Mineral Deposits of the Deep Creek Mountains, Tooele and Juab Counties, Utah

by K. C. Thomson

UTAH GEOLOGICAL AND MINERALOGICAL SURVEY
affiliated with
THE COLLEGE OF MINES AND MINERAL INDUSTRIES
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ERRATA

Page 5. Figures 2 and 3 are reversed.

Page 23. Corrected figure 13 is in back pocket.

Page 35. Table 3, column 4: "10" should read "25," "11" should read "26A," "12" should read "26B," "13" should read "26C," "14" should read "26D."

Page 41. Figure 30 is from Gunnell and Young, 1946.

Page 42. Figure 31 is from Gunnell and Young, 1946.

Page 54. Figure 43 is from Everett, 1961; all assays except nos. 27 and 28 are by the U. S. Bureau of Mines.

Page 63. Figure 50: reference to "Fig. 51" in top half of figure–the 30-foot shaft in manganese-stained limestone–should read "Fig. 51d."

Page 70. The reference to "Everitt, F. W." should read "Everett, F. D., 1961, Tungsten deposits in Utah: U. S. Bur. Mines Inf. Circ. 8014, 44 p."

All references to "plate 8" in the text should read "plate 6." Plate 8 in the table of contents should be deleted.

MINERAL DEPOSITS OF THE DEEP CREEK MOUNTAINS, TOOELE AND JUAB COUNTIES, UTAH

by K. C. Thomson[1]

ABSTRACT

The Deep Creek Mountains, located in the Basin and Range Province, lie on the Utah-Nevada border in Tooele and Juab counties about 40 miles south of Wendover, Utah.

Excluding those of Tertiary and Quaternary age, rocks in the range are chiefly sedimentary and metamorphic, Precambrian to Permian in age, intruded by the Gold Hill quartz monzonite stock in the north end and the Ibapah granite stock in the central part. Scattered outcrops of Tertiary and Quaternary volcanic flows and pyroclastic rocks occur in the north and south parts of the range.

The general structure is a westward-dipping fault block bounded by normal faults. Precambrian rocks occur on the east side and Paleozoic rocks on the west.

Mineral deposits are of four major types: pegmatite dikes, hydrothermal veins, hydrothermal replacement bodies and contact metasomatic deposits, and are related to intrusive rocks in the area, particularly the Gold Hill quartz monzonite and the quartz monzonite porphyry intrusives in the north part of the range, and the Trout Creek alaskite intrusives at the south end. Beryllium-bearing pegmatite dikes are related to the Ibapah stock. Most veins are fracture controlled, but there is no common trend. Most fractures are N. 0° to 40° E., but mineralized fractures lie in nearly all directions. There is minor stratigraphic control of hydrothermal replacement bodies. The Oquirrh Formation, Abercrombie Formation and Trout Creek Sequence contain mineral-susceptible beds in which replacement bodies are formed.

Lindgren's classical zonation of mineral deposits into large areas of hypothermal, mesothermal and epithermal deposits was observed surrounding the Gold Hill and Trout Creek intrusives.

The range is divided into three mining areas exclusive of Gold Hill:

1. Southern Clifton area in the north.
2. Willow Springs area, encompassing the area south of southern Clifton area to the Ibapah stock, and
3. Spring Creek area south from Ibapah stock to Pleasant Valley.

Geochemical and magnetic surveys were conducted over the southern Clifton area and the geology was mapped at a scale of 1:4,800. Anomalous geochemical and magnetic areas occur in Barney Reevey Gulch, north of Overland Canyon, and in the central part of Pony Express Canyon near the Complex property. Underground workings were mapped and their geology plotted.

Five separate properties make up the Willow Springs area: Dewey, North Pass, Willow Springs, Congar Hill and Reilly-Goshute canyons. With the exception of the Congar Hill and Reilly-Goshute canyons areas, the properties are small and have produced small amounts of lead and silver. The Congar Hill property produced small amounts of mercury in the 1940's but is now idle. The Reilly-Goshute canyons properties produced nearly $700,000 from 1934 to 1954. Gold accounted for most of the value. All five properties were mapped on the surface and undergound workings were mapped in plan and section. The 2-mile vein system in the Reilly-Goshute canyons area was sampled. The assays range from trace to 4.5 ounces of gold/ton.

Spring Creek area includes seven areas of mining activity south of the Ibapah stock: Gold Bond, Red Hill mine, Trout Creek, Heavenly Hills, Singleton Canyon, Water Canyon, Johnson Canyon and Queen of Sheba properties. All but Trout Creek, Johnson Canyon and the Queen of Sheba properties are minor prospect areas with mineral potential. In the 1940's and 1950's, Trout Creek produced tungsten and zinc. On the north side of the Trout Creek area, beryl occurs with tungsten in quartz veins and pegmatite dikes. Lead-silver assays from the Johnson Canyon mines range from trace to 70 ounces of silver/ton. Assays from the Queen of Sheba mine are from trace to 2.5 ounces/ton of gold. A geochemical survey for gold and silver on this property revealed that soil samples contained 0 to 2 parts per million gold; silver values were lower.

Nonmetallic mineral deposits throughout the range were investigated. Sand and gravel deposits on both sides of the range were mapped and samples tested. Limestone and dolomite formations were sampled for analysis and their distributions mapped.

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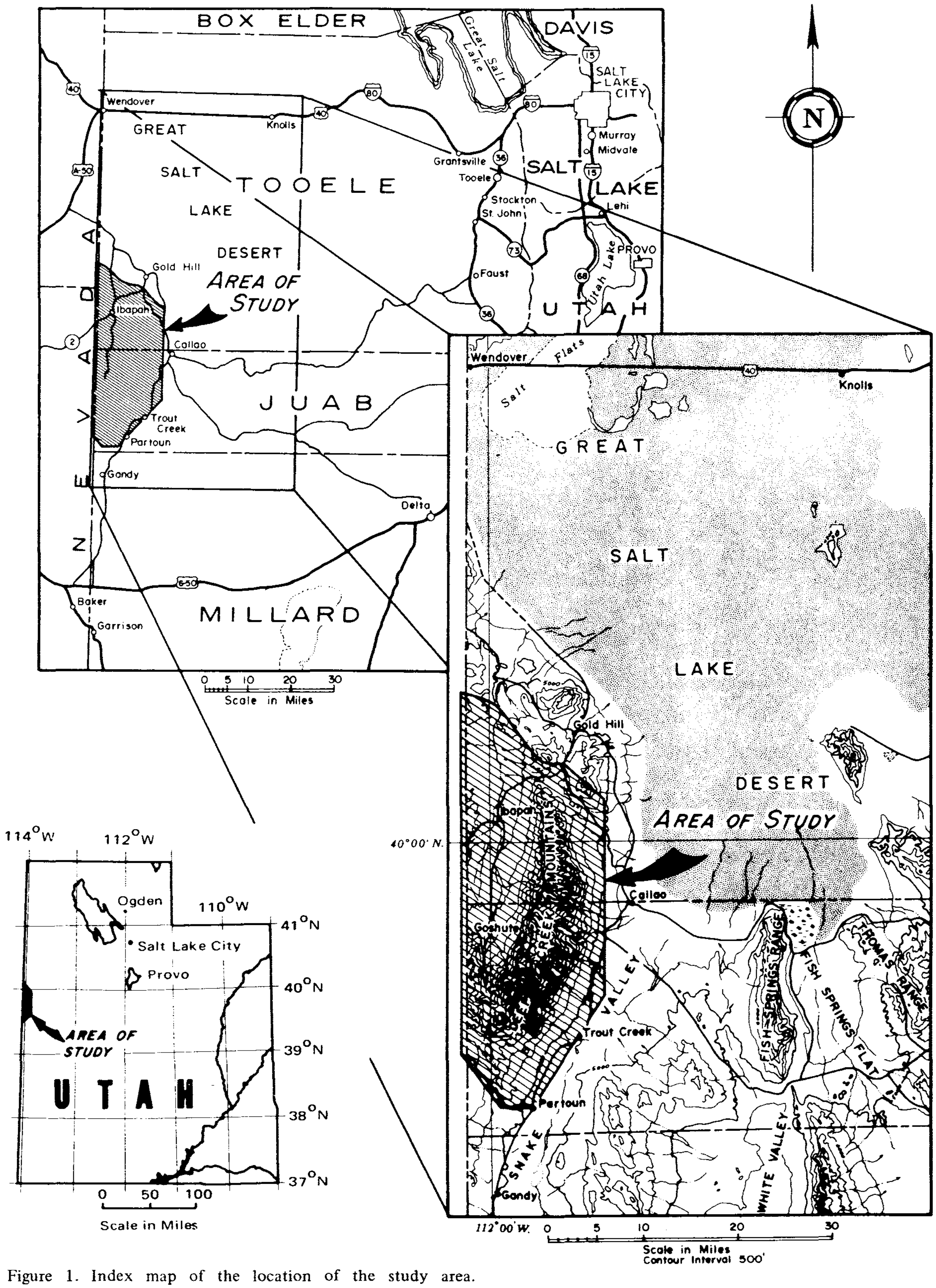


Figure 1. Index map of the location of the study area.

Quartzite formations were evaluated as potential silica deposits. Throughout the range, jasper, aquamarine, quartz, aventurine, chalcedony and petrified wood were located and mapped. Radio-quality quartz from pegmatite dikes in the southwest part of the Ibapah stock was investigated. None of the nonmetallic minerals showed promise as potential economic deposits.

Water resources and geochemistry in the range were investigated. Samples taken from 85 locations were analyzed using atomic absorption spectrophotometry for iron, copper, lead and zinc. Concentrations of these elements appeared near areas of known mineralization.

INTRODUCTION

The Deep Creek Range is a potential producer of gold, silver, lead, copper, tungsten, beryllium and mercury. The mineralization of this area is related broadly to that of the Basin and Range. The results of this study form a useful tool in examination of exploration methods and theories of ore deposition.

Previous regional geologic mapping by Nolan (1935), Bick (1958, 1966) and Nelson (1959, 1966) permitted this writer to restrict himself to detailed mapping of the mineral localities and their immediate environments. Mineral deposits in Gold Hill and vicinity are covered by Shatoury (1970).

The Deep Creek Mountains are located in western Utah between 113°45′00″ and 114°05′00″ west longitude and 39°35′00″ and 40°15′00″ north latitude, 40 miles south of Wendover by dirt road along the Utah-Nevada state line (figure 1).

Six communities in the study area, Gold Hill, Ibapah, Callao, Trout Creek, Goshute and Partoun (figure 1), supply local needs. Ibapah maintains two general supply stores with gas pumps. A hand-operated gas pump at Dorsey Sabey's ranch supplies Callao. Partoun has a cooperatively owned grocery store and gas pump. No commerical electrical power is available; power is furnished where needed by gasoline or diesel generators. Telephone service by radio-telephone became available for the first time in Ibapah in 1968. Mining supplies may be obtained from Salt Lake City, 160 miles east, or from Ely, Nevada, 120 miles southwest. The nearest rail shipping point is Wendover, Utah, 65 to 100 miles north of the mining areas.

Previous Work

Earliest accounts of the Deep Creek Mountains, in reports of the Wheeler Survey (Gilbert, 1875 and Howell, 1875), record a granite stock and sedimentary rocks. Gilbert (1890) described the fault block nature of the Deep Creek Range. Brief articles in the Utah Mining Review, (Henry, 1900, McFarren, 1909, Higgins, 1917 and Reagan, 1917 and 1929), and two anonymous papers, 1889 and 1917, describe the mining activity, general geology and mineral deposits. Custer (1917) described the Clifton mining district. Butler (1920) discussed the general geology and the mineral deposits. Kerr (1946) mentioned the tungsten occurrences in the Trout Creek and Gold Hill areas. Crawford and O'Farrel (1932) worked on the mercury deposits of the Congar Hill area. Nolan (1932) worked out the geologic and stratigraphic data on the Gold Hill mining district, including the entire 15-minute quadrangle surrounding the district. Bick (1958, 1966) studied the structure and stratigraphy of the range south of the 40° parallel and Nelson (1959, 1966) determined the structure and stratigraphy south of 39°50′00″ parallel. Everett (1961), in a U. S. Bureau of Mines report on tungsten properties in Utah, briefly discussed the tungsten properties. Shatoury (1970) discussed the mineralization and alteration of the Gold Hill district. Several private consultants worked on individual areas for claim owners: Spurr and Cox (1909), Burritt (1936), Robins (1938), Dunham (1959) and Flint (1962).

Physical Geography

The Deep Creek Range, the highest in western Utah, rises 7,800 feet above the Great Salt Lake Desert on the east to a maximum altitude of 12,109 feet on Ibapah Peak.

Ibapah Valley on the west side of the range is higher than the valleys to the east and south. It drains northward into the Great Salt Lake Desert. The valley ranges in altitude from 5,000 feet at the north end to 7,000 feet at the south. Snake Valley, southeast of the range, also drains northward into the Great Salt Lake Desert and ranges from 4,200 to 6,000 feet in elevation. Pleasant Valley, at the south end of the range, drains eastward into Snake Valley and ranges from 5,400 to 7,000 feet.

The surrounding valleys and lower slopes of the Deep Creek Range are arid, but with increased altitude and precipitation, the lower vegetation composed of sagebrush, greasewood and scattered grasses changes to juniper, pinyon and scrub oak on higher slopes and pines and quaking aspens in the summit area.

MAPPING AND ANALYTICAL TECHNIQUES

Aerial photographs from the U. S. Department of Agriculture were used in detailed mapping of the mining areas. Mines and prospects were mapped with tape and Brunton compass at waist level using scales from 1 inch = 20 feet to 1 inch = 100 feet. One hundred mines and prospects were entered and mapped or sampled. Unless otherwise indicated on the map, all maps are by the author, assisted by B. Eichbauer, K. Wilson or R. C. Fox.

Chemical and fire assays were made on vein and other mineral samples by Black and Deason, assayers of Salt Lake City. Spectrographic analyses were made by the Metallurgical Laboratories of San Francisco and by the Utah Geological and Mineralogical Survey's analytical laboratory.

Rock types were studied petrographically by the writer to determine mineralogical composition and classification. Polished ore sections aided in identifying minerals and determining paragenetic sequences.

LOCATION OF MINING AREAS AND PROPERTIES

The mineral properties divide easily into three areas on the basis of geographic location and historical divisions indicated in county records. These are the southern Clifton area in the northernmost part of the range, the Willow Springs district in the central part and the Spring Creek area at the south end (plate 1).

The southern Clifton area includes all mineralized ground in the northern part of the Deep Creek Mountains including part of the Gold Hill or Clifton mining district, between 40°04′00″ and 40°06′15″ north latitude and 113°48′00″ and 113°56′00″ west longitude. The Monocco property lies in the northeast part of the area, the Complex area and vicinity in the west and the Overland Canyon mines in the southeast.

The Willow Springs district, an unorganized mining district, lies between the south boundary of the southern Clifton mining area and the north contact of the Ibapah granite stock, a large intrusive occupying the central portion of the mountain range. Included in this district is the Dewey property in the northwest portion, the Congar Hill property in the southwest part, the North Pass area in the northeast, the Willow Springs area in the east central part, and the Reilly-Goshute canyons area in the southeast part. In the Reilly-Goshute canyons area are the Prosperity mine in Reilly Canyon, the Devils Pit-Oro del Rey-Eagles Nest area between Reilly and Goshute canyons, lower Goshute area mines in lower Goshute Canyon, and the Silver Queen in the foothills between Reilly and Goshute canyons.

The Spring Creek area includes all properties from the Ibapah stock south to Pleasant Valley and from Snake Valley on the east to the Utah-Nevada border on the west. It includes the Gold Bond mineralization in the northeast part of the area; Trout Creek, 2 miles south of Granite Creek; Singleton Canyon; and the Heavenly Hills about 3 miles southwest of the community of Partoun. Water Canyon, near the Utah-Nevada border about 6 miles north of Pleasant Valley, Johnson Canyon at the south end of Ibapah Valley along the Utah-Nevada border, and the Queen of Sheba property about 5 miles southeast of the community of Goshute on the west side of the mountain range are also part of this area. The Spring Creek area includes the unorganized mining districts recorded in the county and state records as follows: Trout Creek, Johnson Canyon and Spring Creek districts.

GENERAL GEOLOGY

The Deep Creek Range is a horst bounded on the east and west by long normal faults along which the range was raised above the adjacent valleys and tilted to the west. In the center is the Ibapah granite stock (plate 2). Precambrian to Recent formations in the north end of the range occur as a series of parallel bands striking approximately north-south and dipping from 30° west to vertical. In the south end, metamorphosed rocks of Precambrian age and some Paleozoic sedimentary beds dip to the west and have a north-south strike (plate 2). Figures 2, 3 and 4 show the stratigraphic sections in the three parts of the range.

Nolan's (1935) geologic map was used as a base to map the alteration and mineralization in the north end of the range south to 40°00′00″ north latitude. The studies by Bick (1966) and Nelson (1966) were used as references for the general geology of the area and the names used for the many rock units were taken from their reports.

Stratigraphy

Precambrian Rocks

Trout Creek Sequence. The metamorphic rocks of the Trout Creek sequence in the south part of the area (plate 2) were divided into seven successive units labeled A to G by Nelson (1966, p. 926). Unit A, the oldest, is a 200-foot thick biotite-bearing muscovite schist and schistose quartzite. Unit A is overlain by unit B, a strongly foliated, blue-black and white dolomitic schist 1,100 feet thick, is overlain by unit D, a 600-foot quartzite unit, unit E, a 1,300-foot fine-grained garnetiferous muscovite-biotite schist, unit F, a 3,500-foot dark colored mica schist with light colored quartzitic interbeds, and unit G, a 1,500-foot massive reddish quartzite with interbedded schist. The entire sequence is 8,800 feet thick.

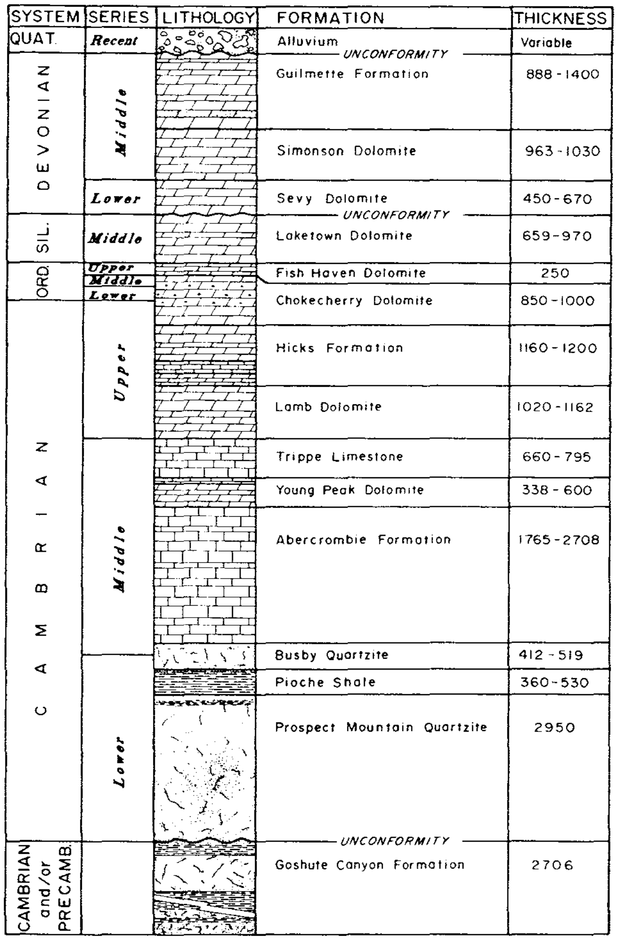


Figure 2. Stratigraphic section in the southern Clifton Hills (after Nolan, 1935, and Bick, 1958, 1966).

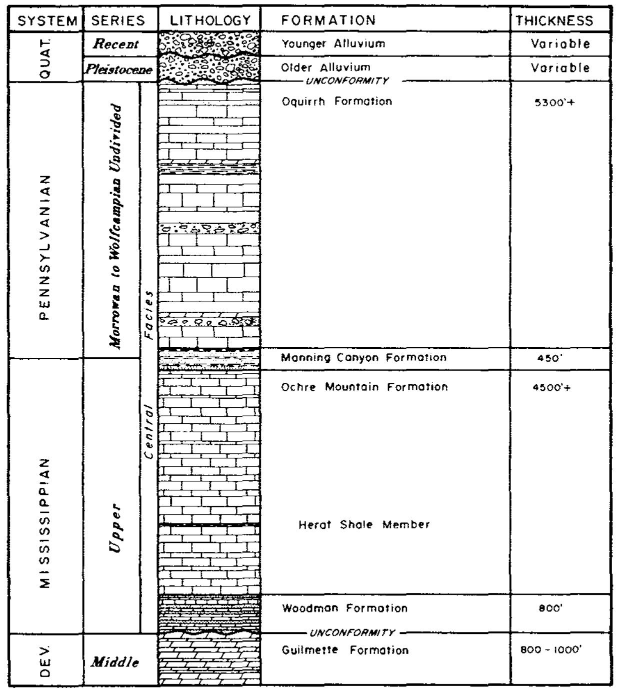


Figure 3. Stratigraphic section in the Willow Springs area (after Nolan, 1935, and Bick, 1966).

Johnson Pass Sequence. A metamorphic unit, the Johnson Pass Sequence is approximately 10,000 feet thick, and is composed of schist, quartzite and minor interbeds of both quartzose marble and amphibolite. Both the marble and amphibolite weather brown or gray. Characteristically, the rocks near the southern border of the Ibapah stock are deep brick red.

Water Canyon Sequence. This 5,000-foot section in the vicinity of Water Canyon (plate 2) consists of argillite, quartzite and purple or green shale.

Cambrian and Precambrian Rocks

Goshute Canyon Formation. The Goshute Canyon Formation is exposed typically in Goshute Canyon (plate 2) and has been divided by Bick (1966, p. 20, 21) into four successive members labeled a, b, c and d. Member a, the lowermost, is 200 feet thick and is composed of light gray quartzite. Member b, an alternating sequence of light gray quartzite and shale beds, is 1,506 feet thick. Member c, 734 feet thick, is a massive quartzite overlain by member d, a sandstone and shale section 265 feet thick.

Lower Cambrian Rocks

Prospect Mountain Quartzite. A light pink to gray quartzite with interbedded lenses of conglomerate weathers yellow-brown and comprises the bulk of the Prospect Mountain Quartzite. Schist and quartzite make up the pebble fraction of the conglomerate lenses. Massive brown outcrops of Prospect Mountain Quartzite are conspicuous in the north part of the east side of the range. The formation is about 2,950 feet thick in this area and from 2,500 to 3,000 feet thick in the southwest part of the range.

Pioche Shale. The Pioche Shale (Cabin Shale of Nolan, 1935, p. 6, 7), ranging from 360 to 530 feet thick, is a micaceous, dark gray-green shale which weathers reddish brown. It contains some limy, medium gray shale which becomes sandy toward the top of the formation.

Busby Quartzite. The Busby Quartzite, a fine- to medium-grained gray-brown to dark yellow-brown quartzite with an argillaceous and micaceous matrix,

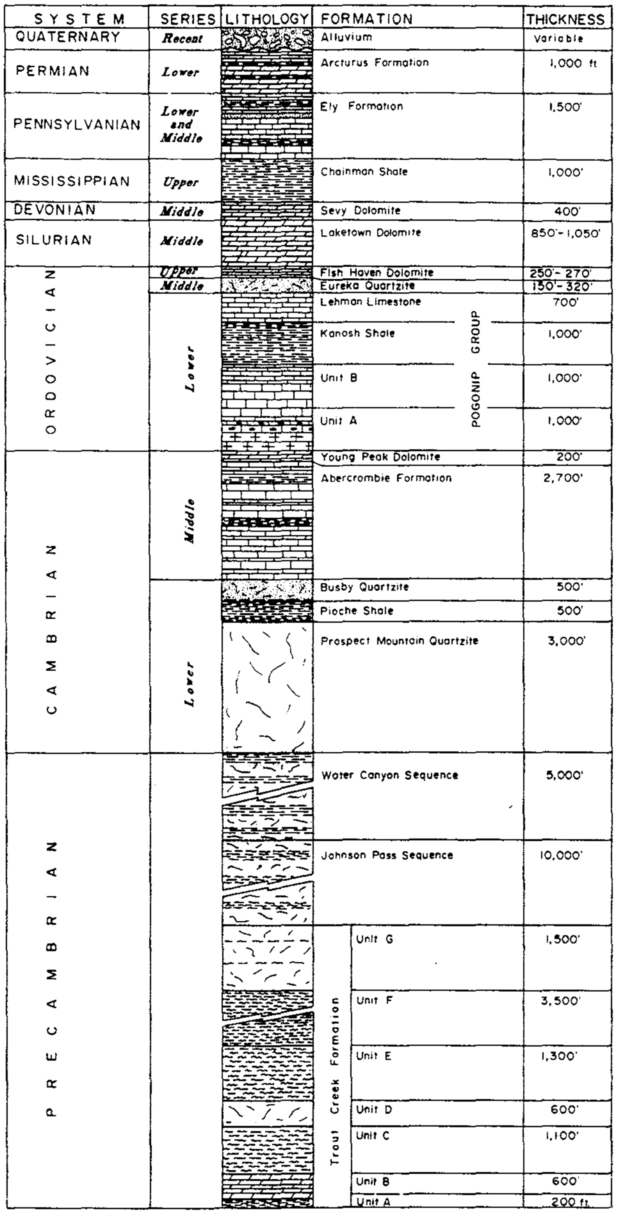


Figure 4. Stratigraphic section in the Spring Creek area (after Nelson, 1959 and 1966).

weathers to a reddish brown. Massive resistant quartzite 412 to 500 feet thick forms cliffs above the readily eroded Pioche Shale.

Middle Cambrian Rocks

Abercrombie Formation. The limestone beds of the Abercrombie Formation are thin-bedded to massive with interbedded shale and sandy shale partings. Blue-gray rocks weather light gray with reddish or yellowish tints at the shale partings in the limestone. The formation is from 1,765 to 2,708 feet thick.

Young Peak Dolomite. Typical of the Young Peak Dolomite is a dark gray to black dolomite containing short, white dolomitic rods and several varieties of limestone, most of which are similar to the underlying Abercrombie Limestone. The remaining limestone is medium gray and very dense. The limestone and dolomite intertongue, with dolomite composing most of the formation in the north and limestone predominating in the south. The formation ranges in thickness from 200 to 600 feet.

Trippe Limestone. The Trippe Limestone is composed of thin- to medium-bedded, light gray limestone beds with yellow-brown and red shale partings. A 64-foot dolomite section occurs 300 feet below the top of the formation. The Trippe Limestone is from 660 to 795 feet thick.

Lamb Dolomite. Coarse-grained, light gray dolomite, making the bulk of the Lamb Dolomite, is overlain by 85 feet of thin-bedded limestone and 22 feet of sandstone. Total thickness of the Lamb Dolomite is from 1,035 to 1,160 feet.

Hicks Formation. The Hicks Formation is mostly a light gray, thin-bedded to massive dolomite. It is oolitic in some parts of the section and sandy in others. The thickness ranges from 753 feet to 1,160 feet.

Upper Cambrian and Lower Ordovician Rocks

Chokecherry Dolomite. The Chokecherry Dolomite is mostly coarse-grained, massive, light gray dolomite. The formation is characterized by abundant chert nodules and sand between layers of dolomite. The thickness is from 850 to 1,100 feet.

Lower Ordovician Rocks

Pogonip Group. The Pogonip Group was divided into four units by Nelson (1966, p. 930-934): an upper unit, the Lehman Limestone, a 700-foot thick, dark gray argillaceous, fossiliferous limestone; the Kanosh Shale, a 1,000-foot thick sequence of greenish gray fissile shale, with interbedded siltstone; Unit B, a light brown, brown-weathering argillaceous limestone containing chert nodules 1,000 feet thick, and a lower unit A, a 1,000-foot thick, medium- to thick-bedded, massive gray limestone. The Pogonip is restricted to the southwest part of the range.

Middle Ordovician Rocks

Eureka Quartzite. The vitreous, white to light gray quartzite and sandstone of the Eureka Quartzite form a 150- to 320-foot thick unit in the cliffs west of Johnson Canyon in the southwest part of the range.

Upper Ordovician Rocks

Fish Haven Dolomite. A dark gray, light gray-weathering, fine-grained dolomite, from 250 to 270 feet thick, makes up the Fish Haven Dolomite.

Middle Silurian Rocks

Laketown Dolomite. The Laketown Dolomite is composed of dark- to medium-gray, medium- to thick-bedded dolomite. Chert nodules and stringers are common throughout the formation. Thicknesses range from 659 to 1,050 feet.

Lower Devonian Rocks

Sevy Dolomite. The Sevy Dolomite consists of evenly bedded, fine-grained, light gray homogeneous dolomite, 450 to 670 feet thick.

Middle Devonian Rocks

Simonson Dolomite. The Simonson Dolomite, 963 to 984 feet thick, is a dark to medium gray, medium-grained dolomite that weathers to a medium gray.

Guilmette Formation. The limestone and dolomite which form the Guilmette Formation in this range are massively bedded, light bluish to dark gray rocks which weather to tan. Sandstone is interbedded with the limestone and dolomite. The Guilmette Formation is from 800 to 1,000 feet thick.

Upper Mississippian Rocks

Woodman Formation. Two main units comprise the Woodman Formation, a lower calcareous sandstone and an upper sandy limestone. The sandstone is purplish to reddish brown and fine-grained. The limestone is dark gray to almost black on fresh fracture and weathers to a light brown or pink. All units are thin-bedded. The thickness of the formation in Sevy Canyon (north part of the range) is 1,027 feet.

Ochre Mountain Limestone. The Ochre Mountain Limestone is composed of fine-grained, brownish gray to light bluish gray limestone with beds from 1 to 10 feet thick. The upper part of the formation measures 4,500 feet in thickness; the base is not exposed.

Chainman Shale. Predominately olive green to dark brown fissile shale, the Chainman Shale weathers to pink, yellow, greenish brown, brown and black, and commonly contains lenses of limestone, sandstone and quartzite. Outcropping only in the south part of the range, it is approximately 1,000 feet thick.

Upper Mississippian and Lower Pennsylvanian Rocks

Manning Canyon Formation. The Manning Canyon Formation, composed of gray to black quartzite with interbedded black shale, is approximately 450 feet thick northeast of Overland Canyon (Nolan, 1935, p. 32). The formation outcrops only in the north part of the range.

Lower and Middle Pennsylvanian Rocks

Ely Formation. The Ely Formation occurs as a medium-grained, gray limestone with several interbedded shale and quartzite units. The formation changes southward to a lower dark gray to bluish gray limestone member and an upper shale, limestone and sandstone member. The formation is approximately 1,500 feet thick. It outcrops only in the south part of the range.

Pennsylvanian and Permian Rocks

Oquirrh Formation. The Oquirrh Formation is composed of dark gray to reddish brown, somewhat nonresistant sandstone, and fine-grained, dark bluish gray to light gray sandy limestone beds containing some chert nodules, many of them jasper. In some areas the limestone is platy and darker in color. The formation outcrops only in the north part of the range (plate 2) and is probably correlative in part with the Ely Formation. Its thickness as determined by Nolan (1935, p. 35) is 5,300 feet.

Lower Permian Rocks

Arcturus Formation. The Arcturus Formation outcrops in the south end of the mountain range (plate 2) as a yellowish to gray sandstone and dolomite unit with minor interbedded limestone and quartzite. Thickness of the formation has not been measured, but is estimated to be 1,000 feet or more (Nelson, 1959, p. 76-78).

Tertiary Rocks

Salt Lake Group. Outcropping in the south part of the mountain range and northwest of Ibapah (plate 2), the Salt Lake Group contains three units: (1) the lowermost unit, a red to yellowish brown calcareous

Table 1. Composition of igneous rocks in the Deep Creek Mountains, Juab and Tooele counties, Utah.

Rock Type	Mineral Content in Percent									
	Plagioclase	K-Feldspar	Quartz	Magnetite	Biotite	Zircon	Apatite	Sphene	Glass	Other
Intrusive Rocks										
Quartz monzonite	10-60	10-50	10-20	A	A	A	A	A		
Granite	25-35	25	28-38	A	10-15	A	A			Muscovite
Alaskite		20-30	30		A-3	A	A			Muscovite
Dike rocks										
Quartz-monzonite porphyry	10-60	10-50	10-20	A	A	A	A	A		
Rhyolite	10-15	35-40	20-40	A	A	A				
Aplite		50	20-30	A			A			Muscovite
Andesite	30-35		0-5	A	A				50	
Basalt	60-70			5-10	A	A	A	A		Olivine
Extrusive rocks										
Welded tuff	10		15		A				60-70	Hornblende
Crystal-vitric tuff	30	25		A	A				35	
Andesite	40-50	5-10	5	A	A	A	A		A	Olivine
Rhyolite	35-40	20	15-20	A	A	A		A		
Tuff	A		A	A					85	Muscovite

A=accessory amounts.

sandstone and arenaceous limestone, overlain by (2) a 2,000-foot sequence of crystal and lithic tuff and vitrophyre of ignimbrite origin, with some rhyolite and andesite flows, and (3) the upper unit, a 400-foot sequence of greenish brown and light brown bentonitic claystone with periodic thin, lignite laminae. The formation is probably Miocene to Pliocene in age (Heylmun, 1965, p. 20, 21).

Quaternary Sediments

Older Alluvium. Outcrops of older alluvium occur in the northeast part of the range. These alluvial deposits contain pebbles and boulders which are all rounded, poorly sorted and sufficiently cemented with calcium carbonate to be considered conglomerate. Composition of the pebbles and boulders ranges from limestone to quartzite, but does not include quartz monzonite or volcanic rocks. Thickness of this unit was not determined.

Alluvium. Alluvium includes all unconsolidated sand and gravel which occur in stream channels, bajadas, alluvial fans and other features. Nearly every lithology in the range is represented in the rounded to subrounded and good to poorly sorted gravels. Thickness of the formation is extremely variable and was not measured.

Igneous Rocks (table 1)

Intrusive Rocks

Gold Hill Stock. Quartz monzonite of the Gold Hill stock covers approximately 40 square miles between Overland Canyon and Gold Hill (plate 1) and intrudes Cambrian to Pennsylvanian sediments in the northeast part of the Deep Creek Mountains. The stock has been dated by Nolan (1935, p. 43) as Late Eocene to Early Oligocene, approximately 40 million years (my) old. Lead-alpha age determinations by Odekirk (Whelan, 1969) give the stock ages of 471 and 499 my, but these ages are anomalous because the stock intrudes rocks as young as Pennsylvanian (250 to 270 my).

Ibapah Stock. The Ibapah granite stock, approximately 64 square miles in area, transects the full width of the range (plate 1). Bick (1966, p. 52) describes the contacts on the north and south sides of the Ibapah stock as smooth and planar, strike N. 70° W. and dip from 40° to 70° S.

Contact metamorphism in the Willow Springs area produced minor recrystallization of the quartzite of the Goshute Canyon Formation and the Prospect

Mountain Quartzite, some recrystallization of the Abercrombie Formation at the contact with the stock and metamorphism of shale to hornfels.

Alaskite Intrusives. Three alaskite intrusives occur in the Spring Creek area where they are associated with mineralized areas: Trout Creek, Queen of Sheba and Johnson Canyon. They are similar in composition.

Of the three areas, only the alaskite at Trout Creek is exposed at the surface; the other two were found in underground workings of the Queen of Sheba mine and in the Bismark mine in the Johnson Canyon area.

Dike Rocks

Porphyry Dikes. Five quartz monzonite porphyry dikes in the Overland Canyon area (plate 3), striking northeasterly within the Gold Hill quartz monzonite, range from 400 to 1,800 feet in length and from 1 to 4 feet in width. Two occur in Hopkins Gulch, one in Barney Reevey Gulch and two outcrop between the two gulches.

The dikes are holocrystalline and porphyritic. Phenocrysts are 1 to 2 cm long. In hand specimen, the dike rocks are light brown to orange, fine-grained, soft and highly altered.

Rhyolite Dikes. Two rhyolite dikes between Barney Reevey Gulch and Hopkins Gulch in Overland Canyon (plate 3), striking nearly east-west, range from 2 to 30 feet wide and from 400 to 600 feet long.

The light gray rock is porphyritic with phenocrysts ranging in size from 0.05 to 0.1 inches in length in a very fine-grained groundmass.

Rhyolite dikes (called aplite dikes by Bick, 1966, p. 54, 55), common within the Ibapah stock and in the adjacent sediments on the north side, range from ½ inch to 1 foot wide. Two large dikes 50 to 100 feet wide, approximately ¼ mile apart, strike N. 20° E. and extend for 2 to 3 miles in quartzite and shale in the southeast part of the Willow Springs area.

Aplite Dikes. White to pink, granular aplite dikes, common in the quartz monzonite intrusive, are exposed in the area of Overland Canyon near the edges of the intrusive (plate 3). One dike is completely within the intrusive, three dikes are on the contact between the intrusive and sedimentary rock, and another is completely surrounded by limestone. The aplite dikes, diverse in their strike, are from 50 to 75 feet wide and from 500 to 800 feet long.

Andesite Dikes. Andesite dikes outcrop in the northeast part of the range in Blood Canyon, a southern branch of Overland Canyon (plate 3). The dark gray porphyritic outcrops reveal quartz and feldspar in hand specimen.

Basalt Dikes. Basalt dikes, none more than 300 feet long and too small to map, outcrop near the mouth of Hopkins Gulch and on the north side of Blood Canyon near Overland Canyon in the north Deep Creek Mountains. In the south end of the range, basalt dikes are exposed north of Granite Canyon, near Singleton Canyon and east of Lime Mountain.

The dark gray, porphyritic rock with obvious flow orientation of laths, is vesicular with some of the vesicles filled with carbonate.

The southern basalt dikes are dark brown to black, fine- to medium-grained.

Pegmatite Dikes. Pegmatite dikes intimately associated with the granite stock occur just north of Granite Canyon, in the south Deep Creek Mountains, in the Gold Hill Stock and in the southwest part of the Ibapah stock.

Extrusive Rocks

Ignimbrite Sequence. In the south part of the range in the Heavenly Hills area (plate 1), a sequence of welded tuff and vitrophyre comprise part of the middle member of the Salt Lake Formation. The welded tuff layers are of two generations with interbedded black vitrophyres. The uppermost welded tuff, red to pink, is a vitric-crystal tuff.

Andesite. A dark greenish gray porphyritic andesite flow, overlying the upper tuff of the ignimbrite sequence, covers the west side of the Heavenly Hills.

Rhyolite. A younger flow rock occurring above the andesite is a light gray, dense, fine-grained, porphyritic rhyolite.

Tuff. White and red tuffs occur in a 2,400-foot square area in the northeast part of the range just east of Blood Canyon Spring. The light gray to white tuff is the more abundant of the two types. The red tuff, although not found in outcrop, occurs in abundance within the white tuff weathered area.

Other Extrusive Rocks. Several varieties of latite and trachyte, discussed by Nolan (1935, p. 50-53), occur in the north part of the range.

Structure

In common with many of the mountain ranges within the Great Basin, the internal structure of the Deep Creek Mountains is extremely complex. In the course of mapping the Gold Hill quadrangle, which in the author's opinion includes the north end of the Deep Creek Mountains, Nolan (1935) made one of the most remarkable analyses of deformation structure ever attempted. He related the structural development of the Gold Hill area to five cycles and eight stages followed by the late normal faulting, which in concert with erosion, has determined the present configuration of the range. Most of the complex structural development, marked by transverse faults accompanied by or transformed into thrusts with associated complex folding, occurred prior to the intrusion of the Gold Hill stock (Late Eocene or Early Oligocene) and subsequent to a deposition of Triassic sediments which are conformable with the underlying Paleozoic beds. A Cretaceous and Eocene age is assigned to the development. Normal faulting was subsequent to the Gold Hill intrusion and has continued nearly to the present time.

Bick (1958, 1966), in mapping the remainder of the range south of the 40th parallel, provided a structural analysis and divided the structural modifications into six episodes, the earliest of which is not repeated in the Gold Hill area. He emphasized the significance of the more or less east-west transverse faults. The Ibapah granite stock, 8 miles wide, lies between two of these transverse faults which it presumably, for the most part, postdates. Nelson (1959, 1966) mapped the part of the Deep Creek Mountains south of the Ibapah stock as well as the Kern Mountains south of Pleasant Valley and the north end of the Snake Range. His interpretations differ slightly from those of Bick.

This writer examined structural features in the mineralized areas to determine what, if any, relationships exist between structure and mineralization. The most obvious conclusion is that the Deep Creek Mountains are divided by more or less east-west structures (plate 4) into the Gold Hill area north of the Blood Canyon fault, the narrow westward-tilted block 5 to 6 miles wide and 10 miles long between the Blood Canyon fault and the Ibapah stock 8 miles wide in a north-south direction, and the Trout Creek-Johnson Pass area 9 miles long in a north-south direction at the south end of the range. Each of these areas possesses unique structural features.

In considering the mineral deposits, this writer has designated that portion of the Gold Hill area between the Blood Canyon fault and the Clifton Flat, the southern Clifton block; the narrow tilted block south of the Blood Canyon fault, the Willow Springs block; and the area south of the Ibapah stock, the Spring Creek block.

Southern Clifton Block

Sedimentary formations in the southern Clifton block strike northeast-northwest and dip 10° to 50° E. Six north-south trending anticlines occur north of Pony Express Canyon in the west part of the area.

Four normal faults north of Blood Canyon striking N. 25° to 70° E. terminate in the quartz monzonite intrusive. South of Ochre Mountain normal faults have a northerly strike and dip east and west. West of Montezuma Peak, normal faults are older than the intrusive and terminate at its contact.

Four lateral faults occur in this area (plate 4):

1. The Overland Canyon fault, a right lateral fault at the south boundary of the Gold Hill stock;

2. A right lateral southeast striking fault in the mouth of Hopkins Gulch;

3. Blood Canyon fault, a left lateral fault trending completely across the range, and

4. South Ochre Mountain fault, a right lateral fault trending from lower Pony Express Canyon to the east side of Clifton Flat.

Two thrust faults occur in Pony Express Canyon. The first, west of Clifton Flat, strikes north and terminates against the south Ochre Mountain fault. The second, the North Pass thrust fault, is exposed twice in Pony Express Canyon and once in the northwest corner of Clifton Flat.

Willow Springs Block

The Willow Springs block is tilted to the west 20° to 45° and is bordered on the east and west sides by normal faults.

The Deep Creek anticline, an asymmetric anticline along the east side of the range (plate 4), shows a nearly north-south axial strike. Beds on its west flank dip 20° to 46° W. and on its east flank dip about 10° to 25° E.

The north-south striking East Flank and West Flank normal faults occur along both sides of the range. Throw of these faults may be as much as 9,000 feet. The faults dip away from the range on both sides.

Other minor normal faults occur on both sides of the range with displacements to 2,000 feet.

A number of east-west striking, right and left lateral faults such as the North Pass fault, Sevy Canyon fault, Dry Canyon fault and Hardscrabble fault occur throughout the block. Displacement ranges from 600 to 2,000 feet.

Two areas of thrusting in the Willow Springs area are (plate 4):

1. Rocky Springs thrust, in the southwest part of the area, carrying Cambrian sediments over Silurian and Devonian strata, and
2. North Pass thrust, in the north end of the range.

Both thrusts showing east and southeast movement are separated and cut apart by younger lateral faults.

Spring Creek Block

Sedimentary formations in the Spring Creek block dip steeply to the west at angles ranging from 80° to 90°. Cutting these sediments on both the east and west sides are N. 5° E. striking normal faults that lifted this part of the range into its present position. The mountain block is terminated on the south end by the Pleasant Valley fault.

The Trout Creek Dome, an anticline just north of Trout Creek, probably was caused by the intrusion of the Trout Creek alaskite stock. At the south end of the range near the Pleasant Valley fault, several small anticlines of varying axial bearings near N. 60° W. occur in the vicinity of Lime Mountain and the Heavenly Hills. A broad anticline strikes N. 5° to 10° E. in Johnson Canyon and a large east-west striking overturned anticline, the Water Canyon anticline, occurs in the south part of Water Canyon.

The Gorgon Ridge syncline, a major overturned syncline, has a north-south axial strike along Gorgon Ridge in the center of the range. A broad syncline strikes N. 5° to 10° E. in Johnson Canyon and many minor synclines are associated with the anticlines in the Heavenly Hills and Lime Mountain.

Two normal fault trends, N. 70° to 80° W. and N. 5° to 10° E., occur in the Spring Creek block. The northwest faults are younger and offset the northeast faults.

A thrust fault on the east side of the range mapped by Nelson (1966, p. 944) carried rocks eastward over the range, leaving younger Cambrian rocks on the east flanks. Several thrust faults occur on the west side of the range, one east of Johnson Canyon and the remainder west of the canyon. They are cut apart by northwest-striking normal faults.

Ibapah Stock

Six sets of joints confined to the Ibapah stock occur as three conjugate sets (Bick, 1966, p. 85-86):

System I	System II	System III
N. 20° E., 75° E.	N. 70° E., 65° N.	N. 40° W., 80° E.
N. 20° E., 70° W.	N. 70° E., 70° S.	N. 40° W., 75° W.

These joints, entirely confined to the stock, are related to the emplacement or cooling of the stock rather than to later deformation.

Alteration

Inasmuch as widespread and intense alteration of country rock is commonly regarded as one of the more favorable indicators of possible hidden ore bodies, the writer gave special attention to this feature in his field examination of the Deep Creek Mountains. Nolan (1935, p. 91-97) described alteration in the Gold Hill area and Shatoury (1970) recently compiled a further study of the same area. The masses of intrusive rock especially were examined for possible areas of propylitic and argillic alteration which, according to Creasey (1966, p. 59-61) and others, accompanies the formation of disseminated copper deposits. In spite of the deep dissection and favorable exposure of these rocks, no significant occurrences of these types of alteration were found. Some altered igneous rocks show formation of sericite with accompanying quartz and pyrite and some chlorite, kaolinite and carbonate. Impure limestone adjacent to igneous contacts was variably replaced by silicate minerals and masses of jasperoid or dense chalcedonic silica is associated with fracture zones in limestone with no obvious relationship to intrusive rock. Variable hematitization, indicated by red color, occurred in some of the limestone, especially in Blood Canyon just south of Overland Canyon. Areas of altered rock associated with mineralization were mapped in Overland Canyon (plate 3), Monocco mine, Pony Express Canyon-Clifton Flat (plate 5), Dewey property, Trout Creek and the Queen of Sheba mine area. Samples from these areas were examined by means of petrographic examination and infrared and X-ray diffraction analyses and the results are given in the description of the individual mines.

Silicification

Silicified rocks in which the original rock, mainly limestone, is replaced by silica occur in several areas.

The masses of silicified rock, jasperoids or siliceous reefs stand out topographically as prominent ridge lines and knobs above the less resistant unaltered rock. All are related to faults and fractures where migrating silica replaced the surrounding limestone, dolomite or igneous rocks for distances of a few inches to several hundred feet from the fracture. Volcanic rocks in the hills just west of White Sage Flat are replaced in two large fault zones in which the fault breccia is both cemented and replaced by cryptocrystalline silica or chalcedony. This silicified zone is 1 to 5 feet in width and a half mile long. Small parts of latite in White Sage Flat are replaced in several areas by chalcedony.

Silica replacements of limestone or dolomite in the vicinity of fractures occurred in the north part of the range in the Ochre Mountain and Oquirrh formations and in the Laketown Dolomite, and large jasperoid areas were observed just north of the Yellow Hammer mine road in the northeast corner of Clifton Flat. These replacements guided by a northeast-trending fault have nearly obliterated the evidence of faulting.

A second area consisting of minor patches of silicification in the Ochre Mountain and Oquirrh formations occurs along the 2-mile east-west striking south Ochre Mountain fault zone in Pony Express Canyon (plate 5). These patches are probably fracture related.

A large east-west trending area of silicified limestone in Overland Canyon occurs along the Overland Canyon fault and its eastward extension.

In one area, silicified Ochre Mountain Formation limestone is capped by Manning Canyon Formation quartzites. Nolan (1935, p. 93) says that silicified limestones ". . . have, in general, the appearance of cemented siliceous breccias, owing to the presence of several generations of quartz." Quartz grains in the silicified quartz groundmass are sand grains in the original limestone.

Silicified rocks occur south of Pony Express Canyon and Clifton Flat in the Silurian Laketown Dolomite and in northeast-trending fault zones in Sevy and Cold Springs canyons. These zones are in a formation which prior to silicification had a high silica content as indicated by the abundance of chert nodules in the dolomite.

Sericitization

Sericitization is confined to igneous rocks, especially the Gold Hill and Ibapah stocks and south alaskite intrusives.

Sericite, pyrite and quartz are the principal minerals in this type alteration, with small amounts of kaolinite, chlorite and carbonate. These minerals occur as fine, highly birefringent aggregates near or within the feldspars, the mineral most commonly attacked. The pyrite in the altered rock oxidized near the surface and released sulfuric acid, which bleached the rocks white and stained them brown with limonite and jarosite. The formation of jarosite $[KFe_3(OH)_6(SO_4)_2]$ is doubtless correlated with the availability of potassium, iron and sulfate. Kaolinite, chlorite and carbonate probably were derived from the plagioclase (andesine).

Fracture zones tend to localize the areas of sericitic alteration. In the Monocco area, the quartz monzonite is highly altered to sericite along the N. 35° to 40° E. striking fractures and veins. Sericitic areas occur in Overland Canyon in the quartz monzonite along the Overland Canyon fault and its projected extension (plate 3). These areas, large near the fractures, become sparse with distance from the fault. The Queen of Sheba alaskite intrusive is highly altered in places to sericite in the lower workings of the mine where it is associated with the Martin vein.

Only small amounts of sericite occur in other intrusives in this area.

Silication

Silicate minerals were formed in the Ochre Mountain Formation limestone, Oquirrh Formation limestone and the Trout Creek Formation.

Two types of silication are illustrated in Overland Canyon. Wollastonite is the major mineral in the first, the second contains garnet and diopside. The wollastonite reaction, $CaCO_3 + SiO_2 = CaSiO_3 + CO_2$, was incomplete or did not reach equilibrium because of the presence of quartz and carbonate remnants in the rock. This phenomenon was observed near the Midas mine in the northeast part of the Overland Canyon area (plate 3).

The second silication type, alteration of impure limestone and dolomite to andradite and diopside with small amounts of calcite and scheelite, appears along the quartz monzonite-limestone contact in Barney Reevey Gulch and near the mouth of Overland Canyon (plate 3). In the Trout Creek area silication occurs in the contacts with alaskite intrusive (plate 6). Quartz, scheelite, siderite, limonite, sphalerite and other contact minerals were observed in the Trout Creek mine and in prospects around the southwest periphery of the intrusive.

ORE DEPOSITS

General Character and Classification of Deposits

Mines in the Deep Creek Mountains produced ores of gold, silver, lead, copper, zinc, arsenic, tungsten and mercury intermittently since the late 1800's. Most of the ore bodies are located in fractures as veins or as bedding replacements in limestone. Surficial alteration has occurred in nearly all deposits, but very little enrichment has taken place.

These metals occur in ore bodies of four genetic types described below: pegmatite dikes, hydrothermal veins, hydrothermal replacements and contact metasomatic deposits.

Pegmatite Dikes

An outer zone of graphic granite (quartz, feldspar and mica) surrounds an intermediate zone of orthoclase, muscovite and quartz. Quartz crystals have been the only mineral mined from the dikes. These are simple, roughly zoned pegmatite dikes occurring only in the granite of the Ibapah stock and in the metamorphic units of the Trout Creek series, with cores of vuggy gray and white quartz containing crystals of quartz and beryl.

Hydrothermal Veins

Most of the mineral deposits in the range are hydrothermal veins. All three of Lindgren's (1936) basic types of hydrothermal veins, hypothermal, mesothermal and epithermal, occur.

Hypothermal Veins. These occur in two areas, both closely related to intrusives–Overland Canyon and Trout Creek Canyon. Hypothermal arsenic-silver-lead-gold veins occur along quartz monzonite porphyry dikes in quartz monzonite in the Cyclone, Monte del Rey, Bonanza, Midnight and Fortuna mines in Overland Canyon. Ore minerals observed are arsenopyrite, chalcopyrite, aikenite, pyrite and sphalerite with quartz and limonite gangue.

Beryl-scheelite-quartz veins occur in the schist and dolomite of the Trout Creek Formation just north of the Trout Creek alaskite intrusive on the Apex Tungsten property.

Mesothermal Veins. These veins contain minerals characteristic of both hypothermal veins and epithermal veins. Mesothermal veins in the range occur in the sedimentary and metamorphic rocks and contain chalcopyrite, galena, sphalerite and tetrahedrite, with quartz, limonite, hematite and calcite as gangue minerals. The veins are generally simple and regular in their strike and dip and show no accompanying brecciation.

Epithermal Veins. Minerals characteristic of epithermal veins occur at the Congar Hill mine. Cinnabar, metacinnabar and stibnite occur with barite, quartz, calcite and dolomite as the gangue minerals in a breccia of dolomite. The cinnabar is dispersed in barite as patches and blebs with stibnite centers. Walls of the brecciated veins are irregular with open spaces.

Bedding Replacement Bodies

Gold-silver-copper-lead replacement bodies of the mesothermal type occur in the Monocco area. These bodies are in selected beds of the Oquirrh Formation limestone adjacent to the mesothermal veins discussed above. Minerals found in replacement bodies are chrysocolla, copper pitch and malachite oxidized from the original chalcopyrite, and hematite. Gangue minerals are quartz, calcite and dolomite. These ore bodies are not large and Nolan (1935, p. 103) states that the ore is "rarely found more than 15 or 20 feet away from the mineralizing fracture . . . "

Replacement bodies near Granite Canyon occur in the Trout Creek Formation. Here quartz containing gold and silver replaces carbonate beds in schist.

Contact Metasomatic Deposits

Contact metasomatic deposits containing native gold associated with various sulfides occur in limestone on the contact between quartz monzonite and limestone. This limestone is recrystallized, replaced by quartz or highly silicated. Intensity of alteration can vary from area to area. Metallic minerals common in this type of deposit are native gold, pyrite, chalcopyrite, bornite, scheelite and magnetite. Gangue minerals are wollastonite, andradite, tremolite, diopside and quartz. Mineralization on the Midas and Gold Star properties is in contact metasomatic zones.

A second type of contact metasomatic deposit occurs at the contact between Trout Creek alaskite intrusive and dolomite of the Trout Creek Formation. Ore minerals are sphalerite and scheelite with a gangue of fluorite, quartz, limonite, actinolite, tremolite, pyrolusite, muscovite and biotite.

Controls of Mineralization

Mineral deposits in the Deep Creek Mountains are related to fractures, stratigraphy and igneous rocks. Analysis of these features shows no consistent mineral control in the area.

Fracture Systems

Most mineral deposits occur in fractures of Cretaceous and Tertiary age. Nolan (1935, p. 55 to 63) and Bick (1966, p. 86-95) outline the structural history of the area.

Most fracturing in the range took place prior to the intrusion of the Ibapah and Gold Hill stocks. The later intrusion of the Trout Creek alaskite is postdated by the mineralized fractures in the Trout Creek area. Normal faults striking nearly north-south, and bounding the range on east and west are the youngest structural features.

Contacts between vein and country rock are generally sharp. Exceptions to this occur in replacement deposits in the Monocco and Gold Bond areas. The Queen of Sheba mine exhibited areas in the country rock where gold and silver pervade it along the Martin vein to form a protore.

Minor ore shoots were observed where younger fractures offset the Martin vein in the Queen of Sheba mine. Change of strike and dip in fractures in other areas, particularly at the Oro del Rey, tended to localize ore.

Mineral deposits in the range exhibit an affinity for a particular fracture direction. Figure 5 shows graphically the mineralized fracture directions in each structural block in the range and their relationships to all fractures in the area.

Stratigraphic Controls

Ore bodies occur in relatively few stratigraphic horizons ranging from Precambrian to Permian in age. Of the formations acting as host rocks for ore bodies, only three, Oquirrh, Abercrombie and Trout Creek, apparently controlled mineralization. In all other formations, veins are clean walled and mineralization is restricted to fracture filling.

Oquirrh Formation limestones have favorable horizons for replacement by copper and lead mineralization. Bedding replacement deposits associated with mesothermal veins in the Oquirrh Formation occur in the Monocco mine. The contact metasomatic deposits of the Midas mine also occur in these limestones. The Oquirrh Formation has been a favorable rock for mineralization in other districts and forms the host rock for Bingham Canyon's lead-zinc mines near Salt Lake City.

The Abercrombie Formation appears to have a horizon favorable to mineralization, a limestone bed 1,116 to 1,260 feet above the base of the formation. In the Willow Springs, North Pass and Prosperity areas, fractures cutting the Abercrombie Formation are mineralized when they encounter this bed.

The Trout Creek Formation contains mineral-susceptible carbonate members near Trout Creek and Granite Canyon. Scheelite and sphalerite in contact metasomatic deposits and veins comprise mineralization in Trout Creek and Apex mines. Limestone beds have been replaced by silver and gold mineralization near Granite Canyon.

Igneous Relationships

Most ore deposits in the Deep Creek Mountains are related to intrusive igneous rocks. Six intrusive bodies occur in the range (from north to south): Gold Hill quartz monzonite stock, rhyolite dikes, Ibapah granite stock, Trout Creek alaskite intrusive, Queen of Sheba alaskite intrusive and the Johnson Canyon alaskite intrusive

Within the Gold Hill stock, several ore deposits occur in or adjacent to quartz monzonite porphyry dikes. Mineralization in these ore deposits is related to fluids from the porphyry magma. Those showing contact metasomatic action along the periphery of the quartz monzonite intrusive were caused by fluids directly attributable to or associated with the quartz monzonite stock.

Relationships between mineralization and intrusives in mineralized areas not directly related to intrusives, such as the Dewey mine, North Pass mines, Willow Springs mines, Congar Hill mine and Reilly-Goshute canyons mines, are probably related to the Gold Hill stock.

Beryllium-bearing pegmatite dikes comprise the only mineralization in the Ibapah stock.

Mineral deposits occur at the peripheries of three alaskite intrusives in the south part of the range. Trout Creek area mineralization surrounds the Trout Creek alaskite and occurs as contact deposits and veins. The alaskite in the Johnson Canyon area does not outcrop and was found in workings of the Bismark mine. The intrusive at the Queen of Sheba mine area likewise does not outcrop, but the relationships between mineralization and intrusive were made in the Queen of Sheba mine. Here alaskite grades into pegmatite dikes which in turn become rich in quartz and lead to quartz veins. These quartz veins contain the gold mineralization. Nowhere was the silica enrichment traced directly from the alaskite to the quartz veins.

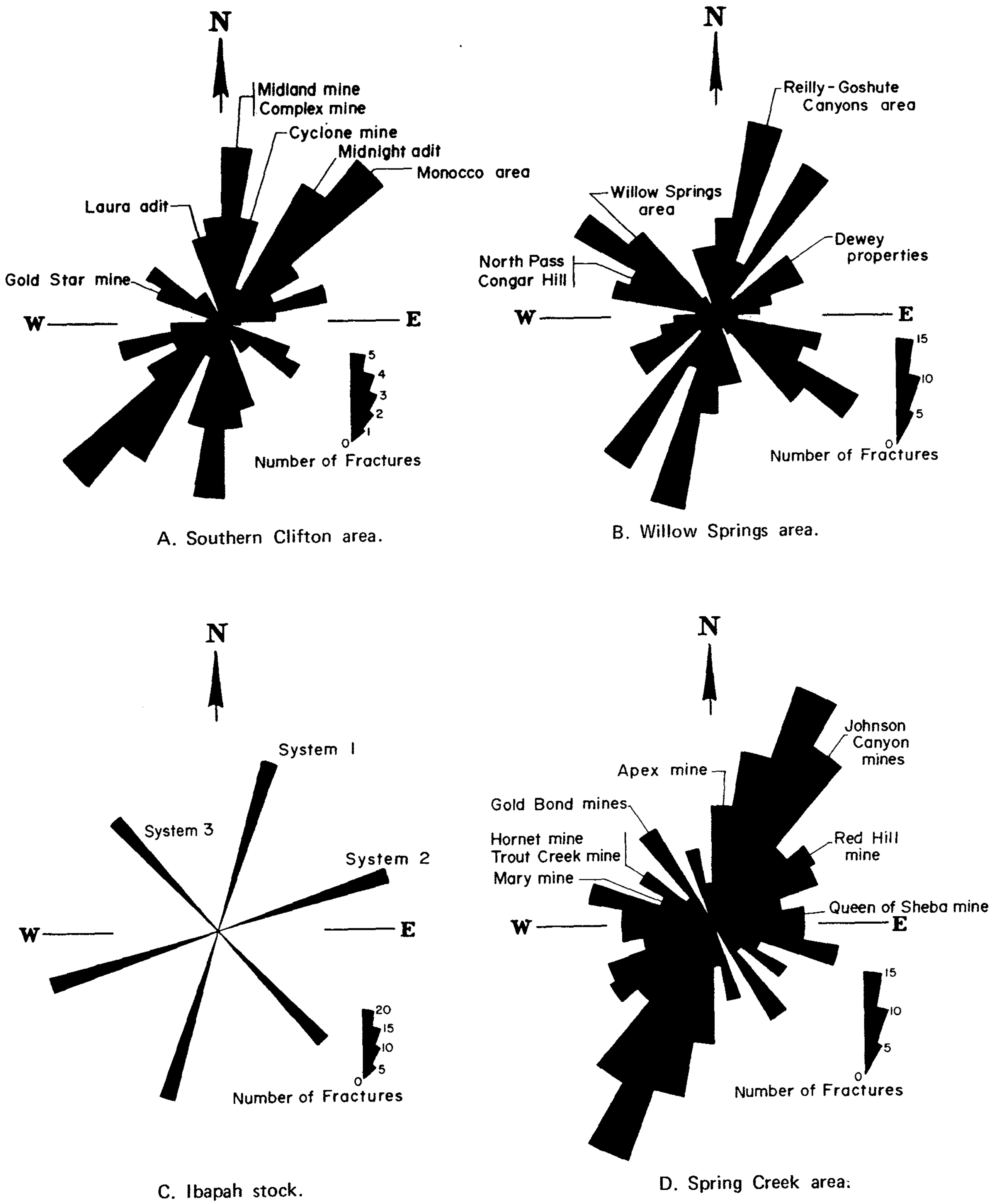


Figure 5. Fracture roses for the southern Clifton, Willow Springs, Ibapah stock and Spring Creek areas showing relations of mineral deposits to fracture trends. The length of the wedge is proportional to the number of fractures.

Table 2. Age relationships of intrusives in the Deep Creek Mountains.

Rock Type	Age (10^6 years)	Reference
Quartz monzonite	499	Odekirk in Whelan (1969) lead-alpha
	471	Odekirk in Whelan (1969) lead-alpha
	40	Nolan (1953) stratigraphic relations
Granite	71	Armstrong (1963) lead-alpha
	22	Armstrong (1963) potassium-argon
Quartz-beryl-muscovite veins related to alaskite intrusive	17.7±0.9	Geochron Laboratories (Park, 1968)

The intrusive rocks apparently represent a part of an igneous rock series, becoming more siliceous with decrease in age (table 2 and figure 6).

The Kern Mountain granite, just south of Pleasant Valley, was included in the diagram to show its relationship to the series. It is probably younger than the quartz monzonite and the Ibapah granite.

In all areas investigated, where mineralization was found within an intrusive, it was directly associated with a post-intrusive porphyry dike. The only mineralization observed directly connected with granitoid intrusives is in areas of contact metasomatism. Dike-associated mineralization occurred in the Gold Hill

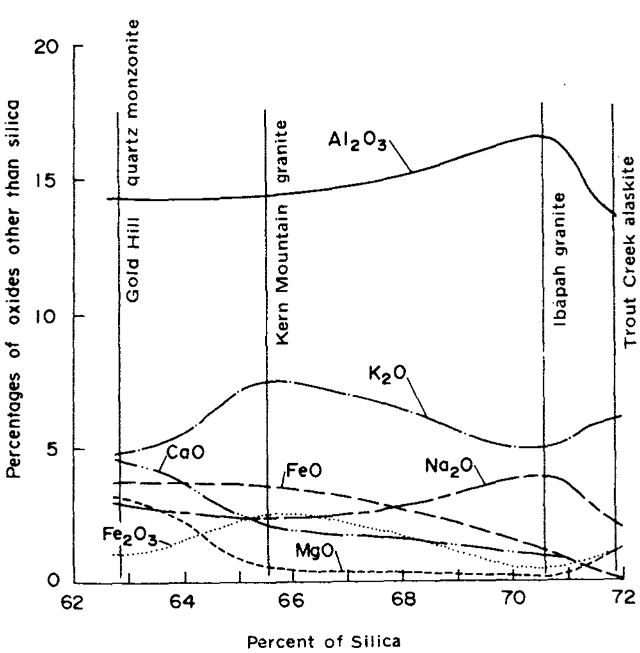


Figure 6. Silica-oxide variation diagram for the Gold Hill quartz monzonite, Kern Mountain granite, Ibapah granite and Trout Creek alaskite.

quartz monzonite stock, where ore bodies were affiliated with quartz monzonite porphyry dikes. These associations were observed at the Midland incline shaft, Midnight adit, Cyclone mine, Bonanza mine, Monte del Rey mine and the Fortuna mine in Overland Canyon. Beryllium-bearing pegmatite dikes occur in the Ibapah stock.

In large porphyry copper deposits, Stringham (1966, p. 39) found that:

1. Intrusives should not be more basic than andesite-diorite, although there seems to be a preference for quartz monzonite-quartz latite associations.

2. Intrusive porphyry is absolutely a necessary feature existing with or without associated granitoid types.

3. Passive intrusive emplacement is the most desired structural condition.

4. Where granitoid and porphyritic-textured intrusives coexist, the porphyry should be late in its development.

5. Sharp boundaries between granitoid and porphyritic types are more favorable, although some graduation is not entirely unfavorable.

6. Wall or country rock may be of all lithologic types, thicknesses and ages, except perhaps Pleistocene.

7. For disseminated deposits, intrusive or highly siliceous metamorphic and sedimentary rocks are the most favorable host rocks.

He also stated (1958, p. 821) that "...an intrusive aphanite porphyry of intermediate to acid composition with or without granite should be present in the district within a distance of 2 miles of the deposit if one expects to find a large mineralized body, at least for 86 percent of the localities." Porphyry intrusives with the above qualifications occur only in the Gold Hill area. They are small and most mineral deposits connected with them are small.

Extrusive Relationships

Although extrusive igneous rocks cover many areas throughout the range, mineralization occurs only in the Heavenly Hills where welded tuffs, rhyolites and andesites are in contact with Mississippian and Pennsylvanian limestones. Small iron oxide zones with little metallic mineral other than iron oxide and a little copper carbonate are developed.

Ore Body Zoning

Nolan (1935, p. 107-108) and Shatoury (1967, p. 113-117) discussed the zonal arrangement of ore deposits in the Gold Hill area. Nolan based his zonal arrangement on temperature of deposition. He identified only one zone which had other lower temperature zones superposed on it, the result of recurrent fracturing and further deposition in a time zonal sequence. Shatoury found zoning based on metal content in the Gold Hill area and extending into the Overland Canyon area.

Zoning throughout the range can be based on the hydrothermal vein type of deposition, with two zonal centers, the Gold Hill stock and the Trout Creek alaskite intrusive. Hypothermal veins and contact metasomatic deposits occur in and immediately surrounding these two intrusives. In the Gold Hill stock, lower temperature deposits are superposed on the hypothermal veins. Surrounding the hypothermal zone to the west and southwest are deposits of the mesothermal type. Included here are parts of the Overland Canyon properties, Monocco mines, Complex mine, Willow Springs mines, North Pass mines and the Reilly-Goshute canyons mines. West and southwest of this zone is the epithermal mercury-antimony-silver zone represented by mines in the Congar Hill and Dewey properties.

In the south part of the area, the Trout Creek alaskite is the center of the zonation. Contact zones and hypothermal veins surround the alaskite. These deposits, exhibited in the Trout Creek, Apex, Mary and Hornet mines, show tungsten, beryllium and zinc mineralization. Mesothermal veins containing gold-silver and lead-zinc-silver lie west and north of the alaskite intrusive at Granite Creek (Gold Bond property), Queen of Sheba property and Johnson Canyon. The Singleton mine, Water Canyon mine and the Heavenly Hills prospect pits could be epithermal deposits, but no diagnostic low-temperature minerals occur. The zoned nature of the area is shown in figure 7.

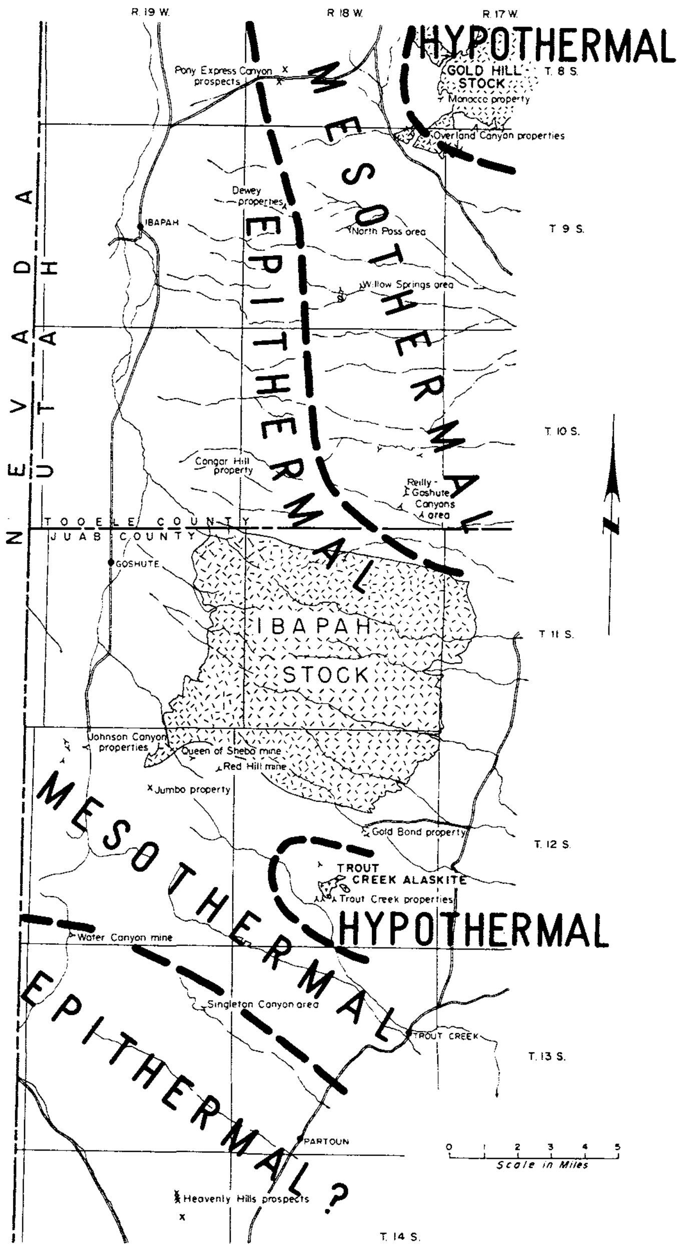


Figure 7. Hydrothermal mineral zones in the Deep Creek Mountains.

Alteration of Mineral Deposits

Alteration resulting from oxygen-charged surface waters acting on the sulfide minerals in ore bodies near the surface is evident in many of the deposits in the range. This alteration may result from weathering only or from oxidation and leaching by meteoric waters. Each deposit type is discussed.

Alteration of Pegmatite Dikes

Alteration of pegmatite dikes results in the breakdown of plagioclase and orthoclase to form quartz, kaolinite, sericite and carbonate. Weathering was the alteration agent in the pegmatite dikes. The contained feldspars are partially altered to sericite and kaolinite. Chlorite is the alteration product of biotite and muscovite.

Alteration of Hydrothermal Veins

Hypothermal Veins. Minerals in lead-silver-zinc-arsenic veins in the Overland Canyon area are oxidized to limonite, scorodite, jarosite and cerussite. Sulfides show little supergene enrichment. Nolan (1935, p. 105) reports that in the Cyclone mine "copper content of the unoxidized ore is low in this mine, ranging from 0.5 to 1.7 percent and is apparently balanced by a sufficient quantity of carbonate in the vein to prevent any downward transportation of copper. There is certainly no accumulation of secondary copper sulphides at the present water table in this mine." The tungsten-zinc-beryllium-quartz veins in the Trout Creek area show limonite and jarosite caused by oxidation of pyrite.

Mesothermal Veins. Limonite, jarosite, copper carbonates, conichalcite and cerussite were produced by oxidation of bornite, chalcopyrite, sphalerite, tetrahedrite, galena and pyrite in mesothermal veins in the range.

Epithermal Veins. Minerals in epithermal veins at Congar Hill were oxidized near the surface by weathering. Mercury minerals, cinnabar and metacinnabar, are unaltered. Stibnite is oxidized to valentinite, senarmonite and stibiconite. Small amounts of pyrite have been oxidized to limonite. Other epithermal deposits, particularly iron oxide zones associated with volcanic rocks, show only limonite with no sulfide minerals present.

Alteration of Bedding Replacement Deposits

Bedding replacement deposits occurring in limestone are almost completely oxidized. Fractures at the Monocco mine contain dark brown to black copper pitch with remnants of chalcopyrite and veins of malachite, azurite and chrysocolla. These oxidized materials spread into the limestone beds where they and limonite-hematite form the bulk of the mineralization. Lead ores formerly containing small amounts of galena are now composed of cerussite, anglesite, jarosite and plumbojarosite. In some parts of the Monocco area, plumbojarosite is the only lead mineral present. Some secondary chalcedony and opal occur, but rarely.

Limonite and some kaolinite and chalcanthite were the alteration products in the gold-silver replacement zones on the Gold Bond property near Granite Creek.

Alteration of Contact Metasomatic Deposits

Contact metasomatic deposit minerals are only slightly altered. Pyrite oxidized to limonite occurs in some deposits.

Genesis of Original Ore Deposits

The ore deposits in the Deep Creek Mountains are closely related to intrusive rocks in the area. Nolan (1935, p. 108-109) discussed the genesis of the ore deposits in the Gold Hill quadrangle. He stated that contact metasomatic deposits were directly related to the Gold Hill quartz monzonite intrusion. This intrusion was followed by four periods of mineral deposition. The first took place during the final state of igneous activity and ". . .resulted in the formation of anhydrous silicate minerals with, locally, tungstates in the form of scheelite." The second stage was the formation of rock-forming elements, iron oxides and volatile constituents. The ". . .third period is marked by the appearance of quartz and the metallic sulphides." The final period is ". . .characterized by the almost complete absence of silicate minerals and metallic sulphides." Nolan further stated that "The abrupt changes in mineralogy shown by the deposits of the four periods appear to have been the result of a constantly decreasing temperature, by which new mineral groups become the stable phase in place of the older minerals that they replaced." The chief modifying factor in the progress of mineral deposit formation was recurrent fracturing. This provided new "plumbing" and tended to cause abandonment of old fractures. Hence, there are many small deposits and no large single deposits.

The above four stages of mineralization are post-quartz monzonite porphyry intrusion and may be related to such dikes within the quartz monzonite Gold Hill stock. These fluids initially formed hypothermal deposits of the above four generations. As the fluids migrated out from the stock in the Willow Springs area, they cooled and formed the mesothermal deposits. Numerous fractures in this part of the range provided pathways for the fluids. Still later, and farther from the source, these fluids probably left the epithermal deposits of the Congar Hill and Dewey properties.

The intrusion of the Ibapah granitic stock, later than most fracturing and later than the formation of the Gold Hill stock, was accompanied by little contact metasomatism. Pneumatolytic activity or metamorphic differentiation formed beryllium-bearing pegmatite dikes in the southwest part of the stock.

Three alaskite intrusives, formed later than the Ibapah stock, cut metamorphic rocks of the Trout Creek series, the Johnson Pass sequence and lower Paleozoic rocks in the south part of the range. It is not known whether these represent one or more intrusions. In the Trout Creek area contact metasomatic zones surround the alaskite. Fluids emanating from the alaskite formed hypothermal veins which fill post-alaskite fractures in the schist and dolomite. As the fluids migrated away from the alaskite area, they cooled and formed mesothermal deposits in the Gold Bond area.

Veins in the Johnson Pass sequence at the Queen of Sheba mine appear to be the result of a differentiation series. Pegmatites can be traced from the alaskite and quartz veins can be followed from the pegmatite dikes. They apparently form a complete series. Gold accompanies the quartz and pervades the quartzite country rock. Spurr (1906, p. 122) described a similar situation in Crystal Peak, Nevada, which he ascribed to a similar differentiation sequence.

Small mineral occurrences at Water Canyon, Singleton Canyon and Heavenly Hills are probably the result of late appearing fluids and are considered by the author to be epithermal because of the preponderance of vugs, breccia, carbonate minerals and very narrowly confined alteration zones.

Supergene weathering processes influenced all deposits and altered their hypogene character; little supergene enrichment occurred.

Summary, Practical Applications and Future of the Area

Ore deposits in the Deep Creek Range are related to fractures and intrusive bodies. Some control was affected by lithologic units.

Most ore deposits occur as quartz vein fillings in fractures. These fractures in the Willow Springs, southern Clifton and Trout Creek areas formed prior to the Gold Hill, Ibapah and alaskite intrusions. The Trout Creek fractures formed earlier than or contemporary with the Trout Creek intrusion, but later than the Gold Hill or Ibapah stock. Mineralization had little preference for any particular fracture direction, least of all those directions as described by Stokes (1968), statistically most favorable to mineralization in the eastern Great Basin. Most of the veins are clean walled; the host rock generally had little to do with localization of mineral deposits in most areas. The Oquirrh, Abercrombie and some members of the Trout Creek formations are favorable to replacement and mineralization.

It appears that most of the mineralization in the range is related to Gold Hill stock and alaskite intrusives. Probably only pegmatitic mineralization can be directly related to the Ibapah granite. Intrusives in the range form part of an igneous rock series characterized by increasing silica content with decreasing age. Mineralization appears to have occurred both early and late in two stages, first associated with the quartz monzonite intrusion and last with the alaskite intrusion. The quartz monzonite-connected mineralization in the Gold Hill stock occurs in quartz monzonite porphyry dikes within the stock. No mineralized porphyry dikes were found within the Ibapah stock although there are some small barren porphyry dikes within the stock. The alaskite stock mineralization occurs in veins adjacent to the stock and in contact metasomatic deposits at its periphery.

Very little mineralization was associated with or is attributable to the influence of extrusive rocks.

Statistically unfavorable fracture directions, few favorable stratigraphic horizons and the paucity of porphyry intrusives make the area an unfavorable environment for large ore bodies. Even so, each of the three Deep Creek Mountain mining areas has produced mineral values, and five areas are potential mineral producers.

In Overland Canyon in the southern Clifton mining area, geophysical (magnetic), geochemical and geological data indicate a potential mineral deposit. This area lies near Barney Reevey Gulch not far from the Cyclone mine, a former gold, silver, lead and zinc producing mine. Drilling in this area should determine the extent of mineralization.

In the Willow Springs mining area, Reilly-Goshute canyons and Congar Hill areas are potential mineral producers. Cinnabar remains in the upper workings of the Congar Hill mine. Further delineation of the deposit by use of the mercury halo method of geochemical prospecting might determine its extent and potential value. The Goshute-Reilly canyons area, with a mineral-related fracture system extending for about 3½ miles, has the greatest potential in the area. Samples taken along the known area of mineralization range in value from a trace of gold and silver to 4.5 ounces of gold and 30 ounces of silver per ton. Systematic sampling of the fractures (N. 5° to 10° E. system) is needed to determine the extent of mineralization and minable areas.

Of the seven areas in the Spring Creek mining area, the Trout Creek and the Queen of Sheba areas stand out as potential mineral producers. Trout Creek, a former tungsten-producing area, still contains areas with scheelite exposed.

Pegmatitic beryl in the Apex area requires delineation through further drilling and geochemical sampling.

Early in the 1900's, the Queen of Sheba mine produced several thousand ounces of gold. The workings are now caved and inaccessible but could be reopened with little difficulty. Reconnaissance geochemical sampling across the veins shows concentrations of gold and silver. Further detailed grid sampling could show the potential of this area.

MINES AND PROSPECTS

Southern Clifton Area

Monocco Property

The Monocco property lies 5½ miles south of Gold Hill and 10 miles northeast of Ibapah on the west slope of Montezuma Peak. It can be reached from the southeast side of Clifton Flat on a dirt road which winds its way east up the slopes of the Clifton Hills (plate 1).

Twelve claims comprise the Monocco property (figure 8). Dandy, Pad No. 1, Monocco No. 2 and Julian, patent No. 6998, were patented in 1928, and Silver King, Hercules and Lion, patent No. 7002, in 1929. The Sheba, Fortune, Jemine and Centuary claimed about 1929 were not patented. The Monocco mineral lot No. 58 was patented prior to 1917. These patents and claims, issued to the Monocco Mining Co. and A. J. Young, are owned by Floyd Myers of Gold Hill, Utah.

Two types of ore deposits occur on the Monocco property-veins and bedding replacement deposits. The veins, striking N. 45° E. and dipping 60° to 90° NW or SE, range from 1 to 6 feet wide and are exposed along distances of 100 to 1,200 feet (figure 9). These veins contain quartz, limonite and small amounts of chalcopyrite, galena, plumbojarosite and chrysocolla. Samples of these veins assay as follows:

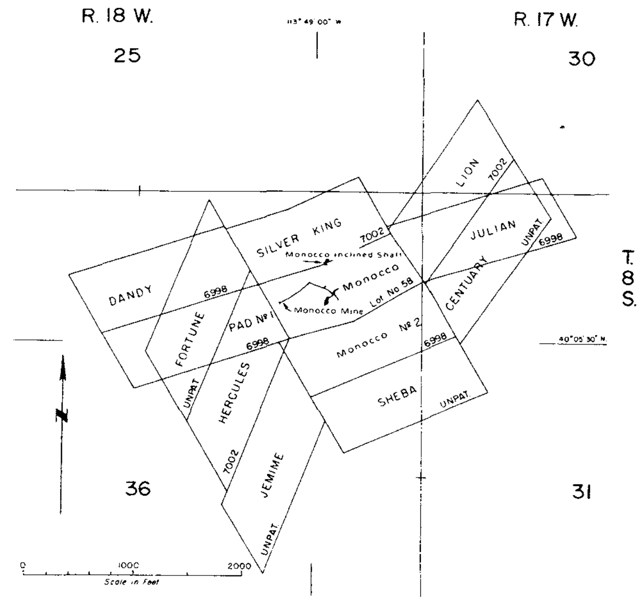


Figure 8. Claim map, Monocco property, southern Clifton area.

The country rock, dark to light gray limestone of the Oquirrh Formation, was bleached white to light cream in an irregular pattern as a result of baking by an underlying intrusive quartz monzonite. The original feldspars in the quartz monzonite were hydrothermally altered to sericite and kaolinite, and the biotite to chlorite.

Bedding replacement bodies in limestone associated with quartz veins contain limonite, hematite, malachite, azurite, copper pitch and chrysocolla.

Development consists of the Monocco mine, the Monocco inclined shaft, several small adits and a number of prospect pits. The mine follows a quartz vein for about 300 feet, then cuts across several other stoped veins. The stopes in the mine are on bedding replacements. Assay results are shown in figure 10. The Monocco inclined shaft opened a bedding replacement zone 40 feet wide and 0.5 to 1 foot thick which dips 15° NE, then followed it for 175 feet. Several stopes developed in the zone west of the incline are shown in figure 11. East of the incline a small adit was driven along a vein for about 60 feet. About 200 feet south of this adit, a 15° to 28° inclined adit follows another vein for about 195 feet. Thirteen prospect pits and seven shafts from 20 to 25 feet deep, all on veins, are scattered around the property (figure 9).

Location	Width of vein (feet)	Ounces/ton		Percent	
		Gold	Silver	Copper	Lead
Vein north of Monocco incline	1.0	0.01	0.80	0.40	2.50
Incline 600 feet east of Monocco mine	grab	trace	3.0	3.90	Not reported
Monocco mine sample 8	1.5	0.02	4.6	2.0	0.70

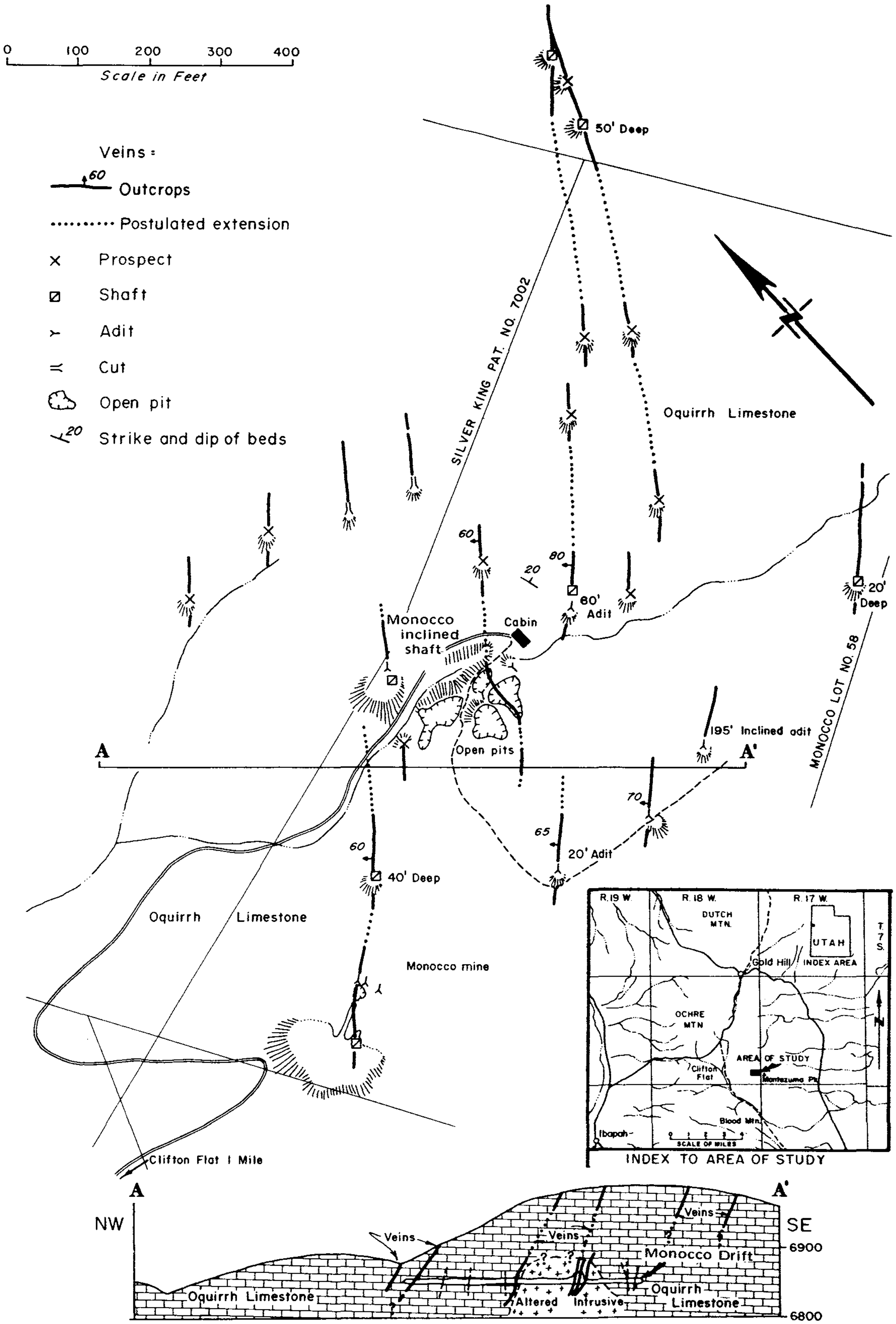
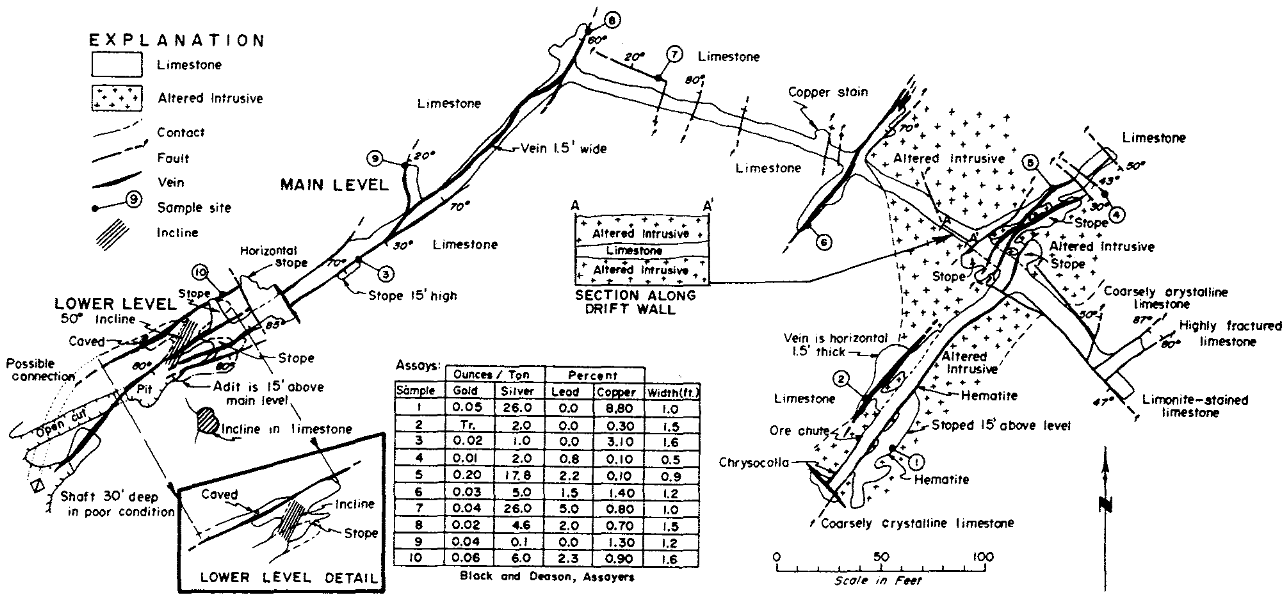


Figure 9. Surface geology and vein system of the Monocco property.



Assays:

Sample	Ounces / Ton Gold	Silver	Percent Lead	Copper	Width(ft.)
1	0.05	26.0	0.0	8.80	1.0
2	Tr.	2.0	0.0	0.30	1.5
3	0.02	1.0	0.0	3.10	1.6
4	0.01	2.0	0.8	0.10	0.5
5	0.20	17.8	2.2	0.10	0.9
6	0.03	5.0	1.5	1.40	1.2
7	0.04	26.0	5.0	0.80	1.0
8	0.02	4.6	2.0	0.70	1.5
9	0.04	0.1	0.0	1.30	1.2
10	0.06	6.0	2.3	0.90	1.6

Black and Deason, Assayers

Figure 10. Geologic map and assay data of the Monocco mine.

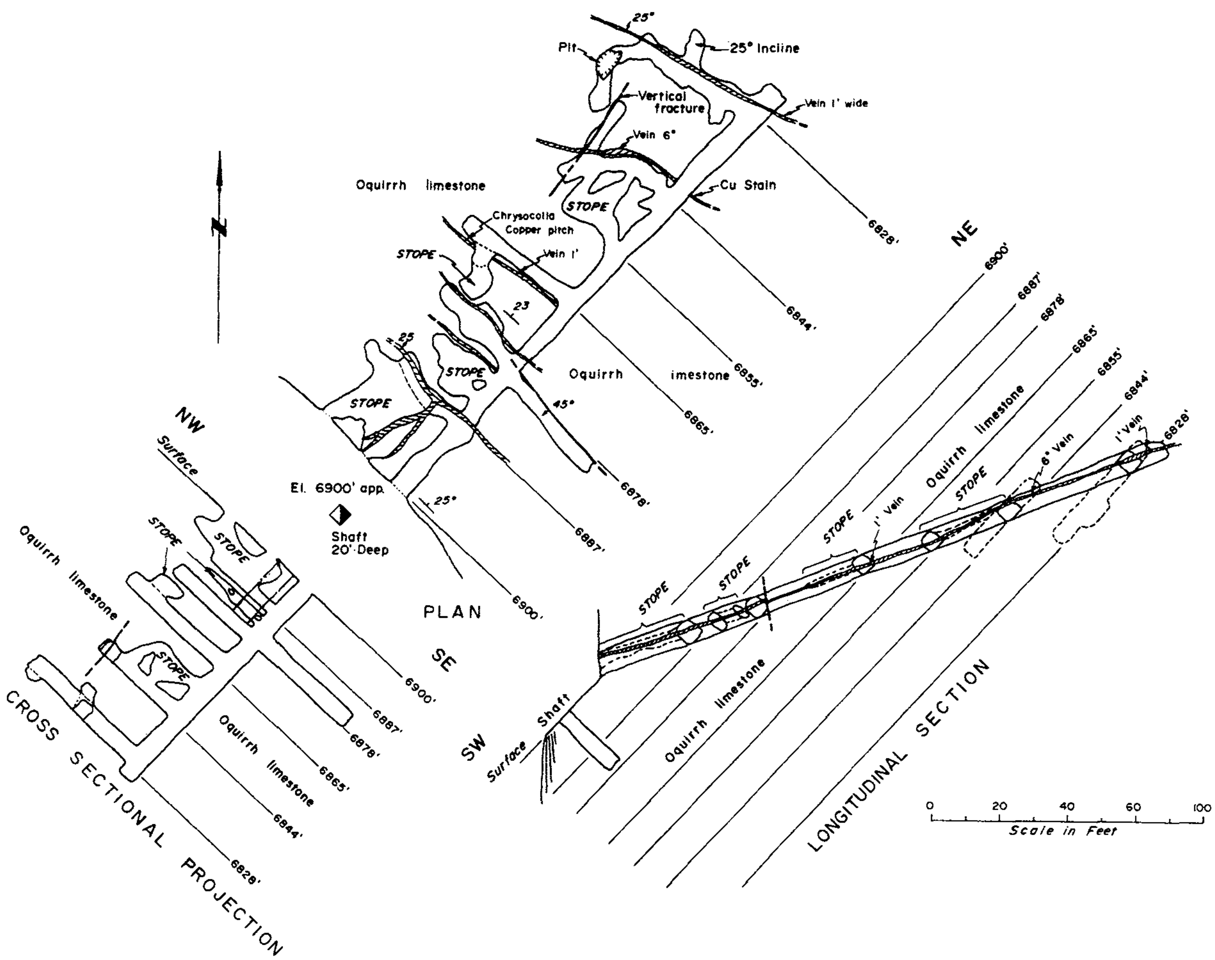


Figure 11. Plan and sections of the Monocco inclined shaft.

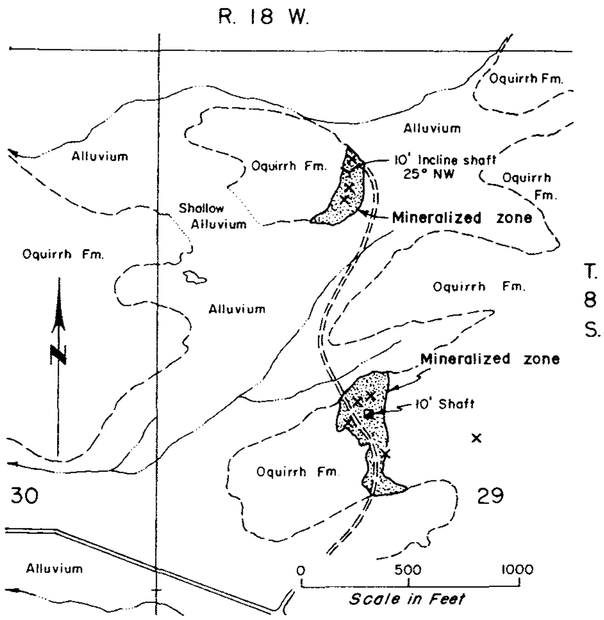


Figure 12. Geologic map of the Complex mine area in Pony Express Canyon.

Prospects in Pony Express Canyon

Iron Blowout. A zone of hematite and limonite in the highly silicified Ochre Mountain Formation occurs in a small side canyon north of Pony Express Canyon at an altitude of 6,700 feet. A 60-foot test pit was sunk at the center of the zone.

Complex Property. The Complex property lies on a N. 10° E. striking thrust fault zone 1,500 feet long and 400 feet wide on the north side of Pony Express Canyon. The zone is mineralized with grossularite, limonite, malachite, azurite and scheelite. Workings consist of a 10-foot prospect pit at the south end of the property and a 10-foot inclined prospect pit bearing N. 40° W. at the north end. Many smaller prospect pits occur around the 10-foot prospect pit and on the hillside to the east. The location of the workings is shown in figure 12.

Silver Queen Claim. The Silver Queen prospect pit, sunk on an iron oxide zone in partially silicified Guilmette Dolomite, lies on the south side of Pony Express Canyon just south of the Complex property. It was sunk by Blake Probert and Gail Lee of Ibapah in 1963. A sample from the bottom of the 5-foot pit assayed trace amounts of gold and silver.

Overland Canyon Properties

Overland and Gold Star Claims. The Overland and Gold Star claims are contiguous properties on the north side of Overland Canyon near its head (figure 13).

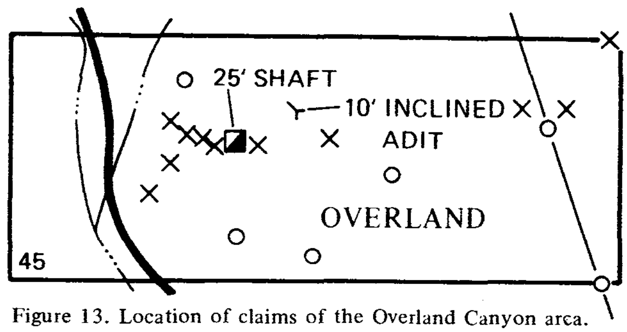


Figure 13. Location of claims of the Overland Canyon area.

The Overland claim, patented in 1886 (No. 45) by G. D. Shell, W. Watson and G. Chandler, is owned by D. B. Shields of Salt Lake City. The Gold Star and Gold Star No. 2 patented in 1910 (No. 4887) by H. D. Thompson are owned by Success Investment Co. of Salt Lake City.

Quartz monzonite, sericitized and limonite-stained, intrudes the Manning Canyon Formation (plate 3). Quartz veins containing malachite, azurite, galena, sphalerite and pyrite strike N. 80° W. on and near the contact between Manning Canyon Formation and quartz monzonite. A spectrographic analysis of a 3-foot vein sample from the 25-foot inclined shaft follows (Metallurgical Laboratories, San Francisco, California):

Major:	Si
1.0-10.0 percent	Pb, Zn, Fe
0.1-1.0 percent	Al, Ca, Mg, Cu
0.01-0.1 percent	Na, Ti, Mn, Sb, Ag, V
$<$ 0.01 percent	Bi, Cd, Mo, K, Cr, Ni, Co, Sr

A sample of the vein assayed a trace of gold and 22 ounces of silver per ton. Silver is probably in the galena. Copper content, as malachite, is less than 1 percent.

Ochre Mountain Limestone is faulted into contact with Manning Canyon Formation quartzite along a N. 80° W. striking Overland Canyon fault (plate 3). The quartz monzonite intrusion came up along the fault and created a contact metasomatic zone composed of grossularite, hematite, malachite, azurite and calcite. An assay from this zone from a 25-foot prospect pit, 3 feet wide and east of the Gold Star shaft, showed traces of gold and silver, and 2.0 percent copper and 0.6 percent lead.

Overland claim development consists of a 25-foot inclined shaft, a 10-foot adit and several prospect pits on the quartz veins.

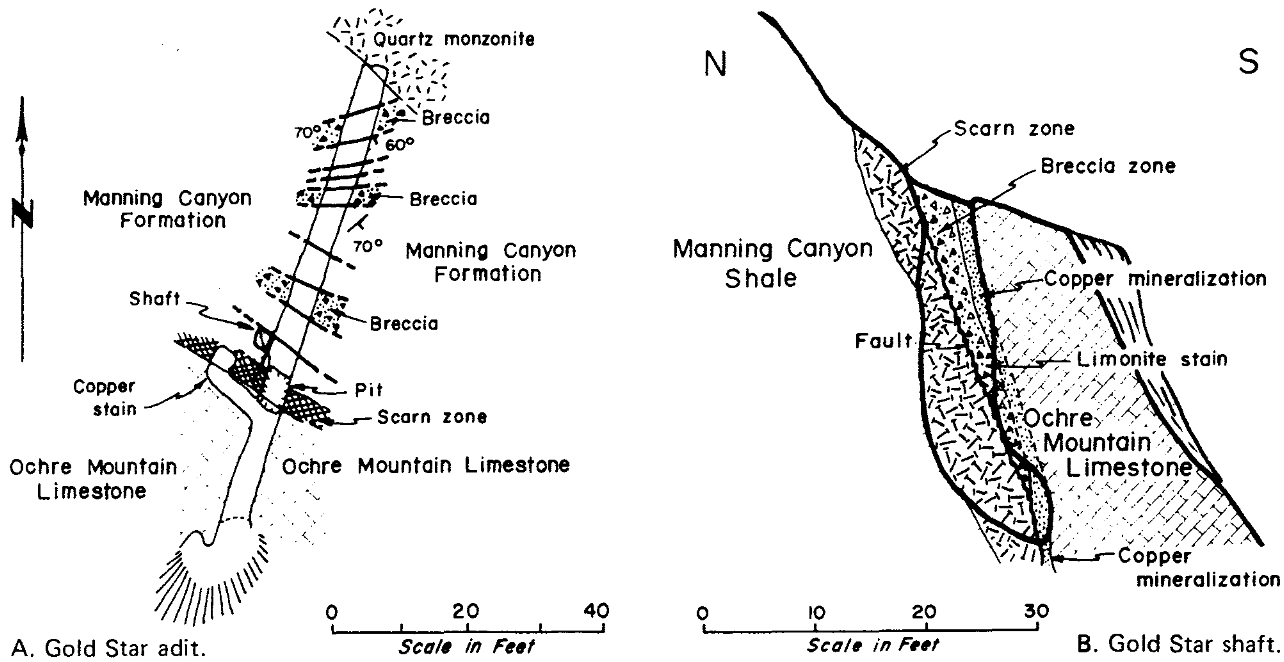


Figure 14. Geology and workings of mines on the Gold Star property.

The Gold Star claims contain a 70-foot adit bearing N. 20° E. The adit penetrates three breccia zones (figure 14) before entering quartz monzonite. A 10-foot shaft intersects the adit. A shaft, 30 feet deep (figure 14b) is on a contact metasomatic zone 100 feet east of the 70-foot adit. Several prospect pits are scattered along the zone.

No production has been reported from these claims.

Midland Claims. The Midland claims, on the southwest slope of Montezuma Peak and 2,000 feet east of the Overland patented claim, were staked by the Copper Queen Midland Mining Co., Grantsville, Utah, in the early 1900's. Present ownership is unknown.

The country rock, quartz monzonite, is cut by N. 10° to 25° E. striking quartz veins which dip 25° to 60° NW. The veins contain quartz, limonite, arsenopyrite, pyrite, sparse galena, sphalerite and chalcopyrite.

Development consists of the Midnight adit (550 feet long), two inclined adits, three adits and several prospect pits. The 550-foot Midnight adit (figure 15) bears approximately N. 30° E. and follows a 1- to 5-foot limonite-quartz vein altered along both sides to sericite and limonite. A sample of this 25 foot-wide altered zone near the incline assayed a trace of gold and 2.8 ounces of silver to the ton, and 0.5 percent copper and 1.0 percent of lead. The two inclined shafts and two adits are northwest of the Midnight adit. The two inclined adits, each bearing N. 10° W., follow parallel N. 10° E. striking limonite-stained fracture zones which dip 45° NW. Figure 16 shows the easternmost inclined adit. Arsenopyrite, pyrite, small amounts of galena, and abundant limonite, jarosite and plumbojarosite were observed. Two samples taken from the westernmost incline assayed:

Sample	Width (feet)	Ounces/ton Gold	Ounces/ton Silver
1	0.25	0.03	19.0
2	0.25	trace	3.0

An adit 100 feet southwest of the west incline follows a limonite-quartz-filled shear zone for 80 feet. An adit 400 feet to the southwest follows a pyrolusite- and psilomelane-stained shear zone which strikes N. 30° W. and dips 47° NE. A sample from this 2-foot zone assayed a trace of gold and 5.5 ounces of silver to the ton.

Nolan (1935, p. 148) reports that small shipments of ore from the Midland claims in 1916, 1918 and 1919 averaged 17.4 ounces of gold per ton, 0.56 percent copper and 15.35 percent lead. No production has been reported since that time.

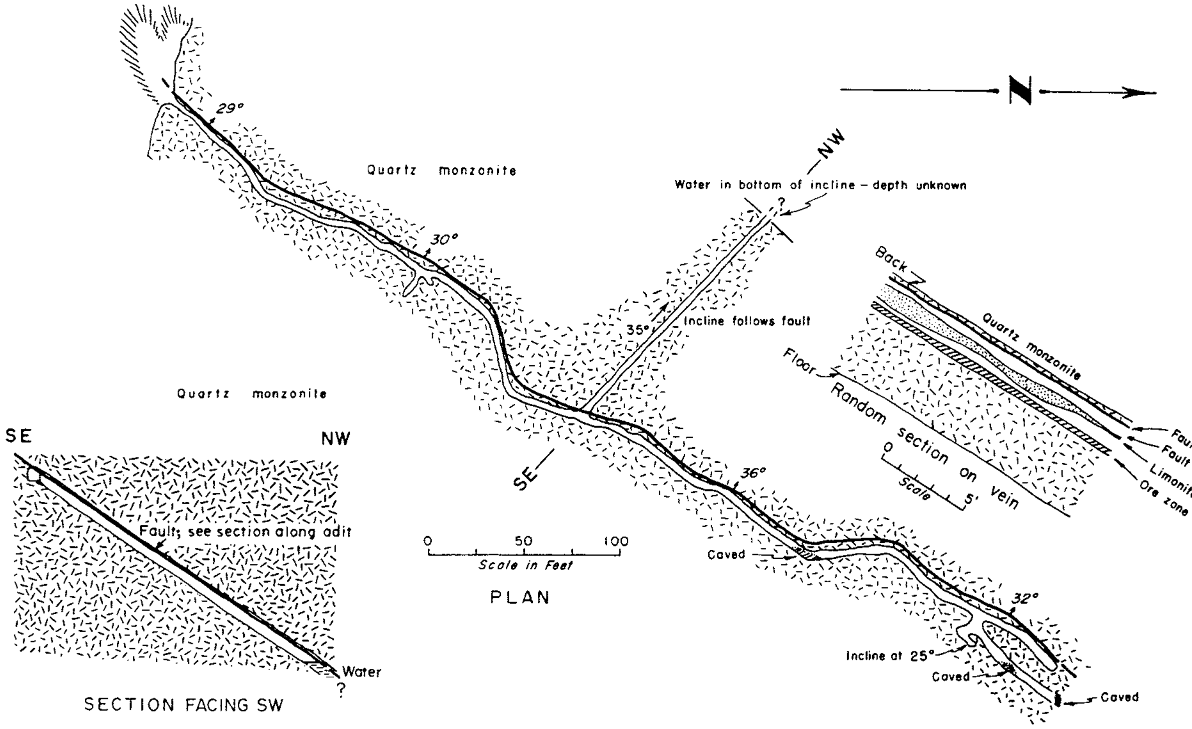


Figure 15. Geology and workings of the Midnight adit on the Midland property in Overland Canyon.

Cyclone and Leap Year Claims. The Cyclone and Leap Year claims are contiguous properties in Barney Reevey Gulch, 2,100 feet north of Overland Canyon. They were patented in 1900 by Duncan McVichie and are now owned by R. W. Johnson of Salt Lake City.

The Cyclone claim is developed by an adit, an inclined shaft and a prospect pit. Several small prospect pits were dug on the Leap Year claim.

The Cyclone mine (figure 17) consists of an inclined shaft on a quartz-sulfide vein. At an inclined depth of 80 feet a drift was extended from the inclined shaft to the north about 400 feet. The drift was filled with water at the time of the author's visit. Several raises have been reported in this drift (Nolan, 1935, p. 144) and the inclined shaft continues down the dip of the vein to an unknown depth. The vein also has been explored with a 100-foot adit whose portal is north of the shaft collar. A winze at the end of this adit probably joins the 400-foot drift.

Country rock is a quartz monzonite (plate 3), cut by a N. 15° E. striking quartz monzonite porphyry dike which dips 55° W., along which the claim has been laid out. At the south end of the claim, quartz monzonite, intruded by an east-west striking rhyolite dike, is sericitized and limonite stained.

A quartz-sulfide vein follows the hanging wall of the quartz monzonite porphyry dike (figure 17). This vein is not continuous and in some areas limonite gouge takes the place of quartz. Nolan (1935, p. 144) reported that in the Cyclone mine, these alternations of quartz and gouge can be correlated with a change in

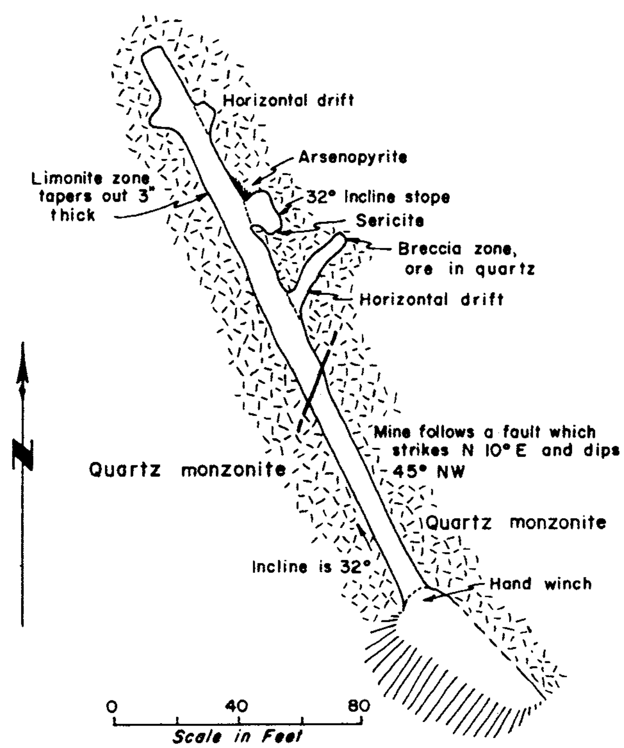


Figure 16. Geology and workings of the 200-foot inclined adit on the Midland property in Overland Canyon.

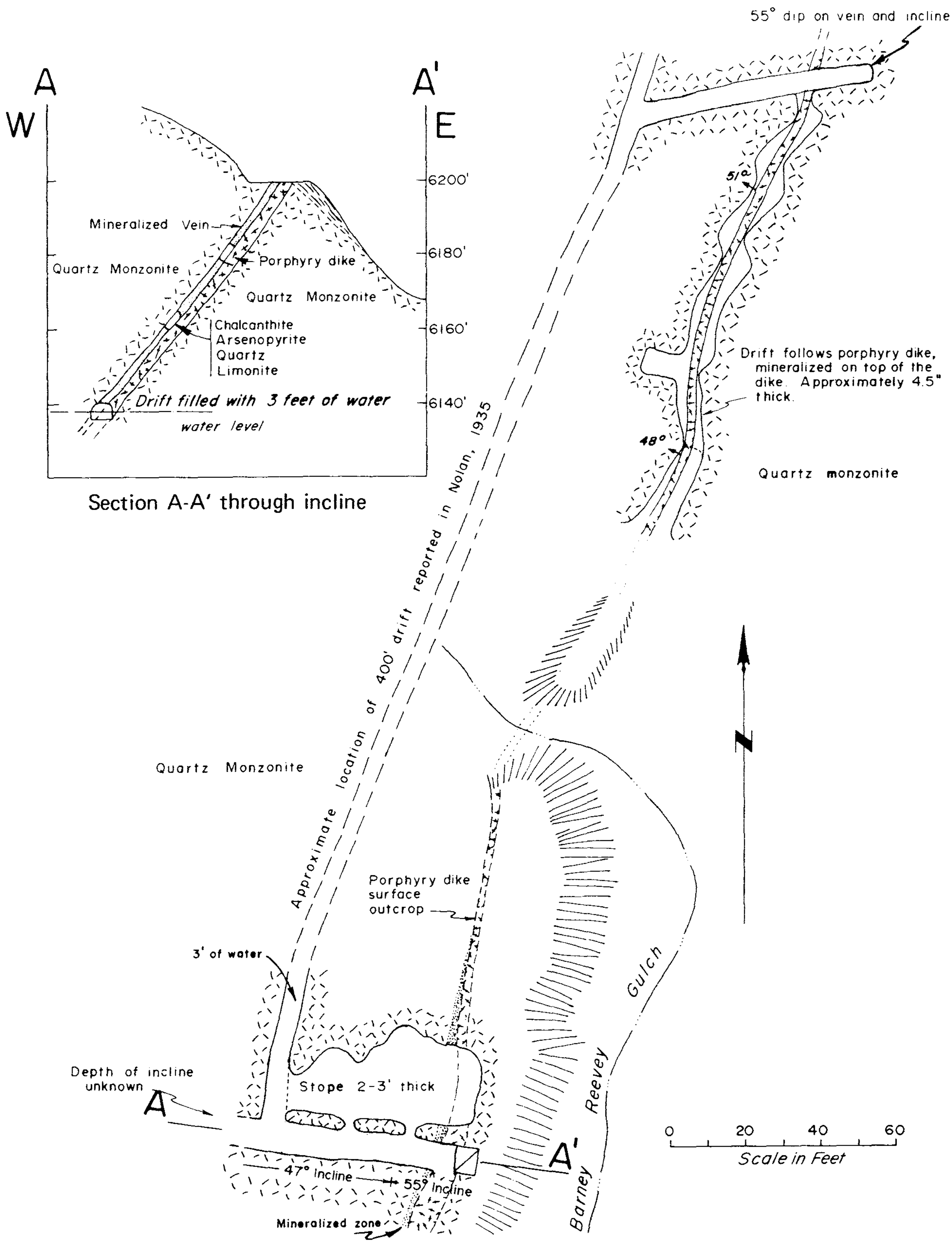


Figure 17. Geology and workings of the Cyclone mine in Overland Canyon.

strike of the vein, that the quartz-sulfide ore shoots measure from 15 to 60 feet long and from 18 inches to 3 feet thick. The vein material is composed of quartz, limonite, pyrite, arsenopyrite, galena, chalcopyrite, sphalerite and a small amount of chalcanthite. Small amounts of aikenite were reported by a Mr. Short (Nolan, 1935, p. 112). Most of the sulfides are fine-grained and difficult to identify. A sample taken by Nolan is compared with an analysis of three samples taken by the author as follows:

Sample No.	Width of vein (feet)	Ounces/ton		Percent		
		Gold	Silver	Lead	Copper	Arsenic
Nolan[1]		0.03	6.0	0.4-8.2	0.5-1.7	0.5-7.3
133	2.0	trace	2.0	n.r.	n.r.	n.r.
134	1.0	trace	trace	n.r.	n.r.	n.r.
138	2.5	0.03	10.0	n.r.	n.r.	n.r.

[1]Nolan's sample average analysis run by USGS.
n. r. indicates not run.

The Leap Year claims lie along the contact between the Gold Hill stock and the Ochre Mountain Formation limestone (plate 3). The quartz monzonite is sericitized and limonite stained and the Ochre Mountain Formation limestone has been silicified.

Ore was shipped in 1923 (Nolan, 1935, p. 144). No record was found to indicate dates or quantities.

Laura Claim. The Laura claim, in Barney Reevey Gulch 250 feet north of Overland Canyon, was patented in 1892 by W. C. Hull and the Florence Mining Co. The present owner is not known.

Quartz monzonite, sericitized and limonite stained in large irregular patches, and Ochre Mountain Formation limestone underlie the claim (plate 3). Quartz veins containing chalcopyrite, malachite and azurite strike north-south to N. 5° E. in quartz monzonite.

A 60-foot adit bears north and enters the claim from the south (figure 18) following a quartz vein. A second adit, 20 feet long, bears N. 20° E. following a second quartz vein.

No production has been reported from this property.

Bonanza Group. The Bonanza group at the head of Barney Reevey Gulch just northeast of the Cyclone mine consists of Bonanza Key, Big Bonanza and Bonanza No. 2 patented claims. The claims were patented in June 1910 (patent No. 5886) by H. D. Thompson, A. H. Humphreys and W. H. Thompson. The present owners are unknown.

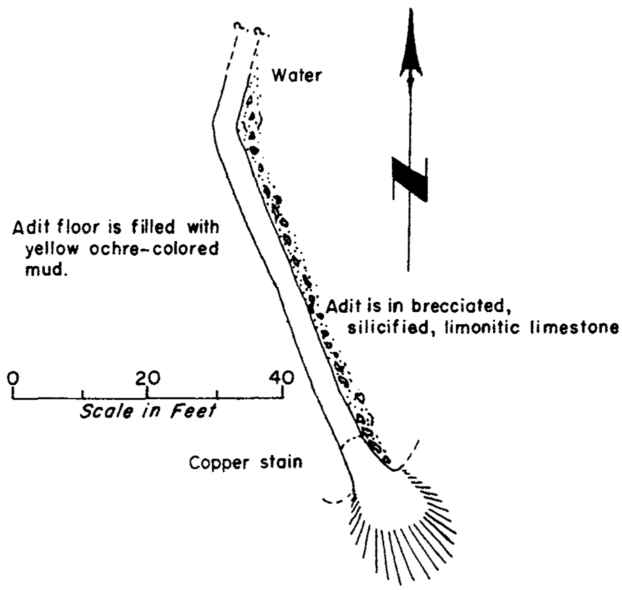


Figure 18. Geology and workings of the Laura adit in Overland Canyon.

Development consists of a few prospects and a reported 181-foot adit bearing N. 12° W. on the Big Bonanza patented claim.

Nolan (1935, p. 144) observed that in the 181-foot adit, arsenopyrite, scorodite and associated lead and zinc minerals occur in shear zones which strike N. 20° E. and dip 65° W. in quartz monzonite. Ore shoots in the zones have been reported as wide as 5 feet.

No production has been reported from this property.

Monte del Rey Property. The Monte del Rey property is located at the head of Hopkins Gulch. Six claims–Monte del Rey, Monte del Rey No. 2, Monte del Rey No. 3 and Maybell, Hero and Quincy, patent No. 6066 were patented in 1911 by P. H. Robinson and are now held by Julian Simpson of Corte Madera, California.

Sericitized and limonite-stained quartz monzonite underlying the claims is intruded by quartz monzonite porphyry dikes which strike N. 5° to 10° E.

Development consists of a caved adit (Monte del Rey mine), a prospect shaft and several prospect pits. The caved Monte del Rey mine was reported by Nolan (1935, p. 144) to have been driven westward in quartz monzonite to cut several veins exposed on the surface. A 30-foot prospect shaft was sunk on a porphyry dike on the Quincy claim about 470 feet west of the Monte del Rey mine.

The Monte del Rey mine follows a quartz vein along a quartz monzonite porphyry dike. Arsenopyrite, pyrite and a little chalcopyrite and galena were found in the vein. The 30-foot shaft on the Quincy claim was sunk on an iron-stained portion of a quartz monzonite porphyry dike.

No production has been reported from the property.

Fortuna Group. The Fortuna claims are in Hopkins Gulch 1¼ miles north of Overland Canyon. Three claims, Fortuna, Fortuna No. 2 and Fortuna Hill, patented in 1910 (No. 5885) by H. D. Thompson, are now held by Success Investment Co. of Salt Lake City.

Quartz monzonite underlying the claims (plate 3) is sericitized and limonite stained in patches. An arsenopyrite- and galena-bearing quartz vein parallels a N. 5° to 10° E. striking quartz monzonite porphyry dike which intrudes the quartz monzonite on the Fortuna claim. East of this vein, also on the Fortuna claim, a similar quartz vein striking N. 45° E. and dipping 30° to the NW lacks the quartz monzonite porphyry dike. Conichalcite and pyrolusite with a little malachite were found in this vein. A sample taken from the 3½-foot vein in the Fortuna mine assayed 0.08 ounces of gold per ton and 10.0 ounces of silver.

Development consists of a 40-foot, N. 45° W. bearing inclined adit and three prospect pits. The 40-foot Fortuna mine follows the N. 45° E. striking quartz vein discussed above. The prospect pits were dug on limonite-stained quartz monzonite.

No production has been reported from this property.

Proberts Property. A group of unpatented claims has been staked and maintained since the late 1940's by Dan Probert of Ibapah, between Barney Reevey Gulch and the Midas mine.

Development consists of a short adit, three prospect shafts, an open pit and several prospect pits. The short adit and a 10-foot prospect shaft lie on the west side of Hopkins Gulch. Two shallow shafts and a series of prospect pits are located east of Barney Reevey Gulch and west of Hopkins Gulch. An open pit 60 feet by 80 feet deep lies just east of Hopkins Gulch. Several prospect pits are located in Barney Reevey Gulch.

The property lies along the contact between quartz monzonite and Ochre Mountain Formation limestone (plate 3). The quartz monzonite was sericitized and limonite-stained along the contact. The limestone is silicified and limonite-stained. The open pit was dug on a contact metasomatic zone in which sericitized quartz monzonite abuts silicified limestone. This silicified zone contains hematite, limonite, malachite, conichalcite and quartz. In Barney Reevey Gulch limestone is altered to wollastonite, grossularite, diopside and calcite; it also contains scheelite.

No production has been reported from the property.

Midas Property. The Midas property is 1,200 feet east of Hopkins Gulch, about 3/4 mile north of Overland Canyon (plate 3). The Midas, Lucky May, June Bug and Golden Eagle (patent No. 4334) were patented in December 1901 by the Midas Gold Mining and Milling Co., presently inactive, owned by R. W. Rosebrough, Salt Lake City.

Workings consist of Midas mine, two small adits, a shaft and several prospect pits. The Midas mine (figure 19) was caved at the time of the author's visit. Nolan (1935, p. 134) states that "The mine developments consist of an adit tunnel, in which about 1,100 feet of work has been done, and several stopes at the surface. It is said that the stopes were connected with the tunnel level by means of four raises, but it is not now possible to pass from one to the other." Two short adits are located north of the Midas mine and one prospect shaft occurs just north of these adits. Other prospect pits are aligned with the adits and shaft. A 40-ton per day cyanide mill was constructed in 1902 about 500 feet southwest of the mine portal. Only ruins remain.

The Midas mine is located on a north-south striking contact metasomatic zone between quartz monzonite and Oquirrh Formation limestone (plate 1). Nolan (1935, p. 135) reported "The ore . . .was composed chiefly of wollastonite, in part altered to spadaite and less abundant diopside and garnet." Butler (and others, 1920) also reports vesuvianite. Sulfides are not abundant and consist of pyrite and various sulfides of copper. In addition Butler notes arsenopyrite. No free gold was observed by the writer. The grade of the ore appears to have been somewhat higher than the average in the Alvarado and Cane Springs mine." Nolan also reported that the ore body had an average thickness of 4 feet, was found in shoots for several hundred feet along the strike of the bed, and that the vertical depth of 100 feet seems to have been the limit of the ore body.

The operation of the mine in 1904 produced $20,000 in gold. Total production of the mine to 1904 was $35,000. No production is reported since that date.

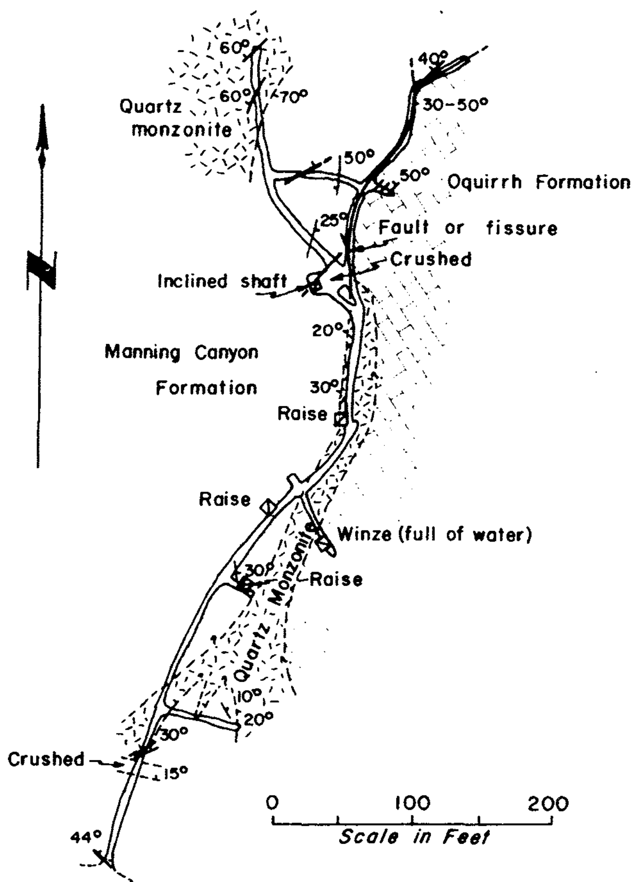


Figure 19. Geology and workings of the Midas mine in Overland Canyon (after Nolan, 1935).

Utah Claim. The Utah claim adjoins the west side of the Midas group. Patented in 1909 by E. T. Crimson, the claim is now owned by Blake Probert of Ibapah.

Development consists of a series of prospect pits along the contact zone in the northeast part of the claim.

The claim includes a broad area of sericitized and limonite-stained quartz monzonite and is bordered on the east side by quartzite and silicified shale of the Manning Canyon Formation (plate 3).

No production from this property has been reported.

Willow Spring Area

Dewey Properties

The Dewey properties, in sec. 17, T. 9 S., R. 18 W., SLM, lie on the steep south-facing slope of Sevy Canyon, approximately 4 miles east of the Ibapah post office (plate 1). The five claims (Dewey Nos. 1-5), patented September 17, 1914, by E. A. Ulrey (patent Nos. 6310 and 6311), are owned by H. D. Mitchell and others, Grand Federal Savings and Loan, LaGrange, Illinois.

The workings lie in a northeast-striking silicified fault zone within the dark gray to black, unfossiliferous, brecciated Silurian Laketown Dolomite. This zone extends from the bottom of Sevy Canyon northeastward for about 1,900 feet where it splits into two zones 20 to 50 feet apart and continues for 600 feet. Dolomite has been replaced by quartz. Some malachite, azurite, jarosite, pyrolusite, limonite and tetrahedrite also occur in the silicified zone. Samples taken at approximately 100-foot intervals showed trace amounts of silver and gold. A spectrographic analysis of one sample gave the following (Metallurgical Laboratories, San Francisco, California):

Major:	Si, Ca
1.0-10 percent	Mg, Pb
0.1-1.0 percent	Fe, Al, Zn
0.01-0.1 percent	Na, Ti, Mn, Sr, V, Cu, Ag, Sn
$<$ 0.01 percent	K, Ni, Cr, Sb, Co, B

Workings consist of three adits, one shaft and four prospect pits. The 35-foot Dewey adit, northernmost of the workings, is driven northeast along the silicified fault zone. It has been stoped in its floor and back and probably produced most of the ore. About 100 feet south of this adit a 50-foot adit is driven north in dolomite. A 30-foot shaft is located next to the portal of this adit. The third adit, 130 feet south-southwest of the Dewey adit, is driven 35 feet north-northeast. Prospect pits lie along the fracture zone northeast and southwest of the adits.

Nolan (1935, p. 167) stated: "Swan Moline, of Gold Hill, reports that a shipment of 800 to 900 pounds of ore was made from the property between 1890 and 1900 and yielded $1,800, the valuable metal being silver." The mineral deposit mined in the late 1800's was apparently a small pod in the silicified fault zone. A grab sample of tetrahedrite from the Dewey mine dump assayed 0.05 ounces of gold and 90.0 ounces of silver per ton (Black and Deason, assayers); this small amount did not justify continuation of mining activity. No production has been recorded since the late 1800's.

North Pass Area

The North Pass area in Bagley Gulch and North Pass Canyon lies 9 miles south of Gold Hill and 12

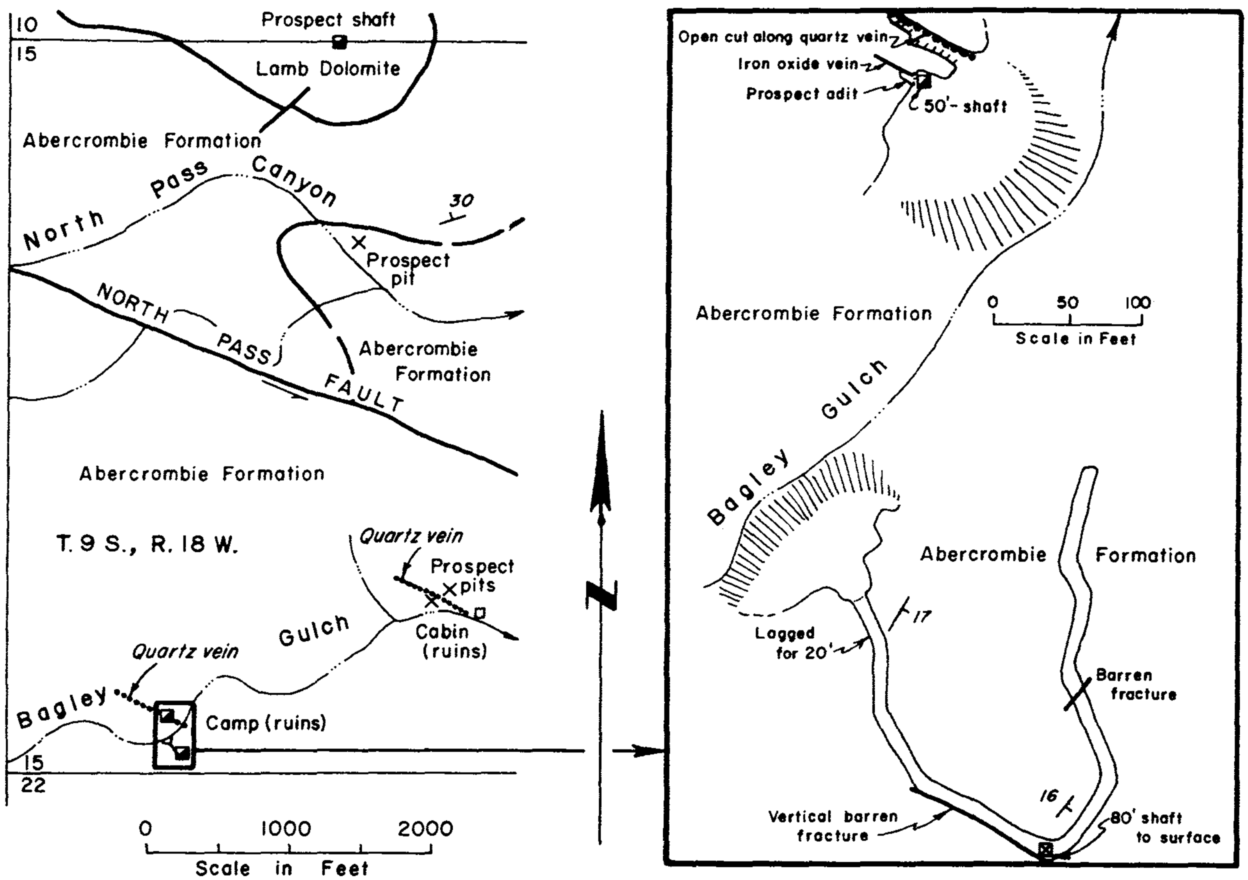


Figure 20. Geology and workings of the North Pass area.

miles northwest of Callao (plate 1). The workings occur on the north and south sides of Bagley Gulch and on the north side of North Pass Canyon (figure 20). The access road to Bagley Gulch workings is nearly obliterated.

Three mineral lots, Silver Dick lode (no. 37), Burro Lode (No. 38) and Native Silver (No. 39) are located in the southeast corner of sec. 9, T. 9 S., R. 19 W. (figure 21), 4,000 feet northwest of the North Pass Canyon prospects. No workings or mineralization was found on these claims Taxes have not been paid in several years and the owner is unknown.

Country rock is west-dipping Cambrian Abercrombie Formation, a limestone with interbedded sandstone and shale, and Cambrian Lamb Dolomite (figure 20).

Tetrahedrite, galena, malachite, siderite, limonite, jarosite, calcite and aragonite occur in 1- to 3½-foot wide N. 70° to 75° W. striking quartz veins which dip 85° to 90° NE or SW. These veins appear to be related to the North Pass Left lateral fault with the same strike.

In Bagley Gulch are two shafts, one adit and two prospect pits (figure 20). The northernmost shaft follows a 3½-foot quartz vein for 50 feet. The southernmost shaft follows a limonite-stained fracture which strikes parallel to the quartz vein. This shaft intersects a S. 30° E. bearing adit at a depth of 50 feet and extends 30 feet below. Two prospect pits occur 2,000 feet northeast of the shafts on a N. 70° W. striking quartz vein.

A sample from the 3½-foot vein near the northernmost shaft assayed 10 ounces of silver per ton. No data on production are available.

In North Pass Canyon, a prospect pit and a shaft on iron oxide zones in limestone comprise the development (figure 20).

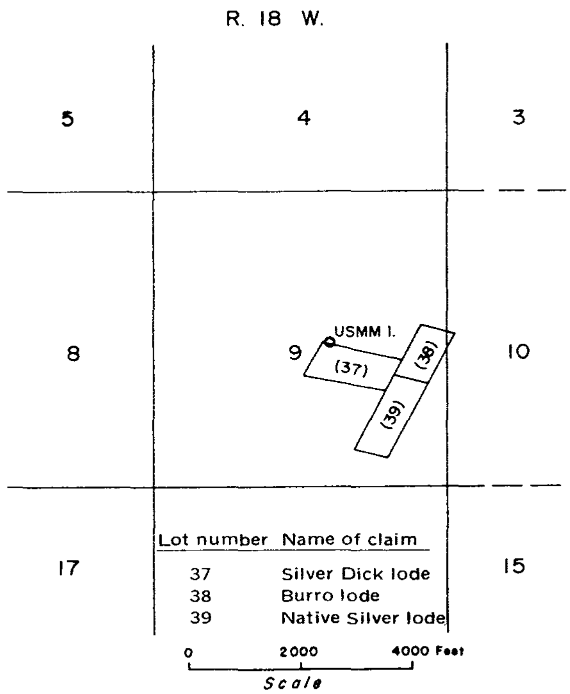


Figure 21. Location of claims in the North Pass area.

Congar Hill Property

The Congar Hill mercury property is 9 miles south southeast of Ibapah, near the head of Arts Canyon on the west side of the range (plate 1). A narrow road with many switchbacks from the mouth of the canyon to the mine provides difficult access to the property.

Five unpatented claims, Congar Hill Nos. 1-5, comprise the property. They belong to Dan Probert of Ibapah, who has maintained the assessment work since they were staked in the early 1930's.

In the mine area, Cambrian Busby Quartzite, Pioche Shale and Prospect Mountain Quartzite are thrust over Devonian Sevy Dolomite along the Rocky Springs thrust fault (figure 22). This thrust plate strikes N. 60° W. and dips from 50° to 55° SW. A mineralized fracture zone to 2 feet wide in the underlying Sevy Dolomite parallels the Rocky Springs thrust. A glory hole was opened on this zone. The ore, in a dolomite breccia cemented with sparsely distributed barite and cinnabar, characteristically shows a zoning of stibnite surrounded by cinnabar and enclosed in barite. Minerals arranged in paragenetic sequence (earliest to latest) are: calcite and dolomite, siderite, quartz and pyrite, stibnite, cinnabar and metacinnabar, sphalerite, stibiconite, valentinite and senarmontite, and limonite. Stibiconite ($H_2Sb_2O_5$), valentinite (Sb_2O_3), senarmotite (Sb_2O_3) and limonite are products of weathered stibnite and pyrite. Cinnabar is the most abundant metallic mineral.

Development consists of an adit, an inclined shaft, a small glory hole and three open pits (figure 22). The adit was driven 125 feet northeasterly beneath the glory hole which is 41 by 35 feet in area and 8 feet deep. An inclined shaft was driven westerly from the bottom of the glory hole, then southerly (figure 23). Approximately 500 feet southeast of the glory hole are three shallow pits.

A retort was built in the canyon to process the cinnabar. Mercury was shipped from the property in the 1940's but no records were found to indicate dates or quantities. Hilpert (1964, p. 109) states: "Since 1907, less than 200 flasks of mercury have been produced; the yield has been sporadic and the records are poor. Most of the metal probably has come from the Probert (Congar Hill) mine, Tooele County."

Willow Springs Area

The Willow Springs area in Dry Canyon in the northeast part of the Deep Creek Mountains includes secs. 26, 27, 28, 33, 34 and 35, T. 9 S., R. 18 W. (unsurveyed; plate 1 and figure 24). It is entered from Gold Hill or Callao on the Overland Canyon road to Roundhouse station near the mouth of Overland Canyon, thence along an unimproved road southwest across the foothills for 3½ miles to a point where a rough road leads west to Dry Canyon.

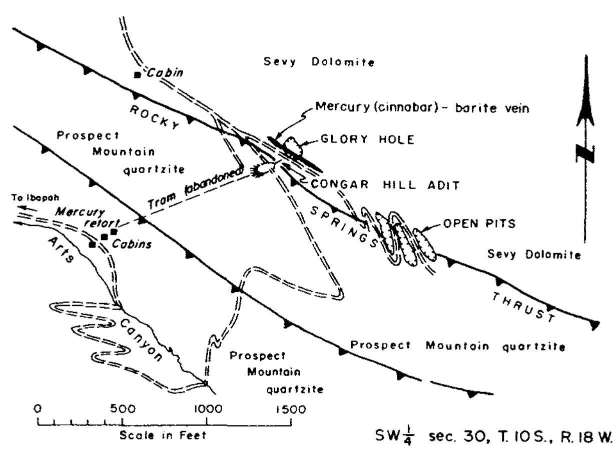


Figure 22. Geologic map of the Congar Hill area.

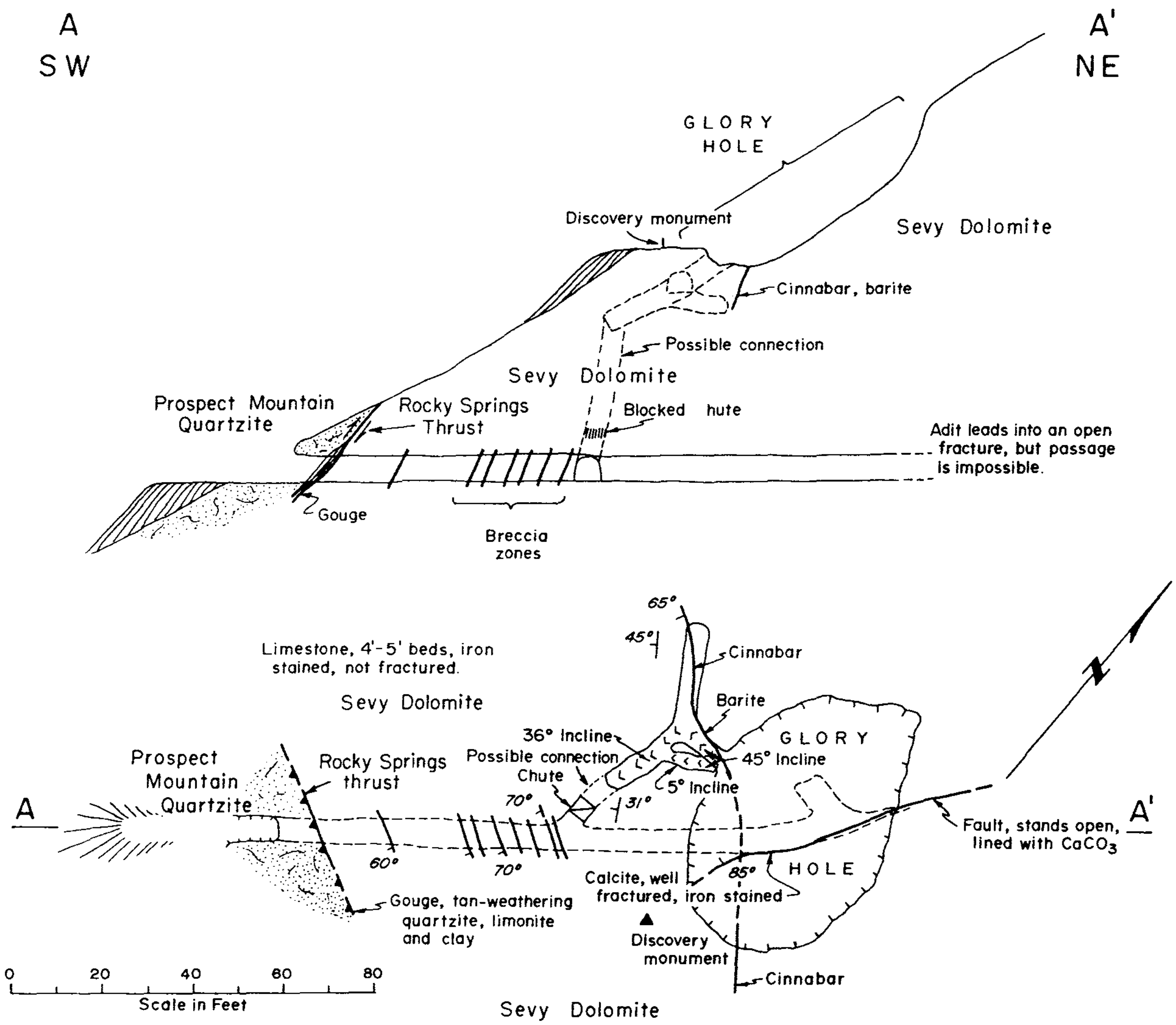


Figure 23. Geologic map and section of the Congar Hill mine.

The Roy group of claims (Roy Nos. 1-5) forms a contiguous block in Dry Canyon (figure 24) and was patented on August 19, 1898 (patent No. 3697) by the Lion Mining Co., Inc. Present ownership is unknown. The Sleuth lode, 700 feet east of the Roy group, and the individually isolated County, Caroline and Dixie lodes 600 to 800 feet west of the Roy group were designated as mineral lots. The ownership of these lots is unknown.

Prospects and workings lie mainly in the Abercrombie Formation, a thin-bedded to massive limestone with interbedded shales. Prospecting also has been done on the massive Prospect Mountain and Busby quartzites.

Development consists of eleven adits, two shafts, one prospect and two inclined shafts (table 3 and figure 24). The Roy mine (figures 24 and 25) in the northwest corner of Roy No. 4 claim is an inclined shaft sunk to the west at 38° following an iron oxide zone. This zone is cut off by a north-south striking fault at 40 feet below the surface. A second iron oxide zone in a north-south fracture 15 feet west was followed by a 30° winze for 20 feet, at which point the winze goes into the hanging wall. At a 46-foot depth, a drift follows a N. 5° W. striking iron oxide-stained fracture for 45 feet to the south. At this point, a winze follows an iron oxide streak in the back for 120 feet at 10° to 30° W. At the point in which the drift leads south from the winze, another winze continues at

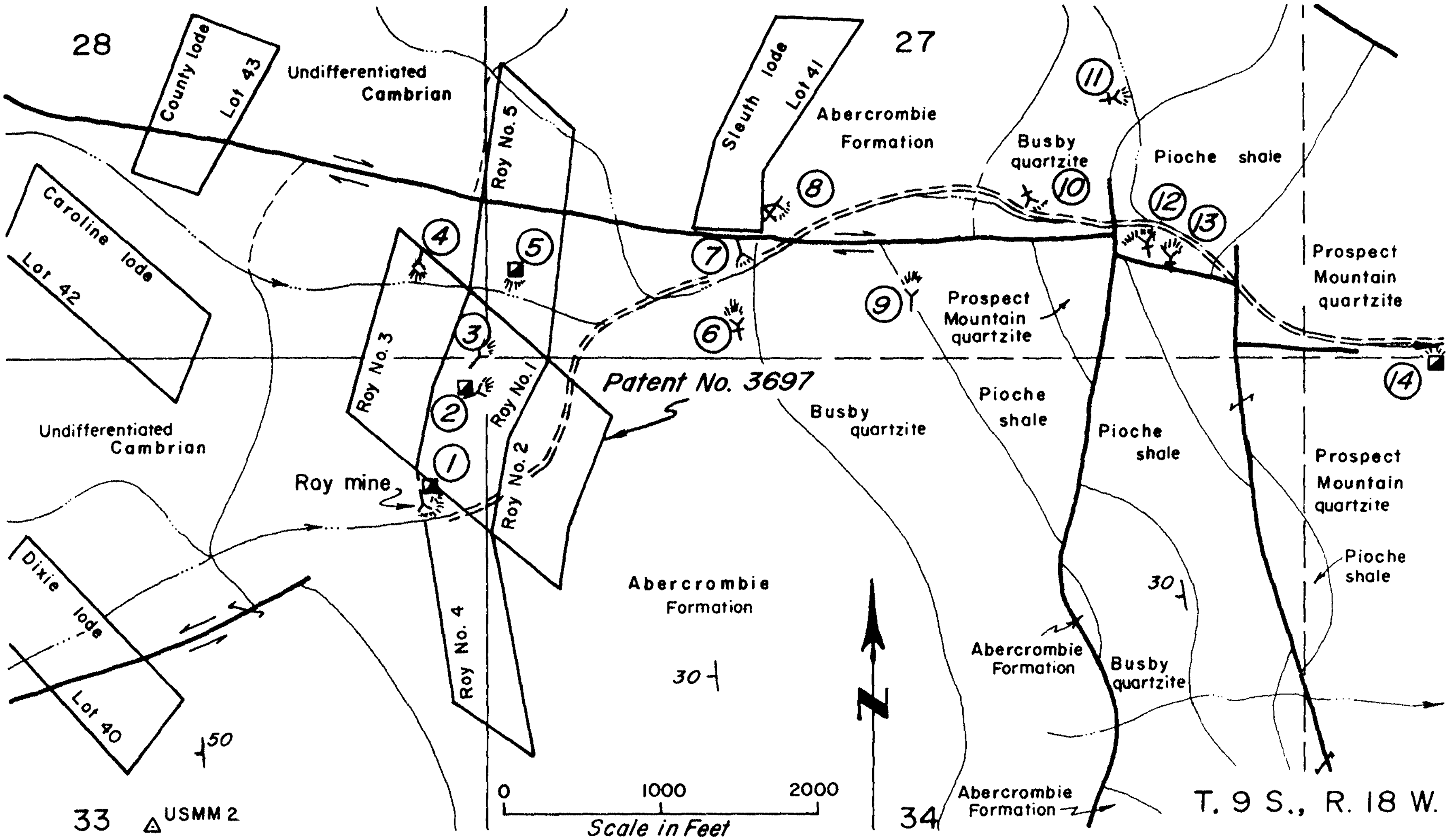
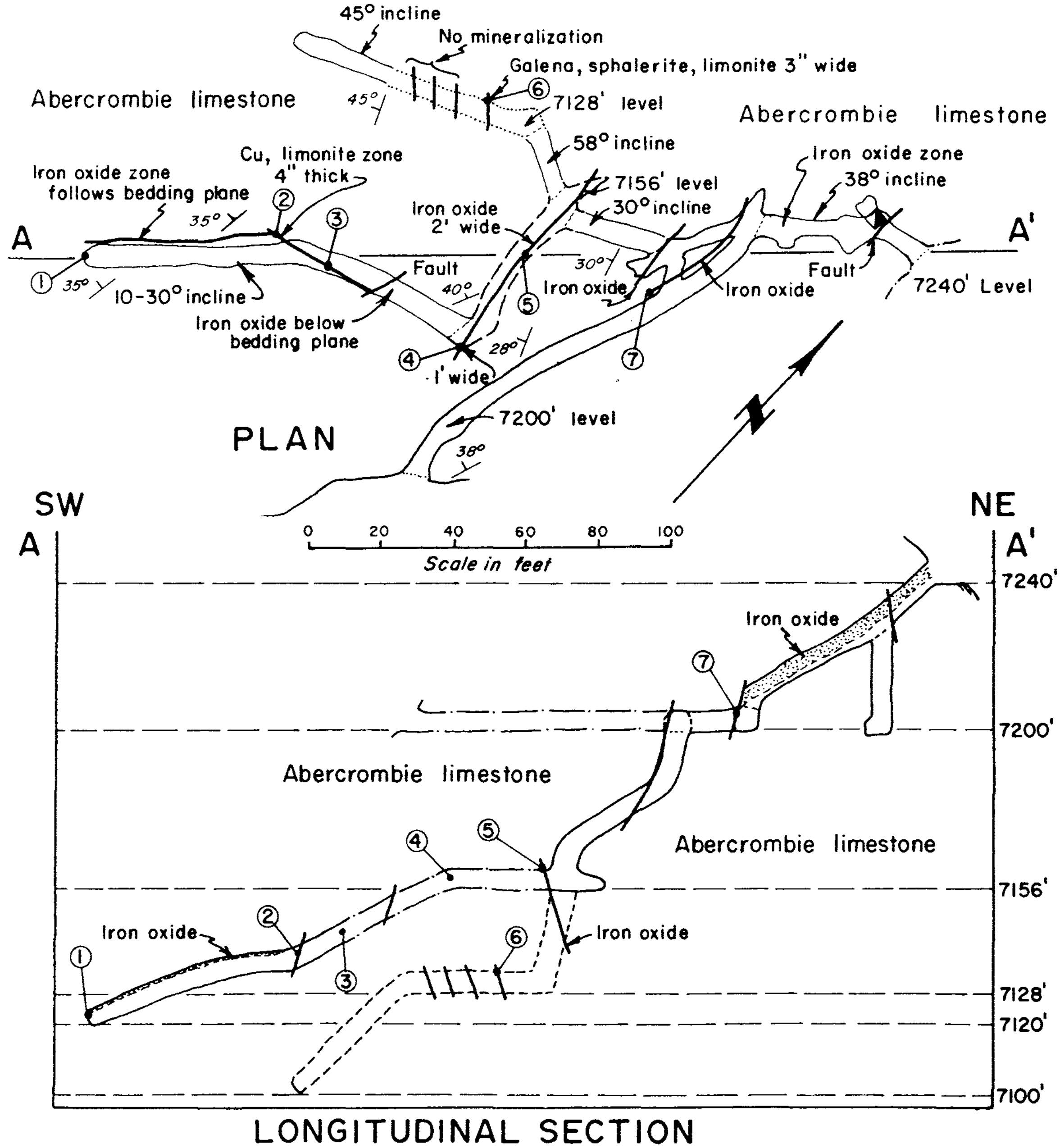


Figure 24. Geology and claims in the Willow Springs area, Willow Springs district. Numbers in circles refer to mines discussed and mapped.



Assays —

Number	Width (ft.)	Ounces/ton Gold	Ounces/ton Silver	% Lead
1	4	Tr.	Tr.	—
2	4	0.005	2.0	2.5
3	4	0.005	4.4	2.0
4	1	Tr.	0.4	1.3
5	1	0.015	36.0	12.5
6	0.3	0.015	44.4	43.0
7	0.7	Tr.	4.8	1.0

Assay number circled on map
Black and Deason, assayers.

Figure 25. Geology and workings in plan and section of the Roy mine, Willow Springs area.

Table 3. Workings in the Willow Springs area.

Location No. (Figure 24)	Name	Type of opening	Length or depth (feet)	Figure No.	Country rock	Status
1	Roy mine	adit		10	Abercrombie Fm.	open
		incline		10	Abercrombie Fm.	open
2		adit		11	Abercrombie Fm.	open
		shaft	6	11	Abercrombie Fm.	open
3		adit		12	Abercrombie Fm.	open
4		adit	120	13	Abercrombie Fm.	open
5		incline	33		Abercrombie Fm.	open
6		adit	unknown		Abercrombie Fm.	closed
7		adit	50	14	Abercrombie Fm.	open
8		incline	30		Abercrombie Fm.	open
9		adit	15		Busby Quartzite	open
10		adit	unknown		Busby Quartzite	closed
11		adit	unknown		Pioche Shale	closed
12		adit	unknown		Pioche Shale	closed
13		adit	unknown		Pioche Shale	closed
14		shaft	10		Prospect Mtn.	open

58° northwest to a depth of 112 feet. Here a drift extends southwest for 40 feet, intersecting four fractures, the first of which contains sulfides. The drift continues southwest as a winze in barren limestone for another 30 feet (figure 25). At a 40-foot depth, the inclined shaft of the Roy mine is intersected by a 110-foot access adit driven from the south.

About 600 feet north northeast of the Roy mine and on the Roy No. 1 claim is a 10-foot shaft and a 30-foot prospect adit on an iron oxide-stained fracture (figures 24 and 26a). North of the shaft by 150 feet is an 80-foot adit which bears roughly south following an iron oxide-stained fracture (figures 24 and 26b). In the northwest corner of the Roy No. 3 claim 1,600 feet north northeast of the Roy mine is a 140-foot adit driven N. 30° E. on a series of limonite-stained fractures (figures 24 and 26c). About 600 feet east of this adit on the Roy No. 5 claim is a 33-foot inclined shaft also sunk on an iron-stained fracture zone. An adit, 1,200 feet east of the shaft, was driven N. 5° W. along an iron oxide-stained fracture zone for 45 feet (figures 24 and 26d). On the north side of Dry Canyon on the southeast side of the Sleuth lode mineral lot, a 30-foot inclined shaft to the west follows an iron oxide-stained limestone bed (figure 24). On the south side of the canyon, 1,500 feet southeast of the 30-foot inclined shaft is a 15-foot adit driven south along an iron oxide-stained fracture in Busby Quartzite (figure 24). On the east side of the area, in the mouth of Dry Canyon on its south side, is a 10-foot shaft sunk on an iron oxide-stained fracture in Prospect Mountain quartzite (figure 24).

Mineral deposits are localized in younger fractures between 1,116 and 1,260 feet above the base of the Cambrian Abercrombie Formation. Fractures striking N. 40° to 50° E. cut the formation with minor displacement. Some iron staining occurs in fractures of N. 50° E. to N. 10° W. strike in the Busby and Prospect Mountain quartzites. Oxidized lead, copper and iron minerals occur near the surface. On the second level of the Roy mine, a 2-foot oxidized vein sample (figure 25) carries 36 ounces of silver per ton. On the third level, galena and tetrahedrite in a 3-inch vein carry 44.4 ounces of silver per ton.

Nolan (1935, p. 169) reports that an 8-ton shipment from the claims in 1917 contained 18 ounces of silver per ton and 37 percent lead. Small ore shipments have been made since then but no production records are available.

Reilly-Goshute Canyons Area

The Devils Pit-Oro del Rey-Eagles Nest, Lower Goshute Canyon area, Prosperity claim and the Silver Queen claims (plate 1) are on the east side of the Deep Creek Mountains between Reilly and Goshute canyons. Access is by means of a rough road leading 6 to 8 miles west from Callao into the Silver Queen and Lower Goshute Canyon workings. Continuing up Goshute

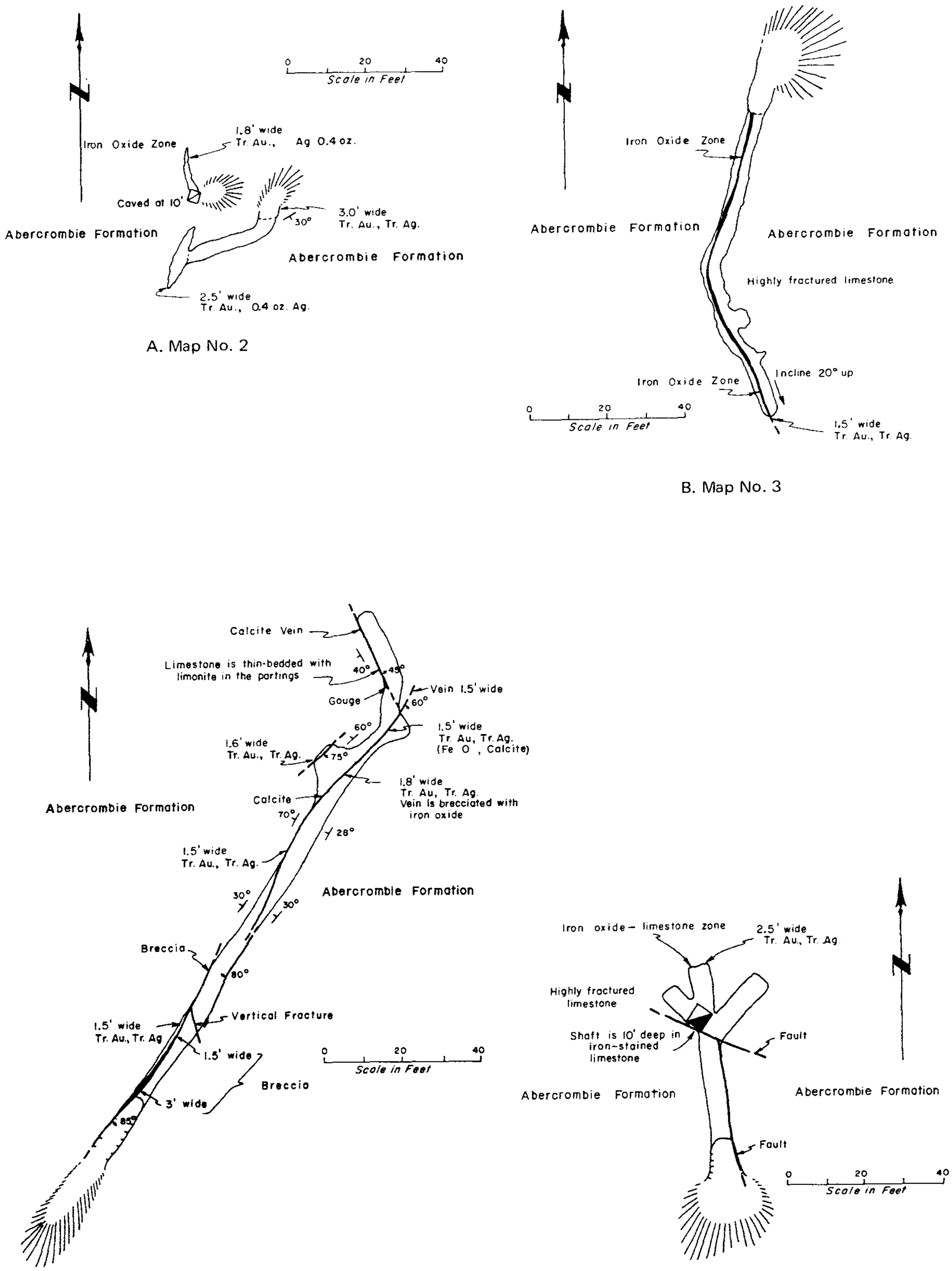


Figure 26. Geology and workings of mines in the Willow Springs area. Map number refers to the location of the mine on the geologic map of the Willow Springs area in figure 24.

Canyon to Devils Pit-Oro del Rey-Eagles Nest area, the road is steep and difficult to traverse. The Prosperity claim is accessible only on foot or horse back from the Oro del Rey area.

The east wall of the Deep Creek Mountain block between Reilly and Goshute canyons is a line of precipitous quartzite cliffs cut by the steep-walled, easterly trending Goshute and Reilly canyons. These cliffs are capped by shale which forms a rounded upland area. The Devils Pit-Oro del Rey-Eagles Nest group lies in quartzite along the tops of these cliffs between the north wall of Goshute Canyon and the south wall of Reilly Canyon. The Prosperity property, stratigraphically higher and in the rounded upland area on the south side of Reilly Canyon, is about 8,000 feet west of the north end of the Devils Pit-Oro del Rey-Eagles Nest property. The Lower Goshute Canyon property is located in the quartzite cliffs 300 feet above the canyon floor on the north side of Goshute Canyon, a half mile from the mouth of the canyon. The Silver Queen property is in the Goshute Canyon Formation, 7,000 feet east of the Oro del Rey area (plate 7).

One patented and approximately 54 unpatented lode claims covering most of the Devils Pit-Oro del Rey-Eagles Nest area are owned by Alma Tripp of Salt Lake City, who maintains the annual assessment work. The Silver Queen claims are owned by the original claimant, Eugene Timms, Callao. The Prosperity claims, last staked by F. Wilson, S. R. Wilson and C. H. Wilson in 1940, have not been maintained and their present ownership is unknown.

Country rock consists of Precambrian to Cambrian quartzite, shale and limestone. Bick (1966, p. 103-105) measured the following formation thicknesses in Goshute Canyon:

Series	Formation	Feet
Cambrian	Abercrombie Fm.	1,765
	Busby Quartzite	412
	Pioche Shale	360
	Prospect Mountain Quartzite	2,950
Precambrian and/or Cambrian	Goshute Canyon Fm.	2,706

The mineral deposits occur in the Goshute Canyon Formation members A and C, the Prospect Mountain quartzite and the Abercrombie Formation (figure 27). These formations dip westerly and are cut by northerly and by westerly to northwesterly trending normal faults. A N. 10° to 15° E. striking system of discontinuous bifurcating fractures, healed erratically by gold-bearing quartz, acts as mineralization control

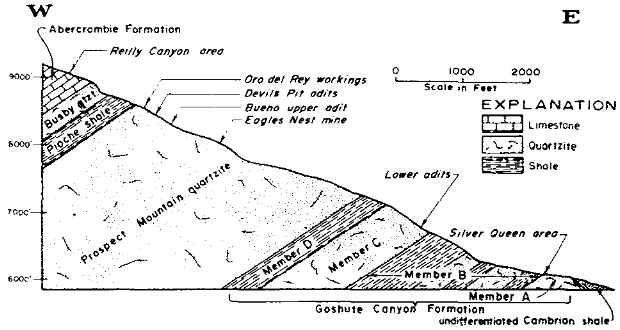


Figure 27. Diagrammatic geologic section showing stratigraphic relations of mine workings in the Reilly-Goshute canyons area.

in the Oro del Rey area (plate 7). Younger nonmineralized fractures striking about N. 65° to 70° W. offset the mineralized fracture system.

Granite and rhyolite are the only igneous rocks. The Ibapah granite stock outcrops about 1 mile south of the Devils Pit-Oro del Rey-Eagles Nest area (plate 7). A half mile west of the Oro del Rey property, two rhyolite dikes, 50 to 100 feet wide and ½ to ¾ mile long, strike N. 10° to 15° E. from the granite.

Prosperity Property. C. H. Wilson, W. F. Wilson and F. L. Wilson located the property about 1895 and worked it until 1914. No records of dates or quantities of ore shipments are available (S. R. Wilson, personal communication).

Malachite, azurite and copper pitch associated with calcite, aragonite and quartz occur in N. 5° to 10° E. striking fractures in the Abercrombie Formation. Assays are shown on top of page 38.

The fractures bifurcate and are cut by younger N. 45° E. to west-east fractures. Caverns and cave formations have been developed along nonmineralized sections of the fractures.

Workings consist of several prospects, a winze and two adits. The upper "101" adit is 97 feet long. It follows veins on two levels, the "50" and "70" which are connected by winzes. The lower "102" adit is 240 feet long (figure 28).

Devils Pit-Oro del Rey-Eagles Nest Area. This property consists of the Eagles Nest mines on the north, on top of the cliffs and overlooking Reilly Canyon, the Devils Pit mines on the south in a steep side canyon north of Goshute Canyon, and the Oro del Rey mines just south of the center. The mines are all

Number	Location	Width (inches)	Ounces/ton		Percent		
			Gold	Silver	Copper	Lead	Zinc
1	Vein in upper adit	4	trace	3.8	11.6	10.0	0
2	Ore dump sample	–	trace	trace	11.5	15.8	0
3	Screened ore pile	–	trace	0.8	8.5	16.8	0.3

on an 8,000-foot long fracture system in the tops of the Prospect Mountain Quartzite cliffs. Samples 2, 3 and 5, tabulated in plate 7, taken from the same vein, illustrate its erratic mineral content. The veins split vertically and horizontally.

Examination of polished sections indicate that the vein minerals were emplaced during two depositional periods. Silicification accompanied by minute inclusions of specularite was followed by a reopening of the vein system. This was accompanied by a second period of quartz deposition with attendant pyrite and galena, disseminated chalcopyrite, specularite, chalcocite, sphalerite, and sparse grains of metallic gold. Silver was not recognized by assay and might be present in the galena. Plumbojarosite, kaolinite, limonite, goethite, malachite and azurite are present as secondary minerals. Assays are shown in plate 7.

Workings on the Eagles Nest property from north to south consist of a shallow prospect pit, the Eagles Nest inclined shaft, a water-filled shaft, a prospect trench and a small westerly trending adit. The 110-foot Eagles Nest inclined shaft bears west and dips from 35° to 50° W. Stopes extend from it along the vein 20 to 40 feet both north and south (figure 29). An abandoned aerial tram once carried ore from an ore bin at the north end of the property to a second ore bin in the bottom of Reilly Canyon 1,000 feet lower. A road leading up Reilly Canyon reached the lower ore bin.

The Oro del Rey mine was developed from adits driven into cliff faces at an elevation of 8,700 feet. Eight adits and one shaft develop the Oro del Rey mine for 1,200 feet horizontally and 300 feet vertically. These are the largest underground workings in the area (figures 30, 31 and 32). Ore, lifted by three aerial trams, was transported down a switchback road to Goshute Canyon and thence out to the range front.

The Devils Pit mine, on a southward extension of the Oro del Rey veins, lies at the head of Hells Hole, a nearly inaccessible steep-walled canyon just south of the Oro del Rey property. Workings at an altitude of about 8,000 feet consist of a 120-foot adit, and 55 feet above it a 60-foot adit; a shaft was sunk at the mouth of the 120-foot adit (figure 33). Ore lifted by an aerial tram was hauled out through Goshute Canyon. Four hundred feet southwest of the Devils Pit is the 20-foot deep Imp No. 1 shaft. Imp No.2, a small adit bearing N. 5° to 10° E., is 1,200 feet south southwest of Imp No. 1. The 150-foot Bueno mine, 2,400 feet south of the Devils Pit, bears N. 5° W. on the north side of the bottom of Goshute Canyon on the same vein as the Devils Pit (figure 34), but 1,000 feet lower in altitude. A 20-foot prospect adit bears due south on the south side of the canyon.

Lower Goshute Canyon Property. Three N. 5° W. bearing adits, the lower 80 feet long, the middle 90 feet long, and the upper 10 feet long, were driven into the quartzite cliffs 300 feet above the canyon floor in lower Goshute Canyon and 5,000 feet southeast of the Oro del Rey mine (figure 35). The adits follow a quartz vein in the C member of the Goshute Canyon Formation.

Silver Queen Property. The Silver Queen property, about 7,000 feet east of the Devils Pit, lies in the foothills north of Goshute Canyon. It is developed by a 34-foot adit, a 50-foot inclined adit and three prospect shafts 15, 10 and 17 feet deep. Several smaller prospect pits are scattered throughout the area (figure 36). Limonite and jarosite stain the quartzite yellow to black on or near the contact between A and B members of the Goshute Canyon Formation. Chalcopyrite, argentiferous galena and pyrite occur with secondary malachite, azurite, limonite and jarosite in a quartz gangue in prospect pits along the contact. The following shows representative assays:

Sample No.		Width (feet)	Ounces/ton		Percent	
			Gold	Silver	Copper	Lead
12	North adit	1.0	0.06	12.6	1.10	–
30	North adit	1.5	trace	22.0	0.80	–
95	Dump sample	–	trace	2.0	0	0

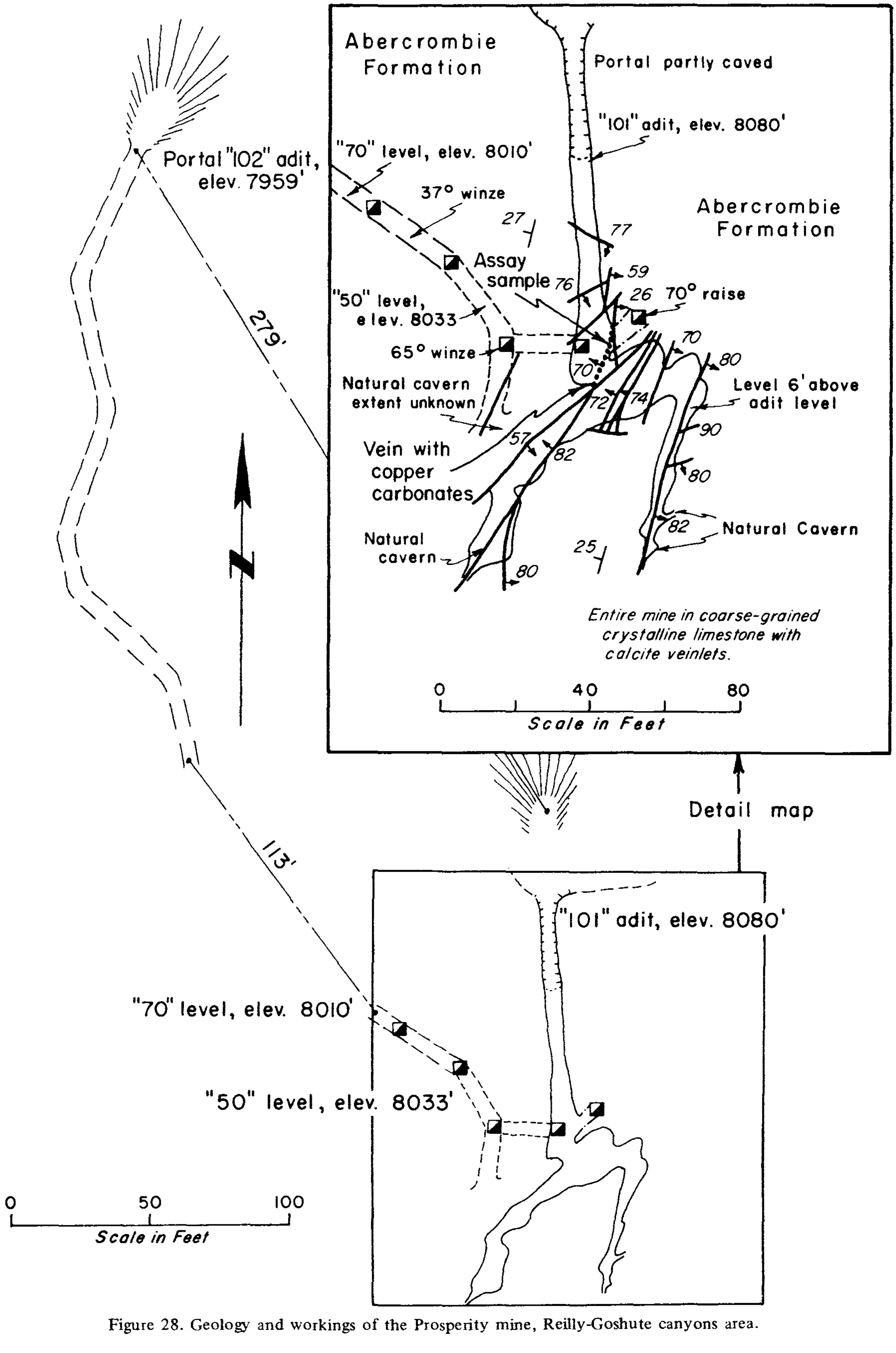
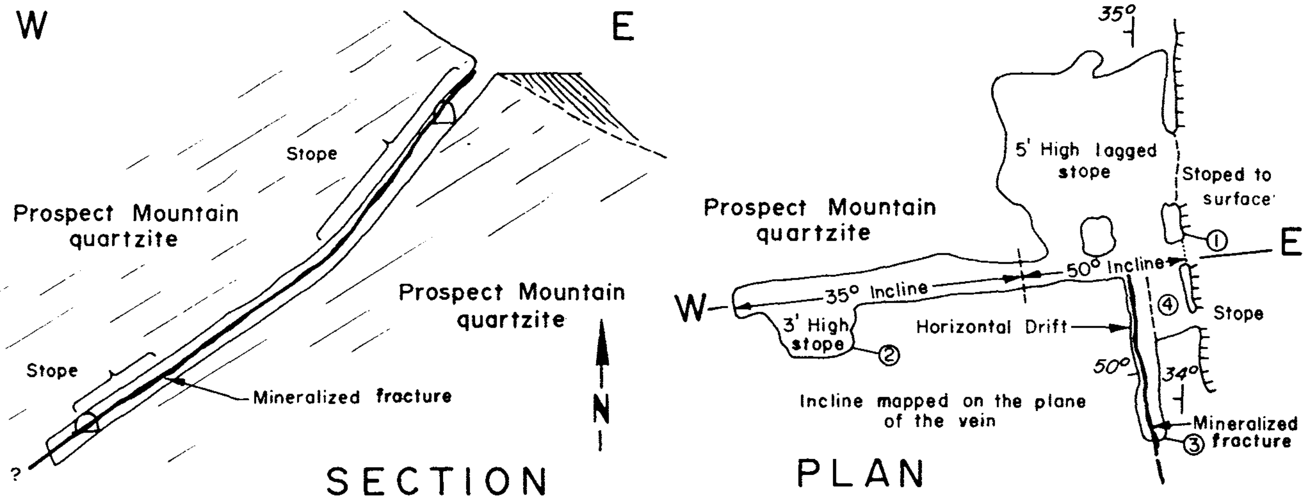
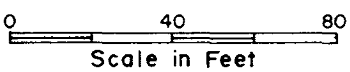


Figure 28. Geology and workings of the Prosperity mine, Reilly-Goshute canyons area.





Assays: Oz / Ton			Width
Sample No.	Au	Ag	(feet)
1	2.2	0.5	0.5
2	1.0	0.5	2.5
3	Tr.	Tr.	4.0
4	3.9	0.6	2.0

Figure 29. Geologic plan and section of the Eagles Nest inclined shaft, Reilly-Goshute canyons area.

Production. Most of the $699,605 produced in the Willow Springs district from 1934 to 1954 came from the mines in the Reilly-Goshute Canyons area. No production has been reported since.

Spring Creek Area

Gold Bond Property

The Gold Bond property in sec. 5, T. 12 S., R. 18 W. (plate 1) lies on the east side of the Deep Creek Mountains in the mouth of Granite Canyon. Graded roads leading 18 miles south from Callao or 4 miles from Trout Creek provide access.

The property consists of ten unpatented claims (Gold Bond Nos. 1-10), staked in 1931 by S. F. Falkenburg. The claims form a solid block extending 3,000 feet along the bed of the canyon and 3,600 feet along the south wall of the canyon and the east flank of the range (figure 37). Although surveyed for patent, action was never completed. Falkenburg maintained the assessment work until his death in 1967. The property belongs to Falkenburg's estate.

The Gold Bond claims lie on the Trout Creek Formation, a dark brown series of fine-grained quartzite and interbedded biotite-sericite schist and limestone as described in the Geology section. Units C and D (figure 37) of this formation strike N. 10° to 15° W. and dip west 20° to 38°. On the north wall of the canyon about a half mile north of the claims, Ibapah granite stock intrudes the Trout Creek Formation. Near the granite, iron-stained pegmatite dikes occur in the quartzites and schists of unit C.

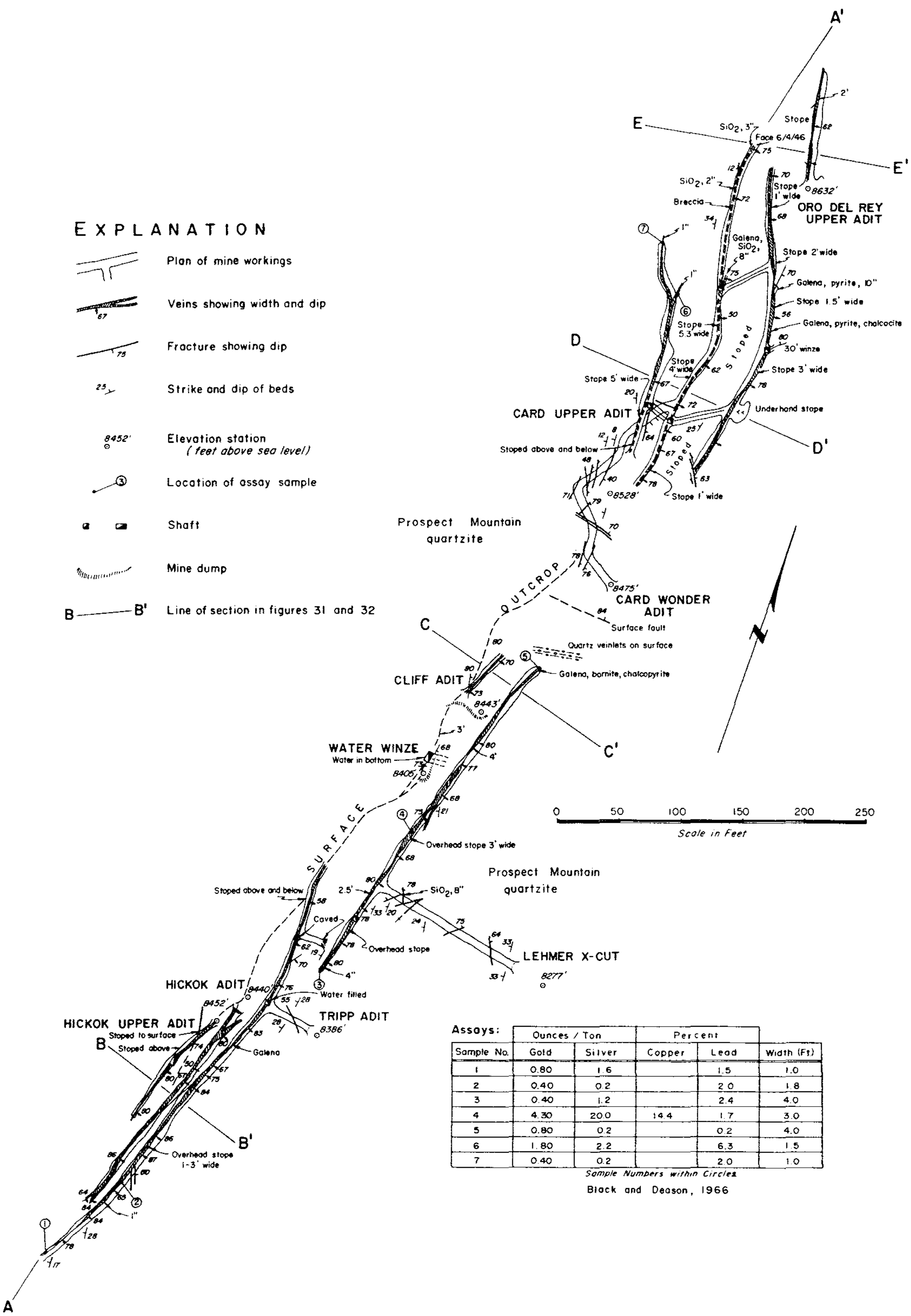
Two types of mineralization occur—gold-bearing quartz veins cutting the schist, and gold-silver-bearing limonite replacements of limestone. The quartz veins, 2 to 3 feet wide, irregular and difficult to follow, are mineralized with malachite, azurite, limonite and pyrolusite.

Six adits, one shaft, one inclined shaft and several prospect pits comprise the development of the Gold Bond claims:

A *180-foot, 20° inclined shaft* (figure 38) sunk to the west on a replacement zone.

A *1,185-foot adit* (figure 39d) driven under the 180-foot inclined shaft, with a raise at the face, collapsed and inaccessible, cut to intersect replacement zones 96 feet above.

A *50-foot adit* (figure 39b) driven northward into a replacement zone 700 feet northeast of the Gold Bond incline.



Assays:

Sample No.	Ounces / Ton Gold	Ounces / Ton Silver	Percent Copper	Percent Lead	Width (Ft)
1	0.80	1.6		1.5	1.0
2	0.40	0.2		2.0	1.8
3	0.40	1.2		2.4	4.0
4	4.30	20.0	14.4	1.7	3.0
5	0.80	0.2		0.2	4.0
6	1.80	2.2		6.3	1.5
7	0.40	0.2		2.0	1.0

Sample Numbers within Circles

Black and Deason, 1966

Figure 30. Geologic map and sample data of the Oro del Rey mine, Reilly-Goshute canyons area.

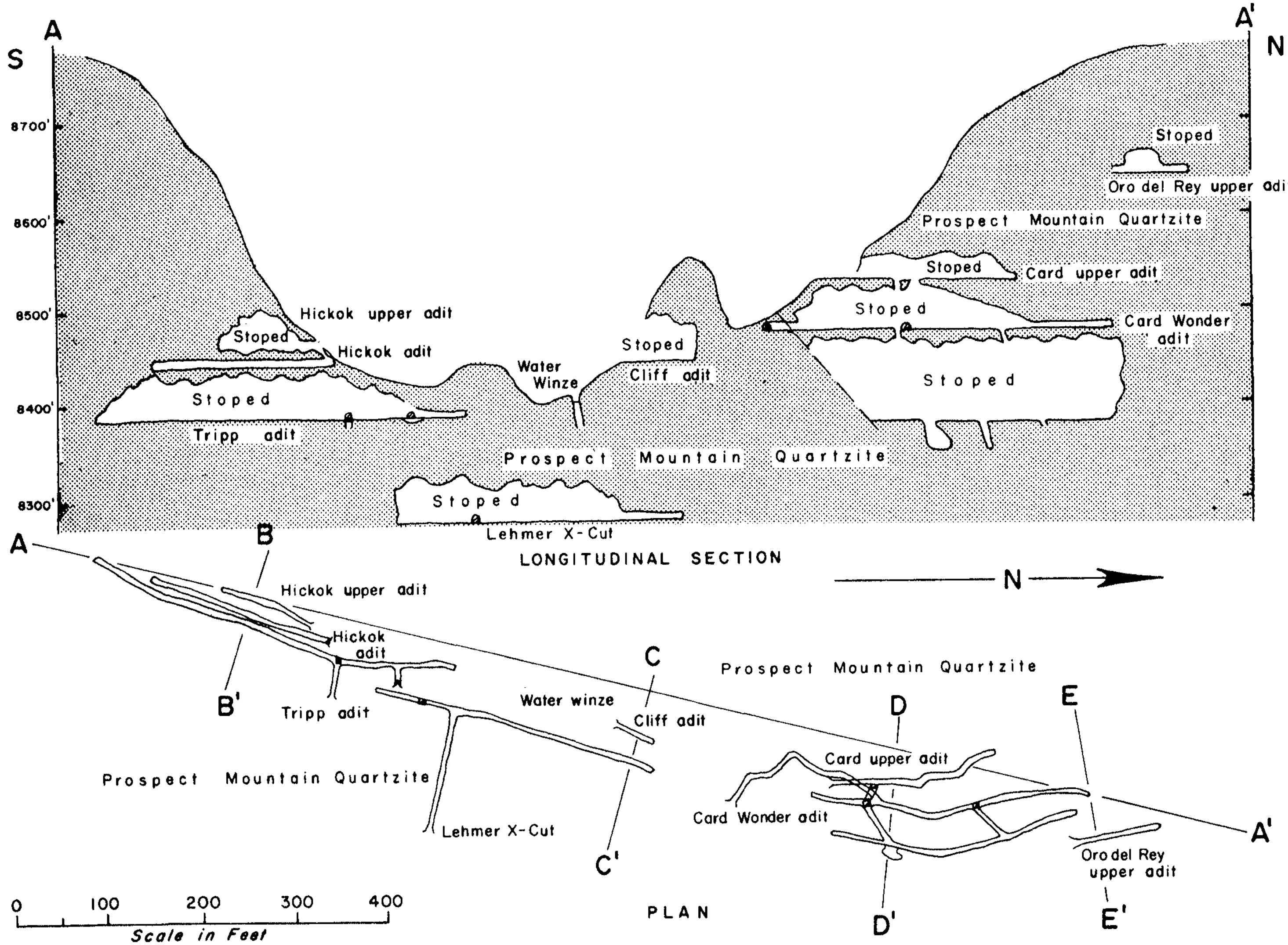


Figure 31. Plan and section of the Oro del Rey mine, Reilly-Goshute canyons area.

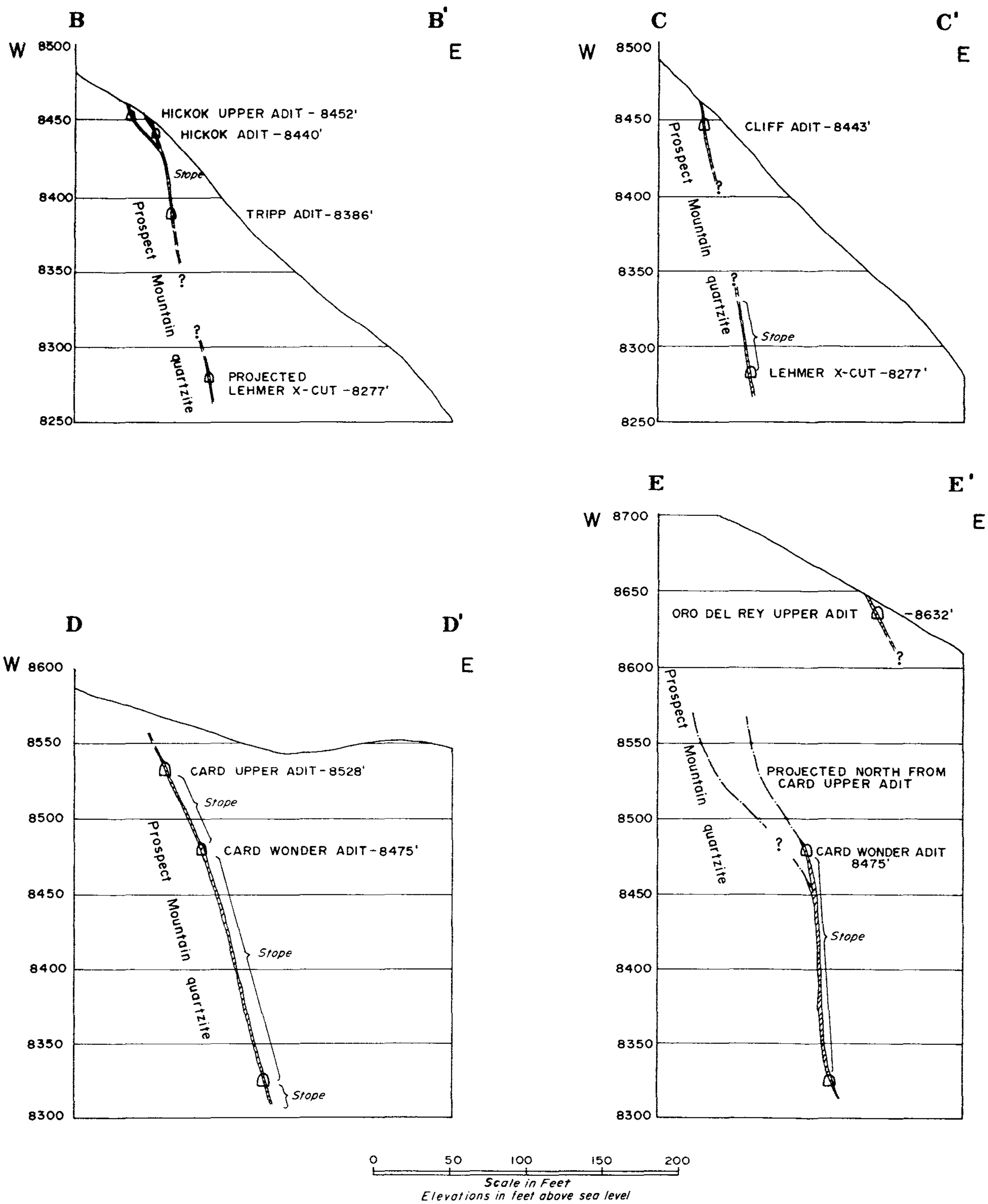
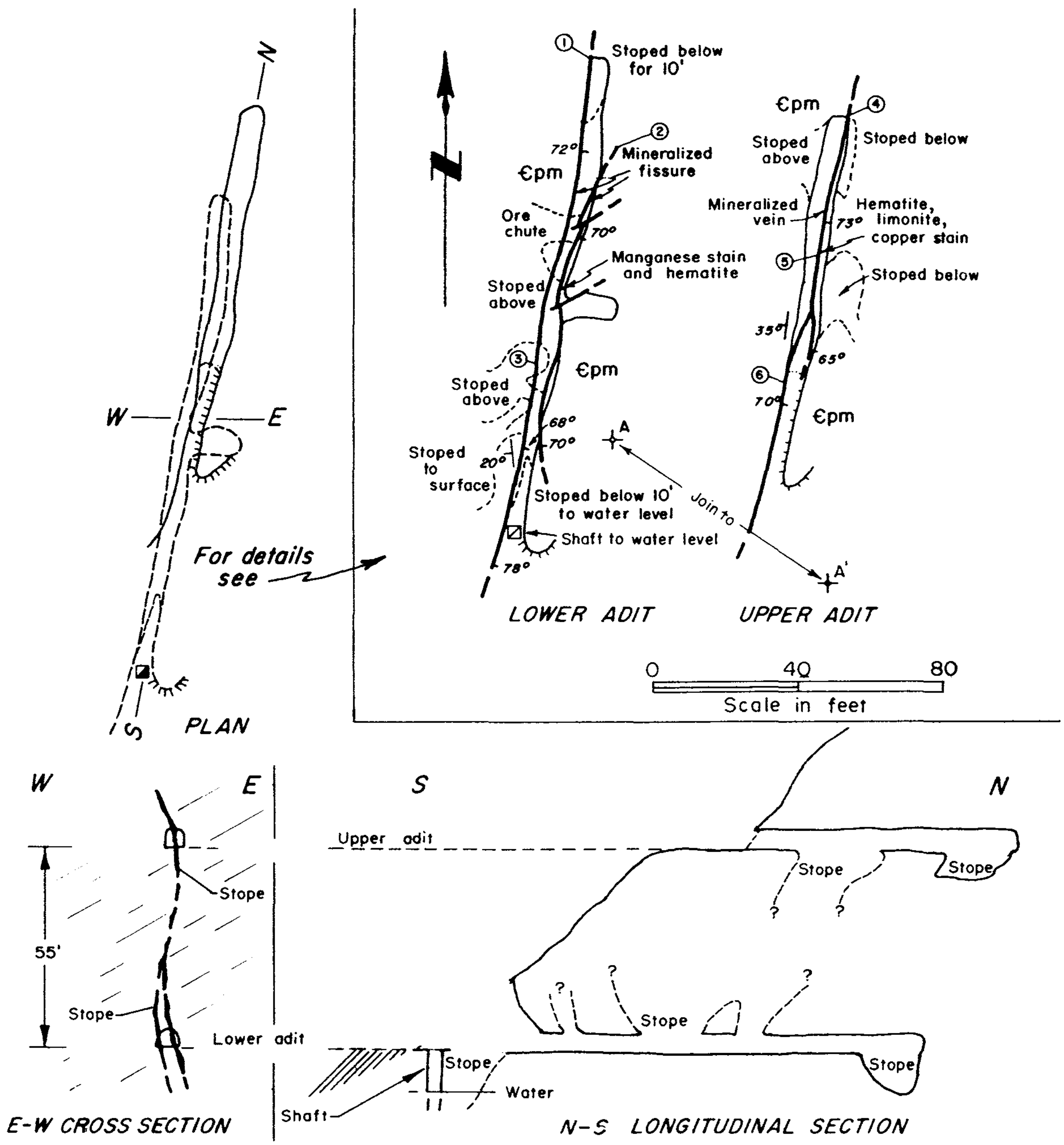


Figure 32. West-east geologic sections facing north of the Oro del Rey mine vein system. See figure 31 for location of sections.



EXPLANATION

€pm Prospect Mountain Quartzite

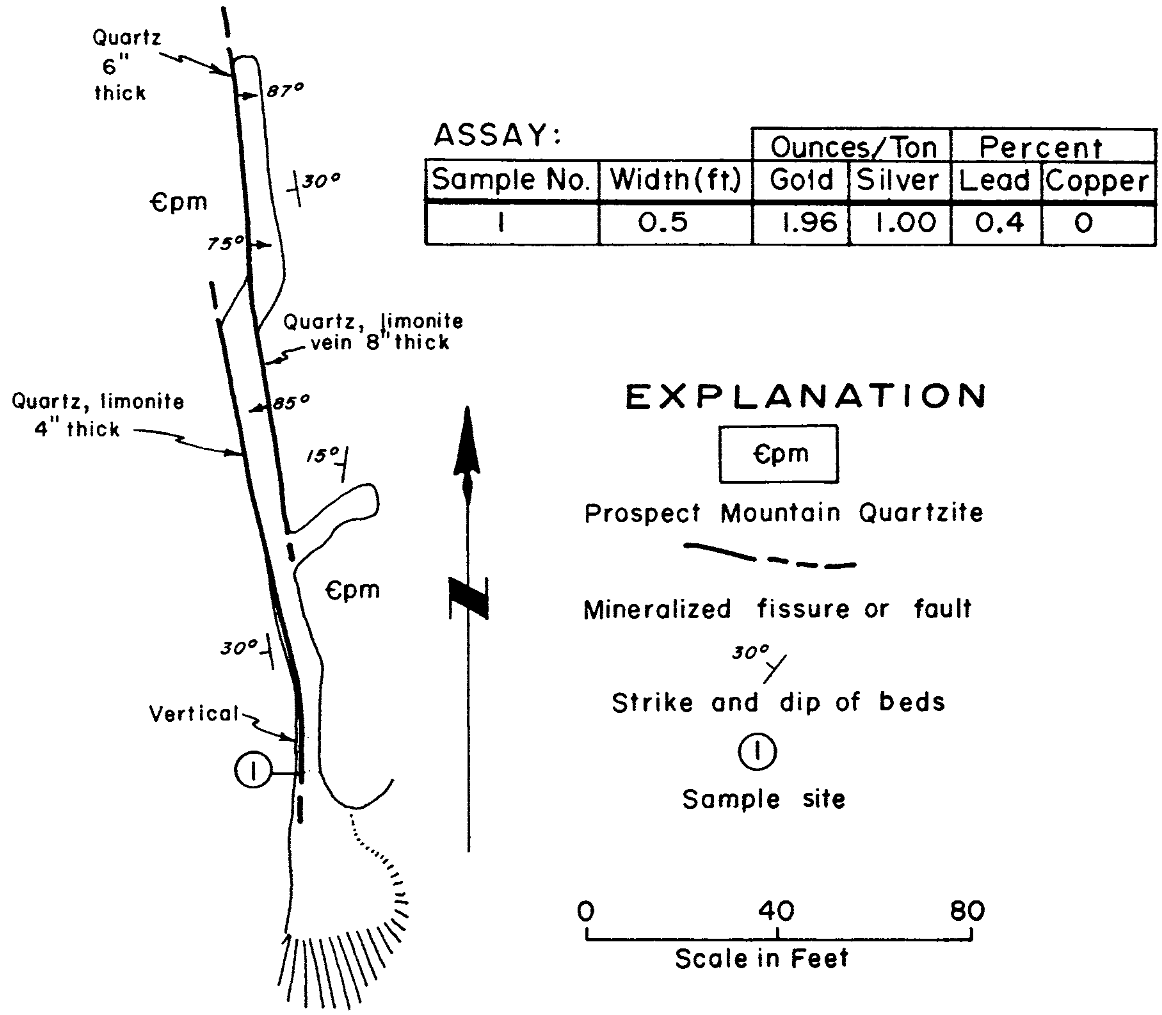
Mineralized fissure or fault

23° Strike and dip of beds

② Sample site

Assays:	Ounces/Ton		%		Width (ft.)
Sample No.	Gold	Silver	Pb	Cu	
1	0.12	0.5	1.8	–	4.0
2	0.015	0.1	–	–	0.5
3	0.24	0.2	–	0.15	1.0
4	0.30	5.2	10.0	0.25	4.0
5	2.50	2.0	8.7	–	1.0
6	1.64	4.5	17.0	0.20	1.0

Figure 33. Geology and workings in plan and section of the Devils Pit mines, Reilly-Goshute canyons area.



ASSAY:

Sample No.	Width (ft.)	Ounces/Ton Gold	Ounces/Ton Silver	Percent Lead	Percent Copper
1	0.5	1.96	1.00	0.4	0

Figure 34. Geology and workings of the Bueno mine, Reilly-Goshute canyons area.

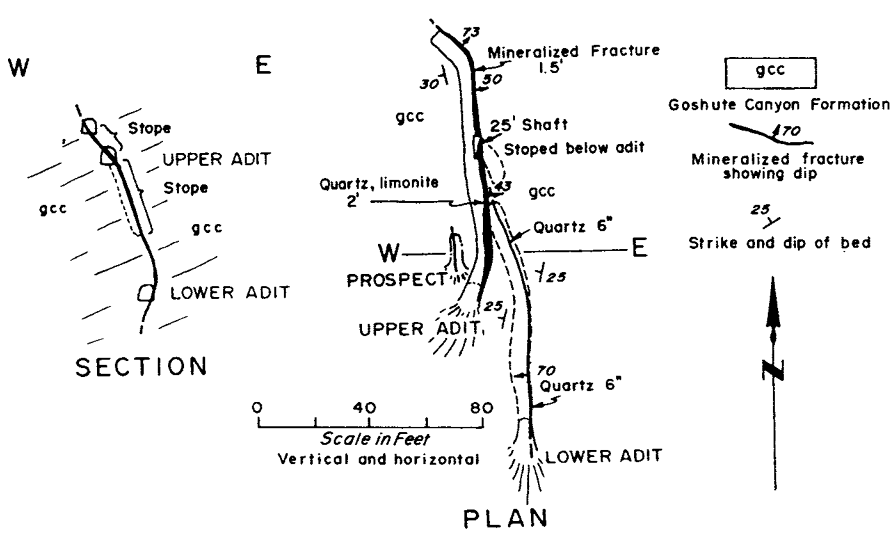


Figure 35. Geology and workings in plan and section of the lower Goshute Canyon mines, Reilly-Goshute canyons area.

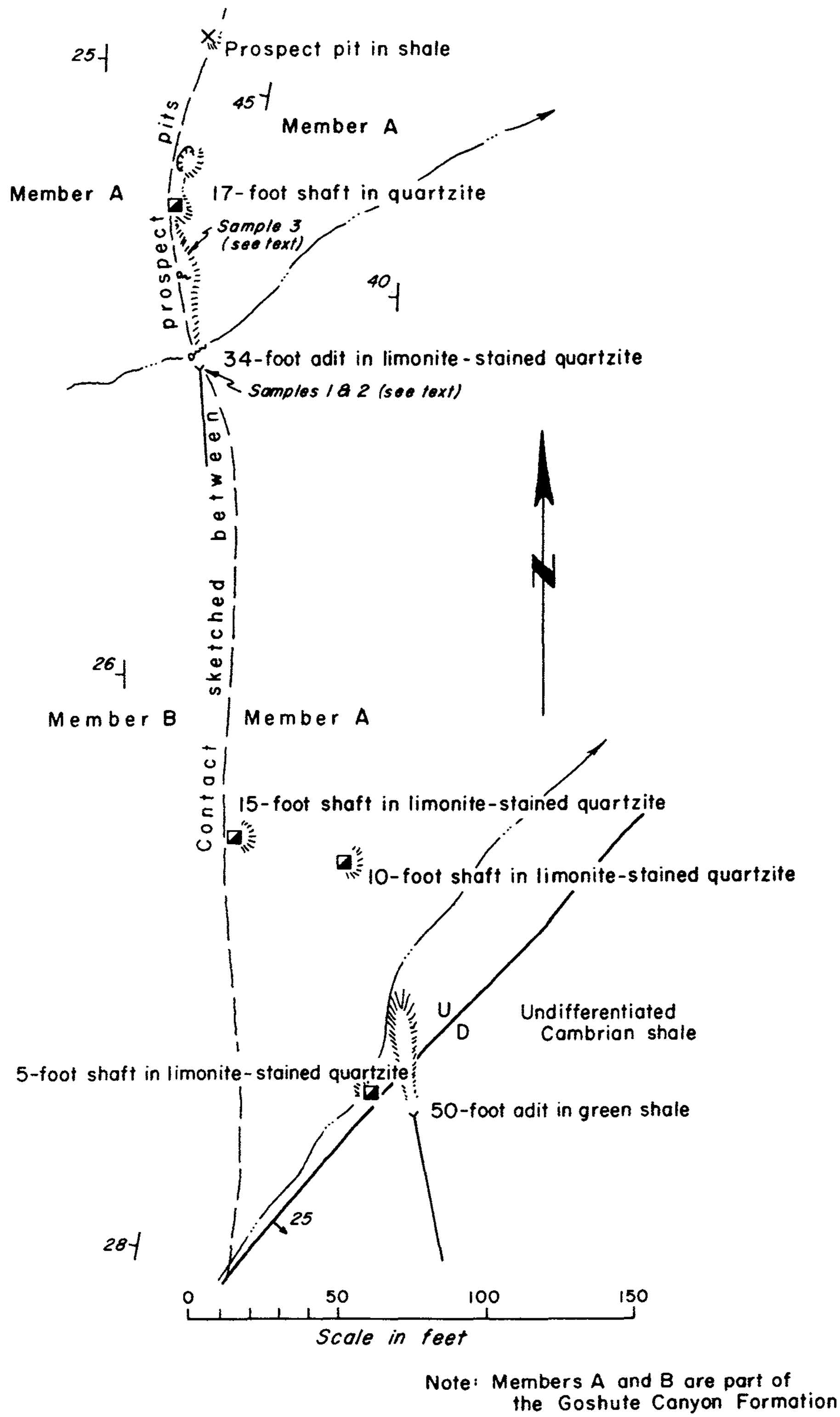


Figure 36. Geologic map of the Silver Queen area, Reilly-Goshute canyons area.

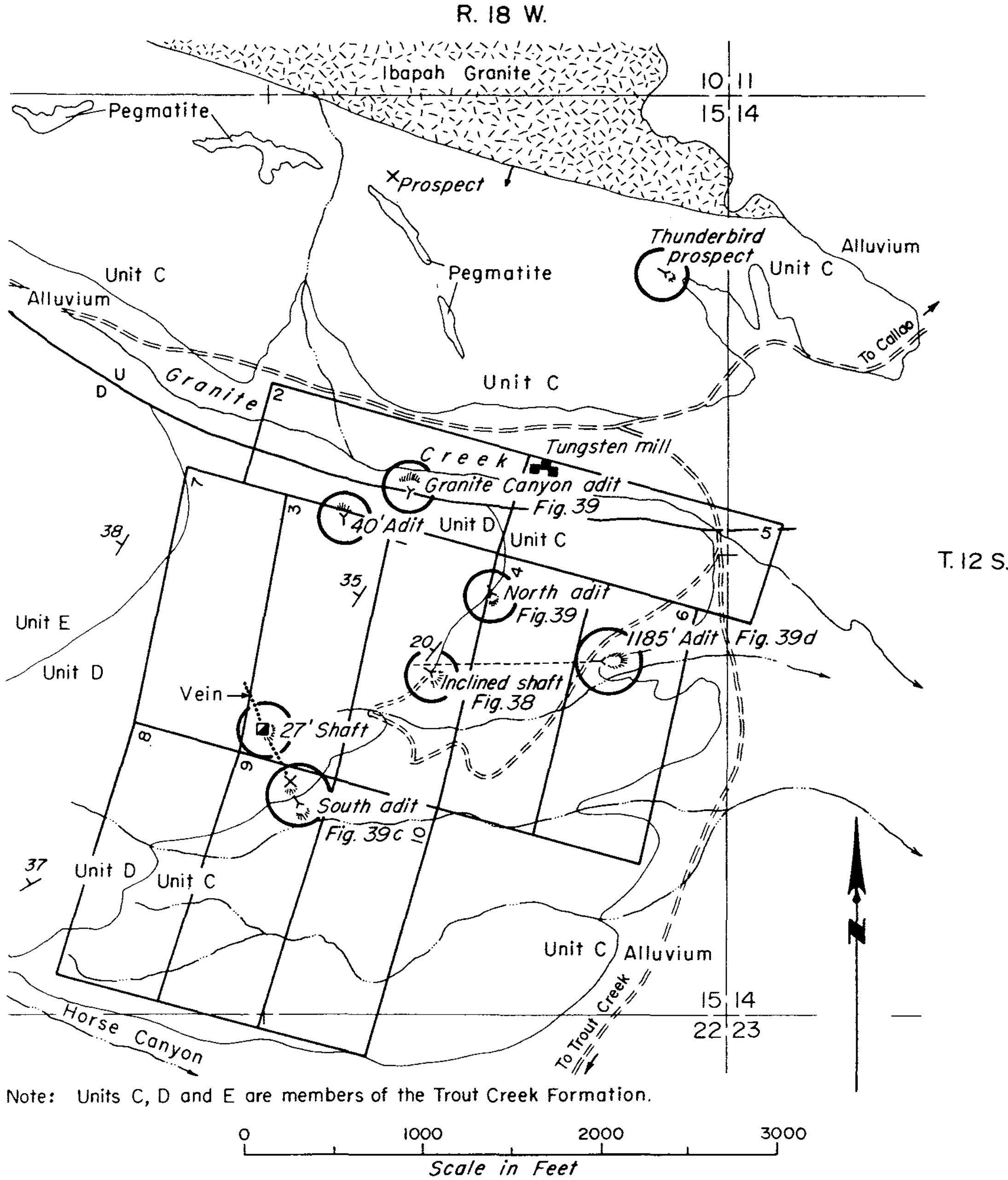
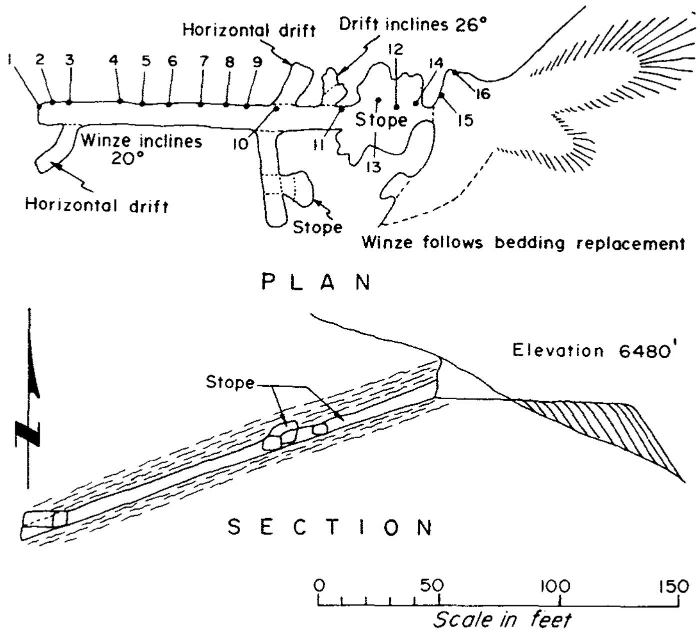


Figure 37. Geologic map of the Gold Bond property in Granite Canyon showing the location of claims and workings.



Sample No.	Width (Ft.)	Ounces / ton	
		Gold	Silver
1	2.25	0.410	0.2
2	2.50	0.530	0.2
3	3.0	0.620	0.3
4	2.5	0.217	0.2
5	1.3	0.230	0.5
6	2.3	0.260	0.3
7	3.0	0.310	Trace
8	2.75	0.300	0.1
9	2.0	0.710	0.2
10	2.08	0.440	0.3
11	2.0	0.270	0.2
12	3.7	0.330	Trace
13	4.0	0.760	0.2
14	4.5	0.860	0.2
15	4.0	0.560	0.6
16	2.0	0.040	0.4

Samples 1-15 assayed by Union Assay Office, Inc. for A. G. Burritt, 1936; 16 by Black and Deason for K. C. Thomson, 1966.

Figure 38. Assay map of the inclined shaft on the Gold Bond property (see figure 37).

Granite Canyon adit (figure 39a), a 200-foot adit driven into the south wall of Granite Canyon on a replacement zone 1,200 feet north of the Gold Bond incline.

A *40-foot adit* driven south in schist about 400 feet west of the Granite Canyon adit.

A *27-foot shaft* sunk on a vein 1,200 feet southwest of the 180-foot inclined shaft.

Two northwest-bearing adits (figure 39c), 25 and 120 feet long, with a 43-foot shaft sunk 70 feet inside the 120-foot adit. Both were driven to intersect an iron oxide zone on the hillside above. They are 1,500 feet southeast of the 180-foot inclined shaft.

North of the Gold Bond claims, several prospect pits and an adit occur in unit C of the Trout Creek Formation on the north wall of Granite Canyon. Here, the Thunderbird adit is driven 10 feet northwest into schists of unit C about one half mile northeast of the Granite Canyon adit. Several prospect pits were dug on pegmatite dikes in the schist north and west of the Thunderbird adit.

Samples obtained in 1965 to 1968 assayed as shown below.

In 1934, Falkenburg shipped 27 tons of ore to the Garfield Smelter for which he received $334.14 ($19.11/ton). The gold assayed 0.71 ounces per ton. No other production has been reported from the property.

Samples cut by S. F. Falkenburg on the inclined shaft, assayed by Union Assay Office, Salt Lake City, in 1936, and a sample collected by the author and assayed by Black and Deason, Salt Lake City, are shown on the mine map (figure 38). Average content of the 1936 samples was 0.46 ounces of gold per ton in contrast to the 1968 sample of 0.23 ounces of silver per ton and 0.040 ounces of gold per ton.

Red Hill Mine

This 60-foot prospect adit near the head of Granite Canyon about 2 miles south southwest of Ibapah Peak (plate 1) lies in rugged terrain at an altitude of about 10,500 feet and is accessible only by foot from the end of Granite Canyon road.

Location	Type of mineralization	Sample width (ft)	Ounces/ton	
			Gold	Silver
Portal of the inclined shaft	Replacement	2.0	0.04	0.40
Portal of the north adit	Replacement	1.5	trace	12.4
Granite Canyon adit	Replacement	2.0	trace	trace
Thunderbird adit	Vein	2.0	trace	trace
27-foot shaft	Vein	1.8	0.02	none

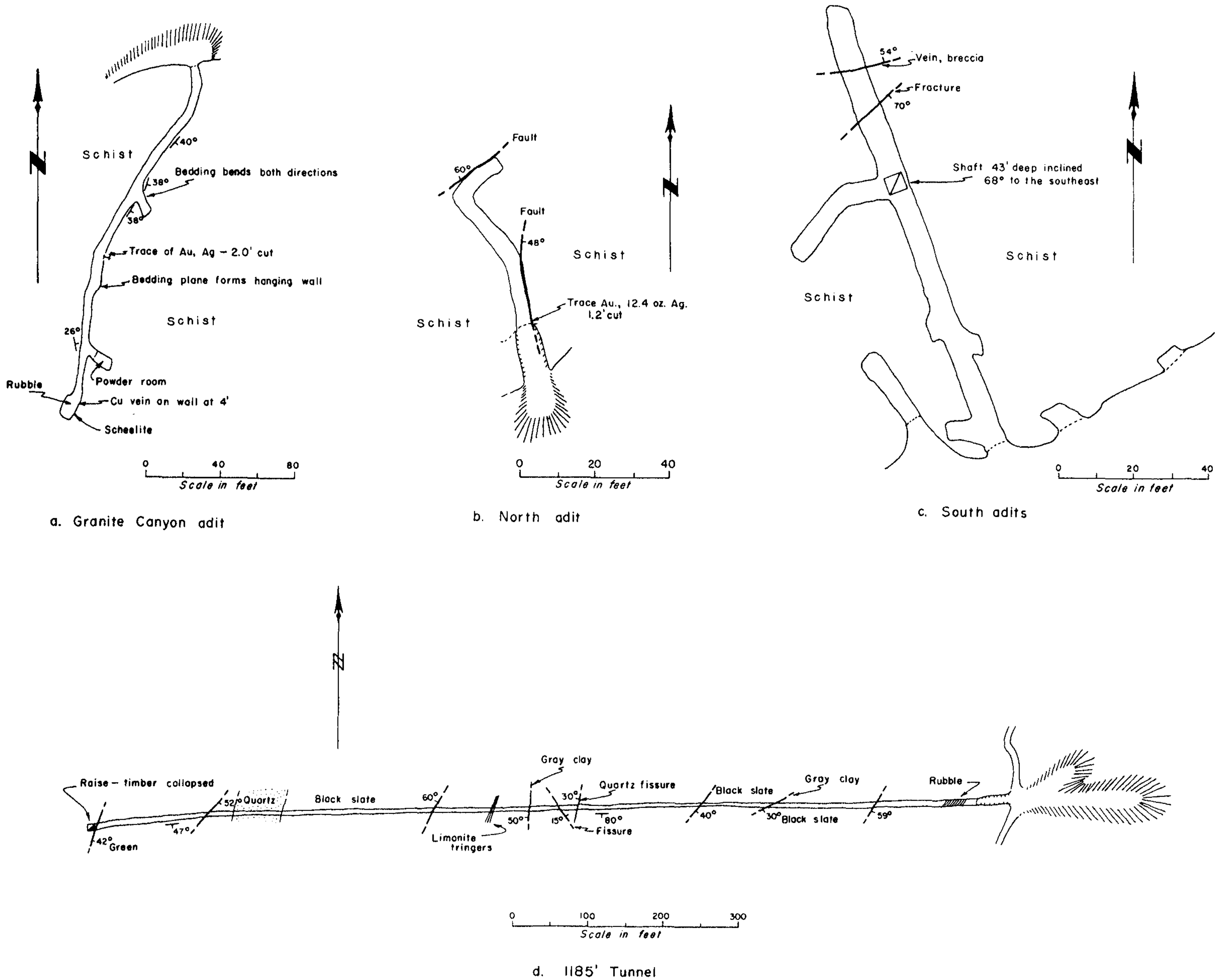


Figure 39. Geology and workings of mines in the Gold Bond area near Granite Canyon.

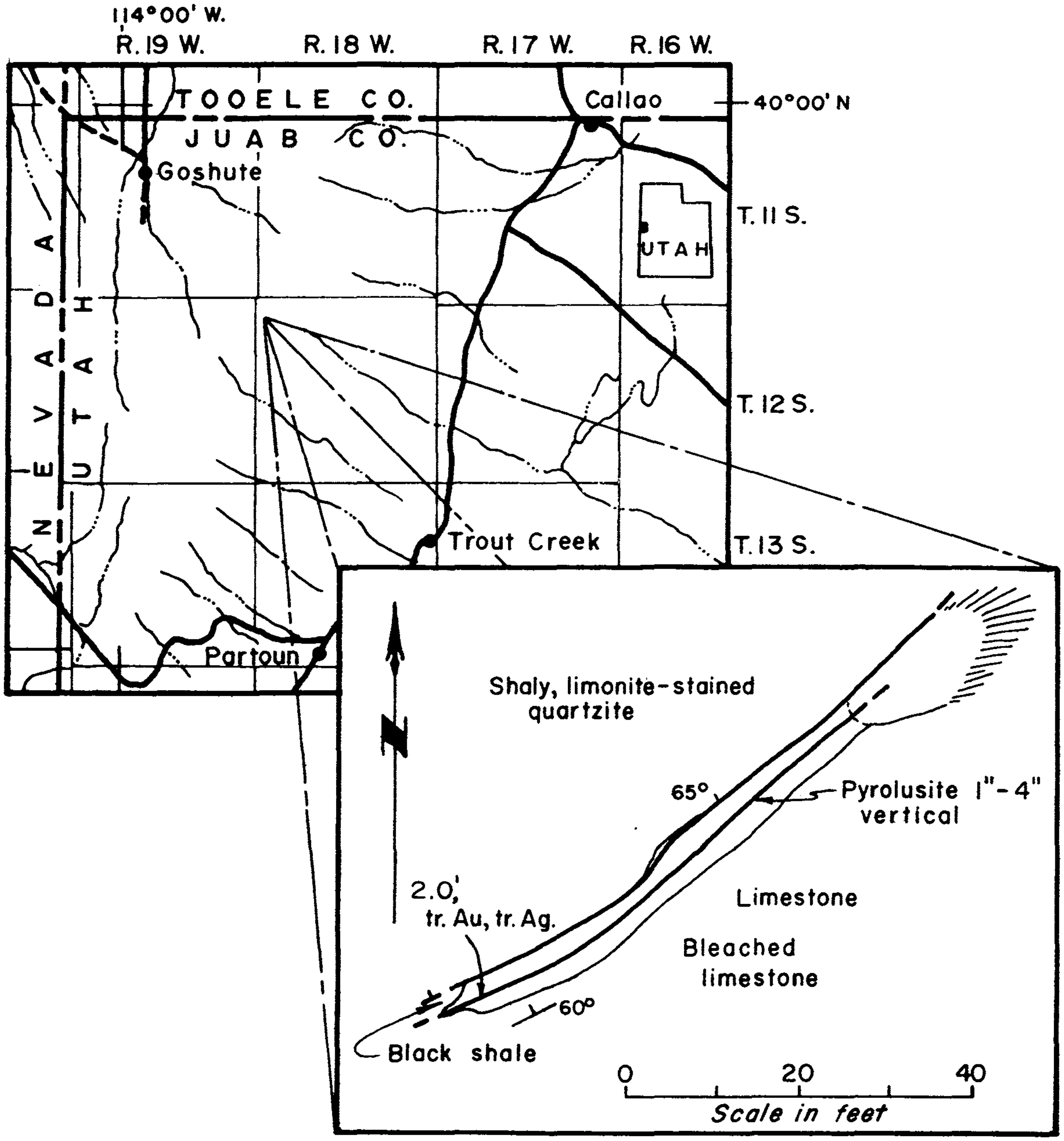


Figure 40. Geology and workings of the Red Hill mine.

The adit follows a barren fracture and pyrolusite-stained contact between quartzite and limestone (figure 40) of the G unit of the Precambrian Trout Creek Formation, which strikes N. 60° E. and dips 60° to 65° W. A 2-foot channel sample taken from the adit face, including the fracture and bedding plane mineralization, assayed a trace of gold and silver.

No production is reported.

Trout Creek Properties

The Trout Creek properties lie just north of Bobcat Ranch, 4½ miles northwest of Trout Creek on the east side of the Deep Creek Mountains (plate 1). The property, consisting of ten patented claims and five unpatented claims, lies in secs. 21, 22, 27 and 28, T. 12 S., R. 18 W. (plate 8). M. Babick of Phoenix, Arizona, owns the Sun, Metal, Merry and Mineral patented claims (patent No. 7286), and the Battle, Bear, Final, Dandy and Chief unpatented claims. The Trout Creek Mining Co., Harold B. Stafford, president, Salt Lake City, owns the Mary, Sport, Gettysburg, Shilo, U. S. Grant and C. J. Higson claims, and Shilo Millsite (patent Nos. 6190A and B).

The country rock, members A, B and C of the Precambrian Trout Creek Formation, forms a dome surrounding an alaskite intrusive (plate 2). Units A and C are muscovite-biotite schists; unit B is a dark gray to white dolomitic marble. The regional dip, exclusive of the dome, is 25° to 30° W. Several west-east striking faults with dips 60° to 90° N. and S. cut the formations around the intrusive. On the east side of the property, a thrust fault occurs with rocks of unit B thrust eastward over unit A.

Development is concentrated into four areas (plate 8):

Area 1. Apex property, Mary claim and vicinity. S½ sec. 21, T. 12 S., R. 18 W.

Area 2. Trout Creek mine and associated prospects. SE¼ NW¼ sec. 28, T. 12 S., R. 18 W.

Area 3. Trout Creek Canyon mines. NE¼ SW¼ sec. 28, T. 12 S., R. 18 W.

Area 4. Hornet mine, MacMillan property, Eastern Trout Creek mine and Meteor prospect. E½ sec. 28, T. 12 S., R. 18 W., W½ sec. 27, T. 12 S., R. 18 W.

Apex Property, Mary Claim and Vicinity (figure 41). The Apex property, consisting of the Sun, Mineral, Merry and Metal patented claims and the Battle, Bear, Final, Dandy and Chief unpatented claims (plate 8), lies in the north part of the Trout Creek area, 1½ miles north northwest of Bobcat Ranch. The Mary and Sport claims adjoin the Merry and Mineral claims on their south sides.

The Apex tungsten mine (figure 42d), a 220-foot adit with an inclined 40-foot winze sunk 45 feet from the portal, lies in the southwest part of the Mineral claim. A 40-foot adit was driven N. 5° E. on the north side of an open pit, 200 feet north of the Apex mine. Several scattered cuts and prospects are on the Mineral patented claim. The 70-foot Apex east adit (figure 42c) is 1,500 feet east of the Apex mine. In 1961-1962, Western Beryllium Co. drilled nine holes 70 to 272 feet deep to explore the mineralization on the Apex property (appendix A). On the Sun patented claim, a small shaft and 10-foot prospect pit were dug in a limonite zone in schist.

The Mary mine, a 165-foot inclined shaft at the north end of the Mary claim, bears N. 35° W. (figure 42a). Seventy feet southeast of the Mary mine is the 35-foot Mary shaft. A quartz zone north and west of the Mary mine was trenched on the north end, explored by prospects on the west and cut for 25 to 30 feet, 1,100 feet to the southwest (plate 8).

In the Apex and Mary properties, beryl, scheelite and fluorite occur in quartz-muscovite veins. These veins assayed trace to 4.5 percent WO_3, while the dolomite adjacent to the vein assayed less than 0.03 percent (table 4). Results of the BeO analyses (made with a beryllometer) of ten samples taken by Western Beryllium Co. and three samples taken by the author on the Apex ground are shown in table 5. Beryllium analyses of veins in the Mary mine by Western Beryllium Co. showed 0.82 to 3.12 percent BeO (figure 49a). Some beryllium and fluorite occur in quartz zones along the dolomite-schist contact.

Trout Creek Mine and Vicinity. The Trout Creek mine, 1 mile northwest of Bobcat Ranch on the Shilo patented claim, is a 450-foot inclined shaft (figure 43) with levels at 0 (adit level), 60, 120, 180 and 415 feet below the surface and several cross-cuts and drifts. A 28 foot-high by 45 foot-long stope on the 60-foot level is on a sphalerite-scheelite zone. A prospect incline adit south of the Trout Creek mine was sunk to 30 feet with a 4- by 20-foot stope inclined 25°W. Lesser prospects lie in the vicinity of these two workings.

In the Trout Creek mine, sphalerite, scheelite and fluorite have been deposited in erratic pockets along a N. 60° W. striking fault in the unit B dolomite. The small prospect incline shaft south of the Trout Creek mine is in a contact metasomatic zone within unit B dolomite. Minerals identified in this zone are muscovite, biotite, beryl, fluorite, quartz, dolomite, limonite, garnet, actinolite and psilomelane.

Trout Creek Canyon Prospects. Seven prospect adits 58 to 180 feet long in Trout Creek Canyon, 3,500 feet west-northwest of Bobcat Ranch, bear northeast to northwest (figure 44c).

Mineralization occurs as traces of scheelite along fractures in B unit dolomite.

Hornet Mine, Macmillan Property and Eastern Trout Creek Mine. The Hornet mine, 1,750 feet north of Bobcat Ranch, consists of a 118-foot N. 42° W. bearing adit (figure 44b) and many bulldozer cuts. Workings on the MacMillan property, which lies 1,200 feet north of the Hornet mine, consist of three 10-foot open cuts. The east Trout Creek mine area, about 5,600 feet east of the Trout Creek mine, contains

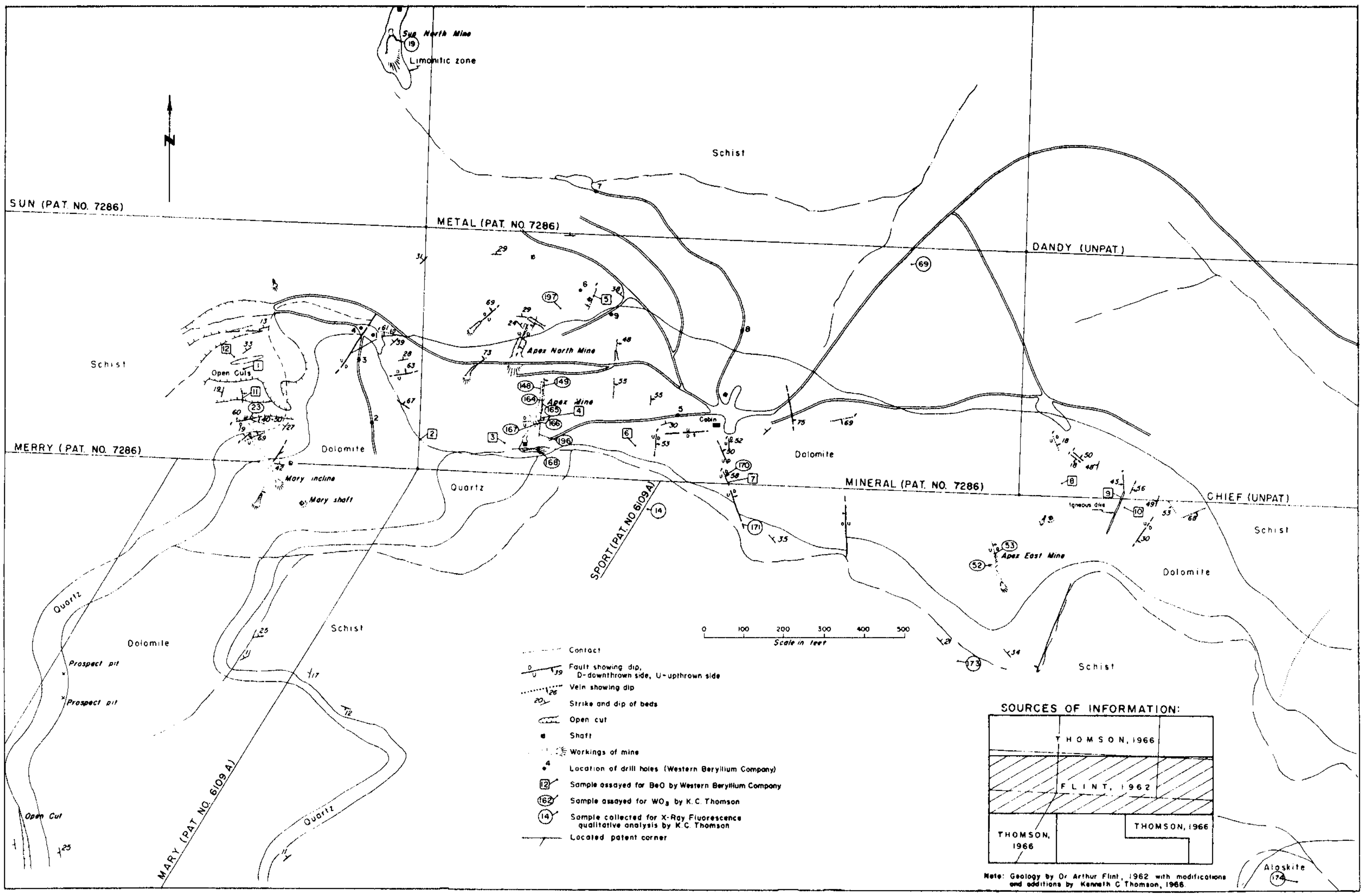


Figure 41. Detail geologic map of the Apex and Mary properties showing the location of sample sites and drill holes of the Western Beryllium Co. and sample sites of K. C. Thomson, 1968.

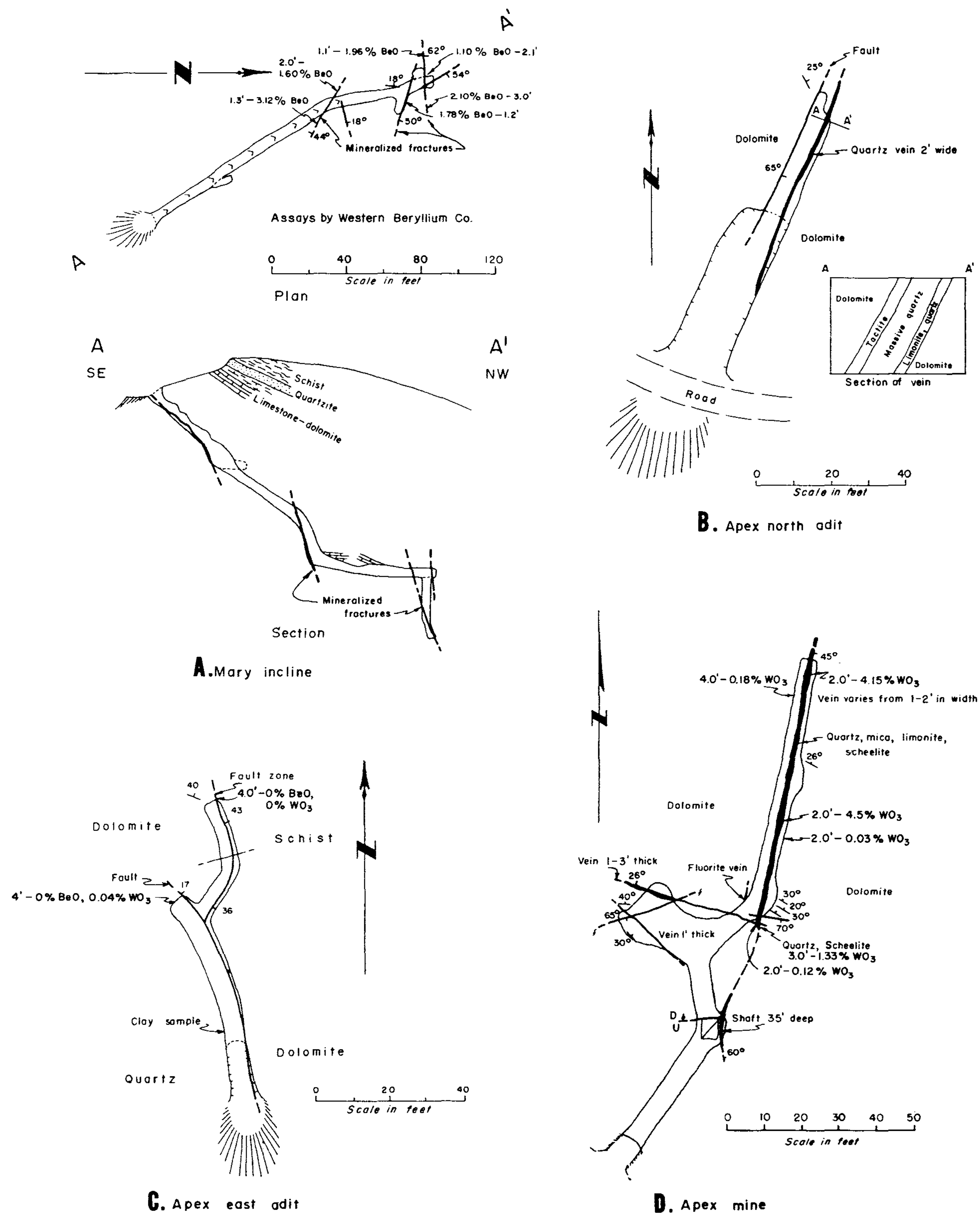
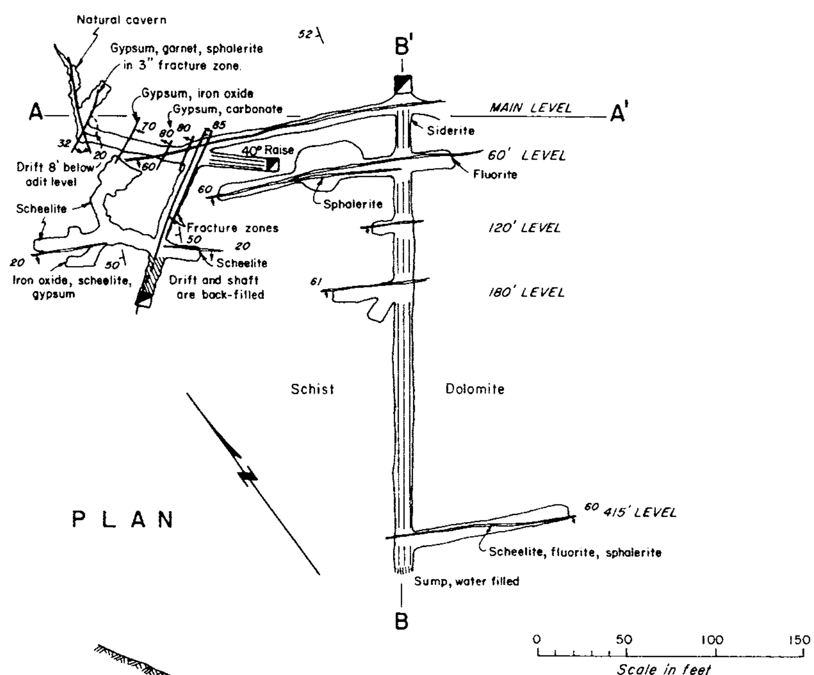


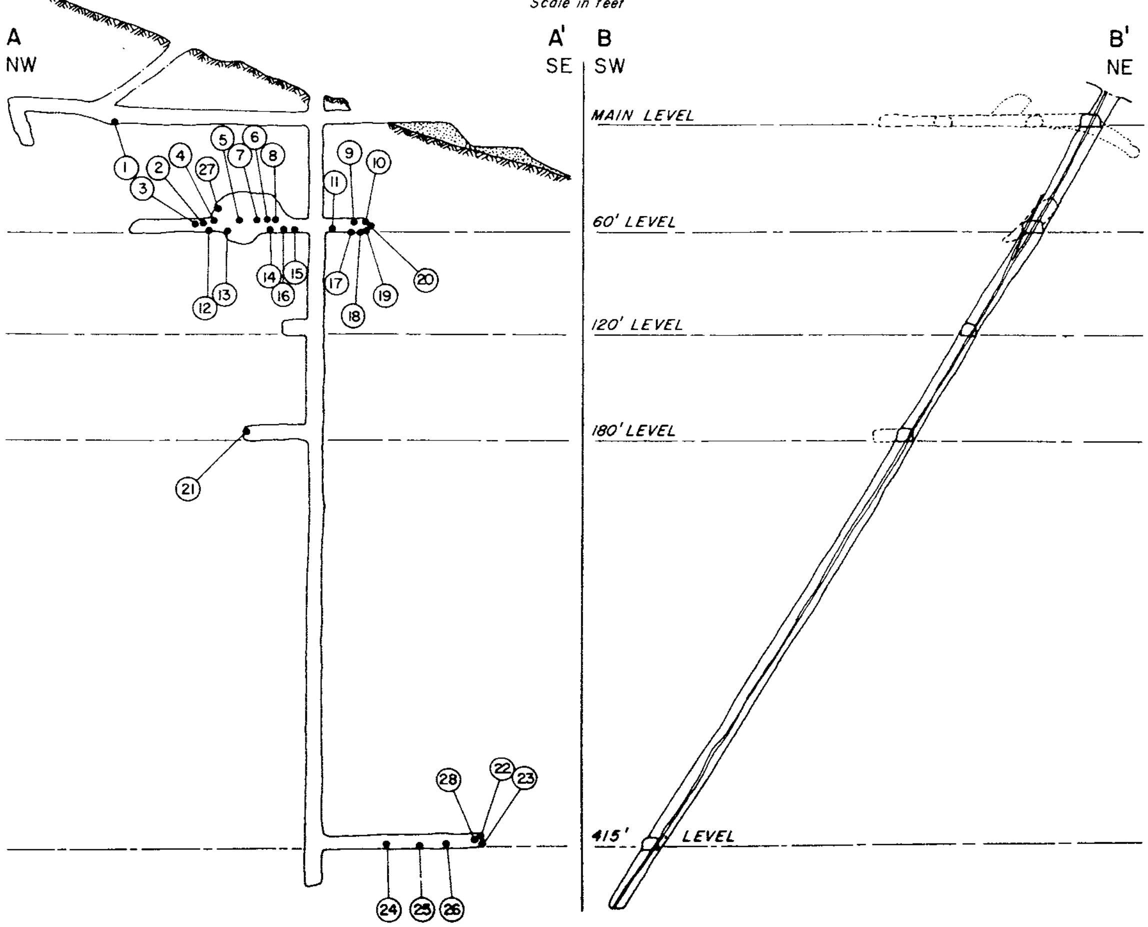
Figure 42. Geology and workings of the mines in the Apex and Mary properties showing assay data.

ASSAYS:

SAMPLE NO.	LENGTH OF CUT	Zn %	WO_3 %
1	35"		0.25
2	6"		3.15
3	6"		1.43
4	20"	27.8	0.26
5	27"	10.6	0.10
6	10"	32.0	0.40
7	19"	12.4	0.10
8	9"	15.8	13.02
9	12"		0.92
10	8"		1.65
11	18"		0.70
12	10"		1.15
13	16"	28.2	0.50
14	10"	23.8	0.30
15	6"	25.0	1.15
16	10"	14.5	0.20
17	24"		0.20
18	12"		0.92
19	10"		2.67
20	20"		0.30
21	24"	0.60	0.10
22	24"	0.20	0.50
23	16"		0.38
24	12"		1.20
25	14"	1.70	0.25
26	12"		1.43
27*	12"	42.0	3.15
28*	15"	1.50	0

*Sampled by K. C. Thomson, 1966





Longitudinal Projection Section Along Vein Cross Section Through the Vein and Shaft

Figure 43. Plan and sections with geology and assay data of the Trout Creek mine.

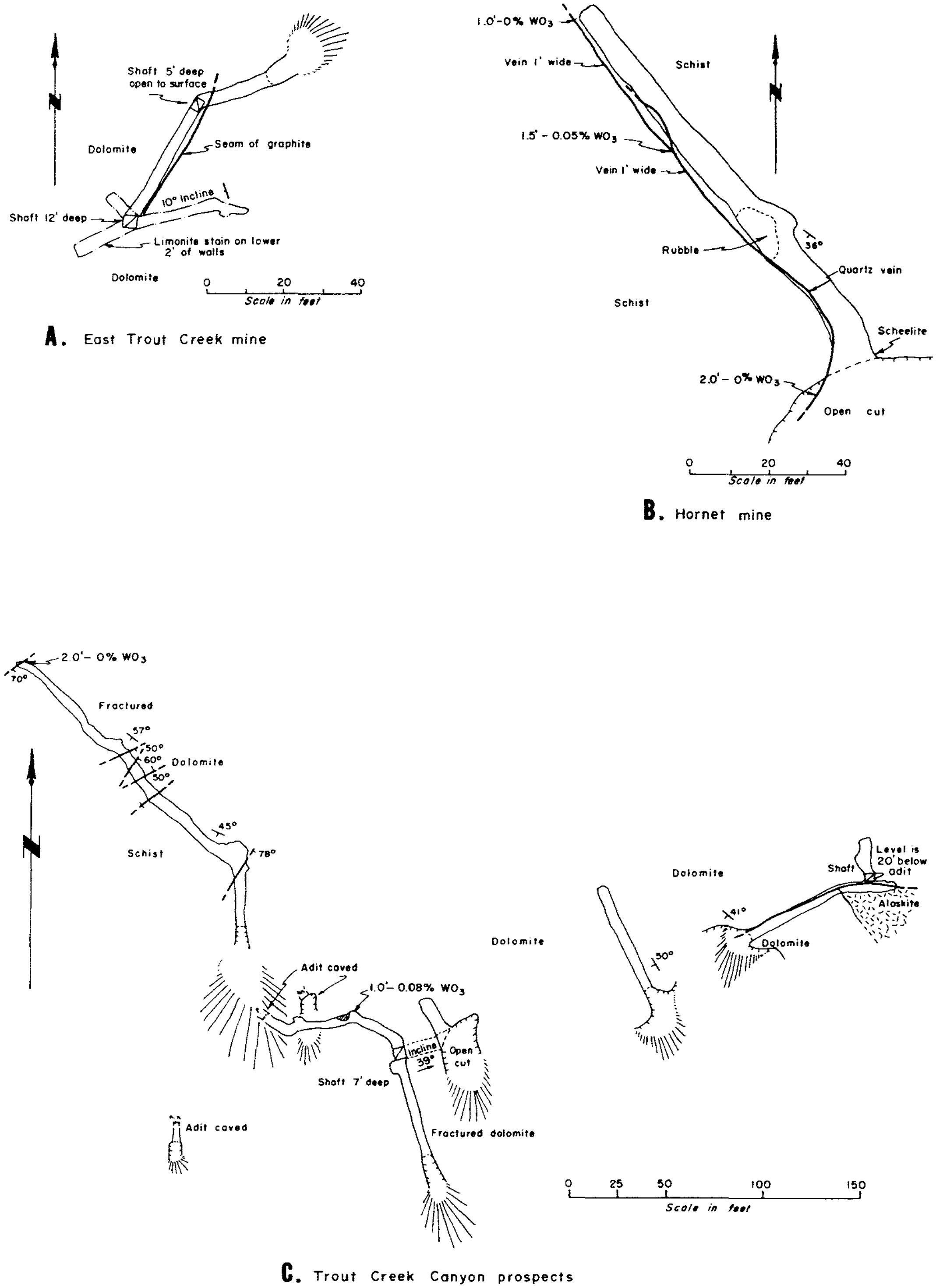


Figure 44. Geology and workings of mines near Trout Creek Canyon.

Table 4. Tungsten assays from the Trout Creek area, Juab County, Utah.

Sample No.	Property	Width (feet)	Tungsten (percent)
1218-164	Apex Tungsten	2.0	4.50
1218-165	Apex Tungsten	2.0	0.03
1218-166	Apex Tungsten	3.0	1.33
1218-167	Apex Tungsten	2.0	0.12
1218-168	Apex Tungsten	dump	0.05
1218-170	Apex Tungsten	2.0	none
1218-148	Apex Tungsten (Apex mine)	4.0	0.18
1218-149	Apex Tungsten (Apex mine)	2.0	4.15
1218-178	Eastern Trout Creek mine	dump	none
1218-179	Eastern Trout Creek	2.5	none
1218-52	East Apex mine	2.0	0.04
1218-53	East Apex mine	3.0	none
1218-181	Hornet mine	1.0	none
1218-183	Hornet mine	1.5	0.05
1218-185	Hornet mine	2.0	none
1218-190	Trout Creek Canyon mines	1.0	none
1218-194	Trout Creek Canyon mines	2.0	none
1218-196	East of Apex mine	1.0	none
1218-10	Trout Creek Canyon west adit	2.0	none
1218-13	Trout Creek Canyon west adit	1.0	0.08
1218-18	Trout Creek mine (415 level)	3.0	none
1218-29	Trout Creek mine (60 level)	2.0	3.15

three shafts and five prospect pits. The easternmost shaft is 20 feet deep. The other two shafts are connected by a 70-foot adit which bears S. 45° W. (figure 44a).

The mineralization at the Hornet claims consists of scheelite coatings on the northwest-striking fractures in unit A amphibolite. The best example of this type of coating was observed at the portal of the Hornet mine on a N. 30° W. striking fracture.

The MacMillan property is on a scheelite-bearing contact metasomatic zone along the alaskite-unit A contact.

Production. Scheelite was discovered in the Trout Creek area in 1916. Everett (1961, p. 29) reported that in 1955, S. F. Falkenburg shipped 125 tons of ore from the Trout Creek mine from which 41 units of WO_3 were recovered. In 1955, Falkenburg constructed a 50-ton/day mill in Granite Canyon about 1½ miles north of the Trout Creek mine to process Trout Creek ores. Falkenburg indicated (personal communication) that several tons of concentrate were processed in the

Table 5. Beryllium assays in the Trout Creek mining area, Juab County, Utah.

Sample No.	Location	Width (feet)	BeO (percent)
Samples assayed by U. S. Bureau of Mines (locations shown in figure 41)			
2	Trout Creek mine	1.0	0
18	450 level–Trout Creek mine	1.5	0
29	60 level–Trout Creek mine	1.0	0
10	Trout Creek Canyon mines (west tunnel)	0.5	0
13	Trout Creek Canyon mines (west tunnel)	0.8	0.05
19	San Prospect channel cut	2.0	0
23	Mary incline–hanging wall	0.4	0
27	Mary incline area contact–selvage zone	grab	0
33	Mary mine–channel sample	2.0	0.712
52	East Apex mine–back of 8-foot NE drift	4.0	0
53	East Apex mine–back of main adit	4.0	0
170	Vein south central part of Mineral claim	grab	0
197	Shaft on NW corner of Mineral claim	grab	0.421
Samples assayed by Western Beryllium Co. (locations shown in figure 41)			
1	Merry claim–280 feet north of the Mary mine	2.5	0.98
2	Creek bed west of Apex mine	1.0	2.62
3	25 feet west of Apex mine	5.0	0.34
4	Apex mine	1.5	0.40
5	440 feet northwest of white cabin, Apex property	3.0	4.46[1]
6	215 feet west–southwest of white cabin, Apex property	3.0	0.35
7	Vein 150 feet south of white cabin, Apex property	?	0.81
8	850 feet east of white cabin, Apex property	3.2	0.55
9	Igneous dike 1,000 feet east of white cabin, Apex property	3.5	2.42
10	Igneous dike 1,000 feet east of white cabin, Apex property	5.0	1.07
11	225 feet north–northwest of Mary mine	3.3	0.56
12	Four samples taken from Mary Bench area	–	0.42-1.46

[1] All samples except number 5 were analyzed with a berylometer run wet by M. Rhinehart, Western Beryllium Co.

mill; no shipments are reported from the area after 1956.

The Apex property was operated in 1940 and 1941. Everett (1961, p. 30) stated that 56 tons of ore were produced and 18 units of WO_3 were recovered.

The Hornet property was located in 1941. Spider Uranium Co. held a lease on the property during 1952 and 1953 and produced 60 tons of ore averaging 2 percent WO_3. A gravity mill constructed by the company operated in Trout Creek Canyon from 1952 to 1953. No production since 1956 has been reported from the area.

Singleton Canyon Area

The Singleton Canyon area, at the south end of the Deep Creek Mountains in sec. 12, T. 13 S., R. 19 W. (plate 1), includes 23 unpatented mining claims (White Cloud Nos. 1-23). Staked in 1962, the claims are owned by George and Lawrence Rawlins of Partoun, Utah, who maintain the assessment work.

Quartzites, schists and marbles of the Precambrian Johnson Pass Formation form the country rock (figure 45). They strike N. 60° to 65° E.

Quartz veins of N. 65° E. strike, dipping 65° to 80° SE occur in the quartzite and schist. They vary from a few inches to 4 feet in width and contain barren white quartz and sparse occurrences of copper pitch, malachite, azurite, limonite and pyrolusite.

The area is cut by a N. 60° to 80° W. striking breccia zone 100 feet wide by 1,000 feet long which dips 80° N. Quartz, schist and quartzite fragments are cemented with white quartz containing vugs of crystalline quartz. This breccia zone is cut by a north-south fault in the north fork of Singleton Canyon.

The schist in the bottom of Singleton Canyon is hydrothermally altered along a N. 80° W. fault trace producing limonite, sericite and kaolinite.

Development consists of two shafts, one adit and several prospect pits (figure 45). The Spaghetti shaft, a 25-foot prospect pit, was sunk 2,500 feet southeast of the mouth of Singleton Canyon. A 20-foot shaft was sunk about 260 feet northwest of the Singleton adit. The Singleton adit bears northwest for 306 feet in a north branch of Singleton Canyon (figure 46). East of the adit, several prospect pits occur in a northeast trend. Many cuts located throughout the south part of the area apparently are for location work only and contain no mineralization.

The Spaghetti shaft is in limonite in hydrothermally altered schist. Samples from the shaft assayed a trace of gold and from a trace to 3.6 ounces of silver per ton (table 6). The 20-foot shaft, malachite and limonite stained, is sunk in breccia.

The Singleton adit was driven to undercut the 20-foot shaft at 131 feet depth. It followed a N. 40° W. striking limonite-stained fracture zone in the breccia (figure 46). About 235 feet beyond the portal, quartzites are pyrolusite and limonite stained, and a N. 65° E. quartz vein was encountered. Samples from the Singleton adit assayed a trace of gold, from a trace to 0.12 ounces of silver, and copper to 0.3 percent.

Table 6. Assays from the Heavenly Hills-Singleton area, Juab County, Utah.

Sample No.	Location	Ounces/ton Gold	Ounces/ton Silver	Percent Copper
1319-21	Rainbow Group	Trace	1.6	1.3
1319-25	Upper adit (Rainbow)	Trace	2.0	
1319-28	Spaghetti claim	Trace	3.6	0
1319-31	Rainbow Group	0.04	2.0	0.80
1319-32	Lower prospects (Rainbow)	0.06	2.0	0.35
1319-105	Spaghetti Shaft no. 1	Trace	Trace	
1319-106	Spaghetti Shaft no. 2	Trace	Trace	none
1319-105	Southern Heavenly Hills	Trace	Trace	none

Northeast of the Singleton adit, a N. 60° W. striking quartz zone in schist contains several prospect pits which show sparse azurite and limonite staining of quartz.

No mineral production is reported.

Heavenly Hills Prospects

The Heavenly Hills, a group of low hills just west of Partoun, Utah, lie at the south end of the Deep Creek Mountains (plate 1). A group of unpatented claims staked by George and Lawrence Rawlins of Partoun in 1955 occupy the central part of these hills.

The country rock, Mississippian Chainman Shale and Pennsylvanian Ely Formation, dips 30° to 35° W. in the south and west, and to the east in the northeast, forming an anticline with an axial strike of N. 10° to 15° W. (figure 47). Erosional remnants of the Salt Lake Formation (Miocene-Eocene) overlie the Ely Formation in the central hills. Beds of this formation strike north-south and dip 20° to 40° W. A series of Tertiary volcanic flows varying from andesite to rhyolite covers the sediments in the west hills.

Ely Formation limestone beds break along a north-south striking thrust fault, override themselves and repeat in the northeast hills (figure 47). The volcanic rocks and Ely Formation are cut by three younger east-west striking normal faults.

Development consists of one shaft and several prospect pits. The shaft, sunk in the northwest part of the area to a depth of 25 feet, is inclined 51° NW (figure 48a) and follows a radioactive lignite seam in late Tertiary gravels. Dunham (1959) reported "... Assays of 0.01-0.31 percent uranium have been made on these seams."

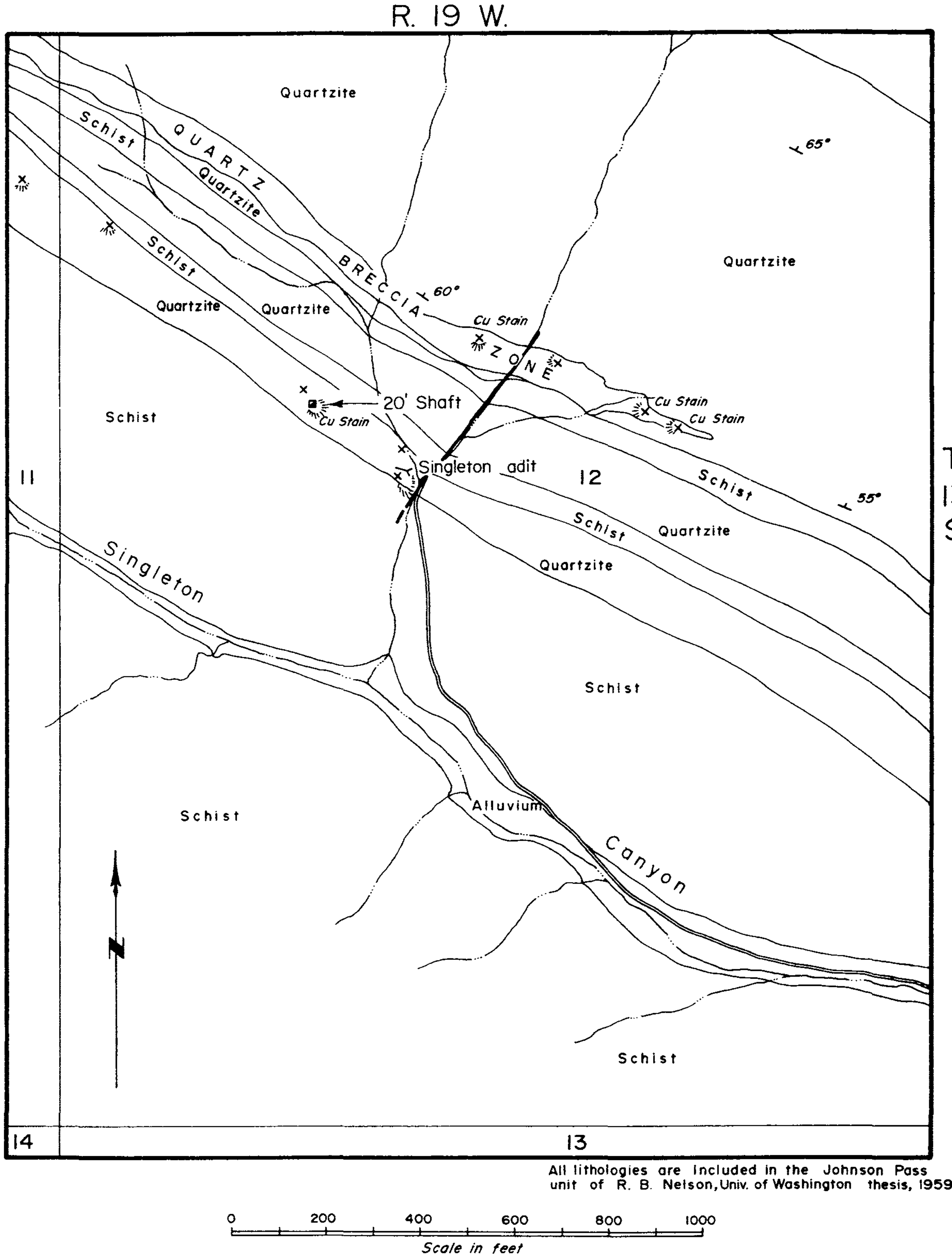
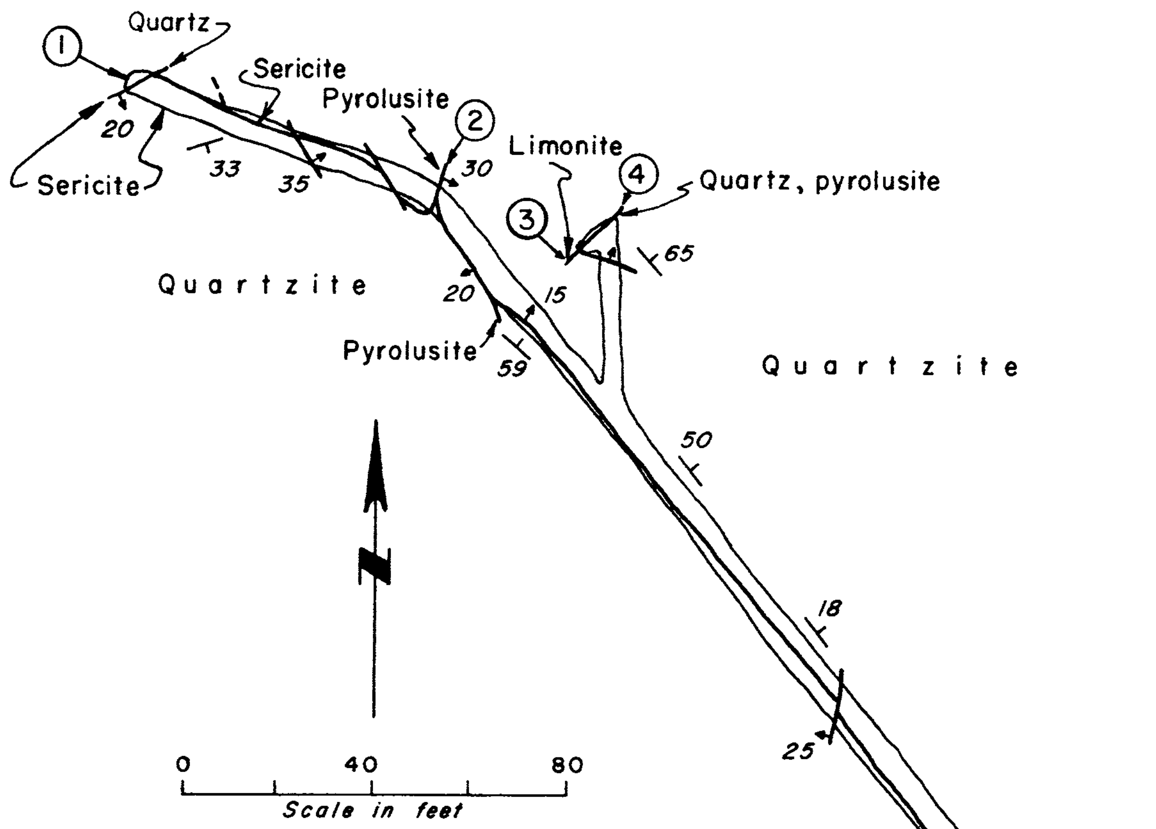


Figure 45. Geologic map of the Singleton Canyon area.



Assays: Number	Width (feet)	Ounces/ton Gold	Ounces/ton Silver	% Copper
1	3.0	Tr.	Tr.	0
2	0.5	Tr.	Tr.	0
3	0.2	Tr.	Tr.	0.30
4	0.3	Tr.	0.12	0.10

Black and Deason, assayers

Figure 46. Geology and workings of the Singleton adit in Singleton Canyon.

Small 10- to 25-foot iron oxide zones in the Ely Formation limestone comprise the mineralization in prospect pits scattered through the central hills (figure 48b, c and d). Assays of samples cut from these pits show trace to 3.6 ounces of silver per ton, but no gold (table 6).

No mineral production is reported.

Water Canyon Mine

The Water Canyon mine, a 205-foot adit bearing N. 63° E. on the east side of Water Canyon, is 5 miles north of Pleasant Valley and 2 miles east of the Utah-Nevada state line (plate 1). The claim was staked in the late 1800's and its present ownership is unknown.

Country rock is a gray to light brown Lower Cambrian Prospect Mountain Quartzite which strikes N. 5° to 10° W. and dips 45° to 60° W. Several N. 60° to 70° W. striking faults cross the area and dip north and south. The adit follows malachite, azurite and limonite in one of these fractures. Samples taken from this fracture assayed 0 to 1.05 percent copper (figure 49).

No mineral production is reported.

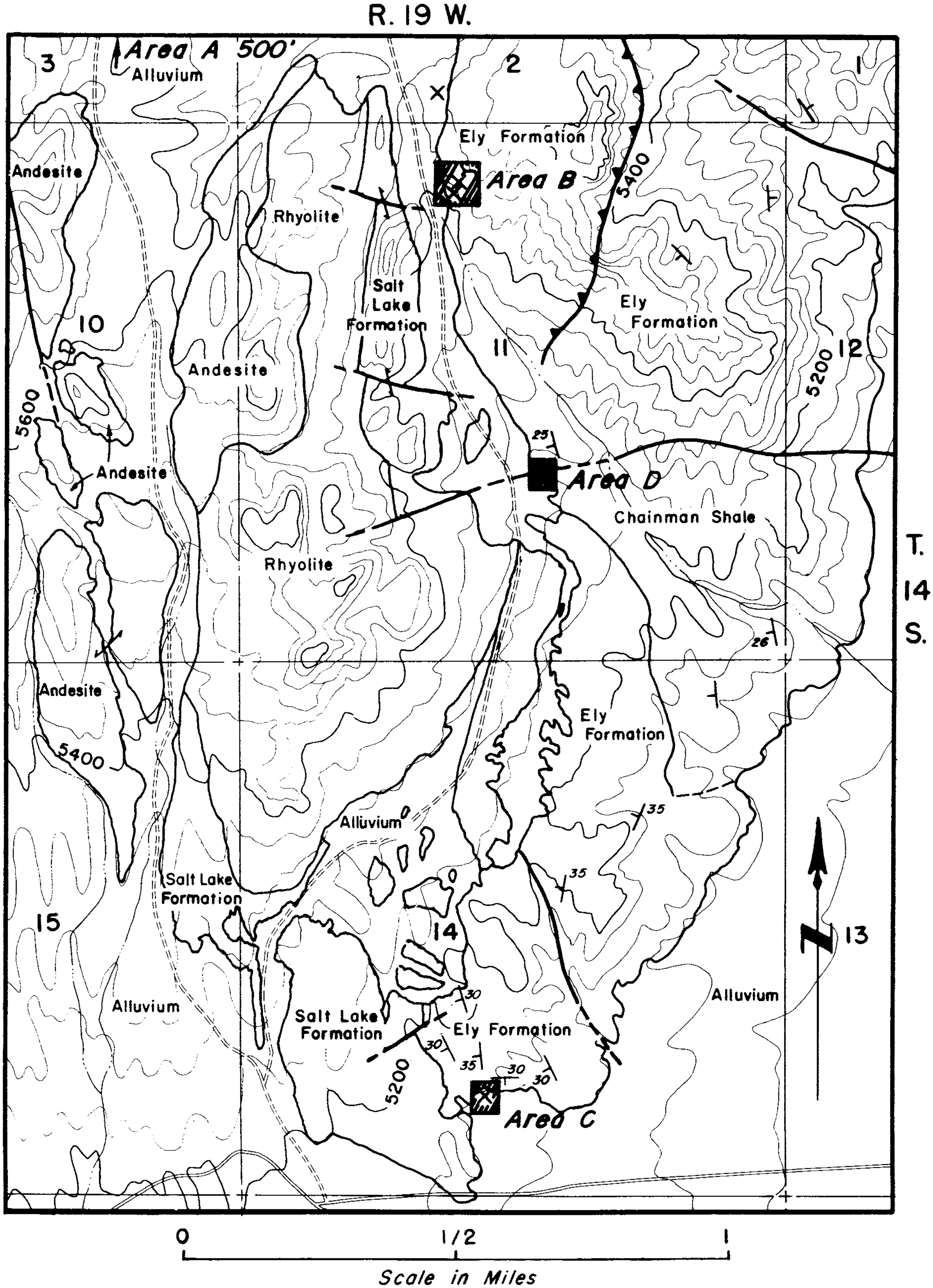


Figure 47. Geology and location of prospect areas in the Heavenly Hills.

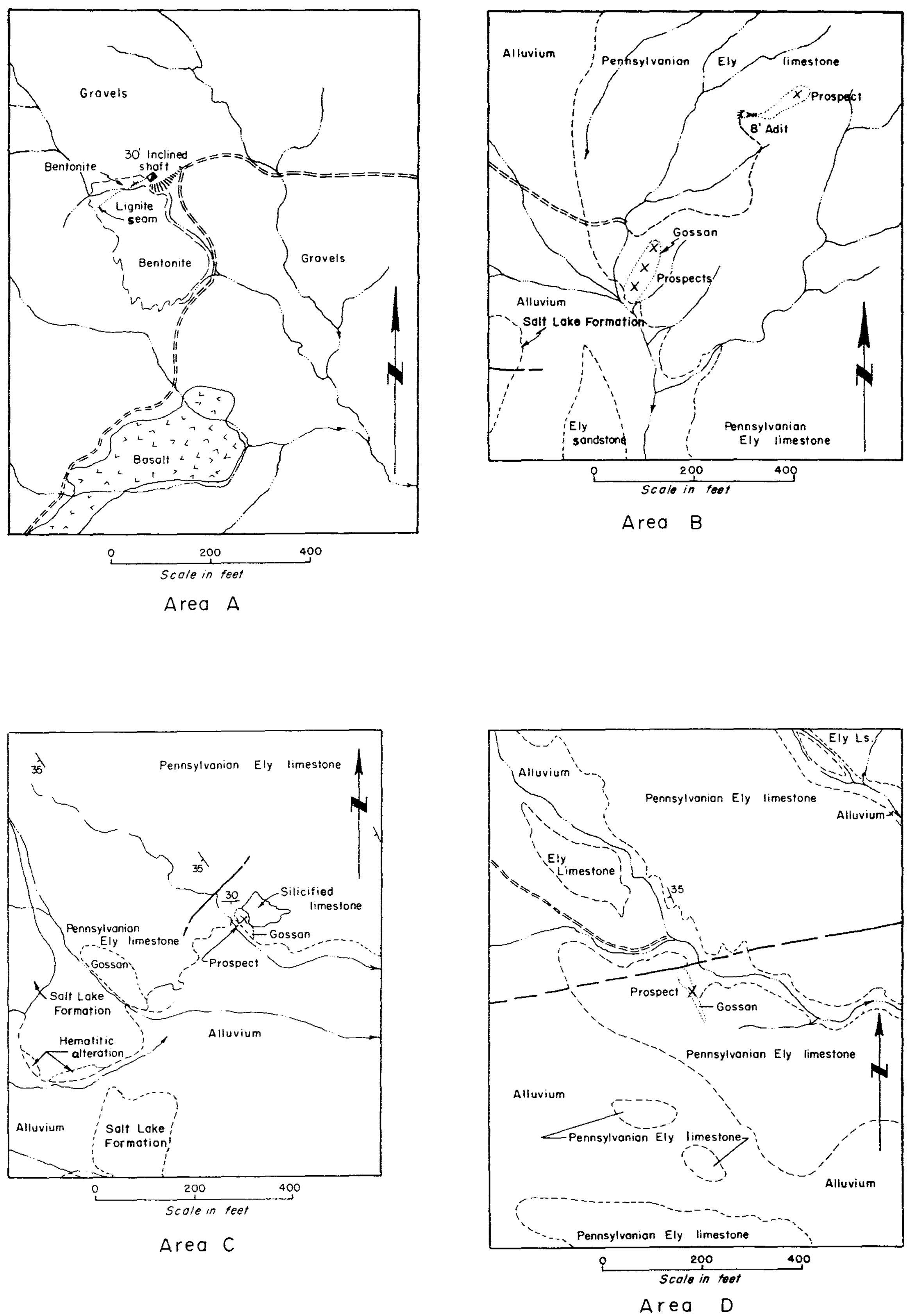


Figure 48. Geologic sketch maps of mineralized areas in the Heavenly Hills. See figure 47 for location of areas

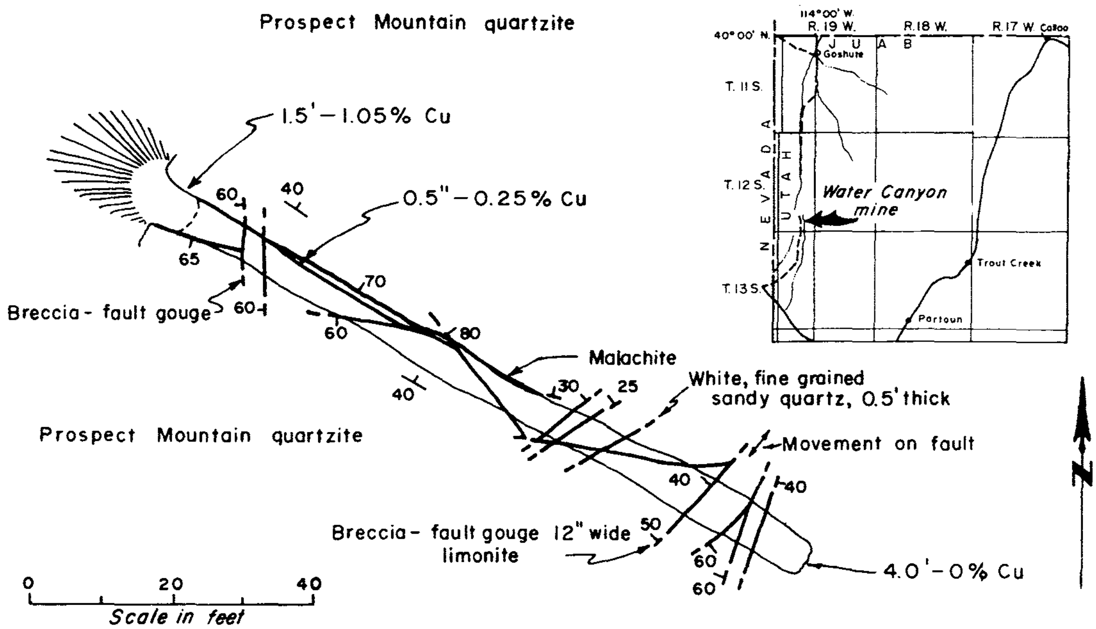


Figure 49. Geology and workings of the Water Canyon mine.

Johnson Canyon Properties

Johnson Canyon properties are in the hills west of Johnson Canyon and in Stud Horse Canyon about 5 miles south of the Indian village of Goshute (plate 1). Access is provided by unimproved roads and trails leading from the Johnson Canyon road.

The properties consist of 20 patented claims (figure 50) of which the following are owned by the Bar X Mining Co. and Thomas Allen Gustin, Eureka, Utah:

Victor Hugo	Dooly	Boston No. 1
Exposition	Southern Cross	Boston No. 2
Mahogany No. 1	Reality	Evening
Mahogany No. 2	Temple	Tempest
Muldoon		

The ownership of these remaining seven patented claims is unknown:

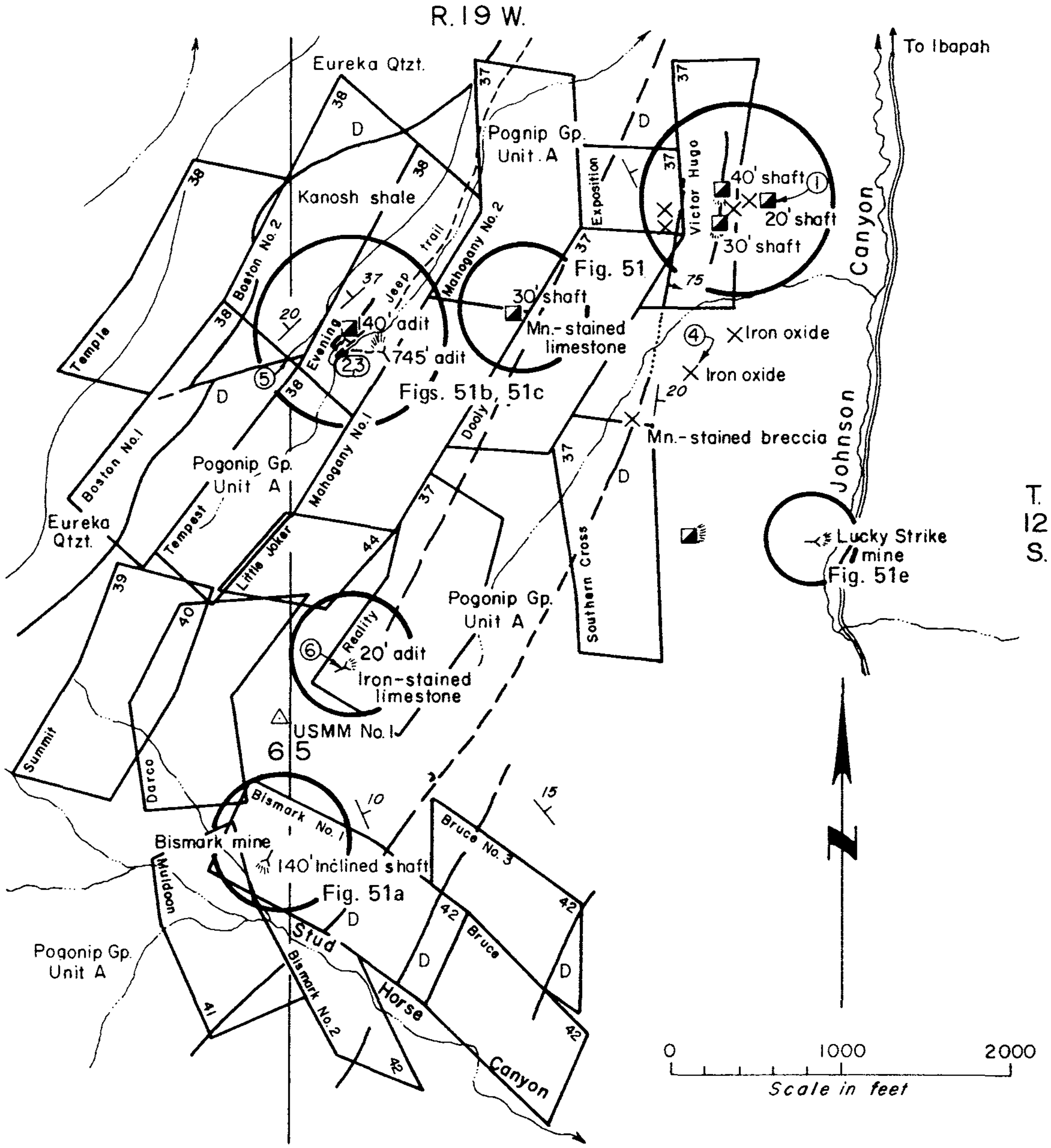
Summit	Bismark No. 1	Bruce Darco
Bismark No. 2	Bruce No. 3	Little Joker Darco

On these claims, the country rock is Ordovician limestone, shale, quartzite and dolomite (figure 50). Kanosh Shale and Eureka Quartzite strike N. 30° to 45° E. and dip 20° to 37° NW. They overlie the A unit of the Pogonip Group, a thick-bedded, massive dolomite, and are partially in fault contact with it along a N. 15° E. normal fault.

An alaskite in the Bismark mine (figure 51a) in Stud Horse Canyon intrudes dolomites of the Pogonip Group A unit, but does not outcrop in the area.

Galena, limestone, malachite, azurite and pyrolusite occur in fractures of N. 50° E. to 5° W. strike. Limonite fills fractures in nearly all mines. Assays are shown in figure 50.

Development consists of five adits, six shafts and several prospect pits. An inclined shaft is sunk at 70° to the northwest on the Evening claim, and from this inclined shaft, two drifts of 20 and 40 feet beneath the collar were driven N. 50° E. (figure 51a). A 180-foot access adit is driven N. 40° W. Assays of 0.01 ounces of gold, 30 and 70 ounces of silver per ton and 3.4 to 6.6 percent lead, 0.2 percent copper and 0 to 5.0 percent zinc were obtained from selected dump samples from this mine. South across the canyon, a 745-foot adit driven S. 30° E., intersects several limonite-stained fractures with strikes from north-south to N. 15° E. (figure 51b). Assays from fractures in the mine showed a trace of gold and a trace to 4 ounces of silver per ton. East of this adit, two small shafts of the Mahogany No. 1 claim are sunk on a manganese-stained limestone zone. These shafts lead to a stope 4 feet high, 30 feet long and 10 feet wide just under the surface (figure 51c). On the west wall of Johnson Canyon 20 feet above the stream level, the Lucky Strike adit trends 165 feet due west (figure 51c) and intersects several fracture zones with N. 1° to 5° W. strikes.



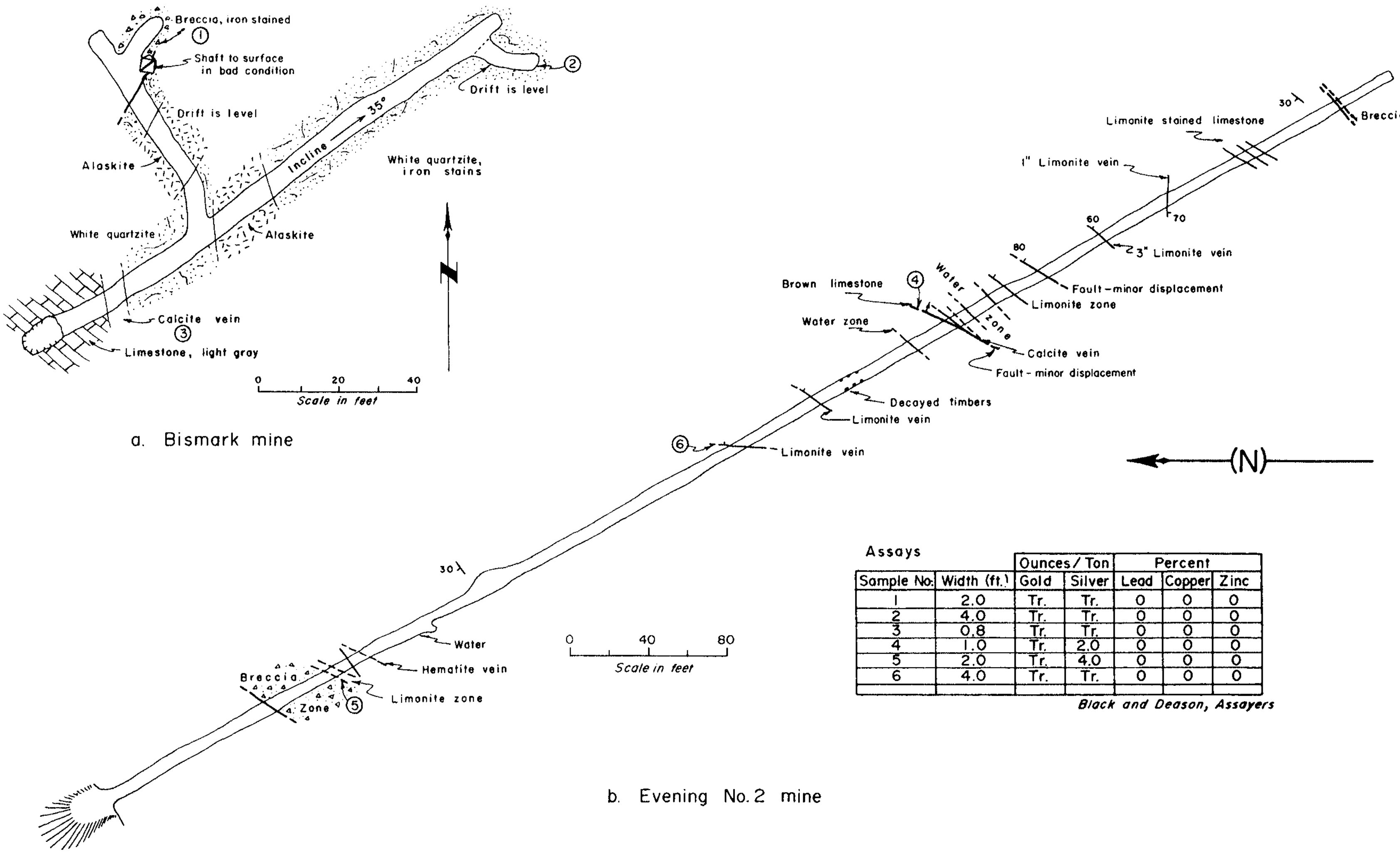
Assays:

Sample No.	Ounces/ton		Percent			Width (feet)
	Gold	Silver	Lead	Copper	Zinc	
1	Tr.	Tr.	1.5	0	2.2	dump
2	0.01	30.0	6.6	0.20	5.0	dump
3	0.01	70.0	3.4	0.20	0	dump
4	Tr.	6.0	0	0	2.5	dump
5	Tr.	12.0	2.0	0	0	dump
6	0.01	10.0	3.0	0	0	1.2

Selected samples

Note: ④ location of samples *Black and Deason, assayers*

Figure 50. Geology and location of claims and workings of the Johnson Canyon area.



Assays

Sample No.	Width (ft.)	Ounces / Ton Gold	Silver	Percent Lead	Copper	Zinc
1	2.0	Tr.	Tr.	0	0	0
2	4.0	Tr.	Tr.	0	0	0
3	0.8	Tr.	Tr.	0	0	0
4	1.0	Tr.	2.0	0	0	0
5	2.0	Tr.	4.0	0	0	0
6	4.0	Tr.	Tr.	0	0	0

Black and Deason, Assayers

Figure 51. Geology and workings of mines in the Johnson Canyon area.

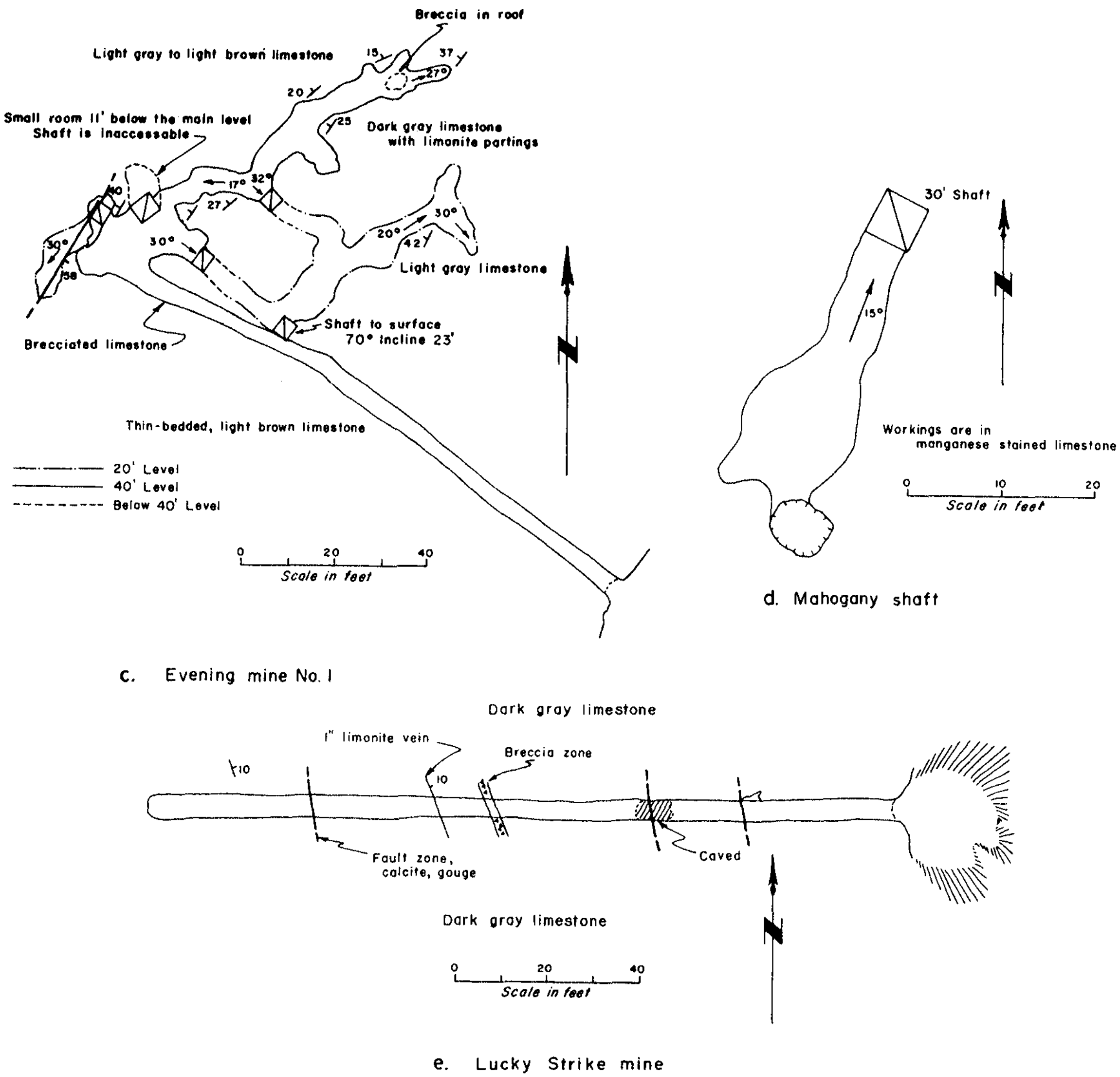


Figure 51. (continued)

A shaft sunk about 900 feet west of this adit is on a limonite-stained fracture. Northwest of this same adit on the Victor Hugo claim are two vertical shafts on limonite-stained fractures—the south, 30 feet deep, and the north, 40 feet deep. Several prospect pits were dug near the shafts. About 1 mile northwest of the mouth of Stud Horse Canyon, the Bismark mine, a 140-foot inclined shaft with a cross-cut at 40-foot depth, bears N. 55° E. (figure 51a) on an iron-stained breccia zone on the Bismark No. 1 claim. About midway between the Bismark mine and the Evening claim, a 20-foot prospect adit on the Reality claim bears S. 45° W. in limonite-stained limestone. An assay on this staining yielded 0.01 ounces of gold and 10 ounces of silver per ton.

The properties, originally prospected by S. S. Worthington of Grantsville, Utah in 1887, were not extensively developed until 1915, when Arthur Southerland and J. B. Thomas began prospecting the area. Late, in 1917, the Gash brothers of Ibapah discovered a rich pocket of galena and shipped a carload of ore which assayed $24.00 in silver per ton. Very little work and no production have been reported since 1917.

Queen of Sheba and Jumbo Properties

The Queen of Sheba and Jumbo properties lie immediately west of Red Mountain in secs. 2 and 11, T. 12 S., R. 19 W. (plate 1).

The Queen of Sheba is comprised of the following patented claims (patent No. 4499):

Cleopatra	North Side	Creosis
Lucy Clayton	Queen Babe	Stanley
Queens Ministers	Bill Nye	Leo
Lydia no. 2		

These claims, owned by the Queen of Sheba Gold Mining Co., K. O. Fishler, Salt Lake City, president, all in sec. 2, form a continuous block along the west flank of Red Mountain and lie on the east wall of the northerly trending Fifteen Mile Canyon.

The Jumbo properties (figure 52), ¼ mile to the west, lie in the foothills associated with north-trending Johnson Canyon. The property is owned by Lyle Davis and Richard Johnson of Salt Lake City and includes a continuous block of patented claims (patent No. 3215):

Waverly	Jumbo
Waverly No. 1	Richmond
Waverly No. 2	Jumbo Extension

The Queen of Sheba property is developed by five adits (figures 53 and 54) as follows:

Adit	Length (feet)	Elevation (feet above sea level)
Lawton	1,100	8,714
Martin	640	9,014
Johnson	160	8,936
Welchman	165	9,079
Queen	130	9,104

The Lawton and Martin adits lead to stopes and winzes (figure 53), jointly called the Queen of Sheba mine, on the gold-quartz Martin vein for 500 feet horizontally and 350 feet vertically. The Welchman and Queen adits lie on a gold-quartz vein 200 feet north of the Queen of Sheba mine. This vein, parallel to the Martin vein, was stoped for 50 feet horizontally and 30 feet vertically. Several small adits are located north and south of the Martin adit. In 1966 the Lawton adit and Queen adit were open, but all workings except the Queen adit are now caved at the portal.

The Jumbo property is developed by prospect pits and adits.

At both properties the country rock, Precambrian Johnson Pass Formation, is a brown to red quartzite-schist which strikes N. 5° to 10° E. and dips from 32° to 40° E.

Granite, pegmatite and alaskite occur in the area. Granite of the Ibapah stock intrudes the Johnson Pass Formation ½ mile north of the Queen of Sheba property. Quartz-muscovite-orthoclase-beryl pegmatite occurs as pods in the granite and as dikes in the quartz-schist near the Queen of Sheba mine. Several pegmatite dikes striking N. 10° to 15° W. were exposed in the Martin adit (figure 53), and an alaskite intrusive occurs in the lower workings of the Queen of Sheba mine, but these were not observed on the surface.

Two fracture systems are recognized in the area. A N. 45° W. system cuts an older N. 80° to 85° E. system, which includes the gold-bearing vein in the Martin adit (figure 54). The vein strikes N. 85° E. and dips from 38° to 65° SW. It varies in width from 1 to 40 feet and contains a trace to 2.79 ounces of gold per ton and a trace to 7.2 ounces of silver per ton. The northwest-striking fractures are barren except where they offset the Martin vein, they are healed with gold-bearing quartz and appear to have localized the ore in the east-trending vein. Mineralization permeates the country rock around the vein. Wide stopes in the Martin adit are the result of mining both the vein and the gold-permeated country rock.

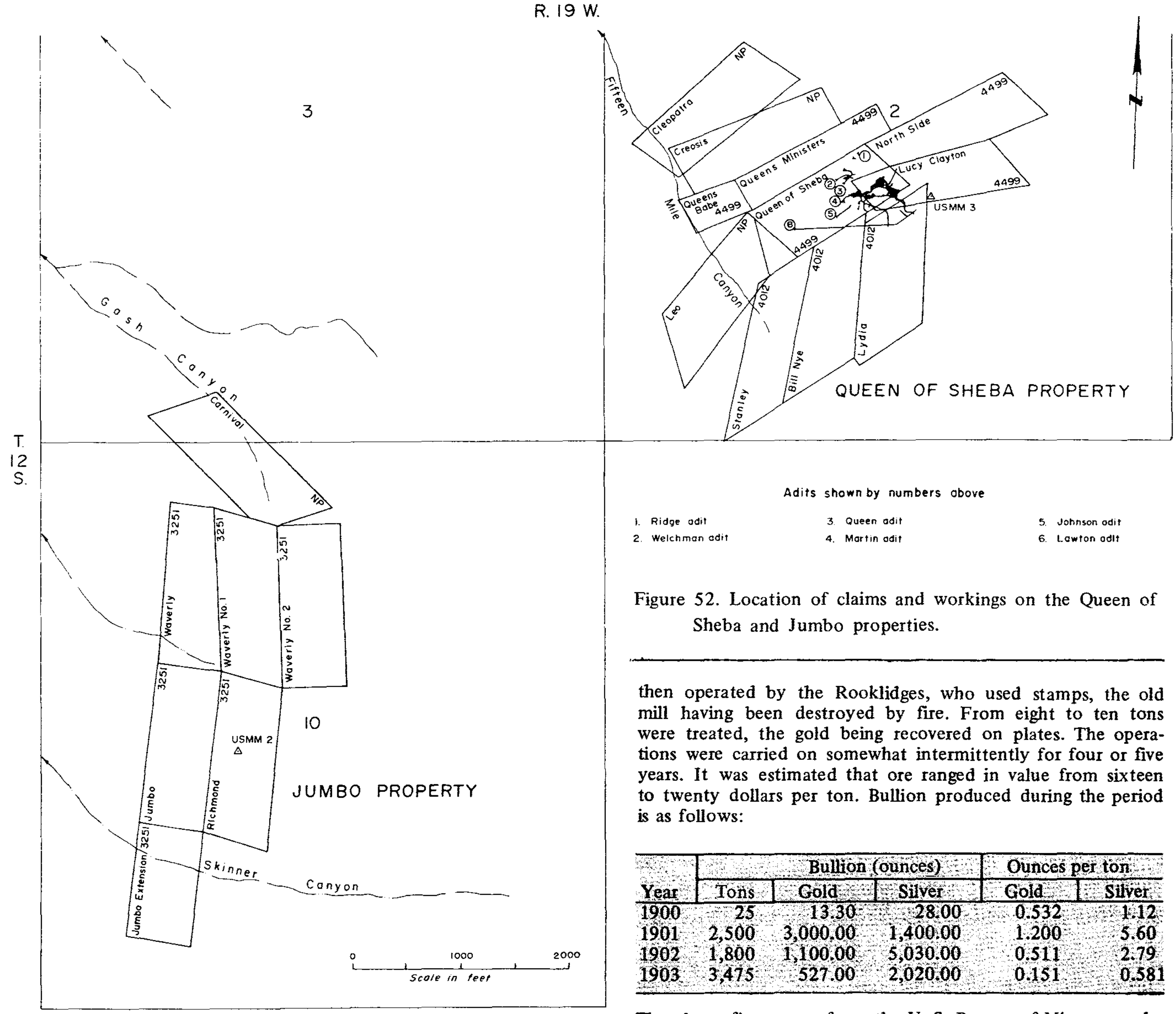


Figure 52. Location of claims and workings on the Queen of Sheba and Jumbo properties.

According to Robins (1938) the area was discovered about 1888 by a prospector named Doc Bailey who did little mining.

Robins (1938) states:

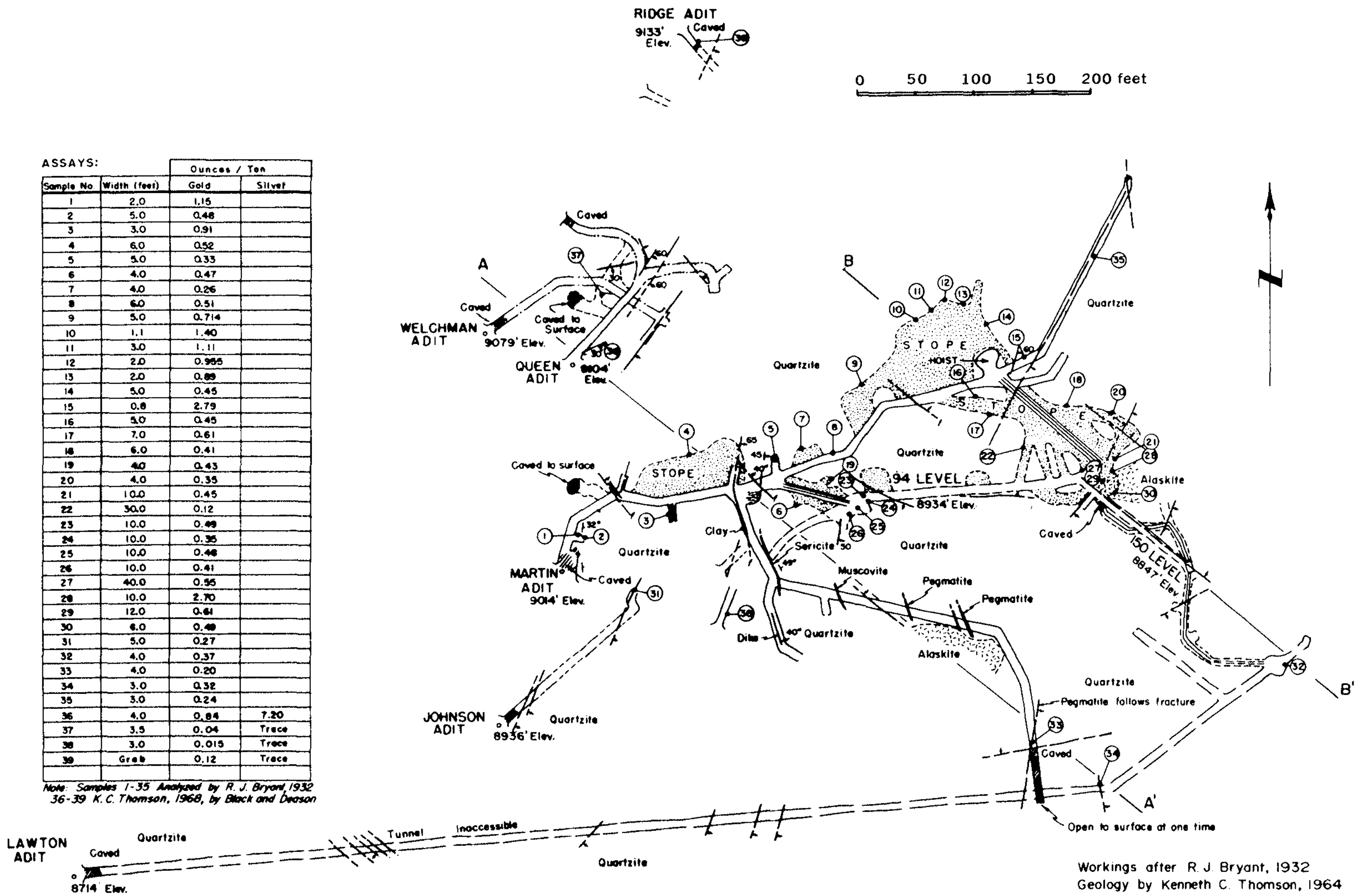
The following was obtained from Mr. W. J. Rooklidge who was closely associated with the operations for many years: 'Soon after the discovery, the property was leased to a man named Raven. Three Crawford mills were installed and operated. It is said that ten to fifteen tons per day were treated by these mills, the gold being recovered on the plates, with a recovery in gold of from fifteen to eighteen hundred dollars per month for about three years. The ore treated was thought to have a value of about fifteen dollars per ton. After this operation ceased, the property was idle for some years. It was then operated by the Rooklidges, who used stamps, the old mill having been destroyed by fire. From eight to ten tons were treated, the gold being recovered on plates. The operations were carried on somewhat intermittently for four or five years. It was estimated that ore ranged in value from sixteen to twenty dollars per ton. Bullion produced during the period is as follows:

		Bullion (ounces)		Ounces per ton	
Year	Tons	Gold	Silver	Gold	Silver
1900	25	13.30	28.00	0.532	1.12
1901	2,500	3,000.00	1,400.00	1.200	5.60
1902	1,800	1,100.00	5,030.00	0.511	2.79
1903	3,475	527.00	2,020.00	0.151	0.581

The above figures are from the U. S. Bureau of Mines records. In 1909, the property was taken under lease and bond by a man named Lawton, who drove the Lawton tunnel. Although the mine and mill were operated, no record was kept during this time of the ore mined and milled. In 1913, a man named Johnson, who had charge of the property for Mr. Lawton, took a lease and worked the mine until 1916. The U.S. Bureau of Mines records credit him with having shipped the following:

		Bullion (ounces)		Ounces per ton	
Year	Tons	Gold	Silver	Gold	Silver
1914	500	78.40	75.00	0.157	0.15
1915	1,200	262.00	262.00	0.285	0.235

A lease was granted in 1929 but very little work was done. Since 1929 there has been no production from the property. It was leased in 1963 to 1965 to Gerald Toone of Salt Lake City and some work was done, but no ore was produced.



ASSAYS:

Sample No.	Width (feet)	Ounces / Ton Gold	Silver
1	2.0	1.15	
2	5.0	0.48	
3	3.0	0.91	
4	6.0	0.52	
5	5.0	0.33	
6	4.0	0.47	
7	4.0	0.26	
8	6.0	0.51	
9	5.0	0.714	
10	1.1	1.40	
11	3.0	1.11	
12	2.0	0.965	
13	2.0	0.89	
14	5.0	0.45	
15	0.8	2.79	
16	5.0	0.45	
17	7.0	0.61	
18	6.0	0.41	
19	4.0	0.43	
20	4.0	0.35	
21	10.0	0.45	
22	30.0	0.12	
23	10.0	0.49	
24	10.0	0.35	
25	10.0	0.48	
26	10.0	0.41	
27	40.0	0.55	
28	10.0	2.70	
29	12.0	0.61	
30	6.0	0.48	
31	5.0	0.27	
32	4.0	0.37	
33	4.0	0.20	
34	3.0	0.32	
35	3.0	0.24	
36	4.0	0.84	7.20
37	3.5	0.04	Trace
38	3.0	0.015	Trace
39	Grab	0.12	Trace

Note: Samples 1-35 Analyzed by R. J. Bryant, 1932
36-39 K. C. Thomson, 1968, by Black and Deason

Figure 53. Geology, workings and assay sample locations in the Queen of Sheba mine.

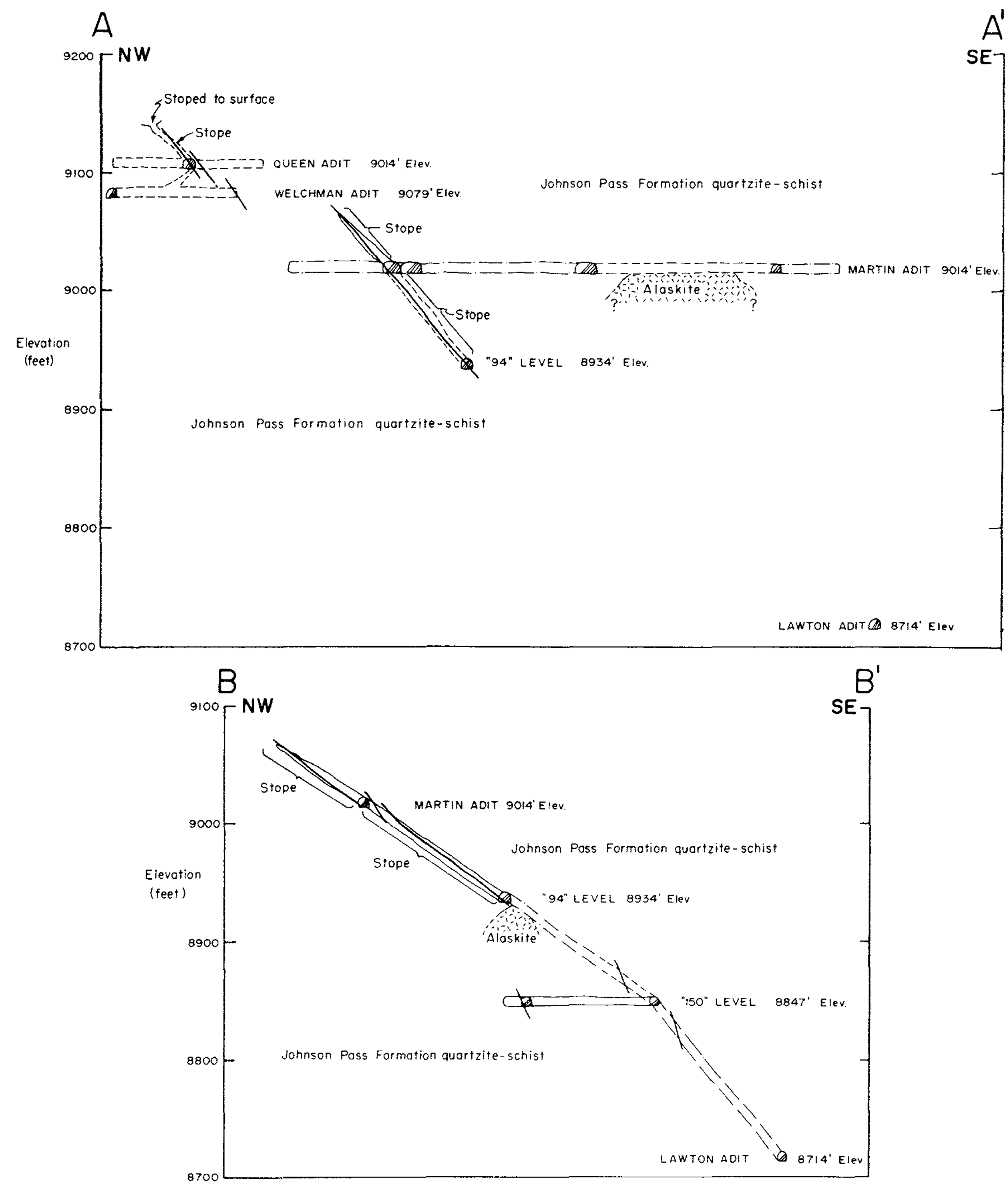


Figure 54. Geologic sections through the Queen of Sheba mine and vein systems. See figure 53 for location of sections.

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APPENDIX

Logs of holes drilled by Western Beryllium Company on the Apex Tungsten Property. (Appendix A of A. E. Flint Report on the Trout Creek beryllium-tungsten property, Juab County, Utah, 1962.)

The drill logs here included in the Appendix are condensed from logs of drill cuttings made in the field from hand-lens examination.

Abbreviations used in the logs are:

ls	- limestone
sch	- schist
qz	- quartz
Mn	- manganese
Fe	- iron

Colors: wh - white; br - brown; rd - red; blk - black; bf - buff; gy - gray; grn - green.

Shades: l - light; m -medium; dr - dark.

Amounts: sp - sparse; c - common; ab - abundant.

Condition: alter - alteration or altered. Means, as used here, the condition of the host rock and refers to the bleaching, dolomitization, silicification, and amphibolization of the limestone, the introduction of iron and manganese minerals into the host rock. Where alteration consists chiefly of minor silicification and bleaching, it is not noted in the logs, for most of the limestone is partly bleached and siliceous.

Drill Hole No. 1
Collar Elevation: 5,826 feet
Total Depth: 95 feet

Depth (feet)	Description
0-9	Surficial
9-23	Sch, br; partly decomposed
23-26	Sch, br; ab qz, mica and Mn
26-39	Ls, l br-l gy; altd; c grn amphibole and br mica
39-55	Ls, l-dr gy and l bf; sp alter
55-67	Ls, l gy-l bf; c alter; little water at 62 feet
67-81	Ls, bf-l gy; c alter; more water at 70 feet
81-83	Ls, l-dr gy
83-95	No sample return (water)

Drill Hole No. 1 (continued)

Assays

Depth (feet)	Beryllium percent BeO (field berylometer)	Depth (feet)	Tungsten percent WO_3 (est. under U-V lamp)
17-19	0.04	29-33	0.25-0.50
21-23	0.03	33-35	0.10-0.25
23-25	0.04	51-59	0.25-0.50
29-33	0.16	73-75	0.25-0.50
33-35	0.04		
35-37	0.10		
37-51	0.04		
51-53	0.04		
55-57	0.16		
57-59	0.04		
61-65	0.07		
67-69	0.07		
71-73	0.10		
75-79	0.03		
81-83	0.04		

Drill Hole No. 2
Collar Elevation: 5,827 feet
Total Depth: 70 feet

Depth (feet)	Description
0-7	Surficial
7-29	Ls, br-bf; c mica; 18-20 feet ab qz; ab alter
29-35	Ls, l-dr gy
35-44	Ls, mostly dr br; ab alter
44-54	Ls, dr-l gy; sp qz; alter locally
54-56	Ls, dr br, gy; c qz; ab alter
56-64	Ls, l, dr gy
64-66	Ls, bf; c qz; c alter
66-70	Ls, dr, l gy; water at 67 feet

Assays

Depth (feet)	Beryllium percent BeO (field berylometer)	Depth (feet)	Tungsten percent WO_3 (est. under U-V lamp)
54-56	0.10	50-54	0.25-0.50
64-66	0.13	56-68	0.10-0.25
66-70	0.08	60-66	0.25-0.50

Drill Hole No. 3
Collar Elevation: 5,827 feet
Total Depth: 79 feet

Depth (feet)	Description
0-5	Surficial
5-35	Sch, br; 10-18 feet altd; sp qz
35-41	Ls, m gy; sp alter
41-55	Ls, l gy; c mica; sp-c qz
55-61	Ls, m br; ab alter; micaceous
61-70	Ls, l gy, l bf; sp alter; poor sample – water at 61 feet
70-79	No sample –water

Assays

Depth (feet)	Beryllium percent BeO (field berylometer)	Depth (feet)	Tungsten percent WO_3 (est. under U-V lamp)
18-20	0.08	18-22	0.25-0.50
22-24	0.04	22-24	0.10
24-26	0.02	24-28	0.25-0.50
		28-32	0.10-0.25
		37-45	0.10-0.25
		45-47	0.25-0.50
		47-49	0.10-0.25

Drill Hole No. 4
Collar Elevation: 5,825 feet
Total Depth: 96 feet

Depth (feet)	Description
0-7	Surficial and decomposed schist
7-14	Ls, bf; sp qz, mica
14-36	Ls, l-m gy; 25-30 feet c qz; sp alter
36-46	Ls, l-m br; c Mn, Fe stn; cavity 40-44 feet (tools dropped)
46-50	Ls, l gy; sp bleach
50-56	Ls, l br; c alter
56-58	Ls, l gy
58-62	Ls, l br, gy; sp-c qz; c-ab mica; c alter
62-80	Ls, l-m gy
80-96	No sample – water

Assays

Depth (feet)	Beryllium percent BeO (field berylometer)	Depth (feet)	Tungsten percent WO_3 (est. under U-V lamp)
10-14	tr+	18-22	0.25-0.50
54-56	0.04	28-40	0.10-0.25
58-62	0.04-0.05	40-44	No sample
70-76	0.04	44-48	0.10-0.25
		56-58	0.10-0.25
		58-60	0.25-0.50
		60-62	0.10-0.25
		62-64	0.25-0.50
		64-70	0.10-0.25
		70-80	0.25-0.50
		80-96	No sample

Drill Hole No. 5
Collar Elevation: 5,751 feet
Total Depth: 160 feet

Depth (feet)	Description
0-32	Ls, l, dr gy; sp alter; ab qz 12-14 feet
32-36	Ls, l br, by; ab alter
36-40	Ls, l, dr gy
40-44	Ls, l br, l gy; c Fe stn
44-46	Ls, l gy
46-66	Ls, br, l br; c qz; c Fe stn
66-72	Ls, l gy
72-82	Ls, l br; c qz 72-74 feet
82-84	Ls, l, m gy
84-92	Ls, l, m br; ab alter; c qz 90-92 feet
92-94	Ls, m, dr gy
94-104	Ls, mostly l br; c-ab alter
104-108	Ls, l, m gy
108-112	Ls, l br; c alter
112-116	Ls, l, m gy; sp alter
116-128	Ls, mostly br; ab mica; c-ab qz; ab alter
128-130	Qz (95%)
130-142	Ls, br; c-ab qz; c br mica; ab alter
142-146	Qz, wh; ab br mica
146-152	Ls, br, gy; ab br mica; c-ab qz
152-156	Sch and ls, blk; ab pyrite
156-160	Sch, l br; c pyrite

Assays

Depth (feet)	Beryllium percent BeO (field berylometer)	Depth (feet)	Tungsten percent WO_3 (est. under U-V lamp)
8-10	0.06	118-134	0.25-0.50
28-42	tr+	134-142	0.10-0.25
42-52	0.03	142-150	0.25-0.50
70-72	0.03-0.04		
114-116	0.04		
120-126	0.04-0.05		
128-130	0.04		
142-144	0.04		
150-152	0.05		
154-156	0.17		

Drill Hole No. 6
Collar Elevation: 5,840 feet
Total Depth: 272 feet

Depth (feet)	Description
0-16	Sch, gy
16-39	Sch, r-br; qz vein 24-26 feet
39-44	Qz, wh
44-46	Ls and sch, gy; contact 45 feet
46-64	Ls, l, dr gy; 20% alter
64-74	Ls and shale, r br; s gy ls; ab alter and Fe stn
74-82	Ls, gy, br; 40% alter
82-90	Ls, L, dr gy
90-91	Ls, br; ab alter
91-95	Qz, wh
95-97	Ls, br; ab alter
97-98	Ls, l m gy

Drill Hole No. 6 (continued)

Depth (feet)	Description
98-126	Ls, l gy; ab bleach
126-134	Ls, l br; qz vein 129-130; ab alter
134-139	Ls, l br, gy; 50% alter
139-141	Qz, wh; Fe stnd
141-142	Ls, l br; ab alter
142-147	Qz, wh
147-150	Ls, br, l gy; ab alter and Fe stn
150-164	Qz, wh (75%); ab wh and br mica; sp br ls
164-173	Ls, l br, l-m gy, and wh; 40% alter
173-179	Qz (80%); sp fluorite; c "Black Jack" sphalerite (est. 6-8% ZnS)
179-182	Ls, l gy, bf; ab qz, wh and br mica; ab alter
182-218	Ls, l, m gy; local qz and mica stringers; silicified in part
218-224	Ls, wh, l gy; c blch; c wh mica
224-238	Ls, l, m gy; drilled hard
238-242	Ls, l gy, bf; c blch; c alter
242-252	Ls, l gy; qz 244-245 feet; cuttings moist; c-ab pyrite
252-272	Ls, l gy; ab pyrite; cuttings very wet – poor sample

Assays

Depth (feet)	Beryllium percent BeO (field berylometer)	Depth (feet)	Tungsten percent WO_3 (est. under U-V lamp)
6-8	0.04	42-46	0.25-0.50
24-26	0.06	148-152	0.25-0.50
28-34	0.05	152-154	0.50-1.00+
40-42	0.06	154-156	0.10-0.25
54-56	0.03	156-158	0.50-1.00+
70-74	0.04	158-166	0.10-0.25
146-148	0.03	172-178	0.25-0.50
162-164	0.03	178-182	0.10-0.25
222-224	0.03	212-214	0.10-0.25
240-242	0.04	244-248	0.10-0.25
250-252	0.03		

Drill Hole No. 7
Collar Elevation: 5,746 feet
Total Depth: 146 feet

Depth (feet)	Description
0-12	Surficial
12-32	Sch, br, gy-br
32-34	Sch, br; ab qz
34-105	Sch, br, gy-br
105-108	Ls, l gy; ab amphibole
108-114	Ls, l gy; ab qz
114-118	Ls, l br; ab alter; water at 118 feet
118-120	Ls, br, and qz
120-138	Ls, l, m gy c-ab qz
138-142	Ls, l gy and qz; sp pyrite
142-146	Ls, gy; sp-c pyrite (samples from 118-146 feet washed before logging)

Drill Hole No. 7 (continued)

Assays

Depth (feet)	Beryllium percent BeO (field berylometer)	Depth (feet)	Tungsten percent WO_3 (est. under U-V lamp)
2-4	tr+		
16-18	tr+		
20-22	0.05		
36-38	0.05		
50-52	tr+		Only a few traces
54-56	tr+		in drill hole samples
56-60	tr+		
70-72	0.05		
106-108	0.04		
112-114	0.08		
132-134	0.06		

Drill Hole No. 8
Collar Elevation: 5,749 feet
Total Depth: 74 feet

Depth (feet)	Description
0-2	Surficial
2-8	Sch, gy
8-10	Sch, br; ab br mica
10-12	Qz (80%); c gy ls, amphibole, br mica
12-20	Ls, l, m gy and br mica
20-24	Qz (60%); c br ls and br mica
24-28	Ls, l m gy
28-44	Ls, mostly br; ab wh and br mica; c qz
44-50	Ls, dr, l gy, wh (selective bleaching along bedding)
50-74	Ls, l m gy

Assays

Depth (feet)	Beryllium percent BeO (field berylometer)	Depth (feet)	Tungsten percent WO_3 (est. under U-V lamp)
2-4	0.03		Only a few traces other
8-12	0.07		than:
34-42	0.05		
48-50	0.06	8-10	0.25-0.50
56-58	0.06	22-26	0.10-0.25
64-68	0.09	54-56	0.10-0.25

Drill Hole No. 9
Collar Elevation: 5,823 feet
Total Depth: 144 feet

Depth (feet)	Description
0-8	Ls, gy, and br sch; sp-c amphibole, qz
8-14	Ls, m gy
14-22	Ls, l br, l gy; 40% alter
22-24	Ls, m gy
24-28	Ls, l br, l gy; ab alter

Drill Hole No. 9 (continued)

Depth (feet)	Description
28-30	Ls, m dr gy
30-32	Ls, l br; ab alter
32-42	Ls, m gy
42-46	Ls, l br, l gy; ab alter
46-58	Ls, l, m gy
58-79	Ls, br; ab br mica; c qz; ab alter
79-82	Ls, l, m gy; siliceous
82-84	Ls, l br; ab alter
84-88	Ls, l, m gy
88-92	Ls, l br, br; c alter
92-94	Ls, l gy, siliceous
94-102	Ls, l br, bf, wh; ab qz; ab bleach
102-116	Ls, l gy, l br; sp-c alter; siliceous
116-114	Ls, l gy, drilled uncommonly east

Assays

Depth (feet)	Beryllium percent BeO (field berylometer)	Depth (feet)	Tungsten percent WO_3 (est. under U-V lamp)
18-20	0.04		
26-28	0.07		
44-48	0.03		
70-72	0.12		Only a few traces
76-78	0.05		in drill hole samples
82-84	0.10		
86-90	0.05		
112-114	0.04		
122-124	0.05		

UTAH GEOLOGICAL AND MINERALOGICAL SURVEY

103 Utah Geological Survey Building
University of Utah
Salt Lake City, Utah 84112

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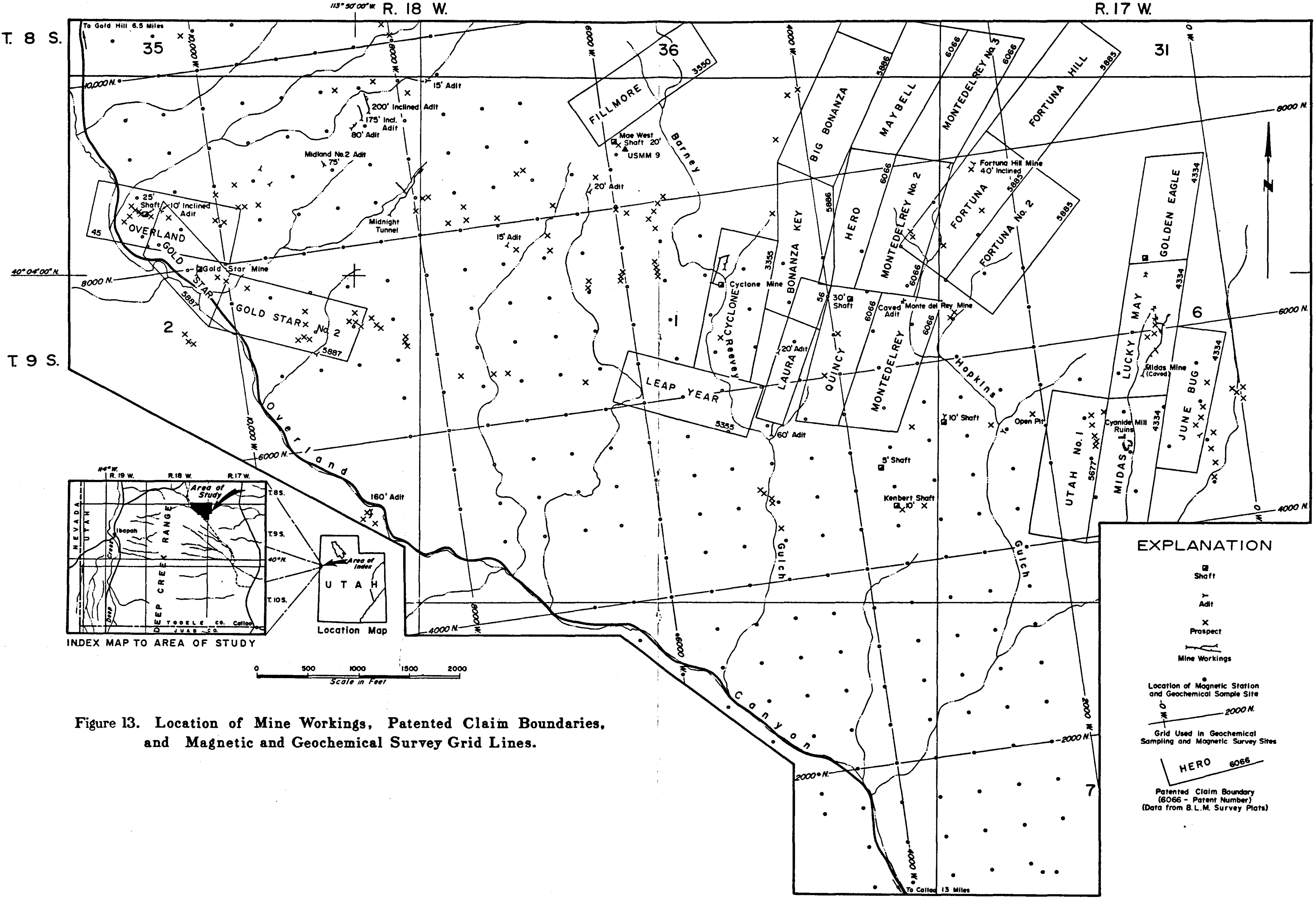

Figure 13. Location of Mine Workings, Patented Claim Boundaries, and Magnetic and Geochemical Survey Grid Lines.

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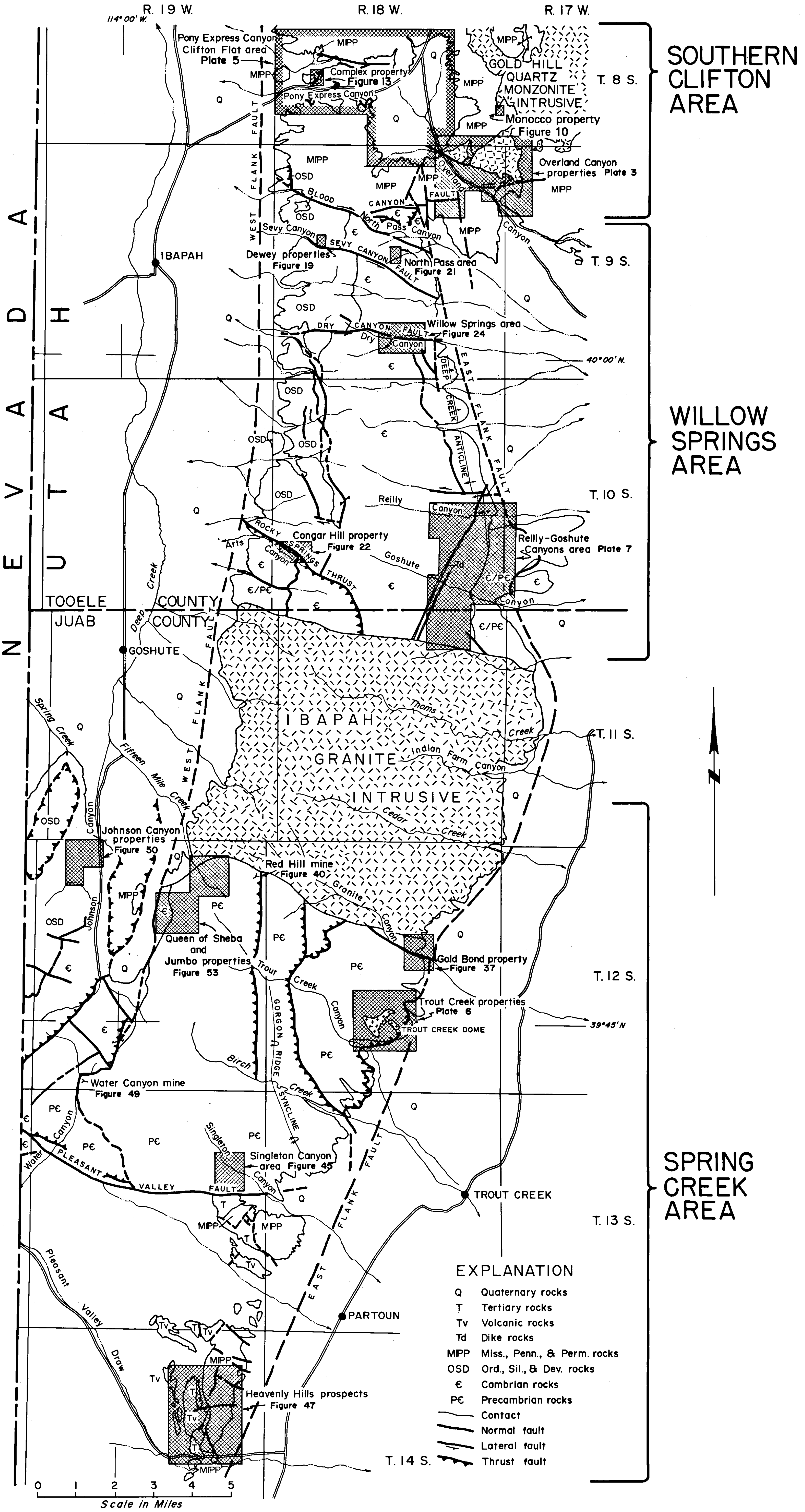

Index Map to Mining Areas and Structures in the Deep Creek Mountains

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BULLETIN 99 Plate 2

GEOLOGIC MAP OF THE DEEP CREEK MOUNTAINS

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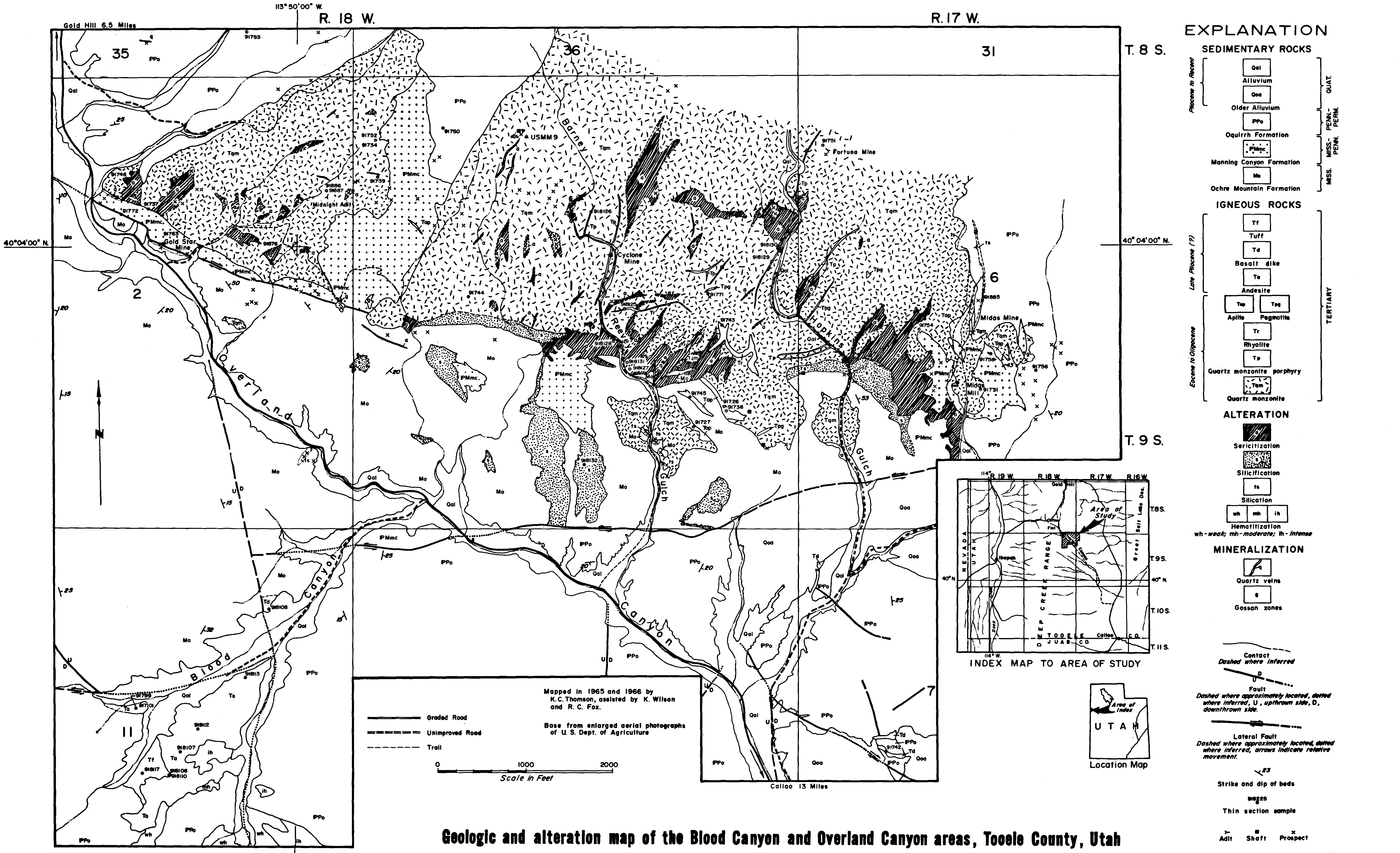

Geologic and alteration map of the Blood Canyon and Overland Canyon areas, Tooele County, Utah

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BULLETIN 99 PLATE 4

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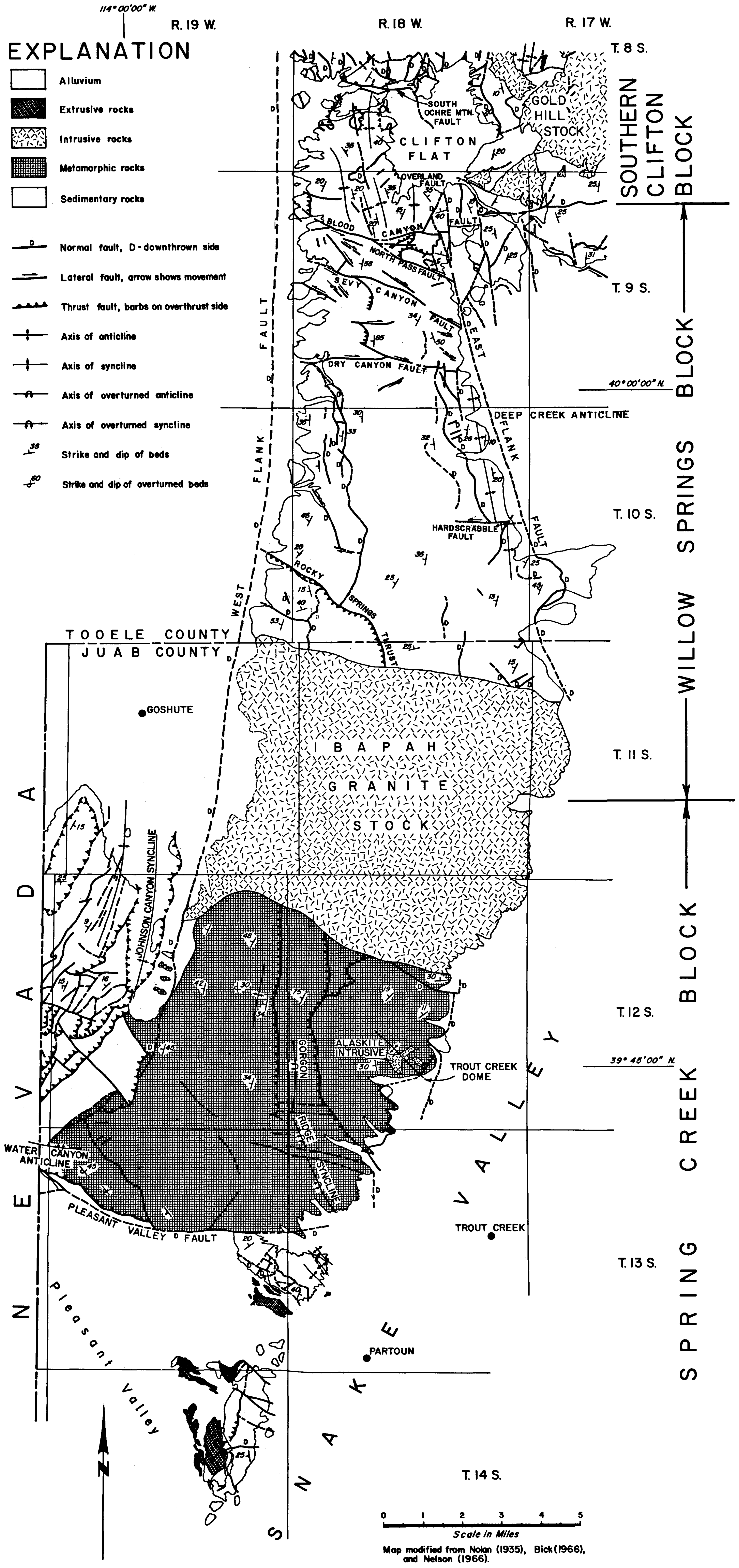

TECTONIC MAP OF THE DEEP CREEK MOUNTAINS

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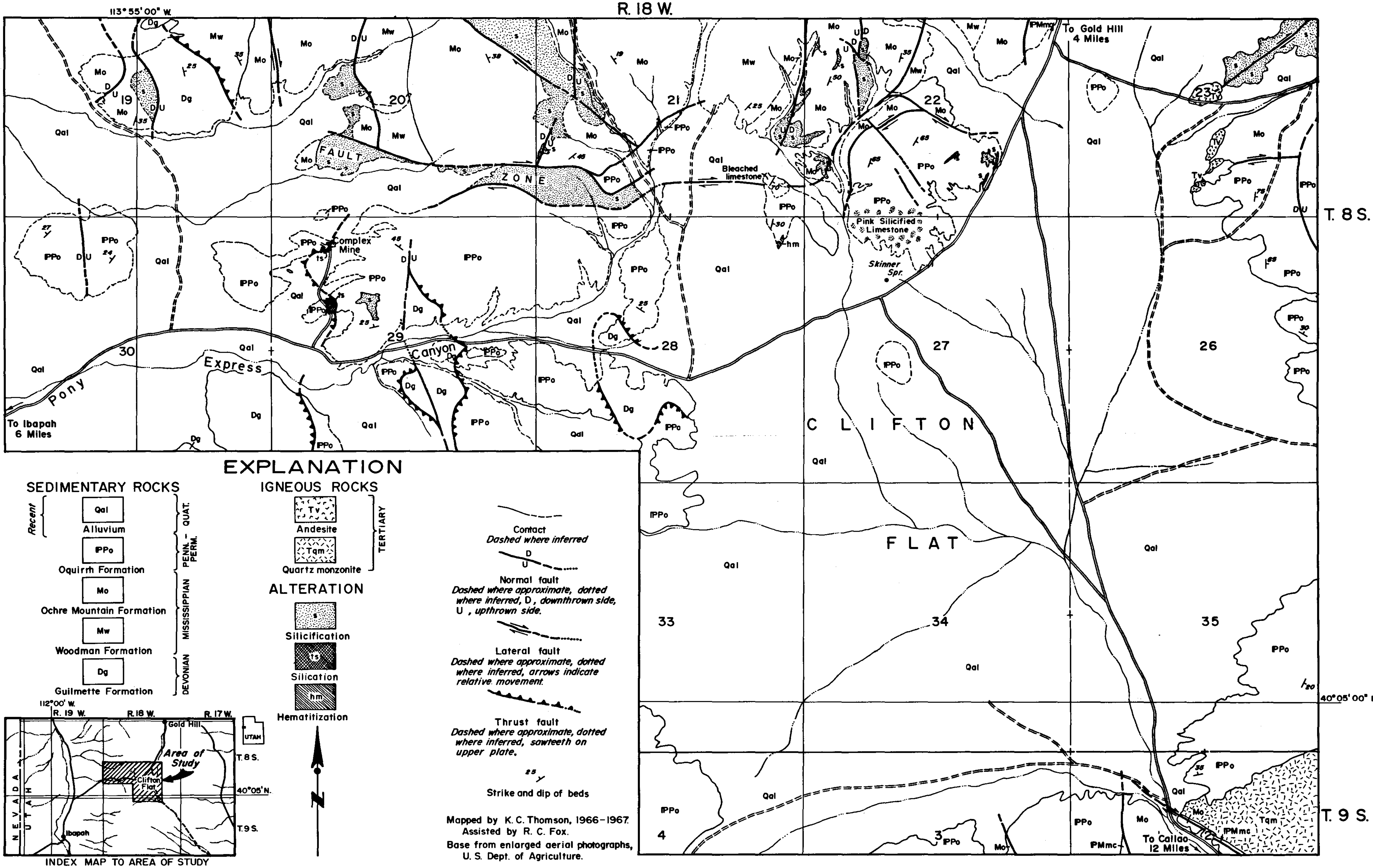
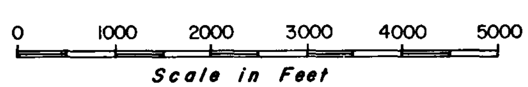


Geologic and Alteration Map of Clifton Flat, Pony Express Canyon, and Vicinity, Tooele County, Utah.



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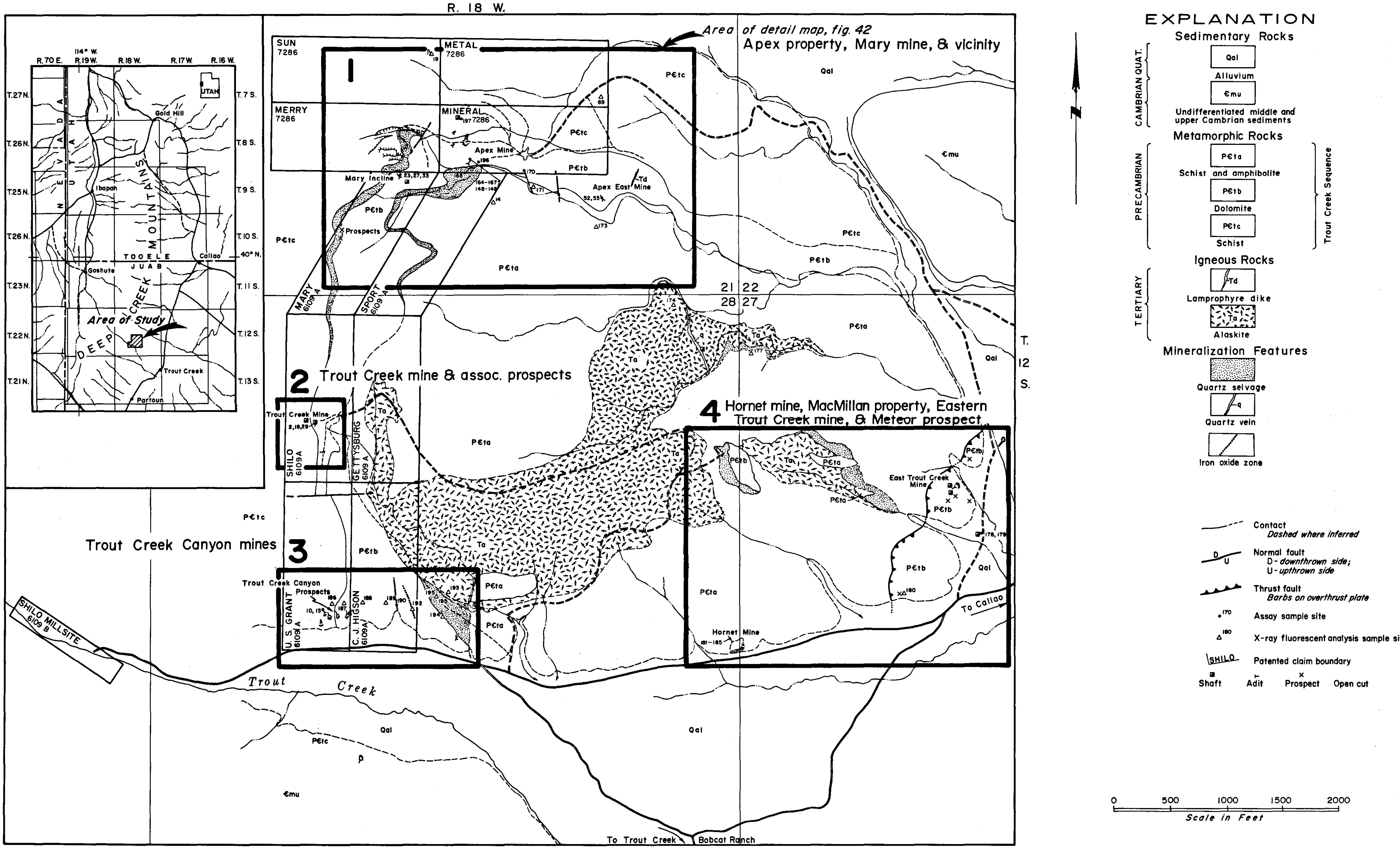

Geologic Map and Assay Sample Sites in the Trout Creek Area, Juab County

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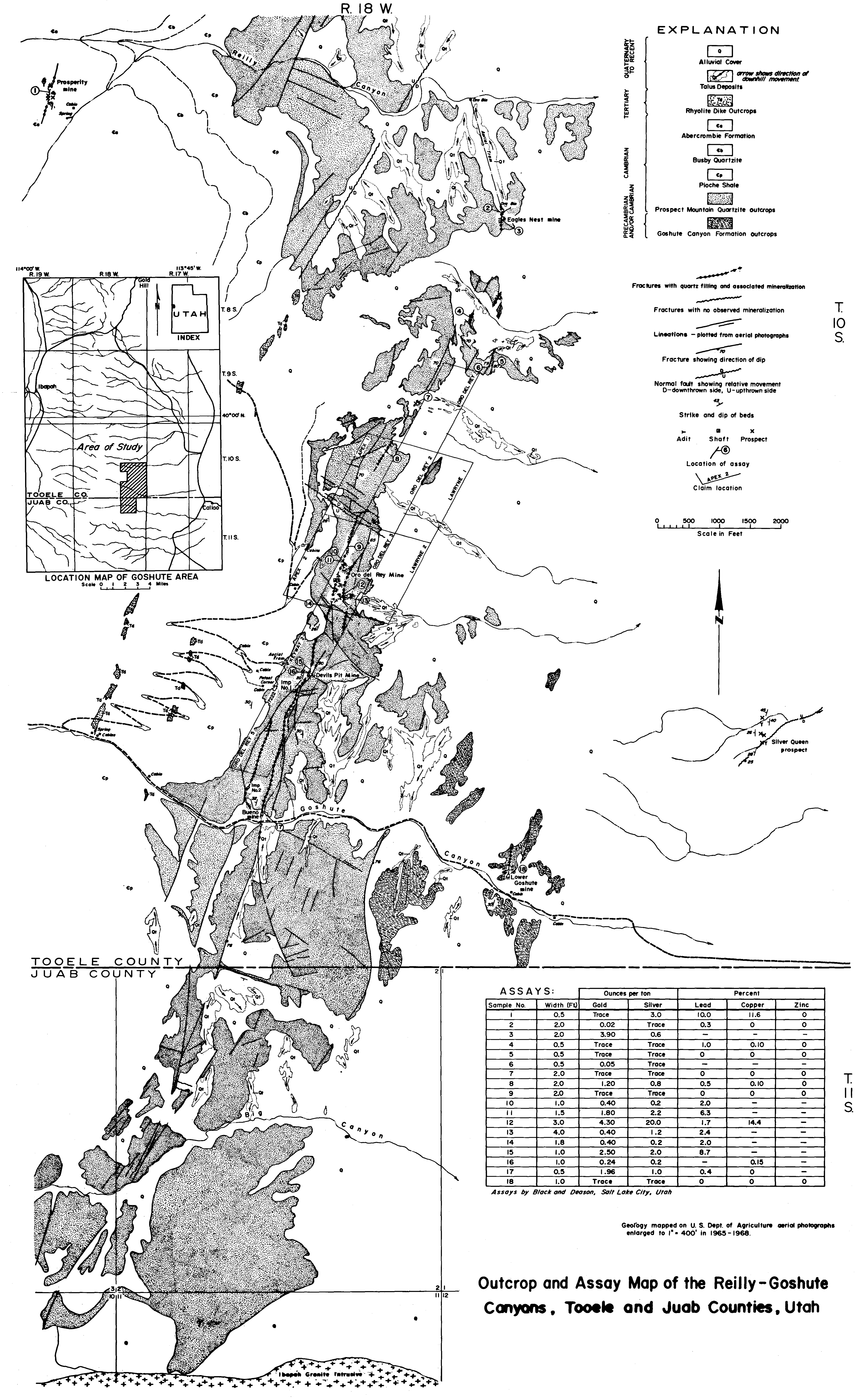

ASSAYS:		Ounces per ton		Percent		
Sample No.	Width (Ft)	Gold	Silver	Lead	Copper	Zinc
1	0.5	Trace	3.0	10.0	11.6	0
2	2.0	0.02	Trace	0.3	0	0
3	2.0	3.90	0.6	–	–	–
4	0.5	Trace	Trace	1.0	0.10	0
5	0.5	Trace	Trace	0	0	0
6	0.5	0.05	Trace	–	–	–
7	2.0	Trace	Trace	0	0	0
8	2.0	1.20	0.8	0.5	0.10	0
9	2.0	Trace	Trace	0	0	0
10	1.0	0.40	0.2	2.0	–	–
11	1.5	1.80	2.2	6.3	–	–
12	3.0	4.30	20.0	1.7	14.4	–
13	4.0	0.40	1.2	2.4	–	–
14	1.8	0.40	0.2	2.0	–	–
15	1.0	2.50	2.0	8.7	–	–
16	1.0	0.24	0.2	–	0.15	–
17	0.5	1.96	1.0	0.4	0	–
18	1.0	Trace	Trace	0	0	0

Assays by Black and Deason, Salt Lake City, Utah

Geology mapped on U. S. Dept. of Agriculture aerial photographs enlarged to 1" = 400' in 1965-1968.

Outcrop and Assay Map of the Reilly-Goshute Canyons, Tooele and Juab Counties, Utah