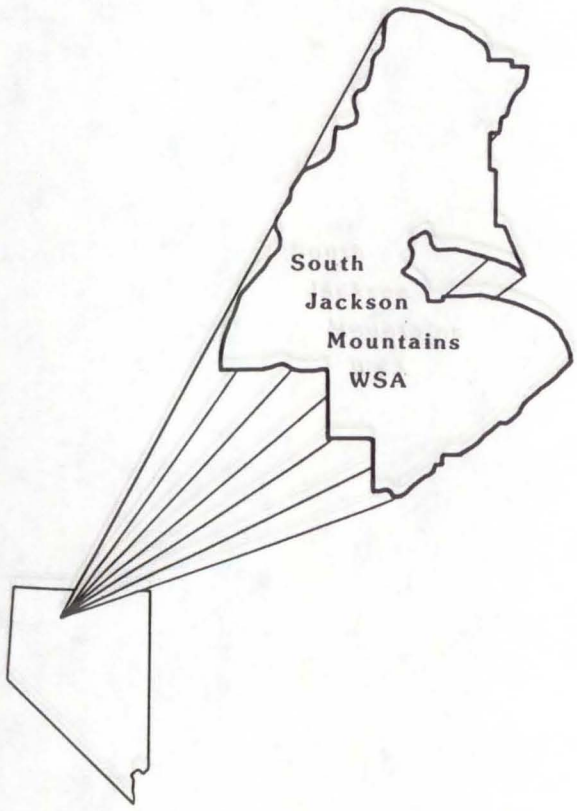
MLA 10-87

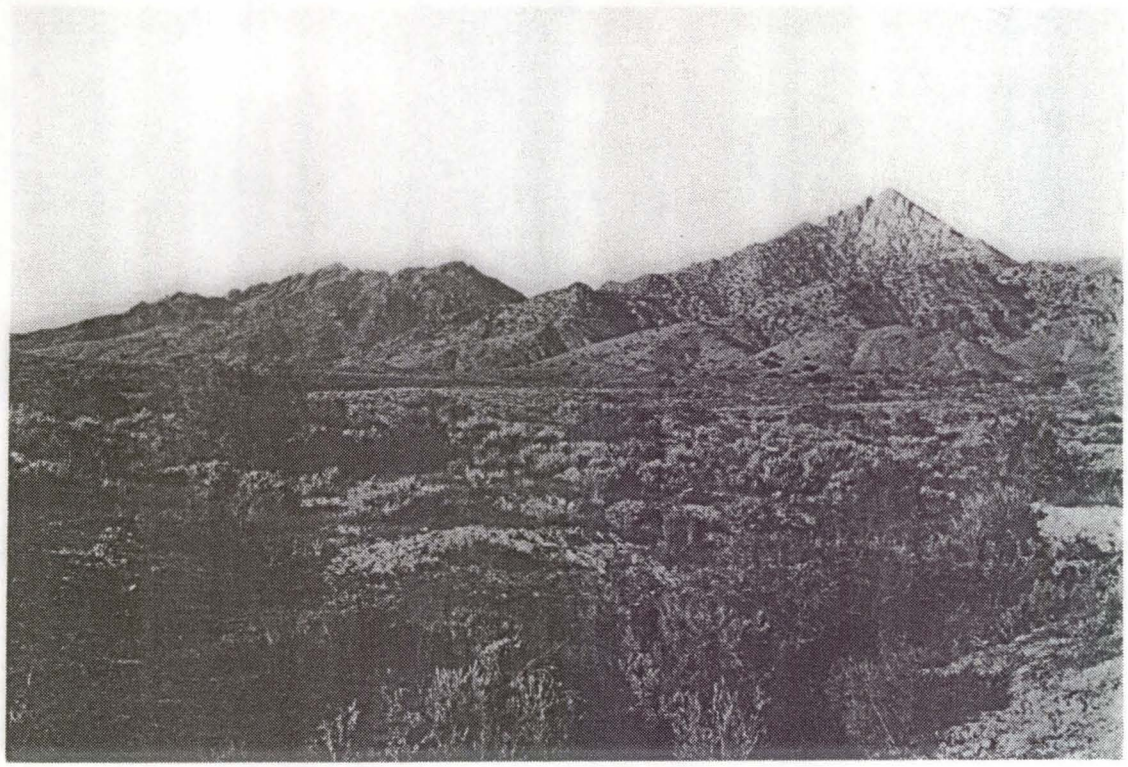
Mineral Land Assessment/1987
Open File Report

Mineral Resources of the South Jackson Mountains Wilderness Study Area, Humboldt County, Nevada



BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR



The Jackson Mountains from the Black Rock Desert, Navajo Peak on the right

MINERAL RESOURCES OF THE SOUTH JACKSON MOUNTAINS WILDERNESS STUDY AREA, HUMBOLDT COUNTY, NEVADA

By
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MLA 10-87

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

BUREAU OF MINES
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PREFACE

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and U.S. Bureau of Mines to conduct mineral surveys on U.S. Bureau of Land Management administered land designated as Wilderness Study 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 Bureau of Mines mineral survey of the South Jackson Mountains Wilderness Study Area (NV-020-603), Humboldt County, NV.

This open-file report will be summarized in a joint report published by the U.S. Geological Survey. The data were gathered and interpreted by Bureau of Mines personnel from Western Field Operations Center, East 360 Third Avenue, Spokane, WA, 99202. The report has been edited by members of the Branch of Mineral Land Assessment at the field center and reviewed at the Division of Mineral Land Assessment, Washington, DC.

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SUMMARY

In 1984 and 1985 the U.S. Bureau of Mines performed a mineral survey of the South Jackson Mountains Wilderness Study Area covering 60,211 acres of mountainous terrain of Humboldt County in northwestern Nevada. Approximately 550 lode claims have been located within or adjacent to the study area from 1900 to the present. Total recorded production for the area is 28.19 ounces gold, 1,105 ounces silver, 959 pounds copper, 6,016 pounds lead, and 12,446 pounds zinc; an additional two carloads from one mine contained an unknown amount of metal. In early 1986, there were eight active properties with a total of 126 claims. Wescord Resources and Long Lac Exploration (Texas) Inc. are involved in a joint exploration of the Jackson Mountains for volcanogenic massive sulfide deposits. Development at the Claudia mine continues in 1986.

Results of the survey indicate that there are no identified mineral resources or reserves within or adjacent to the study area. Twenty-two properties have mineral occurrences containing gold, silver, copper, lead, zinc, iron, antimony, vanadium, and cobalt, with silver, copper, and iron being the most abundant.

Iron occurrences are high grade but very small in extent, occurring as either replacement bodies around the intrusion under Navajo Peak or as occasional volcanogenic lenses in the Happy Creek volcanics on the east side of the area. These occurrences were explored when the Iron King mine was in production during the 1950's.

Vein deposits on the south side of the study area at the Lillian, Tip and Dip, and Claudia properties contain small high-grade shoots of gold, silver, and copper. One occurrence on the east side of the Lillian property probably accounts for a high gold anomaly described by the U.S. Bureau of Land Management, Geology, Energy, and Minerals studies in the area. A 1,000-ft-long mineralized zone exposed at the Claudia mine will be explored for downdip extensions.

Most exploration since 1984 has been for volcanogenic massive sulfide deposits, and resulting information should add greatly to the definition of the minerals of the area. The Red Boy mine, with exposed bedded sulfide veins containing significant concentrations of precious and base metals, is the center of exploration interest. The Clover Creek, Cedar Creek, and Bliss Canyon areas are also being explored. Geophysical anomalies (company surveys) on the northwest side of the study area may represent undiscovered sulfide resources in rocks that are buried under thrust faults.

There are no identified resources of sand, gravel, or other nonmetallic resources in the study area. Limestone outcrops on the west flank of the mountains, while readily accessible, are too far from any potential market to be considered a resource.

INTRODUCTION

This report describes the USBM (U.S. Bureau of Mines) portion of a cooperative study with the USGS (U.S. Geological Survey) to evaluate mineral resources and mineral resource potential of the South Jackson Mountains WSA (Wilderness Study Area) for the BLM (U.S. Bureau of Land Management). The USBM examines individual mines, prospects, claims, and mineralized zones and evaluates identified mineral and energy resources. The USGS evaluates potential for undiscovered resources based on areal geological, geochemical, and geophysical surveys. Results of the investigations will be used to help determine the suitability of the WSA for inclusion into the National Wilderness Preservation System. Although the immediate goal of this and other USBM mineral surveys is to provide data for the President, Congress, government agencies, and the public for land-use decisions, the long-term objective is to ensure the Nation has an adequate and dependable supply of minerals at a reasonable cost.

Setting

The 60,211-acre South Jackson Mountains WSA is in northwestern Nevada 45 mi (mile) northwest of Winnemucca, and can be reached by a number of county and BLM roads that bound the WSA on the west, north, and east (fig. 1). These roads are, for the most part, graded, graveled, and maintained and provide good access except during periods of very wet weather. Approximately 20 mi of unmaintained jeep and mine roads access most of the mines and prospects and are passable only in dry weather. The nearest active railroad line is a mainline of the Western Pacific with a siding 12 mi to the south of the WSA at Jungo, NV.

The terrain consists of a north trending ridge with rugged peaks and drainages flowing east and west into broad flat basins. Elevations range from 4,000 ft (feet) at basin level to 8,923 ft at the summit of King Lear Peak. The higher elevations have apparently been glaciated and cirque basins are at the head of several drainages. The west side of the range is steep with deeply dissected, cliff-faced canyons, and a relief of almost 5,000 ft. The east side has gentler topography with rolling foothills having moderate slopes.

The climate is dry with intermittent streams that carry water only during spring snow melt or occasional heavy rainstorms. Many of the canyons have small springs. Vegetation cover at high elevations consists of juniper, snowberry, and red ozier dogwood, while at lower elevations cover is sagebrush, greasewood, and saltbush. The U.S. Bureau of Land Management Wilderness Technical Report (1983b) identifies one plant in the southwest corner of the WSA as "sensitive" on the Nevada Native Plant Society list, 1982. Major animal species are deer, rabbit, mountain lion, chukar, and mountain sheep. The BLM technical report did not identify any endangered or threatened wildlife species in the WSA.

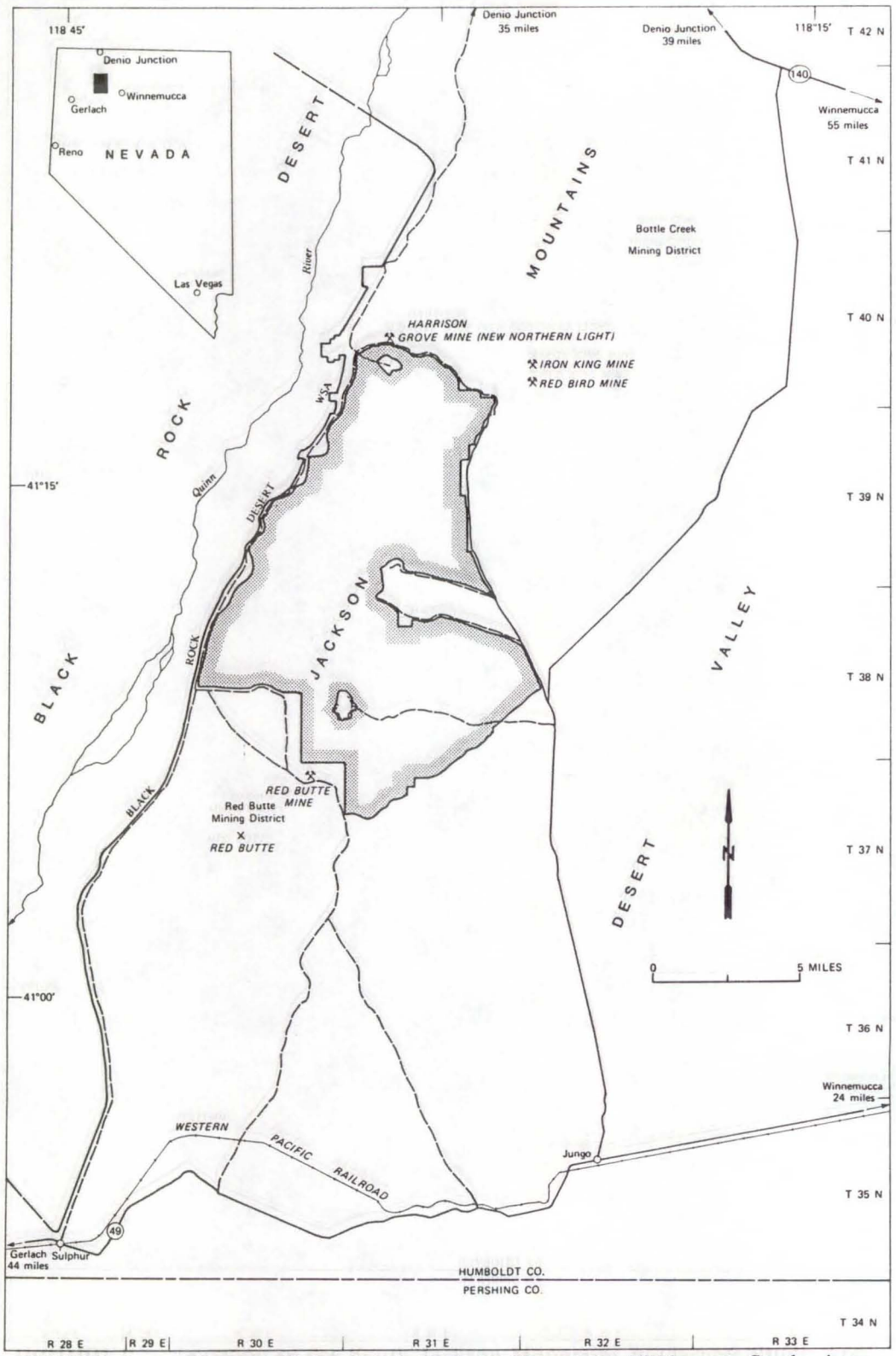


FIGURE 1. – Location of the South Jackson Mountains Wilderness Study Area (NV-020-603), Humboldt County, NV

Previous Studies

Early reports on the Red Butte mining district and the Jackson Creek area by Ransome (1909), Hill (1912), and Vanderburg (1938) contain brief descriptions of early mining activity. During World War II, the USBM examined the Red Boy, Humboldt King, and Harrison Grove (New Northern Light) mines as part of a War Minerals program. The USBM examined the Humboldt King property again for the Defense Minerals Exploration Administration in 1954. The first detailed geologic work on the Jackson Mountains was by Willden (1958, 1960, 1961, 1963, 1964), which included geologic mapping, discussions of geologic history, and descriptions of mineral deposits. Iron deposits in the region were examined by Shawe and others (1962) including several deposits on the east side of the study area. Theses by Solak (1962) and Fisher (1962) describe in detail the geology and magnetic properties of iron deposits in the Iron King mine area. Russell (1981, 1984) mapped and described the geology of the Jackson Mountains. Reports by Barringer Resources, Inc. (1982) and the U.S. Bureau of Land Management (1983a, 1983b, 1983c) include mining and related information on the WSA. Mineral exploration by companies has also resulted in several unpublished reports.

Present Study

Prior to field examination, pertinent literature, county mining records, and USBM, Nevada Bureau of Mines, and BLM files were researched. Claimants, mine owners, and mining companies were contacted to obtain information on claim location, history, and economic geology.

Field work conducted during the summers of 1984 and 1985, consisted of examining mines, prospects, and mineralized sites indicated by prefield research to be within or adjacent to the WSA. Most sites were mapped either by plane table or by Brunton compass and tape. Existing mine and deposit maps were used when available and field checked for accuracy. The WSA was reconnoitered by helicopter and foot or jeep traverses to locate prospects not disclosed by prefield studies. Infrared aerial photographs were scanned to assure total coverage.

A sampling program designed to indicate size and type of mineral resource was applied to each site. Chip samples were taken, when possible, at intervals perpendicular to mineralized structures in order to delineate grade and tonnage. Select samples of vein or mineralized rock were handpicked from mine dumps and stockpiles when the mineral structure was not exposed or was mined out. These samples were used to qualitatively describe the mineral occurrence. Some grab samples were randomly taken in order to estimate a possible resource in a mine dump, or a disseminated mineral occurrence. Petrographic samples were used to study constituents of veins or to better define the nature of the wallrock. Identified resources were classified according to USGS Circular 831.

Two hundred and forty-nine samples were collected during the field study. Additional sample analyses from mining companies and previous USBM studies were used for underground workings that are now inaccessible. Samples were crushed, pulverized, and split with one split sent to the

Bureau of Mines Research Center, Reno, NV, and the other retained at the Western Field Operations Center for future reference. Gold and silver were analyzed by fire-assay/ICP (inductively coupled plasma) methods with detection limits of 0.007 and 0.3 ppm (parts per million), respectively [1 ppm = 0.029 oz/ton (troy ounce)]. Other elements were analyzed using ICP and atomic absorption methods. At least one sample from each mineralized structure was analyzed for 40 1/ elements by semiquantitative spectrometry. Anomalous elements were reanalyzed by quantitative methods to confirm values. All samples were checked for radioactivity and fluorescence. A complete set of sample analyses is on file at the Western Field Operations Center, E. 360 Third Ave., Spokane, WA 99202 and is available to the public.

ACKNOWLEDGEMENTS

The assistance and cooperation of BLM personnel, Winnemucca, NV, especially Vic Dunn; claim owners Terry Harris, Fred Sherill, and Bud Johnson; and Billiton Exploration USA, Inc., Wescord Resources, and Long Lac Mineral Exploration (Texas), Inc. are very much appreciated. Bureau of Mines personnel Vaughn Girol, Spencee Willett, and Vince Vandenbasch assisted in the field study and are commended for their input.

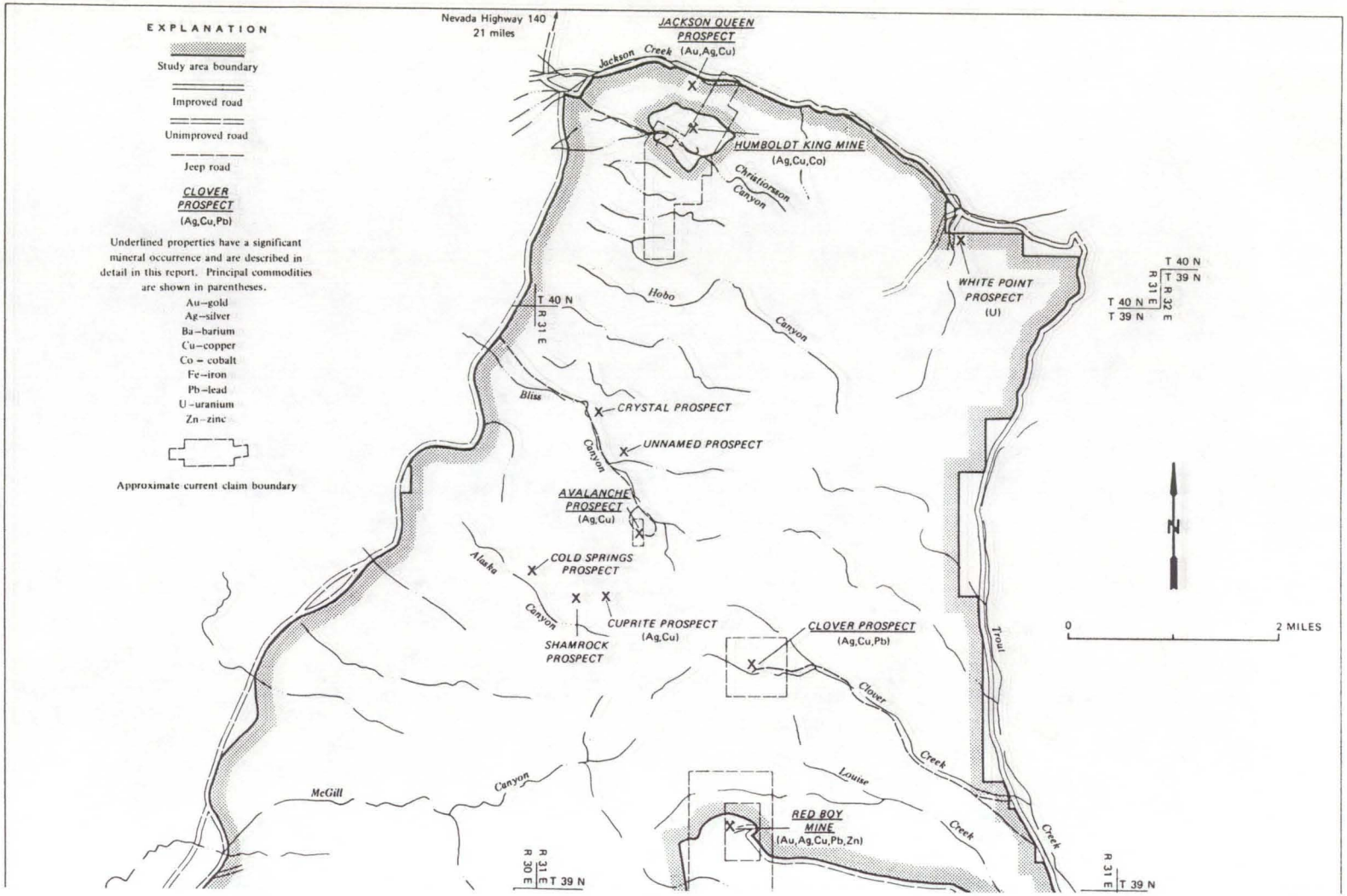
GEOLOGIC SETTING

Regional Geology

The WSA is on the south end of the Jackson Mountains, a fault block range of the Basin and Range Province of northwest Nevada (fig. 2). The geologic history of the Jackson Mountains is complex and not well understood. The following interpretations are from Willden (1958, 1960, 1961, 1963, 1964) and Russell (1981, 1984).

Because of the unclear relationship between rock sequences, Russell (1984) divided the rocks into tectonostratigraphic units and subunits of distinctive stratigraphy bounded by faults. Some of the units appear to be allochthonous and may be exotic terrains or transported remnants of microplates. The oldest, the McGill Canyon unit, consists of deepwater turbidite, mudstone, sandstone, and limestone ranging in age from Devonian to Permian. These rocks are exposed in upturned nappes along the steep western slopes of the WSA. Next in series is the Jackson Mountain unit which consists of Mesozoic rocks grouped into three subunits. The first subunit, the Boulder Creek beds, are pelagic sedimentary rocks that accumulated marginal to a basin in the upper Triassic age. These beds may be, in part, laterally equivalent in time to the next subunit, the Triassic-Jurassic Happy Creek igneous complex.

1/ Aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, chromium, cobalt, copper, gallium, gold, iron, lanthanum, lead, lithium, magnesium, manganese, molybdenum, nickel, niobium, palladium, phosphorus, potassium, platinum, scandium, silicon, silver, sodium, strontium, tantalum, tellurium, tin, titanium, vanadium, yttrium, zinc, and zirconium.


EXPLANATION
Study area boundary
Improved road
Unimproved road
Jeep road
CLOVER PROSPECT (Ag,Cu,Pb)
Underlined properties have a significant mineral occurrence and are described in detail in this report. Principal commodities are shown in parentheses.
Au–gold
Ag–silver
Ba–barium
Cu–copper
Co – cobalt
Fe–iron
Pb–lead
U–uranium
Zn–zinc
Approximate current claim boundary
Nevada Highway 140
21 miles
JACKSON QUEEN PROSPECT (Au,Ag,Cu)
Jackson Creek
HUMBOLDT KING MINE (Ag,Cu,Co)
Christianson Canyon
WHITE POINT PROSPECT (U)
T 40 N
R 31 E
T 40 N
T 39 N
R 31 E
R 32 E
Hobo
Canyon
Bliss
CRYSTAL PROSPECT
UNNAMED PROSPECT
Canyon
AVALANCHE PROSPECT (Ag,Cu)
Alaska
COLD SPRINGS PROSPECT
Canyon
CUPRITE PROSPECT (Ag,Cu)
SHAMROCK PROSPECT
CLOVER PROSPECT (Ag,Cu,Pb)
Trail
Clover
Creek
Louise
Creek
Creek
McGill
Canyon
RED BOY MINE (Au,Ag,Cu,Pb,Zn)
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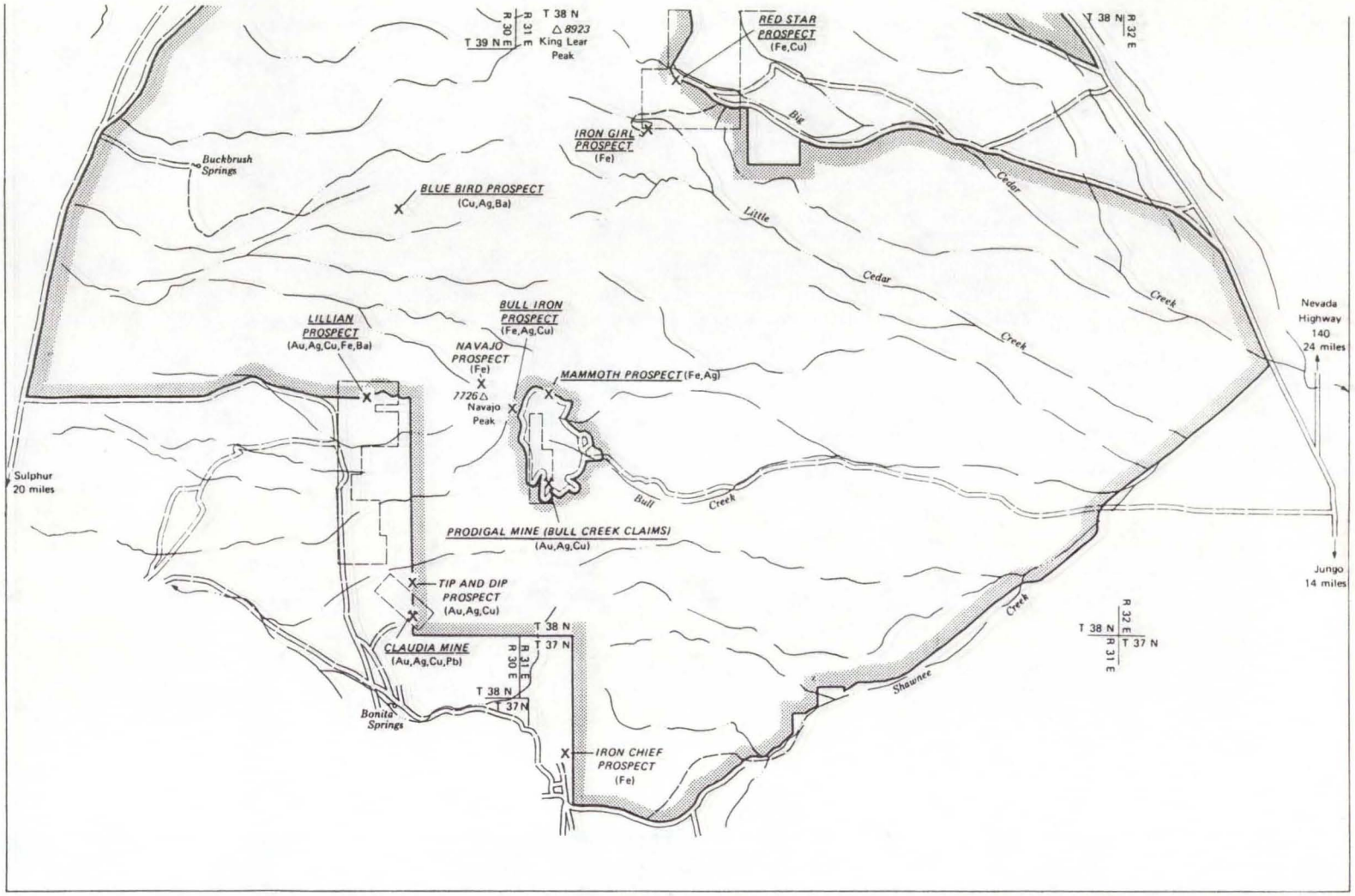


FIGURE 2. – Mines and prospects in and adjacent to the South Jackson Mountains Wilderness Study Area (NV-020-603), Humboldt County, NV

The complex contains thick sequences of andesite, basaltic andesite, dacite, and diorite whose source was subaerial and subaqueous volcanic eruptions along an intraoceanic volcanic arc. These two subunits comprise most of the bedrock in the central part of the WSA. The third subunit is the Cretaceous King Lear Formation that was deposited as fluvial conglomerate, sandstone, mudstone, and lacustrine limestone in intermountain basins. The King Lear of Russell (1984) includes the Pansy Lee Formation of Willden (1963), a rock sequence that differs only in the source area for sediments. Tertiary volcanic and sedimentary rocks are exposed on the southwest corner of the WSA. The only other Tertiary rocks are on the northeast side and consist of dacite flows and a dacite porphyry intrusion.

Four distinct types of igneous rock intruded the Jackson Mountains from the Jurassic to Tertiary periods. Small plugs and dikes of felsite, quartz-hornblende porphyry, and plagioclase-clinopyroxene-hornblende porphyry intruded the Happy Creek complex. A larger stock of diorite underlies Navajo Peak and cuts both Happy Creek and King Lear rocks.

Regional deformation or tectonism started in the Middle Jurassic with broad folding caused by northwest-southeast compressional forces. All pre-Cretaceous rocks had undergone regional metamorphism with mineral assemblages characteristic of the greenschist facies. During early Cretaceous time, additional compression resulted in more folding and the McGill Canyon unit was thrust over the younger Jackson Mountain unit. Local intermountain basins were also formed into which the King Lear Formation was deposited on an erosional unconformity. A second phase of major thrust faulting occurred in Middle Cretaceous. Tertiary deformation in the Basin and Range Province was a response to vertical stress with high-angle faulting and block uplift. Range front faults on the west side of the WSA are probably buried under the alluvium of the Black Rock desert and on the east side under Desert Valley. The abundance of Tertiary volcanic rocks and lineaments apparent on aerial photographs suggest large caldera structures in the region. The Red Butte district and the southwest corner of the WSA may be part of a caldera structure.

Geology of Mineral Occurrences

There are four types of mineral occurrences exposed at properties that are in or adjacent to the WSA: (1) low grade epithermal precious metal occurrences in altered country rock; (2) fissure-filling veins along fracture or fault zones in areas where hydrothermal fluids accumulated during late stages of intrusive events; (3) contact replacement occurrences bordering intrusions such as the diorite body under Navajo Peak; (4) volcanogenic massive sulfide occurrences in andesite, representing exhalite from submarine hot spring vents active when a magmatic arc was forming during Triassic-Jurassic times.

Two areas have been targeted for epithermal deposit exploration. Such deposits result from low temperature, near-surface phases of intrusive events such as hot springs. An unpublished company report by Wescord Resources, 1984, classified an area between Bliss and Hobo Canyons as having "epithermal gold potential, bulk-tonnage sulfur type." The country rocks are Triassic sediments and several prospects in Bliss

Canyon have hot spring-like deposits of layered calcite. The Lillian prospect on the southwest side of the WSA is, in part, on Tertiary volcanic and sedimentary rocks that are locally silicified into jasperoid with occasional barite veins. It has been suggested (Vic Dunn, personal commun., 1984) that these Tertiary volcanics may be a part of a large caldera that covers most of the Red Butte district (fig. 1), a favorable environment for epithermal deposits. Barringer Resources, Inc. (1983, p. 51) found a strong anomaly for gold in a stream sediment survey on the Lillian prospect and labeled the area as having "significant" correspondence with an epithermal model.

Vein deposits are found on a number of properties in the WSA, mainly in the south part associated with the diorite stock under Navajo Peak and parts of the Red Butte district. Veins bearing gold, silver, and copper at the Prodigal mine (Bull Creek claims) are hosted by limestone and shale of the Cretaceous King Lear Formation proximal to the diorite intrusion contact. Gold-, silver-, and copper-bearing veins on the east side of the Lillian prospect are along north to northeast-trending faults in the diorite intrusion. The Claudia mine is in the Red Butte district and also has veins along faults and fractures in the diorite. The veins contain various amounts of gold, silver, copper, and lead. Ransome (1909, p. 30) stated that mineral occurrences in the Red Butte district are associated with Tertiary aplitic dikes suggesting that the late stage intrusive events of the diorite stock may have been the source for mineralization for these vein deposits.

Contact-type deposits are along the boundary of the diorite stock on the south end of the WSA. Occurrences of massive magnetite and hematite are at the Lillian, Navajo, and Bull Iron properties in the Navajo Peak area, and at the Iron Chief in the Red Butte district. These iron occurrences are short, lenticular replacement bodies along fractures in the andesite that often parallel the contact. In addition to the iron, they occasionally contain small amounts of copper, gold, silver, and vanadium. There are at least three possible sources for these metals. Willden (1963, p. 53-57) concluded that the iron occurrences in the Navajo Peak area were derived from the iron constituent of the andesite, which was bleached during alteration by the intrusion to an extremely sodium-rich rock. Another source could be the intrusive magma itself. The proximity of these occurrences to the diorite stock would be supportive evidence. Finally, the fact that the King Lear Formation, which is cut by the diorite stock, contains clasts of magnetite and hematite suggests pre-existing volcanogenic deposits in the andesite were the source. The geology is not fully understood in this area and more work should be done.

The most recent exploration activity in the Jackson Mountains has been for volcanogenic massive sulfide deposits. This type of deposit originated from submarine hot springs associated with an interoceanic magmatic arc active in Triassic-Jurassic times. The Boulder Creek beds and the Happy Creek volcanics are the host rocks for these deposits. Exhalites with gold, silver, lead, zinc, and iron accumulated downcurrent from the vent as flat deposits with thicker sections near the vent or in topographic depressions. During the complex deformation of the Jackson

Mountains, originally bedded metal accumulations would have been broken up and in some cases, redeposited along faults and fractures. These volcanogenic deposits can be grouped into three catagories, iron occurrences, bedded sulfide veins, and stringer veins.

Massive and banded iron deposits that occur at the Red Star, Iron Girl, and Mammoth properties are similar to the large iron deposits in the Iron King mine area which are part of the same volcanogenic system. Bedded sulfide veins with values of gold, silver, copper, lead, and zinc are exposed at the Red Boy mine and at the Clover prospect. The mineral occurrence at the Avalanche prospect in Bliss Canyon has been interpreted by Wescord Resources (unpublished company report, 1984) as a copper-rich pelite interbedded in the Happy Creek igneous complex. The various prospects in Alaska Canyon and the Blue Bird prospect to the south may be associated with small bedded sulfide veins in andesites which have been partially remobilized along fractures and faults. Copper- and silver-bearing stringer vein deposits at the Humboldt King, Jackson Queen, Bull Iron, and Prodigal properties may be associated with vent zone areas.

MINING HISTORY

While regional mining interest for precious metals dates back to the 1860's, it was not until around 1900 that any mining activity started in the Jackson Mountains. The Red Butte unorganized mining district on the southwest side of the WSA was first prospected for gold and copper in 1907. Total production from the district was three carloads of copper-lead ore, one carload of lead-zinc-silver ore, and about 20 tons of antimony ore with most shipped during World War I (Vanderburg, 1938, p. 41). The Claudia mine and the Iron Chief prospect are the only properties in the district that are within or adjacent to the WSA. The Claudia mine was first developed in the 1910's, produced in 1919 and 1947 (U.S. Bureau of Mines production records), and is currently being developed for possible production of precious metals in the future. The Iron Chief was active probably in the 1950's but there is no record of any production of iron ore. The Prodigal mine (Bull Creek claims), just north of the Red Butte district in the Navajo Peak area, produced ore containing gold, silver, and copper in 1923 (U.S. Bureau of Mines production records).

The Jackson Creek unorganized mining district on the north side of the WSA is centered on the Harrison Grove mine (New Northern Light) which was patented in 1907. Hill (1912, p. 213) reported copper mining in the Jackson Creek area shortly thereafter. Based on War Minerals Reports and our investigation, production from the district probably totals no more than 1,000 tons of copper ore. The only properties in or adjacent to the WSA in the district are the Jackson Queen and the Humboldt King. These properties were active in the 1910's and 1920's with intermittent exploration up to 1986. The Humboldt King mine probably had a small amount of production. Exploration of copper occurrences in Christiorsson Canyon and on the west side of the Humboldt King property by Louisiana Land and Exploration Company and McPhar Geophysics in 1973 failed to find any minable deposits.

The iron deposits of the Jackson Mountains were explored and developed during the 1950's and 1960's. The Iron King mine, about 1.5 mi northeast of the WSA, and the Red Bird mine, just south of the Iron King, collectively produced about 1.3 million tons of high-grade magnetite ore between 1952 and 1966 (Moore, 1971, p. 174 and 178). Ore was trucked to a siding at Jungo, NV, and shipped by rail to steel manufacturers in the midwest. During this period, most of the iron occurrences in the WSA were explored including occurrences on the Mammoth, Lillian, Bull Iron, Iron Girl, Iron Chief, Navajo, and Red Star properties. At least three of these prospects, the Bull Iron, Red Star, and the Iron Girl, were drilled in an unsuccessful attempt to develop minable deposits. At present, there is little or no interest in the iron deposits in the Jackson Mountains.

The Red Boy mine on the east side of the WSA produced small amounts of gold-silver-lead-zinc ore in 1940, 1943, and 1948 (U.S. Bureau of Mines production records).

Recent mining activity has been mainly exploration and claim staking. In the late 1970's, the Lillian claim group was mapped and sampled for low grade, bulk-tonnage precious metal deposits. Wescord Resources, Reno, NV, initiated an exploration program in 1984 for volcanogenic massive sulfide deposits in the Jackson Mountains. The program included mapping, sampling, and locating the Avalanche, Red Boy, Red Star, and Clover properties. In 1985, Wescord's interest was leased to Long Lac Minerals Exploration (Texas), Inc., Sparks, NV, which plans to continue the program with more detailed mapping and sampling, geochemical surveys, and possibly drilling.

County claim location records indicate that approximately 550 lode claims have been located within or adjacent to the WSA from 1900 to the 1986. Many of these claims are relocations of previous claims; none were patented. In early 1986, there were eight active properties with a total of 126 claims.

APPRAISAL OF MINERAL RESOURCES

There are no identified mineral resources exposed in the South Jackson Mountains WSA. A number of mineral commodities do occur including gold, silver, copper, lead, zinc, iron, vanadium, barium, and cobalt; silver, copper, and iron are the most abundant.

Exploration since 1984 has been for volcanogenic massive sulfide deposits. The size and extent of possible deposits will become more clear as exploration continues. The Red Boy mine has the best exposures of bedded sulfide veins with significant values in precious and base metals. While this mineral system is mostly outside of the WSA, an extension may be in the Clover Creek and Cedar Creek areas inside the WSA. Long Lac Minerals Exploration plans field work at the Red Boy mine area in 1986. Other volcanogenic related occurrences associated with Happy Creek volcanic rocks that will be the focus of future exploration includes metal bearing veins on the Avalanche, Red Star, Iron Girl, Mammoth, Bull Iron and Prodigal properties.

Veins bearing silver, copper, and cobalt on the Humboldt King property constitute the largest exposed mineral occurrence examined during this study. While most of the exposed mineral occurrences are outside of the WSA, private company geophysical surveys show anomalies that may indicate additional undiscovered mineralization at depth on the west and south sides of the property within the WSA. A magnetometer survey of the WSA by the USGS (D. Plouff, written commun., 1985) suggests a large, unexposed metal occurrence between Hobo and Bliss Canyons that is possibly analogous to the Humboldt King property.

The iron occurrences within the WSA are unlikely to be mined in the foreseeable future. These small occurrences were explored when the Iron King mine was active and there was a local market for iron ore.

Gold-silver-lead-antimony veins at the Claudia, Tip and Dip, and Lillian properties have encouraged mining interest, probably due to the high grade in some parts of the occurrences. The Claudia mine has the only exposed sulfide-bearing zone of any size; recent plans to start mining at the Claudia are based on an assumption by the mine owners of sufficient reserves at depth to support a small mining operation.

While epithermal precious metal resources in the WSA have yet to be delineated, the anomalous gold in stream sediments and the silicified Tertiary rocks on the west side of the Lillian claims are favorable characteristics of such deposits.

MINES AND PROSPECTS

Thirteen properties with mineral occurrences are described in alphabetical order below and summarized in Table 1. Nine prospects with no apparent mineral occurrence, or with mineral structure not sufficiently exposed to permit full evaluation, are only listed in Table 1. All are located on figure 2.

Avalanche Prospect

The prospect is located on the south side of Bliss Canyon about 1.5 mi up from the canyon mouth at an elevation of 5,560 to 6,160 ft (fig. 2). Access from State Highway 140 is by 24 mi of paved and graveled county roads and 3 mi of unmaintained jeep trail that is washed out at the canyon mouth.

County mining records indicate that the original claim staking was between 1904 and 1907. From 1919 to 1921 about 20 claims were located; underground workings along with a number of hand-dug prospect pits presumably date back to this time. Between 1956 and 1962, prospecting included bulldozer trenching of the area around the older workings. Except for a small stope in an adit, there is no indication of production. The prospect was relocated in 1982 as the Copperhead claims and in 1985 as the Avalanche claim. The current owner, Wescord Resources of Reno, NV, has leased the property to Long Lac Mineral Exploration (Texas) Inc. Long Lac plans an exploration program for 1986.

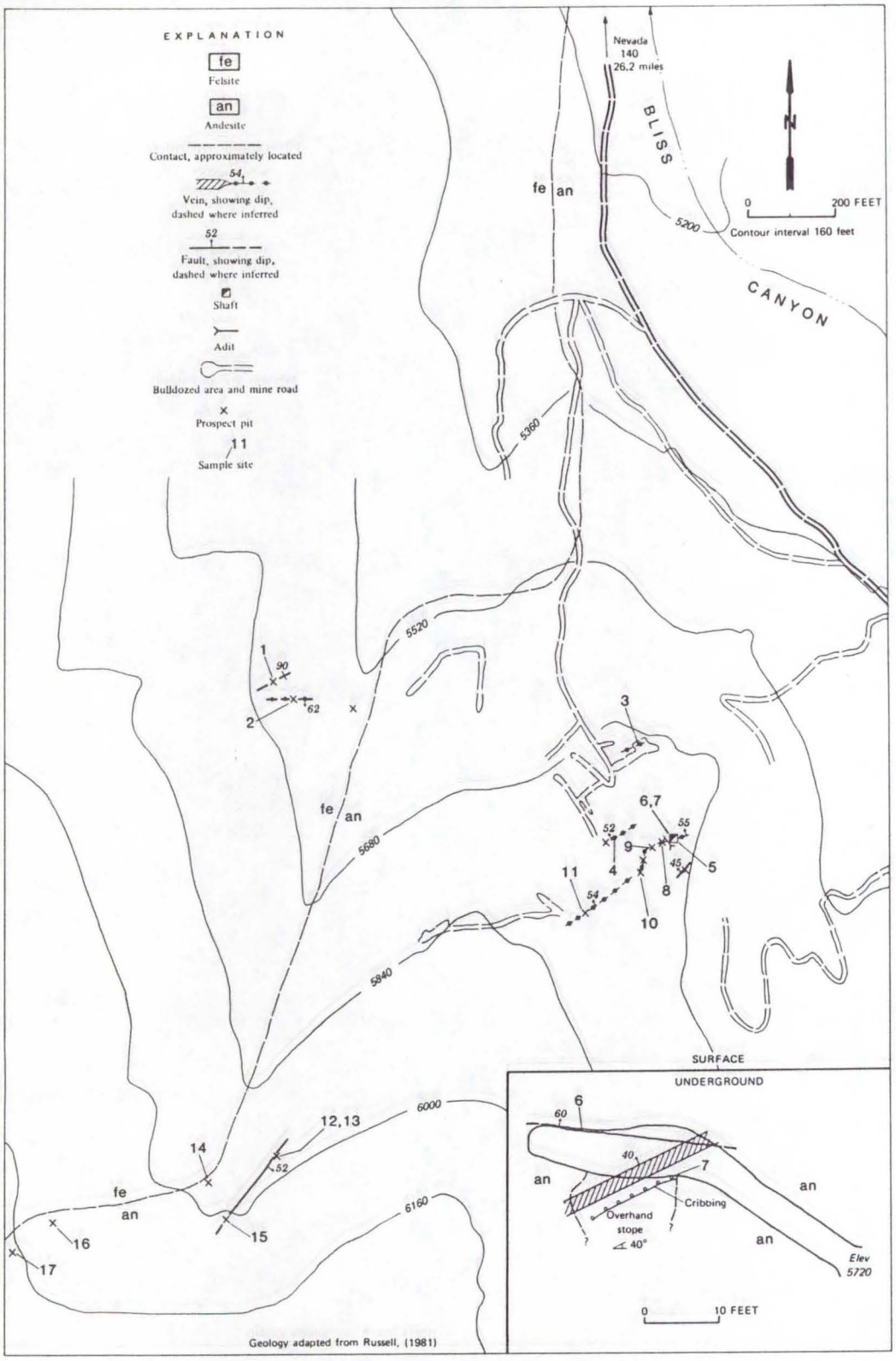


FIGURE 3. – Workings and sample sites of the Avalanche prospect

Data for samples shown in figure 3

(N, none detected; NA, not applicable)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
1	Chip	10.0	Fault zone containing malachite, limonite, hematite, and brecciated felsite adjacent to andesite xenolith----------	N	1.113	0.259
2	do--	1.7	Vein containing malachite, azurite, chalcocite and brecciated, altered felsite adjacent to andesite xenolith----------	0.04	20.47	8.99
3	do--	.08	Vein containing barite, malachite, and arsenopyrite in andesite----------	N	35.03	11.7
4	do--	.04	do----------	.02	24.78	11.8
5	do--	3.4	Limonite-stained, fractured andesite----------	N	N	.041
6	do--	.3	Heavily limonite-stained fault containing gouge, and small amounts of malachite and quartz in andesite----------	N	N	.114
7	do--	3.2	Intersection of fault and a vein containing barite, malachite, chalcanthite, arsenopyrite, and brecciated andesite----------	N	3.489	3.3
8	do--	2.6	Vein containing malachite, azurite, chalcocite, hematite, barite, quartz, and brecciated andesite--	.01	18.17	6.9

Data for samples shown in figure 3--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
9	Chip	4.0	Vein containing malachite, azurite, limonite, and sheared andesite	3.797	1.85	
10	do--	3.0	Limonite-stained, fractured andesite	N	N	0.020
11	do--	9.9	Vein containing malachite, quartz, limonite, and sheared andesite	N	1.745	.31
12	Grab	NA	Limonite-stained, sheared andesite containing pyrolusite and quartz from pit dump	N	N	.0028
13	Chip	3.0	Silicified fault zone containing jasperoid, limonite, hematite, barite, and altered andesite	N	.42	.0027
14	Grab	NA	Altered andesite and fine-grained magnetite from pit dump	N	N	.0026
15	Chip	10.0	Fault containing epidote, magnetite, minor quartz, and a bleached, iron-stained andesite	N	.48	.0027
16 1/	Grab	NA	Massive magnetite, barite, and ankerite in andesite from small stockpile	N	N	.0037
17	do--	NA	Silicified andesite float containing magnetite and epidote	N	N	.0018

1/ Also contained 37.5% iron.

Workings consist of 15 prospect pits, one 50-ft long adit with a small overhead stope, one six-ft deep shaft, and about 5,100 ft of bulldozer scraps and mine roads (fig. 3).

A number of mineral occurrences, trending northeast and dipping northwest, are mainly in andesite of the Happy Creek igneous complex (fig. 3). The main mineral occurrence (sample sites 5, 7-11) is about 340 ft long and averages 4.2 ft wide. At least two small veins are exposed in the bulldozed area just north of the underground workings (sample sites 3 and 4). These veins are oxidized and contain malachite, azurite, chalcocite, and arsenopyrite in a gangue of barite, calcite, quartz, and limonite. Lenses of magnetite with epidote, barite, calcite, and quartz are exposed at sample sites 14, 16 and 17, near the andesite-felsic rock contact. At sample site 1 thin, alternating layers of calcite and hematite (fig. 4) suggest past hot spring activity. Small amounts of jasperoid or chert were found at sample sites 12 and 13. The two mineral occurrences located within the felsic rock (sample sites 1 and 2) are associated with small pendants of andesite.

Alignment of veins with local faulting suggest they were hydrothermally emplaced along zones of weakness in the andesite as fissure-filling veins. However, initial exploration by Wescord Resources interpreted the copper-rich zone as a pelite, a fine-grained, metamorphosed sediment, interbedded with the andesite. This pelite horizon is thought to be a distal remnant of a volcanogenic massive sulfide system with vent-type deposits 4.5 mi to the north.

Seventeen samples are located on figure 3; their descriptions and analyses appear in the accompanying unnumbered table. Assays from veins (nos. 1-5, 7-11) ranged from zero to 35.03 ppm (1.02 oz/ton) silver and averaged 10.9 ppm (0.32 oz/ton); copper values ranged from 0.02 to 11.8 percent and averaged 4.5 percent. Samples 2, 3, 4, 12, 13, 16, and 17 were tested for barium and contained 0.296, 8.4, 5.3, 0.82, 1.68, 1.33, and 0.92 percent, respectively. Sample 2 contained 0.56 percent zinc and samples 14, 15, and 16 averaged 0.55 percent arsenic.

No resources were identified on the property. However, if concentrations of high-grade samples such as those at sample sites 3 and 4, are more typical of unexposed parts of the veins, or if these mineral occurrences represent part of a larger, unexposed volcanogenic deposit, then there is a possibility for undiscovered copper and silver resources (Sorenson and others, 1987, p. B8).

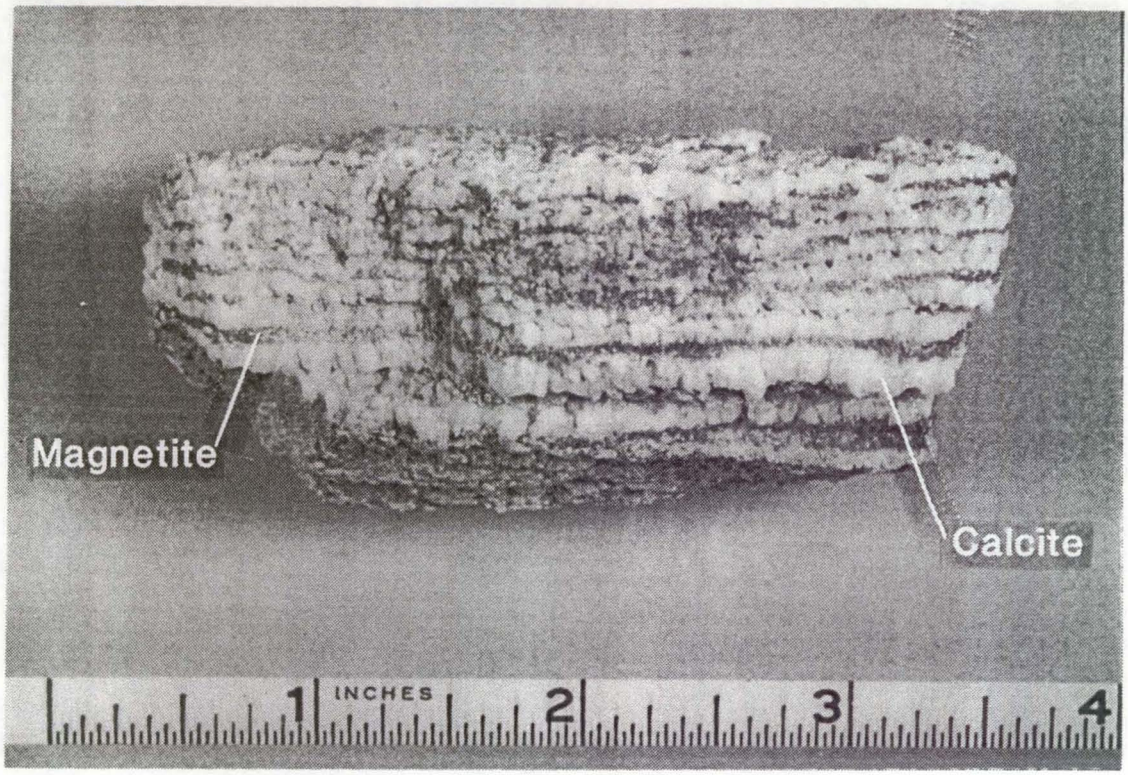


FIGURE 4. - Alternating layers of magnetite and calcite, Avalanche prospect.

Blue Bird Prospect

The Blue Bird is on the west slopes of the Jackson Mountains, about 2 mi southwest of King Lear Peak at an elevation between 5,640 and 5,880 ft (fig. 2). Access is from State Highway 140 by 8 mi of paved or graveled county roads, 3.5 mi of unmaintained jeep roads, and 0.7 mi overland.

The workings, consisting of four prospect pits or trenches, and three adits totaling 120 ft in length (fig. 5), probably date back to the late 1920's when the property was claimed as the Lost Spanish and Black Ox claims. In 1962, it was relocated as the Blue Bird No. 1 and No. 2 claims. There is no indication of any production from this property.

A number of short, 0.4 ft to 3.0 ft wide hydrothermal veins are in shear zones within fine-grained volcanic rocks of the Happy Creek igneous complex that include basalt and greenstone. Veins consist of sheared volcanic rock with hematite, limonite, clay gouge, barite, and the secondary copper minerals malachite, azurite, chrysocolla, and cuprite. The wallrock appears silicified and bleached at sample site 1, but could be a felsic tuff interbedded in the volcanic rocks. At most exposures, the wallrock has been argillically altered.

Ten samples are located on figure 5 and are described in an accompanying unnumbered table. Precious metal assays are generally low and copper assays high, ranging from 0.006 to 10.2 percent. The presence of low but constant amounts of arsenic indicates that arsenopyrite is probably a minor constituent of the unexposed primary sulfides. Six samples averaged 0.6 percent manganese.

Silver and high grade copper occurrences at the Blue Bird prospect are too small and discontinuous to be a resource.

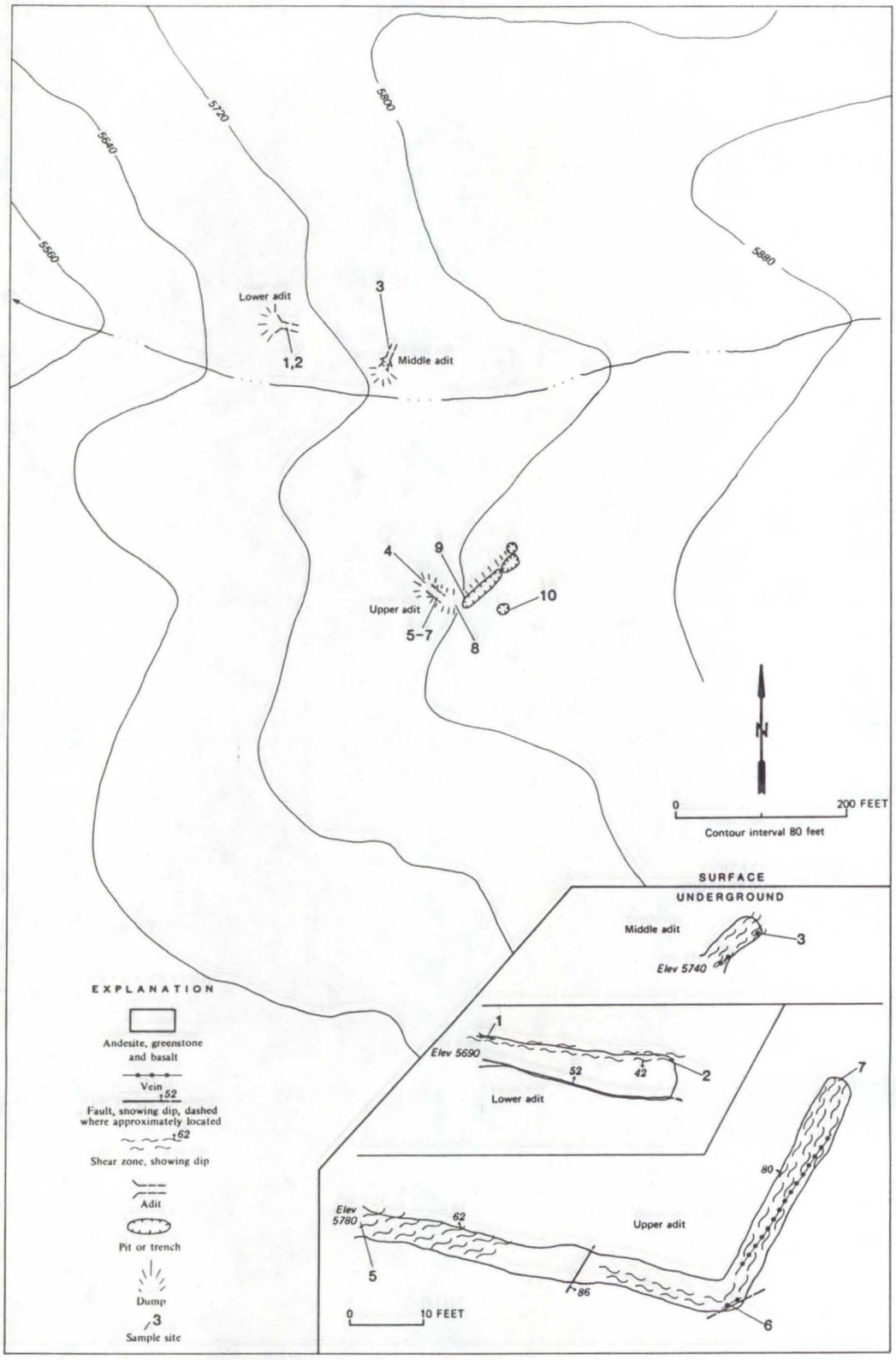


FIGURE 5. – Workings and sample sites of the Blue Bird prospect

Data for samples shown in figure 5.

(N, none detected; NA, not applicable)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
1	Chip	0.4	Vein containing malachite, chrysocolla, specular hematite, magnetite, and limonite in a sheared, silicified andesite----------	N	5.694	6.2
2	do--	2.0	Shear zone containing gouge and fractured andesite----	N	N	.0069
3	do--	1.3	Vein containing malachite, chrysocolla, possible cuprite, magnetite, hematite, limonite, and barite in sheared basalt----------	N	2.229	5.3
4	Grab	NA	Fine-grained volcanic rock from adit dump----------	N	.37	.006
5	Chip	2.0	Shear zone containing malachite, chrysocolla, and greenstone----------	0.013	2.537	3.5
6	do--	3.0	Vein containing malachite, hematite, and limonite, and sheared fine-grained volcanic rock----------	N	.500	.6
7	do--	1.0	Shear zone containing minor malachite, hematite-limonite gouge, and calcite stringers----------	N	N	.27
8 1/	Select	NA	Fine-grained volcanic rock containing malachite, azurite, cuprite, and barite from trench dump---------	N	6.493	8.4
9	Chip	3.0	Vein containing malachite, azurite, chrysocolla, cuprite, barite, and sheared greenstone----------	.028	1.851	3.4

Data for samples shown in figure 5.--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
10 2/	Select	NA	Sheared greenstone containing malachite, chrysocolla, azurite, cuprite, and barite from pit dump----------	.007	11.87	10.2

1/ Also contained 1.26% arsenic and 3.6% barium.
2/ Also contained 1.26% arsenic.

Bull Iron Prospect

The Bull Iron prospect is on the east side of Navajo Peak at the head of Bull Creek (fig. 2). Elevations range from 6,950 to 7,300 ft. Access is from Winnemucca, NV, by 50 mi of graveled county roads and 11.5 mi of unmaintained jeep road. A gate on private land near the county road may restrict access to the jeep road.

The copper exposures on the property were most likely explored and located in the 1920's when development peaked at the Prodigal mine, 0.5 mi to the south. Iron occurrences were first located in 1941 as the Republic Steel prospect. In 1949, the property was relocated as the Bull Iron prospect by the Iron King Royal Company. In the 1950's, regional interest in iron deposits resulted from mining operations at the Iron King and Red Bird mines about 13 mi to the north (fig. 1). A Bureau of Mines Preliminary Examination Report in 1953 described the prospect as having 1,000 ft of bulldozer trenches centered on a small outcrop of hematite. Dodge Construction Company diamond drilled the prospect in 1953 and failed to find any iron resources. By 1962 the prospect consisted of 20 claims known as the Low prospect and workings had extended to the south, uncovering several more iron occurrences (Shawe and others, 1962, p. 109-110). In 1985, there was no mining activity. Mineral occurrences are exposed by about 8,000 ft of bulldozer scrapes, pits, and trenches across 32 acres (fig. 6).

Ten areas of iron occurrence and three areas of copper-silver occurrence are near the contact between a Cretaceous diorite stock and rocks of the Triassic-Jurassic Happy Creek igneous complex (fig. 6). Andesite and dacite of the Happy Creek complex are the host rock; the mineral occurrences within the diorite are associated with andesite roof pendants. Iron mineralization consists of irregular shaped bodies of massive hematite and magnetite with varying amounts of calcite, quartz, and limonite along with inclusions of altered andesite. Dimensions of these bodies range from several feet to several hundred feet in width and there appears to be no structural control other than possibly the joints in the andesites. Some outcrops show flow banding while others contain andesite or dacite breccia. The breccia, containing angular clasts (fig. 7), could be either a flow breccia, created during the original volcanic eruption (Willden, 1963, p. 10-11), or an early stage hydrothermal breccia from a breccia pipe (Polovina, 1984, p. 162-163). Copper-silver occurrences are limited to small zones of brecciated dacite or andesite. The matrix of the breccia contains quartz, hematite, magnetite, and lesser amounts of tetrahedrite, bornite, chrysocolla, and limonite.

The copper-silver mineralization may have been a hydrothermal component of the diorite intrusive event. The distribution of iron around the diorite-andesite contact suggests that they are replacement or scarn-type bodies. Willden (1963, p. 53-57) believes that the iron mineralization near Navajo Peak was derived from andesite that has been bleached, or subjected to alkali metasomatism by the diorite intrusion. The iron may have been leached then concentrated along joints in the andesite. Wescord Resources (unpublished company report, 1984) believes that the Navajo Peak area was probably a vent zone for a massive sulfide,

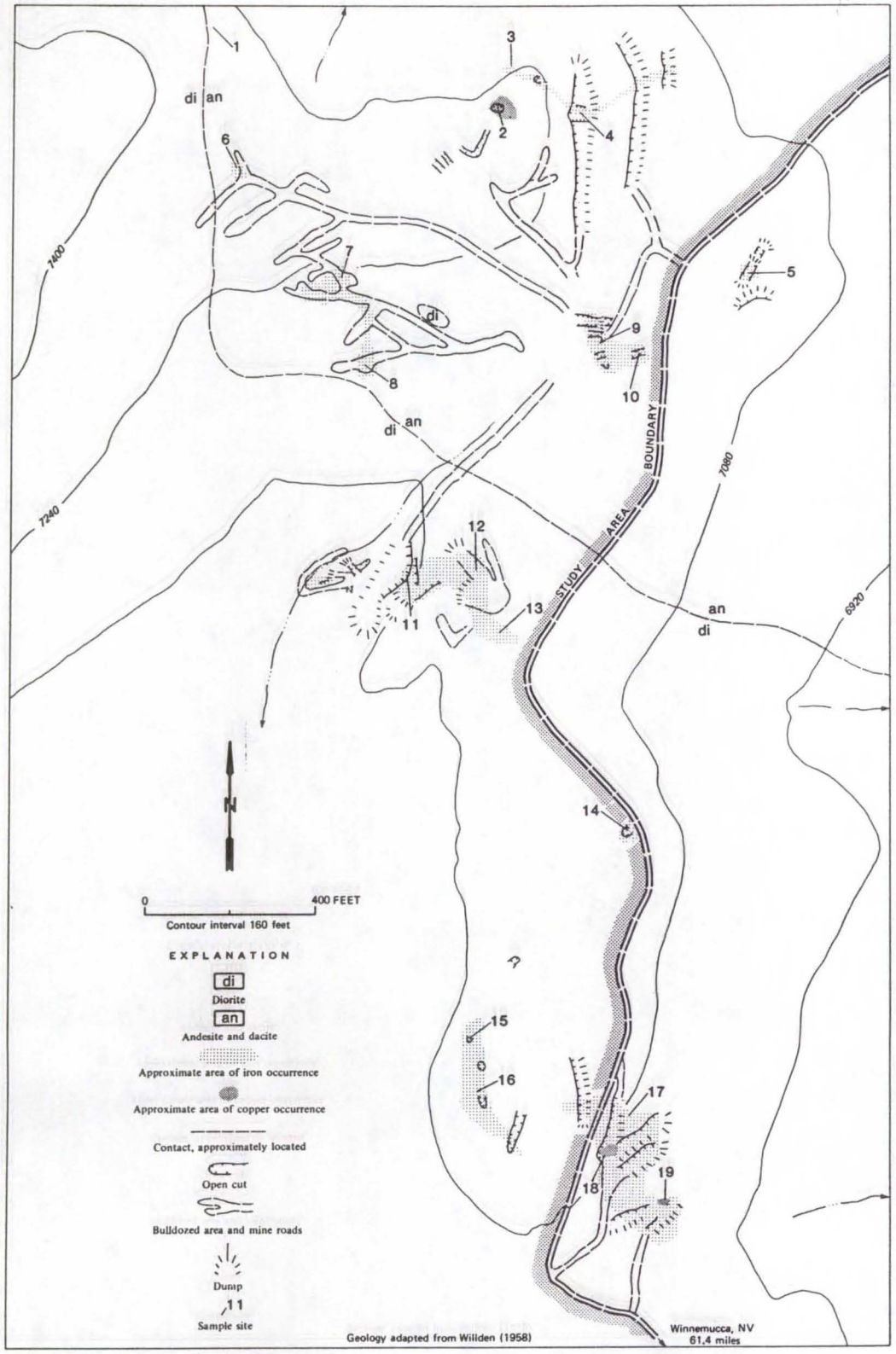


FIGURE 6. – Workings and sample sites of the Bull Iron prospect

Data for samples shown in figure 6

(N, none detected; --, not analyzed; NA, not applicable)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)	Iron (%)
1	Grab--	NA	Andesite breccia float with hematite matrix-----	0.012	N	--	10.0
2	Select	NA	Brecciated, light-colored andesite with fracture fillings of malachite from pit dump----------	.107	1.328	9.9	4.9
3	Chip--	3.2	Banded hematite with numerous angular inclusions of dacite and late-stage calcite veinlets in outcrop----------	.020	N	.033	37.0
4	Grab--	NA	Specular hematite containing angular fragments of dacite from cut dump----------	.021	N	.0069	38.0
5	do----	NA	Banded hematite float containing angular fragments of dark-gray igneous rock and late-stage calcite veinlets----------	.011	N	.004	25.4
6	Chip--	7.0	Banded hematite and magnetite containing angular dacite fragments and calcite veinlets in outcrop	N	N	.0021	31.0
7	Grab--	NA	Specular hematite containing angular fragments of highly altered igneous rock from bulldozed area----------	.025	N	.0022	22.1
8	do----	NA	do----------	.010	N	.0024	13.6
9	do----	NA	do----------	.011	N	.0022	24.6

Data for samples shown in figure 6--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)	Iron (%)
10	Chip--	29.0	Dacite breccia with hematite and limonite matrix	0.008	N	0.0019	17.5
11 1/	do----	3.0	Banded hematite and magnetite containing calcite veinlets and minor quartz in outcrop----------	N	N	.0048	26.6
12	do----	1.5	Dacite breccia with hematite matrix, some chlorite alteration present----------	.045	N	.0016	21.0
13	do----	5.0	Medium-grained, specular hematite and altered andesite----------	.018	N	.0030	35.0
14 2/	do----	6.0	Specular hematite with slickensides containing limonite, and quartz fracture fillings, and euhedral magnetite----------	N	N	.003	41.0
15	do----	3.0	Massive hematite and magnetite containing calcite veins in outcrop----------	N	N	.012	51.0
16	do----	3.0	Fine-grained massive hematite and magnetite-----	N	N	.0091	57.0
17	Grab--	NA	Massive and specular hematite float----------	.009	N	.0034	44.0

Data for samples shown in figure 6--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)	Iron (%)
18	Select	NA	Fractured dacite containing azurite, malachite, chalcocite, minor amounts of chrysocolla and bornite, and limonite-stained quartz from a 1-ton stockpile----------	N	97.86	4.6	--
19	do----	NA	Massive hematite float containing malachite, chalcanthite, limonite, and fracture-filling quartz----------	0.012	6.161	1.32	42.0

1/ Also contained 0.22% vanadium.
2/ Also contained 0.199% vanadium.

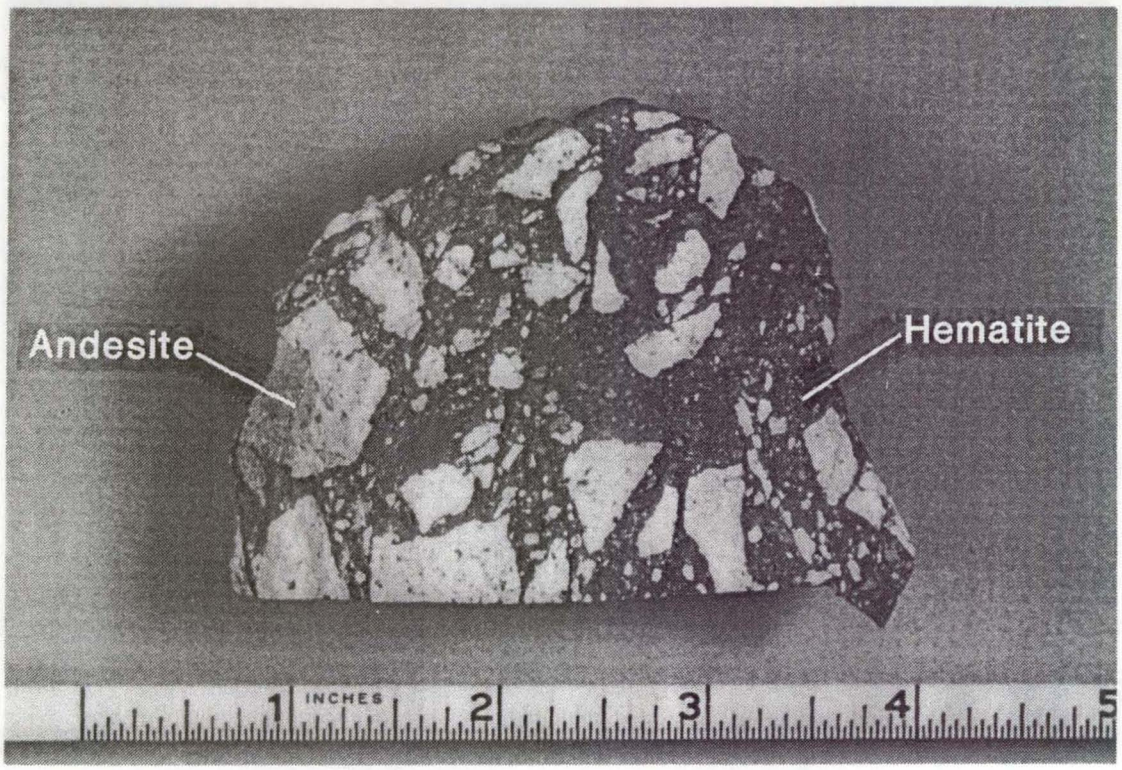


FIGURE 7.--Andesite breccia, Bull Iron prospect.

volcanogenic system that formed during the Triassic and Jurassic periods. Brecciated zones of andesite and dacite with copper-silver-iron minerals may represent vent locations.

Nineteen samples are located on figure 6; their descriptions and analyses appear in the accompanying unnumbered table. The samples of massive hematite and magnetite (nos. 3-17, 19) average 32.9 percent iron. The higher-grade samples are from the south end of the property. The samples from the copper-silver occurrences (nos. 2, 18, 19) average 0.04 ppm (0.001 oz/ton) gold, 35.12 ppm (1.02 oz/ton) silver, and 5.27 percent copper.

These mineral occurrences are not large enough to be considered resources at current (1987) metal prices. Further exploration, however, might determine whether these "hot spots" are scarns, hydrothermal emanations from a massive sulfide deposit at depth, or remnants of a massive sulfide deposit related to a volcanogenic vent zone.

Claudia Mine

The Claudia mine is in the southwest part of the Jackson Mountains in the Red Butte mining district (fig. 2). Elevations range from 5,120 to 5,280 ft. Access from Winnemucca, NV, is by 73 mi of graveled county roads and 4.7 mi of unmaintained jeep roads that may be impassable during wet weather.

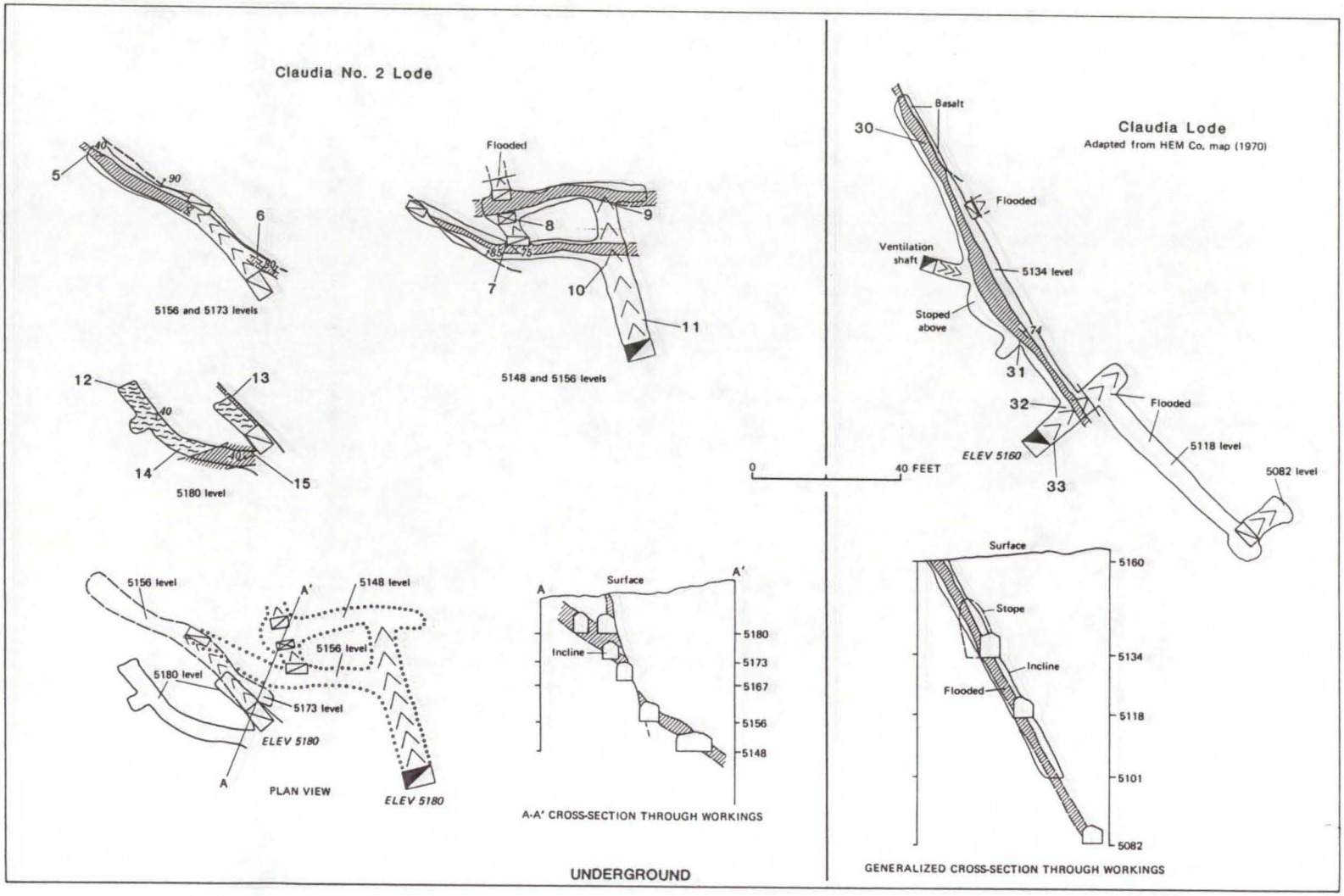
Ransome (1909, p. 30) visited the property in 1908, then known as the Redeemer Claim, and described it as an undeveloped prospect with a small surface mineral exposure. The Claudia Lode was located in 1912 and the Claudia No. 2 in 1917. Company production records indicate that 3,376 lb of concentrate were shipped from the Claudia No. 2 lode in 1919 containing 17.76 oz of gold and 15.45 oz of silver. The size of the workings at the Claudia Lode suggests a similar amount of production. The Vertical and Crusader lodes were added in 1926 to the northeast side of the Claudia lodes. Bureau of Mines records list production for the Redeemer mine in 1947 as being 8 oz gold, 129 oz silver, 262 lb (pound) copper, and 943 lb lead from 41 tons of ore. The prospect was explored in the 1960's and 1970's by extensive bulldozing of mineralized outcroppings and projected vein extensions. In 1986, the property owners are the HEM Company, Winnemucca, NV, and the Nevada Mining and Exploration Company, Sparks, NV. Current activity includes dewatering the Claudia Lode shaft, sampling, mapping, and building a mill for planned mining operations. A generator, pump, and toolshed are near this shaft. The mill would probably be at Bonita Spring, a good source of water 0.5 mi south of the property and where the mine operator, Terry Harris, resides.

Nine prospect pits or trenches and approximately 1,700 ft of bulldozer pits and cuts are along mineral occurrences (fig. 8). Three inclined shafts, one 6-ft deep shaft, and one adit follow veins down dip from surface exposures with about 600 ft of workings. The lower part of workings on both the Claudia lode and the Claudia No. 2 are flooded.

The main mineral occurrence consists of 0.6- to 7-ft wide veins that formed in two mineralized shear zones in a Cretaceous diorite stock (fig. 8). Underground workings are mostly along one shear zone that strikes from N. 40° W. to N. 50° W. and dips between 41° and 86° NE. This part of the occurrence is about 600 ft long and contains a number of fissure-filling veins in various attitudes and altered, mineralized country rock. A second 525-ft-long shear zone on the west side of the property strikes between N. 68° E. and N. 74° E. and dips from 21° to 40° N. Shear zones consist of gouge, limonite, and hematite in altered, silicified diorite. Veins contain quartz, siderite, and sulfide stringers that include pyrite, chalcopyrite, argentiferous tetrahedrite and galena, malachite, azurite, and chalcocite.

Vein deposits were probably a late-stage hydrothermal or intrusive event related to the Cretaceous diorite that comprises the country rock on the property. Ransome (1909, p. 30) states that copper occurrences in the Red Butte district are associated with aplitic dikes with a northwest strike. The alkalic granite of Tertiary age on the east side of the prospect appears to be a north- to northwest-striking dike and may have been the mineralizing agent. Sample 18 (fig. 8) confirms the metal-bearing nature of this intrusion. Tertiary alkalic granite intrusions are attractive exploration targets in Nevada for precious metal deposits. Another possible cause of mineralization may be related to a basalt-diorite contact exposed on the first level of the Claudia Lode shaft.

Thirty-three samples are located on figure 8; descriptions and analyses appear in the accompanying unnumbered table. Twenty-one samples from the main mineralized occurrence (nos. 5-11, 13, 20, 22-33) had as much as 6.904 ppm (0.201 oz/ton) gold, 202.29 ppm (5.90 oz/ton) silver, and 15 percent copper. From the other mineralized shear zone on the west side of the property, seven samples (nos. 1-4, 12, 14, 15) had as much as 13.337 ppm (0.389 oz/ton) gold and 308.57 ppm (9.00 oz/ton) silver, and from 0.0011 to 0.11 percent copper. Metallurgical testing by Denver Equipment Company in 1950 found the ore composed of a silicate and carbonate gangue with considerable clay. The concentrate contained lead carbonate, some copper sulfides and carbonates, and manganese and iron oxides. The sample also contained an "appreciable" amount of gold, both free and embedded in oxide material. A sampling program by the mine owners in 1960 totaled seven samples having from 0.03 oz/ton to 0.52 oz/ton gold, 0.4 oz/ton to 5.8 oz/ton silver, and 0.1 to 0.85 percent copper. In 1981, another sampling program by the mine owners resulted in 19 samples with concentrations from 0.01 oz/ ton to 8.324 oz/ton gold and zero to 129 oz/ton silver.


Claudia No. 2 Lode
5
6
90
5156 and 5173 levels
Flooded
8
9
7
10
11
5148 and 5156 levels
12
13
14
15
40
5180 level
5156 level
5148 level
5180 level
5173 level
ELEV 5180
A
A'
PLAN VIEW
ELEV 5180
Surface
Incline
5180
5173
5167
5156
5148
A-A' CROSS-SECTION THROUGH WORKINGS
UNDERGROUND
Claudia Lode
Adapted from HEM Co. map (1970)
30
Basalt
Flooded
Ventilation shaft
5134 level
Stoped above
74
31
32
Flooded
5118 level
ELEV 5160
5082 level
33
0
40 FEET
Surface
5160
Stope
Incline
5134
Flooded
5118
5101
5082
GENERALIZED CROSS-SECTION THROUGH WORKINGS

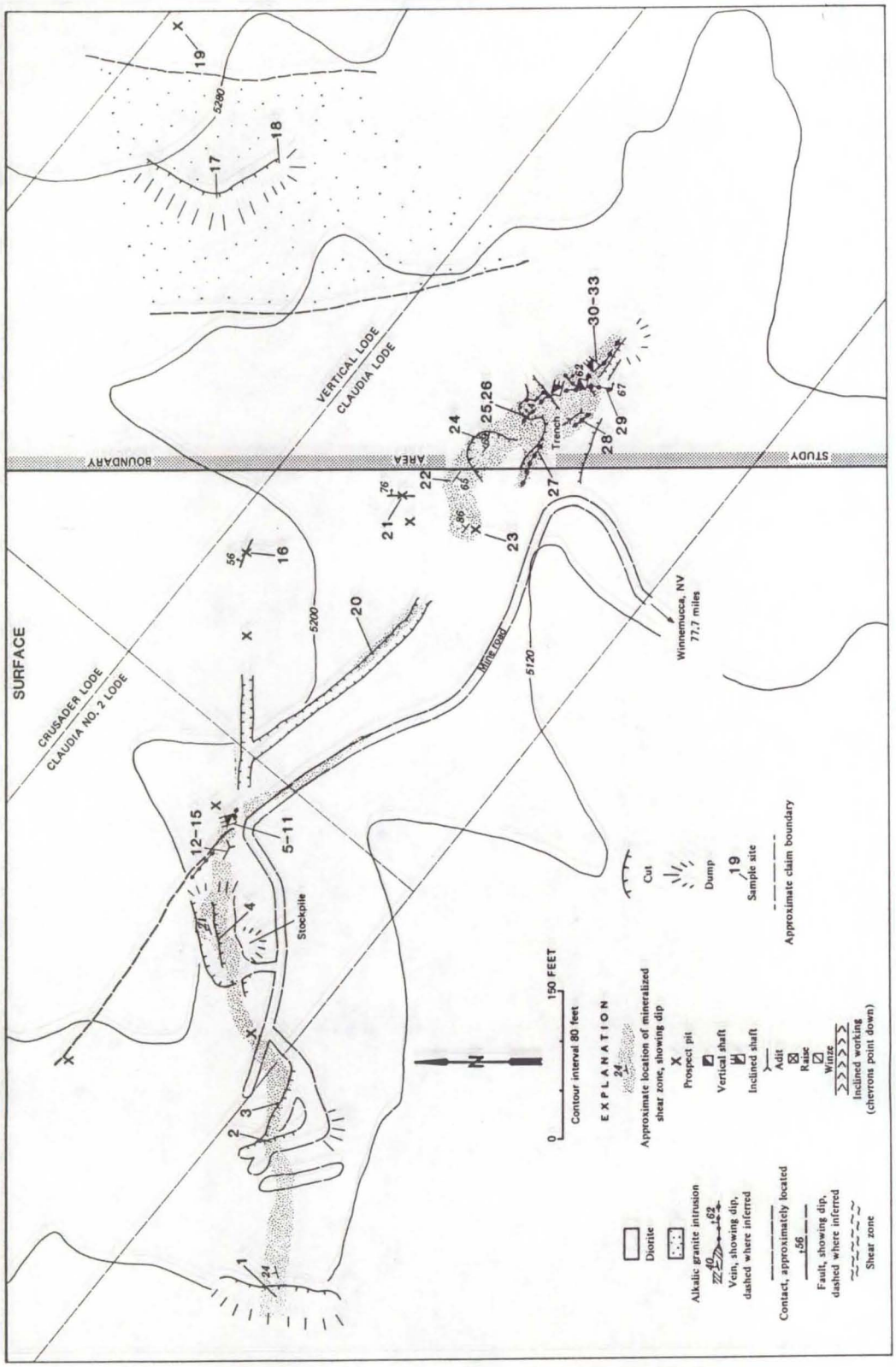


FIGURE 8. – Workings and sample sites of the Claudia mine

Data for samples shown in figure 8

(N, none detected)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
1	Chip--	1.5	Shear zone containing silicified diorite, clay gouge, hematite, and limonite----------	N	N	0.0011
2	do----	12.0	do----------	0.020	N	.0018
3	do----	4.0	Shear zone containing limonite, hematite, jarosite and fractured diorite----------	13.337	308.57	.0071
4	do----	4.0	Shear zone containing gouge, limonite, numerous quartz veinlets, and silicified diorite----------	.249	N	.0016
5	do----	4.75	Quartz veins and highly altered diorite, both containing limonite, jarosite, and minor chalcocite---	.126	.750	.016
6 1/	do----	3.5	Quartz veins, fractured and altered diorite, and sulfide stringers containing malachite, limonite after pyrite, and tetrahedrite----------	2.890	14.74	.15
7	do----	3.0	Quartz veins, fractured and altered diorite, and sulfide stringers containing pyrite, azurite, and tetrahedrite----------	2.434	27.43	.17
8 2/	do----	7.0	Quartz veins, fractured and altered diorite, and sulfide stringers containing malachite, tetrahedrite, and limonite----------	5.486	13.71	.077
9	do----	5.7	do----------	5.624	2.404	.017

Data for samples shown in figure 8--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
10 3/	Chip--	4.2	Quartz veins, clay gouge, and sulfide stringers containing malachite, tetrahedrite, and limonite------	2.023	102.86	0.46
11	do----	4.5	Fractured quartz veins and silicified diorite both containing limonite and jarosite----------	3.429	24.00	.11
12	do----	2.5	Sheared diorite containing fractured quartz, limonite, and jarosite----------	1.924	N	.0023
13	do----	.8	Quartz vein containing malachite in sheared diorite---	.789	2.869	.033
14	do----	6.0	Highly altered, sheared diorite containing quartz, pyrite, and limonite----------	.515	5.921	.0049
15	do----	4.0	Quartz veins and sheared, altered diorite containing clay gouge, limonite, and hematite----------	11.623	34.28	.11
16	do----	2.0	Fault containing silicified diorite with pervasive limonite and hematite----------	.083	N	N
17	do----	6.0	Fractured granite containing sericite, wollastonite, and tremolite----------	.058	N	N
18	do----	6.0	do----------	.068	12.47	N
19	do----	8.0	do----------	N	N	N
20	do----	2.0	Sheared, silicified diorite with limonite----------	.053	.670	N

Data for samples shown in figure 8--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
21	Chip--	4.0	Fault in silicified diorite containing gouge and pervasive limonite----------	N	N	N
22	do----	3.0	Sheared, altered diorite containing limonite----------	0.012	N	0.0009
23	do----	2.5	Sheared, silicified diorite containing limonite, hematite, and jarosite----------	.029	N	N
24	do----	3.0	Sheared, altered diorite containing gouge, quartz veins, limonite, hematite, and minor malachite----------	1.237	13.74	.044
25	do----	5.0	do----------	.222	3.473	.018
26	do----	1.0	do----------	.353	14.74	.097
27 4/	do----	.6	Quartz vein and sulfide stringer containing azurite, malachite, limonite, and siderite----------	4.629	202.29	.79
28	do----	3.0	Quartz veins, sheared and altered diorite, and sulfide stringers containing tetrahedrite and limonite---------	.651	13.71	.067
29	do----	.8	Quartz veins and sheared, silicified diorite containing gouge and pervasive limonite----------	6.904	4.189	.057
30	do----	5.0	Quartz vein containing pyrite and limonite in sheared diorite----------	.079	7.569	.041
31	do----	7.0	Quartz vein containing pyrite, chalcopyrite, tetrahedrite, and limonite in sheared diorite----------	N	10.90	15.0

Data for samples shown in figure 8--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
32	Chip--	3.0	Quartz veins, clay gouge, and sulfide stringers containing pyrite, tetrahedrite, and malachite in sheared diorite----------	1.851	51.43	0.33
33	do----	5.0	do----------	.608	3.625	.017

1/ Also contained 0.14% antimony.
2/ Also contained 0.052% antimony.
3/ Also contained 0.222% antimony and 0.62% lead.
4/ Also contained 0.171% antimony and 0.95% lead.

While several samples have impressive amounts of silver and copper, the overall small size and low average grade of the occurrence does not suggest a resource. Discrepency in metal concentrations between previous sampling programs and this study may be due to data bias from sampling very high-grade but small and discontinuous veins in a larger mineralized zone. The high-grade nature of several samples and previous production does indicate the possibility for resources of gold, silver, and copper in downdip extensions of the mineralized zones.

Metallurgical testing suggests this gold occurrence may be suitable for heap leaching, a low cost method for recovering precious metals. The considerable clay content, the presence of antimony (Chamberlain and Pajar, 1984, p. 5), and possible limitations in the extent of the oxidized parts of the occurrence may cause problems with a leaching operation. Further testing might determine the feasibility for this type of a small scale mining operation.

Clover Prospect

The claim group is located on the east side of the Jackson Mountains on Clover Creek (fig. 2). Access from Winnemucca, Nevada, is by 58 mi of all-weather, graveled county roads and 2.8 mi of unmaintained jeep roads that are probably impassable in wet weather. Elevations range from 5,680 to 6,250 ft.

County mining records indicate initial claiming activity was in 1919, and the seven prospect pits and two adits totaling 170 ft in length on the property probably date back to this time. The prospect was relocated in 1928 and 1985. The current owners, Wescord Resources, Reno, NV, located ten claims, the Clover Nos. 55-64 and leased the property to Long Lac Exploration (Texas), Inc., Sparks, NV. Long Lac plans field work in 1986 as part of its exploration for volcanogenic massive sulfide deposits in the Jackson Mountains.

A small alkalic granite plug of probable Cretaceous-Tertiary age, hosted in volcanogenic sandstones and limestones of the Jurassic-Triassic Boulder Creek beds, is strongly sericitized, and contains pyrite and limonite locally (fig. 9). Three 1.2- to 4-ft wide fissure-filling veins follow faults in the country rock peripheral to the intrusion and contain various amounts of quartz, siderite, and limonite with malachite, azurite, pyrite, galena, and possibly tetrahedrite; the galena and tetrahedrite are argentiferous. The veins are poorly exposed and short with strike length not exceeding 30 ft. Sample sites 7-9 are within the intrusion on iron-stained outcrops of pyrite-bearing granite. On the east side of the property, two prospect pits (sample sites 10 and 11) are on small areas of contact alteration adjacent to a Cretaceous-Jurassic hornblende intrusion. The source for vein minerals may have been either the granitic intrusive event, or a pre-existing deposit in Boulder Creek or Happy Creek rock that was remobilized by the heat of the intrusion.

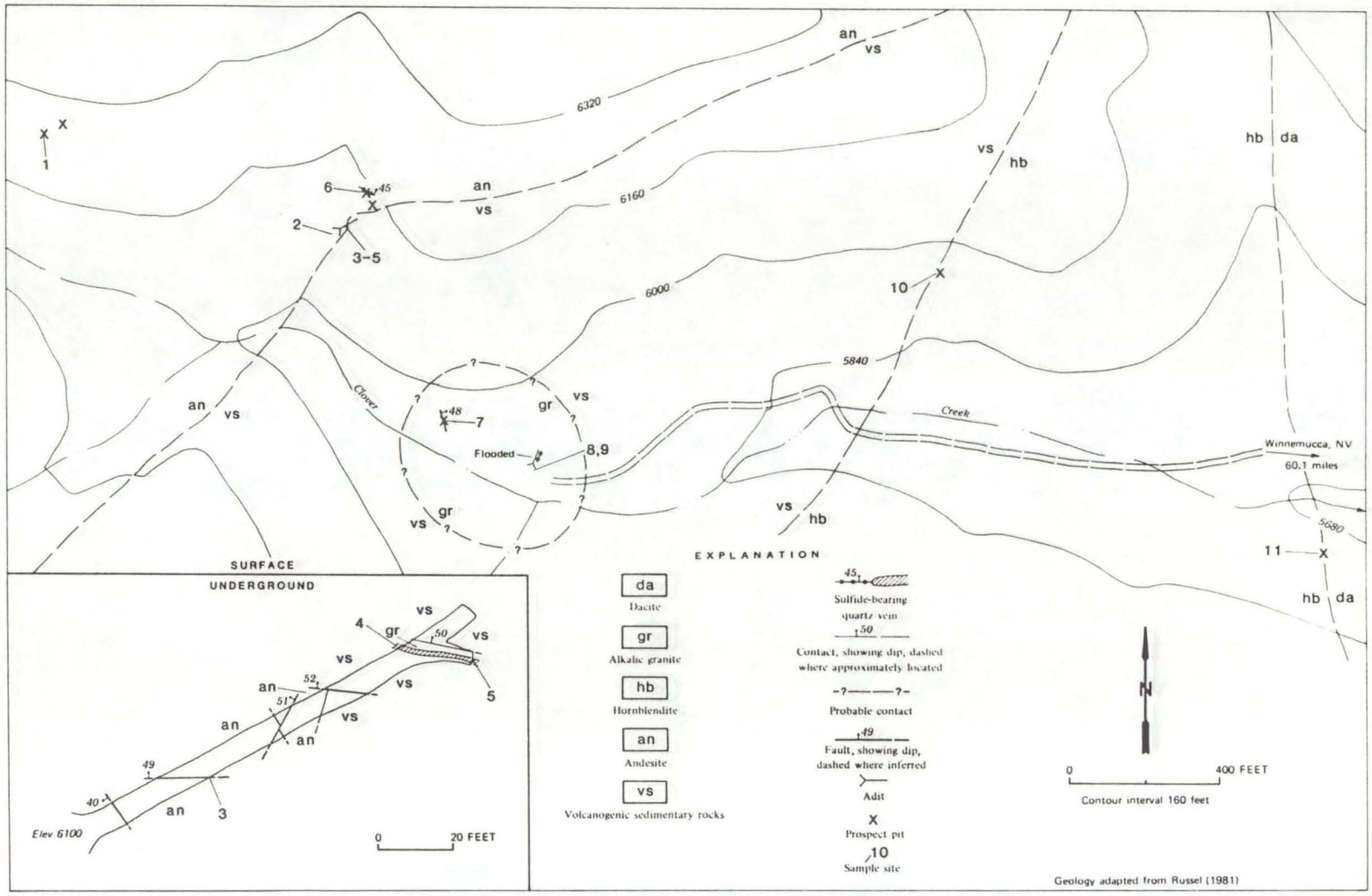


FIGURE 9. – Workings and sample sites of the Clover prospect

Data for samples shown in figure 9

(N, none detected; --, not analyzed; NA, not applicable)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)	Lead (%)	Zinc (%)
1 1/	Select	NA	Bleached, silicified andesite containing malachite, azurite, limonite, quartz veins, and siderite from pit dump----------	0.014	9.961	0.34	0.0027	0.0013
2	do----	NA	Quartz vein containing limonite and small amounts of pyrite, malachite, and galena from adit dump----------	.01	2.95	.018	.031	.02
3	Chip--	1.2	Fault containing clay gouge and limonite in andesite----------	.050	N	--	--	--
4	do----	3.0	Quartz vein containing malachite and limonite, and sheared, altered limestone adjacent to granitic dike----------	.100	10.76	.056	--	--
5	do----	4.0	do----------	N	2.223	.016	.015	.012
6 2/	Select	NA	Altered intrusive rock containing quartz veins, malachite, azurite, galena, and hematite from pit dump----------	.02	98.91	.40	2.95	.037
7	Grab--	NA	Sericitically altered alkalic granite containing disseminated pyrite and limonite from dump----------	.03	1.383	.005	.031	--
8	do----	NA	do----------	N	N	.0043	.0092	--

Data for samples shown in figure 9--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)	Lead (%)	Zinc (%)
9	Grab--	NA	Sericitically altered granite containing disseminated pyrite, and pervasive limonite and chlorite from adit dump----------	0.020	0.490	0.0018	N	--
10	do----	NA	Propylitically altered hornblendite containing limonite and hematite from pit dump----------	N	N	--	--	--
11	do----	NA	do----------	.040	1.462	.012	.010	--

1/ Also contained 0.017% arsenic and 0.051% antimony.
2/ Also contained 0.243% antimony.

Eleven samples are located on figure 9 with descriptions and analyses in the unnumbered accompanying table. The higher grade samples (nos. 2, 4-6) are from a sulfide vein exposed on the surface and crosscut by an adit. Gold concentrations range from zero to 0.1 ppm (0.003 oz/ton), silver from 2.223 ppm to 98.91 ppm (0.065 oz/ton to 2.89 oz/ton), copper as much as 0.4 percent, and lead as much as 2.95 percent.

Resources of gold and silver may be associated with the granite plug, and gold, silver, lead, zinc, and copper associated with a massive sulfide system in the area.

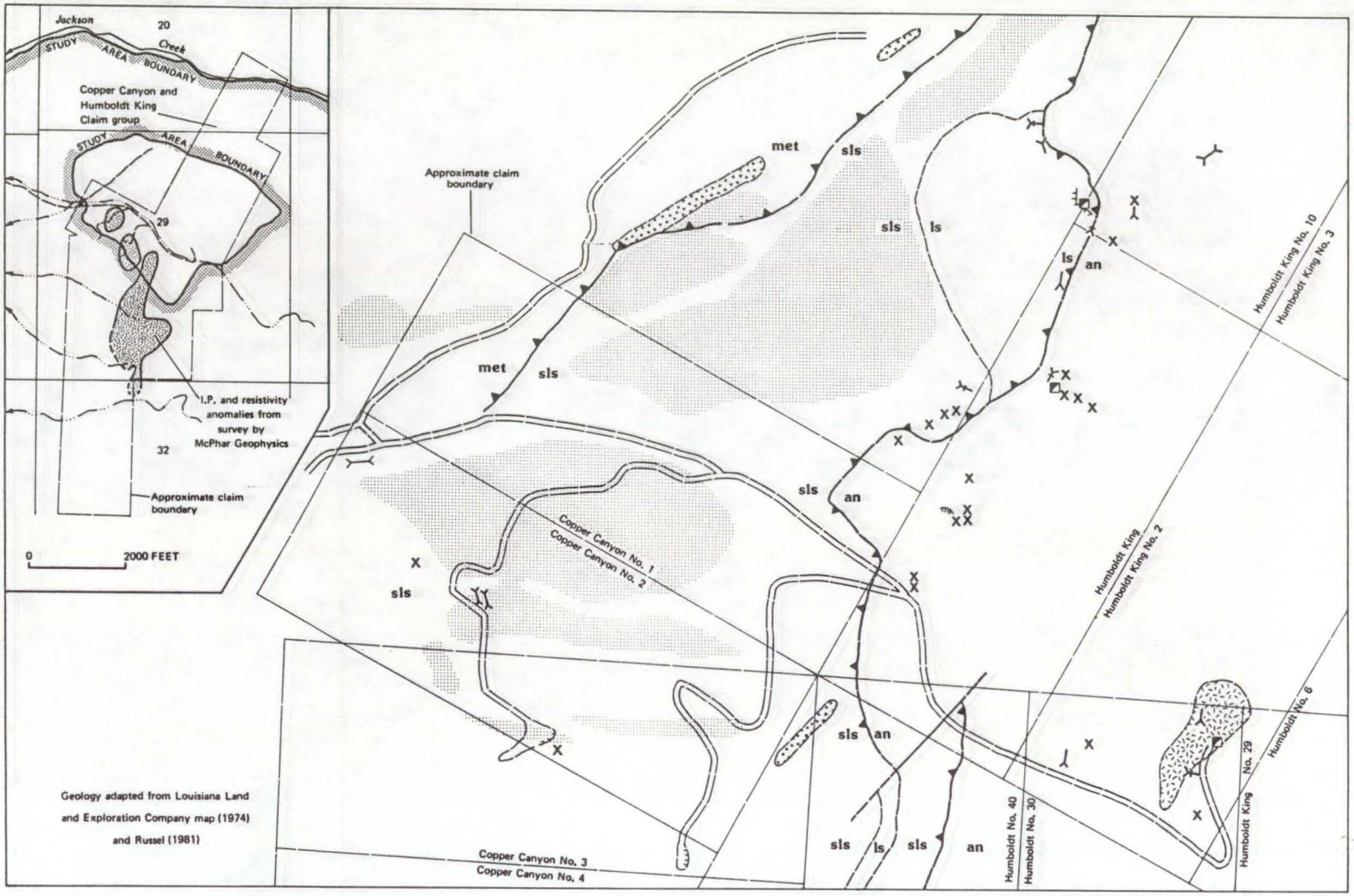
Humboldt King Mine

The claim block covers about 490 acres from Jackson Creek south across Christiorsson Canyon (fig. 2). Workings center on Christiorsson Canyon where elevations range from 4,400 to 5,000 ft. Access from Winnemucca, NV, is by 88.3 mi of graveled county roads and 0.8 mi of unmaintained jeep trail up the pediment to the canyon mouth.

Initial exploration of the property was most likely just after the turn of the century when there was mining activity at the Harrison Grove (New Northern Light) mine about 1 mi northeast (fig. 1). Hill (1912, p. 213) mentions copper mining in the Jackson Creek area in his survey of the mining districts of the western United States. Most of the underground workings probably date back to the 1910's and 1920's. Stopes in the main workings of the Humboldt King mine suggest a small amount of production. The first of the 23 claims that comprise the present property was located in 1952 with subsequent claims filed in 1955, 1960, and 1965-1970. In 1953 the Bureau of Mines assessed the property for the DMEA (Defense Minerals Exploration Administration). The owner, L. F. Bradbury, was applying for a DMEA loan to develop possible resources of copper and cobalt. The Louisiana Land and Exploration Company explored the property in 1973 utilizing geologic mapping, induced polarization, and resistivity surveys by McPhar Geophysics; major anomalies were diamond drilled. The owner in 1986 is Fred Sherrill, of Seattle, WA.

Ten adits, three shafts, and numerous pits and trenches are along the zones of mineral occurrence (figs. 10 and 11) . The Humboldt King mine, which comprises the bulk of the underground workings, is inaccessible and maps of the mine used for this report were obtained from the current claim owner, Fred Sherrill. The mine roads on the west side of the property were part of the drilling program in 1973.

The geologic terrain consists of late Paleozoic to Triassic age metasedimentary and sedimentary rocks thrusted upon metavolcanic rocks of the Triassic-Jurassic Boulder Creek beds (fig. 10). Metasedimentary and sedimentary rocks include argillite, schist, metasiltstone, shale, limestone, and marble. The metavolcanic rocks include andesite, basalt, and dacite that have undergone extensive propylitic alteration and fracturing. Mineralization occurred in 0.3- to 7-ft wide veins hosted mainly by metavolcanic rocks, with fewer in a small limestone-marble unit that is bounded on all sides by faults. Most of the mineral occurrences are scattered within a north-trending 1,500-ft-long mineral zone that


Jackson Creek
20
STUDY AREA BOUNDARY
Copper Canyon and Humboldt King Claim group
STUDY AREA BOUNDARY
29
I.P. and resistivity anomalies from survey by McPhar Geophysics
32
Approximate claim boundary
0
2000 FEET
Approximate claim boundary
met
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Copper Canyon No. 1
Copper Canyon No. 2
Copper Canyon No. 3
Copper Canyon No. 4
Humboldt King No. 10
Humboldt King No. 3
Humboldt King
Humboldt King No. 2
Humboldt No. 40
Humboldt No. 30
Humboldt King No. 29
Humboldt No. 6
Geology adapted from Louisiana Land and Exploration Company map (1974) and Russel (1981)

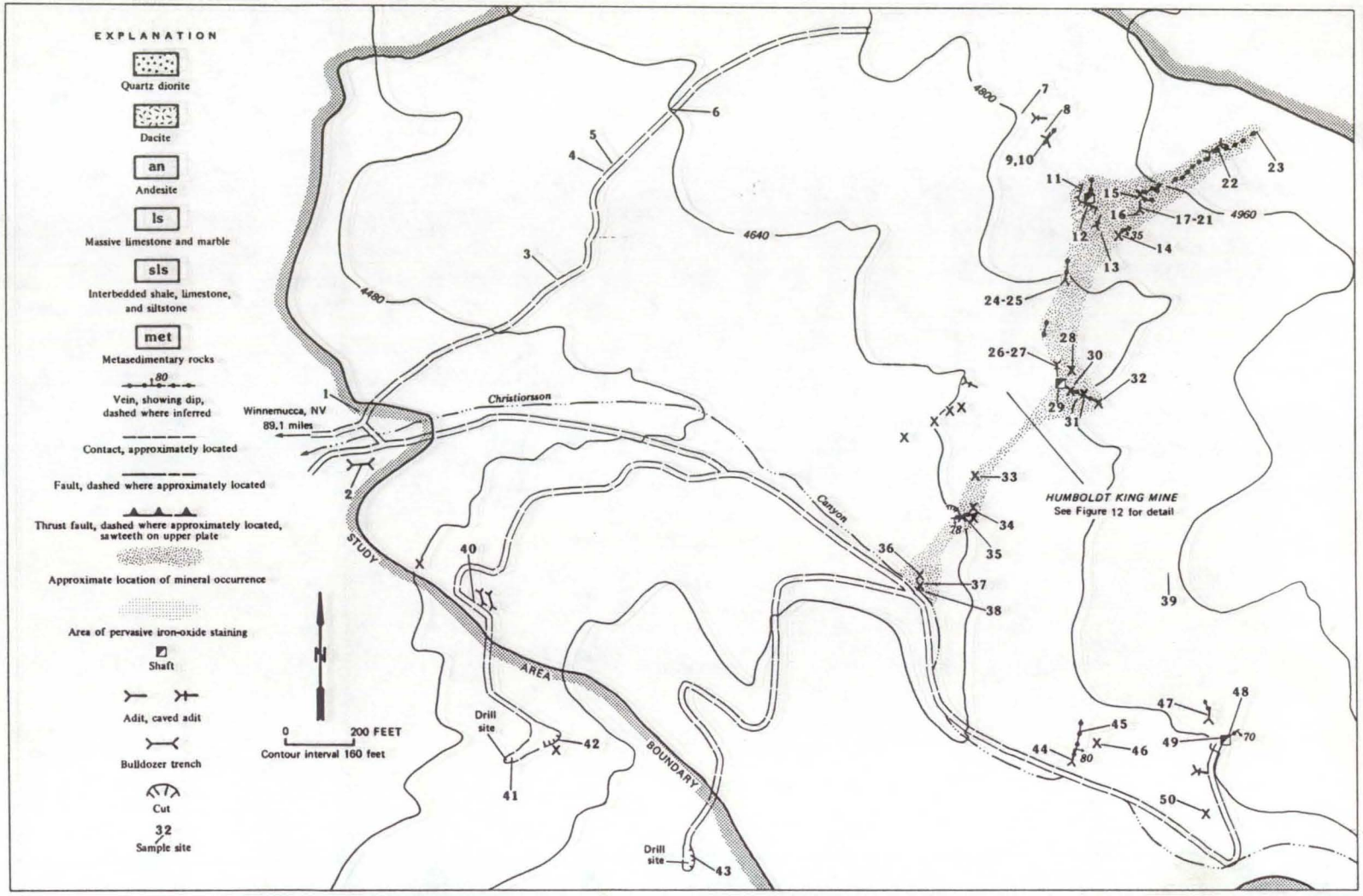

FIGURE 10. – Surface workings and sample sites of the Humboldt King mine

consists of fractured, altered andesite with stringer veins, quartz, and epidote. The small mineral occurrences to the southeast of the main zone are similar with north trends and associated epidote mineralization but are hosted by dacite as well as andesite. Veins contain various amounts of quartz, azurite, chrysocolla, limonite, hematite, epidote, and manganese oxides. The DMEA report, No. 3166, describes the veins in the Humboldt King mine as also containing pyrrhotite, covellite, and erythrite (cobalt bloom). Several replacement-type deposits in the limestone-marble unit contain magnetite and wollastonite.

Metamorphism and faulting have made it difficult to interpret the geology of the mineralization. The metaandesite or greenstone host rock for the mineral has been classified as an intrusion in the past. Hill (1912, p. 213) described the copper occurrences in the Jackson Creek area as being contact deposits between limestone and granite. The DMEA study describes mineralization within a hornfels host rock which implies contact or thermal metamorphism. Russell (1984) mapped the greenstone body as a Jurassic-Cretaceous hornblendite. Exploration work by the Louisiana Land and Exploration Co. classified the mineral host rock as andesite and marble. Similar confusion is found concerning the small dacite body on the southeast side of the property with it being called a monzonite by DMEA and a felsic coarse-grained intrusion by the Louisiana Land and Exploration Co.

Louisiana Land and Exploration Co.'s main interest was the "pyrometasomatic sulfide mineralization in the metamorphosed sediments" on the west and south sides of the property (unpublished report by McPhar Geophysics for Louisiana Land and Exploration Co.). Exploration targets were defined by outlining iron-stained topography on aerial photographs and using anomalies from ground geophysical surveys (fig. 10, inset map). The report by McPhar Geophysics concluded that the anomalies were shallow and were "...bedded concentration of sulfide mineralization with magnetite..." with sulfide content ranging from 3 to 7 percent depending on magnetite content. Louisiana Land and Exploration Co. drilled on several of these anomalies but drill hole data is not available.

In 1985, Wescord Resources, Reno, NV, was involved in exploration for volcanogenic massive sulfide deposits in the Jackson Mountains. Field data from their studies indicates that the Harrison Grove mine-Christiorsson Canyon area was probably a vent zone for a volcanogenic system. Sulfide deposits in andesites may have been partially mobilized by heat and pressure during tectonism and deposited in fractures, faults, within suitable host rock like the limestone unit.

Fifty samples are located on figures 10 and 11 with descriptions and analyses in the unnumbered accompanying table. Samples 1-6 and 40-43 are from metasediments and sediments on the western side of the property and have low mineral concentrations. Samples from the main mineral zone, numbers 11-38, had as much as 0.357 ppm gold (0.01 oz/ton) and 25.81 ppm silver (0.75 oz/ton), and ranged from 0.017 to 13.7 percent copper. On the east side of the property, samples nos. 44-50 contained from zero to 0.067 ppm gold (0.002 oz/ton), 0.98 ppm to 10.9 ppm silver (0.03 oz/ton to 0.3 oz/ton), and 0.018 to 2.0 percent copper. Sample analyses

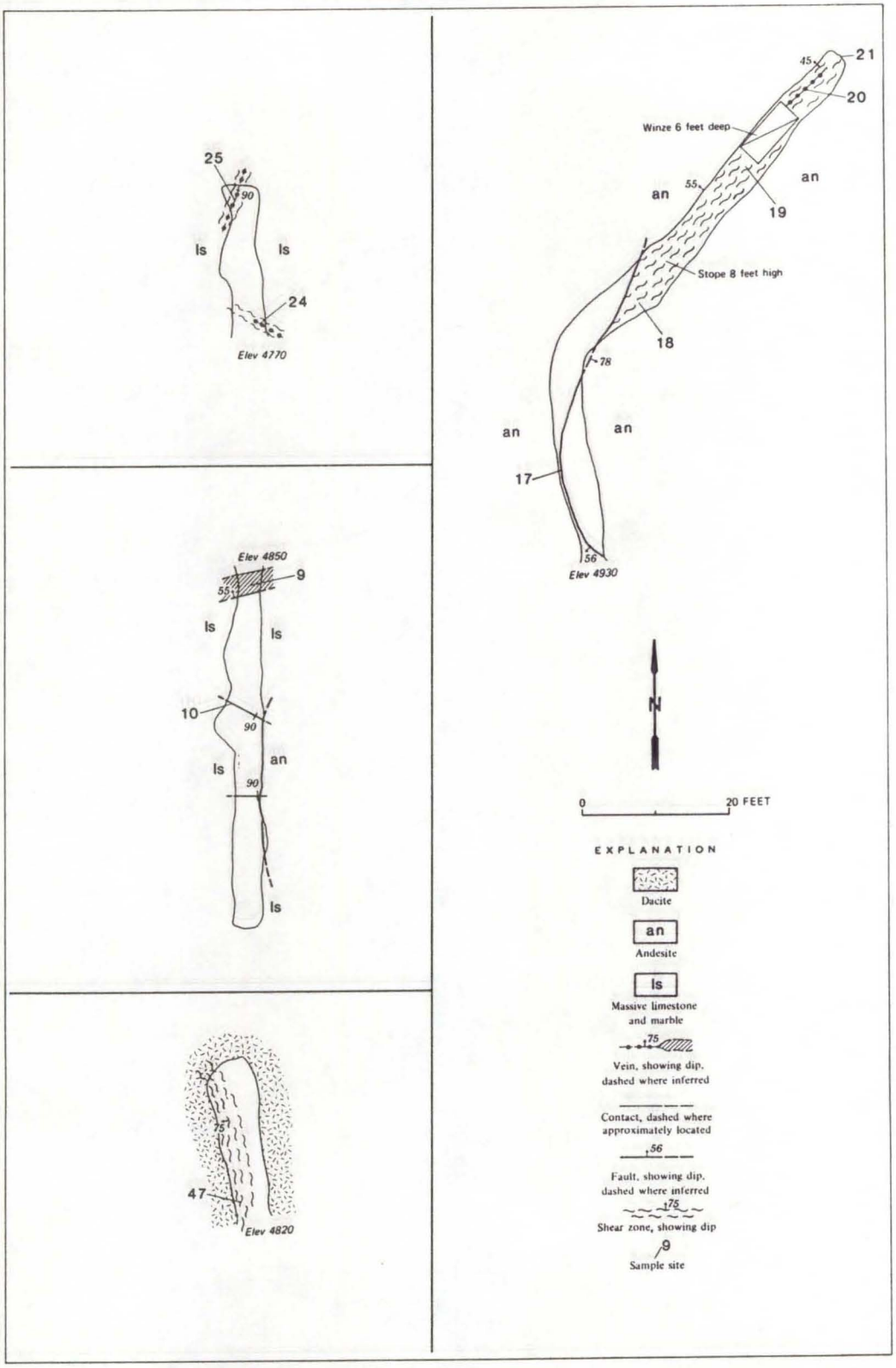

FIGURE 11. – Underground workings and sample sites of the Humboldt King mine area

Data for samples shown in figures 10 and 11

(N, not detected; NA, not applicable)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
1	Chip--	2.5	Fractured, greenish-gray metasiltstone containing calcite, limonite, and manganese dentrites----------	N	N	0.0054
2	do----	4.0	do----------	N	N	.013
3	do----	1.5	Fractured, silicified metasiltstone containing pervasive limonite, hematite, and manganese----------	N	N	.012
4	do----	2.0	Iron-stained, silicified metasiltstone near contact with quartz diorite----------	N	N	.013
5	do----	3.0	Fractured quartz diorite containing limonite---------	N	N	N
6	Grab--	NA	Quartz diorite dike containing limonite and manganese from cut dump----------	N	N	N
7	Select	NA	Limestone containing chlorite, pyrite, magnetite, and quartz from adit dump----------	N	.700	.10
8	do----	NA	Gossan with malachite, marble, and scarn from dump---	N	N	.028
9	Chip--	2.0	Vein containing quartz, wollastonite, malachite, and limonite----------	N	36.19	4.7
10	do----	.5	Fault containing clay gouge and manganese in marble	N	15.20	5.8

Data for samples shown in figures 10 and 11--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
11	Chip--	20.0	Marble and limestone containing pods of magnetite and minor quartz----------	N	0.942	0.157
12	do----	30.0	do----------	0.008	.730	.035
13	Grab--	NA	Marble, greenstone, wollastonite, and malachite from adit dump----------	.008	9.681	1.47
14	Chip--	6.0	Vein containing quartz, calcite, malachite, chrysocolla, pervasive limonite and manganese, and andesite----------	.041	.510	.62
15	do----	5.5	Vein containing malachite, chrysocolla, epidote, limonite, and fractured, altered andesite----------	N	2.007	2.7
16	Select	NA	Vein rock containing altered andesite, malachite, chalcopyrite, and limonite from adit dump----------	.011	N	13.7
17	Chip--	4.5	Fractured greenstone----------	N	N	.111
18	do----	3.5	Sheared andesite containing gouge and malachite------	.01	8.004	1.26
19	do----	5.0	Sheared andesite containing chalcopyrite, pyrite, and limonite----------	N	1.050	2.44
20	do----	.3	Vein containing pyrite, chalcopyrite, and limonite----	.046	3.678	7.8
21	do----	2.5	Sheared andesite containing malachite and minor pyrite and chalcopyrite----------	.008	N	1.08

Data for samples shown in figures 10 and 11--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
22	Chip--	3.0	Vein containing sheared andesite, gouge, malachite, and quartz----------	0.024	0.610	0.49
23	do----	.67	Quartz vein containing magnetite, chalcopyrite, and limonite in andesite----------	N	2.755	.56
24	do----	5.0	Vein containing malachite and altered marble in sheared marble adjacent to contact with andesite------	N	7.896	.49
25	do----	.5	Sheared marble containing clay gouge----------	.357	.915	.116
26	do----	4.5	Sheared andesite containing hematite and limonite near contact with limestone----------	.097	2.099	.077
27 1/	Grab--	NA	Greenstone with pervasive malachite and manganese oxides from adit dump----------	.013	12.53	2.38
28	Chip--	2.0	Limonite-stained, sheared andesite containing minor malachite----------	N	N	.023
29	Grab--	NA	Greenstone with pervasive malachite and manganese oxides from stockpile----------	N	N	2.75
30 2/	Chip--	3.0	Vein containing malachite, pyrite, chalcopyrite, limonite, hematite, pyrolusite, and sheared andesite--	.224	18.52	3.90
31 3/	do----	4.0	Vein containing malachite, limonite, and sheared andesite----------	N	.450	1.88

Data for samples shown in figures 10 and 11--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
32 4/	Chip--	8.0	Vein containing sheared andesite, manganese, limonite, and pervasive malachite----------	0.075	6.535	2.6
33	Grab--	NA	Greenstone containing quartz veins, malachite, chalcopyrite, chalcanthite, and limonite from pit dump	.118	1.771	3.6
34	Chip--	4.0	Vein containing andesite, quartz, malachite, chalcopyrite, hematite, and limonite----------	N	25.81	6.2
35	do----	3.0	Vein containing sheared andesite, malachite, chrysocolla, pyrolusite, and quartz----------	N	.620	.12
36	do----	7.7	Fractured andesite containing malachite, chalcopyrite, chalcocite, limonite, and quartz veinlets----------	N	2.856	.73
37	do----	5.0	Sheared andesite containing quartz and calcite veinlets, epidote, malachite, limonite, and pyrolusite	N	N	.017
38	do----	16.0	Sheared, silicified andesite containing quartz veins, malachite, chalcopyrite, chrysocolla, limonite, and manganese oxides----------	N	11.01	1.2
39	do----	2.0	Limonite-stained dacite----------	.022	.520	--
40	do----	36.0	Black, thin-bedded limestone containing limonite along bedding and limestone breccia containing hematite and gypsum----------	N	N	.0048
41	Grab--	NA	Drill cuttings of metasedimentary rock----------	N	3.268	.0062

Data for samples shown in figures 10 and 11--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
42	Chip--	15.0	Calcareous shale containing limonite and hematite that has been kaolinized and slightly silicified----------	0.008	N	0.0073
43	Grab--	NA	Intensively iron-stained, brown argillite from cut dump----------	.008	.976	.0061
44	Chip--	9.0	Vein containing silicified andesite, epidote, malachite, and limonite----------	.009	11.66	2.22
45	do----	8.0	do----------	N	5.407	0.99
46	do----	4.0	Sheared andesite containing malachite and pyrolusite	N	10.90	1.5
47	do----	2.0	Sheared altered dacite with malachite and limonite---	0.013	1.934	.018
48	do----	8.0	Vein containing altered dacite, malachite, chrysocolla, chalcopyrite, and pyrite in fractured dacite---------	N	.98	2.0
49	Grab--	NA	Epidote-rich dacite containing chalcopyrite, malachite, and minor quartz from shaft dump----------	.015	5.987	.188
50	do----	NA	Iron-stained dacite containing quartz from pit dump--	.067	5.907	.05

1/ Also contained 0.119% arsenic.
2/ Also contained 0.052% zinc.
3/ Also contained 0.189% arsenic.
4/ Also contained 0.079% arsenic.

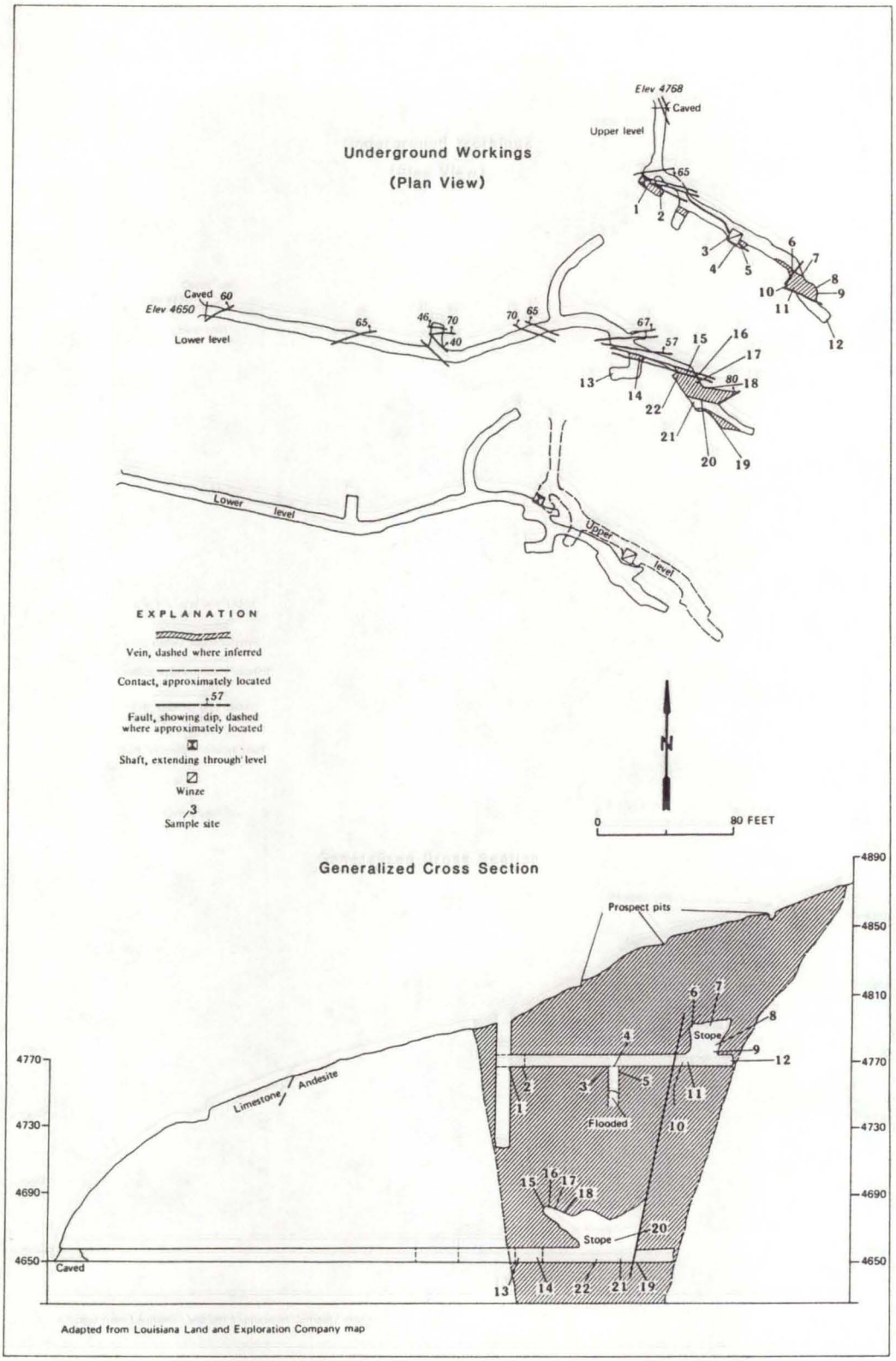

FIGURE 12. – Underground workings and sample sites for the Humboldt King mine

Data for samples shown in figure 12

(N, none detected; Tr, trace)

Sample No.	Type	Length (ft)	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Nickel (%)	Cobalt (%)
1	Chip	4.5	0.001	0.5	3.3	0.015	0.035
2	do--	5.4	N	.1	.7	.051	.049
3	do--	1.8	.001	.5	4.0	.102	.196
4	do--	2.5	.001	.4	1.8	.045	.039
5	do--	2.7	Tr	.1	.8	.035	.028
6	do--	1.0	.001	.4	2.1	.075	.039
7	do--	5.0	Tr	.2	.9	.067	.055
8	do--	2.5	N	N	5.3	.189	.082
9	do--	4.3	.001	.4	1.6	.106	.103
10	do--	4.0	N	N	.2	.110	.045
11	do--	1.9	Tr	.4	1.5	.110	.045
12	do--	5.3	.001	.4	2.4	.04	.068
13	do--	4.0	N	.2	.5	.10	.045
14	do--	6.0	N	.1	.4	.04	.035
15	do--	1.0	N	.1	.4	.070	.039
16	do--	4.0	.001	.7	3.4	.090	.043
17	do--	3.5	Tr	.2	1.0	.063	.033
18	do--	6.0	.001	.4	2.5	.075	.049
19	do--	7.0	.001	.4	2.3	.106	.039
20	do--	6.0	.001	.3	.9	.102	.190
21	do--	1.3	.001	.9	7.0	.075	.059
22	do--	6.0	.001	.5	1.6	.095	.250

accompanying figure 12 are from an undated company map for the Humboldt King mine which is presently inaccessible. These data provide information about ore grade but may be inaccurate as to ore remaining since additional mining may have postdated this map. The 22 samples have a weighted average of 0.317 oz/ton silver, 1.78 percent copper, 0.078 percent nickel, and 0.076 percent cobalt. Cobalt concentrations as high as 1.0 percent in small high-grade areas of the main mineralized zone are described in the DMEA report.

Exposed mineral occurrences consist of a number of short discontinuous veins that in the current depressed market for copper do not constitute a resource. Undiscovered metal resources may occur under thrust plates on the west and south sides of the property. Louisiana Land and Exploration Company's geophysical surveys (fig. 10, inset map) located several significant anomalies in these areas. If the main mineralized zone represents a metamorphosed volcanogenic vent system, there is a possibility for high-grade resources of copper. While sample analyses indicate concentrations for gold and silver are relatively low, past sample programs suggest that any undiscovered resource may have concentrations of nickel and cobalt.

Iron Girl Prospect

The Iron Girl is near the head of Little Cedar Creek at elevations between 5,850 and 6,240 ft (fig. 2). Access from Winnemucca, NV, is by 55 mi of graveled county roads, and 5.5 mi of unmaintained jeep roads. The property would be inaccessible during periods of wet weather.

County mining records indicate the property was first located in 1937. Subsequent claiming was between 1952 and 1958 when the Iron King, Red Bird, and Blackjack mines about 10 mi to the northeast (fig. 1) were active and most iron deposits in the area were explored. Presumably at this time the prospect was drilled by Pacific State Steel Company, Union City, CA (Richard Gerish, personal commun., Gerish Mining and Exploration Co., 1984). The northern side of the prospect was, in 1986, part of the Red Star claim group owned by Wescord Resources, Reno, NV.

Workings on the main mineral occurrence consist of four bulldozer cuts and two prospect pits (fig. 13). Drill sites are located in three of the bulldozer cuts. The small mineral occurrences on the north and south sides of the property were explored by three small bulldozer cuts.

Near the center of the prospect, three discontinuous veins or lenses of magnetite are in a poorly exposed, north-trending zone within an andesite host rock (fig. 13). The mineral zones include andesite breccia and quartz veinlets, and do not exceed 100 ft in strike length. Magnetite is either massive or euhedral with vugs filled with actinolite and secondary calcite. Some magnetite contains intergrowths of euhedral melilite and hornblende (fig. 14). Russell (1984, fig. 2) places the andesite in the Happy Creek igneous complex and the shale and limestones on the northwest side of the prospect in the King Lear Formation. The contact between them is an erosional unconformity with the King Lear the younger of the two. The other workings on the prospect (sample sites 1, 4, 5) were probably dug on minor exposures of copper-stained country rock.

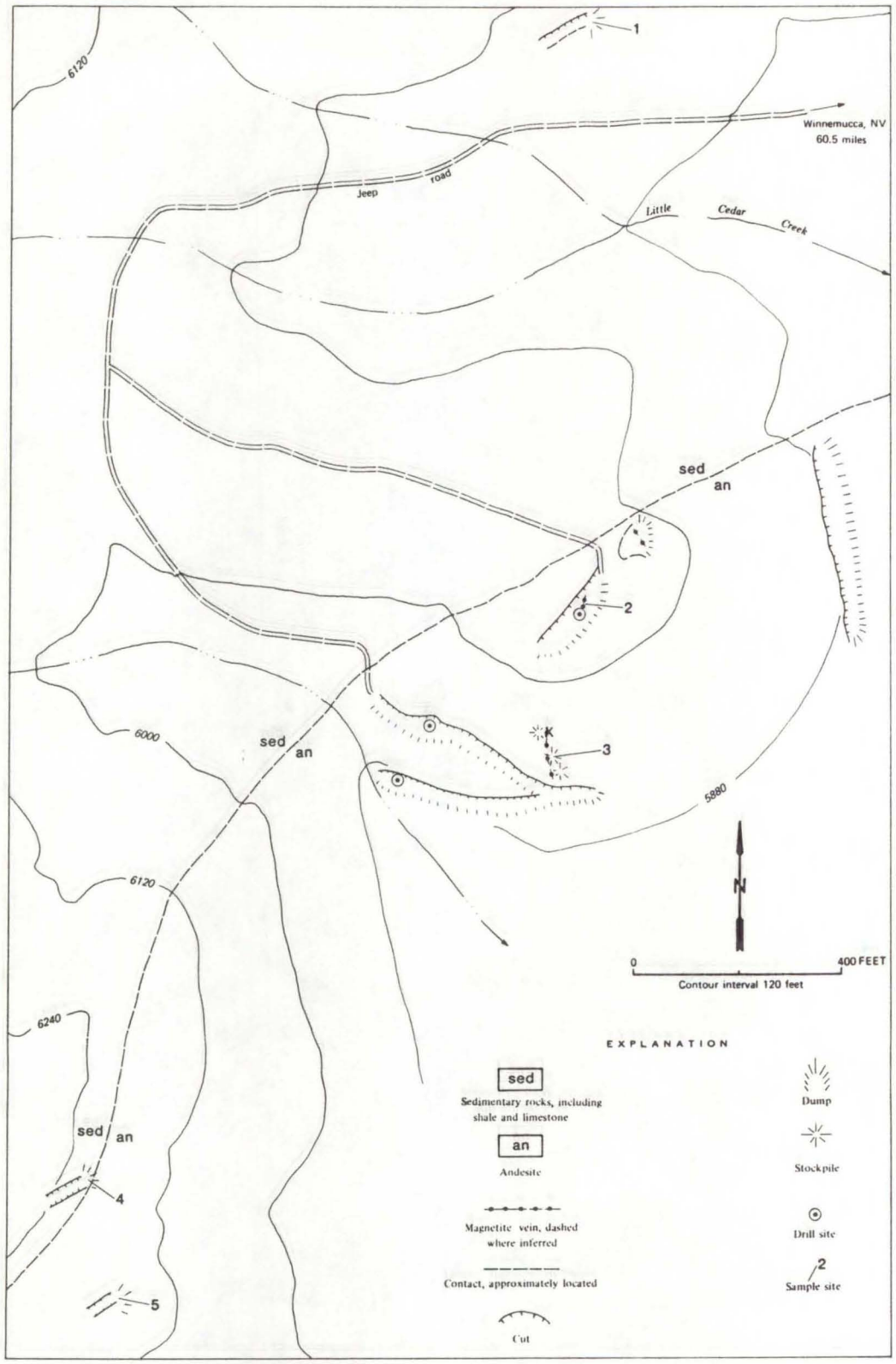

FIGURE 13. – Workings and sample sites of the Iron Girl prospect

Data for samples shown in figure 13

(N, none detected; --, not analyzed)

Sample No.	Type	Description	Gold (ppm)	Silver (ppm)	Copper (%)	Iron (%)
1	Grab--	Maroon to purple-red shale and argillite from cut dump	0.013	N	--	--
2 1/	do----	Massive magnetite and hematite, and andesite breccia containing vuggy quartz from ore stockpile	.013	N	0.0041	59.0
3 2/	do----	Massive magnetite containing euhedral crystals of melilite and hornblende from ore stockpile	N	N	--	61.0
4	do----	Altered limestone containing limonite and calcite veins from trench dump	.010	N	--	--
5	do----	Meta-andesite containing epidote, chlorite, calcite, hematite, and minor malachite from trench dump	.020	0.350	.019	--

1/ Also contained 0.163% vanadium.
2/ Also contained 0.121% vanadium.

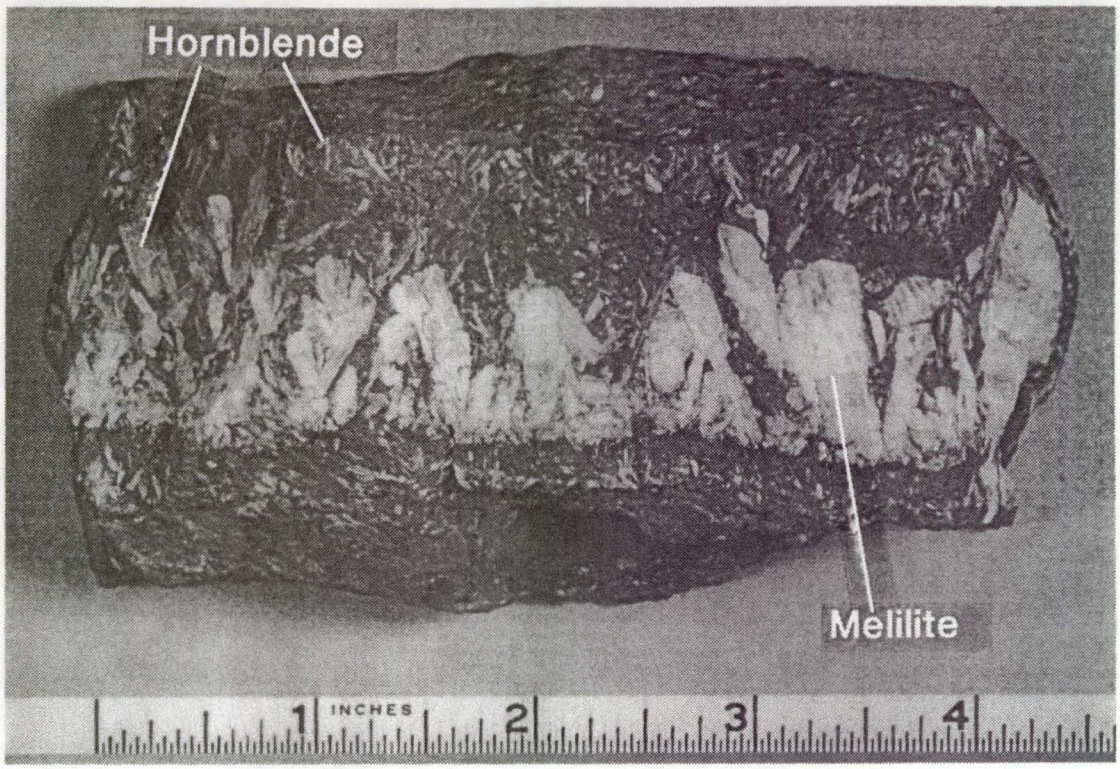

FIGURE 14.--Massive magnetite with intergrowths of melilite and hornblende, Iron Girl prospect.

Five samples are located on figure 13 with descriptions and analyses on the accompanying table. Magnetite samples were high grade with an average of 60 percent iron.

There are no mineral resources identified on the property. The prospect is part of the target area for massive sulfide exploration by Wescord Resources. Whether the iron is an actual remnant of a volcanogenic system or is a result of metal remobilized by the heat and pressure of tectonism is unknown. The coarsely crystalline texture of some of the magnetite suggests the latter method of formation.

Jackson Queen Prospect

This prospect is located on a north-facing slope above Jackson Creek at elevations between 4,520 and 5,000 ft (fig. 2). Access from Winnemucca, NV, is by 77 mi of graveled county roads.

The area was probably first prospected around the turn of the century when there was mining activity at the Harrison Grove (New Northern Light) mine about 0.8 mi to the east (fig. 1). The property was explored by three prospect pits, four adits totaling 260 ft in length, and one caved adit estimated to be less than 50 ft in length (fig. 15). The workings most likely date back to the 1910's and 1920's when the Humboldt King property to the south was active. County records indicate the last claim location was in 1951.

Mineral occurrences consist of a number of discontinuous 2- to 4-ft wide copper-bearing stringer veins in a 1,000-ft wide zone of shears and fractures (fig. 15, sample sites 3-14) trending northeast in andesite host rock that is often metamorphosed into a greenstone. Veins consist of massive white quartz, siliceous country rock, hematite, limonite, clay gouge, chlorite, manganese oxides, pyrite, chalcopyrite, malachite, and chrysocolla. Geologic mapping in 1973 by Louisiana Land and Exploration Company on the Humboldt King property suggests that quartz diorite dikes of probable Tertiary age border the mineral zone. Wescord Resources in 1984 mapped the mineral zone as a felsic horizon in the Happy Creek igneous complex related to a probable volcanogenic massive sulfide vent zone that trends from the Harrison Grove Mine to the Humboldt King property. Russell (1984, fig. 2) identified a thrust fault along the main mineral zone with Triassic metasediments on the west overriding andesites of the Boulder Creek beds.

Fourteen samples are located on figure 15 with descriptions and analyses on an accompanying unnumbered table. Copper content ranged from 0.0027 to 12.0 percent and silver content was as much as 21.85 ppm (0.64 oz/ton). The high-grade samples are similar to those from the Humboldt King property.

While high assay values from the lower adit (sample sites nos. 7-10) are impressive, because of low overall grade and small size, mineral occurrences on this property do not constitute resources.

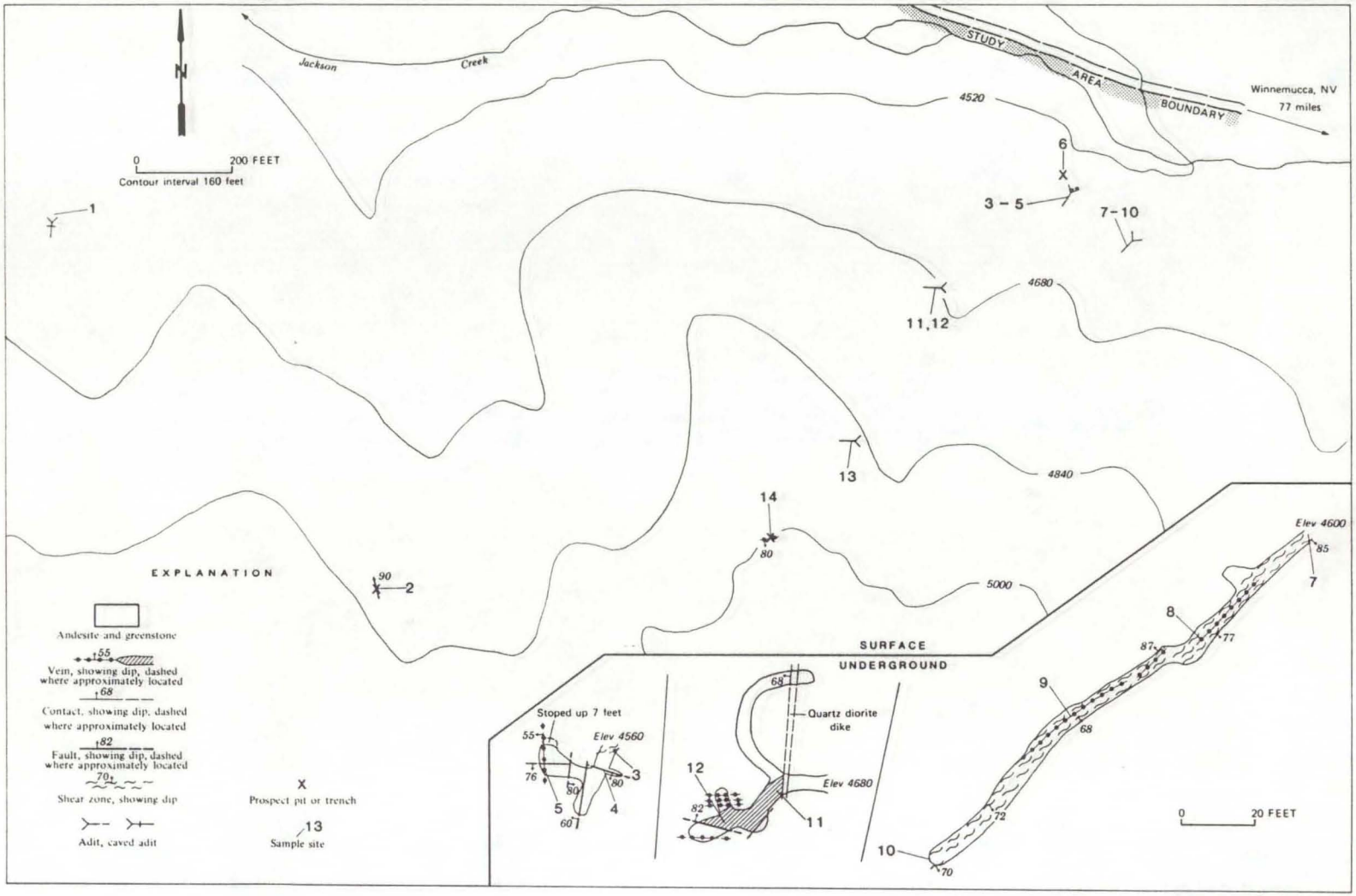

FIGURE 15. – Workings and sample sites of the Jackson Queen prospect

Data for samples shown in figure 15

(N, none detected; NA, not applicable)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
1	Select	NA	Andesite containing malachite and limonite from caved adit dump	0.009	19.62	6.7
2	do----	NA	Greenstone containing malachite, quartz, and limonite from 1-ton ore pile	.021	2.448	.82
3	Chip--	3.0	Quartz vein containing limonite in sheared andesite--	.07	3.627	.014
4	do----	.5	Fault containing clay gouge and limonite in andesite	.035	1.02	.0074
5	do----	1.0	Vein containing silicified andesite, hematite, chlorite, manganese oxides, and minor malachite	3.993	21.85	.055
6	Grab--	NA	Andesite containing limonite-stained quartz veins, barite, pyrite, and possible chalcopyrite from pit dump	.027	1.668	.017
7	Chip--	3.5	Sheared, silicified andesite containing limonite and manganese oxides	.007	N	.0027
8	do----	2.5	Iron- and manganese-stained sheared andesite, and vein containing altered andesite, chalcopyrite, malachite, and chrysocolla	.023	3.079	10.0
9	do----	2.0	Vein containing altered, silicified andesite, chalcopyrite, and abundant malachite and chrysocolla	.07	2.974	12.0

Data for samples shown in figure 15--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
10	Chip--	3.5	Sheared, intensely altered silicified andesite containing barite, malachite, and chrysocolla--------	N	N	0.085
11	do----	4.0	Vein of massive quartz containing spotty malachite---	0.052	4.609	.088
12	do----	4.0	do----------	.043	2.514	.048
13	do----	3.0	do----------	.087	5.031	.097
14	do----	2.5	Vein of malachite-stained quartz and gossan----------	.074	15.27	.93

Lillian Prospect

The property consists of 24 claims situated on the western front of the Jackson Mountains (fig. 2). Elevations range from 4,950 to 5,920 ft. Access from Winnemucca, NV, is by 73 mi of graveled, maintained county roads and 5 mi of unmaintained jeep roads that would be inaccessible during wet weather.

Initial prospecting was probably during the first part of the century when the Red Butte mining district 2 mi to the south was active. According to county records, the earliest claim location was in 1917, most likely on exposures of iron-stained sulfide veins. These areas were relocated a number of times in the 1920's, late 1930's, 1950's, and early 1960's. During the 1950's, interest in the iron deposits at the northern end of the property paralleled mining activity at the Iron King mine area, 14 mi to the northeast (fig. 1). Exploration for low grade, bulk tonnage, precious metals deposits resulted in the location of the present property in 1980. In 1983 the property was examined and evaluated by an independent mining engineer, J. E. Boyle, Jr. The claim group in 1986 consists of the Lillian Nos. 1-18, Lucky Strike Nos. 1-3, and Chukar Nos. 1-3, owned by L. and C. Kaylor, V. and J. Johnson, and J. and M. Chiechi.

Workings are centered on three areas of mining interest (figs. 16 and 17): (1) the iron occurrences on the north side of the property are exposed by a pit with several benches and by three bulldozer cuts; (2) the small zones of mineralization of the west side of the property were explored by one bulldozer cut and seven prospect pits; (3) vein deposits on the east side of the property were worked by eight prospect pits, and by five adits and one inclined shaft totaling 465 ft in length.

Several mineral commodities occur on the property (figs. 16 and 17). Iron occurrences (fig. 16, sample sites 3-6) consist of massive hematite and magnetite in andesite of the Happy Creek igneous complex. The occurrences are near an andesite-diorite stock contact and appear to be replacement bodies distributed along fractures in the andesite that parallel the contact. Iron exposures consist of layers or lenses as thick as 25 ft that include small amounts of specular hematite, altered andesite interbeds or breccia, quartz veinlets, and chlorite. Similar occurrences are at several other properties that border the diorite intrusion underlying Navajo Peak.

Gold-, silver-, and copper-bearing, north- to northeast-trending shear zones occur within the diorite stock and consist of various amounts of 0.8- to 1.3-wide quartz veins, mylonite, clay gouge, limonite, hematite, siderite, pyrite (both as disseminations and as veins), chalcopyrite, malachite, and chlorite (fig. 16, nos. 7-18, fig. 17, nos. 9-12). The exposed mineralized parts of shear zones ranged in width from 0.8 to 10 ft and strike length did not exceed 100 ft. The diorite wallrock is kaolinized and often contains disseminated pyrite. Mineralization was probably related to late-stage hydrothermal activity of the diorite intrusive event.

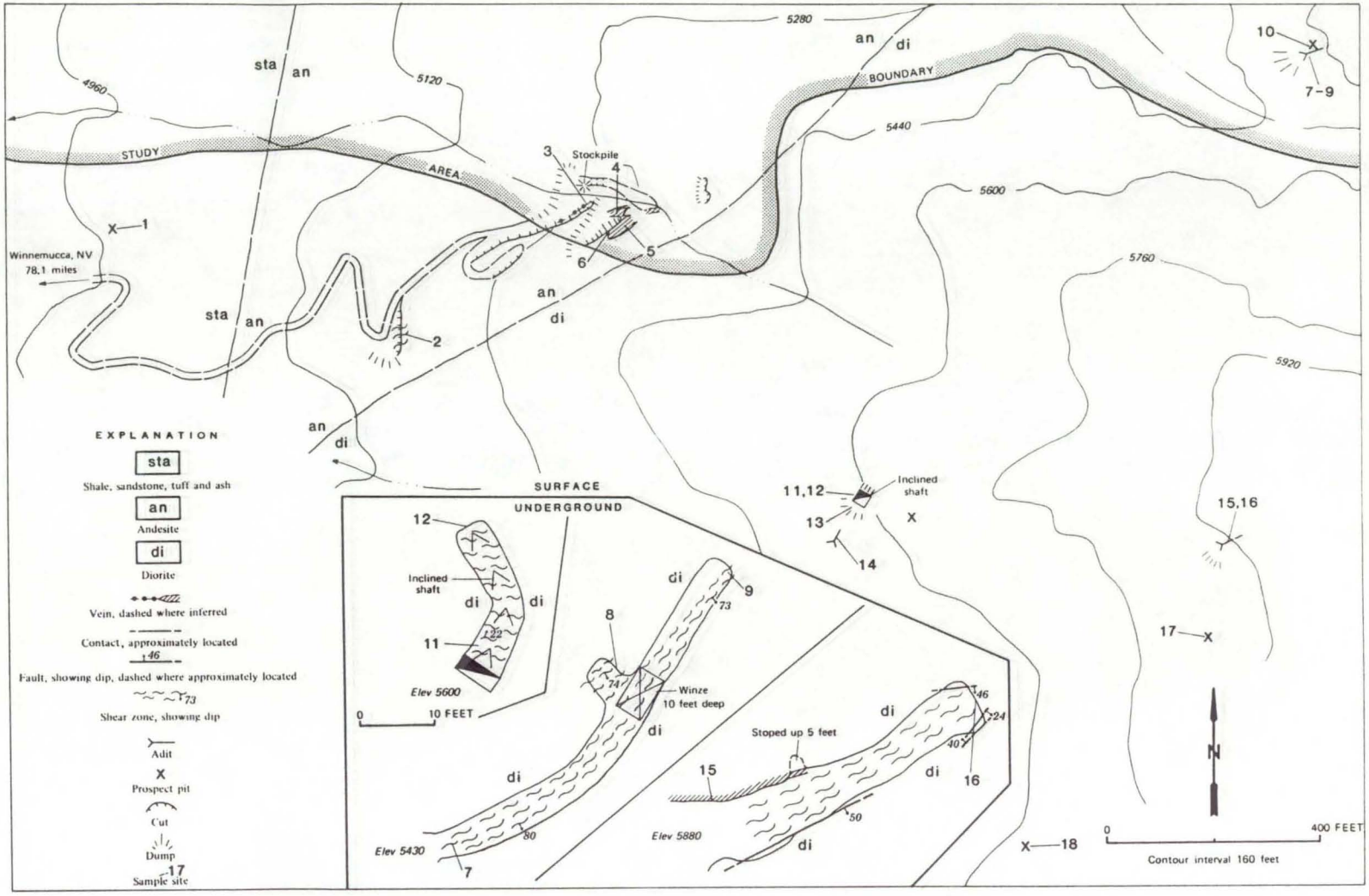

FIGURE 16. – Workings and sample sites in the north part of the Lillian prospect

Data for samples shown in figure 16

(N, none detected; NA, not applicable)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
1	Chip--	3.5	Dark, thin-bedded shale that is slightly metamorphosed----------	N	N	0.0006
2	do----	25.0	Bleached andesite with iron and manganese stains------	N	N	.0019
3	do----	2.5	Massive and specular hematite containing quartz veinlets and altered andesite fragments----------	N	N	.0007
4	do----	13.0	Altered andesite containing stringers of hematite and magnetite up to 2 ft wide----------	N	N	.0015
5	do----	25.0	Massive hematite containing small amounts of quartz, chlorite, and andesite fragments----------	N	N	.0019
6	do----	9.6	Altered andesite containing mica, limonite, quartz, and hematite veinlets----------	N	N	.0003
7	do----	6.0	Sheared, limonite-stained diorite----------	0.032	N	N
8	do----	2.0	Sheared, altered diorite containing minor pyrite and abundant limonite----------	.954	2.4	.0016
9	do----	1.0	Sheared diorite containing quartz vein, pyrite, and limonite----------	1.333	5.535	.018
10	do----	.8	Highly altered, sheared diorite containing hematite and limonite----------	.151	4.615	.024

Data for samples shown in figure 16--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
11	Chip--	5.0	Light-colored, altered diorite containing minor quartz pods and malachite----------	0.073	0.898	0.0057
12	do----	2.0	Sheared, altered diorite containing clay gouge, limonite, hematite, and disseminated euhedral pyrite--	.141	2.158	.0031
13	Select	NA	Buff-colored, altered diorite containing quartz, pyrite, and malachite from shaft dump----------	.070	9.558	.048
14	Chip--	2.0	Highly altered, iron-stained diorite from shear zone exposed in 8-ft-long adit----------	N	N	.0033
15	do----	1.0	Vein containing silicified diorite, and abundant malachite, azurite, pyrite, and limonite in sheared diorite----------	9.532	2022.87	3.1
16 1/	do----	.8	Sheared diorite containing gouge, hematite, and manganese dendrites----------	.056	11.18	.017
17	do----	1.3	Limonite-stained quartz lens containing hornblende, hematite, and jarosite, and diorite containing disseminated euhedral pyrite----------	.024	3.858	.0094
18	do----	5.0	Intensely fractured and altered diorite containing limonite, hematite, and quartz veinlets----------	.011	.730	.0053

1/ Also contained 0.011% antimony.

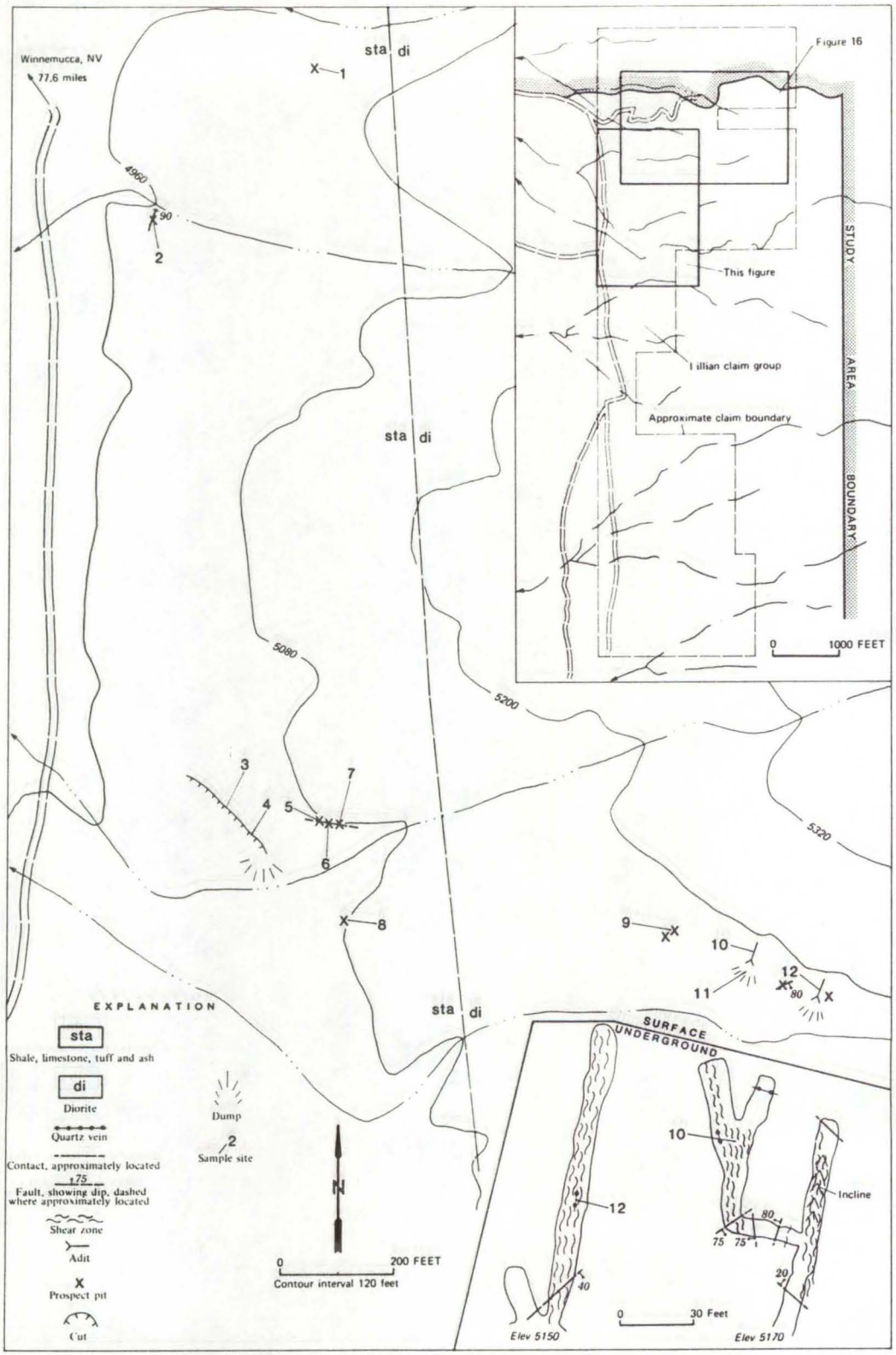

FIGURE 17. – Workings and sample sites in the central part of the Lillian prospect

Data for samples shown in figure 17

(N, none detected; --, not analyzed; NA, not applicable)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
1	Chip--	6.0	Black slate and metamorphosed volcanic ash----------	N	N	0.011
2	do----	10.0	Silicified volcanic rocks containing jasperoid-------	0.015	N	.0003
3	do----	65.0	Tan, silicified volcanic ash containing limonite, manganese, and gypsum----------	N	N	.0012
4	Grab--	NA	Red-brown jasperoid containing hematite and Liesegang banding from cut dump----------	N	N	--
5	Chip--	1.5	Fractured, silicified volcanic rock containing jasperoid, limonite, hematite, and minor malachite---	.02	N	.04
6	do----	5.0	Highly silicified sedimentary rocks containing limonite and hematite in fault zone----------	.023	N	.13
7	do----	4.0	do----------	.017	N	.087
8 1/	do----	4.0	do----------	N	N	.0015
9	do----	10.0	Mylonite containing disseminated euhedral pyrite, calcite, limonite, siderite, quartz veins, alunite, chlorite, and sheared diorite----------	.285	0.965	.05
10	do----	8.0	Mylonite and sheared, altered diorite containing disseminated euhedral pyrite, limonite, gouge, and pervasive silica flooding----------	.252	.35	--

Data for samples shown in figure 17--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
11	Select	NA	Quartz veins containing blebs of pyrite, disseminated pyrite, limonite, and fragments of altered diorite from adit dump----------	10.38	2.343	--
12 2/	Chip--	0.8	Quartz vein and yellow gouge in altered, sheared diorite----------	.09	.38	0.019

1/ Also contained 1.11% barium.
2/ Also contained 0.113% vanadium.

Gold and silver are also found on the western side of the property in unmapped rocks of probable Tertiary age. These rocks include volcanic ash, tuff, shale, arkose, and limestone. Gold- and silver-bearing, altered shear zones include barite veins and jasperoids (fig. 18). These occurrences appear to be epithermal, related to shallow hydrothermal events of the diorite intrusion such as hot springs. Vic Dunn, BLM geologist, observed from aerial photography that these Tertiary rocks are part of a circular structure and may be the northeast side of a large caldera that covers most of the Red Butte mining district (personal commun., 1984).

Thirty samples are located on figures 16 and 17 with descriptions and analyses on the accompanying unnumbered tables. Samples 3-6 (fig. 16) are mostly iron and contained little else of economic interest. Assays of the samples from veins in the diorite (fig. 16, nos. 7-18; fig. 17, nos. 9-12) contained as much as 10.38 ppm gold (0.30 oz/ton) and 2022.87 ppm silver (59.0 oz/ton), and ranged from 0.0016 to 3.1 percent copper. Sample 15 was uniquely high-grade and accounts for the highest silver and copper values. The highest gold value was at the old adits (fig. 17, no. 11) and was 10.38 ppm (0.30 oz/ton). Analyses from sampling by the mine owner in 1982 of the same adits ranged from 2.7 ppm to 22.4 ppm gold (0.08 oz/ton to 0.65 oz/ton) with as much as 17.6 ppm silver (0.51 oz/ton). A study of the property made by an independent mining engineer in 1983 indicated lower concentrations for this area ranging from 0.34 ppm to 2.91 ppm gold (0.01 oz/ton to 0.08 oz/ton) and trace silver. Geochemical surveys by Barringer Resources (1982, v. 1, p. 158) found a significant gold anomaly in the stream sediments on this property.

While there are no identified mineral resources on the prospect, the western side of the area may contain low-grade epithermal type deposits of gold and silver. On the eastern side, there may be undiscovered are possible resources of gold, silver, and copper in veins within the diorite intrusion. The hematite-magnetite occurrences on the northern side of the property are, apparently devoid of other metals of economic value, and are too small and isolated to be an iron resource now or in the foreseeable future, but may be indicative of massive sulfide deposits.

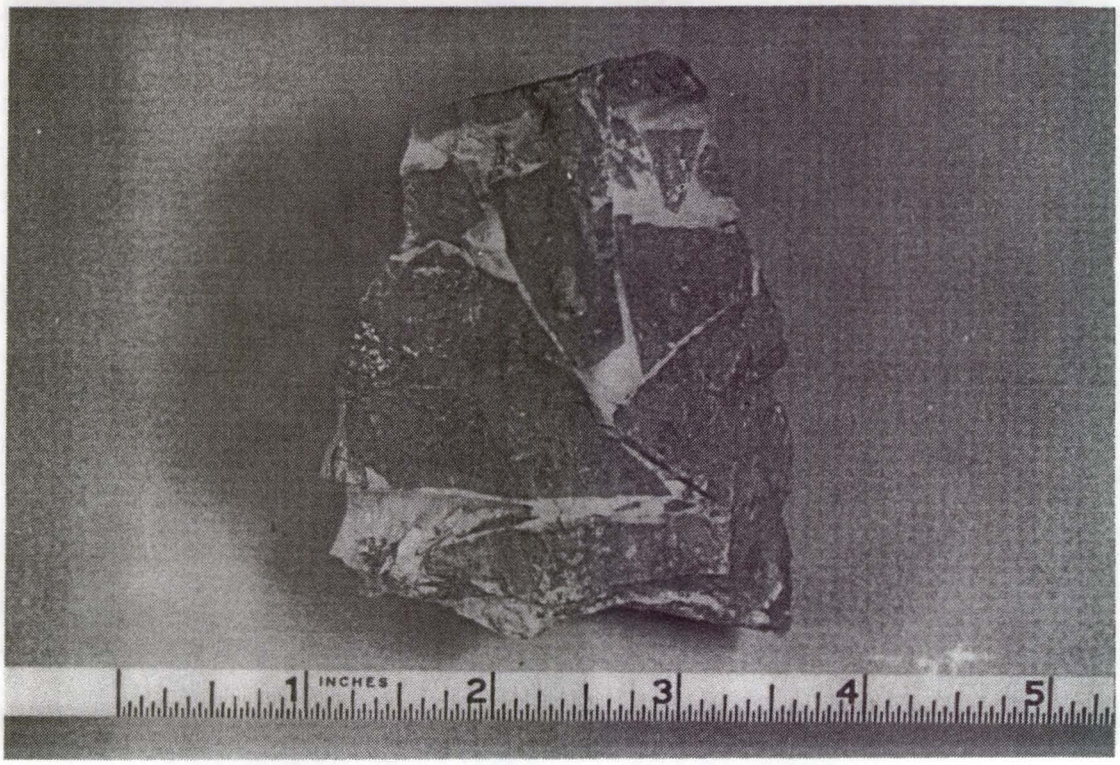

FIGURE 18.--Brecciated, silicified volcanic tuff with jasperoid fillings, Lillian prospect.

Mammoth Prospect

The prospect is located on the northeast side of Navajo Peak at elevations between 6,320 and 6,640 ft (fig. 2). Access from Winnemucca, NV, is by 50 mi of graveled county roads and 11 mi of unmaintained jeep road that is gated on private land near its junction with the county road.

Initial exploration and claim staking was in the 1920's when mining activity peaked at the Prodigal mine 0.8 mi to the south. The Mammoth claim group (eight claims) was located in 1950 when area interest in iron deposits resulted from iron mining at the Iron King mine 12 mi to the northeast (fig. 1). The pit and the 3,000 ft of bulldozer workings probably date back to the 1950's.

Iron occurrences consist of 2- to 3.5-ft wide veins or lenses of hematite and magnetite with strike lengths up to 150 ft within andesite of the Happy Creek igneous complex (fig. 19). The north-trending, discontinuous occurrences are vuggy, occasionally banded, and include varying amounts of altered andesite, limonite, calcite, and pyrite. In contrast, the pits on the south side of the prospect (sample sites 5, 6) are on zones of hydrothermal alteration in sedimentary rocks of the King Lear Formation, adjacent to a fault contact with the Happy Creek.

Six samples are located on figure 19; their descriptions and analyses appear on the accompanying unnumbered table. Samples of the iron occurrences have a weighted average of 37 percent iron. The two samples on the south side of the prospect showed low concentrations for gold, silver, and copper.

While the iron occurrences of the prospect are part of a number in the Navajo Peak area, they are too small and remote to be considered resources. The prospect is part of an area being explored for volcanogenic massive sulfide deposits.

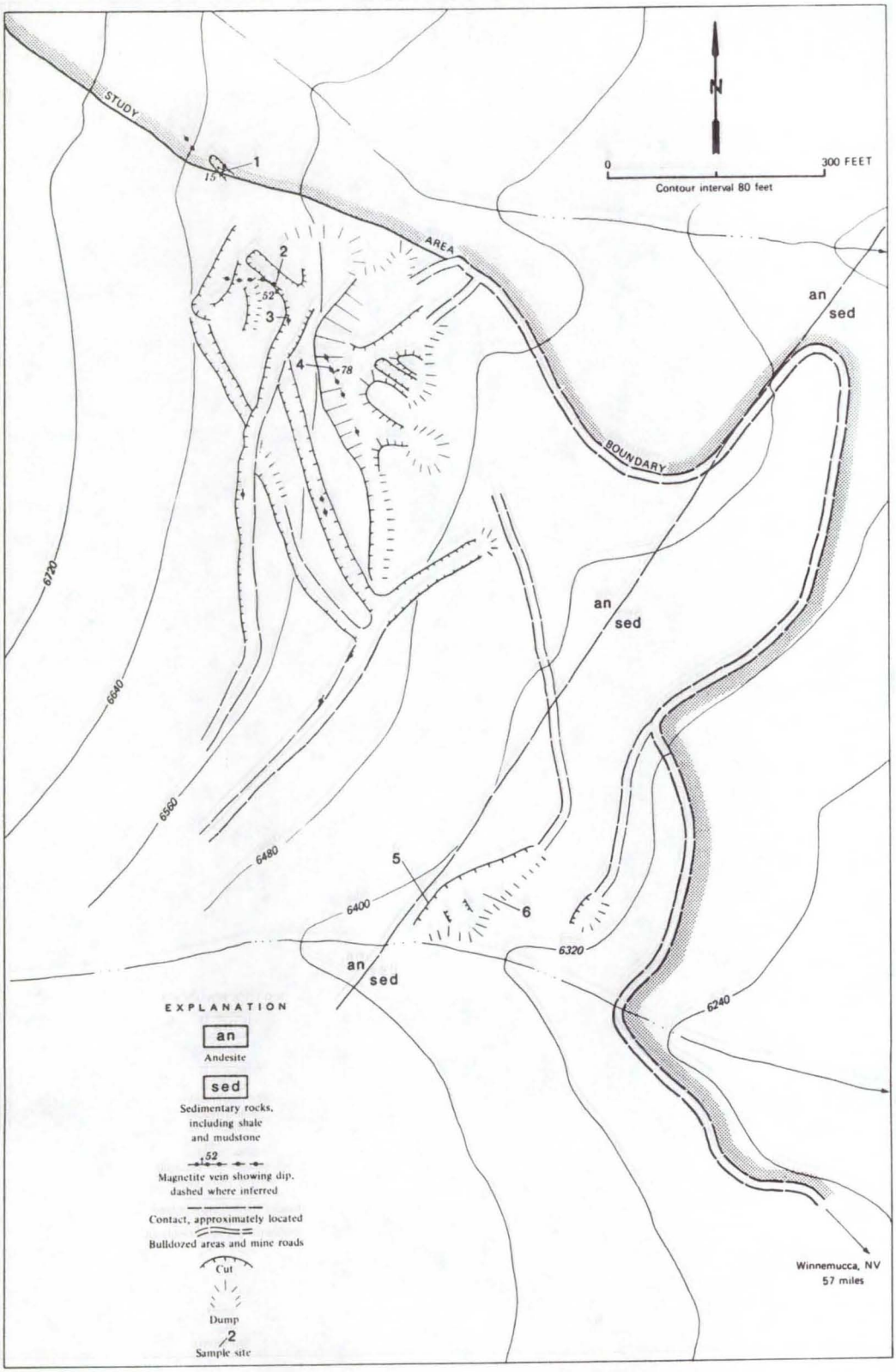

FIGURE 19. – Workings and sample sites of the Mammoth prospect

Data for samples shown in figure 19

(N, none detected; --, not analyzed; NA, not applicable)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)	Iron (%)
1 1/	Chip--	2.0	Vein containing massive hematite and magnetite, some specular hematite, calcite, and limonite in andesite----------	N	N	0.0015	33.0
2	do----	3.5	Vein containing banded, vuggy hematite and magnetite, andesite fragments, and limonite------	N	0.4	.0022	39.0
3 2/	do----	3.0	Vein containing massive hematite, massive magneite, specular hematite, and lenses of altered andesite----------	N	N	.0031	44.0
4	do----	2.5	Vein containing banded hematite, fragments of andesite, and minor pyrite----------	N	N	.0030	31.0
5	do----	10.0	Limonitic clay, propylitically altered sedimentary rock fragments, and lenses of quartz	0.007	N	.0009	--
6	Grab--	NA	Bleached, silicified limestone from cut dump-----	N	6.137	.0007	--

1/ Also contained 0.087% vanadium.
2/ Also contained 0.119% vanadium.

Prodigal Mine (Bull Creek Claims)

The property is located on the east side of the Jackson Mountains at the head of Bull Creek at elevations between 6,280 and 7,000 ft (fig. 2). Access is from Winnemucca, NV, by 50 mi of graveled county roads and 8 mi of unmaintained jeep road. Although the jeep road is passable, access may be limited by gates on private land at the county road.

A copper-stained outcrop on a hillside was located as the Prodigal Mine in 1916. Approximately 85 claims were located (many as relocations) at and around the mine between 1920 and 1960. A millsite with bunkhouses dating back to the 1920's and a spring are about 3,000 ft northeast of the main workings. Bureau of Mines records list metal production for 1923 as 1.43 oz gold, 213 oz silver, and 648 lb copper recovered from 28 tons of ore. Nevada Mining and Exploration Company, Winnemucca, NV, located the Bull Creek Nos. 1-6 and Bull Creek millsite claims in 1982 and 1985.

Although the three adits and six prospect pits on the property were caved and no vein exposures were found, the presence of vein rock in dump material indicates that a vein runs between sample sites 3 and 7 (fig. 20). The mineral occurrence runs 1,000 ft along a fault in shaly, impure limestone and black, thin-bedded shale of the Cretaceous King Lear Formation. The vein contains silver and copper minerals in a gangue of bull quartz, limonite, and calcite. The primary copper-silver bearing mineral is tetrahedrite; malachite and azurite staining is prevalent. Small amounts of bornite and arsenopyrite were also observed (sample sites 4-6).

The eight samples taken are located on figure 20; their descriptions and analyses appear in the accompanying unnumbered table. Along the vein, samples 3-7 contained 0.037 to 1.187 ppm gold (0.001 oz/ton to 0.035 oz/ton), 13.84 to 266.5 ppm silver (0.40 oz/ton to 7.8 oz/ton), and 0.021 to 1.53 percent copper. The antimony in sample 5 and a small amount of arsenic in samples 4-6 are probably constituents of tetrahedrite and arsenopyrite, respectively. Nevada Mining Company's sampling program in 1982 had one high-grade sample from sample site 5 that assayed 2.056 oz/ton gold and 16.458 oz/ton silver. The six samples they took from the property averaged 0.689 oz/ton gold and 4.972 oz/ton silver.

The lack of vein exposures make determination of resources impossible. The caved adit by the road (sample site no. 8) was probably dug in an attempt to crosscut the high-grade part of the vein, which, judging by the lack of vein rock in the dump, it did not. If the Navajo Peak area was a volcanogenic, massive sulfide vent zone area during Triassic-Jurassic time as some investigators believe, there could be a resource of gold, silver, and copper at depth.

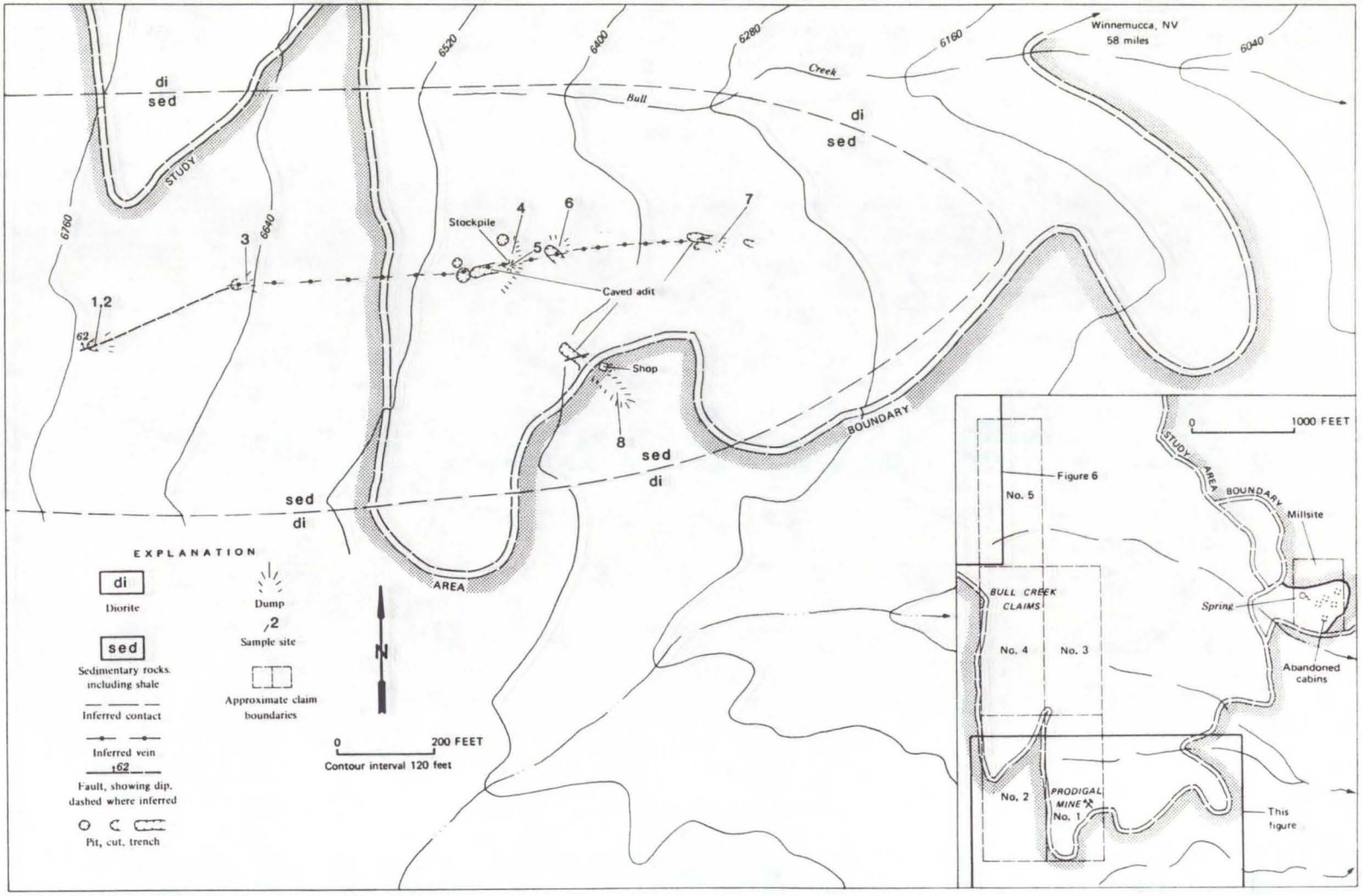

FIGURE 20. – Workings and sample sites of the Prodigal mine (Bull Creek claims)

Data for samples shown in figure 20.

(N, none detected; NA, not applicable)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)
1	Chip--	1.5	Sheared, shaley limestone containing calcite veinlets and dark-gray, fissile shale containing limonite------	0.009	0.350	N
2	do----	9.0	do----------	.007	.360	N
3	Select	NA	Iron-stained, altered shale and copper-stained quartz from pit dump----------	.105	13.84	0.021
4	Grab--	NA	Iron-stained limestone containing veinlets of quartz and calcite, shale, and copper-stained quartz from caved adit dump----------	.189	37.26	.216
5 1/	Select	NA	Quartz containing azurite, malachite, tetrahedrite, and bornite from stockpile----------	1.187	266.5	1.53
6	Grab--	NA	Altered gray limestone and black shale, both containing limonite and minor malachite from trench dump---------	.157	18.88	.154
7	do----	NA	Quartz, altered limestone containing calcite veinlets, and minor malachite from caved adit dump----------	.037	15.90	.075
8	do----	NA	Iron-stained limestone and scarn, black shale, calcite veins, and hematite from caved adit dump----------	.008	3.431	.019

1/ Also contained 0.46% antimony.

Red Boy Mine

The mine is about 2 mi northeast of King Lear Peak at elevations from 5,760 to 6,700 ft (fig. 2). Access from Winnemucca, NV, is by way of 55 mi of maintained, graveled county roads and 3.3 mi of unmaintained jeep roads that would be impassable during wet weather.

County records indicate the property was first claimed in 1919 with subsequent relocations in the 1920's, 1930's, 1940's, and 1950's, 1970's, and 1980's. The Red Boy Nos. 1 and 2 claims were located in 1940 and development work started shortly thereafter. Bureau of Mines records list metal production for 1940 as 1 oz gold, 132 oz silver, 908 lb lead, and 4,908 lb zinc recovered from 3 tons of zinc and 1 ton of lead concentrate. In 1943 the USBM examined the property and, in War Minerals Memorandum (W.M.M. Nev. 114), reported production of two car loads of ore shipped to a lead smelter in Utah. The mine was described as consisting of one 30-ft adit with an 18-ft shaft on the upper level and a 75-ft adit with a 65-ft winze on the lower level. Ore was exposed in all the workings. In the same year, the USBM recommended further development of the mine and approved funding for a mine access road. The mine was evaluated again by the USBM in 1945 as part of the War Minerals Examination program. The property had renewed mining activity including a mining camp, compressor and pump, and a variety of new mining equipment. The shaft was deepened to 23 ft and a lower crosscut adit was being dug to undercut the ore zone. Bureau of Mines records for 1948 show a production of 616 oz silver, 49 lb copper, 4,165 lb lead, and 7,538 lb zinc recovered from 44 tons of ore. In 1984, Wescord Resources, Reno, NV, located the Red Boy Nos. 1-6 claims as part of an exploration project for volcanogenic massive sulfide deposits in the Jackson Mountains. In 1986 the property is leased to Long Lac Mineral Exploration (Texas), Inc. which plans to initiate an exploration program including mapping, sampling, and possibly drilling.

In 1986, workings consist of four adits, one flooded shaft, eleven prospect pits and one cut (fig. 21). Three of the adits are caved and one, 20 ft in length, was apparently an abandoned attempt to crosscut the mineral structure at the upper mine workings. The caved adits at the mine near the center of the property were mapped by two USBM examinations in 1943 and 1945 and this information was used in figure 21. The caved adit on the south-east side of the property is estimated to be about 50 ft in length.

Three mineralized zones are exposed at the mine (fig. 21). At the upper workings (sample sites 5 and 6), a vein strikes N. 35° E. and dips 27° NW. At the lower workings, one vein (sample site 7) strikes N. 55° E. and dips 68° NW., and another is exposed in a gossan zone above a caved adit (sample site 8). Mineralized structures in workings now caved or flooded were described in unpublished USBM War Minerals reports by Smith in 1943 and Benson in 1945. According to them, at the upper workings, in a flooded vertical shaft, is a mineralized wedge-shaped section dipping 10° to 12° NE. between fractures trending N. 40° E., dipping 40° NW., and fractures trending N. 20° E., dipping 65° SE. The veins exposed in the

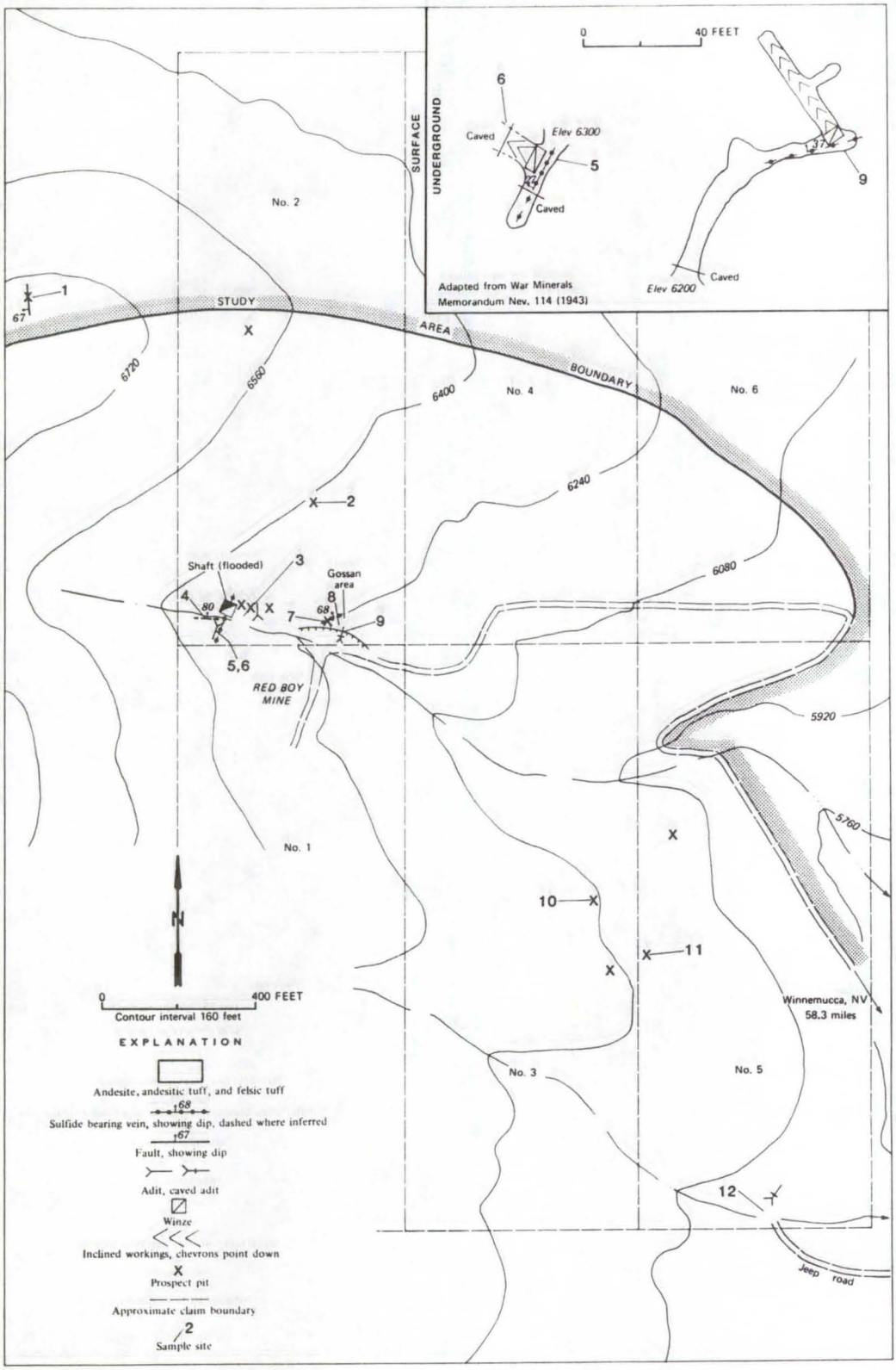

FIGURE 21. – Workings and sample sites of the Red Boy mine

Data for samples shown in figure 21

(--, not analyzed; NA, not applicable)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)	Lead (%)	Zinc (%)
1	Grab--	NA	Altered andesitic tuff containing limonite, hematite, and siliceous boxwork from pit dump----------	0.016	0.750	--	--	--
2	do----	NA	Altered andesitic tuff containing calcite veinlets up to 1 in. thick from pit dump-----	.010	.913	--	--	--
3 1/	Select	NA	Vein material containing pyrtie, sphalerite, galena, arsenopyrite, and limonite from shaft dump----------	5.032	189.1	0.103	1.93	23.5
4	Chip--	1.6	Limonitic clay and iron-stained silicified andesitic tuff in fault----------	.042	3.762	.014	.058	.35
5	do----	3.0	Vein containing galena, pyrite, arsenopyrite, sphalerite, quartz, limonitic gouge, malachite, and silicified andesite----------	3.145	354.2	.134	10.0	3.5
6 2/	do----	3.0	Vein material----------	5.04	63.0	.06	.4	4.8
7 3/	do----	2.75	Silicified andesite containing clay gouge, limonite, and hematite in a fault----------	.704	502.4	.123	3.4	3.9
8	do----	6.5	Gossan containing minor galena and quartz, and iron-stained, altered andesite----------	.110	100.4	.039	.79	4.6
9 4/	do----	1.5	Vein material----------	.21	88.2	--	1.2	7.0

Data for samples shown in figure 21--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)	Lead (%)	Zinc (%)
10 5/	Grab--	NA	Heavily iron-stained andesite containing veins of calcite and barite from pit dump----	0.076	115.6	--	0.52	0.78
11	do----	NA	Siderite vein material 2 to 4 in. wide and limonite from pit dump----------	.016	1.143	--	--	.0092
12	do----	NA	Brecciated andesite and felsic tuff containing limonite along fractures from caved adit dump----------	.017	.710	--	--	--

1/ Also contained 0.099% cadmium.
2/ Sample analysis from unpublished USBM War Minerals Examination, 1945.
3/ Also contained 1.63% arsenic.
4/ Sample analysis from unpublished USBM War Minerals Memorandum, 1943.
5/ Also contained 0.012% cadmium.

upper workings range in width from 8 to 30 in. with an average of 18 in. In the lower caved adit a vein reportedly averages 18 in. in width, trends N. 75° E., and dips 37° NW. Veins consist of quartz, clay gouge, and limonite with varying amounts of pyrite, chalcopyrite, argentiferous galena, sphalerite, arsenopyrite, and magnetite. There has been one unconfirmed report of cerargyrite (AgCl) at the mine (Humboldt County mining records). The country rock is andesite, andesite tuff, and andesite agglomerate or flow breccia of the Happy Creek igneous complex. Wescord Resources in an unpublished report, 1985, described the stratigraphy from bottom to top as follows:

> "chloritized pyroxene andesite flows with some disseminated pyrite-chalcopyrite; argillized andesite tuff and carbonate-$BaCO_3$ chemical sediment; argillized and goethite-stained andesite tuff; massive gossan; andesite tuff with the upper portions argillized and veined with quartz-sulfide; siliceous Pb-Zn clast supported breccia; and hanging wall andesite agglomerate."

Other mineral occurrences on the property consist of small mineralized zones in Happy Creek volcanic rocks. They include siliceous hematite veins (sample site 1), carbonate veins (sample sites 10 and 11), and altered andesites or tuffs (sample site 12).

Benson described mineral occurrences at the Red Boy mine as hydrothermal replacement deposits along zones of weakness in the country rock. Wescord Resources exploration work in 1984 and 1985 has redefined the occurrences as massive sulfides or exhalite horizons in a volcanogenic system with vent areas to the northwest. Our investigation supports Wescord's findings.

Twelve samples are located on figure 21 with descriptions and analyses on the accompanying unnumbered table. Samples from the mine area (nos. 3-9) had from 0.042 ppm to 5.04 ppm gold (0.001 oz/ton to 0.15 oz/ton), 3.762 ppm to 502.4 ppm silver (0.11 oz/ton to 14.7 oz/ton), 0.014 to 0.134 percent copper, 0.058 to 10 percent lead, and 0.35 to 23.5 percent zinc. Sampling from a previous USBM study of the main veins indicated the mineral occurrence averages 9.19 ppm (0.27 oz/ton) gold, 205.71 ppm (6.00 oz/ton) silver, 2.0 percent lead, and 16.0 percent zinc. The cadmium in samples 3 and 10 is probably a constituent of the sphalerite; the arsenic in sample 7 is a constituent of arsenopyrite.

Exposures of mineral occurrences are too small to be resources. The Red Boy mine and surrounding area is the center for current exploration for massive sulfide volcanogenic deposits.

Red Star Prospect

The prospect consists of 50 claims northeast to east from King Lear Peak (fig. 2). Elevations range from 5,560 to 7,360 ft. Access from Winnemucca, NV, is by 55 mi of maintained county roads and 4.4 mi of unmaintained jeep roads that would be passable only in dry weather.

The claim group was located in 1985 by Wescord Resources, Reno, NV, to cover any possible extensions of the volcanogenic massive sulfide deposits on their Red Boy property. The claim group encompasses several iron deposits at the head of Big Cedar Creek. These deposits were first located in 1941 as the Bullion claim group. A number of relocations in the 1950's resulted from interest related to iron mining in the Iron King mine area (fig.1). Pacific State Steel of Union City, CA, drilled the iron deposits during 1958-1959 using a rotary drill with 100-ft holes on 100-ft centers (Richard Gerish, Gerish Mining and Exploration Co., personal commun., 1984). Between 1959 and 1985, the property was idle. The claim group is leased to Long Lac Minerals Exploration (Texas), Inc. which plans on an exploration program including mapping and sampling in 1986.

Workings on the property are located at the head of Big Cedar Creek and consist of seven prospect pits or trenches, and about 5,000 ft of bulldozer cuts and scraps, and drill site access roads (fig. 22). The bulldozer workings cover an area of about 15 acres.

Andesite, andesite tuff, and andesite flow breccia of the Happy Creek igneous complex underlie most of the prospect (fig. 22). Iron occurrences (sample sites 2-10) consist of lenticular 1.4- to 5.75-ft wide veins containing both massive and euhedral magnetite with interstitial actinolite along with lesser amounts of epidote, quartz, hematite, limonite, pyrite, and malachite. The veins trend northeast, dip between 25° and 72° northwest, and vary in strike length from several feet to 160 ft. Some wallrock appears to be potassically altered. The crystalline texture of some of the occurrences suggests hydrothermal or metamorphic deposition related to the Deer Creek Thrust Fault on the southeast side of the property. Wescord Resources also found poorly exposed outcrops of pyrite-chalcopyrite rich chert underlying the iron deposits (unpublished company report, 1984). This would suggest that occurrences are related to a volcanogenic massive sulfide system.

Ten samples are located on figure 22 with descriptions and analyses on the accompanying unnumbered table. Iron samples (nos. 2, 4, 6, 7, 9, 10) have a weighted average of 52.8 percent iron and 0.193 percent vanadium. Altered wallrock samples (nos. 3 and 5) showed the highest precious metal concentrations with an average of 0.100 ppm (0.003 oz/ton) gold and 0.991 ppm (0.029 oz/ton) silver.

While there are no identified resources on the property, iron occurrences are consistently high grade. Pacific State Steel's drilling program did not result in any additional development work.

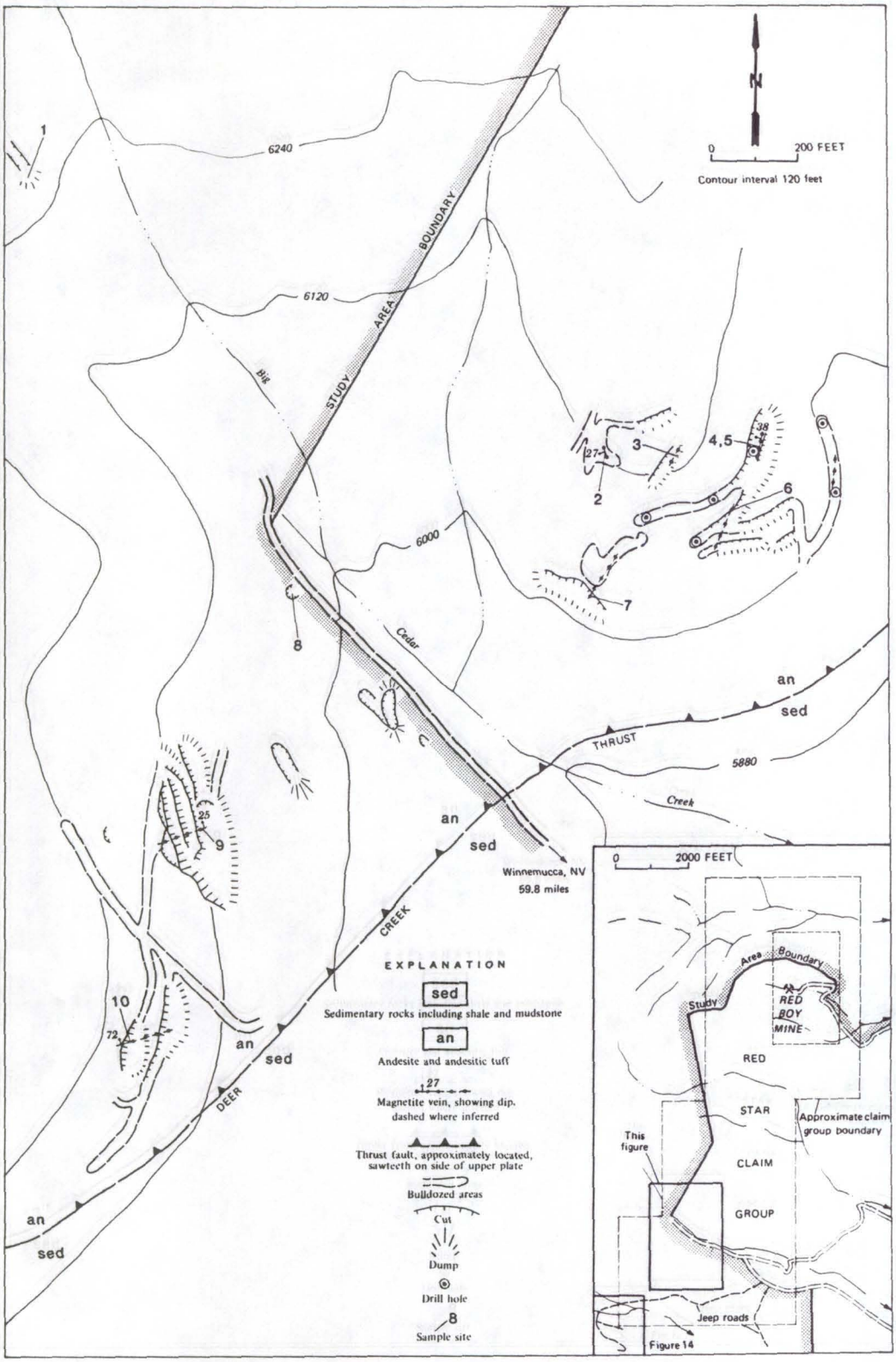

FIGURE 22. – Workings and sample sites of the Red Star prospect

Data for samples shown in figure 22

(N, none detected; --, not analyzed; NA, not applicable)

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)	Iron (%)
1	Grab	NA	Andesite and andesite tuff containing veinlets of quartz, epidote, and limonitic clay from trench dump----------	0.014	N	--	--
2 1/	Chip	5.75	Medium-grained magnetite vein composed of euhedral crystals with actinolite-limonite interstitial fillings----------	N	N	0.0094	51.0
3	Grab	NA	Andesite tuff containing magnetite veinlets and minor malachite from cut dump----------	.051	.953	--	--
4 1/	Chip	2.75	Massive magnetite vein containing andesite fragments and hornblende----------	N	N	.018	58.0
5	do--	5.0	Vein wallrock of potassically altered andesite containing malachite, alunite, and fracture fillings of chlorite and epidote----------	.198	1.029	.41	14.3
6 1/	do--	2.0	Massive magnetite vein containing actinolite, chlorite, epidote, and minor malachite----------	.023	N	.050	51.0
7	do--	3.5	Massive magnetite vein with slickensides containing quartz fracture fillings and minor malachite, and silicified andesite----------	.044	N	.052	49.0
8	Grab	NA	Andesite containing epidote, minor pyrite, and blebs of hematite from pit dump----------	N	N	.0016	9.8

Data for samples shown in figure 22--Continued

Sample No.	Type	Length (ft)	Description	Gold (ppm)	Silver (ppm)	Copper (%)	Iron (%)
9 1/	Chip	2.0	Magnetite vein composed of euhedral crystals as much as 2 in. wide and interstitial actinolite--	N	N	0.0017	57.0
10 1/	do--	1.4	Massive magnetite vein, highly altered andesite, and clay gouge----------	N	N	.0025	56.0

1/ Also contained 0.214%, 0.236%, 0.258%, 0.113%, 0.160%, 0.180%, vanadium, respectively.

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APPENDIX.--SUMMARY TABLE OF MINES AND PROSPECTS IN AND ADJACENT TO THE SOUTH JACKSON MOUNTAINS WILDERNESS STUDY AREA (NV-020-603), NV

APPENDIX.--Summary table of mines and prospects in and adjacent to the South Jackson Mountains Wilderness Study Area (NV-020-603), NV

Name (commodity)	Summary	Workings and production	Sample data
Avalanche prospect (silver, copper)	Silver- and copper-bearing veins trend northeast and dip northwest in Happy Creek andesite near a felsite intrusion contact. The main vein is 340 ft long and averages 4.2 ft wide. Currently being explored as a volcanogenic massive sulfide deposit.	One 50-ft adit with a small stope, one shallow shaft, 15 prospect pits, and a number of bulldozer scrapes.	Eleven chip samples from veins and mineralized shear zones contained as much as 0.04 ppm gold, and 35.03 ppm silver, and from 0.02% to 11.8% copper. Two chip and four grab samples from structures on the southwest side of the property contained as much as 0.48 ppm silver and ranged from 0.0018% to 0.0037% copper.
Bluebird prospect (copper, silver, barium)	Several small, discontinuous, copper- and barium-bearing veins follow faults in Happy Creek andesite, greenstone, and basalt.	Three adits totaling 120 ft and four pits and trenches.	Seven chip samples from oxidized veins and altered wallrock contained as much as 0.028 ppm gold and 5.694 ppm silver, and from 0.006% to 6.2% copper. Two select samples from dumps contained as much as 0.007 ppm gold, from 6.493 ppm and 11.87 ppm silver, and from 8.4% and 10.2% copper. One grab sample of basalt contained no significant mineral concentrations.
Bull Iron prospect (iron, silver, copper)	Replacement-type iron occurrences occur in Happy Creek andesite, near a contact with a diorite stock, and in andesite roof pendants. Three small silver-copper sulfide occurrences are in andesite breccia.	Extensive bulldozer cuts and trenches with contour cuts, pits, and several older prospect pits. Drilled by Dodge Construction Co. in 1953.	Six grab and nine chip samples from iron occurrences contained from zero to 0.045 ppm gold, 0.0016% to 0.033% copper, and 13.6% to 57% iron; they averaged 32.9% iron. Three select samples of sulfides contained as much as 0.107 ppm gold, and ranged from 1.328 ppm to 97.86 ppm silver, 1.32% to 9.9% copper, and 4.9% to 42% iron. One grab sample of andesite breccia contained 10% iron.
Claudia mine (gold, silver, copper, lead)	A 1,100-ft-long sulfide-bearing zone in diorite has numerous small sulfide veins. Two veins strike about N. 45° W. and N. 70° E. and dip 60° NE. and 30° N., respectively. An alkalic granite intrusion on east side of property contains silver. Currently being developed for production.	Three inclined shafts and one adit expose veins downdip. A number of exploration pits and bulldozer trenches are along mineral zones. Production for 1919 and 1947 totals 25.8 oz gold, 144 oz silver, 262 lb copper, and 943 lb lead.	Twenty-eight chip samples from two mineralized zones contained as much as 13.337 ppm gold, 308.57 ppm silver, and 15% copper. Five samples taken northeast of the zones contained as much as 0.068 ppm gold and 12.47 ppm silver.
Clover prospect (silver, copper, lead)	Sulfide veins in Happy Creek andesite and Boulder Creek sedimentary rocks are close to an alkalic granite plug. The granite is altered and contains pyrite. On the east side of the prospect, minor alteration occurs at the contact between an intrusive hornblendite and sedimentary rocks. Currently being explored for volcanogenic massive sulfide deposits.	Two adits totalling 170 ft in length and seven prospect pits.	Three chip samples from sulfide veins and mineralized fractures contained as much as 0.100 ppm gold and 10.76 ppm silver; three select contained from 0.01 ppm to 0.02 ppm gold, 2.95 ppm to 98.91 ppm silver, 0.018% to 0.40% copper, and 0.0027% to 2.95% lead. Three grab samples of altered granite were devoid of significant mineral concentrations as were two from altered hornblendite.

APPENDIX.--Summary table of mines and prospects in and adjacent to the South Jackson Mountains Wilderness Study Area (NV-020-603), NV--Continued

Name (commodity)	Summary	Workings and production	Sample data
Cold Springs prospect	Altered shear zone in felsite strikes N. 40° E. and dips 80° SE.	One adit 40 ft long, one caved adit, and one prospect pit.	Three chip samples contained small amounts of copper, barium, and iron.
Crystal prospect	Highly altered shale and limestone with layered calcite occurrences, hematite, and barite veins is adjacent to felsite intrusion.	One 35-ft-deep shaft and two cuts.	One grab sample of altered dump rock with calcite veins had no significant concentrations.
Cuprite prospect (silver, copper)	Pendant of limestone in Happy Creek andesite contains garnet scarn with copper. Copper also occurs in andesite.	One pit.	One grab sample of altered limestone contained 3.492 ppm silver and 0.39% copper. One grab sample of andesite contained 0.022% copper.
Humboldt King mine (silver, copper, cobalt)	A 1,500-ft-long sulfide-bearing zone occurs in sheared andesite and in an adjacent, overlying thrust sheet. Geophysical anomalies on the west and south sides of the property may indicate massive sulfide deposits at depth, possibly under a thrust sheet. Currently being explored for volcanogenic massive sulfide deposits.	Ten adits, three shafts, and numerous cuts, trenches, and pits are along mineral zones. There are several old drill sites. The Humboldt Kine mine, which comprises the bulk of the underground workings, is inaccessible.	Ten samples of altered metasedimentary rock contained no significant mineral concentrations. Twenty-three chip samples from the main mineralized zone contained as much as 0.357 ppm gold and 25.81 ppm silver, and from 0.017% to 7.8% copper; four grab samples averaged 0.035 ppm gold, 6.00 ppm silver, and 2.55% copper; one select sample contained 0.011 ppm gold, and 13.7% copper. From other smaller veins seven chip samples contained from as much as 0.013 ppm gold and 36.19 ppm silver, and from 0.018% to 5.8% copper; two grab samples averaged 0.041 ppm gold, 5.947 ppm silver, and 0.12% copper; two select contained as much as 0.70 ppm silver and 0.10% copper. Two grab samples of altered volcanic rock contained no significant minerals. Twenty-two samples (company data) from the Humboldt King mine averaged 0.317 oz/ton silver, 1.78% copper, 0.078% nickel, and 0.076% cobalt.
Iron Chief prospect (iron)	A replacement body of massive hematite and magnetite occurs in andesite adjacent to a diorite stock.	One large pit about 300 ft by 200 ft and 8 ft deep.	One grab sample contained 51% iron.
Iron Girl prospect (iron)	Three short lenses of magnetite occur in Happy Creek andesite. Three other small occurrences of altered country rock have minor copper. Currently being explored for volcanogenic massive sulfide deposits.	Four bulldozer contour cuts with drill sites, and two pits are on the main occurrence. Three bulldozer trenches are on smaller occurrences.	Five grab samples: two of magnetite and hematite averaged 60% iron, and three from altered country rock had no significant concentrations.

APPENDIX.--Summary table of mines and prospects in and adjacent to the South Jackson Mountains Wilderness Study Area (NV-020-603), NV--Continued

Name (commodity)	Summary	Workings and production	Sample data
Jackson Queen prospect (gold, silver, copper)	Copper-bearing quartz veins in andesite and greenstone trend northeast. Currently being explored for volcanogenic massive sulfide deposits.	Four adits total about 300 ft in length. There are also three prospect pits and one caved adit.	Eleven chip samples from the main mineral zone contained as much as 3.993 ppm gold and 21.85 ppm silver, and 0.0027% to 12% copper; one grab sample from the same zone contained 0.027 ppm gold, 1.668 ppm silver, and 0.017% copper. Two select samples from small veins contained 0.009 ppm and 0.021 ppm gold, 19.62 ppm and 2.448 ppm silver, and 6.7% and 0.82% copper.
Lillian prospect (gold, silver, copper, iron, barium)	Iron occurrences on the north side of the claim group are in Happy Creek andesite close to a diorite intrusion contact. On the east side, short sulfide veins in diorite follow north-trending faults. On the west side, altered Tertiary volcanic rocks contain barite veins and jasperoids, possibly indicative of epithermal precious metal deposits.	The iron occurrences are exposed by a pit with several benches and three bulldozer cuts. The veins in diorite are exposed in five adits and one inclined shaft totaling 465 ft in length, and eight prospect pits. The Tertiary rocks have been explored in one bulldozer cut and seven prospect pits.	Fourteen chip samples of veins in diorite contained as much as 9.532 ppm gold and 2,022.87 ppm silver, and from 0.0016% to 3.1% copper; two select from these veins contained 0.07 ppm and 10.38 ppm gold, and 9.558 ppm and 2.343 ppm silver. Samples from altered Tertiary volcanic and sedimentary rock, eight chip and one grab, contained as much as 0.023 ppm gold and 0.13% copper. Three chip samples of iron deposits and two chip samples of altered andesite contained no significant concentrations.
Mammoth prospect (iron, silver)	Iron occurrences consist of lenses of hematite and magnetite in Happy Creek andesite. On the south side of the property, altered sedimentary rocks adjacent to a fault were explored. Currently being explored for volcanogenic massive sulfide deposits.	Three thousand ft of bulldozer cuts and pits stairstep up a hillside.	Four chip samples of hematite and magnetite averaged 37% iron. One chip and one grab sample of altered country rock contained as much as 0.007 ppm gold and 6.137 ppm silver.
Navajo prospect (iron)	Iron occurrences of hematite and magnetite in Happy Creek andesite are near contact with a diorite stock and are probably replacement-type deposits.	One bulldozer trench and several prospect pits.	Three chip samples averaged 19.13% iron.
Prodigal mine (Bull Creek claims) (gold, silver, copper)	A small, poorly exposed gold-silver-copper-bearing vein in limestone and shale of the King Lear is close to a diorite intrusive contact. A high-grade section of vein is in the center of development.	Three caved adits, six prospect pits, and a number of abandoned buildings on a millsite. Production in 1923 as the Prodigal mine was 1.43 oz gold, 213 oz silver, and 648 lb copper.	Two select samples from the poorly exposed main mineral zone contained 1.187 ppm and 0.105 ppm gold, 13.84 ppm and 266.5 ppm silver, and 0.021% and 1.53% copper; four grab samples averaged 0.391 ppm gold, 18.87 ppm silver, and 0.116% copper. Two chip samples of an altered fault zone contained no minerals of economic interest.

APPENDIX.--Summary table of mines and prospects in and adjacent to the South Jackson Mountains Wilderness Study Area (NV-020-603), NV--Continued

Name (commodity)	Summary	Workings and production	Sample data
Red Boy mine (gold, silver, copper, lead, zinc)	Massive sulfide deposits containing chalcopyrite, argentiferous galena, and sphalerite in Happy Creek andesite are poorly exposed at two locations 300 ft apart. Currently being explored for volcanogenic massive sulfide deposits.	One shaft and two adits are caved or flooded. One 20-ft-long adit is open. There are also 11 prospect pits and one cut. Production in 1940 and 1948 totaled 1 oz gold, 748 oz silver, 49 lb copper, 5,073 lb lead, and 12,446 lb zinc. In 1943, two carloads of ore, containing an unknown amount of metal, were shipped to a smelter.	Six chip samples of the main sulfide-bearing vein contained from 0.042 ppm to 5.04 ppm gold, 3.762 ppm to 502.4 ppm silver, 0.014% to 0.134% copper, 0.058% to 10% lead, and 0.35% to 7.0% zinc; one select sample from the same vein contained 5.032 ppm gold, 189.1 ppm silver, 0.103% copper, 1.93% lead, and 23.5% zinc; one grab sample from a carbonate vein contained 0.076 ppm gold, 115.6 ppm silver, 0.52% lead, and 0.78% zinc. Two chip and two grab samples of altered andesite contain no minerals of economic significance.
Red Star prospect (iron, copper)	Fifty claims cover an area being currently explored for volcanogenic massive sulfide deposits. Several small iron veins of magnetite and hematite are in the middle of the claim group in happy Creek andesite.	Iron veins are explored by several thousands of feet of bulldozer cuts and scrapes on both sides of Big Cedar Creek. These deposits were drilled in 1958 by Pacific Steel Co.	Six chip samples of iron deposits averaged 52.8% iron; one chip sample of altered wallrock contained 0.198 ppm gold, 1.029 ppm silver, 0.41% copper, and 14.3% iron. Three grab samples of andesite contained no minerals of economic significance.
Shamrock prospect	Brecciated, bleached andesite is recemented with limonite and barite.	One prospect pit.	Of two grab samples, one contained 0.173% barium. There were no other mineral concentrations.
Whitepoint prospect (uranium)	Exploration for uranium was in moderately altered Tertiary dacite.	About 1,300 ft of bulldozer trenches and scrapes.	Nine samples averaged 9.14 ppm uranium. A geophysical survey showed low radioactivity of 150 to 200 counts per second.
Tip and Dip prospect (gold, silver, copper)	Small sulfide veins are in diorite along fault zones. These veins appear to be extensions of the mineral occurrences to the south at the Claudia mine. Alteration zones along faults on the east side of the property were explored.	One 20-ft deep inclined shaft and four prospect pits are scattered across the property.	One select sample of sulfide veins in altered diorite contained 14.74 ppm gold, 339.4 ppm silver, 17% copper, and 0.77% antimony; two grab samples of altered fault zones contained 5.570 ppm and 0.024 ppm gold, 4.383 ppm and 1.240 ppm silver, and 0.65% and 0.0069% copper. Two chip and one grab sample of sheared diorite contained no minerals of economic interest.
Unnamed prospect	Altered shear zone with pyrite and barite in a felsic intrusion trends N. 75° E. and dips 40° NW.	One prospect pit.	One chip sample contained 0.015% copper.