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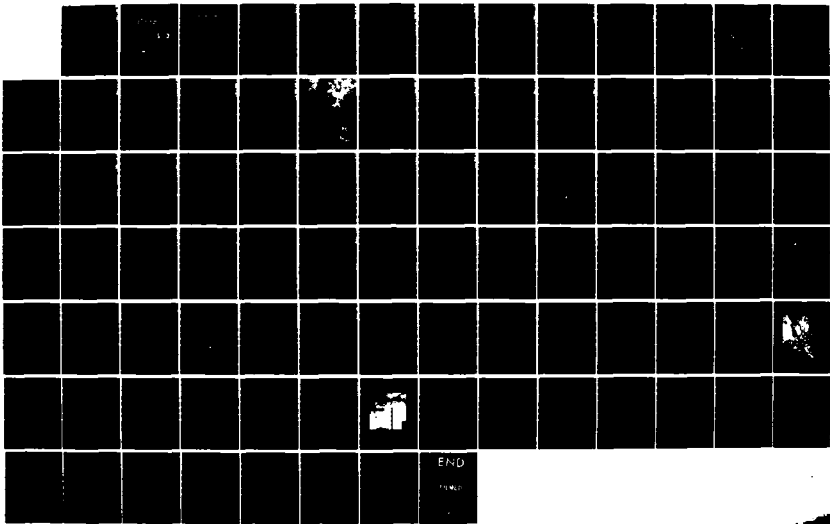

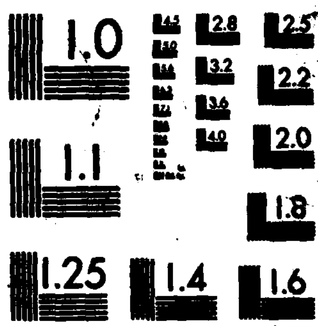

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AD-A163 455

Mineral Deposits and Mineral Potential of the Randsburg Wash Test Range

by
Carl F. Austin
William F. Durbin
Therese AtienzaMoore
George Featherstone
Steven C. Bjornstad
Jeffrey C. Roquemore
Public Works Department

DECEMBER 1983

NAVAL WEAPONS CENTER
CHINA LAKE, CALIFORNIA 93555

Naval Weapons Center

AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

FOREWORD

The Randsburg Wash Test Range portion of the Naval Weapons Center complex was investigated for its mineral deposits and mineral potential under Task Z0833-SL for MAT 052.

The investigation was conducted during fiscal year 1983 by members of the Geothermal Utilization Division, Public Works Department, Mr. Conrad L. Neal, project manager.

This report was reviewed for technical accuracy by James A. Whelan and LCdr. David Stevens.

Approved by
H. H. HARRELL
Capt., CEC, U.S. Navy
Public Works Officer
16 December 1983

Under authority of
K. A. DICKERSON
Capt., U.S. Navy
Commander

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Geode Beds	Iron Occurrences	Randsburg Wast Test Range	Water Analysis

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China Lake, California.

(U) *Mineral Deposits and Mineral Potential of the Randsburg Wash Test Range*, by Carl F. Austin, William F. Durbin, Therese AtienzaMoore, George Featherstone, Steven C. Bjornstad, and Jeffrey C. Roquemore. China Lake, Calif., Naval Weapons Center, December 1983. 88 pp. (NWC TP 6465, publication UNCLASSIFIED.)

(U) This report presents the results of a literature search and an appropriate field survey of all reported claims and prospects on the Randsburg Wash Test Range (RWTR), and in the area of the RWTR access road. The field survey was of sufficient scope to ensure the validity of the literature and to obtain data on minerals of current high interest. The mineral commodities evaluated include gold, silver, iron, mercury, uranium, semiprecious gems, building stone, gravel, volcanic ash, geothermal, and water resources. Each of the resources is described and the location mapped. Assay results and a detailed water analysis are included. Keywords. Wells; Naval shore facilities; Ranges (Facilities);

Stop

19. KEY WORDS (contd.)
Water Resources
Wells

CONTENTS

Tables:

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The contributions of C. Rodgers, C. Nyholm, J. Crow, and R. Wilhelm in the areas of mine safety and data collection during the field evaluation of the Randsburg Wash Test Range are sincerely acknowledged. Special thanks to the members of the Indian Wells Valley Search and Rescue Team for their assistance during the investigations of the Coin Consumer Group and the Chuckawalla Complex. The efforts of S. Kendall, R. Clodt, H. Dixon, and W. Mauldin in the careful preparation of assay samples and map drafting are gratefully acknowledged. The help of these people and others who made contributions is acknowledged with appreciation.

SUMMARY

The mineral potential of the Randsburg Wash Test Range of the Naval Weapons Center (NWC), China Lake, Calif., was investigated by extensive literature search and confirmatory field work. Field evaluation was restricted to mineral occurrences and prospects claimed and explored prior to establishment of the Naval Weapons Center in 1943. The following mineral commodities were evaluated for the Randsburg Wash Test Range: gold, silver, iron, uranium, mercury, semiprecious gemstones, building stone, and gravel. Strategic minerals and other commodities, observed in various laboratory analyses but not formerly explored or developed, are referenced in Appendix B, even though no values were found that are of commercial interest. Scattered mineral occurrences that contain both precious and base metals are located within the Randsburg Wash Test Range. Although occasional ore-grade hand samples were found, all of the deposits located were too limited in quantity and too low in grade to be of economic interest barring major changes in technology or the economy.

A commercial gold potential, suitable for small-scale operations utilizing a dry washer process, occurs in gravels along the western boundary of the test range in the vicinity of Christmas Canyon. A potential commercial lode gold deposit adjacent to the western boundary in the vicinity of Christmas Canyon clearly extends eastward beneath the base just north of Sea Site.

Nitrate deposits on the Randsburg Wash Test Range are not considered to be of commercial importance due to their relatively minor occurrence and low grade.

Geologic conditions favorable for uranium deposition are frequently associated with geothermal systems, three of which may exist in the southern, southwestern, and eastern portions of the test range. Aerial surveys of the Garlock Fault area by the Atomic Energy Commission (AEC) in 1955 and more recent detailed field examinations by a number of corporations and by the Navy have not revealed commercial-grade outcrops of uranium worth investigation within the test range although such deposition occurs in small amounts a few miles to the west. These geothermal areas also offer a potential for gold and mercury deposits. With the increasing industrial interest in gold deposits associated with geothermal areas, the Christmas Canyon deposits, the Myrick Springs area, and the areas north and east of the Red Mountain geothermal system will come under repeated industrial scrutiny over the next few years.

Gravels of the Randsburg Wash Test Range are generally of an acceptable quality for use as aggregate. Large commercial deposits are available throughout the desert region and have been developed on both public and private lands. Thus, it is expected that there will be no unique market or need for these gravels in the foreseeable future.

There is a definite possibility that geothermal energy resources exist under the Randsburg Wash Test Range in the vicinity of Myrick Springs, north of the Christmas Canyon area, and to the north and east of Red Mountain. There is also a possibility that heat exists in the Haystack Peak in the vicinity of the Randsburg Wash access road.

Small but saleable amounts of gem-quality opal and chalcedony, in the form of geodes suitable for the rock-hound trade, also occur in the Randsburg Wash Test Range.

Decorative and building stone and volcanic ash could be produced from deposits in the Randsburg Wash Test Range. Both commodities are readily available for production from adjacent public and private lands, although no such production is taking place at this time. The geologic environment favorable for the accumulation of commercial quantities of oil and gas does not exist in the Randsburg Wash Test Range and access road areas.

INTRODUCTION

The Randsburg Wash Test Range includes that portion of the eastern complex of NWC lying predominantly in the valley separating the Mojave B North and Mojave B South Ranges. It is located about 23 miles southeast of the main China Lake complex in San Bernardino County. Figure 1 is an index map of the entire NWC base, including the Randsburg Wash Test Range, Randsburg Wash access corridor, and Mojave B Ranges, compiled from the United States Geological Survey 15-minute quadrangles. Included in study of the mineral resources is the Navy access corridor to the west of the test range.

The Randsburg Wash Test Range encompasses a small portion of the southern tip of the Slate Range. The Slate Range is terminated by the Garlock Fault, which forms the approximate western boundary of the test range. The Randsburg Wash Test Range completely encompasses Pilot Knob Valley, which forms the bulk of the range area. Other physiographic features within the test range are Robbers Mountain and the northern flank of the Black Hills, which lie in the southern and southwestern areas, respectively. The test range is bounded on the northeast by the Quail Mountains, on the east and southeast by the Granite Mountains, on the south by Pilot Knob, on the southwest by Almond Mountain, and on the west by the Lava Mountains.

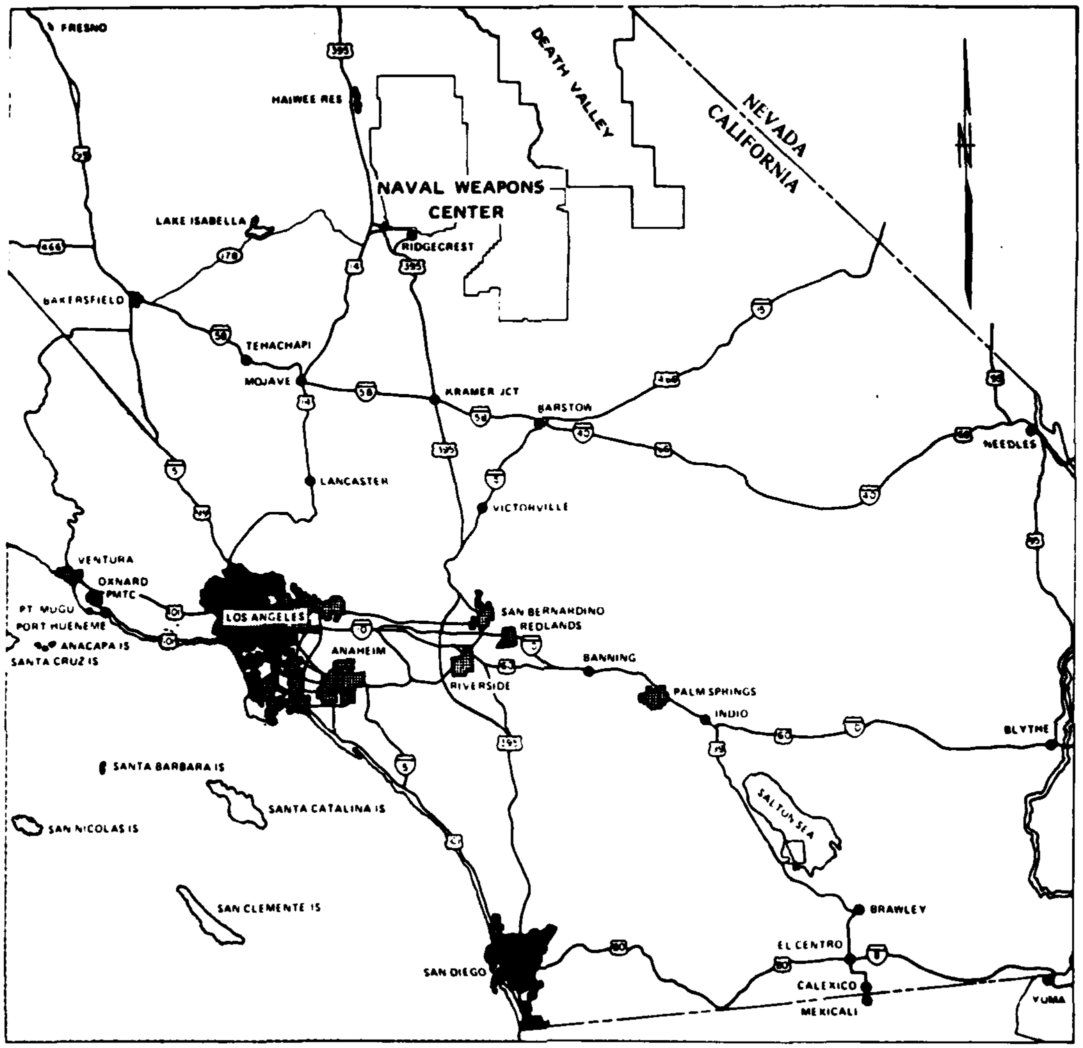

FIGURE 1. Index Map of Naval Weapons Center, China Lake Complex and Mojave B/Randsburg Wash Test Ranges, Calif.

The Randsburg Wash access road courses from the main base south of Salt Wells Valley, through the Spangler Hills and Searles Valley, crosses the Garlock Fault about midway along the range western boundary, crosses the mouth of Christmas Canyon, and then enters Pilot Knob Valley from the west.

Access to the Randsburg Wash Test Range controlled by the Navy. The primary access route is through the Randsburg Wash gate near the mouth of Christmas Canyon. In special cases, arrangements can be made through the Safety and Security Department and Range Control to enter the test range through Fort Irwin or through Mojave B North or Mojave B South test ranges. Although gravel roads through Randsburg Wash to Navy facilities and to significant springs are maintained, most of the former mine roads are not maintained and are frequently difficult to locate, especially when obliterated by flash flooding.

Developed water resources are minimal and are supplied by wells in Pilot Knob Valley. Local surface water sources are Blue Chalcedony Spring, Moonshine Spring, Lead Pipe Spring, Myrick Spring, and other unnamed springs rising along the southern boundary hills. Water flows from the springs are intermittent and small.

The climate is arid, and in summer months the temperature regularly exceeds 100°F. Thunderstorms can frequently cause flash flooding of the washes. Higher hills regularly receive snow in the winter, and occasional storms blanket the entire area with a few inches each winter.

PROCEDURES

With the increased national interest in the mineral resources found on military withdrawn lands, and the requirements of the Federal Land Policy and Management Act of 1976 (FLPMA), NWC elected to conduct a Level 1-1/2 mineral survey in support of its continued occupancy of the Randsburg Wash Test Range as a part of its national defense mission. A Level 1-1/2 mineral survey consists essentially of a Level 1 survey (a literature search) accompanied by a sufficient field survey of all reported claims and prospects to ensure the validity of the literature and to obtain data on minerals of current high interest. The added field work was done for a number of reasons. A significant amount of the prospecting of the late 1930s was promotional and tended to be overstated in the literature. Changing technology in the past 20 years, especially in the areas of geothermal systems and related deposits, has meant that the modern literature has not adequately covered the mineral potential of this area because of its long-term inaccessibility to industry.

Indeed, very little technical evaluation was done on deposits in this region, even during periods of active prospecting and mining, although a rather voluminous folklore and literature has resulted from both promotional enthusiasm and the passage of time. Thus, we commonly hear reports throughout this desert region of assays of purported rich vein materials. On-site examinations typically disclose that the vein—even where present and rich—is only a fraction of an inch in width and thus worthless; or, more commonly, there is no recognizable mineral value at all. When one views the multitude of prospects in desert regions such as make up the Randsburg Wash Test Range and access road area, rather than become enamored of the number of such prospects (or the lack of in some instances) one must also bear in mind the typical odds of success for prospecting. It is not unusual to find the odds of success on the order of the following:

- 1000 prospects are considered by prospectors to be worthy of claiming and exploratory effort on their part
- 250 of the 1000 prospects, after examination by a professional team from industry, are found to be worth a second look
- 65 of the "second looks" deserve serious attention by industry
- Three of those getting serious attention by industry are worth an option to purchase and heavy exploratory effort
- One profitable mine results, the profit from which must support all of the exploratory activity needed to find the next mine

Hence at the raw prospect level, which is all that exists at the Randsburg Wash Test Range and access road area, we are, from a statistical point of view, dealing with odds of the order of 1 in 1000. The gaming tables of Las Vegas are obviously far more attractive from a statistical point of view; and it is hope based variously on hunch, geological talent, and blind luck that combine to keep the industry supplied with prospects.

By employing field investigation coupled with a sampling program, three deficiencies of the Level 1 mineral survey are corrected:

1. The actual occurrence, grade, and width of the reported deposits are verified and whether or not mining (i.e., stoping) took place can be determined.

2. Deposits that never became involved in promotional literature will receive fair treatment. The NWC Geothermal Utilization Division staff, with a background of over 20 years of continuous field investigations of the test ranges of the Center, is aware of the location of virtually every mine opening, test pit, and prospect on the Randsburg Wash Test Range and in the Randsburg Wash access road area.

3. With changing technology and market trends, there has been a considerable shift in what might constitute a potential mineral deposit since the end of World War II, when the industrial prospecting of the test range ceased and new literature citations were no longer being made.

The Level 1 search reviewed all available literature including governmental and industry records, materials obtained by interlibrary loan, and items reviewed at historical libraries and universities. Additional data were obtained from the California Division of Mines, from the United States Geological Survey, and from the United States Bureau of Mines. The extensive files on the mineral occurrences of the region that are held by the Geothermal Utilization Division, Public Works Department, NWC, were of particular help. The Naval Ordnance Test Station (NOTS), now NWC, legal archives were also reviewed as part of the literature search, as was data developed by the geothermal utilization staff for various nearby condemnation actions involving mining claims.

The results of the AEC aerial survey of the Garlock Fault were of particular importance in evaluating the potential for uranium in deposits of the region. Geophysical investigations and field examinations of the same region, performed variously by a number of mining companies in their search for commercial uranium deposits, provided additional data. It is important to note the fact that the uranium deposits of the Red Mountain geothermal system, prospected in 1947, are of much greater significance both in grade and potential tonnage than is the uranium potential in the near vicinity of the Randsburg Wash Test Range, yet they were never put into commercial production.

Field examinations of sites and prospects in both the Randsburg Wash access road area and the test range area itself were conducted by the geological staff of the NWC Geothermal Utilization Division. Additional investigations were made by the Division's senior scientists at sites where significant mineral values were reported to exist or where geological evidence suggested a zone of potential deposition despite a lack of surface outcrop of economic mineralization.

Where mineralization was found, hand samples were taken of apparent best-grade material. The experience and judgment of the investigating team in choosing sample sites was relied upon for identification of those sites where mineral "salting" might have been done by mine or prospect promoters during active mining periods or just prior to Navy acquisition. Where sampling was done on in-place mineralized zones from either underground workings or surface outcrops, a few inches of surface rock were stripped away before proceeding with the chip or channel sample method as required for each particular case. This method would help to ensure an honest representative sample if, for example, the mineralized vein surface had been salted with metallic gold or gold-bearing solution.

Where sampling of "ore" piles on the surface was necessary, two questions had to be answered: Does this material bear any resemblance to the underground in-place material or to visible surface outcrop? Does the "ore" pile really represent what was mined or prospected for in a location where all workings are caved or filled in? Naturally, when mine openings and prospects are accessible, samples taken from in-place material are more desirable; but where the workings are caved in or too dangerous to enter, the "ore" pile sampling method is the alternative. Where possible, the "ore" pile sample was composed of representative, uniformly sized material collected along evenly spaced intervals from the top, sides, and from within the pile. Complete sampling from the surface to the core of the "ore" piled helped to ensure a valid assay result in the event that the pile had been "topped" with foreign mineral material.

Results of sampling sorted piles are not conclusive evidence of the presence or absence of value. If a pile is clearly local vein material and was clearly segregated for some purpose, its value or lack thereof is a clue to what is present. The validity of the approach of sampling selected for sorted "ore" piles makes more sense after one becomes familiar with this region and its history. Even through the Depression era this desert area was remote and very difficult to reach. A prospector would move in, set up camp, and mine out a pile of rock, sorting the vein (usually an obvious quartz vein) until some fixed time or expenditure was completed. Only then would a sample be hauled to town for assay; if it had no value, the prospector would never return. The desert is dotted with short adits, trenches, and shafts with piles of worthless quartz containing pyrite or limonite beside the dump or sitting on a sorting deck. Such a typical worthless pile is that seen at the crude mill site just west of Christmas Canyon where an operator at some nearby desert site had collected a truckload of quartz, hauled it to a small mill, and dumped it; there it will sit essentially undisturbed except by occasional sample collectors taking more worthless samples.

A number of samples were evaluated in the NWC Geothermal Utilization Division laboratories with a Kevex Energy Dispersive Spectrometry system. The system was used to prescreen samples to determine potential worth by looking for lead, zinc, iron, silver K-alpha and K-beta excitation peaks, and arsenic and copper values used as indicators for gold. X-ray evaluation was made on a loose-powder preparation basis. The Kevex was also used to check independent laboratory results. Mercury was evaluated by use of a Jerome Mercury Analyzer using the thin gold film technique. The results of evaluation of selected samples are given in Appendix A.

All samples taken during the field examination were submitted for independent commercial laboratory analysis for gold and silver. These precious metal values were determined by the fire-assay technique. Base metals were evaluated by atomic absorption methods. Skyline Laboratory, Inc., Wheatridge, Colo., performed the fire-assaying and the AA-evaluation of the samples.

Kevex investigations and in-house mercury analyses were performed by NWC staff members.

Precious metal values are reported in troy-ounce (troy-oz) per ton. Mercury is reported in parts per billion (ppb) and converted to pounds-avoirdupois per ton. Other base metals are reported in weight-percent (wt. %). By careful selection of what appeared to be the most mineralized of the high-grade sites, where such could be visually identified, and by preparing the samples in accordance with strict engineering procedures and conducting preliminary in-house analyses for prescreening and cross-checking independent laboratory assay results, a consistent and prudent evaluation could be made of the grade and values represented by each prospect that could be sampled on the Randsburg Wash Test Range and access road area. Where no mineralization could be identified visually, sufficient check samples were still taken to ensure that the lack of mineralization was not due to its obscurity, in the case of precious metals.

When the sample assay results return from laboratory analysis, the task remains of interpreting the data and applying an overall grade and value estimate to each mine* or prospect.

The evaluator, at this point, must make a number of decisions requiring good judgment as to the relative importance of erratic high values—an intermingling of mainly low-grade assay values with occasional high-grade assay values for a single deposit or prospect. The high assay value could, indeed, be a genuine result after "salting" has been ruled out during field evaluation. A second cause for a high-grade assay value could be, as Austin (1978)[1] states:

"A mineralized zone with occasional flakes or blebs of gold is very difficult to sample; i.e., narrow channel samples are generally of either no value or of a rather high value."

The dilemma of interpreting the value of a particular zone with such "erratic high assays" is discussed in detail by McKinstry (1948, pp. 49-59)[2] in his excellent text on mining geology.

Where these erratic high values presented themselves, the mine or prospect was revisited and the specific sample locations were resampled to check the reproducibility of assay results. Further sampling was conducted along the mineralized zone to delineate the area of potentially commercial value, if indeed it actually existed.

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*The term "mine" is used in this report only if actual stoping for production can be verified on scene.

[1]Naval Weapons Center. *Mines and Mineral Deposits of the South Portion of the Chocolate Mountain Gunnery Range*, by Carl F. Austin, William F. Daniel III, and James A. Whelan. China Lake, Calif., NWC, May 1978. (NWC TM 3483, publication UNCLASSIFIED.)

[2]H. E. McKinstry. *Mining Geology*. Englewood Cliffs, NJ, Prentice-Hall, 1948, pp. 49-59.

GEOLOGY

A geological map showing the Randsburg Wash Test Range area and Randsburg Wash access road is given in Figure 2. The map is reproduced, in part, from the Trona Sheet compiled by Jennings, Burnett, and Troxel (1962),[3] California Division of Mines and Geology.

Randsburg Wash Test Range

The Randsburg Wash Test Range is situated at the boundary between two major geological provinces. The Mojave B Range North to the north is considered to lie in the southwest corner of the Great Basin geological province, although the prominent Slate Range is a fold rather than a fault block. The Mojave B Range South to the south is in the Mojave Desert geological province. The Garlock Fault, which strikes generally east-west, is the major structural feature of the Randsburg Wash Test Range and forms the boundary between these geological provinces. The Brown Mountain Fault, a steeply dipping, northwest-trending range-front fault associated with the Panamint Valley Fault zone, is truncated by the Garlock Fault in the northeast corner of the Randsburg Wash Test Range. The Blackwater Fault, which trends northwesterly, lies near the western boundary of the range and separates Almond Mountain to the west from Grass Valley. A series of small, widely separated parallel faults that trend northeasterly cross the north-central portion of the Mojave B Range South just south of the Randsburg Wash Test Range border.

Almond Mountain consists of Pliocene andesites intruded by Tertiary hypabyssal volcanic and/or plutonic rocks.

Pilot Knob Valley contains Quaternary alluvium and lake deposits bounded on the west by Plio-Pleistocene nonmarine deposits.

Black Mountain and other unnamed mountains on the valley floor to the east are composed of Tertiary volcanics, with pre-Cretaceous metasedimentary rocks present in the low hills to the west.

The southern flank of the Slate Range contains Mesozoic granitic rocks and pre-Cenozoic granitic and metamorphic rocks.

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[3]C. W. Jennings, J. L. Burnett, and B. W. Troxel. "Geological Map of California, Trona Sheet (1:250,000)." California Division of Mines and Geology, 1962.

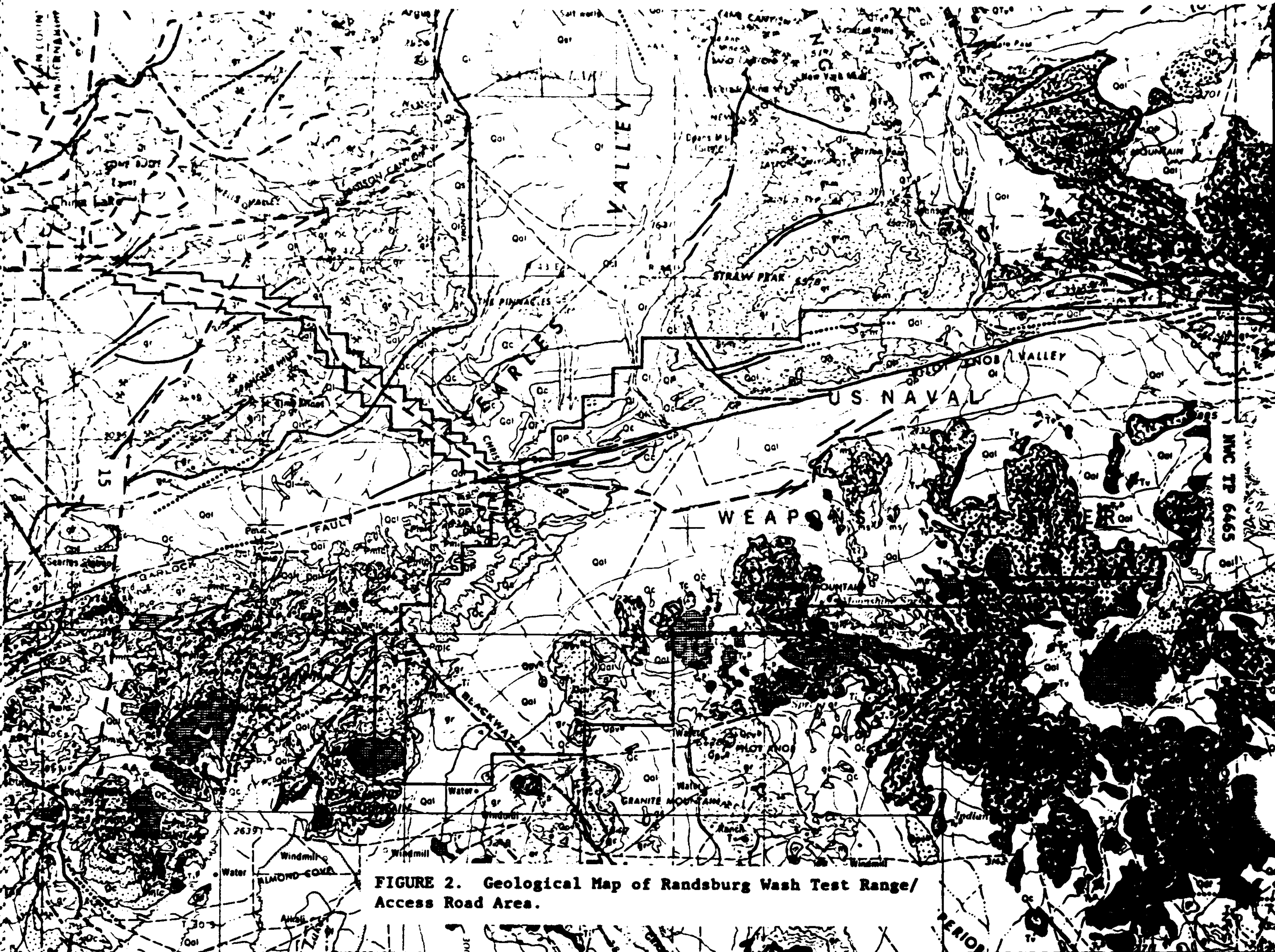

FIGURE 2. Geological Map of Randsburg Wash Test Range/ Access Road Area.

EXPLANATION

SEDIMENTARY AND METASEDIMENTARY ROCKS

- Qs — Dune sand
- Qal — Alluvium
- Qsl — Salt deposits
- Ql — Quaternary lake deposits
- Qc — Pleistocene nonmarine
- QP — Plio-Pleistocene nonmarine
- Pmlc — Middle and/or lower Pliocene nonmarine
- Tc — Tertiary nonmarine
- m, ls — Pre-Cretaceous metamorphic rocks (ls = limestone or dolomite)
- ms — Pre-Cretaceous metasedimentary rocks
- P, ls — Paleozoic marine (ls = limestone or dolomite
- € — Cambrian marine
- p€ — Undivided Precambrian metamorphic rocks
  $p€g$ = gneiss, $p€s$ = schist
- Earlier Precambrian metamorphic rocks

IGNEOUS AND META-IGNEOUS ROCKS

- Qpv — Pleistocene volcanic: Qpv^{r} —rhyolite; Qpv^{a}—andesite; Qpv^{b} —basalt; Qpv^{p} —pyroclastic rocks
- Pv — Pliocene volcanic: Pv^{r} —rhyolite; Pv^{a}—andesite; Pv^{b} —basalt; Pv^{p} —pyroclastic rocks
- Mv — Miocene volcanic: Mv^{r} —rhyolite; Mv^{a} - andesite; Mv^{b} —basalt; Mv^{p} —pyroclastic rocks
- QTv — Cenozoic volcanic: QTv^{r}—rhyolite; QTv^{a}- andesite: QTv^{b} —basalt; QTv^{p} -pyroclastic rocks
- Tertiary intrusive (hypabyssal) rocks: Ti^{r} -rhyolite; Ti^{a} -andesite; Ti^{b} —basalt
- Tv — Tertiary volcanic: Tv^{r} —rhyolite; Tv^{a} —andesite; Tv^{b} —basalt; Tv^{p} —pyroclastic rocks
- gr — Mesozoic granitic rocks: gr^{g}-granite and adamellite; gr^{gd}-granodiorite; gr^{t}-tonalite and diorite
- gr-m — Pre-Cenozoic granitic and metamorphic rocks

The Quail Mountains to the northeast consist of Tertiary volcanics with Plio-Pleistocene nonmarine sediments on the southern flank bordering Pilot Knob Valley. Early pre-Cambrian metamorphic rocks, along with Mesozoic intrusive rocks, extend westerly from the Quail Mountains within the bounds of the Garlock Fault zone.

The Granite Mountains contain Mesozoic granites overlain to the west by Tertiary volcanics.

A large area to the west of Myrick Spring and including Robbers Mountain contains Tertiary volcanic rocks intruded in places by Tertiary hypabyssal rhyolites, basalts, and andesites. Pleistocene basalt caps the Tertiary volcanic hill due north of Blue Chalcedony Spring.

A small unnamed north-south trending range of hills, composed of Mesozoic granite and capped by Pleistocene basalt, lies southwest of Robbers Mountain and east of the Blackwater Fault.

Grass Valley, to the south and east of Blackwater Fault, contains Quaternary alluvium. A belt of severely altered pre-Cretaceous metasedimentary rocks cut by intermediate dikes borders the south side of the Garlock Fault and extends into the Sea Site area of the Randsburg Wash Test Range.

Randsburg Wash Access Road Area

The Randsburg Wash access road area passes over the thin Quaternary alluvium of Salt Wells Valley, onto the Mesozoic granitic rocks and associated prominent spessartite dike swarms of the Spangler Hills, and across the Quaternary alluvium and nonmarine deposits of the southern Searles Valley area. The access road crosses the Garlock Fault at the mouth of Christmas Canyon, onto Plio-Pleistocene nonmarine sediments previously described for the western part of the Randsburg Wash Test Range.

MINERAL RESOURCES

Mineral commodities have been produced in very limited quantities despite nearly a century of intense prospecting within the area known as the Randsburg Wash Test Range. Mineral occurrences include deposits prospected for their content of gold, silver, iron, mercury, semiprecious gemstones, building stone, and gravel.

Little literature was located during the literature search conducted as part of this study despite numerous rumors of valuable mineral discoveries in the Randsburg Wash Test Range area. Summary compilations for total gross metal values of production from the test range area apparently have not been documented. Indeed, with today's requirements of the "prudent-man" rule and marketability test, it is unlikely that any of the prospects of the test range area would constitute a valid discovery.

Each deposit or prospect that could be located on the ground is described in the following detailed sections. There are obvious prospect sites where the geologist today can only surmise what the prospector in the past may have had in mind when he expended his efforts. If nothing else is present, one generally assumes gold and silver were the object, as the region underwent intensive prospecting at the time the nearby New York, Alta, and the extensive Lone View and San Francisco properties were in production in the 1870s.

Each of the deposits or prospects for the Randsburg Wash Test Range, whose location could be found, is shown on location grid map Figure 3. The deposits or prospects that occur on or near the Randsburg Wash access road are plotted on location grid map Figure 4.

GOLD PROSPECTS

Spangler Canyon Prospect (W-01)

The Spangler Canyon prospect is located in the Spangler Hills mining district near the mouth of the Spangler Canyon and southwest of the Randsburg Wash access road. It lies on unsurveyed land, but a projection of the adjacent public land survey to the west places it in the SE1/4, NW1/4, NW1/4, Sec. 16, T26S, R42E, MDB&M (Figure 4).

The deposit host rock is a Mesozoic leucogranite, and the locus for mineralization is in the form of a shear zone that ranges from 8 inches to 3 feet in total width. The mineralized zone contains quartz that is present as vein material from 6 inches to 1 foot thick and as blocky, brecciated masses that fill the entire shear in some areas. Clay and sericite are present as interstitial filling in quartz breccia and occur along the shear zone contacts in fine seams. Minerals present include irregularly distributed limonite in the forms of quartz-stain and fracture-filling, as scattered psuedomorphic crystals after pyrite, disseminated pyrite, and very sparse fracture-filling chrysocolla. The quartz zone appears to pinch southward.

The prospector followed the shear zone, which strikes N40W and dips from 19 degrees to 8 degrees southeasterly, shallowing with depth. Development consists of about 420 feet of drift and decline accessed by three portals. One 9-foot shaft was driven at the site. Figure 5 is a surface plan view showing the location of the workings. There has been

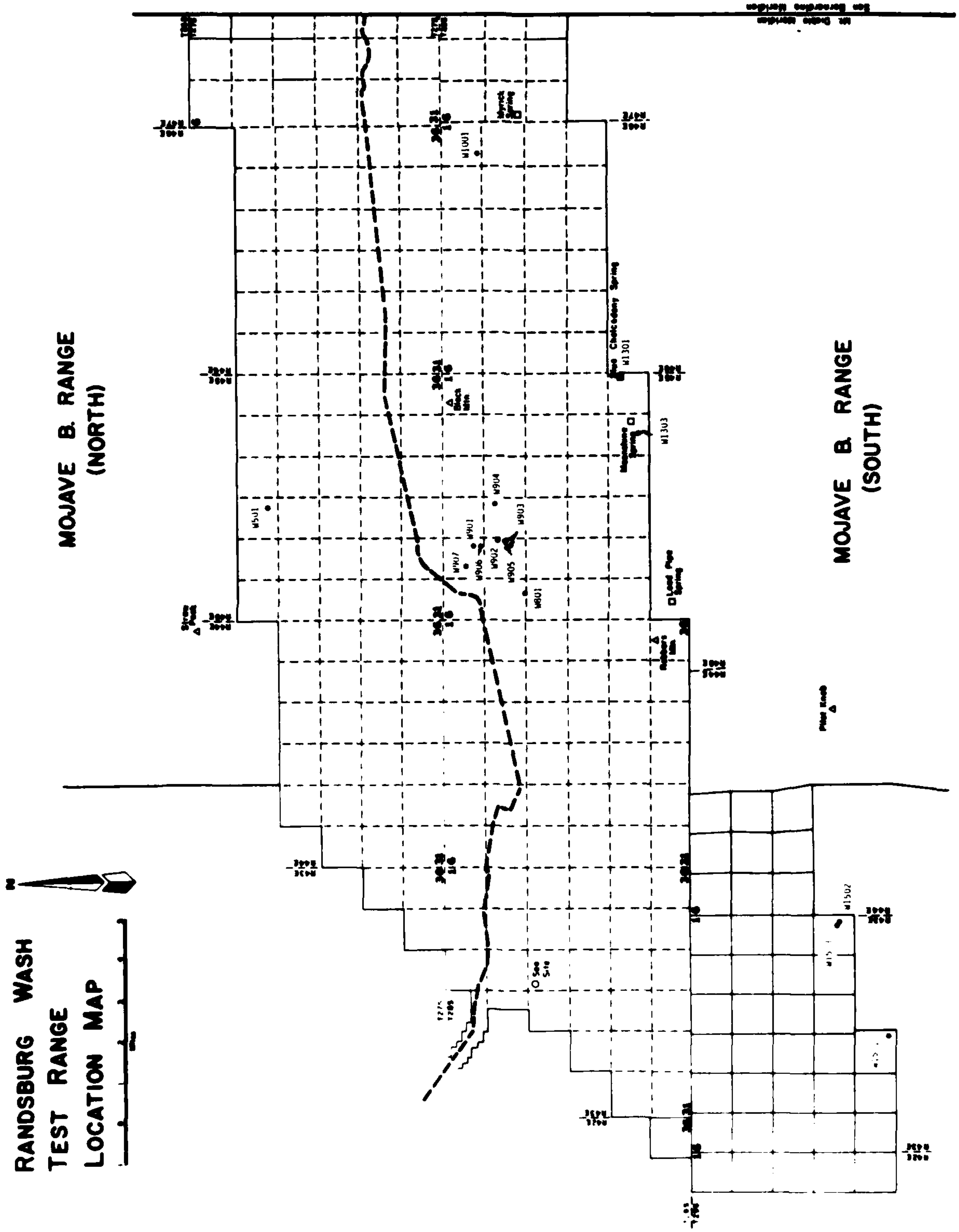

FIGURE 3. Prospect Location Map, Randsburg Wash Test Range.

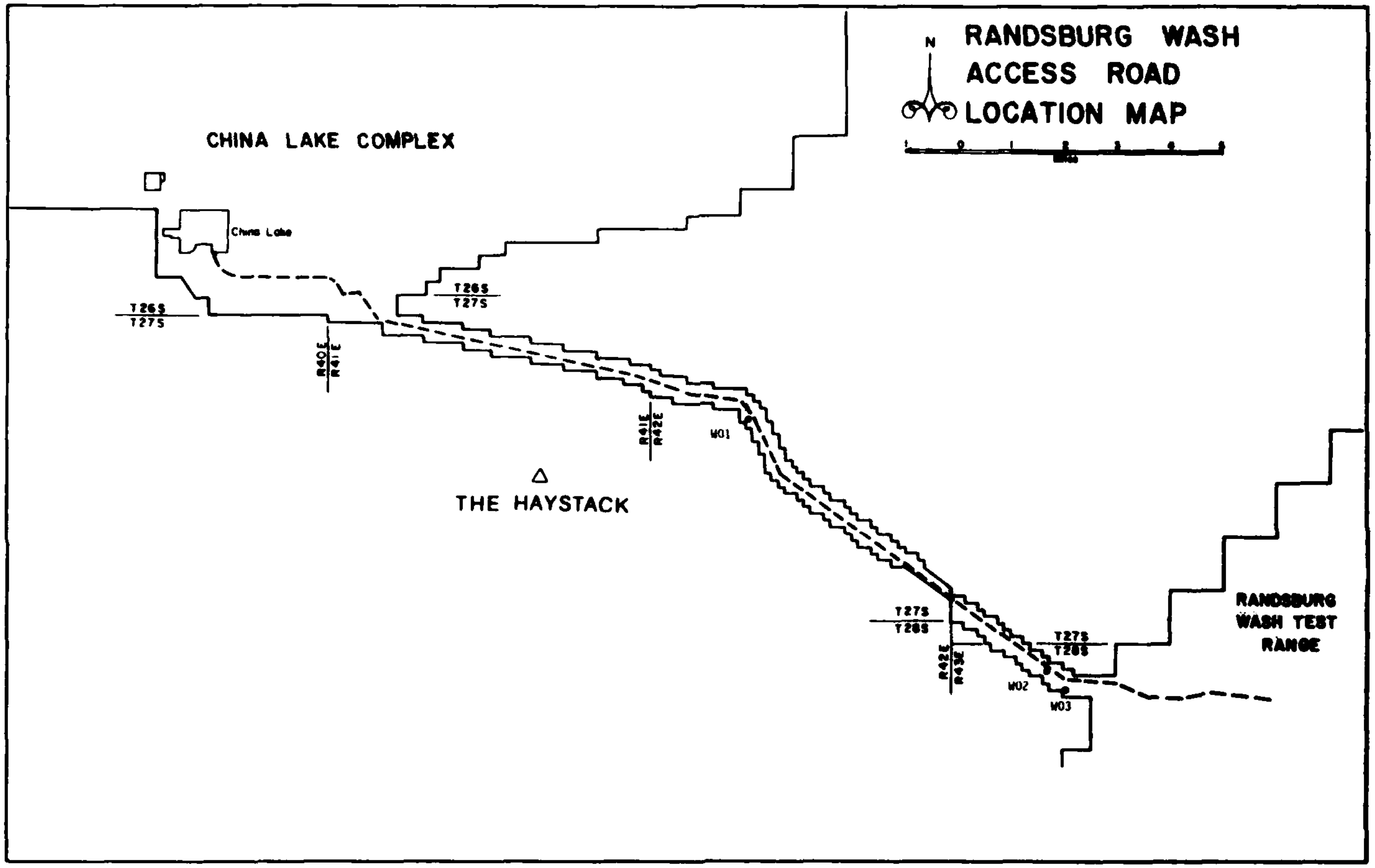

FIGURE 4. Prospect Location Map, Randsburg Wash Access Road Area.

a minor amount of stoping, a few tens of cubic feet, from the near-surface portion of the mine. The down-dip extent of the quartz mineralization, as explored by a series of short declines, appears to decrease in thickness and mineral content, although the shear zone averages between 2 and 2-1/2 feet in width. Figure 6 shows the extent of the workings for adits 1 and 1A, and Figure 7 shows the plan view and cross sections for adit 2.

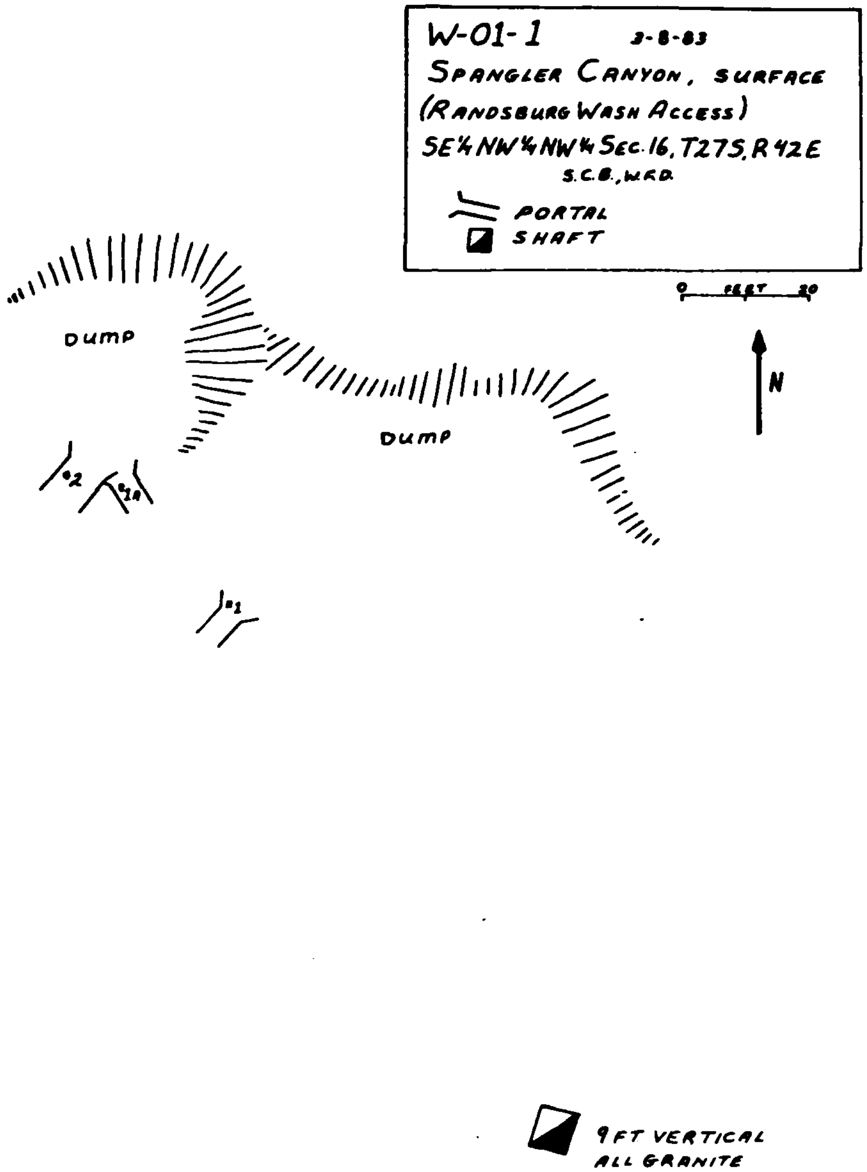

FIGURE 5. Spangler Canyon Claim, Surface and Location of Adits 1, 1A, 2, and Shaft (W-01-1).

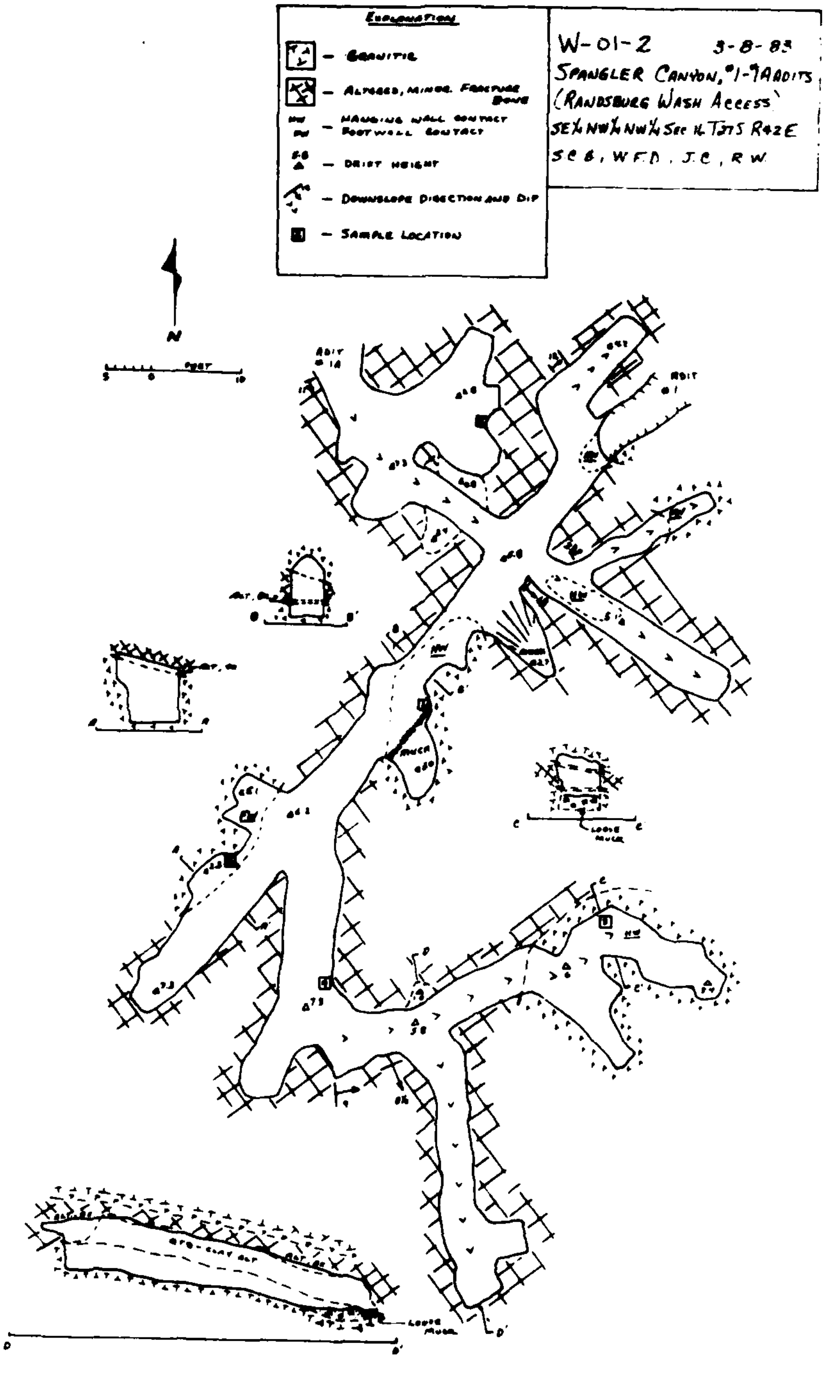

FIGURE 6. Spangler Canyon Claim, Adits 1 and 1A, Plan View (W-01-2).

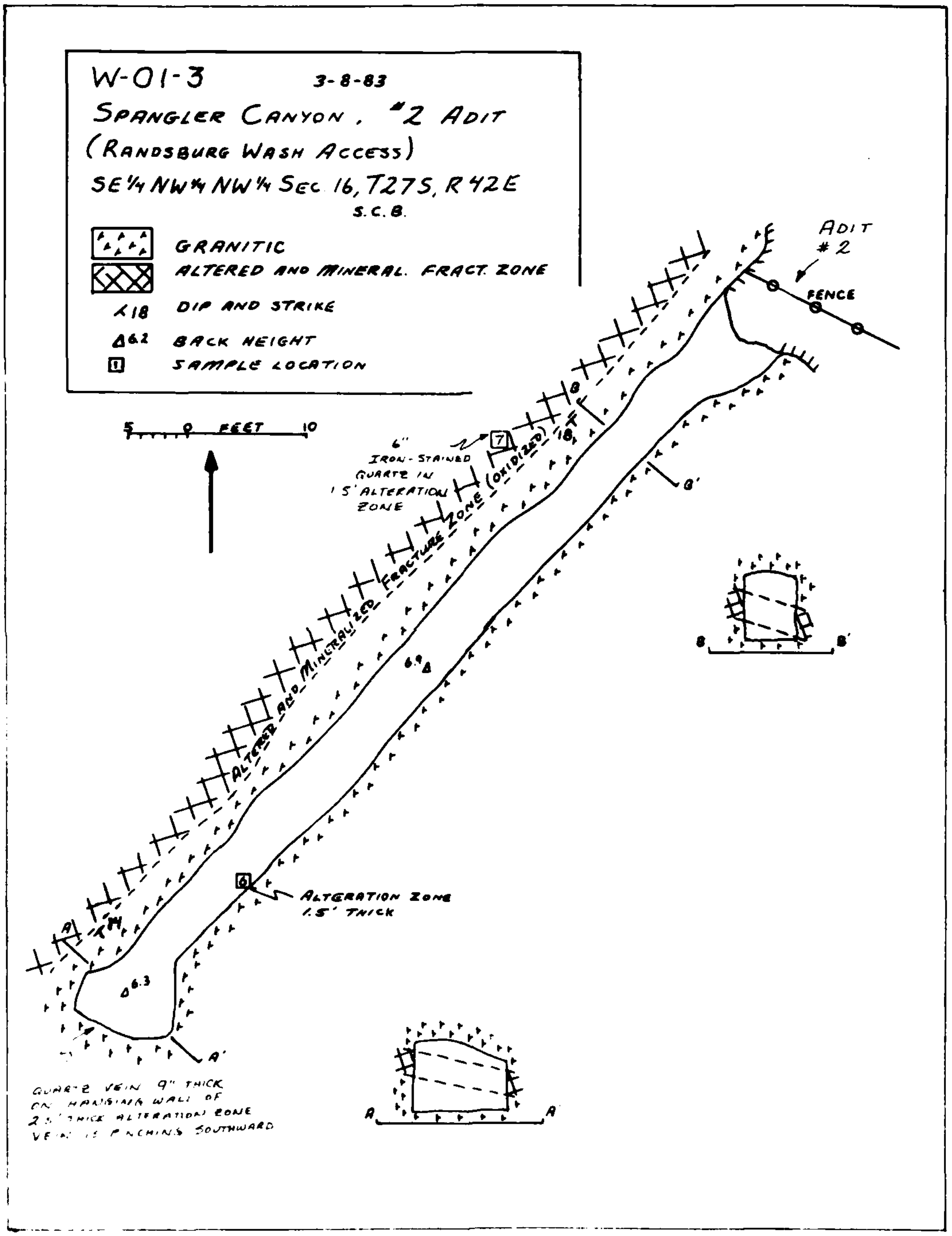

FIGURE 7. Spangler Canyon Claim, Adit 2 Plan View (W-01-3).

Seven samples were taken at the Spangler Canyon prospect, and the complete list of assay results of the samples is found in Appendix Table B-1. The samples labeled W-01-2 and W-01-6 warrant special mention and are listed in Table 1 for precious metal values.

TABLE 1. Assay Results for Spangler Canyon Prospects.

Sample	Gold, troy-oz/ton	Gold, \$/ton[a]	Silver, troy-oz/ton	Silver, \$/ton[b]	Total precious metal values, \$/ton
W-01-2	0.130	65.00	0.122	1.38	66.83
W-01-6	0.320	160.00	0.238	3.57	163.57

[a]Gold at \$500/troy-oz.

[b]Silver at \$15/troy-oz.

Although the grade and value for the two samples looks encouraging, the following considerations should be taken into account.

All samples were taken of apparent best-grade material and do not necessarily represent an entire vein width, alteration width, or mineable width. Therefore, the assay values for this prospect should not be regarded as indicative of average "as mined" values. Sample W-01-2 was taken from a 6- to 8-inch-wide quartz vein with limonite staining and fracture-filling with clay, approximately 62 feet in from the portal of adit 1. Figure 6 shows the sample location. Sample W-01-6 was taken from a 6- to 8-inch-wide quartz-limonite-clay vein within an 18-inch-wide shear zone approximately 61 feet from the portal of adit 2 as shown in Figure 7. The two samples were taken from the same structure, and W-01-6 is located approximately 30 feet up-dip of W-01-2. If a minimum mining width of 18 to 24 inches (averaging 21 inches) is used in stoping the vein (averaging 7 inches wide), the total precious metal value would equate to 7/21 [(\$66.83 + 163.57)/2] or \$38.40/ton.

Surface reconnaissance of the area up-dip from adit 2 revealed no evidence of the shear zone and no quartz outcrop that might reasonably have been prospected by at least trenching.

This prospect is typical of dozens located in the Spangler Hills outside the Center boundary. The region contains numerous scattered lenses of quartz with minor pyrite and chalcopyrite within shear zones. Prospectors in this district locating such a zone generally drive extensive openings on each weakly altered joint in the host rock to result in extensive workings but no mineable deposit. At none of the openings are the lenses wide enough, rich enough, or close enough together to have enabled mining from one to another as a successful continuous operation.

None of the samples of mineralized material collected from this prospect show commercial potential for the production of precious metals or other commodities. The mineralization present does indicate that hydrothermal deposition has occurred, but it is not pervasive and there are no identifiable geological targets on the Spangler Canyon prospect that would warrant the expenditure of exploration funds by a knowledgeable prospector or mining firm.

Unnamed Adit and Prospect Pit (W-801)

A prospect located in the Myrick Mining District approximately 8.05 air miles south-southeast of Straw Peak vertical angle elevation benchmark (VABM) was explored, presumably, for precious metals. It is shown as W-801 on Figure 3. The prospect pit and adit are on unsurveyed land, but a projection of the adjacent public lands survey to the west places it in the SE1/4, SW1/4, SE1/4 Sec. 7, T28S, R45E, MDB&M (Figure 8).

The property was explored by means of an 8-foot adit plus a pit directly above the adit face. The adit was driven to expose possible mineralization in the Tertiary volcanic pyroclastic rock, a rhyolitic ignimbrite, along an intruding northwest trending aphanitic mafic dike. However, all that the adit exposes is clay alteration of the rhyolitic ignimbrite.

No identifiable mineralization was found beyond the alteration of the dike margin, a geologic setting widely tested throughout this region with no success. Quite possibly, this work was done as a result of the "phonolite myth," which was widespread throughout the western United States in the 1870s.[4]

Chuckawalla Mine (W-902)

Examination of a claim marker still in place disclosed a lode claim notice that enabled identification of a group of prospectors. The claimant, Walter B. Turner, named the claim the Chuckawalla No. 2 of the Myrick mining district in San Bernardino County and filed the claim on 10 August 1938. The discovery monument was found on a small northwest-trending ridge southwest of the major workings. The description of the layout of the mining claims taken from the notice places

[4]G. Montague Butler. "Some Facts About Ore Deposits." Arizona Bureau of Mines Geological Series No. 8, Bulletin 139, 15 August 1939.

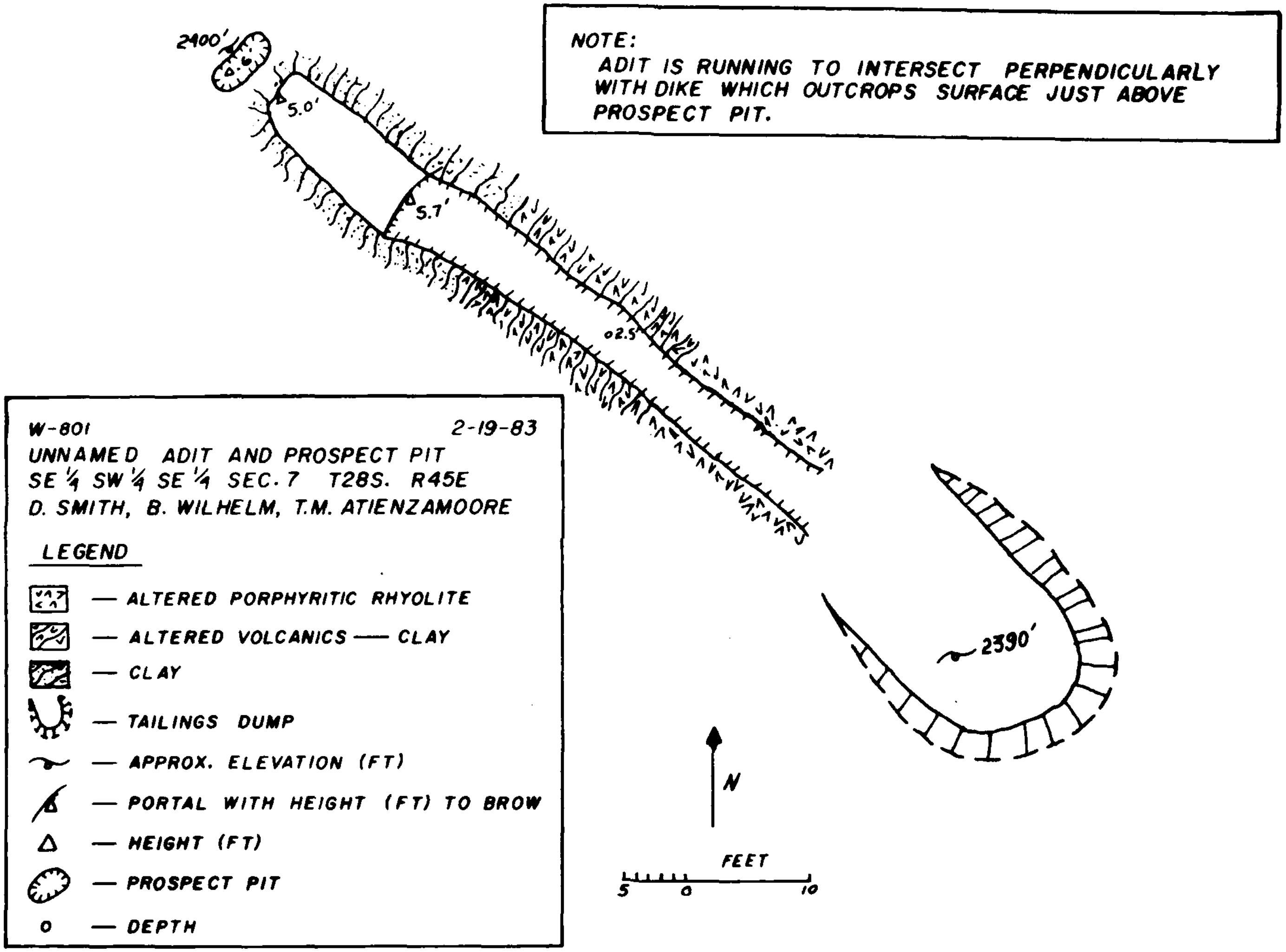

FIGURE 8. Unnamed Adit and Prospect Pit, Plan View (W-801).

the major workings, an adit, an inclined shaft, and a vertical shaft in the Chuckawalla No. 1. Smaller prospects to the north of the vertical shaft would be located in Chuckawalla No. 3. The quartz outcrop covered by Chuckawalla No. 2 is immediately south of Chuckawalla No. 4, which is the site of a foundation, probably used as a small loading dock. No other discovery monuments or corner posts could be located.

A second notice was found in the No. 1 adit consisted of an annual labor assessment notice for the assessment year ending 1 July 1937. In the notice the property was called Black Gold No. 1. The assessment work was done for the estate of F. M. Myrick by C. H. Churchill on 23 May 1937.

The complex is located approximately 8.9 miles north from Lead Pipe Spring and 7.55 air miles south-southeast of Straw Peak VABM. It is shown as W-902 in Figure 3. The claims are on unsurveyed land, but a projection of the adjacent public lands survey to the west places it in the SW1/4, NE1/4, NE1/4, Sec. 8, T28S, R45E, MDB&M.

The workings lie on a block of pre-Cretaceous metasedimentary rock, primarily slate with some overlying limestone, which has been exposed by intense deformation along the south side of the Garlock Fault zone. The block overlays a Tertiary rhyolitic ignimbrite. Figure 2 gives the regional geology.

Mineral exploration has taken place on the Chuckawalla claims in six areas, only three of which have had sufficient work done on them to warrant mapping and sampling. The others had no apparent mineralization.

The unmapped and unsampled workings consist of (1) four scattered scratchings, located on the ridge to the south of the major workings, in unmineralized red and black slates; (2) three prospect pits in the quartz outcrop southwest of the shaft, with minor manganese and iron staining along the fractures in the quartz; and (3) six pits and trenches in the slate just below the limestone contact.

The major exploratory workings consist of (1) the adit shown as W-902-1 in Figure 9. It has no identifiable mineralization. The adit was driven in the metasediments at the contact between the slates and an altered rhyolite ignimbrite. The adit has two small drifts to the north where the operator was following slip zones. The unmineralized shear zone at the inner end of the adit crosscuts the bedding planes in the slate. This zone had clearly been sampled by previous investigators; a new sample, known as W-902-1, was taken in the same area by the present investigators to determine if any values were present. (2) The inclined shaft to the south known as W-902-2 is shown in plan view in Figure 10. A 2-foot-wide iron-stained clayey zone pinches out at the bottom of the shaft. A sample of this clayey area, known as W-902-2-1, was taken near the opening where the iron staining was most

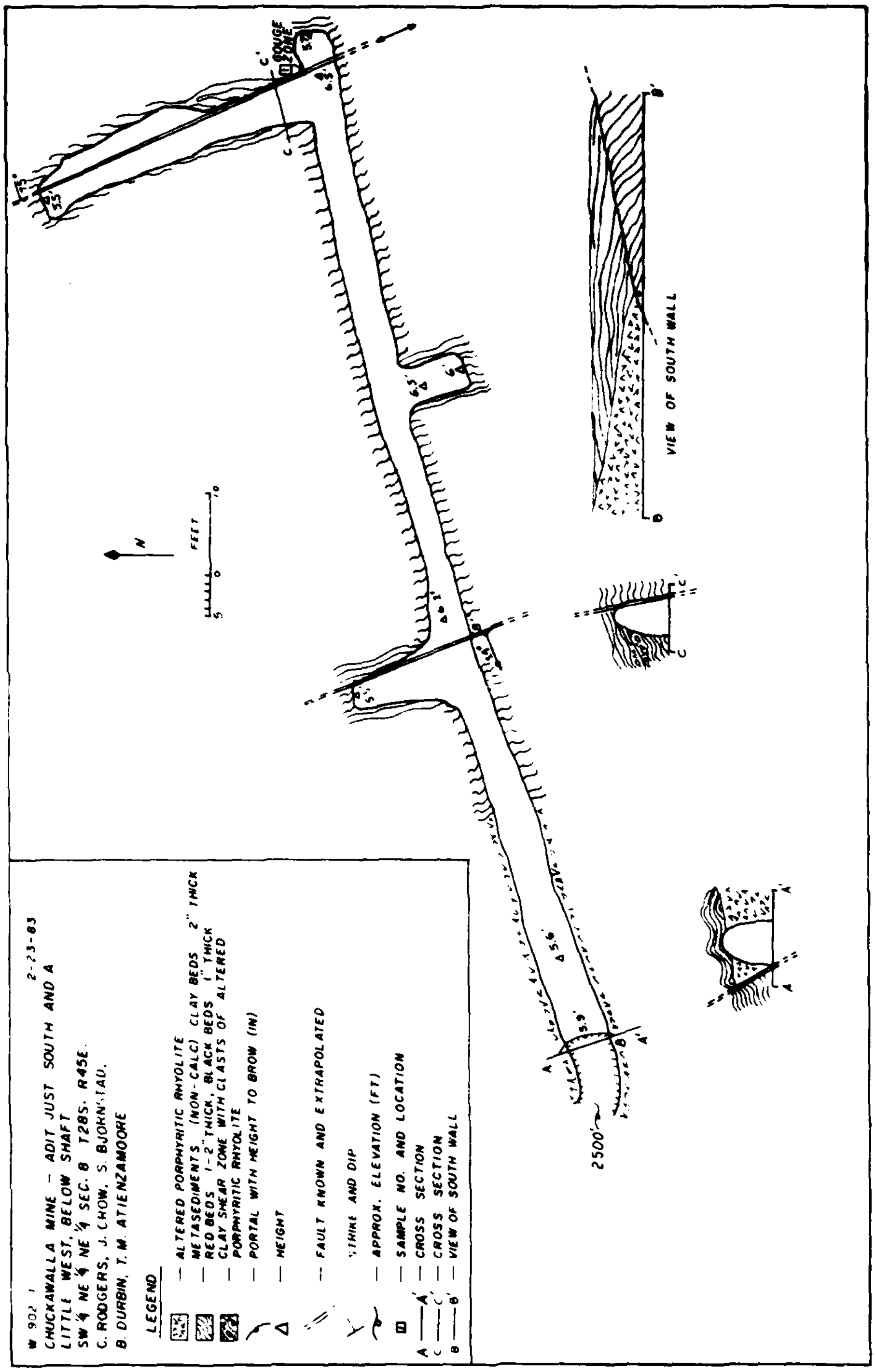

FIGURE 9. Chuckawalla Prospect Adit 1 Plan View (SW of Shaft) (W-902-1).

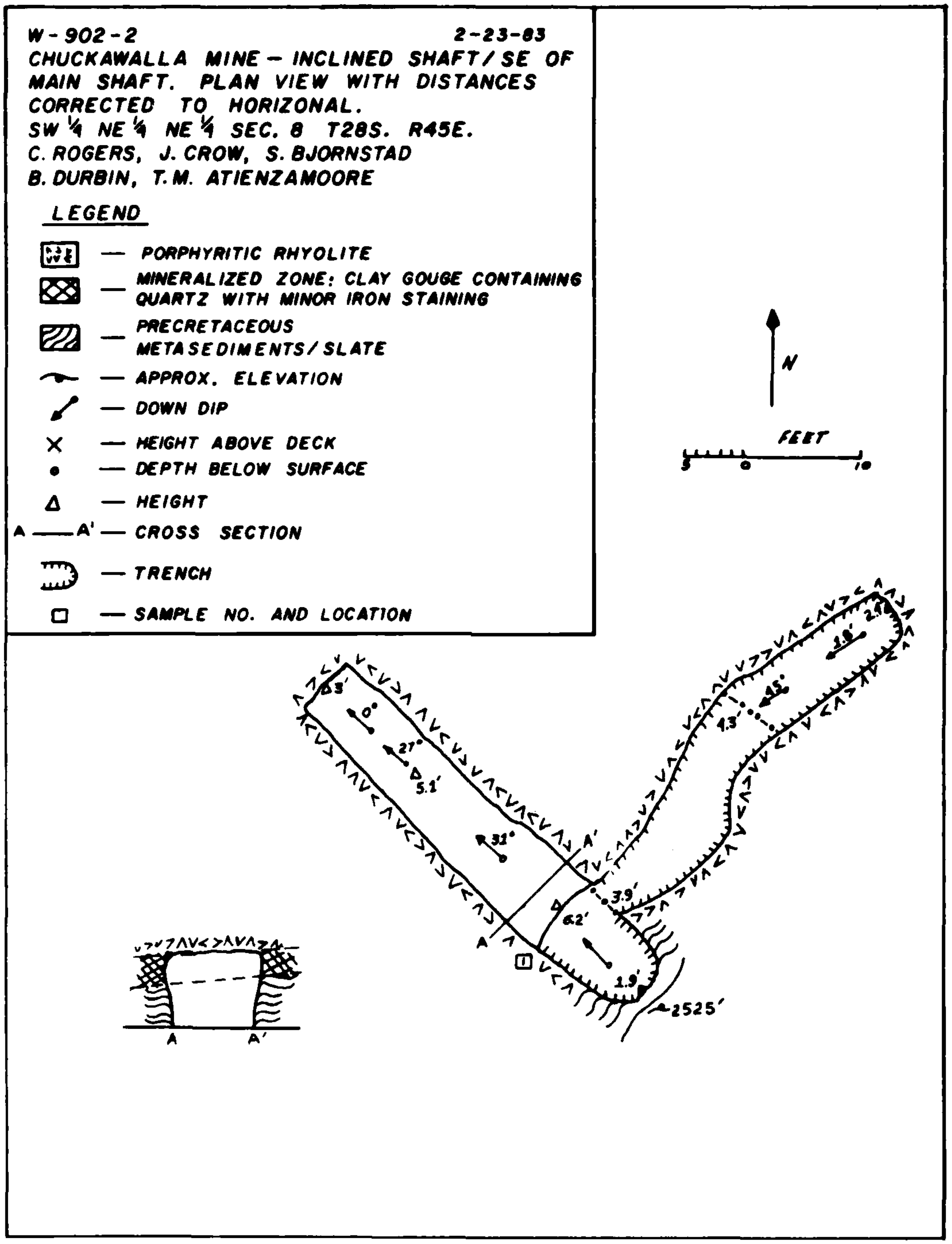

FIGURE 10. Chuckawalla Prospect Adit 2 Inclined Shaft Plan View (SE of Shaft) (W-902-2).

intense. (3) The vertical shaft known as W-902-3 is shown in plan view and cross section by Figure 11. It was driven through the slate and the rhyolitic ignimbrite to a brecciated zone, 16 to 18 inches wide, containing 30-40% quartz with clay and limonite stain. The precious metal assay results of these samples and the others in reference above are shown in Table 2. The results of all sampling of the Chuckawalla Complex for all metals assayed are shown in the Appendix Table B-1.

TABLE 2. Assay Results for the Chuckawalla Mine.

Sample	Gold, troy-oz/ton	Gold, $/ton[a]	Silver, troy-oz/ton	Silver, $/ton[b]	Total precious metal value, $/ton
W-902-1	0.001	0.50	0.017	0.26	0.76
W-902-2-1	0.014	7.00	0.070	1.05	8.05
W-902-3-1	0.011	5.50	...	...	5.50
W-902-3-2	<0.005	<2.50	0.377	5.66	8.16
W-902-3-3	0.005	2.50	0.261	3.92	6.42

[a] Gold at $500/troy-oz.

[b] Silver at $15/troy-oz.

The fire assay results clearly indicate that the Chuckawalla claims have exposed no commercial values for precious metals, nor does the geology suggest any specific exploration targets in this immediate vicinity that would warrant an expenditure of funds in the hope of making a discovery. The general geological setting, howev r, is the host to significant possible precious metal deposits to the west, and is revived as a part of the general discussion of this potential precious metals belt.

Unnamed Prospect (W-903)

This prospect is located in the Myrick mining district approximately 4.5 miles north from Lead Pipe Springs and 7.85 air miles south-southwest of Straw Peak VABM. It is shown as W-903 on Figure 3. The workings lie on unsurveyed land, but a projection of the adjacent public lands survey to the west places it in the NW1/4, NE1/4, SE1/4, Sec. 8, T28S, R45E, MDB&M.

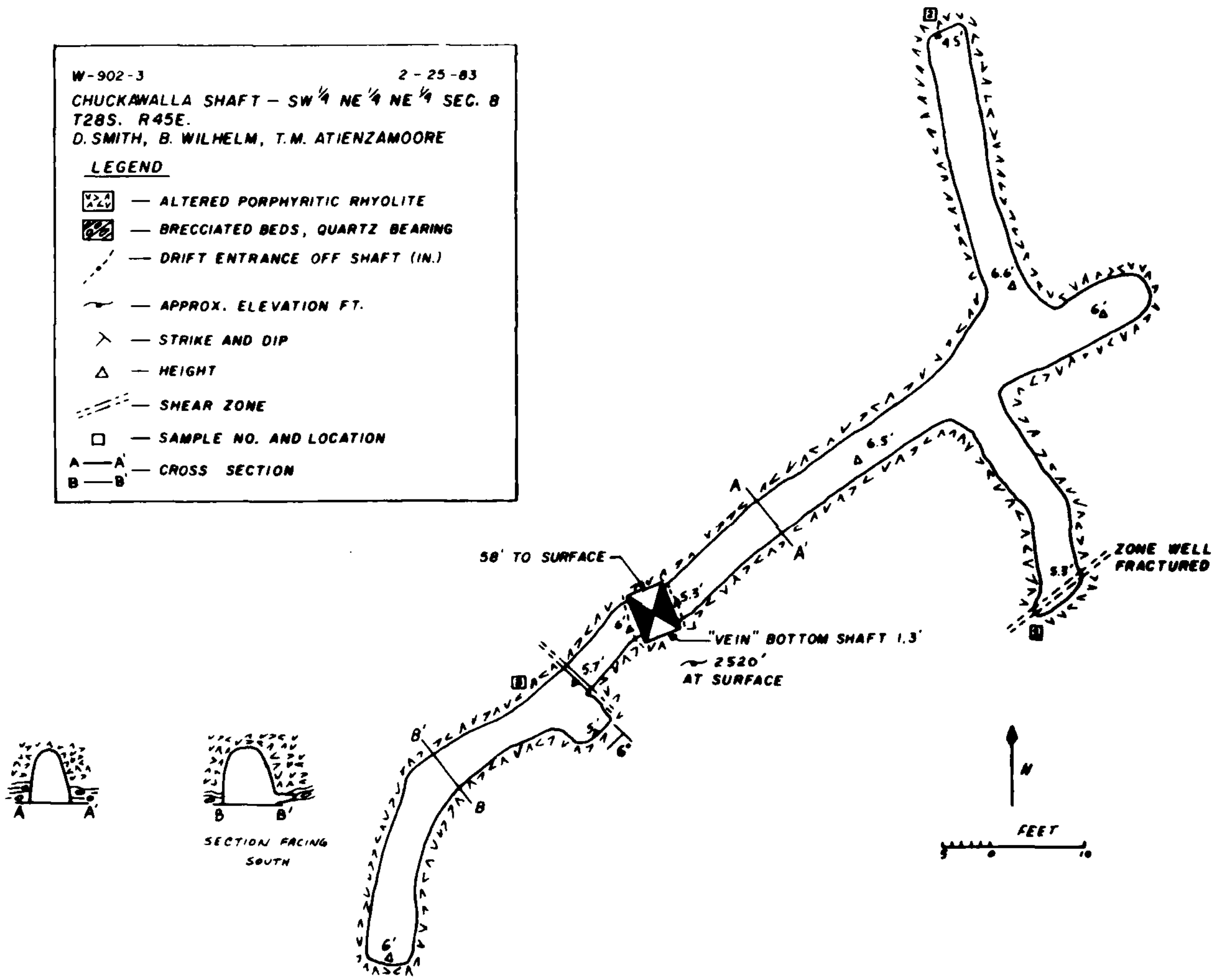

FIGURE 11. Chuckawalla Prospect 3 Shaft Plan View (W-902-3).

Exploration on the property has been along north-trending mafic dikes that cut pre-Cretaceous metasedimentary and Tertiary volcanic rocks. The prospect consists of five shallow pits and trenches, three of which lie along a mafic dike that cuts through black and red slates. The major excavation on the property is an inclined shaft shown in plan view on Figure 12. The shaft was driven in a narrow alteration zone 2 to 3 feet wide, striking N16W and dipping approximately 60 degrees southwest. There was a small sorted pile of material from the alteration zone on the dump. A sample was taken from this pile of material. This sample is known as W-903-1 and the assay results are shown in Table 3. Sample results of other metal values are shown in Appendix Table B-1.

TABLE 3. Assay Results for the Unnamed Prospect.

Sample	Gold, troy-oz/ton	Gold, $/ton[a]	Silver, troy-oz/ton	Silver, $/ton[b]	Total precious, metal values $/ton
W-903-1	0.052	26.00	0.020	0.30	26.30

[a]Gold at $500/troy-oz.

[b]Silver at $15/troy-oz.

The iron existing in veinlets as limonite was assayed at 25 weight percent and pyrolusite as a fracture coating was assayed at 0.82 weight percent manganese. Iron and manganese, although above background, are uneconomic at the levels reported.

The zone extends a maximum of 2000 feet along the strike. The mineralization, evidenced only by iron staining, decreases with depth even across the short exposures of the present shaft. There is no mineralization of commercial value exposed at this prospect, and there is no geological reason to expect any improvement.

Coin Consumer Group (W-904)

The Coin Consumer Group is located on surveyed land in SW1/4, NE1/4, NE1/4, Sec. 9, T28S, R45E, MDB&M (Figure 3). The host rock for this deposit is Tertiary rhyolite. Mining operations took place to explore the extent of mineralization in quartz and limonite-bearing shear zones within the rhyolite and near the rhyolite contact with dark-colored pre-Cretaceous metasedimentary rocks. The main shear zone strikes generally north-scuth with steep easterly dips and ranges from 1-1/2 to 17 feet wide. The property was developed by a series of shafts with interconnecting levels and sublevels. Figure 13 is a plan view of shafts at the surface. Workings total 482 feet of shaft and raise, and over 872 feet of drift with one small stope area of approximately 4000 cubic feet. The workings are shown in Figures 14 through 26.

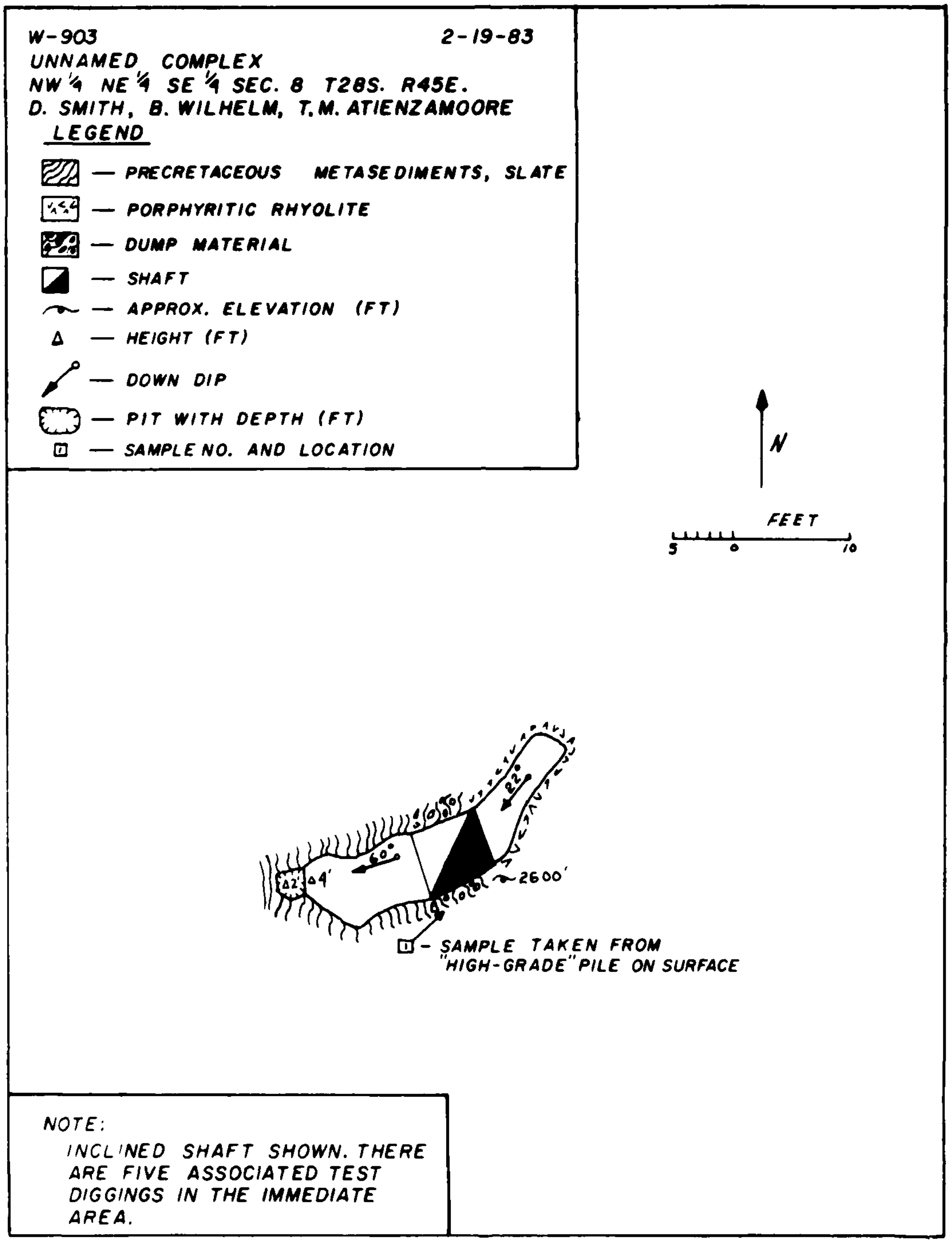

FIGURE 12. Unnamed Prospect Plan View (W-903).

Eleven samples were taken throughout the mine and included chip samples from mineralized shear zone rhyolite, fairly fresh rhyolite, metasediments, and a muckpile grab sample from the material within the stope. The assay results are summarized in Appendix Table B-1. Only one of the samples showed precious metal values worthy of note. The sample is labeled W-904-5 and its location is noted in Figure 15. Precious metal assay results are presented in Table 4.

TABLE 4. Assay Results for the Coin Consumer Group.

Sample	Gold, troy-oz/ton	Gold, \$/ton[a]	Silver, troy-oz/ton	Silver, \$/ton[a]	Total precious metal value, \$/ton
W-904-5	0.281	140.50	0.180	2.70	143.20

[a]Gold at \$500/troy-oz.

[b]Silver at \$15/troy-oz.

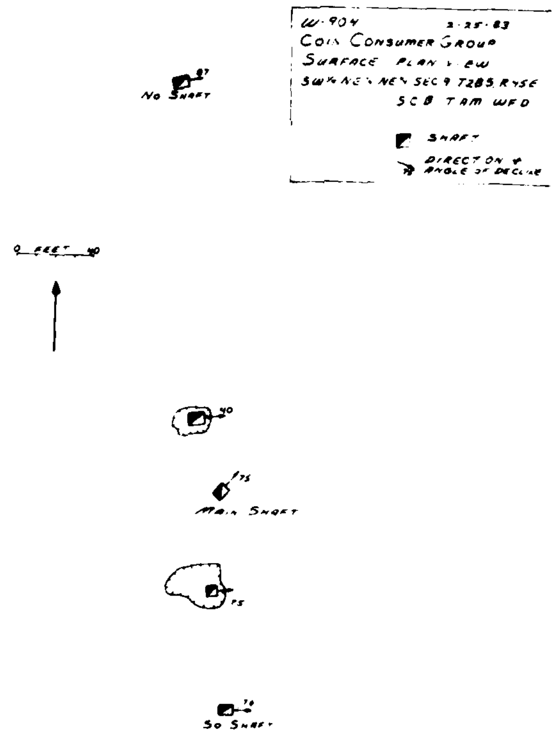

FIGURE 13. Coin Consumer Group Surface Plan View (W-904).

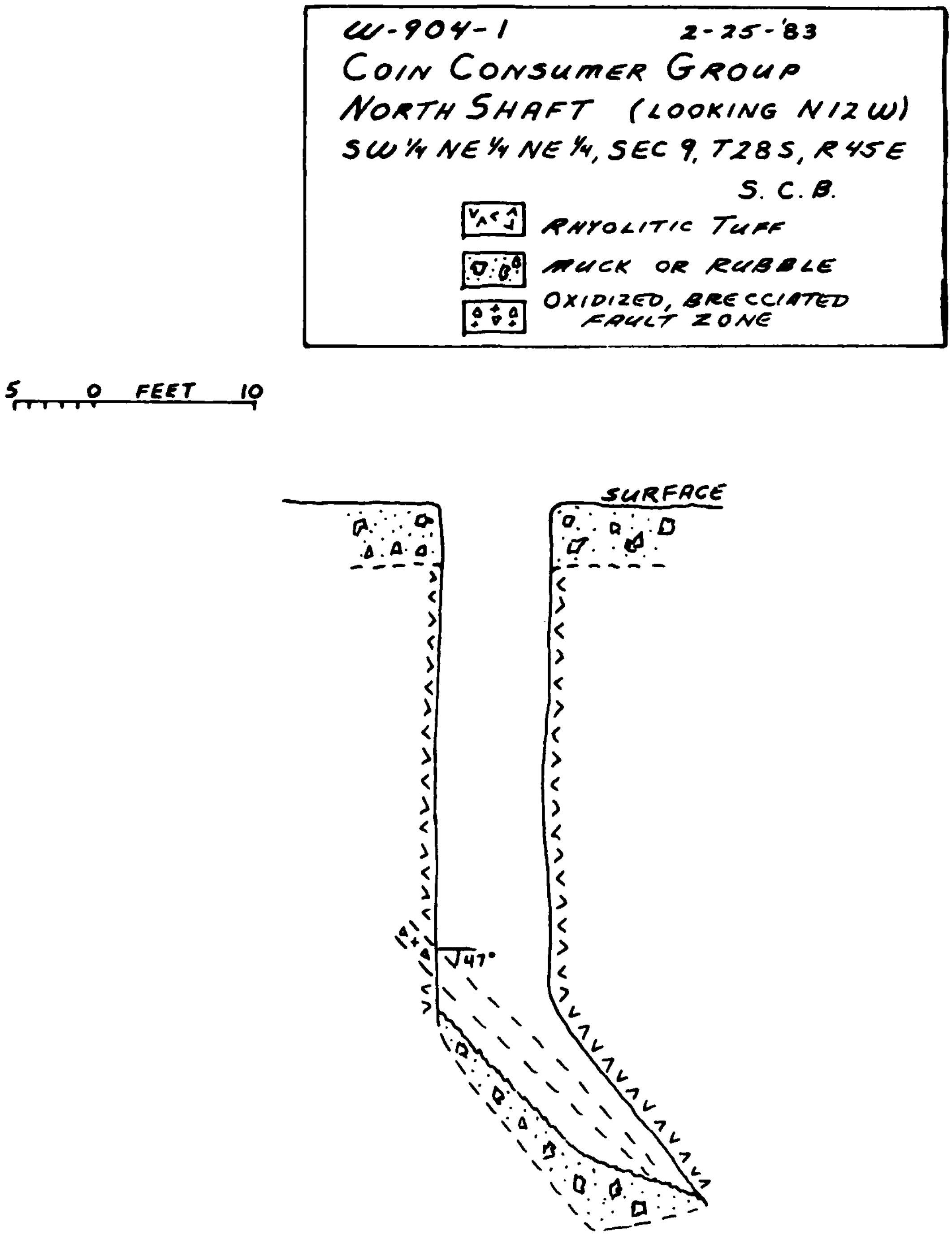

FIGURE 14. Coin Consumer Group North Shaft Vertical Cross Section (W-904-1).

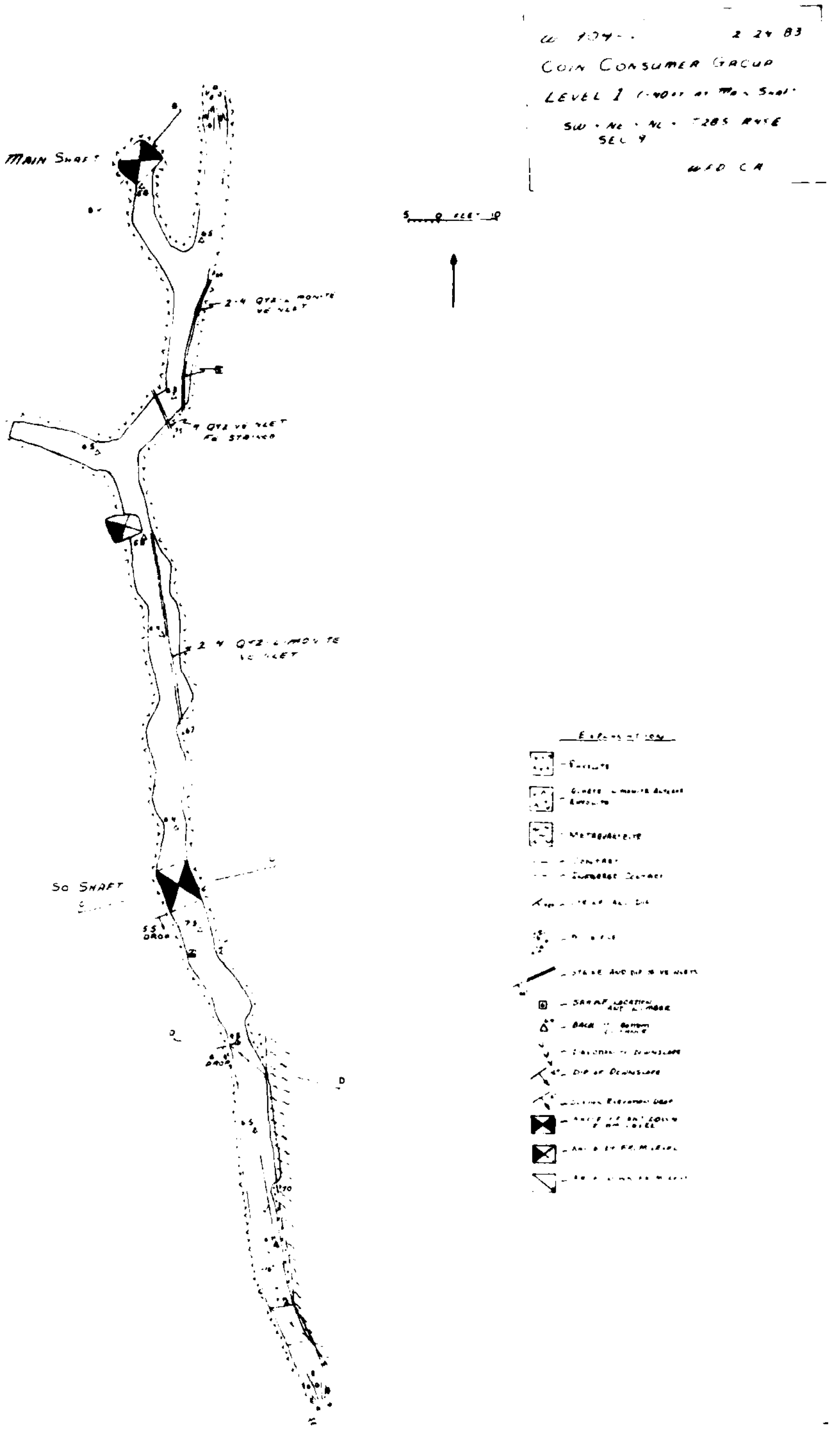

FIGURE 15. Coin Consumer Group Level 1 (Main Shaft) Plan View (W-904-2).

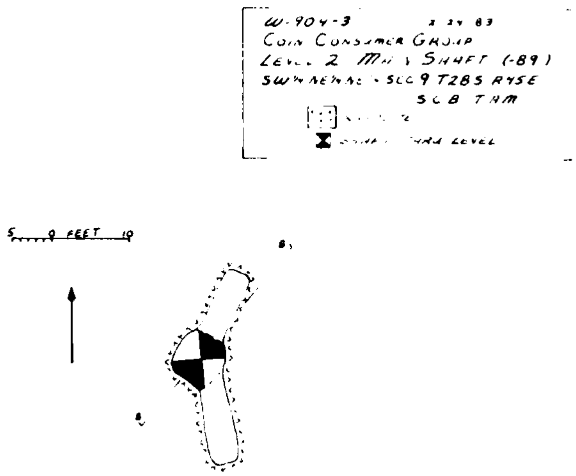

FIGURE 16. Coin Consumer Group Level 2 (Main Shaft) Plan View (W-904-3).

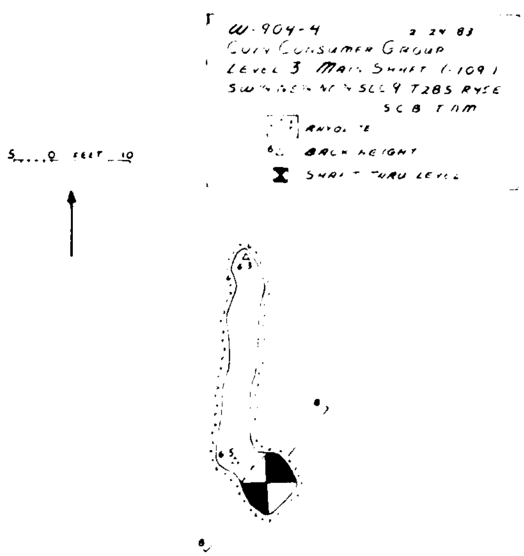

FIGURE 17. Coin Consumer Group Level 3 (Main Shaft) Plan View (W-904-4).

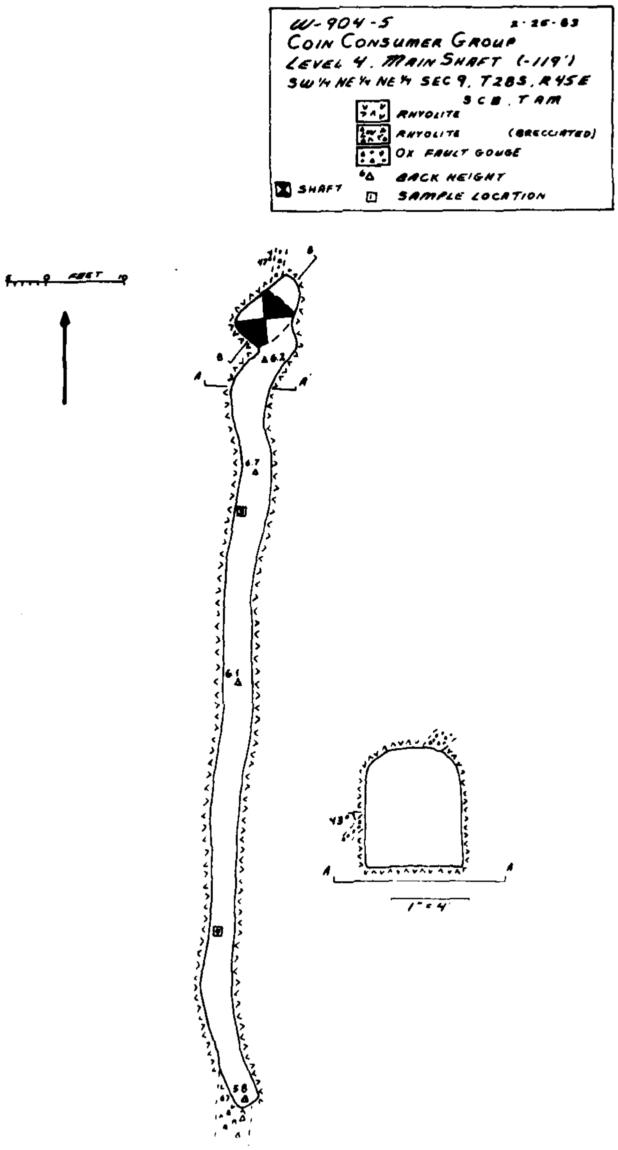

FIGURE 18. Coin Consumer Group, Level 4 (Main Shaft) Plan View and Cross Section A-A' (W-904-5).

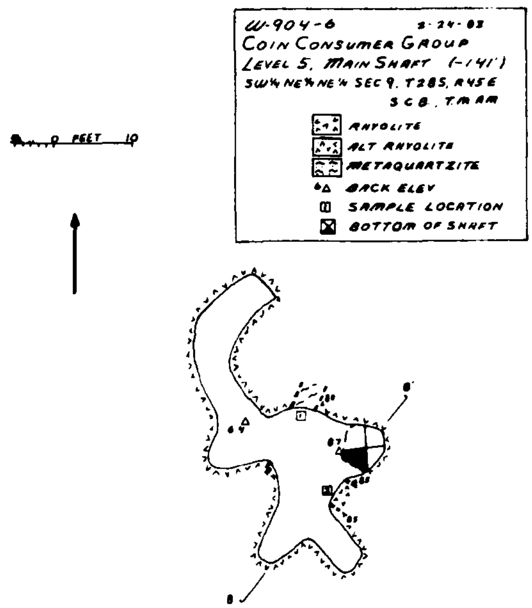

FIGURE 19. Coin Consumer Group Level 5 (Main Shaft) Plan View (W-904-6).

The sample was taken from a 2-inch-wide fracture that contained milky quartz with abundant limonite. This must be considered uneconomic because driving a drift as small as 3 feet wide would result in a dilution factor of 18. Dilution would yield an equivalent precious metal value of $7.96/ton for the overall material mined even if resuing methods prevented dilution of the sorted mineral material produced.

A small amount of stoping was done on Level 4 South, as shown in Figure 25. Approximately 125 tons of broken rock were left in the stoping area. A muckpile sample labeled W-904-7 was taken and the assay results proved nil for precious metal values, explaining why the stoping effort was abandoned.

One building and the ruins of former cyanide leach tanks are all that remain of the mine plant on the property.

Frank Jaynes, Pearl Perkins, Chet R. Perkins, and F. I. Jaynes claimed the property in 1935. It was apparently worked until 1941. No claims after 1935 are on record, but numerous magazines and newspapers found in the mine are dated to 1941.

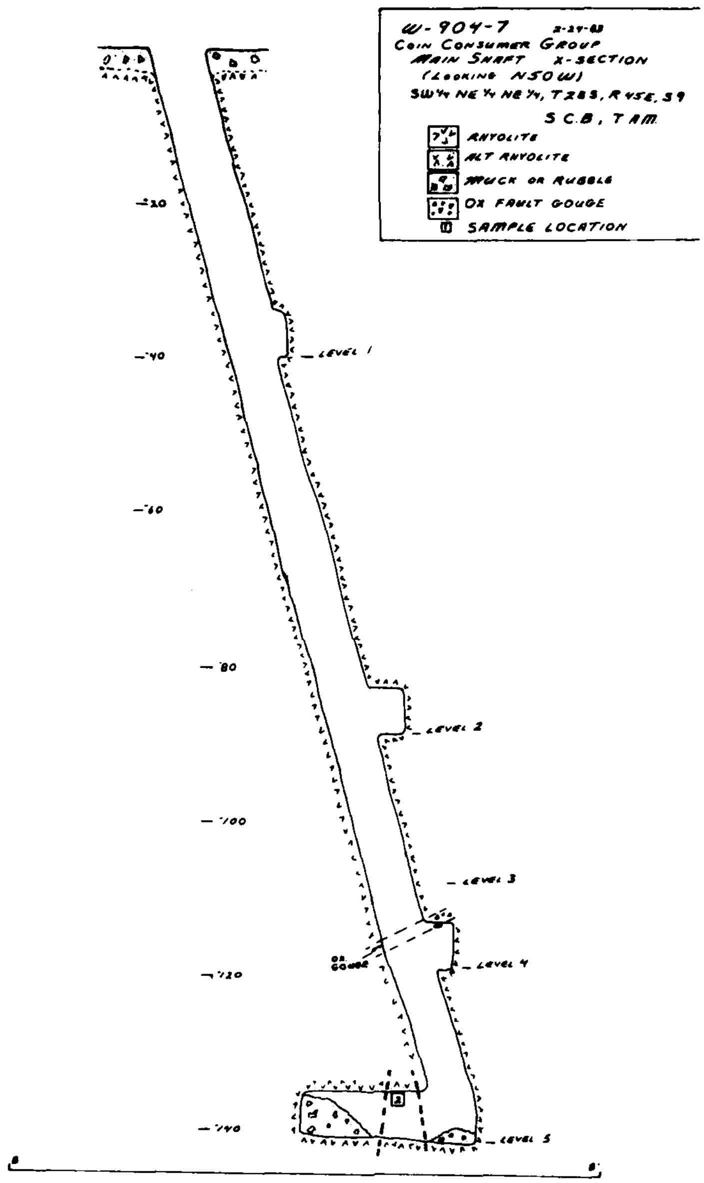

FIGURE 20. Coin Consumer Group Main Shaft Vertical Cross Section B-B' (W-904-7).

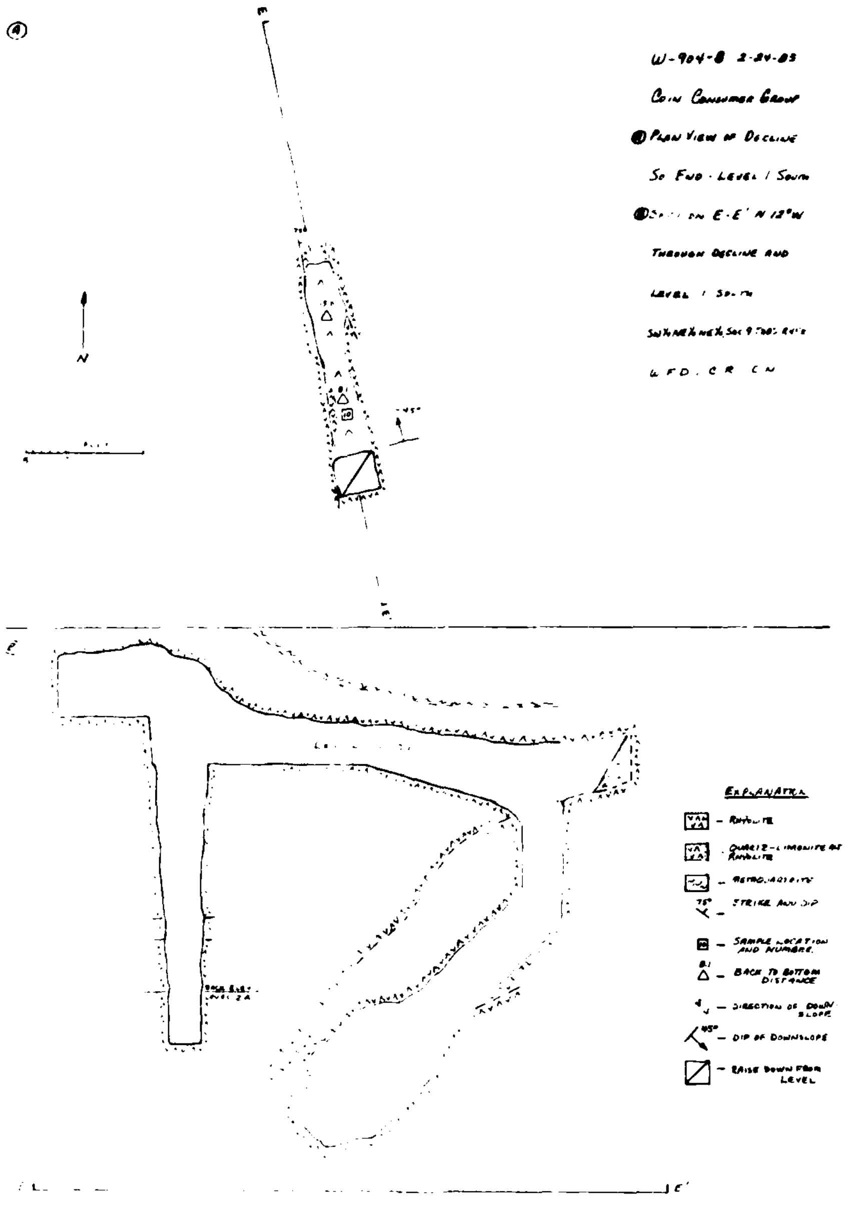

FIGURE 21. Coin Consumer Group Decline, South End Level 1, Plan View and Cross Section E-E' (W-904-8).

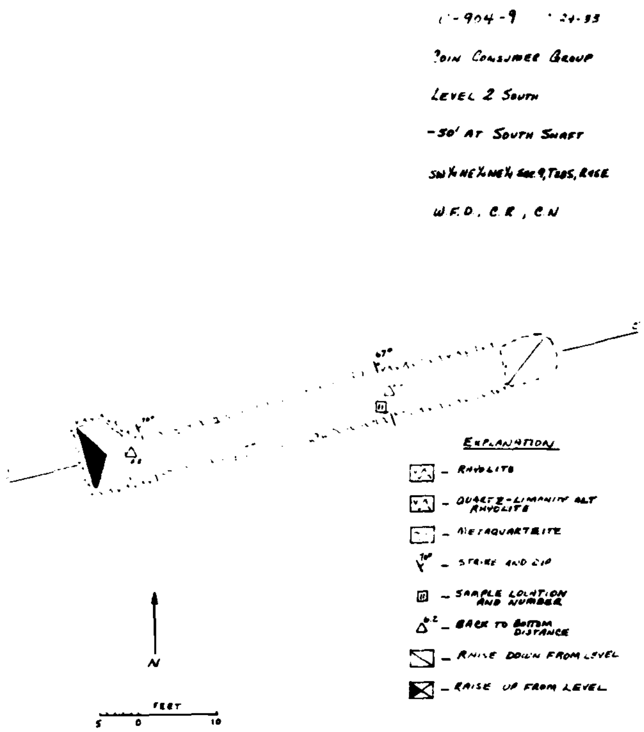

FIGURE 22. Coin Consumer Group Level 2 South (W-904-9).

The precious metal values of mineralization exposed at the Coin Consumer Group are not economic. Although this prospect is a part of a belt of gold deposition in metasediments along the south edge of the Garlock Fault that extends for several miles. It is not until 13 miles further west that mineralization becomes more pervasive and a clear-cut opportunity exist for exploration activities for precious metals.

Unnamed Prospect (W-905)

This site is approximately 4.6 miles north from Lead Pipe Springs and 7.8 air miles south-southeast of Straw Peak VABM. It lies on the south side of Pilot Knob Valley in the Myrick mining district. The prospect is shown as W-905 on Figure 3. It lies on unsurveyed land, but a projection of the adjacent public lands survey to the west places it in the NE1/4, NW1/4, SE1/4, Sec. 8., T28S, R45E, MDB&M.

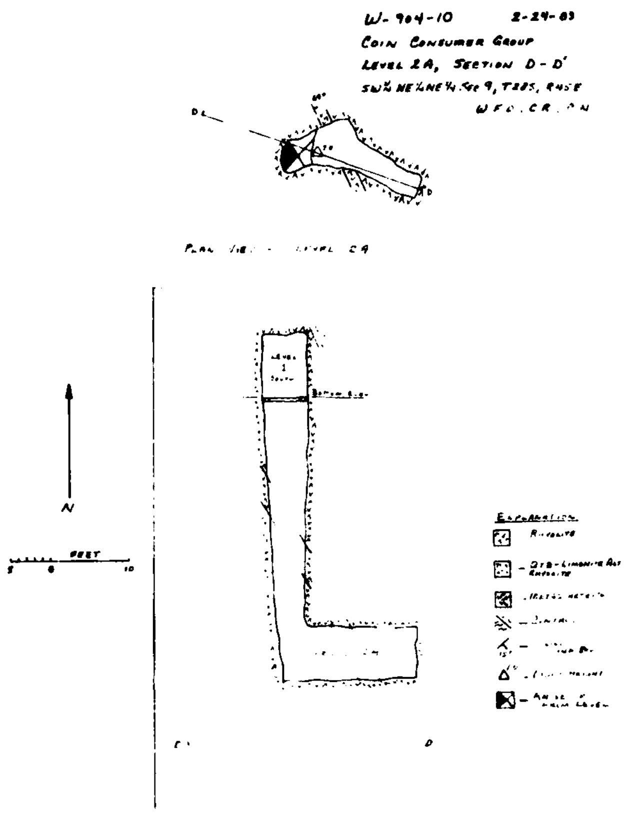

FIGURE 23. Coin Consumer Group Level 2A, Plan View and Cross Section D-D' (W-904-10).

The property was explored by two small adits, a trench, and a pit along an alteration zone. Figure 27 shows the workings in plan view and their positions with respect to each other. The largest of the workings, a 50-foot-long adit, shows decreasing alteration from the portal to the face in both the wall rock, which is porphyritic rhyolite, and the vein material, rhodochrosite to rhodonite. The vein is nearly horizontal and strikes N7W with an average width of 4 inches. Correspondingly the mineralogy changes from rhodochrosite with microflakes of cerrusite at the portal to rhodonite approximately 17 feet into the drift and continuing to the working face. A chip sample, labeled W-905-1 was taken along the vein from the north wall of the drift. Assay results are shown in Table 5 and complete assay results for sample W-905-1 are listed in Appendix Table B-1.

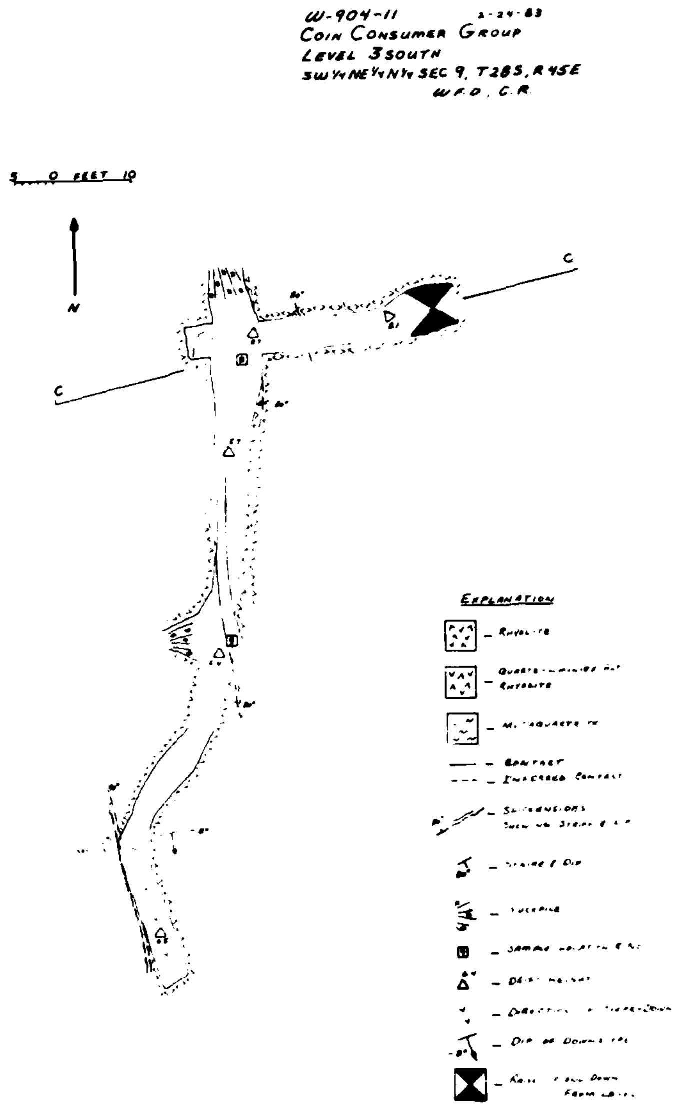

FIGURE 24. Coin Consumer Group Level 3 South Plan View (W-904-11).

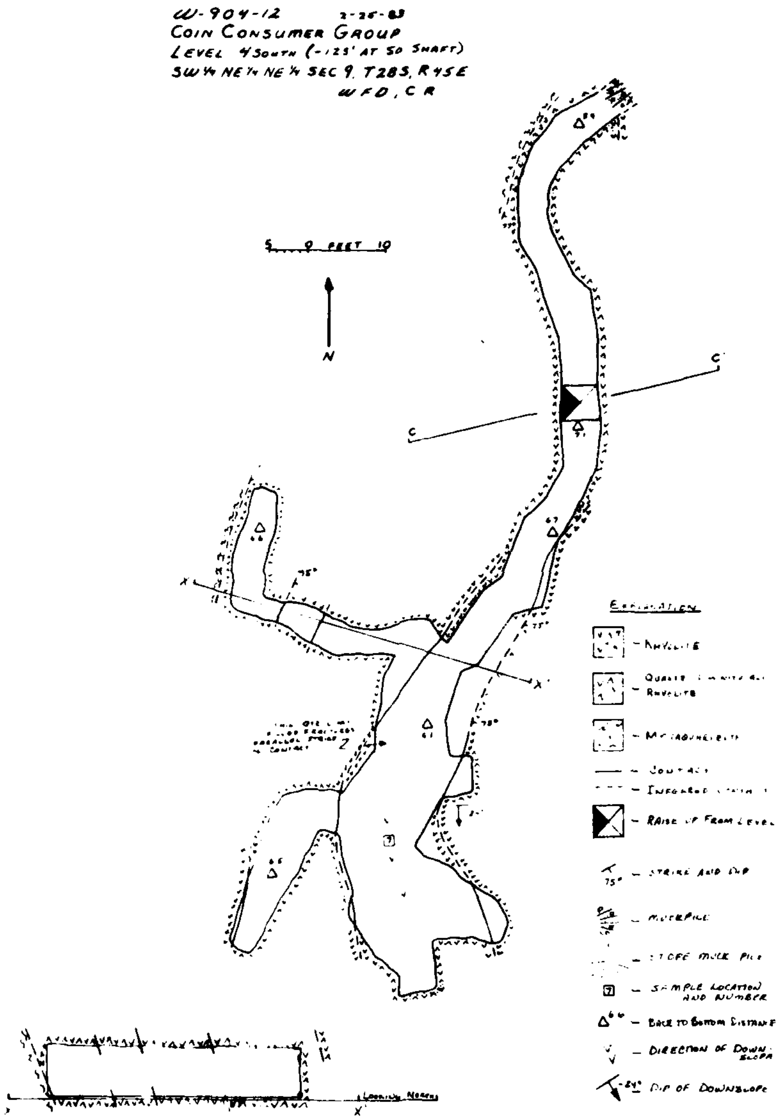

FIGURE 25. Coin Consumer Group Level 4 South Plan View (W-904-12).

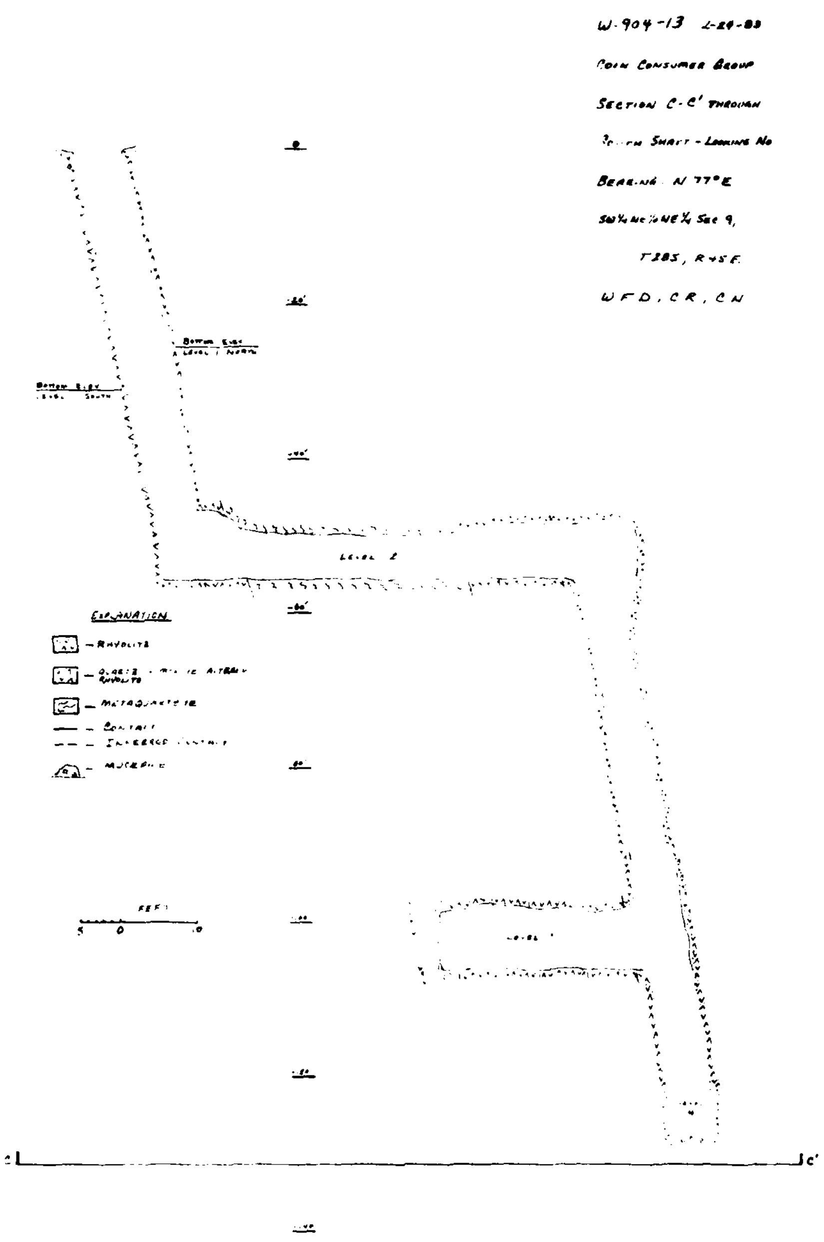

FIGURE 26. Coin Consumer Group South Shaft Cross Section C-C' (W-904-13).

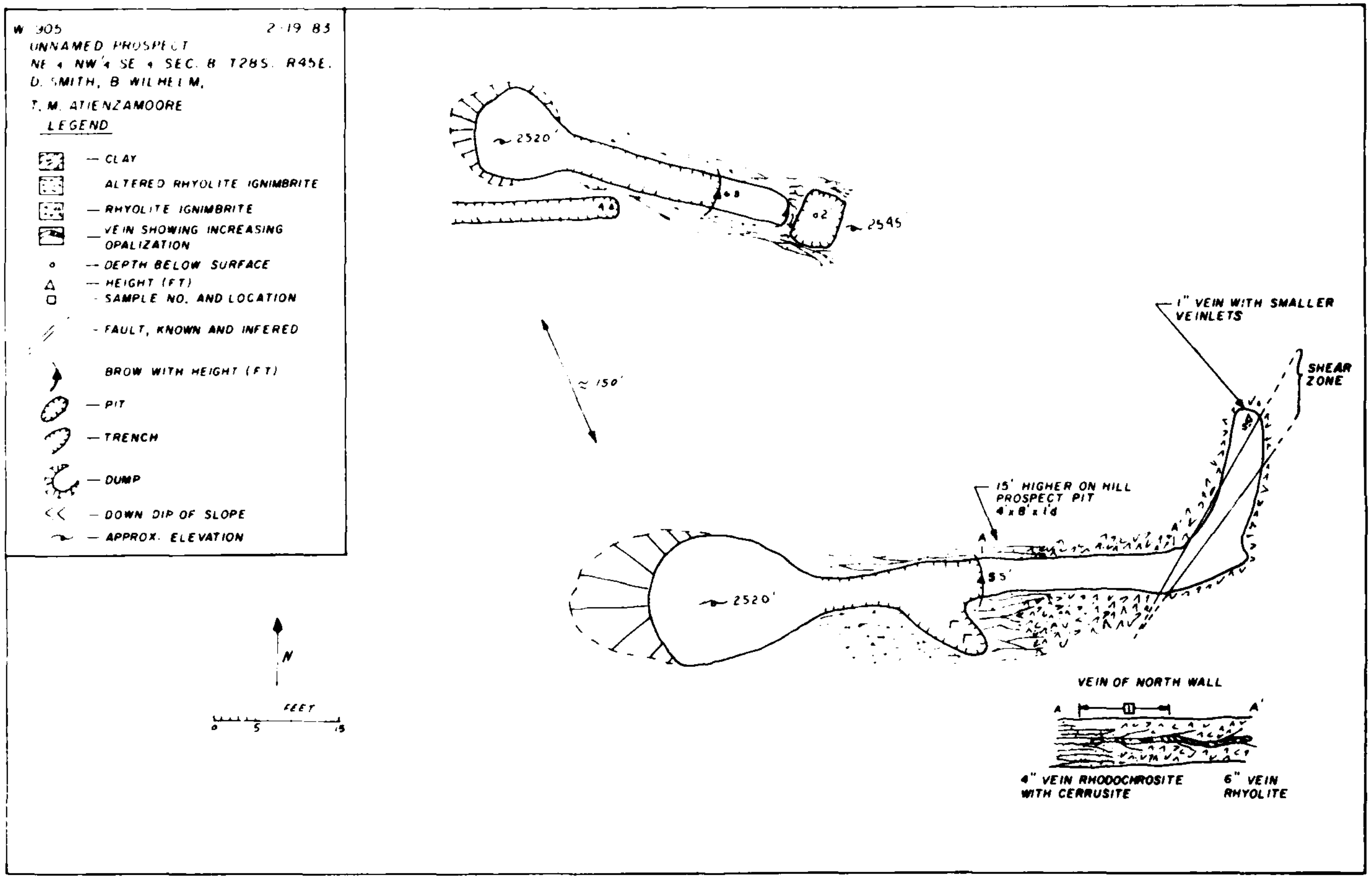

FIGURE 27. Unnamed Prospect Plan View of Dumps, Test Pit and Adit; Cross Section of Trench; Cross Section A-A' (W-905).

TABLE 5. Assay Results for the Unnamed Prospect.

Gold, troy-oz/ton	Silver, troy-oz/ton	Lead, wt.%	Zinc, wt.%	Manganese, wt.%	Iron, wt.%
0.005	0.012	Not detectable	0.01	1.45	5.00

The rhodonite found at this site is of insufficient vein width to make commercial development for a "cut and polish" stone economically feasible. In addition, there are no precious metal values suggesting commercial mineralization.

Unnamed Prospect (W-906)

This prospect pit is found within the Myrick mining district. It is located on a hill along the south side of Pilot Knob Valley, just south and east of the southern ash bed quarry (W-901) and approximately 7.2 air miles south-southeast of Straw Peak VABM. The site is shown as W-906 on Figure 3. It lies on unsurveyed land, but a projection of the adjacent public lands survey to the west places it in the SE1/4, SW1/4, NE1/4, Sec. 5, T28S, R45E, MDB&M.

The property was developed by a shallow trench 16 feet long in pre-Cretaceous metasediments that are primarily red and black slates. The prospect terminates on the south end in a pit that lies along the contact of the metasediments and a northwest-striking mafic dike. Figure 28 is a plan view of this site.

There was no evidence of silification, quartz vein formation, or any other type of mineralization. The assumption was made that the exploratory effort was seeking precious metals but no mineralization was exposed in either outcrop or in the trenching.

Unnamed Shaft (W-907)

The site, located in the Myrick mining district, is approximately 6.8 air miles south-southwest of Straw Peak VABM. It is shown as W-907 on Figure 3. The shaft is on unsurveyed land, but a projection of the adjacent public lands survey to the west places it in NW1/4, NE1/4, SW1/4, Sec. 5, T28S, R45E, MDB&M.

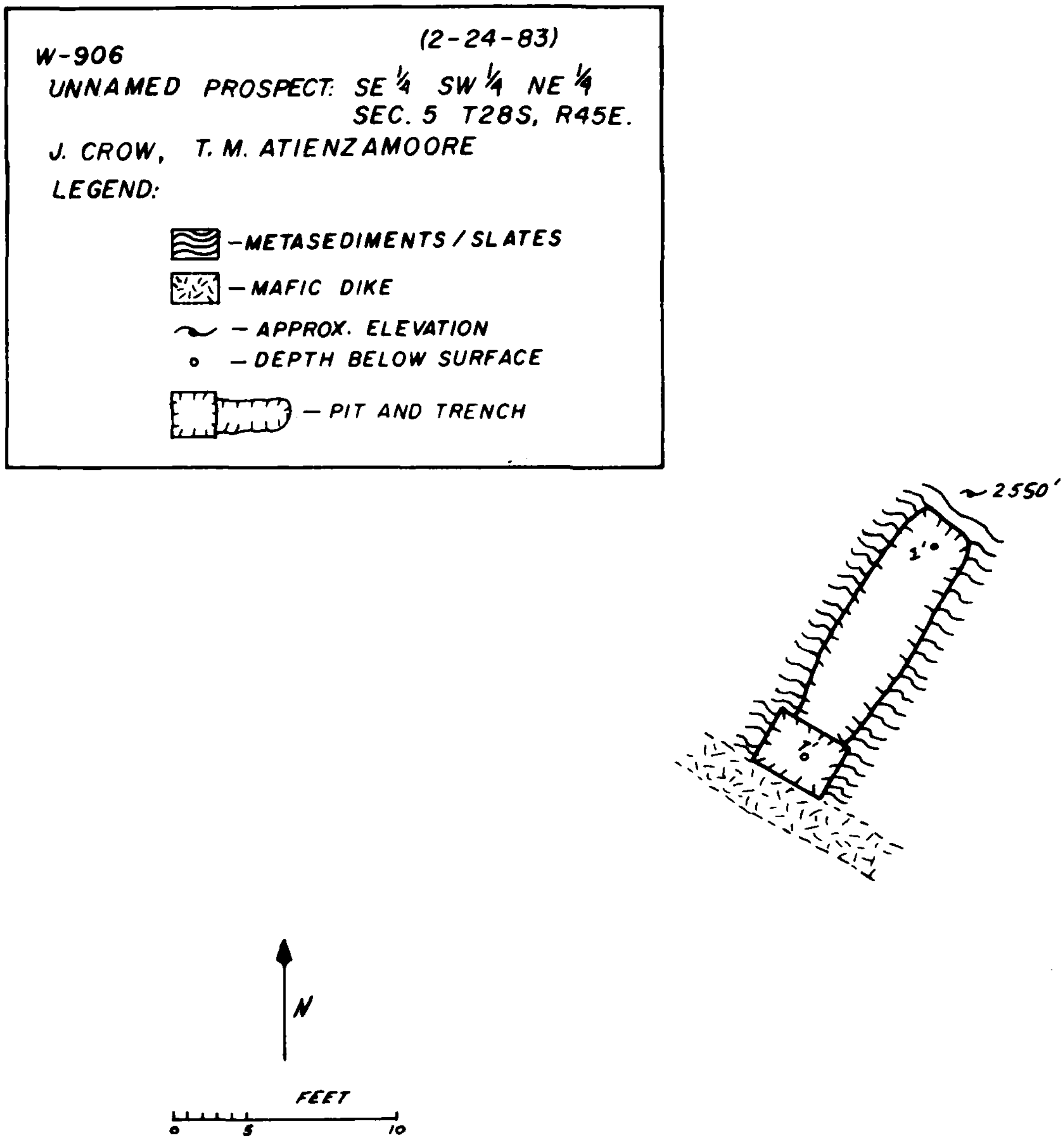

FIGURE 28. Unnamed Prospect Plan View (W-906).

The property was explored by a shaft that was 4 by 5 feet at the surface and collapsed just below the surface. The size of the dump indicates a total depth of 10 feet. The shaft was sunk in pre-Cretaceous metasedimentary rock, primarily slates. There was no evidence of mineralization in the shaft or in the dump material, and the assumption is that the prospect was seeking precious metals.

Unnamed Shaft (W-1501)

This unnamed shaft is located in NW1/4, SE1/4, SE1/4, Sec. 28, T29S, R43E, MDB&M as shown in Figure 3. The host rock is strongly altered biotite quartz diorite containing scattered 1/2-inch quartz stringers with limonite fracture-fillings. This prospect was developed by a 28-foot-deep shaft dipping from 64 degrees down to 34 degrees. The plan view and cross section of the shaft are shown in Figure 29. These exploratory workings are considered to have been driven in search of precious metals; however, a sample of the quartz-limonite stringer material taken from the shaft back indicates only very low values present. The sample is shown as W-1501-1-1 in Appendix Table B-1.

Unnamed Adit (W-1502)

This unnamed adit is situated in the SW1/4, NE1/4, SW1/4, Sec. 24, T29S, R43E MDB&M as shown on Figure 3. A 6.5-foot shear zone that strikes N18W and dips 70 degrees westerly was the target for exploration, presumably in the search for precious metals. The shear zone is developed along the contact of mesozoic biotite-rich quartz diorite and the foothill side of a mesozoic aplite dike of unknown thickness. The shear is composed mainly of crushed, altered biotite quartz diorite with scattered quartz blebs to 1-inch diameter, 1/2- to 1-inch white quartz stringers paralleling the strike of the zone, and abundant white clay filling interstices throughout the shear zone. No limonite or other mineralization was visible. The shear zone was explored by a 45-foot drift as shown by Figure 30. A chip sample, labeled W-1502-1, was taken across the face of the drift, normal to the shear zone, and included all of the zone material. Appendix Table B-1 shows the complete assay results and indicates no commercial value for precious metals or other commodities.

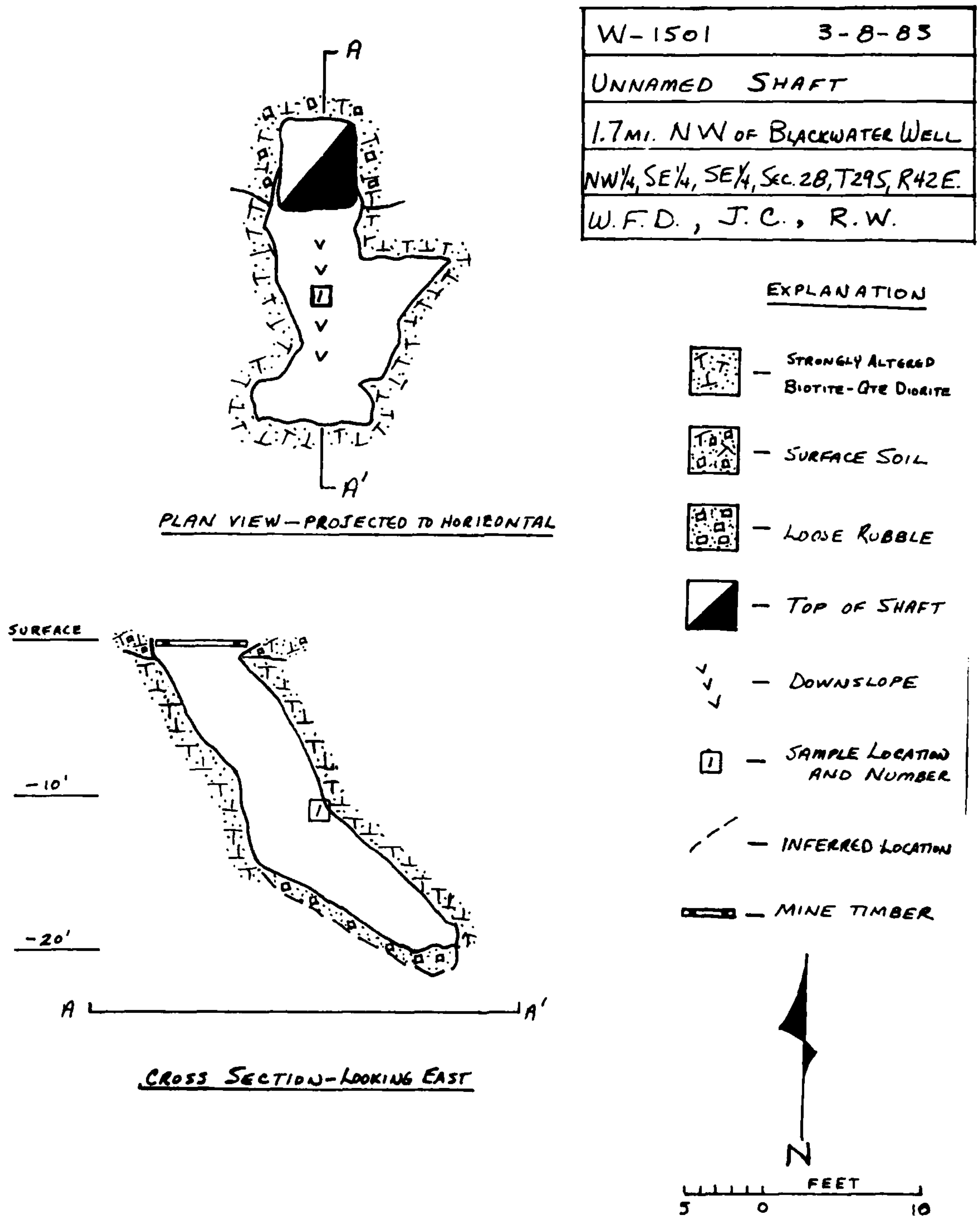

FIGURE 29. Unnamed Shaft Plan View and Cross Section A-A' (W-1501).

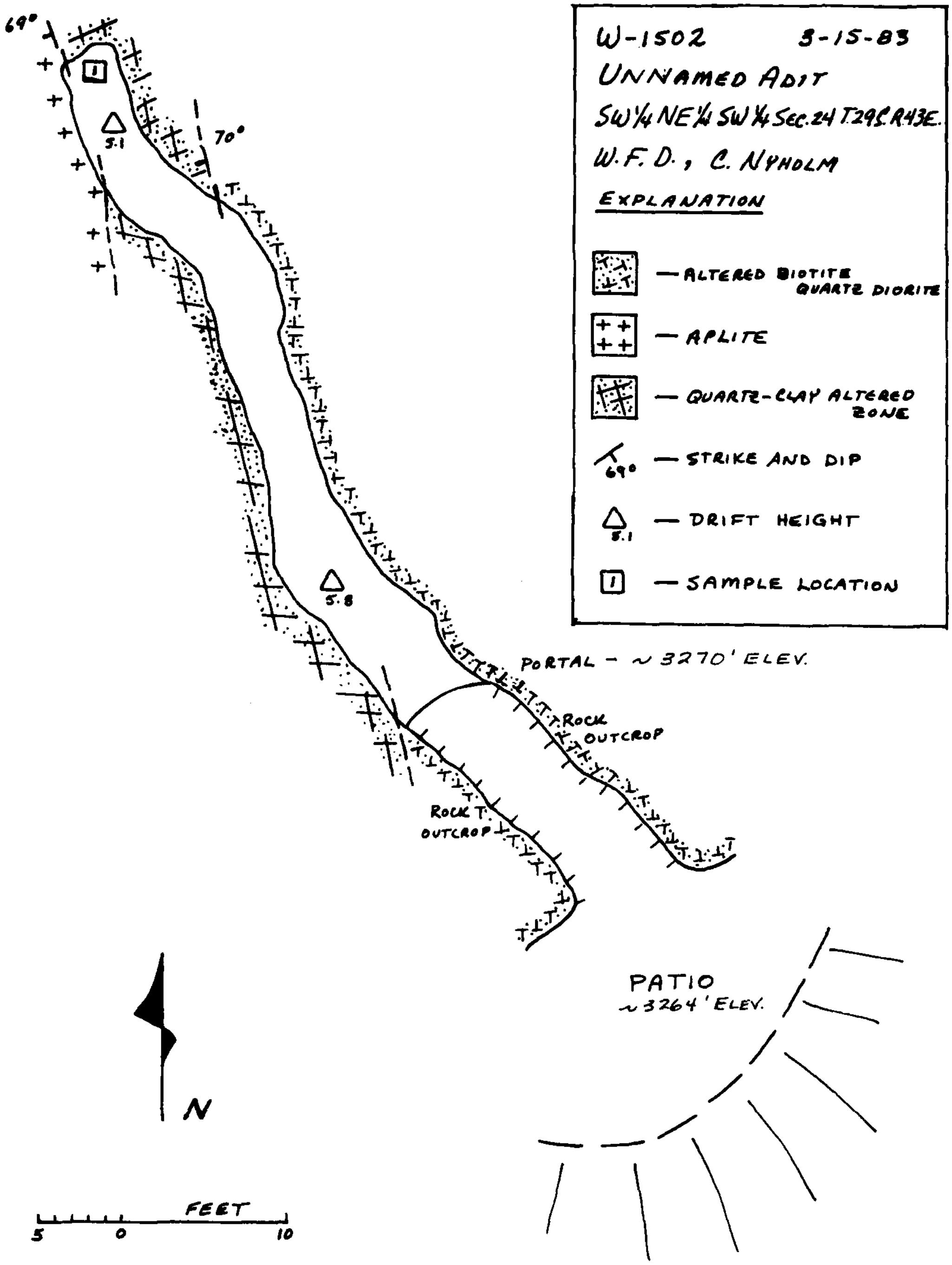

FIGURE 30. Unnamed Adit Plan View (W-1502).

Unnamed Adit (W-1503)

The adit is situated in SE1/4, NW1/4, SE1/4, Sec. 24, T29S, R43E, MDB&M and the site location is shown in Figure 3. A 15-foot-long drift was driven through nonmineralized slope wash into biotite quartz diorite as shown in Figure 31. There is no mineralization present as surface float at this location and the exploratory workings encountered no discernable mineralization. The assumption is made that precious metals were being sought.

Malibu (Denver) Prospect (W-1303)

The NOTS (now NWC) legal archives only briefly mentioned this property as the "Denver Mine." The claim notice found near the property indicates that it is the Malibu mine discovered by F. M. Myrick on 30 May 1921.

The Malibu (Denver) prospect is located within the Myrick mining district near Moonshine Spring, approximately 1.5 air miles west-southwest of Blue Chalcedony Spring and 8.5 air miles northeast of Pilot Knob VABM. The prospect is shown as W-1303 on Figure 3. The prospect lies on unsurveyed land, but a projection of the adjacent public lands survey to the west and south places it in the SE1/4, NE1/4, NW1/4, and the NE1/4, NE1/4, SW1/4, Sec. 26 T28S, R45E, MDB&M.

The property was explored at two separate sites along a small northwest-trending hill. The first site is a 10-foot-long trench or the start of an adit on the east flank of the hill. Quartz float was found at this location but was untraceable to an outcrop. The second site is a shaft with a trench and is located on the south edge of the hill as shown in Figure 32, which shows the plan view of these workings. Two additional test diggings lie along the hillside between the two major sites.

The sites lie in an exposed portion of complex pre-Cretaceous metasedimentary rocks, as shown in Figure 2. These rocks are primarily red and black slates showing remnant bedding, striking N34W and dipping an average of 34 degrees southwest, with discontinuous quartz veinlets averaging 1/8 inch wide that contain minor iron and manganese staining along fractures. No samples were taken at this site. The workings exposed no commercial mineralization and the assumption is made that precious metals were being sought.

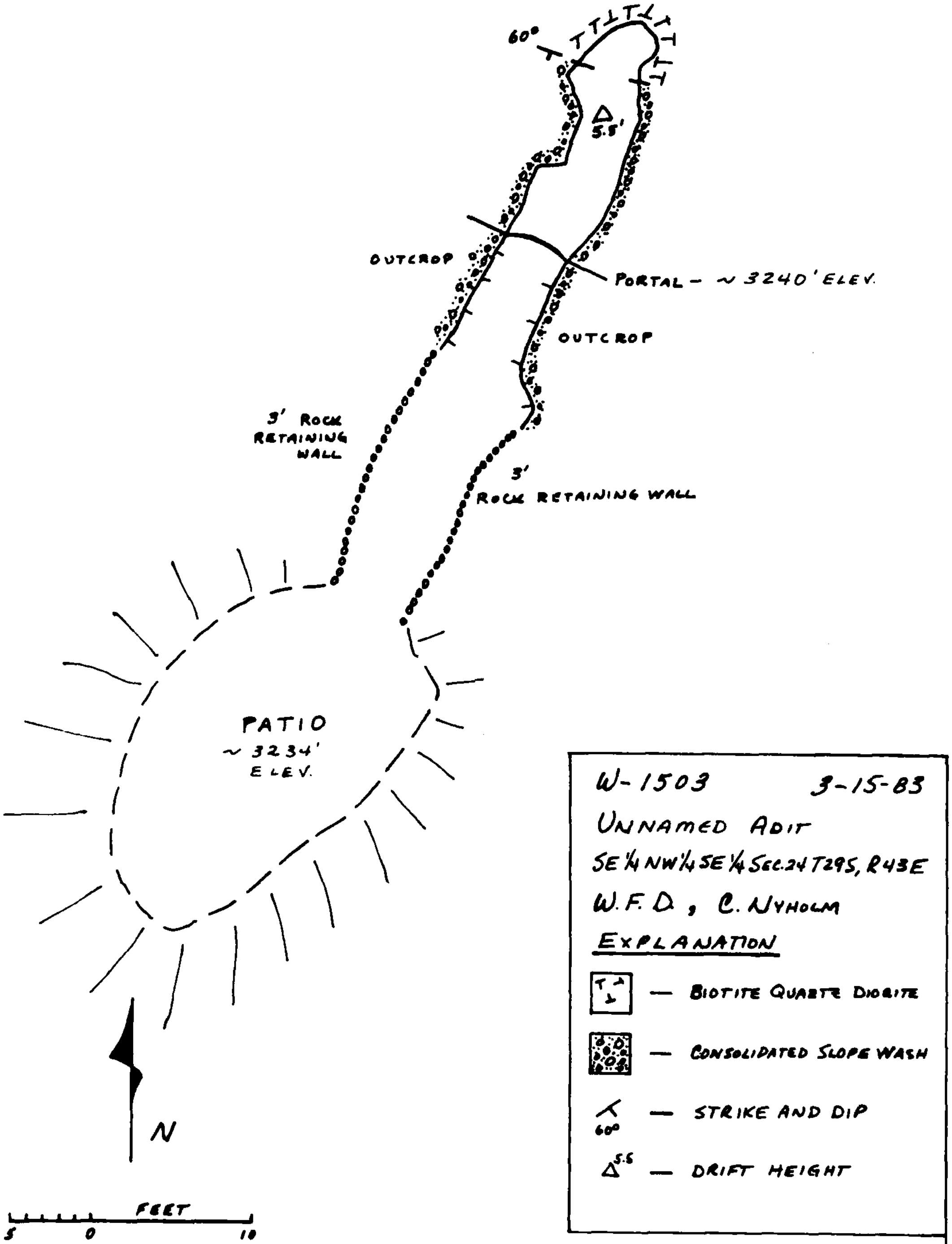

FIGURE 31. Unnamed Adit Plan View (W-1503).

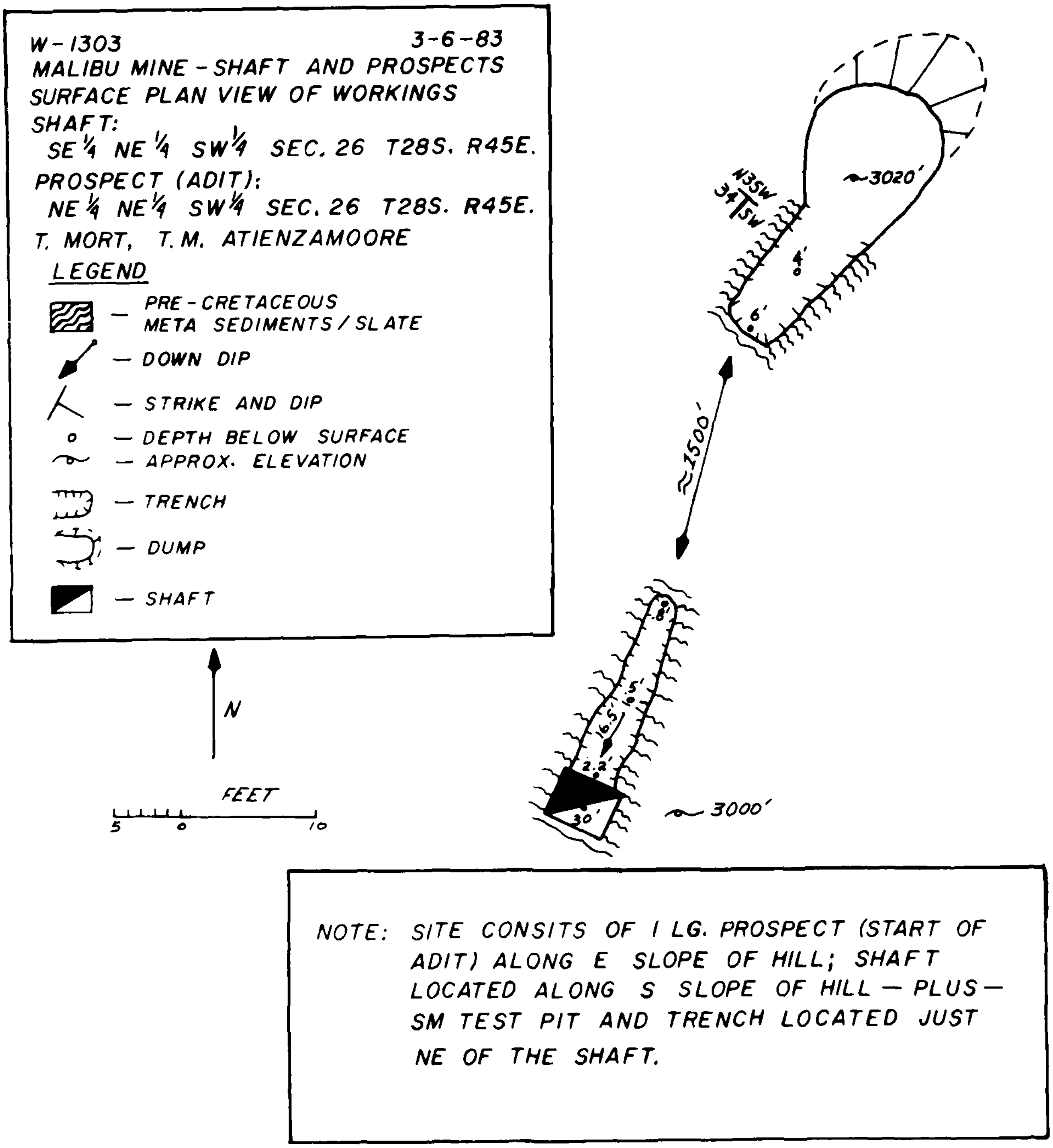

FIGURE 32. Malibu (Denver) Prospect Plan View (W-1303).

IRON OCCURRENCES

Unnamed Prospect (W-501)

This prospect is situated near the southern edge of the Slate Ridge approximately 3.5 air miles southeast of Straw Peak VABM and is shown on Figure 3. It lies on unsurveyed land, but a projection of the adjacent public lands survey to the northwest places it in NW1/4, SE1/4, SE1/4, Sec. 9, T27S, R45E, MDB&M.

Two outcrops of severely altered pre-Cenezoic metamorphic rock have been exposed at this site by a series of at least two flash flooding periods that have stripped away a thin capping of Quaternary alluvium and formed a wash that trends northwest-southeast. The outcrop located on the southwest side of the wash is exposed for a very limited extent and contains limonitized metamorphic rock of uncertain composition with abundant hematite as disseminated grains and as fracture-fillings. The outcrop located on the northeast side of the wash is a possible block of material that was broken from the southwestern outcrop and emplaced during one of the early flashflooding periods. The exposed outcrop contains disseminated hematite grains and fracture-fillings and hematite is relatively concentrated in a 4-inch-wide fault zone that strikes N72W and dips 44 degrees northeasterly.

The only evidence of exploration in the area was limited to the northeastern outcrop where a 15-foot-long shallow bench was cut at the edge of the wash. Approximately 180 cubic feet of materials was removed.

One sample, labeled W-501-1, was taken from high-grade material within the fault zone in the northeastern outcrop. A complete list of assay results for the sample is given in Appendix Table B-1. Specific analyses for iron and gold are presented in Table 6.

TABLE 6. Assay Results for the Unnamed Prospect (W-501).

Sample	Iron, wt.%	Gold, troy-oz/ton	Gold, $/ton[a]
W-501-1	17.69	<0.005	2.50

[a]Gold at $500/troy-oz.

The scattered small iron deposits in this desert region have been tapped on a limited basis for hematite, which has been used as flux material in local precious metal smelting operations.

There is no commercial tonnage or grade for iron or other commodities at this location.

URANIUM OCCURRENCES

Uranium Prospect Pits (W-02)

The NOTS (now NWC) legal archives make brief reference to uranium deposits at other locations on the southern ranges, but no specific location was identified.

Numerous prospect pits are located approximately 4.8 miles southeast of the Spangler crossing on the Trona Railroad adjacent to the NWC Randsburg Wash Test Range access road. They are unsurveyed lands, but a projection of the adjacent public lands survey to the west places them in Sec. 5, T28S, R43E, MDB&M. The location of this property is shown in Figure 4 as W-02.

The prospects were located as a result of an AEC aerial survey that was released early in 1955. The pits were cut by bulldozers and were put in to comply with the claim location requirements of that time: viz claimants were required to move a certain volume of earth—called a discovery pit—to complete the claiming procedure. The pits are in Quaternary alluvium. The radioactive source of the region was identified by the AEC as "high count aplite." There is no commercial grade of mineralization exposed, and these properties were not developed even at the height of the uranium "boom" period.

MERCURY OCCURRENCES (CINNABAR MINES)

Myrick Mine (W-1001)

The Myrick mine is on unsurveyed land, but a projection of adjacent public lands survey northward places it in NW1/4, SE1/4, SW1/4, Sec. 1, T28S, R46E, MDB&M. This is shown as W-1001 in Figure 3. The host rock is Tertiary porphyritic rhyolite. Mineralization is in the form of traces of cinnabar with realgar and abundant hematite that have impregnated irregular and discontinuous veins and bodies of milky white opal. Most of what people assumed to be "myrick" or cinnabar in opal that can be cut and polished is in reality hematite in opal. The prospect was explored by means of a 37-foot-long surface trench and a 15-1/2-foot-long decline as shown in Figure 33. Two samples were

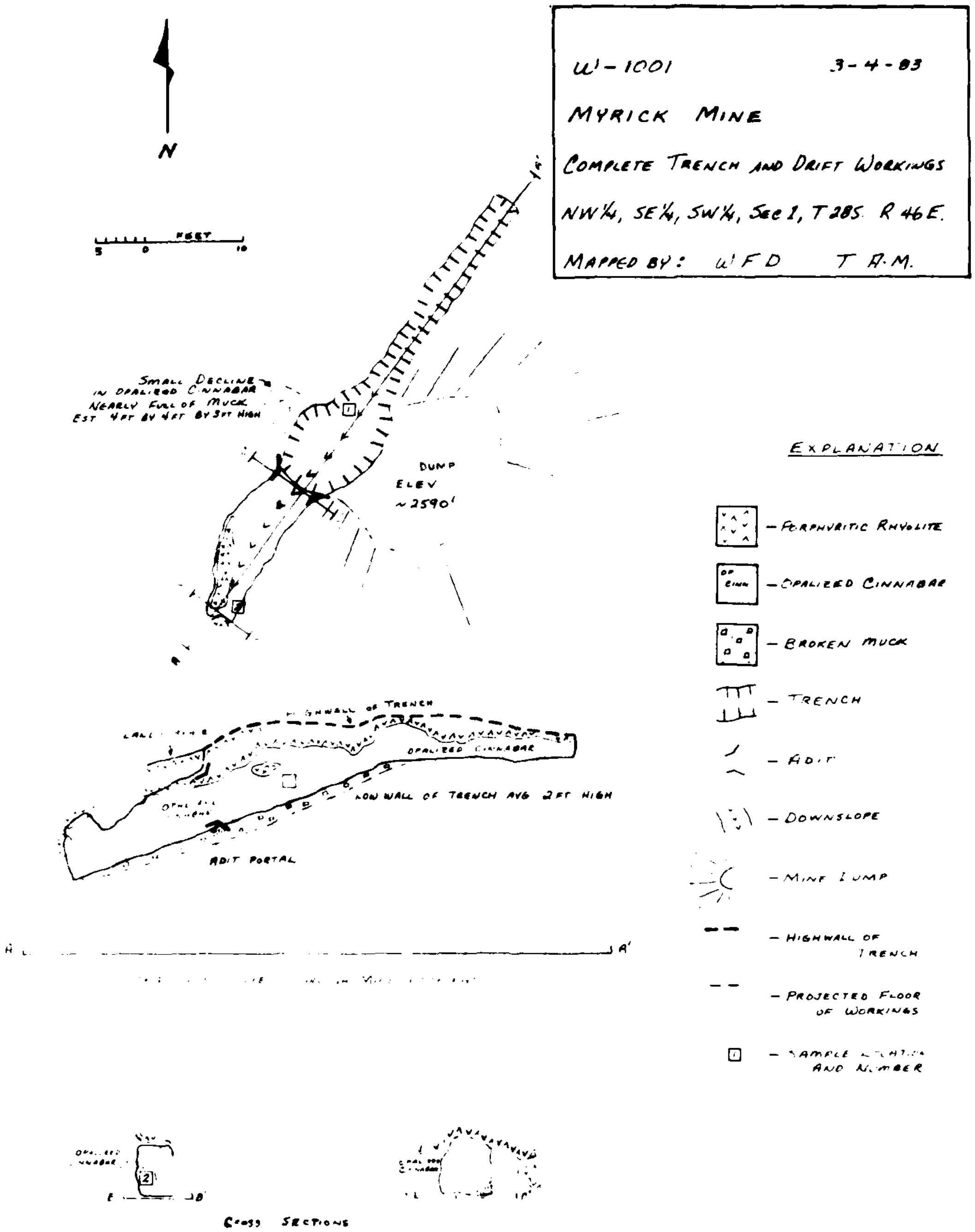

FIGURE 33. Myrick Mine Plan View (W-1001).

taken: one on the high-wall side of surface trench, the other at the face of the adit. A summary of assay results of 17 elements is found in Appendix Table B-1. The two samples, labeled W-1001-1 (trench) and W-1001-2 (decline), were analyzed for mercury by the use of the thin gold film detection technique. Assay results are shown in Table 7.

TABLE 7. Assay Results for the Myrick Mine.

Sample	Mercury, ppb[a]	Mercury, lb/ton[b]	Mercury, $/ton[c]
W-1001-1	693	0.001	0.006
W-1001-2	416	0.001	0.003

[a]Parts per billion.

[b]Assay value shown as lb avoirdupois/ton converted from ppb.

[c]Value taken as $380/flask (76.1 lb/flask).

No commercially viable mercury deposit has been exposed to date at this site.

The CDMG Bulletin 189, "Minerals of California," 1966, lists occurrences of cinnabar in the general vicinity of the Myrick mine.[5] There is no indication that any production of cinnabar was achieved at this prospect. As noted, the opaline zone, in addition to cinnabar staining, contains abundant hermatite staining. Thus, although there is much purple-red opal, very little is the semiprecious gem variety "myrickite," named for F. M. "Shady" Myrick, the reputed locator of the deposit. The opaline material toward the northern end of the opal zone also has a reddish to yellow-orange color as small blotches, the colors of realgar, orpiment and sulfur. Detailed analysis of this material showed sufficient traces of arsenic to verify the assumption that this fossil hot springs mound did indeed deposit both mercury and arsenic as traces of sulfides within the abundant opal of the deposit, as well as apparent minor traces of native sulfur.

[5]California Division of Mines and Geology Bulletin 189, "Minerals of California," 1966.

SEMIPRECIOUS GEMSTONES

Blue Chalcedony Spring Geode Bed (W-1301)

The Blue Chalcedony Spring geode bed is located approximately 8.9 air miles northeast of Pilot Knob VABM just south of the spring in the Randsburg Wash Test Range. The deposit and working are shown as W-1301 on Figure 1. The deposit lies on unsurveyed land, but a projection of the adjacent public lands surveyed to the west and to the south places it in the E1/2, NE1/4, Sec. 25, T28S, R45E, MDB&M.

The description and evaluation of the geode bed is taken from the observations made by Austin, Whelan, and Danti (1979, p. 154-5)[6] in evaluating the neighboring Mojave B Ranges.

> *...blue chalcedony nodules occur immediately below the cap rock [i.e., rhyolitic or rhyodcite ignimbrite], the geodes occur in a well indurated phase of ash of about fifty feet below the cap rock. The geodes range in size up to 8 inches and are generally chalcedony lined.*
>
> *Chalcedony ranging in color from gray to deep blue is found as nodules in gray tuff, mostly altered to clay in a zone immediately under the red welded tuff. The nodules are normally red ignimbrite with chalcedony cores. They vary in size from an inch or less to about eight inches. The chalcedony cores are seldom more than a few inches across, however.*
>
> *At Blue Chalcedony Spring the nodules were milled* from a cut about 20 feet above the valley floor. The cut is about 100 feet long and exposes about the top two feet of gray ash. Less than ten percent of the nodules contain chalcedony of a deep blue color.*

A revisit to this site by a member of the geologic staff resulted in the same conclusions. The geodes are sparsely located. The nature

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*Although "milled" appears in the original report, "mined" is the word intended.

[6]Naval Weapons Center. *Mineral Resource Evaluation of Mojave B Ranges*, by Carl F. Austin, J. A. Whelan, and K. Danti. China Lake, Calif., NWC, 31 July 1979. (Report Reg 266-760, document UNCLASSIFIED.)

of the host rock makes extraction of unbroken nodules very difficult. Even when extracted whole, they are generally unmarketable as geodes because their voids are very small although an occasional one is found with white quartz pseudomorphs of barite in the voids. Their pale color and the thinness of the chalcedony coating make them largely undesirable in the "cut and polish" market. This site has only marginal commercial value at best and would be of interest only to weekend rock hounds and hobbyists were it not on the test range.

BUILDING STONE

Quarry Operations/Ash Beds (W-901)

The quarry operations and ash bed sites are located along the Randsburg Wash Road approximately 20.7 miles east from Granite Wells and 7.0 air miles south-southeast of Straw Peak VABM. They are shown as W-901 on Figure 3. The quarries are on unsurveyed land, but a projection of the adjacent public lands survey to the west places them in the SE1/4, Sec. 5, T28S, R45E, MDB&M.

The property consists of Tertiary ash beds. It has been developed by small quarry sites. The two westernmost sites have developed thin 1/2- to 1-1/2-inch-thick alternating unconsolidated and indurated layers of white ash. This white ash bed extends approximately 4000 feet to the north and 2000 feet to the east. The ash bed is a minimum of 15 feet thick. The white ash was probably prospected as a source of abrasive for the production of polishing and cleaning agents as was done at the Holly Cleanser and Old Dutch Cleanser volcanic ash deposits of the Last Chance Canyon area approximately 25 miles to the west.

The eastern quarry site was developed by five small quarry sites. The site is a green ash bed consisting of 6- to 18-inch-thick indurated layers. The stone is easily quarried into slabs that are suitable as facing and walkway stones. The green ash bed is overlain by another white ash bed approximately 2 feet thick and from 1 to 3 feet of Quaternary alluvium. The upper beds have been cut and erroded away by intermittent streams and therefore are not very extensive. The green ash bed in this area extends a maximum of 500 feet down slope and 200 feet in the northerly direction. The apparent limited tonnage of the green ash material would make it marginal to uneconomical to develop a market for it. The white ash beds would be in competition with the very pure massive ash beds of Last Chance Canyon which have been idle for over 20 years.

GRAVEL PITS

Christmas Canyon (W-03)

The Christmas Canyon gravel pits site is approximately 19 miles southeast of Ridgecrest along the Randsburg Wash access road. It lies 1200 feet to the south of the road in Christmas Canyon. It is on unsurveyed land, but a projection of the adjacent public lands survey to the west places it in the SW1/4, SW1/4, Sec. 3, T28S, R43E, MDB&M.

The pits are in Pleistocene nonmarine sediments and reworked gravels. They produced pea gravels for a former on-site asphalt plant. The plant was probably operational in the early 1940s, about the time the Navy's Randsburg Wash test facilities were being built.

There is no evidence that the operator recovered gold concurrently with the gravel production, despite ample evidence that placer gold occurs in gravels of this area and lode gold deposits are also present as shown in Figure 2. Figure 4 shows the location of this site.

A placer operator located further upstream in this canyon has reported values of $0.94/cubic yard from a random sample of surface gravel and prior operators have done extensive placering as dry washing of both slope gravels and wash bottoms up stream and to the west. Higher values are expected at depth especially where the steeply dipping thin bedding of the shallow rough bedrock structures serves as natural riffles in the various washes. There is no evidence today of any attempt to take advantage of the natural bedrock riffles in the gravel pit area but over 40 years of repeated flash flooding could easily obliterate such evidence.

The lack of by-product gold interest could be simply that the gravel pits were developed by Navy contractors for the express purpose of making road gravels; or, if the gravel pits operated during World War II while directive L-208* was in effect, there may have been no attempt at any form of gold production concurrent with the short lived gravel production efforts.

WATER RESOURCES

WELLS

Water for the Randsburg Wash facility is furnished by two wells completed in Quaternary alluvium. Navy well 25, completed in December 1952, in the gunline area, is a 12-inch-diameter well drilled to a

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*This order prohibited most gold mining during World War II.

depth of 690 feet. Static water level was 248 feet. The well is perforated at depths of 250 to 320 feet, 335 to 405 feet, and 435 to 445 feet. The well is producing at 200 gallons per minute (gpm) but drawdown is not known.

Navy well 24A is located approximately 100 feet to the southeast of well 25 and was drilled during 1980 to 700 feet but gravel packed back to 630 feet. It is completed with a diameter of 12 inches. The casing is perforated from 290 to 350 feet and 600 to 630 feet. The waters from these wells is of exceptional quality for the desert southwest. Total dissolved solids based on one analysis from the old well and three analyses from the new well range from 417 to 522 parts per million (ppm). It meets Environmental Protection Agency (EPA) and State of California drinking water standards. Analyses are given in Appendix Table C-1.

These wells are in the Pilot Knob groundwater basin (WESTEC Services, Inc., 1979).[7] This basin is bounded on the northern and southern edges by the Garlock Fault and Blackwater Fault, respectively, and cover over 160 square miles. The primary areas of recharge for the basin are the alluvial fans fringing Pilot Knob Valley (WESTEC p. 57). There may be outflow from this basin into the Searles Valley groundwater basin, into Superior Valley to the south, and deep underflows may reach as far west as Fremont Valley and Leach Lake Valley to the east. The size of the basin and limited competition for water should ensure an adequate supply of good quality water for the ranges for the forseeable future.

Springs

Three springs are located on the Randsburg Wash Test Range: Blue Chalcedony, Moonshine, and Myrick (Figure 3).

Blue Chalcedony is a small seep spring. A section of a 55-gallon oil drum has been sunk in the ground as a collecting basin. The usual "spring" grasses halo the basin. The basin had standing water but no outflow. Blue green algae were growing in the water. Water temperature was 70°F. A complete water analysis is presented in Appendix Table C-1.

Moonshine Spring is apparently intermittant as no flow or seep was evident when the site was visited on 2 September 1983. The spring occurs on the edge of a gully. Three calcitic spring terraces occur on

[7] *Environmental Assessment for Naval Weapons Center Withdrawal of Mojave B Ranges*, Tustin, Calif., WESTEC Services, Inc., September 1979. 207 pp.

the south bank of the gully. Below the terraces is a natural or manmade catchment behind which is a patch of willow, grasses, and a few salt cedars. The soil was moist, but unfortunately, a major summer storm occurred 19 August 1983 and it is not known whether the moisture was due to ground water or to the storm. Three shallow holes were dug in the moist soil in the catchment basin, but the soil was clayey and there was no seepage.

Myrick Spring is on the flanks of a knoll about 2 miles due east of the Myrick fossil hot spring deposits. Despite the evidence for relatively recent geothermal leakage in the area this spring is not anomalously warm. The spring consists of a very small pool surrounded by typical spring grasses. There is no outflow. An analysis of the water is given in Appendix Table C-1. The water contains sodium, calcium, mangesium, bicarbonate, and chloride with a low sulfate content. The mercury content of 2.2 ppm and arsenic content of 0.2 ppm are noteworthy.

UNEXPLORED RESOURCE POTENTIALS

GEOTHERMAL SYSTEMS

Myrick System (W-GR-10)

The unexplored Myrick geothermal system is located in the vicinity of Myrick Spring (Figure 34). The rock types in the area are Tertiary volcanics that include a red, acidic ignimbrite or flow that overlies a white tuff unit.

Small amounts of opal were noted, mainly as fracture and vesicle-filling within the ignimbrite. No opalized cinnabar (Myrickite) was discovered.

Myrick Spring, is a relatively cool spring, and was sampled on 19 May 1979. The water analysis is presented in Appendix Table C-1.

The high bicarbonate content of the water indicates a surface water component. The relatively high contents of sulfate, arsenic, and boron could indicate a potential geothermal component. The sodium-potassium-calcium equilibration temperature of the water was 151°C, the quartz inductive silica temperature was 112°C.

Additional data, obtained through detailed structural mapping, deep electrical studies, thermal gradient drilling and water well drilling, would be necessary to determine whether an active geothermal system exists in the area.

FIGURE 34. NASA Satellite Photograph Showing the Randsburg (Red Mountain/Lava Mountain), South Searles Valley and Myrick Geothermal Systems and the Haystack.

Randsburg (Red Mountain/Lava Mountain) Geothermal System (W-GR-3)

The Randsburg (Red Mountain/Lava Mountain) known geothermal resource area (KGRA)/noncompetitive lease unit area is situated approximately 11 air miles south of China Lake. The area encompasses some 120 square miles of land and includes such features as the Red Mountain, Lava Mountains, and Almond Mountain.

The Randsburg geothermal system is an administrative KGRA; that is, an area of potential interest to geothermal resource developers who have been granted leases by the Department of the Interior on a competitive bid basis. A large land area encircling the KGRA is made up of numerous noncompetitive lease units.

As indicated by Figure 34, the geothermal system boundary borders the west side of the Randsburg Wash Test Range. If a geothermal resource is present in the area, it could well extend under the Test Range.

A geologic summary of the Randsburg KGRA follows:

The Lava Mountains are composed of three formations (Smith, 1964).[8] The oldest being middle Pliocene bedrock spring formation about 5000 feet thick consisting of coarse grained, feldspar-rich sandstone and conglomerate, which unconformably overlie the bedrock spring formation.

The Almond Mountain volcanics consist of interbedded tuffs, lapilli tuffs, volcanic breccia, flow breccia, standstone and conglomerate in the Lava Mountains and at Red Mountain. The Almond Spring volcanics have been propylitically altered.

The Lava Mountain andesite occurs as flows, large domes, and small mound-like intrusives.

A series of northeast-trending faults cuts the area. They are called the Brown's Ranch Fault zone (Smith, 1964).[8] They are nearly vertical but can dip to the southeast or northwest. They exhibit some strike slip movement and have vertical displacements from tens to a thousand feet. Sometimes these faults will have opposite types of separation at their two ends. Faulting occurred from the late Pliocene through the early Quaternary period.

[8]G. I. Smith. *Geology and Volcanic Petrology of the Lava Mountains, San Bernardino County, California*. U.S. Geological Survey, 1964. (USGS Professional Paper 457.)

At the north edge of and parallel to the Brown's Ranch Fault system is the Dome Mountain anticline. Folding along the anticline began after the deposition of the bedrock spring formation and continued during or until after late Pliocene, when the Almond Mountain volcanics were deposited (Smith, 1964).[8] Folding may or may have not affected the late Pliocene Lava Mountain andesites or the Quarternary volcanic and sedimentary rocks.

Surface manifestations of a geothermal system consist of hematite alteration and hot spring opal at Red Mountain. A well drilled in altered volcanics in the Lava Mountains (steam well) as a prospect for mercury in 1920 encountered steam at a depth of 415 feet. The temperature of the steam at the surface was 96°C. In 1960 the temperature in this well was measured at 98.7°C—the boiling point at that elevation (Bureau of Land Management, 1976, p. 2-23).[9] Also in 1960, a new well was drilled to a depth of 772 feet near the earlier well and a maximum temperature of 116°C was recorded (McNitt, 1963;[10] U.S. Department of the Interior, 1975;[11] California Regulatory Water Quality Control Board, 1975[12]). The Lava Mountains are considered nonbearing of ordinary ground water (Bureau of Land Management, p. 2-16).[9]

The Cuddeback Basin aquifers are in alluvial material. Recharge occurs along the alluvial fans on the east and west sides of the valley. In 1969 maximum depth to water was measured at 358 feet (Bureau of Land Management, 1976, p. 2-19).[9] Ground water moves south. The storage capacity of the Cuddeback Basin totals 1,380,000 acre-foot (U.S. Department of Interior, 1975).[11]

Water level measurements indicate a ground-water barrier about 4 miles west of Cuddeback Lake (Moyle, 1971).[13] The location of the

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[9] *Final Environmental Analysis Record for Proposed Geothermal Leasing in the Randsburg-Spangler Hills-So. Searles Lake Areas*. Riverside, Calif., Bureau of Land Management District Office, July 1976. (BLM 1791 (Randsburg), CA-060-6-HD-86.)

[10] J. R. McNitt. *Exploration and Development of Geothermal Power in California*. Sacramento, Calif., California Division of Mines and Geology, 1963. Special Report 75, 45 pp.

[11] U.S. Department of the Interior. *Unit Resource Analysis for National Resource Lands in the El Paso and Red Mountain Planning Units*, by Bureau of Land Management, California Desert Planning Staff, Sacramento, Calif., 1975.

[12] California Regional Water Quality Control Board. *Water Quality Control Plan Report, South Lahontan Basin*. State Water Resources Control Board, Department of Water Resources, Sacramento, Calif., 1975.

[13] W. R. Moyle, Jr. *Water Wells in the Harper, Superior, and Cuddeback Valley Areas, San Bernardino County, California*. California Department of Water Resources Bulletin No. 91-19, 1971, 49 pp.

barrier coincides with a southward projection of the Brown's Ranch Fault zone. The barrier causes a head change of about 150 feet, with the high head on the west. The barrier may result from silification along the fault zone as noted by Smith (1964).[8] South and east of the steam well abnormally high temperatures were recorded in several wells completed in alluvium. These wells are downslope from the Brown's Ranch Fault zone and the steam well. The wells range in depth from 60 to 160 feet and have recorded temperatures of 20 to 25°C. It is possible that the water is heated in the area of the steam well and flows downslope to where it is intersected by the drilled wells. If this is the case, then a near-surface permeable zone probably bridges the proposed ground-water barrier imposed by the Brown's Ranch Fault zone.

Unfortunately no analyses of water from fluids from the steam well are available. Analyses of waters from the Cuddeback Basin are given in Appendix Table C-1 together with their computed geochemical temperatures. W-4—the sample location closest to the surface geothermal manifestations—gives a sodium/potassium temperature (revised) of 130°C, its sodium-potassium-calcium temperature is 119°C, and its silica temperatures registered up to 115°C. While these temperatures are low, it must be remembered that any geothermal fluids present are greatly diluted by shallow Cuddeback ground water. Unfortunately, analyses suitable for making mixing models are not available. Several companies have drilled gradient and observation holes in the unit. One company geologist told the writers that on the basis of the thermal gradient holes and a lost observation hole, they felt there might be a "good" but small geothermal resource in the area.

South Searles Valley System (W-GR-11)

A Bureau of Land Management geothermal lease unit—the south Searles Lake lease unit—abuts a portion of the northwest boundary of the Randsburg Wash Test Range (Bureau of Land Management, 1976).[9] If a geothermal resource should exist under the lease unit it could well extend under the Range. The lease unit is located at the south end of Searles Valley. The possibility of a geothermal resource was first indicated by abnormally high bottom-hole temperatures of holes that were drilled during exploration for salines. There are no surface manifestations that could indicate a geothermal resource.

Only one ground-water analysis was available from Searles Valley (Bureau of Land Management, 1976, pp. 2-21 - 2-22).[9] The sample was collected from a 430-foot-deep well in Sec 6, T28S, R43E, MDB&M. Analytical results (in mg/l) are shown in Appendix Table C-1. Unfortunately, potassium was not determined so no NaK or Na-K-Ca temperatures could be calculated. Silica geochemical thermometer (Fournier, 1981, p. 14)[14] data are presented in Appendix Table C-1. It must be remembered that this water is moving toward the lease unit and therefore probably does not contain a geothermal component.

The Haystack Area

The Haystack is a jagged, isolated outlier of the Spangler Hills. It is situated off Navy property approximately 2-1/2 miles south-southeast of the NWC south gate. It is shown on Figures 4 and 34 and is placed in the NE1/4, SE1/4, NE1/4, Sec. 17, T27S, R41E, MDB&M.

The main point of interest concerning Haystack Peak is that it is considered to be a "snow melt" area. That is, after a light snowfall, the snow melts off of The Haystack before it melts off of the adjacent Spangler Hills or the surrounding Indian Wells Valley. This is indicative of high heat flow in this area and a characteristic of the Roosevelt, Utah, and Coso KGRA geothermal fields, among others.

Haystack Peak is composed of a fine-grained Mesozoic leucogranite. The dominant minerals are white feldspar, probably albite, quartz, and muscovite with average grain size under 1 mm. Though occasional quartz grains were noted up to 2 mm. The intrusive has a prominent set of joints that trend in a northwest-southeast direction and dip approximately 75 degrees northeasterly. Aplite dikes, frequently striking northwesterly, are present and a few barren milky quartz veins and veinlets were noted.

The nearby Spangler Hills rocks are predominantly syenites, composed mainly of potassium feldspar and, in order of decreasing amounts, white feldspar, quartz, hornblende (in needles up to 7 mm long), and biotite.

It is probable that The Haystack is an intrusion into the Spangler Hills granitics. The apparent heat flow may be associated with ground water, at depth, penetrating the well-developed joint pattern of the Haystack intrusive.

Although the Haystack is not in the Randsburg Wash access corridor, it is adjacent to it and geothermal exploration or development could cause encroachment on the corridor.

[14] Robert O. Fournier. "Application of Water Geochemistry to Geothermal Exploration and Reservoir Engineering," in *Geothermal Systems: Principles and Case Histories*, L. Ryback and L. J. P. Muffler, ed. Chichester, England, John Wiley & Sons Ltd., 1981, pp. 109-43.

GOLD DEPOSITS

Christmas Canyon Extension

The Randsburg Wash Test Range has a broad area which, although it has had little exploration, has the potential of containing commercial scale gold deposits. The Christmas Canyon area is located along the south side of the Garlock Fault at the western boundary of the Randsburg Wash Test Range. The zone of relatively intense mineralization covers approximately 3 square miles of exposure plus several adjacent square miles with shallow gravel cover. The mineralization is best exposed in Christmas Canyon and in the wash to the west.

Christmas Canyon is in an area of Plio-Pleistocene nonmarine sediments (Figure 2). These unconsolidated sediments cover a block of strongly pyritized pre-Cretaceous metasedimentary rock comprised of shale, limestone, and intermediate dikes. This rock has been intricately folded and faulted and brought to the surface by the drag and associated rotation of the rocks adjacent to the Garlock Fault.

Two sources of gold are indicated in this area. The first is non-locally derived placer gold found in the Plio-Pleistocene sediments. Placer values of $0.94/cubic yard in a random sample of surface gravel have been reported by an operator whose claims adjoin the western base boundary. The gold is clean and well-rounded and is believed to be associated with yellow quartzite cobbles in the gravels whose parent source is to the east. Higher gold values are expected on bedrock where vertical thin bedding crosses active dry washes and where the main washes lose velocity at the canyon mouths.

The second source of gold is derived from weathering of veins within the metasedimentary rock. This gold is angular and is stained with reddish clay and oxides. The metasediments consist of limestone and shale beds. The beds have been cut by numerous intermediate composition granitic dikes and then mineralized by a siliceous fluid containing pyrite and gold. Chemical weathering of the beds has left a broad clay zone with nearly vertical, east-west trending mineralized bands. The mineralized bands are evidenced by silification and limonite. The present operator of the lode claims in Christmas Canyon has reported fire assay gold values from 0.84 to 1.68 troy-oz/ton, with silver values ranging from 0.2 to 0.8 troy-oz/ton for total precious metal values from $423 to $849.60/ton.* Similar values have been reported by the operator working in the canyon immediately west of Christmas Canyon.

*Gold at $500/troy-oz. Silver at $15/troy-oz.

The immediate exposure of mineralization extends 3 miles to the west and averages 1 mile wide. This zone also extends east of Christmas Canyon onto the Center in an area 3/4-mile long by 1 mile wide where it is largely covered by a thin layer of nonmarine sediments. This is shown by an aerial photograph in Figure 35. The regional mineralized trend extends from the Coin Consumer area west along the Garlock Fault to the Summit diggings. Outliers of mineralized blocks of carbonate rock on the south edge of the Garlock Fault zone can be found as far east as the Cave Spring region in Fort Irwin.

NONMETALLIC MINERAL RESOURCES

Nonmetallic mineral resources, other than those already described, which have not been reported from Randsburg Wash include gem quality opal and chalcedony, decorative stone, and clays.

Blue chalcedony and opal are found just south of the southern boundary of Randsburg Wash Test Range. Austin, Whelan, and Danti (1979, pp. 154-155)[6] describe the occurrence as follows:

> *Silica family minerals found include geodes, blue chalcedony, and opal. All are found in the vicinity of Blue Chalcedony Spring. (Blue Chalcedony Spring is in the Randsburg Wash Range, and the opal units in Mojave B South. However, the relationship of their occurrence makes it logical to discuss them together.) All occur in ash beds underlying a rhyolitic or rhyodacitic ignimbrite cap rock.*
>
> *The geodes are found on the east side of the same hill that contains the opal "mine." While the opal and blue chalcedony nodules occur immediately below the cap rock, the geodes occur in a well indurated phase of ash about fifty feet below the cap rock. The geodes range in size up to 8 inches and are generally chalcedony lined.*
>
> *Chalcedony ranging in color from gray to deep blue is found as nodules in a gray tuff, mostly altered to clay in a zone immediately under the red welded tuff. The nodules are normally red ignimbrite with chalcedony cores. They vary in size from an inch or less to about eight inches. The chalcedony cores are seldom more than a few inches across, however.*

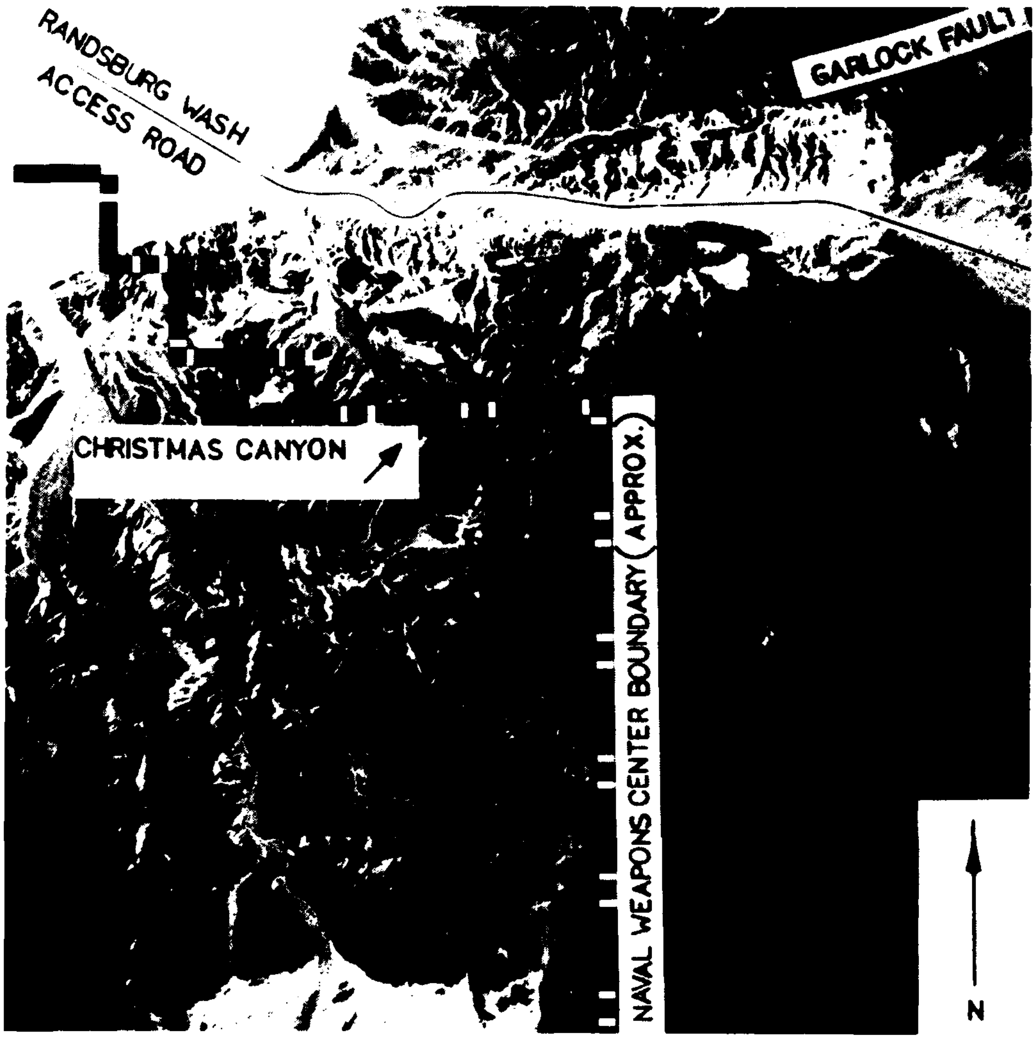

FIGURE 35. Photograph of Christmas Canyon Area.

At Blue Chalcedony Spring the nodules were milled from a cut about 20 feet about the valley floor. The cut is about 100 feet long and exposes about the top two feet of gray ash. Less than ten percent of the nodules contain chalcedony of a deep blue color.*

One of the best ways to obtain the blue chalcedony is to search for "float" nodules in the washes to the west of Blue Chalcedony Spring.

Opal nodules are found in the same type of occurrence about 175 feet above the valley floor, on a hill at about 3922N, 4925W on the U.S.G.S. Pilot Knob Quadrangle. The cut is about fifty feet long and originally exposed 8 to 13 feet of ash. It has washed in so that now the exposed face is seldom larger than 5 feet. Nodules are very plentiful but most are composed of white, common opal. A few chips of precious opal were found by the writers, and one nodule which has precious opal exposed on the end. Fire opal has been reported. Less than one percent of the nodules would be of gem quality.

Small specimens of milky white to nearly clear opal have been colleted from the top of Robbers Mountain.

Since the same volcanic units occur in much of the southern portion of Randsburg Wash Test Range, there is the possibility of other opal or chalcedony deposits being found. However, intensive prospecting in the past makes the probability of finding significant deposits small.

Some of the pre-Createceous metasedimentary rocks could possibly furnish small quantities of decorative stone.

Some of the volcanic ashes, tuffs, and volcanics have locally been altered to clays, which might provide small quantities of refractory clay.

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*Although "milled" appears in the original report, "mined" is the word intended.

TERTIARY INTRUSIVE CENTERS

The Tertiary volcanics of the Randsburg Wash Test Range and the adjacent Mojave B Range South are intruded by a series of Tertiary hypabyssal rocks. They range in composition from basalt through andesite to rhyolite. Rhyolitic compositions are most common. The stock-like intrusions vary in shape from elongate to equant. The largest instrusion is equant and about 2 miles across. A typical rhyolite intrusive is a porphyry with a white groundmass and quartz phenocrysts up to 1 millimeter across. Phenocrysts make up less than 10% of the rock. The intrusives occur in a northwest-trending belt.

No mineralization has been found directly associated with the intrusives and with the intensive prospecting during the Depression years, the probability of finding significant high-grade mineralization is very low. It must be noted, however that epithermal gold, uranium, and molybdenum mineralization has been associated with such stocks. A blind but large molybdenum deposit has been found in such a stock as Pine Grove, Wah Wah Mountains, Utah (the top of the mineralization is at a depth of approximately 2000 feet) and is currently being explored through a joint venture of Getty Mineral Resources Co. and Phelps Dodge Corp, and of more local significance, mineralization including mercury, uranium and extensive molybdenum as jordisite occur over an apparent buried intrusive in the nearby Sierra Nevada to the west between Waller Basin and the main Kern River.

CONCLUSIONS

Although numerous mineral occurrences were prospected for gold and silver values on the Randsburg Wash Test Range and the Randsburg Wash access road area, field and laboratory evaluation indicate that none of these occurrences expose mineralization of commercial grade or tonnage. The most promising gold values would be expected to occur in the carbonate-rich metasediments covered by shallow Quarternary alluvium east of Christmas Canyon along the south edge of the Garlock Fault, an extension of mineralization in Christmas Canyon that is just outside the test range boundary.

Semiprecious gemstones do not occur in sufficient quality or quantity to be of major commercial interest, but constitute the type of deposit a retired person typically locates on to enable inexpensive living in the desert while catering to the rock hound trade.

Building stone is available in the volcanic ash deposits of the Randsburg Wash Test Range but in insufficient quantity to be of significant commercial value. Volcanic ash beds have marginal value as abrasives, but larger idle deposits of superior quality and quantity are available nearby and are located outside withdrawn lands.

There is good geological reason to conclude that a geothermal potential is present in the vicinity of Myrick Spring in the southeastern portion of the test range. This prediction is based on the occurrence of traces of mercury and arsenic in opal plus high values of selenium in the water of Myrick Spring. A geothermal potential is evidenced by anomalously warm ground water and trace uranium values in southern Searles Valley, and anomalous snow melt patterns in the vicinity of the feature called the Haystack suggest heat may underlie the Randsburg Wash access road just south of the China Lake Pilot Plant.

A geothermal potential extends east from the Randsburg KGRA. Some structural interpretations indicate that portions of the Randsburg Wash Test Range west of the Blackwater Fault should be considered to have the best economic potential. Any major young geothermal system has a potential for uranium, gold, and mercury ores. The recognition of these four geothermal prospects that occur at or adjacent to the Randsburg Wash Test Range and Randsburg Wash access road indicates that industrial interest in these sites must be anticipated. Until such time as deep geophysical work and deep stratigraphic test holes and heat flow holes are drilled, these prospects remain merely broad zones for potential opportunity for locating mineral deposits. The zones are fair to good places to look for prospects but the data are very scanty at this time.

With the exception of the Myrick system, the most favorable of these potential prospects appears to be outside the withdrawn or acquired Navy lands so that the Navy presence should be no deterrent to commercial exploration. Only if such exploration occurs and the data indicates heat or deposits extend under Navy lands should direct encroachment become an issue although air pollution and security considerations could be severe too. With the rapid reduction of slant drilling costs this past decade making 1 to 2 miles of slant drilling attractive to the petroleum industry in heavy oil areas, the presence of the Center boundary becomes even less a barrier to subsurface geothermal exploration and production with minimal to no impact on the Center mission, for those deposits near the Center boundaries.

The AEC aerial survey of the Garlock Fault and field examinations by a number of corporations indicate that the uranium mineralization of the Randsburg Wash Test Range area is too low in grade and tonnage to be of commercial value. The uranium mineralization of the Red Mountain Range to the southwest outside of the withdrawn lands is only marginally commercial and has not been exploited successfully to date.

No minerals of strategic importance or other mineral commodities were indicated that warrant prospecting with the technology of today or that of the forseeable future. The geologic environment favorable for the accumulation of commercial quantities of oil and gas does not exist in the Randsburg Wash Test Range and access road areas.

REFERENCES

The following references appear in Table C-1.

1. W. R. Moyle, Jr. *Water Wells and Springs in Panamint, Searles, and Pilot Knob Valleys, San Bernardino and Inyo Counties*. California Department of Water Resources Bulletin No. 91-17, 1969.

2. Alfred H. Truesdell. "Summary of Section III Geochemical Techniques in Exploration," in *Proceedings, Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, California, USA, 20-29 May 1975*. Volume 1. Washington, D.C., U.S. Government Printing Office, 1976, pp. liii-lxxix.

3. Robert O. Fournier. "A revised Equation for the Na/K Geothermometer," in *Expanding the Geothermal Frontier, Transactions Volume 3, Geothermal Resources Council Annual Meeting, 24-27 September 1979, Reno, Nevada*. Davis, Calif., Geothermal Resources Council, September 1979, pp. 221-24.

4. R. O. Fournier and A. H. Truesdell. "An Empirical Na-K-Ca Geothermometer for Natural Waters." *Geochimica et Cosmochimica Acta*, 37, 1973, pp. 1255-75.

Appendix A

KEVEX RESULTS FOR A PORTION OF RANDSBURG WASH TEST RANGE/ACCESS ROAD SAMPLES

TABLE A-1. Kevex Results for a Portion of Randsburg Wash Test Range/Access Road Samples.

Sample no.	Ag, troy-oz/ ton	Fe, wt %	Zn, wt %	Cu, wt %	Pb, wt %	Sb, wt %	Ba, wt %	Sn, wt %	Mo, wt %	As, wt %
W-01-7	0.348	3.897	0.0009	0.0194	0.0025	None detected	0.533	0.0013	0.0008	0.0024
W-501	None detected	17.690	0.0015	0.0155	0.0004	None detected	0.0537	None detected	0.0006	None detected
W-902-3-1	None detected	4.884	0.0033	0.0109	0.0002	0.0020	0.0437	None detected	None	None detected
W-902-3-2	0.377	2.284	0.0010	0.0117	0.0016	0.0036	0.0795	0.0002	0.0003	0.0029
W-902-3-3	0.261	2.336	0.0017	0.0103	0.0028	0.0050	0.0420	None detected	0.0003	0.0050

Appendix B

COMPLETE ASSAY RESULTS FOR ALL PROSPECT OR CLAIM SAMPLES SUBMITTED FROM RANDSBURG WASH TEST RANGE/ACCESS ROAD AREA

TABLE B-1. Assay Results of Samples Taken from Randsburg Wash Test Range.

Skyline report item no.	NWC ref. sample no.	Gold, troy-oz/ton	Silver, troy-oz/ton	Copper, wt %	Lead, wt %	Zinc, wt %	Cadmium, wt %	Cobalt, wt %	Nickel, wt %	Molybdenum, wt %	Tin, wt %	Arsenic, wt %	Antimony, wt %	Barium, wt %	Bismuth, wt %	Manganese, wt %	Iron, wt %	Calcium, wt %
26	W-01-1	0.064	0.162	0.08	0.04	<0.01	Nil	<0.01	Nil	<0.01	Nil	0.02	Nil	0.02	0.01	0.04	9.90	1.40
27	W-01-2	0.130	0.122	0.02	0.03	<0.01	Nil	Trace	Trace	Trace	Nil	<0.01	Nil	0.05	0.02	0.02	3.50	0.15
28	W-01-3	0.046	0.107	0.03	0.01	<0.01	Nil	<0.01	Nil	Trace	Nil	<0.01	Nil	0.07	0.01	0.05	3.60	0.38
29	W-01-4	0.012	0.180	0.04	<0.01	<0.01	Nil	Nil	Nil	Trace	Nil	<0.01	Nil	0.02	Trace	0.04	[illegible].10	0.18
30	W-01-5	0.026	0.023	0.24	<0.01	<0.01	Nil	Nil	Nil	Nil	Nil	<0.01	Nil	0.05	Trace	0.03	2.20	1.30
31	W-01-6	0.320	0.238	0.10	0.02	<0.01	Nil	Nil	Nil	<0.01	Nil	<0.01	Nil	0.03	<0.01	0.02	4.90	0.89
32	W-902-1	0.001	0.017	<0.01	Nil	0.01	Nil	Trace	0.01	Nil	Nil	<0.01	<0.01	0.06	Trace	0.03	4.70	0.43
33	W-902-2-1	0.014	0.070	<0.01	Nil	<0.01	Nil	Nil	<0.01	Nil	Nil	0.01	<0.01	0.02	Nil	0.07	2.90	2.00
34	W-903-1	0.052	0.020	0.04	<0.01	0.09	Nil	0.01	0.02	Nil	Nil	0.01	0.01	0.05	Nil	0.82	25.00	1.50
35	W-904-1	0.032	0.012	0.01	<0.01	<0.01	Trace	Nil	0.01	<0.01	Nil	<0.01	Trace	0.02	Nil	0.08	2.60	0.79
36	W-904-2	0.003	Trace	<0.01	Nil	0.03	Trace	<0.01	0.02	<0.01	Nil	0.01	<0.01	0.08	Nil	0.10	4.50	0.29
37	W-904-3	0.015	0.012	<0.01	Nil	0.03	Trace	<0.01	0.03	<0.01	Nil	0.02	<0.01	0.08	Nil	0.15	9.00	0.24
38	W-904-4	0.014	0.012	0.01	Trace	0.03	Trace	<0.01	0.03	<0.01	Nil	0.01	<0.01	0.02	Nil	0.72	7.80	0.63
39	W-904-5	0.281	0.180	0.15	0.07	0.15	Trace	<0.01	0.06	Nil	Nil	0.40	<0.01	0.04	Trace	0.12	39.60	1.20
40	W-904-6	0.099	0.012	0.02	<0.01	0.05	Trace	<0.01	0.02	<0.01	Nil	0.07	Trace	0.06	Nil	0.12	12.90	0.49
41	W-904-7	0.003	Trace	<0.01	Trace	0.02	Trace	<0.01	0.02	Trace	Nil	0.01	Trace	0.22	Trace	0.42	8.40	0.58
42	W-904-8	0.003	Trace	<0.01	<0.01	0.01	Nil	<0.01	<0.01	Trace	Nil	<0.01	Trace	0.10	Trace	0.12	2.70	0.16
43	W-904-9	0.005	Trace	0.01	Nil	0.04	Trace	<0.01	0.03	Trace	Nil	<0.01	Trace	0.09	Nil	0.36	5.90	1.00
44	W-904-10	0.093	0.206	<0.01	<0.01	0.04	Trace	<0.01	0.02	Trace	Nil	0.01	Trace	0.13	Nil	0.52	5.70	0.58
45	W-904-11	0.008	0.006	<0.01	Nil	<0.01	Nil	<0.01	<0.01	<0.01	Nil	<0.01	Trace	0.03	Nil	0.12	2.40	0.14
46	W-905-2[a]	0.005	0.012	0.01	Nil	0.01	Nil	0.01	0.01	Trace	Nil	<0.01	Trace	0.09	Trace	1.45	5.00	0.29
47	W-1001-1	0.001	0.006	<0.01	Trace	<0.01	Nil	Nil	Nil	Trace	Nil	<0.01	Nil	0.04	Nil	0.34	3.10	0.48
48	W-1001-2	Trace	0.023	<0.01	<0.01	<0.01	Nil	Nil	Trace	Trace	Trace	<0.01	Trace	0.03	Nil	0.34	1.50	0.44
49	W-1501-1-1	Trace	0.017	<0.01	Nil	<0.01	Nil	Nil	Nil	Trace	Nil	<0.01	<0.01	0.14	Nil	0.34	3.00	0.48
50	W-1502-1	0.001	0.029	0.20	0.04	0.02	<0.01	Nil	Nil	<0.01	Nil	0.02	Nil	0.03	0.01	0.27	1.80	0.10
10	W-902-3-1	0.011	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
11	W-902-3-2	<0.005	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12	W-902-3-3	<0.005	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	W-01-7	0.110	0.350	0.02	Nil	Nil	...	...	...	Trace	Nil	<0.01	Nil	0.53	Nil	Nil	3.90	...
	W-501	<0.005	Nil	0.02	Nil	Nil	...	...	...	Nil	Nil	...	Nil	Nil	...	...	28.11	...

[a]Shown as Sample 1 on Figure 27 and as W-905-2 on Skyline Report. Only one sample taken at this property.

Appendix C

WATER ANALYSIS

TABLE C-1. Water Analysis.

	Navy water wells			Springs			Cuddeback							South Searles Valley Moyle, 1969[b]
							Ground water basin							
Sample no.	25	24A		Moonshine	Blue Chalcedony	Myrick	Well W-1	Well W-2	Well W-3	Well W-4	Well W-5	Well W-6	Well W-7	
Date sampled	7-19-82	4-15-81	?	9-2-83	9-2-83	5-19-79	Data from Moyle, 1971[a]							
Analyst or reference	NWC	NWC	NWC	...	BC Labs	NWC	BLM (1976). Proposed geothermal leasing of Randsburg, Spangler Hills, South Searles Valley, Final Environmental Analysis Record							
pH, units	7.99	7.6	8.20	Spring dry	7.5	8.0	7.7	8.0	...	7.6	7.6	8.0	...	9.0
Total dissolved solids, mg/l	430.0	417.0	522.0		687.0	2931.0	670.0	556.0	1720.0	2130.0	4420.0	...	1190.0	...
Specific conductance														
Microhms/cm at 25°C	650.0	690.0	780.0		720.0	4260.0	998.0	1020.0	...	3520.0	3730.0	6880.0	...	18,000.0
Alkalinity, total (as $CaCO_3$), mg/l	...	...	...		...	...	...	...	...	...	...	...	...	...
Carbonate	...	0.0	0.0		0.0	1228.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	288.0
Bicarbonate	224.5	264.0	302.0		369.0	275.4	192.0	165.0	138.0	122.0	95.0	88.0	188.0	2,330.0
Total	224.5	264.0	302.0		369.0	1503.7	192.0	165.0	138.0	122.0	95.0	88.0	188.0	2,618.0
Hardness, total (as $CaCO_3$), mg/l	80.0	60.0	58.0		...		...	...	...	...	...	...	...	...
Calcium (Ca), mg/l	25.2	19.2	23.0		24.0	42.2	76.0	40.0	171.0	174.0	567.0	464.0	69.0	8.0
Magnesium (mg), mg/l	4.1	2.93	12.0		6.5	21.0	31.0	9.0	31.0	28.0	13.0	85.0	12.0	1.3
Chloride (Cl), mg/l	60.0	41.0	44.0		28.0	890.0	69.0	177.0	888.0	966.0	2220.0	2310.0	500.0	3,330.0
Sulfate (SO_4), mg/l	48.0	49.0	59.0		43.0	6.7	240.0	68.0	35.0	20.0	37.0	56.0	74.0	2,270.0
Silica (S_iO_2), mg/l	43.0	38.6	87.0		70.0	62.0	...	...	66.0	...	...	50.0	85.0	19.0
Sodium (Na), mg/l	107.0	125.0	36.0		126.0	970.0	84.0	147.0	401.0	415.0	818.0	866.0	336.0	4,490.0
Potassium (K), mg/l	6.21	6.40	8.70		13.5	35.0	0.8[c]	8.0	...	12.0	18.0	15.0	...	...
Iron (Fe), mg/l	<0.03[d]	0.17	0.07		<0.05	0.08	...	...	1400.0[e]	...	...	...	50.0[e]	Trace
Copper (Cu), mg/l	<0.01	0.06	<0.03		<0.01	0.01	...	...	...	...	...	...	...	...
Color, units	...	1.0	...		...	...	...	...	...	...	...	...	...	...
Turbidity, NTV	...	0.56	0.35		...	...	...	...	...	...	...	...	...	...
Nitrogen nitrates (NO_3), mg/l	2.5	3.10	10.6		3.1	5.0	0.0	3.3	7.8	11.0	0.0	5.0	3.5	...
Fluoride, mg/l	0.8	0.32	0.46		0.50	0.39	0.7	0.2	...	0.1	0.2	0.8	...	...
Phenols, mg/l	...	<0.03	...		...	...	...	...	...	...	...	...	...	...
Arsenic (As), mg/l	...	<0.05	<0.01		<0.01	0.2	...	...	...	...	...	...	...	...

TABLE C-1. (Continued.)

Sample no.	Navy water wells 25	24A		Springs Moonshine	Blue Chalcedony	Myrick	Cuddeback Ground water basin Well W-1	Well W-2	Well W-3	Well W-4	Well W-5	Well W-6	Well W-7	South Searles Valley Moyle, 1969[b]
Date sampled	7-19-82	4-15-81	?	9-2-83	9-2-83	5-19-79	Data from Moyle, 1971[a]							
Analyst or reference	NWC	NWC	NWC	...	BC Labs	NWC	BLM (1976). Proposed geothermal leasing of Randsburg, Spangler Hills, South Searles Valley, Final Environmental Analysis Record							
Cadmium (Cd), mg/l	...	<0.03	<0.01		...	...	...	...	...	...	...	...	...	...
Chromium (Cr), mg/l	...	<0.03	<0.01		...	...	...	...	...	...	...	...	...	...
Barium (Ba), mg/l	...	0.075	...		...	...	...	...	...	...	...	...	...	...
Gold (Au), mg/l	...	<0.05	...		...	...	...	...	...	...	...	...	...	...
Manganese (Mn), mg/l	<0.01	<0.03	0.07		<0.01	0.12	...	...	...	...	...	...	...	...
Mercury (Hg), mg/l	...	0.001	<0.0001		<0.00002	2.2	...	...	...	...	...	...	...	...
Lead (Pb), mg/l	...	<0.05	<0.001		...	...	...	...	...	...	...	...	...	...
Selenium (Se), mg/l	...	0.005	<0.001		...	...	...	...	...	...	...	...	...	...
Zinc (Zn), mg/l	...	<0.05	...		<0.01	0.0002	...	...	...	...	...	...	...	...
Boron (B), mg/l	0.82	...	0.77		0.31	0.01	270.0[e]	600.0[e]	...	1650.0[e]	1950.0[e]	1500.0[e]	...	193.0
Synthetic detergents														
Apparent ABS, mg/l[f]	0.034	...	...		...	...	...	...	...	...	...	...	...	...
Phosphate (PO_4), mg/l	<0.05	...	...		2.1	6.3	...	...	...	...	...	...	...	...
Hydroxide (OH), mg/l	...	...	...		0.0	0.0	...	...	...	...	...	...	...	...
Lithium (Li), mg/l	...	...	...		0.07	0.28	...	...	...	...	...	...	...	...
Ammonium, mg/l	...	...	...		1.10	0.50	...	...	...	...	...	...	...	...
Nitrite (NO_2), mg/l	...	...	...		0.17	<0.001	...	...	...	...	...	...	...	...
Aluminum (Al), mg/l	...	...	...		<0.01	<0.01	...	...	...	...	...	...	...	...
Bromide (BrO_4), mg/l	...	...	...		<0.01	<0.01	...	...	...	...	...	...	...	...
Noncarbonate														
Hardness as $CaCO_3$	...	...	...		...	...	318.0	...	...	...	...	...	...	...
Percent sodium (Na)	...	...	...		...	...	36.0	68.0	61.0	62.0	54.0	55.0	77.0	100.0
Na/K temperature (°C)	136.0	125.0	144.0		193.0	99.0[g]	24.0[g]	130.0[g]	...	84.0[g]	67.0[g]	54.0[g]	...	...
Na/K modified (°C)	174.0	166.0	181.0		221.0	143.0[h]	74.0[h]	170.0	...	130.0[h]	114.0[h]	102.0[h]	...	...

TABLE C-1. (Continued.)

Sample no.	Navy water wells: 25	Navy water wells: 24A		Moonshine	Springs: Blue Chalcedony	Springs: Myrick	Cuddeback, Ground water basin: Well W-1	Well W-2	Well W-3	Well W-4	Well W-5	Well W-6	Well W-7	South Searles Valley Moyle, 1969[b]
Date sampled	7-19-82	4-15-81	?	9-2-83	9-2-83	5-19-79	Data from Moyle, 1971[a]							
Analyst or reference	NWC	NWC	NWC	...	BC Labs	NWC	BLM (1976). Proposed geothermal leasing of Randsburg, Spangler Hills, South Searles Valley, Final Environmental Analysis Record							
Na/K/CaB = 4/3 (°C)[i]	79.0	87.0	95.0		109.0	165.0	5.0	80.0	...	73.0	68.0	67.0	...	...
Na/K/CaB = 1/3 (°C)[i]	144.0	142.0	153.0		177.0	152.0	66.0	142.0	...	119.0	110.0	103.0	...	...
Quartz-conductive cooling (°C)	95.0	90.0	130.0		118.0	112.0[j]	...	...	115.0[j]	...	...	102.0[j]	128.0[j]	62.0[j]
Quartz maximum steam loss (°C)	98.0	94.0	127.0		118.0	113.0[j]	...	...	115.0[j]	...	...	104.0[j]	126.0[j]	68.0[j]
Chalcedony (°C)	63.0	58.0	101.0		88.0	81.0[j]	...	...	85.0[j]	...	...	70.0j	99.0[j]	25.0[h]
α-cristobalite (°C)	45.0	40.0	80.0		...	62.0[j]	...	...	65.0[j]	...	...	51.0[j]	78.0[j]	...
β-cristobalite (°C)	-2.0	-6.0	31.0		...	14.0[j]	...	...	17.0[j]	...	...	5.0[j]	29.0[j]	...
Amorphous silica (°C)	-20.0	-24.0	10.0		...	-5.0[j]	...	...	-2.0[j]	...	...	-14.0[j]	9.0[j]	...
Sodium Lithium (Na/Li) (°C)	...	...	...		47.0	21.0	...	...	...	...	...	...	...	...
Na/K/Ca/Mg (°C)	R=19.23 NA	R=17.68 NA	R=41.87 40		68.0	R=36.53[j] 39	R=40.07[j] NA	R=25.17[j] 79	...	R=20.39[j] NA	R=3.582[j] NA	R=22.90[j] NA	...	...

[a] Moyle, 1971 (Footnote 13).

[b] W. R. Moyle, Jr. ***Water Wells and Springs in Panamint, Searles, and Pilot Knob Valleys, San Bernardino and Inyo Counties***. California Department of Water Resources Bulletin No. 91-17, 1969.

[c] Probably an erroneous result.

[d] Symbol indicates "less than."

[e] Given in micrograms per liter.

[f] ABS-alkyl benzene sulfonate.

[g] Alfred H. Truesdell. "Summary of Section III Geochemical Techniques in Exploration," in ***Proceedings, Second United Nations Symposium on the Development and Use of Geothermal Resources, San Francisco, California, USA, 20-29 May 1975***. Volume 1. Washington, D.C., U.S. Government Printing Office, 1976, pp. liii-lxxix.

[h] Robert O. Fournier. "A Revised Equation for the Na/K Geothermometer," in ***Expanding the Geothermal Frontier, Transactions Volume 3, Geothermal Resources Council Meeting, 24-27 September 1979, Reno, Nevada***. Davis, Calif., Geothermal Resources Council, September 1979, pp. 221-224.

[i] R. O. Fournier and A. H. Truesdell. An Empirical Na-K-Ca Geothermometer for Natural Waters. ***Geochemica et Cosmochemica*** 37, 1973, p. 1255-75.

[j] R. O. Fournier. 1981 (Footnote 14).

Appendix D

OCCURRENCES NOT LOCATABLE ON THE GROUND

NWC Reference Number	Reported Location
W-701	(Proj.) Sec. 3, T28S, R43E, MDB&M
W-1101	Sec. 12, Sec. 13, T29S, R42E, MDB&M
W-1302	(Proj.) Sec. 25, T28S, R45E, MDB&M

END

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DTIC