Geochemical Reconnaissance in the Pequop Mountains and Wood Hills, Elko County Nevada

GEOLOGICAL SURVEY BULLETIN 1198-E

Geochemical Reconnaissance in the Pequop Mountains and Wood Hills, Elko County Nevada

By R. L. ERICKSON, A. P. MARRANZINO, UTEANA ODA, *and* W. W. JANES

CONTRIBUTIONS TO GEOCHEMICAL PROSPECTING FOR MINERALS

GEOLOGICAL SURVEY BULLETIN 1198-E

Discussion of anomalously high concentrations of zinc, lead, and mercury in the Guilmette Formation and Simonson Dolomite of Devonian age in the Pequop Mountains and Wood Hills

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1966

UNITED STATES DEPARTMENT OF THE INTERIOR

STEWART L. UDALL, *Secretary*

GEOLOGICAL SURVEY

William T. Pecora, *Director*

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

CONTENTS

ILLUSTRATIONS

TABLES

CONTRIBUTIONS TO GEOCHEMICAL PROSPECTING FOR MINERALS

GEOCHEMICAL RECONNAISSANCE IN THE PEQUOP MOUNTAINS AND WOOD HILLS, ELKO COUNTY, NEVADA

By R. L. Erickson, A. P. Marranzino, Uteana Oda, and W. W. Janes

ABSTRACT

Geochemical reconnaissance in the Pequop Mountains and Wood Hills has shown that anomalously high concentrations of metals (chiefly zinc, lead, and mercury) occur in iron-rich fracture fillings and in small gossan pods in silicified dolomite and limestone. The strongest anomalies detected in the Pequop Mountains and in most of the old prospects in the Wood Hills are in the Guilmette Formation and Simonson Dolomite of Devonian age. Small white barite pods and lenses are common in the Guilmette Formation. Other metal anomalies were detected in metamorphic rocks in the Wood Hills.

The most successful method of geochemical reconnaissance was the analysis of float cobbles and pebbles collected in the major drainages. Conventional stream-sediment sampling and analysis failed to reveal any anomalous metal content except in drainage from the Spruce Mountain mining district at the south end of the Pequop Mountains.

INTRODUCTION

Geochemical reconnaissance of the Pequop Mountains and Wood Hills, Elko County, Nev., was begun in 1962 to determine whether anomalously high amounts of metal were present at the surface in this predominantly Paleozoic carbonate terrane. The area has no history of metal production. A few small barite shows have been prospected, but only one small metal prospect was found in the Pequop Mountains. Prospectors probably considered the mountain range unfavorable for the occurrence of ore deposits because of the lack of gossan outcrops, conspicuous alteration, or intrusive rocks. Two of the three general criteria for occurrence of ore deposits, however, do exist in this range: favorable structure and host rocks, particularly dolomite, in the lower part of the Paleozoic section. The third criterion—evidence that metal-bearing solutions have migrated through the rocks—has not been demonstrated. The question to be answered is: Should this area be eliminated from consideration as potentially favorable for concealed ore deposits because conventional prospecting has not revealed such deposits?

GEOLOGIC SETTING

The Pequop Mountains are a northward-trending eastward-tilted fault block, about 50 miles long and 5 miles wide at the widest point, in the eastern part of Elko County. U.S. Highway 40 crosses the northern part of the range. The Wood Hills, about 6 miles west of the northern part of the Pequop Mountains and immediately south of U.S. Highway 40, is a small northward-trending elongate dome covering about 75 square miles.

The geology of a part of the northern Pequop Mountains and of the Wood Hills was mapped and described by Thorman (1962). Snelson (1955) and Robinson (1961) described the geology of a part of the southern Pequop Mountains. The geology as described here and as shown on the illustrations is generalized from Thorman (1962) and is extended into the unmapped areas. Thorman described the Pequop Mountains and Wood Hills as consisting of regionally metamorphosed marble, quartzite, and schist of Middle Cambrian through Middle Devonian age overthrust by unmetamorphosed Ordovician through Permian rocks. The age of the thrusting is presumed to be Mesozoic.

The Wood Hills is composed chiefly of metamorphic rocks of the lower plate; upper plate rocks are preserved on the northeast, northwest, and south flanks of the dome. In contrast, the Pequop Mountains consist chiefly of rocks of the upper plate; the metamorphic rocks occur only in a small crescent-shaped area at the base of the west flank of the range (pl. 1).

The thickness of the lower plate rocks is unknown but exceeds 4,000 feet. The thickness of the upper plate rocks exceeds 15,000 feet; they consist, from bottom to top, of about 7,500 feet of carbonate and minor clastics of Ordovician through Devonian age, a clastic succession about 4,200 feet thick of Mississippian and earliest Pennsylvanian age, and an upper succession of limestone and subordinate clastics of Pennsylvanian and Permian age. According to Thorman, the lower carbonate unit includes the Pogonip Group, Eureka Quartzite, Ely Springs, Laketown, and Simonson Dolomites, Guilmette Formation, and Pilot(?) Shale. The predominantly clastic unit includes the Chainman Shale and Diamond Peak Formation, and the upper carbonate unit includes the Ely Limestone and the Ferguson Mountain and Pequop Formations of Bissel (1960).

Tertiary sedimentary rocks lie unconformably on metamorphic rocks in the Wood Hills; Tertiary volcanic rocks rest unconformably on Paleozoic rocks of the upper plate in the northeastern part of the Pequop Mountains.

Intrusive rocks are scarce; a few narrow dikes of intermediate to silicic composition occur in the southern half of the Pequop Mountains, particularly between the Western Pacific Railroad tunnel and the gravel road that crosses the range about 6 miles to the north. Thorman recorded the occurrence of many small unmapped pegmatite dikes in the Wood Hills.

In this investigation, Thorman's map units are grouped together to show most advantageously the results of the geochemical reconnaissance. These groups include (1) metamorphic rocks, (2) Eureka Quartzite and older rocks, (3) post-Eureka Quartzite, Silurian and Devonian rocks, (4) Mississippian and younger Paleozoic rocks, and (5) Tertiary rocks.

GEOCHEMICAL RECONNAISSANCE

Geochemical reconnaissance of the Pequop Mountains and Wood Hills was undertaken because analysis of small yellow-brown to red-brown iron-rich pods and irregular masses in the carbonate section exposed along U.S Highway 40 roadcut west of Pequop Summit showed high amounts of mercury (as much as 14,000 ppb), zinc (as much as >1 percent), and lead (as much as 2,000 ppm). Many pods contained white crystalline barite. Further impetus for undertaking the geochemical reconnaissance was provided by the results of geochemical reconnaissance in the Egan Range in White Pine County, Nev. (Brokaw and others, 1962); strong and extensive metal anomalies were detected in a terrane heretofore not known to be mineralized. The findings suggested that areas containing favorable host rocks and structure should be prospected by modern methods even though metal deposits have not been found previously. The Pequop Mountains seemed to be such an area. A few metal prospects were known in the Wood Hills, and they were studied as part of an overall reconnaissance program in east-central Nevada.

In this investigation, 390 rock samples and 145 samples of stream sediments were analyzed. Most of the samples were prepared and analyzed for 30 elements in the field in a truck-mounted spectrographic laboratory. In the Denver laboratory, the rock samples were analyzed for mercury by H. W. Knight and J. H. McCarthy, Jr., for tellurium by H. M. Nakagawa and J. B. McHugh, and for gold by H. W. Lakin, H. M. Nakagawa, and J. B. McHugh; the stream sediment samples were analyzed for copper, lead, zinc, and arsenic by J. B. McHugh and K. W. Leong.

The geochemical reconnaissance was carried on by stream-sediment and float sampling in the major drainages as near as possible to canyon mouths. The concept of float sampling is particularly important in this study. Float samples represent an unknown but specific bedrock sample site, whereas stream sediments represent a composite sample of the drainage basin. Because the area was not known to contain metal deposits, we expected that stream sediments would probably be barren of metal anomalies. Presumably, gossan or mineralized outcrops large enough to contribute appreciable amounts of metal to the stream sediments would already have been found and recorded by prospectors. Buried or concealed metal deposits having no conspicuous surface manifestation might be detected only by recognition of leakage of metals into fractures, joints, or faults. Therefore, in major drainages, collection and analysis of float pebbles and cobbles that are iron stained, discolored, altered, or that suggest any possibility of containing abnormal amounts of metal may reflect leakage. In effect, this type of float sampling is "fracture" sampling, because most of the iron-stain discoloration or alteration takes place along breaks in the rocks.

SAMPLE MEDIA AND ANALYTICAL RESULTS

Plate 1 shows the strong contrast between the uniformly low lead and mercury content of stream sediments (−50 mesh) and the large range from low to very high metal content of float cobbles and pebbles. No anomalous metal pattern was detected in stream sediments except in the drainage from the Spruce Mountain mining district in the south end of the Pequop Mountains. Anomalously high metal values in some float and bedrock samples in both the Pequop Mountains and Wood Hills, however, suggest at least weak primary dispersion of metals in fractures, joints, and faults—particularly in the middle Paleozoic carbonate rocks.

Analyses of the float and outcrop rock samples show that the lead (<10 ppm to >1 percent) and zinc (<200 ppm to >1 percent) are most concentrated in gossan and silicified carbonate rocks in the Simonson Dolomite and Guilmette Formation in the central part of the Pequop Mountains and on the southeast flank of the Wood Hills. Zinc is usually more concentrated than lead in gossan associated with white crystalline barite pods in the Guilmette Formation, but lead concentration is commonly equal to or greater than that of zinc in nonbaritic gossan in the Simonson Dolomite. Some zinc occurs in oxidized pyrite clusters in pyritic clastic sedimentary rocks, chiefly in the Chainman and Diamond Peak Formations.

The data also show that arsenic (as much as 3,000 ppm), antimony (as much as 1,000 ppm), and tungsten (as much as 1,500 ppm) commonly occur together in metal-bearing samples from all parts of the stratigraphic section. Tungsten, however, is not common in the high lead- and zinc-bearing fracture fillings and gossan in the Guilmette

Formation or Simonson Dolomite. Tungsten, in association with arsenic and antimony, is most common in the metamorphic rocks of the lower plate that are in the central part of the Pequop Mountains and in carbonate rocks (Ely Limestone and younger rocks) of late Paleozoic age in the southern half of the Pequop Mountains.

Mercury (<10–14,000 ppb), is most concentrated in the zinc-rich gossan and fracture-filling material associated with barite pods and lenses in the Guilmette Formation. Anomalously high amounts of mercury also occur in lead-rich gossan in the Simonson Dolomite. Lesser but still anomalous amounts (>200 but <1,000 ppb) occur in metal-bearing samples from pyritic clastic, metamorphic, and upper Paleozoic carbonate terrane. The silver content of most samples is less than 1 part per million. At two localities, both in Simonson Dolomite, as much as 300 ppm silver was detected in tetrahedrite-bearing quartz veinlets. The gold content of 95 metal-bearing samples ranges from less than 30 to 300 parts per billion (<0.001–0.01 oz per ton). Only six samples contained more than 70 ppb gold, and they were from the Guilmette Formation and Simonson Dolomite.

Tellurium content, determined in 151 metal-bearing samples, ranged from less than 0.1 to 60 ppm. One hundred twenty-one samples contained less than 0.1 ppm; 22 contained 0.1–1 ppm. Seven samples contained more than 1 ppm tellurium; most of these samples were arsenic and antimony bearing and were from the upper Paleozoic carbonate section. Only two samples from the area of high zinc-lead content contained more than 1 ppm tellurium.

In contrast to the float samples, stream-sediment samples contained very low concentrations of metal. The lead content ranged from less than 10 to 50 ppm. Only two samples contained as much as 50 ppm, and they were from drainages in middle Paleozoic carbonate terrane in the central Pequop Mountains. The lead content was very low (10 ppm or less) in most stream sediment samples from the Wood Hills and in upper Paleozoic carbonate terrane (Ely Limestone and younger rocks) in the southern half of the Pequop Mountains (pl. 1).

The mercury content of stream-sediment samples ranged from 10 to 110 ppb and was generally lower in carbonate terrane and higher in stream sediments in pyritic clastic terrane (pl. 1). The arsenic content of all samples was low: less than 10 to a maximum of 20 ppm. All samples that contained as much as 20 ppm were from stream sediments in pyritic clastic terrane. The copper (5–40 ppm) and zinc (25–150 ppm) contents were highest in stream sediments in pyritic clastic terrane.

An important consideration in geochemical prospecting is clearly illustrated by the preceding observations. The highest zinc, copper, arsenic, and mercury content in stream sediments occurs in pyritic clastic terrane, the least favorable ground for discovery of concealed metal deposits. The high metal content is probably due to the contribution of small amounts of these metals from oxidation of pyrite in black shale, siltstone, sandstone, and conglomerate of the Chainman and Diamond Peak Formations.

The lowest content of these metals occurs in stream sediments in carbonate terrane, a part of which has been shown in this study to be the most favorable ground for discovery of concealed metal deposits. This low metal content is due to the very low indigenous metal content of carbonate rocks and to the lack of mineralized outcrops large enough to contribute appreciable amounts of metal to the stream sediment load.

PEQUOP MOUNTAINS

U.S. HIGHWAY 40 ROADCUT

Anomalously high amounts of mercury (as much as 14,000 ppb), zinc (as much as > 1 percent), and lead (as much as 2,000 ppm) were found in yellow-brown to red-brown gossanlike pods and irregular masses and fracture fillings in the Guilmette Formation of Devonian age exposed in the U.S. Highway 40 roadcut (fig. 1). Many of the pods are jasperoid masses rich in barite, and some are surrounded by as much as 2 feet of white crystalline barite.

Fifteen sample sites were selected, beginning on the west flank of the range, probably near the base of the Guilmette Formation, and progressing upward in the stratigraphic section through shaly limestone of the Pilot (?) Shale and into black shale, black chert, and chert conglomerate of the Chainman Shale of Mississippian age (fig. 1). Much of the limestone in the Guilmette Formation, particularly that from sample sites 1–9, is coarsely recrystallized and is friable, sandy, and iron stained; some is dolomitized.

The distribution of barium relative to that of lead and zinc in the Highway 40 roadcut suggests an epithermal vertical zoning similar to that described by Hewett (1964), in which manganese oxide veins are nearest the original surface and are succeeded in depth by veins containing abundant barite, abundant fluorite, gold and silver, and finally, base metals. The low manganese content of these samples (table 1) may invalidate this comparison; however, the abundance of mercury, as well as of barium, in the upper part of this section and its persistence into rocks overlying the Guilmette Formation support the idea that the geochemical anomalies in the Guilmette Formation are a part of near-surface epithermal zones and that presumably, more productive zones may be concealed at some greater depth.

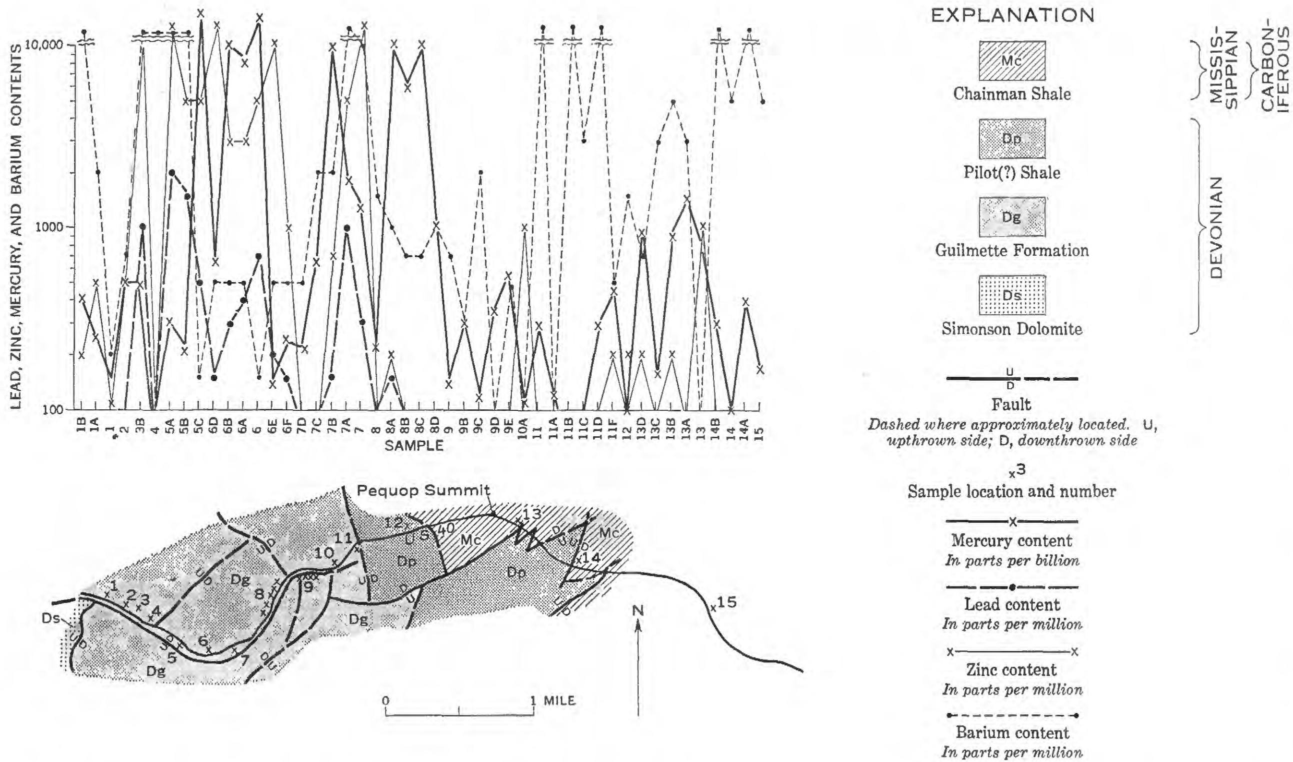

FIGURE 1.—Logarithmic graph and geologic map showing location and lead, zinc, mercury, and barium content of rock samples collected in U.S. Highway 40 roadcut. Geology adapted from Thorman (1962)

TABLE 1.—*Spectrographic and chemical analyses of rocks and fracture-*

[Spectrographic analyses by Uteana Oda. Chemical analyses for gold by H.W. Lakin, H.M. Nakagawa, absorption analyses for mercury by H. W. Knight and J. H. McCarthy,

Field No.	Description	Percent			Parts per million				
		Ca	Fe	Mg	Ti	Mn	Ag	B	Ba
PQ-1	Limy material, brick-red; in fracture in limestone.	20.0	0.5	5.0	200	100	<1	<10	200
1A	Clay, light-brown; in dense limestone.	1.5	2	1	2,000	700	<1	200	2,000
1B	Clay, red; same loc. as PQ-1A.	>20	2	.5	700	500	<1	30	>10,000
2	Clay gouge from breccia zone in limestone.	20	3	.7	1,500	100	<1	50	700
3B	Iron-rich material, brown and yellow-brown; surrounds white barite mass.	.3	>20	.15	50	300	<1	50	>10,000
4	Limestone, dark-gray, fine-grained.	>20	.15	2	20	20	<1	<10	>10,000
5A	Jasperoid, yellow-brown to dark-brown.	1	20	.1	100	70	<1	20	>10,000
5B	Iron-rich material, brown, soft; around hard cores of jasperoid.	1	>20	1.5	300	700	<1	20	>10,000
5C	Clay, red-brown	.2	>20	.15	300	50	<1	20	150
5D	Calcite sand, black; contains some iron stain.	10	.5	5	<10	100	<1	<10	150
6	Iron-rich material, yellow	.2	>20	.15	100	70	<1	30	150
6A	Iron-rich material, red; surrounds yellow material above.	.2	>20	.2	200	70	<1	30	500
6B	Iron-rich material, purple	.2	>20	.2	200	70	<1	30	500
6D	Iron-rich material, red	10	5	>5	200	500	<1	10	500
6E	do	3	15	5	<10	300	<1	15	500
6F	Iron-rich material, yellow-brown; 100 ft east of PQ-6.	.3	15	.2	20	100	<1	10	500
7	Jasperoid, dark-brown	3	15	.7	500	50	<1	10	10,000
7A	Iron-rich material, brown, soft; around hard jasperoid cores.	.2	15	.1	200	50	<1	20	>10,000
7B	Jasperoid; center of altered mass.	.15	20	.15	100	20	10	20	2,000
7C	Clay gouge, yellow-brown	5	2	5	3,000	30	<1	30	2,000
7D	Clay gouge, red	20	1	>5	500	150	<1	10	500
8	Limestone, dolomitic, red-stained.	>20	1	>5	1,500	50	<1	20	1,500
8A	do	7	3	>5	100	200	<1	<10	1,000
8B	do	>20	1	10	500	100	<1	10	700
8C	Calcite sand, red-stained	20	1	3	150	70	<1	<10	700
8D	Dolomite sand	>20	.7	5	700	100	<1	10	1,000
9	Clay gouge, brick-red	15	2	1	3,000	70	<1	50	700
9B	Sandstone, mottled pink and yellow; 50 ft east of PQ-9.	>20	.7	1	1,500	300	<1	15	300
9C	Clay gouge, brick-red; 150 ft east of PQ-9.	>20	1.5	1	3,000	150	<1	20	2,000
9D	Iron-rich material, yellow-brown and red; in massive limestone on north side of highway across from loc. 9.	20	7	.15	70	30	<1	<10	70
9E	Clay gouge, brick-red; same loc. as PQ-9D.	>20	10	.7	2,000	500	<1	50	500
10A	Clay, brick-red; pod in gray limestone.	10	.3	.7	5,000	50	1	50	100
11	Clay, brick-red; along bedding plane in dark-gray limestone.	>20	1	.7	1,500	150	<1	20	>10,000
11A	Limestone, red-stained	>20	.7	.1	70	15	<1	<10	100
11B	Calcite, black- and red-stained.	>20	1	.15	70	100	<1	<10	>10,000
11C	Limestone, dolomitic, yellow, soft, altered.	>20	.5	10	100	300	<1	<10	3,000
11D	Iron-rich material, red-brown.	>20	5	.15	300	200	<1	20	>10,000

filling material, U.S. Highway 40 roadcut, Pequop Mountains

and J. B. McHugh. Chemical analyses of tellurium by H. M. Nakagawa and J. B. McHugh. Atomic Jr. Symbol used: n.d., not determined. Sample localities shown on pl. 1]

Parts per million—Continued														Parts per billion	
Be	Cr	Cu	Ga	Mo	Ni	Pb	Sc	Sr	Te	V	Y	Zn	Zr	Au	Hg
<1	5	100	<5	<2	5	70	<5	200	n.d.	20	10	<200	10	n.d.	140
3	100	100	20	<2	30	50	15	150	n.d.	200	10	500	100	n.d.	250
1	30	30	7	<2	20	50	<5	500	n.d.	70	15	200	20	n.d.	400
1	50	30	15	<2	20	20	10	150	n.d.	100	10	500	70	n.d.	500
2	<5	30	20	10	10	1,000	<5	700	<0.1	50	20	10,000	15	<30	500
<1	<5	2	<5	<2	<5	<10	5	300	n.d.	10	<10	<200	<10	n.d.	20
1	10	50	15	10	30	2,000	<5	1,000	<.1	500	20	>10,000	<10	<30	300
2	10	50	20	15	50	1,500	<5	1,000	n.d.	200	30	5,000	20	n.d.	250
<1	5	50	20	15	5	500	<5	20	<.1	50	20	5,000	15	<30	14,000
<1	<5	5	<5	<2	<5	10	<5	200	n.d.	10	<10	<200	<10	n.d.	90
<1	<5	50	20	15	5	700	<5	30	<.1	50	20	5,000	<10	<30	13,000
<1	7	30	50	15	5	500	<5	30	<.1	50	20	3,000	<10	n.d.	8,500
<1	5	30	50	15	5	300	<5	30	<.1	50	30	3,000	<10	<30	10,000
<1	10	30	10	<2	10	150	<5	150	<.1	50	<10	>10,000	10	<30	650
<1	<5	20	15	5	<5	200	<5	100	n.d.	50	15	10,000	<10	n.d.	140
2	7	200	10	5	100	150	<5	20	n.d.	100	10	1,000	<10	n.d.	240
1	7	100	10	5	50	300	<5	150	<.1	200	<10	>10,000	10	n.d.	1,300
2	10	150	10	5	30	1,000	<5	2,000	<.1	100	10	5,000	20	30	1,800
<1	7	70	20	30	70	150	<5	150	<.1	200	10	700	<10	200	10,000
<1	500	70	20	<2	100	70	30	200	n.d.	200	10	<200	70	n.d.	650
<1	15	10	<5	<2	5	10	<5	150	n.d.	20	<10	<200	70	n.d.	220
<1	50	5	15	<2	7	20	<5	200	n.d.	100	<10	<200	70	n.d.	220
2	15	30	15	<2	15	150	<5	150	n.d.	50	<10	200	15	n.d.	10,000
<1	10	7	<5	<2	5	70	<5	100	<.1	15	<10	<200	50	<30	6,000
<1	5	2	<5	<2	<5	<10	<5	150	<.1	10	<10	<200	50	50	10,000
<1	20	10	5	<2	10	30	<5	150	<.1	20	10	<200	50	<30	1,000
3	50	30	15	<2	70	20	7	50	n.d.	150	10	500	150	n.d.	140
<1	15	15	5	<2	5	10	<5	150	n.d.	15	10	<200	200	n.d.	300
1	70	30	15	<2	30	15	10	150	n.d.	200	15	<200	100	n.d.	120
5	<5	30	10	<2	20	30	<5	200	n.d.	30	<10	<200	10	n.d.	350
5	50	50	10	2	50	70	5	150	n.d.	150	20	<200	200	n.d.	550
2	100	50	15	<2	100	30	10	70	n.d.	150	20	1,000	150	n.d.	110
1	50	20	10	<2	20	10	5	1,000	n.d.	100	10	<200	50	n.d.	300
<1	7	2	<5	<2	<5	<10	<5	200	n.d.	15	<10	<200	<10	n.d.	120
<1	<5	1	<5	<2	<5	<10	<5	500	n.d.	15	<10	<200	<10	n.d.	70
<1	7	7	<5	<2	5	10	<5	150	n.d.	30	20	<200	<10	n.d.	60
2	10	20	5	<2	20	20	<5	200	n.d.	100	10	<200	10	n.d.	300

TABLE 1.—*Spectrographic and chemical analyses of rocks and fracture-*

Field No.	Description	Percent			Parts per million				
		Ca	Fe	Mg	Ti	Mn	Ag	B	Ba
11F	do	7	15	.2	500	200	<1	50	500
12	Clay gouge, red; in gray calcareous shale.	15	1.5	.5	1,500	100	<1	50	1,500
13	Iron-rich material, yellow-brown; in shear zone in dark-gray shale.	.15	>20	.15	1,500	200	<1	70	n.d.
13A	Chert, iron-stained	.1	3	.1	1,000	300	<1	50	3,000
13B	do	.5	5	.7	2,000	>10,000	<1	150	5,000
13C	Shale, black	.7	3	.7	5,000	70	<1	50	3,000
13D	Jasperoid, brown; in shale	.07	15	.3	2,000	500	<1	150	700
14	Calcite, milky white	>20	.5	.15	<10	200	<1	<10	5,000
14A	Chert, black	.7	1	.1	2,000	150	1	50	>10,000
14B	Limestone, dark-gray	>20	.7	2	700	100	<1	20	>10,000
15	Shale, black	1.5	7	1.5	2,000	200	1	100	5,000

Note: As <500, Bi <10, Cd <20, Co <20, La <100, Sn <10, W <50, Sb <100 except PQ-8B which is 200

AREA NORTH OF U.S. HIGHWAY 40

No significant geochemical anomalies were detected in the chiefly clastic rocks of Mississippian and younger age exposed over much of the Pequop Mountains north of U.S. Highway 40. Float samples from a few drainages (pl. 1) showed moderately high mercury content (<200 and >1,000 ppb), but these samples were chiefly clusters of goethite-after-pyrite crystals derived from slightly pyritic sandstones and siltstones. Some of the clusters contained small amounts of zinc (as much as 1,000 ppm) and arsenic (as much as 3,000 ppm). The mercury content of stream sediments in this area ranges from 40 to 80 ppb and is somewhat higher than that of stream sediments in the carbonate environment immediately south of U.S. Highway 40 (10–60 ppb). The higher average mercury content in clastic rocks is attributed to contributions of mercury from disseminated pyrite.

AREA SOUTH OF U.S. HIGHWAY 40

High concentrations of mercury, zinc, and lead were detected in oxidized iron-rich float pebbles and cobbles collected in drainages south of U.S. Highway 40 that expose the Simonson Dolomite and Guilmette Formation of Devonian age (pl. 1). Later reconnaissance traverses of three of these drainages led to discovery of iron-rich fracture fillings or small gossan pods having anomalously high metal content in outcrops of the Simonson Dolomite and Guilmette Formation. None of these areas contain known metal deposits of minable size or grade.

Spectrographic and chemical analyses of float and outcrop samples collected in these three drainages (tables 2, 3, 4) show that zinc and lead are the most abundant metals; arsenic, antimony, and copper are concentrated in some samples. The mercury concentration appears anomalously high (>200 ppb) in most samples that contain anoma-

filling material, U.S. Highway 40 roadcut, Pequop Mountains—Continued

Parts per million—Continued														Parts per billion	
Be	Cr	Cu	Ga	Mo	Ni	Pb	Sc	Sr	Te	V	Y	Zn	Zr	Au	Hg
2	20	30	5	<2	20	15	<5	100	n.d.	100	30	200	50	n.d.	450
1	50	7	15	<2	5	15	<5	500	n.d.	50	10	<200	50	n.d.	20
5	30	30	10	20	20	20	30	30	n.d.	100	20	1,000	100	n.d.	800
1	20	15	<5	<2	20	<10	<5	70	n.d.	70	20	<200	20	n.d.	1,400
1	100	30	5	10	70	<10	10	150	n.d.	150	20	200	70	n.d.	900
<1	70	30	<5	2	20	<10	<5	100	.1	300	20	<200	150	<30	160
5	50	30	10	7	30	15	5	10	n.d.	100	30	200	50	n.d.	1,000
<1	<5	1	<5	2	<5	<10	10	200	n.d.	<10	<10	<200	<10	n.d.	70
<1	30	20	<5	<2	20	<10	<5	150	n.d.	150	10	<200	100	n.d.	400
<1	20	10	<5	<2	5	<10	<5	1,500	n.d.	50	10	<200	10	n.d.	300
2	70	30	<5	3	15	<10	5	150	n.d.	150	20	200	70	n.d.	170

lous amounts of other metals. Sample localities on the geologic-geochemical maps are keyed to field numbers in the tables. Analyses of samples from other drainages in the Pequop Mountains are not tabulated because no significant metal concentrations were detected.

The traverse up the canyon at locality PQ–31 (pl. 1 and table 2) was entirely within the carbonate section above the Eureka Quartzite. The mineralized jasperoid and gossan float cobbles appear to have come partly from widely spaced northeast-striking fractures and shear zones in the massive limestone ledges of the Guilmette Formation at the head of the canyon and partly from fractures and shears in the Simonson Dolomite on the ridge that forms the north side of the canyon. Samples PQ–115 through PQ–124 are probably from the Guilmette Formation; samples PQ–125 through PQ–128 are probably from the Simonson Dolomite (table 2). The maximum metal content detected in outcrop or float samples was 5,000 ppm lead, 7,000 ppm zinc, 1,000 ppm arsenic, 200 ppm antimony, 300 ppm copper, and 7,000 ppb mercury.

Most of the metal-bearing float jasperoid and gossan collected in the canyon at locality PQ–65 (pl. 1 and table 3) probably came from a zone about 1,000 feet wide in the Simonson Dolomite; this zone contains many narrow gossan pods and stringers. A barite prospect is in the Guilmette Formation near the top of the ridge, several hundred feet vertically above this zone. A narrow white quartz vein near the west end of the zone contains sparsely disseminated tetrahedrite(?) and yellow and green secondary minerals. Analysis of the vein showed more than 1 percent lead, 3,000 ppm antimony, 3,000 ppm copper, 300 ppm silver, 200 ppm bismuth, 200 ppm tin, 30 ppb gold, and 15,000 ppb mercury (PQ–140, table 3). The strike of this quartz vein can be projected about 1 mile to the southwest across the saddle

TABLE 2.—*Spectrographic and chemical analyses of float and*

[Spectrographic analyses by Uteana Oda. Chemical analyses for gold by H. W. Lakin, H. M. Nakagawa, absorption analyses for mercury by H. W. Knight and J. H. McCarthy, Jr.

Field No.	Description	Percent			Parts per million				
		Ca	Fe	Mg	Ti	Mn	Ag	As	Ba
PQ-31	Jasperoid float, iron-stained	0.5	15.0	0.3	2,000	500	<1	<500	2,000
115	Siliceous boxwork in breccia zone; in light-gray dolomite outcrop.	7	2	1.5	50	300	<1	<500	300
116	Jasperiod float, dark-brown, vuggy.	.07	10	.01	20	200	<1	<500	100
117	do	.1	>20	.1	70	700	<1	<500	100
118	do	.1	15	.1	50	200	<1	500	200
118A	Iron-rich material, brown, soft; in dark-brownish-gray limestone outcrop.	3	>20	.3	150	700	<1	1,000	700
119	Jasperoid, brown, vuggy; contains secondary quartz crystals; in light-gray limestone ledge.	3	20	.2	50	200	<1	<500	700
120	Jasperoid float, brown; in Guilmette Formation.	.5	20	.3	20	200	<1	1,000	200
121	do	.2	>20	.2	50	150	<1	<500	>10,000
122	Calcite and iron-rich material; in fracture in Guilmette Formation.	>20	3	1	20	200	<1	<500	1,000
123	Jasperoid float, dark-brown	.07	15	.01	50	70	<1	500	300
124	do	.07	10	.1	1,000	70	2	<500	70
125	Siliceous boxwork, brown-stained; in sandy dolomite.	7	.5	3	200	500	<1	<500	300
125A	Jasperoid float, dark-brown	.2	20	.05	50	70	<1	<500	30
125B	Siliceous boxwork, yellow and brick-red; in dolomite outcrop.	>20	.7	10	70	300	<1	<500	50
126	Jasperoid float, black, porous.	2	>20	1	500	200	<1	<500	100
127	Siliceous boxwork, brown, translucent; in light-gray dolomite.	10	5	3	200	200	<1	<500	1,000
127A	Jasperoid, light-brown	10	2	2	150	200	<1	<500	1,000
128	Siliceous boxwork float, red to orange-brown stain.	15	1	3	70	150	<1	<500	300

Note: B <20, Be <1, Bi <10, Cd <20, Co <20, La <50, Sc <5, Sn <10, W <50, Y <20 in all samples.

through gossan stringers at localities PQ–170 and PQ–171 (table 3) to the only metal prospect known in the Pequop Mountains (loc. PQ–66). The prospect is in a northeastward-trending fault zone. Iron-stained dolomite breccia from the fault contains 1,500 ppm antimony, 1,000 ppm lead, 300 ppm copper, 100 ppm tin, 15 ppm silver, and 450 ppb mercury. This metal suite is identical to that found at locality PQ–140.

Samples from the canyon at locality PQ–86 on the east side of the range are chiefly from barite prospects in the Guilmette Formation at localities PQ–92 and PQ–94 (pl. 1 and table 4). Several gossan-containing north-striking altered zones as much as 20 feet wide occur in limestone at locality PQ–92. Zinc (as much as 7,000 ppm), lead (as much as 5,000 ppm), and arsenic (as much as 1,000 ppm) are the most abundant metals in the gossan. All samples but one contain highly anomalous amounts of mercury, ranging from 400 to 7,000 *outcrop samples, canyon at locality PQ–31, Pequop Mountains*

and J. B. McHugh. Chemical analyses for tellurium by H. M. Nakagawa and J. B. McHugh. Atomic Symbol used: n.d., not determined. Sample locations shown on pl. 1]

Parts per million—Continued												Parts per billion	
Cr	Cu	Ga	Mo	Ni	Pb	Sb	Sr	Te	V	Zn	Zr	Au	Hg
300	30	10	10	50	3,000	<100	70	<.1	150	200	50	n.d.	950
10	30	<5	<2	30	30	<100	150	n.d.	50	<200	10	n.d.	40
<5	10	<5	5	<5	2,000	<100	20	<.1	10	1,500	<10	n.d.	3,500
7	150	5	7	5	2,000	<100	20	<.1	500	5,000	<10	n.d.	1,200
<5	100	5	5	<5	1,000	<100	20	n.d.	200	1,500	<10	n.d.	1,400
7	100	10	10	30	1,500	200	30	<.1	300	7,000	<10	70	1,800
5	30	10	5	5	1,500	<100	20	n.d.	300	1,500	<10	n.d.	850
5	30	5	5	5	2,000	<100	<20	<.1	300	500	<10	<30	1,700
5	7	10	7	7	500	<100	200	n.d.	15	<200	<10	n.d.	1,600
<5	10	<5	<2	5	20	<100	200	n.d.	10	<200	<10	n.d.	70
5	30	5	2	5	1,500	150	<10	<.1	20	1,000	<10	<30	7,000
10	50	5	100	30	100	<100	<10	<.1	50	<200	20	<30	1,800
5	3	<5	<2	<5	<10	<100	70	n.d.	10	<200	<10	n.d.	90
<5	50	5	5	5	300	<100	<10	n.d.	30	<200	<10	n.d.	1,300
<5	1	<5	<2	<5	<10	<100	100	n.d.	10	<200	<10	n.d.	70
<5	300	20	20	100	5,000	<100	<10	<.1	200	<200	<10	<30	700
5	5	<2	<2	20	20	<100	100	n.d.	200	<200	<10	n.d.	10
5	3	<2	<2	5	<10	<100	150	n.d.	15	<200	<10	n.d.	10
<5	30	<2	<2	<5	<10	<100	100	n.d.	15	<200	<10	n.d.	20

ppb (table 4). The gossan float sample at locality PQ–95 (pl. 1 and table 4) was not traced to its source but probably came from Pennsylvanian or Permian carbonate rocks on the ridge to the south.

Sparse chalcopyrite, pyrite, and secondary copper minerals were found in a few pieces of chert-pebble conglomerate from the north side of the gravel road that crosses the range about 6 miles north of The Western Pacific Railroad Co. tunnel through the Pequop Mountains (loc. PQ–79, pl. 1). The conglomerate is interbedded with limestone and quartzite and is probably in the upper part of the Diamond Peak Formation of Mississippian age. Analyses of the copper-bearing conglomerate showed 15 ppm silver, but no significant concentrations of other metals were detected. At the same locality an unusual rock, composed almost entirely of biotite, contains 15 ppm silver and 200 ppm antimony, and may be a skarn-type deposit.

TABLE 3.—*Spectrographic and chemical analyses of float and*

[Spectrographic analyses by Uteana Oda. Chemical analyses for gold by H.W. Lakin, H. M. Nakagawa, absorption analyses for mercury by H. W. Knight and J. H. McCarthy,

Field No.	Description	Percent			Parts per million				
		Ca	Fe	Mg	Ti	Mn	Ag	As	B
PQ-65A	Jasperoid float, dark brown	1.5	>20	0.2	150	70	<1	<500	10
137	do	3	10	.3	500	70	<1	<500	<10
138	Pyritic skarn; in dark gray dolomite outcrop.	5	5	7	7,000	500	<1	<500	10
139	Gossan, red to black, vuggy; in dark-gray dolomite outcrop.	2	15	.3	500	200	<1	500	20
140	Vein quartz, white: contains scarce tetrahedrite(?); in dolomite.	10	.5	5	70	150	300	700	<10
141	Jasperoid float, brown	1	20	.2	700	150	10	<500	10
170	Gossan float; in dolomite	5	>20	.2	150	200	<1	<500	<10
171	do	1	>20	.1	150	100	<1	<500	<10
173	do	3	>20	.2	500	100	<1	500	10
174	Iron-rich material, chalky; in Guilmette Formation.	.7	15	.07	500	500	<1	<500	20
175	Gossan float, vuggy	7	20	.2	300	100	<1	<500	<10
176	Gossan, dark-brown; in dolomite outcrop.	1.5	>20	.1	500	150	<1	<500	<10

NOTE: Be <1, Cd <20, Co <10, W <50, Y <20 in all samples; Bi <10 in all samples except PQ-140 which contained 200 ppm; Sn <10 in all samples except PQ-140, which contained 200 ppm.

TABLE 4.—*Spectrographic and chemical analyses of float and*

[Spectrographic analyses by Uteana Oda. Chemical analyses for gold by H. W. Lakin, H. M. Nakagawa, absorption analyses for mercury by H. W. Knight and J. H. McCarthy, Jr.

Field No.	Description	Percent			Parts per million				
		Ca	Fe	Mg	Ti	Mn	As	B	Ba
PQ-86A	Jasperoid float, brown, vuggy.	0.5	>20	0.15	200	500	<500	<10	70
91	Conglomerate, chert pebble, yellow-brown stain; outcrop.	1.5	10	.05	700	500	<500	20	700
91A	Jasperoid float, yellow-brown.	.1	10	.005	30	300	1,000	<10	>10,000
91B	Jasperoid float, purplish-red to black.	.1	10	.1	1,500	>10,000	1,000	30	3,000
92	Gossan, yellow-brown; in limestone outcrop.	2	20	.05	200	150	1,000	<10	>10,000
92A	Gossan, red-brown	.2	>20	.02	200	200	500	<10	2,000
92B	Gossan, dark-brown, hard.	.15	>20	.1	10	150	<500	20	1,000
92C	Gossan, yellow-brown, and barite.	1	15	.03	50	50	<500	<10	>10,000
92D	Gossan, red-brown	.2	>20	.1	700	200	700	20	>10,000
94	Gossan, deep-red to violet, and white barite.	>20	7	.05	30	100	<500	<10	>10,000
94A	Gossan, yellow-brown, and white barite.	1.5	20	.05	50	100	1,000	<10	>10,000
95	Gossan float, yellow-brown.	.01	10	.02	10	15	500	<10	2,000

Note: Ag <1, Bi <10, Cd <20, Ga <10, La <50, Sc <5, Sn <10, W <50, Y <20 in all samples.

outcrop samples, canyon at locality PQ–65, Pequop Mountains

and J. B. McHugh. Chemical analyses for tellurium by H. M. Nakagawa and J. B. McHugh. Atomic Jr. Symbol used: n.d., not determined. Sample locations shown on pl. 1]

Parts per million—Continued														Parts per billion	
Ba	Cr	Cu	Ga	Mo	Ni	Pb	Sc	Sb	Sr	Te	V	Zn	Zr	Au	Hg
1,000	<5	15	10	5	5	1,500	<5	<100	20	<.1	30	1,000	<10	n.d.	100
100	10	50	5	15	30	20	<5	<100	150	n.d.	70	<200	15	n.d.	110
1,000	1,000	70	5	7	150	10	20	200	300	n.d.	300	<200	500	n.d.	30
100	5	300	5	10	20	200	<5	<100	10	<.1	100	<200	15	n.d.	280
1,500	10	3,000	<5	5	5	>10,000	<5	3,000	700	.2	150	500	<10	30	15,000
1,000	<5	150	20	10	10	1,000	<5	<100	30	n.d.	70	<200	10	n.d.	425
200	<10	30	<5	20	15	10,000	<5	100	20	n.d.	200	200	<10	n.d.	2,000
200	10	30	<5	70	15	2,000	<5	150	20	.2	150	500	20	30	70
700	10	30	<5	20	10	7,000	<5	<100	50	<.1	300	700	20	<30	140
200	20	15	<5	5	30	<10	<5	<100	20	n.d.	50	1,000	100	n.d.	120
150	10	20	<5	5	5	3,000	<5	<100	30	<.1	50	100	10	<30	50
1,500	15	20	<5	15	2	3,000	<5	<100	100	<.1	100	300	30	30	1,700

outcrop samples, canyon at locality PQ–86, Pequop Mountains

and J. B. McHugh. Chemical analyses for tellurium by H. M. Nakagawa and J. B. McHugh. Atomic Symbol used: n.d., not determined. Sample locations shown on pl. 1]

Parts per million—Continued													Parts per billion	
Be	Co	Cr	Cu	Mo	Ni	Pb	Sb	Sr	Te	V	Zn	Zr	Au	Hg
1	<5	<5	30	7	7	300	<100	<10	n.d.	70	1,000	<10	n.d.	200
2	20	10	20	3	150	<10	<100	100	n.d.	50	700	100	n.d.	600
1	<5	10	30	5	15	3,000	<100	1,000	<.1	70	7,000	<10	50	4,000
3	50	20	30	20	100	30	<100	100	n.d.	100	500	50	n.d.	400
<1	<5	150	30	30	5	5,000	<100	1,500	<.1	70	1,500	<10	n.d.	1,500
1	<5	100	15	15	5	2,000	100	20	<.1	100	2,000	<10	<30	1,200
<1	5	<5	5	10	15	150	<100	<10	<.1	150	7,000	10	150	2,800
1	<5	20	30	3	7	100	<100	10,000	n.d.	70	700	<10	n.d.	1,300
<1	<5	10	20	10	7	5,000	100	500	n.d.	150	2,000	30	n.d.	7,000
<1	<5	5	10	<2	5	100	<100	3,000	n.d.	70	1,000	<10	n.d.	90
<1	5	15	30	5	15	150	<100	3,000	<.1	100	1,500	<10	<30	2,200
<1	<5	<5	7	3	7	2,000	<100	10	<.1	15	>10,000	<10	n.d.	4,500

Pale-orange-brown jasperoid and white calcite in northwestward-trending vertical fractures in limestone occur at locality PQ–185 on the east side of the range and just above the Western Pacific Railroad tunnel (pl. 1). This fracture-filling material contains 1,500 ppm lead, 500 ppm arsenic, and 2 ppm tellurium.

No significant base-metal anomalies were detected in the Pequop Mountains south of the Western Pacific Railroad tunnel; however, float and outcrop samples from a few drainages contain anomalous amounts of arsenic, antimony, and tungsten (pl. 1). The Western Pacific Railroad cut at locality PQ–168 exposes highly fractured upper Paleozoic gray limestone cut by numerous yellow- and red-stained clastic dikes. Coarse-grained almost colorless calcite veins and masses having smooth kidney-shaped surfaces are coated with a thin film of deep-purplish-red iron oxide. Analyses of the stained calcite showed as much as 1,000 ppm arsenic, 700 ppm tungsten, 500 ppm antimony, and 2 ppm tellurium.

Dense yellow jasperoid float at locality PQ–195 contained 500 ppm tungsten; iron-stained limestone float in the drainage at locality PQ–198 contained 700 ppm tungsten and 500 ppm antimony, and a yellow-brown-stained jasperoid reef about 3 feet wide at locality PQ–199 contained 200 ppm antimony (pl. 1).

As might be expected, gossan float in the main easterly drainage from the Spruce Mountain mining district (loc. PQ–221, pl. 1) contained anomalously high amounts of arsenic (3,000 ppm), lead (1,500 ppm), antimony (1,000 ppm), copper (1,000 ppm), molybdenum (200 ppm), silver (7 ppm), tellurium (1 ppm), and mercury (2,000 ppb). Sparse gossan float from the next drainage to the southeast (about half a mile) contained anomalously high amounts of zinc, arsenic, copper, lead, and tin. The tellurium content of this gossan (60 ppm) was much higher than that of any other samples collected in this investigation. A reconnaissance traverse in this drainage may prove fruitful.

WOOD HILLS

The most intense geochemical metal anomalies in the Wood Hills occur in association with a few previously known small mineralized areas that have been prospected by pits and shallow, inclined shafts in carbonate rocks of the upper plate (probably Simonson Dolomite of Devonian age) on the southeast flank of the Wood Hills (pl. 1). This is part of the same stratigraphic section that contains most of the base-metal anomalies in the Pequop Mountains.

Dark-brown to orange-brown jasperoid gossan occurs as irregular masses, stringers, and pods in Simonson Dolomite over an area several hundred feet in diameter at locality WH–26 (pl. 1). Analyses of samples from the one small prospect pit in this area show that lead is not only the most abundant metal (as much as >1 percent), but virtually the only metal present in appreciable concentrations. Small amounts of zinc (as much as 1,000 ppm) and mercury (as much as 2,000 ppb) were also detected (table 5). No metallic minerals were seen.

Gossan and jasperoid showings in dolomite on the ridge to the southwest (loc. WH–29, pl. 1) have been prospected by several small pits and one shallow inclined shaft. The prospects occur for about 600 feet along the strike of the ridge.

The northwesternmost prospect exposes a metalliferous white quartz vein 2½–3 feet wide that strikes N. 10° E., dips steeply west, and is the most intensely mineralized rock exposed on this ridge. The dump contains much hard brown jasperoid gossan, some lustrous black goethite(?), and secondary yellow-green, green, and blue minerals. Analyses of two samples from this prospect (loc. WH–29 and WH–29–B, table 5) show high amounts of copper (as much as >1 percent), lead (as much as 5,000 ppm), antimony (as much as 1 percent), zinc (as much as 1 percent), arsenic (as much as 2,000 ppm) and mercury (as much as 5,000 ppb). Anomalous amounts of silver (as much as 15 ppm) and tellurium (as much as 0.8 ppm) were also detected. Samples from five other prospects on this ridge show varying concentrations of the same metals (table 5).

Gossan from the prospect pits at localities WH–30 and WH–31, like the gossan at WH–26, is chiefly lead rich (table 5). The barium and mercury contents are also anomalously high at locality WH–30.

This large block of dolomite, covering about 7 square miles, merits additional exploration. Detailed mapping of structure and vein systems and plotting of metal distributions and concentrations may reveal a metal zonation and structural pattern worthy of exploratory drilling. The covered area between the two ridges (loc. WH–26 and WH–29, pl. 1) should be investigated by employing geophysical and geochemical methods. Mercury analysis of soil and alluvium across the covered area might provide additional drilling targets.

Small amounts of galena occur in a shear zone that strikes N. 70° W. in altered marble of Thorman's (1962) metamorphic rocks of the lower plate (loc. WH–14, pl. 1). An adit about 40 feet long intersects a steeply inclined shaft about 15 feet deep at this prospect. Spectrographic analysis of a galena concentrate from the dump shows 1,000 ppm antimony, 500 ppm silver, and 200 ppm tin. Jasperoid and gossan material collected from nearby fractures, however, are almost devoid of metals.

White brecciated dolomite laced with narrow white quartz veins

TABLE 5.—*Spectrographic and chemical analyses of*

[Spectrographic analyses by Uteana Oda. Chemical analyses for gold by H. W. Lakin, H. M. Nakagawa, cury by H. W. Knight and J. H. McCarthy, Jr. Symbol used:

Field No.	Description	Percent			Parts per million				
		Ca	Fe	Mg	Ti	Mn	Ag	As	Ba
WH-26	Gossan, brown; in dolomite	2.0	20.0	0.15	150	50	<1	<500	200
26A	Jasperoid, brown, dense	.05	20	.07	300	30	<1	<500	150
26C	Dolomite, grayish-brown, highly fractured: quartz crystals line fractures.	.1	>20	.1	300	150	<1	<500	70
26D	Fines sieved from dump of prospect.	1	20	.5	1,500	200	<1	<500	150
29	Jasperoid, brown	.3	20	.1	15	70	2	2,000	200
29B	Fines sieved from dump	15	10	3	2,000	500	10	700	2,000
29C	Gossan, brown, soft, porous; from small pit 100 ft N. 65° E. of WH-29.	1	>20	.3	200	100	7	<500	1,000
29D	Fracture filling, brown; in light-gray dolomite from steeply inclined shaft about 450 ft SW of WH-29.	.7	20	.2	50	50	15	1,000	200
29F	Fines sieved from prospect showing red stain on light-gray dolomite; 100 ft S. 45° E. of WH-29D.	20	7	>10	700	1,000	<1	<500	1,000
29G	Gossan, black to brown, vuggy; prospect pit 40 ft south of WH-29F.	.15	>20	.3	300	100	2	<500	5,000
29H	Jasperoid, brown; malachite and azurite stain; 250 ft N. 53° E. of WH-29D.	3	>20	.2	20	150	15	3,000	300
30	Gossan, brown to iridescent brown, vuggy; dump at prospect pit and shallow vertical shaft.	3	>20	.2	200	70	<1	<500	5,000
30A	Fines sieved from dump	3	>20	1.5	200	3,000	<1	<500	>10,000
31	Gossan, brown, vuggy, prospect pit in light-gray dolomite.	1.5	20	.5	20	70	<1	<500	2,000
31A	Fines sieved from dump	5	>20	3	200	500	<1	<500	2,000

Note: B <20, Be <1, Ga <5, Sc <10, W <20, Y <20 in all samples. Bi <5 except WH-29D, which is

in the small adit about 20 feet long at locality WH-20 (pl. 1) is stained with malachite and azurite and contains sparsely disseminated tetrahedrite and chalcopyrite. A heavy mineral concentrate made from mineralized rock in the dump of the adit contains 19 percent copper, 3.65 percent silver, 2.75 percent lead, and 1.25 percent zinc, determined by atomic absorption methods by Claude Huffman, U.S. Geological Survey, Denver; about 5 percent antimony and 1 percent arsenic, determined by wet chemical methods by G. H. Van Sickle, U.S. Geological Survey, Denver; and 250 ppb gold (0.007 oz. per ton), determined by H. W. Lakin, H. M. Nakagawa, and J. B. McHugh. The analyses suggest that the most abundant sulfide mineral is an argentian tetrahedrite. Three other prospect pits about 150 feet west, at the head of the canyon, show a slight green copper stain, but the intensity of mineralization is not impressive; however, brown-stained, leached, and partly silicified dolomite crops out for several hundred feet in an east-west direction. A detailed geochemical program in the area of *gossan and jasperoid, southeast flank of Wood Hills*

and J. B. McHugh. Chemical analyses for tellurium by J. B. McHugh. Atomic absorption analyses for mer-
n.d., not determined. Sample locations shown on pl. 1]

Parts per million—Continued												Parts per billion	
Co	Cr	Cu	Mo	Ni	Pb	Sb	Sr	Te	V	Zn	Zr	Au	Hg
<5	10	10	20	10	1, 500	<100	30	0. 1	<10	300	<10	n.d.	350
<5	10	20	10	7	5, 000	<100	30	. 1	20	300	50	30	600
<5	10	2	15	7	>10, 000	<100	30	<. 1	20	500	<10	30	900
<5	20	10	20	10	>10, 000	<100	30	<. 1	30	1, 000	20	150	2, 000
50	10	>10, 000	20	2, 000	5, 000	10, 000	30	. 8	500	10, 000	<10	n.d.	1, 400
15	200	5, 000	5	100	5, 000	1, 000	200	. 2	500	1, 000	50	30	5, 000
5	10	50	20	30	1, 500	100	50	<. 1	100	200	<10	n.d.	200
<5	10	>10, 000	20	30	>10, 000	5, 000	30	4	20	1, 000	<10	30	3, 500
<5	20	30	5	30	70	<100	500	<. 1	300	<100	20	n.d.	2, 000
<5	10	30	15	20	1, 500	<100	100	<. 1	150	200	<10	n.d.	180
<5	<10	>10, 000	30	70	10, 000	7, 000	70	<. 1	500	1, 500	<10	<30	15, 000
5	10	20	20	20	1, 500	<100	100	<. 1	20	200	<10	n.d.	600
<5	20	50	20	30	3, 000	<100	500	<. 1	30	200	10	30	1, 000
<5	10	10	15	50	300	<100	50	<. 1	30	100	<10	n.d.	50
<5	10	15	20	100	2, 000	<100	200	<. 1	100	100	10	<30	160

300 ppm, and WH–29H, which is 500 ppm. Sn <10 except WH–31A, which is 150 ppm.

altered dolomite may reveal stronger and more extensive mineralized areas presently concealed by talus or barren bedrock.

Float samples containing anomalously high amounts of zinc and (or) lead and (or) mercury were found in other drainages in the northwestern part of the Wood Hills (pl. 1). Most of these drainages were not investigated, however, to determine the source of the float, but at locality WH–49 a float train of dark-brown gossan 15–20 feet wide can be traced N. 10° W. for at least 300 feet. Spectrographic analyses of the gossan show 2,000 ppm zinc, 1,000 ppm arsenic, 300 ppm lead, 2 ppm silver, and 200 ppb mercury. Outcrops on either side of the gossan float train are of light-gray dolomite containing light-colored silica boxwork. No prospect pits were observed in this area.

SUMMARY

The purpose of this geochemical reconnaissance study was to determine whether geochemical metal anomalies could be found in the

Pequop Mountains—an area considered unfavorable for the occurrence of ore deposits because of the lack of gossan outcrops, conspicuous alteration, and intrusive rocks. A few metal prospects were known in the Wood Hills.

The discovery of anomalously high concentrations of metals (mainly zinc, lead, mercury, and some silver) in oxidized iron-rich fracture fillings and small gossan pods in silicified limestone and dolomite, chiefly in the Guilmette Formation and Simonson Dolomite of Devonian age, indicates that the Pequop Mountains should not be eliminated from consideration as an area for ore discoveries.

The most successful method of geochemical prospecting in this terrane was analysis for base metals and mercury in float cobbles and pebbles collected in the major drainages and subsequent reconnaissance of drainages that contained metal-rich float. Conventional sampling and analysis of stream sediments failed to reveal any anomalous metal content except in drainage from the Spruce Mountain mining district at the southern end of the Pequop Mountains.

This reconnaissance study does not presume to evaluate the significance of the anomalies discovered. Whether or not the metals came from sizable concealed metal deposits can be determined only by detailed geologic mapping and exploration.

REFERENCES CITED

Bissell, H. J., 1960, Eastern Great Basin Permo-Pennsylvanian strata—Preliminary statement: Am. Assoc. Petroleum Geologists Bull., v. 44, p. 1424–1435.

Brokaw, A. L., Gott, G. B., Mabey, D. R., McCarthy, Howard, and Oda, Uteana, 1962, Mineralization associated with a magnetic anomaly in part of the Ely quadrangle, Nevada: U.S. Geol. Survey Circ. 475, 7 p.

Hewett, D. F., 1964, Veins of hypogene manganese oxide minerals in the southwestern United States: Econ. Geology, v. 59, no. 8, p. 1429–1472.

Robinson, G. B., Jr., 1961, Stratigraphy and Leonardian fusulinid paleontology in central Pequop Mountains, Elko County, Nevada: Brigham Young Univ. Geology Studies, v. 8, p. 93–145.

Snelson, Sigmund, 1955, Geology of the southern Pequop Mountains in Elko County, northeastern Nevada: Univ. Washington, M.S. thesis.

Thorman, C. H., 1962, Structure and stratigraphy of the Wood Hills and a portion of the northern Pequop Mountains, Elko County, Nevada: Univ. Washington, Ph. D. thesis, 278 p.

U.S. GOVERNMENT PRINTING OFFICE:1966