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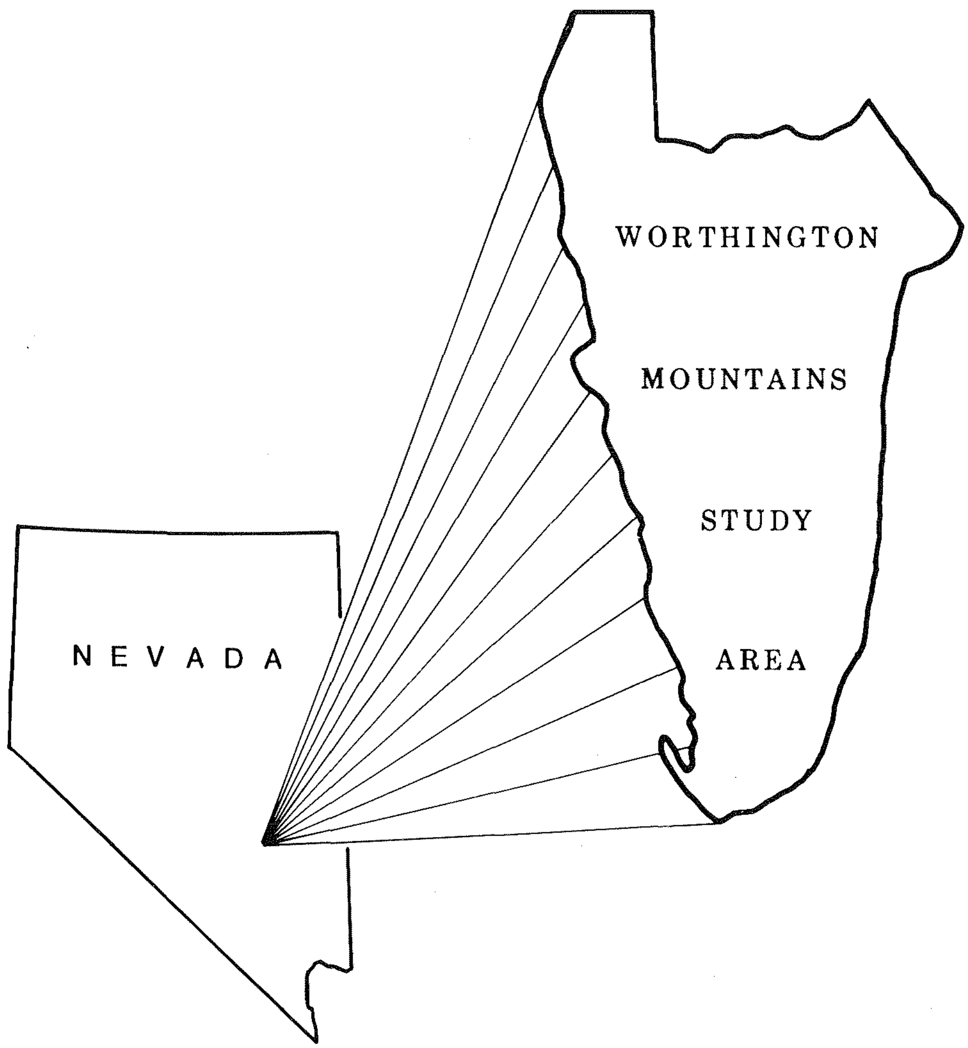
Mineral Resources of the Worthington Mountains Study Area, Lincoln County, Nevada



United States Department of the Interior
Bureau of Mines

MINERAL RESOURCES OF THE WORTHINGTON MOUNTAINS STUDY AREA, LINCOLN COUNTY, NEVADA

by

Robert H. Wood II

MLA 69-85
1985

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 (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 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 Worthington Mountains Wilderness Study Area (NV-040-242), Lincoln County, Nevada.

This open-file report summarizes the results of a Bureau of Mines mineral study and will be incorporated in a joint report with the Geological Survey. 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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UNITS OF MEASURE ABBREVIATIONS USED IN THIS REPORT

cu ft	cubic foot, feet
ft	foot, feet
in.	inch(es)
lb	pound
mi	mile(s)
ppm	part(s) per million
%	percent
oz	troy ounce(s)
oz/ton	troy ounce(s) per short ton
sq mi	square mile(s)

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SUMMARY

The Worthington Mountains Bureau of Land Management Wilderness Study Area (NV-040-242) is in the Basin and Range physiographic province in Lincoln County, southcentral Nevada. The wilderness study area comprises 47,633 acres; the present study covers the 26,587 acres preliminarily recommended as suitable by the Bureau of Land Management for inclusion in the National Wilderness Preservation System. In the fall of 1983 and spring of 1984, the Bureau of Mines studied mines, prospects, mineral occurrences, and mineralized areas inside and within 1 mi of the study area. Such investigations are authorized by Public Law 94-579.

Five areas of precious and base metals are present in and near the study area. The Smelter Shaft area, inside the northern boundary, contains a total indicated plus inferred resource of approximately 825,000 short tons of limestone breccia with a silver-zinc-lead-copper grading about 2.91 troy ounces of silver per short ton, 7.4 percent zinc, 1.95 percent lead, and 0.99 percent copper. The in-place value of this material would be as much as $89 million based on May 1985 metal prices. Drilling and geophysical surveys would be required to verify and delineate the size of the mineralized area and determine if there is an underlying primary sulfide mineral zone. Silver-lead-zinc deposits along faults in limestone occur at four other locations within a mile of the northern area boundary. Most of the mineralized faults trend toward the study area, but ground cover prevented tracing them into the area.

The limestone host rock associated with all of the workings at the north end of the Worthington Mountains is part of the Pogonip Group. Extensive Pogonip Group limestone beds crop out in the northern and western parts of the study area and underlie most of the remaining parts. Two Tertiary granitic stocks have intruded Pogonip limestone in the north end of the Worthington Mountains and may have been sources for the mineralizing solutions. Additional deposits could occur along faults in limestone in the northern part of the study area near the two granitic stocks.

A tungsten-bearing tactite zone is closely related to the western-most granitic stock at the north end of the Worthington Mountains. An aeromagnetic survey suggests that the western-most granitic intrusion extends under part of the study area. Detailed soil geochemistry and a ground magnetometer survey would be required to further evaluate this occurrence.

Large quantities of limestone, dolomite, quartzite, and sand and gravel suitable for industrial purposes are present in the study area. The limestone, dolomite, and sand and gravel are suitable for road metal and fill. Some of the limestone is suitable for agricultural or chemical uses. The quartzite is suitable for glass manufacture.

Petroleum resources are not known to exist in the area. The study area was rated by the U.S. Geological Survey as having a low potential for petroleum.

INTRODUCTION

In the fall of 1983 and the spring of 1984, the Bureau of Mines studied the mineral resources of part of the Worthington Mountains Wilderness Study Area (WSA), Lincoln County, Nevada (fig. 1). The land is administered by the Bureau of Land Management (BLM). These studies are done in conjunction with

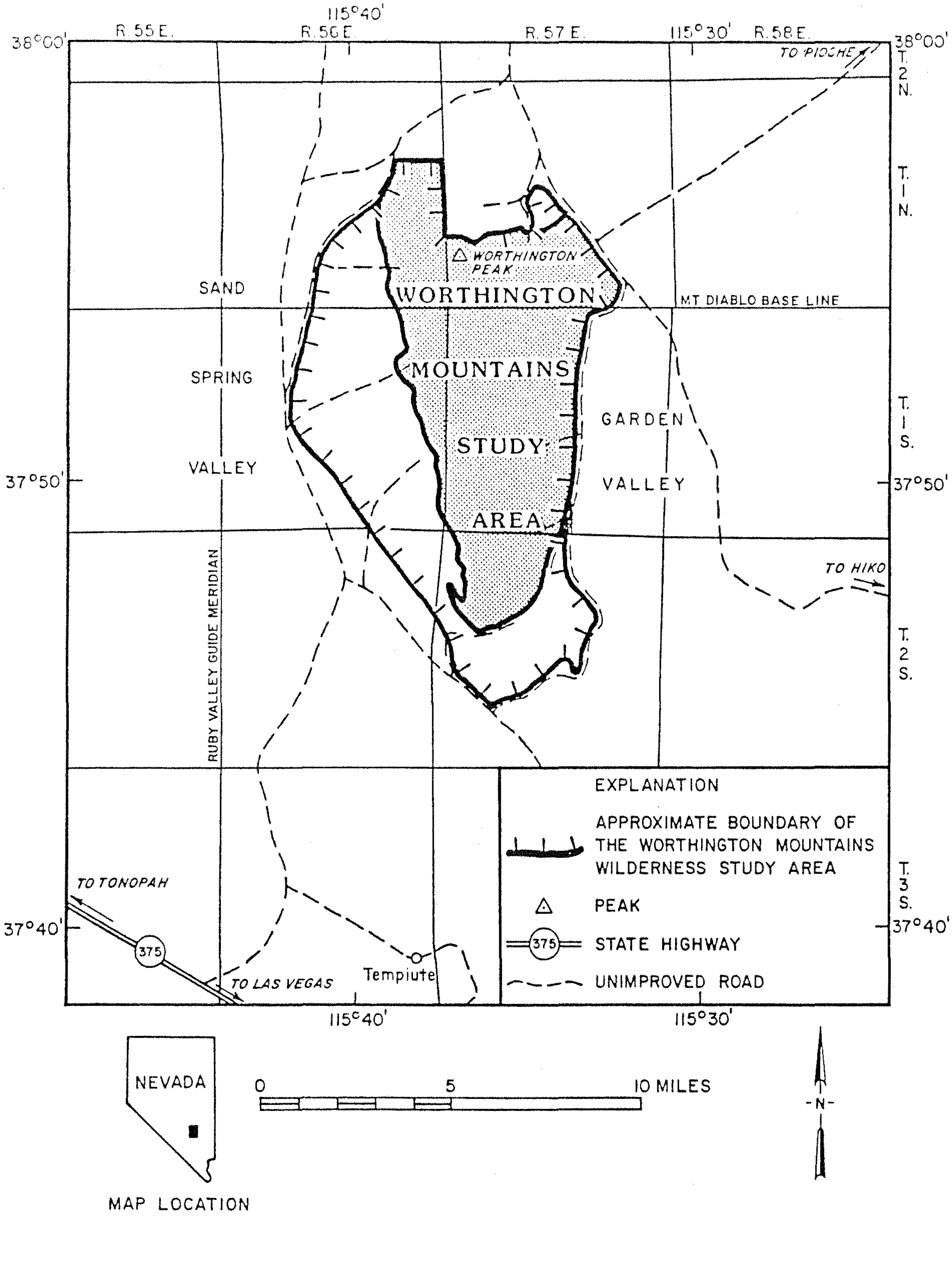


Figure 1.--Index map of the Worthington Mountains Wilderness Study Area, Lincoln County, Nevada, showing area studied.

the U.S. Geological Survey (USGS). The Bureau investigates mines, prospects, and mineralized areas inside and up to 1 mi outside the study area to evaluate quantity and quality of possible mineral reserves and resources. The USGS assesses the mineral potential of the study area based on regional geological, geochemical, and geophysical studies. This report presents the results of the Bureau study which was completed before the Survey's data were available. The USGS will publish results of its study separately. A joint Bureau-USGS report, to be published by the USGS, will integrate and summarize all the results.

Geographic setting

The Worthington Mountains WSA contains 47,633 acres in western Lincoln County, southcentral Nevada. The current study area (SA) covers 26,587 acres of the WSA preliminarily recommended by the BLM as suitable for inclusion into the National Wilderness Preservation System (fig. 1). Most of the Worthington Mountains and parts of the Sand Spring and Garden Valleys make up the SA. This elongate north-trending range and adjacent basins are typical of the Basin and Range physiographic province. Elevations range from 8,850 ft on Worthington Peak, to approximately 5,600 ft along the eastern border of the SA.

Tonopah, Nevada is about 100 mi to the west, and Las Vegas, Nevada is about 120 mi south of the study area. Hiko, Nevada, the nearest town, is about 20 mi to the southeast. Tempiute is a mine and mill site. State Highway 375 is about 12 mi south of the SA. Graded dirt roads from Hiko and off State Highway 375 provide access to the boundaries of the SA. Access within the boundaries is provided by a few jeep trails or by foot. The nearest railhead is about 60 mi east of the area at Pioche, Nevada.

Previous investigations

Few studies have been made pertaining to the geology and mineral deposits of the Worthington Mountains. A regional study by Tschanz and Pampeyan (1970) briefly described the geology and mineral deposits of Lincoln County. The geology and mineral resource evaluation of the Worthington Mountains Geology-Energy-Minerals (G-E-M) resource area, which shows a moderate favorability for metallic minerals in the north part of the WSA and a low favorability in the remainder of the study area, was done by Great Basin GEM Joint Venture (Worthington Mountains G-E-M resource area, GRA no. NV-18, technical report, WSA NV 040-242, unpublished BLM administrative report, contact no. YA-554-RFP2-1054, 1983). The petroleum potential of wilderness lands in Nevada was evaluated by Sandberg (1983).

Methods of investigation

The Bureau's pre-field investigation included a detailed literature search for geologic and mining information pertinent to the SA. Mineral lease and mining claim information was obtained from the BLM in Nevada. Lincoln County records were checked for mining claim location notices and ownership of patented claims.

The Bureau's field investigation was conducted by 4 Bureau geologists (56 employee-days) with helicopter support. Accessible mine workings were mapped by compass-and-tape method and sampled. Rock chip samples were taken across veins and other suspected mineralized structures. Grab samples were taken at inaccessible workings from about 0.5 ft below the dump surface. Select grab samples consisted of specific dump material. Panned-concentrate samples, obtained from about one heaped 18-in. pan, were collected from major drainages in the study area. Selected beds of quartzite and limestone were sampled to determine their chemistry for evaluation of their suitability for specific applications.

Ninety-two mineralized rock, 21 panned-concentrate, 2 quartzite, and 19 limestone samples were analyzed by the Bureau's Reno Research Center, Reno, Nevada (tables 1, 3-5 and figs. 3-5). All of the rock and panned-concentrate samples were fire assayed for gold and silver and were analyzed by a semiquantitative optical emission spectrograph for 40 elements. Arsenic, beryllium, boron, calcium, lithium, molybdenum, nickel, niobium, and some of the copper, lead, and zinc values were determined by inductively coupled plasma spectrometry (ICP); cadmium, and the rest of the copper, lead, and zinc values were determined by atomic absorption spectrophotometry (AA); tungsten content was determined by x-ray fluorescence. Quartzite samples were analyzed by a semiquantitative optical emission spectrograph for 40 elements and by ICP for silica and oxides of aluminum, and iron. All limestone samples were analyzed by ICP for oxides of aluminum, calcium, iron, magnesium, silica, and sulfur. Loss on ignition (LOI) was determined gravimetrically.

Geologic setting

The Worthington Mountains are an uplifted homoclinal section of predominantly Paleozoic sedimentary rocks in which the oldest rocks are at the north end of the range and the youngest at the south end. Sedimentary rock units exposed in the SA include the Ordovician Pogonip Group, Eureka Quartzite and Ely Springs Dolomite; Silurian Laketown Dolomite; Devonian Sevy Dolomite, Simonson Dolomite, and Guilmette Formation; Mississippian Pilot Shale and Scotty Wash Quartzite; and an unnamed Pennsylvanian limestone. Quartzite, limestone, and dolomite form steep cliffs and ridges, and are the dominant rock types in the area. Undifferentiated Cretaceous(?) or Tertiary volcanic rocks crop out in the southeastern part of the study area. Two Tertiary granitic stocks have intruded Paleozoic carbonate rocks at the north end of the range, just outside the SA. Granitic and lamprophyric dikes are present in the SA. Range-front faults, concealed by alluvium, have been mapped on both sides of the range. (See Tschanz and Pampeyan, 1970.)

Acknowledgments

Appreciation is expressed to Tom Beam of Encinitas, California for providing mining and geologic information on the area, and allowing access to his patented mining claims.

MINING ACTIVITY

The Freiberg (Worthington) mining district extends into the SA from the north (pl. 1). Between 1919 and 1948, at least 274 oz of gold, 12,600 lb of lead, 2,359 oz of silver, and 7,600 lb of zinc were mined from small fracture-controlled replacement lenses in limestone (Tschanz and Pampeyan, 1970, p. 172-173). No production has been reported from the prospects in a tungsten-bearing skarn, at the northern part of the Freiberg district, about 1 mi northeast of the study area.

With the exception of one small prospect pit at the south end of the study area, all of the evidence of past or present mining is at the north end (pl. 1). In the fall of 1983, diamond core drilling for sulfide zones containing precious and base metals was being conducted just north of the boundary area by Tom Beam, claim owner. Recent drill sites were also noted near the Smelter Shaft. According to Mr. Beam, the Smelter Shaft dump was processed for silver in the late 1970's or early 1980's; remains of a heap leaching operation (probably for gold and silver) are about 2 mi north of the area.

The nearest active mining district, the Tem Piute district, is about 10 mi south of the SA. Tungsten, occurring in or near tactite skarns associated with a Tertiary granite stock, is the main, and currently the only, commodity being mined in that district. Copper, gold, lead, silver, and zinc have also been produced in the past from mines in this district (Tschanz and Pampeyan, 1970, p. 140-147). Development work was being done in one of the tungsten mines in this district by Union Carbide Corp. in the fall of 1983. The tungsten mill was temporarily closed in the fall of 1983 because of low prices.

Nevada BLM records indicate that, as of May 1984, all the patented and unpatented mining claims inside and within 2 mi of the study area are near the northern boundary (pl. 1). About 30 unpatented mining claims are in or partly in the SA; four patented mining claims are within 1/2 mi of the boundary.

APPRAISAL OF SITES EXAMINED

Six mineralized areas are at the north end of the SA in the Freiberg (Worthington) mining district (pl. 1). Mineralized areas include five silver-zinc-lead-copper deposits along faults in limestone and one tungsten skarn.

Smelter Shaft

A silver-zinc-lead-copper resource has been delineated in brecciated limestone at the Smelter Shaft. The Smelter Shaft is about 1/3 mi inside the eastern SA boundary and is accessible by an unpaved road (pl. 1). More than 800 ft of underground workings are present in the oxidized part of a deposit in brecciated Pogonip Group limestone (figs. 2A, 2B, and 2C).

Internal faults in the breccia appear to be randomly oriented and irregularly spaced. Aurichalcite, calcite, galena, limonite, and malchite were identified in the most intensely mineralized rock, which occurs in the

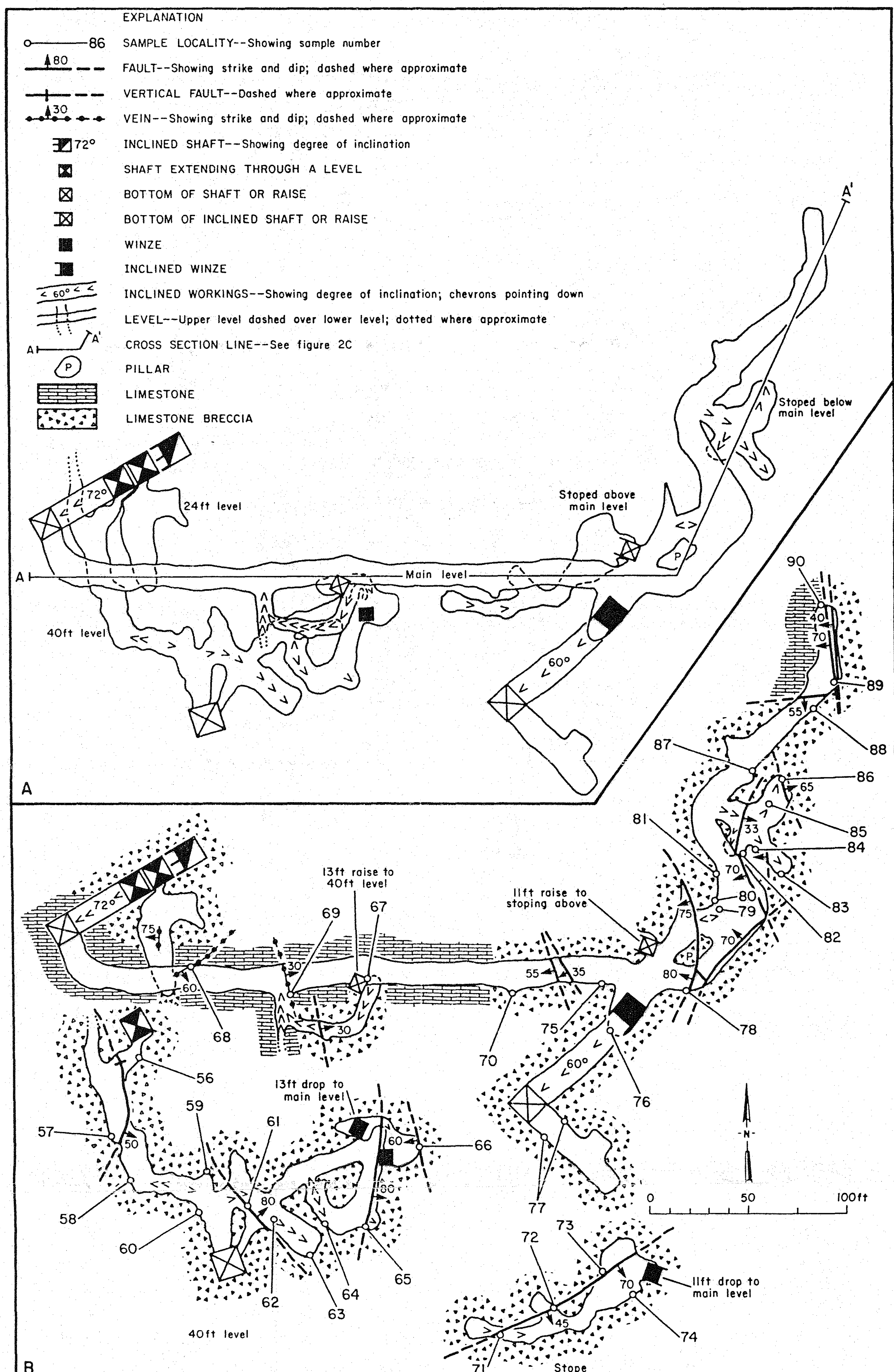


Figure 2A.--Composite map of the Smelter Shaft. B.--Smelter Shaft showing details of levels and sample localities 56-90.

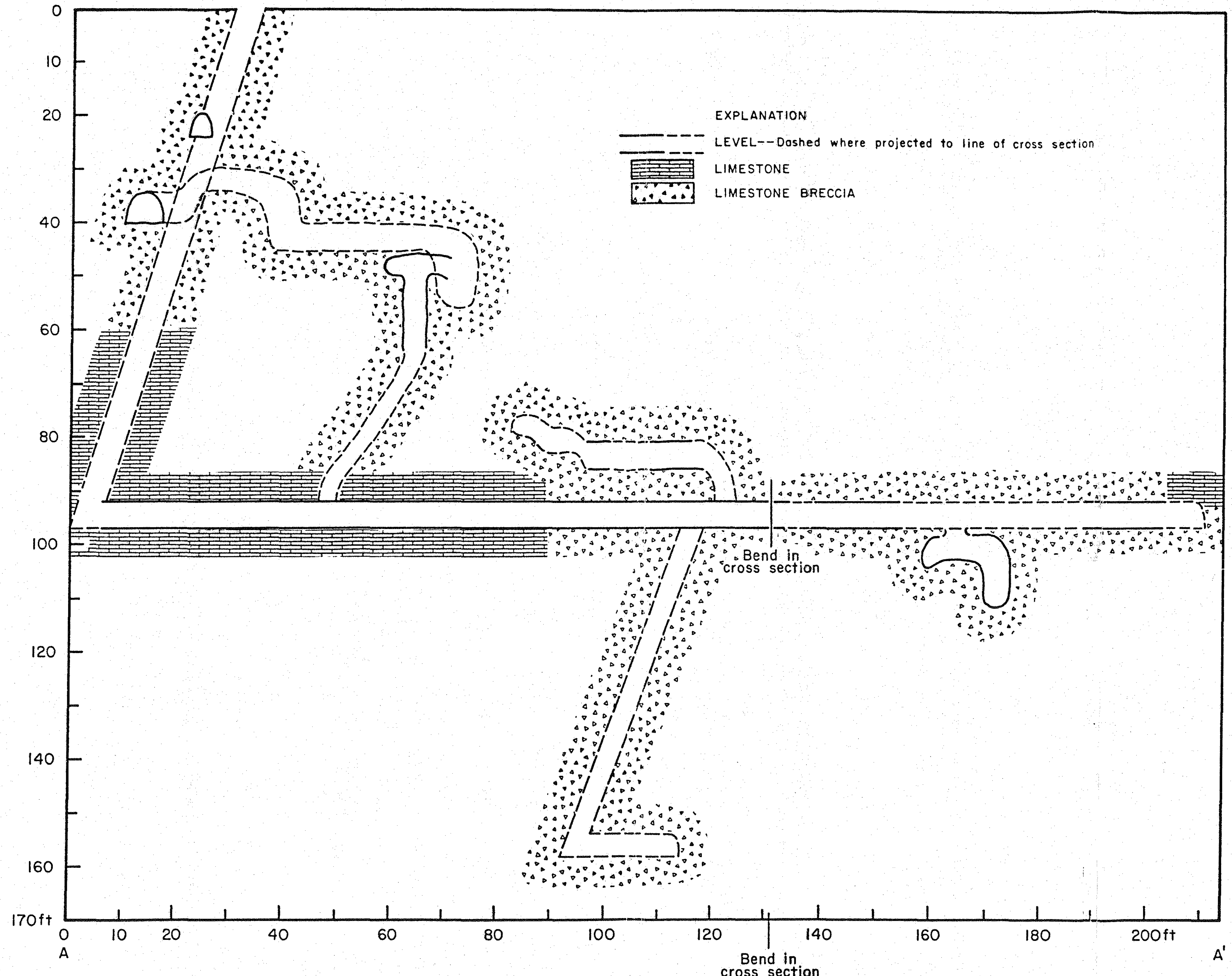


Figure 2C.--Cross section of the Smelter Shaft between A & A' (see fig. 2A and 2B).

hanging walls of major faults. Thirty-five samples were taken, mainly from the hanging walls of faults in the Smelter Shaft. One sample was taken across a fault in a small prospect pit near the Smelter Shaft (table 1). Samples contained as much as 0.02 oz gold/ton, 13.3 oz silver/ton, 0.139% cadmium, 3.3% copper, 10.1% lead, and 22.1% zinc. Based on Bureau sampling, the weighted average grade for all of the Smelter Shaft samples is 2.91 oz silver/ton, 7.4% zinc, 1.95% lead, and 0.99% copper. Gold and cadmium possibly could be recovered but were not found in enough samples to be calculated in this resource estimate. Spectrographic analysis of Smelter Shaft samples indicated elevated arsenic levels in most of the samples and in some samples antimony, cadmium, barium, and tin were detected (appendix B, sample nos. 56-90).

The resources for the Smelter Shaft were calculated using the measured and projected extent of the limestone breccia, as follows:

Width		Length		Average thickness		Tonnage factor		Resource estimate
100 ft	x	400 ft	x	165 ft	x	12.0 ft^3/ton	=	550,000 ton indicated
100 ft	x	200 ft	x	165 ft	x	12.0 ft^3/ton	=	275,000 ton inferred
							Total	825,000 ton

The resource classification used in this report is that in USGS Circular 831 (1980).

Table 1.--Analytical data and description of samples from the Smelter Shaft area.

[Concentrations were determined by fire assay for Au and Ag; by spectrographic analysis for As; and by AA or ICP for Cd, Cu, Pb, and Zn; ND, not detected; TR, trace; xxx, not assayed for.]

Sample		Analytical data						
No.	Chip length (ft)	Au oz/ton	Ag oz/ton	As % (except where indicated)	Cu % (except where indicated)	Pb % (except where indicated)	Zn % (except where indicated)	Description
55	5	ND	ND	ND	xxx	ND	0.011	Limestone; silicified fault zone, strike N. 10° E., dip vertical; limonite; from pit north of shaft..
56	4	TR	5.7	9	3.3	1.4	6.1	Malachite, limonite; 0.139% cadmium; 7.1% As by ICP.
57	2	ND	.7	1	1.70	.106	1.78	Limonite.
58	4	TR	2.0	4	1.2	1.2	1.3	Malachite, aurichalcite, limonite; 2.9% As by ICP.
59	3.5	ND	13.3	7	2.6	7.7	1.6	Malachite, limonite.
60	6	ND	.7	.06	620 ppm	.11	.80	Limonite.
61	4	ND	9.1	10	2.67	.235	1.41	Malachite, limonite.
62	5.5	ND	.4	.3	.28	.45	9.0	Limonite, calcite, aurichalcite.
63	2.5	ND	.6	.3	1.74	.145	22.1	Do.
64	3	ND	6.8	.8	1.6	8.3	6.4	Malachite, calcite, limonite, galena?.
65	3.5	ND	2.3	.8	1.03	2.61	1.44	Malachite, limonite.
66	4	TR	2.2	4	1.7	1.6	10.1	Aurichalcite, limonite, calcite.
67	12	TR	.7	.8	.38	510 ppm	14.3	Do.

Table 1.--Analytical data and description of samples from the Smelter Shaft area--Continued

Sample No.	Sample Chip length (ft)	Au (oz/ton)	Ag (oz/ton)	As (% except where indicated)	Cu (% except where indicated)	Pb (% except where indicated)	Zn (% except where indicated)	Description
68	3.5	ND	ND	ND	ND	ND	0.038	Calcite, limonite.
69	1	ND	ND	ND	ND	ND	.031	Calcite, limonite.
70	2	TR	0.4	ND	220 ppm	660 ppm	.26	Do.
71	12	TR	1.1	2	.75	1.4	14.9	Limonite, aurichalcite?.
72	1	0.02	8.8	4	1.92	7.7	12.5	Limonite, aurichalcite?, galena?.
73	3	TR	11.9	10	1.11	8.0	2.62	Do.
74	5	ND	13.3	1	2.6	10.0	6.2	Limonite, galena, calcite, aurichalcite?.
75	2	TR	.5	.2	.16	.39	3.7	Limonite.
76	2	ND	1.1	.1	.38	.32	6.5	Do.
77	10	TR	.9	.2	1.4	.49	7.3	Malachite, limonite.
78	1.5	ND	.4	ND	80 ppm	.086	.46	Limonite.
79	5	TR	1.7	1	.69	.15	13.0	Do.
80	2	TR	.7	.3	1.78	.170	19.3	Malachite, limonite, calcite.
81	2	TR	8.1	1	1.37	6.7	13.3	Do.
82	5	TR	2.2	.9	.83	1.64	15.0	Do.
83	3	ND	.6	ND	82 ppm	.111	.79	Limonite.
84	2.5	TR	4.7	ND	.186	2.54	2.74	Do.

Table 1.--Analytical data and description of samples from the Smelter Shaft area--Continued

Sample No.	Sample Chip length (ft)	Analytical data Au (oz/ton)	Ag (oz/ton)	As (% except where indicated)	Cu	Pb	Zn	Description
85	4.5	TR	6.0	5	1.7	8.0	13.4	Malachite, galena, limonite, calcite; 0.109% cadmium.
86	2	TR	.4	.06	.080	.262	1.58	Limonite.
87	5	TR	.3	ND	28.0 ppm	.086	.79	Do.
88	3	TR	.3	ND	150 ppm	.15	.49	Do.
89	.5	ND	5.0	.07	3.3	.098	6.6	Malachite, limonite.
90	4	ND	1.2	ND	.014	.262	.85	Limonite.

The in-place value of the resources at the Smelter Shaft ($89 million) is calculated using average metal prices in effect at the time of this report (May 1985) and the weighted average for Ag (2.91 oz/st), Cu (.99%), Pb (1.95%), and Zn (7.4%), as follows:

	Weighted average		Unit price		Value per ton
Ag	2.91 oz/ton	x	$6.50	=	$ 18.91
Cu	19.8 lb/ton	x	0.69	=	13.66
Pb	39.0 lb/ton	x	.22	=	8.58
Zn	148.0 lb/ton	x	.45	=	66.60
				Total	$107.75

$107.75/ton x 825,000 ton = $89 million

The overall value may be lower than $89 million because most of the samples were taken from what appeared to be the more mineralized rock in the hanging wall of major faults. Other distribution of mineralized rock was highly variable and sample results were also highly variable.

The 825,000 tons are an indicated resource. The percent of that resource recoverble would depend on the mining method used. Because complex oxidized silver-zinc-lead-copper ores are not commonly mined and milled in the U.S. at present, the recoverable metal values must be determined by metallurgical testing and cannot be estimated.

Preliminary tonnage and grade estimates at the Smelter Shaft suggest the presence of a potentially economic silver-zinc-lead-copper resource. Additional detailed sampling and studies are needed to further evaluate the economics of this deposit. Drilling and geophysical surveys could be performed in order to 1) further delineate the size of the mineralized area defined by underground mapping; 2) determine if there is an underlying primary sulfide zone; and 3) aid in determining mine layout. Metallurgical testing would be needed to determine the most efficient recovery methods for handling this mineral assemblage.

Roadside property

Between 1919 and 1921, lead-silver ore valued at $5,000 was produced from the Roadside property, about 1/3 mi north of the Smelter Shaft, adjacent to the northern SA boundary (Tschanz and Pampeyan 1970, p. 172-173). At least 10 small pits are present at the Roadside property. Production from this area reportedly came from a heavily iron-stained pocket in Ordovician Pogonip Group limestone above a fault intersection (pl. 1, sample site 53) (Tom Beam, claim owner, oral commun., October 1983). Most of the pits in this area are in faulted, iron-stained limestone similar to that at the nearby Smelter Shaft. Access to the Roadside property is provided by an unpaved road.

Gold, lead, silver, and zinc were detected in the three samples taken from this area (table 2, samples no. 52-54). Samples contained as much as 0.02 oz gold/ton, 13.5 oz silver/ton, 5.8% lead, and 3.5% zinc. Spectrographic analyses detected antimony, arsenic, copper, and manganese values in one or more of the samples (appendix B, sample nos. 52-54).

Gold, lead, silver, and zinc are associated with faults in limestone in small scattered prospect pits. The small size, discontinuous nature of the mineralized pockets, and insufficient data on the extent of the associated faults precluded the determination of a resource. The faults trend toward but could not be traced into the SA because of ground cover.

Kathleen Shaft and Middle Tunnel

The Kathleen Shaft and Middle Tunnel are on patented mining claims (Kathleen No. 1 and Kathleen Extension of the No. 1) about 1/4 mi north of the study area boundary (pl. 1). The Kathleen Shaft area is accessible by a narrow jeep trail but the underground workings are inaccessible. The Middle Tunnel is accessible and is within 500 ft of a jeep trail.

Table 2.--Analytical data and description of rock samples 1-10, 19-25, 51-54, 115, 122-123, 129 from in and near the Worthington Mountains Study Area, Nevada.

[Concentrations were determined by fire assay for Au and Ag; by ICP for As, B, Cu, Mo, Pb, and Zn; by AA for Cd, Cu, Pb, and Zn; and by X-ray florescence for W; ND, not detected; TR, trace; xxx, not assayed for; ---, not applicable.]

Sample			Analytical data					
No.	Type	Length (ft)	Au	Ag	Cu	Pb	Zn	Description
			oz/ton		ppm (except where indicated)			
1	Chip	2	ND	ND	xxx	xxx	xxx	Tactite; scheelite, calcite; 66 ppm boron, 930 ppm molybdenum, 9.6% tungsten.
2	do.	2	ND	ND	xxx	xxx	xxx	Tactite; scheelite, calcite; 220 ppm boron, 230 ppm molybdenum, 4.6% tungsten.
3	do.	3	ND	0.2	ND	340	16.1%	Limestone; fault, strike N. 50° E., dip 40° NW.; sphalerite, galena, pyrite.
4	do.	1	ND	ND	xxx	xxx	xxx	Lamprophyre dike, strike N. 30° E., dip vertical.
5	do.	10	ND	ND	xxx	xxx	xxx	Limestone; contact with lamprophyre dike.
6	do.	5	ND	ND	xxx	xxx	xxx	Limestone; calcite stringers.
7	do.	1	TR	.1	92	100	24	Limestone; fault, strike N. 36° E., dip 12° NW.; limonite.
8	do.	1	0.02	ND	ND	520	160	Limestone; pyrite, limonite.
9	Grab (select)	---	ND	3.9	87	180	62	Do.

Table 2.--Analytical data and description of rock samples 1-10, 19-25, 51-54, 115, 122-123, 129 from in and near the Worthington Mountains Study Area, Nevada--Continued

Sample			Analytical data					
No.	Type	Length (ft)	Au (oz/ton)	Ag (oz/ton)	Cu ppm (except where indicated)	Pb ppm (except where indicated)	Zn ppm (except where indicated)	Description
10	Chip	1	0.02	1.1	280	1.6%	0.13%	Limestone; bedding plane, strike EW., dip 15° N.; pyrite, galena.
19	do.	1	ND	.1	ND	170	180	Limestone; fault, strike N. 15° W., dip vertical; limonite; 310 ppm arsenic.
20	Grab (select)	---	TR	.9	0.26%	1.8%	700	Limestone; limonite; 0.53% arsenic, 10 ppm cadmium
21	Grab	---	ND	ND	xxx	xxx	xxx	Limestone alluvium; limonite, calcite stringers.
22	Chip	3	ND	ND	ND	240	93	Limestone; fault, strike EW., dip 45° N.; limonite.
23	Grab (select)	---	TR	6.2	ND	3.8%	ND	Limestone; fault; pyrite, galena, limonite; 4.9% arsenic, 4 ppm cadmium.
24	Chip	4	TR	4.3	ND	6.6%	410	Limestone; fault intersection, strike N. 63° E. and N. 30° W., dip 53° NW. and 70° NE.; limonite; 2.7% arsenic.
25	Grab (select)	---	.25	ND	ND	.58%	100	Limestone; arsenopyrite, pyrite, limonite, calcite; 28% arsenic, 8.2 ppm cadmium.
51	Chip	1	TR	TR	xxx	xxx	xxx	Lamprophyre dike, strike N. 20° E., dip vertical.

Table 2.--Analytical data and description of rock samples 1-10, 19-25, 51-54, 115, 122-123, 129 from in and near the Worthington Mountains Study Area, Nevada--Continued

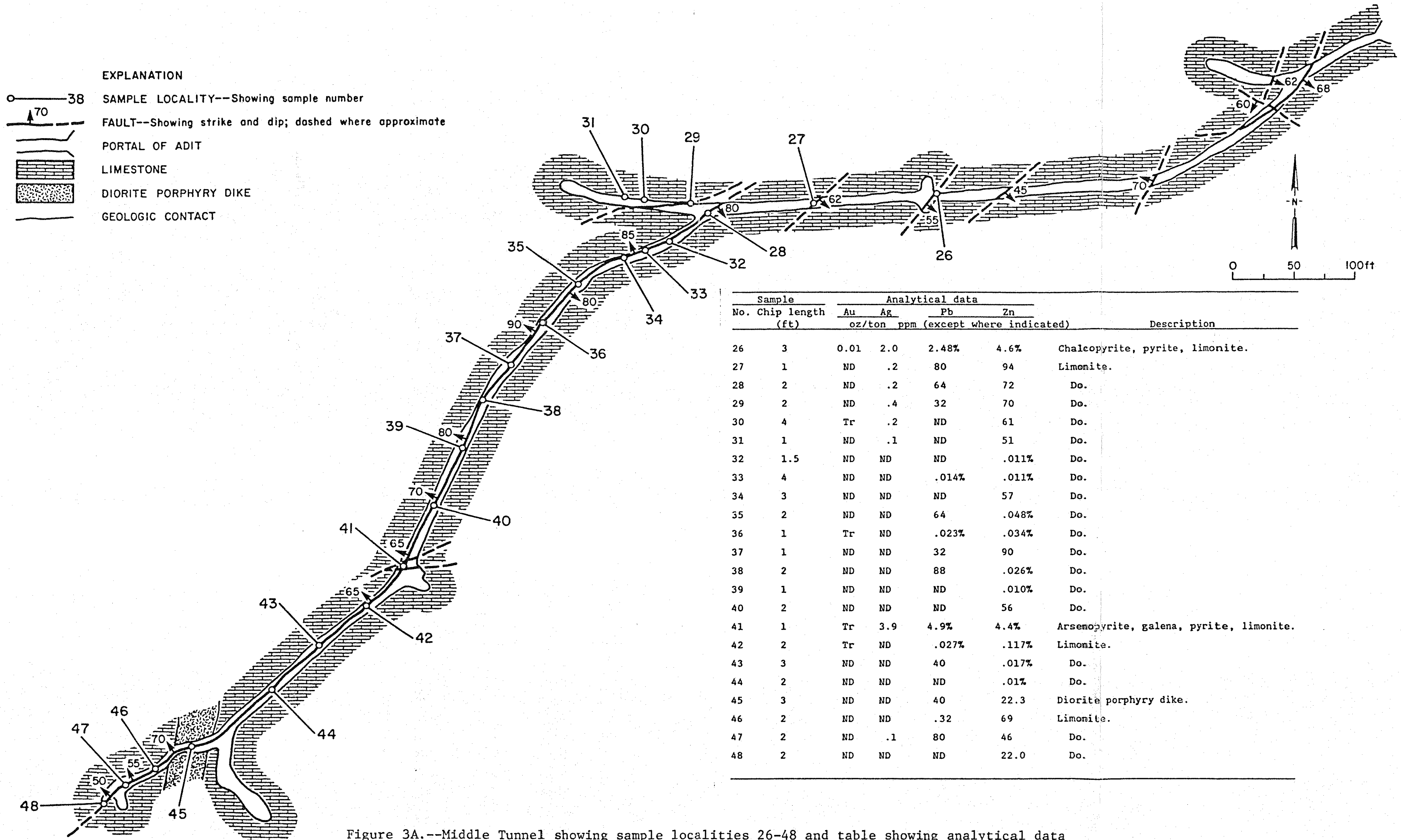
Sample			Analytical data					
No.	Type	Length (ft)	Au oz/ton	Ag oz/ton	Cu ppm (except where indicated)	Pb ppm (except where indicated)	Zn ppm (except where indicated)	Description
52	Grab (select)	---	0.02	3.8	xxx	1.01%	2.5%	Limestone; 4-ft-wide fault, strike N. 60° W., dip 57° NE.; limonite.
53	Chip	3	.01	12.6	xxx	4.4%	3.5%	Limestone; 3-ft-wide fault; strike N. 34° W., dip 57° NE., limonite.
54	Grab (select)	---	.02	13.5	xxx	5.8%	1.32%	Limestone; limonite.
115	Chip	4	ND	ND	xxx	xxx	xxx	Limestone; 4-ft-wide fault, strike N. 45° W., dip 70° SW., limonite.
122	Grab (select)	---	ND	ND	xxx	xxx	xxx	Lamprophyre dike float.
123	do.	---	ND	ND	xxx	xxx	xxx	Limestone; calcite stringers.
129	do.	---	ND	.4	xxx	xxx	xxx	Lamprophyre dike float.

The Kathleen Shaft produced high-grade silver-lead ore in the early 1900's from a fault-controlled replacement deposit in Pogonip Group limestone. Most of the ore was developed above the 100 ft level in the 175-ft-deep Kathleen Shaft. The 1,300-ft-long Middle Tunnel, and possibly a 100-ft-long adit below the Middle Tunnel, known locally as the Lower Tunnel, were driven to intersect the Kathleen Shaft ore shoot but did not connect with it or encounter any ore zones. (Tom Beam, claim owner, oral commun., 1983.)

Several faults, up to 4 ft wide, and a porphyry dike, up to 25 ft wide, are intersected in the Middle Tunnel (figs. 3A and 3B). The last half of the Middle Tunnel follows a small fault, up to 1 ft wide. Minerals identified from this working include pyrite, arsenopyrite, galena, limonite, and calcite. The Lower Tunnel is in barren limestone.

Analyses were performed on the 23 samples taken in the Middle Tunnel (fig. 3A) and 1 sample from a stockpile at the Kathleen Shaft (table 2, sample no. 25). Precious- and base-metal values were as much as 0.01 oz gold/ton, 3.9 oz silver/ton, 4.9% lead, and 4.6% zinc (fig. 3A, sample nos. 26 and 41). Sample no. 25, from a small (about 10 tons) stockpile at the Kathleen Shaft, was very high in arsenic (28%) and contained 0.25 oz gold/ton.

Two shafts and three prospect pits are between the Kathleen Shaft and the SA boundary (pl. 1, sample site nos. 19-24). At least three of these workings are on faults; all are in Pogonip Group limestone. Traces of gold (sample nos. 20, 23, and 24), 6.2 oz silver/ton (sample no. 23), 6.6% lead (sample no. 24), and 0.07% zinc (sample no. 20) were detected in samples from some of these workings (table 2). Spectrographic analysis detected antimony, arsenic, barium, boron, copper, nickel, and tin values in one or more samples (appendix B, samples nos. 19-24).



Sample No.	Chip length (ft)	Au oz/ton	Ag ppm	Pb ppm (except where indicated)	Zn ppm (except where indicated)	Description
26	3	0.01	2.0	2.48%	4.6%	Chalcopyrite, pyrite, limonite.
27	1	ND	.2	80	94	Limonite.
28	2	ND	.2	64	72	Do.
29	2	ND	.4	32	70	Do.
30	4	Tr	.2	ND	61	Do.
31	1	ND	.1	ND	51	Do.
32	1.5	ND	ND	ND	.011%	Do.
33	4	ND	ND	.014%	.011%	Do.
34	3	ND	ND	ND	57	Do.
35	2	ND	ND	64	.048%	Do.
36	1	Tr	ND	.023%	.034%	Do.
37	1	ND	ND	32	90	Do.
38	2	ND	ND	88	.026%	Do.
39	1	ND	ND	ND	.010%	Do.
40	2	ND	ND	ND	56	Do.
41	1	Tr	3.9	4.9%	4.4%	Arsenopyrite, galena, pyrite, limonite.
42	2	Tr	ND	.027%	.117%	Limonite.
43	3	ND	ND	40	.017%	Do.
44	2	ND	ND	ND	.01%	Do.
45	3	ND	ND	40	22.3	Diorite porphyry dike.
46	2	ND	ND	.32	69	Limonite.
47	2	ND	.1	80	46	Do.
48	2	ND	ND	ND	22.0	Do.

Figure 3A.--Middle Tunnel showing sample localities 26-48 and table showing analytical data for samples. [Concentrations were determined by fire assay for Au and Ag; and by AA for Pb and Zn; ND, not detected; Tr, trace; xxx, not assayed.]

Figure 3B.--Middle Tunnel in background, steam boiler and other ruins in foreground.

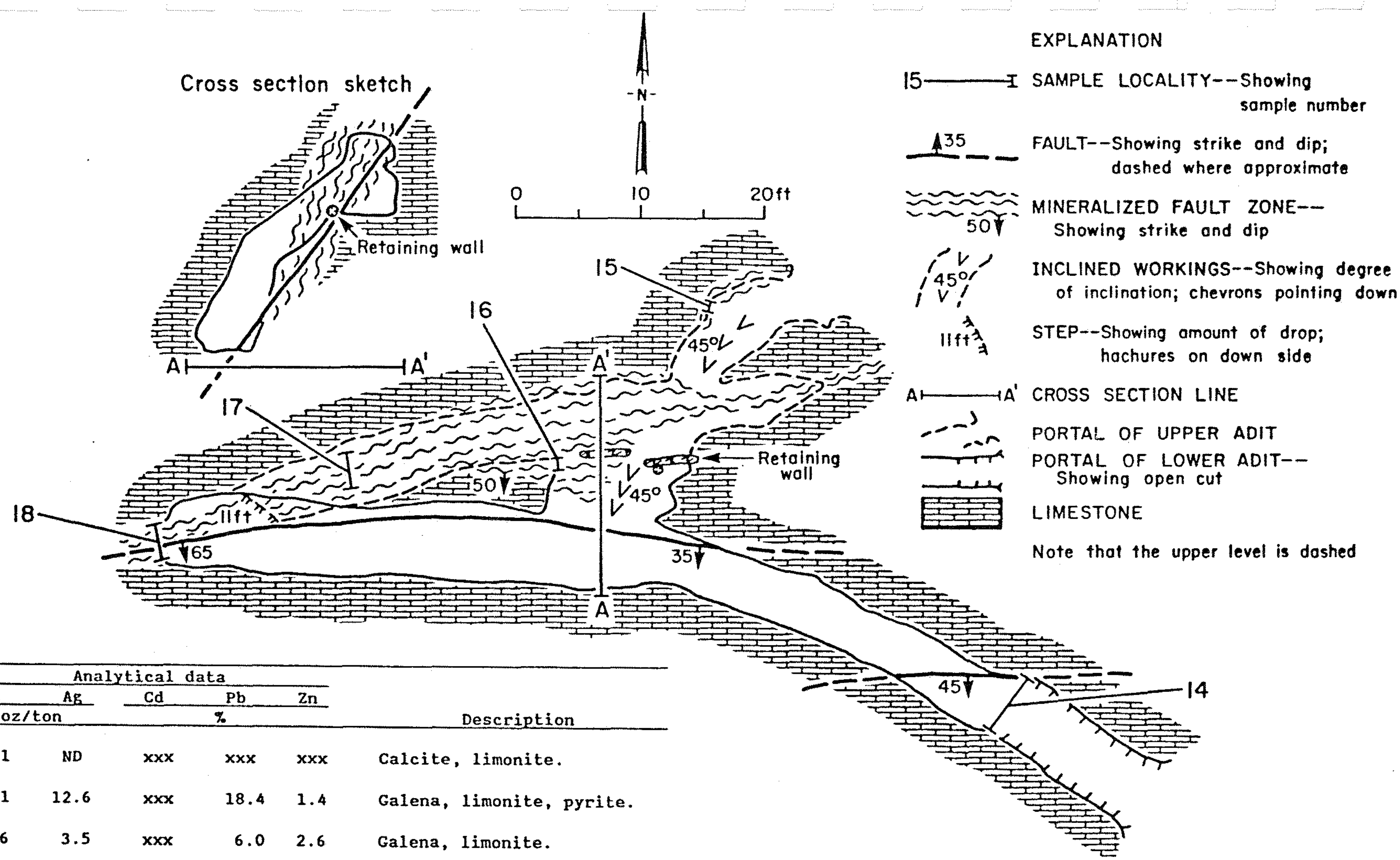
No metallic mineral resources were identified at the Kathleen Shaft, Middle Tunnel, or nearby prospects because the mineralized rock exposures were small and discontinuous and most workings were inaccessible. Additional fault-related deposits like the deposit mined at the Kathleen Shaft are possible in the study area. Most of the faults identified in these workings trend toward the area boundary but ground cover prevented tracing them into the SA. The Kathleen Shaft mine was inaccessible and could not be evaluated.

Mountain View

A precious- and base-metal occurrence along a west-trending fault in Pogonip Group limestone is on the Mountain View patented mining claim. The Mountain View is on the west side of the Kathleen extension of the No. 1 claim and is about 1/4 mi north of the SA boundary (pl. 1). The workings, not accessible by road, consist of two adits connected by stoping and total 130 ft in length. Calcite, galena, pyrite, and secondary limonite were identified in the workings. The fault-controlled mineral occurrence in the upper adit narrows to less than 1 in. in the lower adit, where only limonite and calcite were identified (fig. 4).

Samples from the main fault (fig. 4, sample nos. 15-18) contained between 0.01 and 0.19 oz gold/ton, 3.5 and 12.6 oz silver/ton, 6.0 and 18.4% lead, and 0.55 and 3.3% zinc. Spectrographic analysis detected antimony, boron, cadmium, nickel, and tin in some samples and arsenic, barium, lead, and manganese in all of the samples (appendix B, sample nos. 14-18).

No resources were identified on the Mountain View mining claim because of the discontinuous nature of the mineralized zone. The main mineralized fault associated with these workings projects westerly toward the SA boundary but ground cover and a thrust faulted block of Pogonip Group limestone above the



Sample No.	Sample Chip length (ft)	Analytical data Au (oz/ton)	Ag (oz/ton)	Cd (%)	Pb (%)	Zn (%)	Description
14	6	0.01	ND	xxx	xxx	xxx	Calcite, limonite.
15	1.5	.01	12.6	xxx	18.4	1.4	Galena, limonite, pyrite.
16	2	.16	3.5	xxx	6.0	2.6	Galena, limonite.
17	2	.19	11.9	0.011	15.7	.55	Galena, limonite, pyrite.
18	3	.05	8.7	.039	16.4	3.3	Galena, limonite, calcite.

Figure 4.--Mountain View adits, showing cross-sections A-A' sample localities 14-18, and table showing analytical data for samples. [Copper was analyzed by ICP in samples 15-18 but not detected. Concentrations were determined by fire assay for Au and Ag; by ICP for Pb and Zn; and by AA for Cd; xxx, not assayed; ND, not detected.]

faulted section of Pogonip Group limestone prevented tracing it along the surface 3/4 mi west into the SA.

Mountain View #3

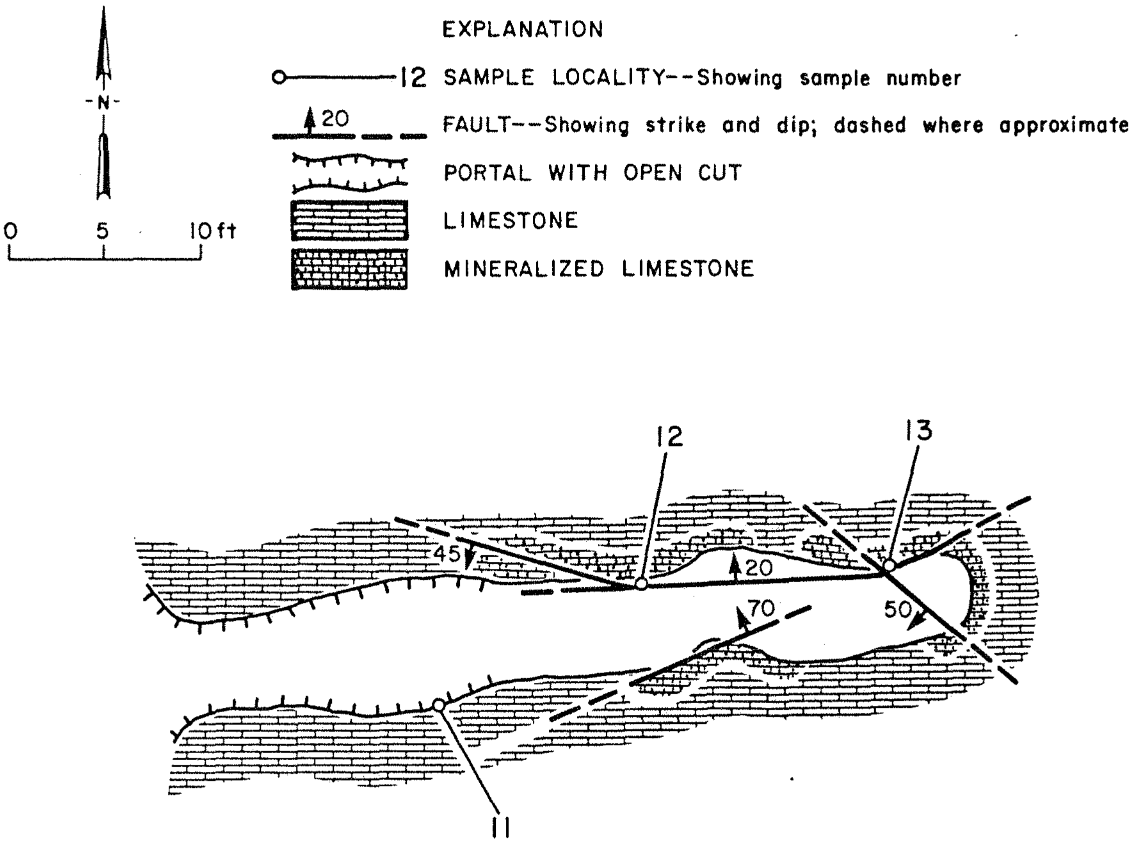
The Mountain View #3 is a patented mining claim about 1/2 mi north of the northern area boundary and is not accessible by road. One 25-ft-long adit was found on this claim (fig. 5). Two adits, both less than 15 ft long, and one pit are northwest and within 1/2 mi of the claim (pl. 1, sample site nos. 7-13).

Precious and base metals occur along bedding planes and along faults in the Pogonip Group limestone on and near the Mountain View #3 claim. Calcite, galena, limonite, and pyrite were identified in some of these workings. Samples across mineralized faults in the 25-ft-long adit on the Mountain View #3 claim contained as much as 0.18 oz gold/ton, 6.7 oz silver/ton, 18.5% lead, and 16.3% zinc (fig. 5, samples 11-13). Generally lower values, up to 0.02 oz gold/ton, 3.9 oz silver/ton, 1.6% lead, and 0.13% zinc were obtained from the other nearby prospects (table 2, samples 7-10).

No resources were identified in the study area near the Mountain View mining claim because the mineralized pockets along the faults and bedding planes in the prospects examined were small and discontinuous (fig. 5). Although the Pogonip Group limestone and the faults strike south and west toward the area boundary, ground cover prevented tracing them into the SA.

Tungsten prospects

The tungsten prospects are about a mile northeast of the SA and are accessible by unpaved roads (pl. 1, samples site nos. 1 and 2). One 13-ft-long adit and a 20-ft-deep shaft are the main workings in this area. The tungsten prospects are in a tactite zone in Pogonip Group limestone along



Sample No.	Chip length (ft)	Au (oz/ton)	Ag (oz/ton)	Pb (% (except where indicated))	Zn (% (except where indicated))	Description
11	3.5	ND	ND	510 ppm	29 ppm	Unaltered wallrock.
12	1.5	0.08	4.9	4.6	16.3	Galena, calcite, pyrite, limonite.
13	.5	.18	6.7	18.5	8.5	Galena, calcite.

Figure 5.--Mountain View #3 adit showing sample localities 11-13, and table showing analytical data for samples. [Copper was analyzed by ICP in all samples but not detected. Concentrations were determined by fire assay for Au and Ag; by ICP for Pb and Zn; ND, not detected.]

the northern edge of the western-most granitic stock. The nearby granitic stock is the most likely cause of the tactite formation and source of the tungsten. Minerals identified in the tactite zone include actinolite, calcite, garnet, scheelite, and possibly powellite. Ground cover prevented tracing the tactite zone into the SA.

An ultraviolet light was used to identify the more concentrated scheelite bearing area in the workings. The scheelite content was highly variable in each of the workings; a sample was taken in the most mineralized location in each working. Analytical results indicate concentrations of 9.6 and 4.6% WO_3 (table 2, samples nos. 1 and 2). Sample no. 2 contained 0.022% boron and sample no. 1 contained 0.093% molybdenum.

In order to determine the maximum near-surface extent of the tungsten occurrences, panned-concentrate samples were taken from major drainages around the study area (pl. 1). Between 0.01 and 0.03% WO_3 was detected in all these samples (table 3). These concentrations are at or barely above the 0.01% detection limit for WO_3, and the presence of a near-surface tungsten deposit is probably not indicated. Gold, silver, boron, lithium, molybdenum, and niobium were also detected in some of the panned-concentrate samples (table 3), but there was no apparent spatial relationship of the anomalous values to bedrock.

An east-trending aeromagnetic anomaly related to the granitic stocks near the north end of the study area suggests the presence of the granitic stock under the limestone exposed in the study area (USGS Open-File Report 76-364, 1976). Subsurface exploration, ground magnetometer, and detailed soil geochemical surveys, would be required to identify possible tungsten deposits in the study area. Tungsten has been mined about 10 mi south of the study area at Tempiute

Table 3.--Analytical data for panned-concentrate samples from selected drainages in the Worthington Mountains Study Area.

[Concentrations were determined by fire assay for Au and Ag; by ICP for B, Li, Mo, and Nb; and by X-ray florescence for W; ND, not detected; TR, trace.]

Sample No.	Au (oz/ton)	Ag (oz/ton)	WO_3 (%)	B (ppm)	Li (ppm)	Mo (ppm)	Nb (ppm)
92	ND	ND	0.03	ND	ND	ND	ND
93	ND	ND	.03	46	19	35	57
94	ND	ND	.02	28	ND	14	19
95	ND	0.2	.02	95	28	40	63
96	ND	ND	.02	77	20	32	45
113	ND	.3	.02	32	ND	7.2	2.9
114	ND	.3	.02	9.9	23	3	7.2
116	ND	.1	.02	25	ND	15	6.7
117	ND	.1	.03	36	ND	15	20
118	ND	.1	.02	94	35	44	72
119	ND	.4	.02	23	ND	3.7	ND
120	ND	.1	.02	51	ND	21	37
121	ND	.1	.02	140	61	63	120
124	ND	ND	.02	ND	ND	ND	13
125	ND	.3	.02	110	37	46	79
127	ND	ND	.02	24	ND	9.3	4.8
128	ND	ND	.03	9.7	ND	2.4	ND
130	TR	.3	.02	9.7	ND	1.7	ND
131	ND	.4	.01	41	ND	18	28
132	TR	ND	.01	210	120	96	210
134	ND	.3	.02	49	29	21	38

where a tungsten mill exists and would enhance the development possibility of any deposits in the SA.

CARBONATE ROCKS

Carbonate rocks (limestone and dolomite) are the most abundant rocks in the study area. Visually pure carbonate rock units were sampled at readily accessible locations in the SA. A section of carbonate rock in the Guilmette Formation was measured and sampled. In general, the calcium carbonate and magnesium carbonate content was variable. The calcium carbonate content ranged between 51.9 and 98.4% and the magnesium carbonate content ranged between 0.5 and 41.4% (table 4 and fig. 6). About half of the limestone beds sampled are suitable for agricultural uses [greater than 85% $CaCO_3$ or 85% $CaMg(CO_3)_2$]. A 20-ft-thick section of Pogonip Group limestone (sample no. 126) contained in excess of 98% calcium carbonate, high enough to be considered for general chemical uses. This sample was taken near the base of the range and is overlain by over 1,000 ft of lower quality limestone. Most of the SA carbonate rocks are suitable for road metal or fill. Carbonate rocks are high-bulk, low-value commodities, and generally require local markets to be economically developed. Because of the remote location, demand for the carbonate rocks in the Worthington Mountains is unlikely in the foreseeable future.

QUARTZITE

The Ordovician Eureka Quartzite is about 450 ft thick and crops out in the SA near the northern and western borders (fig. 7). The outcrop along the northern border, on the eastern flank of the Worthington Mountains, dips about 20 degrees east, and is about 1/2 mi wide by 1 mi long. The outcrop along the western border, on the western flank of the Worthington Mountains, dips to the

Table 4.--Analytical data for carbonate rock samples from in and near the Worthington Mountains Study Area, Lincoln County, Nevada.

[Concentrations were determined by ICP for SO_3, Al_2O_3, $CaCO_3$, Fe_2O_3, $MgCO_3$, and SiO_2; and by gravimetric methods for LOI: ND, not detected.]

Sample			Analytical data							
No.	Type	Thickness of bed (ft)	SO_3	LOI	Al_2O_3	$CaCO_3$	Fe_2O_3	$MgCO_3$	SiO_2	Description
			%							
Measured section of Guilmette Formation (fig. 6)										
97	Chip	6	0.91	43.29	0.27	74.4	0.14	16.1	1.5	See fig. 6.
98	do.	39	1.04	41.69	.39	93.9	.16	.88	1.6	Do.
99	do.	14	.43	42.20	.21	87.5	.12	3.6	1.1	Do.
100	do.	5	.35	42.42	.35	88.7	.093	4.4	1.2	Do.
101	do.	19	.39	42.36	.13	90.0	.094	5.0	1.1	Do.
102	do.	12	1.74	41.14	.49	88.9	.17	1.61	2.2	Do.
103	do.	38	.69	42.31	.36	83.0	.17	9.0	1.4	Do.
104	do.	4	.46	44.41	.64	51.9	.34	41.4	3.3	Do.
105	do.	31	.52	43.66	.73	80.0	.042	11.1	1.7	Do.
106	do.	24.5	.30	43.60	.029	84.8	.041	8.2	.46	Do.
107	do.	8	.22	43.31	.071	85.3	.091	6.5	1.1	Do.
108	do.	8	.48	42.73	ND	89.9	.022	.5	.20	Do.
109	do.	3.5	.51	42.75	ND	88.0	.02	.54	.45	Do.
110	do.	3	.39	43.74	.056	82.8	.04	8.6	.69	Do.
111	do.	13	.30	42.61	.048	90.1	.33	.98	.53	Do.
112	do.	8.5	.41	42.81	.09	91.6	.031	1.95	.47	Do.
Other Carbonate Rock Analysis										
49	Chip	3	0.36	29.03	2.7	81.4	1.1	2.01	16.7	Pogonip Group limestone; gray; from Middle Tunnel.
50	do.	5	.36	29.68	1.3	83.2	.28	3.6	17.3	Pogonip Group limestone; gray; from face of Lower Tunnel.
126	do.	20	.49	42.89	.038	98.4	.046	1.32	.31	Pogonip Group limestone; medium bedded, gray calcilutite.

Sample No.	Thickness (ft)	Description
97	>100	Limestone; gray; weathers tan; massive bedded, forms several-hundred-ft cliffs.
NS	39	Covered.
98	39	Limestone; gray; medium bedded.
NS	18	Covered.
99	14	Limestone; gray; medium bedded.
NS	38	Covered.
100	5	Limestone; gray; fossiliferous (bryozoans).
NS	3.5	Covered.
101	19	Limestone; gray; medium bedded; fossiliferous (bryozoans).
NS	45	Covered; four 1- to 2-ft-thick limestone beds exposed.
102	12	Limestone; gray; minor iron staining.
NS	40	Covered; one 1-ft-thick gray limestone bed with abundant stromatolites.
103	38	Limestone; gray; medium bedded; fossiliferous (stromatolites).
NS	61	Covered.
104	4	Dolomite; gray.
NS	48	Covered.
NS	6	Limestone; gray; thin bedded; up to 3/4 in. calcite veining.
NS	18	Covered.
NS	2.5	Limestone; gray.
NS	3.5	Covered.
NS	6	Limestone; gray; thin bedded.
NS	7	Covered.
105	31	Limestone; gray; fossils.
NS	27	Alternating 1- to 2-ft-thick limestone beds and 1- to 3-ft-thick covered.
106	24.5	Limestone; gray; fossiliferous; 1/2 in. calcite veining.
NS	5	Covered.
107	8	Limestone; gray; brachiopods.
NS	6	Covered.
108	8	Limestone; gray.
NS	2.5	Covered.
109	3.5	Limestone; gray.
NS	5	Covered.
NS	2.5	Limestone; tan.
NS	1.5	Covered.
110	3	Limestone; tan.
NS	4	Covered.
111	13	Limestone; gray.
NS	6.5	Covered.
112	8.5	Limestone; gray; lowest outcrop on hillside.
NS	---	Covered.

Figure 6.--Measured section from within the Guilmette Formation. [Sample results on table 5; NS, not sampled; >, greater than; ---, not applicable; thin bedded, 1 in. to 12 in.; medium bedded, 1 ft to 3 ft.]

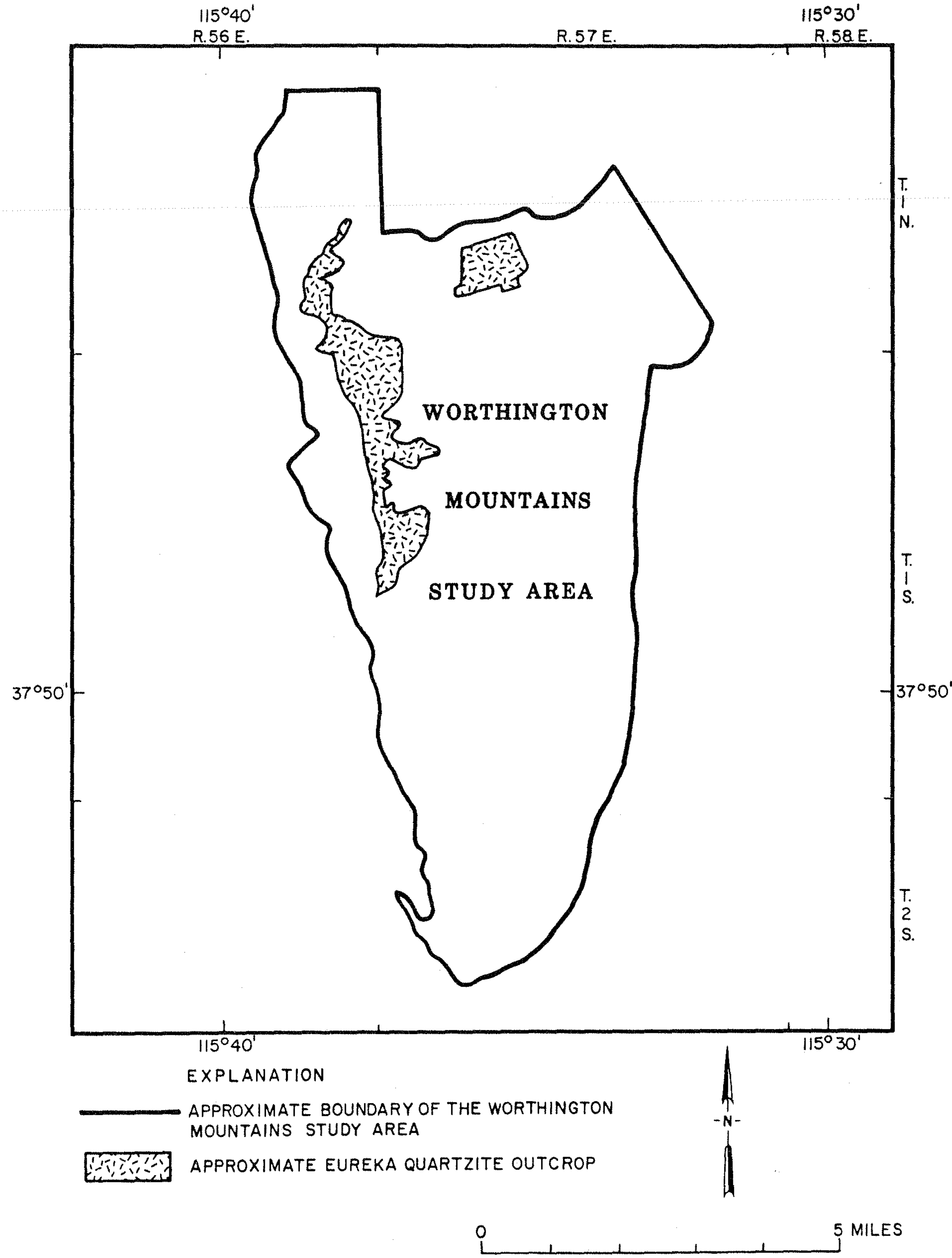


Figure 7.--The Worthington Mountains Study Area showing the approximate outcrop area of the Eureka Quartzite (modified after du Bray and others, 1985).

west about 30 degrees and is about 4 mi long (du Bray and others, 1985). Samples of Eureka Quartzite (pl. 1, sample site nos. 91 and 133) taken on the east and west side of the study area contained 99.0 and 99.2% SiO_2, respectively (table 5).

The Eureka Quartzite is generally very pure wherever it occurs, and it has a high potential value for use in metallurgical processes, glass manufacture, and as a source of silica (Ketner, 1976). Outcrops of Eureka Quartzite and correlative formations occur in numerous locations in central Idaho, western Utah, Nevada, and southeastern California (Ketner, 1982, p. 237). Close access to processing sites and transportation is critical to the development of the quartzite because it is a high-bulk low-unit-value commodity. The quartzite in the SA is unlikely to be developed in the foreseeable future because of its remote location and availability of Eureka Quartzite nearer to marketing areas.

SAND AND GRAVEL

Sand and gravel occur in the study area along the flanks and along the drainages of the Worthington Mountains. The most common uses of sand and gravel are aggregate in concrete and road metal and fill. Transportation costs and low unit price limit the economic marketing range. Only local uses such as road fill or surfacing material would be feasible for these commodities.

OIL AND GAS

The Worthington Mountains SA was evaluated by the USGS as having a low potential for petroleum. "Nothing is known about the maturation of source beds in Paleozoic sedimentary rocks" present in the SA, and "Cretaceous to Tertiary source beds in adjacent valleys may be thermally mature" (Sandberg,

Table 5.--Analytical data for quartzite samples from in the Worthington Mountains Study Area.

[Concentrations were determined by ICP.]

Sample		Analytical data		
No.	Chip length (ft)	Al_2O_3	Fe_2O_3 %	SiO_2
91	40	0.36	0.16	99.0
133	5	.32	.26	99.2

1983, p. H8). As of March 1984, about 10 sq mi in the WSA had been leased for oil and gas. Oil and gas leases are concentrated in the valleys on both sides of the Worthington Mountains (pl. 1). Seismic surveys have been conducted in the valleys around the Worthington Mountains study area, but there has been no drilling.

COMMODITY HIGHLIGHTS

The principal commodities in the Worthington Mountains Study Area are copper, lead, silver, zinc, limestone (lime), and quartzite. Silver, copper, lead, and zinc generally are considered strategic or critical minerals. Domestic production, consumption, and percentage imported are shown on table 6.

CONCLUSIONS

Ordovician limestone in the Pogonip Group hosts fault-related precious- and base-metal deposits and a tungsten-bearing tactite near the northern end of the Worthington Mountains Study Area. At the Smelter Shaft, within the study area, an identified silver-zinc-lead-copper resource of 825,000 short tons of limestone breccia averaging 2.91 oz of silver/ton, 7.4% zinc, 1.95% lead, and 0.99% copper was identified. Based on May 1985 metal prices, the in-place value is about $89 million. The above estimate for the Smelter Shaft may exceed the actual values present because most of the samples were from the more visibly mineralized rock in the hanging walls of faults. The recoverability of these resources has not been evaluated.

Precious- and base-metal deposits are at four other sites within 1/2 mi of the study area. Resources were not calculated for these sites because the occurrences were small and discontinuous. Additional precious- and base-metal deposits could occur in the north end of the study area where the Pogonip limestone host rock is intruded by the two granitic stocks which are most likely the source of the mineralizing fluids.

Table 6.--Commodity highlights.

[Principal metallic commodities in the Worthington Mountains Study Area are copper, lead, silver, zinc, carbonate rock, and quartzite. Sand and gravel, also present, is difficult to assess in terms of marketability and price and not covered in the following summary. Commodity statistics are from the Bureau of Mines Mineral Commodity Summaries (1985).]

Commodity	Domestic mine production	Apparent consumption	Units	Major import sources	Net import reliance (%)	Average 1984 domestic price (dollars)	Price unit	Expected U.S. demand through 1980	Major Uses
Copper	1,050,000	2,100,000	metric tons	Chile Canada Mexico Peru	21	$ 0.66	pound	Annual increase rate of 1.8%	Construction, electrical, industrial machinery, transportation
Lead	340,000	1,030,000	metric tons	Peru Honduras Canada Mexico Australia	18	$ 0.25	pound	Annual increase rate of 1.3%	Transportation, construction, ammunition, electrical, TV glass, paint, ceramics, weights, containers
Silver	44,000,000	170,000,000	troy oz	Canada Mexico Peru United Kingdom	61	$ 8.25	troy oz	Annual increase rate of 2.2%	Photography, electrical, sterling ware and electro-plated ware, jewelry, brazing alloys, and solders.
Zinc	265,000	1,030,000	metric tons	Canada Peru Mexico Australia	67	$ 0.48	pound	Annual increase rate of 2.2%	Construction, transportation machinery, electrical.
Lime	16,100,000	16,320,000	short tons	Canada Mexico	1	$53.00	ton	Annual increase rate of 3.7%	Environmental, chemical, industrial, construction, refractories, agriculture.
Industrial sand and gravel (Quartzite)	29,000,000	28,000,000	short tons	Australia Canada	0	$12.90	ton	Annual increase rate of 1.5%.	Glassmaking sand, foundary sand, abrasive sand, hydraulic fracturing sand.

A tungsten-bearing tactite is associated with the western most granitic intrusion near the northern end of the study area. A west-trending aeromagnetic anomaly shows that the granitic stock continues under the study area and additional tungsten-bearing tactite could be present.

Industrial mineral commodities present in the SA include limestone, dolomite, quartzite, and sand and gravel. About half of the limestone outcrops sampled indicated the rock is suitable for agriculture uses; some is pure enough to be considered for various chemical uses. Study area quartzite is very pure and suitable for glass manufacture. All of these commodities could be used as road metal and fill. All of the industrial commodities in the area are too far from marketing areas to be considered for development in the foreseeable future.

The Worthington Mountains SA is considered unlikely to have a petroleum resource.

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

Element	Detection limit (%)	Element	Detection limit (%)
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	.0009
Mg	.0001	Zn	.0001
Mn	.001	Zr	.003

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.

APPENDIX B--Results of Semiquantitative optical emission spectrographic analyses of samples from the Worthington Mountains Study Area, Lincoln County, Nevada.

[>, greater than; <, less than]

	Sample numbers														
ELEMENTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Values in percent														
AG	<.002	<.0009	<.005	<.0009	<.003	<.002	<.0005	<.0005	<.002	.008	<.0006	.009	.02	<.002	.09
AL	>5.	>5.	.6	>6.	.5	.4	>4.	>3.	.9	>3.	.7	.4	.1	>3.	.9
AS	.1	.1	<.03	<.03	<.02	<.009	.05	3.	9.	.5	<.02	.2	.07	.5	.8
AU	<.005	<.004	<.002	<.007	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
B	.06	.08	<.004	.01	<.005	<.003	.01	.009	<.008	.009	<.003	<.003	<.003	.07	.01
BA	.008	.007	<.002	.1	.005	<.002	.09	.01	.007	.04	.01	<.002	<.002	.003	.006
BE	<.0001	<.0001	<.0001	.0005	<.0001	<.0001	<.0002	.0003	.0005	.0005	<.0001	<.0001	<.0001	<.0001	.0004
BI	<.01	<.01	<.02	<.02	<.01	<.01	<.02	<.01	<.01	<.01	<.01	<.01	<.06	<.02	<.05
CA	>10.	>10.	<.9	10.	>10.	>10.	4.	10.	<.05	10.	>10.	8.	>9.	>10.	3.
CD	<.0005	<.002	.02	<.0005	<.0005	<.0005	<.0005	<.002	<.05	<.04	<.0005	<.001	<.0005	<.03	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.002	<.001	<.001	<.001	<.001	<.001	<.001
CR	.002	<.0004	<.0003	<.0007	<.0003	<.0003	<.0008	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003
CU	<.0006	<.0006	<.0006	.0006	<.0006	<.0006	.005	<.0006	.001	.02	<.0006	.2	.3	<.0006	<.0006
FE	3.	5.	6.	7.	.2	.1	4.	5.	10.	10.	.2	3.	2.	2.	10.
GA	<.0007	<.0005	<.0002	<.001	<.0002	<.0002	<.0002	<.0002	<.0003	<.0002	<.0002	<.0002	<.001	<.0002	<.001
K	<.6	<.6	<.6	7.	<.6	<.6	>10.	6.	8.	6.	<.6	<.6	<.6	<.6	<.9
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.003	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
MG	>10.	3.	.2	3.	1.	1.	1.	1.	.005	.8	2.	.5	.6	1.	.4
MN	.9	>2.	>10.	.6	.04	.04	.06	.04	<.0008	.2	.05	.5	.3	>8.	.3
MO	<.001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	>10.	2.	<.3	<.3	<.3	<.3	<.3	<.3	<.3	>10.	6.	<.3	<2.
NB	<.02	<.02	<.007	<.02	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007
NI	.001	<.0007	<.003	.002	.001	<.0006	.001	.001	.004	.006	<.0005	<.0003	.0008	<.001	<.003
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.8	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	<.002	<.002	.01	<.003	<.002	<.002	<.007	.01	<.003	3.	.01	5.	8.	.9	10.
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.001	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
SB	<.06	<.06	<.06	<.08	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	>10.	>10.	>10.	3.	2.	>10.	>10.	>10.	>10.	>10.	.9	.5	2.	>10.
SN	<.004	<.004	<.009	<.01	<.002	<.0007	<.005	<.004	<.03	<.03	<.0006	.1	.3	<.004	.04
SR	.002	.04	<.0001	.01	.009	.02	.005	.007	.0002	.006	.007	.0006	.0009	.002	.0003
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	.5	.3	<.04	.5	<.03	<.03	.1	<.03	<.03	<.06	<.03	<.03	<.03	.08	<.03
V	<.005	<.005	<.005	.02	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.4	.2	.2	.03	<.0001	<.0001	.008	.009	.004	.08	<.0004	.2	.2	.2	.4
ZR	.004	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	.005	<.003	<.003	<.003	<.003	.009

Note: High values obtained by spectrographic analysis for cadmium are due to arsenic interference indicated by values obtained for selected samples run by AA.

ELEMENTS	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Sample numbers														
	Values in percent														
AG	.03	.07	.05	.005	.02	<.0005	<.002	.02	.01	.03	<.004	<.002	<.004	<.002	<.001
AL	.9	.6	.6	1.	.4	>4.	>2.	.6	>3.	.5	.6	>3.	>3.	>3.	>2.
AS	9.	9.	6.	.09	.8	<.01	<.009	4.	4.	10.	.06	<.01	.03	.09	.07
AU	<.003	<.002	<.002	<.003	<.009	<.002	<.004	<.003	<.003	<.009	<.002	<.002	<.002	<.002	<.002
B	.03	<.008	.01	<.004	<.009	<.007	.01	.01	.01	.04	<.003	<.003	<.003	<.003	<.003
BA	.03	.008	.01	.002	.006	.03	.006	<.002	.008	.007	<.002	.005	.002	<.002	.01
BE	<.0001	<.0002	<.0001	<.0001	.001	<.0001	<.0001	<.0001	.0005	.0005	<.0001	<.0001	<.0001	<.0001	<.0001
BI	<.02	<.02	<.03	<.01	<.01	<.01	<.01	<.01	<.01	<.06	<.02	<.03	<.05	<.02	<.02
CA	<.1	.6	.3	>10.	2.	>10.	>10.	>10.	2.	<.05	>10.	>10.	10.	>10.	10.
CD	<.1	>10.	<.8	<.0005	<.2	<.0005	<.0005	<4.	<.08	>8.	.07	<.0005	<.0005	<.0007	<.0005
CO	<.002	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.002	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0004	<.0003	<.0003	<.0003	<.0003	<.0003	<.0005	<.0003	<.0006	<.0003	<.0003	<.0004	<.0008	<.0003	<.0003
CU	<.0009	<.0006	<.0006	<.0006	.3	<.0006	<.0006	.0008	.002	.0007	<.0006	<.0006	<.0006	<.0006	<.0006
FE	10.	9.	10.	3.	>10.	3.	2.	7.	6.	>10.	5.	2.	.9	2.	3.
GA	<.0003	<.0002	<.0002	<.0002	<.0002	<.0002	<.0005	<.0002	<.0009	<.0003	<.0002	<.0002	<.0002	<.0002	<.0002
K	<.9	2.	<2.	<.6	10.	<.6	<.6	<.6	<.6	10.	<.6	<.6	<.6	<.6	<.6
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.002	<.002	<.003	<.002	<.002	<.002	<.002	<.004	<.002	<.002	<.002
MG	.6	.2	.2	2.	.3	1.	.6	.5	.4	.05	.8	2.	.8	.3	2.
MN	.2	.04	>2.	.06	<.01	.1	.2	.1	.02	<.01	.3	.1	.07	.1	.04
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.5	<.3	<2.	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<6.	<.3	<.3	<.3	<.3
NB	<.01	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007
NI	.004	.003	<.002	.001	<.009	.0008	.001	.002	.001	<.002	.0008	.0008	.0008	<.0006	.001
P	<1.	<.7	<.8	<.7	<.7	<.7	<.7	<.7	<.7	<2.	<.7	<.7	<.7	<.7	<.7
PB	5.	7.	8.	.02	3.	<.002	.02	5.	3.	1.	2.	<.002	<.002	<.002	<.002
PD	<.0002	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0008	<.0006	<.0006	<.0006	<.001	<.0006	<.0006	<.0006	<.0006	<.0009	<.0006	<.0006	<.0006	<.0006	<.0006
SB	.2	<.06	<.1	<.06	<.06	<.06	<.06	<.06	.2	<.06	<.06	<.06	<.06	<.06	<.06
SC	<.0006	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	>10.	>10.	3.	2.	>10.	>10.	>10.	>10.	5.	4.	>10.	>10.	>10.	>10.
SN	.05	.03	.04	.004	.2	<.001	<.004	.01	<.01	.05	<.001	<.0006	<.0006	<.0006	<.0006
SR	<.0001	.0004	<.0001	.002	<.0001	.006	.0002	.0004	.0003	<.0001	.003	.002	.001	.001	.003
TA	<.02	<.02	<.02	<.02	<.08	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.06	<.04	<.04	<.04	<.04	<.04	<.05	<.04	<.07	<.04	<.04	<.04	<.04	<.04	<.04
TI	<.04	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.05	.08	<.03	<.03
V	<.007	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.006	<.005	<.005	<.005	<.005	<.005	<.005
Y	<.001	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.3	.2	.4	<.0006	.09	.001	.01	<.0004	.07	.01	>10.	.006	.005	.02	.004
ZR	<.004	<.003	<.003	<.003	<.003	<.003	<.003	<.003	.005	<.004	<.003	<.003	<.003	<.003	<.003

Note: High values obtained by spectrographic analysis for cadmium are due to arsenic interference indicated by values obtained for selected samples run by AA.

ELEMENTS	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
	Sample numbers														
	Values in percent														
AG	<.001	<.002	<.002	<.002	<.002	<.0007	<.0005	<.0008	<.0009	<.001	.01	<.001	<.0008	<.001	<.0007
AL	>3.	.9	>2.	>3.	>2.	>3.	>3.	1.	.2	>3.	.6	>3.	1.	>2.	>3.
AS	<.02	.04	.05	.04	<.009	<.02	<.009	<.009	<.009	<.03	<.01	.03	<.009	<.02	<.03
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
B	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.004	<.003	<.003	<.004	<.003	<.007
BA	.03	<.002	<.002	.005	.009	.005	.02	<.002	.004	.04	.002	.05	.02	.003	.02
BE	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0003	<.0001	<.0001	<.0001	<.0001	.0005
BI	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.02	<.02	<.02	<.01	<.02	<.03
CA	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	10.	7.	10.	>10.	10.	2.
CD	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	.2	<.0005	<.0005	<.0005	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0004	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003
CU	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
FE	1.	1.	2.	2.	1.	3.	3.	.9	.4	3.	9.	2.	2.	2.	4.
GA	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
K	<.6	<.6	<.6	<.6	<.6	<.6	<.6	<.6	<.6	9.	<.6	<2.	<.6	<.6	6.
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	.03	<.002	.02	.006	.01	<.005
MG	.7	.1	.6	.4	1.	1.	1.	.4	.6	1.	.4	.8	2.	.8	1.
MN	.04	.09	.1	.06	.04	.3	.09	.09	.2	.06	.1	.2	.2	.4	.1
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<9.	<.3	<.3	<.3	<.3
NB	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007	<.007
NI	.0009	<.0004	<.0006	.0008	<.0005	<.0006	.0008	<.0005	<.0005	.0008	<.0003	<.0006	<.0007	<.0007	<.0005
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	<.002	<.002	<.004	<.002	<.002	.01	<.002	<.002	<.002	<.002	4.	<.007	<.003	<.002	<.002
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
SB	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.09	<.06	<.06	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	5.	>10.	>10.	>10.	>10.	>10.	>10.	3.	>10.	5.	>10.	>10.	>10.	>10.
SN	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0007	<.003	<.0006	<.0006	<.0006	<.0006
SR	.008	.005	.002	.006	.009	.007	.01	.006	.01	.003	.0006	.003	.004	.0006	<.0001
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	<.06	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.03	<.04
V	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.002	.01	.01	.002	.08	.03	.004	.02	.004	.005	>10.	.2	.02	.007	.006
ZR	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003

Note: High values obtained by spectrographic analysis for cadmium are due to arsenic interference indicated by values obtained for selected samples run by AA.

ELEMENTS	46	47	48	51	52	53	54	55	56	57	58	59	60	61	62
	Sample numbers														
	Values in percent														
AG	<.0009	<.001	<.0008	<.0005	<.01	.03	.07	<.003	.02	<.002	.008	.04	<.002	.04	<.0008
AL	>2.	>3.	.4	>5.	.09	.3	.2	.5	.7	.4	.4	.3	1.	.03	>3.
AS	<.01	.6	<.009	.05	<.009	<.08	.07	<.009	9.	1.	4.	7.	.06	10.	.3
AU	<.002	<.002	<.002	<.005	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
B	<.003	<.003	<.003	.009	<.004	<.009	<.007	<.005	<.003	<.005	<.006	<.005	.01	<.003	<.008
BA	.006	.002	<.002	.1	<.002	<.002	<.002	.007	.008	.004	.01	.02	.02	.03	.02
BE	<.0001	<.0001	<.0001	.0004	<.0002	.0005	.0004	.0004	<.0001	<.0001	<.0001	<.0001	<.0002	.0003	<.0002
BI	<.01	<.03	<.01	<.01	<.02	<.03	<.01	<.05	<.01	<.01	<.02	<.02	<.01	<.02	<.01
CA	>10.	10.	>10.	9.	<.3	<2.	1.	2.	6.	>10.	>10.	2.	7.	1.	5.
CD	<.0005	<.09	<.0005	<.0005	<.001	<.01	<.0005	<.0005	>10.	.6	<.008	<.02	<.003	<.2	<.04
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.002	<.002	<.001	<.001	<.001
CR	<.0003	<.0003	<.0003	.003	<.0003	<.0005	.001	.02	<.0003	<.0003	<.0004	<.0004	<.0005	<.0003	<.0003
CU	<.0006	<.0006	<.0006	<.0006	.008	.1	.2	.001	7.	4.	1.	7.	.08	6.	.3
FE	1.	2.	.2	7.	6.	6.	4.	3.	8.	4.	9.	>10.	2.	8.	4.
GA	<.0002	<.0002	<.0002	<.0004	<.0002	<.0003	<.0002	<.0002	<.0002	<.0002	<.0003	<.0003	<.0002	<.0002	<.0002
K	<.6	<.6	<.6	5.	<1.	<.7	<.6	<1.	<.9	<.6	<.9	<.9	<.8	<1.	<.6
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.003	<.002	<.002	<.002	<.002	<.002	.01	<.002	<.002	<.002	<.002	<.005	<.002	<.005
MG	.5	2.	.5	2.	<.04	.09	.03	.2	.2	.1	.3	.1	.8	.02	.3
MN	.1	.1	.03	.5	>10.	>8.	.2	.1	.3	.8	.3	.06	.3	.004	>2.
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	.0006	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	1.	<3.	<5.	<.8	<.3	4.	<1.	<.5	<.5	<.3	<.3	<***
NB	<.007	<.007	<.007	<.02	<.007	<.007	<.007	<.007	<.007	<.007	<.01	<.01	<.007	<.007	<.007
NI	<.0004	<.0006	<.0002	.001	<.001	<.002	<.0004	.002	.002	<.0006	.002	.003	<.0006	.004	<.0003
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<1.	<1.	<.8	<.7	<.7
PB	<.002	<.002	<.002	<.002	1.	3.	4.	<.002	1.	.06	1.	4.	.2	.1	.9
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0002	<.0002	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0008	<.0008	<.0006	<.0006	<.0006
SB	<.06	<.06	<.06	<.07	<.1	<.3	.2	<.06	<.07	<.06	<.1	<.1	<.06	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0006	<.0006	<.0004	<.0004	<.0004
SI	>10.	>10.	2.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	7.	2.	>10.	>10.	>10.
SN	<.0006	<.0006	<.0006	<.01	<.004	<.0006	<.0009	.003	.01	<.0007	.009	<.005	<.0006	.01	<.003
SR	.006	.001	.01	.009	<.0001	<.0001	.0003	.0002	.0009	.0005	.0007	.0006	.0005	.002	.001
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.05	<.04	<.05	<.04	<.04	<.04	<.04	<.06	<.06	<.04	<.04	<.04
TI	<.03	<.03	<.03	.3	<.03	<.03	<.03	<.03	<.03	<.03	<.04	<.04	<.03	<.03	<.03
V	<.005	<.005	<.005	<.01	<.005	<.005	<.005	<.005	<.005	<.005	<.007	<.007	<.005	<.005	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.001	<.001	<.0009	<.0009	<.0009
ZN	.0008	.002	<.0007	.02	>7.	1.	.7	.005	.3	.9	.5	.3	.6	.4	>8.
ZR	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.004	<.004	<.003	<.003	<.003

Note: High values obtained by spectrographic analysis for cadmium are due to arsenic interference indicated by values obtained for selected samples run by AA.

ELEMENTS	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
	Sample numbers														
	Values in percent														
AG	<.005	.02	.02	.009	.005	<.001	<.002	<.002	<.003	.02	.07	.09	<.003	<.003	<.002
AL	.8	1.	.8	1.	.5	.4	.7	.3	.7	.4	.6	>2.	.6	.8	.5
AS	.3	.8	.8	4.	.8	<.01	<.02	<.02	2.	4.	10.	1.	.2	.1	.2
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
B	<.003	<.006	.009	<.007	.01	<.003	<.005	<.003	<.005	<.003	<.003	.009	<.005	<.005	<.006
BA	.007	<.003	.009	.02	.008	<.002	.005	.006	<.003	<.002	.007	.009	.01	.01	<.003
BE	<.0001	<.0001	.0006	<.0001	.0003	<.0001	<.0001	<.0001	<.0001	<.0001	<.0002	<.0002	<.0001	<.0001	<.0001
BI	<.08	<.02	<.01	<.01	<.01	<.01	<.01	<.01	<.02	<.04	<.06	<.02	<.01	<.01	<.02
CA	.2	.6	.2	>10.	.3	>10.	>10.	10.	6.	2.	.9	4.	10.	3.	5.
CD	<.01	<.001	<.1	<.03	<.0005	<.0005	<.0005	<.0005	<.06	<2.	<.2	<.0005	<.007	<.002	<.0007
CO	<.001	<.002	<.001	<.001	<.001	<.001	<.001	<.001	<.002	<.001	<.001	<.001	<.001	<.001	<.002
CR	<.0003	<.0004	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	<.0004	<.0003	<.0003	<.0003	<.0003	<.0003	<.0004
CU	4.	2.	2.	3.	.3	<.0006	<.0006	.006	.4	4.	2.	8.	.2	.3	2.
FE	.8	7.	9.	7.	10.	.3	.6	.6	6.	6.	7.	8.	2.	3.	7.
GA	<.0002	<.0003	<.0007	<.0002	<.0002	<.0002	<.0002	<.0002	<.0003	<.0002	<.0002	<.0002	<.0002	<.0002	<.0003
K	<.6	<1.	<2.	<.6	<1.	<.6	<.6	<.6	<.9	<.6	<1.	<.6	<.6	<.6	<.9
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.004	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
MG	.09	.7	.09	.3	.09	1.	.8	.2	.2	.5	.3	.5	.7	.7	.2
MN	.7	.7	.2	>2.	.5	.4	.4	.4	1.	.2	.1	>2.	.8	.9	.7
MO	<.0001	<.0001	<.0003	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	.002	<.0001	<.0003	<.0001	<.0001	<.0001
NA	<***	<5.	<2.	<10.	<10.	<.3	<.3	<.3	<***	<***	<4.	<6.	<1.	<10.	<10.
NB	<.007	<.01	<.007	<.007	<.007	<.007	<.007	<.007	<.01	<.007	<.007	<.007	<.007	<.007	<.01
NI	<.0005	<.001	.003	<.001	.003	<.0003	.0008	<.0006	<.0009	.0008	.002	<.002	<.0007	<.0006	<.001
P	<.7	<1.	<.7	<.7	<.7	<.7	<.7	<.7	<1.	<.7	<.7	<.7	<.7	<.7	<1.
PB	.2	5.	3.	2.	.02	<.002	<.003	.03	1.	4.	4.	4.	.4	.3	.3
PD	<.0001	<.0002	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0002	<.0001	<.0001	<.0001	<.0001	<.0001	<.0002
PT	<.0006	<.0008	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0008	<.0006	<.0006	<.0006	<.0006	<.0006	<.0008
SB	<.06	<.1	.2	<.1	<.2	<.06	<.06	<.06	<.1	<.06	<.06	<.07	<.06	<.06	<.1
SC	<.0004	<.0006	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0006	<.0004	<.0004	<.0004	<.0004	<.0004	<.0006
SI	>10.	>10.	>10.	>10.	>10.	3.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.
SN	<.0006	<.002	.02	.01	<.02	<.0006	<.001	<.0006	<.002	<.001	.006	<.01	<.001	<.0009	<.001
SR	.0002	<.0001	<.0001	.0008	.001	.0008	.001	<.0001	<.0001	<.0001	.004	.002	.0003	<.0001	<.0001
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.06	<.04	<.04	<.04	<.04	<.04	<.04	<.06	<.04	<.04	<.04	<.04	<.04	<.06
TI	<.03	<.04	<.03	<.03	<.03	<.03	<.03	<.03	<.04	<.03	<.03	<.07	<.04	<.05	<.04
V	<.005	<.007	<.005	<.005	<.005	<.005	<.005	<.005	<.007	<.005	<.005	<.005	<.005	<.005	<.007
Y	<.0009	<.001	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.001	<.0009	<.0009	<.0009	<.0009	<.0009	<.001
ZN	>9.	2.	.6	1.	.7	.06	.03	.1	>10.	>7.	.9	.8	.5	1.	2.
ZR	<.003	<.004	<.003	<.003	<.003	<.003	<.003	<.003	<.004	<.003	<.003	<.003	<.003	<.003	<.004

Note: High values obtained by spectrographic analysis for cadmium are due to arsenic interference indicated by values obtained for selected samples run by AA.

ELEMENTS	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
	Sample numbers														
	Values in percent														
AG	<.0005	<.002	<.006	.02	<.003	<.0009	.02	.02	<.001	<.0005	<.0005	.005	<.002	<.001	<.003
AL	1.	1.	.2	.1	.8	.9	.8	.7	1.	.4	.9	>3.	.5	.1	.4
AS	<.02	1.	.3	1.	.9	<.01	<.03	5.	.06	<.009	<.03	.07	<.01	<.009	<.01
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
B	<.007	<.008	<.003	<.003	<.003	<.007	.009	<.01	<.007	<.003	<.007	<.003	<.003	.01	<.008
BA	.01	.003	<.002	<.002	<.002	.009	.004	.004	.01	<.002	.008	.007	.003	.003	.002
BE	<.0002	<.0001	<.0001	<.0001	<.0001	<.0002	.0005	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	.0006	.0004
BI	<.01	<.02	<.04	<.04	<.04	<.02	<.02	<.03	<.02	<.01	<.01	<.06	<.01	<.02	<.02
CA	3.	7.	8.	9.	5.	7.	4.	<.08	7.	10.	7.	.9	>10.	<.06	.7
CD	.008	<.005	.8	1.	2.	.01	.06	<.3	<.0005	.005	<.0005	.02	009	<.0005	<.0005
CO	<.001	<.002	<.001	<.001	<.001	<.001	<.001	<.002	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0003	<.0004	<.0003	<.0003	<.0003	<.0003	<.0003	<.0004	<.0003	<.0003	<.0003	<.0003	<.0003	<.0006	.003
CU	.001	.6	4.	3.	1.	.002	.2	5.	.07	<.0006	.003	10.	.004	<.0006	<.0006
FE	2.	6.	5.	5.	4.	1.	3.	10.	2.	.9	2.	5.	2.	.1	2.
GA	<.0002	<.0003	<.0002	<.0002	<.0002	<.0002	<.0002	<.0003	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002
K	<2.	<.9	<.6	<.6	<.6	<.8	<2.	<1.	<.6	<.6	<.9	<.6	<.6	<.6	<.6
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.002	<.002	<.004	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
MG	1.	.4	.8	1.	.5	.8	.6	.2	.9	.6	.8	.5	.5	.008	.3
MN	.8	>3.	>6.	.9	>4.	.7	.5	1.	.5	>2.	.6	.7	>4.	.01	.02
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<10.	<***	<***	<***	<.4	<5.	>10.	<.9	<.3	<.3	<10.	<.3	<.3	<.3
NB	<.007	<.01	<.007	<.007	<.007	<.007	<.007	<.01	<.007	<.007	<.007	<.007	<.007	<.007	<.007
NI	<.0002	<.0005	<.002	<.0003	<.001	<.0003	<.0004	<.001	<.0005	<.0002	<.0006	.001	<.0007	<.0004	.0008
P	<.7	<1.	<.7	<.7	<.7	<.7	<1.	<1.	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	.06	2.	.1	4.	3.	.2	4.	6.	.3	.05	.1	.09	.4	<.002	<.002
PD	<.0001	<.0002	<.0001	<.0001	<.0001	<.0001	<.0001	<.0002	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0008	<.0006	<.0006	<.0006	<.0006	<.0006	<.0008	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
SB	<.06	<.1	<.07	<.06	<.1	<.06	.1	<.1	<.06	<.06	<.06	<.06	<.06	<.06	<.06
SC	<.0004	<.0006	<.0004	<.0004	<.0004	<.0004	<.0004	<.0006	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	>10.	>10.	4.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.	>10.
SN	<.0006	<.004	<.0006	<.0006	<.0006	<.0006	.003	<.008	<.0006	<.0006	<.0006	<.001	<.0006	<.0009	<.002
SR	<.0001	<.0001	.0006	.0005	.0002	<.0001	.0003	<.0001	.0006	.0009	<.0001	.0006	.0003	<.0001	<.0001
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.06	<.04	<.04	<.04	<.04	<.04	<.06	<.04	<.04	<.04	<.04	<.04	<.07	<.09
TI	<.03	<.04	<.03	<.03	<.03	<.03	<.03	<.04	<.03	<.03	<.03	<.03	<.03	<.03	<.03
V	<.005	<.007	<.005	<.005	<.005	<.005	<.005	<.007	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Y	<.0009	<.001	<.0009	<.0009	<.0009	<.0009	<.0009	<.001	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.7	1.	>10.	>10.	>10.	.8	>8.	2.	.8	.6	.3	>9.	.6	.006	.005
ZR	<.003	<.004	<.003	<.003	<.003	<.003	<.003	<.004	<.003	<.003	<.003	<.003	<.003	<.003	.005

Note: High values obtained by spectrographic analysis for cadmium are due to arsenic interference indicated by values obtained for selected samples run by AA.

	Sample numbers														
ELEMENTS	93	94	95	96	113	114	115	116	117	118	119	120	121	122	123
	Values in percent														
AG	<.0006	<.0007	<.0005	<.0005	<.0005	<.001	<.004	<.0009	<.002	<.001	<.0009	<.003	<.0009	<.001	<.0007
AL	.8	.2	.4	.8	.3	>4.	>2.	.6	.3	.5	.5	.7	.6	>6.	.1
AS	<.009	<.009	<.009	<.009	<.009	<.01	<.009	<.009	<.009	<.009	<.009	<.009	<.009	.04	<.01
AU	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.006	<.002
B	<.003	<.003	<.003	<.003	<.003	.009	.01	<.003	<.003	<.003	<.003	<.003	<.003	.01	<.003
BA	<.002	<.002	.002	.006	<.002	.1	.1	.01	<.002	.003	.003	.005	<.002	.1	<.002
BE	<.0001	<.0001	<.0001	<.0001	<.0001	.0008	.0009	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	.0004	<.0001
BI	<.01	<.01	<.01	<.01	<.01	<.04	<.04	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
CA	>10.	>10.	>10.	>10.	9.	4.	2.	>10.	>10.	>10.	>10.	>10.	>10.	10.	>10.
CD	<.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	<.001	<.001	<.001	<.001	<.001
CR	<.0006	<.0003	<.0003	<.0003	<.0006	.002	.04	<.0003	<.0003	<.0003	<.0003	<.0003	<.0003	.003	<.0003
CU	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	.0008	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	.006	<.0006
FE	3.	.2	.4	3.	1.	6.	6.	3.	.3	3.	1.	1.	.7	7.	.05
GA	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0008	<.0002
K	<.6	<.6	<.6	<.6	<.6	6.	2.	<.6	<.6	<.6	<.6	<.6	<.6	<2.	<.6
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.002	<.004	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
MG	3.	4.	4.	3.	1.	.9	.7	2.	4.	>10.	3.	4.	3.	2.	1.
MN	.1	.009	.02	.09	.03	.4	.005	.07	.02	.04	.03	.03	.03	.6	.02
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	<.3	2.	<.3	<.3	<.3	<.3	<.3	<.3	<.3	2.	<.3
NB	<.02	<.007	<.01	<.02	<.007	<.01	<.007	<.007	<.007	<.007	<.007	<.007	<.02	<.02	<.007
NI	<.0006	<.0002	<.0002	<.0005	<.0003	.002	.004	.0008	<.0005	.0008	<.0005	<.0007	<.0006	.002	<.0005
P	<.7	<.7	<.7	<.7	<.7	<.7	<2.	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	<.002	<.002	<.002	<.002	<.002	<.003	<.002	<.002	<.002	<.002	<.002	<.002	<.002	.01	<.002
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
SB	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.06	<.08	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	4.	.8	3.	5.	>10.	>10.	>10.	>10.	4.	3.	2.	3.	2.	>10.	.07
SN	<.0008	<.0006	<.0006	<.0006	<.0006	<.004	<.006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0008	<.01	<.0006
SR	.0006	.0001	.0003	.001	.0002	.02	.01	.003	.0006	.0003	.001	.002	.001	.01	.002
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
TI	<.03	<.03	<.03	<.03	<.03	.2	<.05	<.03	<.03	<.03	<.03	<.03	<.03	.4	<.03
V	<.005	<.005	<.005	<.005	<.005	<.005	.05	<.005	<.005	<.005	<.005	<.005	<.005	.01	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.003	<.0002	<.0002	.005	.001	.02	.05	.006	<.0004	.001	<.0007	.0008	<.0002	.09	.003
ZR	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003

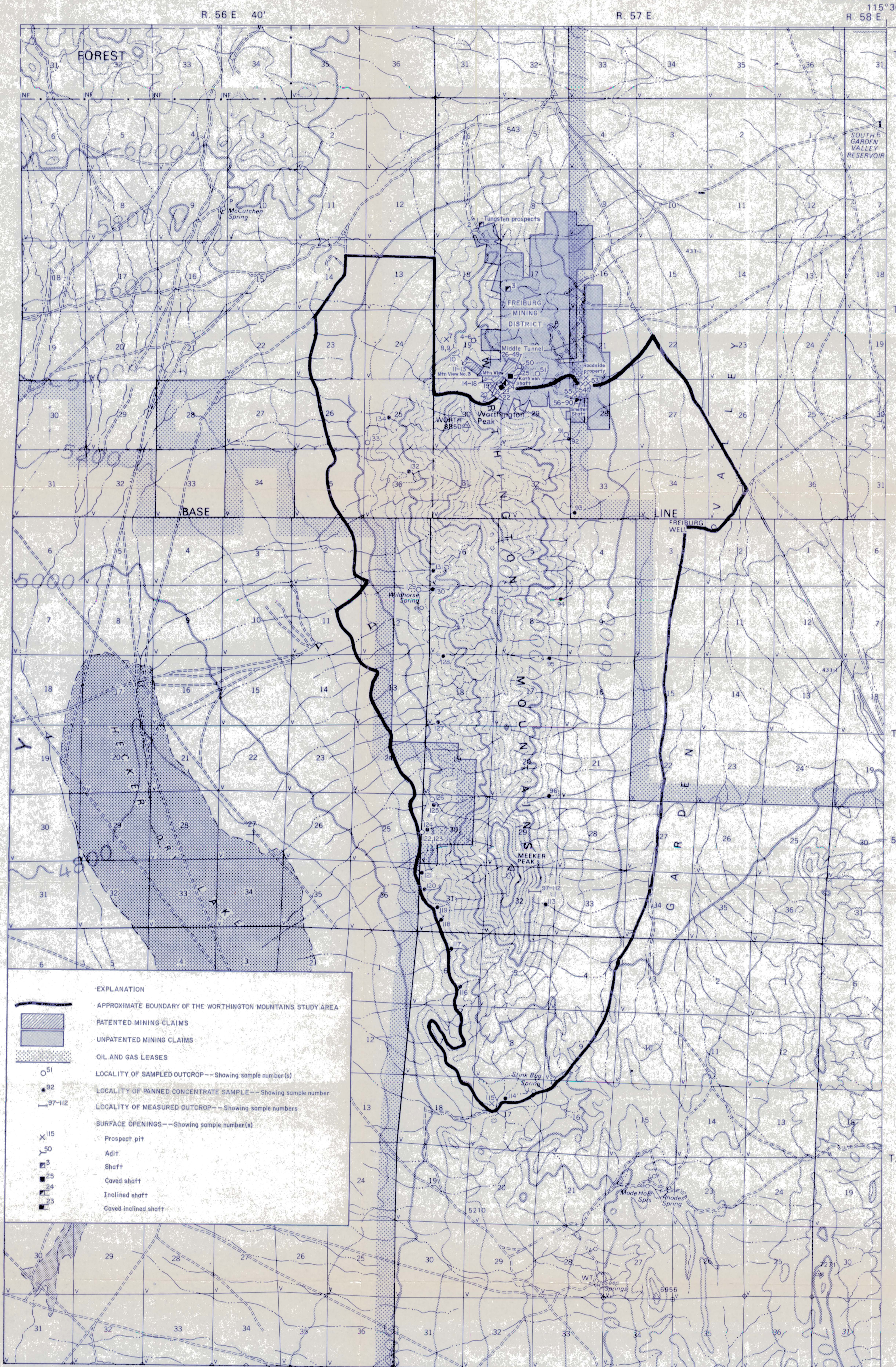
Note: High values obtained by spectrographic analysis for cadmium are due to arsenic interference indicated by values obtained for selected samples run by AA.

ELEMENTS	124	125	127	128	129	130	131	132	133	134
	Sample numbers									
	Values in percent									
AG	<.001	<.0005	<.0005	<.003	<.001	<.0005	<.0009	<.003	<.0008	<.0008
AL	>2.	.6	.4	1.	>6.	.6	.6	1.	.07	>3.
AS	<.009	<.009	<.009	.03	<.02	<.009	<.009	<.01	<.02	<.009
AU	<.002	<.002	<.002	<.002	<.004	<.002	<.002	<.002	<.002	<.002
B	<.003	<.003	<.003	.01	<.008	<.003	<.003	<.003	.009	<.005
BA	.01	<.002	<.002	.01	.06	.003	<.002	.01	<.002	.04
BE	<.0001	<.0001	<.0001	.0007	<.0003	<.0001	<.0001	<.0001	.0007	<.0002
BI	<.01	<.01	<.01	<.04	<.01	<.01	<.01	<.02	<.03	<.01
CA	>10.	>10.	>10.	1.	10.	6.	>10.	>10.	<.05	10.
CD	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005
CO	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
CR	<.0009	<.0003	<.0003	.01	.005	<.0008	<.0003	.001	.001	.006
CU	<.0006	<.0006	<.0006	<.0006	.002	<.0006	<.0006	<.0006	<.0006	<.0006
FE	5.	.3	1.	3.	7.	1.	1.	4.	.2	5.
GA	<.0002	<.0002	<.0002	<.0004	<.0006	<.0002	<.0002	<.0002	<.0002	<.0002
K	<.6	<.6	<.6	<.6	<.6	<.6	<.6	<.6	<.6	<.7
LA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
LI	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
MG	4.	3.	4.	.4	3.	1.	2.	1.	.003	2.
MN	.2	.01	.03	.08	.6	.03	.04	.1	.004	.4
MO	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
NA	<.3	<.3	<.3	<.3	2.	<.3	<.3	<.3	<.3	<.3
NB	<.007	<.01	<.01	<.007	<.03	<.007	<.007	<.007	<.007	<.01
NI	.0008	<.0002	<.0002	.001	.003	<.0003	<.0004	.001	<.0003	.001
P	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7	<.7
PB	<.002	<.002	<.002	<.004	<.002	<.002	<.002	<.002	<.002	<.002
PD	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
PT	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006	<.0006
SB	<.06	<.06	<.06	<.06	<.08	<.06	<.06	<.06	<.06	<.06
SC	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004	<.0004
SI	>10.	4.	4.	>10.	>10.	>10.	>10.	>10.	>10.	>10.
SN	<.002	<.0006	<.0006	.002	<.009	<.0006	<.0006	<.001	<.0006	<.003
SR	.002	.0008	.0003	.0009	.01	.0003	.006	.006	<.0001	.006
TA	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
TE	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.07	<.04
TI	.1	<.03	<.03	.1	.4	<.03	<.03	.09	<.03	.2
V	<.005	<.005	<.005	<.008	.01	<.005	<.005	<.005	<.005	<.005
Y	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009	<.0009
ZN	.05	<.0002	<.0005	.006	.05	.001	<.0004	.003	.006	.008
ZR	<.003	<.003	<.003	.006	<.003	<.003	<.003	<.003	<.003	<.003

Note: High values obtained by spectrographic analysis for cadmium are due to arsenic interference indicated by values obtained for selected samples run by AA.

DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

OPEN FILE REPORT
MLA 69-85
PLATE 1



Base from U.S. Geological Survey, 1:250,000
Caliente, Nevada, Utah, 1970.
Oil and gas lease information from Bureau of Land Management as of 1984.

SCALE 1:50,000
1/2 0 1 2 3 MILES
CONTOUR INTERVAL 200 FEET

NEVADA
MAP LOCATION

Field work completed in 1984 by Robert H. Wood II, assisted by Maynord L. Dunn, Jr., and Clay M. Martin; supervised by Clarence E. Ellis.

MINE AND PROSPECT MAP OF THE WORTHINGTON MOUNTAINS STUDY AREA, LINCOLN COUNTY, NEVADA

BY

ROBERT H. WOOD II, U.S. BUREAU OF MINES

1985