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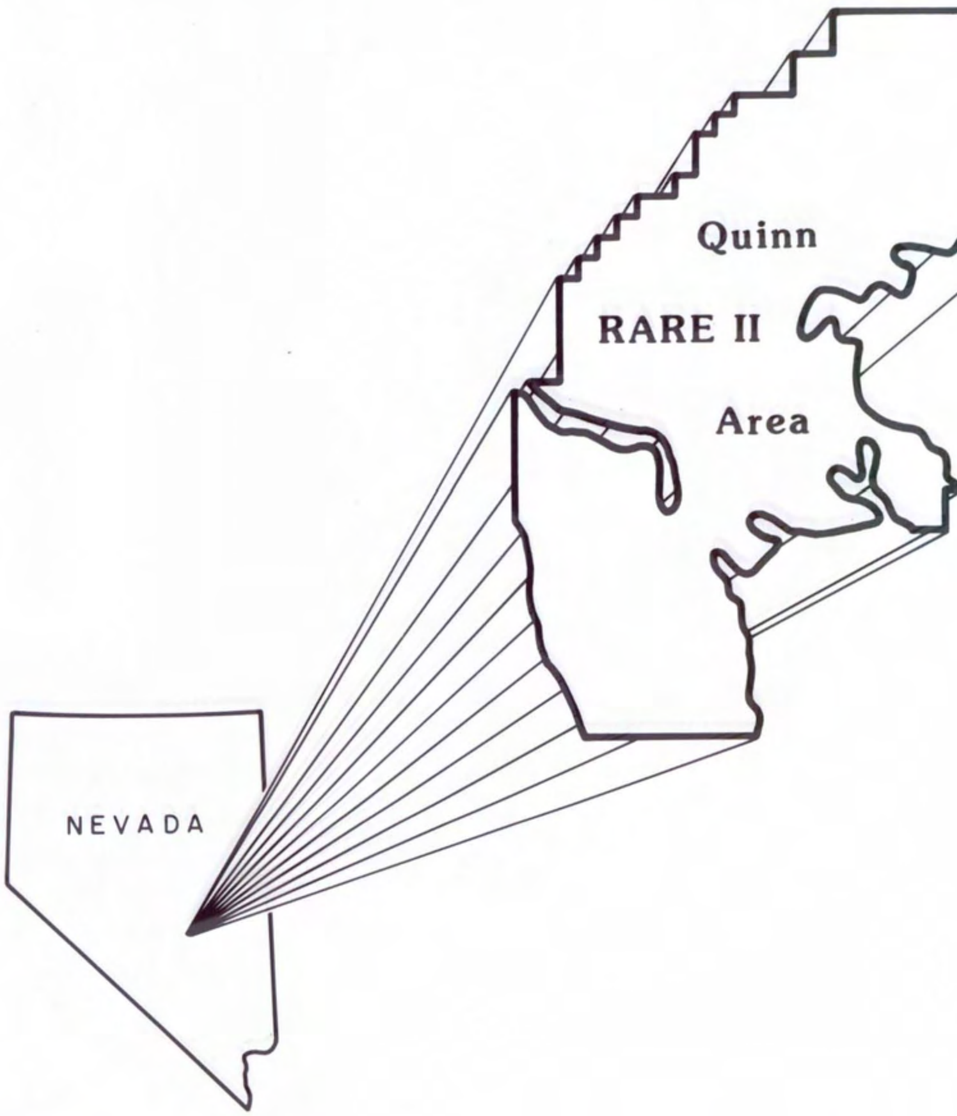
Mineral Land Assessment
Open File Report/1988

Mineral Resources of the Quinn RARE II Area, Lincoln and Nye Counties, Nevada



BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL RESOURCES OF THE QUINN RARE II AREA, LINCOLN AND NYE COUNTIES, NEVADA

by

John R. Thompson

MLA 49-88
1988

Intermountain Field Operations Center
Denver, Colorado

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

BUREAU OF MINES
T S Ary, Director

PREFACE

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine the mineral values, if any, that may be present. Results must be made available to the public and be submitted to the President and Congress. This report presents the results of a mineral survey of the Quinn Recommended Wilderness Area, Humbolt National Forest, Lincoln and Nye Counties, Nevada. The area was classified as a wilderness recommended area during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

This open-file report presents the results of a Bureau of Mines wilderness study. The report is preliminary and has not been edited or reviewed for conformity with the Bureau of Mines editorial standards. This study was conducted by personnel from the Branch of Resource Evaluation, Intermountain Field Operations Center, P.O. Box 25086, Denver Federal Center, Denver, CO 80225.

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UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

°	degree
°F	degree, Fahrenheit
ft	foot
in.	inch
mi	mile
m.y.	million years
m.y.b.p.	million years before present
ppb	part per billion
ppm	part per million
%	percent
lb	pound
st	short ton
sq mi	square mile
oz/st	troy ounce per short ton

MINERAL RESOURCES OF THE QUINN RARE II AREA, LINCOLN AND NYE COUNTIES, NEVADA

by

John R. Thompson, Bureau of Mines

SUMMARY

The Quinn RARE II Area is in the Humboldt National Forest in Lincoln and Nye Counties, east-central Nevada. The study area covers about 102,600 acres recommended for wilderness under RARE II, 1979. During the summer of 1985, under authority of the Wilderness Act (Public Law 88-577), the Bureau of Mines mapped and sampled mines, prospects, and mineralized areas in and near the area to examine and appraise the mineral resources present.

The Quinn Canyon Range, which includes the Quinn RARE II Area, lies in the Basin and Range physiographic province. In the north part of the range, cliff-forming, Paleozoic limestone is the predominant rock type. The south part of the range contains Tertiary volcanic rocks. Mineralization in the study area is related to a mid-Tertiary granite pluton, intrusive dikes and Tertiary volcanics.

The east-central part of the range contains low-grade gold associated with fluorite, jasperoids and limestone. Except for fluorspar development, the area is largely unexplored. This area, adjacent to the eastern boundary of the study area, has the highest likelihood for exploration and development because of the indications for a large near-surface, low-grade gold deposit.

In the studied part of the Quinn Canyon Range, 12 mineralized areas were identified. Six areas that contain precious and base metals are inside the Quinn RARE II Area; six areas that contain fluorite are adjacent to or within 1 mile of the study area boundary. From north to south the six mineralized

areas inside the study area are Gold Canyon, Nyala Canyon, Willow Creek, Big Creek Canyon, North Fork Cottonwood Creek, and Badger Gulch.

Nyala Canyon, in the northwest part of the study area, is heavily mineralized with silver, gold, arsenic, lead and zinc concentrations in replacement zones in limestones. Identified subeconomic resources of gold and silver are present and may be amenable by surface-mining methods.

Lesser important areas are Willow Creek, just south of Nyala Canyon and Gold Canyon, just north of Nyala Canyon; both have many workings driven on quartz veins that contain traces of gold. The Melbourn Mine along Willow Creek, contains low-grade gold, but gold concentrations are too low and surface exposures are insufficient to estimate a resource for Willow Creek or Gold Creek.

On the east side of the study area, North Fork Cottonwood Creek and Badger Gulch contain sulfides bearing silver, gold, lead and zinc concentrations. No resource could be identified because of insufficient exposures, but a sulfide zone may extend between these areas, covered by Tertiary volcanics.

The six mineralized areas outside the Quinn RARE II Area are, counter-clockwise around the area: Water Canyon, Quinn Canyon, Davis Creek, South Fork Cottonwood Creek, Pine Creek and Sawmill Canyon. Each area contains fluorspar, an industrial commodity; the Water Canyon and Pine Creek areas produced fluorspar for several years.

Water Canyon, on the west side of the study area, five miles inside the National Forest, has been excluded from the study area by a cherry stem. Fluorspar occurs here in veins and was mined by underground methods. This area contains identified subeconomic resources of fluorite, that may extend into the study area.

At Pine Creek, near the east-central study area boundary, fluorite was mined from a replacement deposit in limestone by open-pit methods. This area contains an identified subeconomic resource of fluorite, but the resource does not appear to extend into the study area. Low-grade gold occurs with the fluorite, and may constitute a resource.

Sawmill Canyon is the northernmost mineralized area on the east side of the range. Low-grade fluorite and gold concentrations occur in jasperized limestone within and adjacent to the study area. No fluorite resource is identified, but the area contains low-grade gold concentrations and appears to be similiar geologically and mineralogically to the Relief Canyon gold deposit currently being mined in Pershing County, Nevada. Therefore, the Sawmill Canyon and Pine Creek areas have the highest likelihood for exploration and possible development of a large low-grade gold deposit.

The Quinn Canyon, Davis Creek, and South Fork Cottonwood Creek mineralized areas are just outside the southern boundaries of the study area. They contain high-grade fluorite in small, discontinuous veins, but there is no surface evidence that they extend inside the study area.

The Quinn Canyon RARE II Area was previously rated as having low oil and gas potential because the area is underlain almost entirely by Tertiary volcanic rocks. No geothermal leases cover the study area, and no hot springs were observed during the field investigation.

Identified subeconomic resources of sand, gravel, and limestone are present within the study area, but because of the remoteness of the area and the common occurrence of these industrial commodities throughout the region they are not likely to be developed, except for small local use.

INTRODUCTION

In the summer of 1985, the Bureau of Mines (Bureau) conducted a mineral investigation of the Quinn RARE II Wilderness Recommended Area, Lincoln and Nye Counties, Nevada, on lands administered by the U.S. Forest Service, Ely District Office. The Bureau surveys and studies mines, prospects, and mineralized areas to appraise the identified resources.

Geographic setting

The Quinn RARE II Area (study area) contains about 102,600 acres of Federal land in the Humboldt National Forest. The study area is located in Lincoln and Nye Counties in east-central Nevada (fig. 1).

The study area comprises most of the Quinn Canyon Range, a southwest extension of the north-trending Grant Range, and extends from Cherry Creek on the northeast to Quinn Canyon on the southwest. The study area is about 20 mi long and 11 mi wide. Garden Valley lies to the east and Railroad Valley lies to the west of the range.

Topography is rugged and mountainous with elevations ranging from 5,400 ft at the northwest corner of the area, to 10,185 ft near the head of Big Creek Canyon. Most streams are intermittent, but springs flow at several sites on the east and west sides of the range. Climate is arid. Sage brush covers low areas and pinyon-juniper woodlands cover upper slopes.

Distances to the largest cities in the region are Ely about 90 mi north, Tonopah about 80 mi west, and Las Vegas about 140 mi south. The nearest towns are Currant, 40 mi north of the west side of the range near the junction of Nyala Road and U.S. Highway 6, and Sunnyside, 40 mi northeast of the range on State Highway 318.

Access to the west side of the study area is by jeep and foot trails that lead from Nyala Road to major drainages. The east side is accessible by jeep

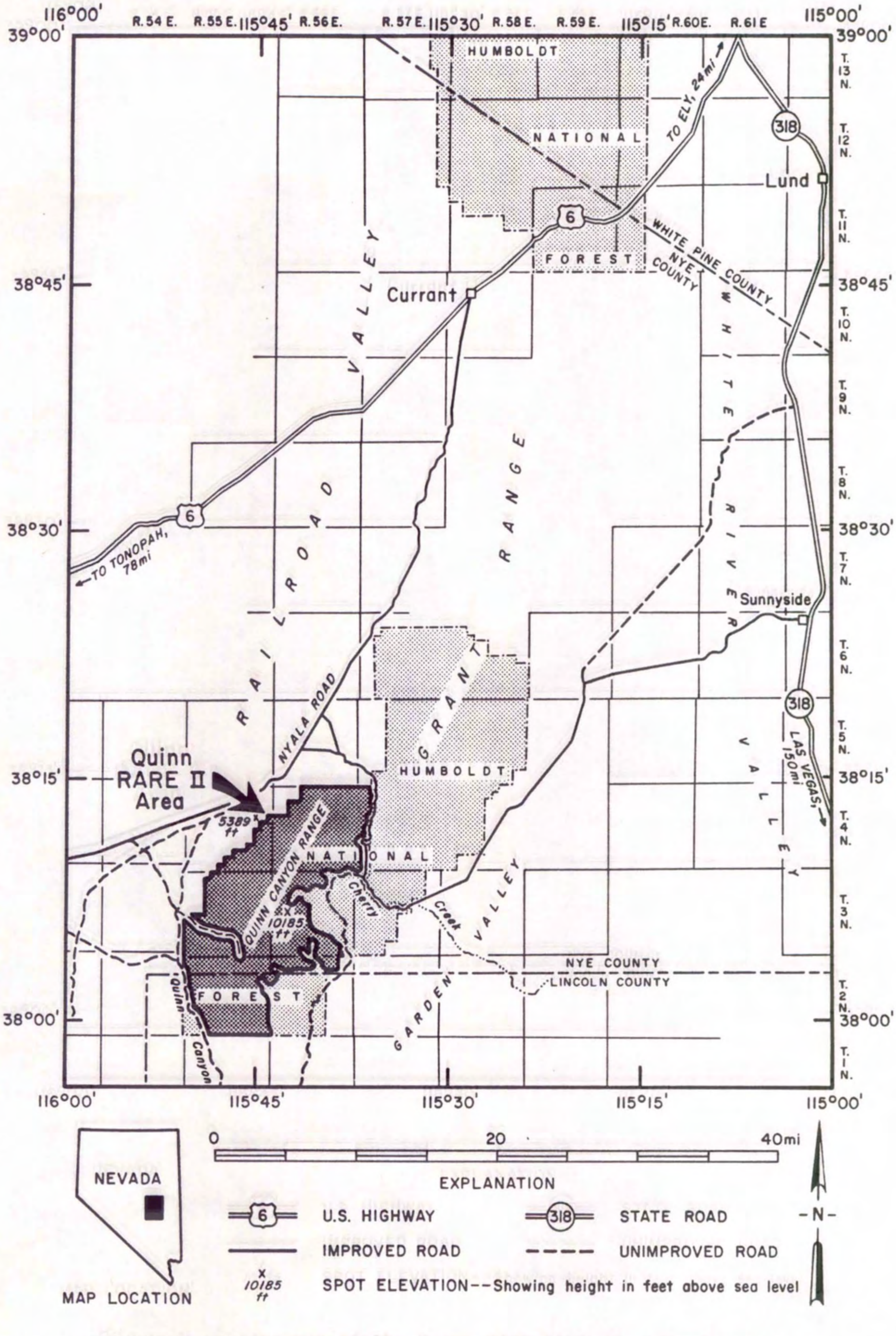

Figure 1.--Index map of the Quinn RARE II Area, Lincoln and Nye Counties, Nevada.

and foot trails that lead from gravel roads in Cherry Creek. The nearest paved roads are at Currant and Sunnyside.

Previous studies

The geology of the Quinn Canyon Range was discussed by Spurr (1905), who mapped eastern Nevada. Hill (1916) described the metal mining districts in the north part of the range. Sainsbury and Kleinhampl (1969) discussed the geology of the Quinn Canyon Range in their study of the fluorite deposits in the range. Papke (1979) mapped the fluorite prospects and deposits in the range in detail. Kleinhampl and Ziony (1985) added geologic details and age dating of igneous events in the area.

Methods of investigation

A detailed literature search for pertinent geologic and mining information was made by Bureau personnel prior to the field investigation. Bureau of Land Management (BLM) and county records were examined for locations of patented and unpatented mining claims, mineral leases, and oil and gas leases in and near the study area.

The field study concentrated on the examination of known mines, prospects, and mineralized areas inside and within 1 mi of the study area boundary. A total of 148 field days was spent studying the area.

All accessible mine and prospect workings were mapped and sampled. Chip samples were collected across veins, faults, dikes, and altered and mineralized rock outcrops. The strike and dip of structures were recorded where possible. At inaccessible workings, select samples of mineralized material and country rock were collected from dumps and stockpiles. Stream-sediment samples were taken from drainages to determine if mineralization extended beyond the known exposures.

A total of 743 samples were collected, including 682 rock samples and 61 stream-sediment samples. All rock samples were fire-assayed for gold and silver, and 676 samples were analyzed by inductively coupled plasma-atomic emission spectrometry for copper, molybdenum, lead, zinc, and other elements. Where fluorite was identified, samples were analyzed by the specific ion electrode method, and silica oxide was measured by fusion and gravimetric finish. Analyses were performed by the Bureau of Mines Reno Research Center, Reno, Nevada, and Bonder-Clegg Laboratories, Lakewood, Colorado. Analytical results in this report are listed as received from the laboratories.

Geology

The Quinn Canyon Range lies in the Great Basin section of the Basin and Range physiographic province. Features of this province include complex geology, recent faulting, and structural rather than erosional valleys.

Basin and range-type faults divide the Quinn Canyon Range into several structural blocks. In the north part of the range, cliff-forming Paleozoic limestone is the predominant rock type, where low-angle thrust faults have placed older rocks on younger (Kleinhampl and Ziony, 1985). The south part of the range contains extensively eroded Tertiary volcanic rocks (fig. 2).

A nearly complete sequence of Cambrian-age rocks crops out in the northwest part of the study area. Prospect Mountain Quartzite and Pioche Shale, consisting of argillites, limestone, and sandstone crop out in the north part of Gold Canyon. The Pole Canyon Limestone is thick-bedded, and lies conformably above the Pioche Shale in the mouths of Gold, Nyala, and Willow Canyons. Late Cambrian Dunderberg Shale, containing shale and silty limestone, crops out in the higher elevations of the Quinn Canyon Range. The Windfall Formation, consisting predominatly of thick-bedded limestone, crops

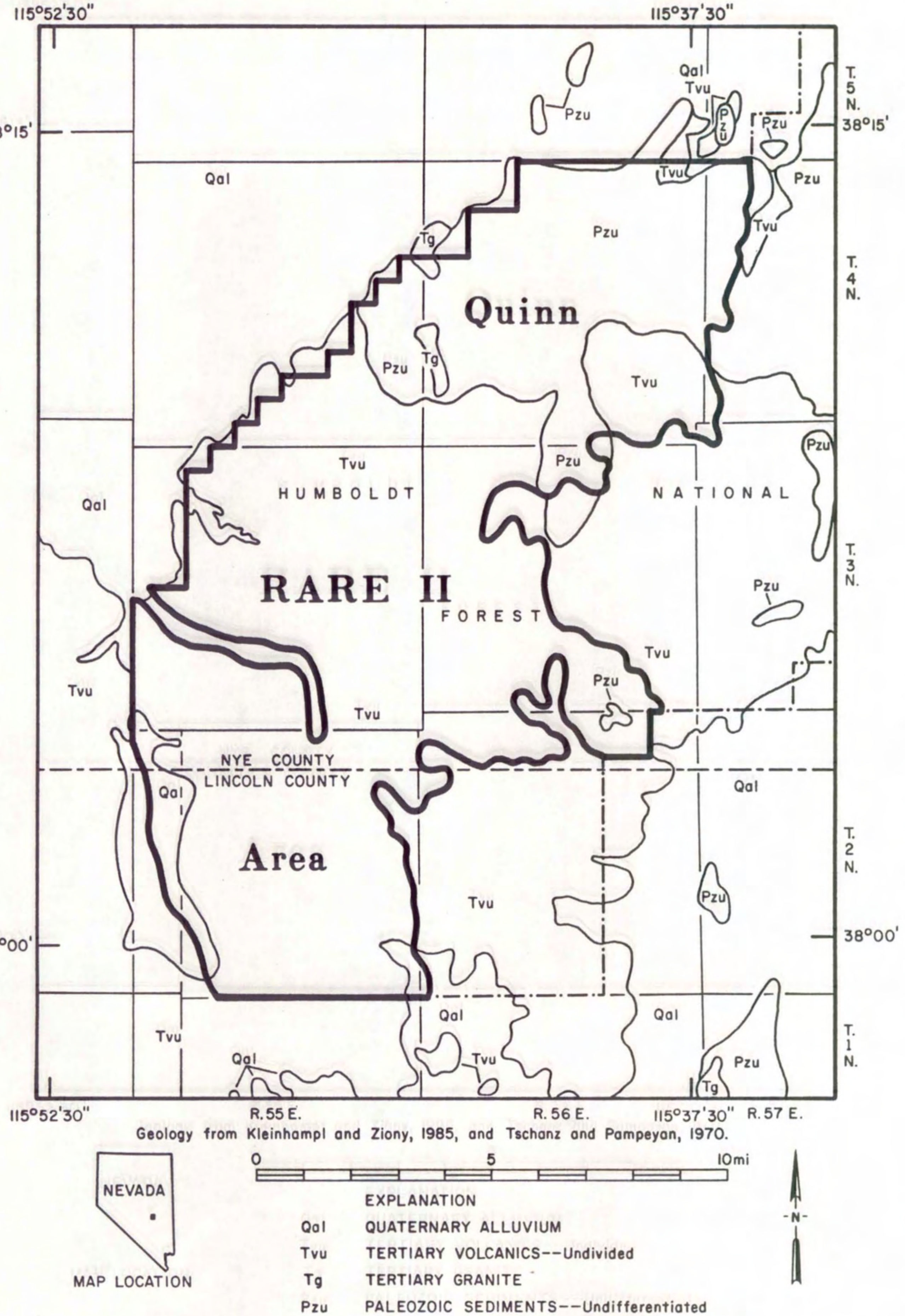

Figure 2.--Simplified geologic map of the Quinn RARE II Area.

out on the east side of the range. This cliff-forming limestone section is often considered to be in the lower part of the Pogonip Group. (See Kleinhampl and Ziony, 1985, p. 32-41.)

Ordovician-age strata consists predominately of carbonate facies of uniform thickness. The Pogonip Group contains thick-bedded massive limestone with abundant chert. The Middle Ordovician Eureka Quartzite crops out at Willow Creek and in Sawmill Canyon. Late Ordovician Ely Springs Dolomite, consisting of dark-gray to brownish black dolomite and local zones of conglomerate, is in Big Creek Canyon. (See Kleinhampl and Ziony, 1985, p. 46-55.)

The Silurian-age Laketown Dolomite, massive and poorly bedded, crops out in Big Creek Canyon. Devonian-age rocks crop out in the northeast section of the study area. Sevy Dolomite is a dense, thin-bedded dolomite containing sandstone in the uppermost part of the formation. Middle Devonian Simonson Dolomite is well-bedded dolomite that forms broken cliffs and steep slopes in Big Creek Canyon. (See Sainsbury and Kleinhampl, 1969.) The upper Paleozoic- and Mesozoic-age rocks have either been eroded or were not deposited.

The Tertiary-age rocks of the range include igneous and nonmarine sedimentary strata. The majority of the igneous rocks are extrusive rhyolites, including ash-flow and air-fall tuffs, and lavas. Intrusive rocks include a granitic stock and granitic and rhyolitic dikes.

Along Cherry Creek, basaltic dikes and flows occur along the valley. North of Willow Creek, andesite dikes cut through limestone, and similar dikes occur at other areas in the northern section. South of Big Creek Canyon, on the west side of the range, extensive rhyolite flows cover the Lower Paleozoic strata. In the Quinn Canyon Range, the volcanic rocks have not been studied extensively and several units have been grouped into mappable units (Kleinhampl and Ziony, 1985, p. 107).

The Oligocene-age Shingle Pass and Needles Range Formations, both welded tuffs, extend from Big Creek Canyon to Water Canyon on the west side of the range, and from Cherry Creek to Cottonwood Creek on the east. These units are at least 3,000-5,000 ft thick. The great thickness and other features led Sainsbury and Kleinhampl (1969) to conclude that the range was an eruptive center, but additional studies are necessary to determine which ash flows in the region were vented from the center. Rhyolitic welded tuffs, 22-23 m.y. old, that crop out locally in the Quinn Canyon Range, form one of the youngest ash-flow units in the region (Kleinhampl and Ziony, 1985, p. 110).

Rhyolitic dikes and irregular bodies of rhyolite and quartz latite porphyry, as much as several miles across, intrude parts of the ash-flow tuff section and are probably of Miocene-age. The rhyolite dikes are spatially, and in part, perhaps genetically associated with fluorite deposits in the south part of the range (Sainsbury and Kleinhampl, 1969, p. C7).

At Willow Creek, the granitic stock which crops out for about 1 mi^2 has been age dated at 26 ± 0.5 m.y.b.p., using the potassium-argon method on biotite (Kleinhampl and Ziony, 1985, p. 99). Mineralization at Willow Creek appears to have been associated with this stock.

The Sheep Pass Formation, a predominantly lacustrine sedimentary unit, contains the only documented Paleocene and Eocene sedimentary rocks in central Nevada. This formation forms much of the reservoir rock and is the source rock for oil in the Eagle Springs oil field in Railroad Valley. Outcrop distribution in the Grant and Quinn Canyon Ranges indicates that the depositional basin was quite broad here (Kleinhampl and Ziony, 1985, p. 106).

The Sheep Pass Formation may be present under the Oligocene volcanic rocks in the south part of the study area.

Basin and range-structure had not yet developed in the early Tertiary. Crustal extension in the region began in the early to middle Miocene. The beginning of large-scale, high-angle normal faulting was between 10-20 m.y. ago, however, most of the displacement on the high-angle faults took place during the past 7 m.y. (See Kleinhampl and Ziony, 1985, p. 145.) Scattered northwest- to west-striking faults of early Tertiary-age, oriented transverse to the dominant basin and range fault pattern, are exposed at several parts of the range. These types of faults are mineralized at several places in the study area.

The attitude of Cambrian rocks in the north end of the Quinn Canyon Range indicates a fault that trends generally east-west (Spurr, 1905, p. 69). Strike-slip movement along this fault may have shifted the Quinn Canyon Range west of the main part of the Grant Range. A 120-mi-long east-trending structural and stratigraphic discontinuity, the Warm Springs lineament, extends from the Nevada-California border through the Tonopah silver district, to Warm Springs, Nevada (Ekren and others, 1976, p. 4-5). If this lineament is traced further east, 40 mi across Railroad Valley, it would intercept the north end of the Quinn Canyon Range. The mineralized zones in the Quinn Canyon Range are similar to those in the Grant Range, but they are offset to the west. This is evidence for a strike-slip (right-handed) fault in this area, and would have been the latest major geologic event.

Mining history and activity

There are two mining districts in and near the study area. The Willow Creek district, in the northwest corner of the study area, includes the area just north of Gold Canyon, south to the ridge just south of Willow Creek. The first claims in the Willow Creek district were staked at Gold Canyon in 1911. In 1913, 40 tons of ore shipped from the area contained $320 of gold, and $2,600 of silver. In the Willow Creek drainage, free gold was discovered in the Melbourn vein in 1913. A 500 lb shipment of high-grade free-gold ore is said to have returned $39.40 per lb. (See Hill, 1916, p. 145-148.) This is equivalent to about 950 oz of gold.

The Quinn Canyon district includes fluorite deposits at Pine Creek, near the northeast part of the study area, and in Water Canyon and Sawmill Canyon on the west side of the study area. In Lincoln County, fluorite occurrences are near the southwest and southeast parts of the study area. In 1934, the first claims were staked at Pine Creek. Production from the district was estimated to be 29,500 tons between 1934 and 1971 (Papke, 1979, p. 48).

Recent mining activity in the Quinn Canyon Range centers around the Willow Creek mining district. Golden Mountain Mining Company has claims in Willow Creek and was studying the area in 1985. Two patented mining claims are inside the study area at Gold and Nyala Canyons, and one patented mining claim is near the boundary at Badger Gulch (pl. 1). Unpatented mining claims cover most of the mineralized areas. In 1985, geophysical exploration for oil and gas was being done in Railroad and Garden Valleys. Oil and gas lease applications cover the southwest part of the Quinn Canyon Range (fig. 3).

Energy resources

Oil, gas, and geothermal resources are present nearby and may be present in the study area. Nevada's first oil field at Eagle Springs was discovered in Railroad Valley by Shell Oil Co. in 1954. The Eagle Springs Oil Field, about 20 mi north of the study area, produces oil from fault traps in

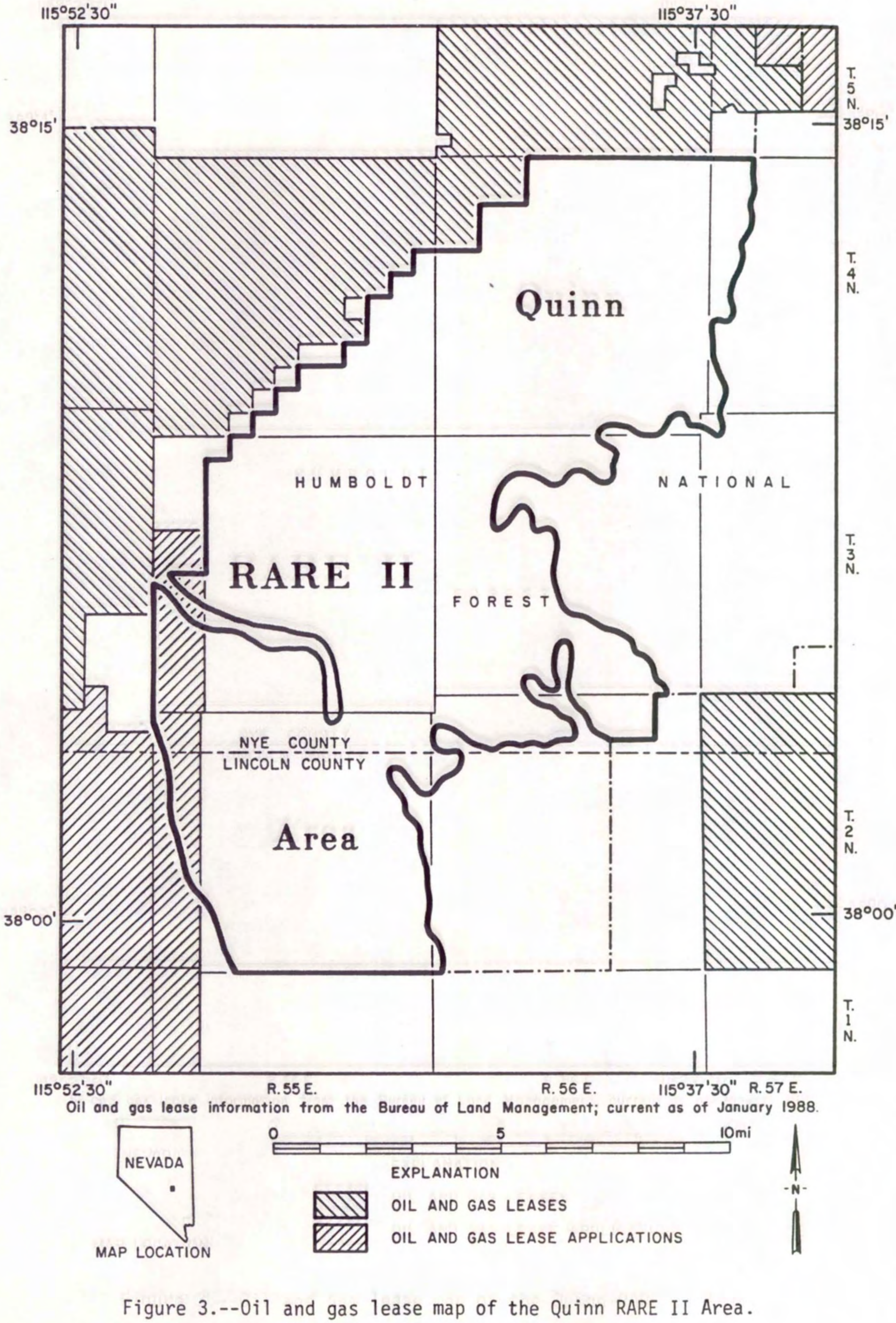

Figure 3.--Oil and gas lease map of the Quinn RARE II Area.

Oligocene volcanic rocks and the Sheep Pass Formation. The traps are sealed by Miocene-Recent valley fill sediments. Paleozoic rocks form a bottom seal, and the boundary fault that separates Railroad Valley from the Grant Range forms the east seal. The field is limited to the north and west by water beneath the oil column. (See Bortz and Murray, 1979.) The Eagle Springs field was used as a model in designing the exploration program that led to the discovery of the Trap Spring field, in the center of Railroad Valley.

The Quinn RARE II Area was rated as having low oil and gas potential by Sandberg (1983, p. H3) during his study of petroleum potential of wilderness lands in Nevada. This rating is based on the fact that the area contains mostly Tertiary volcanic rocks, except for several small patches of Paleozoic sedimentary rocks. Nothing is known about the maturation of possible source beds in the Paleozoic rocks, however, because of the presence of volcanic rocks, some of the Cretaceous to Tertiary source beds in the adjacent valleys may be thermally mature. (See Sandberg, 1983, p. H8.) Oil and gas leases cover the valleys on either side of the study area (fig. 3).

The Basin and Range physiographic province has characteristics that relate to geothermal sources including: high regional heat flow, thin crust, extensional faulting and seismicity, numerous thermal springs, thick thermally insulating basin-fill deposits, and young silicic volcanism. However, southcentral Nevada is marked by abnormally low heat flow--the so called Eureka Low--possibly caused by interbasin hydrologic heat drain through thick permeable carbonate sequences. (See Grose and Keller, 1979.)

Railroad Valley has several hot springs, and a geothermal area is on the eastern edge of the valley, north of the Quinn Canyon Range. Temperatures of thermal springs, in Railroad Valley, range from 84° to 160° F. Thermal springs and wells occur along the margins of this valley, on either side of the basin and range-faults. (See Garside and Schilling, 1979, p. 50-54.) Although there are numerous springs on the east and west flanks of the Quinn Canyon Range, the water temperature was not measured but felt cool and no sinter was noted. There are no geothermal leases in the study area.

APPRAISAL OF SITES EXAMINED

In this report, the mineralized areas discussed are named for the canyon in which they occur. Twelve areas of concentrated surface and underground workings were investigated; six contain precious and/or base metals; six contain fluorspar. The precious- and base-metal areas, mostly in the northwest and east parts of the range are: Gold Canyon, Nyala Canyon, Willow Creek, Big Creek Canyon, North Fork Cottonwood Creek, and Badger Gulch. The fluorspar areas, mostly to the east and southwest, are: Water Canyon, Quinn Canyon, Davis Creek, South Fork Cottonwood Creek, Pine Creek, and Sawmill Canyon (pl. 1). A summary of the geology, production, commodities, and resources of the mineralized areas is shown on Table 1.

Precious- and base-metal mineralized areas

Precious metals found in the Quinn Canyon Range are gold and silver, and the base metals are arsenic, copper, lead, molybdenum, and zinc. These metals are found in quartz veins, fault zones, and replacement zones related to intrusives. Most of these deposits occur in limestone, some in clastic sedimentary rocks; one deposit is on a rhyolite-limestone contact.

Gold Canyon

The Gold Canyon area is inside the northwest boundary of the study area (pl. 1). This area can be reached from the Nyala road by a jeep trail that extends up the main drainage, but is washed-out near the National Forest boundary (fig. 4A). Gold Canyon is the northernmost extent of mineralization in the Quinn Canyon Range. Mining occurred in three drainages, with the middle or main drainage containing the most workings. Steep, randomly oriented quartz veins cut Cambrian quartzite, and Cambrian and Ordovician limestone and dolomite.

The north drainage contains prospects (fig. 4A, B) on northeast-trending quartz veins. Samples from the prospects (no. 3-4, 6-25) contained as much as 0.03 oz/st gold, 0.5 oz/st silver, and slightly elevated concentrations of base metals (table 2). Iron-stained quartzite wall rock (sample no. 23) contained 0.02 oz/st gold and 0.1 oz/st silver.

The main drainage contains numerous workings on quartz veins (fig. 4A, no. 27, 29-84, 86-116), that are concentrated about 1/2 mi inside the study area. Near the National Forest boundary, an east-trending quartz vein is traceable for about 1,200 ft on the north side of the Canyon (fig. 4A, C, no. 29-43). Of 12 samples taken from the quartz vein, 6 contained gold concentrations ranging from a trace to 0.02 oz/st. Samples of limestone breccia, from the dump of a shaft (fig. 4A, no. 92-95), contained as much as 0.03 oz/st gold.

The small southern drainage contains four prospects in silicified limestone, intrusive dikes, and a quartz vein (fig. 4A, no. 119-125). Two samples from these workings contained as much as 0.1 oz/st silver (table 2).

Quartz veins of diverse orientation but limited extent were extensively prospected in Gold Canyon. Gold concentrations range as high as 0.07 oz/st, along with some silver and copper. Although gold is found in most of the structures, the concentration is too low and the structures too discontinuous to estimate an identified resource.

Nyala Canyon

Nyala Canyon, just south of Gold Canyon, is accessible from Nyala road by a four-wheel-drive trail that leads into two drainages (pl. 1). The northern jeep trail leads into the study area through the east area of Nyala Canyon. The southern trail leads to the west area of Nyala Canyon, along the RARE II boundary.

In Nyala Canyon, Cambrian limestones and dolomites are cut by gold- and silver- bearing quartz veins and fault zones. Some of the limestones have been heavily silicified. The structures strike northeast to northwest and dip steeply; vein thicknesses vary, but are generally less than 4 ft. Granitic dikes have intruded the limestones forming marble and localized skarns. Arsenopyrite is common, and sometimes occurs with sphalerite and galena. Oxidized and leached sulfides have formed gossans. The intrusions in the west part of Nyala Canyon may have supplied mineralizing hydrothermal solutions.

East area

The east area of Nyala Canyon contains an adit, 4 shafts, and 15 prospect pits (fig. 5A, no. 190-231). The adit (fig. 5B) crosscuts to a northwest-trending fault, and a sub-parallel quartz vein. Each of the seven samples of the fault and quartz vein contained precious- and base-metal concentrations. Four samples along the 45-ft-long drift on the fault assayed from 0.02 to 0.21 oz/st gold and 1.2 to 13.9 oz/st silver. Along the 30-ft-long drift on the quartz vein, three samples contained from 0.03 to 0.05 oz/st gold and 4.0 to 32.9 oz/st silver. Arsenic, lead, and zinc concentrations were relatively high in the fault and vein, as were concentrations of the trace elements barium, cadmium and antimony. An indicated subeconomic resource of 900 tons of 0.1 oz/st gold and 7 oz/st silver is estimated at this adit, and the tonnage would increase if the vein continues beyond its exposure.

Numerous prospect pits and shafts in the east part of Nyala Canyon have exposed many randomly oriented structures. Limestone near the mineralized structures has been heavily silicified. Four of six samples of the silicified limestone contained concentrations of precious- and base-metals, and one sample (no. 194) contained 0.21 oz/st gold and 2.1 oz/st silver (table 4). Limonite in veins, breccias, gossans, and fault zones also contain concentrations of precious- and base-metals. Sample no. 196, of a limonitic vein, contained 0.17 oz/st gold, and sample no. 200, of a limestone breccia, contained 16.2 oz/st silver.

A small gold and silver resource is in the east area of Nyala Canyon based on sample and geologic evidence. If the mineralization in the structures and in the country rock extends at depth, then this area may have possibilities for open pit mining. The high arsenic content, however, may present problems in treating the ore.

West area

In the west area of Nyala Canyon (fig. 5A, no. 127-189), gold concentrations are higher than the east area, but silver concentrations are lower. Two adits, 9 shafts and 23 prospect pits were dug on northeast- to northwest- trending quartz veins and fault zones. Granitic dikes have intruded into the limestones forming marble and weak zones for the emplacement of quartz veins. Arsenopyrite is abundant, along with sulfides, and is common to the veins and the intrusives.

Hill (1916) described the Rustler Mine and the Queen of the West prospect in the general area of Nyala Canyon, as replacement arsenopyrite and silver deposits in limestone along bedding planes. The information by Hill was not enough to determine the exact location of the discussed sites.

A concentration of workings is located near the center of the west area. Shafts were sunk on north- to northeast-trending quartz veins, dikes, and gossan zones (fig. 5C). The arsenopyrite that occurs with the quartz is massive and occurs with pyrite, hematite, and limonite. Sphalerite and galena also occur in the quartz, but are not as abundant as arsenopyrite. At the shafts, in-place sampling of mineralized material could not be reached from the surface, but abundant vein material was on the dumps. A select sample of sulfide-bearing quartz (table 3, no. 178) assayed 0.47 oz/st gold and 2.5 oz/st silver. A 1-ft-long chip sample of gossan (no. 165) contained 0.39 oz/st gold and 0.4 oz/st silver.

In the west part of these workings, a 140-ft-adit was driven on a sulfide-bearing quartz vein (fig. 5C, D). This may be the Rustler Mine of Hill (1916), as arsenopyrite was abundant here. A 2-ft-long chip sample (no. 151) of the vein assayed 0.26 oz/st gold and 1.5 oz/st silver. This adit contains an indicated subeconomic resource of 1,400 tons of 0.12 oz/st gold and 0.4 oz/st silver.

Other quartz veins and gossan zones in the west area contain concentrations of precious metals. Base-metal concentrations were not as consistent as the precious metals, but were higher than background (table 4). A select sample of massive arsenopyrite (fig. 5C, no. 166) contained 8.2 percent lead. Another arsenopyrite sample (fig. 5D, no. 149) contained 7.2 percent zinc. Concentrations of cadmium, nickel, and antimony are randomly distributed in samples from the west area. An inferred subeconomic resource of 50,000 tons containing 0.026 oz/st gold is in an area about 150 ft x 40 ft on fig. 5C, assuming a 50 ft mining depth. If the mineral concentration continues at depth, the Nyala Canyon mineralized area may be suitable for mining by surface methods, but the high arsenic concentrations would present problems in treating the ore.

Willow Creek

The Willow Creek mineralized area is on the west side of the range just south of Nyala Canyon. A jeep trail from Nyala road leads up the drainage and extends more than 1 mi into the study area. A foot trail continues up the drainage and provides access to the interior of the canyon (pl. 1).

Near the mouth of the canyon, a Tertiary granitic stock has intruded the Cambrian limestone and formed skarns. Further up the canyon, Cambrian and Ordovician limestones and dolomites are cut by steeply dipping, randomly oriented quartz veins, faults, and granitic dikes. Two types of mineral occurrence are in Willow Creek. One type is quartz veins carrying free gold closely associated with minor talc and calcite. The second type is limestone replacement along bedding planes near fissures (Hill, 1916, p. 148). The Willow Creek area has been heavily prospected, with most of the activity occuring in the early 1900's. Locations of the workings are shown on figure 6A. Hill (1916) described the major mines in the Willow Creek mining district when most of them were operating.

Over 250 samples were collected from mine workings in Willow Creek. A description of major workings and pertinent sample data for the Willow Creek area can be found on the table at the end of the Willow Creek section and on figs. 6 A-L, tables 5-7. Most of the mine workings contain only trace amounts of gold, but the gold concentrations in the mines increase southeastward near the head of Willow Creek.

Up the Willow Creek drainage (fig. 6A), on the north side, workings expose a northwest-trending quartz vein known as the Melbourn vein (fig. 6I). Hill (1916) described the Melbourn Mine, as a drift 150 ft long, with a 50 ft winze about 30 ft from the portal. Some beautiful specimens of native gold were seen at the mine during its operation. Most of the gold is associated with green talc, though some occurs in the quartz. (See Hill, 1916, p. 151.)

Since the 1916 report, the Melbourn Mine was developed by more drifts on the vein, and stopes and a winze on rich parts of the vein (fig. 6J). Crosscutting faults were explored by over 200 ft of drifts, and other structures were explored by crosscuts. The stopes were too steep to be sampled, but of 18 samples on the accessible vein, 11 contained gold ranging from a trace to 0.08 oz/st (table 6). The low gold content of samples between stopes show that the high-grade pockets in the mine may have been worked out. The size of the stopes indicates that additional high-grade pockets would be small. Other metal concentrations were low.

Just below the Melbourn Mine is a caved portal with a large dump and ore-storage bin (fig. 6I, no. 396-400). This may have been the haulage level for the Melbourn Mine. Two select samples from the dump and ore bin contained 0.37 and 0.36 oz/st gold (table 5, no. 395, 397). This is probably equivalent to ore that was found in the stopes and winzes of the Melbourn Mine. On the hill above the Melbourn Mine (fig. 6I, no. 444-458) are prospects, shafts, a caved adit, and a trench dug on the same or parallel quartz veins. Each sample of vein quartz contained at least a trace of gold, and a select sample of vein quartz contained 0.41 oz/st gold (table 5).

The Willow Creek area contains many workings, all driven on diversely oriented mineralized structures (fig. 7). The granite stock at the mouth of

Willow Creek can be considered as the source of mineralizing solutions for this area. The veins near the stock are thick and continuous, but do not contain concentrations of gold and silver. Perhaps the source of gold is an unexposed stock which would explain why the Melbourn area, near the head of the canyon, is the most mineralized. Resources of gold may exist at the Melbourn Mine, but this could not be confirmed because the stopes are inaccessible for sampling. Apparently, the northwest-striking faults in this area received more of the gold concentration than other veins in the canyon. No resources could be identified in Willow Creek at the available exposures.

Mine name, sample no.	Figure no.	Description	Workings	Sample data (highest value noted)
None, 235-239.	6B	Skarn zone, granite. Calcite vein.	20 ft adit 12 ft shaft.	Trace of gold, 230 ppm tungsten.
None, 273-277.	6C	Granite, limestone. Quartz vein.	60 ft adit	220 ppm zinc.
Mayflower, 256-272.	6D	Limestone, quartz veins.	220 ft adit	Trace of gold, 0.5 oz/ton silver.
None, 292-310.	6E	Limestone, quartz vein.	200 ft adit	Trace of gold, 150 ppm lead.
None, 327-348.	6F	Limestone, quartz vein.	6 adits, 5 prospects.	0.02 oz/ton gold, 62 ppm molybdenum.
None, 349-356.	6G	Limestone, quartz vein.	150 ft adit	210 ppm arsenic.
None, 372-393.	6H	Fractured limestone	280 ft adit	0.02 oz/ton gold, 300 ppm zinc.
Workings on Melbourne vein, 395-401, 444-458.	6I	Limestone, quartz veins.	2 adits, 4 shafts, 1 trench, 5 prospects.	0.41 oz/ton gold, 0.4 oz/ton silver.
Melbourne Mine, 401-443.	6J	Limestone, quartz vein.	660 ft adit with stopes and winzes.	0.08 oz/ton gold, 0.2 oz/ton silver.

Mine name, sample no.	Figure no.	Description	Workings	Sample data (highest value noted)
None, 459-472.	6K	Limestone, quartz vein.	70 ft adit with 70 ft winze.	Trace of gold, 0.27% arsenic.
None, 473-486.	6L	Limestone, quartz vein.	140 ft adit	0.03 oz/ton gold, 650 ppm lead.

Big Creek Canyon

Big Creek Canyon mineralized area is the next large drainage south of Willow Creek (pl. 1). A four-wheel-drive trail leads to the mouth of the canyon, but is washed out near the study area boundary.

The north side of the canyon consists of complexly faulted, Ordovician, Silurian, and Devonian limestones and dolomites, while the south side is mostly Tertiary rhyolite flows. The rhyolite strikes northwest and dips gently to the south. A major post-volcanic fault striking about N. 20° W. and dipping steeply to the south is present in the drainage bottom. North of the major post-volcanic fault, older faults in the Paleozoic rocks have no common trend. (See Sainsbury and Kleinhampl, 1969.)

Four prospect pits were found in this drainage (no. 495-496, 499-502, 504); two were dug on northeast-striking quartz veins in rhyolite, and two are on a northwest- striking fault (pl. 1). Outcrop samples were taken from altered rhyolite (no. 498, 503) and a quartz breccia (no. 505). No gold was detected in samples from the prospects or outcrops, and only one sample (no. 496) had detectable silver (table 8). Arsenic, molybdenum, lead, and zinc concentrations are slightly above the average abundance for igneous rocks (Levinson 1980, p. 43), but these concentrations are not high enough to be indicative of the presence of precious or base-metal deposits.

Big Creek Canyon is the major division between sedimentary rocks to the north and volcanics to the south. Abundant faulting in the area could have provided passage-ways for hydrothermal fluids, but since the structures in Big Creek Canyon do not contain appreciable concentrations of metals, they may have occured post-mineralization. No resource is identified in Big Creek Canyon.

North Fork Cottonwood Creek

Cottonwood Creek is on the east side of the study area and drains the highest peaks in the Quinn Canyon Range (pl. 1). Roads leading up Cottonwood Creek are deleted from the study area by cherry stems. Just south of the creek, workings have been dug on rhyolite and a small island of Devonian limestone. The limestone is partially brecciated and fractured, and rhyolite dikes have intruded several zones of weakness.

Workings consist of a 25-ft-deep shaft (no. 644-648) and four prospect pits (no. 649-657). At the shaft, a 4-ft-wide, vertical, altered zone in rhyolite strikes N. 10° W. The shaft was inaccessable, but select samples of the dump contained quartz with pyrite and galena. Gold concentrations in these samples ranged from 235 to 825 ppb, and silver ranged from 1.8 to 38.9 ppm. Lead content ranged from 617 ppm to 5.6%, and zinc from 512 to 4,200 ppm (table 9).

At the prospects, five samples were taken on four northwest-striking dikes (no. 653-657). As much as 395 ppb gold, 43 ppm silver, 1.7% lead and 1,086 ppm zinc were detected in these samples (table 9). A northeast-striking breccia zone in limestone contained 155 ppm lead, (no. 649-650) and a gossan zone and skarn (no. 651-652) contained as much as 1,197 ppm arsenic.

Concentrations of precious and base metals occur in northwest-trending structures, but not in northeast-trending breccia zones. The grade and width of the altered zone at the 25-ft-deep shaft suggests a resource could be present, but since the zone is not reachable from the surface no resource can be quantified.

Badger Gulch

Badger Gulch is on the east side of the range, and forms part of the eastern boundary of the study area (pl. 1). This mineralized area is 3 mi north of the North Fork Cottonwood Creek area. Country rock is Ordovician limestone that strikes east and dips steeply to the north. Limestone at the workings has been brecciated, and sulfide-mineral-forming solutions have deposited sulfides, including galena, chalcopyrite, pyrite, and bornite.

Mine workings were driven on a steeply dipping, west-trending, brecciated fault zone with abundant sulfides and hematite. Workings include a 100 to 200 ft adit that was flooded at the time of the investigation, a 40-ft-deep shaft, and several prospect pits and trenches. Along the west trend of the fault, one trench and two prospects (no. 672, 675, and 677) expose gossan that may be the oxidized or upper part of the sulfide zone.

The adit (no. 681-686) was not accessible, but select samples of vein calcite from the dump showed a maximum of 175 ppb gold, and 2.61 oz/st silver (table 10). The fault zone continues for about 300 ft, up the hill (west) from the adit, where it thins and horsetails to calcite stringers.

Gold concentrations in the Badger Gulch area are generally low; the highest content being 970 ppb. The highest gold concentration from an in-place sample (no. 676) was 305 ppb. Silver concentrations are erratic, ranging from 0.6 ppm to 51.74 oz/st. The highest gold and silver concentrations are in a select sample containing galena, chalcopyrite, sphalerite, and pyrite (no. 679). This sample also contained the highest base-metal concentrations; arsenic is greater than 2,000 ppm, copper is 3.48%, molybdenum is 128 ppm, lead is 16.3%, and zinc is 10% (table 10). Low base-metal concentrations are found in the limestone breccia.

The fault provided a channel-way and deposition zone for ore-forming solutions. Brecciated limestone shows that there was post-mineralization movement along the fault, as this breccia is barren of ore minerals. An inferred subeconomic resource of 15,000 tons containing 8 oz/st silver and 1% lead, with byproduct zinc, copper, and gold is estimated for the zone, and additional resources may be found at depth.

Badger Gulch and North Fork Cottonwood Canyon mineralized areas are the only two known sites on the east side of the range with base-metal-sulfide mineralization, and Nyala Canyon is the only known area on the west side of the Range that contains base-metal sulfides. All three areas are on a north trend and may be indicative of geologic structures buried beneath intervening Tertiary volcanics.

Fluorspar mineralized areas

Fluorspar is an industrial commodity composed principally of the mineral fluorite (CaF_2). It is used to make hydrofluoric acid for the aluminum and chemical industries, and is also important in the manufacture of steel, ceramics, and glass.

Fluorspar is marketed in three grades: acid, ceramic, and metallurgical. Acid-grade fluorspar contains a minimum of 97% CaF_2 and a maximum of 1.5% SiO_2 (silica). Limits are commonly placed on other common impurities such as calcite, sulfide sulfur, total sulfur, iron, lead, zinc, and phosphorus.

Ceramic-grade fluorspar varies according to consumer demands but generally contains 85-96% fluorite and has limits on silica, calcite, iron oxides, sulfide sulfur, lead, and zinc. Metallurgical-grade fluorspar (metspar) is commonly listed in market quotations as 60, 70, and 72.5 effective CaF_2 units. This unit measure is obtained by multiplying the silica content of the ore by 2.5 and subtracting this figure from the fluorite content of the ore. Acid-grade fluorspar can often be prepared by flotation; a mill test would be needed to show if this is feasible. (See Worl and others, 1973, p. 223.)

Fluorspar districts occur along and near tensional rifts and lineaments. Evidently large volumes of fluorine leaked upward from the lower crust or mantle along rift zones and other deep zones of weakness. Cenozoic volcanic rocks and fluorspar deposits are associated with these zones of weakness that extend deep into the earths crust and served as a channel-way for igneous rocks, fluorine, and ore-forming solutions. The Oregon-Nevada lineament is a Late Tertiary, northwest-trending belt of closely spaced, en echelon, normal-faults that stretches from north-central Oregon to central Nevada. A projection of this lineament, southeast from the Eureka district, Nevada, extends into the Quinn Canyon fluorspar district. (See Van Alstine, 1976, p. 983.)

The largest concentration of fluorspar in Nevada is in the Quinn Canyon mining district, where 17 occurrences or deposits are known (Papke, 1979, p. 48). Except for one deposit north of Cherry Creek, all the fluorspar areas are contiguous to but outside the study area. Fluorite occurs in limestone at the northeast part of the study area, and rhyolite is the host rock on the west, central, and southeast parts. The deposits appear to be hydrothermal in origin, and the fluorite occurs as veins and replacement deposits. For discussion, the fluorspar occurrences have been grouped into six areas: Water Canyon, Quinn Canyon, Davis Creek, South Fork Cottonwood Creek, Pine Creek, and Sawmill Canyon. All of these known fluorspar areas are adjacent to, and most have been deleted from the RARE II study area. Development has been precluded by the district's isolation and small size of the deposits.

Water Canyon

The Water Canyon area is about 5 mi inside the western boundary of the National Forest. The road leading to the mineralized area has been deleted from the study area by a cherry stem (pl. 1). Development in the area includes prospect pits, a 70-ft-long adit, and the Nyco Mine a 400-ft-adit with stoping. Three exploration drill sites were also found in Water Canyon above the adits. The host rock is a light-gray, Tertiary rhyolite porphyry.

The lower adit (fig. 8) was driven on a minor fault and exposes a small amount of fluorite. Most of the samples were barren of fluorite, but one sample (no. 523) contained 16% CaF_2, and 160 ppm molybdenum.

Papke (1979) states that the main adit was driven in 1951, and samples of all material removed averaged 51% CaF_2. Papke also estimated total production as 1,100 tons. According to Horton (1961, p. 18) 14 tons of ore containing 50% CaF_2 was shipped to the Kaiser Mill in Fallon, Nevada.

The main 400-ft-adit (fig. 9) was driven on a west-trending fluorite vein, that dips about 50° N. The vein is fractured in places and is from 1 to 4 ft thick, with an average thickness of 3 ft. Heavily timbered stopes occur on the vein near the portal. The vein is either offset or a parallel vein occurs after the stopes. Samples of the purple, green, and gray fluorite vein contained from 31% to 95% CaF_2, and from 2% to 52% SiO_2 (table 11).

The same vein was exposed uphill in outcrop and shallow prospect pits (fig. 9). The fluorite content at the surface was generally higher than underground, but the vein was thinner and often split into stringers. An indicated subeconomic resource of 19,000 tons of 58% CaF_2, and an inferred subeconomic resource of 35,000 tons of 58% CaF_2 is estimated for the Nyco Mine. This deposit could extend into the study area.

Quinn Canyon

The Quinn Canyon area is adjacent to the western boundary of the study area (pl. 1). Two known flourite occurrences are in this area; the Bruno workings in the north (no. 573-587), and the Rainbow workings in the south (no. 588-598). Host rock is Tertiary rhyolite.

At the northern part of the Bruno workings, a pit (no. 573-574) exposes a 0.8 ft fluorite vein and veinlets striking N. 28° W., and dipping 71° NE. in a two-ft-wide breccia zone. The vein contains 80.3% CaF_2 and 9.1% SiO_2 (table 12). The surrounding breccia contains 45.3% CaF_2 and 40.4% SiO_2. South of this pit, bulldozer scrapings are nearly covered by wind-blown soil (no. 575-578). Fluorite was seen in only one sample (no. 575) of rhyolite breccia, which contains 19.3% CaF_2 and 63.3% SiO_2.

At the central part of the Bruno workings, a shaft and two prospect pits (no. 579-582) expose a thin fluorite vein striking N. 33° E. that contains 86.6% CaF_2 (sample no. 580). A bulldozer pit, about 50 x 40 x 12 ft deep exposes a 1-ft-thick, N. 85° W. striking, fluorite vein containing 97.5% CaF_2 (no. 583).

At the southern part of the Bruno workings, a 25-ft-long bulldozer trench and two prospects expose northwest-striking fluorite veins (no. 584-587).

Fluorite concentration in the veins ranged from 54% to 95% CaF_2, and a rhyolite breccia sample contained 14.6% CaF_2.

At the Rainbow workings, south of the Bruno workings, the Rainbow Mine produced about 200 tons of high-grade fluorspar in the mid-1940's (Kral, 1951, p. 216). Country rock is a rhyolite tuff. The fluorspar vein at the Rainbow Mine strikes N. 20° E, and dips 40° NW., and thickness varies from 1 to 4 ft. The mine consists of a trench about 100 ft long and 8 ft deep. Samples taken by the Bureau of Mines in 1945 averaged 92.6% CaF_2 and 3.7% SiO_2. (See Papke, 1979, p. 56.)

The Rainbow Mine (no. 588-589) had been bulldozed and sloughed in since Papke's 1979 report. The only vein material found at the site during our investigation contained rhyolite and 37.8% CaF_2 (no. 588). Samples from the three northeast-striking veins exposed near the Rainbow Mine ranged from 18% to 81% CaF_2 (no. 592, 595, 597). A north-striking vein (no. 594) at one site contained 76% CaF_2 (table 12).

A trace of gold was found in 7 of 25 samples from the Quinn Canyon area, and one sample (no. 579) contained 0.02 oz/st gold. Silver was detected in 19 of the 25 samples; concentrations ranged from 0.1 to 0.3 oz/st. The Quinn Canyon area is on the upthrown side of a north-trending fault mapped by Sainsbury and Kleinhampl (1969). No workings or fluorite were found in the downthrown block, which is in the study area.

The Bruno workings contain some veins with high grade fluorite, but the veins are too thin to estimate an identified resource. The Rainbow Mine also contains some veins with high-grade fluorite, but the veins pinch out a short distance along strike. The northeast-striking veins trend toward the study area, but could not be traced beyond the workings. Precious metal concentration in some samples is of geological and geochemical interest, and could indicate additional mineralization.

Davis Creek

The Davis Creek area is on the southeast side of the range, about 1 mi outside the study area (pl. 1). This area is divided into four fluorite prospects: the Emerald, Shannon Queen, Blue Bell, and Sunbeam. Workings in the Davis Creek area consist of two bulldozed sites and two prospect pits that are dug on fluorite-bearing veins in Tertiary rhyolite (no. 611-619).

The southernmost working is the Emerald prospect, which is in porphyritic rhyolite (no. 611-612). A vertical, 2-ft-wide fluorite vein striking N. 70° E. was exposed but could not be traced for more than 3 ft. A select sample (table 13, no. 611) of the vein contained 38.2% CaF_2 and 51.5% SiO_2.

The Shannon Queen prospect (no. 613) is 1 mi east of the Emerald prospect. The host rock is an iron-stained rhyolite with five quartz veins containing some fluorite. The veins strike easterly and form an en echelon pattern for about 500 ft in a northeast direction in a poorly defined alteration zone. The veins are thick, but none can be traced more than 100 ft. A sample (no. 613) from a pit on a 4-ft-wide, east-striking fluorite-quartz vein contained 65.8% CaF_2 and 21.5% SiO_2.

The Blue Bell prospect is northeast of the Shannon Queen prospect in rhyolite tuff (no. 614-618). The working consists of a cut on the side of a mountain, exposing an east-trending fluorite-breccia zone (fig. 10). The fluorite zone is 150 ft x 40 ft, and the north side is a vertical face 65 ft high (Papke, 1979, p. 58). A sample from the area contained 88.8% CaF_2 and 3.0% SiO_2. The rhyolite breccia and fault gouge also contained moderate concentrations of fluorite. Arsenic and lead concentrations were relatively high, ranging from 147 ppm to 823 ppm and 149 ppm to 572 ppm respectively (fig. 10).

The Sunbeam prospect (no. 619) is north of the Bluebell prospect. Papke (1979) described the Sunbeam prospect as fluorite in a breccia zone that extends about 20 ft. The thin zone strikes N. 35° E. and dips 65° NW. A sample (no. 619) from a small pit on the fluorite breccia contained 37.8% CaF_2 and 48.5% SiO_2 (table 13).

The Davis Creek area contains sites of high-grade fluorite in discontinuous veins and breccia zones, but these structures are not continuous or wide enough to be mineable. The relatively high concentrations of arsenic and lead are geologically and geochemically interesting, and may be indicators of buried base-metal mineralization.

South Fork Cottonwood Creek

The South Fork Cottonwood Creek is in the southeastern part of the study area. A cherry-stem deletes the jeep-trail and most of the mine workings from the study area (pl. 1). Two prospects are in this area: the Green Spar prospect in the north (no. 623-632), and the El Cortez prospect in the south (no. 633-637). Host rock is Tertiary rhyolite and welded rhyolite tuff. Workings consist of trenches, pits, and bulldozer scrapings.

There has been no production from these two prospects. Although some of the exposed veins contain high-grade fluorite, none are economically mineable because of their small size. The fluorspar commonly occurs in silicified rock or has a thin border of fine-grained quartz. The abundant iron oxides throughout the area may have been derived from oxidation of pyrite. (See Papke, 1979, p. 57.)

At the Green Spar prospect, bulldozer cuts (no. 623-627, 630-632) exposed fluorite veins of diverse orientation, in altered rhyolite. Samples of the 1-ft-wide veins contained from 84% CaF_2 and 8% SiO_2 (table 14, no. 624) to 49% CaF_2 and 44% SiO_2 (no. 630). Just east of the above cut, a small pit on a rhyolite tuff with disseminated pyrite assayed 15 ppb gold (no. 628).

The El Cortez prospect contains four sites where bulldozer cuts expose rhyolite tuff (no. 633-637). A northeast-striking fluorite vein contains 75% CaF_2 and 12% SiO_2 (no. 634). At the other sites, no fluorite veins were seen, but a quartz breccia contains 26% CaF_2 and 62% SiO_2 (no. 636). The veins are too thin to constitute an identified resource.

Pine Creek

The Pine Creek mineralized area includes six properties; five of which have workings (pl. 1). Country rock is Ordovician and Devonian limestone and dolomite, with intrusive dikes and jasperoids. Fluorspar occurs as replacement in the limestone, replacement in brecciated jasperoid, and as vug fillings in the jasperoid. The properties from south to north are: Horseshoe Mine, Northern Horseshoe, Jumbo, Rocket, Big Jim prospects, and the Spar Mine (Papke, 1979, p. 51-55.)

The Horseshoe Mine is accessable by a road from Pine Creek and consists of two open-pits in gray, crystalline, Ordovician limestone (fig. 11). The limestone is massive and contains chert. Quartz latite dikes crop out north and south of the area. Fluorspar occurs as a replacement of limestone in zones that trend north to northwest and dip steeply.

The only production was in 1970 and 1971 when Adaven Fluorspar Co. developed the two open pits and shipped metallurgical-grade fluorspar to

Kaiser Steel Co. in California. The recorded production is less than 4,000 tons, but a total production of 28,000 tons was estimated. (See Papke, 1979, p. 53).

The larger pit (fig. 11, no. 690-696) contains high-grade fluorspar that is brecciated, vuggy, and contains some quartz. Most of the ore occurs as banded fluorite called "coonstail" ore by Sainsbury and Kleinhampl (1969, p. C7). This consists of alternating gray and white bands; the white bands contain only fluorite and the gray bands contain fluorite, quartz, and host rock (Papke, 1979, p. 53-54). The fluorspar zone trends northwest and dips north. Samples of the high-grade ore zone contained from 78% to 99% CaF_2, and from 2% to 20% SiO_2.

The smaller pit (fig. 11, no. 687-689) to the north contains a thin, north-trending zone of high-grade fluorspar, that dips steeply to the east. White fluorite and "coonstail" ore occur in the pit. Samples of the "coonstail" ore contained from 72% to 95% CaF_2, and from 1% to 9% SiO_2.

The fluorite zone at the Horseshoe Mine contains an indicated subeconomic resource of 13,000 tons of 90% CaF_2 and an inferred subeconomic resource of 300,000 tons of 90% CaF_2.

The Northern Horseshoe prospect is in a large, N. 25° W.-striking jasperoid body. The jasperoid masses form bold, rugged, iron-stained outcrops. The unsilicified adjacent rock is medium-gray, finely crystalline, Ordovician limestone that dips about 35° W. The jasperoid was brecciated after silicification. Much of the silicified material has only a few fluorite-lined vugs. Fluorite content is as much as 30% CaF_2 in only a few small areas. (See Papke, 1979, p. 53.)

Fluorite was not found at the Northern Horseshoe prospect during this investigation, but two northwest-trending structures were sampled in this area (pl. 1, no. 697-698). An andesite dike was barren, but a nearby gossan zone assayed 0.03 oz/st gold and 23.9 oz/st silver, 20.2% lead, 2.7% zinc, 0.37% arsenic, 0.27% copper, and 500 ppm molybdenum (table 15, no. 697).

At the Jumbo prospect, just north of the Northern Horseshoe prospect, there has been no excavation for fluorspar, and no outcrops of fluorite were found. Papke (1979) states that fluorspar occurs in an outcrop 3 ft in diameter, replacing brecciated jasperoid. Impurities are unreplaced jasperoid and some quartz introduced with the fluorite (Papke, 1979, p. 52-53).

The Rocket prospect is a pit on a west-trending fluorite zone (pl. 1, no. 700). Host rock is a jasperoid derived from dolomite. Fluorspar replaced the brecciated jasperoid and formed nodular, banded masses with kaolinite and quartz (Papke, 1979, p. 52). A sample of the zone (table 15, no. 700) contained 22% CaF_2 and 72% SiO_2.

The Big Jim prospect is a 15-ft-long adit with a 6-ft-deep winze (pl. 1, no. 699). The working was driven on a fluorite pod in jasperoid. The pod is irregular in shape and has a vertical thickness of 7 ft. A sample of the purple fluorite contained 99% CaF_2 and 0.5% SiO_2 (table 15).

The Spar Mine is accessible from Pine Creek by a steep road that is washed out in places. A small tonnage of fluorspar was produced in 1970 by Adaven Fluorspar Co. An iron-stained quartz-latite dike, trending northeast, has intruded the thin-bedded dolomite. Fluorspar occurs in replacement bodies at the altered contacts of dolomite and quartz latite. A sample taken in 1950 by a Bureau engineer across 2 ft of a mineralized zone contained 70.4% CaF_2. (See Papke, 1979, p. 51.)

A bulldozed pit exposes fluorite on the east contact of the dike and dolomite (fig. 12, no. 701-708). Fluorite content in three samples ranged from 81% to 91% CaF_2 and 2% to 7% SiO_2. Trace amounts of gold were found in three other samples from this area.

The only identified fluorite resource in the Pine Creek area is at the Horseshoe Mine. The other prospected areas contain fluorite, but are not of sufficent grade or tonnage to be classified as an identified resource. The concentrations of precious- and base-metals that occur with the fluorite are geologically interesting. Jasperoid and fluorite can often be indicators for low-grade gold deposits in Nevada.

Sawmill Canyon

This area contains the Mammoth prospects, the northernmost workings on the east side of the Quinn Canyon Range (pl. 1). There has been no recorded production, but extensive trenching and drilling were done in 1957 by Union Carbide Ore Co. (Papke, 1979, p. 48).

Country rock is north-trending Ordovician limestone that dips about 20° W. The limestone has been silicified and partly replaced by fluorite, resulting in jasperoiod and fluorite zones. The jasperoid is faulted and locally brecciated; unreplaced limestone occurs in parts of this body. Fluorite is present throughout the silicified mass, but the zones of concentration and distribution are variable and irregular. Most of the fluorite is light gray, and some is "coonstail" ore. Quartz and calcite were the only impurities, occurring mostly in unreplaced jasperoid or limestone. (See Papke, 1979, p. 48-50.) Quartz-latite float was present, but was not found in outcrop.

According to Sainsbury and Kleinhampl (1969, p. C13), the silicified material contains 16% to 22% CaF_2 and 70% to 74% SiO_2. Samples of jasperoid and silicified limestone, taken during this investigation, ranged from 2% to 10% CaF_2 (fig. 13, no. 721, 723, 729-731). Samples of the fluorspar zone contained from 24% to 74% CaF_2 (no. 715-717, 725-728).

Precious-metal concentrations were found in most of the samples taken from the Mammoth area. Gold content ranged from a trace to 0.08 oz/st, with the greatest concentration being in the "coonstail" fluorite. Silver content ranged from 0.1 to 0.3 oz/st. Base-metal concentrations were also above average abundance for limestone (Levinson, 1980). No fluorite resources are identified for the Sawmill Canyon area, but the wide-spread presence of gold indicates that the area should be explored in detail.

Gold associated with fluorite

In Nevada, large, low-grade gold deposits have characteristics similar to the east-central part of the study area including: carbonate host rocks, nearby volcanic activity, and complex faulting.

The Sawmill Canyon and Pine Creek areas have similarities to the Relief Canyon gold deposit in Pershing County, Nevada. At the Relief Canyon deposit, fluorite was the original mineral that was prospected. The fluorspar prospects were dug in limestone and silicified limestone. Trace elements, especially arsenic, were used in locating the gold deposit. Both Relief Canyon and Sawmill Canyon/Pine Creek areas contain intrusive rocks, dolomitic limestone, jasperoids, and gold.

At the Relief Canyon deposit, gold occurs along a highly brecciated fault contact in jasperoid breccia, limestone breccia, and silicified limestone. Several drill holes at Relief Canyon showed weak gold mineralization extending deep into the massive limestone, possibly from high-grade feeder structures. (See Parratt and others, 1987.) This compares favorably with brecciated jasperoids at the Sawmill Canyon/Pine Creek areas.

Silicification is present 5 mi east of Sawmill Canyon in the Crystal Group prospects, a jasperoid area containing gold and a small fluorite-bearing breccia pipe (Kness, 1988). Silicification is present southward to the Pine Creek and South Fork Cottonwood Creek fluorite areas, which contain jasperoids and gold concentrations. The entire area of these deposits warrants exploration for gold resources.

OTHER COMMODITIES

Inferred subeconomic resources of common variety limestone, and sand and gravel are present in the study area, but because they have no unique properties, the remoteness of the area, and the common occurrence of these industrial minerals throughout the region they will probably not be developed in the forseeable future.

COMMODITY HIGHLIGHTS

The principal commodities of interest in the Quinn RARE II Area are gold and fluorspar. Currently (1988), gold is one of the few mineral commodities that is actively explored for and mined in the western U.S. Commodity statistics are from the U.S. Bureau of Mines, Mineral Commodity Summaries 1988.

Commodity	Domestic mine production	Apparent consumption	Units	Major import sources	Net import reliance	Average 1987 domestic price ($U.S.)	Expected U.S. demand through 1990	Major uses
Gold	4.90	2.80	million troy oz	Canada Uruguay Switzerland	about 15%	444.00/oz	Annual increase of 2.0%	Jewelry electric dental.
Fluorspar	100	650	thousand tons	Mexico South Africa	about 65%	90.00/ton	Unchanged	Aluminum and steel making, chemical.

CONCLUSIONS

In the studied part of the Quinn Canyon Range, 12 mineralized areas were identified. Six of these areas contain precious- and base-metals and are inside the Quinn RARE II Area; six areas containing fluorspar are adjacent to or within 1 mi of the study area boundary. The six precious-metal-bearing mineralized areas inside the study area are Gold Canyon, Nyala Canyon, Willow Creek, Big Creek Canyon, North Fork Cottonwood Creek, and Badger Gulch.

Nyala Canyon, North Fork Cottonwood Creek, and Badger Gulch areas contain deposits with precious- and base-metal sulfides. Paleozoic sedimentary rocks were intruded by sulfide-bearing solutions and granite and rhyolite dikes. In Gold Canyon and Willow Creek the unfractured quartz veins generally contain low concentrations of precious- and base-metals. The Gold Canyon and Willow Creek areas are north and south respectively, of the sulfide-containing Nyala Canyon area, and appear to have received less of the gold-bearing solutions. Apparently, conditions were favorable and the source of mineralizing fluids closer to the Nyala Canyon area. The Nyala Canyon area has a likelihood for further exploration, and may contain an open-pittable gold resource; however, the high arsenic content could present problems with treating the ore.

The North Fork Cottonwood Creek and Badger Gulch areas were not as extensively prospected in the past as Nyala Canyon, but the sulfides present contain comparable precious and base metals. Both areas are smaller, and the alteration not as well developed as at Nyala Canyon. The 3 mi between these areas has not been prospected for sulfides or fluorite because Tertiary rhyolite covers the Paleozoic rocks. Additional sulfide deposits may exist below the rhyolite. All three sulfide areas lie on a north-south trend, that cuts through the middle of the range. The North Fork Cottonwood Creek area is just north of a fluorite area, and the Badger Gulch area is just south of one. A major, north-trending, undiscovered fault could have provided passageways for mineralizing fluids in this region. The unprospected area just east of the Melbourn Mine, the only part of the Willow Creek area with appreciable gold, is on this north-trend of auriferous areas. The Pine Creek fluorite-gold deposit is on this trend, and the Sawmill Canyon fluorite-gold deposit nearly on the trend. Although this trend may be circumstantial, and the gold related to some other geologic feature, the entire trend warrants exploration for gold.

Big Creek Canyon is the east-west dividing line between Paleozoic rocks to the north and Tertiary volcanics to the south. This canyon contains low concentrations of metals and appears to be the southern limit for metal mineralization on the west side of the range. Based on field observations, most of the mineralizing episodes occurred prior to or concurrently with the Tertiary volcanism, except for the fluorite and associated mineralization.

The six fluorspar mineralized areas adjacent to the Quinn RARE II Area are Water Canyon, Quinn Canyon, Davis Creek, South Fork Cottonwood Creek, Pine Creek, and Sawmill Canyon. Each area contains fluorspar, an industrial commodity, and the Pine Creek and Sawmill Canyon areas also contain gold.

At Water Canyon, on the western boundary of the study area, and at Pine Creek, on the east-central boundary of the study area, fluorite was produced in the past and additional identified resources remain. Renewed development would depend on the price of fluorspar. The Pine Creek fluorspar area could be open-pit mined, and is thus more likely to be developed. The trace amounts of gold that were found with the fluorite at Pine Creek could be associated with nearby jasperoids.

At the Sawmill Canyon area low concentrations of gold occur with the fluorite, jasperoid, and silicified limestone. The Pine Creek/Sawmill Canyon areas have geological and mineralogical similarities to the Relief Canyon gold deposit in Pershing County, Nevada. The Crystal mineralized area, 5 mi east in the Grant Range, is also similiar. Gold in the Pine Creek/Sawmill Canyon areas has never been reported in the literature, and except for fluorspar development, the area is largely unexplored. These three areas may define a large area of near-surface, low-grade gold deposits. This area has the highest likelihood for exploration and development, and the gold mineralization may extend into the study area.

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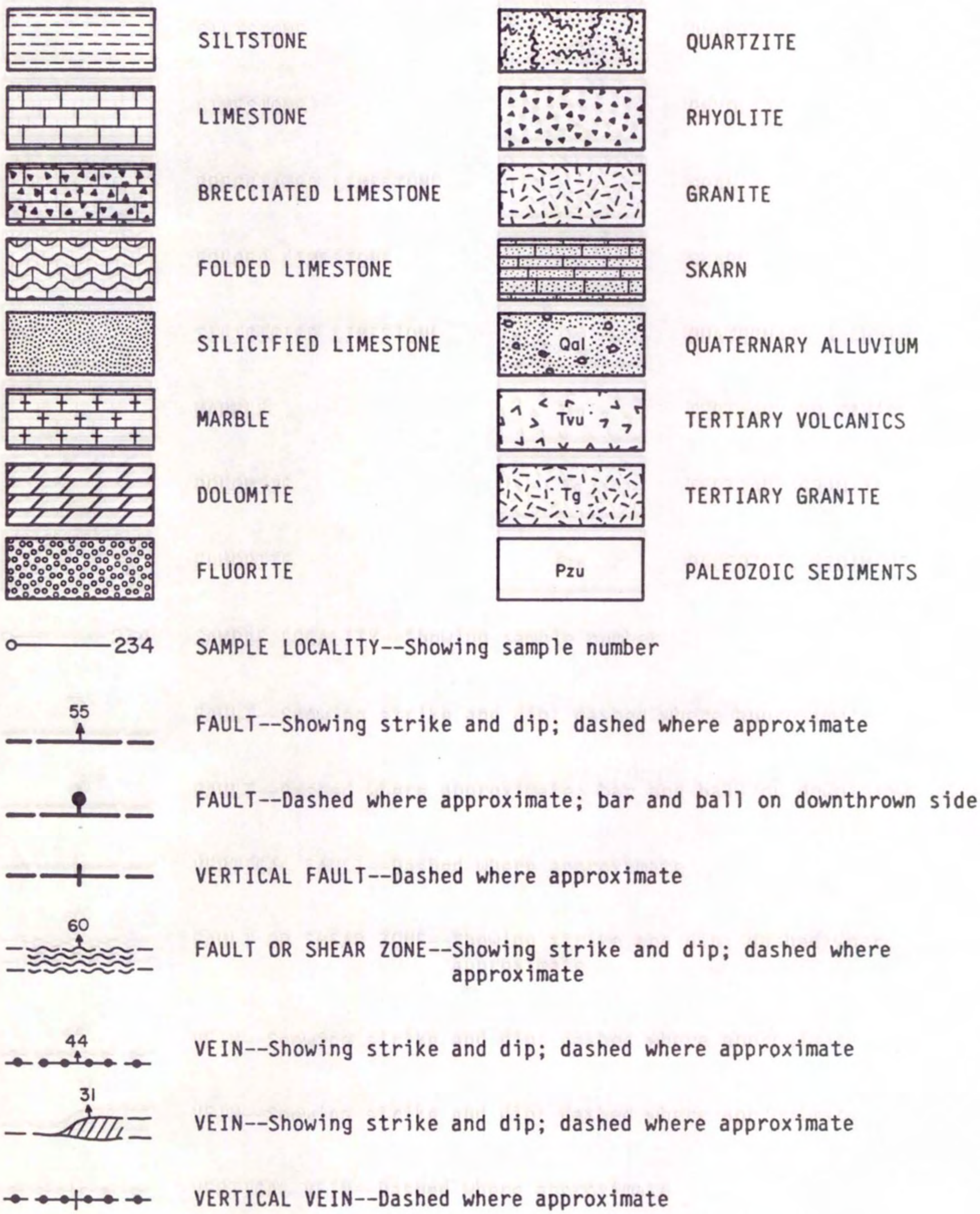
EXPLANATION OF SYMBOLS FOR FIGURES 4-13



EXPLANATION OF SYMBOLS FOR FIGURES 4-13--Continued

CONTACT--Showing strike and dip; dashed where approximate

VERTICAL DIKE

STRIKE AND DIP OF BEDDING

VERTICAL BEDDING

APPROXIMATE BOUNDARY OF THE QUINN RARE II AREA

PATENTED MINING CLAIMS

ROAD

TRAIL

INTERMITTENT STREAM

TOPOGRAPHIC CONTOUR--Showing elevation in feet above sea level

LOCALITY OF SAMPLED OUTCROP--Showing sample number

LOCALITY OF STREAM-SEDIMENT SAMPLE--Showing sample number

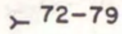
ORE BIN--Showing sample number

DUMP

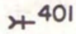
SURFACE OPENINGS--Showing sample number(s); symbol may represent more than one working

Shaft

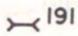
EXPLANATION OF SYMBOLS FOR FIGURES 4-13--Continued



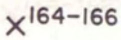
Adit



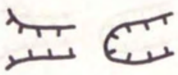
Inaccessible adit



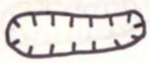
Trench



Prospect pit


OPENCUT

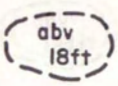

PIT


TRENCH


WINZE

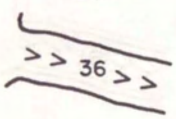

RAISE


SHAFT

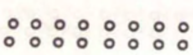


STOPED ABOVE--Showing height in feet

STOPED BELOW--Showing depth in feet



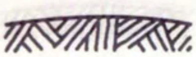
INCLINED WORKINGS--Showing degree of inclination; chevrons pointing down


TIMBERING

ORE CHUTE


DUMP

EXPLANATION OF SYMBOLS FOR FIGURES 4-13--Continued

?	QUERIED WHERE UNKNOWN
	BACKFILL OR TALUS
	SURFACE ON CROSS SECTION
---	Not detected
tr	Trace
>	Greater than
na	Not analyzed for
xx	Not applicable

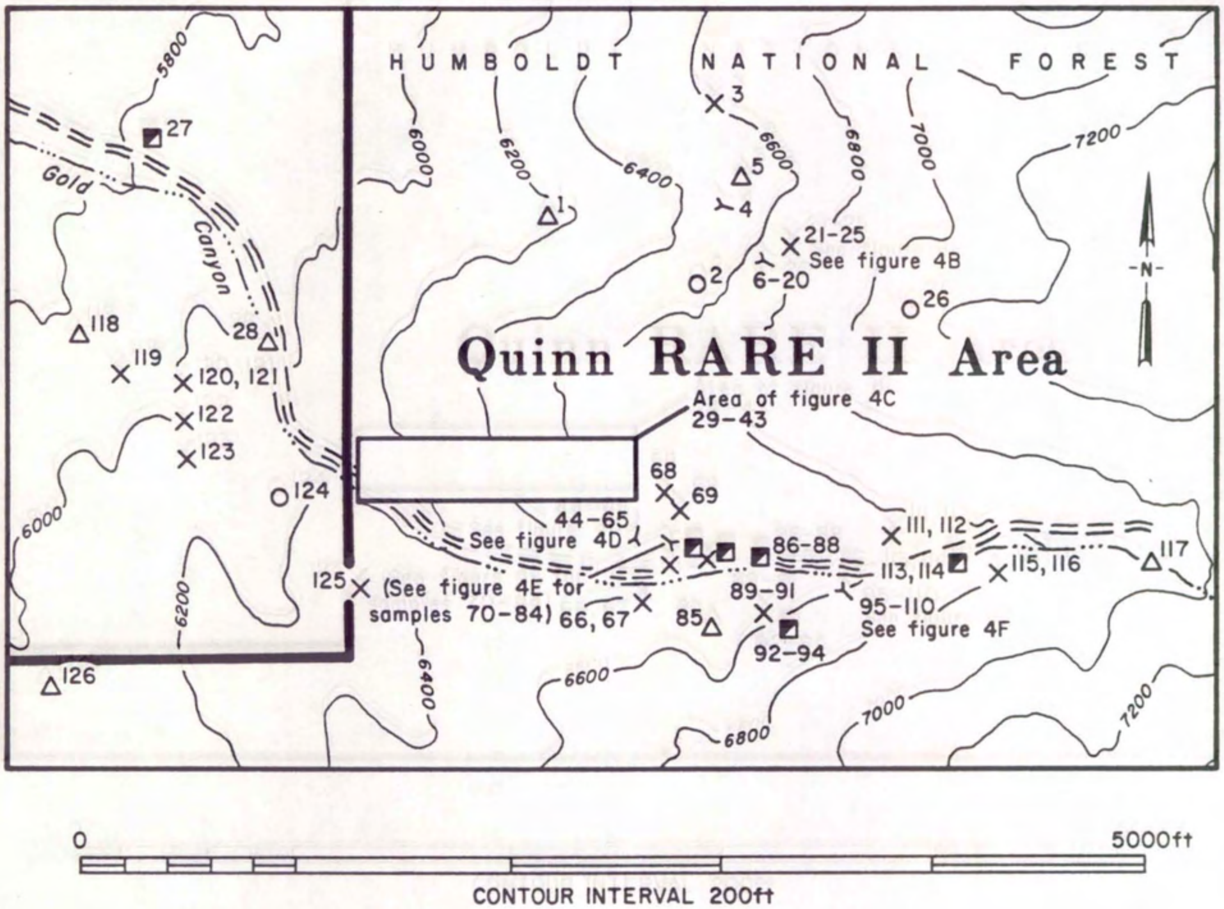
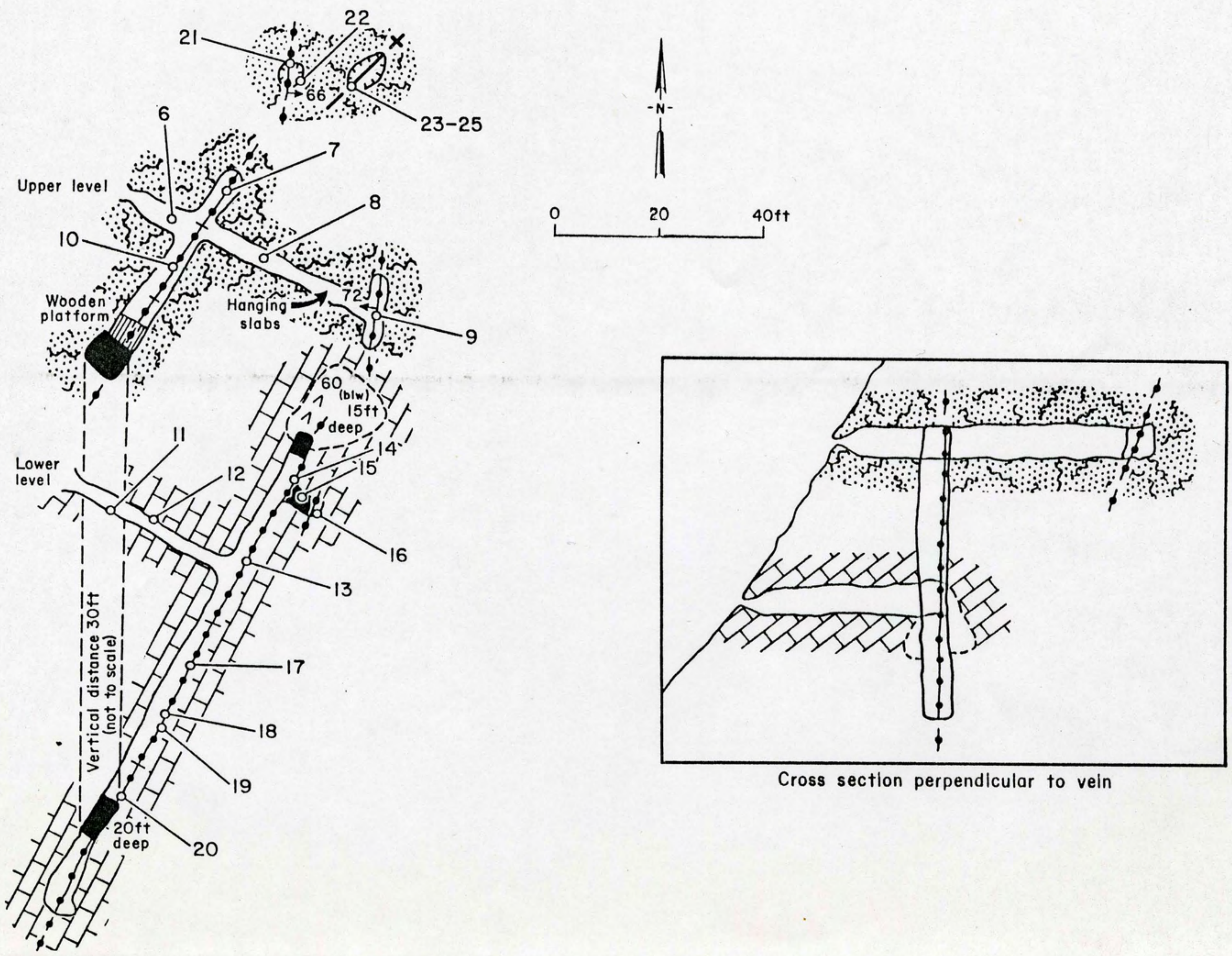
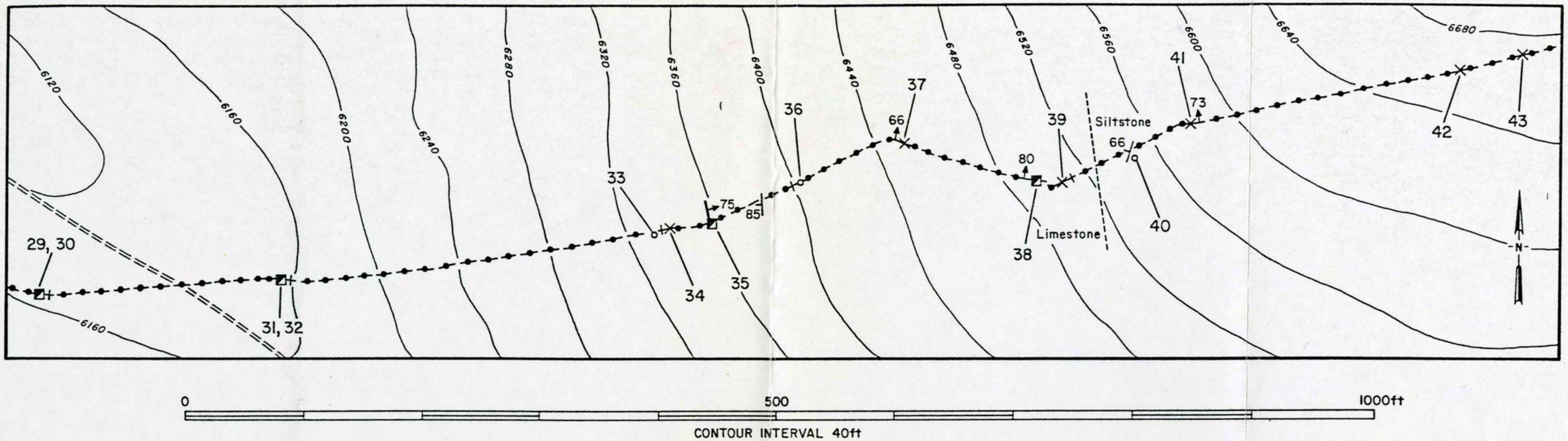


Figure 4A.--Gold Canyon area showing sample localities 1-126.



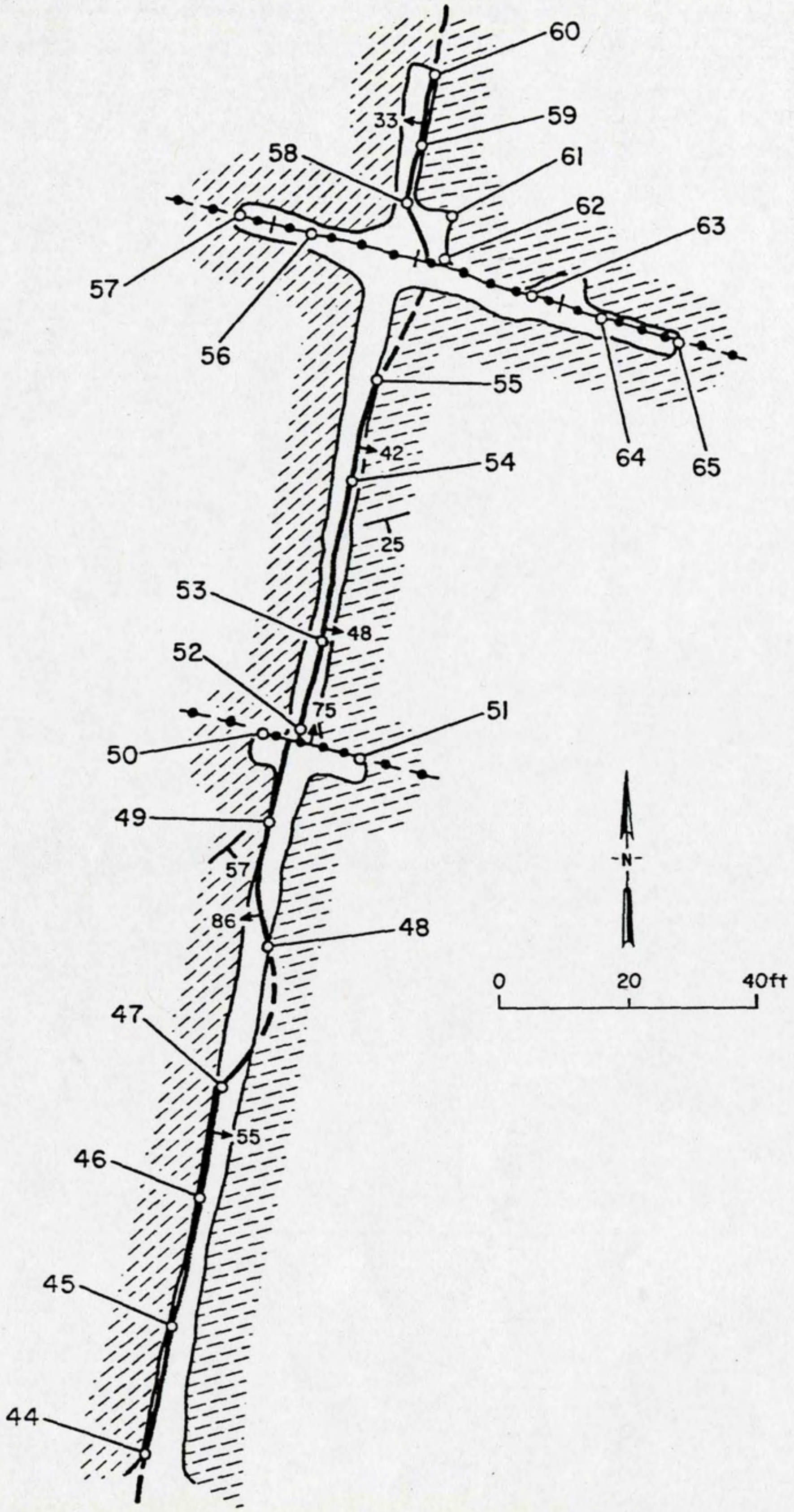
Sample No.	Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Other
6	2.0	Disseminated hematite after pyrite.	---	---	230	16	12	---	90	580 Ba.
7	1.2	Fault gouge; hematite, limonite.	tr	---	690	34	24	---	160	730 Ba.
8	.5	Hematite stains.	---	---	160	---	9	20	40	970 Ba.
9	1.8	Quartz vein; limonite, disseminated black mineral.	tr	0.1	160	16	28	480	84	
10	3.0	Quartz breccia; gouge, hematite, limonite.	tr	---	300	130	15	100	330	560 Ba.
11	3.0	Calcite, hematite, limonite.	---	---	190	18	20	---	77	650 Ba.
12	.8	Silicious limestone, hematite.	---	---	230	33	17	---	150	710 Ba, 95 W.
13	1.1	Fault gouge; hematite, limonite.	tr	.1	300	39	16	---	320	670 Ba.
14	2.3	do.	---	---	280	53	16	---	110	710 Ba.
15	.7	Fractured quartz vein; hematite, limonite.	0.02	.1	200	---	9	19	52	10 Sn.
16	.4	Black siliceous zone; limonite stains.	.01	---	94	12	7	11	62	
17	1.4	Fault gouge; hematite, limonite.	---	.1	330	22	17	---	140	520 Ba.
18	1.7	do.	tr	---	310	30	19	---	170	630 Ba.
19	3.0	Fractured quartz vein; hematite, limonite.	---	---	250	22	9	---	160	690 Ba.
20	1.4	Fault gouge; hematite, limonite.	tr	---	330	73	27	140	430	560 Ba, 98 W.
21	1.5	Quartz vein; abundant limonite, pyrite.	tr	.1	380	---	24	190	63	
22	xx	Select of red siltstone; quartz stringers.	---	---	95	---	10	14	71	
23	xx	Select of quartzite; limonite stains.	.02	.1	140	9	18	50	46	
24	xx	Select of gray silicified limestone; vuggy limonite.	tr	.1	680	7	140	---	50	
25	xx	Select of gouge, hematite, limonite.	tr	.1	270	27	17	---	98	870 Ba.

Figure 4B.--Adits in drainage north of Gold Canyon showing sample localities 6-25. Table shows sample data.



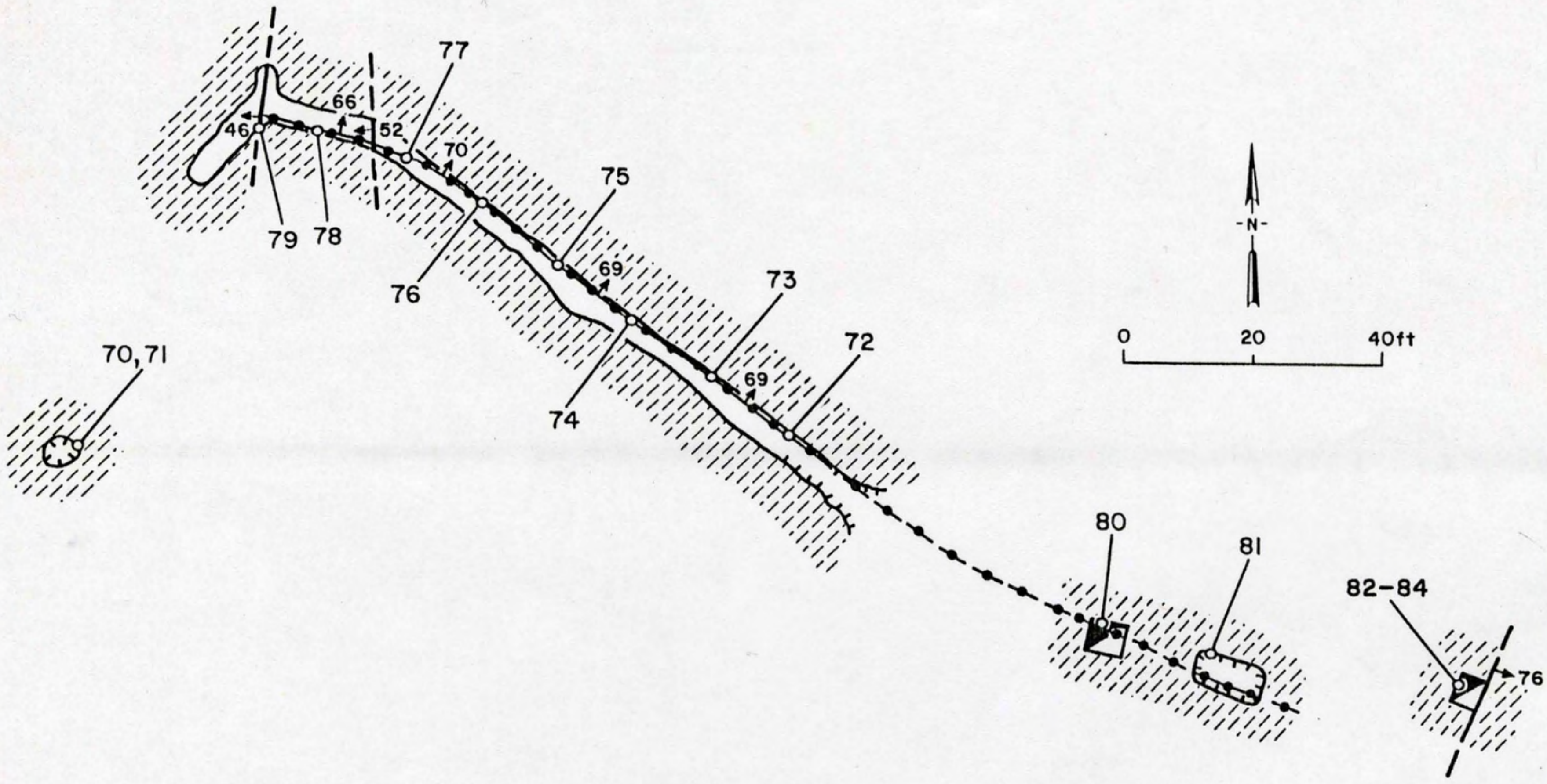
Sample No.	Type	Length (ft)	Description	Au (oz/st)	Ag (oz/st)	As	Cu	Mo	Pb	Zn	Other
						ppm, except where noted					
29	Select	xx	Quartz vein; limestone breccia, hematite, calcite.	---	---	100	7	8	---	55	700 Ba.
30	do.	xx	Vein quartz; disseminated pyrite, hematite.	---	---	87	---	7	---	54	
31	do.	xx	Vein quartz; hematite, limonite.	0.01	---	100	8	16	---	65	
32	do.	xx	do.	---	---	100	140	19	22	65	
33	do.	xx	Hematite after disseminated pyrite.	---	---	250	110	13	---	200	0.27% Ba, 78 Ni.
34	do.	xx	Vein quartz; abundant limonite, limestone pods.	---	---	98	7	12	---	91	
35	do.	xx	Brecciated limestone; quartz stringers, hematite stain.	---	---	110	---	23	---	140	
36	Chip	2.0	Quartz vein; hematite.	---	---	---	---	---	---	39	
37	do.	2.2	Quartz breccia; abundant calcite, hematite, limestone pods.	.01	0.1	68	8	17	---	54	
38	do.	2.0	Quartz vein; vuggy hematite, limonite.	.02	---	66	---	6	---	45	130 Li.
39	do.	2.0	Quartz vein; hematite, limonite.	---	---	55	---	16	---	55	
40	Select	xx	Hematite after disseminated pyrite.	---	---	200	11	9	---	92	0.11% Ba.
41	Chip	2.5	Quartz vein; limonite, pyrite, hematite.	.02	---	170	37	13	550	460	
42	Select	xx	Quartz vein; limonite, hematite, disseminated	.01	---	190	6	8	0.11%	65	
43	do.	xx	Quartz vein goes to stringers; hematite.	.02	---	76	---	---	150	62	

Figure 4C.--Vein outcrop near National Forest boundary in Gold Canyon showing sample localities 29-43. Table shows sample data.



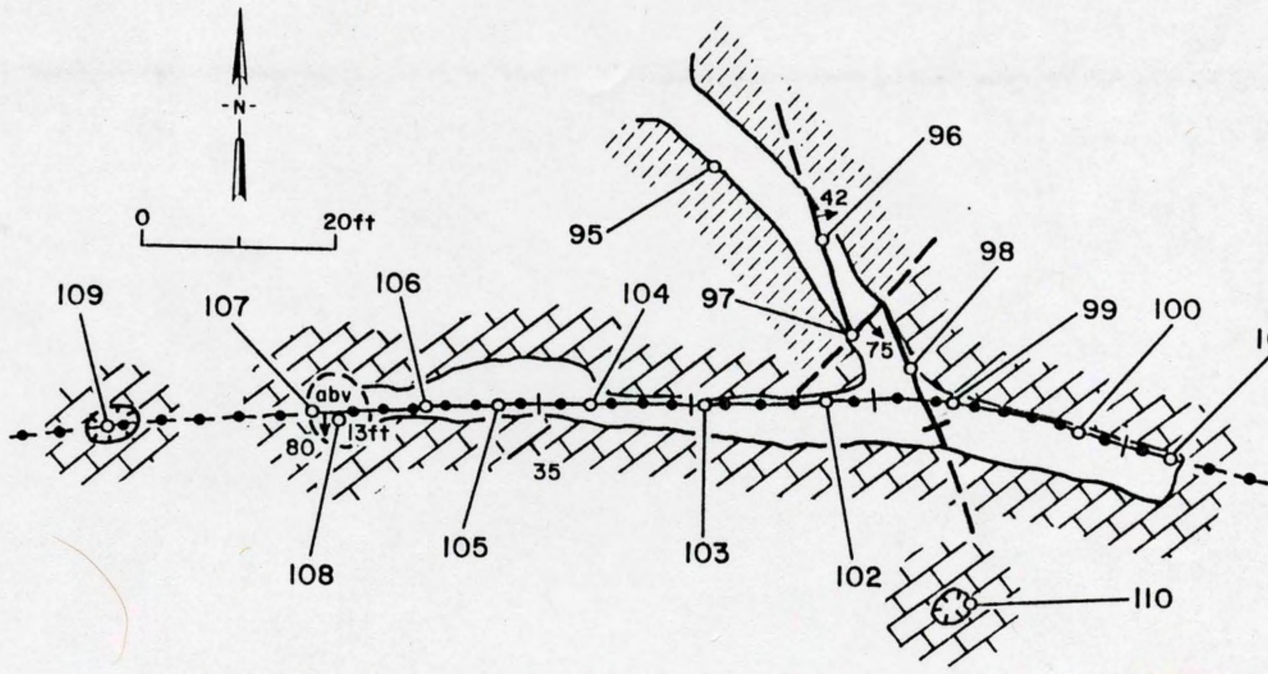
Sample No.	Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As	Cu	Mo	Pb	Zn	Other
					ppm, except where noted					
44	0.4	Fault gouge; hematite, limonite, disseminated pyrite.	---	---	560	35	8	22	130	930 Ba.
45	.8	Fault gouge; hematite, limonite, black mineral.	---	---	230	25	12	---	110	0.10% Ba.
46	.7	Fault gouge; hematite, limonite, disseminated pyrite.	---	---	220	39	9	---	130	.10% Ba.
47	1.7	Hematite, limonite, disseminated pyrite.	---	---	170	7	7	50	96	570 Ba.
48	.4	Fault gouge; hematite, limonite.	---	---	160	29	7	---	110	0.12% Ba.
49	1.0	do.	---	---	220	17	9	---	130	0.10% Ba.
50	2.2	Quartz vein; gouge, hematite, limonite, disseminated pyrite, black mineral.	---	---	130	22	12	13	71	
51	1.2	Quartz vein and fault gouge; hematite, limonite, disseminated pyrite.	---	---	150	9	71	---	55	
52	.8	Hematite stringers.	---	---	170	---	10	---	89	790 Ba.
53	.5	Fault gouge; hematite, limonite.	---	---	200	12	10	---	61	0.17% Ba.
54	.4	do.	tr	---	140	---	6	---	100	0.65% Ba.
55	.4	Fault gouge; hematite, limonite, quartz stringers.	---	---	110	---	8	27	570	960 Ba.
56	1.6	Quartz vein; hematite.	---	---	92	---	16	23	58	
57	2.0	Quartz vein; hematite, limonite, gouge.	---	---	120	9	23	---	62	
58	1.0	Fault gouge; hematite, limonite, quartz.	---	---	570	19	15	330	140	0.12% Ba.
59	2.0	do.	---	---	410	36	11	---	190	0.14% Ba.
60	2.0	Fault gouge; quartz, hematite, limonite.	---	---	250	22	13	---	190	0.14% Ba.
61	4.0	Silicified zone; quartz stringers, hematite, limonite, disseminated pyrite.	---	---	70	---	---	40	85	
62	.8	Fault gouge; quartz vein, hematite, limonite, disseminated pyrite.	---	---	150	---	14	---	48	
63	1.1	Quartz vein; gouge, hematite, limonite, disseminated pyrite.	---	---	210	19	10	---	81	730 Ba.
64	2.5	Quartz stringers, disseminated pyrite.	---	---	160	13	8	---	67	
65	2.5	Quartz vein; gouge, hematite, limonite, disseminated pyrite.	---	---	180	7	22	33	61	

Figure 4D.--Adit in main drainage of Gold Canyon showing sample localities 44-65. Table shows sample data.



Sample No.	Sample Type	Length (ft)	Description	Au (oz/st except where noted)	Ag (oz/st except where noted)	As (ppm, except where noted)	Cu	Mo	Pb	Zn
70	Chip	2.5	Abundant calcite, quartz stringers, disseminated pyrite.	tr	---	---	---	---	---	50
71	do.	3.0	Abundant mica, disseminated pyrite.	---	---	140	13	7	---	49
72	do	.9	Quartz vein.	tr	---	120	67	8	33	79
73	do.	1.0	do.	tr	---	110	55	9	51	75
74	do.	1.0	Quartz vein; hematite.	0.07	---	96	59	12	120	56
75	do.	1.3	Quartz vein.	---	---	---	20	---	57	49
76	do.	1.9	do.	tr	---	59	120	---	38	41
77	do.	1.9	do.	tr	---	51	96	7	130	45
78	do.	2.0	Quartz vein; gouge.	---	---	62	87	7	78	58
79	do.	.7	Fault gouge; hematite, calcite, quartz.	---	---	150	9	6	---	100
80	Select	xx	Abundant mica, hematite, quartz stringers, pyrite.	---	---	120	17	8	---	99
81	do.	xx	Abundant hematite, pyrite, disseminated pyrite.	---	---	110	23	71	---	63
82	do.	xx	Abundant disseminated pyrite, quartz stringers.	0.923 ppm	0.030 ppm	92	40	9	---	52
83	do.	xx	Quartz stringers.	.500 ppm	.347 ppm	89	---	7	---	65
84	do.	xx	Vein quartz; hematite, pyrite, malachite.	---	.1	---	180	---	110	37

Figure 4E.--Adit and workings in main drainage of Gold Canyon showing sample localities 70-84. Table shows sample data.



Sample No.	Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)
95	2.0	Hematite stains.	tr	---	68	16	---	---	60
96	4.0	Fault gouge; hematite, limonite.	---	---	110	10	7	---	71
97	.5	Fault gouge; calcite, quartz, hematite, limonite, limestone pods.	---	0.1	110	---	7	---	53
98	.7	Fault gouge, breccia; quartz, calcite, hematite, limonite.	---	---	150	11	6	---	94
99	.5	Fault gouge; banded quartz.	tr	---	37	7	31	47	82
100	.5	Quartz vein; hematite.	tr	---	---	7	---	16	54
101	.5	Quartz vein; gouge, hematite.	tr	---	---	---	---	---	44
102	.5	do.	tr	---	---	11	11	81	61
103	.7	Fault gouge; hematite, limonite.	0.07	.1	140	20	19	150	170
104	.5	Quartz vein; gouge, hematite.	---	---	40	7	7	75	100
105	.7	Quartz vein; hematite, limonite.	tr	---	85	11	13	---	64
106	.5	Fault gouge; hematite, limonite.	---	---	130	26	8	---	110
107	1.5	Quartz vein; hematite.	tr	.1	53	10	---	140	67
108	2.0	do.	tr	---	32	10	---	31	66
109	1.2	Quartz vein; hematite, pods of limestone.	tr	---	---	9	---	14	47
110	5.0	Quartz stringers, calcite, hematite stains.	.02	.8	---	8	---	---	30

Figure 4F.--Adit on south side of main drainage of Gold Canyon showing sample localities 95-110. Table shows sample data.

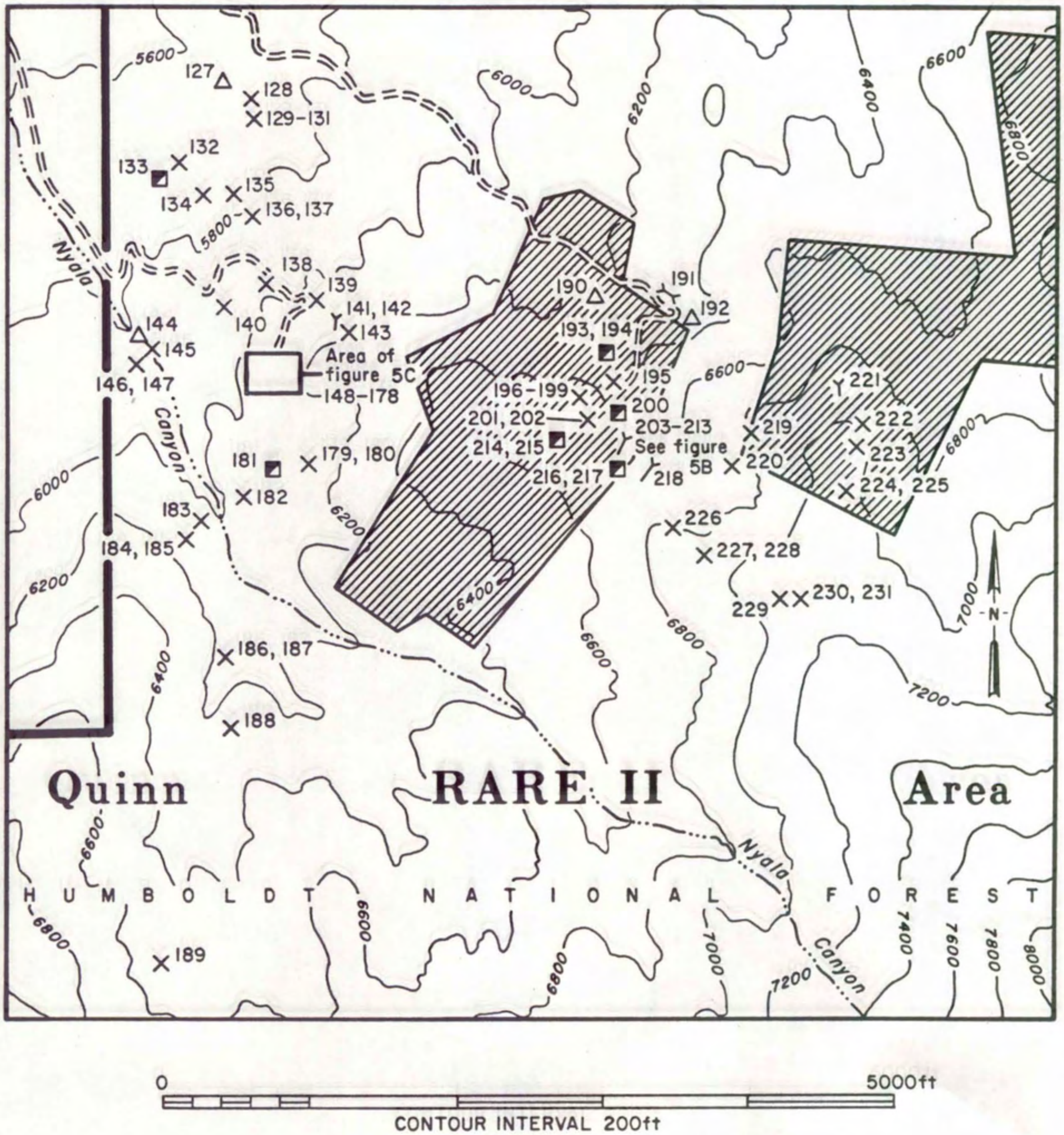
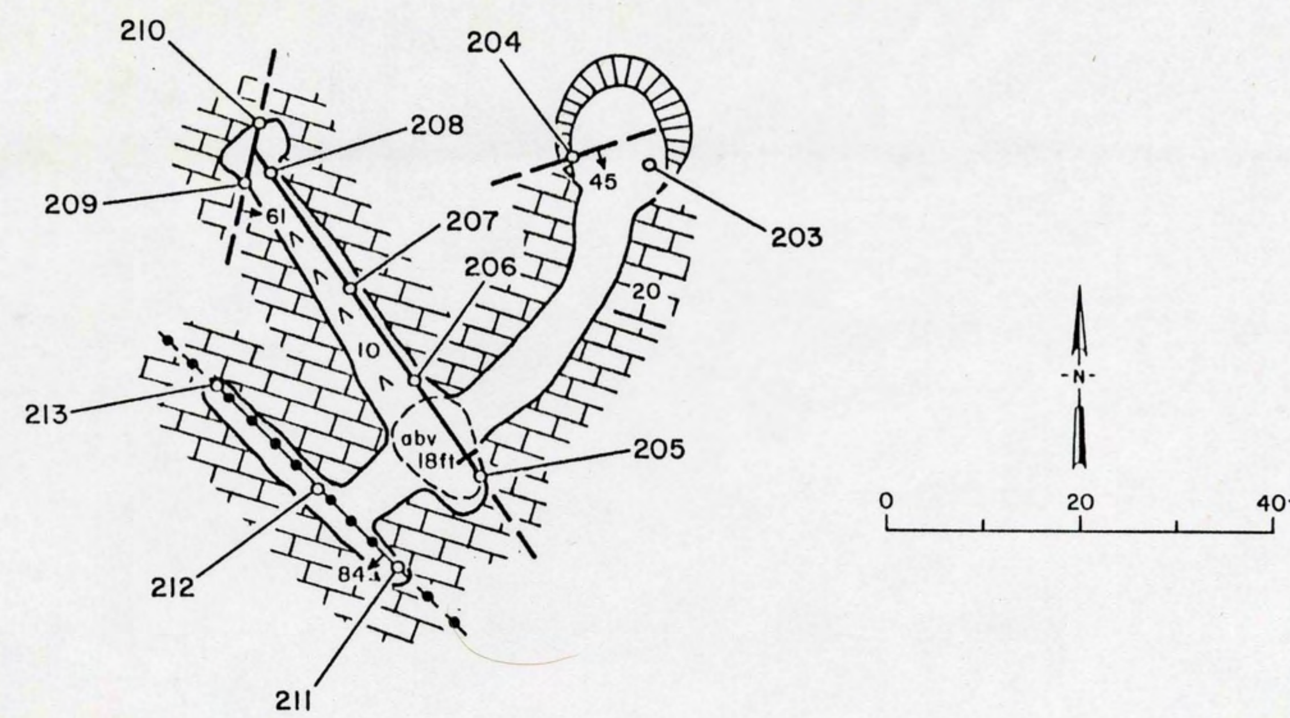


Figure 5A.--Nyala Canyon area showing sample localities 127-231.



Sample No.	Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As	Cu	Mo	Pb	Zn	Other
			Analytical data							
			oz/st		ppm, except where noted					
203	xx	Select of vein quartz; abundant pyrite, chalcopyrite, arsenopyrite.	0.60	29.0	>10%	630	55	2.4%	1.3%	150 Cd, 1.4% Sb.
204	3.0	Abundant hematite, limonite.	---	---	310	30	19	---	73	0.41% Ba, 110 V, 92 W.
205	xx	Select of silicified limestone; calcite stringers, hematite, limonite.	.08	3.0	1.8%	95	16	.11%	.27%	680 Sb, 130 V.
206	2.5	Fault gouge; limonite.	.17	1.2	4.6%	91	20	.21%	.37%	0.21% Ba, 740 Sb.
207	3.5	Fault gouge; limonite, chert pods.	.21	13.9	5.2%	450	28	.97%	.60%	790 Ba, 81 Cd, 0.29% Sb.
208	3.0	do.	.02	6.2	.38%	200	26	.34%	.18%	720 Ba, 180 Sb.
209	4.0	Fault gouge; limonite, brecciated chert.	.03	1.3	.44%	90	19	.20%	.17%	550 Sb.
210	4.0	do.	tr	.1	580	22	14	29	670	270 Sb.
211	3.0	Silicified limestone; gouge, hematite, limonite, quartz.	.03	4.0	.82%	110	27	650	.22%	810 Ba, 560 Sb.
212	1.0	Silicified limestone; quartz, hematite, limonite.	.03	6.5	.81%	160	25	.38%	.39%	0.11% Sb.
213	1.5	Fault gouge; limonite, quartz.	.05	32.9	.99%	0.11%	47	2.3%	.97%	700 Ba, 90 Cd, 0.65% Sb.

Figure 5B.--Adit in east part of Nyala Canyon showing sample localities 203-213. Table shows sample data.

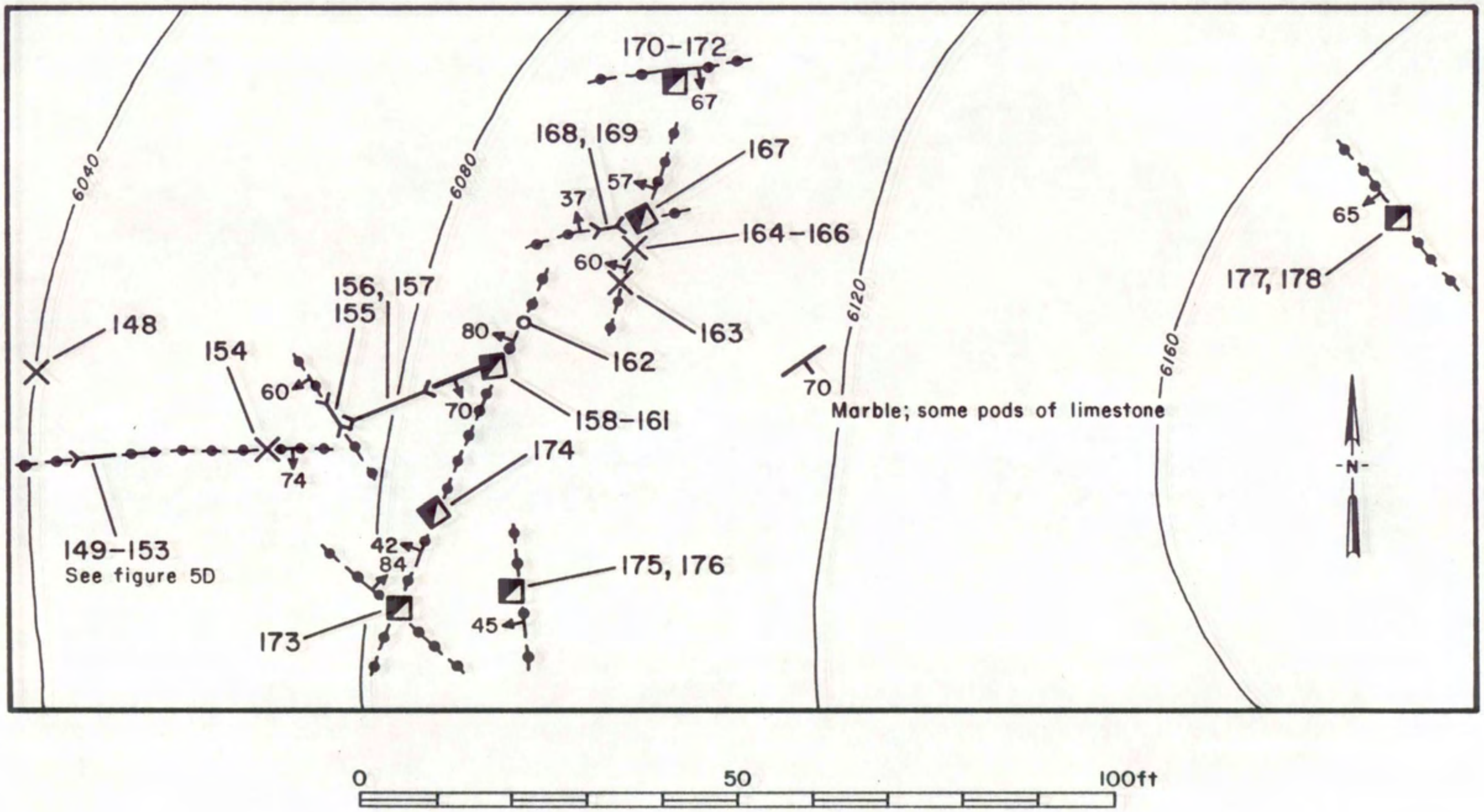
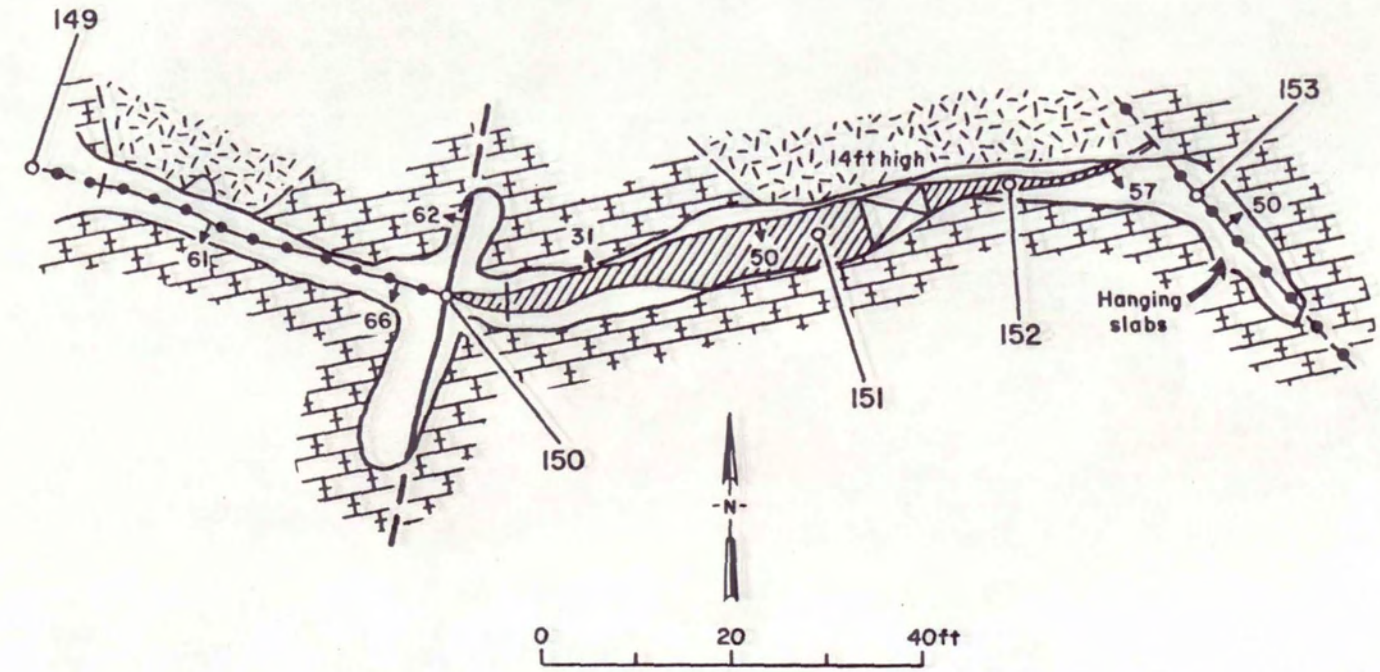


Figure 5C.--Workings in west part of Nyala Canyon showing sample localities 148-178. Table 3 shows sample data.



Sample No.	Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As	Cu	Mo	Pb	Zn	Other
			Analytical data (ppm, except where noted)							
149	xx	Select of massive arsenopyrite; pyrite, sphalerite.	0.17	0.4	>10%	31	32	430	7.2%	590 Cd, 330 Sb.
150	2.0	Fault gouge; abundant limonite.	.01	---	1.3%	190	30	---	.85%	
151	2.5	Crumbly arsenopyrite, pyrite.	.26	1.5	>10%	410	23	260	.39%	120 Cd.
152	2.0	Massive arsenopyrite, pyrite.	.23	.1	>10%	430	24	370	610	
153	2.0	Crumbly sulfides; arsenopyrite, pyrite.	.01	---	.78%	690	25	97	160	

Figure 5D.--Adit in west part of Nyala Canyon showing sample localities 149-153. Table shows sample data.

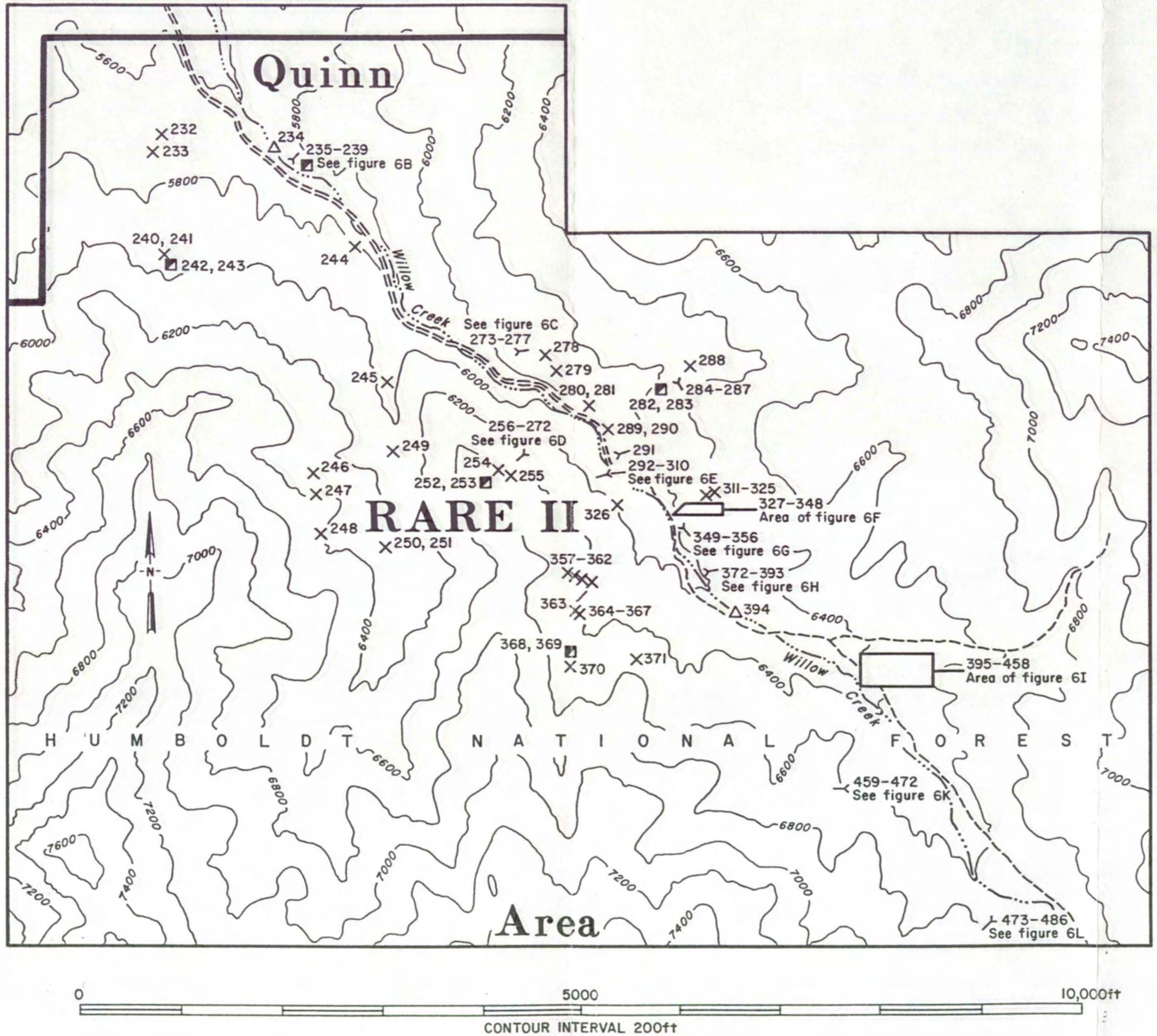
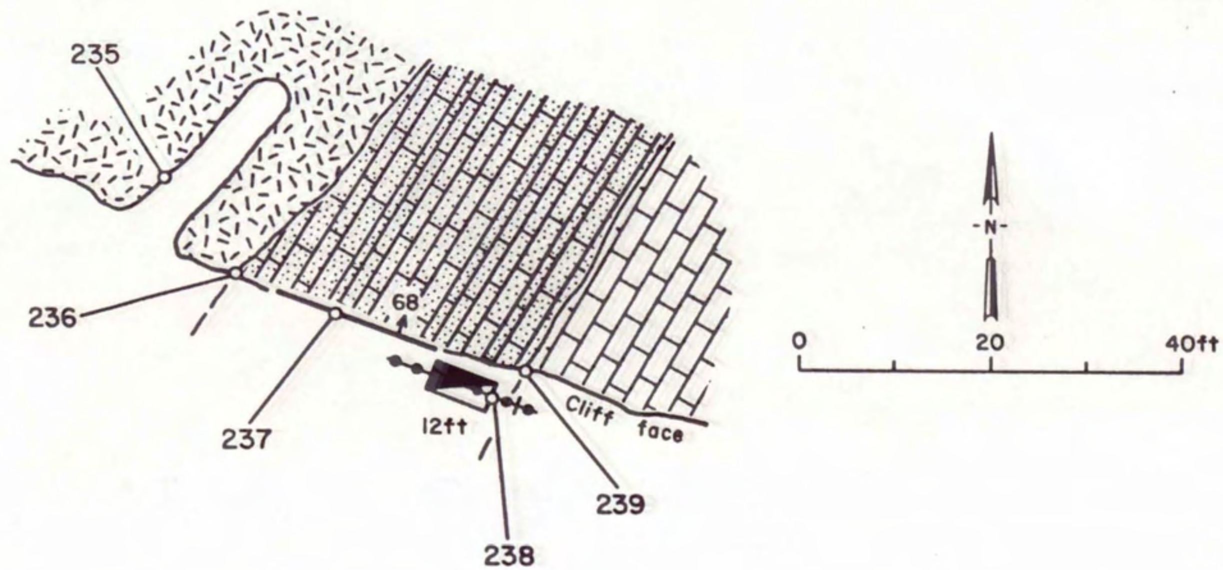
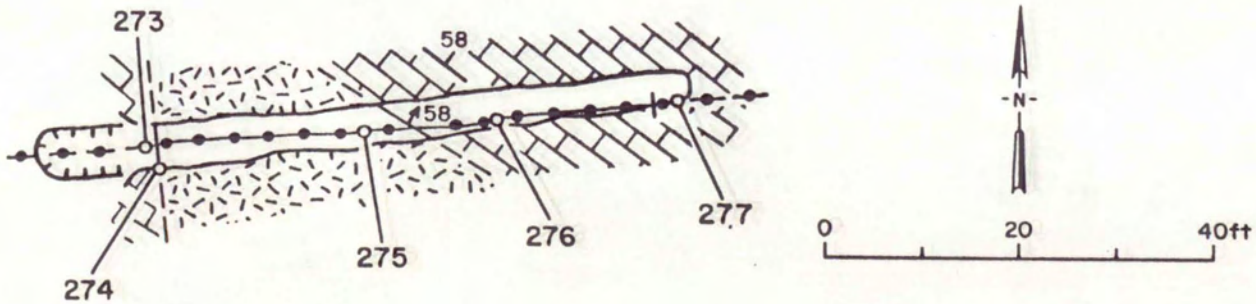


Figure 6A.--Willow Creek area showing sample localities 232-486.



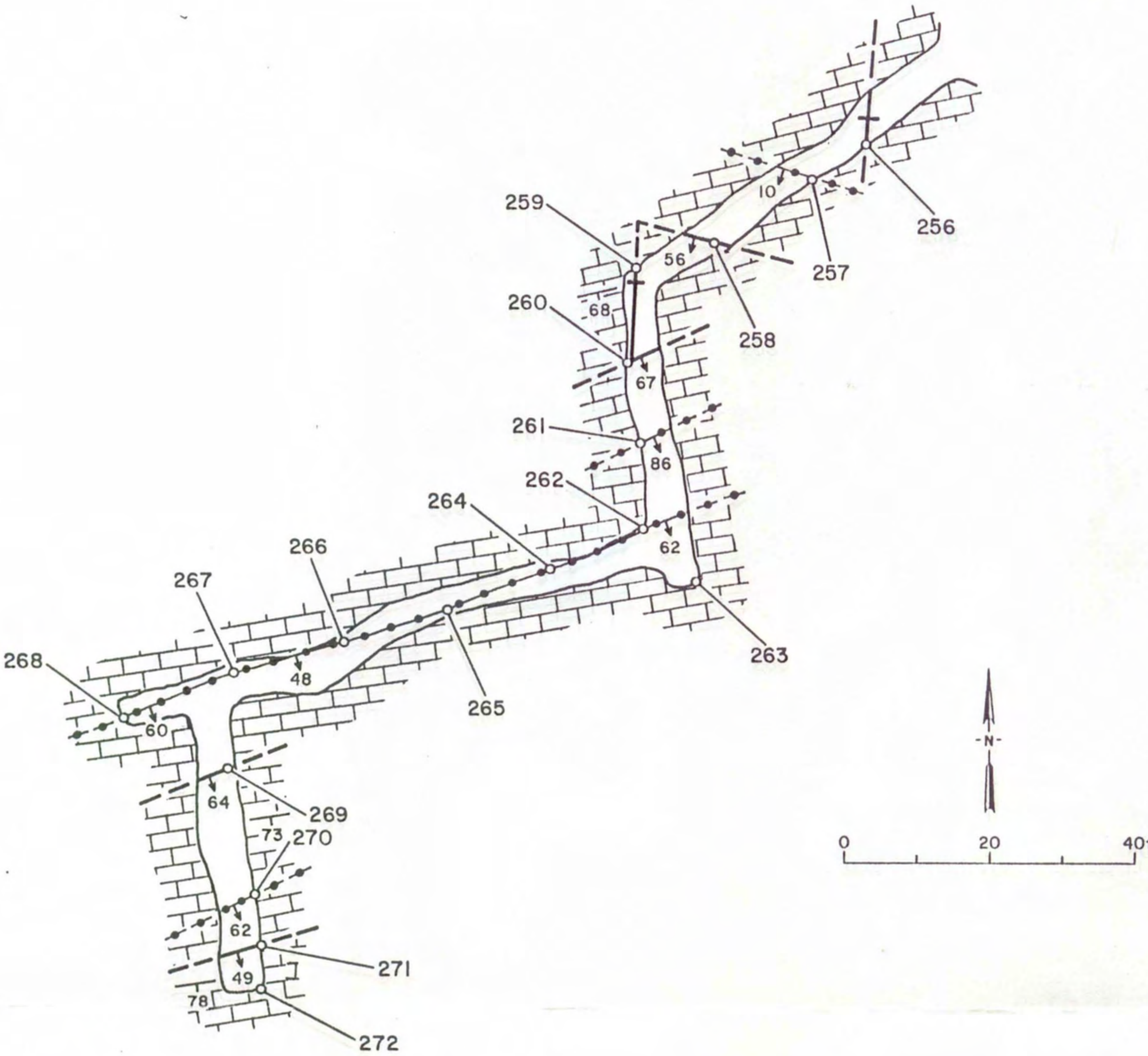
Sample No.	Sample Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As	Cu	Mo	Pb	Zn	Other
			Analytical data		ppm, except where noted					
235	3.0	Chilled margin of granite.	---	---	210	7	17	---	45	97 W.
236	1.0	Granite-skarn contact; chlorite.	---	---	410	52	18	---	69	100 W.
237	3.0	Fractured skarn; chlorite.	tr	---	0.11%	78	23	---	74	230 W.
238	1.0	Calcite breccia; skarn, limonite.	tr	---	280	---	13	---	74	44 W.
239	3.0	Skarn-limestone contact; calcite, chlorite.	tr	---	39	8	16	---	160	200 W.

Figure 6B.--Prospects on skarn zone showing sample localities 235-239. Table shows sample data.



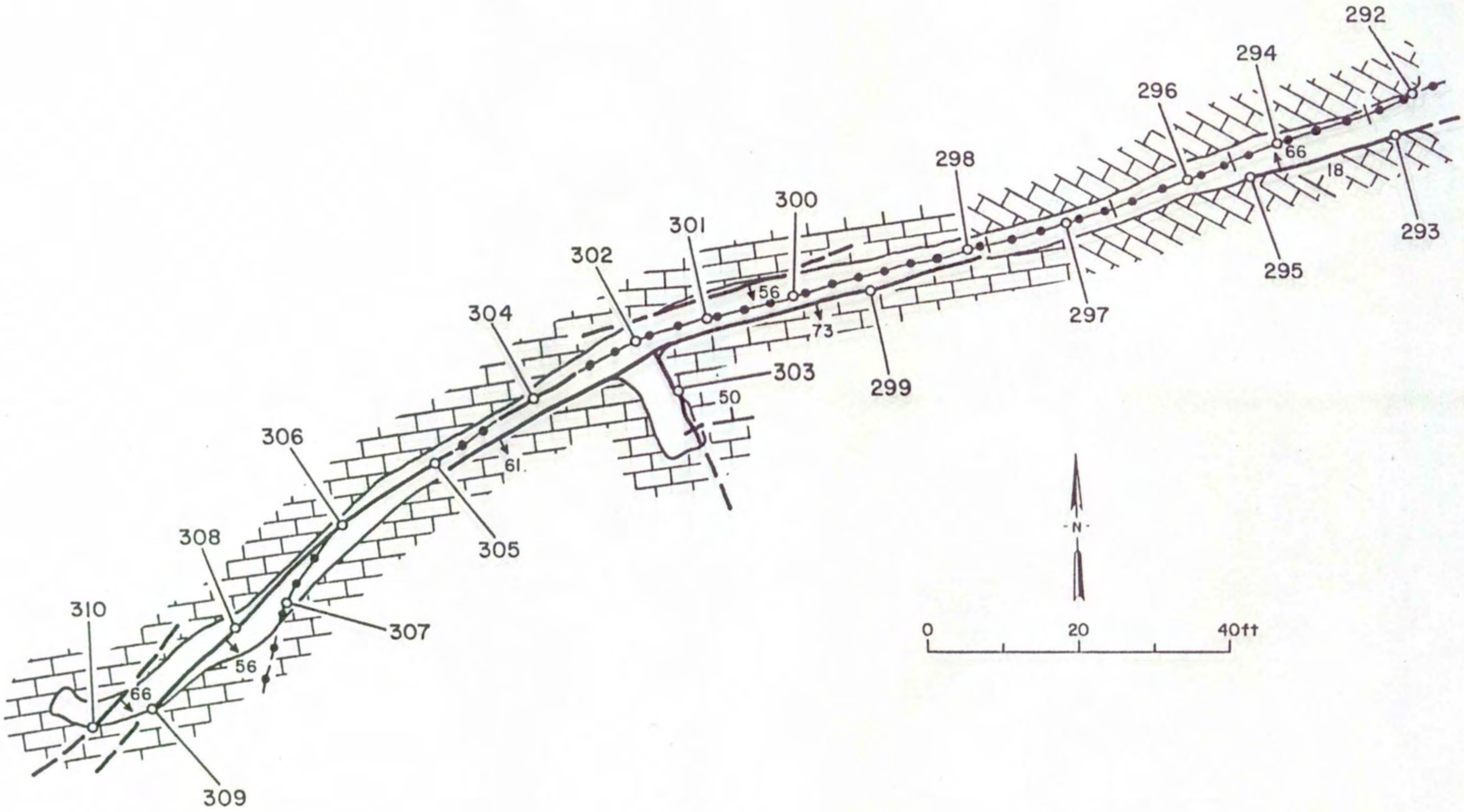
Sample No.	Sample Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Other
273	0.8	Quartz vein; hematite, limonite stringers.	---	---	150	---	18	---	49	
274	.4	Fault gouge; hematite, limonite.	---	---	230	47	14	---	220	860 Ba, 10 Co, 35 Ni, 100 V, 21 Y.
275	.9	Quartz vein; hematite, limonite stringers.	---	---	170	7	10	---	29	
276	.8	do.	---	---	240	---	13	---	45	
277	.7	Brecciated limestone; quartz stringers, calcite, hematite.	---	---	240	23	12	15	160	2 Be, 9 Co, 32 Ni, 8 Sn, 20 Y.

Figure 6C.--Adit on granite-limestone contact showing sample localities 273-277. Table shows sample data.



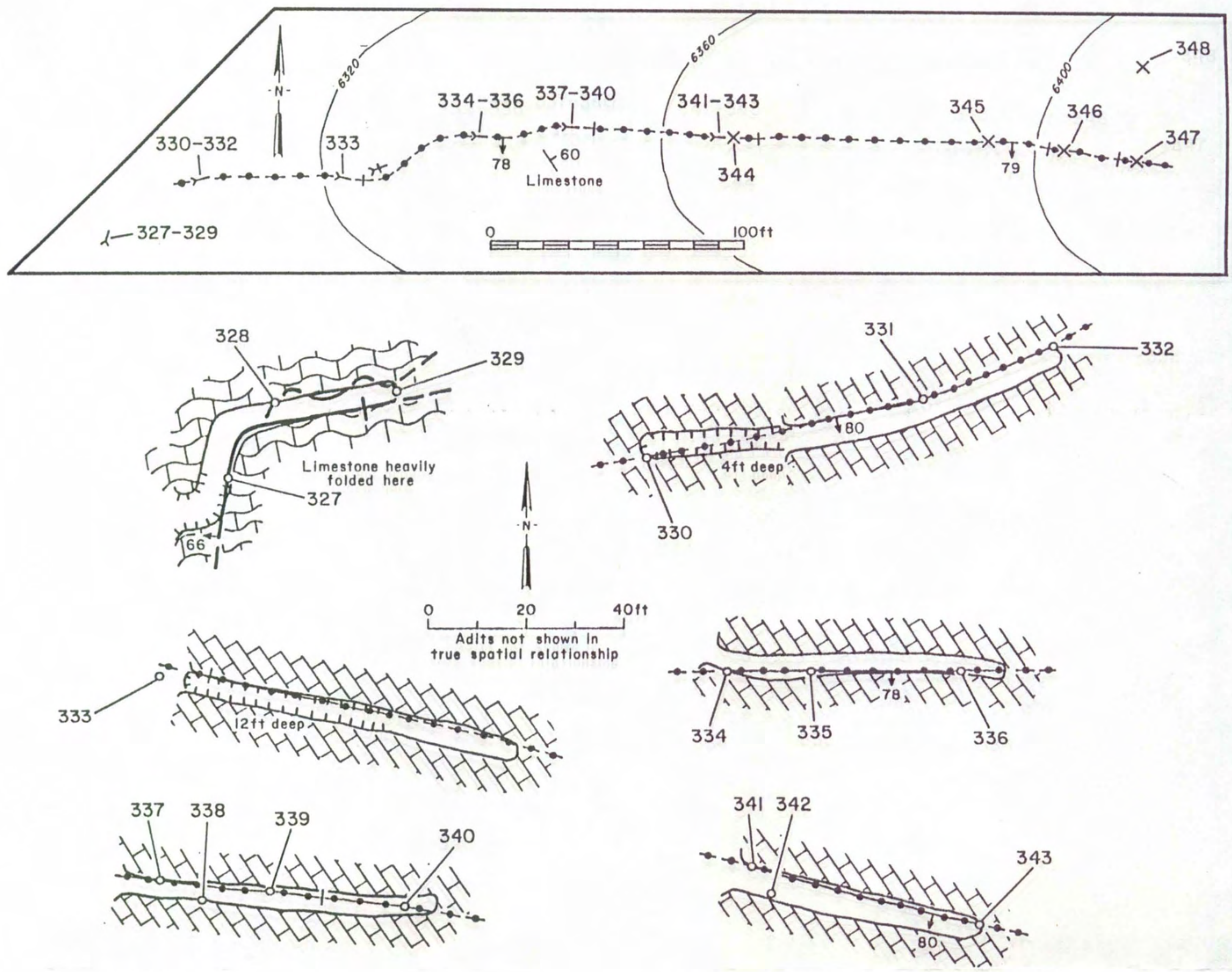
Sample No.	Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Other
256	1.0	Calcite.	---	---	91	15	---	41	89	1200 Sr.
257	.5	Quartz vein; abundant limonite.	tr	---	85	---	---	29	52	
258	1.0	Calcite, slight gouge.	---	---	190	25	---	28	95	
259	2.0	Calcite, limonite.	---	---	170	66	---	26	74	1000 Sr.
260	1.5	Calcite, gouge.	---	---	130	23	---	32	94	
261	2.0	Quartz veinlets, limonite, calcite.	---	---	160	22	---	14	76	
262	1.0	Brecciated quartz vein; abundant limonite, calcite.	---	0.1	95	7	---	14	45	
263	1.0	Calcite and quartz stringers; limonite, limestone.	---	---	120	17	---	27	90	
264	1.0	Brecciated quartz vein; abundant limonite, calcite.	---	---	160	16	---	17	55	
265	1.0	Brecciated quartz vein; abundant limonite, chalcopyrite.	tr	.5	130	54	---	120	110	
266	1.5	Brecciated quartz vein that splits into three veins of 6 in., 3 in., and 9 in.; abundant limonite, calcite.	---	.2	51	290	---	42	48	
267	3.0	Fault gouge; limestone pods, quartz, calcite, limonite.	---	.3	300	66	---	99	120	
268	2.0	Brecciated quartz stringers and veinlets; abundant limonite.	---	.1	110	81	---	110	43	
269	.5	Fault gouge; abundant limonite, hematite, calcite.	---	---	370	50	18	140	200	130 Bi, 130 Sb, 110 Te, 91 W.
270	1.0	Fractured quartz-calcite stringers; hematite, limonite.	---	---	170	16	29	35	98	
271	1.0	Fault gouge, breccia; abundant calcite and quartz, abundant limonite.	---	---	230	24	19	37	120	12 Co.
272	1.0	Abundant limonite and hematite stringers, calcite.	---	---	180	20	19	39	110	14 Co.

Figure 6D.--Mayflower adit showing sample localities 256-272. Table shows sample data.



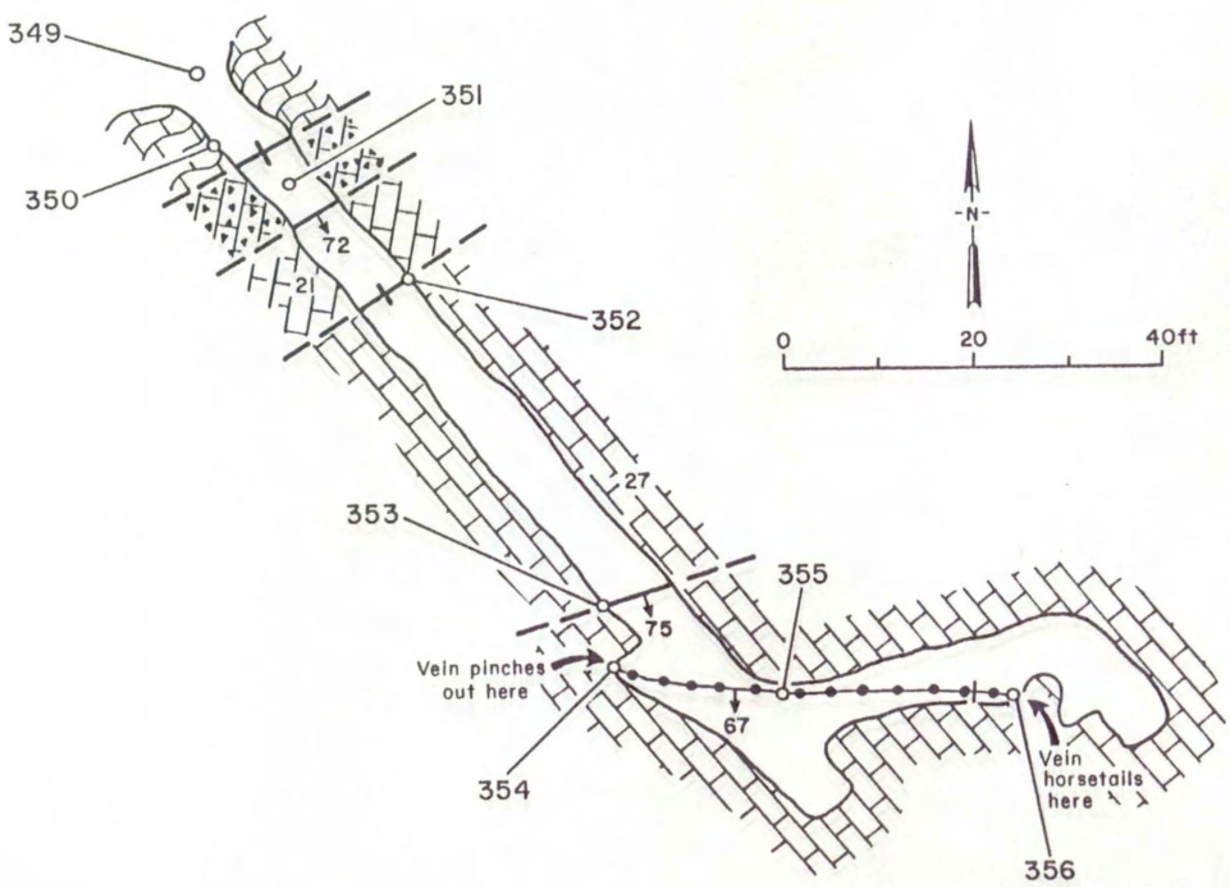
Sample No.	Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Other (ppm)
292	4.0	Fractured quartz-calcite vein; limonite, limestone pods.	---	---	61	---	---	---	---	
293	.8	Fault gouge; calcite, limonite.	tr	---	300	27	---	18	78	50 Li.
294	3.0	Fractured quartz breccia; abundant limonite, calcite, limestone pods.	---	---	70	19	---	12	87	
295	.5	Fault gouge; abundant limonite and hematite, quartz.	tr	0.1	280	44	---	20	96	
296	3.0	Quartz vein; abundant calcite, abundant limonite, limestone pods.	---	.1	59	---	---	---	6	
297	2.0	do.	---	.1	37	8	---	52	94	
298	2.0	Quartz vein; abundant limonite, limestone pods, calcite.	---	.1	100	22	---	150	210	
299	.8	Fault gouge; hematite, limonite, calcite stringers.	---	---	210	25	---	40	88	
300	2.0	Fractured quartz vein; gouge, abundant limonite, calcite.	---	.1	200	59	---	120	150	
301	2.5	Fractured and crumbly quartz vein, gouge, calcite, limonite.	---	.1	140	16	---	52	96	
302	3.0	do.	---	---	220	21	---	37	140	
303	2.0	Fault gouge; limonite, calcite.	---	.1	220	29	---	22	100	
304	2.0	do.	---	.1	230	26	---	46	91	
305	2.0	do.	---	.1	220	20	---	36	72	
306	2.5	do.	tr	.1	150	20	6	53	110	1200 Sr, 56 Te.
307	2.0	Calcite vein; quartz, limonite.	tr	.1	210	18	---	35	96	
308	2.0	Fault gouge; limonite, calcite.	---	---	210	52	---	28	83	
309	1.0	Fault gouge; abundant limonite, calcite.	---	---	200	52	6	130	160	
310	1.0	Fault gouge; calcite veinlets, hematite, limonite, limestone pods.	tr	---	320	23	---	49	110	

Figure 6E.--Adit below the Mayflower adit showing sample localities 292-310. Table shows sample data.



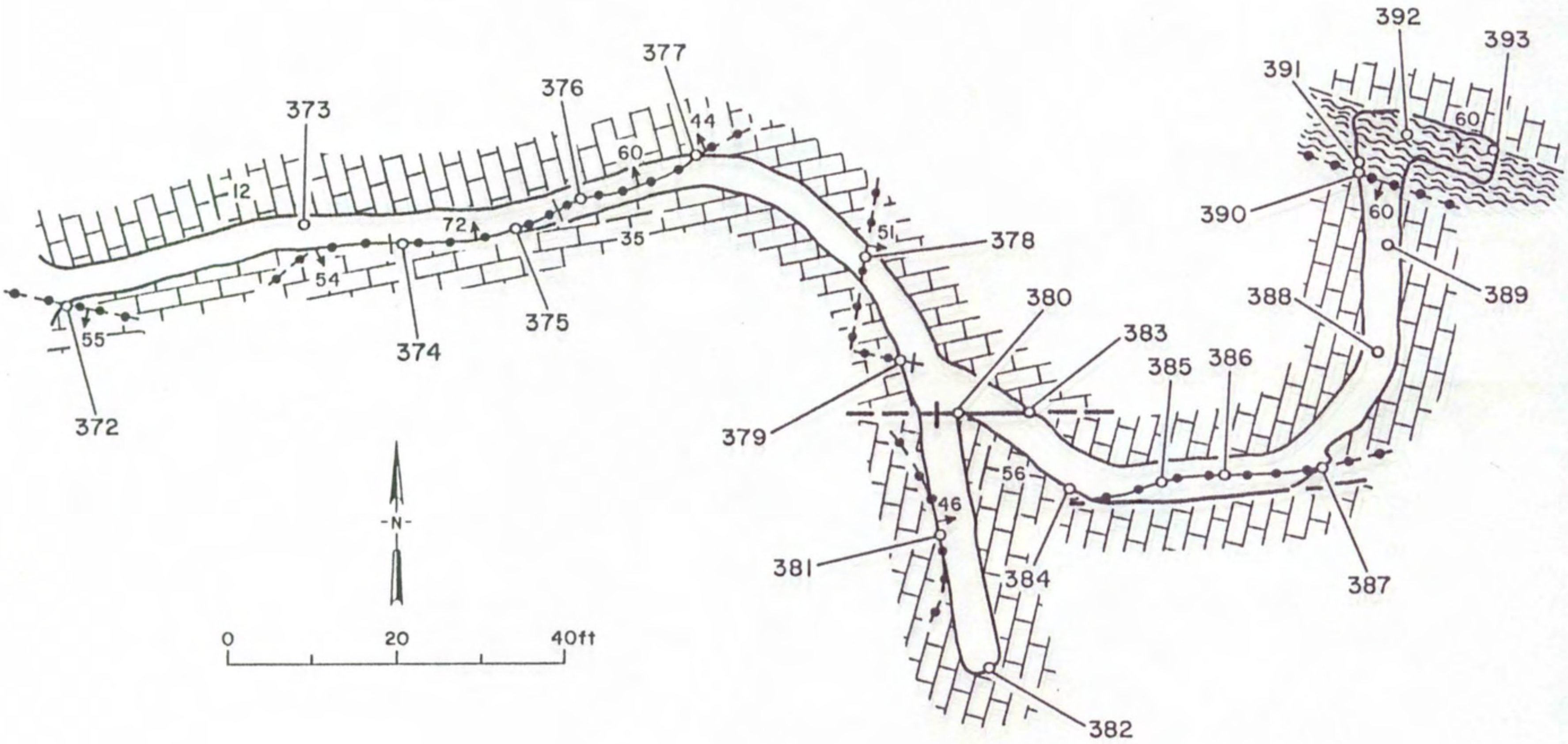
No.	Sample Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Other (ppm)
327	4.0	Limestone breccia; gouge, limonite.	---	---	95	16	9	---	93	
328	1.0	do.	---	---	---	8	7	---	31	
329	.6	Limestone breccia; limonite.	tr	---	79	---	12	---	36	
330	.7	Quartz vein; disseminated hematite after pyrite.	---	---	42	---	62	32	25	1500 Ba.
331	4.0	Quartz stringers; hematite.	---	---	41	11	19	114	32	
332	.7	Quartz vein; disseminated hematite after pyrite.	---	---	---	8	12	---	24	
333	xx	Select of quartz vein; brecciated limestone, hematite.	0.02	---	---	7	9	---	13	
334	.8	Quartz vein; hematite stains.	---	---	34	31	8	30	42	
335	2.0	Quartz vein; hematite after pyrite.	---	---	43	24	8	73	66	
336	1.0	Quartz vein; limonite, hematite.	tr	---	---	---	9	---	25	
337	1.6	Quartz vein; limestone pods, limonite after pyrite.	---	---	52	15	10	36	65	
338	.7	Fault, breccia; gouge, hematite.	---	---	100	50	17	---	93	3400 Ba, 380 Sr, 190 V.
339	1.5	Quartz vein; limonite, hematite.	---	---	58	10	9	13	63	
340	1.2	Quartz vein; limestone pods, hematite.	---	---	46	7	10	11	49	
341	1.6	Fractured quartz vein; limonite.	---	---	---	---	---	---	12	
342	2.0	Fractured limestone; hematite.	---	---	170	38	17	---	72	2000 Ba, 10 Co, 270 Sr, 76 W.
343	.4	Fractured quartz vein; limonite.	.02	---	86	9	9	---	35	2400 Ba, 13 Sn.
344	.9	Quartz vein; limonite stains.	.01	---	86	20	13	---	28	26 Sn.
345	1.0	Quartz vein; limonite, limestone pods.	tr	---	90	20	11	---	31	
346	1.7	Quartz vein; limonite, hematite.	tr	0.1	110	14	10	---	14	
347	xx	Select of quartz vein; limonite.	tr	---	100	14	8	---	25	
348	xx	Select of quartz breccia; limonite.	---	---	190	12	8	---	20	

Figure 6F.--Vein outcrop and adits on north side of Willow Creek showing sample localities 327-348. Table shows sample data.



No.	Sample Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Other
349	xx	Select of vein quartz; limonite, hematite.	---	---	41	9	9	---	31	
350	4.0	Hematite stains.	---	---	180	---	15	---	29	670 Ba, 18 Nb.
351	3.0	Fault; gouge; breccia, hematite.	---	---	79	10	7	---	49	
352	1.0	Fault; gouge, hematite, limonite.	---	---	---	---	6	---	31	480 Sr.
353	.8	Fault; gouge, breccia; hematite, limonite.	---	---	210	8	7	27	55	
354	1.0	Calcite and quartz veinlets; hematite stains.	---	---	49	8	6	---	42	
355	1.3	Quartz vein; hematite, limonite, calcite, limestone pods.	---	---	---	14	5	---	46	
356	1.8	Quartz vein; calcite, hematite, limonite.	---	---	47	17	8	24	28	

Figure 6G.--Adit at base of hill below vein, showing sample localities 349-356. Table shows sample data.



No.	Sample Length of chip (ft)	Description	Au	Ag	As	Cu	Mo	Pb	Zn	Other
			Analytical data							
			oz/st		ppm					
372	2.0	Quartz-calcite vein; limonite.	---	---	69	7	12	---	39	65 Te.
373	3.0	Calcite veinlets.	---	---	110	44	14	---	300	710 V.
374	1.5	Quartz-calcite vein; limonite.	---	0.1	54	---	10	---	28	
375	1.0	do.	---	---	62	---	9	---	24	
376	1.5	do.	---	---	39	---	10	---	24	
377	.8	Quartz-calcite vein; limonite, pyrite.	0.02	1.0	38	---	10	18	34	
378	1.0	Fractured quartz-calcite vein, limonite.	tr	---	220	53	31	---	260	77 W.
379	1.0	Fractured quartz-calcite pod, limonite.	---	---	160	16	10	12	76	
380	.5	Limestone breccia; limonite, calcite.	---	---	---	---	7	16	46	
381	2.0	Fractured quartz-calcite vein; hematite, limonite, calcite.	---	---	---	10	8	---	49	
382	2.0	Fractured limestone; calcite.	---	---	42	18	20	11	210	
383	1.2	Limestone breccia; gouge, hematite.	---	---	210	10	12	---	77	
384	1.7	Fractured limestone; calcite, limonite.	---	----	---	---	7	11	47	
385	1.0	Fractured quartz vein; hematite, limonite, calcite.	---	.1	56	---	11	43	57	
386	.9	do.	---	.1	72	---	9	63	140	
387	1.0	Fractured quartz vein; limonite.	---	.1	43	---	10	11	31	
388	1.2	Fractured limestone; calcite.	---	.1	32	15	15	---	91	
389	2.0	Fractured limestone; limonite, calcite.	---	.1	180	33	19	11	140	
390	1.4	Limestone breccia; calcite, limonite.	---	---	56	14	14	---	63	
391	1.4	Fault gouge, breccia, hematite, limonite, calcite.	---	.1	na	na	na	na	na	
392	1.5	Fractured limestone; calcite, limonite.	---	---	---	---	7	---	41	
393	2.5	Fractured limestone; calcite, hematite.	---	---	56	---	7	---	54	

Figure 6H.--Adit on fractured quartz vein showing sample localities 372-393. Table shows sample data.

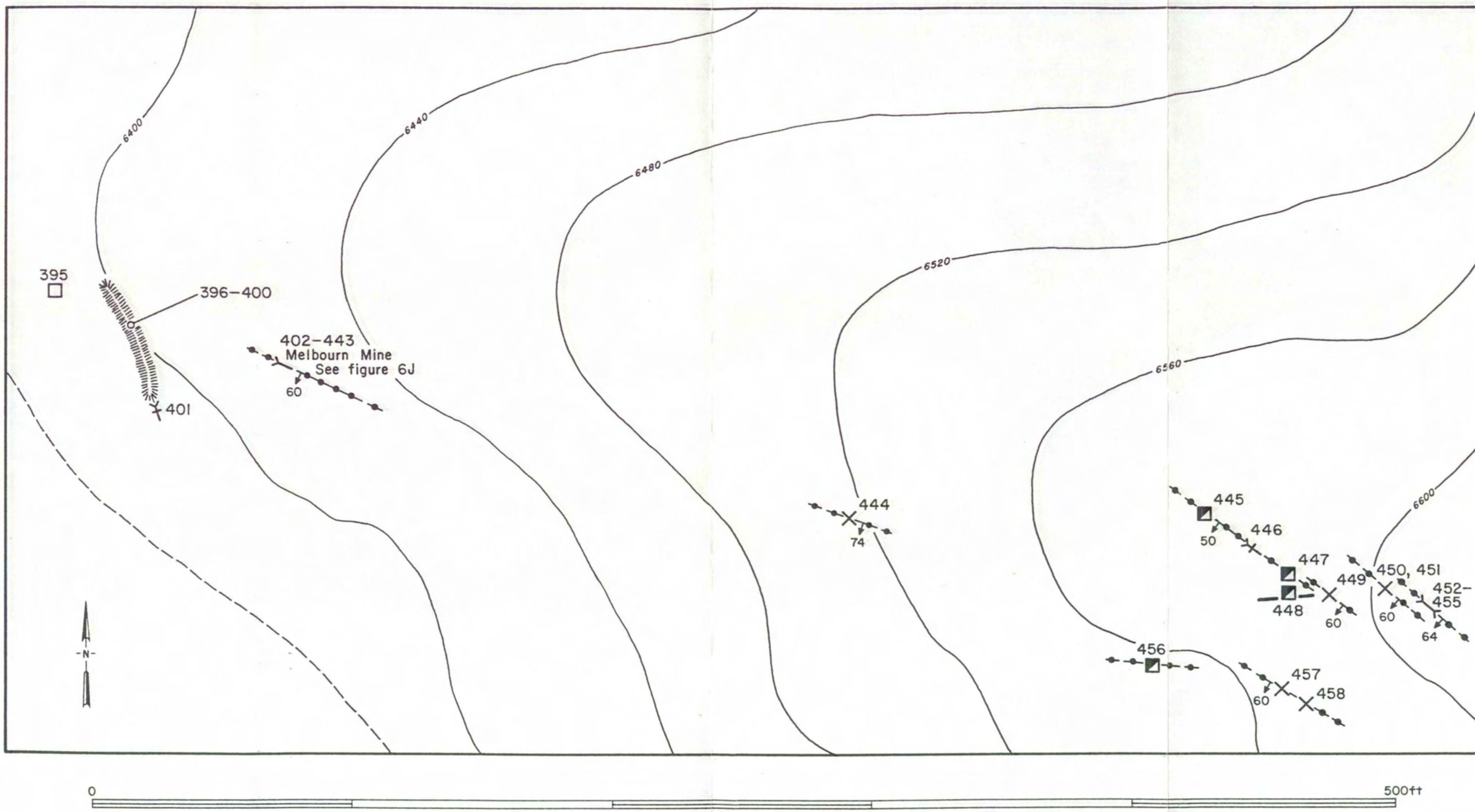


Figure 6I.--Workings on Melbourne vein showing sample localities 395-458. Table 5 shows sample data.

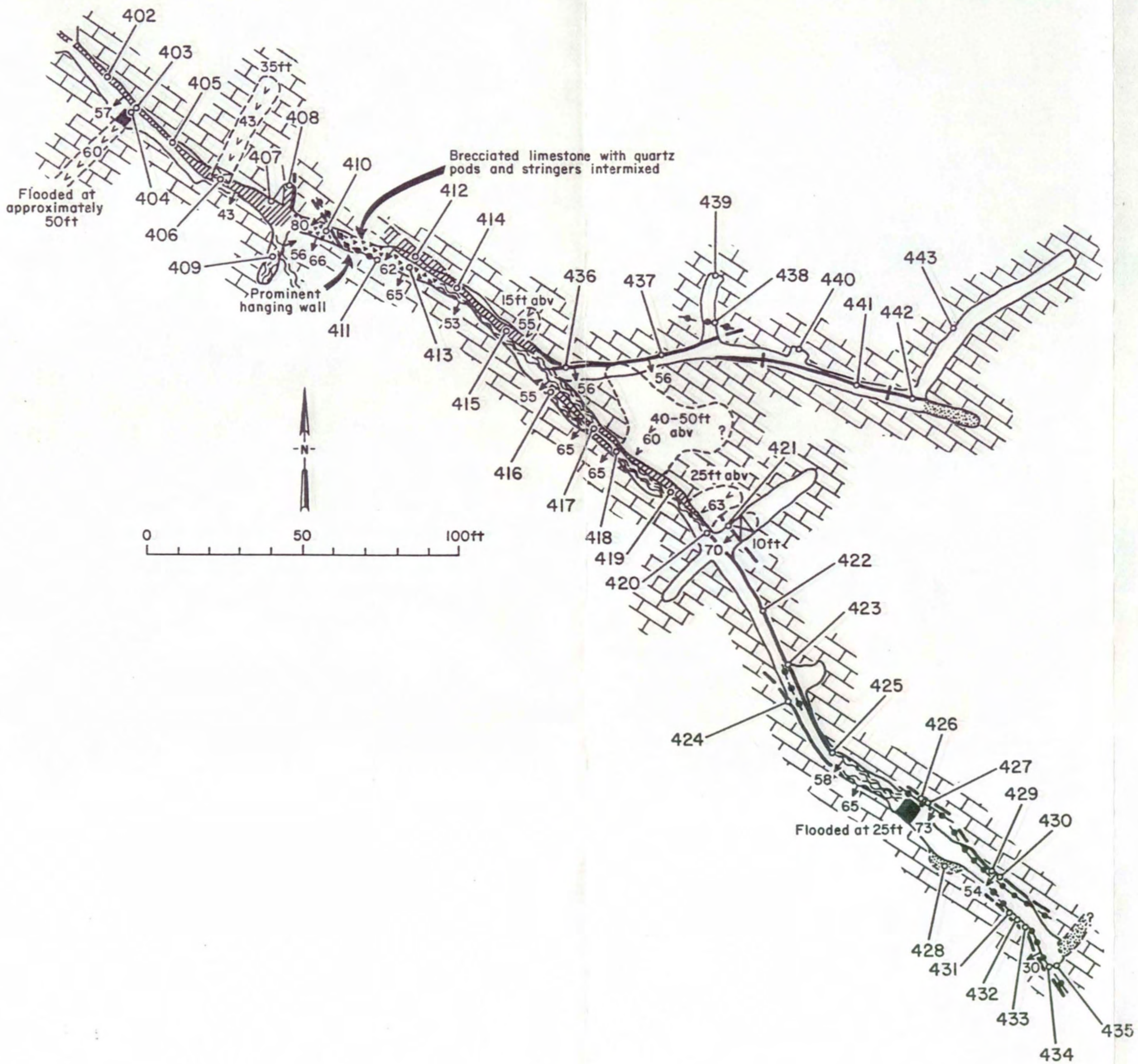
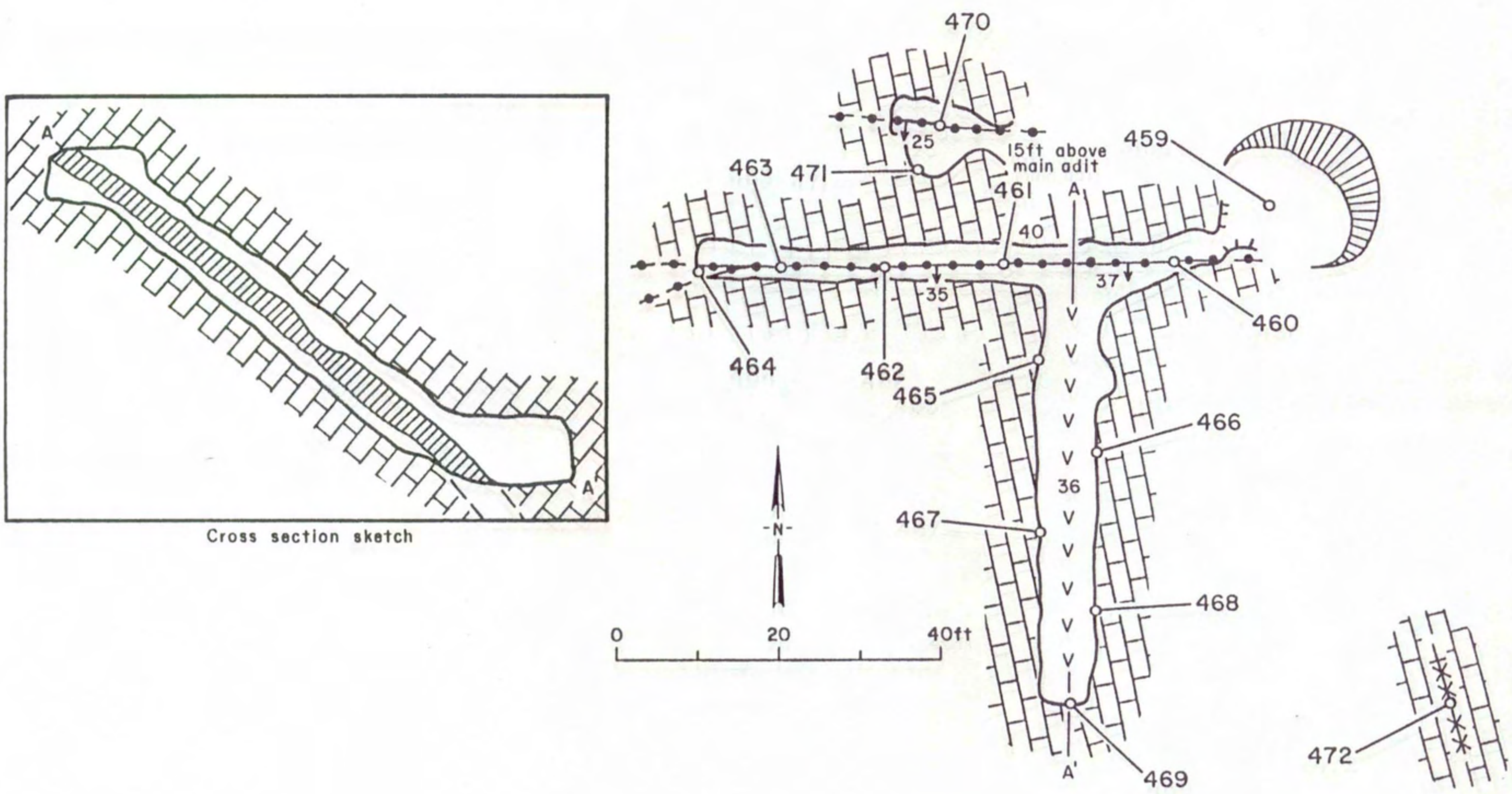
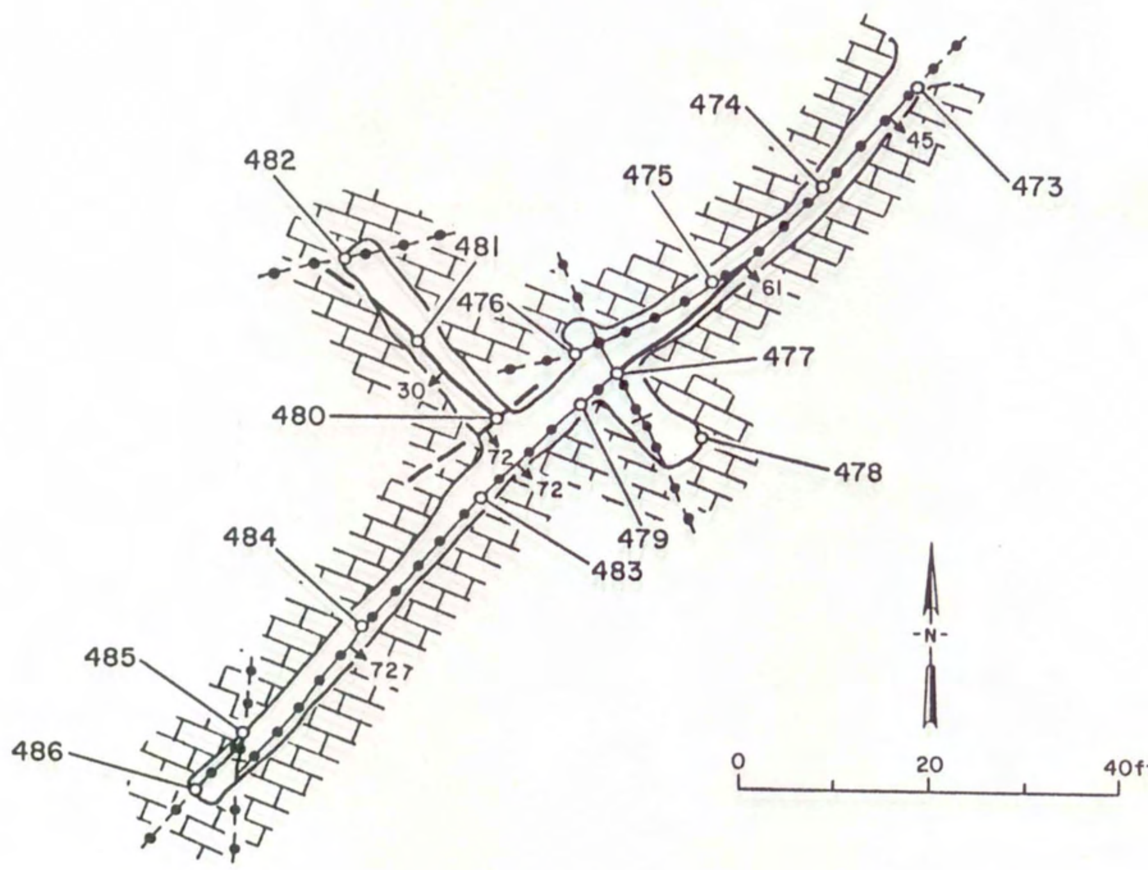


Figure 6J.--Melbourn Mine showing sample localities 402-443. Table 6 shows sample data.



No.	Sample Length of chip (ft)	Description	Analytical data Au	Ag	As	Cu	Mo	Pb	Zn	Other
			oz/st		ppm, except where noted					
459	xx	Select of calcite, limonite, gouge.	tr	---	470	---	46	---	53	170 Zr.
460	2.5	Quartz vein; calcite, limonite, gouge, limestone pods.	tr	---	---	---	---	---	36	
461	.6	Quartz-calcite vein; limestone pods, limonite.	---	---	---	---	6	---	52	
462	2.0	Quartz-calcite vein; limestone pods.	---	---	---	---	6	---	44	
463	5.0	Calcite and quartz stringers.	---	---	95	24	28	---	160	510 V.
464	3.0	Calcite and quartz stringers; hematite.	---	---	180	11	17	---	84	
465	4.0	Quartz-calcite vein; limonite, gouge.	tr	---	31	22	6	---	42	
466	1.0	Quartz-calcite vein; limonite.	tr	---	340	---	16	---	83	
467	3.5	Quartz-calcite vein; limonite, gouge.	tr	---	45	---	---	---	46	
468	.8	Quartz-calcite vein; limonite.	tr	---	0.27%	10	35	---	79	85 Sb.
469	2.0	Quartz-calcite vein.	---	---	---	---	---	---	25	
470	1.5	Quartz vein; calcite, limonite.	---	---	33	---	9	---	29	
471	2.0	Calcite and quartz veinlets; abundant limonite.	---	---	160	16	26	---	120	970 Ba, 220 Zr.
472	xx	Select of limonite.	---	---	160	10	11	---	110	740 Ba, 10 Co.

Figure 6K.--Adit on south side of Willow Creek showing sample localities 459-472. Table shows sample data.



Sample No.	Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Other (ppm)
473	3.5	Quartz vein; limonite, gouge, calcite, limestone pods.	tr	---	130	31	6	71	77	
474	3.0	Quartz vein; limestone pods; limonite.	tr	0.1	190	63	10	80	210	
475	3.5	Quartz vein; gouge, limonite.	tr	---	160	31	9	35	130	
476	2.0	Quartz vein; limonite, gouge.	0.03	.1	320	12	11	21	100	
477	.5	Brecciated quartz vein; gouge, calcite, limonite.	tr	---	310	17	13	---	270	41 Ni.
478	5.0	Fractured quartz; disseminated hematite after pyrite.	tr	.1	200	6	13	---	48	22 Nb, 94 Zr.
479	3.0	Fractured quartz vein; limonite.	.01	---	180	12	9	29	97	
480	.8	Quartz and calcite veinlets; abundant limonite.	---	.1	150	49	10	---	93	
481	.8	do.	---	---	160	13	11	---	57	
482	.5	Quartz vein; calcite, hematite, limonite.	---	---	70	---	8	32	45	
483	1.0	Brecciated quartz vein; calcite, limonite, gouge, limestone pods.	tr	---	220	47	11	650	560	9 Cd.
484	1.5	Brecciated quartz vein; calcite, gouge, limestone pods.	.01	.1	150	29	9	---	82	
485	.4	Calcite vein; black mineral.	tr	---	260	37	14	---	120	
486	2.0	Fractured quartz vein; calcite, limonite.	tr	.1	150	13	10	---	70	

Figure 6L.--Easternmost adit in Willow Creek showing sample localities 473-486. Table shows sample data.

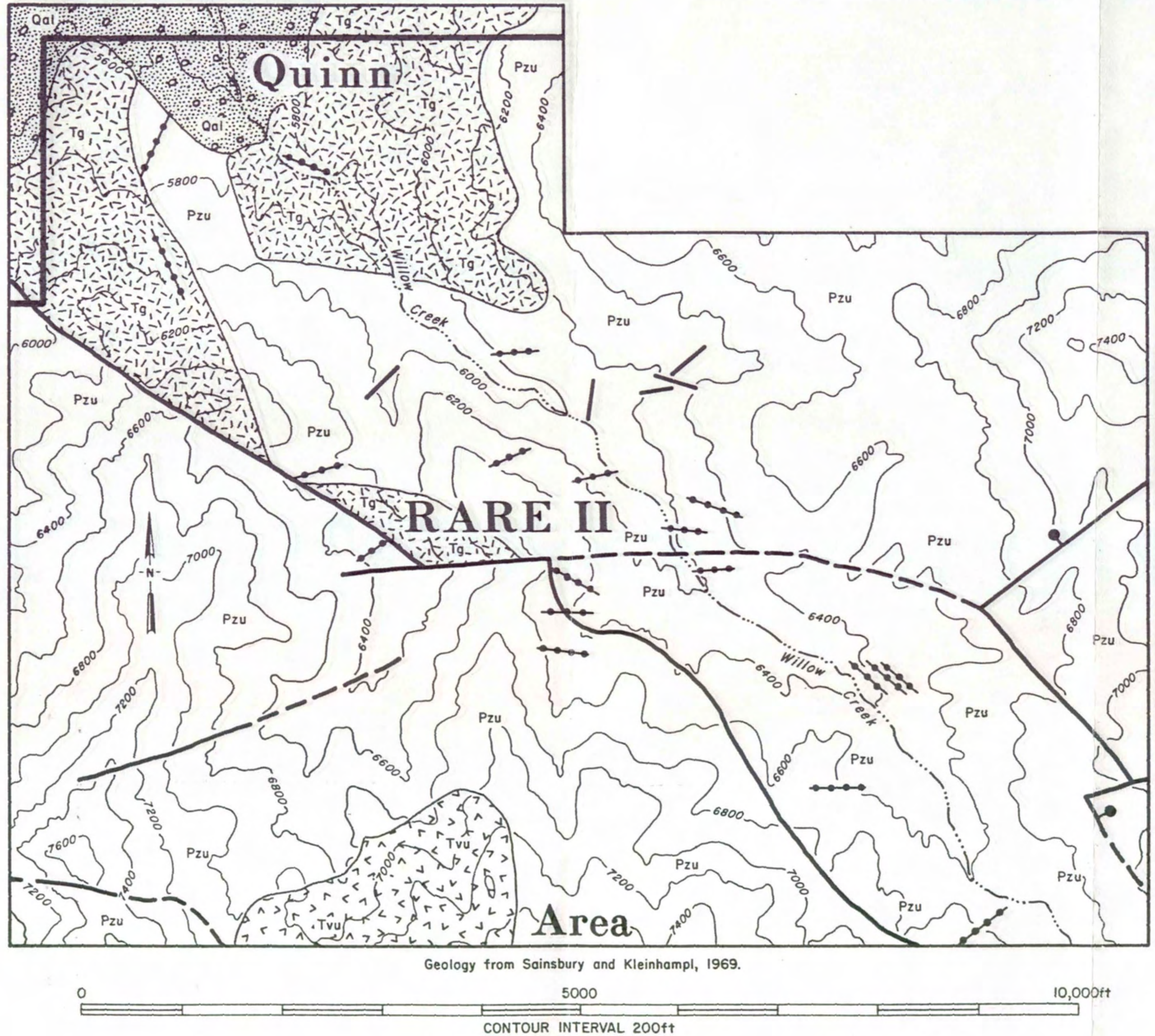
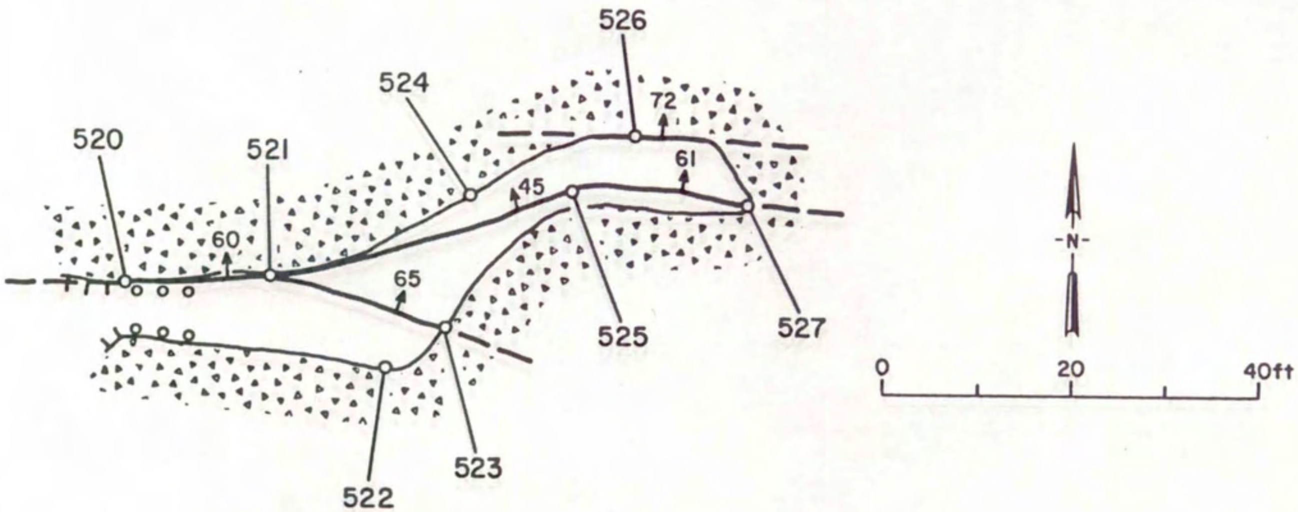


Figure 7.--Simplified geology of the Willow Creek area.



Sample No.	Length of chip (ft)	Description	CaF$_2$ (%)	SiO$_2$ (%)	Au (ppb)	Ag (ppm)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)
520	2.0	Altered rhyolite; hematite, limonite, fluorite.	2.1	78	---	0.8	26	4	40	30	98
521	2.5	Altered rhyolite tuff; fault gouge, quartz, limonite.	1.5	78	---	1.0	10	7	12	24	48
522	2.5	Rhyolite; fluorite, hematite, disseminated pyrite.	.3	74	---	1.1	10	5	25	27	32
523	2.0	Altered rhyolite fault gouge; fluorite, pyrite.	16.0	66.5	---	.7	30	3	160	23	27
524	3.0	Altered rhyolite.	.7	81	---	1.0	15	1	13	24	34
525	3.0	Fault gouge, quartz, calcite, hematite.	.3	81	---	.9	33	2	16	26	36
526	2.0	Altered rhyolite; quartz.	.2	76	---	---	---	1	3	25	19
527	3.0	Altered rhyolite; hematite.	.3	78.5	---	---	7	1	17	27	27

Figure 8.--Lower adit in Water Canyon showing sample localities 520-527. Table shows sample data.

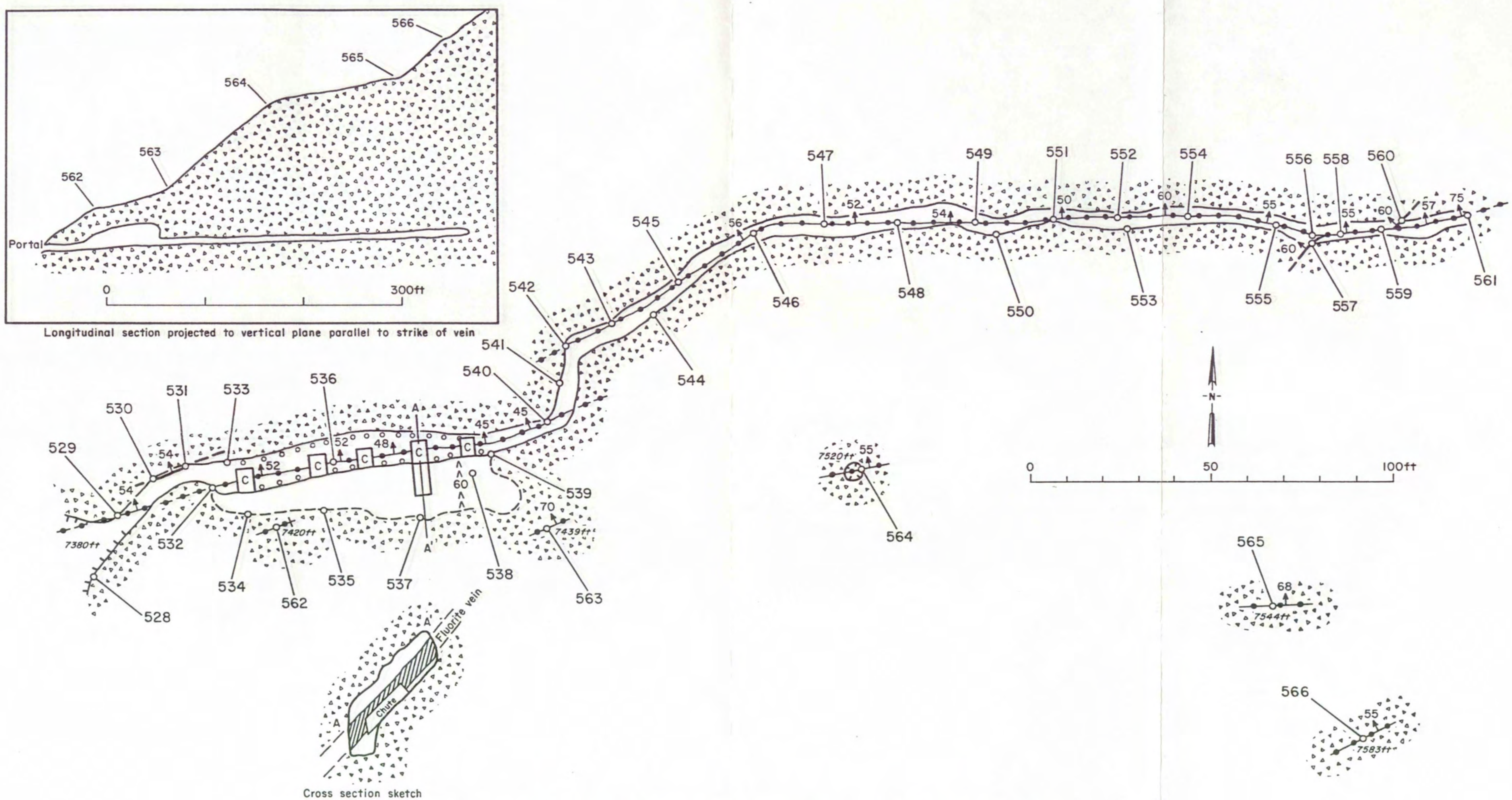
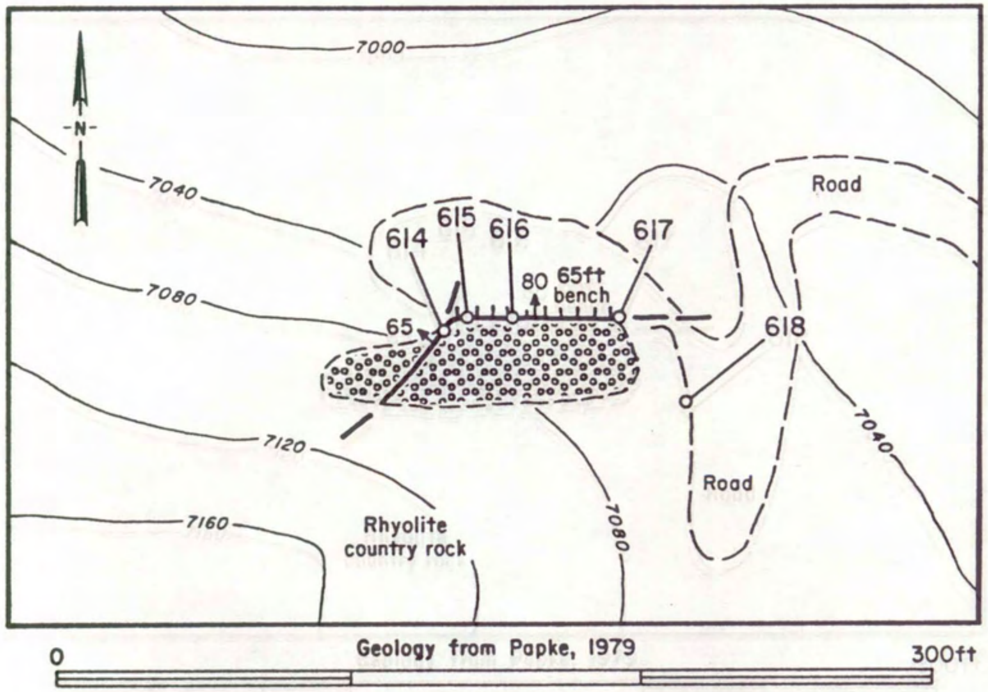
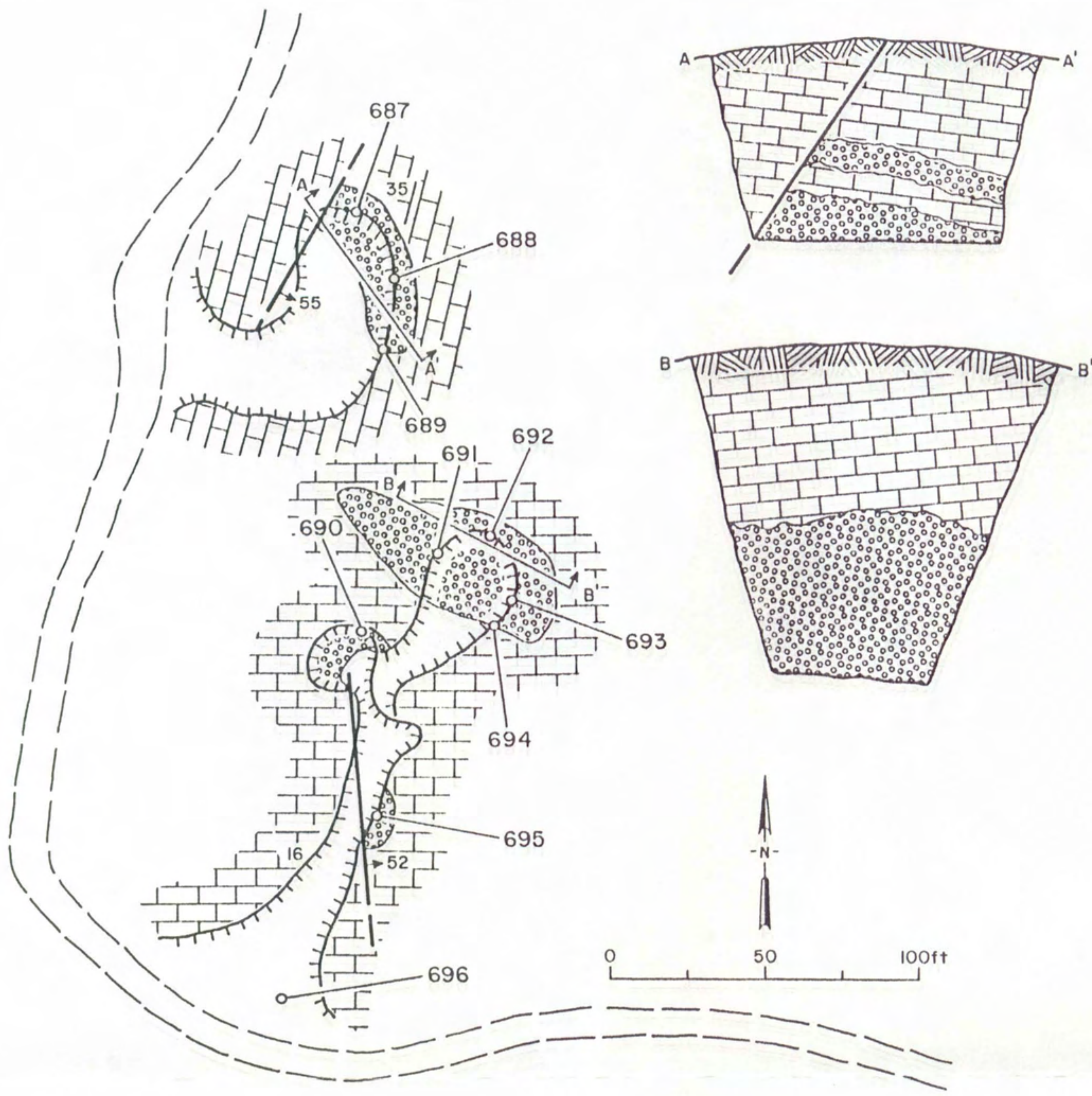


Figure 9.--Nyco Mine showing sample localities 528-566. Table 11 shows sample data.



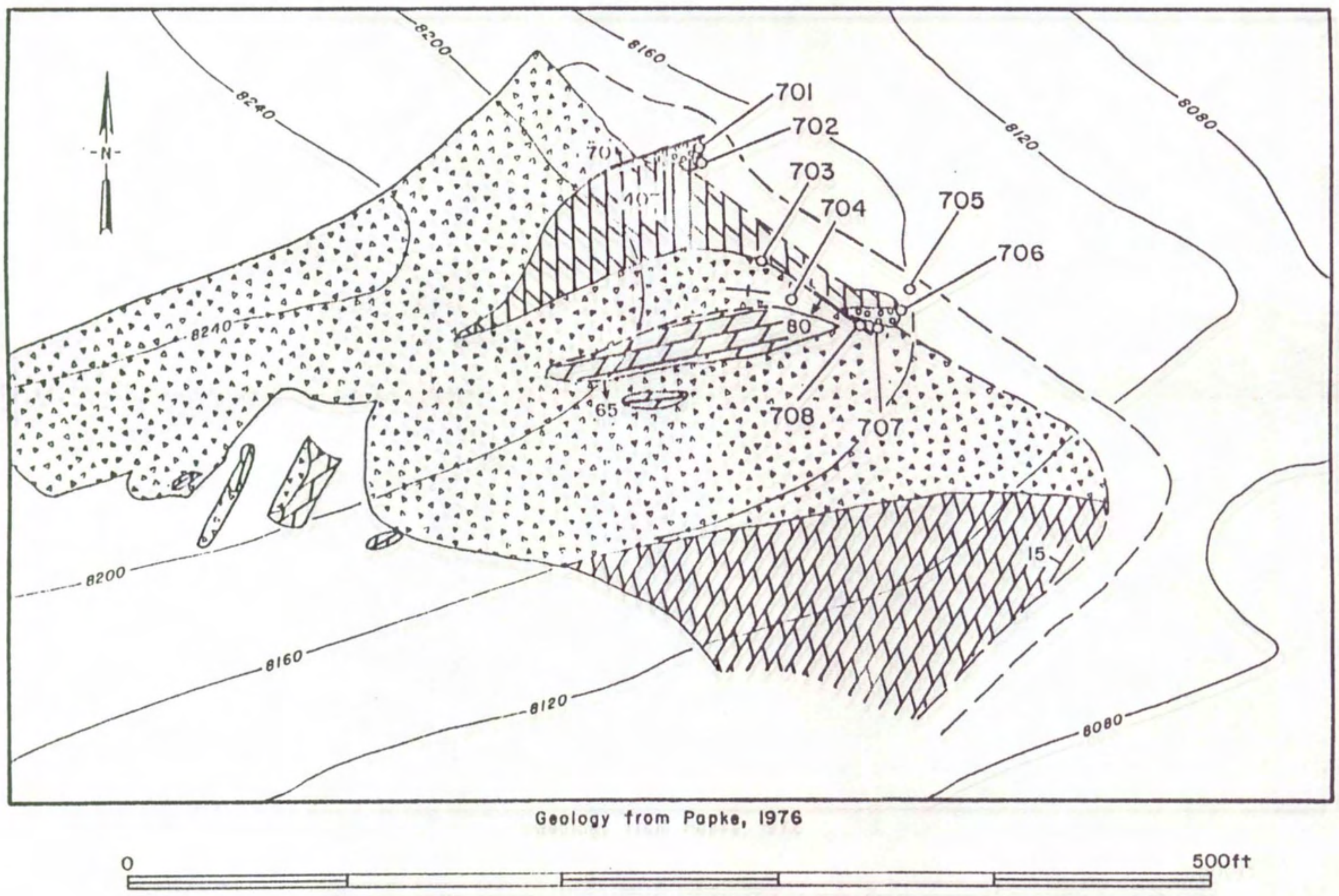
Sample No.	Type	Length (ft)	Description	CaF_2 (%)	SiO_2 (%)	Au (ppb)	Ag (ppm)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)
614	Chip	3.0	Rhyolite breccia; white and green fluorite.	20.6	63.5	---	3.9	147	11	24	149	82
615	do.	.8	Fault, strikes east, dips 80° N.; fluorite, hematite, calcite.	23.1	58.5	---	3.7	592	11	44	572	189
616	Select	xx	White fluorite.	88.8	3.0	---	2.2	823	11	5	558	103
617	do.	xx	Rhyolite breccia; white and green fluorite.	17.5	66.0	---	2.8	284	19	14	244	72
618	do.	xx	Rhyolite; chlorite, manganese oxide.	.3	64.0	---	1.3	249	8	8	203	80

Figure 10.--Blue Bell prospect in Davis Creek showing sample localities 614-618. Table shows sample data.



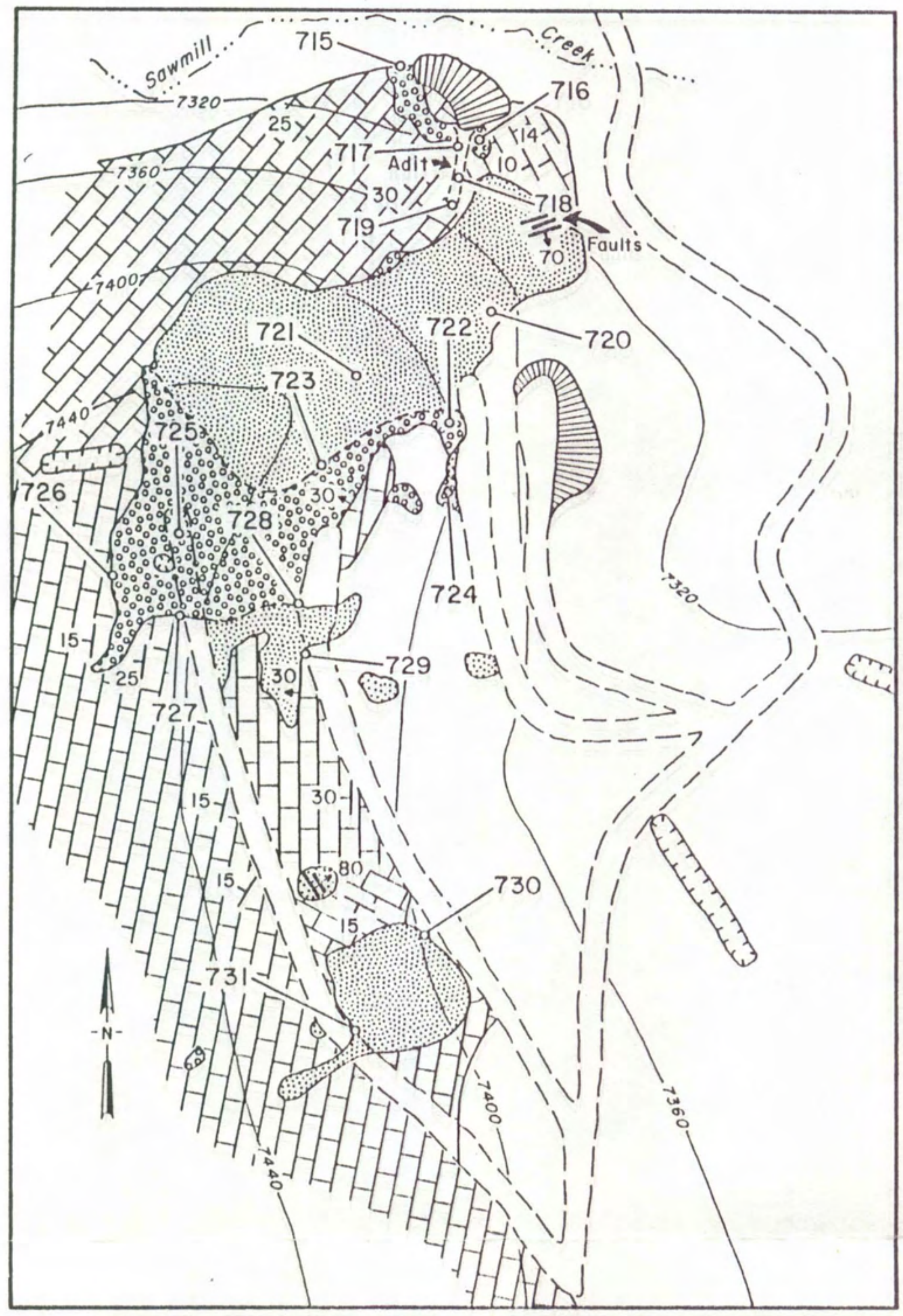
No.	Sample Length of chip (ft)	Description	CaF_2 (%)	SiO_2 (%)	Au (oz/st)	Ag (oz/st)	As (ppm, except where noted)	Cu	Mo	Pb	Zn
687	5.0	"Coonstail" fluorite zone; limestone, calcite.	95	2.3	---	0.1	---	---	---	---	42
688	5.0	do.	72	9.1	---	.1	---	---	18	---	33
689	3.5	do.	94	1.4	---	---	---	---	---	---	34
690	4.0	White fluorite; limestone.	95	3.5	tr	.3	---	---	18	---	28
691	4.0	Purple and white fluorite; calcite.	89	8.2	tr	---	32	---	22	---	40
692	4.0	do.	99	2.7	tr	.1	---	---	---	---	37
693	3.0	White fluorite; limestone, calcite.	99	2.3	---	.1	---	---	---	---	32
694	4.0	White fluorite; calcite.	97	3.2	---	---	---	---	---	---	26
695	4.0	do.	78	19.7	---	---	---	---	29	---	60
696	xx	Select of purple fluorite; limestone.	84	11.2	---	---	54	---	43	---	50

Figure 11.--Horseshoe Mine in Pine Creek showing sample localities 687-696. Table shows sample data.



No.	Sample Length of chip (ft)	Description	CaF2	SiO2	Au	Au	As	Cu	Mo	Pb	Zn	Other
			%		oz/st		ppm, except where noted					
701	4.5	White fluorite vein strikes N. 30° E., dips 50° NW.; calcite.	42	11.7	tr	---	---	---	---	---	41	320 Li.
702	5.0	Fractured limestone; fluorite.	81	7.7	---	0.1	---	---	24	---	38	
703	3.0	Fault zone strikes N. 55° W., dip undetermined; calcite.	1	25.8	---	---	---	---	---	---	50	
704	5.0	Hornfels; hematite stains.	na	na	tr	.2	150	---	12	---	61	800 Ba, 40 Nb.
705	xx	Select of purple and white fluorite; calcite.	91	5.1	---	.1	---	---	26	---	32	
706	3.0	White fluorite vein strikes N. 20° W., dips 45° SW.; calcite.	85	1.5	---	---	---	---	---	---	49	
707	3.0	Hornfels; hematite stains.	na	na	tr	.1	92	---	16	---	65	1,400 Ba, 37 Nb.
708	2.0	Contact between hornfels and fluorite strikes N. 60° W., dip undetermined; hematite.	11	56.4	---	.1	130	7	9	---	170	

Figure 12.--Spar Mine in Pine Creek showing sample localities 701-708. Table shows sample data.



Geology from Papke, 1979

0 500ft

Sample No.	Type	Length (ft)	Description	CaF_2 (%)	SiO_2 (%)	Au (oz/st except where noted)	Ag (oz/st except where noted)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)
715	Chip	1.0	Limestone; "Coonstail" fluorite.	60	38.9	0.08	---	32	---	---	---	37
716	do.	5.0	Limestone; fluorite veinlets.	24	69.4	---	---	---	---	---	---	37
717	do.	5.0	Limestone; fluorite fracture coatings and veinlets.	26	64.8	---	---	---	---	---	---	40
718	do.	4.0	Limestone; fluorite and calcite veinlets.	3.6	21.7	.03	---	---	---	---	---	37
719	do.	5.0	Limestone; calcite veinlets.	.50	7.9	tr	---	---	---	---	---	28
720	Select	xx	Limestone breccia; jasper.	14	80.6	0.031 ppm	0.370 ppm	43	---	6	---	38
721	do.	xx	Red and tan jasperoid.	7.5	82.0	.218 ppm	.800 ppm	160	8	39	---	59
722	Chip	2.5	Limestone breccia; fluorite veinlets, calcite.	3.8	54.9	tr	.1	72	---	15	23	89
723	Select	xx	Silicified limestone breccia; limonite, fluorite veinlets.	4.0	59.4	tr	.1	100	11	18	19	88
724	Chip	3.0	Limestone breccia; fluorite veinlets, calcite.	21.7	75.5	.05	.1	46	7	9	11	73
725	Select	xx	Silicified limestone; breccia; green and white fluorite.	74	25.4	tr	---	---	---	---	---	34
726	do.	xx	Limestone; white fluorite.	53	46.4	tr	---	---	---	---	---	41
727	do.	xx	Limestone; brecciated fluorite; hematite.	24.8	56.8	tr	.2	170	17	43	29	81
728	do.	xx	Limestone; brecciated fluorite.	29.6	51.2	.03	.3	68	8	14	20	69
729	do.	xx	Silicified limestone; hematite, white fluorite veinlets.	10.8	75.0	.03	.1	87	13	18	14	74
730	do.	xx	Red jasperoid.	2.2	85.6	.05	.1	82	---	15	15	72
731	do.	xx	Silicified limestone; hematite.	4.6	78.2	tr	.1	48	---	6	10	60

Figure 13.--Mammoth prospect in Sawmill Canyon showing sample localities 715-731. Table shows sample data.

Table 1.--Summary of information regarding mineralized areas in and near the Quinn RARE II Area.

[Possible by-products shown in parenthesis.]

Mineralized area sample numbers	Commodities	Geology: Setting	Geology: Deposit	Development and production	Resources
Gold Canyon, inside the study area, samples 1-126.	Au, Ag, As, (Cu, Pb, Zn).	Cambrian shale, quartzite, limestone, dolomite.	Quartz veins, fault zones trending northeast.	5 adits, 10 shafts, 22 prospect pits, Small Au, Ag production.	None.
Nyala Canyon, inside the study area, samples 127-231.	Au, Ag, As, Pb, Zn (Cu).	Cambrian and Olovician shale, limestone, dolomite.	Quartz veins, fault zones; replacement zones.	5 adits, 13 shafts, 4 trenches, 34 prospect pits, Moderate Au, Ag; small Pb, Zn production.	50,000 tons 0.26 oz/ton Au, 900 tons 0.1 oz/ton Au, 7 oz/ton Ag.
Willow Creek, inside the study area, samples 232-486.	Au, Ag.	Cambrian limestone, dolomite; Tertiary granite, granitic dikes.	Quartz veins, fault zones, skarns.	19 adits, 9 shafts, 38 prospect pits, 1 trench, small Au, Ag production.	None.
Big Creek Canyon, inside the study area samples 494-506.	As	Ordovician, Silarian and Devonian limestone, dolomite; Tertiary rhyolite.	Fault zones, fracture zones.	4 prospect pits.	None.
North Fork Cottonwood Creek, inside the study area, samples 644-657.	Au, Ag, As, Pb, Zn.	Tertiary rhyolite.	Altered zones, silicified zones.	1 shaft, 4 prospect pits.	None.
Badger Gulch, partially inside the study area, samples 671-686.	Au, Ag, pb, As, (Cu, Zn).	Ordovician limestone.	Sulfide replacement, breccia zone strikes west.	1 adit, 1 shaft, 2 prospect pits.	15,000 tons 8 oz/ton Ag, 1% Pb.
Water Canyon, partially inside the study area, samples 516-572.	CaF_2	Tertiary rhyolite.	Fluorite vein strikes northeast.	2 adits, 1 bulldozer trench, 3 drill holes, Small CaF_2 production.	Indicated: 19,000 tons of 58% CaF_2. Inferred: 35,000 tons of 58% CaF_2.
Quinn Canyon, outside the study area, samples 573-599.	CaF_2 (Au)	Tertiary rhyolite.	Breccia zone, fluorite veins.	4 bulldozer trenchs, 12 prospect pits, 1 shaft.	None.
Davis Creek, outside the study area, samples 611-619.	CaF_2	Tertiary rhyolite.	Fluorite veins.	Bulldozer cuts.	None.
South Fork Cottonwood Creek, outside the study area, samples 623-637.	CaF_2	Tertiary rhyolite.	Fluorite veins.	8 prospects.	None.

Table 1.--Summary of information regarding mineralized areas in and near the Quinn RARE II Area--Continued

Mineralized area sample numbers	Commodities	Geology		Development and production	Resources
		Setting	Deposit		
Pine Creek, outside the study area, samples 687-708.	CaF_2 (Au)	Devonian limestone, dolomite; Tertiary dikes and sills.	Fluorite replacement, fluorite veins.	2 open-pit mines, 1 shaft, 3 bulldozer trenches, Moderate CaF_2 production.	Indicated: 13,000 tons of 90% CaF_2. Inferred: 300,000 tons of 90% CaF_2.
Sawmill Canyon, outside the study area, samples 715-731.	Au, CaF_2	Ordovician limestone.	Fluorite replacement, jasperoid.	4 bulldozer prospects.	None.

Table 2.--Data for samples 2-4, 26-27, 66-69, 86-94, 111-116, 119-125 from the Gold Canyon mineralized area not shown on figures 4B-4F.

[xx, not applicable; --, not detected; tr, trace.]

Sample				Analytical data							
No.	Type	Length (ft)	Description	Au (oz/st)	Ag (oz/st)	As	Cu	Mo	Pb	Zn	Other
						ppm, except where noted					
2	Chip	1.0	Quartz vein strikes N. 70° W., vertical dip; hematite.	---	---	---	11	9	---	38	
3	Select	xx	Brecciated limestone; limonite.	---	0.5	32	370	9	0.22%	.19%	
4	do.	xx	Vein quartz; limonite, black mineral.	0.03	---	130	8	18	16	100	
26	Chip	4.0	Green shale; hematite after disseminated pyrite.	---	---	170	30	18	---	130	620 Ba, 110 W.
27	Select	xx	Rhyolite breccia zone; quartz.	---	.1	84	13	15	---	170	
66	Chip	1.8	Black limestone; limonite stains.	---	---	---	---	---	25	98	760 Sr.
67	do.	5.0	Siliceous limestone; quartz stringers, malachite.	---	.1	160	0.39%	8	---	88	500 Ba.
68	do.	1.3	Limestone breccia strikes N. 85° W., vertical dip; quartz stringers, limonite.	---	.1	91	27	22	19	82	
69	do.	1.0	Quartz vein strikes N. 70° W., vertical dip; hematite, limonite.	---	---	72	15	11	---	32	
86	Select	xx	Quartz vein strikes N. 70° E., dips 12° SE.; hematite, limonite, limestone pods.	tr	---	---	54	---	27	40	
87	do.	xx	Limestone; hematite, limonite, disseminated pyrite.	tr	.1	150	47	---	---	44	
88	do.	xx	Red shale; disseminated pyrite, calcite.	---	---	130	40	15	---	80	
89	do.	xx	Limestone; calcite, quartz stringers, hematite, disseminated pyrite.	---	---	---	13	7	160	80	
90	do.	xx	Green shale; disseminated pyrite, hematite stains.	---	---	140	32	14	---	94	560 Ba.
91	do.	xx	Vein quartz; hematite stains.	.02	.1	---	---	---	---	34	160 Li.
92	do.	xx	Quartz breccia; limestone pods, hematite.	.01	---	38	15	---	---	43	
93	do.	xx	Limestone breccia; disseminated pyrite.	.03	---	---	---	26	120	96	
94	Chip	.5	Quartz vein strikes N. 80° W., dip unknown; hematite.	tr	---	36	21	---	---	34	160 Li.
111	do.	1.5	Quartz vein strikes N. 75° W., dips 73° NE.; hematite stains.	---	---	---	49	---	11	40	130 Li.

Table 2.--Data for samples 2-4, 26-27, 66-69, 86-94, 111-116, 119-125 from the Gold Canyon mineralized area not shown on figures 4B-4F--Continued

Sample				Analytical data							
				Au	Ag	As	Cu	Mo	Pb	Zn	Other
No.	Type	Length (ft)	Description	oz/st		ppm, except where noted					
112	Chip	2.5	Hornfels strikes N. 70° E., dips 20° SE.; hematite.	tr	---	100	19	6	---	67	840 Ba, 25 Nb.
113	Select	xx	Limestone breccia zone; calcite, hematite.	---	---	---	---	---	---	84	0.11% Ba, 20 Y.
114	do.	xx	Limestone breccia; calcite, hematite, disseminated pyrite.	---	0.1	77	9	10	---	100	550 Ba.
115	do.	xx	Vein quartz; calcite, limestone pods, hematite stains.	---	---	---	---	---	---	180	
116	Chip	.5	Quartz vein strikes N. 75° W., dips 60° NE.; calcite, limestone pods.	tr	---	---	---	---	---	480	
119	Select	xx	Silicified limestone; hematite stains.	---	.1	160	12	17	---	100	580 Ba.
120	do.	xx	Andesitic dike strikes N. 30° E., vertical dip; hematite stains.	---	---	150	140	18	---	120	830 Ba.
121	do.	xx	Silicified limestone; hematite, limonite.	---	---	180	21	19	---	120	920 Ba.
122	do.	xx	Quartz vein, abundant hematite, limonite.	---	.1	---	11	12	---	75	0.17% Ba, 770 Sr.
123	Chip	2.0	Limestone; quartz stringers, hematite.	---	---	---	10	12	---	63	
124	Select	xx	Granitic dike strikes N., vertical dip; hematite.	---	---	270	28	24	---	100	600 Ba, 570 Sr, 190 V, 110 W, 200 Zr.
125	do.	xx	Brecciated quartz vein strikes N. 60° W., vertical dip; hematite, limonite.	---	---	97	11	17	37	52	

Table 3.--Data for samples 148, 154-178 from the Nyala Canyon mineralized area shown on figure 5C.

[xx, not applicable; ---, not detected; tr, trace; > greater than.]

Sample No.	Sample Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm, except where noted)	Cu	Mo	Pb	Zn	Other
148	xx	Select of siderite; hematite.	tr	12.7	530	480	31	0.16%	0.59%	740 Ni, 0.18% Sb, 260 V, 550 Sr.
154	1.5	Quartz vein; hematite, limonite, arsenopyrite.	0.21	1.2	>10%	69	25	.51%	3.2%	400 Cd, 510 Sb.
155	xx	Select of granitic dike; hematite, limonite.	tr	---	.15%	41	18	46	760	770 Ba.
156	3.0	Quartz; abundant limonite, hematite.	.13	.4	>10%	370	18	---	900	83 Sb.
157	3.0	Altered granitic dike; hematite.	.12	.4	>10%	21	20	33	50	
158	2.0	Siderite vein; hematite, limonite.	.11	.3	>10%	150	18	160	46	620 Sr.
159	3.0	Granitic dike; quartz, hematite stains.	tr	---	760	9	18	32	200	0.15% Ba, 550 Sr, 83 W.
160	1.5	Limestone; hematite, limonite, quartz, calcite.	.04	---	3.4%	61	26	520	2.2%	360 Cd, 77 Sb.
161	3.0	Crumbly dike; hematite.	.16	1.0	>10%	16	18	67	.14%	150 Sb.
162	xx	Select of massive arsenopyrite; quartz, pyrite.	.25	1.4	>10%	58	23	250	.25%	490 Sb.
163	2.0	Fault strikes N. 30° E., dips 55° SE.; gouge, hematite, limonite.	.01	.3	880	120	24	---	260	270 V.
164	xx	Gossan zone; limonite.	.23	1.6	>10%	190	14	770	.54%	350 Cd.
165	1.0	Gossan zone; limonite, hematite.	.39	.4	4.0%	110	10	230	.13%	890 Sr.
166	xx	Select of massive arsenopyrite; pyrite, galena.	.18	6.3	>10%	360	28	8.2%	860	190 Sb.
167	xx	Select of gossan; hematite, limonite.	.03	4.9	1.8%	400	27	5.5%	1.8%	240 Cd, 640 Ni, 85 Sb.
168	xx	Select of massive pyrite, quartz.	.02	.8	660	24	13	230	.55%	
169	xx	Select of massive arsenopyrite; sphalerite, pyrite.	.20	.7	>10%	200	23	.59%	4.5%	400 Cd, 370 Sb.
170	2.0	Gossan zone; hematite, limonite.	.02	.2	.63%	200	24	28	240	82 W.
171	2.0	Andesite dike; hematite stains.	---	---	920	19	16	44	130	610 Ba, 80 W.

Table 3.--Data for samples 148, 154-178 from the Nyala Canyon mineralized area shown on figure 5C--Continued

Sample			Analytical data							
	Length of chip		Au	Ag	As	Cu	Mo	Pb	Zn	Other
No.	(ft)	Description	oz/st		ppm, except where noted					
172	xx	Select of massive arsenopyrite; pyrite, quartz.	0.33	1.1	>10%	88	17	19	380	150 Cd, 100 Sb.
173	xx	Select of gossan zone, limonite, hematite.	.02	.9	.84%	0.14%	89	1.5%	4.4%	470 Cd.
174	xx	Select of brown silicified limestone, abundant hematite.	tr	.3	.31%	140	53	.39%	.82%	610 Ni.
175	xx	Select of quartz; arsenopyrite, pyrite, galena.	.28	5.5	>10%	650	22	5.1%	.24%	
176	xx	Select of gossan zone; limonite, hematite.	tr	3.2	.80%	440	54	3.1%	1.1%	280 Cd.
177	xx	Select of granitic dike; quartz, hematite.	---	---	440	31	20	76	.18%	0.56% Ba.
178	xx	Select of quartz; arsenopyrite, pyrite.	.47	2.5	>10%	300	25	.88%	730	180 Sb.

Table 4.--Data for samples 128-143, 145-147, 179-189, 191, 193-202, 214-231 from the Nyala Canyon mineralized area not shown on figures 5B-5D.

[xx, not applicable; ---, not detected; tr, trace; >, greater than.]

Sample				Analytical data							
No.	Type	Length (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm, except where noted)	Cu	Mo	Pb	Zn	Other
128	Chip	8.0	Calcite vein strikes N. 30° W., dips 65° NE.; limonite stains.	---	0.1	620	12	12	---	40	870 Ba.
129	do.	13.0	Massive arsenopyrite vein strikes N. 60° E., dips 30° SE.; pyrite.	0.15	2.8	>10%	170	23	100	100	20 Cd.
130	Select	xx	Massive arsenopyrite; pyrite.	.20	2.1	>10%	130	16	---	45	19 Cd.
131	do.	xx	Limonite between limestone and arsenopyrite; hematite.	.04	2.1	2.1%	100	220	0.12%	0.14%	250 V.
132	do.	xx	Gossan zone strikes N. 52° W., vertical dip; hematite, limonite.	.03	.6	.36%	540	120	---	150	
133	do.	xx	Granitic dike strikes N. 73° E., dips 47° NW.; abundant hematite.	.01	1.2	.48%	150	25	.35%	.16%	
134	do.	xx	Granitic dike strikes N. 80° E., dips 55° SE.; quartz stringers, hematite.	---	.1	710	21	30	170	330	
135	do.	xx	Fractured granitic dike strikes N., dip undetermined; quartz, hematite.	.02	.4	.42%	55	20	900	.16%	
136	do.	xx	Limestone breccia; hematite stains.	tr	.1	480	60	9	---	150	50 Sn.
137	do.	xx	Limestone breccia; quartz, hematite stains.	tr	---	390	25	12	---	120	10 Sn.
138	Chip	2.0	Crumbly granitic dike strikes N., dip undetermined; hematite.	tr	.1	.14%	23	16	22	440	76 W.
139	do.	1.4	Fault strikes N. 25° W., dips 67° SW.; gouge, hematite, limonite, quartz.	.16	1.1	6.3%	59	18	130	450	
140	do.	5.0	Fractured granitic dike strikes N. 68° E., vertical dip; gouge, hematite, quartz.	tr	.2	590	17	120	300	310	250 Cr.
141	do.	.5	Fault strikes N., dips 70° W.; gouge, hematite, limonite, calcite.	---	2.3	1.4%	320	18	.65%	1.5%	0.13% Ba, 130 Cd, 220 Sb.
142	do.	.7	do.	.05	4.9	1.2%	360	23	.30%	1.6%	0.11% Ba, 120 Cd, 220 Sb.

Table 4.--Data for samples 128-143, 145-147, 179-189, 191, 193-202, 214-231 from the Nyala Canyon mineralized area not shown on figures 5B-5D--Continued

Sample				Analytical data							
		Length		Au	Ag	As	Cu	Mo	Pb	Zn	Other
No.	Type	(ft)	Description	oz/st		ppm, except where noted					
143	Select	xx	Limestone; hematite, calcite, quartz stringers.	0.04	---	0.13%	17	24	18	90	
145	do.	xx	Quartz; chalcopyrite, disseminated pyrite.	.08	0.7	120	0.61%	13	---	620	
146	do.	xx	Gossan zone strikes N. 70° W., dips 75° SW.; hematite, limonite.	---	.2	490	660	37	---	120	
147	do.	xx	Skarn zone strikes N. 70° W., dips 75° SW.; hematite, pyrite.	.01	.1	160	210	17	---	420	
179	do.	xx	Andesitic dike strikes N. 78° E., dips 20° SE.; pyrite, arsenopyrite.	.31	.7	>10%	350	24	---	61	
180	do.	xx	Gossan; hematite, limonite.	.22	.3	>10%	440	32	---	86	
181	Chip	0.5	Siderite vein strikes N. 10° E., vertical dip; hematite, limonite, calcite, quartz.	.02	1.4	.60%	130	44	0.74%	2.9%	0.18% Ba, 230 Cd, 430 Ni, 130 Sb.
182	do.	4.0	Skarn zone strikes N. 30° E., dips 68° SE.; garnets.	---	---	200	300	22	---	190	81 W.
183	Select	xx	Limestone; hematite, calcite.	---	---	100	12	10	---	61	
184	Chip	2.0	Diorite dike strikes N. 30° E., dips 70° SE.; hematite.	tr	.1	220	290	19	41	120	0.12% Ba, 88 W.
185	Select	xx	Silicified limestone; quartz, hematite.	tr	.1	230	9	15	38	160	810 Ba, 65 Sn.
186	Chip	2.0	Crumbly andesitic dike strikes N. 15° E., dip undetermined; hematite stains.	---	---	230	18	19	---	110	700 Ba, 96 W, 220 Zr.
187	Select	xx	Limestone; wollastonite.	---	---	230	8	30	---	34	
188	do.	xx	Limestone breccia; quartz, hematite, limonite, calcite.	tr	---	.12%	10	16	12	94	0.30% Ba.
189	Chip	3.0	Quartz vein strikes N. 55° E., vertical dip; limonite.	---	---	150	---	7	---	32	
191	do.	2.0	Silicified limestone; quartz veinlets, limonite.	---	---	450	7	23	---	78	
193	Select	xx	Quartz; pyrite, chalcopyrite, arsenopyrite.	.24	14.3	5.1%	350	32	1.5%	.30%	0.91% Sb.
194	do.	xx	Dark gray silicified limestone; hematite stains, arsenopyrite.	.21	2.1	6.4%	100	30	.14%	.30%	770 Sb.
195	Chip	.4	Limonite vein strikes N. 35° E., dips 30° NW.	---	---	370	200	97	---	86	670 Ba.

Table 4.--Data for samples 128-143, 145-147, 179-189, 191, 193-202, 214-231 from the Nyala Canyon mineralized area not shown on figures 5B-5D--Continued

Sample				Analytical data							
				Au	Ag	As	Cu	Mo	Pb	Zn	Other
No.	Type	Length (ft)	Description	oz/st		ppm, except where noted					
196	Chip	0.7	Limonite vein strikes N. 20° W., dips 82° NE.; hematite.	0.17	4.3	6.4%	78	30	0.39%	0.36%	0.15% Ba, 350 Sb.
197	do.	4.0	Limestone; abundant calcite stringers.	tr	.1	.13%	9	19	69	540	
198	do.	1.0	Limonite vein strikes N. 20° W., dips 82° NE.; hematite.	.02	3.0	1.4%	40	17	.15%	.28%	0.10% Ba, 0.23% Sb.
199	do.	1.7	do.	.15	4.9	>10%	97	35	.30%	.15%	0.13% Ba, 0.12% Sb.
200	Select	xx	Limestone breccia strikes N. 15° W., dips 82° NE.; hematite, calcite.	.01	16.2	920	340	33	380	.12%	0.11% Ba, 520 Sb, 310 V.
201	do.	xx	Silicified limestone; abundant hematite, calcite, quartz.	tr	14.4	820	420	47	.22%	660	360 Sb.
202	do.	xx	Vein quartz; pyrite, arsenopyrite, chalcopyrite.	.59	14.5	>10%	640	39	.23%	.51%	0.26% Sb.
214	do.	xx	Quartz zone strikes N. 5° W., dips 75° SW.; arsenopyrite, pyrite.	.55	6.3	>10%	200	22	1.6%	1.8%	120 Cd, 1.2% Sb.
215	do.	xx	Gossan strikes N. 5° W., dips 75° SW.; hematite, limonite.	tr	1.0	.13%	66	22	830	.18%	570 Ni, 510 Sb.
216	do.	xx	Silicified limestone; calcite.	.01	.3	750	18	16	46	.10%	
217	do.	xx	Limestone; pyrite, yellow mineral.	.17	12.8	4.0%	510	41	2.4%	1.4%	180 Cd, 1.4% Sb.
218	Chip	5.0	Fault zone strikes N.10° W., dips 63° SW.; limonite, limestone pods.	tr	.1	520	25	17	40	130	0.14% Ba, 55 Sb.
219	do.	5.0	Silicified limestone strikes N.10° E., dip undetermined.	---	---	270	42	20	---	66	0.17% Ba, 98 W.
220	Select	xx	Limestone; hematite stringers.	---	---	220	97	130	---	95	150 V.
221	Chip	2.0	Crumbly andesite dike strikes N. 40° W., dips 55° SW., hematite, limonite.	---	.1	.12%	13	20	110	190	80 Sb.
222	Select	xx	Gossan zone strikes N. 53° W., dip undetermined; hematite, limonite.	.01	.7	>10%	83	62	---	38	150 Sb.
223	do.	xx	do.	.01	.4	3.0%	49	78	---	77	120 Sb.
224	Chip	2.0	Quartz zone strikes N. 5° W., dips 45° SW.; pyrite, chalcopyrite, hematite, limonite.	.03	.9	>10%	140	41	280	340	350 Sb.

Table 4.--Data for samples 128-143, 145-147, 179-189, 191, 193-202, 214-231 from the Nyala Canyon mineralized area not shown on figures 5B-5D--Continued

Sample				Analytical data							
No.	Type	Length (ft)	Description	Au	Ag	As	Cu	Mo	Pb	Zn	Other
				oz/st		ppm, except where noted					
225	Chip	4.0	Quartz latite dike strikes N. 10° W., dips 35° SW.; hematite stains.	---	---	380	12	19	---	140	740 Ba, 400 Sr 78 W.
226	Select	xx	Marble; hematite stains.	---	0.1	100	15	15	---	74	770 Sr.
227	do.	xx	Gossan; hematite, limonite, calcite.	0.01	.3	0.44%	9	30	450	550	770 Ba, 920 Sb.
228	do.	xx	Siderite; hematite, calcite.	.02	---	.57%	17	47	87	780	390 Sb.
229	do.	xx	Andesite dike strikes N. 70° E., dip undetermined, hematite.	---	---	180	20	17	---	120	25 Co, 450 Sr, 210 V, 83 W.
230	do.	xx	Gossan zone strikes N. 5° E., dip undetermined; hematite.	.03	3.8	.16%	380	77	2.4%	0.88%	110 Sb, 140 V.
231	do.	xx	Gossan zone strikes N. 5° E., dip undetermined; limonite.	.03	2.0	.23%	220	91	1.8%	.94%	61 Cd, 130 Sb, 110 V.

Table 5.--Data for samples 395-401, 444-458 from workings in Willow Creek shown on figure 6I.

[xx, not applicable; --, not detected; tr, trace.]

Sample				Analytical data							
No.	Type	Length (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Other
395	Select	xx	Fractured vein quartz; abundant limonite, limestone pods.	0.36	0.4	---	---	---	---	---	
396	do.	xx	Vein quartz; calcite.	---	.2	---	7	---	---	10	
397	do.	xx	Vein quartz; calcite, limestone pods.	.37	.3	30	15	10	18	62	
398	do.	xx	Gray dolomite; black mineral.	---	.4	220	13	---	---	62	24 Co, 210 Zr
399	do.	xx	Diorite; calcite veinlets.	---	.1	220	15	---	---	84	16 Co
400	do.	xx	Tan siltstone; disseminated limonite after pyrite, quartz.	---	.2	190	56	---	---	79	16 Co
401	do.	xx	Diorite dike.	---	---	240	20	---	---	90	28 Co
444	do.	xx	Limestone breccia, vein quartz, limonite.	.01	.1	---	---	5	11	---	
445	do.	xx	do.	tr	.1	70	10	22	---	26	
446	do.	xx	do.	tr	.1	32	---	---	---	---	
447	do.	xx	Limestone breccia, vein quartz; limonite.	tr	.1	100	7	---	---	---	
448	Chip	3.0	Andesitic dike; hematite stains.	---	---	710	24	11	---	110	28 Co, 400 Cr, 190 Ni
449	do.	1.0	Quartz vein strikes N. 55° W., dips 60° SW.; abundant limonite.	.02	.1	89	---	12	---	28	
450	do.	1.0	Quartz-calcite vein strikes N. 60° W., dips 70° SW.; abundant limonite.	tr	---	170	---	7	---	50	
451	do.	1.0	Silicified limestone; hematite, limonite.	tr	---	240	9	11	---	41	
452	do.	3.0	Silty limestone; calcite veinlets, limonite.	---	---	270	22	12	---	88	410 Ba, 25 Ni
453	do.	3.0	do.	tr	---	190	24	14	---	110	0.28% Ba, 20 Nb, 28 Ni
454	do.	1.5	Quartz-calcite vein strikes N. 60° W., dips 64° SW.; abundant limonite.	---	---	110	---	9	47	41	

Table 5.--Data for samples 395-401, 444-458 from workings in Willow Creek shown on figure 61--Continued

Sample				Analytical data							
		Length		Au	Ag	As	Cu	Mo	Pb	Zn	Other
No.	Type	(ft)	Description	oz/st		ppm					
455	Select	xx	Vein quartz; calcite, abundant limonite.	0.41	0.4	92	11	16	---	41	
456	do.	xx	do.	tr	.1	---	---	---	---	---	
457	do.	xx	Limestone breccia, fractured vein quartz; limonite.	tr	.1	---	---	---	---	---	
458	do.	xx	Gray limestone; limonite.	tr	.1	260	18	---	---	88	26 Co, 200 Zr.

Table 6.--Data for samples 402-443 from Melbourne Mine shown on figure 6J.

[xx, not applicable, ---, not detected; tr, trace.]

Sample			Analytical data						
No.	Length of chip (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)
402	0.9	Fractured quartz vein; hematite.	tr	0.1	81	8	7	---	47
403	1.5	Brecciated limestone; brecciated quartz vein.	0.01	.2	190	23	21	---	72
404	2.5	Fractured limestone; calcite, hematite.	---	---	170	12	15	---	120
405	2.0	Fractured quartz vein; hematite, limestone breccia.	tr	---	100	12	10	12	56
406	1.8	Fractured quartz vein; hematite.	tr	---	91	54	7	---	42
407	2.5	Fractured quartz vein; hematite, calcite.	tr	---	73	20	6	---	33
408	2.5	Limestone breccia; fractured quartz vein; quartz-calcite breccia, hematite.	.04	---	210	16	8	---	51
409	2.7	Fault gouge; hematite.	---	---	290	13	25	---	590
410	.5	Limestone breccia; quartz-calcite vein.	tr	---	140	34	12	11	55
411	1.0	Limestone breccia; limonite, quartz, calcite.	tr	---	220	17	13	---	69
412	2.0	Quartz vein; hematite.	tr	.1	74	17	8	---	38
413	1.5	Limestone breccia; limonite, quartz, calcite.	---	---	210	17	20	---	84
414	1.5	Quartz vein; hematite.	---	---	130	6	16	---	46
415	2.5	Fractured quartz vein; hematite.	---	.1	80	7	15	---	44
416	.8	do.	---	---	46	---	---	---	38
417	2.1	Limestone breccia; fractured quartz vein; hematite gouge.	tr	.1	120	10	16	---	54
418	1.9	Limestone breccia; fractured quartz vein; gouge; calcite, hematite.	---	.1	160	19	16	---	53
419	2.1	Fractured quartz vein.	tr	---	64	---	7	---	39
420	1.0	Fault gouge; limestone breccia, limonite, quartz.	---	---	300	18	17	---	97
421	.8	Fault gouge; limonite, quartz, calcite.	---	---	200	14	11	---	77

Table 6.--Data for samples 402-443 from Melbourne Mine shown on figure 6J--Continued

Sample No.	Sample Length of chip (ft)	Description	Au (oz/ton)	Ag (oz/ton)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)
422	1.8	Fractured limestone; calcite.	---	0.1	220	21	12	---	110
423	1.3	Fault gouge; limonite, quartz, calcite.	---	.1	200	15	11	---	86
424	1.5	Fault gouge; limonite, calcite.	---	---	220	25	17	---	120
425	.8	Limestone breccia; fault gouge; quartz.	tr	.1	220	9	14	---	66
426	1.5	Fractured limestone; hematite, limonite.	---	.1	270	22	---	---	46
427	.7	Quartz vein; hematite.	0.08	.1	33	18	---	---	---
428	1.8	Limestone breccia; hematite, quartz.	tr	.1	73	68	---	---	---
429	.8	Limestone breccia; quartz vein; hematite.	---	---	---	---	---	---	---
430	2.5	Altered limestone; gouge, hematite, limonite.	---	.1	260	29	---	---	74
431	.5	Fractured limestone; hematite, limonite, calcite.	---	.2	88	20	---	---	67
432	1.5	Quartz vein; hematite, limonite.	---	.1	---	---	---	---	---
433	1.0	Fractured limestone; hematite.	---	---	250	34	---	---	120
434	2.5	Quartz vein; hematite, limonite, calcite.	---	.1	---	---	---	---	---
435	3.0	Black limestone; hematite, limonite, calcite veinlets.	---	.1	57	17	---	---	32
436	1.4	Limestone breccia; fault gouge; calcite, limonite.	---	---	210	9	---	---	31
437	1.4	do.	---	.1	190	28	---	---	85
438	1.4	Quartz zone; calcite, silicified limestone.	---	.1	110	25	---	10	65
439	4.0	Black limestone; calcite, chert layers.	---	---	130	22	---	---	64
440	3.0	Fractured limestone; calcite, gouge, hematite, limonite.	---	.1	180	27	---	---	78
441	2.0	Fractured limestone; calcite, limonite.	---	.1	130	20	---	---	64
442	2.0	do.	---	.1	140	15	---	---	59
443	2.5	Fractured limestone; hematite, limonite, calcite.	---	---	230	33	---	---	77

Table 7.--Data for samples 232-233, 240-255, 278-291, 311-326, 357-371 from the Willow Creek mineralized area not shown on figures 6B-6L.

[xx, not applicable; ---, not detected; tr, trace.]

Sample				Analytical data							
No.	Type	Length (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm, except where noted)	Cu	Mo	Pb	Zn	Other
232	Select	xx	Brecciated quartz vein strikes N. 37° E., dip undetermined; limonite.	0.01	---	40	---	8	---	57	
233	do.	xx	Brecciated calcite vein, abundant hematite.	---	0.2	72	8	13	33	97	10 Ni, 16 Sn.
240	Chip	4.0	Silicified limestone; calcite.	---	.1	130	71	13	31	780	150 V.
241	Select	xx	Limestone; abundant hematite, limonite.	tr	.1	170	63	31	48	250	19 Ni, 14 Sn, 480 Sr, 110 V.
242	do.	xx	Quartz breccia strikes N. 25° W., vertical dip; abundant hematite.	---	---	150	7	12	12	120	
243	do.	xx	Gray vein quartz; hematite.	---	---	85	---	7	12	58	
244	Chip	3.0	Skarn; chlorite, limonite.	---	---	170	38	16	---	110	91 W.
245	do.	1.5	Fault strikes N. 40° E., dips 41° SE.; gouge, limonite.	tr	---	200	19	14	27	110	1800 Ba, 19 Ni, 610 Sr.
246	Select	xx	Quartz vein strikes N. 70° E., dip undetermined; galena.	---	.1	83	9	20	0.13%	230	
247	do.	xx	Skarn; magnetite, epidote.	---	---	210	23	16	40	110	1100 Ba, 26 Ni, 530 Sr.
248	Chip	2.0	Brecciated limestone strikes N. 60° E., dip undetermined; hematite.	---	---	230	23	37	110	170	180 Bi, 16 Co, 25 Ni, 120 Sb, 42 Sn, 220 Te, 130 W.
249	do.	3.0	Granite; hematite stains.	tr	---	230	---	15	41	84	
250	Select	xx	Skarn zone; hematite, limonite.	tr	---	210	14	18	17	130	1400 Ba.
251	do.	xx	Quartz vein strikes N. 53° E., dips 54° SE.; hematite.	---	---	93	10	11	36	74	1100 Ba.
252	do.	xx	Crumbly granite; hematite.	---	---	230	15	17	32	65	
253	do.	xx	Vein quartz; hematite, chalcopyrite, malachite.	tr	.2	55	730	6	110	69	

Table 7.--Data for samples 232-233, 240-255, 278-291, 311-326, 357-371 from the Willow Creek mineralized area not shown on figures 6B-6L--Continued

Sample				Analytical data							
No.	Type	Length (ft)	Description	Au	Ag	As	Cu	Mo	Pb	Zn	Other
				oz/st		ppm, except where noted					
254	Select	xx	Vein quartz; hematite, chalcopyrite, malachite.	tr	0.4	47	47	---	160	180	110 Li.
255	Chip	2.0	Quartz vein strikes N. 85° E., dips 72° SE.; abundant limonite, limestone pods.	tr	---	71	34	7	11	45	
278	do.	.9	Skarn strikes N. 70° W., vertical dip; calcite, limonite.	---	---	180	75	17	---	99	1,600 Ba, 190 Sn.
279	Select	xx	Skarn strikes N. 75° E., dips 58° NW.; epidote, magnetite.	tr	---	64	10	26	---	220	250 V, 140 W.
280	Chip	3.0	Granitic dike strikes N. 12° W., dips 84° SW.; limonite.	---	---	180	11	19	---	42	
281	do.	1.4	Fault strikes N. 12° W., dips 84° SW.; gouge, hematite.	tr	---	400	7	18	---	87	13 Co, 33 Nb, 43 Ni, 410 Sr, 95 W.
282	do.	1.0	Silicified limestone; hematite stains.	tr	.2	230	40	13	100	190	22 Co, 50 Ni, 57 Sn.
283	do.	.8	Fault strikes N. 74° E., dips 73° NW.; gouge, hematite, calcite.	---	---	290	35	22	150	200	12 Cd, 26 Co, 50 Ni, 58 Sn, 540 Sr, 92 W.
284	do.	.7	Fault strikes N. 70° W., vertical dip; gouge, hematite, calcite.	---	---	780	110	---	15	68	520 Ba, 180 V.
285	do.	2.5	Fractured hornfels; calcite, hematite, limonite.	---	.1	0.13%	84	---	29	62	190 V.
286	do.	2.0	Fractured hornfels; hematite, limonite, calcite, manganese oxide.	tr	---	240	77	---	19	130	0.18% Ba, 750 Sr.
287	do.	4.0	do.	tr	---	290	190	---	23	100	0.25% Ba, 700 Sr.
288	do.	3.5	Fault strikes N. 50° E., dips 23° SE.; limestone breccia, calcite.	---	.1	280	16	---	12	38	1,300 Ba.
289	do.	3.0	Crumbly granite; abundant hematite.	tr	---	190	9	11	---	54	25 Nb, 62 Sn.
290	Select	xx	Caliche; hematite stains.	---	---	---	---	---	---	33	
291	do.	xx	Vein quartz; limonite stringers, limestone pods.	tr	.1	34	51	---	47	---	

Table 7.--Data for samples 232-233, 240-255, 278-291, 311-326, 357-371 from the Willow Creek mineralized area not shown on figures 6B-6L--Continued

Sample				Analytical data							
No.	Type	Length (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm, except where noted)	Cu	Mo	Pb	Zn	Other
359	Chip	1.5	Silicified limestone; abundant limonite.	---	---	240	21	14	---	69	19 Sn, 77 W.
360	do.	.8	Quartz vein strikes N. 80° W., dips 55° SW.; limonite.	---	---	110	9	8	---	25	16 Sn.
361	do.	2.0	Brecciated quartz vein strikes N. 83° E., dips 65° SE.; gouge, limonite.	---	---	180	11	10	---	56	23 Sn.
362	do.	1.0	do.	tr	---	290	13	13	---	61	
363	Select	xx	Fractured vein quartz; calcite, hematite, limonite.	tr	---	90	---	7	---	28	
364	Chip	5.0	Quartz latite dike; disseminated hematite after pyrite.	---	---	370	15	18	25	64	78 W.
365	do.	1.2	Quartz vein strikes N. 83° W., dips 17° SW.; hematite, Limonite, calcite.	tr	---	110	6	10	13	36	
366	Select	xx	Vein quartz; abundant calcite, limonite.	---	---	220	10	10	15	44	11 Sn.
367	do.	xx	Andesitic dike; hematite stains.	---	---	250	10	15	---	88	77 W.
368	do.	xx	Quartz breccia; abundant limonite, calcite.	---	---	120	7	12	28	52	
369	do.	xx	Silicified limestone.	---	---	60	---	10	12	38	940 Sr.
370	Chip	4.0	Diorite dike strikes N. 75° E., dip undetermined; hematite stains.	tr	---	190	29	16	---	110	0.18% Ba, 26 Co, 720 Sr, 92 W, 260 Zr.
371	Select	xx	Silicified limestone; hematite stains.	---	---	200	37	46	24	69	0.55% Ba.

Table 7.--Data for samples 232-233, 240-255, 278-291, 311-326, 357-371 from the Willow Creek mineralized area not shown on figures 6B-6L--Continued

Sample				Analytical data							
No.	Type	Length (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Other (ppm)
359	Chip	1.5	Silicified limestone; abundant limonite.	---	---	240	21	14	---	69	19 Sn, 77 W.
360	do.	.8	Quartz vein strikes N. 80° W., dips 55° SW.; limonite.	---	---	110	9	8	---	25	16 Sn.
361	do.	2.0	Brecciated quartz vein strikes N. 83° E., dips 65° SE.; gouge, limonite.	---	---	180	11	10	---	56	23 Sn.
362	do.	1.0	do.	tr	---	290	13	13	---	61	
363	Select	xx	Fractured vein quartz; calcite, hematite, limonite.	tr	---	90	---	7	---	28	
364	Chip	5.0	Quartz latite dike; disseminated hematite after pyrite.	---	---	370	15	18	25	64	78 W.
365	do.	1.2	Quartz vein strikes N. 83° W., dips 17° SW.; hematite, Limonite, calcite.	tr	---	110	6	10	13	36	
366	Select	xx	Vein quartz; abundant calcite, limonite.	---	---	220	10	10	15	44	11 Sn.
367	do.	xx	Andesitic dike; hematite stains.	---	---	250	10	15	---	88	77 W.
368	do.	xx	Quartz breccia; abundant limonite, calcite.	---	---	120	7	12	28	52	
369	do.	xx	Silicified limestone.	---	---	60	---	10	12	38	940 Sr.
370	Chip	4.0	Diorite dike strikes N. 75° E., dip undetermined; hematite stains.	tr	---	190	29	16	---	110	0.18% Ba, 26 Co, 720 Sr, 92 W, 260 Zr.
371	Select	xx	Silicified limestone; hematite stains.	---	---	200	37	46	24	69	0.55% Ba.

Table 8.--Data for samples 495-496, 498-505 from the Big Creek Canyon mineralized area shown on plate 1.

[xx, not applicable; ---, not detected.]

Sample				Analytical data							
No.	Type	Length (ft)	Description	Au	Ag	As	Cu	Mo	Pb	Zn	Other
				oz/st		ppm, except where noted					
495	Chip	3.0	Fractured rhyolite; hematite, limonite.	---	---	300	8	43	31	88	
496	do.	2.5	Fault, strikes N. 7° W., vertical dip; gouge, hematite.	---	0.1	430	---	20	35	100	
498	do.	4.0	Altered green rhyolite.	---	---	210	12	12	37	89	780 Ba.
499	Select	xx	Vein quartz, fractured and brecciated; abundant hematite.	---	---	100	---	87	42	85	
500	Chip	2.0	Altered and fractured rhyolite zone, strikes N. 35° W., vertical dip; dark green color, looks like a skarn.	---	---	260	8	20	29	120	940 Ba.
501	do.	1.5	Altered rhyolite, brecciated quartz vein, strikes N. 60° E., vertical dip; abundant hematite.	---	---	98	---	99	26	91	
502	do.	2.0	Altered rhyolite; abundant limonite, quartz stringers.	---	---	350	12	45	29	110	600 Ba.
503	do.	2.5	Altered rhyolite zone, strikes N. 30° W., dip undetermined; abundant hematite.	---	---	270	7	16	22	96	830 Ba.
504	do.	4.0	Fault zone, strikes N. 11° W., dips 80° SW.; abundant limonite.	---	---	270	8	17	20	110	0.11% Ba.
505	Select	xx	Quartz breccia; abundant hematite, limonite.	---	---	0.25%	29	45	81	610	48 Be, 180 Bi, 41 Cd, 47 Sn, 240 Te.

Table 9.--Data for samples 644-657 from the North Fork Cottonwood Creek mineralized area shown on plate 1.

[xx, not applicable; ---, not detected; >, more than.]

Sample				Analytical data						
		Length		Au	Ag	As	Cu	Mo	Pb	Zn
No.	Type	(ft)	Description	ppb	ppm, except where noted					
644	Select	xx	Silicified rhyolite; abundant pyrite, galena.	235	31.5	>2,000	11	30	2.00%	4,200
645	do.	xx	Altered rhyolite; hematite, epidote.	240	24.8	>2,000	16	267	5.10%	767
646	do.	xx	Silicified rhyolite; abundant pyrite, galena.	740	33.0	>2,000	21	41	1.89%	2,334
647	do.	xx	Altered rhyolite; hematite, manganese oxide.	---	1.8	1,002	4	2	617	512
648	do.	xx	Quartz; pyrite, galena.	825	38.9	>2,000	13	54	5.60%	3,200
649	Chip	3.0	Limestone breccia, strikes N. 20° E., dips 68° SE.; hematite, calcite.	---	---	806	25	48	155	61
650	do.	3.0	Siliceous limestone breccia, strikes N. 20° E., dips 55° SE.; hematite.	---	---	305	12	10	119	42
651	Select	xx	Gossan; abundant hematite, vuggy limonite.	---	---	1,197	46	88	52	61
652	do.	xx	Skarn; quartz, fluorite, epidote.	---	---	54	11	1	34	64
653	do.	xx	Altered rhyolite dike, strikes N. 30° W., vertical dip; hematite, epidote.	305	34.6	>2,000	13	26	1.70%	735
654	Chip	4.0	Altered zone in rhyolite, strikes N. 40° W., vertical dip; hematite, epidote.	395	43.0	>2,000	19	14	6,700	229
655	do.	2.5	Altered andesite dike, strikes N. 40° W., vertical dip; hematite, manganese oxide.	---	1.8	796	47	3	197	354
656	Select	xx	Altered rhyolite; abundant manganese oxide.	---	2.3	1,227	10	6	211	1,086
657	Chip	3.5	Altered andesite dike, strikes N. 40° W., vertical dip; abundant hematite.	---	3.5	1,574	6	5	1,081	685

Table 10.--Data for samples 671-686 from the Badger Gulch mineralized area shown on plate 1.

[xx, not applicable; ---, not detected; >, more than.]

Sample				Analytical data						
		Length		Au	Ag	As	Cu	Mo	Pb	Zn
No.	Type	(ft)	Description	ppb	ppm, except where noted					
671	Select	xx	Limestone; epidote, calcite, pyrite, chalcopyrite.	435	2.92 oz/st	>2,000	880	40	8.00%	7.90%
672	do.	xx	Gossan zone; limonite, hematite, pyrite.	45	2.09 oz/st	1,093	1,150	41	2.50%	4.50%
673	Chip	3.0	Brecciated limestone; quartz.	---	1.7	90	47	7	98	132
674	Select	xx	Brecciated limestone; malachite coatings.	---	4.0	299	2,400	6	438	661
675	do.	xx	Oxidized sulfides; abundant hematite and limonite, cubic pseudomorphs of hematite after pyrite.	145	11.6	998	50	86	185	496
676	Chip	1.0	Limestone; calcite vein, strikes N. 85° E., dips 63° NW.; disseminated chalcopyrite.	305	225	>2,000	345	85	313	1,295
677	do.	.5	Siderite zone; hematite, limonite, malachite.	20	12.7	385	338	16	1,483	1,034
678	Select	xx	Siderite; hematite, limonite.	140	16.3	>2,000	417	88	481	525
679	do.	xx	Galena, chalcopyrite, malachite, bornite, and pyrite.	970	51.74 oz/st	>2,000	3.48%	128	16.30%	10.00%
680	do.	xx	Altered, brecciated limestone; actinolite, chlorite.	5	32.4	1,096	713	7	1,720	2,468
681	do.	xx	Gossan; abundant hematite and limonite.	---	0.6	1,483	36	11	161	83
682	do.	xx	Calcite vein; chalcopyrite, hematite, limonite, galena.	175	2.61 oz/st	>2,000	2,000	35	3.50%	4.60%
683	do.	xx	Limestone; disseminated pyrite and chalcopyrite, calcite, galena.	60	35.4	>2,000	1,350	10	2,500	15,854
684	do.	xx	Limestone breccia; hematite, calcite.	---	2.5	440	53	15	245	420
685	do.	xx	Limestone breccia; calcite, limonite.	---	1.7	212	26	7	243	452
686	do.	xx	Limestone breccia; calcite.	---	---	57	12	4	78	141

Table 11.--Data for samples 528-566 from the Nyco Mine shown on figure 9.

[tr, trace; ---, not detected.]

Sample No.	Length of chip (ft)	Description	CaF_2 (%)	SiO_2 (%)	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)
528	1.0	Rhyolite; limonite.	5.24	67.9	---	0.2	190	7	55	30	74
529	1.0	White fluorite; quartz, hematite.	34.1	23.0	---	---	20	---	36	---	5
530	1.3	Fault gouge; hematite.	7.9	72.0	---	---	12	---	270	28	28
531	.8	Altered rhyolite; fault gouge.	3.84	71.7	---	.2	200	8	150	34	100
532	1.5	Altered rhyolite; purple, white and gray fluorite; gouge.	49.6	31.0	---	.1	89	---	65	11	81
533	1.0	Rhyolite; hematite.	6.2	73.5	---	---	6	6	48	22	32
534	1.7	Green and purple fluorite breccia, chlorite, hematite.	40.0	6.0	---	---	---	---	17	11	3
535	1.4	Purple and green fluorite; hematite, gouge.	34.6	24.0	---	---	---	---	33	---	6
536	1.0	Purple and gray fluorite.	67.5	25.9	---	.1	84	9	73	27	78
537	1.3	Purple fluorite breccia; hematite stain.	41.6	8.0	---	---	9	---	12	---	4
538	.9	Green and purple fluorite; hematite.	35.5	14.5	---	---	---	---	34	---	6
539	1.3	Green fluorite breccia; hematite, gouge.	41.6	6.5	---	---	27	6	138	---	12
540	1.5	Altered rhyolite; fault gouge; hematite,	.74	72.0	---	.1	200	9	54	39	74
541	1.5	Rhyolite; minor fluorite.	6.78	74.3	---	.1	130	7	230	29	60
542	1.0	Purple and green fluorite.	94.8	2.4	---	.1	42	---	88	20	63
543	2.0	Green fluorite; hematite, gouge, quartz.	81.9	9.2	---	.1	---	---	92	15	42
544	1.0	Rhyolite; hematite, disseminated pyrite, gray fluorite.	2.37	73.1	---	.1	140	7	180	33	68
545	2.0	Altered rhyolite; purple and green fluorite; gouge.	31.0	54.6	---	.1	86	---	300	50	75
546	2.0	Gray fluorite; gouge.	90.5	5.9	---	.1	43	---	63	62	60
547	2.0	Green and purple fluorite; gouge, hematite.	65.7	27.9	---	.1	54	---	100	22	56

Table 11.--Data for samples 528-566 from the Nyco Mine shown on figure 9--Continued

Sample No.	Sample Length of chip (ft)	Description	Analytical data CaF$_2$ (%)	SiO$_2$ (%)	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)
548	2.5	Purple fluorite; hematite, altered rhyolite.	53.9	32.7	---	0.1	84	7	190	28	72
549	2.0	Purple and gray fractured fluorite; hematite, altered rhyolite.	64.2	23.4	tr	.1	58	---	310	22	63
550	2.0	Altered rhyolite, hematite, limonite, gray fluorite.	5.51	68.0	---	.2	130	7	450	40	74
551	2.0	Fault gouge; gray fluorite; hematite.	34.2	48.4	---	.1	84	---	110	16	58
552	2.0	Gray and purple fluorite; hematite, gouge.	56.4	33.2	0.01	.1	65	---	43	11	61
553	4.0	Altered rhyolite, gouge, hematite, disseminated pyrite.	4.94	67.9	---	.1	200	---	62	28	69
554	1.5	Purple and green fluorite; hematite, gouge.	46.0	42.2	---	.1	77	---	71	19	67
555	2.0	Gray fractured fluorite; hematite.	32.4	52.7	---	.1	76	---	71	16	64
556	1.5	Purple fluorite; hematite, altered rhyolite.	67.9	26.3	tr	---	61	---	87	24	63
557	3.0	Fault gouge; altered rhyolite, hematite, fluorite.	2.51	67.4	---	.1	190	---	84	29	83
558	2.0	Gray fluorite; abundant hematite.	76.4	19.3	---	---	50	---	100	20	69
559	2.0	Fault gouge; rhyolite, hematite, fluorite.	5.94	80.4	tr	---	100	---	120	13	64
560	.5	Fault gouge; fractured fluorite; hematite.	31.0	48.5	---	---	120	---	55	25	72
561	2.5	Fault gouge; abundant hematite, fractured fluorite.	7.68	69.8	---	.1	180	10	84	30	83
562	1.5	White fluorite vein, splits into veinlets; hematite, quartz.	70.0	14	---	1.7	15	4	6	45	14
563	1.5	White and gray fluorite vein.	60.0	29.5	---	.9	17	3	11	19	12
564	2.0	do.	58.5	31	20	1.1	17	3	55	13	10
565	3.0	White and purple fluorite vein.	82.5	5	---	.7	40	2	3	20	7
566	1.0	Purple and white fluorite vein, brecciated.	90.7	4.5	---	---	13	2	2	13	8

Table 12.--Data for samples 573-598 from the Quinn Canyon mineralized area shown on plate 1.

[xx, not applicable; na, not analyzed; ---, not detected; tr, trace.]

Sample No.	Sample Type	Sample Length (ft)	Description	Analytical data CaF_2 (%)	SiO_2 (%)	Au (oz/st)	Ag (oz/st)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)	Other
573	Chip	0.8	Rhyolite breccia; fluorite vein, strikes N. 28° W., dips 71° NE.; limonite.	80.3	9.1	---	---	46	---	---	---	67	
574	Select	xx	Rhyolite breccia; fluorite, limonite.	45.3	40.4	---	0.1	120	---	---	---	80	
575	do.	xx	Rhyolite breccia; fluorite.	19.3	63.3	tr	.1	100	---	---	---	86	
576	do.	xx	Rhyolite; jasperoid.	na	na	---	.1	220	---	14	46	91	
577	do.	xx	do.	na	na	---	---	110	---	---	---	78	120 Cr.
578	do.	xx	Rhyolite agglomerate; chlorite, quartz.	na	na	---	---	210	---	---	31	90	
579	Chip	.5	Fluorite vein, strikes N. 25° E., vertical dip; green and white fluorite.	73.6	10.1	0.02	---	39	---	---	---	60	
580	do.	.7	Fluorite vein, strikes N. 33° E., dips 33° NW.; in fault zone; green and white fluorite.	86.6	7.1	---	---	32	---	---	---	59	
581	do.	1.0	Fluorite vein, strikes N. 66° E., dips 40° NW.; white and green fluorite.	42.1	44.4	tr	.1	110	---	---	---	72	
582	Select	xx	Fluorite vein, strikes N. 35° E., dips 50° NW.; green and white fluorite.	64.3	26.8	---	.1	87	---	---	---	79	
583	Chip	.5	Red rhyolite; fluorite vein strikes N. 85° W., dips 62° NE.; white fractured fluorite.	97.5	2.1	---	---	47	---	---	---	72	
584	do.	.8	Fluorite vein, strikes N. 50° E., dips 32° SE.; white fluorite.	95.1	4.3	tr	---	31	---	---	---	61	
585	Select	xx	Rhyolite breccia; fluorite.	14.6	65.9	---	.1	120	---	17	---	69	
586	Chip	1.0	Fluorite vein, strikes N. 68° E., vertical dip; purple and white fluorite.	53.8	34.0	---	.1	86	---	17	---	69	1.6% Ba.
587	do.	2.0	Rhyolite; fluorite vein, strikes N. 31° E., vertical dip; white fluorite.	66.9	28.1	tr	.1	47	---	---	---	60	
588	Select	xx	Fluorite surrounding rhyolite clasts; purple, green and white fluorite.	37.8	48.9	---	.1	110	---	---	---	66	
589	do.	xx	Rhyolite agglomerate; chlorite.	na	na	---	.1	190	---	---	---	80	

Table 12.--Data for samples 573-598 from the Quinn Canyon mineralized area shown on plate 1--Continued

Sample				Analytical data									
No.	Type	Length (ft)	Description	CaF_2	SiO_2	Au	Ag	As	Cu	Mo	Pb	Zn	Other
				%		oz/st		ppm					
590	Select	xx	Green rhyolite; white and green fluorite.	59.4	27.5	---	0.1	89	---	---	---	66	
591	do.	xx	Altered green rhyolite; limonite.	na	na	---	.2	210	---	---	27	85	
592	Chip	1.0	Fluorite breccia zone, strikes N. 53° E., vertical dip, white and green fluorite.	52.0	40.1	---	.1	57	---	16	---	55	
593	Select	xx	Green and white fluorite; quartz.	24.6	61.8	tr	.3	92	---	11	20	72	
594	Chip	.8	Rhyolite; fluorite vein, strikes N. 3° W., dips 47° NE.; purple and green fluorite.	76.0	19.2	---	.1	53	---	---	---	61	
595	do.	.5	Fluorite vein, strikes N. 50° E., vertical dip; green and white fluorite, quartz.	17.8	70.0	tr	.1	110	---	48	29	69	
596	Select	xx	Quartz breccia; hematite, limonite.	3.2	84.7	---	.1	120	---	120	38	71	100 Cr.
597	do.	xx	Fluorite zone, strikes N. 27° E., dips 72° SE., white fluorite.	81.1	5.3	---	.1	63	---	---	---	65	
598	do.	xx	Altered quartz latite; hematite, fluorite.	6.6	67.1	tr	.1	210	---	---	28	85	

Table 13.--Data for samples 611-613, 619 from the Davis Creek mineralized area not shown on figure 10.

[xx, not applicable; na, not analyzed; ---, not detected.]

Sample				Analytical data								
No.	Type	Length (ft)	Description	CaF_2 (%)	SiO_2 (%)	Au (ppb)	Ag (ppm)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)
611	Select	xx	Green and white fluorite.	38.2	51.5	---	---	9	3	3	18	13
612	do.	xx	Gossan; hematite, quartz.	na	na	---	0.8	23	5	8	34	40
613	Chip	4.0	Fluorite vein, strikes east, dips 56° N.; white and gray fluorite, quartz.	65.8	21.5	---	1.2	6	2	---	---	---
619	do.	.5	White fluorite vein, strikes N. 35° E., dips 65° NW.	37.8	48.5	---	2.8	123	4	30	103	40

Table 14.--Data for samples 623-637 from the South Fork Cottonwood Creek mineralized area shown on plate 1.

[xx, not applicable; na, not analyzed; ---, not detected.]

Sample				Analytical data								
No.	Type	Length (ft)	Description	CaF_2 (%)	SiO_2 (%)	Au (ppb)	Ag (ppm)	As (ppm)	Cu (ppm)	Mo (ppm)	Pb (ppm)	Zn (ppm)
623	Select	xx	Rhyolite dike; hematite.	na	na	---	1.0	90	12	5	58	61
624	Chip	1.0	Green, purple, and white fluorite vein, strikes N. 40° W., dips 83° SW.	83.97	8.0	---	---	23	3	---	20	12
625	Select	xx	Altered rhyolite tuff; hematite, chlorite.	na	na	---	---	13	5	3	26	37
626	Chip	1.0	White fluorite vein, strikes N. 25° E., vertical dip.	80.36	9.5	---	1.9	13	---	3	13	6
627	Select	xx	Rhyolite dike; hematite.	na	na	---	---	25	21	7	28	127
628	do.	xx	Rhyolite tuff; hematite.	na	na	15	8.4	117	46	50	206	86
629	do.	xx	Rhyolite; white and pale green fluorite.	33.45	49.0	---	1.3	74	5	23	82	21
630	Chip	1.0	White fluorite vein, strikes N. 20° W., vertical dip; abundant hematite.	48.88	43.5	---	---	8	2	7	16	10
631	Select	xx	Altered rhyolite tuff; abundant hematite.	na	na	---	2.1	87	16	286	81	48
632	do.	xx	Altered rhyolite tuff.	na	na	---	1.4	37	6	10	40	12
633	do.	xx	Rhyolite dike; hematite.	na	na	---	---	33	4	9	24	11
634	Chip	.5	White fluorite vein, strikes N. 34° E., dips 70° SE.	75.44	12.0	---	---	16	3	24	11	6
635	do.	3.0	Rhyolite dike; strikes N. 55° E., dips 17° NW.; hematite, fluorite stringers.	na	na	---	---	10	8	31	15	59
636	Select	xx	Quartz breccia; hematite, fluorite.	26.24	62.0	---	---	26	4	18	18	14
637	do.	xx	Quartz breccia; hematite, sparse fluorite.	8.32	80.5	---	---	33	8	51	26	18

Table 15.--Data for samples 697-700 from the Pine Creek mineralized area not shown on figures 11 and 12.

[xx, not applicable; na, not analyzed; ---, not detected.]

Sample				Analytical data									
		Length		CaF_2	SiO_2	Au	Ag	As	Cu	Mo	Pb	Zn	Other
No.	Type	(ft)	Description	%		oz/st		ppm, except where noted					
697	Select	xx	Gossan zone strikes N. 55° W., dips 56° SW.; hematite, limonite.	na	na	0.03	23.9	0.37%	0.27%	500	20.2%	2.7%	340 Bi, 210 Cd.
698	Chip	2.5	Andesite dike strikes N. 60° W., dips 54° SW.; hornblende.	na	na	---	.1	63	12	---	140	100	400 Ba, 15 Co.
699	do.	3.0	Purple fluorite zone strikes N., dips 20° W.; calcite.	99	0.5	---	---	---	---	---	37	39	
700	do.	1.7	Disseminated fluorite; quartz.	22	72.2	---	.1	---	---	91	22	37	

Table 16.--Data for rock samples 487-493, 510-512, 515, 517, 569-571, 602-603, 608-610, 638, 665-668, 710-714, 739-741, shown on plate 1 but not on other figures.

[xx, not applicable; ---, not detected; tr, trace; na, not analyzed.]

Sample				Analytical data							
No.	Type	Length (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm, except where noted)	Cu (ppm, except where noted)	Mo (ppm, except where noted)	Pb (ppm, except where noted)	Zn (ppm, except where noted)	Other (ppm, except where noted)
487	Chip	4.0	Fractured limestone zone strikes N. 45° E., dips vertical; abundant limonite.	tr	---	370	---	13	46	61	
488	do.	2.0	Cherty limestone; calcite.	tr	0.1	580	8	25	22	65	
489	Select	xx	Limonite; hematite and manganese coatings.	---	2.2	510	12	32	42	58	
490	do.	xx	Gossan vein strikes N. 65° W., dips 53° NE.; abundant hematite.	tr	6.6	370	0.18%	57	5.7%	1.4%	120 Cd, 39 Ni.
491	do.	xx	Gossan; abundant limonite.	---	---	630	950	110	7.0%	10.5%	140 Cd, 25 Ni.
492	do.	xx	Baked limestone; gouge, hematite.	tr	.1	380	480	140	4.7%	14.9%	180 Cd, 55 Ni.
493	do.	xx	Brecciated limestone; abundant calcite.	---	1.9	na	na	na	na	na	
510	Chip	10.0	Red rhyolite.	---	---	270	---	21	130	190	76 W.
511	do.	3.0	Marble, strikes N. 65° E., dips 58° NW.	tr	---	na	na	na	na	na	
512	do.	2.0	Contact between rhyolite and limestone; baked limestone pods.	0.01	---	na	na	na	na	na	
515	do.	4.0	Quartz latite; abundant hematite.	---	---	---	---	---	27	57	
517	Select	xx	Green rhyolite tuff.	---	.1	190	---	12	32	85	
569	do.	xx	White and gray fluorite; quartz latite.	---	---	130	---	20	---	37	53.0% CaF_2, 37.4% SiO_2.
570	do.	xx	White, gray, and green fluorite; quartz latite.	---	---	65	---	25	---	20	84.0% CaF_2, 14.5% SiO_2.
571	do.	xx	Altered quartz latite, chlorite.	---	---	200	---	28	---	61	
602	Chip	3.0	Green rhyolite tuff.	---	---	160	---	10	---	100	1600 Ba.
603	Select	xx	Andesite; hematite, limonite.	---	---	---	22	7	13	52	
608	do.	xx	Green rhyolite tuff.	---	---	97	---	7	---	61	1400 Ba.
609	do.	xx	Limestone breccia.	---	----	---	---	---	---	40	350 Sr.

Table 16.--Data for rock samples 487-493, 510-512, 515, 517, 569-571, 602-603, 608-610, 638, 665-668, 710-714, 739-741, shown on plate 1 but not on other figures--Continued

Sample				Analytical data							
No.	Type	Length (ft)	Description	Au (oz/st)	Ag (oz/st)	As (ppm, except where noted)	Cu	Mo	Pb	Zn	Other
610	Select	xx	Hematite breccia; manganese stain.	---	---	88	---	420	---	69	0.71% Ba, 18 Be, 0.29% Ni, 0.10% Sr, 380 V.
638	do.	xx	Jasperoid; hematite, limonite.	---	---	---	8	---	---	59	
665	do.	xx	Rhyolite porphyry; quartz, biotite.	---	---	---	9	---	19	42	
666	do.	xx	Skarn; epidote, hematite.	---	---	---	---	---	12	25	
667	do.	xx	Silicified black limestone.	---	---	---	7	---	---	27	
668	do.	xx	Tan rhyolite; quartz, limonite stains.	---	---	---	---	---	28	23	
710	do.	xx	Rhyolite dike strikes N. 20° E., dips 80° SE.; hematite stains.	tr	---	230	---	22	42	69	490 Ba, 57 Nb, 12 Sn, 79 W.
711	do.	xx	Crumbly quartzite; hematite stains.	---	---	210	---	20	37	66	710 Ba, 51 Nb, 10 Sn.
712	do.	xx	Granitic dike strikes N. 40° E., dips vertical; epidote, hematite stains.	---	---	270	8	22	12	110	0.11% Ba, 54 La, 95 W.
713	do.	xx	Rhyolite; hematite stains.	---	---	280	---	26	40	66	0.13% Ba, 51 La, 59 Nb, 14 Sn, 92 W.
714	do.	xx	Andesitic dike strikes N. 40° E., dips vertical; epidote.	---	---	260	11	24	16	78	0.11% Ba, 55 La, 110 W.
739	Chip	2.0	Green rhyolite; quartz, biotite.	---	---	350	7	17	14	79	
740	do.	1.0	Gray rhyolite; quartz, biotite.	---	---	330	---	19	13	89	430 Ba.
741	Select	xx	Brown rhyolite; quartz, biotite.	---	---	290	---	15	---	74	500 Ba.

Table 17.--Data for stream-sediment samples shown on plate 1 and figures 4A, 5A, and 6A.

[---, not detected.]

Sample no.	Analytical data									
	Au	Ag	As	Cu	Mo	Pb	Sb	Sn	Zn	Other
	ppm									
1	---	---	210	22	21	---	---	---	120	13 Nb.
5	---	---	220	23	21	27	---	---	160	13 Nb.
28	---	---	190	18	19	---	---	---	100	
85	---	---	210	23	20	14	---	9	130	11 Nb.
117	---	---	160	17	19	---	---	---	120	
118	---	---	180	17	18	---	4	---	100	
126	---	---	150	12	17	---	---	---	97	
127	---	---	120	17	13	18	---	---	120	
144	---	---	140	17	14	---	3	---	100	
190	0.017	2.073	250	24	16	34	7.8	---	160	
192	---	---	82	12	11	---	---	---	82	
234	---	---	89	---	6	---	---	---	53	
394	---	---	150	---	10	---	---	---	71	16 Nb.
494	---	---	170	---	10	---	---	---	88	20 Nb.
497	---	---	160	7	13	---	---	---	78	
506	---	---	170	9	15	---	---	---	84	16 Nb.
507	---	1.285	44	---	---	---	---	---	57	
508	---	1.032	45	---	---	---	---	---	49	
509	---	---	37	---	---	---	---	---	46	
513	---	.380	31	---	---	---	---	---	43	
514	---	.896	44	---	---	---	---	---	51	

Table 17.--Data for stream-sediment samples shown on plate 1 and figures 4A, 5A, and 6A--Continued

Sample no.	Analytical data ppm									
	Au	Ag	As	Cu	Mo	Pb	Sb	Sn	Zn	Other
516	---	---	54	---	---	---	---	---	54	
518	---	---	64	---	---	---	---	---	48	
519	---	---	57	---	---	---	---	---	54	
567	---	---	45	---	---	---	3	---	59	
568	---	0.770	48	---	6	---	---	---	61	
572	---	---	31	---	---	---	---	---	52	
599	---	---	49	---	---	---	---	---	49	
600	---	---	---	---	---	---	---	6	39	3 Be, 34 Nb
601	---	1.129	50	---	---	---	---	38	56	3 Be, 89 Nb
604	---	---	49	---	---	---	---	---	62	
605	---	---	48	---	---	---	---	---	49	
606	---	---	44	---	---	---	---	---	51	
607	---	---	43	---	---	---	---	---	38	
620	---	---	---	---	---	---	---	---	49	
621	---	---	43	---	---	---	---	---	46	
622	---	---	36	---	---	---	---	---	59	
639	0.200	.380	47	---	---	---	---	---	53	
640	---	---	40	---	---	---	---	---	79	
641	---	.640	48	---	---	---	---	8	65	
642	---	.660	49	---	---	---	---	---	50	
643	---	---	33	---	---	---	---	6	43	

Table 17.--Data for stream-sediment samples shown on plate 1 and figures 4A, 5A, and 6A--Continued

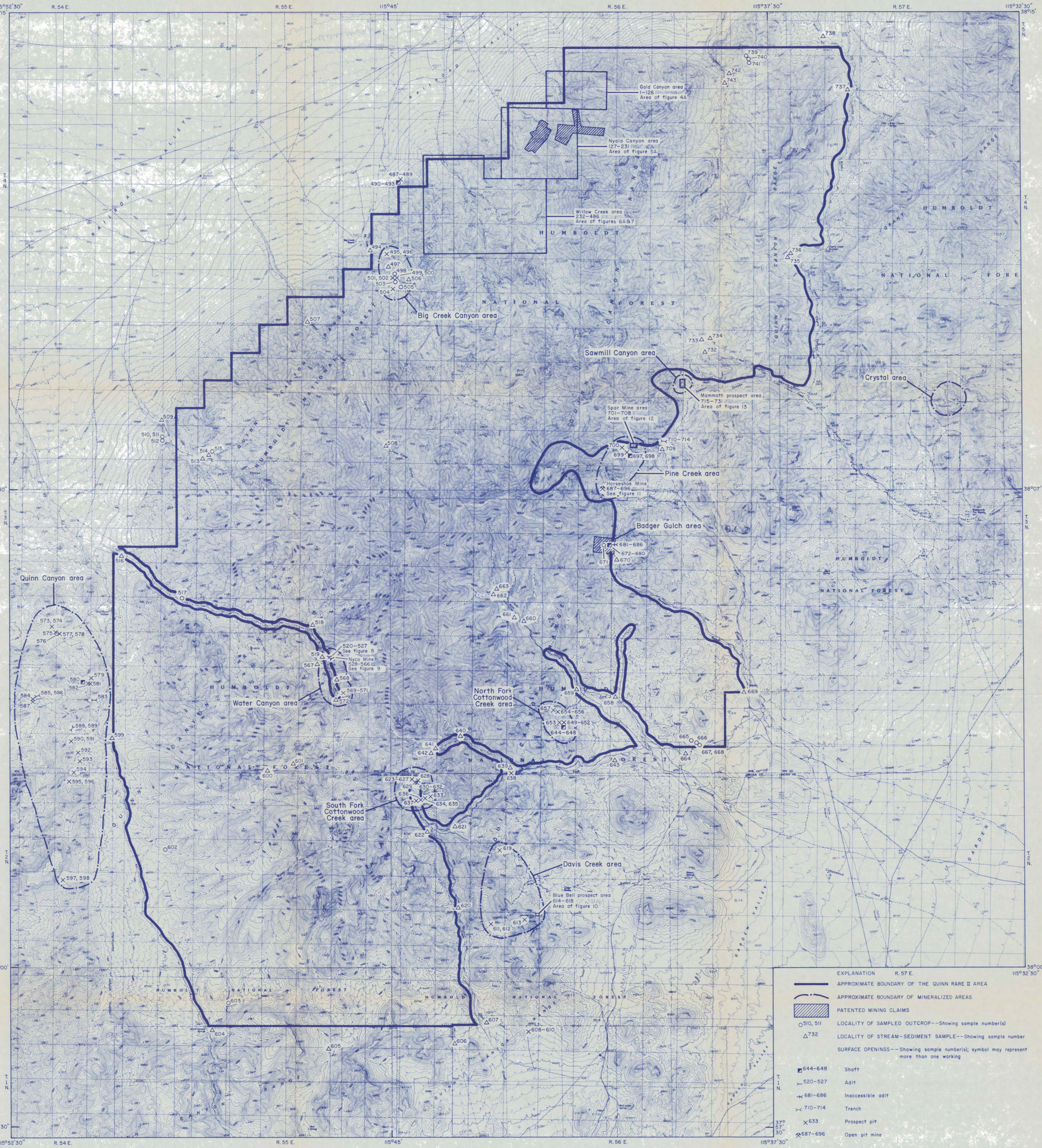
Sample no.	Analytical data									
	Au	Ag	As	Cu	Mo	Pb	Sb	Sn	Zn	Other
	ppm									
658	0.391	0.470	31	---	---	---	---	---	49	
659	---	.903	49	---	---	---	---	---	70	
660	---	---	45	---	---	---	---	---	57	
661	---	---	39	---	---	---	---	---	64	
662	---	.370	50	---	---	---	---	---	54	
663	---	.360	44	---	---	---	---	---	60	
664	---	---	36	---	---	---	---	---	65	
669	---	---	45	---	---	---	---	15	62	
670	---	.400	---	---	---	---	---	---	56	
709	---	3.562	38	---	---	---	3	---	67	
732	---	---	---	---	---	---	---	15	49	
733	---	.430	47	---	---	---	---	---	50	
734	.244	.390	44	---	---	---	---	---	52	1,100 Ba.
735	---	---	35	---	---	---	---	11	59	
736	---	---	68	---	---	---	5	---	52	
737	---	---	37	---	---	---	---	---	56	
738	---	---	---	---	---	---	---	---	40	
742	---	---	130	---	9	---	---	---	61	10 Nb.
743	---	---	110	---	8	---	---	---	60	

Table 18.--Detection limits for analyses.

Ag	0.1 oz/st fire assay, 0.3 ppm fire assay/ICP
As	300 ppm
Au	0.01 oz/st fire assay, 0.007 ppm fire assay/ICP, 5 ppb fire assay/AAS
Cu	6 ppm
Mo	5 ppm
Pb	10 ppm
Sb	30 ppm
Sn	2 ppm
Zn	3 ppm

DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

OPEN FILE REPORT
MLA 49-88
PLATE 1



Base from the U.S. Geological Survey, 1:24,000 provisional editions Adaven, 1985; Badger Gulch, 1985; Big Creek Ranch, 1985; Goat Ranch Springs, 1985; McCutchen Spring, 1985; Nyala, 1985; Quinn Canyon Springs, 1986; and Wadsworth Ranch, 1985.

MN

SCALE 1:50,000
0 ½ 1 2 3 4 mi
CONTOUR INTERVAL 40 ft

NEVADA
MAP LOCATION

Field work completed in 1985 by John R. Thompson; assisted by Mark L. Chatman, Brian J. Hannigan, Clay M. Martin, and John T. Neubert.

MINE AND PROSPECT MAP OF THE QUINN RARE II AREA, LINCOLN AND NYE COUNTIES, NEVADA

BY

JOHN R. THOMPSON, U.S. BUREAU OF MINES

1988