in the district is the Lead King near the summit of White Cloud Mountain about 7-8 mi northwest of the study area. Recorded district production from 1949 to 1952 totalled 92 tons of ore containing a trace of gold, 197 oz silver, 225 lb copper, 25,985 lb lead, and 1,553 lb zinc valued at $4,481 for this time period. No other information on the district was located.

The Mount Moriah mining area is south of the WSA in the Humboldt National Forest and is named for mines and prospects on and around Mount Moriah (fig. 1). This mining area has produced quartzite building stone, garnet abrasives, gold, silver, copper, lead, and zinc. The Grand View tungsten prospect is on the west slope of Mount Moriah. A zone containing coarse-grained scheelite in 3 ft of silicified limestone assayed up to 7% WO_3.

OIL AND GAS

Drilling has occurred near the north boundary of the study area. A dry hole marker was located in Marble Wash (pl. 1), but no records were located. Oil and gas leases are shown on plate 1.

Sandberg (1983, p. H1-H8) evaluated the petroleum potential of wilderness lands in Nevada using the following four major parameters that govern oil and gas accumulation: presence of source rocks, hydrocarbon maturation, reservoir rocks, and traps. He rated the Marble Canyon study area as having medium potential because of optimum maturity of source rocks in the upper Devonian-age Pilot Shale and the Mississippian-age Chainman Shale. However, metamorphosed lower plate rocks, thin sequences of faulted upper plate rocks, and extrusive volcanic rocks exposed in the study area may preclude the presence of hydrocarbons.

RESULTS OF FIELD INVESTIGATION

Deposits related to the northern Snake Range decollement, or detachment fault, may occur in the WSA. Limestone and marble occur in the study area.

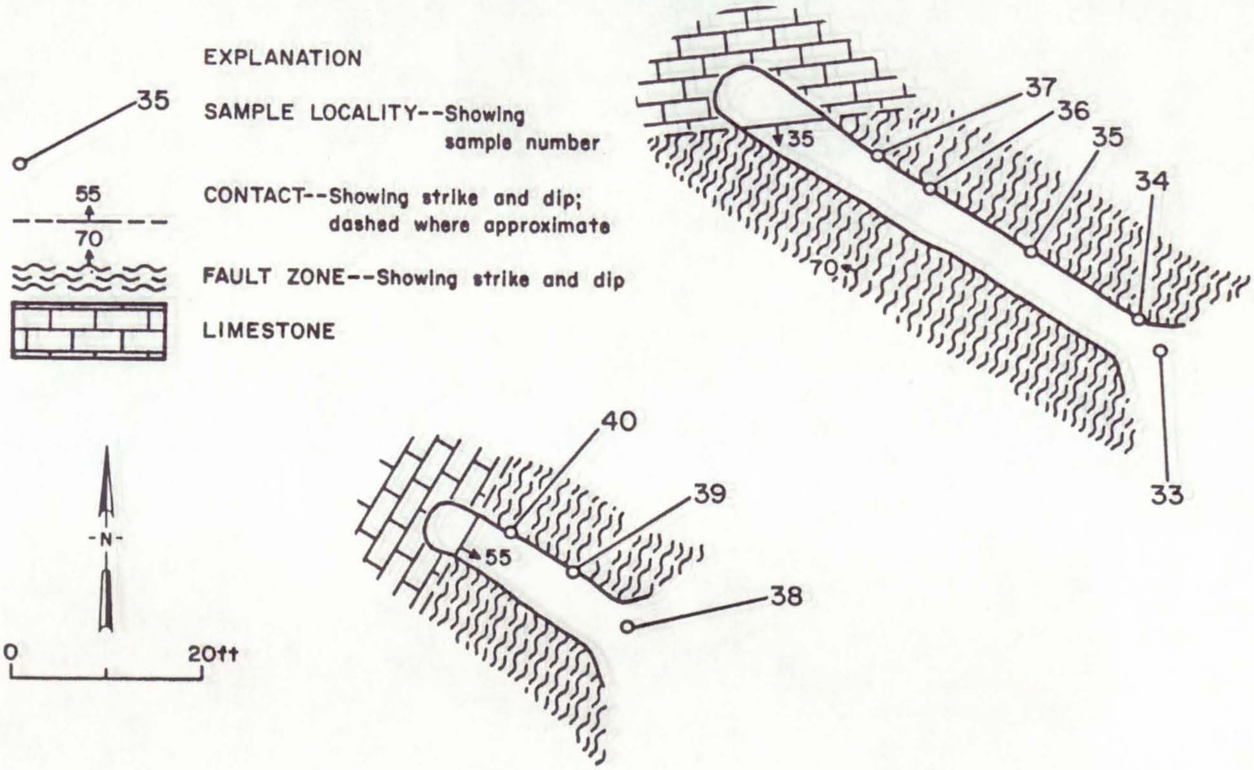
Detachment fault-related deposits

The NSRD extends along the east side of Bars Canyon. Lee (1987) mapped this fault in detail and its location is shown on plate 1. This low-angle fault continues southward into the Mount Moriah division of the Humboldt National Forest (Hose, 1981).

Pathfinder or geochemical signature elements are closely associated with, and may assist in finding mineral occurrences or deposits. Pathfinders associated with detachment faults related to metamorphic core complexes are arsenic, barium, copper, iron, gold, fluorine, silver, mercury, and tungsten (Bouley, 1986, p. 251).

Stream-sediment samples were taken from drainages in and near the WSA to determine if pathfinder elements may indicate the presence of mineral occurrences related to the NSRD and faulted upper plate rocks. Samples contained no significant differences in pathfinder element concentrations between lower plate sediment sources and upper plate sediment sources (table 1). Surface indications and analytical data indicate that near the surface this detachment fault is not mineralized.

Two short adits are inside the southeastern study area boundary (pl. 1, sample localities 33-40). Barite, calcite, and manganese oxide are in northeast-striking fault breccia zones in upper plate limestone. The breccia zones could not be traced beyond the workings due to surface talus. Christiansen and others (1987) mapped this upper plate limestone as a middle-Cambrian carbonate formation (undifferentiated). Samples of fault breccia contained arsenic, beryllium, bismuth, mercury, molybdenum, tungsten, and high barium and manganese (fig. 2). Gold and uranium were not detected and silver was at detection limits (0.2 ppm). No resources could be defined.



[Gold analyzed by fire assay/atomic absorption; fluorine analyzed by specific ion; other elements analyzed by inductively coupled plasma-atomic emission-spectroscopy. Gold and uranium below and silver at detection limits. ---, not detected; >, greater than. Detection limits: gold, 5 ppb; silver, 0.2 ppm; arsenic (As), 5 ppm; barium (Ba), 10 ppm; beryllium (Be), 0.5 ppm; bismuth (Bi), 2 ppm; copper (Cu), 1 ppm; fluorine (F), 20 ppm; mercury (Hg), 1 ppm; molybdenum (Mo), 1 ppm; manganese (Mn), 1 ppm; lead (Pb), 2 ppm; tungsten (W), 5 ppm; uranium (U), 10 ppm; zinc (Zn), 1 ppm.]

Sample		Assay data												
No.	Type and/ or length	As	Ba	Be	Bi	Cu	F	Hg	Mo	Mn	Pb	W	Zn	Remarks
		ppm												
33	Select	655	6,020	12.5	---	37	140	---	12	8,940	52	25	144	Fault breccia, iron stained, traceable 20 ft; barite, calcite, manganese.
34	Chip, 48 in.	345	6,560	7.5	---	49	270	2	24	>10,000	96	55	231	Fault breccia, iron stained; barite, calcite, manganese.
35	Chip, 42 in.	180	6,200	6	4	25	170	3	13	>10,000	54	40	140	Do.
36	Chip, 42 in.	575	8,290	12	2	56	190	6	24	>10,000	144	80	235	Do.
37	Chip, 40 in.	205	4,960	4.5	4	16	160	---	7	6,880	36	20	80	Do.
38	Select	45	4,830	2	2	10	260	---	4	5,250	22	10	68	Do.
39	Chip, 30 in.	60	4,920	2	2	23	180	3	11	>10,000	28	30	128	Fault breccia, 2- by 6-in. calcite pod.
40	Chip, 36 in.	75	4,720	2	2	13	180	1	7	7,860	20	25	85	Fault breccia, iron stained; calcite.

Figure 2.--Smith Creek adits showing sample localities 33-40, table shows sample data.

Mineralization is structurally controlled in upper plate carbonate rocks and some of the elements present are pathfinders for detachment-related deposits.

Limestone and marble

Large inferred limestone and marble resources are in the study area and must meet industry standards or specifications in order to be marketable. Limestone and marble are used in the chemical and construction industries. Other rocks may be utilized or substituted for these carbonate rocks, such as granite, sandstone, and slate used as dimension or cut stone. Sand and gravel is a frequently used alternative to crushed limestone and marble.

Impurities such as chert, clay, iron, organic matter, and silica may affect utilization of carbonate rocks. Pure calcite or dolomite marble is white; coloration results from impurities. Gray, pink, and white marble were noted during the field investigation. The upper marble units in the northern Snake Range contain a high percentage of quartz and quartz content averages 15-20% but may be as high as 40% (Nelson, 1969, p. 335).

Most chemical uses require high-calcium limestone of more than 95% calcium carbonate ($CaCO_3$), some uses specify ultra-high calcium limestone greater than 97% $CaCO_3$ (Carr and Rooney, 1983, p. 836, 846). Limestone and marble samples in and near the study area contained calcium carbonate ranging from 75.73% to 94.83% (table 2). In general, marble samples contained higher magnesium carbonate than limestone samples. Analytical data indicate that limestone and marble may not meet composition requirements for chemical uses.

Limestone and marble may be cut and used as dimension stone. Principal uses are in building construction and monuments. Most dimension marble is cut into thin slabs (7/8 to 1 1/4 in.) for use as veneer or curtain wall construction. Quarry blocks typically weigh 15 to 30 tons and may be rejected for unacceptable color, or more commonly, structural unsoundness (cracks, joints, or fractures). Most bedded deposits are sawed parallel to bedding and therefore irregular small scale folds may make it impossible to saw slabs of uniform texture and color. Some marble units in the study area are contorted, folded, and fractured. Dimension-stone quarries produce a large amount of waste because about 25% of the quarried stone is sent to the mill for sawing. Another 50% of the stone may be lost during manufacturing. (See Power, 1972, p. 44; Power, 1978, p. 64.)

Marble dimension-stone marketability is governed largely by stone availability and aesthetic qualities (uniform color, pattern, and texture) determined by architects and architectural fashions. A new prospect or deposit may be successful if it matches or closely matches a currently fashionable stone available in large quantities. (See Power, 1972, p. 44.) Marble production has remained in traditional areas having favorable geology and market proximity such as the Pittsford District, Vermont, and the Tate District, Georgia. Significant marble dimension stone tonnage is imported from Italy.

Further testing is necessary to determine if marble in and near the study area is suitable for dimension stone. Soundness and aesthetic qualities of the stone are largely unknown. Large inferred resources are present, but impurities, small scale folds, and fractures are also present in some marble units. It is not known whether large uniform, sound, blocks are present. Selective mining might be required if suitable marble units are identified. Transporation costs are high because of weight and special handling to prevent damage of finished stone. Aesthetic qualities that determine marketability of the marble have not been determined.

Limestone and marble may be crushed and used as aggregate. A private mining consultant's report (1970) estimated the Marble Wash deposit contained marble resources totaling 300 million tons. Marketability of large volume bulk material such as aggregate is affected by transportation costs. Aggregate is a high bulk, low unit value commodity shipped mostly by truck. In general, hauling crushed stone greater than 30 mi is not economical (Schenck and Torries, 1983, p. 73-74). The distance from the Marble Wash marble deposits via the Snake Valley Road to U.S. Highway 6 and 50 is about 37 mi. Ely, Nevada is the closest market. Transportation costs exceed the unit value of the commodity.

CONCLUSIONS

The exposed northern Snake Range decollement or detachment fault within the study area is not mineralized at the surface, as indicated by stream-sediment samples which contained no gold, silver, or consistent pathfinder element concentrations. Samples taken from fault-breccia zones in unmetamorphosed carbonate rocks above the northern Snake Range decollement contained some pathfinder elements typical of detachment-related deposits.

Large inferred subeconomic limestone and marble resources are present in the study area; however, no special or unique carbonate rock properties were identified. Low calcium carbonate content may preclude utilization for chemical purposes. Aesthetic qualities of the marble are unknown and the presence of impurities, folds, and fractures may make it unsuitable for dimension stone. The carbonate rocks are suitable for aggregate, but transportation costs to the nearest markets exceed the unit value, and carbonate rocks closer to market areas may be utilized or other rocks substituted. The remoteness of the area would limit development of the rock for all but local uses. Local demand is presently nonexistent. No markets were identified, and similar quality resources are present elsewhere.

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Table 1.--Data for samples 1-13, 20-24, 26-32 from the Marble Canyon Wilderness Study Area, White Pine County, Nevada, and Millard County, Utah.

[Gold analyzed by fire assay/atomic absorption; fluorine analyzed by specific ion; other elements analyzed by inductively coupled plasma-atomic emission-spectroscopy. Gold and uranium below and silver at detection limits. ---, not detected. Detection limits: gold, 5 ppb; silver, 0.2 ppm; arsenic (As), 5 ppm; barium (Ba), 10 ppm; beryllium (Be), 0.5 ppm; bismuth (Bi), 2 ppm; copper (Cu), 1 ppm; fluorine (F), 20 ppm; mercury (Hg), 1 ppm; molybdenum (Mo), 1 ppm; manganese (Mn), 1 ppm; lead (Pb), 2 ppm; uranium (U), 10 ppm; tungsten (W), 5 ppm; zinc (Zn), 1 ppm. Abbreviation used: NSRD, northern Snake Range decollement.]

Sample		Assay data												
No.	Type and/ or length	As	Ba	Be	Bi	Cu	F	Hg	Mo	Mn	Pb	W	Zn	Remarks
		ppm												
1	Stream Sediment	---	160	1	---	9	270	---	---	362	14	---	43	Upper plate rocks and NSRD.
2	Chip, Random	---	30	---	---	---	70	---	---	35	4	---	1	Quartzite near NSRD.
3	Stream Sediment	---	60	.5	---	5	270	---	---	271	10	---	25	Lower-upper plate rocks and NSRD.
4	do.	---	90	.5	---	10	450	---	---	347	6	---	35	Upper plate rocks and NSRD.
5	do.	---	140	1	---	21	630	---	---	585	26	---	65	Do.
6	do.	5	150	.5	---	22	620	---	---	634	30	---	59	Do.
7	do.	5	130	1	---	13	540	---	---	480	22	---	54	Do.
8	do.	---	110	.5	---	10	450	---	---	400	18	---	41	Lower-upper plate rocks and NSRD.
9	do.	10	150	1	---	19	540	---	---	570	20	---	68	Lower plate rocks.
10	do.	5	110	.5	---	13	390	---	---	438	16	---	42	Do.
11	do.	---	100	.5	---	9	450	---	---	318	12	---	34	Do.

Table 1.--Data for samples 1-13, 20-24, 26-32 from the Marble Canyon Wilderness Study Area, White Pine County, Nevada, and Millard County, Utah--Continued

Sample No.	Sample Type and/ or length	As	Ba	Be	Bi	Cu	F	Hg	Mo	Mn	Pb	W	Zn	Remarks
		Assay data (ppm)												
12	Stream Sediment	---	130	0.5	---	19	720	---	---	394	14	---	54	Lower plate rocks.
13	do.	5	160	1	---	14	480	1	---	457	18	---	55	Do.
20	Chip, 24 in.	5	50	---	2	---	160	---	---	352	6	---	5	Limestone, thin bedded, mica along bedding planes, thin shale beds.
21	Stream Sediment	5	100	.5	---	10	640	1	---	367	12	---	36	Upper plate rocks.
22	do.	---	150	1	---	11	440	---	---	369	14	---	45	Do.
23	do.	---	130	.5	---	10	440	---	---	358	14	---	45	Do.
24	Chip, 12 in.	10	60	---	---	---	260	---	2	84	6	---	27	Limestone, gray, iron stained along fractures.
26	Stream Sediment	---	70	.5	---	7	250	---	---	257	10	---	27	Upper plate rocks.
27	do.	---	90	.5	---	6	250	---	---	258	14	---	25	Do.
28	do.	---	110	.5	---	9	200	---	---	339	20	---	37	Do.
29	Chip, 48 in.	535	240	8	---	9	240	---	---	529	52	15	48	Fault breccia zone in limestone, 4- to 6-ft-wide, strike N. 60° W., dip 60° SW., iron stained; manganese.

Table 1.--Data for samples 1-13, 20-24, 26-32 from the Marble Canyon Wilderness Study Area, White Pine County, Nevada, and Millard County, Utah--Continued

Sample No.	Type and/ or length	As	Ba	Be	Bi	Cu	F	Hg	Mo	Mn	Pb	W	Zn	Remarks
		ppm												
30	Stream Sediment	5	170	0.5	---	7	200	---	---	322	20	---	33	Upper plate rocks.
31	Chip, 36 in.	5	1,120	---	---	5	80	---	---	90	36	---	9	Limestone, gray, fine grained, thick-bedded; calcite veinlets; 15-ft adit.
32	Chip, 19 in.	10	70	---	---	6	100	---	---	82	150	---	18	Do.

Table 2.--Data for samples 14-20, 25, 31, 32 of marble and limestone from the Marble Canyon Wilderness Study Area, White Pine County, Nevada, and Millard County, Utah.

[Analysis of samples by inductively coupled plasma-atomic emission-spectroscopy. $CaCO_3$, calcium carbonate; $MgCO_3$, magnesium carbonate; Al_2O_3, aluminum oxide; Fe_2O_3, iron oxide; K_2O, potassium oxide; MnO, manganese oxide; Na_2O, sodium oxide; P_2O_5, phosphorous pentoxide; SiO_2, silicon dioxide; TiO_2, titanium dioxide; LOI, loss on ignition; ---, not detected. All detection limits are 0.01% except for K_2O which is 0.1%.]

Sample		Assay data										
No.	Type and/ or length	$CaCO_3$	$MgCO_3$	Al_2O_3	Fe_2O_3	K_2O	MnO %	Na_2O	P_2O_5	SiO_2	TiO_2	LOI	Description
14	Select	77.14	19.39	0.29	0.39	0.6	---	---	0.11	0.51	0.01	44.49	Marble, pink and white laminated, iron stained along fractures.
15	do.	82.48	14.56	.4	.41	.7	---	---	.11	.56	.02	44.04	Marble, white, fractured.
16	Chip, Random	81.60	14.62	.35	.42	.6	---	---	.09	.56	.02	44.13	Marble, pink and white laminated, iron stained along fractures, 6 ft thick, horizontal.
17	do.	75.73	20.85	.51	.41	.6	0.01	---	.12	.6	.02	44.74	Marble, gray laminated.
18	do.	86.32	10.06	.31	.36	.5	---	---	.08	.5	.02	43.68	Marble, pink and white laminated, iron stained along fractures.
19	do.	93.12	2.18	1.34	.53	1.1	---	---	.11	1.66	.05	43.17	Marble, pink and white laminated, thin-bedded, 25 ft thick, mica along foliation.

Table 2.--Data for samples 14-20, 25, 31, 32 of marble and limestone from the Marble Canyon Wilderness Study Area, White Pine County, Nevada, and Millard County, Utah--Continued

Sample		Assay data (%)											
No.	Type and/ or length	$CaCO_3$	$MgCO_3$	Al_2O_3	Fe_2O_3	K_2O	MnO	Na_2O	P_2O_5	SiO_2	TiO_2	LOI	Description
20	Chip, 24 in.	89.87	1.92	0.66	0.65	1.1	0.05	---	0.17	2.93	0.03	42.2	Limestone, thin-bedded, thin shale beds, mica along bedding planes.
25	Chip, Random	89.24	3.3	.61	.55	1.2	---	---	.11	2.33	.02	42.37	Limestone, gray, fine-grained; calcite veinlets.
31	Chip, 36 in.	94.83	2.2	.45	.43	.8	.01	---	.08	.47	.02	43.29	Limestone, gray, fine-grained, thick-bedded; calcite veinlets.
32	Chip, 19 in.	92.76	4.66	.47	.56	1.1	.01	---	.11	.35	.01	43.87	Do.

DEPARTMENT OF THE INTERIOR
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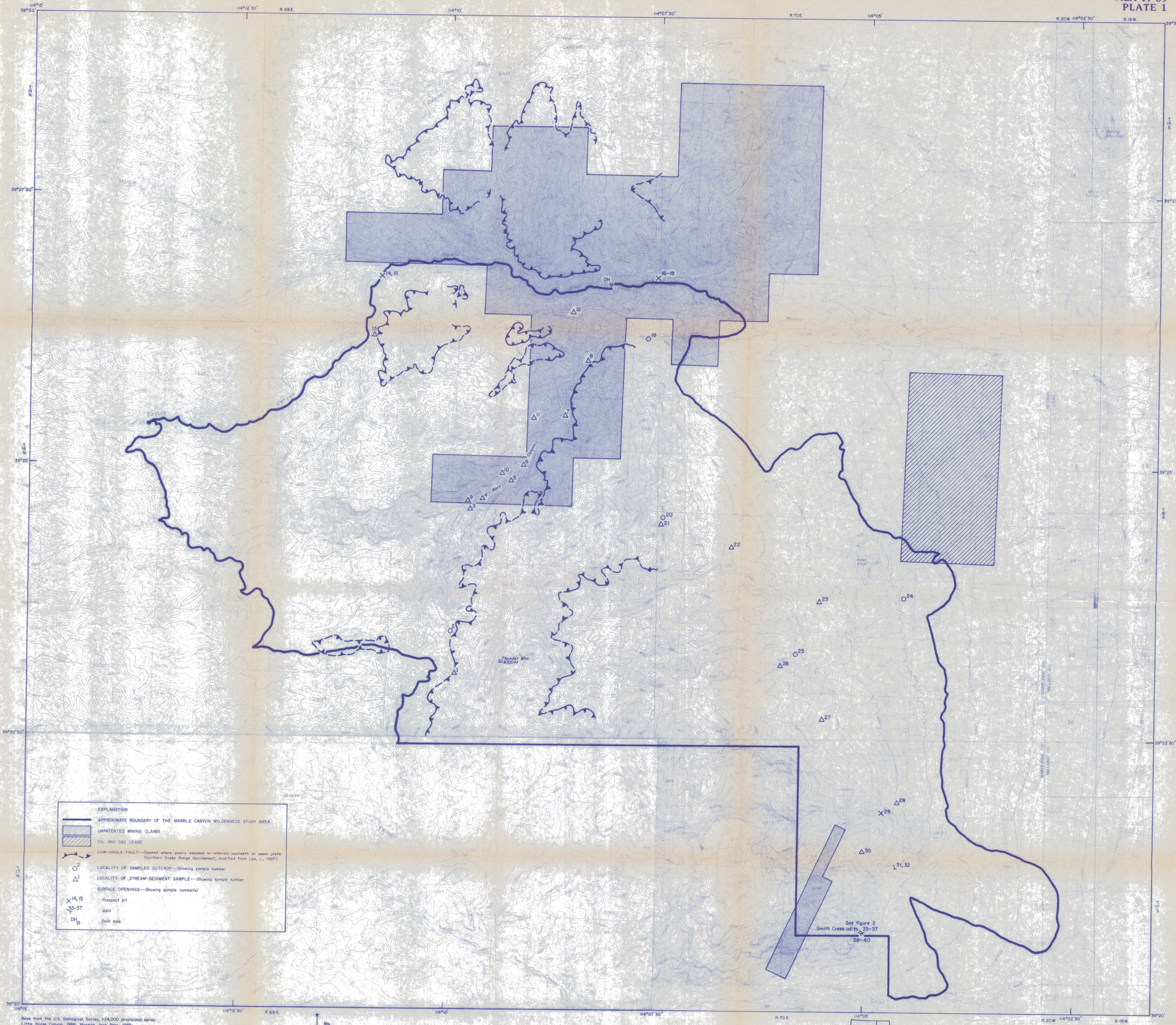
OPEN FILE REPORT
MLA 17-89
PLATE 1



Base from the U.S. Geological Survey, 1:24,000 provisional series
Little Horse Canyon, 1986; Mormon Jack Pass, 1986;
Mt Moriah, 1986; and Spring Mtn, 1986.

SCALE 1:24,000
0 — 1/2 — 2 mi
CONTOUR INTERVAL 40ft

MAP LOCATION

Field work completed in 1987 by Richard
F. Kness; assisted by Russell A. Schreiner.

PROSPECT AND SAMPLE LOCALITY MAP OF THE MARBLE CANYON WILDERNESS STUDY AREA, WHITE PINE COUNTY, NEVADA, AND MILLARD COUNTY, UTAH

BY

RICHARD F. KNESS, U.S. BUREAU OF MINES

1989